RF Test Report
2.4G Hopping Radio

Report No.	:	FCCBWFX-WAY-P211110037-1R2
Customer	:	Hanmi Micronics Inc.
Address	:	72, Samdo-ro 48beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea.
Use of Report	:	Certification
Model Name	:	WK-3 RECEIVER
FCC ID / IC	:	2A3QW-K-RECEIVER
Date of Test	:	2021.11.22 to 2021.12.06
Test Method Used	:	FCC 47 CFR PART 15 Subpart C (Section §15.247)
Testing Environment	:	Refer to the Test Condition

Test Result : ☒ **Pass** ☐ **Fail**

ISSUED BY: BV CPS ADT Korea Ltd., EMC/RF Laboratory

ADDRESS: Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 16675

TEST LOCATION: HeungAn-daero 49, DongAn-gu, Anyang-si, Gyeonggi-do, Korea, 14119

Tested by

Name : Donghwa Shin

Technical Manager

Name : Jongha Choi

2021. 12. 29

BV CPS ADT Korea Ltd.

RELEASE CONTROL RECORD

REPORT NO.	REASON FOR CHANGE	DATE ISSUED
FCCBWFX-WAY-P211110037-1	Original release	2021.12.17
FCCBWFX-WAY-P211110037-1R1	Typo Correction	2021.12.27
FCCBWFX-WAY-P211110037-1R2	Typo Correction	2021.12.29

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1 Summary of Test Results

The EUT has been tested according to the following specifications

Applied Standard : FCC Part 15, Subpart C 15.247				
FCC Part Section(s)	**Test Description**	**Limit**	**Test Result**	**Reference**
15.247(b)(1)	Maximum Peak Output Power	< 1 Watt if ≥ 75 non-overlapping channels used	PASS	Section 3.2
15.247(a)(1)	Carrier Frequency Separation	> 2/3 of 20 dB BW for systems with Output Power < 125 mW	PASS	Section 3.3
15.247(a)(1)(iii)	20 dB Channel Bandwidth	N/A	PASS	Section 2.5
-	Occupied Bandwidth (99 % Bandwidth)	N/A	PASS	Section 2.5
15.247(a)(1)(iii)	Number of Hopping Channels	> 15 Channels	PASS	Section 3.4
15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	< 0.4 sec in 31.6 sec period	PASS	Section 3.5
15.247(d)	Band Edge / Out-of-Band Emissions (Conducted Spurious Emission)	> 20 dBc	PASS	Section 3.6
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in Restricted bands must meet the radiated limits detailed in 15.209 (RSS-247 limits)	PASS	Section 3.6
15.207	AC Conducted Emissions (150 kHz – 30 MHz)	< FCC 15.207 limits (RSS-Gen [8.8] limits)	PASS	Section 3.7

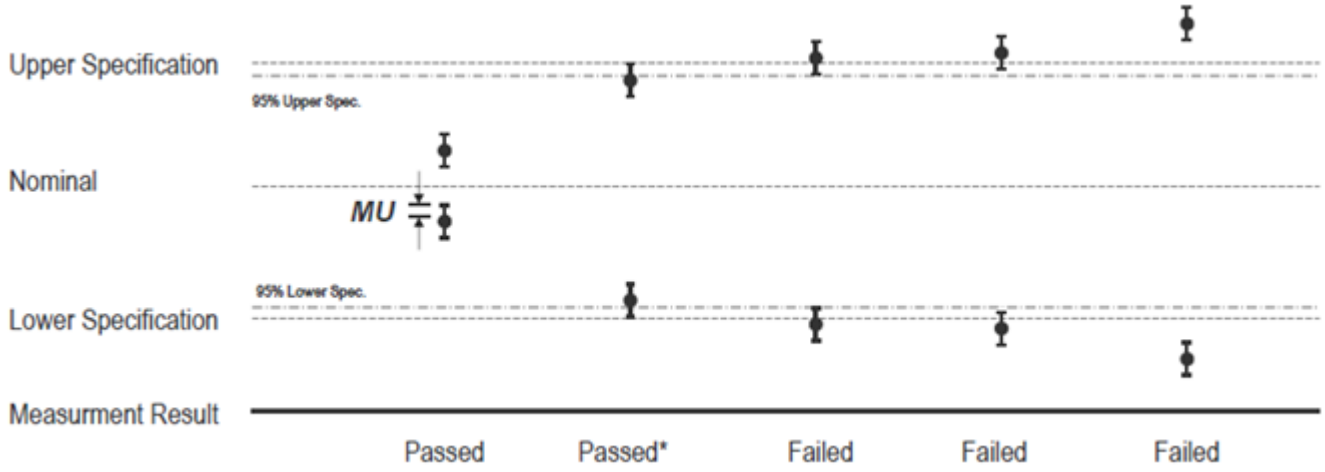
NOTES

1) The general test methods used to test on this devices are ANSI C63.10.

2) If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

3) Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

1.1 Decision Rules for Statement of Conformity



QUA-52 Decision Rule(QA Document) was applied.

Step 1) : Reference Check, Daily Check, Peripheral device Check

Step 2) : Re-test Procedure (Repeat the test maximum 3 times, Different Test Engineer)

1) If the original test results are subject to retesting and the judgement is unclear, the retest is carried out.
2) If the result of the first retest is the same as the initial test, the judgement is made based on the value.
3) If the result of the first retest differ from the results of the initial test, the second re-test is carried out.
4) After completion of the second retest, the average of the three test results is determined as the final result. However, if the deviation of the three test values is more than 5 % of the reference value, the technical manager should review the reproducibility of the test from the beginning.

1.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2

Measurement Items	Frequency Range	Expanded Uncertainty U = *k*Uc (*k* = 2)
Conducted Emissions at main ports	150 kHz – 30 MHz	2.99
Radiated Spurious Emissions	9 kHz – 30 MHz	1.92
	30 MHz – 1 GHz	4.00
	1 GHz – 18 GHz	5.68
	18 GHz – 26.5 GHz	5.24

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k = 2.

2 General Information

2.1 General Description of EUT

Product	Receiver
Brand	WIZMAX
Model	WK-3 RECEIVER
Identification No. of EUT	-
Series Model	-
Model Difference	-
Power Supply	DC 5 V(from PC)
Modulation Type	GFSK
Transfer Rate	-
Operating Frequency	2.4G Hopping Radio : 2 403 ㎒ – 2 480 ㎒
Number of Channel	2.4G Hopping Radio : 16
Output Power	2.4G Hopping Radio : -2.46 dBm (0.57 mW)
Antenna Type	PCB Antenna
Antenna Connector	Internal
H/W Version	V1.0
S/W Version	V3.0

NOTES

1) The above equipment has been tested by **Bureau Veritas Consumer Products Services ADT Korea**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2) The following antennas were provided to the EUT

Antenna	Type	Connector	Peak Gain (dBi)
			2.4 GHz
2.4G	PCB Antenna	Internal	2.24

3) List of Accessories

Accessories	Brand	Model	Manufacturer	Specification
-	-	-	-	-

2.2 Description of Test Mode

[Test Channel of EUT]

- 2.4G Hopping Radio

Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
0	2 403	4	2 422	8	2 441	12	2 463
1	2 407	5	2 426	9	2 445	13	2 466
2	2 414	6	2 436	10	2 453	14	2 473
3	2 419	7	2 439	11	2 459	15	2 480

2.2.1 Test Mode Applicability and Tested Channel Details

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X axis for radiated emission. Following channel(s) was(were) selected for the final test as listed below :

EUT Configure mode	Applicable to				Description
	RE < 1G	RE ≥ 1G	PLC	APCM	
-	√	√	√	√	-

Where RE ≥ 1 G : Radiated Emission above 1 GHz & Bandedge Measurement
RE < 1 G : Radiated Emission below 1 GHz
PLC : Power Line Conducted Emission
APCM : Antenna Port Conducted Measurement

Radiated Emission Test (Below 1 GHz)

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

- 2.4G Hopping Radio

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 15	15	GFSK	-

Radiated Emission Test (Above 1 GHz)

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

- 2.4G Hopping Radio

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 15	0, 8, 15	GFSK	-

Power line Conducted Emission Test

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

- 2.4G Hopping Radio

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 15	15	GFSK	-

Antenna Port Conducted Measurement

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.

☒ Following channel(s) was (were) selected for the final test as listed below.

- 2.4G Hopping Radio

Available Channel	Tested Channel	Modulation Type	Packet Type
0 to 15	0, 8, 15	GFSK	-

Test Condition

Applicable to	Environmental Conditions	Test Voltage	Tested by
RE < 1G	22 °C, 49 % RH	DC 5 V	Donghwa Shin
RE ≥ 1G	23 °C, 51 % RH	DC 5 V	Donghwa Shin
PLC	22 °C, 48 % RH	DC 5 V	Donghwa Shin
APCM	23 °C, 50 % RH	DC 5 V	Donghwa Shin

2.3 Maximum Output Power

- 2.4G Hopping Radio

Frequency Range [MHz]	Test Items	Test Mode	Result [dBm]	Result [mW]
2 403 ~ 2 480 ANT1	Average Power	BDR(GFSK)	-2.72	0.53
	Peak Power	BDR(GFSK)	-2.46	0.57

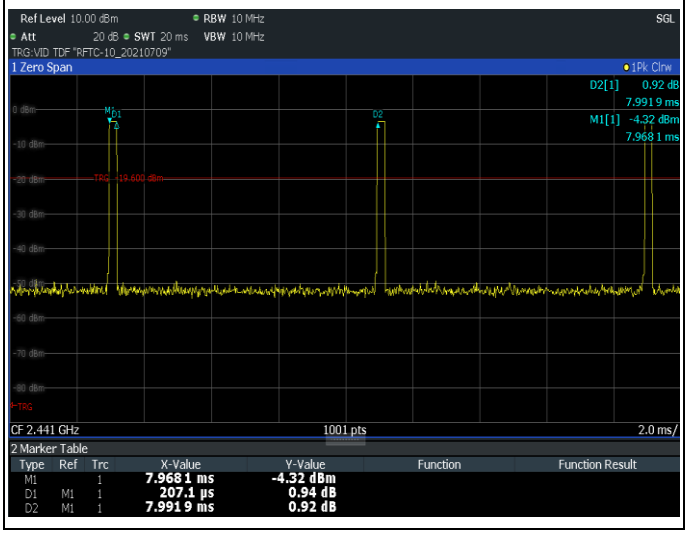
2.4 Duty Cycle of Test Signal

- 2.4G Hopping Radio

Test Mode	Test Items	Packet Type	On Time B [msec]	Period [msec]	Duty Cycle X [Linear]	Duty Cycle [%]
2.4G Hopping Radio	Duty Cycle	GFSK	0.207	7.992	0.026	95.0

Test Plot of Duty Cycle

GFSK - 2.4G Hopping Radio



2.5 20 dB and 99 % Bandwidth

[Test Data of 20 dB Bandwidth and 99 % Bandwidth]

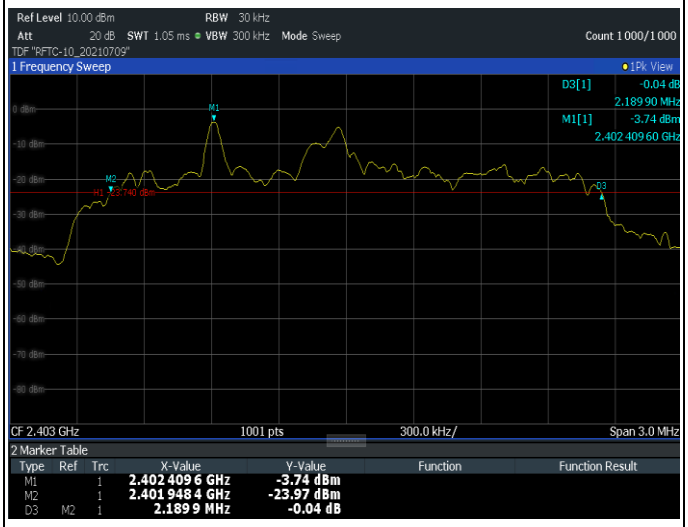
- 2.4G Hopping Radio mode

Test Mode	Channel	Frequency [MHz]	20 dB BW [MHz]	99 BW [MHz]
2.4G Hopping Radio	Lowest	2 403	2.190	2.138
	Middle	2 441	2.187	2.117
	Highest	2 480	2.193	2.114
Worst Result			2.193	2.138

