

# Test Report

**Report No.:** MTi211223003-04E1

**Date of issue:** Mar. 05, 2022

**Applicant:** Shenzhen Jiayz photo industrial., Ltd

**Product:** Microphone

**Model(s):** Vlink2 HU

**FCC ID:** 2ARN3-VLINK2HU

Shenzhen Microtest Co., Ltd.

<http://www.mtitest.com>

## Instructions

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2. The test results in this test report are only responsible for the samples submitted
3. This test report is invalid without the seal and signature of the laboratory.
4. This test report is invalid if transferred, altered, or tampered with in any form without authorization.
5. Any objection to this test report shall be submitted to the laboratory within 15 days from the date of receipt of the report.


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<b>Test Result Certification</b>	
<b>Applicant:</b>	<b>Shenzhen Jiayz photo industrial., Ltd</b>
Address:	A16 Building, Intelligent Terminal Industrial Park of Silicon Valley Power, Guanlan, Longhua District, Shenzhen, China
<b>Manufacturer:</b>	<b>Shenzhen Jiayz photo industrial., Ltd</b>
Address:	A16 Building, Intelligent Terminal Industrial Park of Silicon Valley Power, Guanlan, Longhua District, Shenzhen, China
<b>Factory:</b>	<b>Shenzhen Jiayz photo industrial., Ltd</b>
Address:	A16 Building, Intelligent Terminal Industrial Park of Silicon Valley Power, Guanlan, Longhua District, Shenzhen, China
<b>Product description</b>	
Product name:	Microphone
Trademark:	N/A
Model name:	Vlink2 HU
Serial Model:	N/A
Standards:	FCC 47 CFR Part 15 Subpart C
Test method:	ANSI C63.10-2013
<b>Date of Test</b>	
Date of test:	2022-01-10 ~ 2022-03-05
Test result:	Pass

**Test Engineer :**


(Yanice Xie)

**Reviewed By: :**


(Leon Chen)

**Approved By: :**


(Tom Xue)

## 1 General Description

### 1.1 Description of the EUT

Product name:	Microphone
Model name:	Vlink2 HU
Series Model:	N/A
Model difference:	N/A
Electrical rating:	Input: DC 5V 1A Battery: Accepts two AA batteries or an customized rechargeable Li-ion battery.
Hardware version:	V1.1
Software version:	V1.1
Accessories:	Cable: USB-A to USB-C cable (1.2m)
EUT serial number:	MTi211223003-04-S0001
<b>RF specification:</b>	
Operation frequency:	2406MHz - 2474MHz
Modulation type:	GFSK
Antenna designation:	Whip antenna, antenna Gain: 5.33 dBi
Max. peak conducted output power:	3.273 dBm

### 1.2 Description of test modes

#### 1.2.1 Operation channel list

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2406	12	2450
2	2410	13	2454
3	2414	14	2458
4	2418	15	2462
5	2422	16	2466
6	2426	17	2470
7	2430	18	2474
8	2434		
9	2438		
10	2442		
11	2446		

### 1.2.2 Test channels

Chanel	Frequency
Lowest (CH1)	2406MHz
Middle (CH9)	2438MHz
Highest (CH18)	2474MHz

Note: The test software has been used to control EUT for working in engineering mode, that enables selectable channel, and capable of continuous transmitting mode.

### 1.2.3 Description of support units

Support equipment list			
Description	Model	Serial No.	Manufacturer
Adapter	HW-090200CH1	/	Huizhou BYD Electronics Co., Ltd.
Headphone	/	/	/
Speaker	E-BS19578	/	China Etech Groups Ltd

### 1.3 Measurement uncertainty

Parameter	Measurement uncertainty
AC power line conducted emission (9 kHz~30 MHz)	±2.5 dB
Occupied Bandwidth	±3 %
Conducted RF output power	±0.16 dB
Conducted spurious emissions	±0.21 dB
Radiated emission (9 kHz ~ 30 MHz)	±4.0 dB
Radiated emission (30 MHz~1 GHz)	±4.2 dB
Radiated emission (above 1 GHz)	±4.3 dB

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

## 2 Summary of Test Result

No.	FCC reference	Description of test	Result
1	§ 15.203	Antenna requirement	Pass
2	§ 15.207	AC power line conducted emissions	Pass
3	15.247(a)(1)	20dB occupied bandwidth	Pass
4	15.247(b)(1)	Conducted peak output power	Pass
5	15.247(a)(1)	Carrier Frequencies Separation	Pass
6	15.247(a)(1)	Average time of occupancy (Dwell time)	Pass
7	15.247(a)(1)	Number of hopping channels	Pass
8	15.247(d)	Conducted emission at the band edge	Pass
9	15.247(d)	Conducted spurious emissions	Pass
10	15.247(d)	Radiated spurious emissions	Pass

**Note:** N/A means not applicable.

### 3 Test Facilities and Accreditations

#### 3.1 Test laboratory

Test laboratory:	Shenzhen Microtest Co., Ltd.
Test site location:	101, No. 7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	(86-755)88850135
Fax:	(86-755)88850136
CNAS Registration No.:	CNAS L5868
FCC Registration No.:	448573



## 4 Equipment List

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
MTi-E002	EMI Test Receiver	R&S	ESCI3	101368	2021/06/02	2022/06/01
MTi-E023	Artificial power network	Schwarzbeck	NSLK8127	NSLK8127# 841	2021/06/02	2022/06/01
MTi-E025	Artificial power network	Schwarzbeck	NSLK8127	8127183	2021/06/02	2022/06/01
MTi-E043	EMI test receiver	R&S	ESCI7	101166	2021/06/02	2022/06/01
MTi-E046	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00044	2021/05/30	2023/05/29
MTi-E044	Broadband antenna	Schwarzbeck	VULB9163	9163-1338	2021/05/30	2023/05/29
MTi-E045	Horn antenna	Schwarzbeck	BBHA9120D	9120D-2278	2021/05/30	2023/05/29
MTi-E047	Pre-amplifier	Hewlett-Packard	8447F	3113A06184	2021/06/02	2022/06/01
MTi-E048	Pre-amplifier	Agilent	8449B	3008A01120	2021/06/02	2022/06/01
MTi-E120	Broadband antenna	Schwarzbeck	VULB9163	9163-1419	2021/05/30	2023/05/29
MTi-E121	Pre-amplifier	Hewlett-Packard	8447D	2944A09365	2021/04/16	2022/04/15
MTi-E123	Pre-amplifier	Agilent	8449B	3008A04723	2021/05/06	2022/05/05
MTi-E135	Horn antenna	Schwarzbeck	BBHA 9170	00987	2021/05/30	2023/05/29
MTi-E136	Pre-amplifier	Space-Dtronics	EVLAN1840G -G45	210405001	2021/06/02	2022/06/01
MTi-E062	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2021/06/23	2022/06/22
MTi-E067	RF Control Unit	Tonscend	JS0806-1	19D8060152	2021/06/02	2022/06/01
MTi-E068	RF Control Unit	Tonscend	JS0806-2	19D8060153	2021/06/02	2022/06/01
MTi-E069	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2021/06/02	2022/06/01
MTi-E010S	EMI Measurement Software	Farad	EZ-EMC Ver. EMEC-3A1	/	/	/
MTi-E014S	RF Test System	Tonscend	TS@JS1120 V2.6.88.0330	/	/	/

## 5 Test Result

### 5.1 Antenna requirement

#### 15.203 requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### Description of the antenna of EUT

The antenna of EUT is Whip antenna (Antenna Gain: 5.33 dBi). which is no consideration of replacement.

## 5.2 AC power line conducted emissions

### 5.2.1 Limits

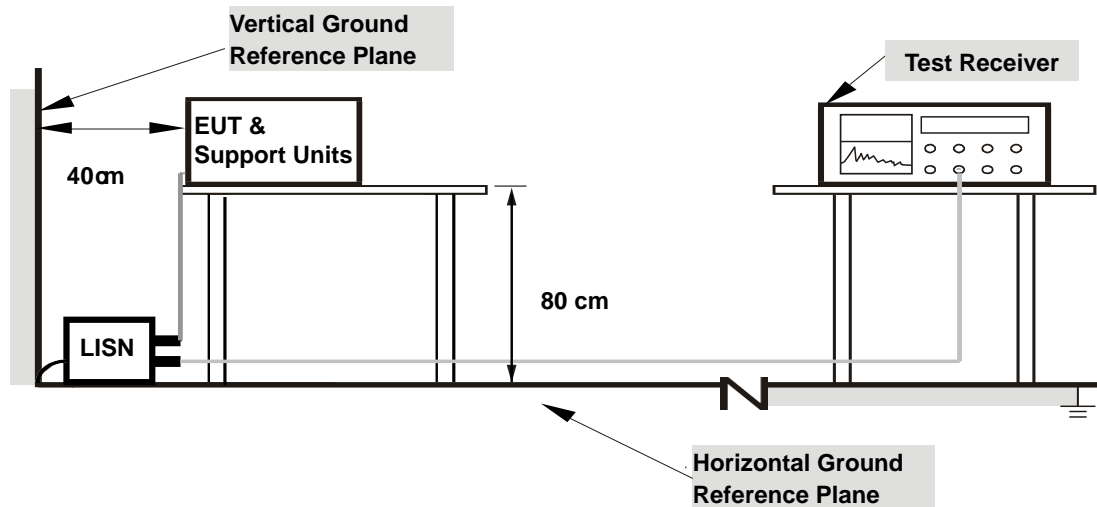
Frequency (MHz)	Detector type / Bandwidth	Limit-Quasi-peak dB $\mu$ V	Limit-Average dB $\mu$ V
0.15 -0.5	Average / 9 kHz	66 to 56	56 to 46
0.5 -5		56	46
5 -30		60	50

**Note 1:** the limit decreases with the logarithm of the frequency in the range of 0.15 MHz to 0.5 MHz.

### 5.2.2 Test Procedures

- The test setup is refer to the standard ANSI C63.10-2013.
- The EUT is connected to the main power through a line impedance stabilization network (LISN). All support equipment is powered from additional LISN(s).
- Emissions were measured on each current carrying line of the EUT using an EMI test receiver connected to the LISN powering the EUT.
- The test receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes described in Item 1.2.
- The test data of the worst-case condition(s) was recorded.

