Test Report

Date : 2020-08-25
No. : HMD20020001

Applicant	:	GV Concepts, Inc. 3240 S. White Road, #286, San Jose California United States
Supplier / Manufacturer	:	GV Concepts, Inc. 3240 S. White Road, #286, San Jose California United States
Description of Sample(s)	:	Submitted sample(s) said to be Product: Electronic Stethoscope Brand Name: doctorgram Stethoscope Model No.: DES-I FCC ID: 2AVUQ-DES-I-A10
Date Samples Received	:	2020-02-25
Date Tested	:	2020-03-16 to 2020-03-17
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)

LEUNG Kwun Hang, Joey
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:	Electronic Stethoscope
Manufacturer:	GV Concepts, Inc. 3240 S. White Road, #286, San Jose California United States
Brand Name:	doctorgram Stethoscope
Model Number:	DES-I
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 an Electronic Stethoscope. 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

2020-02-25

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2020-03-16 to 2020-03-17

1.6 Country of Origin

China

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1.7 RF Module Details

Module Model Number: ABLE42M1
Module FCC ID: 2ARFOABLE42M1
Module Transmission Type: Bluetooth 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: PCB antenna
Antenna Gain: 0dBi

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 C63.10:2013for FCC Certification.
According FCC KDB 558074 DTS Measurement Guidance, Duty cycle ≧98%.
The device was realized by test software.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary						
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	☒	☐	☐
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.10: 2013	N/A	☒	☐	☐
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10: 2013	N/A	☒	☐	☐
Power Spectral Density	FCC 47CFR 15.247(e)	ANSI C63.10: 2013	N/A	☒	☐	☐
6dB Bandwidth	FCC 47CFR 15.247(a)(2)	ANSI C63.10: 2013	N/A	☒	☐	☐
Band Edge Emissions (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	N/A	☒	☐	☐
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	☒	☐	☐

Note: N/A - Not Applicable

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3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Output Power

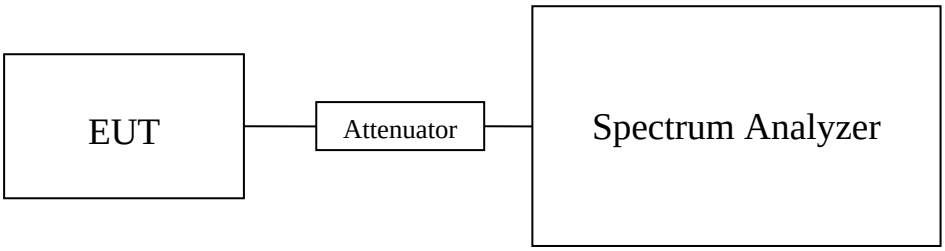
Test Requirement:	FCC 47CFR 15.247(b)(3)
Test Method:	ANSI C63.10: 2013
Test Date:	2020-03-16
Mode of Operation:	Bluetooth DTS Tx mode

Ambient Temperature: 25℃ 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.

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]:

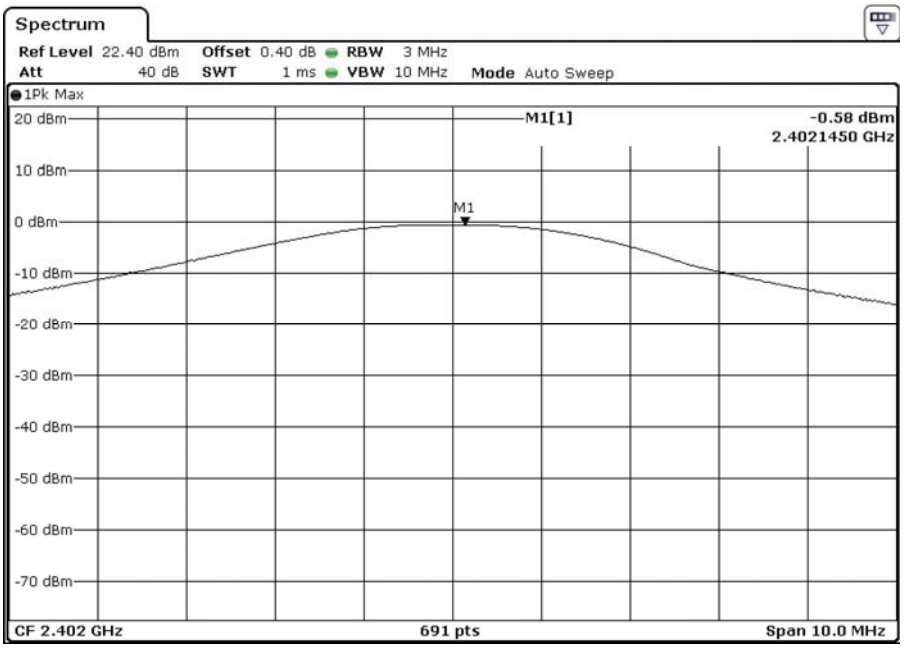
For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt (30dBm)

Results of BT DTS Tx Mode (2402MHz to 2480MHz) : Pass (TX Unit) (GFSK)					
Channel	**Frequency(MHz)**	**Conducted power(dBm)**	**Antenna Gain(dB)**	**E.I.R.P(dBm)**	**E.I.R.P (Watt)**
0	2402	-0.58	0	-0.58	0.000875
19	2440	-0.18	0	-0.18	0.000959
39	2480	0.06	0	0.06	0.001014

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

Test plot of Maximum Peak Conducted Output Power :

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



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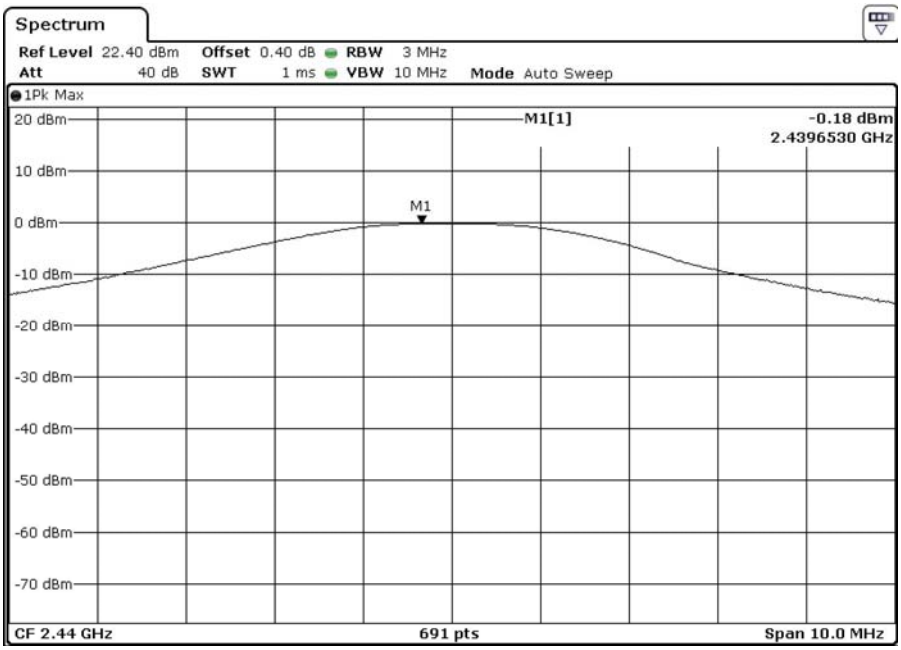
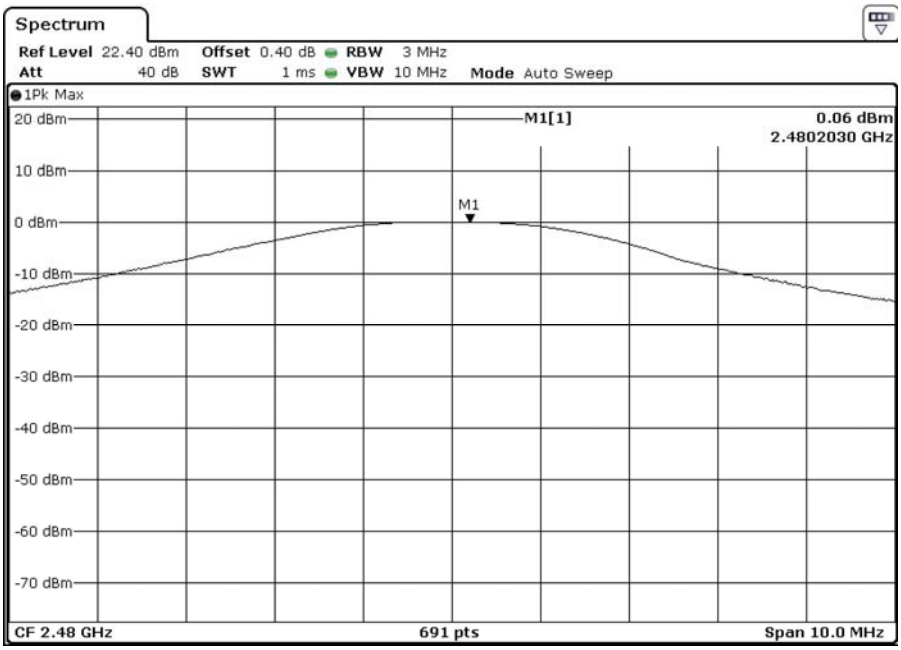
Bluetooth Communication mode (BT DTS-GFSK, 2440MHz)



