



Test Report

Date : 2018-12-19
No. : HMD18110011

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Applicant : Milo Sensors, Inc.
721 W Islay Street, Santa Barbara, CA 93101, USA

Supplier / Manufacturer : Gitel Ltd.
7th. Floor, Building #20, Yifenghua Industrial Zone, Huaning Road
W., Longhua Dalang, Baoan District, Shenzhen, China

Description of Sample(s) : Submitted sample(s) said to be
Product: Bluetooth Bracelet
Brand Name: ION
Model No.: A1
FCC ID: 2AR63-A1

Date Samples Received : 2018-11-02

Date Tested : 2018-11-09 to 2018-12-18

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)



CHEUNG Chi, Kenneth
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:	Bluetooth Bracelet
Manufacturer:	Gitel Ltd. 7th. Floor, Building #20, Yifenghua Industrial Zone, Huaning Road W., Longhua Dalang, Baoan District, Shenzhen, China
Brand Name:	ION
Model Number:	A1
Rating:	5Vd.c.(power by Micro USB port) / Li-ion rechargeable battery x1 = 3.7Vd.c

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a Bluetooth Bracelet. 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 frequency hopping spread spectrum Modulation.

1.3 Date of Order

2018-11-02

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2018-11-09 to 2018-12-18

1.6 Country of Origin

China

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1.7 RF Module Details

Module Model Number: BL483
Module FCC ID: N/A
Module Transmission Type: Bluetooth V4.2
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: Multilayer antenna
Antenna Gain: 2402MHz: 1.6dBi
2440MHz: 2.5dBi
2480MHz: 2.0dBi

1.9 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	21	2442
2	2404	22	2444
3	2406	23	2446
4	2408	24	2448
5	2410	25	2450
6	2412	26	2452
7	2414	27	2454
8	2416	28	2456
9	2418	29	2458
10	2420	30	2460
11	2422	31	2462
12	2424	32	2464
13	2426	33	2466
14	2428	34	2468
15	2430	35	2470
16	2432	36	2472
17	2434	37	2474
18	2436	38	2476
19	2438	39	2478
20	2440	40	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 $\geq 98\%$.
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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Spurious Emissions	FCC 47CFR 15.209	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"/>
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:	2018-12-18
Mode of Operation:	Bluetooth DTS Tx mode

Ambient Temperature: 25°C

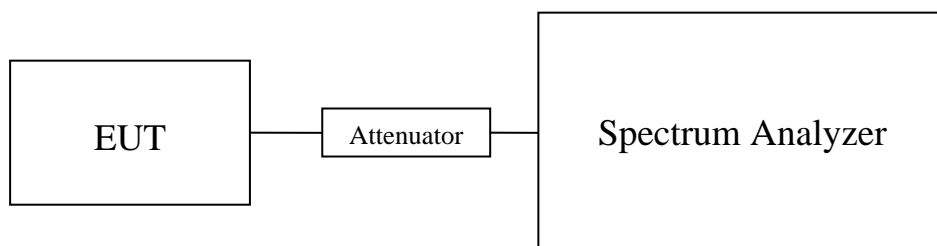
Relative Humidity: 51%

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.

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)
1	2402	0.06	1.6	1.66	0.001466
20	2440	-1.16	2.5	1.34	0.001361
40	2480	-1.14	2.0	0.86	0.001219

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

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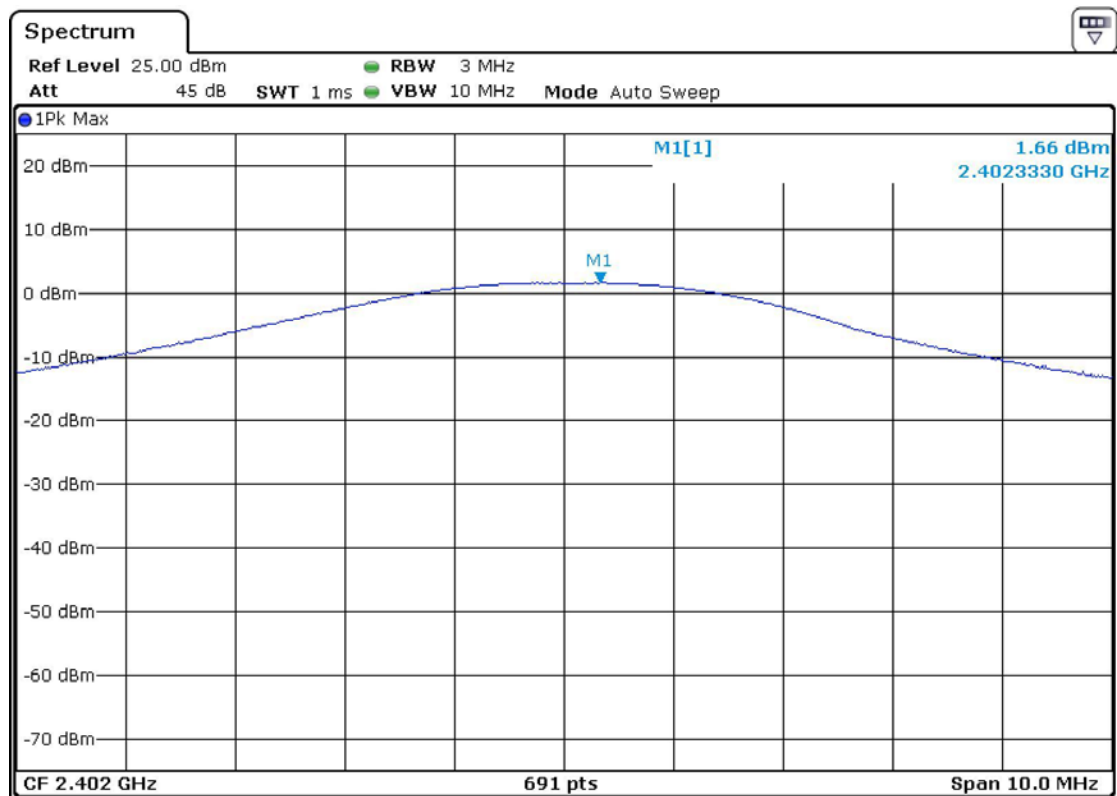
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Test plot of Maximum Peak Conducted Output Power :

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



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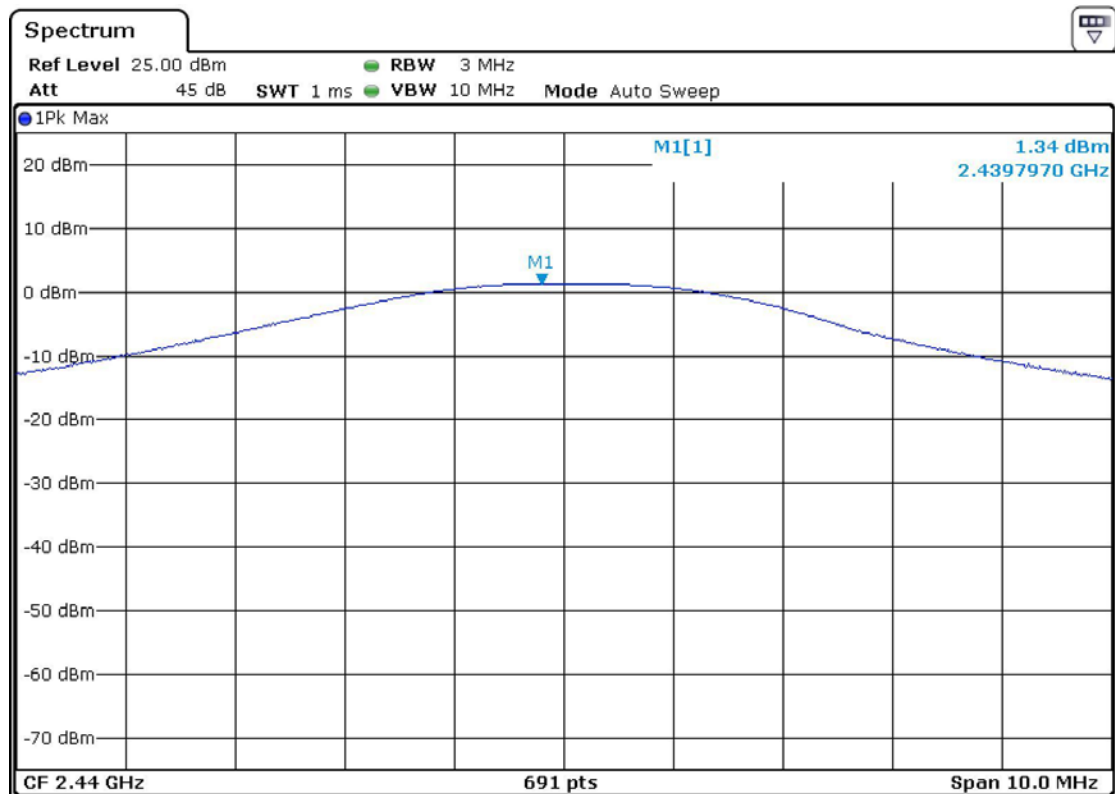


