



## Test Report

Date : 2020-12-30  
No. : HMD20120016

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**Applicant** : Feelmore Labs Inc.  
370 Jay Street, 7th Floor, Brooklyn, NY11201, United States

**Supplier / Manufacturer** : Feelmore Labs Inc.  
370 Jay Street, 7th Floor, Brooklyn, NY11201, United States

**Description of Sample(s)** : Submitted sample(s) said to be  
Product: Cove  
Brand Name: Cove  
Model No.: CV100  
FCC ID: 2AWV5-CV100

**Date Samples Received** : 2020-12-18

**Date Tested** : 2020-12-23 to 2020-12-28

**Investigation Requested** : Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2017 and ANSI C63.10:2013 for FCC Certification.

**Conclusions** : The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

**Remarks** : Bluetooth DTS (GFSK)

  
Dr. LEE Kam Chuen,  
Authorized Signatory





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### **1.0 General Details**

#### **1.1 Test Laboratory**

The Hong Kong Standards and Testing Centre Ltd.  
EMC Laboratory  
10 Dai Wang Street, Taipo Industrial Estate, New Territories, Hong Kong  
Telephone: 852 2666 1888  
Fax: 852 2664 4353

#### **1.2 Equipment Under Test [EUT]**

##### **Description of Sample(s)**

Product: Cove  
Manufacturer: Feelmore Labs Inc.  
370 Jay Street, 7th Floor, Brooklyn, NY11201, United States  
Brand Name: Cove  
Model Number: CV100  
Rating: 5Vd.c.(power by USB port) / 3.7Vd.c (Li-ion rechargeable battery x1)

##### **1.2.1 Description of EUT Operation**

The Equipment Under Test (EUT) is a Cove. The transmission signal is digital modulated with channel frequency range 2402-2480MHz. The R.F. signal was modulated by IC; the type of modulation used was digital transmission Modulation.

#### **1.3 Date of Order**

2020-12-18

#### **1.4 Submitted Sample(s):**

1 Sample

#### **1.5 Test Duration**

2020-12-23 to 2020-12-28

#### **1.6 Country of Origin**

China

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### 1.7 RF Module Details

Module Model Number: CC2642R  
Module FCC ID: N/A  
Module Transmission Type: Bluetooth 5.1 BLE  
Modulation: GFSK  
Data Rates: 1Mbps  
Frequency Range: 2400-2483.5MHz  
Carrier Frequencies: 2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

### 1.8 Antenna Details

Antenna Type: Ceramic Chip antenna  
Antenna Gain: 1.7dBi

### 1.9 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

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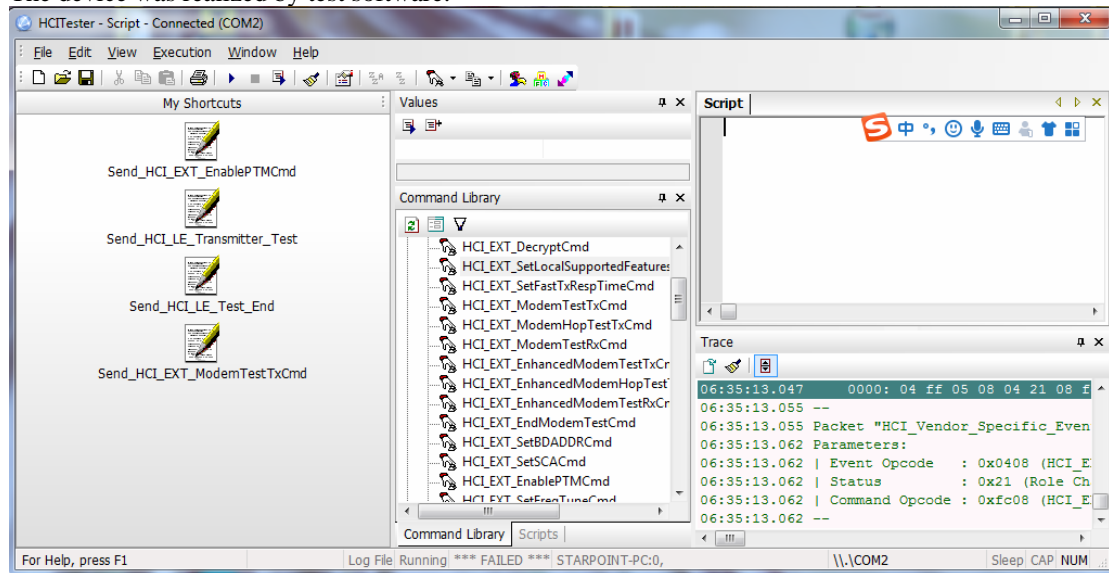
### 2.0 Technical Details

#### 2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2017 Regulations and ANSI C63.10:2013 for FCC Certification.

According FCC KDB 558074 DTS Measurement Guidance, Duty cycle  $\cong$  98%.

The device was realized by test software.



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### 2.2 Test Standards and Results Summary Tables

<b>EMISSION Results Summary</b>						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Failed	N/A
Maximum Peak Output Power	FCC 47CFR 15.247(b)(3)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Spurious Emissions	FCC 47CFR 15.209 FCC 47CFR 15.205	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conducted Spurious Emissions	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Power Spectral Density	FCC 47CFR 15.247(e)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6dB Bandwidth	FCC 47CFR 15.247(a)(2)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Band Edge Emissions (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: N/A - Not Applicable

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### 3.0 Test Results

#### **3.1 Emission**

##### **3.1.1 Maximum Peak Output Power**

Test Requirement:	FCC 47CFR 15.247(b)(3)
Test Method:	ANSI C63.10: 2013
Test Date:	2020-12-25
Mode of Operation:	Bluetooth DTS Tx mode

Ambient Temperature: 25°C      Relative Humidity: 51%      Atmospheric Pressure: 101 kPa

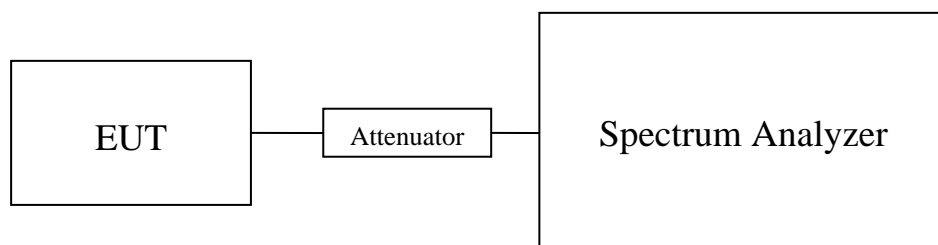
#### **Test Method:**

The RF output of the EUT was connected to the spectrum analyzer. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in Watt.

#### **Spectrum Analyzer Setting:**

RBW = 2 MHz,  
VBW= 6MHz,  
Sweep = Auto,  
Span = 6MHz  
Detector = Peak,  
Trace = Max. hold

#### **Test Setup:**



Note: a temporary antenna connector was soldered to the RF output.



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### Limits for Peak Output Power of Fundamental & Harmonics Emissions [FCC 47CFR 15.247]:

For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt (30dBm)

Results of BT DTS Tx Mode (2402MHz to 2480MHz) : Pass (TX Unit) (GFSK)					
Channel	Frequency(MHz)	Conducted power(dBm)	Antenna Gain(dBi)	E.I.R.P.(dBm)	E.I.R.P (Watt)
0	2402	-4.348	1.7	-2.648	0.00184
19	2440	-4.605	1.7	-2.905	0.00195
39	2480	-5.030	1.7	-3.330	0.00215

Calculated measurement uncertainty : 30MHz to 1GHz 1.7dB  
1GHz to 26GHz 1.7dB

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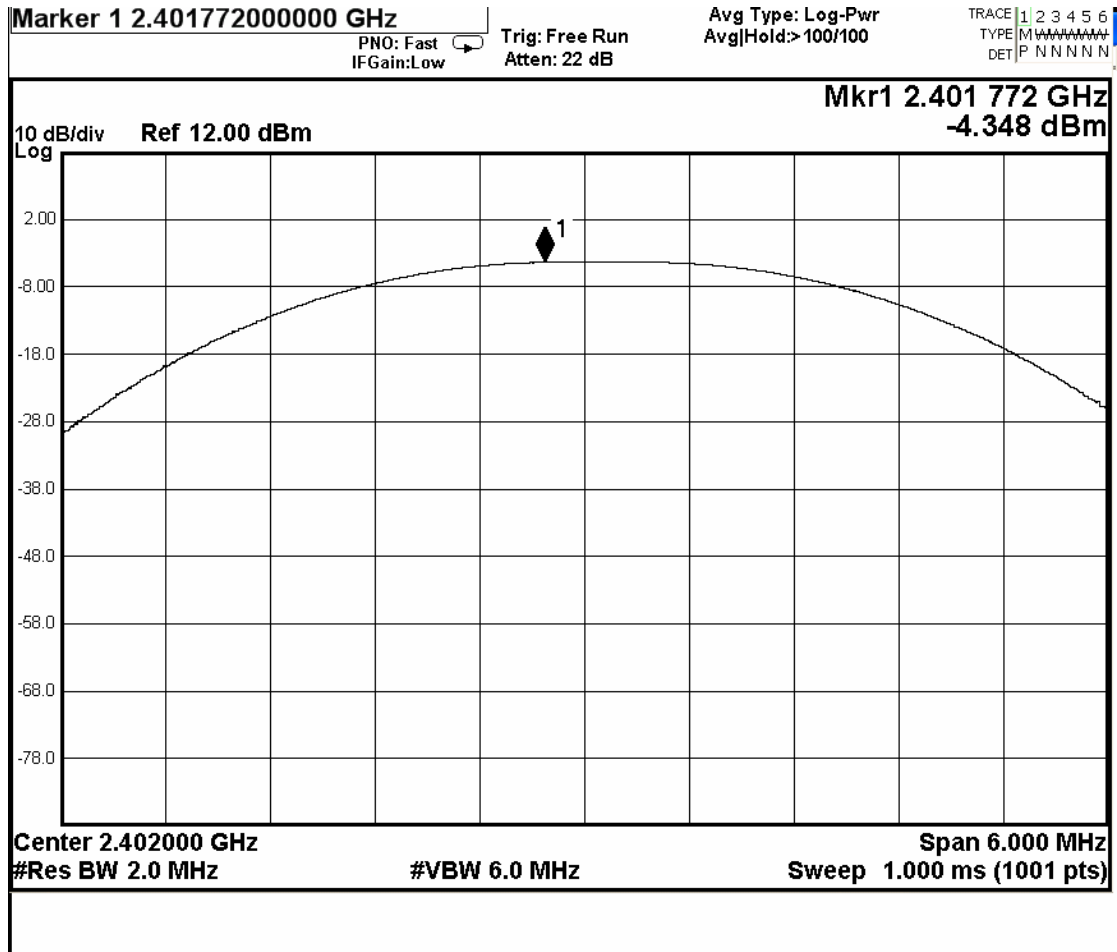
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Test plot of Maximum Peak Conducted Output Power :