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:	2020-03-16
Mode of Operation:	Tx mode / Bluetooth Communication mode (GFSK)

Ambient Temperature: 25℃ 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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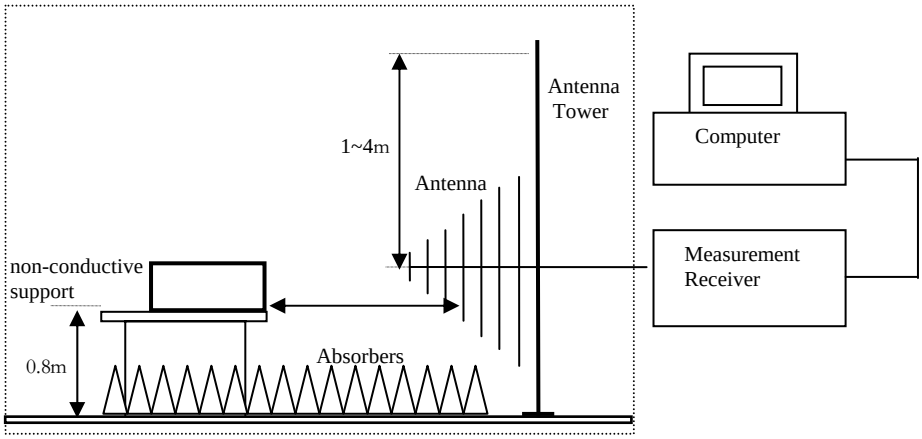
Spectrum Analyzer Setting:

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 15.247 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/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

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

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dB	E-Field Polarity
4804.0	14.4	41.5	55.9	74.0	18.1	Vertical
4804.0	13.5	42.4	55.9	74.0	18.1	Horizontal
7206.0	9.6	45.1	54.7	74.0	19.3	Vertical
7206.0	8.6	46.2	54.8	74.0	19.2	Horizontal
9612.0	7.3	48.0	55.3	74.0	18.7	Vertical
9612.0	6.0	48.8	54.8	74.0	19.2	Horizontal
12010.0	3.7	51.8	55.5	74.0	18.5	Vertical
12010.0	3.3	52.4	55.7	74.0	18.3	Horizontal

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dB	E-Field Polarity
4804.0	-2.1	41.5	39.4	54.0	14.6	Vertical
4804.0	-2.3	42.4	40.2	54.0	13.9	Horizontal
7206.0	-6.6	45.1	38.5	54.0	15.5	Vertical
7206.0	-7.3	46.2	38.9	54.0	15.1	Horizontal
9612.0	-8.3	48.0	39.7	54.0	14.3	Vertical
9612.0	-9.4	48.8	39.4	54.0	14.6	Horizontal
12010.0	-11.7	51.8	40.2	54.0	13.9	Vertical
12010.0	-13.2	52.4	39.21	54.0	14.8	Horizontal

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

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

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

Field Strength of Spurious Emissions Peak Value						
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	14.6	41.6	56.2	74.0	17.8	Vertical
4880.0	13.4	42.5	55.9	74.0	18.1	Horizontal
7320.0	2.1	53.2	55.3	74.0	18.7	Vertical
7320.0	9.3	46.3	55.6	74.0	18.4	Horizontal
9760.0	7.3	48.1	55.4	74.0	18.6	Vertical
9760.0	6.6	48.9	55.5	74.0	18.5	Horizontal
12200.0	4.1	51.6	55.7	74.0	18.3	Vertical
12200.0	3.6	52.5	56.1	74.0	17.9	Horizontal

Field Strength of Spurious Emissions Average Value						
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	-2.3	41.6	39.4	54.0	14.7	Vertical
4880.0	-3.2	42.5	39.3	54.0	14.7	Horizontal
7320.0	-6.8	45.2	38.4	54.0	15.6	Vertical
7320.0	-7.8	46.3	38.5	54.0	15.5	Horizontal
9760.0	-8.9	48.1	39.2	54.0	14.8	Vertical
9760.0	-10.3	48.9	38.6	54.0	15.4	Horizontal
12200.0	-12.3	51.6	39.4	54.0	14.7	Vertical
12200.0	-12.7	52.5	39.8	54.0	14.2	Horizontal

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

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

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

Field Strength of Spurious Emissions Peak Value						
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	15.0	41.4	56.4	74.0	17.7	Vertical
4960.0	12.7	42.7	55.4	74.0	18.6	Horizontal
7440.0	9.3	45.6	54.9	74.0	19.2	Vertical
7440.0	9.0	46.5	55.5	74.0	18.5	Horizontal
9920.0	7.1	48.6	55.7	74.0	18.3	Vertical
9920.0	5.64	49.7	55.3	74.0	18.7	Horizontal
12400.0	4.3	51.7	56.0	74.0	18.0	Vertical
12400.0	3.2	52.7	55.9	74.0	18.1	Horizontal

Field Strength of Spurious Emissions Average Value						
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	-2.1	41.4	39.3	54.0	14.7	Vertical
4960.0	-4.6	42.7	38.1	54.0	15.9	Horizontal
7440.0	-7.5	45.6	38.1	54.0	15.9	Vertical
7440.0	-7.4	46.5	39.1	54.0	14.9	Horizontal
9920.0	-10.0	48.6	38.6	54.0	15.4	Vertical
9920.0	-10.5	49.7	39.2	54.0	14.8	Horizontal
12400.0	-11.6	51.7	40.1	54.0	13.9	Vertical
12400.0	-13.1	52.7	39.6	54.0	14.4	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

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dB	E-Field Polarity
2390.0	9.7	36.8	46.5	74.0	27.5	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dB	E-Field Polarity
2390.0	1.3	36.8	38.1	54.0	15.9	Vertical

Result： RF Radiated Emissions (Highest) -GFSK

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dB	E-Field Polarity
2483.5	8.3	36.8	45.1	74.0	28.9	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dB	E-Field Polarity
2483.5	1.1	36.8	37.9	54.0	16.1	Vertical

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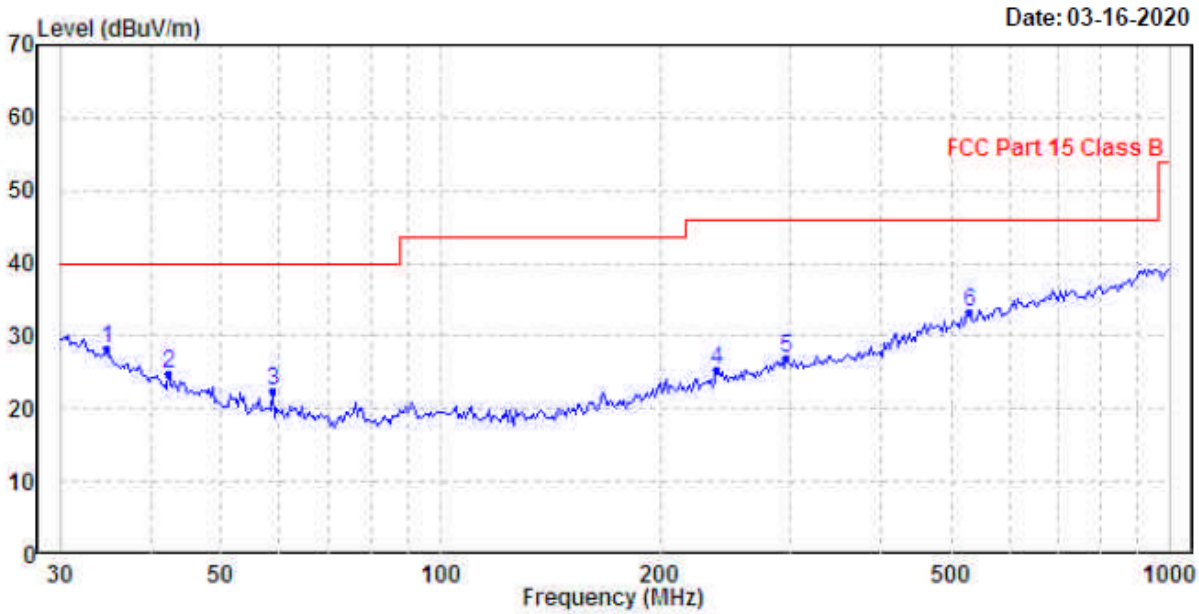
Results of Bluetooth Communication mode (2402.0 MHz) (30MHz – 1GHz): Pass