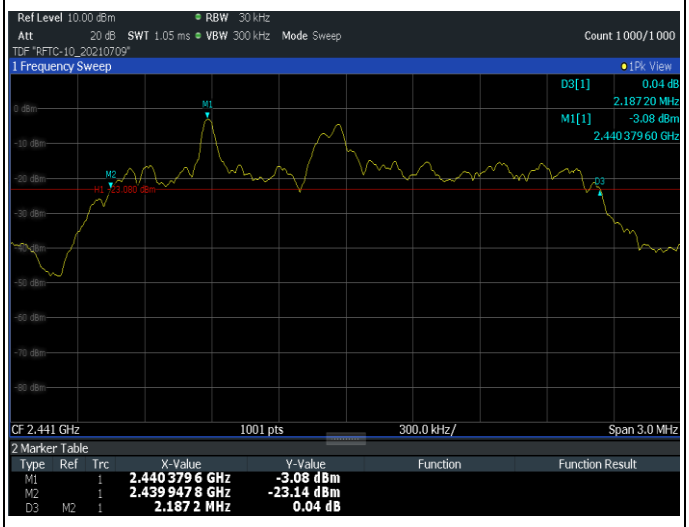
Test Plot of 20 dB Bandwidth

20 dB Bandwidth - 2.4G Hopping Radio

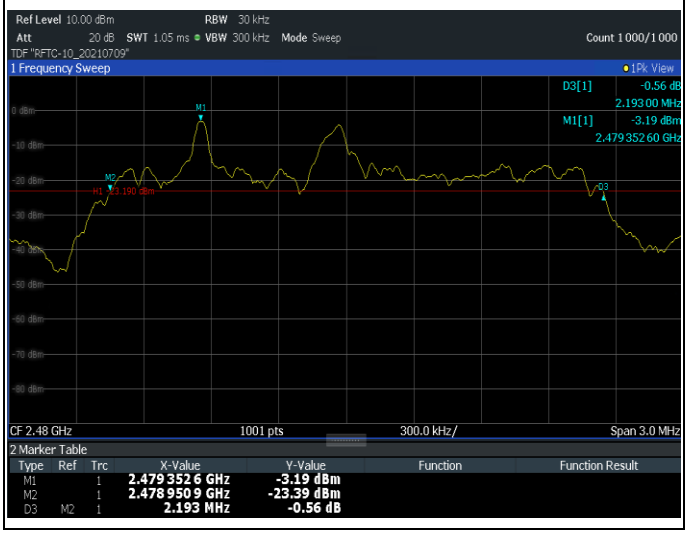
2 403 MHz



2 441 MHz



2 480 MHz



Test Plot of 99 % Bandwidth

99 % Bandwidth - 2.4G Hopping Radio	
2 403 MHz	**2 441 MHz**
	
2 480 MHz	
	

2.6 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards.

FCC CFR 47 Part 15, Subpart C (§15.247)
KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10-2013

All test items in this test report have been performed and recorded as per the above standards.

2.7 Test Equipment

Test Equipment is traceable to the National Institute of Standards and Technology (NIST). Measurement antenna used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Equipment	Model	Serial Number	Manufacturer	Description	Cal Date	Cal Due
Loop Antenna	HFH2-Z2E	349806	R&S	Active Loop Antenna, 30 M Hz	2021-02-18	2023-02-18
Bi-log Antenna	VULB 9163	1099	Schwarzbeck	Trilog Antenna, 3 GHz (with 6 dB ATT.)	2021-09-03	2023-09-03
Horn Antenna	HF907	102772	R&S	Horn Antenna, 18 GHz	2021-12-03	2022-12-03
Horn Antenna	BBHA9170	00955	Schwarzbeck	15 - 40 GHz, 10 W (cont.) 2 5 W (peak)	2020-12-09	2021-12-09
Amplifier	SCU08F2	8400016	R&S	Signal Conditioning Unit, 8 GHz	2021-11-23	2022-11-23
Amplifier	SCU-18F	180111	R&S	Signal Conditioning Unit, 18 GHz	2021-11-23	2022-11-23
Amplifier	JS44-18004000-3 3-8P	2142086	L3 Narda-MITEQ	Amplifier, 40 GHz	2021-11-29	2022-11-29
Signal analyzer	FSW50	101403	R&S	DC Coupled : 2 Hz to 50 GHz AC Coupled : 10 MHz to 5 0 GHz	2021-11-22	2022-11-22
Attenuator	PE7087-10	1712-2	Pasternack	10 dB Atten / 2 W / DC t o 26 GHz	2021-06-04	2022-06-04
High Pass Filter	HPM17543	028	Micro-Tronics	3 GHz High Pass Filter	2021-06-04	2022-06-04
EMI Receiver	ESR	102529	R&S	DC ~ 7 GHz	2021-11-23	2022-11-23
Signal Generator	SMB100A	MY41006053	R&S	100 kHz ~ 40 GHz	2021-06-04	2022-06-04
Signal analyzer	FSV30	103631	R&S	10 Hz to 30 GHz / 1W	2021-11-22	2022-11-22
MIMO Power Set Master	MP400B	NONE	Keysight Technologies	50 MHz to 18 GHz / 20 dB m / RBW 30 MHz	2021-12-03	2022-12-03
Attenuator	40AH2W-10	1	Aeroflex	DC to 40 GHz / 10 dB / 2 W	2021-06-04	2022-06-04
LISN	ENV216	102437	R&S	9 kHz - 30 MHz	2021-11-23	2022-11-23
EMI Test Receiver, 3.6 GHz	ESR	102529	R&S	9 kHz - 3.6 GHz	2021-11-23	2022-11-23

3 Test Results

3.1 Antenna Requirement

Except from §15.203 of the FCC Rules/Regulations:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 the section.

- The antenna(s) of the EUT are Permanently attached.
- There are no provisions for connection to an external antenna.

Result

The EUT complies with the requirement of §15.203

3.2 Maximum Peak Output Power

3.2.1 Regulation

§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.

§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.

§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.

3.2.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

This is an RF conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation.

a) Use the following spectrum analyzer settings:

Peak Power Measurement

1) Span : Approximately five times the 20 dB bandwidth, centered on hopping channel.
2) RBW > 20 dB bandwidth of emission being measured.
3) VBW ≥ RBW.
4) Sweep : Auto.
5) Detector function : Peak.
6) Trace : Max hold.

b) Allow trace to stabilize

c) Use the marker-to-peak function to set the marker to the peak of the emissions

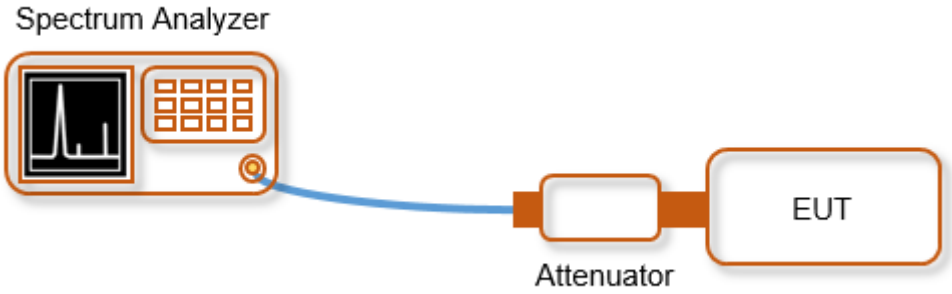
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

e) A plot of the test results and setup description shall be included in the test report.

3.2.3 Deviation from Test Standard

No deviation.

3.2.4 Test Setup



3.2.5 Test Result

[Test Data of Peak Power]

- 2.4G Hopping Radio

Test Mode	Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
2.4G Hopping Radio	Lowest	2 403	-2.76	21.00	23.76
	Middle	2 441	-2.65	21.00	23.65
	Highest	2 480	-2.46	21.00	23.46
Worst Result			-2.46	21.00	23.46

[Test Data of Average Power]

- 2.4G Hopping Radio

Test Mode	Channel	Frequency [MHz]	Aveage Power [dBm]	Aveage Power [mW]
2.4G Hopping Radio	Lowest	2 403	-3.00	0.50
	Middle	2 441	-2.79	0.53
	Highest	2 480	-2.72	0.53

Remarks

1. Peak Power(dBm) = Peak Reading Value(dBµV/m) + Duty Cycle Correction Factor(dB)
2. Average Power(dBm) = Average Reading Value(dBµV/m) + Duty Cycle Correction Factor(dB)

[Test Plot of Peak Power]

3.3 Carrier Frequency Separation

3.3.1 Regulation

§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.

3.3.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

a) The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

b) Span: Wide enough to capture the peaks of two adjacent channels.

c) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

d) Video (or average) bandwidth (VBW) ≥ RBW.

e) Sweep: Auto.

f) Detector function: Peak.

g) Trace: Max hold.

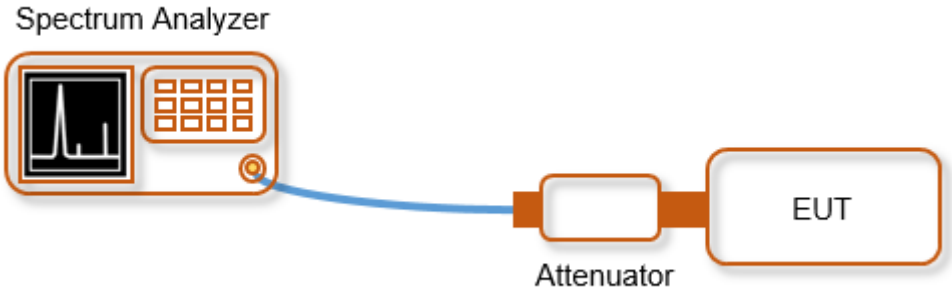
h) Allow the trace to stabilize.

i) Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

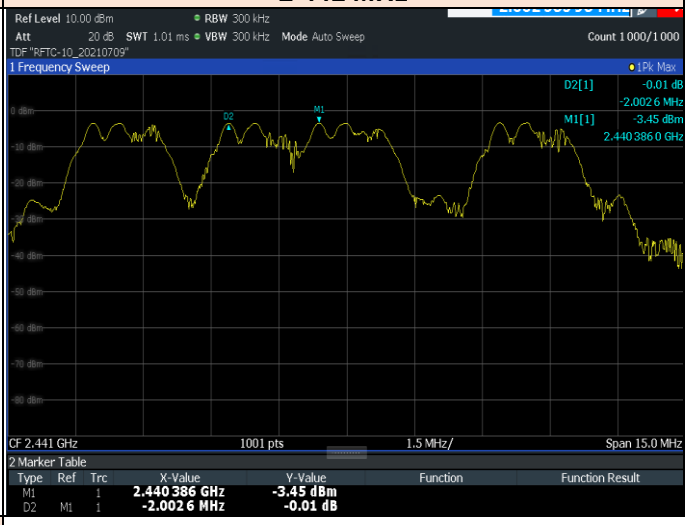
3.3.3 Deviation from Test Standard

No deviation.

3.3.4 Test Setup



3.3.5 Test Result

2.4G Hopping Radio mode	
2 403 MHz	2 441 MHz
	
2 480 MHz	
	

3.4 Number of Hopping Channels

3.4.1 Regulation

§15.247(a)(1)(iii) : Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

§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.

3.4.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

c) VBW ≥ RBW.

d) Sweep: Auto.

e) Detector function: Peak.

f) Trace: Max hold.

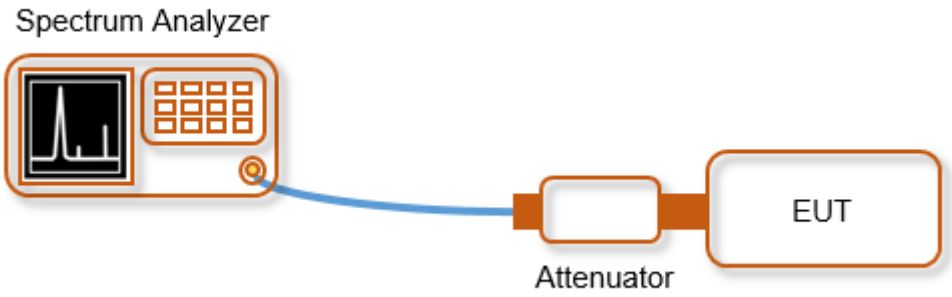
g) Allow the trace to stabilize.