### 5.2.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the test setup.

### 5.2.4 Test Result

#### Notes:

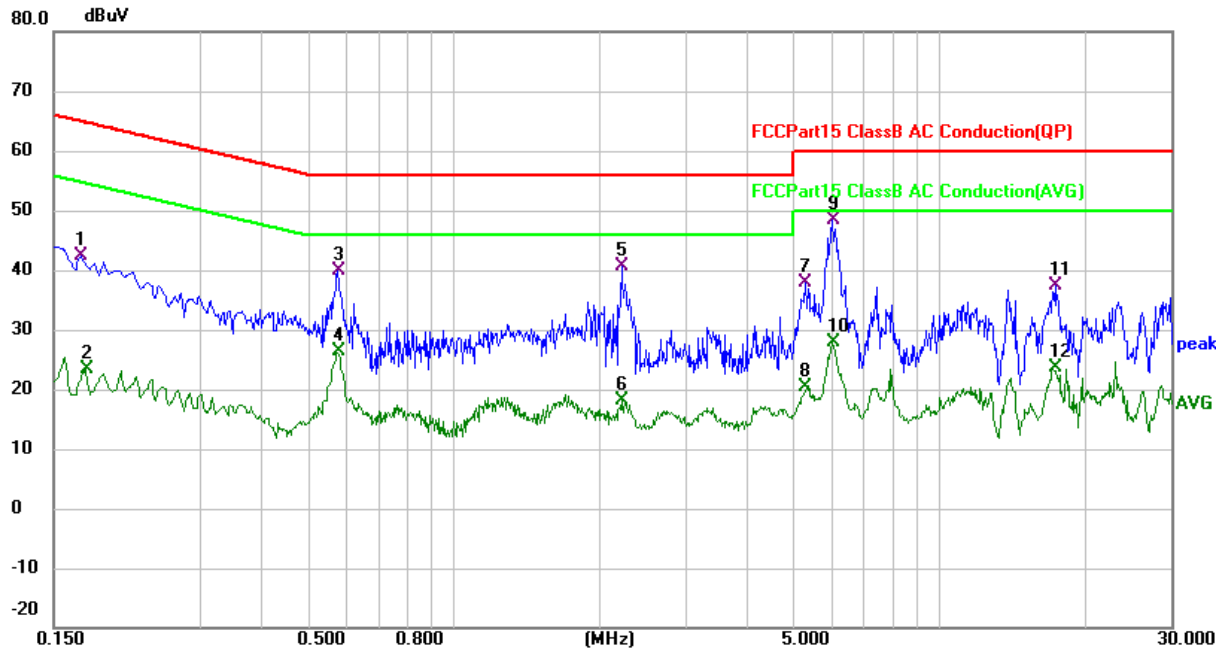
All modes of operation of the EUT were investigated, and only the worst-case results are reported.

#### Calculation formula:

Measurement (dB $\mu$ V) = Reading Level (dB $\mu$ V) + Correct Factor (dB)

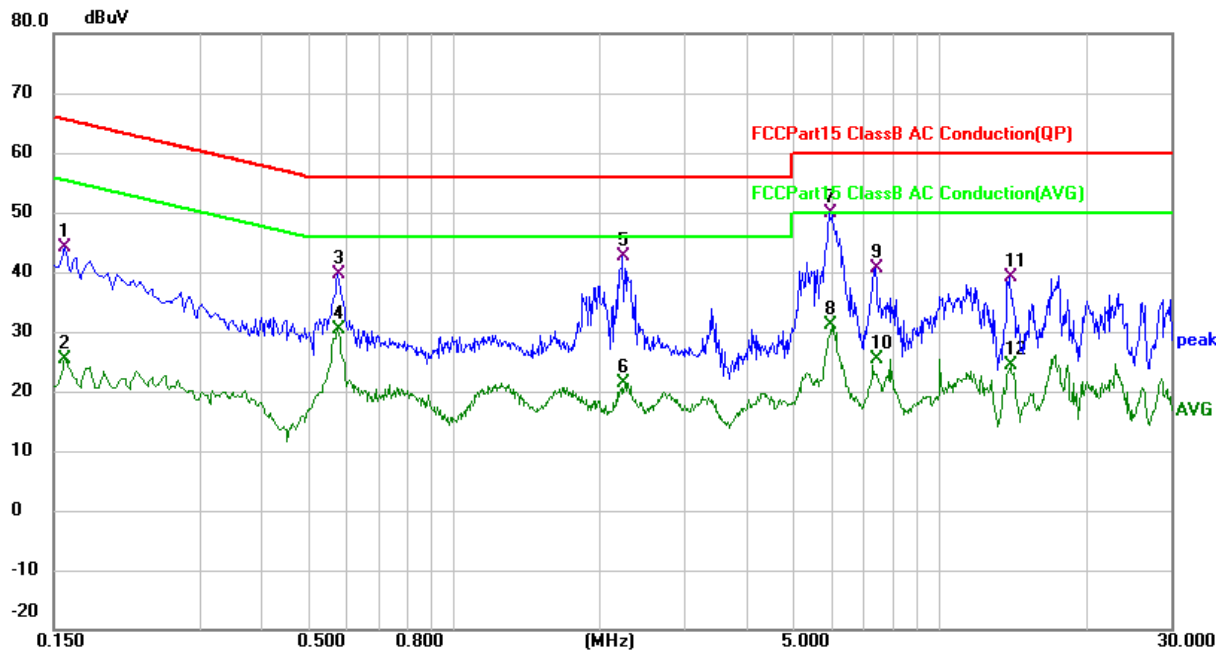
Over (dB) = Measurement (dB $\mu$ V) – Limit (dB $\mu$ V)

Test mode:	Charging+TX	Phase:	L
Power supply:	Power by AC/DC adapter (AC 120V/60Hz)	Test site:	CE chamber 1



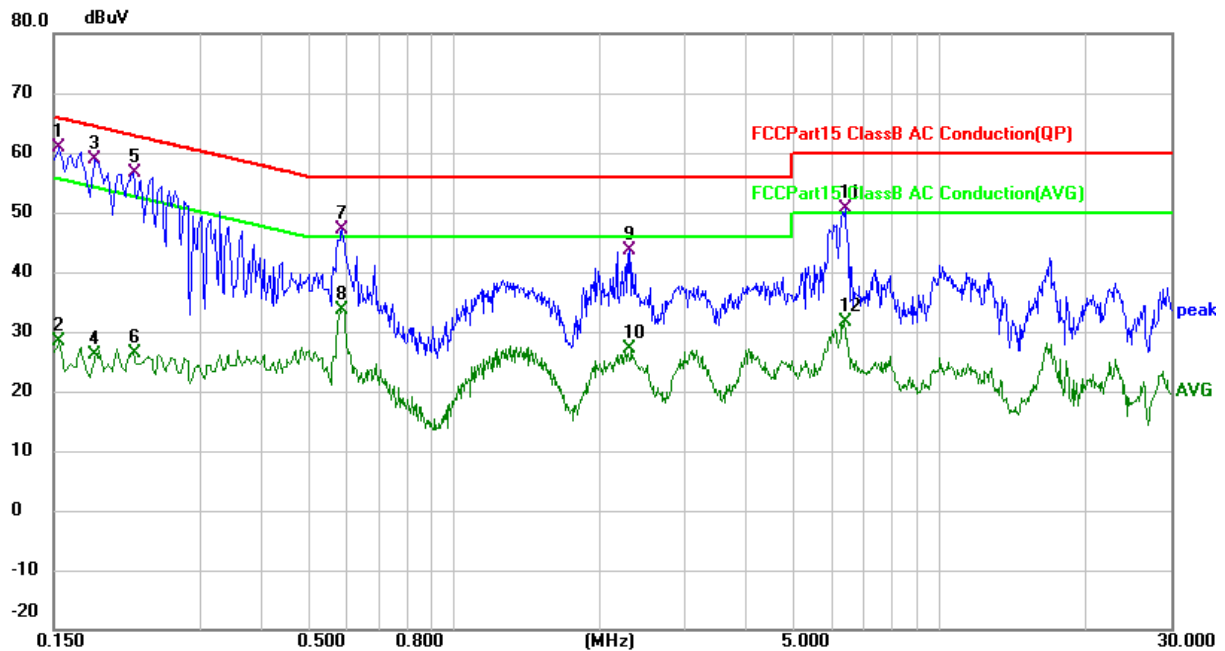
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.1700	31.50	10.98	42.48	64.96	-22.48	QP
2		0.1740	12.33	10.98	23.31	54.77	-31.46	AVG
3		0.5780	28.88	11.07	39.95	56.00	-16.05	QP
4		0.5780	15.25	11.07	26.32	46.00	-19.68	AVG
5		2.2180	24.80	15.86	40.66	56.00	-15.34	QP
6		2.2180	2.23	15.86	18.09	46.00	-27.91	AVG
7		5.3300	26.50	11.50	38.00	60.00	-22.00	QP
8		5.3300	9.00	11.50	20.50	50.00	-29.50	AVG
9	*	6.0380	36.79	11.55	48.34	60.00	-11.66	QP
10		6.0380	16.41	11.55	27.96	50.00	-22.04	AVG
11		17.3819	25.51	11.78	37.29	60.00	-22.71	QP
12		17.3819	11.86	11.78	23.64	50.00	-26.36	AVG

