FCC RF Test Report

APPLICANT : Quectel Wireless Solutions Co., Ltd.

EQUIPMENT: Wi-Fi & Bluetooth Module

BRAND NAME : Quectel MODEL NAME : FCE860L

FCC ID : XMR2023FCE860L

STANDARD : FCC Part 15 Subpart C §15.247

CLASSIFICATION : (DTS) Digital Transmission System

TEST DATE(S) : Oct. 19, 2023 ~ Dec. 20, 2023

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia



Sporton International Inc. (Kunshan)

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

Sporton International Inc. (Kunshan)

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Report Version : Rev. 01

Report No.: FR352903B

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE	
FR352903B	Rev. 01	Initial issue of report	Dec. 22, 2023	

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SUMMARY OF TEST RESULT

Report Section	FCC Rule	FCC Rule Description		Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	1
3.1	-	99% Bandwidth	-	Report only	-
3.2	15.247(b)(3)	Peak Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.05 dB at 2483.62 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 10.20 dB at 0.435 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

- The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or
 in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of
 non-compliance that may potentially occur if measurement uncertainty is taken into account.
- 2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

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1 General Description

1.1 Applicant

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

1.2 Manufacturer

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

1.3 Product Feature of Equipment Under Test

Product Feature					
Equipment	Wi-Fi & Bluetooth Module				
Brand Name	Quectel				
Model Name	FCE860L				
FCC ID	XMR2023FCE860L				
SN Code	Conducted: E1N23CH0F000074 Conduction: D1823HKCC000062 Radiation: E1N23CH0F000074				
HW Version	R1.0				
SW Version	NA				
EUT Stage	Identical Prototype				

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification					
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz				
Number of Channels	40				
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)				
Maximum Output Power to Antenna	BLE 1Mbps: 8.28 dBm (0.0067 W)				
Maximum Output Power to Antenna	BLE 2Mbps: 8.83 dBm (0.0076 W)				
99% Occupied Bandwidth	BLE 1Mbps: 1.019 MHz				
39 % Occupied Bandwidth	BLE 2Mbps: 2.042 MHz				
Antenna Type / Gain	Dipole Antenna type with gain 0.73 dBi				
Type of Modulation	Bluetooth LE : GFSK				

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

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1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)						
	No. 1098, Pengxi North	n Road, Kunshan Econom	ic Development Zone				
Test Site Location	Jiangsu Province 215300 People's Republic of China						
	TEL: +86-512-57900158						
	Sporton Sito No	ECC Designation No.	FCC Test Firm				
Test Site No.	Sporton Site No.	FCC Designation No.	Registration No.				
rest one NO.	CO01-KS 03CH05-KS TH01-KS	CN1257	314309				

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	TH01-KS	SPORTON	FCC 15C-15E Test Tools Ver10.0_210607	10.0
2.	03CH05-KS	AUDIX	E3	210616
3.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

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

Remark:

- All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
2400-2483.5 MHz	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

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2.2 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases					
Test Item	Data Rate / Modulation					
rest item	Bluetooth – LE / GFSK					
	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 1Mbps					
	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 1Mbps					
Conducted	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 1Mbps					
Conducted	Mode 4: Bluetooth Tx CH00_2402 MHz _BLE 2Mbps					
TCs	Mode 5: Bluetooth Tx CH19_2440 MHz _BLE 2Mbps					
	Mode 6: Bluetooth Tx CH38_2478 MHz _BLE 2Mbps					
	Mode 7: Bluetooth Tx CH39_2480 MHz _BLE 2Mbps					
	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 1Mbps					
	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 1Mbps					
Radiated	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 1Mbps					
TCs	Mode 4: Bluetooth Tx CH00_2402 MHz _BLE 2Mbps					
ICS	Mode 5: Bluetooth Tx CH19_2440 MHz _BLE 2Mbps					
	Mode 6: Bluetooth Tx CH38_2478 MHz _BLE 2Mbps					
	Mode 7: Bluetooth Tx CH39_2480 MHz _BLE 2Mbps					
AC						
Conducted	Mode 1: Bluetooth Link + WLAN Link (2.4G) + Test Jig					
Emission						
Remark: For F	Radiated Test Cases, The tests were performance with Test Jig & Notebook.					