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

3.4.3 Deviation from Test Standard

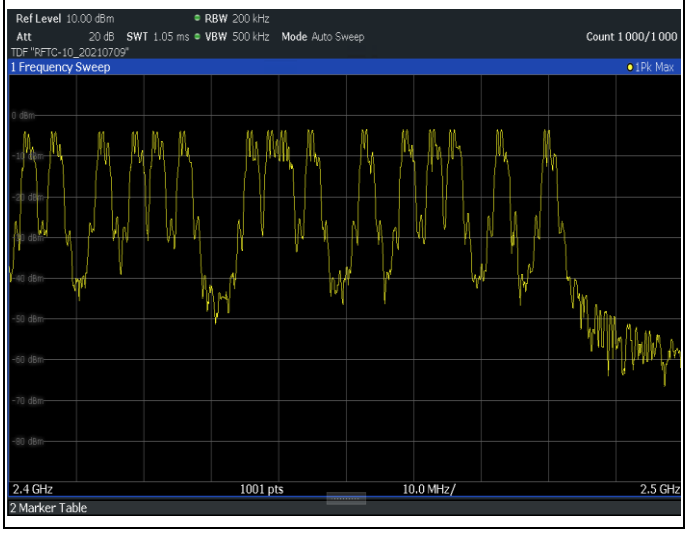
No deviation.

3.4.4 Test Setup



3.4.5 Test Result

[Test Plot]

2.4G Hopping Radio mode
GFSK


3.5 Time of Occupancy (Dwell Time)

3.5.1 Regulation

§15.247(a)(1)(iii) : Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

3.5.2 Test Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: Zero span, centered on a hopping channel.

b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

d) Detector function: Peak.

e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

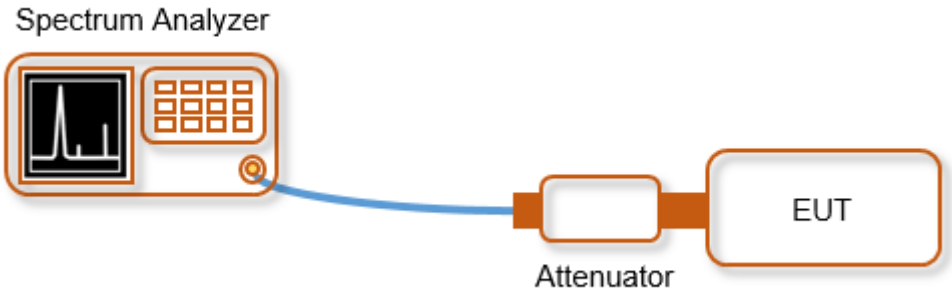
The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

3.5.3 Deviation from Test Standard

No deviation.

3.5.4 Test Setup



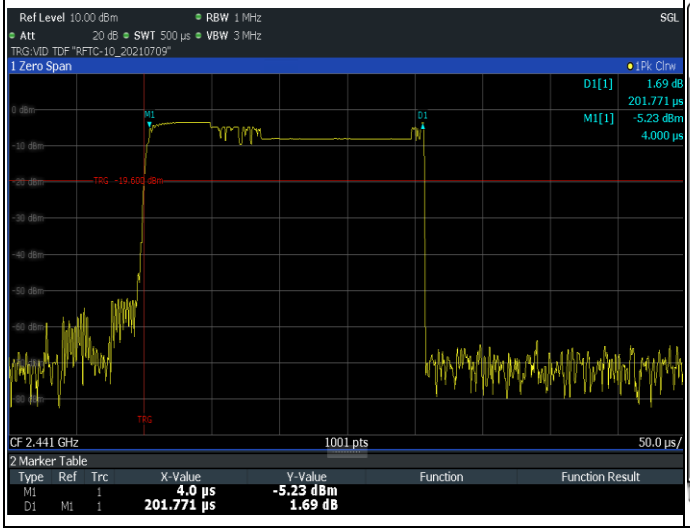
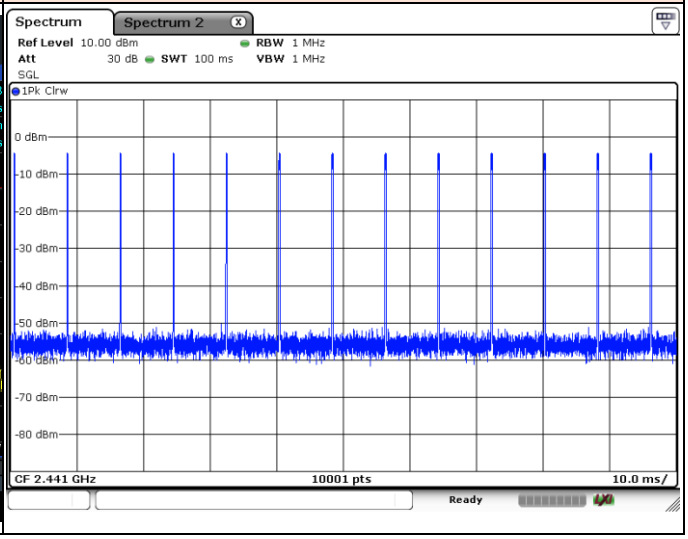
3.5.5 Test Result

[Test Data]

- 2.4G Hopping Radio

Adaptive Mode	Test Mode	Packet Type	Pulse Width [msec]	Hopping Rate [Hop/100ms]	Hopping Rate [Hop/6.4s]	Number of Channels	Results [sec]	Limit [sec]	Margin [sec]
2.4G Hopping Radio	Hopping	GFSK	0.201	13	832	16	0.167232	0.400	0.23276800

[Test Plot] – 2.4G Hopping Radio mode

On time	Hop/100 ms
	

3.6 Spurious Emission, Band edge and Restricted Bands

3.6.1 Regulation

§15.247(d) : In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

§15.209(a) : Except as provided elsewhere in this subpart, 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 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§15.231 and 15.241.

§15.205(a) : Except as shown in paragraph (d) of this section, 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
[1]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	([2])
13.36-13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2]Above 38.6

§15.205 (b) : Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

3.6.2 Test Procedure

Band-edge Compliance for RF Conducted Emissions

These procedures are applicable for determining compliance at authorized-band band-edges where the requirements are expressed as a value relative to the in-band signal level. Procedures for determining compliance with field strength limits at or close to the band-edges are given in 6.10.6 (see also Table A.2).

Band-edge tests are typically performed as a conducted test but may be performed as radiated measurements on a test site meeting the specifications in 5.2, at the measurement distances specified in 5.3. The instrumentation shall meet the requirements in 4.1.1 using the bandwidths and detectors specified in 4.1.4.2.

When performing radiated measurements, the measurement antenna(s) shall meet the specifications in 4.3. The EUT shall be connected to an antenna and operated at the highest power settings following procedures in 6.3.

For other than frequency-hopping devices, this test sequence shall be performed once. For devices that support frequency hopping, this test sequence shall be performed twice: once with the hopping function turned OFF and then repeated with the hopping function turned ON. The purpose of the test with the hopping function turned on is to confirm that the RF power remains OFF while the device is changing frequencies, and that the oscillator stabilizes at the new frequency before RF power is turned back ON. Overshoot of any oscillator, including phase-lock-loop stabilized oscillators, can cause the device to be temporarily tuned to frequencies outside the authorized band, and it is important that no transmissions occur during such temporary periods. Particular attention to the hopping sequence requirements specified below is needed in the case of adaptive frequency-hopping devices:

a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).

b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).

c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normalmode of operation” as specified in 6.10.3.

d) If using the radiated method, then use the applicable procedure(s) of 6.4, 6.5, or 6.6, and orient the EUT and measurement antenna positions to produce the highest emission level.

e) Perform the test as follows:

    1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.

    2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

    3) Attenuation: Auto (at least 10 dB preferred).

    4) Sweep time: Coupled.

    5) Resolution bandwidth: 100 kHz.

    6) Video bandwidth: 300 kHz.

    7) Detector: Peak.

    8) Trace: Max hold.

f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can takeseveral minutes to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.

g) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

h) Repeat step c) through step e) for every applicable modulation.

i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).

j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Spurious RF Conducted Emissions

Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at the maximum transmit powers.

Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results,account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

Spurious Radiated Emissions

1. The preliminary radiated measurement were performed to determine the frequency producing the maximum emissions in an semi-anechoic chamber at a distance of 3 meters.

2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360^{o}.

3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1000 MHz using the Bi-Log antenna, and from 1000 MHz to 26500 MHz using the horn antenna.

4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 x 4 meter in an semi-anechoic chamber. The EUT was tested at a distance 3 meters.

5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector fuction with specified bandwidth.

6. The 0.8 m height is for below 1 GHz testing, and 1.5 m is for above 1GHz testing.

- Procedure for unwanted emissions measurements below 1 000 MHz

The procedure for unwanted emissions measurements below 1 000 MHz is as follows:

a) Follow the requirements in 12.7.4.

b) Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

- Procedure for peak unwanted emissions measurements above 1 000 MHz

The procedure for peak unwanted emissions measurements above 1 000 MHz is as follows:

a) Follow the requirements in 12.7.4.

b) Peak emission levels are measured by setting the instrument as follows:

1) RBW = 1 MHz.

2) VBW ≥ [3 × RBW].

3) Detector = peak.

4) Sweep time = auto.

5) Trace mode = max hold.

6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not ontinuous, then the time required for the trace to stabilize will increase by a factor of pproximately 1 / D, where D is the duty cycle. For example, at 50 % duty cycle, the easurement time will increase by a factor of two, relative to measurement time for ontinuous transmission.

- Procedure for average unwanted emissions measurements above 1 000 MHz

Method VB-A is averaging using reduced video bandwidth. The procedure for this method is as follows:

a) RBW = 1 MHz.

b) Video bandwidth:

1) If the EUT is configured to transmit with D ≥ 98 %, then set VBW ≤ RBW / 100 (i.e., 10 kHz), but not less than 10 Hz.

2) If the EUT D is < 98%, then set VBW ≥ 1 / T, where T is defined in item a1) of 12.2.

c) Video bandwidth mode or display mode:

1) The instrument shall be set with video filtering applied in the power domain. Typically, this requires setting the detector mode to RMS (power averaging) and setting the average-VBW type to power (rms).

2) As an alternative, the instrument may be set to linear detector mode. Video filtering shall be applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode to accomplish this. Others have a setting for average-VBW type, which can be set to "voltage" regardless of the display mode.

d) Detector = peak.

e) Sweep time = auto.

f) Trace mode = max hold.

g) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 % duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where D is the duty cycle. For example, use at least 200 traces if the duty cycle is 25 %. (If a specific emission is demonstrated to be continuous—i.e., 100 % duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 50 traces should be averaged.)

- Sample Calculation

- Field Strength Level [dBµV/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m] + Duty Cycle Correction [dB]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable loss [dB]
- Margin [dB] = Field Strength Level [dBµV/m] – Limit [dBµV/m]

- Duty Cycle Correction Factor Calculation – 2.4G Hopping Radio mode

- Time to cycle through all channel = T ms X 16 channels

  2.4G Hopping Radio = 0.202 ms x 16 = 3.232 ms

- 100 ms / Time to cycle through all Channel = H

  2.4G Hopping Radio = 100 ms / 3.232 ms = 30.94 → Round up to nex highest integer, H= 31

- Wosrt case maximum dwell time

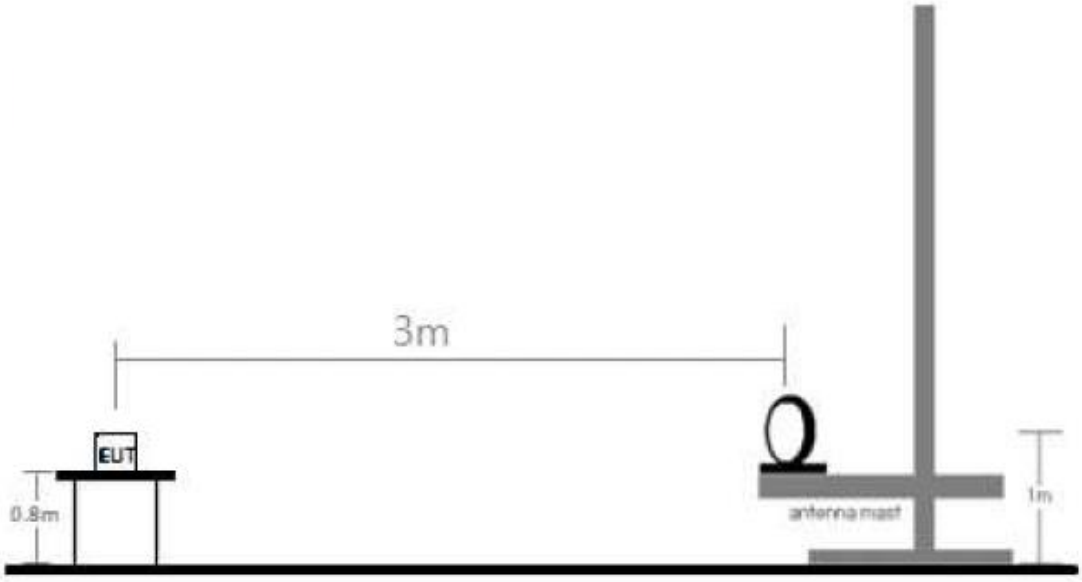
  2.4G Hopping Radio = 0.202 ms * 31 = 6.262 ms