Bluetooth Communication mode (BT DTS-GFSK, 2402MHz)



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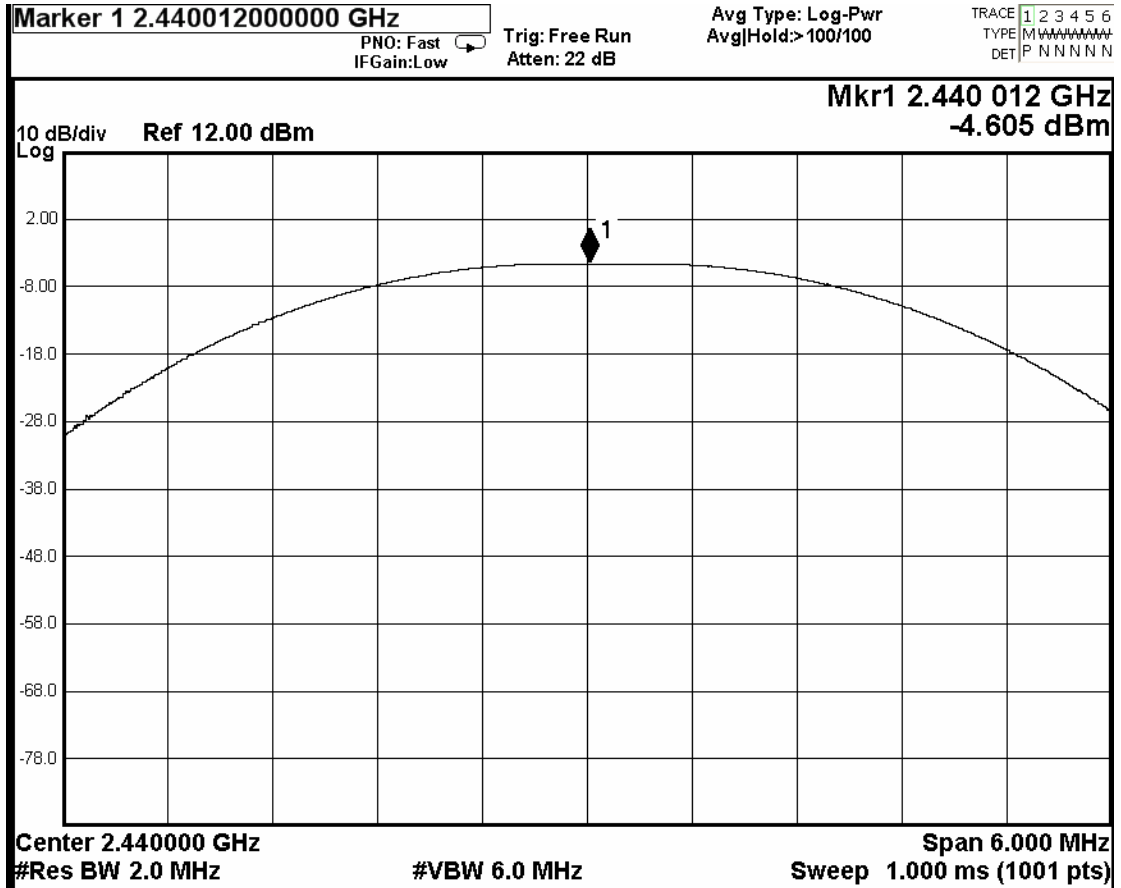


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Bluetooth Communication mode (BT DTS-GFSK, 2440MHz)



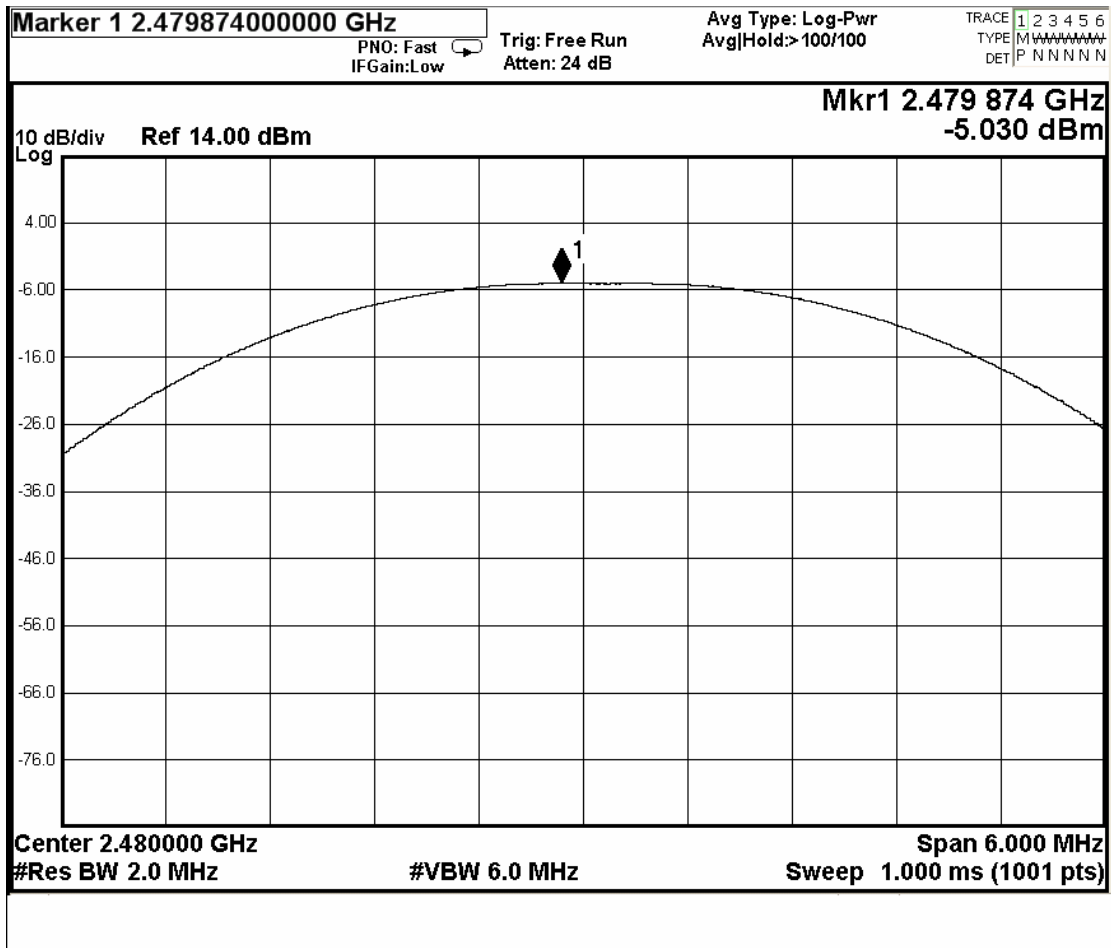


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Bluetooth Communication mode (BT DTS-GFSK, 2480MHz)





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### 3.1.2 Radiated Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10:2013
Test Date:	2020-12-25 to 2020-12-28
Mode of Operation:	Tx mode / Bluetooth Communication mode (GFSK)

Ambient Temperature: 25°C      Relative Humidity: 50%      Atmospheric Pressure: 101 kPa

#### **Test Method:**

For emission measurements at or below 1 GHz, the sample was placed 0.8m above the ground plane of semi-anechoic Chamber\*. For emission measurements above 1 GHz, the sample was placed 1.5m above the ground plane of semi-anechoic Chamber\*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

\* Semi-Anechoic chamber located on the G/F of The Hong Kong Standards and Testing Centre Ltd. with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.

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### Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)

RBW: 10kHz  
VBW: 30kHz  
Sweep: Auto  
Span: Fully capture the emissions being measured  
Trace: Max. hold

30MHz – 1GHz (QP)

RBW: 120kHz  
VBW: 120kHz  
Sweep: Auto  
Span: Fully capture the emissions being measured  
Trace: Max. hold

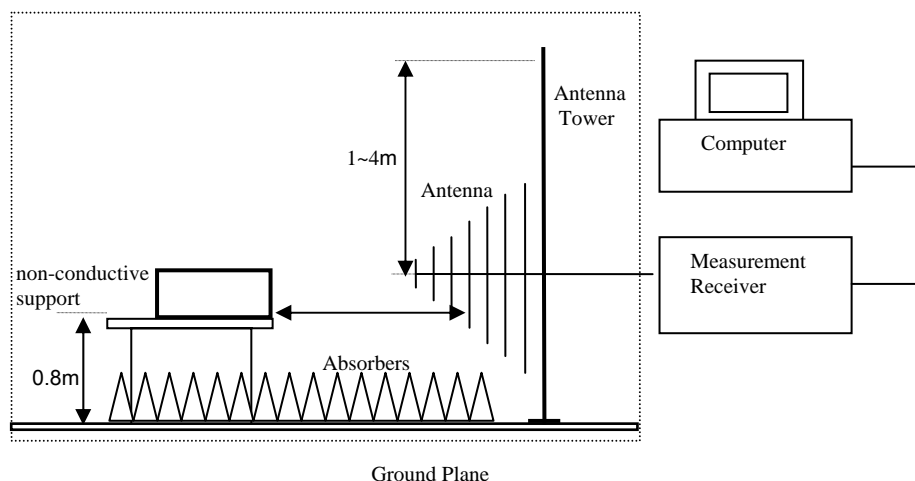
Above 1GHz (Pk)

RBW: 1MHz  
VBW: 1MHz  
Sweep: Auto  
Span: Fully capture the emissions being measured  
Trace: Max. hold

Above 1GHz (Av)

RBW: 1MHz  
VBW: 10Hz  
Sweep: Auto  
Span: Fully capture the emissions being measured  
Trace: Max. hold

### Test Setup:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used.

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### **Limits for Radiated Emissions FCC 47 CFR 15.209]:**

Frequency Range [MHz]	Quasi-Peak Limits [ $\mu$ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

#### Remarks:

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz

\* Denotes restricted band of operation.

Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty

- (9kHz-30MHz): 2.0dB
- (30MHz -1GHz): 4.9dB
- (1GHz -6GHz): 4.02dB
- (6GHz -26.5GHz): 4.03dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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**Result of Tx mode (2402.0 MHz) (GFSK) (9kHz – 30MHz): Pass**

<b>Field Strength of Spurious Emissions Peak Value</b>						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
<b>Emissions detected are more than 20 dB below the FCC Limits</b>						

**Result of Tx mode (2402.0 MHz) (GFSK) (Above 1GHz): Pass**

<b>Field Strength of Spurious Emissions Peak Value</b>						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dB	E-Field Polarity
4804.0	14.5	41.5	56.0	74.0	18.0	Vertical
4804.0	13.6	42.4	56.0	74.0	18.0	Horizontal
7206.0	10.5	45.1	55.6	74.0	18.4	Vertical
7206.0	9.4	46.2	55.6	74.0	18.4	Horizontal
9608.0	7.3	48.0	55.3	74.0	18.7	Vertical
9608.0	6.7	48.8	55.5	74.0	18.5	Horizontal
12010.0	3.2	51.8	55.0	74.0	19.0	Vertical
12010.0	3.7	52.4	56.1	74.0	17.9	Horizontal

<b>Field Strength of Spurious Emissions Average Value</b>						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dB	E-Field Polarity
4804.0	-2.5	41.5	39.1	54.0	15.0	Vertical
4804.0	-2.6	42.4	39.9	54.0	14.2	Horizontal
7206.0	-4.1	45.1	41.0	54.0	13.0	Vertical
7206.0	-6.4	46.2	39.8	54.0	14.2	Horizontal
9608.0	-9.0	48.0	39.1	54.0	15.0	Vertical
9608.0	-8.9	48.8	39.9	54.0	14.1	Horizontal
12010.0	-12.1	51.8	39.7	54.0	14.3	Vertical
12010.0	-12.1	52.4	40.3	54.0	13.7	Horizontal

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**Result of Tx mode (2440.0 MHz) (GFSK) (9kHz – 30MHz): Pass**

<b>Field Strength of Spurious Emissions Peak Value</b>						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
<b>Emissions detected are more than 20 dB below the FCC Limits</b>						

**Result of Tx mode (2440.0 MHz) (GFSK) (Above 1GHz): Pass**

<b>Field Strength of Spurious Emissions Peak Value</b>						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dB	E-Field Polarity
4880.0	14.5	41.6	56.1	74.0	17.9	Vertical
4880.0	13.4	42.5	55.9	74.0	18.1	Horizontal
7320.0	1.9	53.2	55.1	74.0	18.9	Vertical
7320.0	9.4	46.3	55.7	74.0	18.3	Horizontal
9760.0	7.3	48.1	55.4	74.0	18.7	Vertical
9760.0	7.2	48.9	56.1	74.0	17.9	Horizontal
12200.0	3.7	51.6	55.3	74.0	18.8	Vertical
12200.0	2.8	52.5	55.3	74.0	18.7	Horizontal

<b>Field Strength of Spurious Emissions Average Value</b>						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dB	E-Field Polarity
4880.0	-0.5	41.6	41.2	54.0	12.9	Vertical
4880.0	-2.7	42.5	39.8	54.0	14.2	Horizontal
7320.0	-5.8	45.2	39.4	54.0	14.6	Vertical
7320.0	-6.4	46.3	39.9	54.0	14.1	Horizontal
9760.0	-8.9	48.1	39.2	54.0	14.8	Vertical
9760.0	-7.7	48.9	41.2	54.0	12.8	Horizontal
12200.0	-11.5	51.6	40.1	54.0	13.9	Vertical
12200.0	-12.4	52.5	40.2	54.0	13.9	Horizontal

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**Result of Tx mode (2480.0 MHz) (GFSK) (9kHz – 30MHz): Pass**

<b>Field Strength of Spurious Emissions Peak Value</b>						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
<b>Emissions detected are more than 20 dB below the FCC Limits</b>						

**Result of Tx mode (2480.0 MHz) (GFSK) (Above 1GHz): Pass**

<b>Field Strength of Spurious Emissions Peak Value</b>						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dB	E-Field Polarity
4960.0	14.7	41.4	56.1	74.0	17.9	Vertical
4960.0	13.2	42.7	55.9	74.0	18.1	Horizontal
7440.0	9.6	45.6	55.2	74.0	18.8	Vertical
7440.0	8.9	46.5	55.4	74.0	18.6	Horizontal
9920.0	7.3	48.6	55.9	74.0	18.1	Vertical
9920.0	6.0	49.7	55.7	74.0	18.3	Horizontal
12400.0	4.3	51.7	56.0	74.0	18.0	Vertical
12400.0	3.6	52.7	56.3	74.0	17.7	Horizontal

<b>Field Strength of Spurious Emissions Average Value</b>						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dB	E-Field Polarity
4960.0	-0.3	41.4	41.2	54.0	12.9	Vertical
4960.0	-1.8	42.7	40.9	54.0	13.1	Horizontal
7440.0	-5.6	45.6	40.1	54.0	14.0	Vertical
7440.0	-7.0	46.5	39.5	54.0	14.5	Horizontal
9920.0	-7.6	48.6	41.0	54.0	13.0	Vertical
9920.0	-8.3	49.7	41.4	54.0	12.6	Horizontal
12400.0	-9.7	51.7	42.0	54.0	12.0	Vertical
12400.0	-10.7	52.7	42.0	54.0	12.0	Horizontal



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**Radiated Emissions Measurement:**

**Limit :**

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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).

**Result: RF Radiated Emissions (Lowest)-GFSK**

<b>Field Strength of Band-edge Compliance</b>						
<b>Peak Value</b>						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB $\mu$ V	dB/m	dB $\mu$ V/m	dB $\mu$ V/m	dB	
2390.0	8.7	36.8	45.5	74.0	28.5	Vertical

<b>Field Strength of Band-edge Compliance</b>						
<b>Average Value</b>						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB $\mu$ V	dB/m	dB $\mu$ V/m	dB $\mu$ V/m	dB	
2390.0	0.2	36.8	37.0	54.0	17.0	Vertical

**Result: RF Radiated Emissions (Highest) -GFSK**

<b>Field Strength of Band-edge Compliance</b>						
<b>Peak Value</b>						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB $\mu$ V	dB/m	dB $\mu$ V/m	dB $\mu$ V/m	dB	
2483.5	19.2	36.8	56.0	74.0	18.0	Vertical

<b>Field Strength of Band-edge Compliance</b>						
<b>Average Value</b>						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB $\mu$ V	dB/m	dB $\mu$ V/m	dB $\mu$ V/m	dB	
2483.5	1.5	36.8	38.3	54.0	15.8	Vertical



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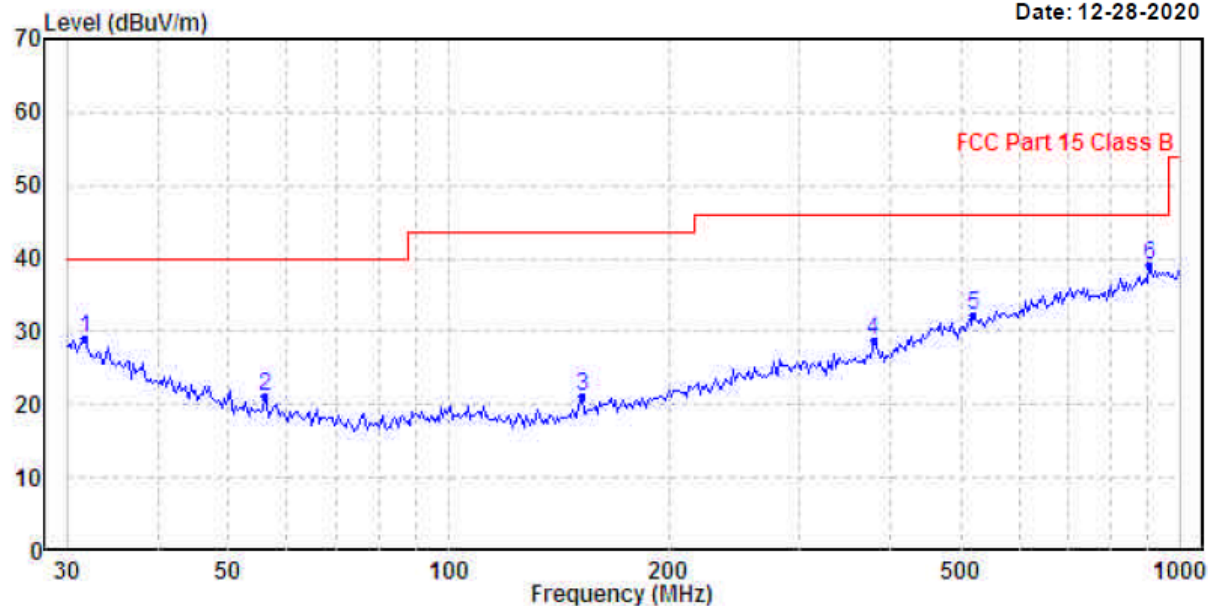
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**Results of Bluetooth Communication mode (2402.0 MHz) (30MHz – 1GHz): Pass**

Please refer to the following table for result details(The data is the worst cases)

Horizontal

Date: 12-28-2020



Ambient Temperature: 24.6°C

Relative Humidity : 50.3%

	Freq	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	31.731	29.19	40.00	-10.81	QP	Horizontal
2	56.001	21.12	40.00	-18.88	QP	Horizontal
3	151.597	21.23	43.50	-22.27	QP	Horizontal
4	379.914	28.88	46.00	-17.12	QP	Horizontal
5	520.888	32.11	46.00	-13.89	QP	Horizontal
6	906.482	39.07	46.00	-6.93	QP	Horizontal