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Bluetooth Communication mode (BT DTS-GFSK, 2440MHz)



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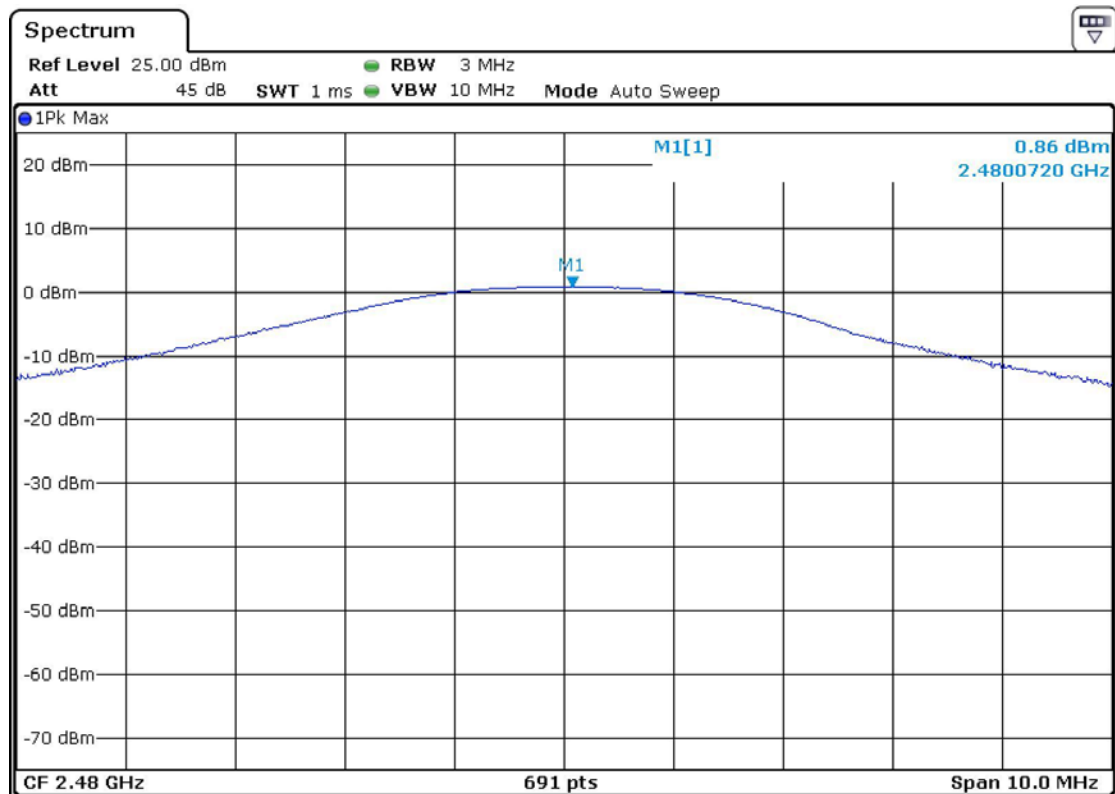


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Bluetooth Communication mode (BT DTS-GFSK, 2480MHz)



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3.1.2 Radiated Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10:2013
Test Date:	2018-11-09
Mode of Operation:	Tx mode / Bluetooth Communication mode (GFSK)

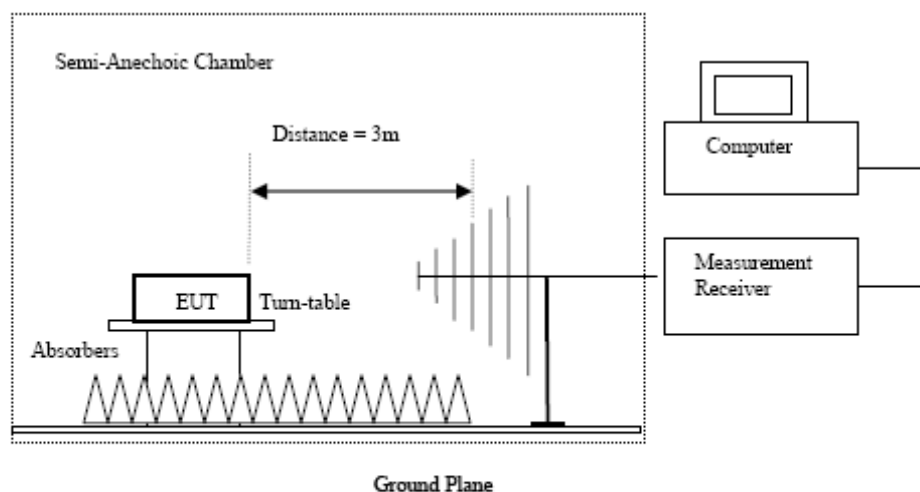
Ambient Temperature: 24°C Relative Humidity: 52% Atmospheric Pressure: 101 kPa

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.

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, 9kHz to 30MHz loop antennas are used.

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Limits for Radiated Emissions FCC 47 CFR 15.247 Class B1:

Frequency Range	Quasi-Peak Limits
[MHz]	[μ 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
Above 960	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.

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

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	μ V/m	μ V/m	
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	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB	
4804.0	13.7	41.5	55.2	74.0	18.9	Vertical
4804.0	12.5	42.4	54.9	74.0	19.1	Horizontal
7206.0	10.2	45.1	55.3	74.0	18.7	Vertical
7206.0	8.6	46.2	54.8	74.0	19.2	Horizontal
9608.0	7.2	48.0	55.2	74.0	18.8	Vertical
9608.0	6.5	48.8	55.3	74.0	18.7	Horizontal
12010.0	4.3	51.8	56.1	74.0	18.0	Vertical
12010.0	3.4	52.4	55.8	74.0	18.2	Horizontal

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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	-3.0	41.5	38.5	54.0	15.5	Vertical
4804.0	-4.2	42.4	38.2	54.0	15.8	Horizontal
7206.0	-6.0	45.1	39.1	54.0	14.9	Vertical
7206.0	-7.6	46.2	38.6	54.0	15.4	Horizontal
9608.0	-9.2	48.0	38.8	54.0	15.2	Vertical
9608.0	-9.6	48.8	39.2	54.0	14.8	Horizontal
12010.0	-12.3	51.8	39.5	54.0	14.5	Vertical
12010.0	-13.5	52.4	38.91	54.0	15.1	Horizontal

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	12.7	41.6	54.3	74.0	19.7	Vertical
4880.0	12.1	42.5	54.6	74.0	19.4	Horizontal
7320.0	1.9	53.2	55.1	74.0	18.9	Vertical
7320.0	9.0	46.3	55.3	74.0	18.7	Horizontal
9760.0	7.2	48.1	55.3	74.0	18.7	Vertical
9760.0	6.2	48.9	55.1	74.0	19.0	Horizontal
12200.0	4.0	51.6	55.6	74.0	18.4	Vertical
12200.0	3.5	52.5	56.0	74.0	18.0	Horizontal

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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	-3.5	41.6	38.1	54.0	15.9	Vertical
4880.0	-4.4	42.5	38.2	54.0	15.9	Horizontal
7320.0	-6.1	45.2	39.1	54.0	14.9	Vertical
7320.0	-7.6	46.3	38.7	54.0	15.3	Horizontal
9760.0	-8.9	48.1	39.2	54.0	14.8	Vertical
9760.0	-10.1	48.9	38.8	54.0	15.2	Horizontal
12200.0	-12.3	51.6	39.4	54.0	14.7	Vertical
12200.0	-12.8	52.5	39.7	54.0	14.3	Horizontal