- Duty cycle correction factor = $20\log_{10}(6.262 \text{ ms} / 100 \text{ ms})$ = -24.06 dB

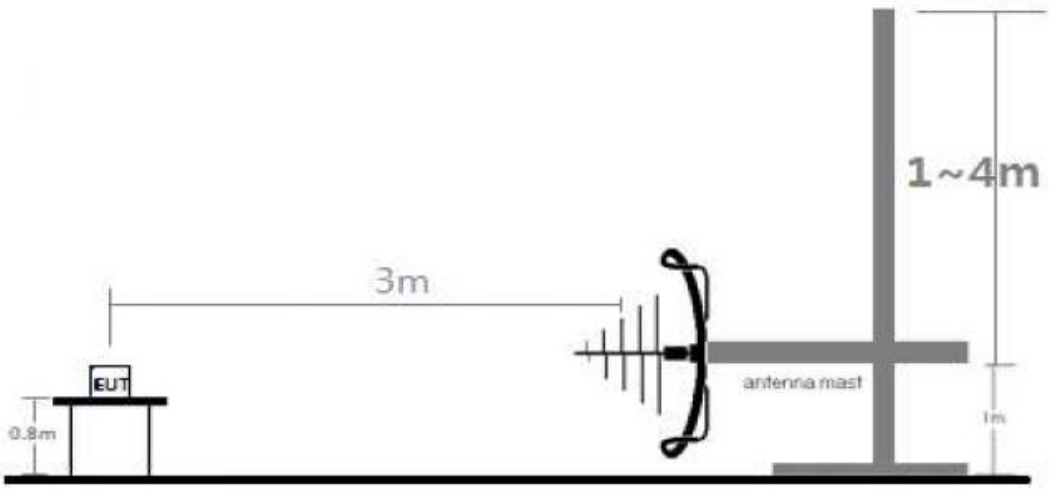
3.6.3 Deviation from Test Standard

No deviation.

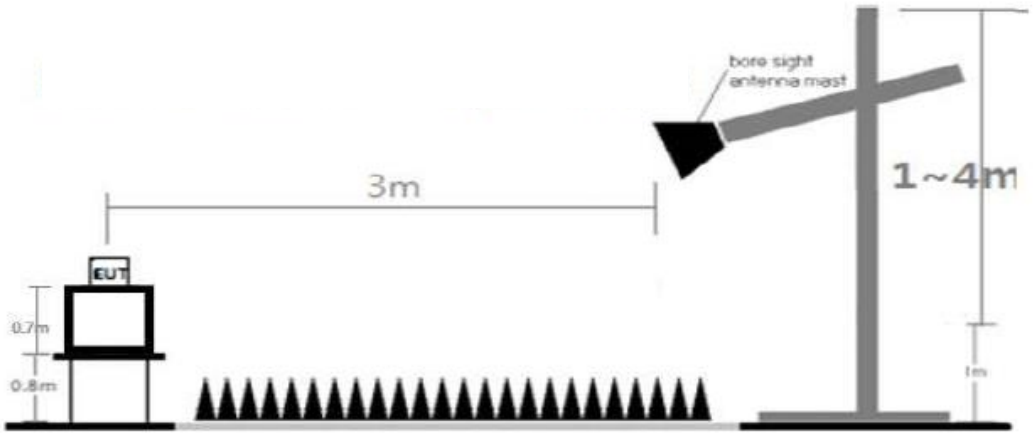
3.6.4 Test Setup

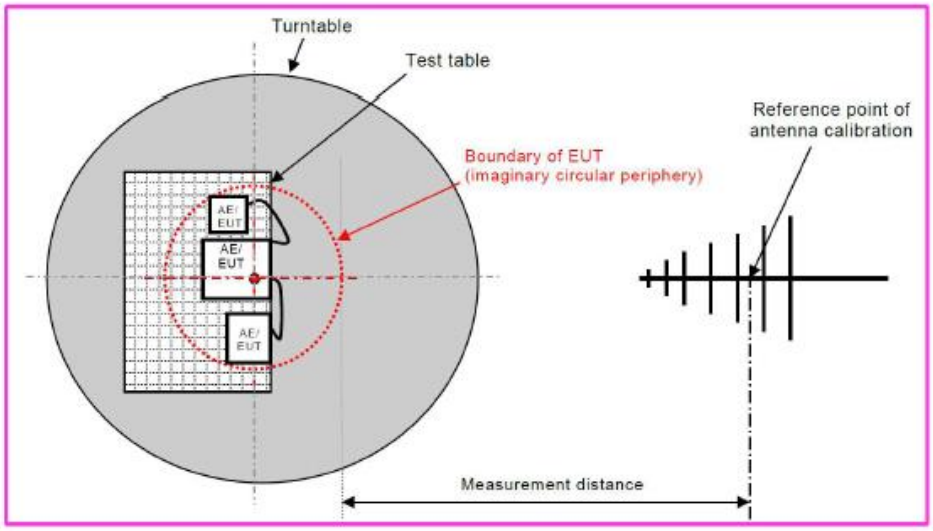


[Radiated Emission Test Setup Below 30 MHz]

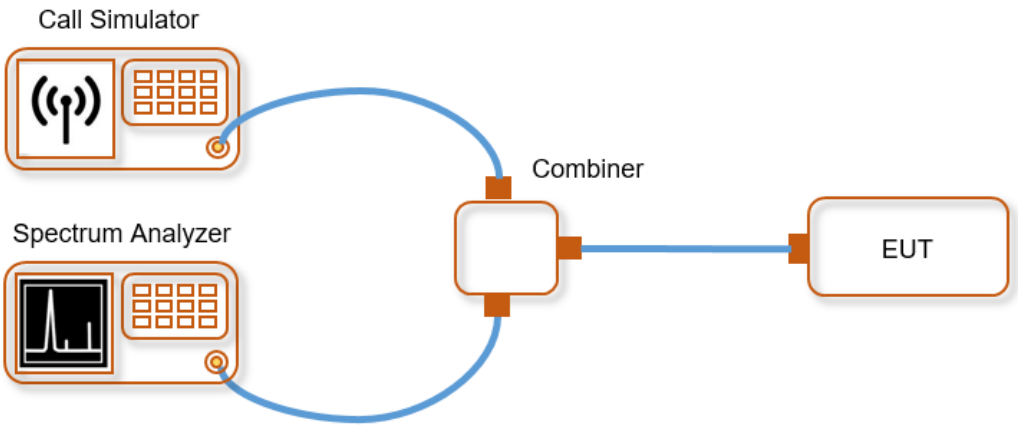


[Radiated Emission Test Setup Below 1 GHz]





[Radiated Emission Test Setup Above 1 GHz]

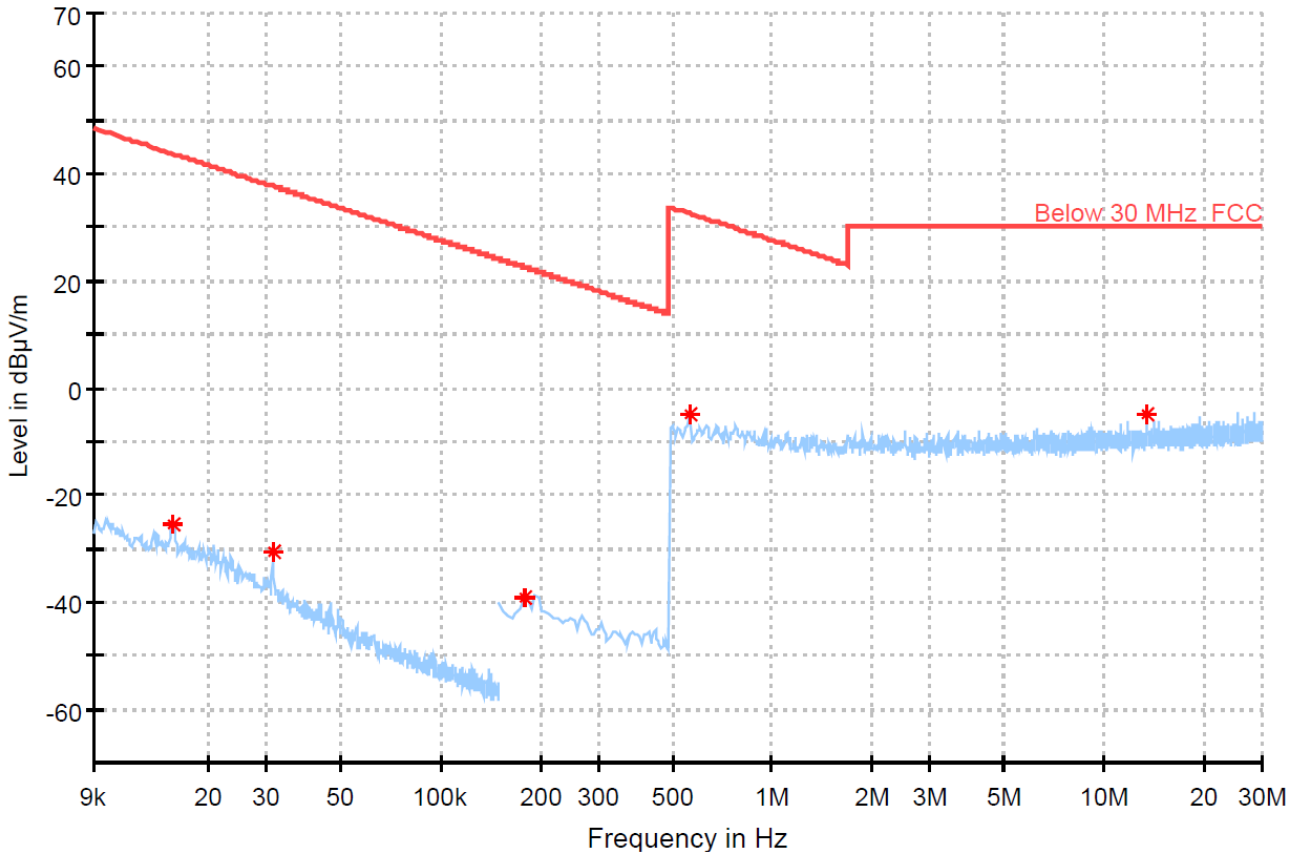


[Conducted Spurious Emission]