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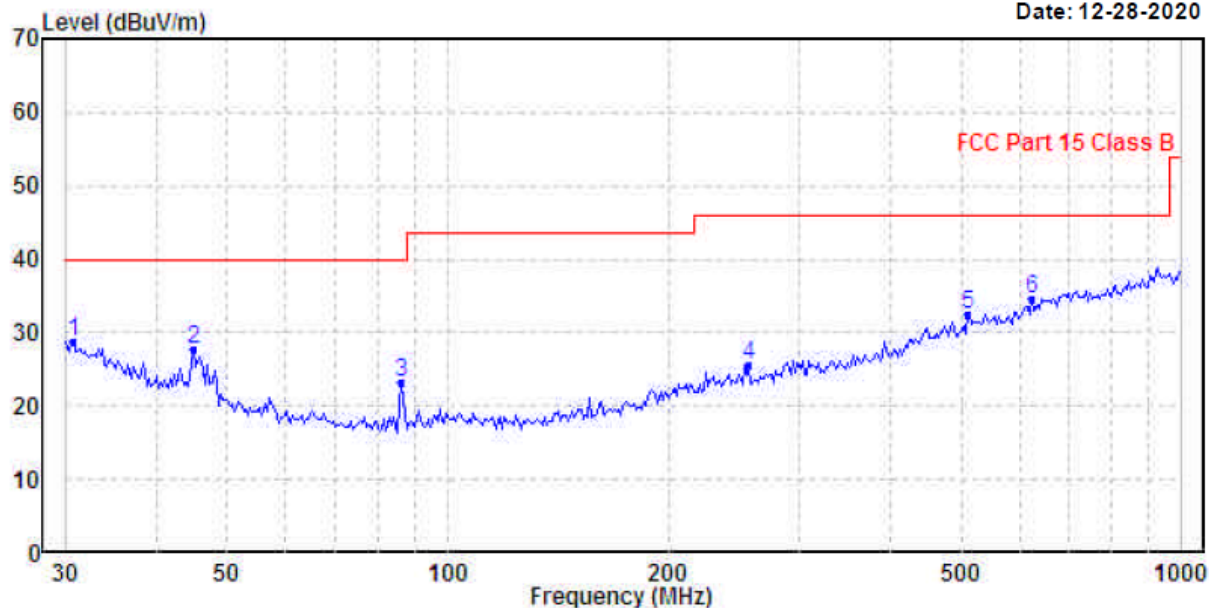
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**Results of Bluetooth Communication mode (2402.0 MHz) (30MHz – 1GHz): Pass**

Please refer to the following table for result details(The data is the worst cases)

Vertical

Date: 12-28-2020



Ambient Temperature: 24.6°C

Relative Humidity : 50.3%

	Freq	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	30.853	28.91	40.00	-11.09	QP	Vertical
2	45.058	27.69	40.00	-12.31	QP	Vertical
3	86.503	23.28	40.00	-16.72	QP	Vertical
4	256.521	25.58	46.00	-20.42	QP	Vertical
5	510.044	32.56	46.00	-13.44	QP	Vertical
6	625.078	34.73	46.00	-11.27	QP	Vertical

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### 3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10:2013
Test Date:	2020-12-23
Mode of Operation:	TX mode
Test Voltage:	120V a.c. 60Hz

Ambient Temperature: 25°C      Relative Humidity: 51%      Atmospheric Pressure: 101 kPa

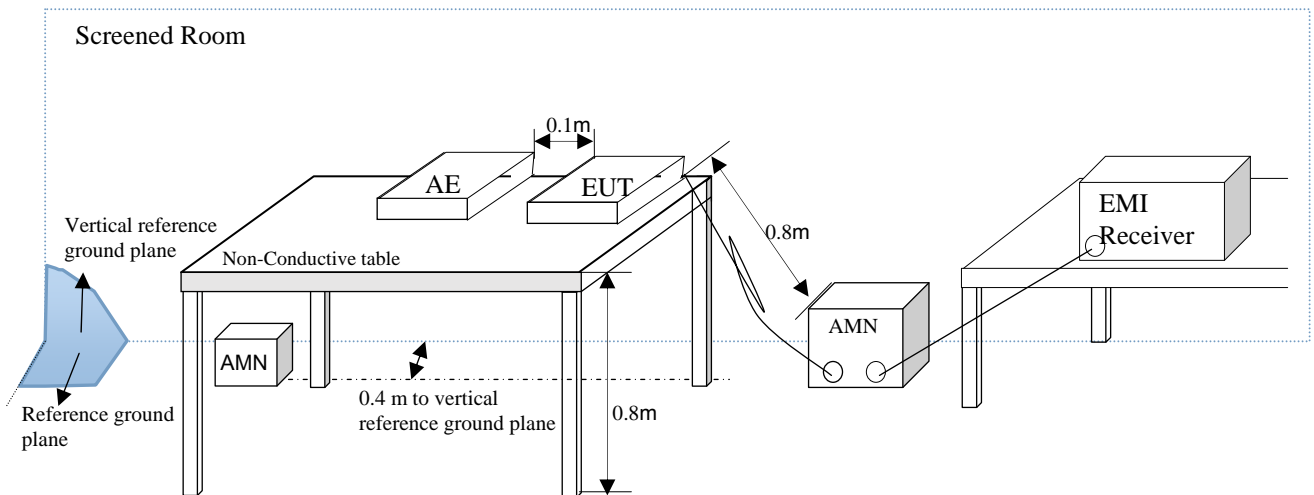
#### Test Method:

The test was performed in accordance with ANSI C63.10:2013, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

#### Receiver Setting:

Bandw. = 9 kHz, Meas. Time= 10.0 ms, Step Width = 5.0kHz, Detector = MaxPeak and CISPR AV

#### Test Setup:



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### Limits for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [dB $\mu$ V]	Average [dB $\mu$ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

\* Decreases with the logarithm of the frequency.

#### Remarks:

Calculated measurement uncertainty (0.15MHz – 30MHz): 3.25dB

-\*- Emission(s) that is far below the corresponding limit line.

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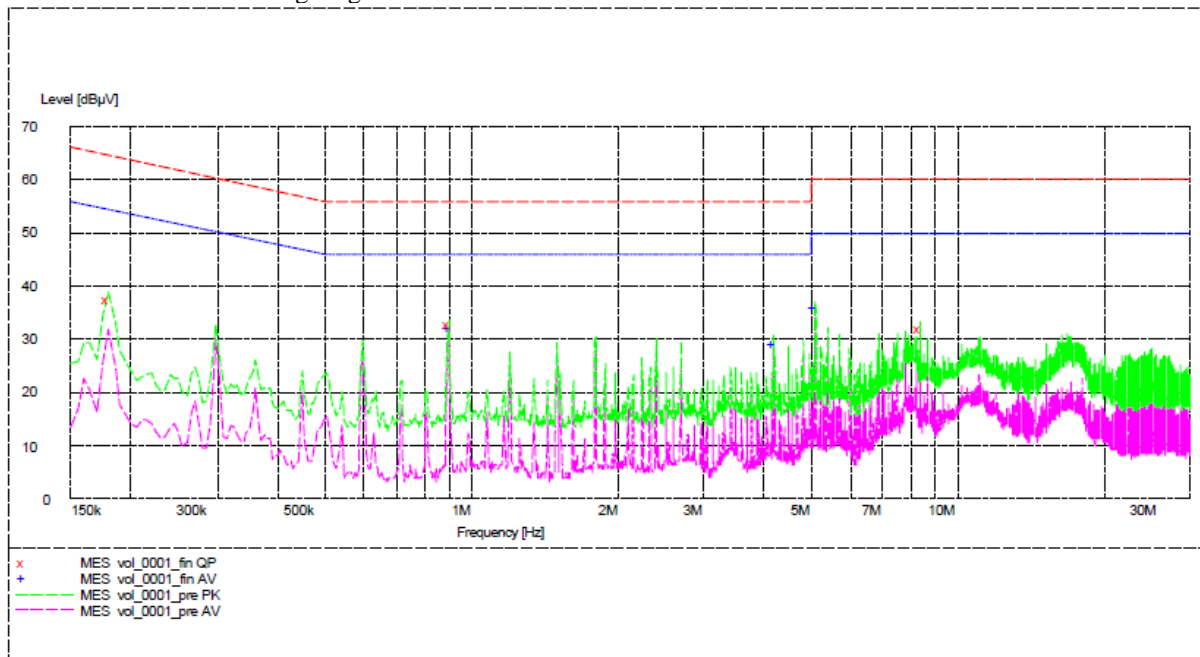
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**Results of TX mode(Charging with Charger) (L): PASS**

Please refer to the following diagram for individual results.



**MEASUREMENT RESULT: "vol\_0001\_fin AV"**

12/23/2020 7:16PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.900000	32.00	9.7	46	14.0	L1	GND
4.195000	28.80	9.7	46	17.2	L1	GND
5.095000	35.90	9.7	50	14.1	L1	GND

**MEASUREMENT RESULT: "vol\_0001\_fin QP"**

12/23/2020 7:16PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.180000	37.30	9.6	65	27.2	L1	GND
0.900000	33.00	9.7	56	23.0	L1	GND
8.395000	32.20	9.8	60	27.8	L1	GND

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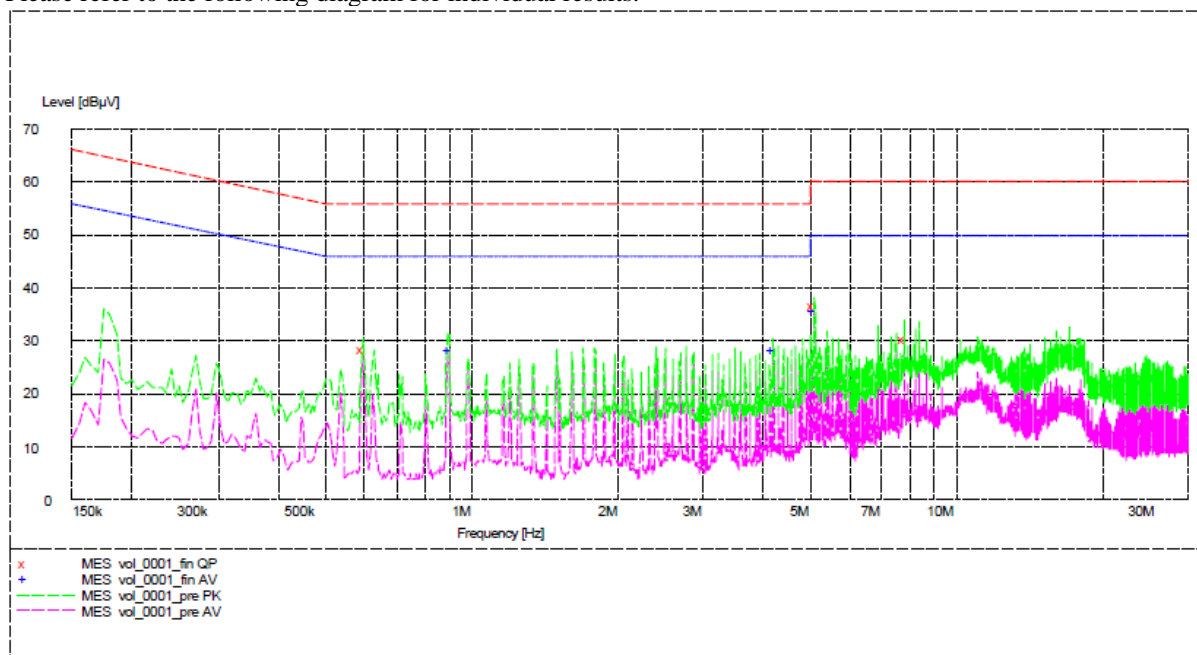
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**Results of TX mode(Charging with Charger) (N): PASS**

Please refer to the following diagram for individual results.