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	12.7	41.4	54.1	74.0	19.9	Vertical
4960.0	11.6	42.7	54.3	74.0	19.7	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	6.9	48.6	55.5	74.0	18.5	Vertical
9920.0	5.48	49.7	55.2	74.0	18.8	Horizontal
12400.0	4.4	51.7	56.1	74.0	17.9	Vertical
12400.0	3.1	52.7	55.8	74.0	18.3	Horizontal

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Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB	E-Field Polarity
4960.0	-3.2	41.4	38.2	54.0	15.8	Vertical
4960.0	-4.2	42.7	38.5	54.0	15.5	Horizontal
7440.0	-6.6	45.6	39.1	54.0	15.0	Vertical
7440.0	-7.2	46.5	39.3	54.0	14.7	Horizontal
9920.0	-8.9	48.6	39.7	54.0	14.3	Vertical
9920.0	-10.5	49.7	39.2	54.0	14.8	Horizontal
12400.0	-11.4	51.7	40.3	54.0	13.7	Vertical
12400.0	-12.9	52.7	39.8	54.0	14.2	Horizontal

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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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 dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB	E-Field Polarity
2390.0	8.3	36.8	45.1	74.0	28.9	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB	E-Field Polarity
2390.0	-0.5	36.8	36.3	54.0	17.7	Vertical

Result: RF Radiated Emissions (Highest) -GFSK

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB	E-Field Polarity
2483.5	7.8	36.4	44.2	74.0	29.8	Horizontal

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB	E-Field Polarity
2483.5	0.1	36.4	36.5	54.0	17.5	Horizontal

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Limits for Radiated Emissions FCC 47 CFR 15.247 Class B1:

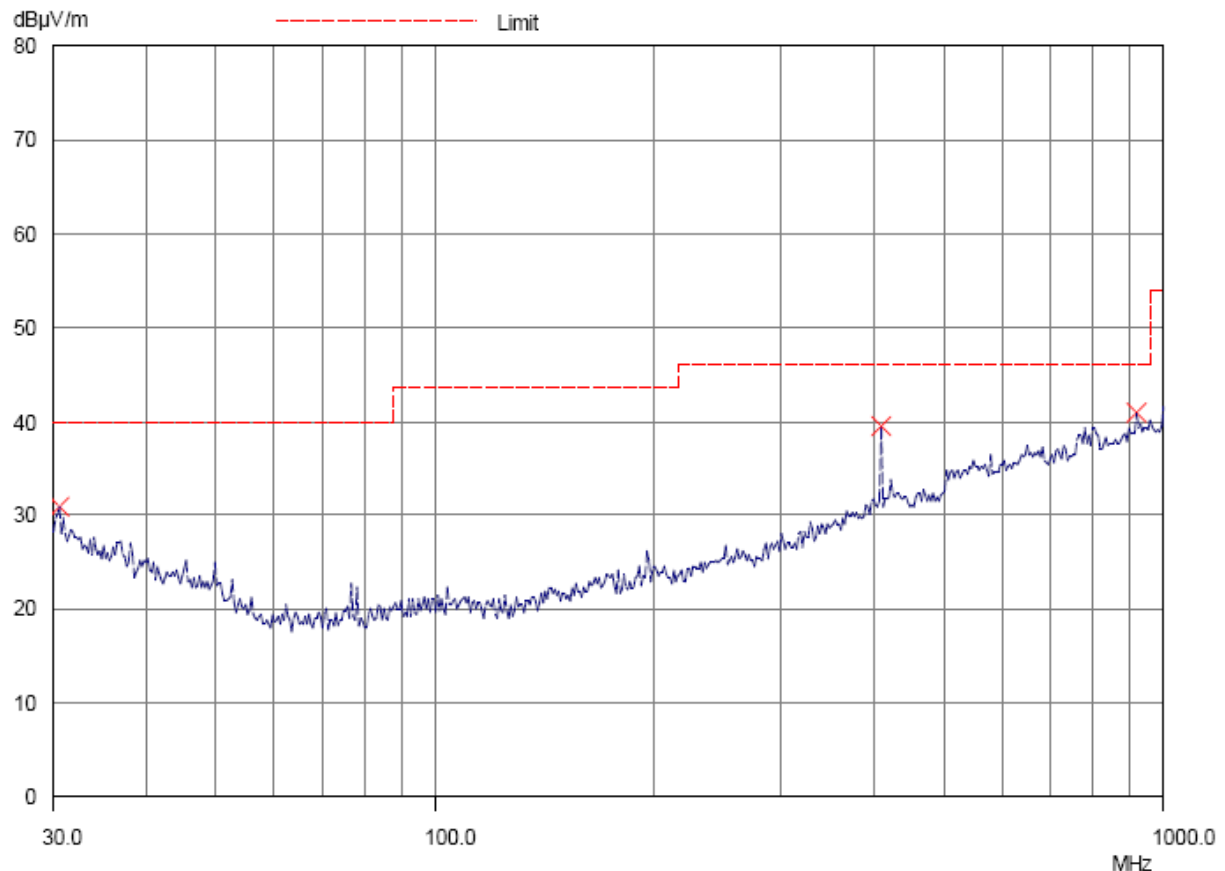
Frequency Range	Quasi-Peak Limits
[MHz]	[μ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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.

Results of Bluetooth mode (2480.0 MHz) (30MHz – 1GHz): Pass

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

Horizontal



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Result of Bluetooth mode (2480.0 MHz) (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dB μ V/m	Limit @3m dB μ V/m	Level @3m μ V/m	Limit @3m μ V/m
30.4	Horizontal	27.9	40.0	24.8	100
408.0	Horizontal	39.5	46.0	94.4	200
915.6	Horizontal	35.6	46.0	60.3	200

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Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

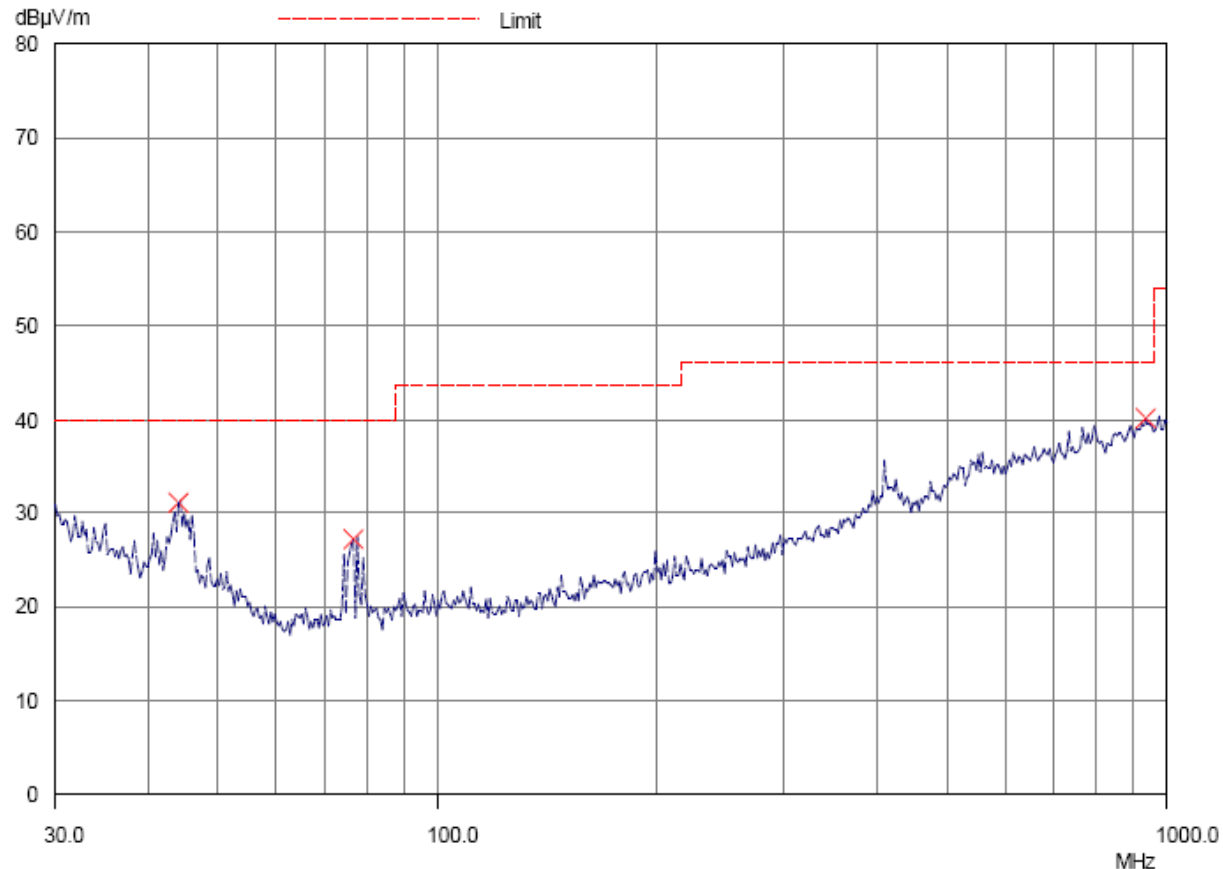
Frequency Range	Quasi-Peak Limits
[MHz]	[$\mu\text{V/m}$]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above 960	500

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.