3.6.5 Test Result of Radiated Spurious Emission

3.6.5.1 Radiated Emissions (Below 30 MHz)

Worst case - RSE(Below 30 MHz)_2.4G Hopping Radio_GFSK_2480_Y



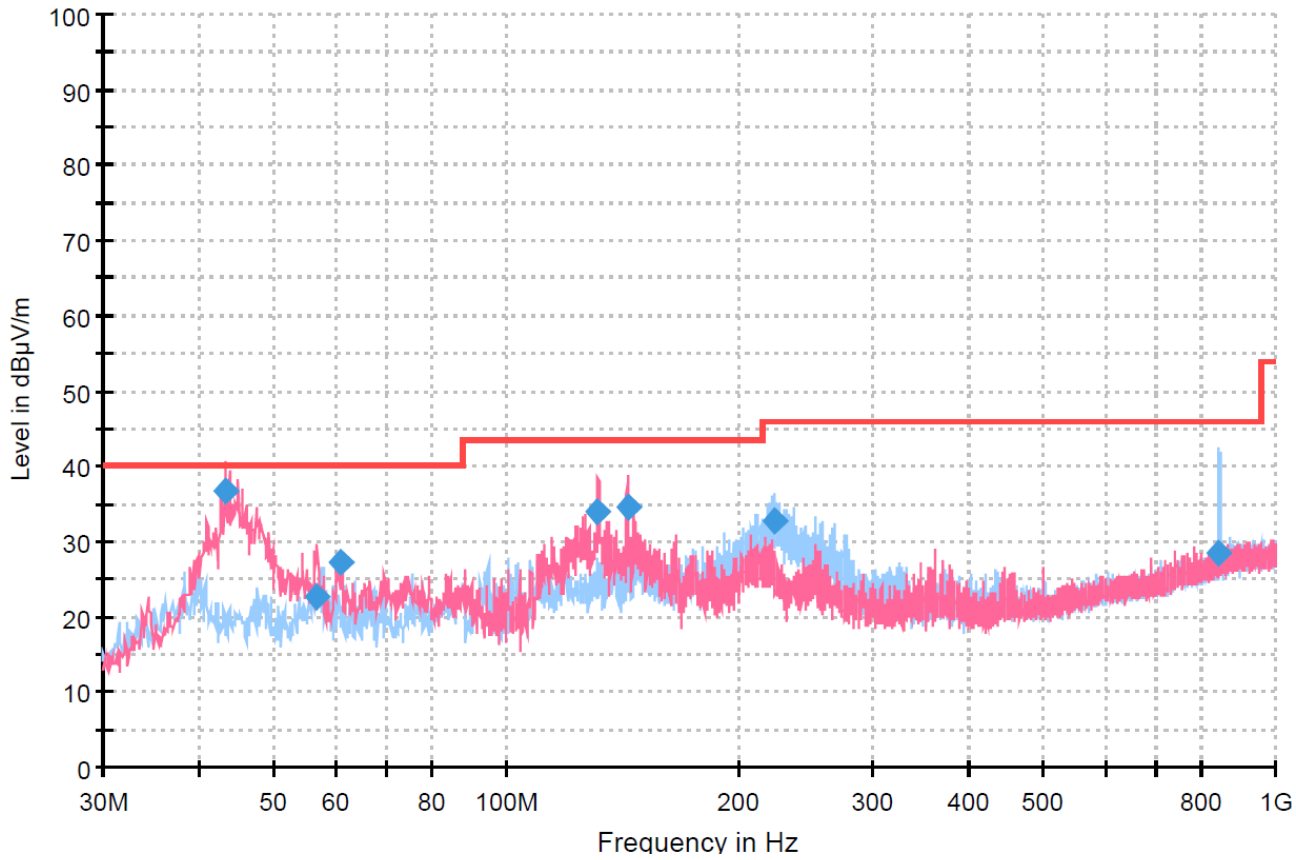
Frequency [MHz]	Peak Reading Value [dBuV]	Peak [dBuV/m]	Distance Correction Factor [dB]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB/m]
0.02	34.11	-25.39	-80.00	43.67	69.06	100.00	Perpendicular	215.00	-59.50
0.03	28.67	-30.73	-80.00	37.71	68.44	100.00	Perpendicular	353.00	-59.40
0.18	20.22	-39.18	-80.00	22.59	61.77	100.00	Perpendicular	88.00	-59.40
0.56	14.28	-5.02	-40.00	32.63	37.65	100.00	Perpendicular	158.00	-19.30
13.47	12.57	-5.13	-40.00	30.00	35.13	100.00	Perpendicular	96.00	-17.70

Remarks

1. Peak(dBuV/m) = Peak Reading Value(dBµV/m) + Correction Factor(dB) + Distance Factor(dB)
2. Correction Factor(dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin(dB) = (Peak) Result (dBµV/m) – (Peak) Limit (dBµV/m)

3.6.5.2 Radiated Emissions (Below 1 GHz)

Worst case - RSE(Below 1 GHz)_2.4G Hopping Radio_GFSK_2480

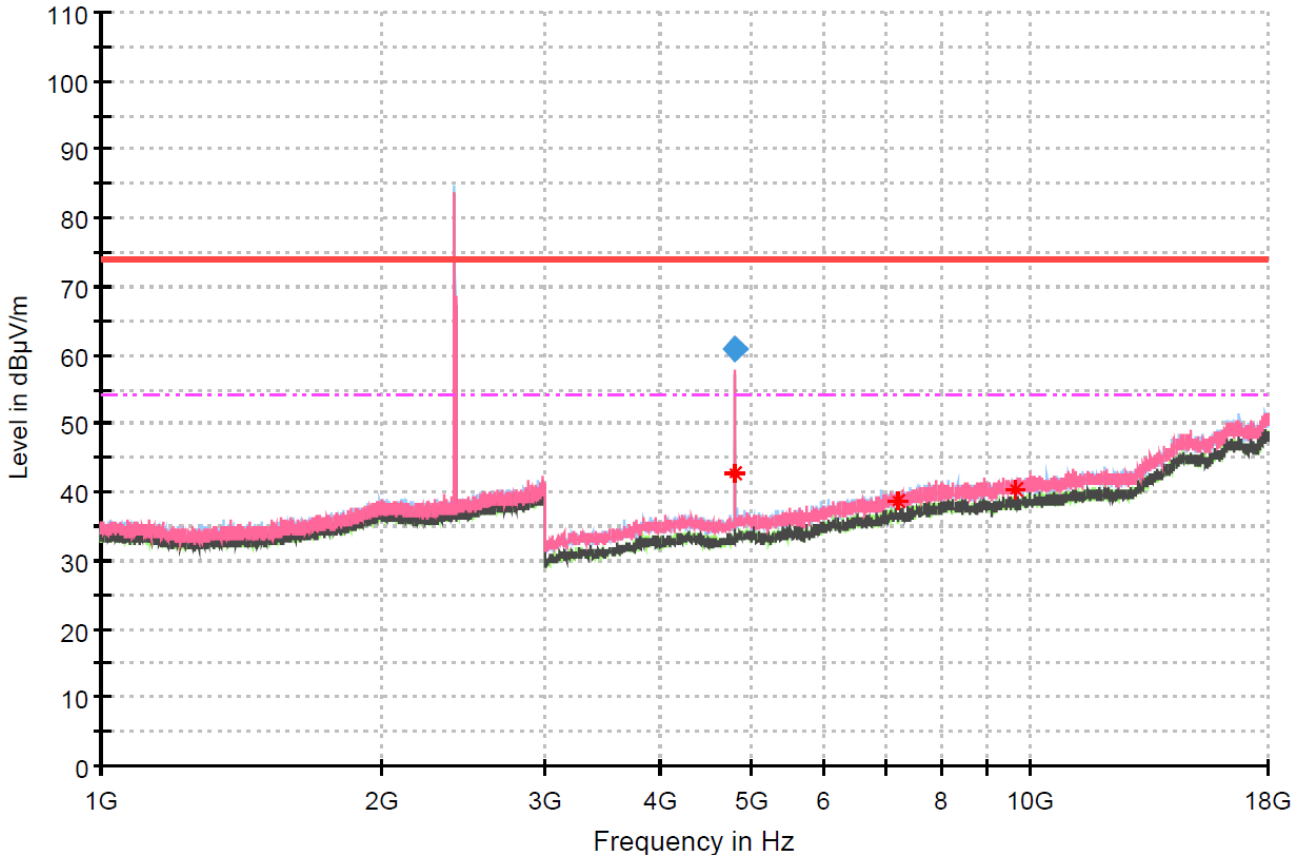


Frequency [MHz]	Quasi Reading Value [dBuV]	Quasi Peak [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB/m]
43.19	54.48	36.78	40.00	3.22	100	V	358	-17.70
56.97	41.52	22.52	40.00	17.48	170	V	358	-19.00
61.14	46.78	27.08	40.00	12.92	150	V	192	-19.70
131.85	57.30	33.80	43.52	9.72	105	V	351	-23.50
143.98	58.68	34.68	43.52	8.84	104	V	7	-24.00
224.00	52.67	32.87	46.02	13.15	206	H	238	-19.80
844.80	36.27	28.57	46.02	17.46	250	H	8	-7.70

Remarks
1. Quasi Peak(dBµV/m) = Quasi Peak Reading Value(dBµV/m) + Correction Factor(dB)
2. Correction Factor(dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin(dB) = (Quasi Peak) Result (dBµV/m) – (Quasi Peak) Limit (dBµV/m)

3.6.5.3 Radiated Emissions (Above 1 GHz)

RSE Bluetooth_2.4G Hopping Radio_2403

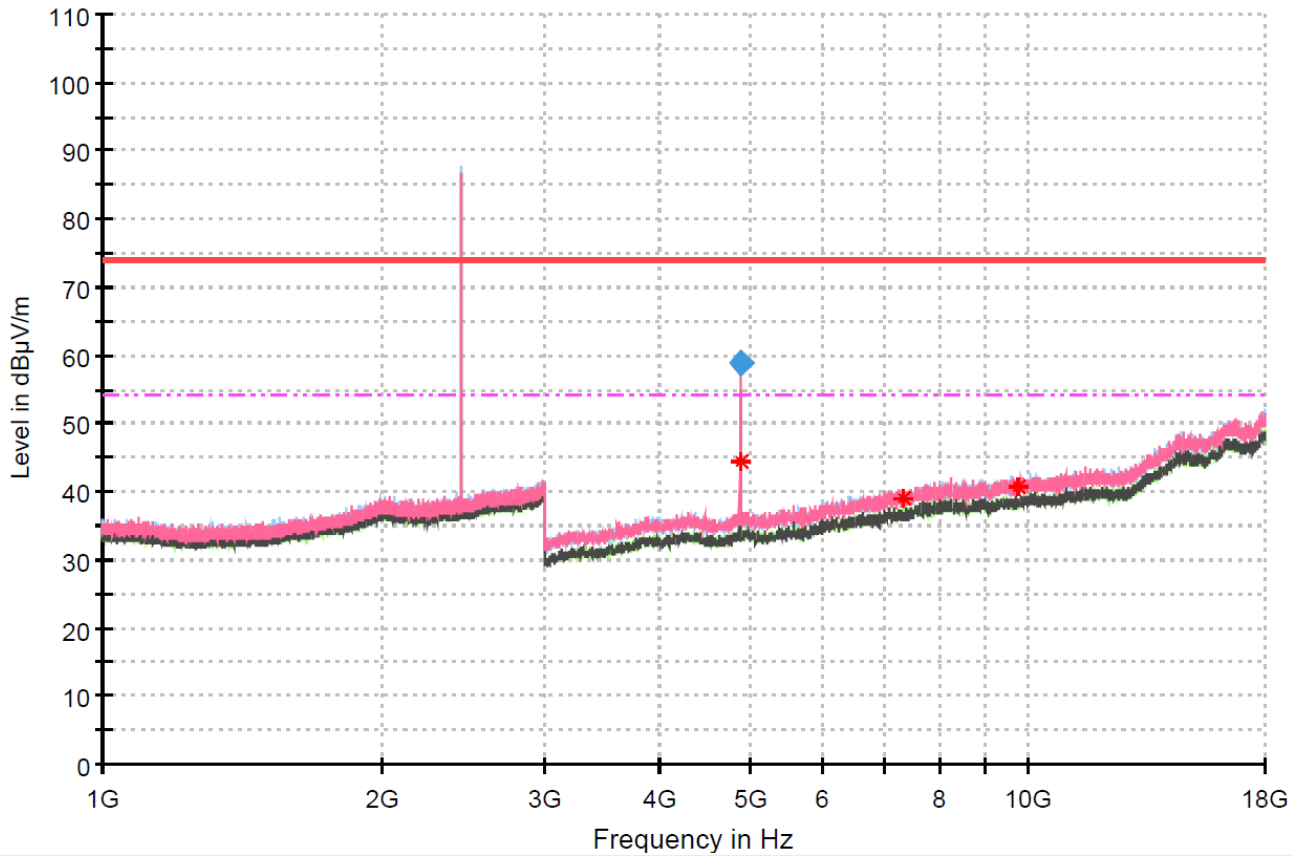


	Frequency [MHz]	Peak Reading Value [dBuV]	Peak Result [dBuV/m]	AVG Reading Value [dBuV]	AVG Result [dBuV/m]	DCCF [dB]	Height [cm]	Pol [H/V]	Azimuth [deg]	Correction Factor [dB/m]	Peak Margin [dB]	Peak Limit [dBuV/m]	AVG Margin [dB]	AVG Limit [dBuV/m]
*	4 804.69	40.00	42.80	---	---	---	163	V	2	2.80	31.20	74.00	---	---
*	4 804.69	---	---	40.00	18.77	-24.03	163	V	2	2.80	---	---	35.23	54.00
	7 208.91	30.89	38.79	---	---	---	200	H	284	7.90	35.21	74.00	---	---
	9 612.19	29.56	40.36	---	---	---	200	V	158	10.80	33.64	74.00	---	---

Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Result (dBuV/m) – (Peak/AVG) Limit (dBuV/m)
6. * - indicates frequency in CFR Part 15 Restricted Band.