**MEASUREMENT RESULT: "vol\_0001\_fin AV"**

12/23/2020 7:14PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.900000	28.30	9.7	46	17.7	N	GND
4.195000	28.40	9.7	46	17.6	N	GND
5.095000	35.60	9.7	50	14.4	N	GND

**MEASUREMENT RESULT: "vol\_0001\_fin QP"**

12/23/2020 7:14PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.600000	28.50	9.7	56	27.5	N	GND
5.095000	36.80	9.7	60	23.2	N	GND
7.790000	30.50	9.8	60	29.5	N	GND

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### 3.1.4 Power Spectral Density

Test Requirement: FCC 47CFR 15.247(e)  
Test Method: ANSI C63.10:2013  
Test Date: 2020-12-24  
Mode of Operation: Tx mode

Ambient Temperature: 25°C      Relative Humidity: 51%      Atmospheric Pressure: 101 kPa

#### Test Method:

The RF output of the EUT was connected to the spectrum analyzer. Set the fundamental frequency as the center frequency of the spectral analyzer. Use RBW=3kHz , VBW= 10KHz , Set the span to 1.5 times the DTS channel bandwidth. Detector = peak, Sweep time = auto couple , Trace mode = max hold. Measure the Power Spectral Density (PSD) and record the results in dBm.

#### Test Setup:

As Test Setup of clause 3.1.1 in this test report.

#### Test Limit:

The maximum power spectral density (PSD) shall not exceeded 8dBm in any 3kHz band.

#### Results of Tx Mode GFSK (Tx:2402MHz to 2480MHz) : Pass (Tx Unit)

##### Maximum power spectral density

Transmitter Frequency (MHz)	Maximum Power spectral density level / 3kHz band (dBm)	Maximum Power spectral density / 3kHz band limit
2402.0	-15.474	8dBm
2440.0	-15.652	8dBm
2480.0	-16.286	8dBm

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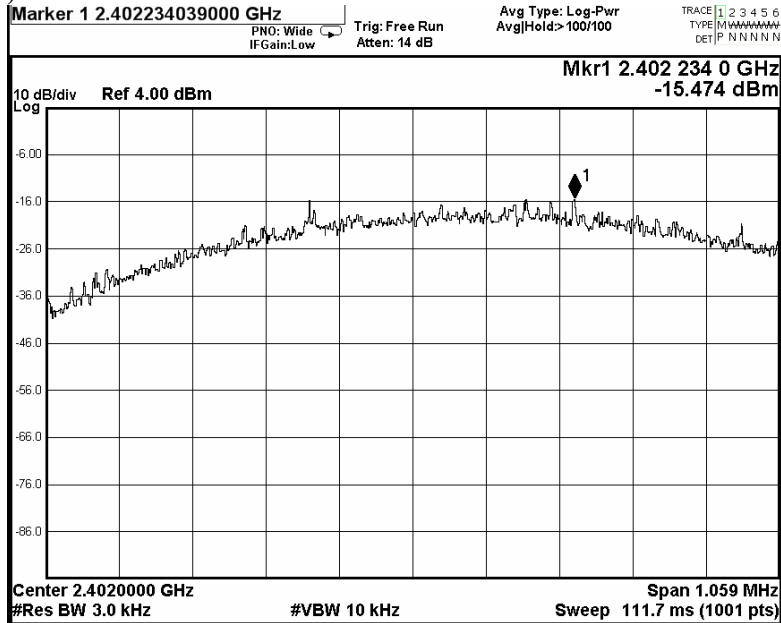


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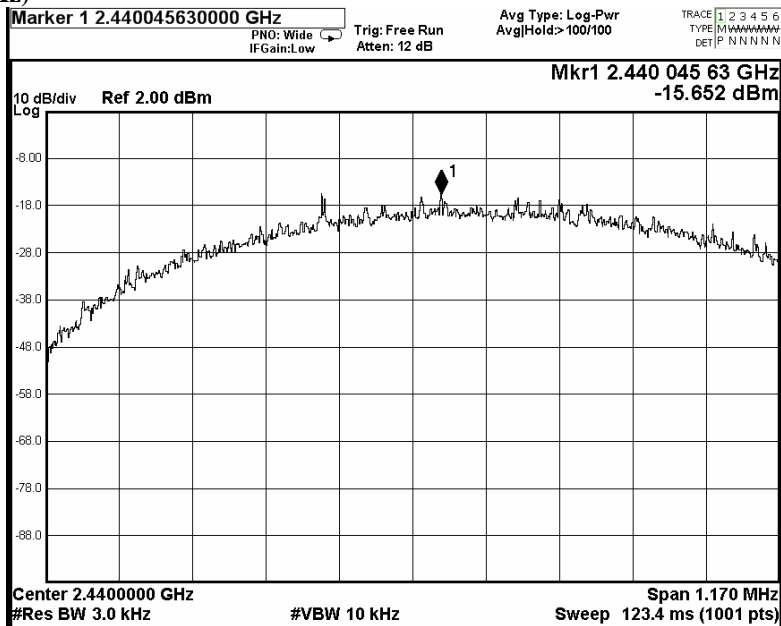
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Tx mode GFSK (Tx: 2402MHz to 2480MHz)  
 CH 0 (2402.0 MHz)



CH 19 (2440.0 MHz)



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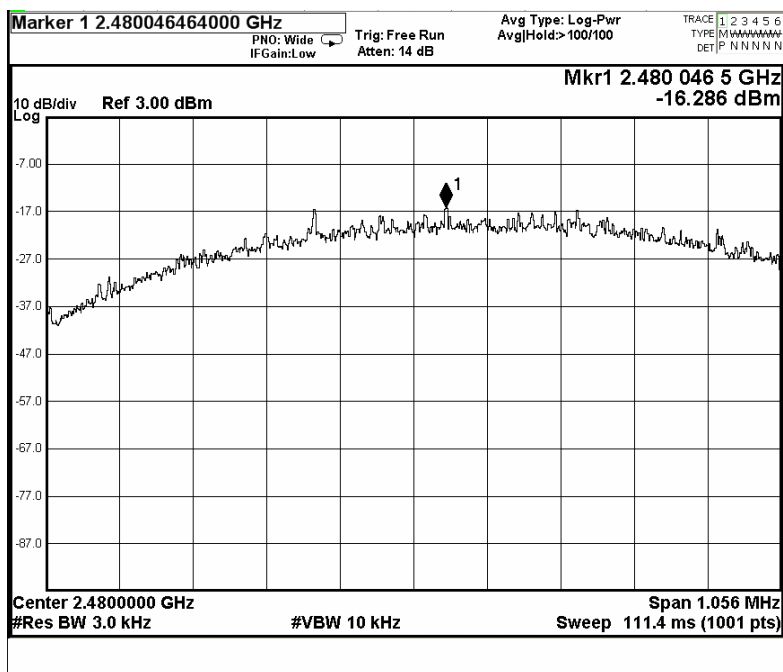


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CH 39 (2480.0 MHz)



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### 3.1.5 6dB Spectrum Bandwidth Measurement

Test Requirement: FCC 47CFR 15.247(a)(2)  
Test Method: ANSI C63.10:2013  
Test Date: 2020-12-24  
Mode of Operation: Tx mode

Ambient Temperature: 25°C      Relative Humidity: 51%      Atmospheric Pressure: 101 kPa

#### **Test Method:**

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

#### **Test Setup:**

As Test Setup of clause 3.1.1 in this test report.