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

Horizontal



Ambient Temperature: 25C
Relative Humidity : 50%

	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	34.760	28.39	40.00	-11.61	QP	Horizontal
2	42.302	24.90	40.00	-15.10	QP	Horizontal
3	58.819	22.52	40.00	-17.48	QP	Horizontal
4	239.147	25.32	46.00	-20.68	QP	Horizontal
5	297.224	26.83	46.00	-19.17	QP	Horizontal
6	528.246	33.39	46.00	-12.61	QP	Horizontal

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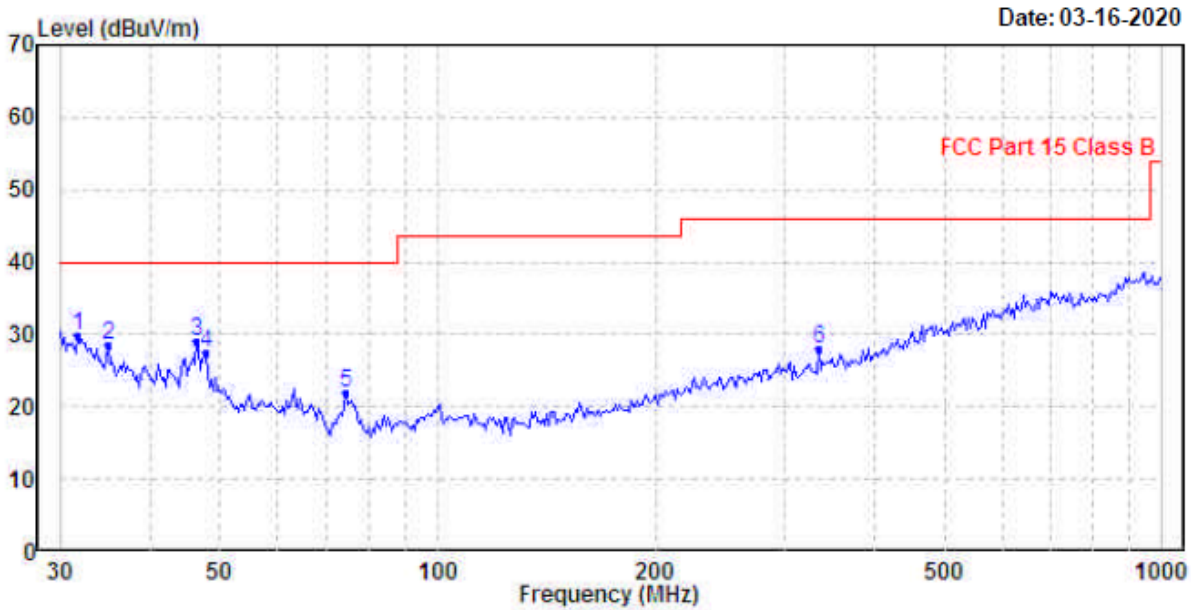
Results of Bluetooth Communication mode (2402.0 MHz) (30MHz – 1GHz): Pass
Please refer to the following table for result details(The data is the worst cases)
Vertical



Ambient Temperature: 25C
Relative Humidity : 50%

	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	31.731	29.92	40.00	-10.08	QP	Vertical
2	35.005	28.50	40.00	-11.50	QP	Vertical
3	46.340	29.02	40.00	-10.98	QP	Vertical
4	47.659	27.44	40.00	-12.56	QP	Vertical
5	74.657	21.92	40.00	-18.08	QP	Vertical
6	334.859	27.97	46.00	-18.03	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:	2020-03-16
Mode of Operation:	Bluetooth play mode
Test Voltage:	120Va.c. 60Hz

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

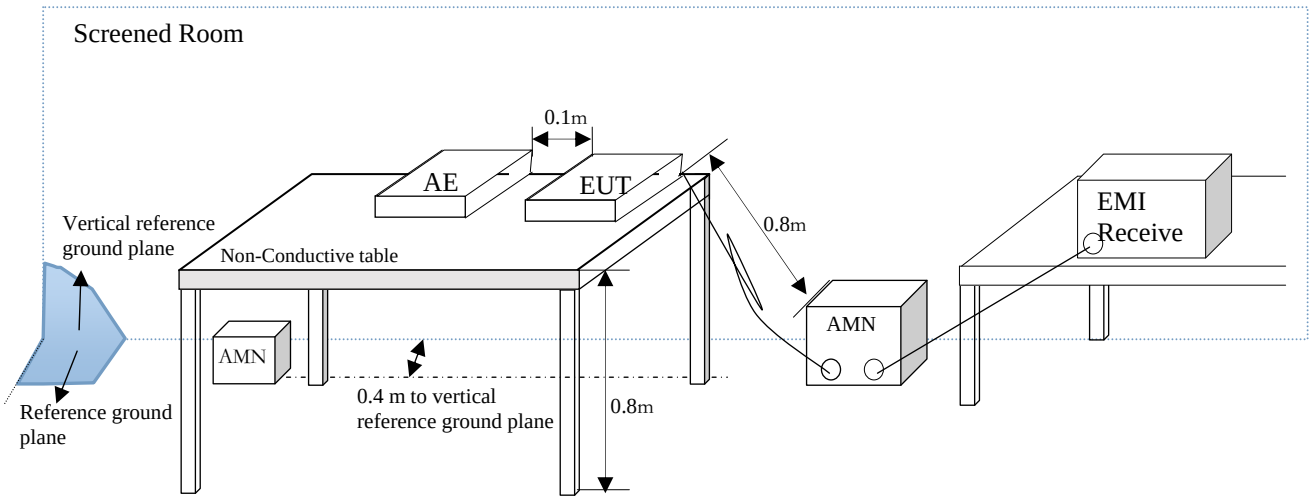
Test Method:

The test was performed in accordance with ANSI 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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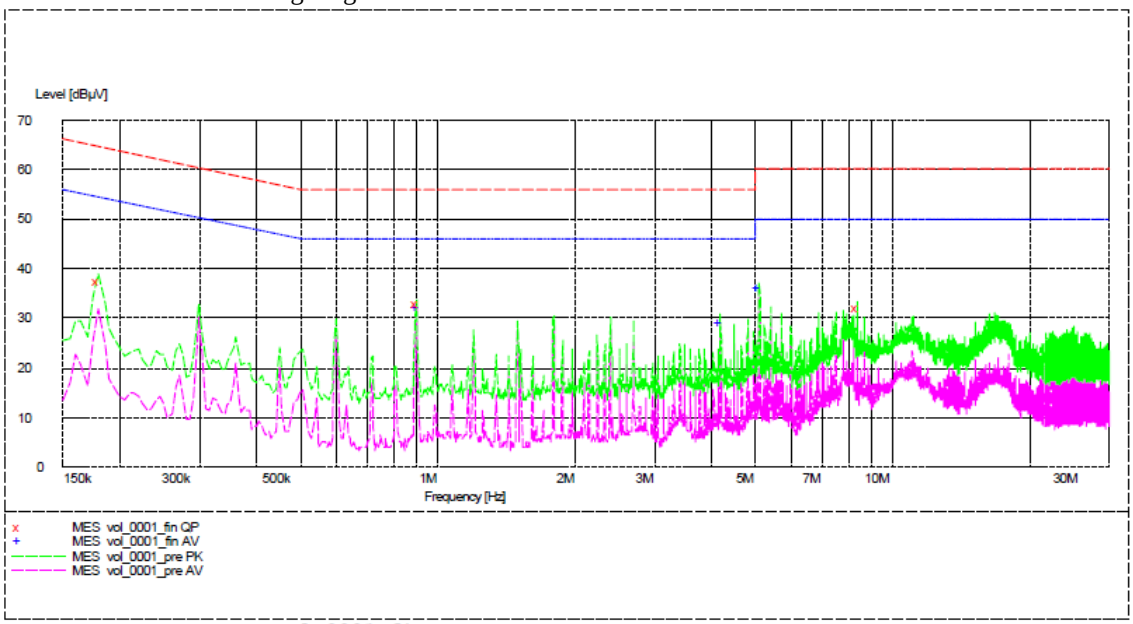
Limits for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
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.