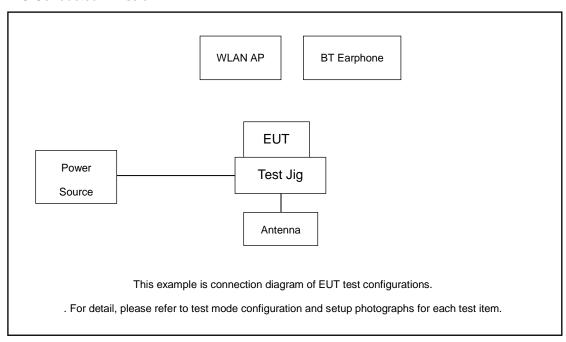
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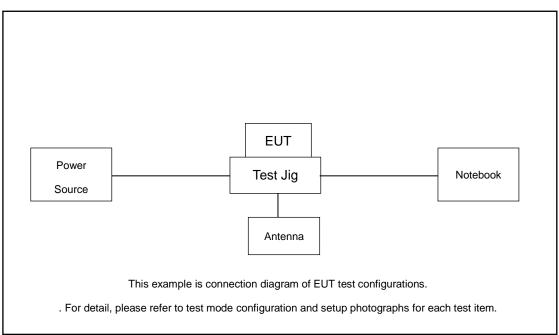
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2.3 Connection Diagram of Test System

AC Conducted Emission:



Radiated Emission:



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2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	V130-15IKB005	N/A	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Adapter	N/A	N/A	N/A	N/A	N/A
4.	Antenna	N/A	N/A	N/A	N/A	N/A
5.	Test Jig	N/A	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For BLE function, the engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 1.86 dB and 10dB attenuator.

$$Offset(dB) = RF \ cable \ loss(dB) + attenuator \ factor(dB).$$

= 1.86 + 10 = 11.86 (dB)

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3 **Test Result**

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

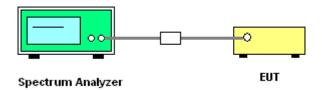
3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

- The testing follows ANSI C63.10-2013 clause 11.8
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- Set to the maximum power setting and enable the EUT transmit continuously. 3.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the 99% OBW and the VBW is set to 3 times of the RBW.
- Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

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3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

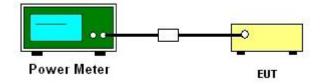
3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

- The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1
 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



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3.2.5 Test Result of Peak Output Power

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	7.48	30.00	0.73	8.21	36.00	Pass
BLE	1Mbps	1	19	2440	8.28	30.00	0.73	9.01	36.00	Pass
BLE	1Mbps	1	39	2480	8.71	30.00	0.73	9.44	36.00	Pass

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	7.79	30.00	0.73	8.52	36.00	Pass
BLE	2Mbps	1	19	2440	8.53	30.00	0.73	9.26	36.00	Pass
BLE	2Mbps	1	38	2478	8.83	30.00	0.73	9.56	36.00	Pass
BLE	2Mbps	1	39	2480	-1.84	30.00	0.73	-1.11	36.00	Pass

3.2.6 Test Result of Average Output Power (Reporting Only)

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	3.76	7.27
BLE	1Mbps	1	19	2440	3.76	8.01
BLE	1Mbps	1	39	2480	3.76	8.39

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	2Mbps	1	0	2402	5.50	7.65
BLE	2Mbps	1	19	2440	5.50	8.33
BLE	2Mbps	1	38	2478	5.50	8.19
BLE	2Mbps	1	39	2480	5.50	-2.12

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3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.3.3 Test Procedures

- The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.
- 7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

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3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

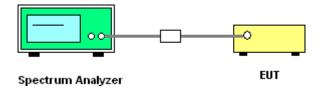
3.4.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.4.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 11.13
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges Plots

Please refer to Appendix A.

3.4.6 Test Result of Conducted Spurious Emission Plots

Please refer to Appendix A.