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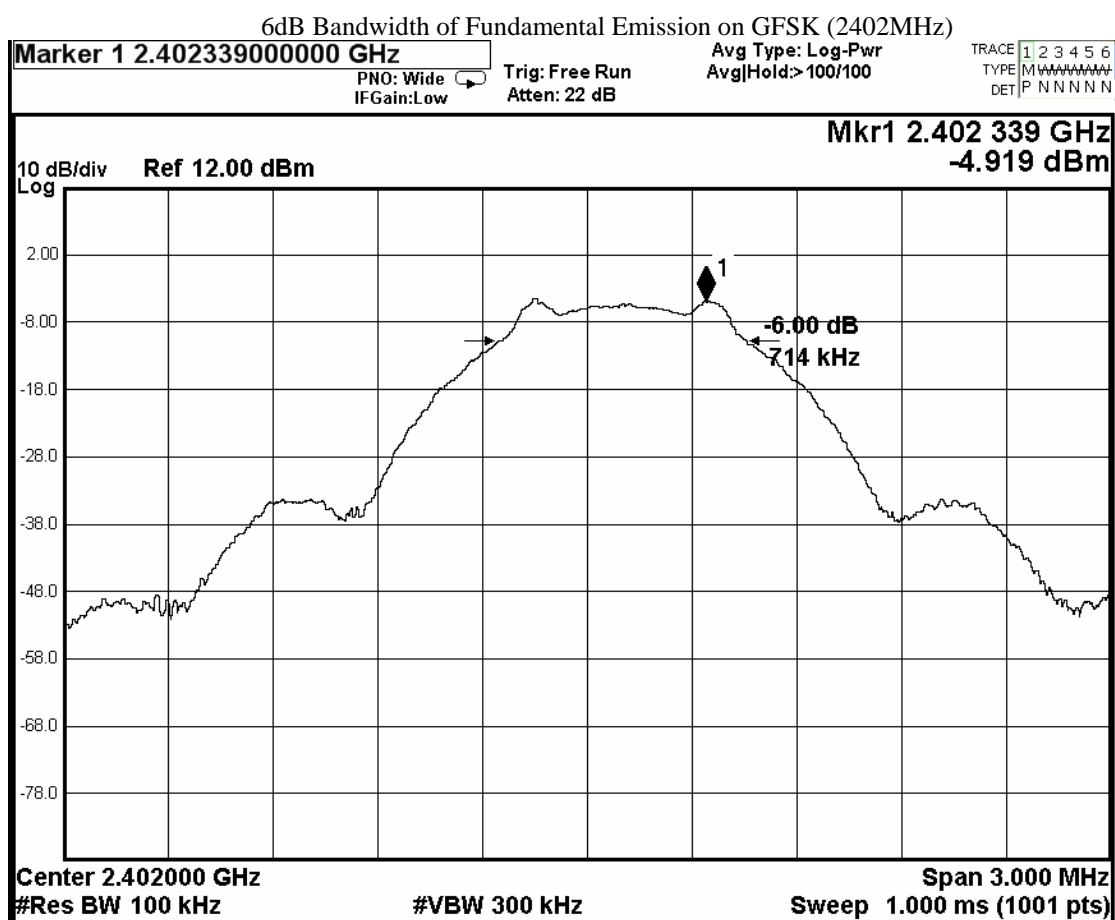
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**Limits for 6dB Spectrum Bandwidth Measurement:**

Center Frequency [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2402.0	714.0	> 500





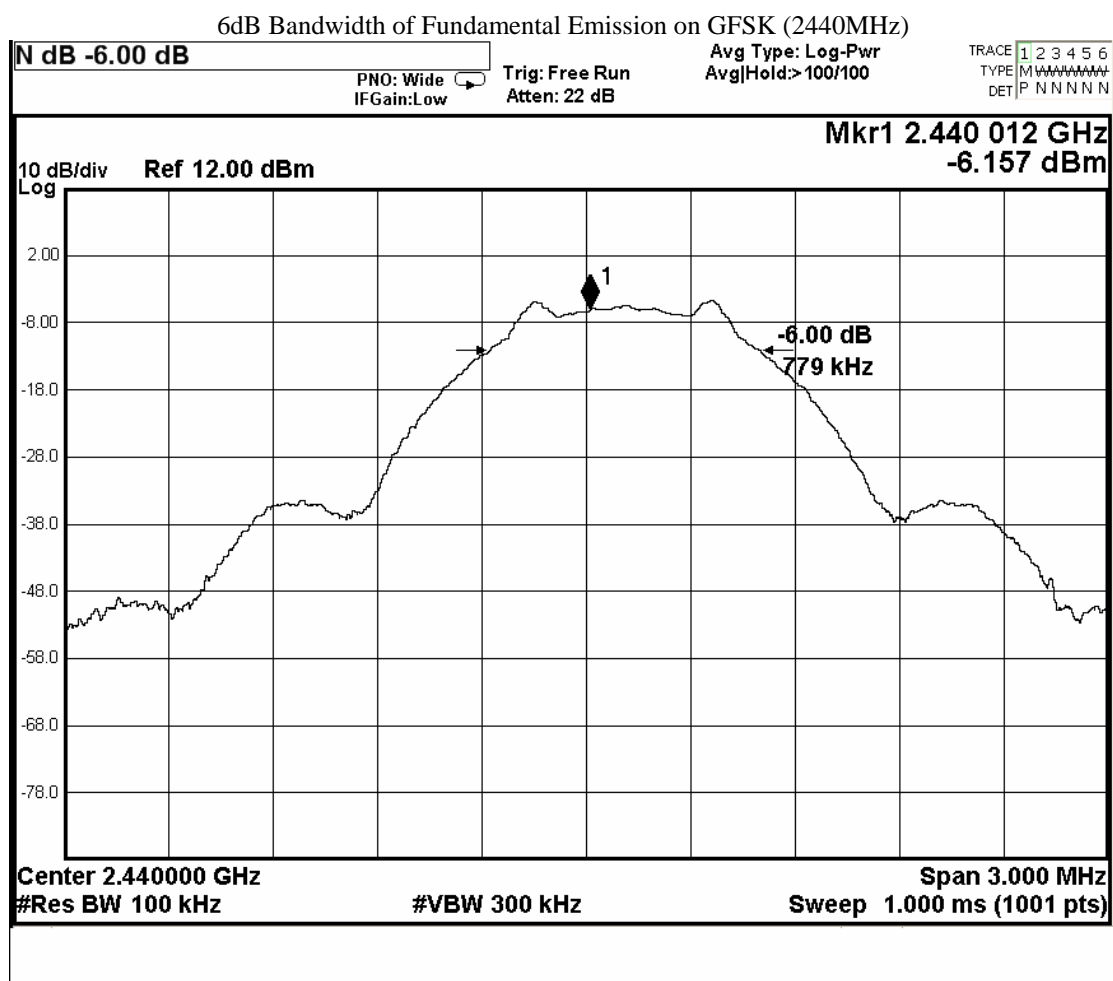
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**Limits for 6dB Spectrum Bandwidth Measurement:**

Frequency Range [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2440.0	779.0	> 500





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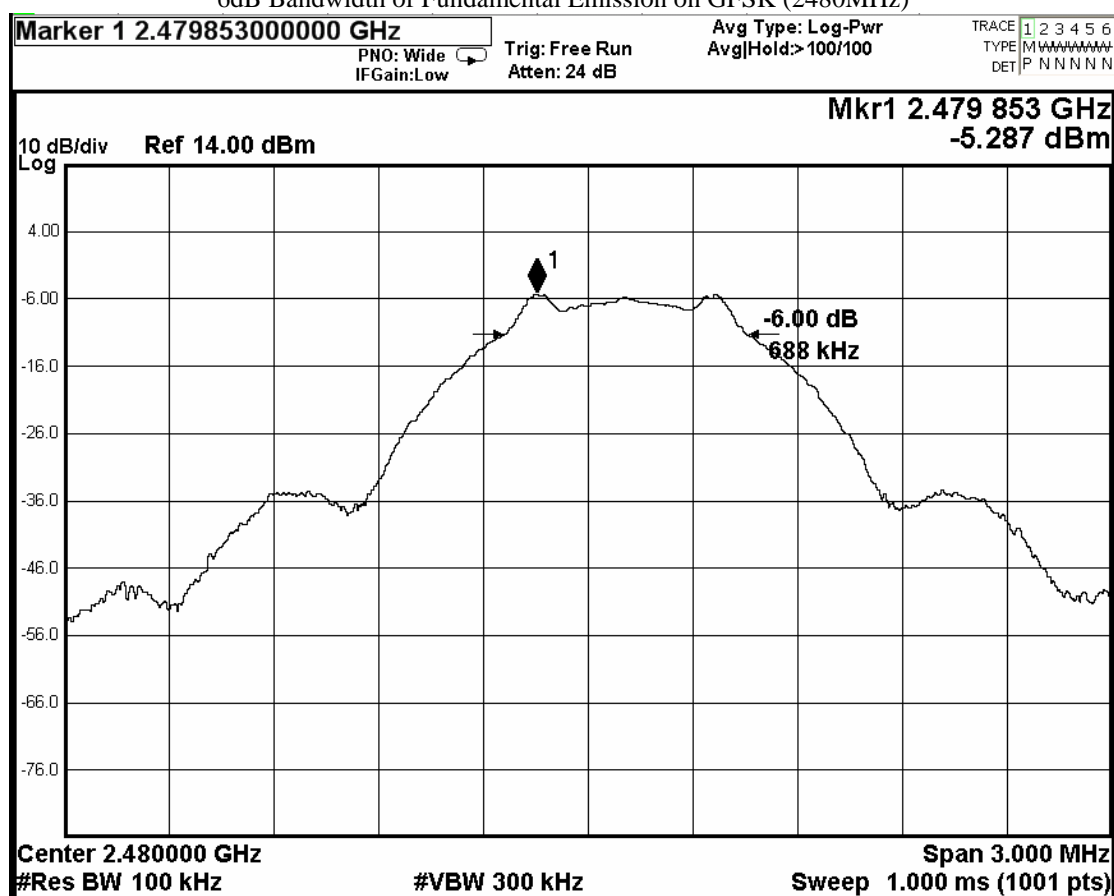
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**Limits for 6dB Spectrum Bandwidth Measurement:**

Frequency Range [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2480.0	688.0	> 500

6dB Bandwidth of Fundamental Emission on GFSK (2480MHz)





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### 3.1.6 Band Edges Measurement

Test Requirement: FCC 47CFR 15.247  
Test Method: ANSI C63.10:2013  
Test Date: 2020-12-24  
Mode of Operation: Tx mode

Ambient Temperature: 25°C      Relative Humidity: 51%      Atmospheric Pressure: 101 kPa

#### Test Method:

The band edge is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. The RBW are set to 100kHz and VBW are set to 300kHz for this measurement.

#### Test Setup:

As Test Setup of clause 3.1.2 in this test report.