Results of Bluetooth Communication mode (L): PASS
Please refer to the following diagram for individual results.



MEASUREMENT RESULT: "vol_0001_fin AV"

3/16/2020 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"

3/16/2020 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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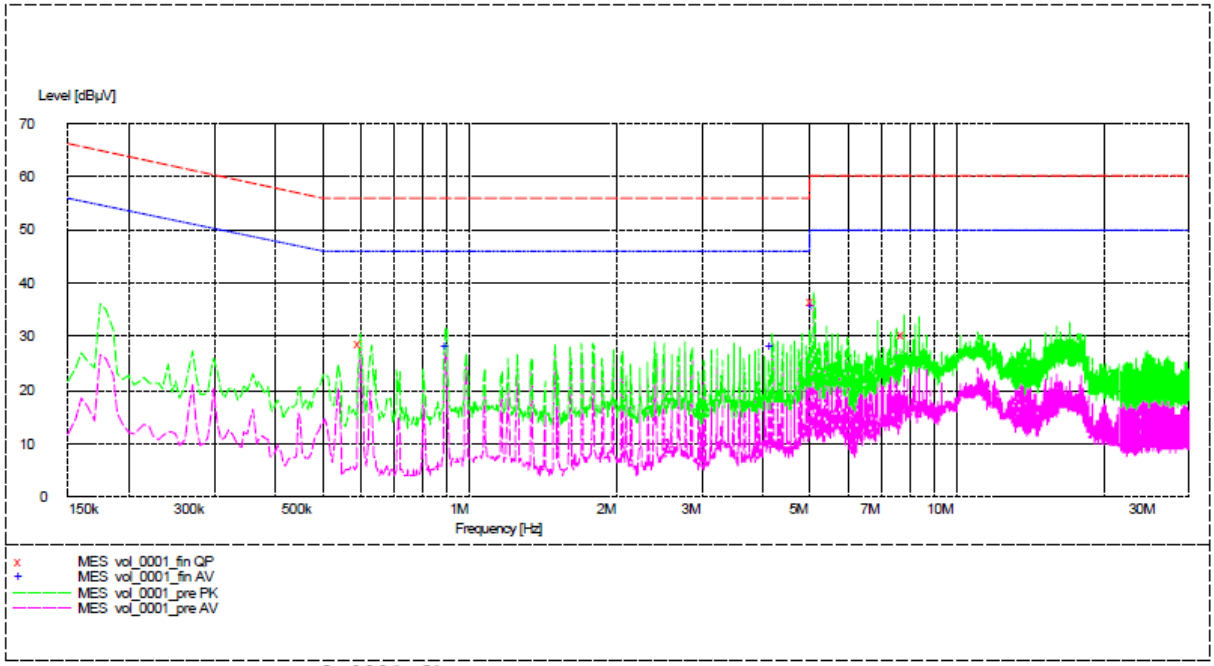
Results of Bluetooth Communication mode (N): PASS
Please refer to the following diagram for individual results.



MEASUREMENT RESULT: "vol_0001_fin AV"

3/16/2020 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"

3/16/2020 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

Remarks:
Calculated measurement uncertainty (0.15MHz – 30MHz): 3.25dB
-*- Emission(s) that is far below the corresponding limit line.

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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:	2020-03-16
Mode of Operation:	Tx mode

Ambient Temperature: 25℃ 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	-15.92	**8dBm**
2440.0	-15.16	**8dBm**
2480.0	-15.13	**8dBm**

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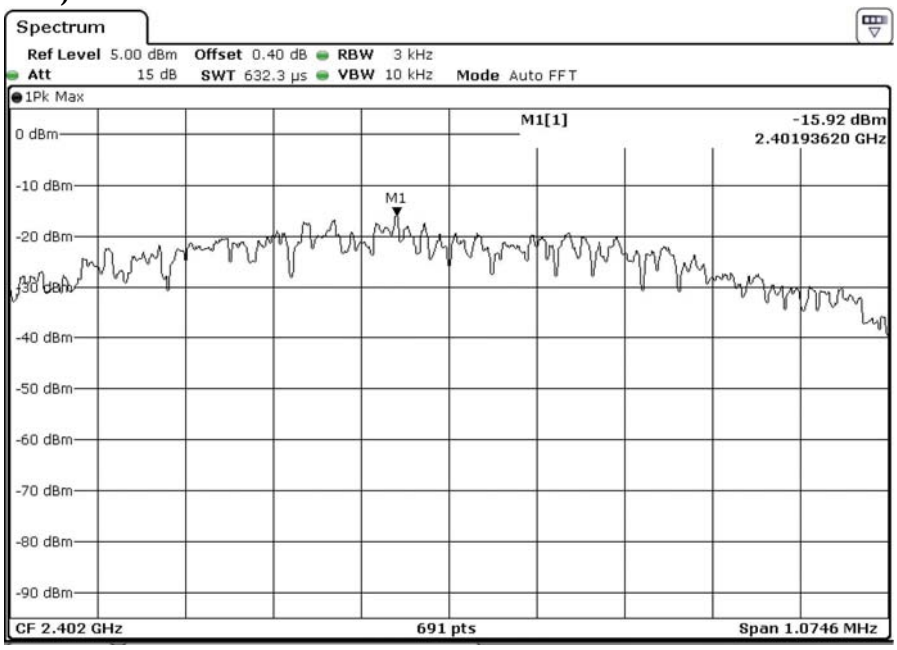
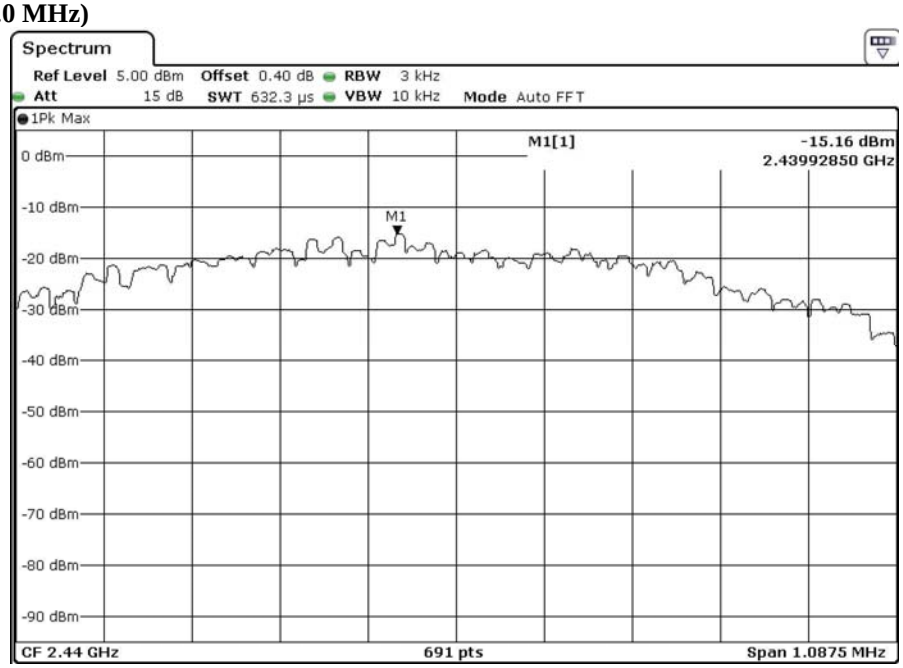
Tx mode GFSK (Tx: 2402MHz to 2480MHz)

CH 0 (2402.0 MHz)



CH 19 (2440.0 MHz)