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3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

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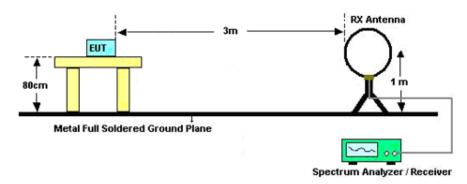
3.5.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- The EUT was set 3 meters from the interference receiving antenna, which was mounted on the 4. top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
- 6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than 7. peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \ge 1$ GHz for peak measurement. For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

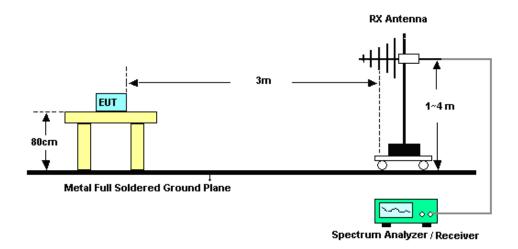
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3.5.4 Test Setup

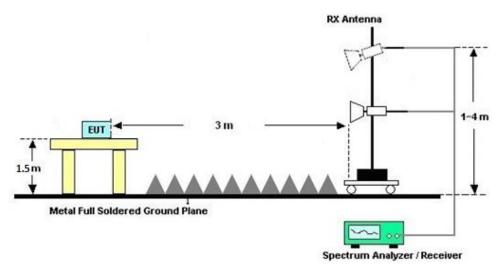
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

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There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

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3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

^{*}Decreases with the logarithm of the frequency.

3.6.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.6.3 Test Procedures

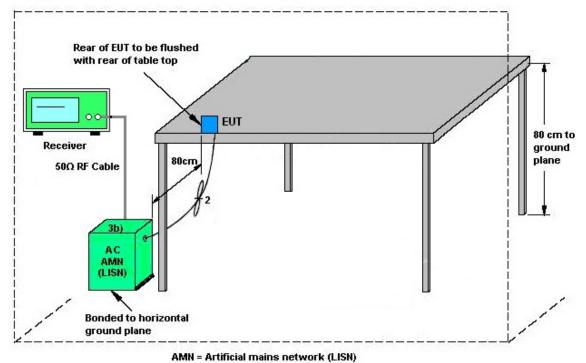
- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

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3.6.4 Test Setup



AE = Associated equipment

EUT = Equipment under test

ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

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3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

Non-standard antenna connector is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

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4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;Ma x 30dBm	Oct. 10, 2023	Dec. 19, 2023	Oct. 09, 2024	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 44	10Hz-44G,MAX 30dB	Mar. 24, 2023	Dec. 19, 2023	Mar. 23, 2024	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 10, 2023	Dec. 19, 2023	Oct. 09, 2024	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	Apr. 09, 2023	Dec. 19, 2023	Apr. 08, 2024	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218642	1GHz~18GHz	Apr. 06, 2023	Dec. 19, 2023	Apr. 05, 2024	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 08, 2023	Dec. 19, 2023	Jan. 07, 2024	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 06, 2023	Dec. 19, 2023	Jul. 05, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM18G40GA	060852	18~40GHz	Jan. 05, 2023	Dec. 19, 2023	Jan. 04, 2024	Radiation (03CH05-KS)
high gain Amplifier	EM	EM01G18GA	060839	1Ghz-18Ghz	Oct. 10, 2023	Dec. 19, 2023	Oct. 09, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM01G18GA	060833	1Ghz-18Ghz	Jan. 05, 2023	Dec. 19, 2023	Jan. 04, 2024	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Dec. 19, 2023	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Dec. 19, 2023	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Dec. 19, 2023	NCR	Radiation (03CH05-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Oct. 19, 2023	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 11, 2023	Oct. 19, 2023	Oct. 10, 2024	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Oct. 19, 2023	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 11, 2023	Oct. 19, 2023	Oct. 10, 2024	Conduction (CO01-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	May 16, 2023	Dec. 20, 2023	May 15, 2024	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2023	Dec. 20, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2023	Dec. 20, 2023	Jan. 04, 2024	Conducted (TH01-KS)