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### Band-edge Compliance of RF Conducted Emissions Measurement:

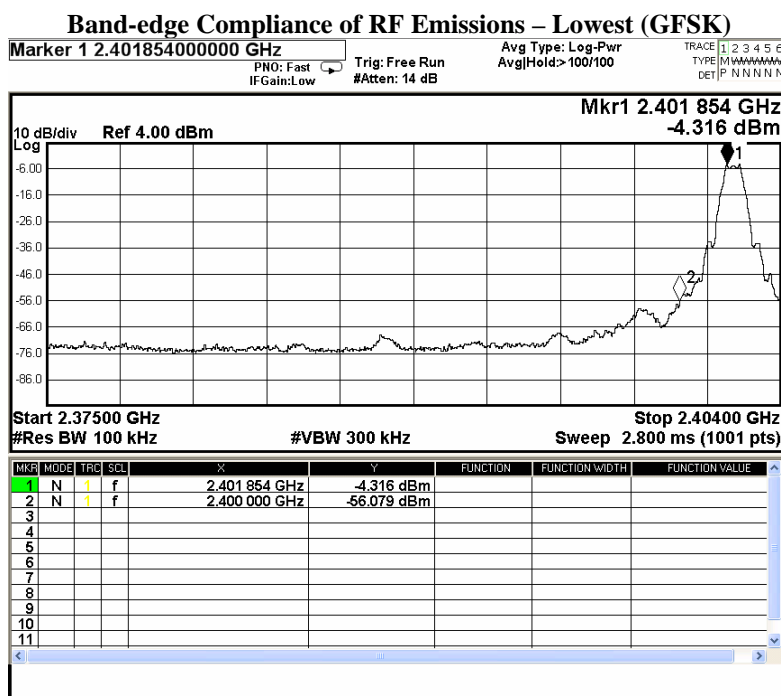
#### Limit :

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. Attenuation below the general limits specified in Section 15.209(a) is not required.

Remark: Emissions under the fixed frequency mode and hopping mode have been investigated, the worst-case measurement results were recorded in the test report

### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Reference level [dBm]	Limit [dBm]	The highest conducted band edge emission [dBm]	Result
2400 – Lowest Fundamental (2402)	-4.316	-24.316	-56.079	PASS





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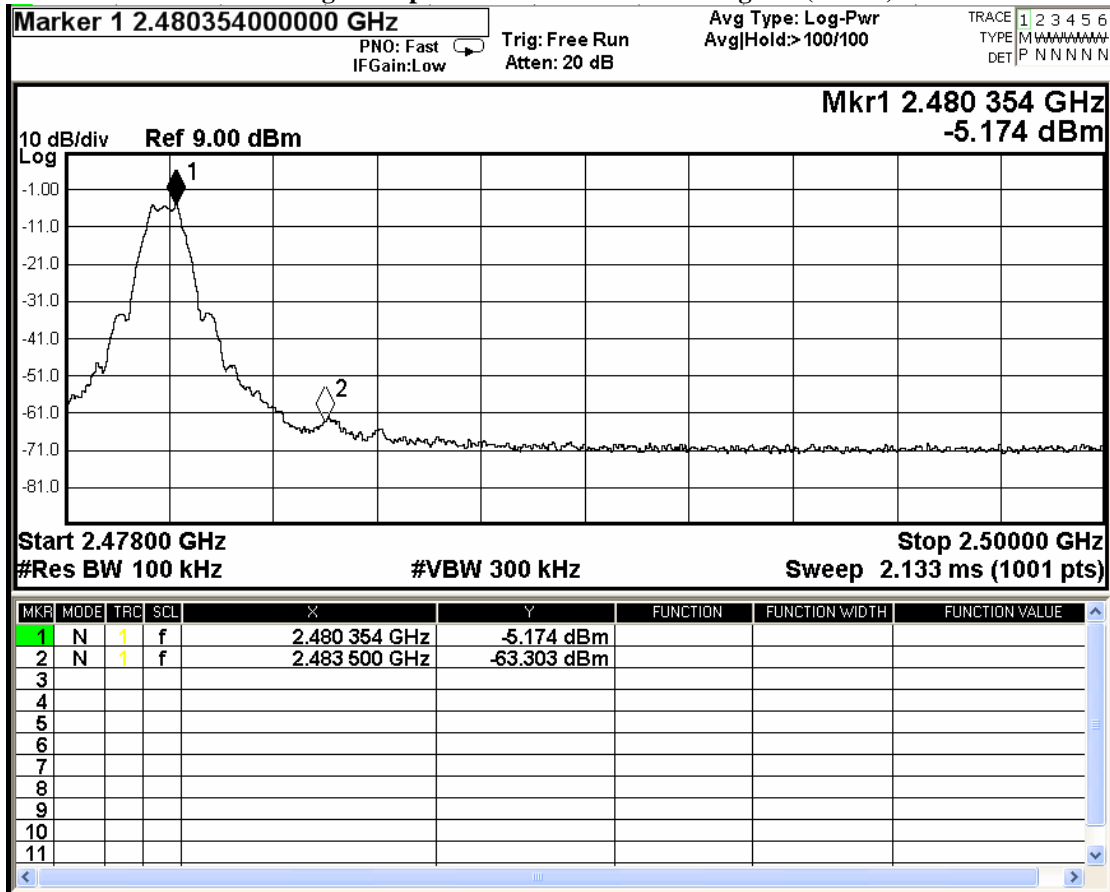
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**Band-edge Compliance of RF Conducted Emissions Measurement:**

Frequency Range [MHz]	Reference level [dBm]	Limit [dBm]	The highest conducted band edge emission [dBm]	Result
2483.5 - Highest Fundamental (2480)	-5.174	-25.174	-63.303	PASS

**Band-edge Compliance of RF Emissions – Highest (GFSK)**





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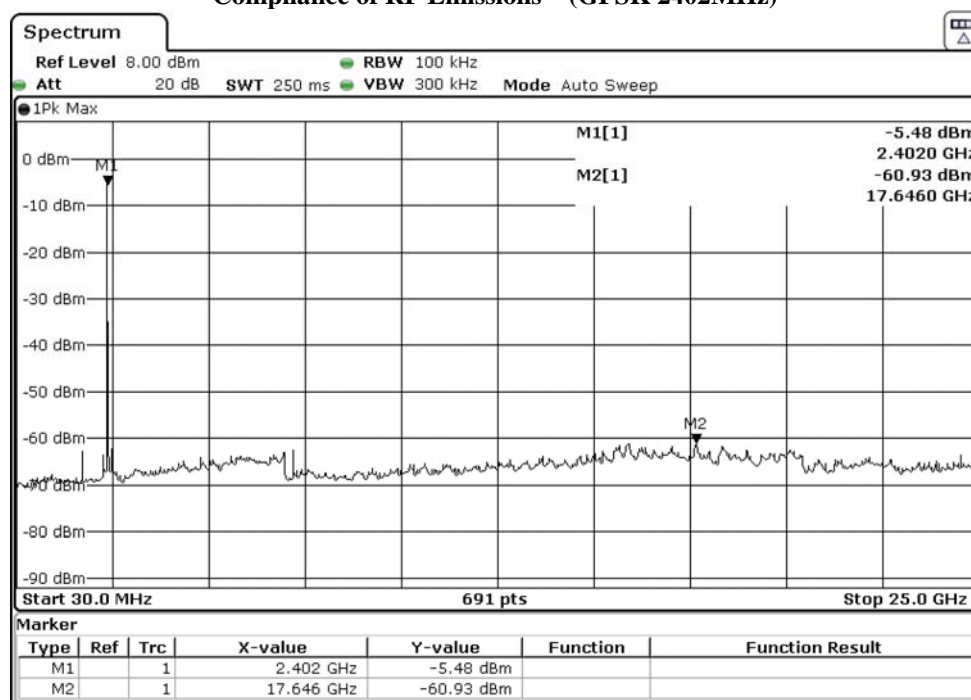
**Compliance of RF Emissions Measurement:**

**Limit :**

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. Attenuation below the general limits specified in Section 15.209(a) is not required.

Remark: Emissions under the fixed frequency mode and hopping mode have been investigated, the worst-case measurement results were recorded in the test report

**Compliance of RF Emissions – (GFSK 2402MHz)**



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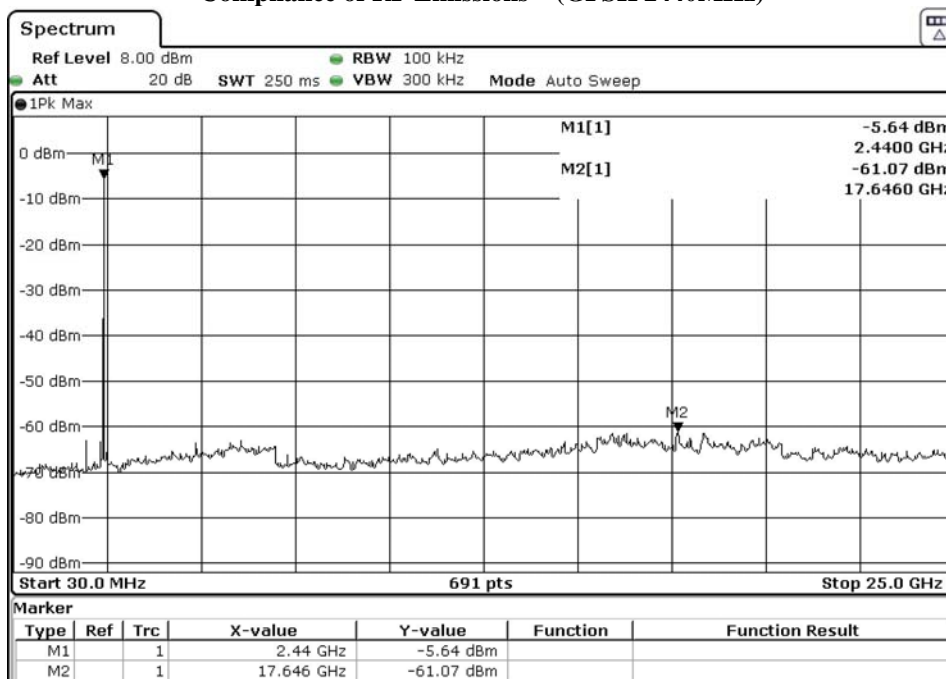