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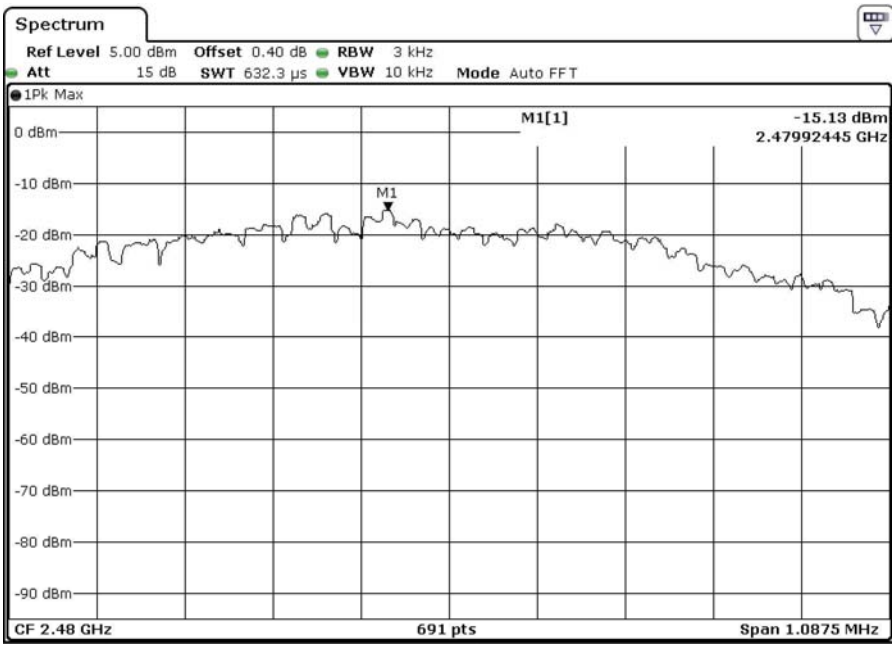
CH 39 (2480.0 MHz)



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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:	2020-03-16
Mode of Operation:	Tx mode

Ambient Temperature: 25℃ 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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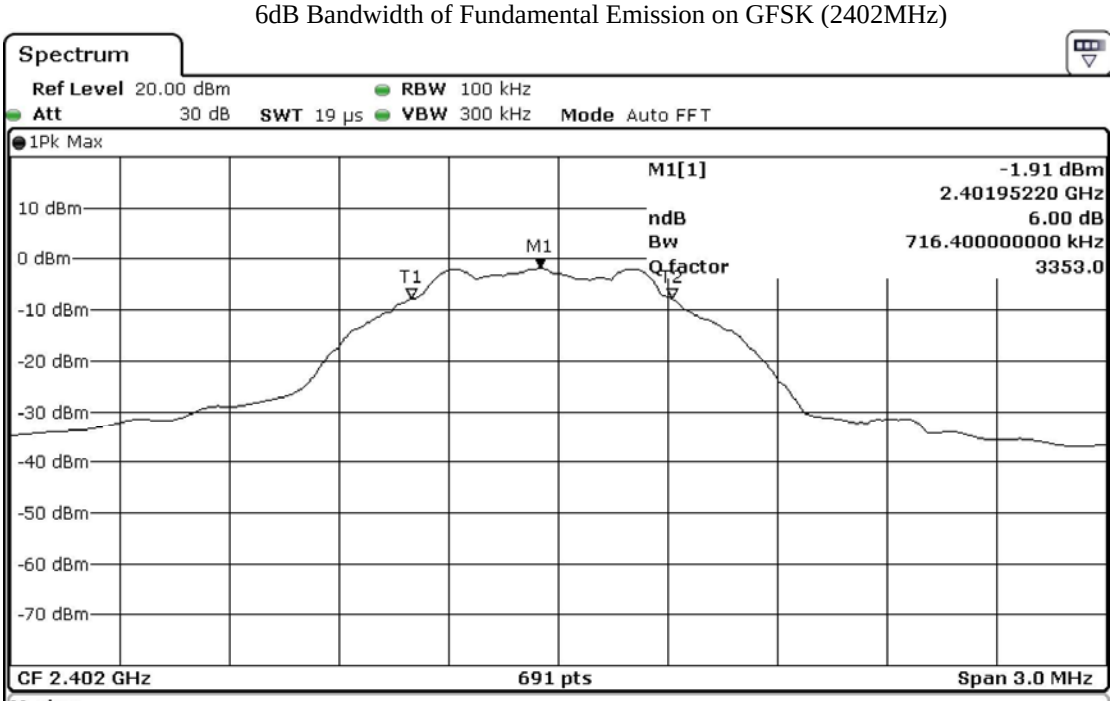
Limits for 6dB Spectrum Bandwidth Measurement:

Center Frequency [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2402.0	716.4	> 500

6dB Bandwidth of Fundamental Emission on GFSK (2402MHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4019522 GHz	-1.91 dBm	ndB down	716.4 kHz
T1		1	2.4015962 GHz	-7.88 dBm	ndB	6.00 dB
T2		1	2.4023126 GHz	-7.87 dBm	Q factor	3353.0

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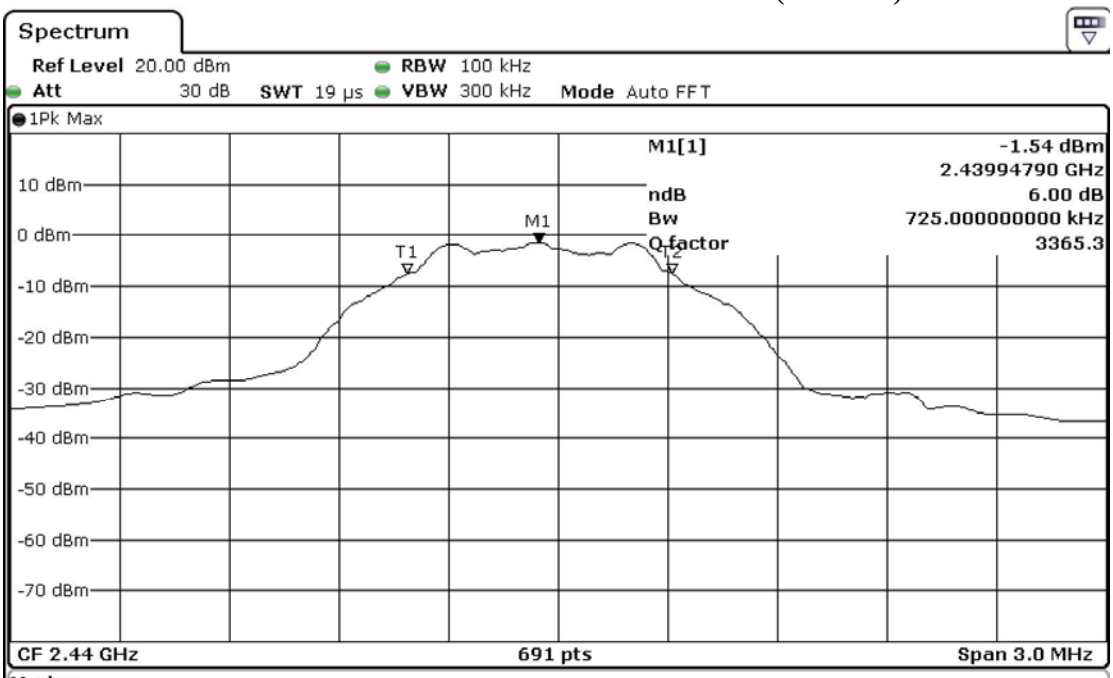
Limits for 6dB Spectrum Bandwidth Measurement:

Frequency Range [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2440.0	725.0	> 500

6dB Bandwidth of Fundamental Emission on GFSK (2440MHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4399479 GHz	-1.54 dBm	ndB down	725.0 kHz
T1		1	2.4395876 GHz	-7.53 dBm	ndB	6.00 dB
T2		1	2.4403126 GHz	-7.53 dBm	Q factor	3365.3