Test mode:	Charging+TX	Phase:	N
Power supply:	Power by AC/DC adapter (AC 120V/60Hz)	Test site:	CE chamber 1



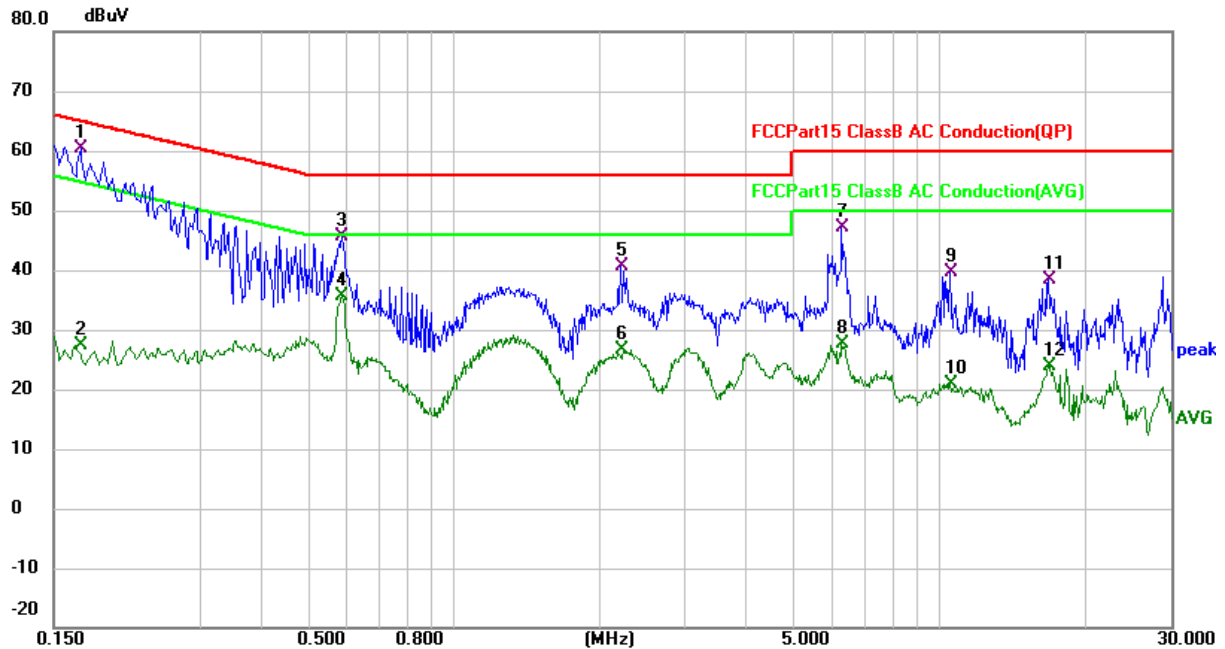
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.1580	33.20	10.98	44.18	65.57	-21.39	QP
2		0.1580	14.48	10.98	25.46	55.57	-30.11	AVG
3		0.5780	28.63	10.96	39.59	56.00	-16.41	QP
4		0.5780	19.45	10.96	30.41	46.00	-15.59	AVG
5		2.2340	26.77	15.86	42.63	56.00	-13.37	QP
6		2.2340	5.46	15.86	21.32	46.00	-24.68	AVG
7	*	5.9580	38.60	11.39	49.99	60.00	-10.01	QP
8		5.9580	19.66	11.39	31.05	50.00	-18.95	AVG
9		7.4020	29.21	11.42	40.63	60.00	-19.37	QP
10		7.4020	14.05	11.42	25.47	50.00	-24.53	AVG
11		13.9380	27.56	11.67	39.23	60.00	-20.77	QP
12		13.9380	12.79	11.67	24.46	50.00	-25.54	AVG

Test mode:	Charging+TX	Phase:	L
Power supply:	Power by AC/DC adapter (AC 240V/60Hz)	Test site:	CE chamber 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1	*	0.1539	49.78	10.99	60.77	65.79	-5.02	QP
2		0.1539	17.34	10.99	28.33	55.79	-27.46	AVG
3		0.1819	47.87	10.97	58.84	64.40	-5.56	QP
4		0.1819	15.08	10.97	26.05	54.40	-28.35	AVG
5		0.2180	45.60	10.98	56.58	62.89	-6.31	QP
6		0.2180	15.38	10.98	26.36	52.89	-26.53	AVG
7		0.5899	36.06	11.07	47.13	56.00	-8.87	QP
8		0.5899	22.67	11.07	33.74	46.00	-12.26	AVG
9		2.3020	27.70	16.00	43.70	56.00	-12.30	QP
10		2.3020	11.05	16.00	27.05	46.00	-18.95	AVG
11		6.3859	39.06	11.57	50.63	60.00	-9.37	QP
12		6.3859	19.98	11.57	31.55	50.00	-18.45	AVG

Test mode:	Charging+TX	Phase:	N
Power supply:	Power by AC/DC adapter (AC 240V/60Hz)	Test site:	CE chamber 1



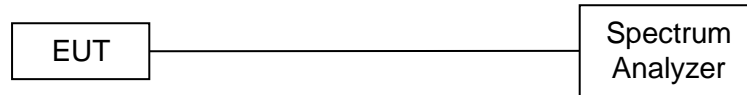
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1	*	0.1700	49.35	10.96	60.31	64.96	-4.65	QP
2		0.1700	16.49	10.96	27.45	54.96	-27.51	AVG
3		0.5899	34.74	10.97	45.71	56.00	-10.29	QP
4		0.5899	24.65	10.97	35.62	46.00	-10.38	AVG
5		2.2020	24.79	15.80	40.59	56.00	-15.41	QP
6		2.2020	10.93	15.80	26.73	46.00	-19.27	AVG
7		6.3140	35.71	11.39	47.10	60.00	-12.90	QP
8		6.3140	16.16	11.39	27.55	50.00	-22.45	AVG
9		10.5620	27.99	11.57	39.56	60.00	-20.44	QP
10		10.5620	9.40	11.57	20.97	50.00	-29.03	AVG
11		16.8380	26.71	11.75	38.46	60.00	-21.54	QP
12		16.8380	12.07	11.75	23.82	50.00	-26.18	AVG

### 5.3 20dB occupied bandwidth

#### 5.3.1 Limits

None, for reporting purposes only.

#### 5.3.2 Test setup



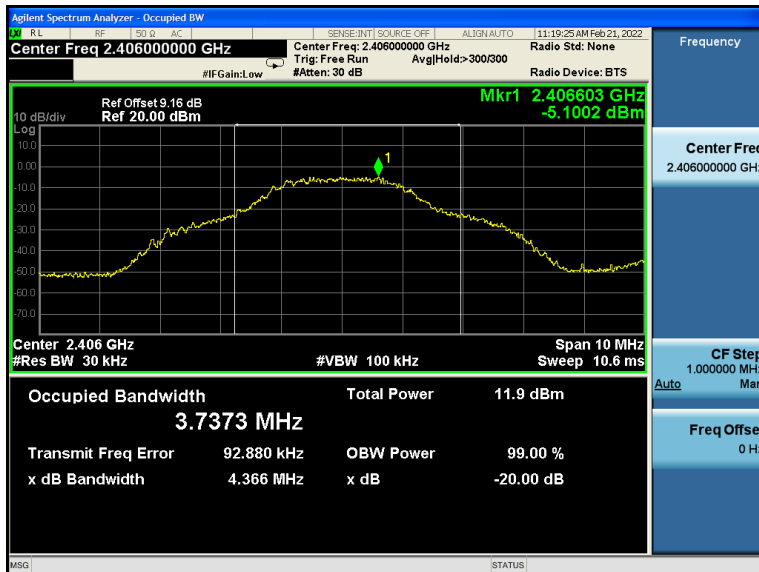
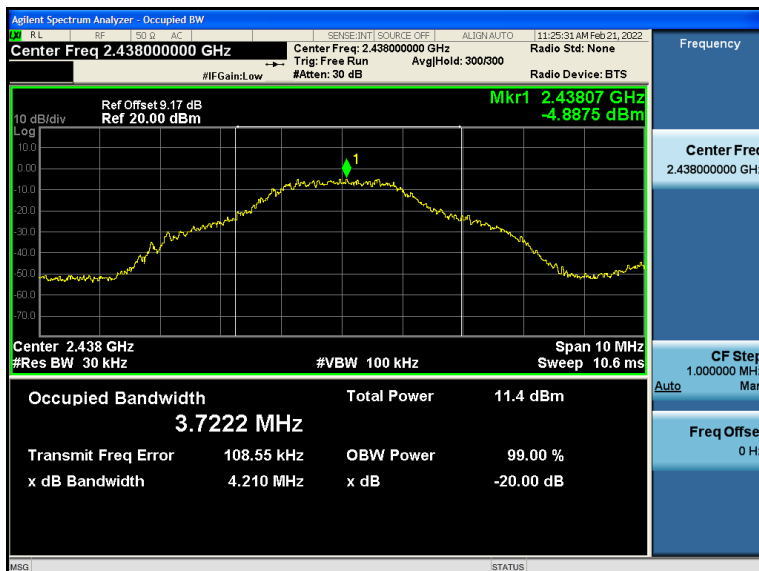
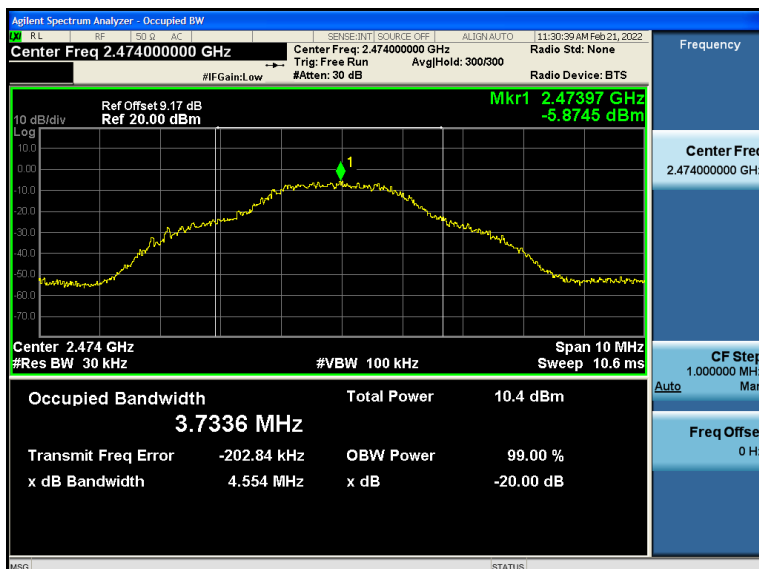
#### 5.3.3 Test procedures