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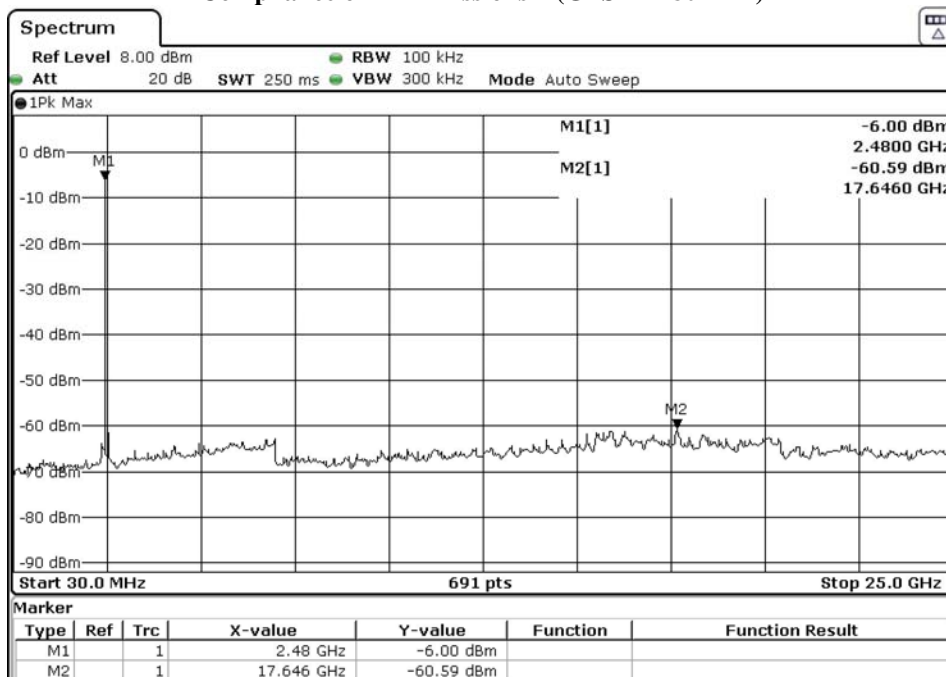
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### Compliance of RF Emissions – (GFSK 2440MHz)



### Compliance of RF Emissions – (GFSK 2480MHz)



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### 3.1.7 Antenna Requirement

Ambient Temperature: 25°C      Relative Humidity: 51%      Atmospheric Pressure: 101 kPa

**Test Requirements:** § 15.203

#### **Test Specification:**

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.

#### **Test Results:**

This is Ceramic Chip antenna. There is no external antenna, the antenna gain = 1.7dBi. User is unable to remove or changed the Antenna.

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## Test Report

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### Appendix A

#### List of Measurement Equipment

##### Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM217	ELECTRIC POWERED TURNABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2020/04/20	2021/04/20
EM356	ANTENNA POSITIONING TOWER	ETS-LINDGREN	2171B	00150346	N/A	N/A
EM336	PRECISION CONICAL DIPOLE	SEIBERSDORF LABORATORIES	PCD 3100	6236/M	2020/05/30	2022/05/30
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2020/05/13	2021/05/13
EM276	BROADBAND HORN ANTENNA	A-INFOMW	JXTXLB- 10180-SF	J203109090300 7	2019/03/20	2021/03/29
EM300	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-09	00130130	2020/04/28	2022/04/28
EM301	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-10	00130988	2020/04/28	2022/04/28
EM022	LOOP ANTENNA	ETS_LINDGREN	6502	00206533	2019/11/30	2021/11/30
EM200	DUAL CHANNEL POWER METER	R & S	NRVD	100592	2019/10/11	2021/10/11
EM012	PRE-AMPLIFIER	HP	HP8448B	3008A00262	2019/11/08	2021/11/08

Remarks:-

CM Corrective Maintenance  
N/A Not Applicable  
TBD To Be Determined

### Appendix B

#### Ancillary Equipment

ITEM NO.	DESCRIPTION	MODEL NO.	FCC ID	REMARK
1	AC Adapter	HW-059200CHQ	N/A	Input: 100-240V a.c. 50/60Hz, 0..5A Output: 5Vd.c. 2A Name: HUAWEI
2	Charge cable	N/A	N/A	1M CABLE

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### Appendix C

#### Photographs of EUT

**View of the product**



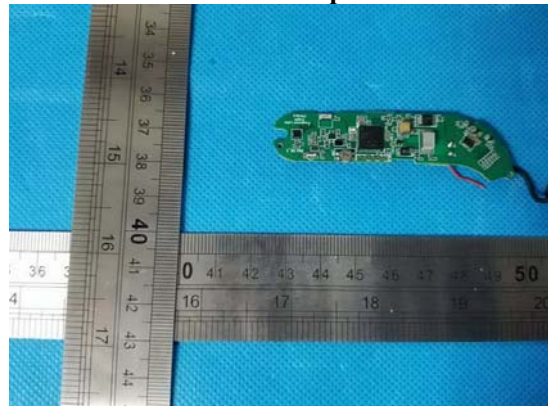
**View of the product**



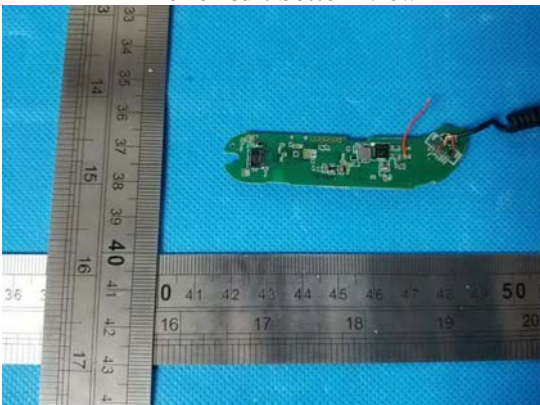
**Inside View of the product**



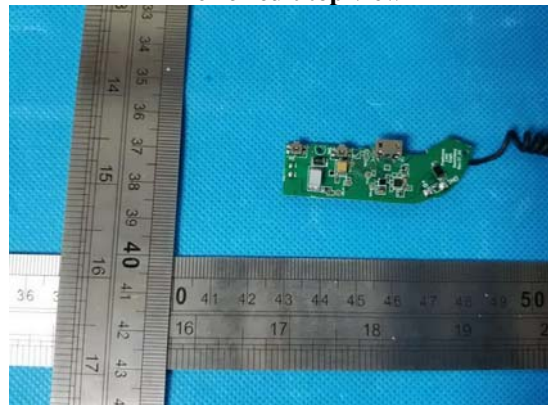
**Inner circuit top view**



**Inner circuit bottom view**



**Inner circuit top view**



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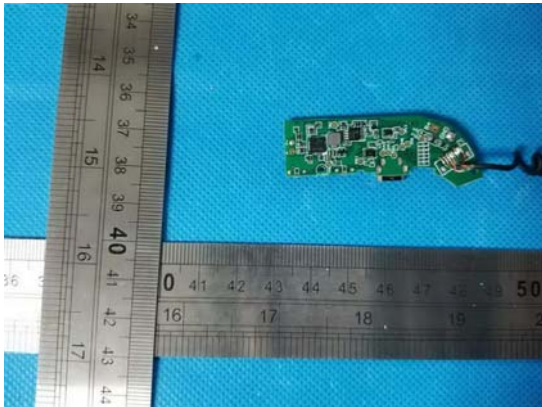
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### Photographs of EUT

**Inner circuit bottom view**



**Inner circuit top view**



**Inner circuit bottom view**



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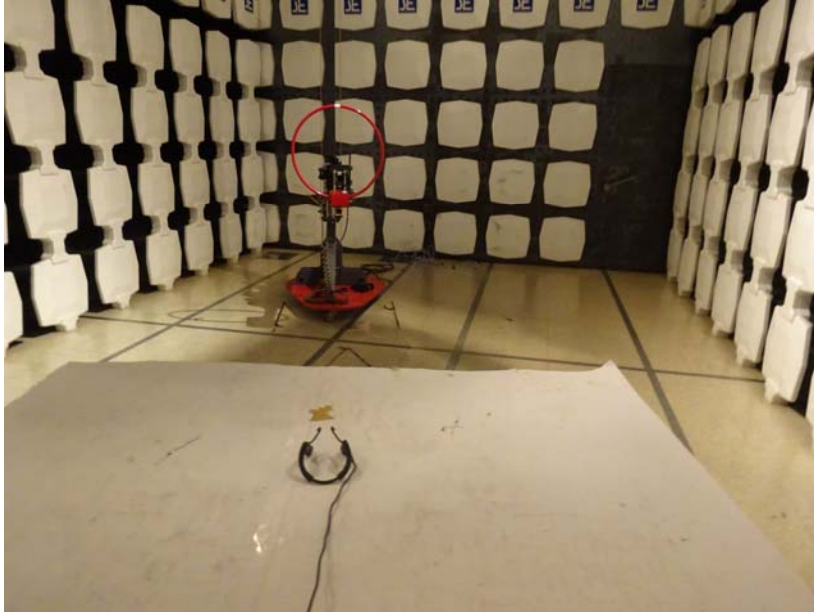
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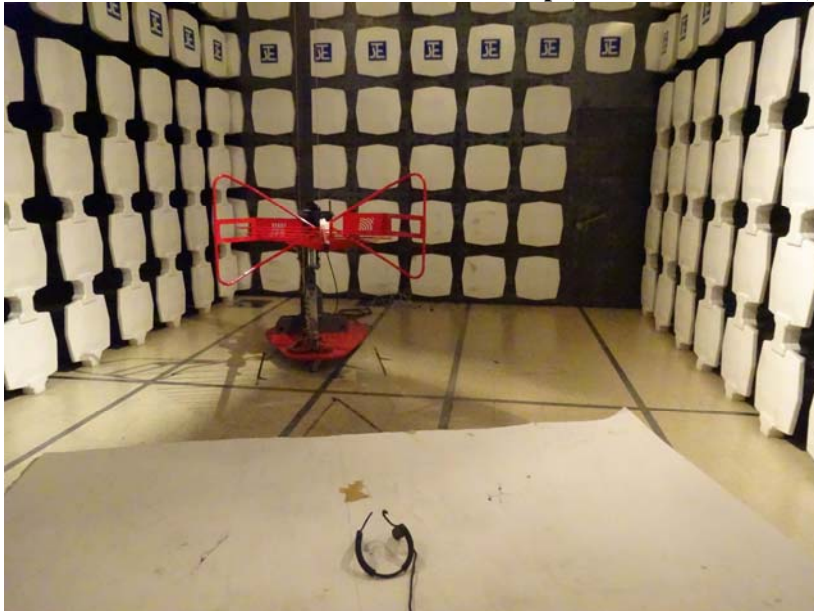
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### Photographs of EUT

**Measurement of Radiated Emission Test Set Up (9kHz to 30MHz)**



**Measurement of Radiated Emission Test Set Up (30MHz to 1000MHz)**



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### Photographs of EUT

**Measurement of Radiated Emission Test Set Up (Above 1000MHz)**



**Measurement of Conducted Emission Test Set Up**



**\*\*\*\*\* End of Test Report \*\*\*\*\***

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