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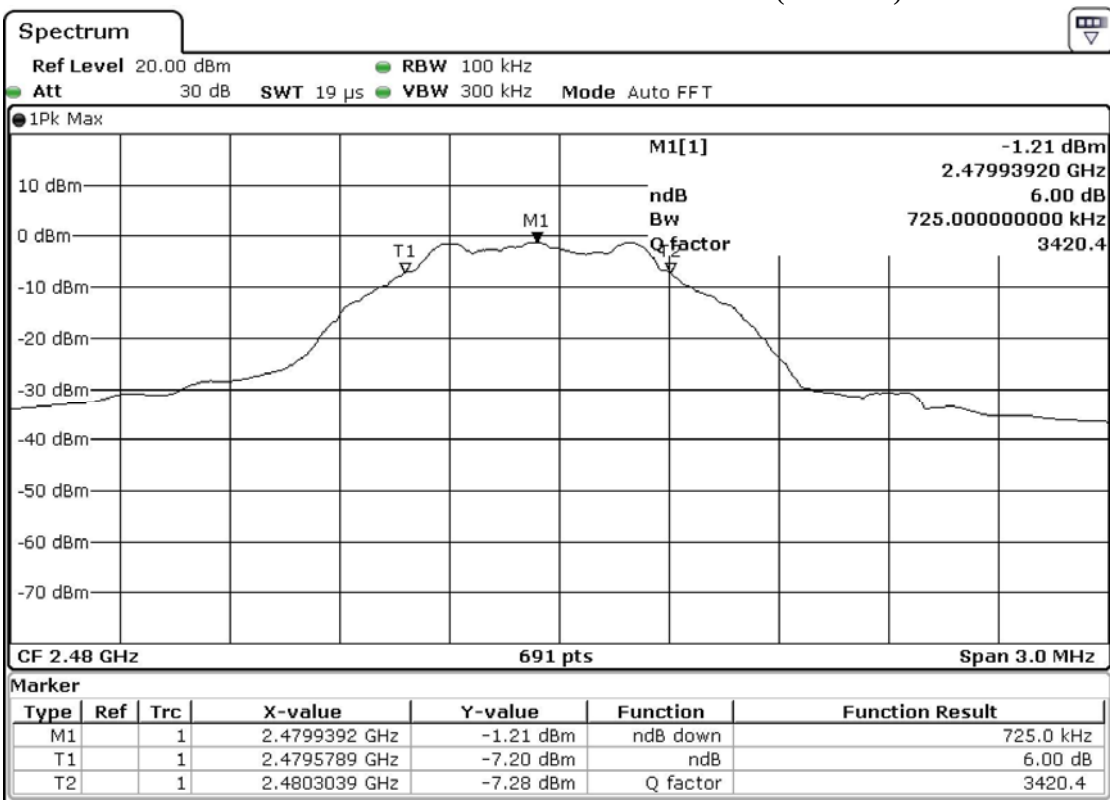
Limits for 6dB Spectrum Bandwidth Measurement:

Frequency Range [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2480.0	725.0	> 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:	2020-03-16
Mode of Operation:	Tx mode

Ambient Temperature: 25℃ 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:

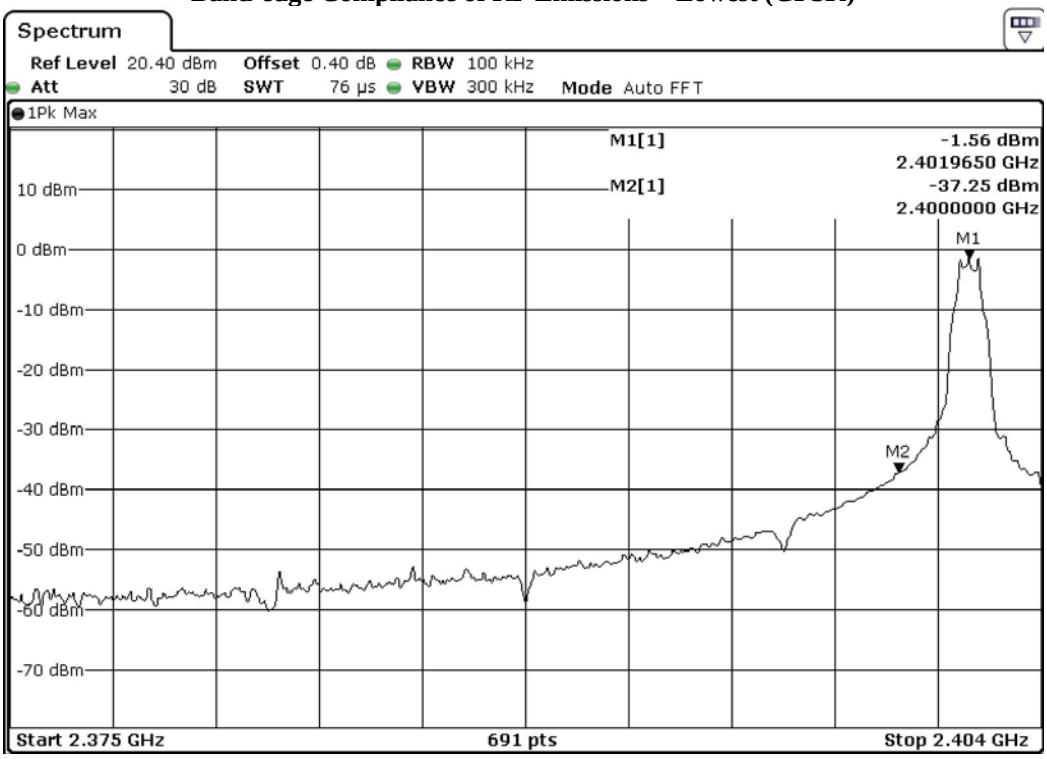
Limit：
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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)	-1.56	-21.56	-37.25	PASS

Band-edge Compliance of RF Emissions – Lowest (GFSK)



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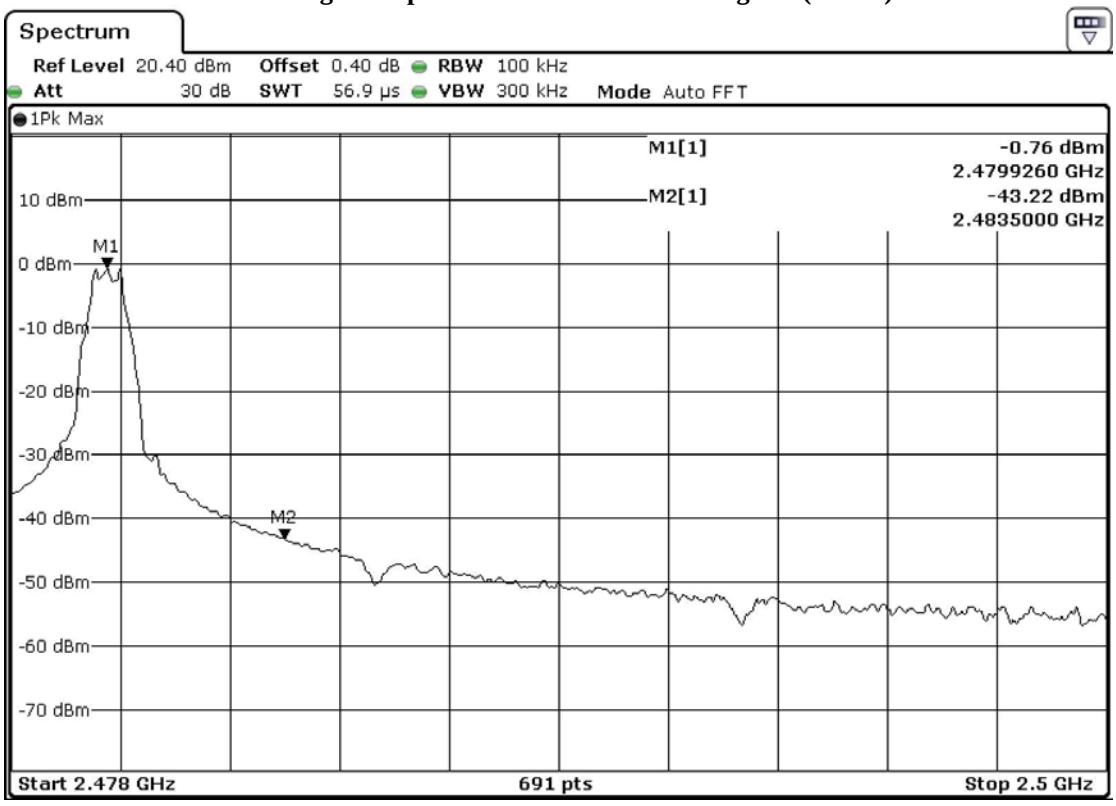
Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Reference level [dBm]	Limit [dBm]	The highest conducted band edge emission [dBm]	Result
2483.5 - Highest Fundamental (2480)	-0.76	-20.76	-43.22	PASS