- a) Test method: ANSI C63.10-2013 Section 6.9.2.
- b) The transmitter output of EUT is connected to the spectrum analyzer.
- c) Spectrum analyzer setting: RBW=30 kHz, VBW=100 kHz, detector= Peak

#### 5.3.4 Test results

Mode	Test channel	Frequency (MHz)	20dB Bandwidth (MHz)
GFSK	CH1	2406	4.366
	CH9	2438	4.210
	CH18	2474	4.554



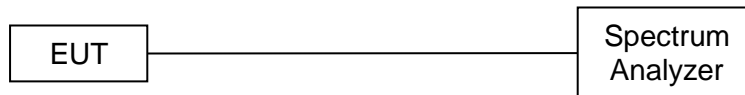
**GFSK mode - 20dB occupied bandwidth**
**CH1**

**CH9**

**CH18**


## 5.4 Conducted peak output power

### 5.4.1 Limits

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.

### 5.4.2 Test setup



### 5.4.3 Test procedure

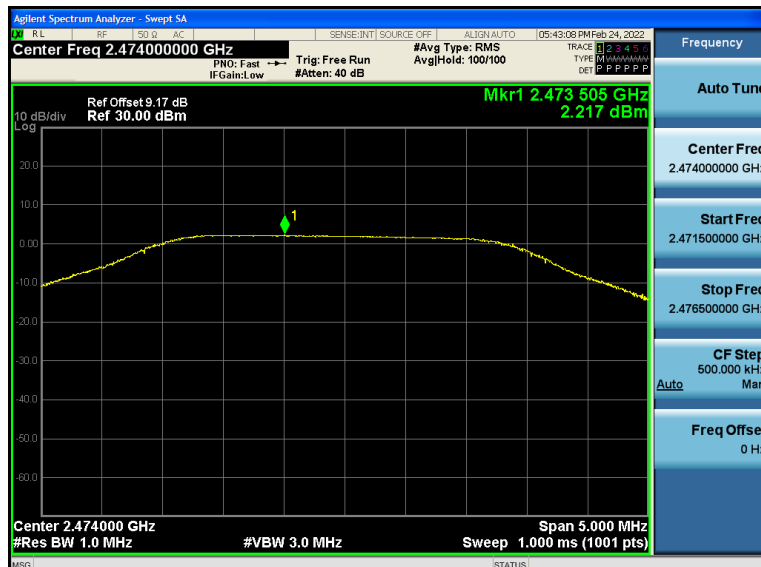
- a) Test method: ANSI C63.10-2013 Section 7.8.5.
- b) The EUT was set to continuously transmitting in the max power during the test.
- c) The transmitter output of EUT is connected to the spectrum analyzer.
- d) Spectrum analyzer setting: RBW > 20dB occupied bandwidth, VBW ≥ RBW, detector= Peak

### 5.4.4 Test results

Mode	Test channel	Frequency (MHz)	Conducted peak output power (dBm)	Limit (dBm)
GFSK	CH1	2406	2.969	≤ 20.97
	CH9	2438	3.273	≤ 20.97
	CH18	2474	2.217	≤ 20.97

**GFSK mode - peak conducted output power**
**CH1**

**CH9**

**CH18**


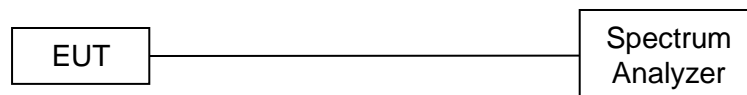
## 5.5 Carrier frequency separation

### 5.5.1 Limits

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

### 5.5.2 Test setup



### 5.5.3 Test procedure

- a) Test method: ANSI C63.10-2013 Section 7.8.2.
- b) The EUT was set to hopping mode during the test.
- c) The transmitter output of EUT is connected to the spectrum analyzer.
- d) Spectrum Setting: RBW = 30 kHz, VBW = 100 kHz, detector= Peak.

### 5.5.4 Test results

Mode	Test channel	Test Result (MHz)	Limit (MHz)	Result
GFSK	Hop-mode	4	$\geq 3.036$	Pass

Carrier frequency separation

GFSK

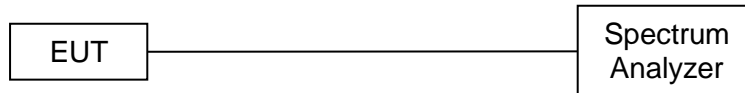


## 5.6 Average time of occupancy

### 5.6.1 Limits

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.