Results of Bluetooth mode (2480.0 MHz) (30MHz – 1GHz): Pass

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

Vertical
dB $\mu\text{V/m}$



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Result of Bluetooth mode (2480.0 MHz) (30MHz – 1GHz): Pass

Radiated Emissions					
Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dB μ V/m	Limit @3m dB μ V/m	Level @3m μ V/m	Limit @3m μ V/m
44.2	Vertical	28.1	40.0	25.4	100
76.7	Vertical	25.3	40.0	18.4	100
932.9	Vertical	35.5	46.0	59.6	200

Remarks:

Calculated measurement uncertainty (30MHz – 1GHz): 4.9dB

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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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:	2018-11-10
Mode of Operation:	Bluetooth mode
Test Voltage:	120V a.c. 60Hz

Ambient Temperature: 25°C

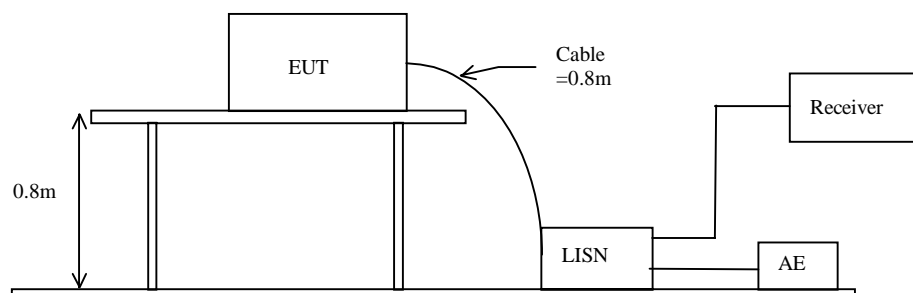
Relative Humidity: 51%

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.

Test Setup:



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Limits for Conducted Emissions (FCC 47 CFR 15.207):

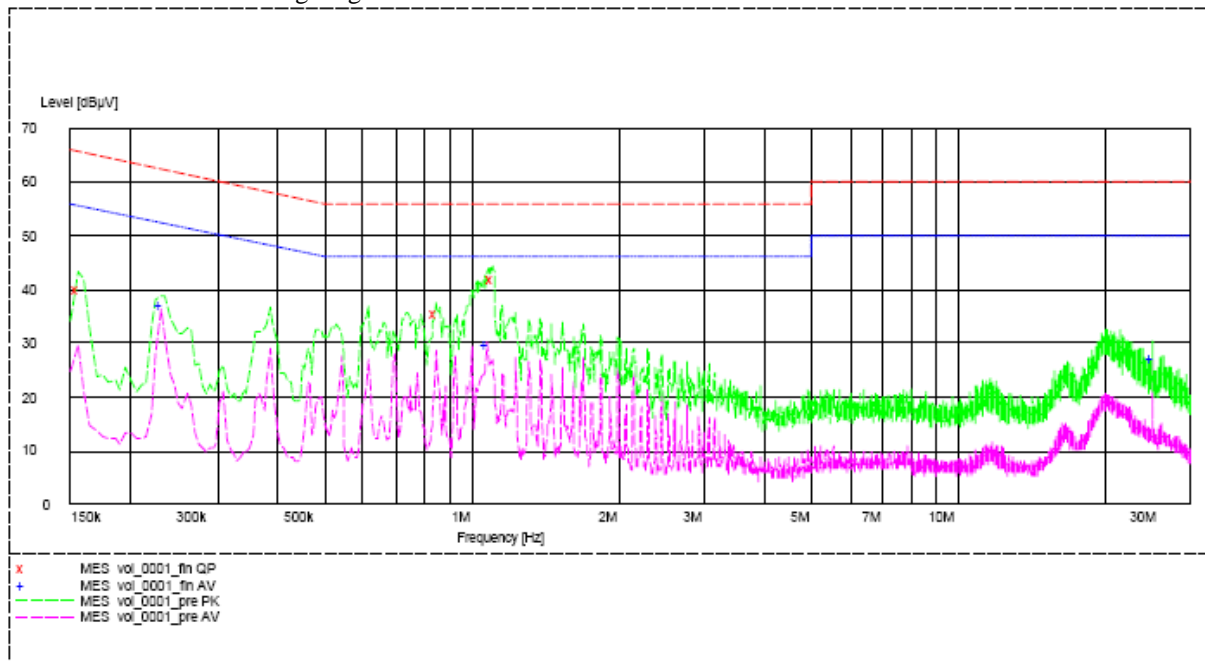
Frequency Range [MHz]	Quasi-Peak Limits [dB μ V]	Average [dB μ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of Bluetooth mode (Connected to PC, PC Mains) (L): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dB μ V	Limit dB μ V	Level dB μ V	Limit dB μ V
Live	0.155	40.2	66.0	-*-	-*-
Live	0.845	35.6	56.0	-*-	-*-
Live	1.105	41.7	56.0	-*-	-*-
Live	0.230	-*-	-*-	36.9	52.0
Live	1.080	-*-	-*-	29.8	46.0
Live	25.060	-*-	-*-	27.1	50.0

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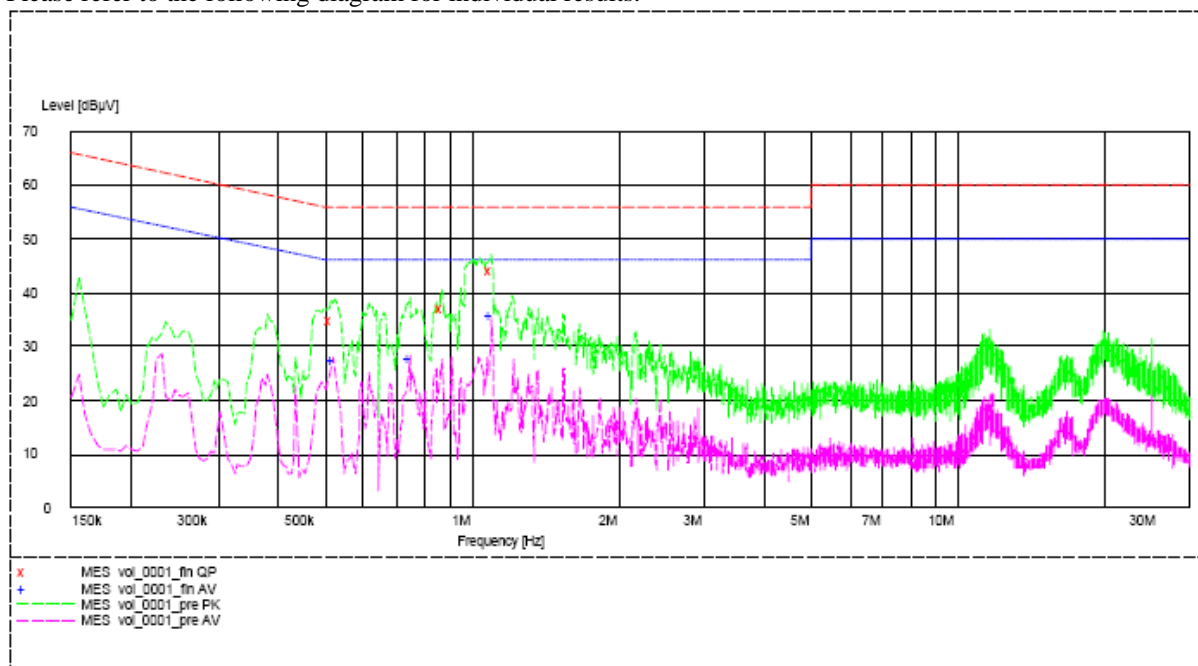
Frequency Range [MHz]	Quasi-Peak Limits [dB μ V]	Average [dB μ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of Bluetooth mode(Connected to PC, PC Mains) (N): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dB μ V	Limit dB μ V	Level dB μ V	Limit dB μ V
Neutral	0.515	34.8	56.0	-*-	-*-
Neutral	0.870	36.9	56.0	-*-	-*-
Neutral	1.100	44.3	56.0	-*-	-*-
Neutral	0.520	-*-	-*-	27.5	46.0
Neutral	0.745	-*-	-*-	27.8	46.0
Neutral	1.100	-*-	-*-	35.9	46.0