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



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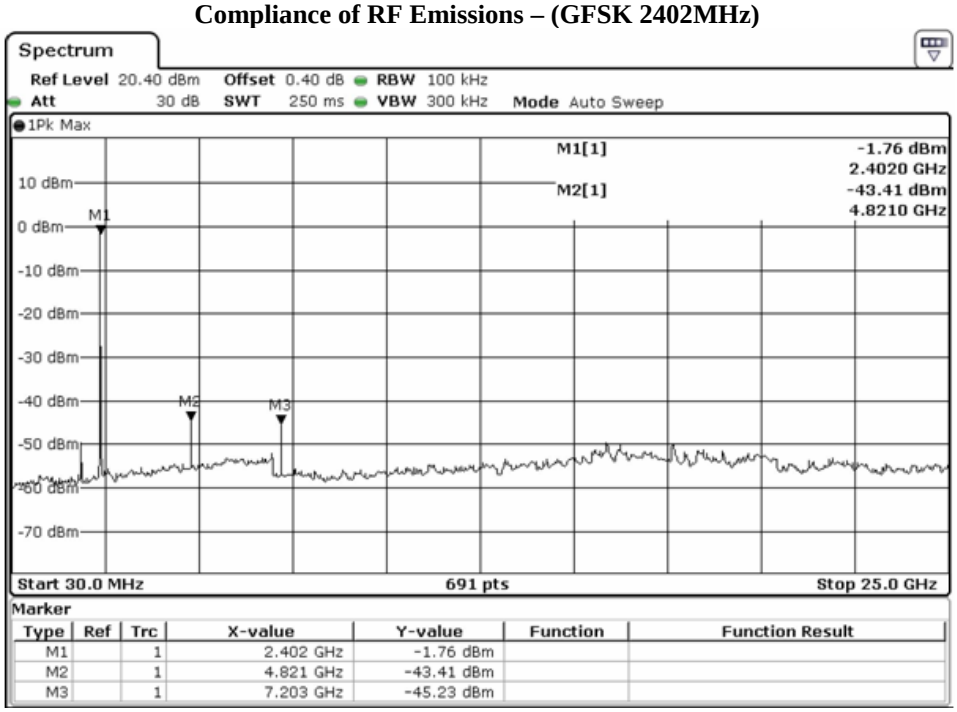
Compliance of RF Emissions Measurement:

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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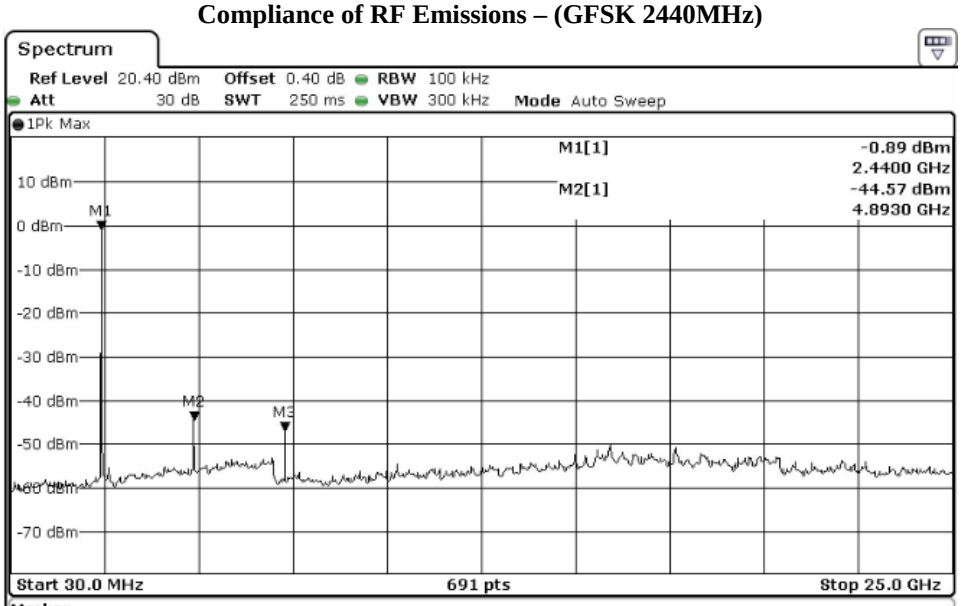
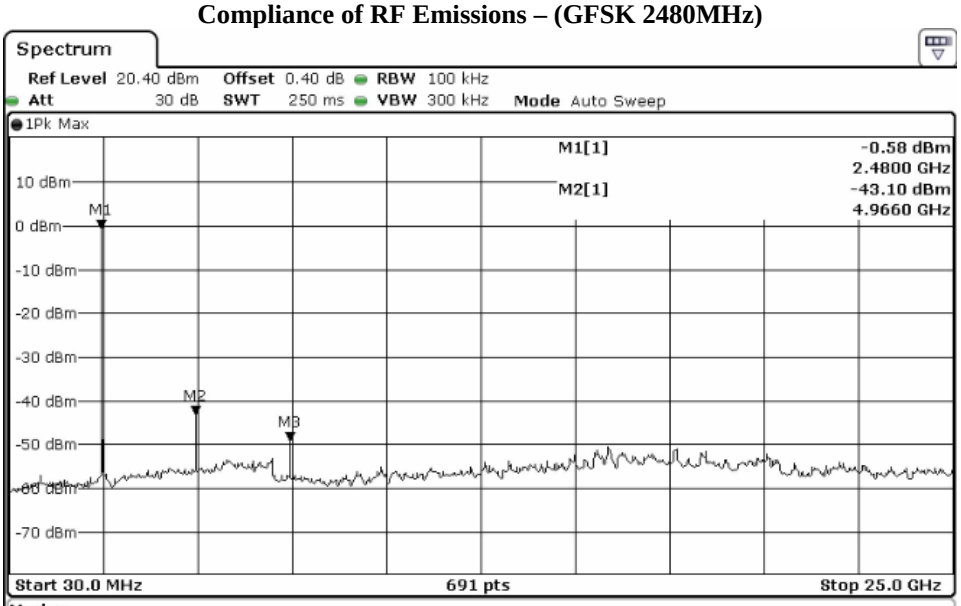
Compliance of RF Emissions – (GFSK 2440MHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44 GHz	-0.89 dBm		
M2		1	4.893 GHz	-44.57 dBm		
M3		1	7.311 GHz	-46.98 dBm		

Compliance of RF Emissions – (GFSK 2480MHz)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48 GHz	-0.58 dBm		
M2		1	4.966 GHz	-43.10 dBm		
M3		1	7.456 GHz	-48.99 dBm		

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3.1.7 Antenna Requirement

Ambient Temperature: 25℃ 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 PCB antenna. There is no external antenna, the antenna gain = 0dBi. User is unable to remove or changed the Antenna.

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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 TURNTABLE	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	J2031090903007	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

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2020/06/30	2021/06/30
EM145	EMI TEST RECEIVER	R & S	ESIB7	100072	2020/05/13	2021/05/13
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2020/01/13	2021/01/11
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2017/02/02	2022/02/02
N/A	MEASUREMENT AND EVALUATION SOFTWARE	ROHDE & SCHWARZ	BSIB-K1	V1.20	N/A	N/A

Remarks:-

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

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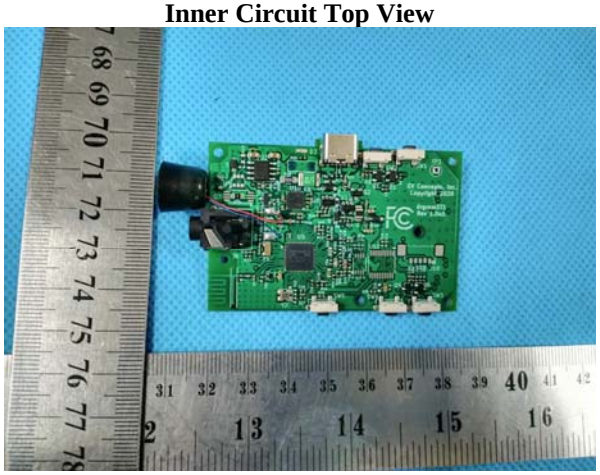
Appendix B