### 5.6.2 Test setup



### 5.6.3 Test procedure

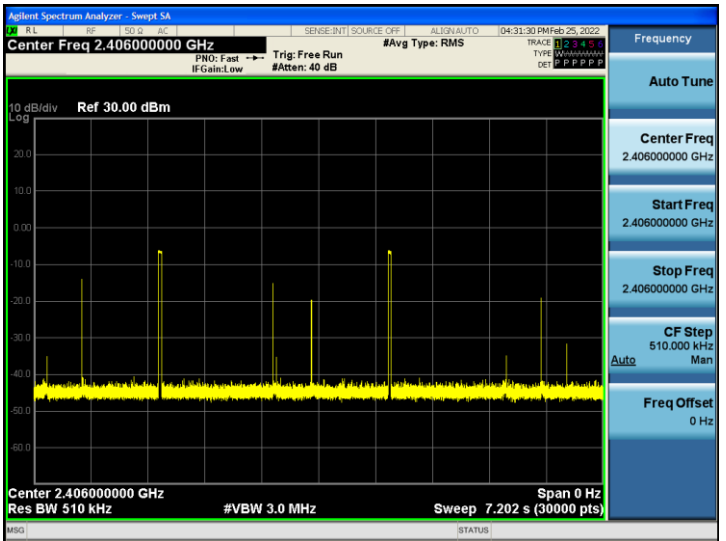
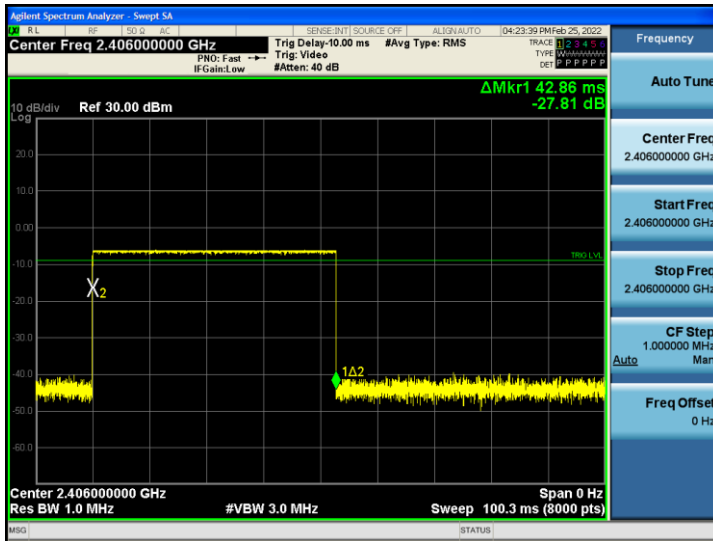
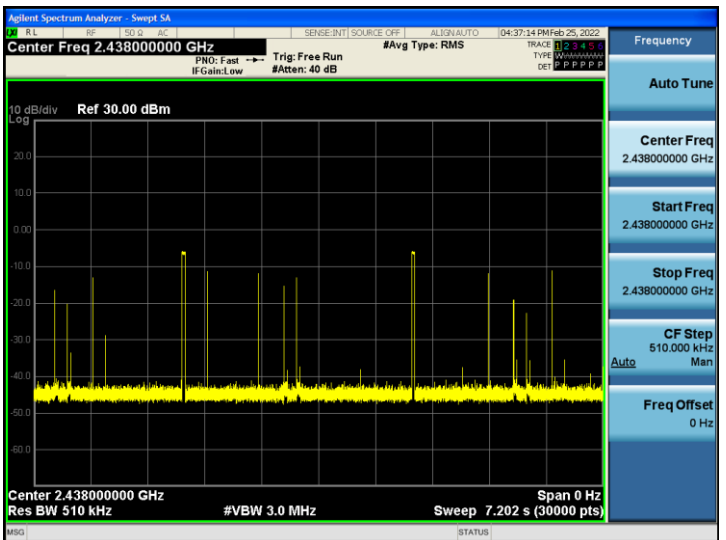
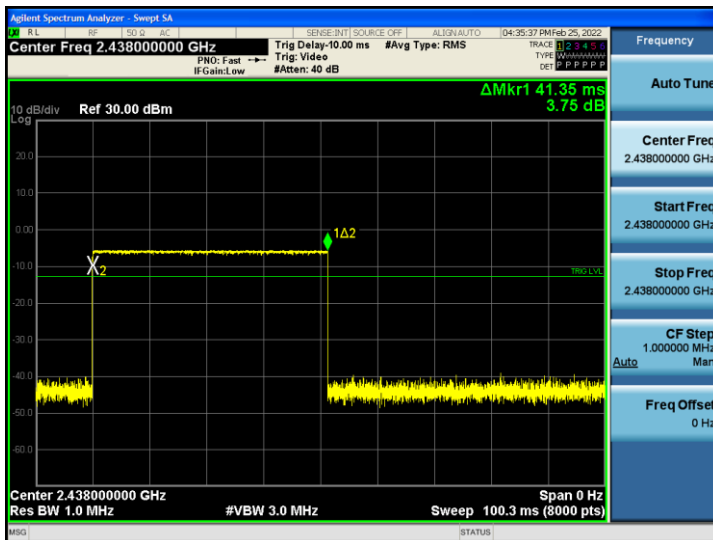
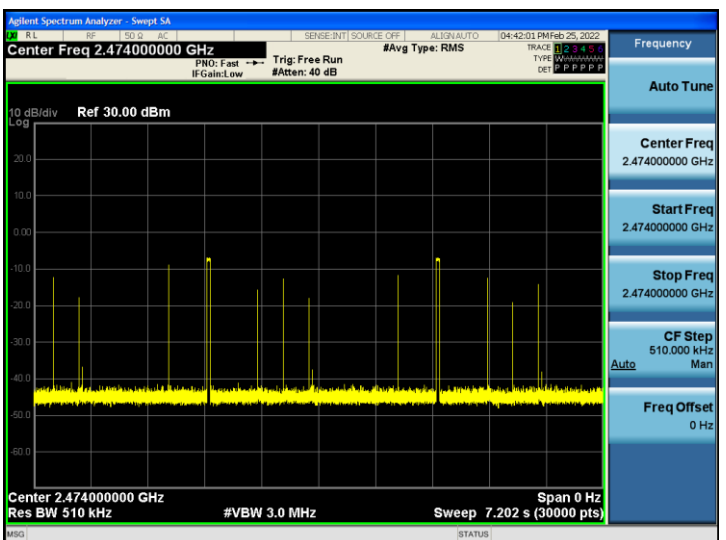
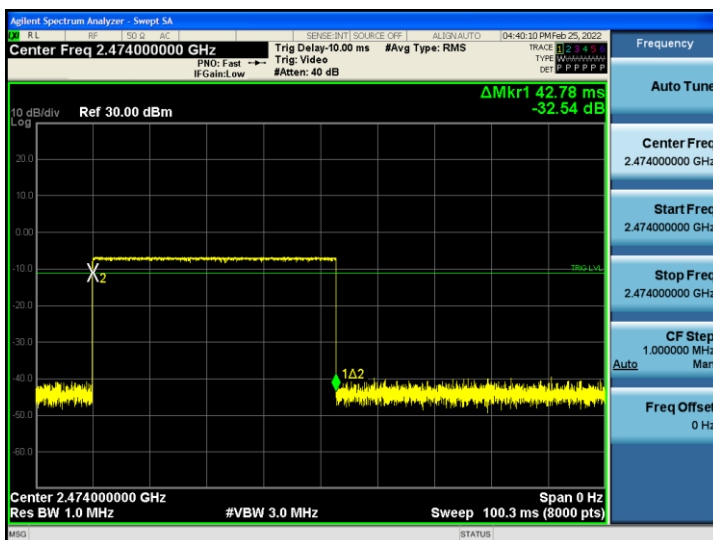
- a) Test method: ANSI C63.10-2013 Section 7.8.4
- b) The EUT was set to hopping mode during the test.
- c) The transmitter output of EUT is connected to the spectrum analyzer.
- d) Spectrum analyzer setting: RBW = 1MHz, VBW = 3MHz, Span = 0Hz, Detector = Peak, sweep time: As necessary to capture the entire dwell time per hopping channel.
- e) 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:
- f) 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.

### 5.6.4 Test results

Mode	Frequency (MHz)	Pulse width (ms)	Number of pulses in 7.2s	Average time of occupancy (s)	Limit (s)	Result
GFSK	2406	42.86	2	0.08572	<=0.4	Pass
	2438	41.35	2	0.0827	<=0.4	Pass
	2474	42.78	2	0.08556	<=0.4	Pass

#### Notes:

1. Period time = 0.4 (s) \* 18 = 7.2(s)
2. Average time of occupancy = Pulse width \* Number of pulses in 7.2s

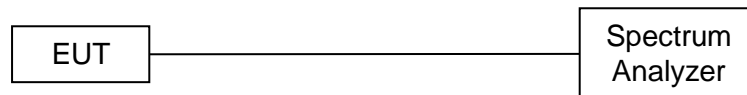
**GFSK mode - Average time of occupancy**  
**Pulse width – 2406**

**Pulse width – 2438**

**Number of pulses in 3.16 s**
**Pulse width –2474**

**Number of pulses in 3.16 s**

## 5.7 Number of hopping channels

### 5.7.1 Limit

Frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 channels.

### 5.7.2 Test setup



### 5.7.3 Test procedure

- a) Test method: ANSI C63.10-2013 Section 7.8.3
- b) The EUT was set to hopping mode during the test.
- c) The transistor output of EUT is connected to the spectrum analyzer.
- d) Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, Detector = Peak.

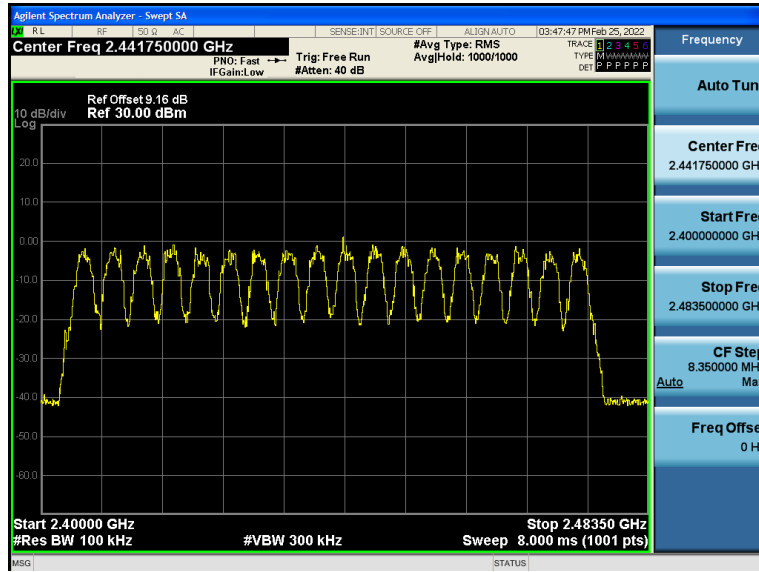
### 5.7.4 Test results

Mode	Quantity of Hopping Channel	Limit	Results
GFSK	18	≥15	Pass



Number of hopping channels

GFSK

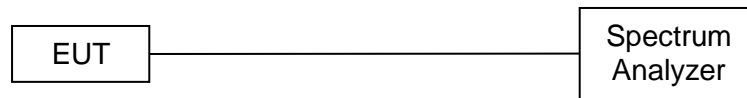


## 5.8 Conducted emissions at the band edge

### 5.8.1 Limits

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)).

### 5.8.2 Test setup



### 5.8.3 Test procedure

- Test method: ANSI C63.10-2013 Section 6.10.4
- The EUT was set to non-hopping mode & hopping mode during the test.
- The transmitter output of EUT is connected to the spectrum analyzer.
- Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, Detector = Peak.

### 5.8.4 Test results

**GFSK mode - conducted emissions at the band edge**

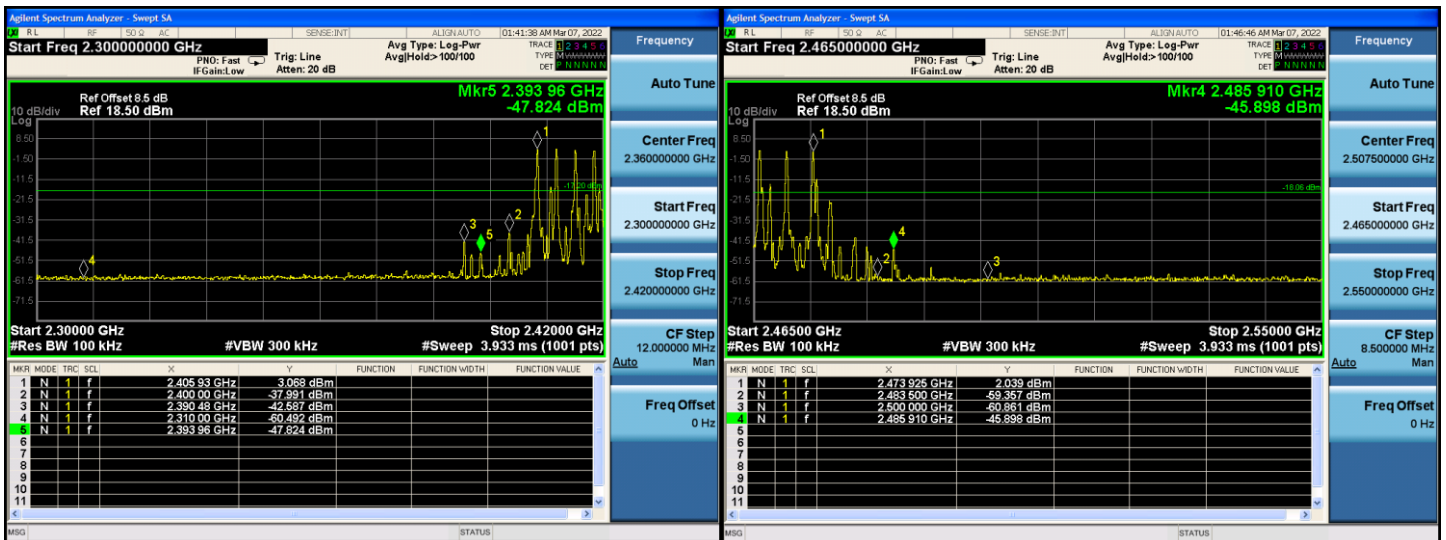
Low band-edge (no-hopping mode mode)