RSE Bluetooth_2.4G Hopping Radio_2441

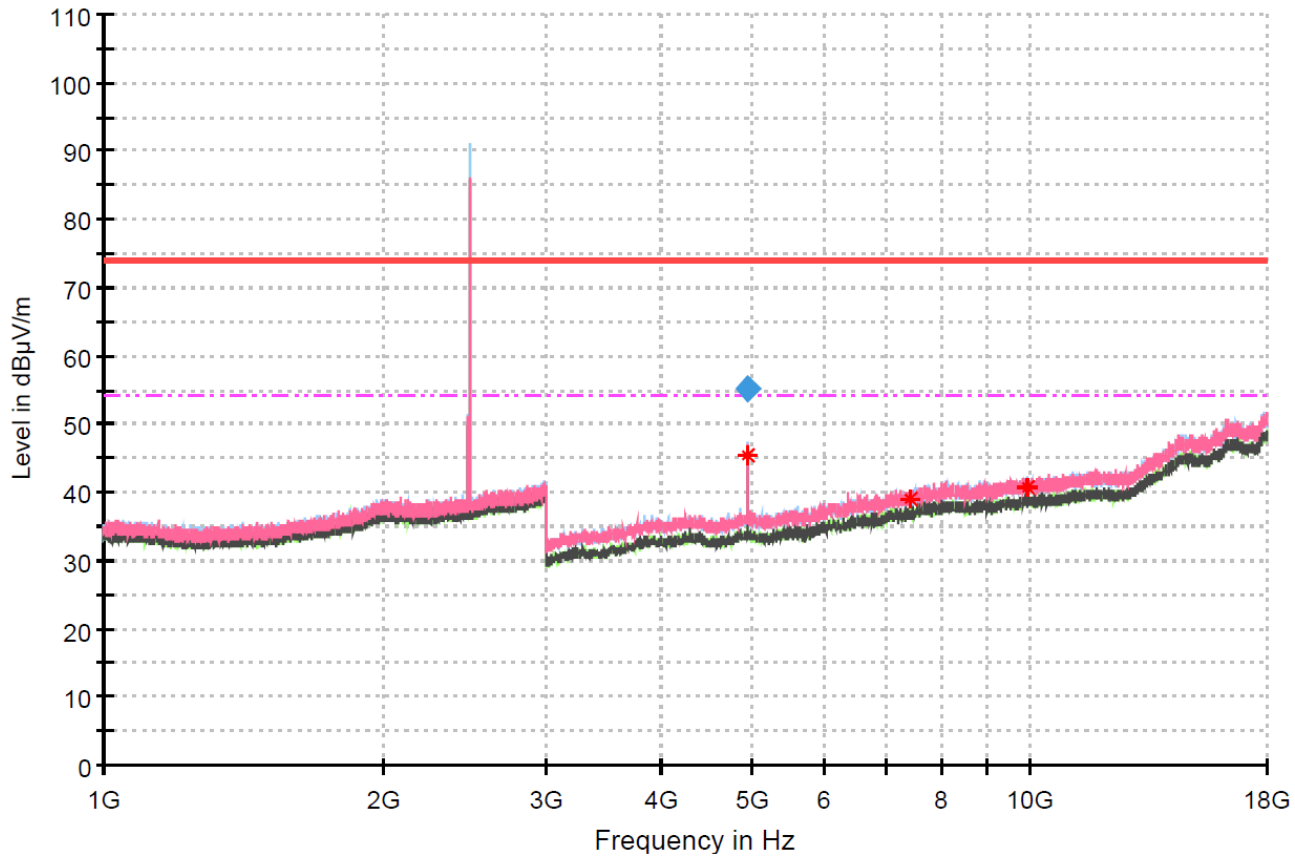


	Frequency [MHz]	Peak Reading Value [dBuV]	Peak Result [dBuV/m]	AVG Reading Value [dBuV]	AVG Result [dBuV/m]	DCCF [dB]	Height [cm]	Pol [H/V]	Azimuth [deg]	Correction Factor [dB/m]	Peak Margin [dB]	Peak Limit [dBuV/m]	AVG Margin [dB]	AVG Limit [dBuV/m]
*	4 881.56	41.25	44.55	---	---	---	200	V	-20	3.30	29.45	74.00	---	---
*	4 881.56	---	---	41.25	20.52	-24.03	200	V	-20	3.30	---	---	33.48	54.00
*	7 322.81	31.05	39.05	---	---	---	300	V	90	8.00	34.95	74.00	---	---
*	7 322.81	---	---	31.05	15.02	-24.03	300	V	90	8.00	---	---	38.98	54.00
	9 764.06	29.85	40.85	---	---	---	200	H	188	11.00	33.15	74.00	---	---

Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Result (dBuV/m) – (Peak/AVG) Limit (dBuV/m)
6. * - indicates frequency in CFR Part 15 Restricted Band.

RSE Bluetooth_2.4G Hopping Radio_2 480



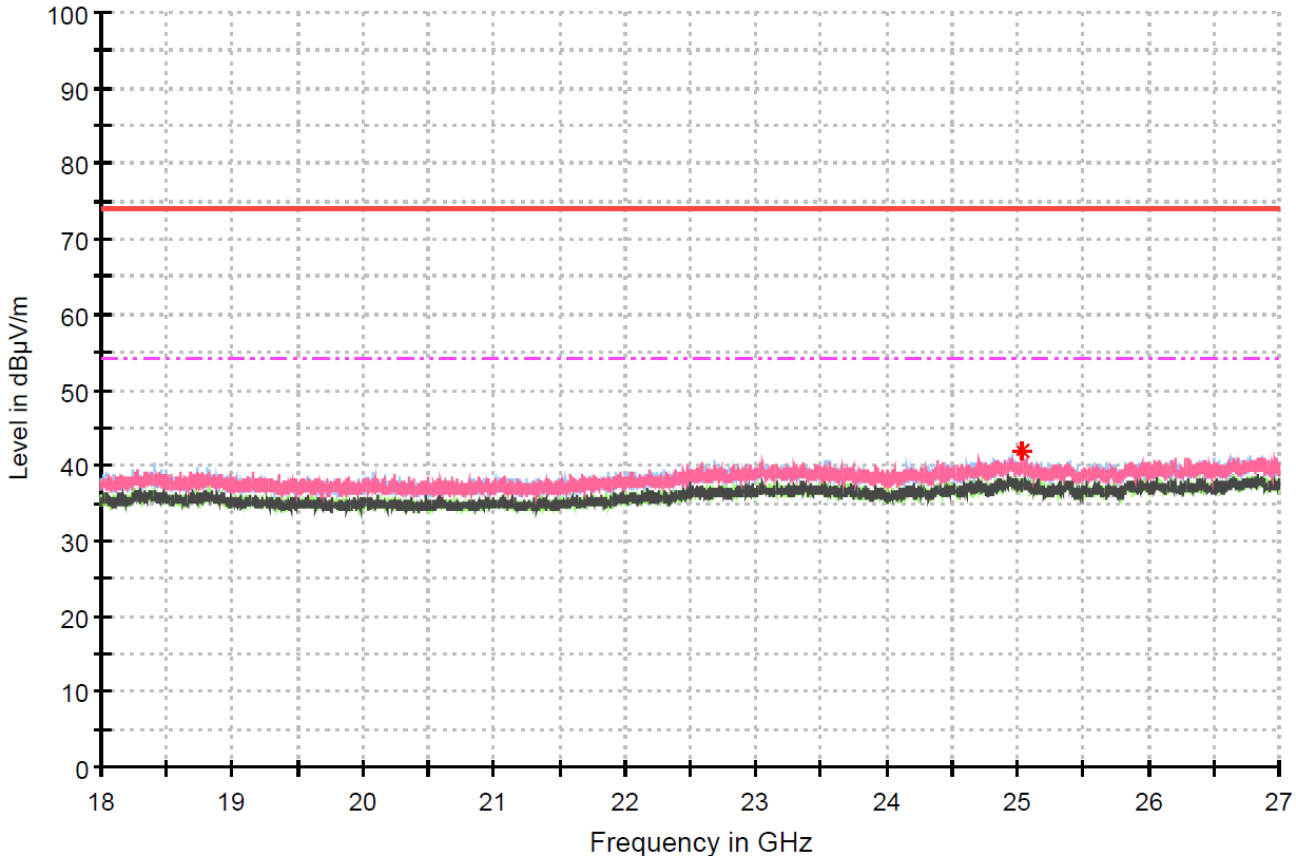
	Frequency [MHz]	Peak Reading Value [dBuV]	Peak Result [dBuV/m]	AVG Reading Value [dBuV]	AVG Result [dBuV/m]	DCCF [dB]	Height [cm]	Pol [H/V]	Azimuth [deg]	Correction Factor [dB/m]	Peak Margin [dB]	Peak Limit [dBuV/m]	AVG Margin [dB]	AVG Limit [dBuV/m]
*	4 960.31	41.75	45.25	---	---	---	250	V	9	3.50	28.75	74.00	---	---
*	4 960.31	---	---	41.75	21.22	-24.03	250	V	9	3.50	---	---	32.78	54.00
*	7 440.00	30.64	39.04	---	---	---	300	H	138	8.40	34.96	74.00	---	---
*	7 440.00	---	---	30.64	15.01	-24.03	300	H	138	8.40	---	---	38.99	54.00
	9 920.16	29.33	40.63	---	---	---	300	V	358	11.30	33.37	74.00	---	---

Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Result (dBuV/m) – (Peak/AVG) Limit (dBuV/m)
6. * - indicates frequency in CFR Part 15 Restricted Band.

3.6.5.4 Radiated Emissions (Above 18 GHz)

Worst Case - RSE(Below 18 GHz)_2.4G Hopping Radio_GFSK_2480



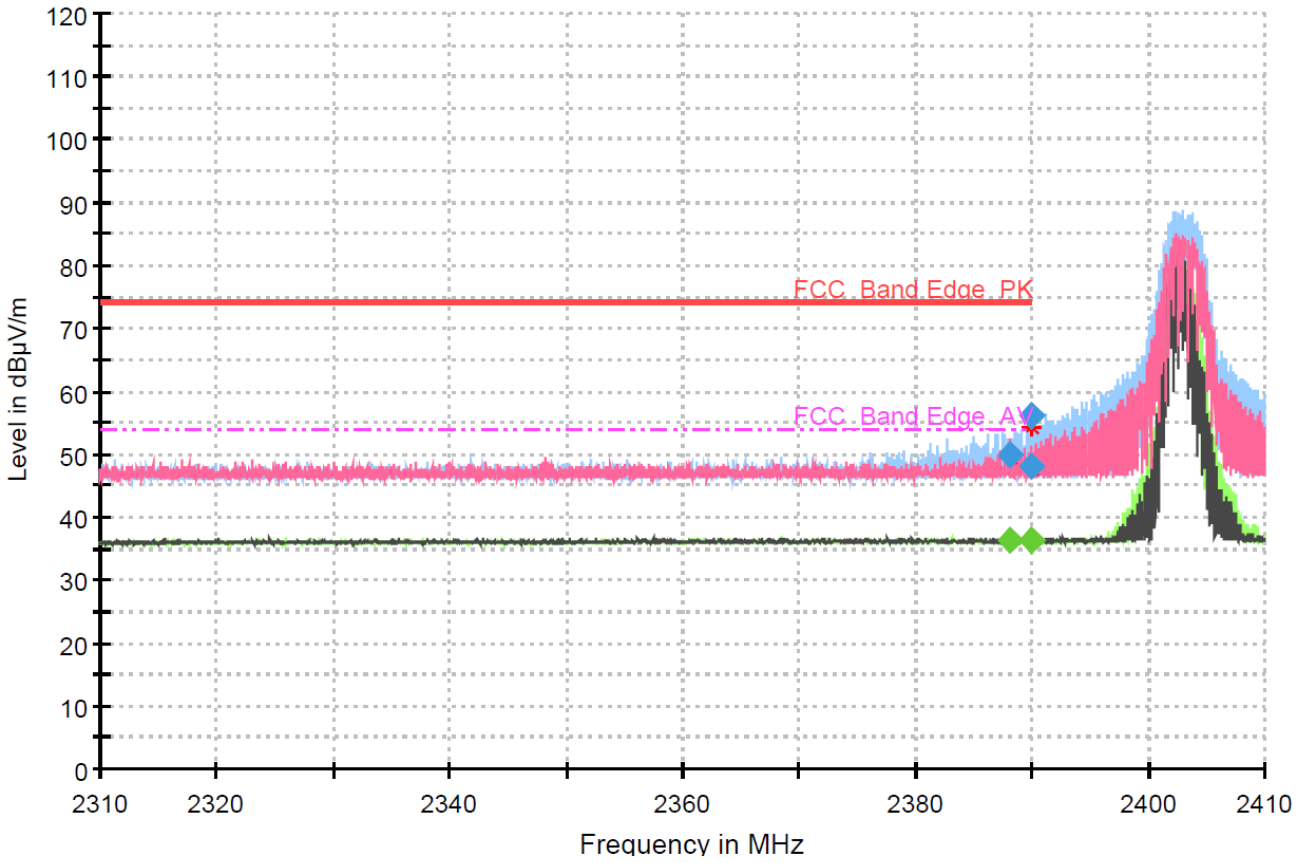
Frequency [MHz]	Peak Reading Value [dBuV]	Peak Result [dBuV/m]	AVG Reading Value [dBuV]	AVG Result [dBuV/m]	DCCF [dB]	Height [cm]	Pol [H/V]	Azimuth [deg]	Correction Factor [dB/m]	Peak Margin [dB]	Peak Limit [dBuV/m]	AVG Margin [dB]	AVG Limit [dBuV/m]
26 822.53	40.01	41.81	-	-	-	200	V	246	1.80	32.19	74.00	-	-

Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Result (dBuV/m) – (Peak/AVG) Limit (dBuV/m)

3.6.5.5 Restricted Band Edge Measurements

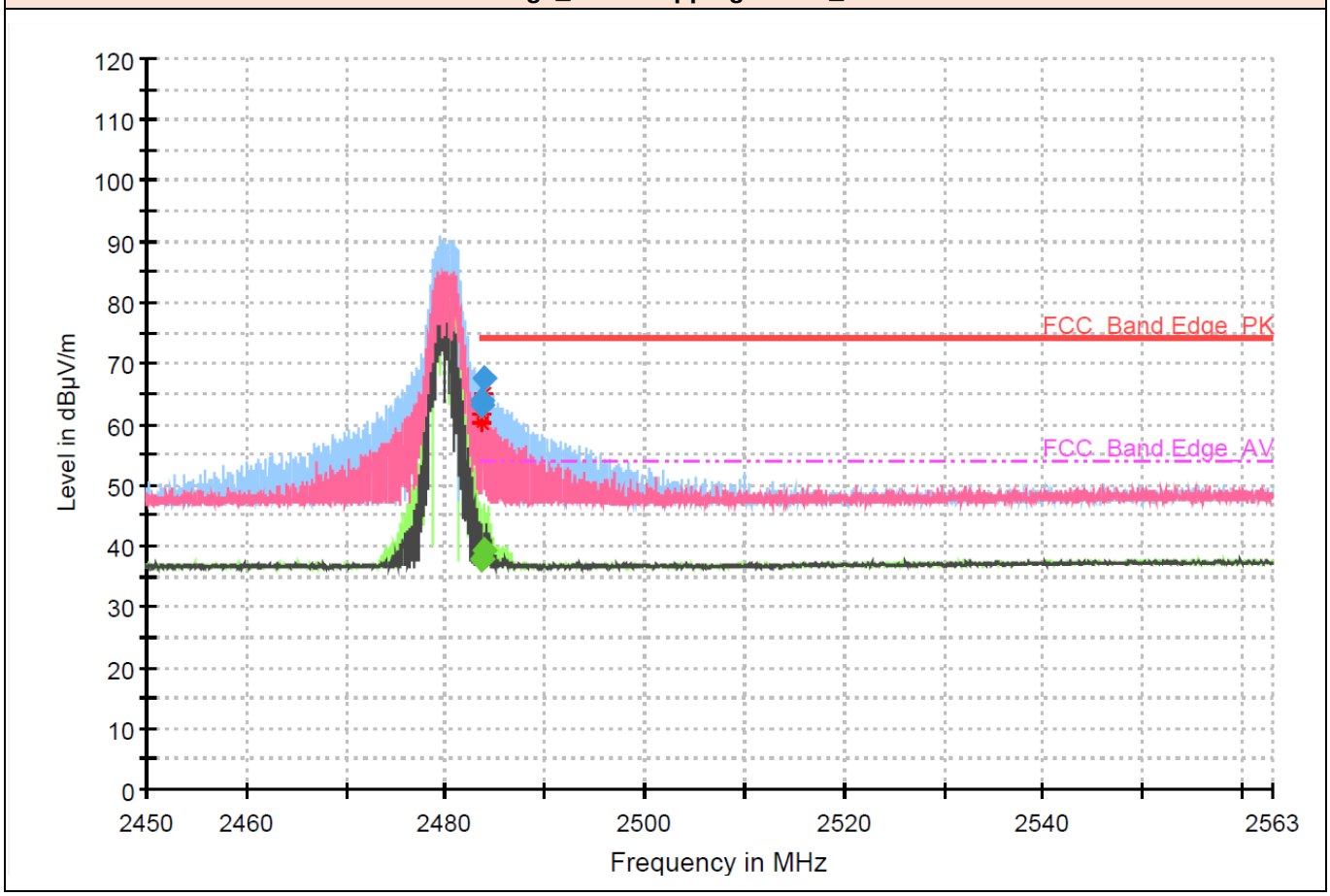
Band Edge_2.4G Hopping Radio_2403



Frequency [MHz]	Peak Reading Value [dBuV]	Peak Result [dBuV/m]	AVG Reading Value [dBuV]	AVG Result [dBuV/m]	DCCF [dB]	Height [cm]	Pol [H/V]	Azimuth [deg]	Correction Factor [dB/m]	Peak Margin [dB]	Peak Limit [dBuV/m]	AVG Margin [dB]	AVG Limit [dBuV/m]
2 388.10	46.63	50.03	---	---	---	330	V	352	3.40	23.97	74.00	---	---
2 388.10	---	---	36.35	25.97	-24.06	330	V	352	3.40	---	---	28.03	54.00
2 389.89	44.74	48.14	---	---	---	350	H	227	3.40	25.86	74.00	---	---
2 389.89	---	---	36.35	24.08	-24.06	350	H	227	3.40	---	---	29.92	54.00
2 390.00	52.77	56.17	---	---	---	150	H	19	3.40	17.83	74.00	---	---
2 390.00	---	---	36.39	32.11	-24.06	150	H	19	3.40	---	---	21.89	54.00

Remarks
1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Result (dBuV/m) – (Peak/AVG) Limit (dBuV/m)

Band Edge_2.4G Hopping Radio_2 480

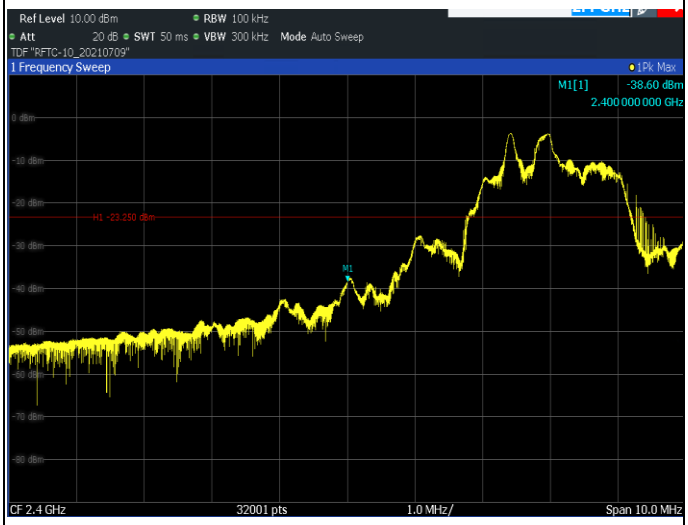
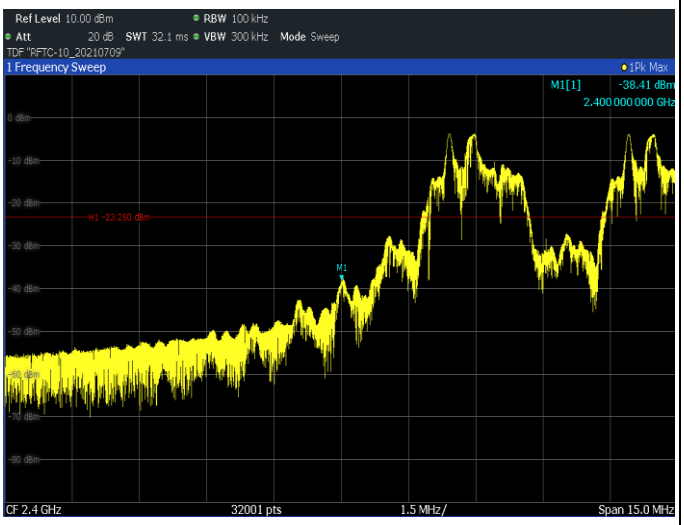
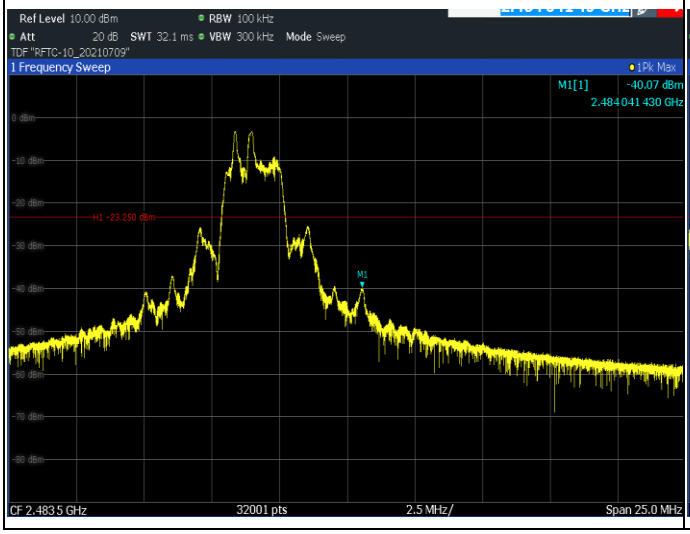
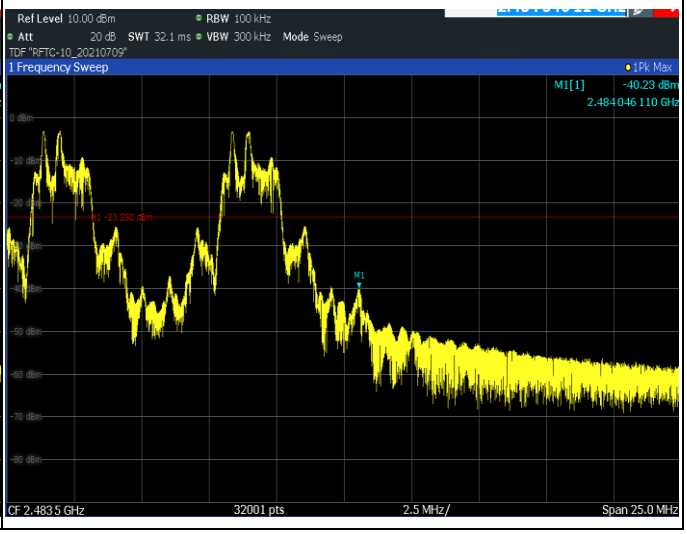