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: 2018-12-18
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 exceed 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	-13.28	8dBm
2440.0	-13.39	8dBm
2480.0	-14.02	8dBm

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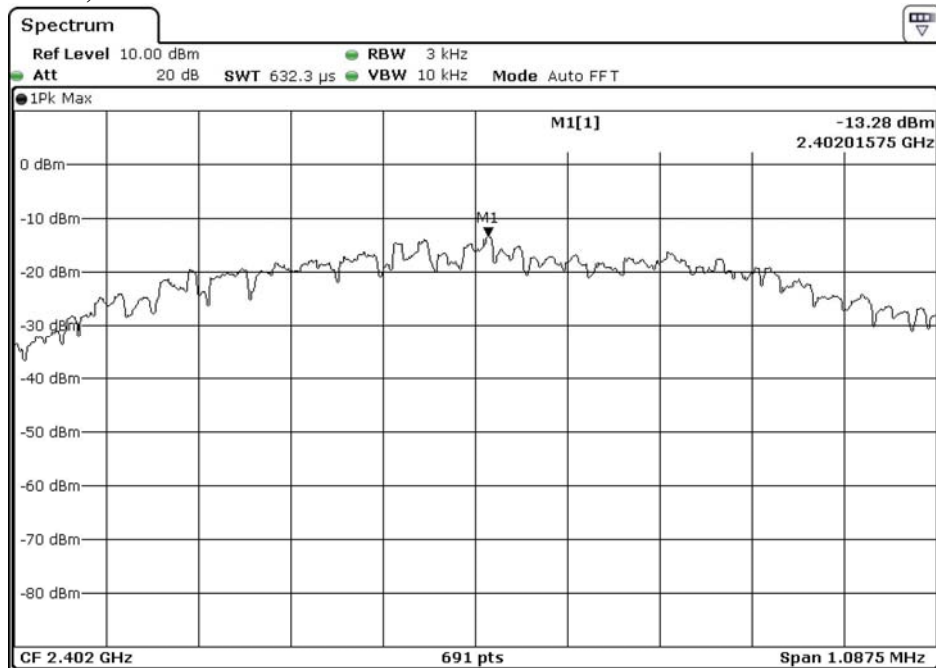


Test Report

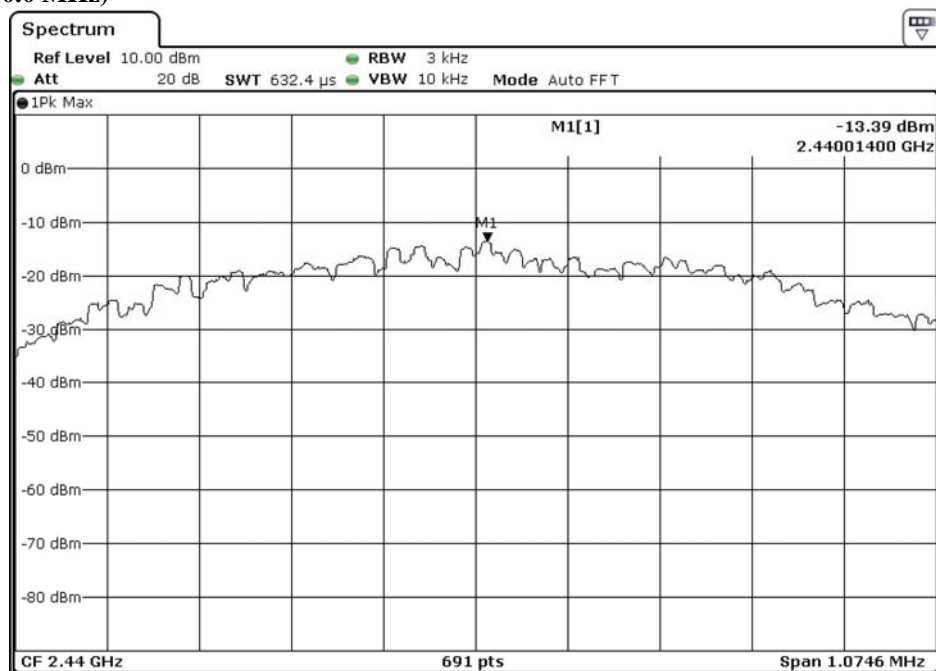
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Tx mode GFSK (Tx: 2402MHz to 2480MHz)
CH 1 (2402.0 MHz)



CH 20 (2440.0 MHz)



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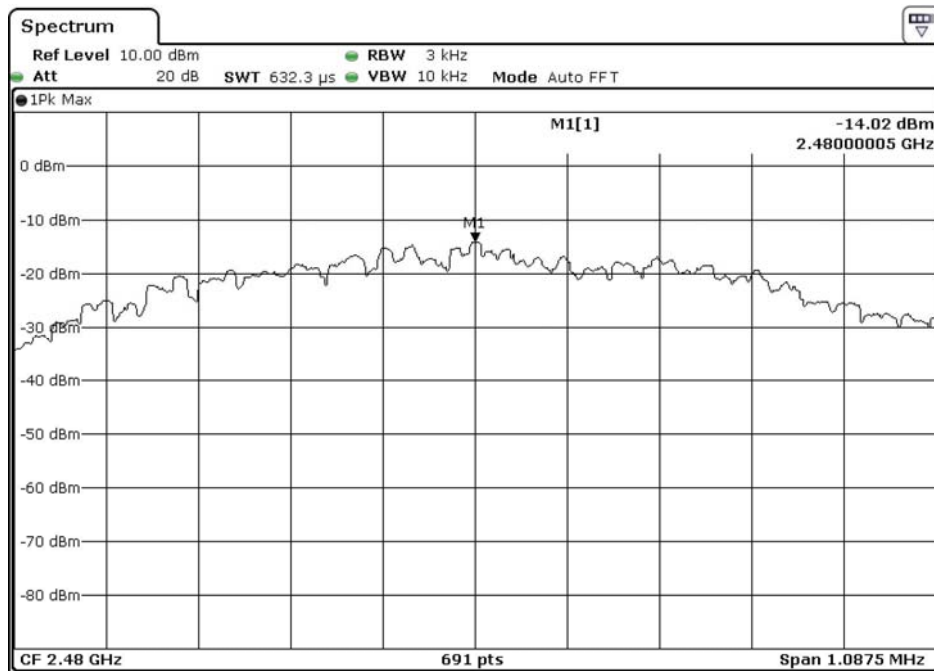
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CH 40 (2480.0 MHz)