High band-edge (non-hopping mode)



Low band-edge (hopping mode)

High band-edge (hopping mode)

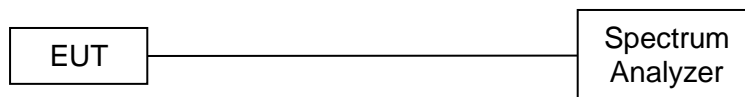


## 5.9 Conducted spurious emissions

### 5.9.1 Limits

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)).

### 5.9.2 Test setup



### 5.9.3 Test procedure

- Test method: ANSI C63.10-2013 Section 6.10.4
- The EUT was set to non-hopping mode & hopping mode during the test.
- The transmitter output of EUT is connected to the spectrum analyzer.
- Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, Detector = Peak.

### 5.9.4 Test results

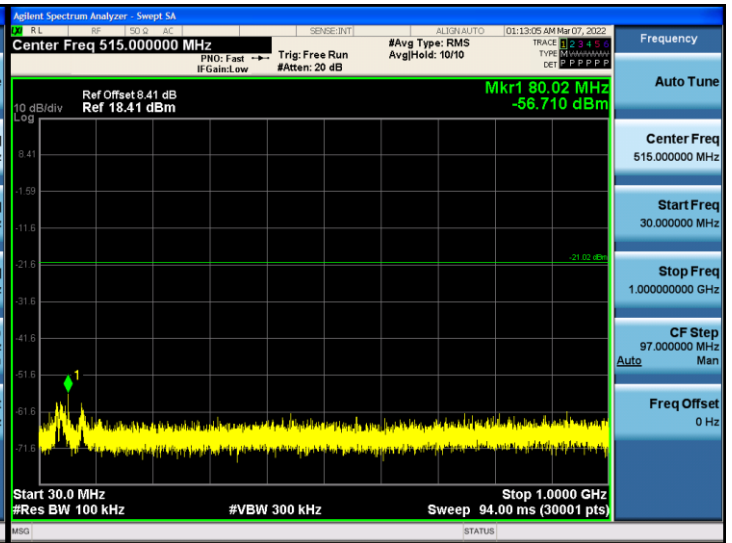
#### Notes:

All modes of operation of the EUT were investigated, and only the worst-case results are reported. The worst-case mode: TX mode (GFSK).

**Conducted spurious emissions – GFSK mode**

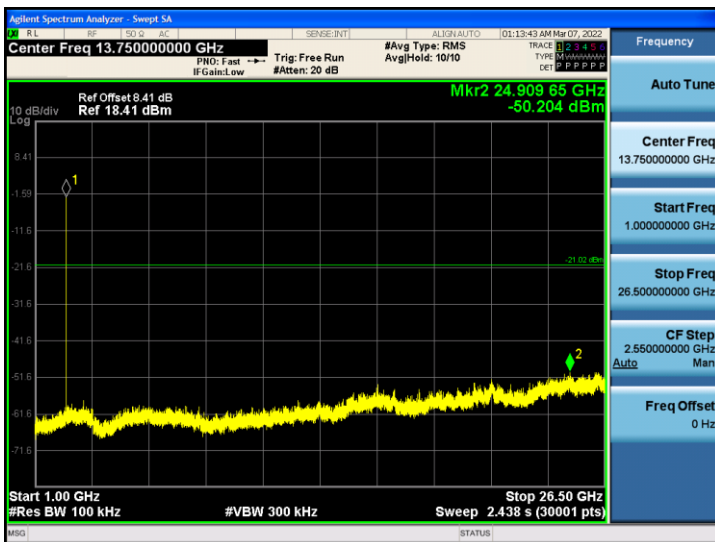
CH1

CH1



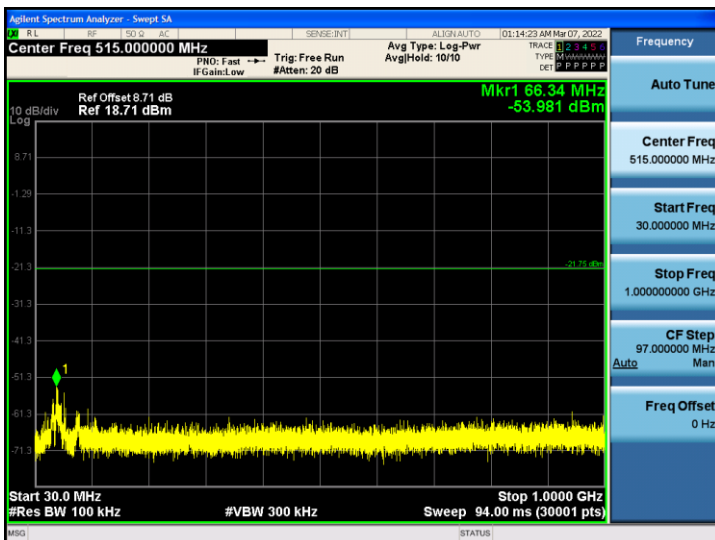
CH1

CH9



CH9

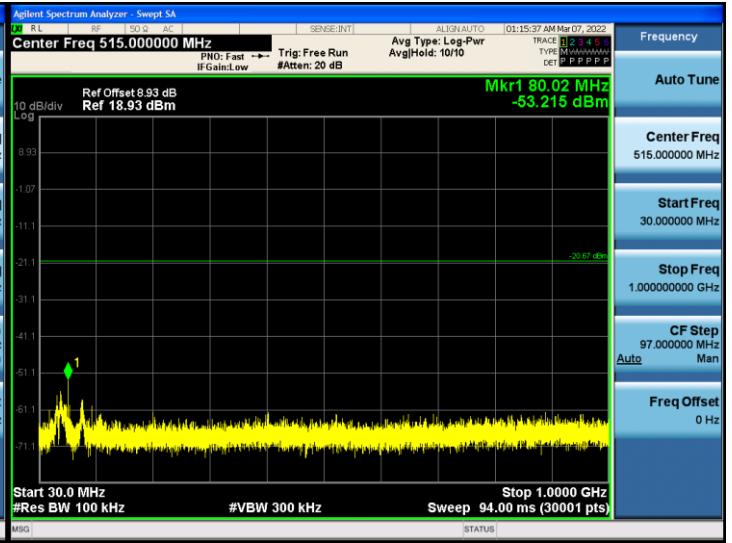
CH9



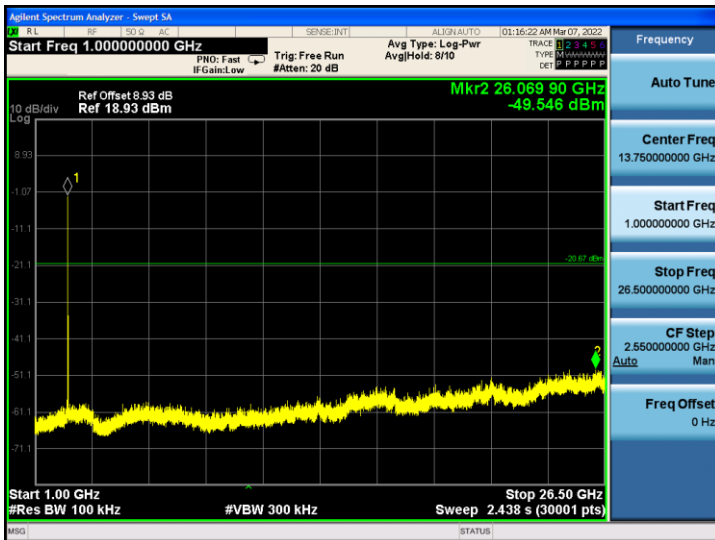
**Conducted spurious emissions – GFSK mode**

CH18

CH18



CH18



## 5.10 Radiated spurious emission

### 5.10.1 Limits

§ 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 Radiated emission limits; general requirements.