Photographs of EUT

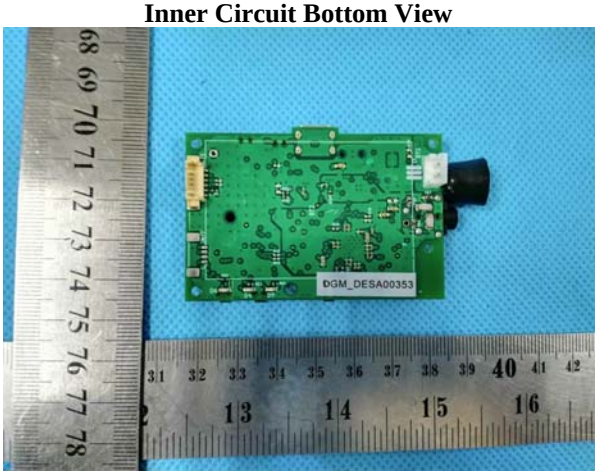
View of the product

View of the product

Inner Circuit Top View



Inner Circuit Bottom View



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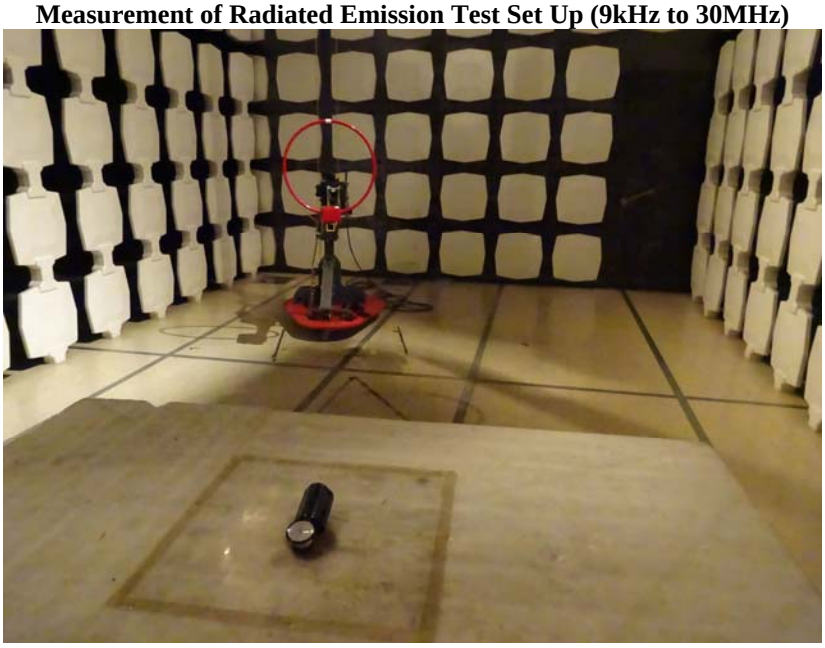
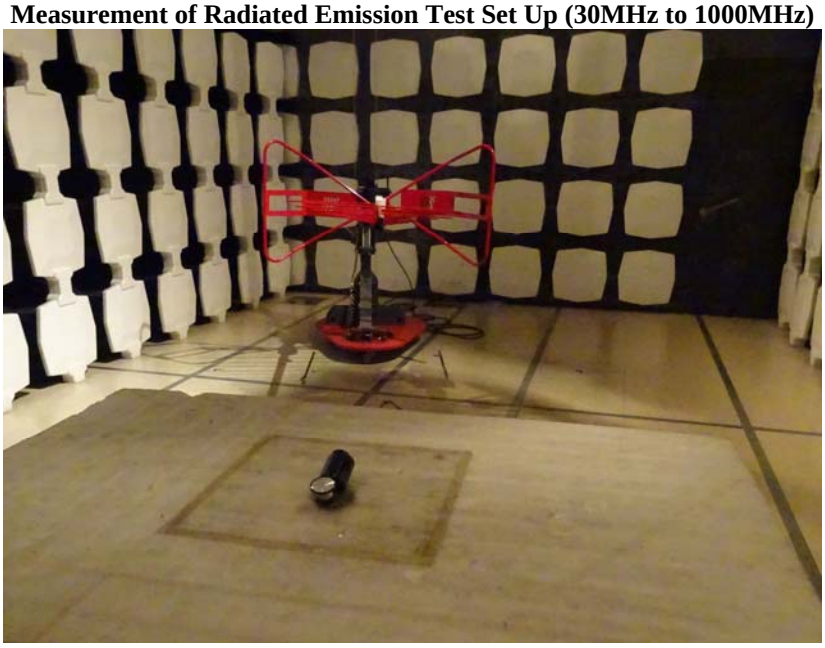
Photographs of EUT

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



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



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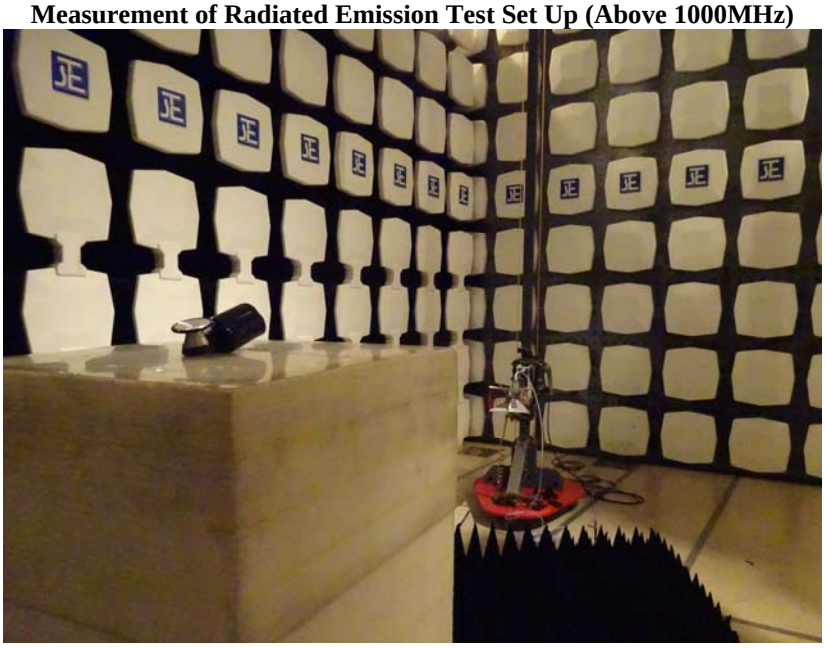
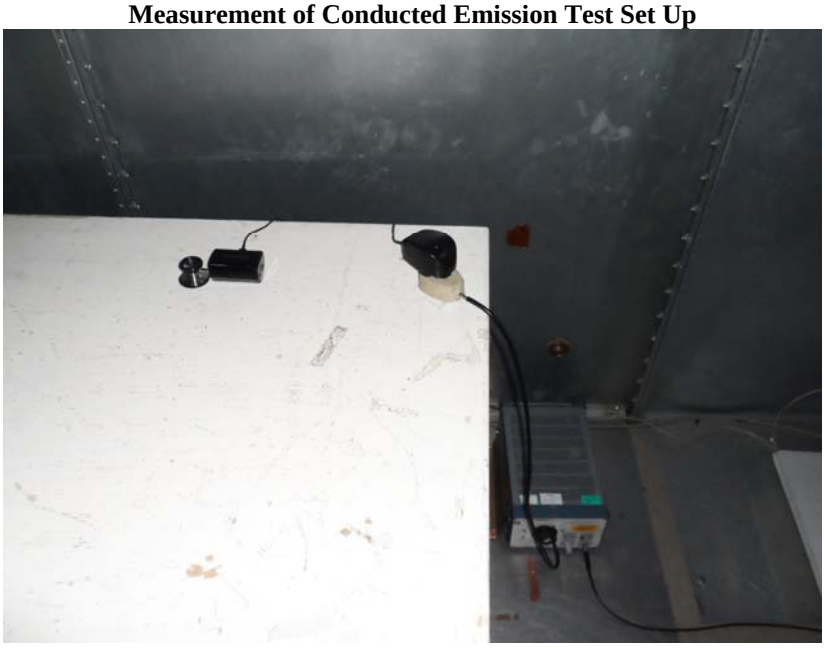
Photographs of EUT

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



Measurement of Conducted Emission Test Set Up



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

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4. The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

5. The results in Report apply only to the sample as received and do not apply to the bulk, unless the sampling has been carried out by the Company and is stated as such in the Report.

6. When a statement of conformity to a specification or standard is provided, the ILAC-G8 Guidance document (and/or IEC Guide 115 in the electrotechnical sector) will be adopted as a decision rule for the determination of conformity unless it is inherent in the requested specification or standard, or otherwise specified in the Report.

7. In the event of the improper use the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

8. Sample submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

9. The Company will not be liable for or accept responsibility for any loss or damage howsoever arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.

10. Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

11. Subject to the variable length of retention time for test data and report stored hereinto as to otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of this test report for a period of three years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after the retention period. Under no circumstances shall we be liable for damages of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

12. Issuance records of the Report are available on the internet at www.stc.group. Further enquiry of validity or verification of the Reports should be addressed to the Company.