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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: 2018-12-18
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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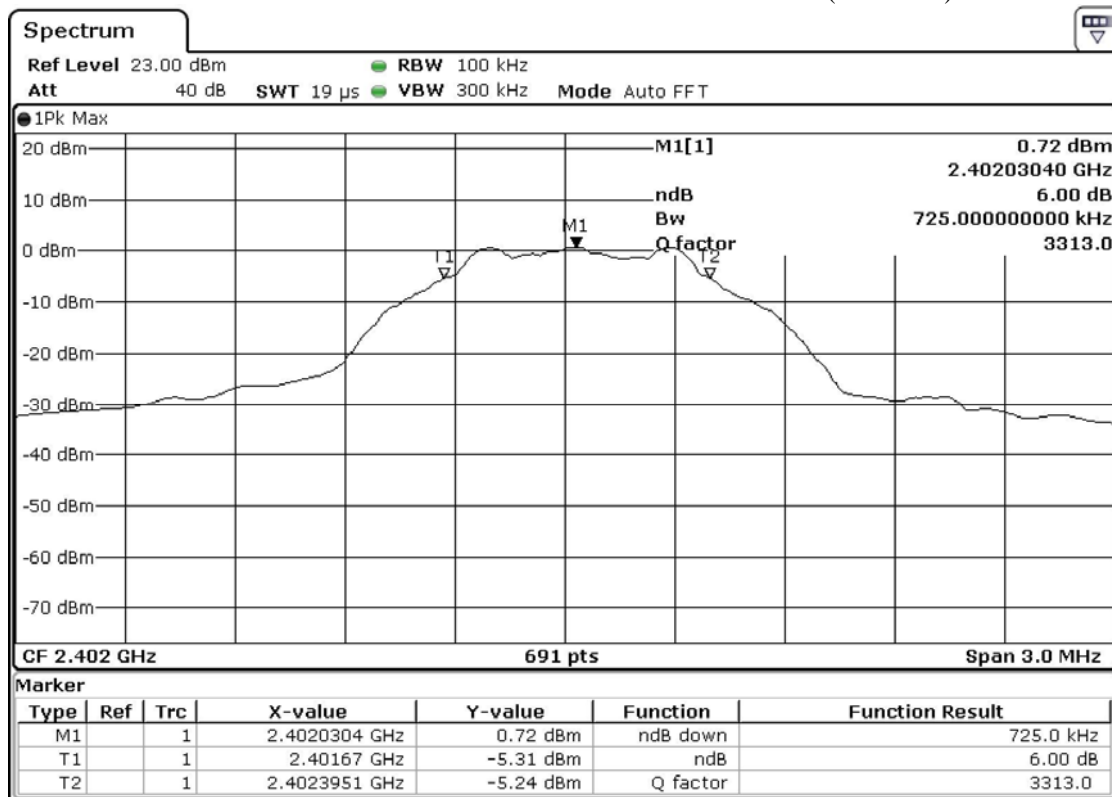
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Limits for 6dB Spectrum Bandwidth Measurement:

Center Frequency [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2402.0	725.0	> 500

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



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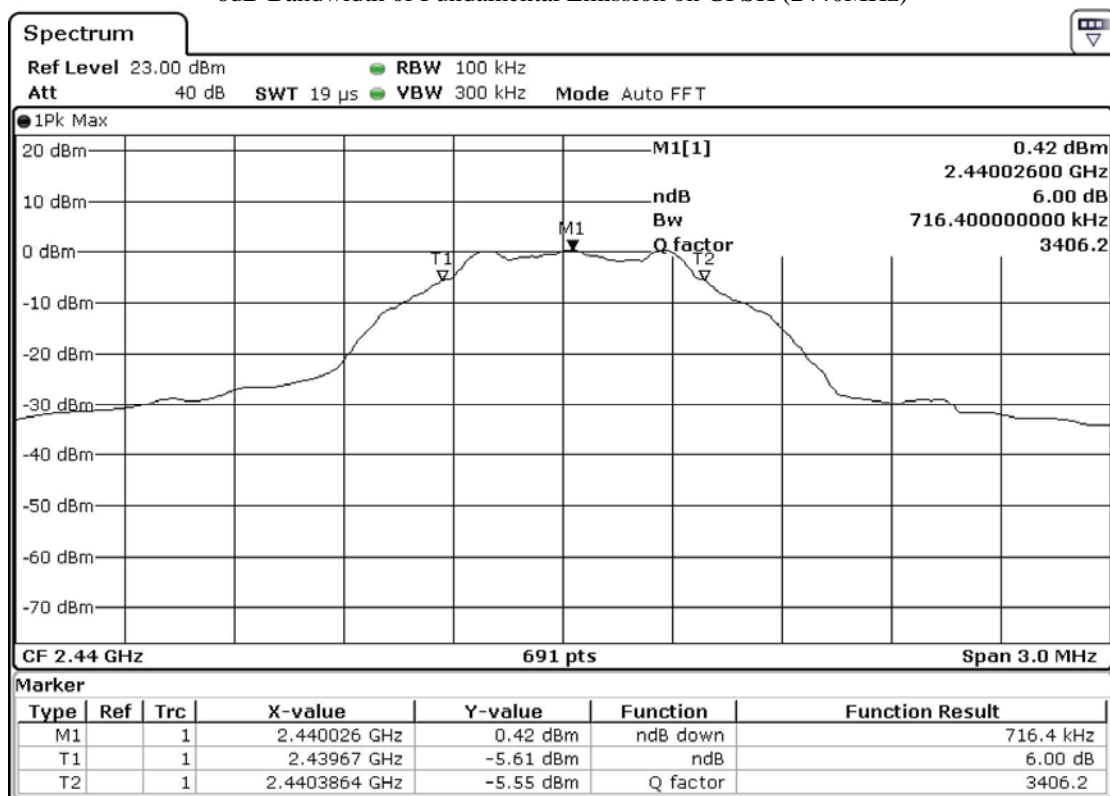
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Limits for 6dB Spectrum Bandwidth Measurement:

Frequency Range [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2440.0	716.0	> 500

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



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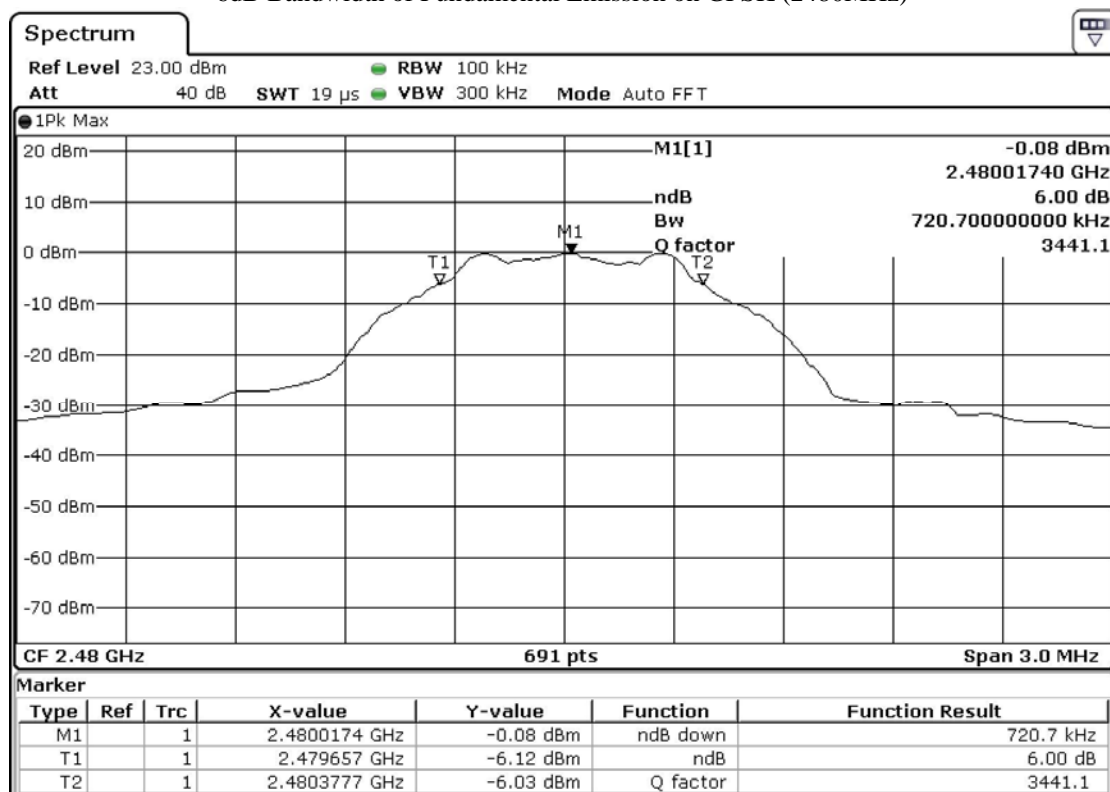
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Limits for 6dB Spectrum Bandwidth Measurement:

Frequency Range [MHz]	6dB Bandwidth [KHz]	FCC Limits [kHz]
2480.0	720.7	> 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: 2018-12-18
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:

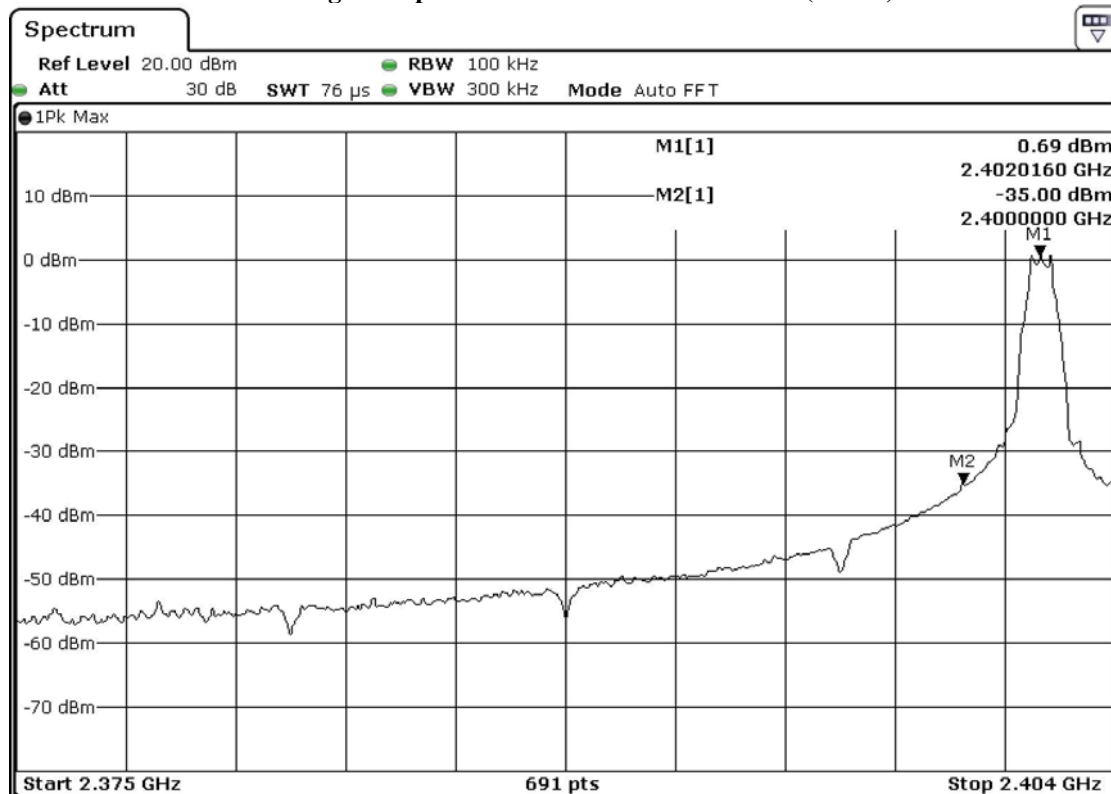
Limit :

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

Frequency Range	Conducted Emission Attenuated below the Fundamental
[MHz]	[dB]
2400 – Lowest Fundamental (2402)	35.69

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



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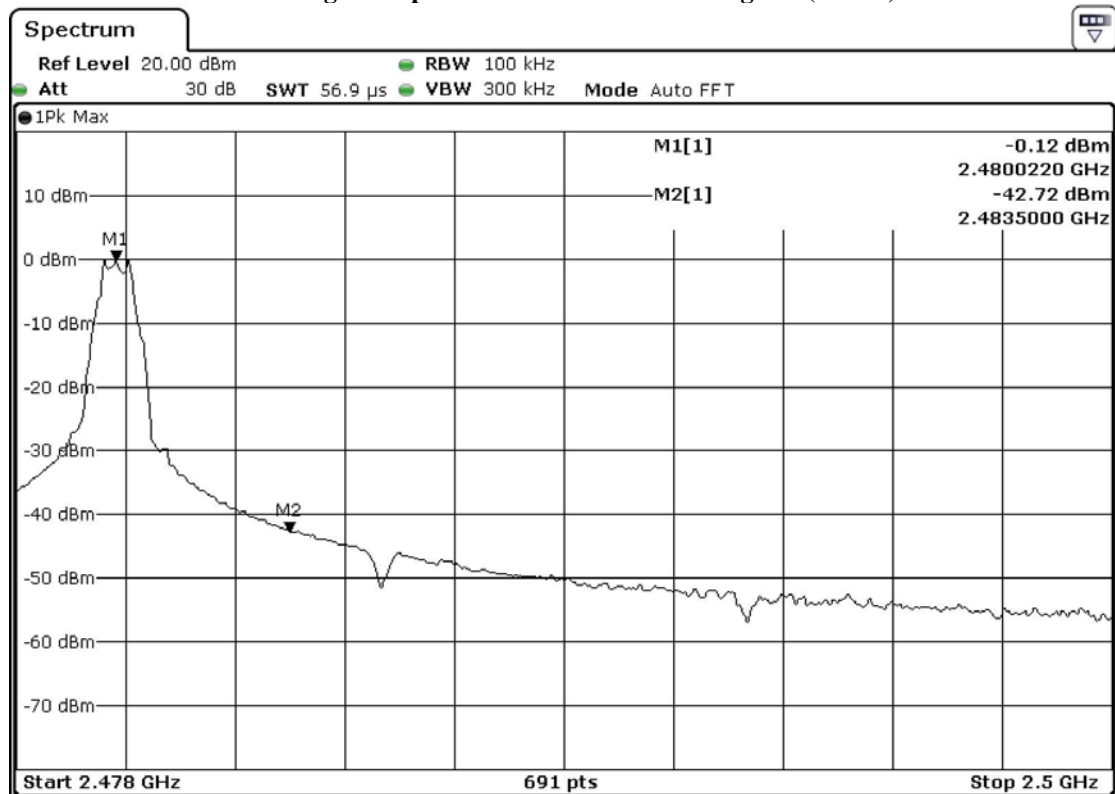
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Conducted Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	42.60

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



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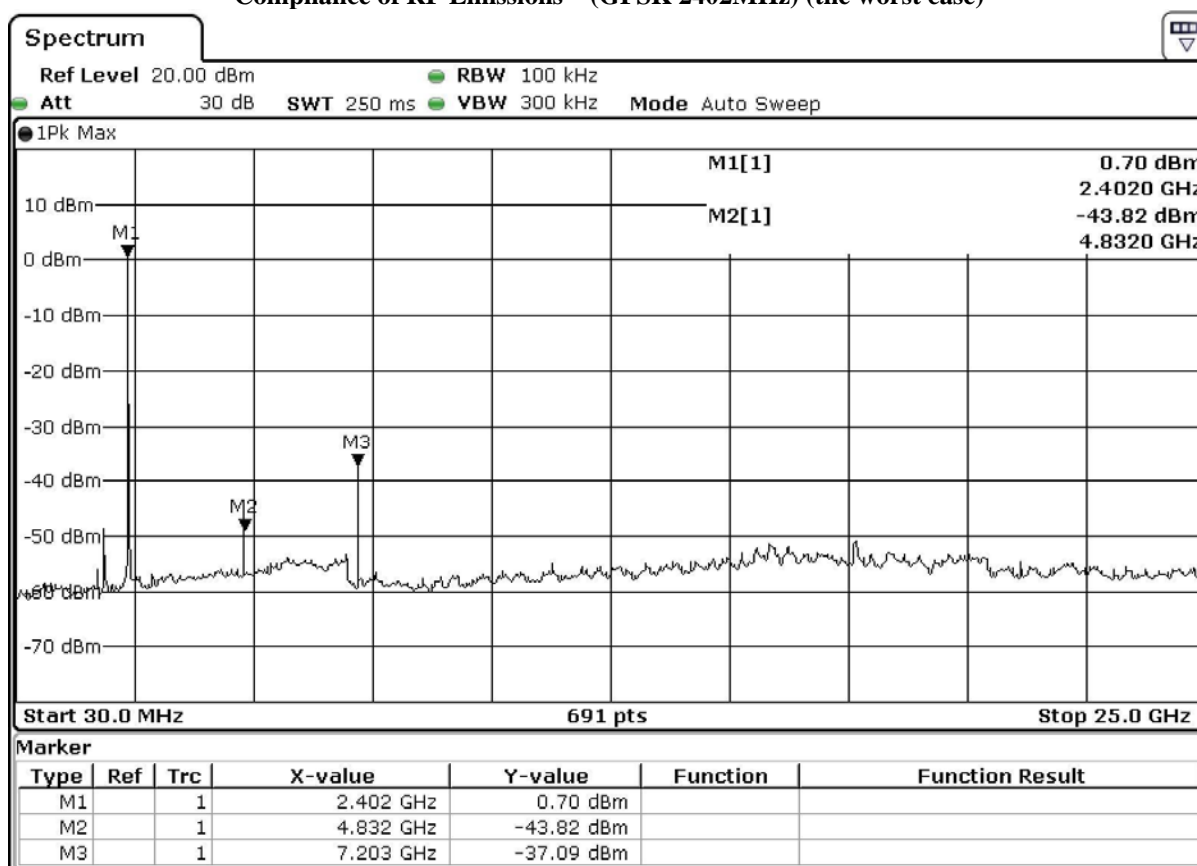
Compliance of RF Conducted Emissions Measurement:

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

Compliance of RF Emissions – (GFSK 2402MHz) (the worst case)



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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 Multilayer antenna. There is no external antenna, the antenna gain: 2402MHz= 1.6dBi, 2440MHz+ 2.5dBi, 2480MHz= 2.0dBi. 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 TURN TABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2018/01/24	2019/01/24
EM356	ANTENNA POSITIONING TOWER	ETS-LINDGREN	2171B	00150346	N/A	N/A
EM354	BICONILOG ANTENNA	ETS-LINDGREN	3143B	00142073	2018/03/29	2020/03/29
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2018/06/01	2019/06/01
EM276	BROADBAND HORN ANTENNA	A-INFOMW	JXTXLB- 10180-SF	J203109090300 7	2018/04/27	2020/04/27
EM300	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-09	00130130	2018/05/13	2019/05/13
EM301	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-10	00130988	2018/05/13	2019/05/13
EM302	PRECISION OMNIDIRECTIONAL DIPOLE (1 – 6GHZ)	SEIBERSDORF LABORATORIES	POD 16	161806/L	2018/05/11	2020/05/11
EM303	PRECISION OMNIDIRECTIONAL DIPOLE (6 – 18GHZ)	SEIBERSDORF LABORATORIES	POD 618	6181908/L	2018/05/11	2020/05/11
EM353	LOOP ANTENNA	ETS_LINDGREN	6502	00206533	2018/04/16	2020/04/16
EM045	POWER METER	ROHDE & SCHWARZ	NRVD	843246/028	2018/06/01	2020/06/01

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2018/11/29	2019/11/29
EM145	EMI TEST RECEIVER	R & S	ESCS 30	830245/021	2018/06/01	2019/06/01
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357- 8810.52/54	2018/01/11	2019/01/11
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



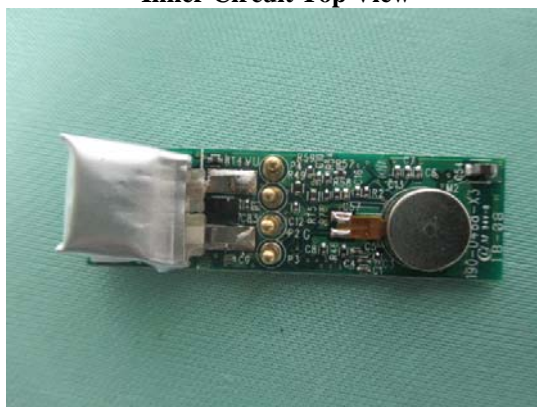
View of the product



Inside View of the product



Inner Circuit Top View



Inner Circuit Bottom View



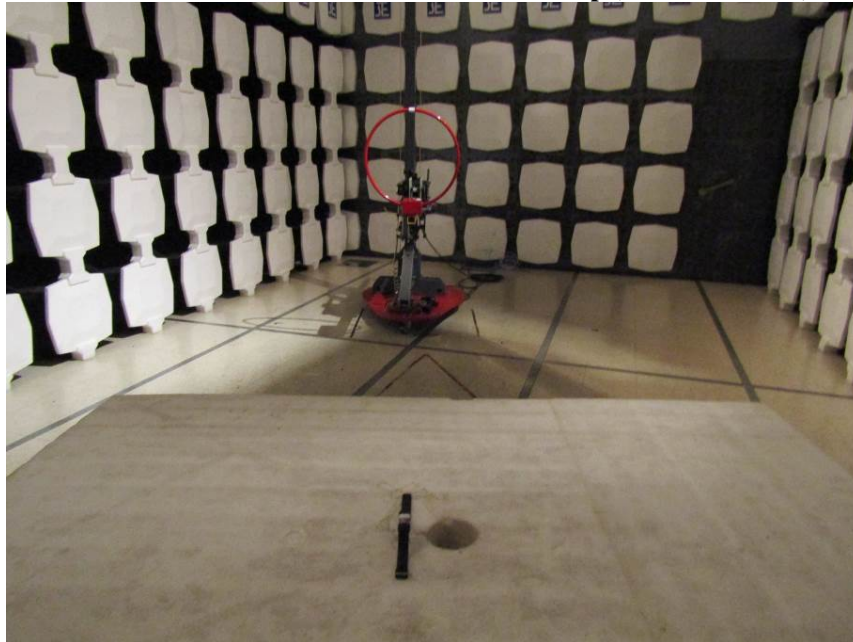
Test Report

Date : 2018-12-19
No. : HMD18110011

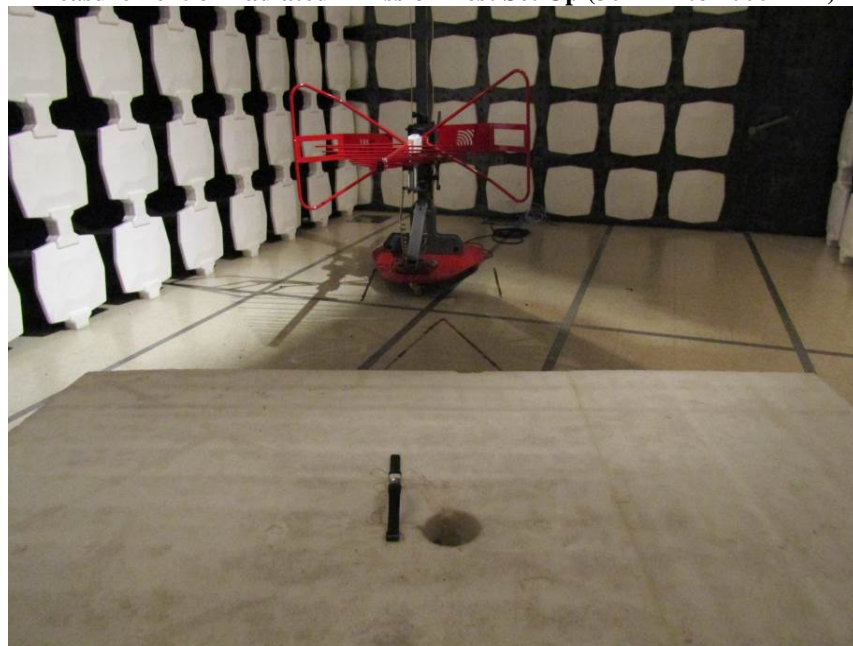
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Photographs of EUT

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



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



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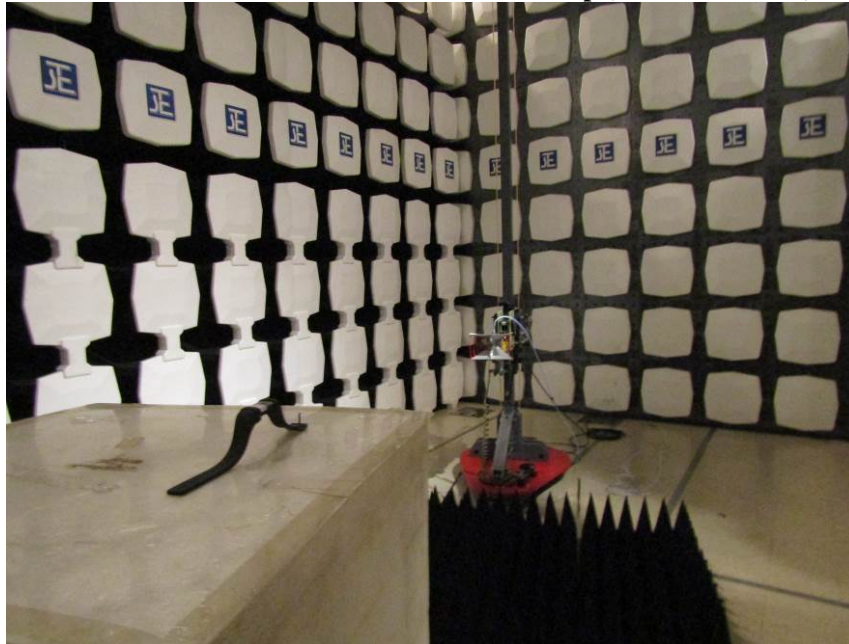
Test Report

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No. : HMD18110011

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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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