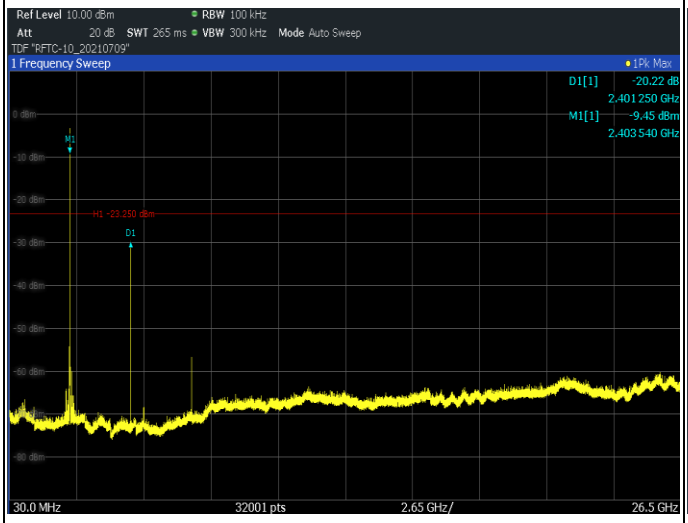
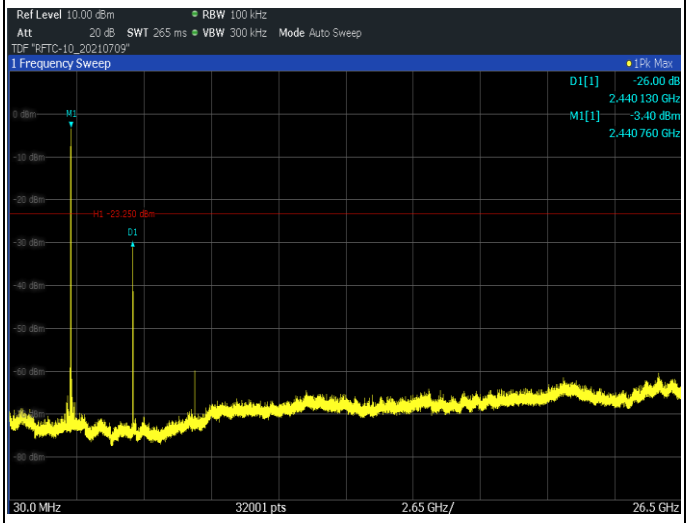
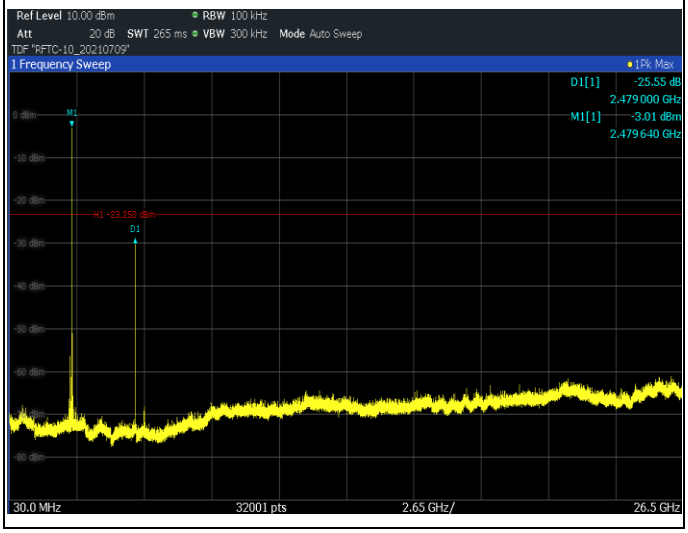
Frequency [MHz]	Peak Reading Value [dBuV]	Peak Result [dBuV/m]	AVG Reading Value [dBuV]	AVG Result [dBuV/m]	DCCF [dB]	Height [cm]	Pol [H/V]	Azimuth [deg]	Correction Factor [dB/m]	Peak Margin [dB]	Peak Limit [dBuV/m]	AVG Margin [dB]	AVG Limit [dBuV/m]
2 483.50	59.26	63.06	---	---	---	278	H	311	3.80	10.94	74.00	---	---
2 483.50	---	---	37.77	39.00	-24.06	278	H	311	3.80	---	---	15.00	54.00
2 483.55	59.97	63.77	---	---	---	264	V	-6	3.80	10.23	74.00	---	---
2 483.55	---	---	37.93	39.71	-24.06	264	V	-6	3.80	---	---	14.29	54.00
2 483.88	63.70	67.50	---	---	---	159	H	44	3.80	6.50	74.00	---	---
2 483.88	---	---	39.41	43.44	-24.06	159	H	44	3.80	---	---	10.56	54.00

Remarks

1. Peak Result(dBuV/m) = Peak Reading Value(dBuV) + Correction Factor(dB/m)
2. AVG Result(dBuV/m) = Peak Result(dBuV/m) + DCCF
3. DCCF(Duty Cycle Correction Factor) = 20 x Log(worst dwell time/100 ms)
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor (dB)
5. Margin(dB) = (Peak/AVG) Result (dBuV/m) – (Peak/AVG) Limit (dBuV/m)

3.6.6 Test Result of Conducted Spurious Emission

Band Edge – 2.4G Hopping Radio	
2 403 MHz	Hopping_Low edge
	
2 480 MHz	Hopping_High edge
	

Spurious – 2.4G Hopping Radio	
2 403 MHz	**2 441 MHz**
	
2 480 MHz	
	

3.7 AC Conducted Emissions (150 kHz to 30 MHz)

3.7.1 Regulation

§15.207(a) : Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

	Conducted limit (dBµV)	
Frequency of emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

3.7.2 Test Procedure

a) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm / 50 µH of coupling impedance for the measuring instrument.

b) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

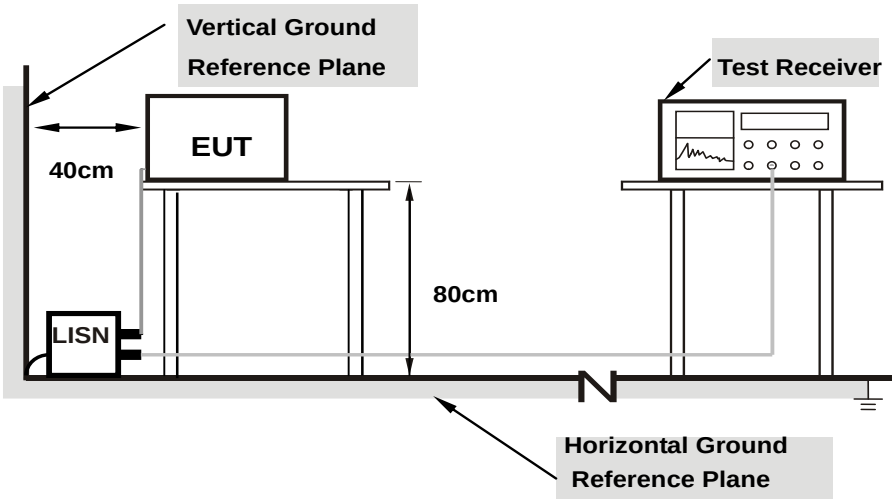
c) The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Remark : The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

3.7.3 Deviation from Test Standard

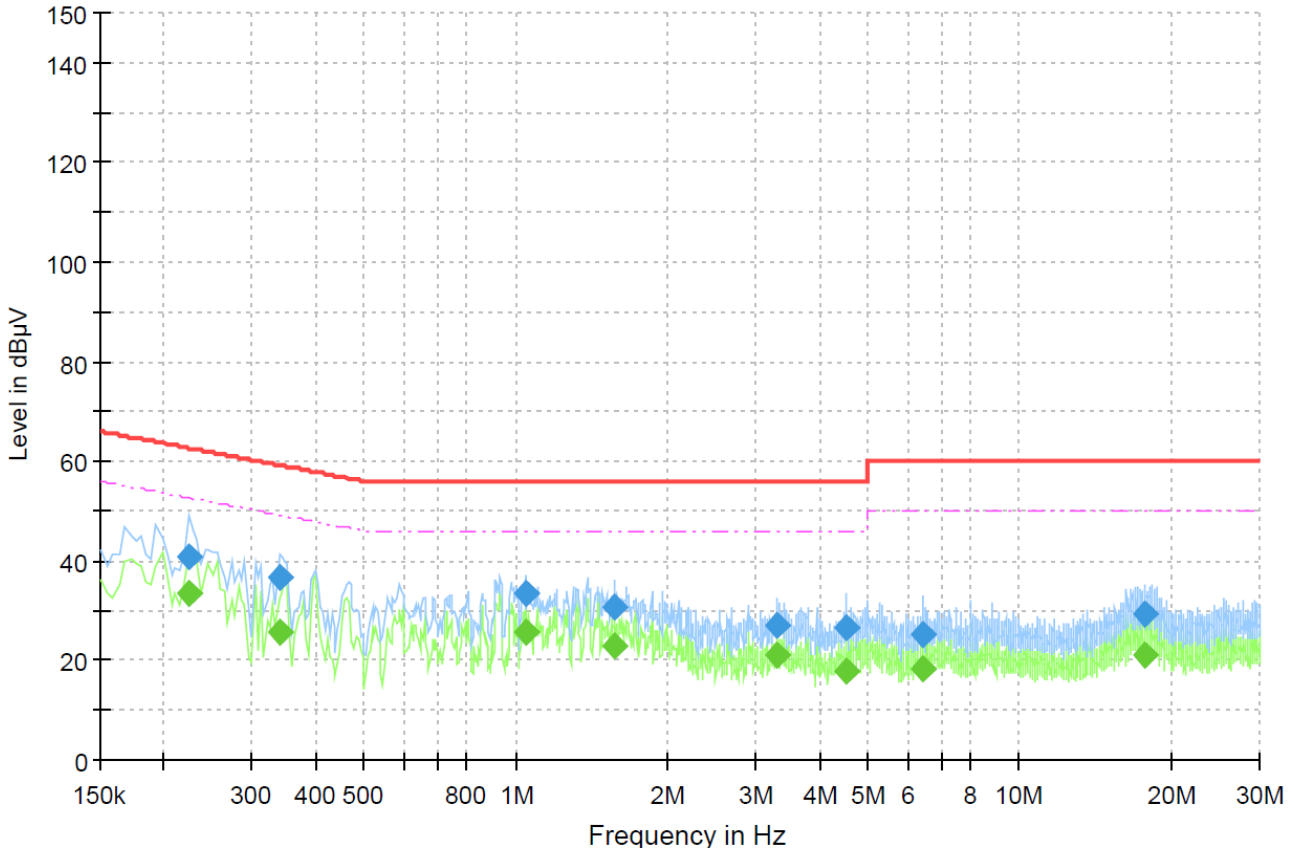
No deviation.

3.7.4 Test Setup



3.7.5 Test Result

Worst Case – 2.4G Hopping Radio_GFSK_2480



Frequency [MHz]	Quasi Peak Reading Value [dBuV]	Quasi Peak Result [dBuV]	CAV Reading Value [dBuV]	CAV Result [dBuV]	Line	Correction Factor [dB/m]	Quasi Peak Margin [dBuV]	Quasi Peak Limit [dBuV]	CAV Margin [dBuV]	CAV Limit [dBuV]
0.22	31.42	41.02	---	---	L1	9.60	23.53	64.55	---	---
0.22	---	---	23.67	33.27	L1	9.60	---	---	21.39	54.66
0.34	26.93	36.53	---	---	L1	9.60	19.47	56.00	---	---
0.34	---	---	16.06	25.66	L1	9.60	---	---	20.34	46.00
1.05	24.06	33.66	---	---	L1	9.60	22.34	56.00	---	---
1.05	---	---	16.01	25.61	L1	9.60	---	---	20.39	46.00
1.57	21.07	30.67	---	---	L1	9.60	25.33	56.00	---	---
1.57	---	---	13.13	22.73	L1	9.60	---	---	23.27	46.00
3.30	17.53	27.13	---	---	L1	9.60	28.87	56.00	---	---
3.30	---	---	11.35	20.95	L1	9.60	---	---	25.05	46.00
4.54	16.88	26.58	---	---	L1	9.70	29.42	56.00	---	---
4.54	---	---	8.19	17.89	L1	9.70	---	---	28.11	46.00
6.45	15.52	25.22	---	---	L1	9.70	30.78	56.00	---	---
6.45	---	---	8.52	18.22	L1	9.70	---	---	27.78	46.00
17.77	19.44	29.34	---	---	N	9.90	26.66	56.00	---	---
17.77	---	---	11.39	21.29	N	9.90	---	---	24.71	46.00

Remarks
1. Final Value (QP and/or CAV) = Reading Value (QP and/or CAV) + Corr. (LISN Insertion Loss + Cable Loss)
Margin (QP and/or CAV) = Limit – Final Value (QP and/or CAV)
QP = Quasi-Peak, CAV = CISPR-Average, Corr. = Correction Factor
2. Two graphs measured for both Live (L1) and Neutral (N) of the LISN are combined into one graph.

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services Korea. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

Test Firm Name : BV CPS ADT Korea Ltd.

Address : Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675 KOREA

FCC

Designation Number : KR0158
Test Firm Registration Number : 666061

ISED

Designation Number : KR0158
Test Firm Registration Number : 25944

If you have any comments, please feel free to contact us at the following:

Email: Meyer.Shin@bureauveritas.com
Web Site: www.bureauveritas.co.kr/cps/eaw

The address and road map of all our labs can be found in our web site also.

- End of report -