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

**Note 1:** the tighter limit applies at the band edges.

**Note 2:** the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector

§ 15.35 (b) requirements:

When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

According to ANSI C63.10-2013, the tests shall be performed in the frequency range shown in the following table:

**Frequency range of measurements for unlicensed wireless device**

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

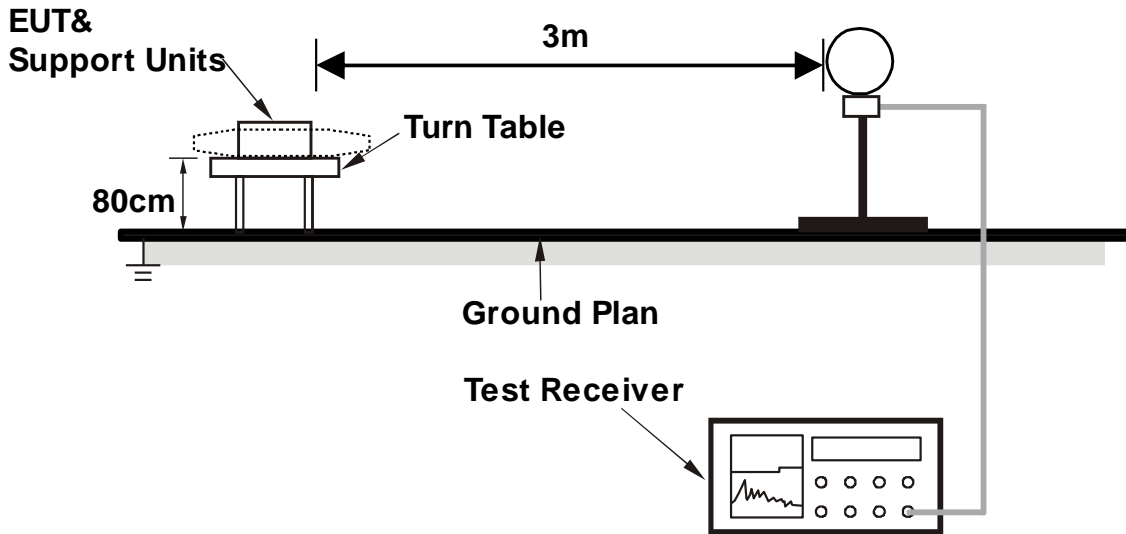
**Frequency range of measurements for unlicensed wireless device with digital device**

Highest frequency generated or used in the device or on which the device operates or tunes	Upper frequency range of measurement
Below 1.705 MHz	30 MHz
1.705 MHz to 108 MHz	1000 MHz
108 MHz to 500 MHz	2000 MHz
500 MHz to 1000 MHz	5000 MHz
Above 1000 MHz	5th harmonic of the highest frequency or 40 GHz, whichever is lower

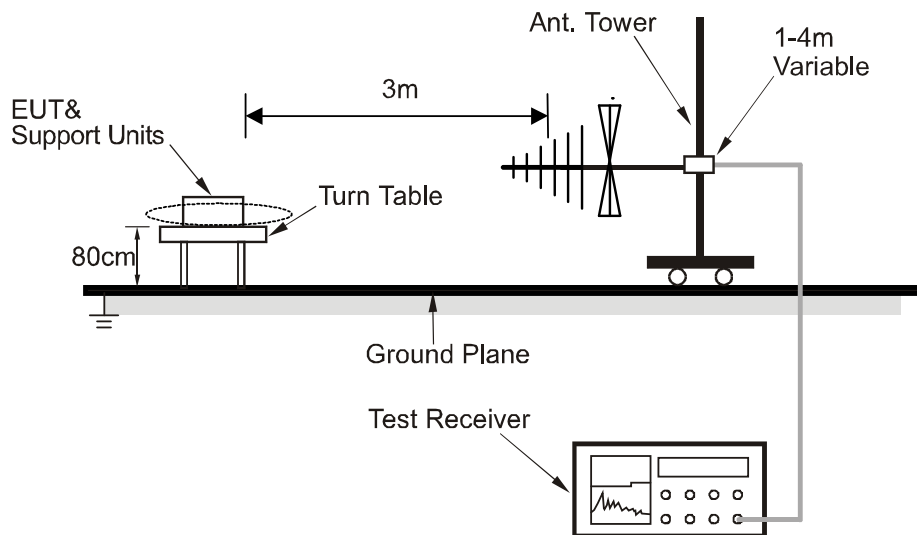


**5.10.2 Test setup**

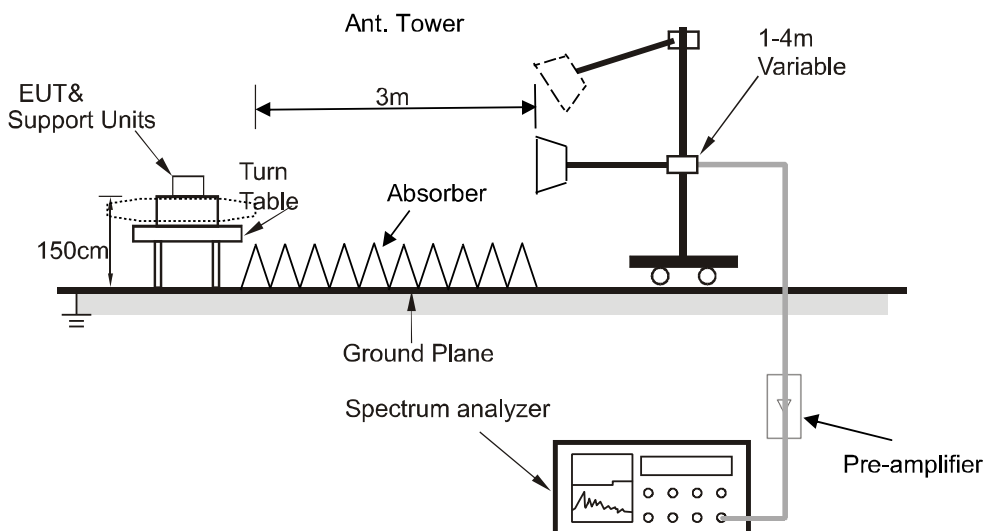
Below 30MHz



30MHz~1GHz



Above 1GHz



For the actual test configuration, please refer to the related item – Photographs of the test setup.

### 5.10.3 Test procedure

- a) Test method: ANSI C63.10-2013 Section 6.3, 6.4, 6.5, 6.6, 6.10.
- b) The EUT is placed on an on-conducting table 0.8 meters above the ground plane for measurement below 1GHz, 1.5 meters above the ground plane for measurement above 1GHz.
- c) Emission below 18 GHz were measured at a 3 meters test distance, above 18 GHz were measured at 1.5-meter test distance with the application of a distance correction factor
- d) The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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The use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the unwanted emission limit is subject to an average field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

### Test instrument setup

Frequency	Test receiver / Spectrum analyzer setting
9 kHz ~ 150 kHz	Quasi Peak / RBW: 200 Hz
150 kHz ~ 30 MHz	Quasi Peak / RBW: 9 kHz
30 MHz ~ 1 GHz	Quasi Peak / RBW: 120 kHz
Above 1 GHz	Peak / RBW: 1 MHz, VBW: 3MHz, Peak detector AVG / RBW: 1 MHz, VBW: 1/T, Peak detector

### 5.10.4 Test results

#### Notes:

The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

All modes of operation of the EUT were investigated, and only the worst-case results are reported.

There were no emissions found below 30MHz within 20dB of the limit.

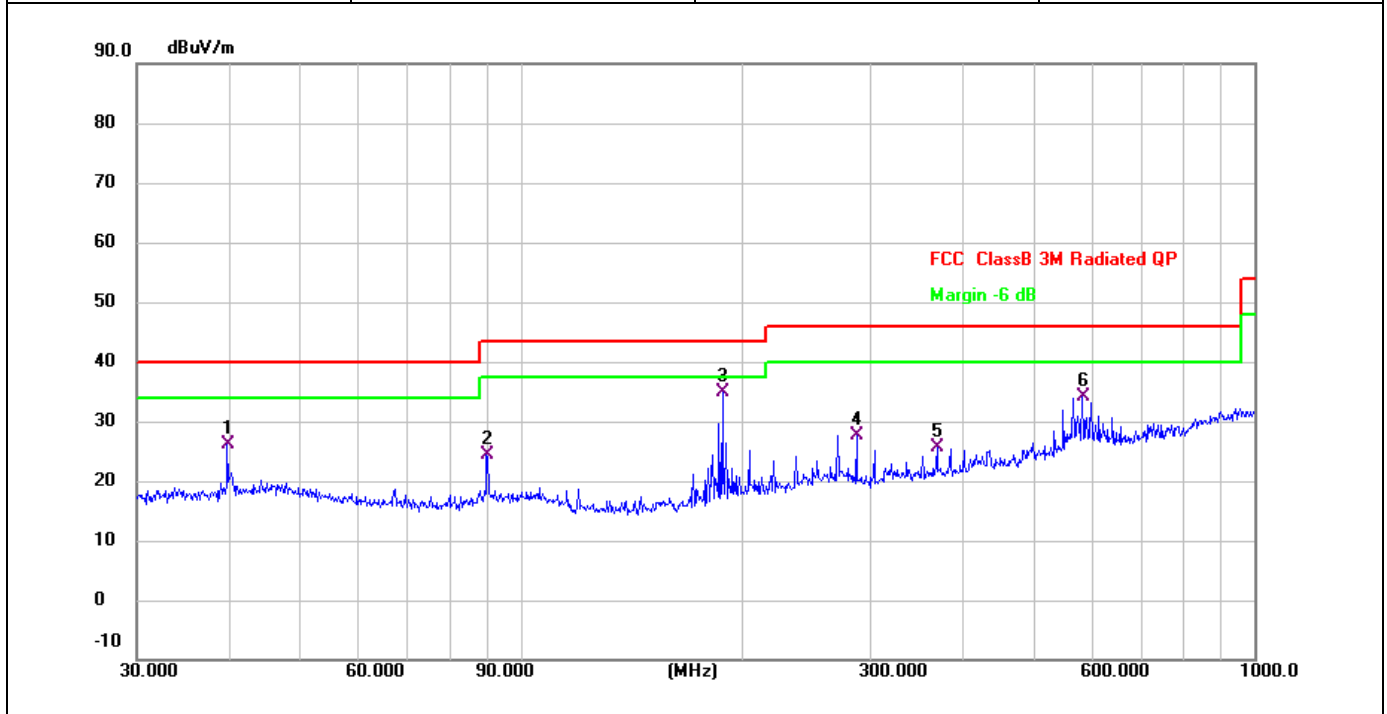
#### Calculation formula:

Measurement (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Correct Factor (dB/m)

Over (dB) = Measurement (dB $\mu$ V/m) – Limit (dB $\mu$ V/m)

**Radiated emissions between 30MHz – 1GHz**

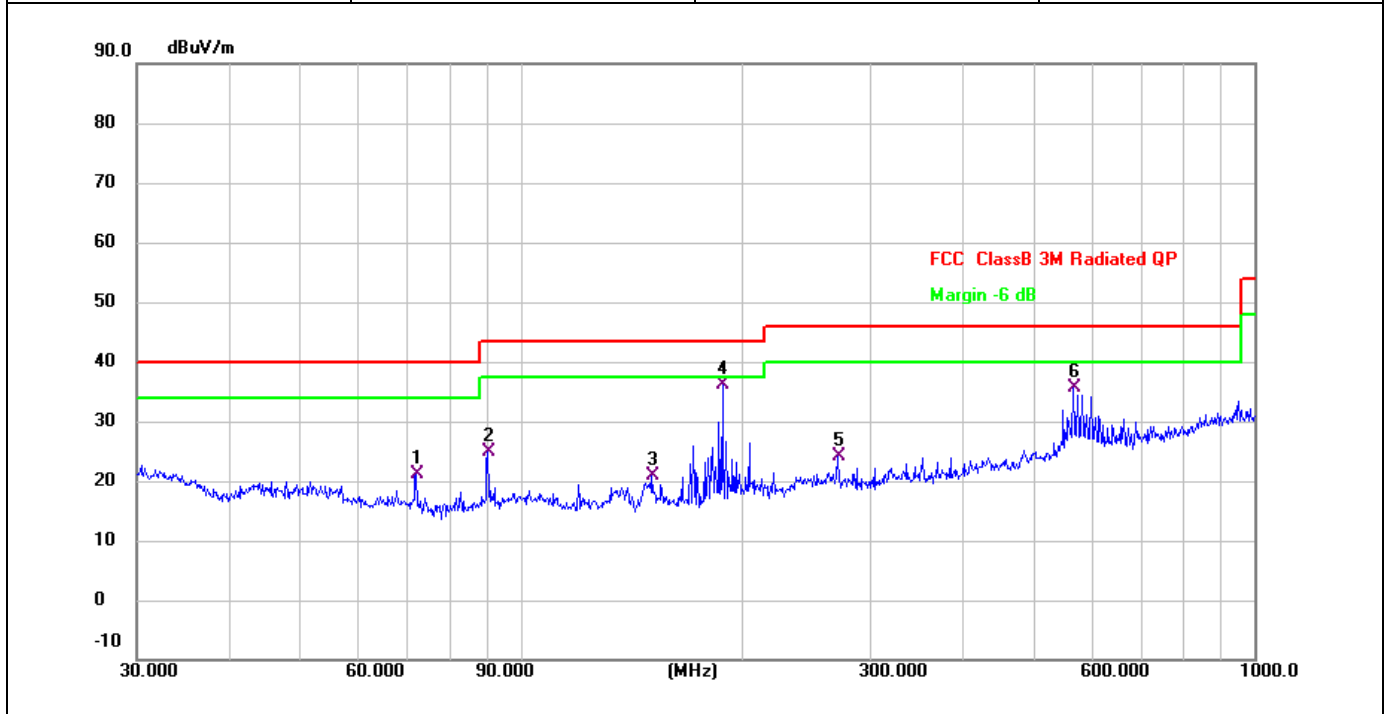
Test mode:	TX DH5-2438	Polarization:	Horizontal
Power supply:	DC 3V	Test site:	RE chamber 2



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		39.8542	34.26	-8.18	26.08	40.00	-13.92	QP
2		89.9047	33.19	-8.92	24.27	43.50	-19.23	QP
3	*	188.4125	43.57	-8.61	34.96	43.50	-8.54	QP
4		286.9823	33.46	-5.74	27.72	46.00	-18.28	QP
5		369.4047	30.10	-4.49	25.61	46.00	-20.39	QP
6		582.7425	34.17	-0.14	34.03	46.00	-11.97	QP

**Radiated emissions between 30MHz – 1GHz**

Test mode:	TX DH5-2438	Polarization:	Vertical
Power supply:	DC 3V	Test site:	RE chamber 2



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		72.0843	31.24	-10.04	21.20	40.00	-18.80	QP
2		90.2205	33.67	-8.90	24.77	43.50	-18.73	QP
3		151.0666	31.11	-10.31	20.80	43.50	-22.70	QP
4	*	188.4125	44.66	-8.61	36.05	43.50	-7.45	QP
5		270.3748	29.80	-5.66	24.14	46.00	-21.86	QP
6		566.6223	36.22	-0.62	35.60	46.00	-10.40	QP

**Radiated emissions 1 GHz ~ 25 GHz**

Frequency (MHz)	Reading Level (dB $\mu$ V)	Correct Factor (dB/m)	Measuremen t (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Over (dB)	Detector Peak/AVG	Polarization H/V
<b>GFSK - 2406 MHz TX mode</b>							
4812	41.47	1.53	43	74	-31	Peak	V
4812	34.59	1.53	36.12	74	-37.88	AVG	V
7218	40.69	5.46	46.15	74	-27.85	Peak	V
7218	33.69	5.46	39.15	54	-14.85	AVG	V
9624	42.88	6.34	49.22	74	-24.78	Peak	V
9624	36.23	6.34	42.57	54	-11.43	AVG	V
4812	42.55	1.53	44.08	74	-29.92	Peak	H
4812	36.02	1.53	37.55	54	-16.45	AVG	H
7218	40.68	5.46	46.14	74	-27.86	Peak	H
7218	34.02	5.46	39.48	54	-14.52	AVG	H
9624	42.82	6.34	49.16	74	-24.84	Peak	H
9624	36.24	6.34	42.58	54	-11.42	AVG	H
<b>GFSK - 2438 MHz TX mode</b>							
4876	41.47	1.67	43.14	74	-30.86	Peak	V
4876	34.58	1.67	36.25	54	-17.75	AVG	V
7312	40.3	5.45	45.75	74	-28.25	Peak	V
7312	32.69	5.45	38.14	54	-15.86	AVG	V
9752	41.59	6.37	47.96	74	-26.04	Peak	V
9752	33.99	6.37	40.36	54	-13.64	AVG	V
4876	45.39	1.67	47.06	74	-26.94	Peak	H
4876	35.81	1.67	37.48	54	-16.52	AVG	H
7314	40.84	5.45	46.29	74	-27.71	Peak	H
7314	31.33	5.45	36.78	54	-17.22	AVG	H
9752	43.68	6.37	50.05	74	-23.95	Peak	H
9752	33.77	6.37	40.14	54	-13.86	AVG	H

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization
(MHz)	(dB $\mu$ V)	(dB/m)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	Peak/AVG	H/V
<b>GFSK - 2474 MHz TX mode</b>							
4848	42.13	1.62	43.75	74	-30.25	Peak	V
4848	32.34	1.62	33.96	54	-20.04	AVG	V
7422	41.28	5.44	46.72	74	-27.28	Peak	V
7422	31.15	5.44	36.59	54	-17.41	AVG	V
9896	41.42	6.41	47.83	74	-26.17	Peak	V
9896	31.28	6.41	37.69	54	-16.31	AVG	V
4848	41.79	1.62	43.41	74	-30.59	Peak	H
4848	31.83	1.62	33.45	54	-20.55	AVG	H
7422	40.52	5.44	45.96	74	-28.04	Peak	H
7422	30.25	5.44	35.69	54	-18.31	AVG	H
9896	40.9	6.41	47.31	74	-26.69	Peak	H
9896	31.48	6.41	37.89	54	-16.11	AVG	H

**Radiated emissions at band edge**

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization
(MHz)	(dB $\mu$ V)	(dB/m)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	Peak/AVG	H/V
<b>GFSK – Low band-edge</b>							
(MHz)	(dB $\mu$ V)	(dB/m)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	Peak/AVG	H/V
2310	47.80	-6.60	41.20	74	-32.80	Peak	V
2310	38.18	-6.60	31.58	54	-22.42	AVG	V
2390	48.28	-6.23	42.05	74	-31.95	Peak	V
2390	38.87	-6.23	32.64	54	-21.36	AVG	V
2310	48.83	-6.6	42.23	74	-31.77	Peak	H
2310	38.69	-6.6	32.09	54	-21.91	AVG	H
2390	50.58	-6.23	44.35	74	-29.65	Peak	H
2390	40.34	-6.23	34.11	54	-19.89	AVG	H
<b>GFSK – High band-edge</b>							
2483.5	53.03	-5.79	47.24	74	-26.76	Peak	V
2483.5	42.86	-5.79	37.07	54	-16.93	AVG	V
2500	48.95	-5.72	43.23	74	-30.77	Peak	V
2500	38.76	-5.72	33.04	54	-20.96	AVG	V
2483.5	54.26	-5.79	48.47	74	-25.53	Peak	H
2483.5	45.29	-5.79	39.5	54	-14.5	AVG	H
2500	49.57	-5.72	43.85	74	-30.15	Peak	H
2500	39.35	-5.72	33.63	54	-20.37	AVG	H

## Photographs of the Test Setup

See the appendix – Test Setup Photos.



## Photographs of the EUT

See the appendix - EUT Photos.

---End of Report---