NCR: No Calibration Required

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5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Conducted Spurious Emission & Bandedge	±2.26 dB		
Occupied Channel Bandwidth	±0.1%		
Conducted Power	±0.46 dB		
Conducted Power Spectral Density	±0.88 dB		
Frequency	±0.4 Hz		

Uncertainty of AC Conducted Emission Measurement (0.15 MHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	2.94 dB
of 95% (U = 2Uc(y))	2.94 UB

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	3.30 dB
of 95% (U = 2Uc(y))	3.30 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.28 dB
---	---------

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence	4,88 dB	
of 95% (U = 2Uc(y))	4.00 UD	

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence	5.26 dB
of 95% (U = 2Uc(y))	5.26 UB

----- THE END -----

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Appendix A. Conducted Test Results

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PORTON LAB. FCC RF Test Report Report Report No.: FR352903B

Ambient Condition: $\underline{25}$ °C, $\underline{45}$ %RH

Test Date: 2023/12/20 Test Engineer: rise

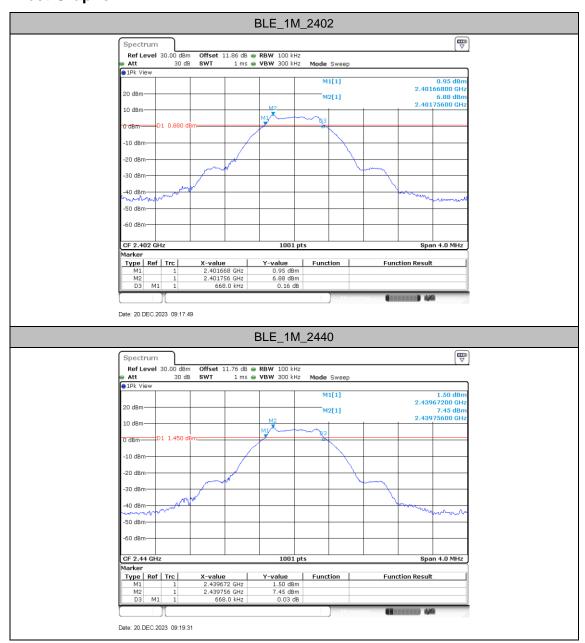
DTS Bandwidth

Test Result

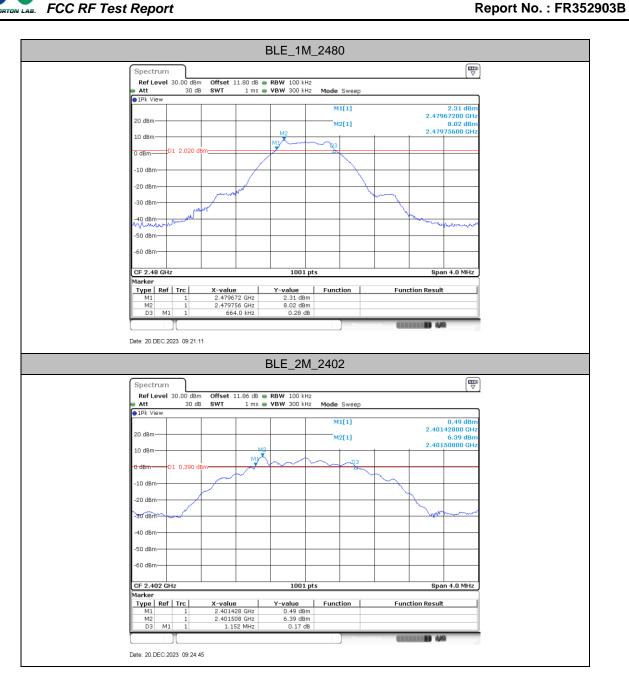
TestMode	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
	2402	0.67	2401.67	2402.34	0.5	PASS
BLE_1M	2440	0.67	2439.67	2440.34	0.5	PASS
	2480	0.66	2479.67	2480.34	0.5	PASS
BLE_2M	2402	1.15	2401.43	2402.58	0.5	PASS
	2440	1.15	2439.43	2440.58	0.5	PASS
	2478	1.16	2477.43	2478.59	0.5	PASS
	2480	1.16	2479.42	2480.58	0.5	PASS

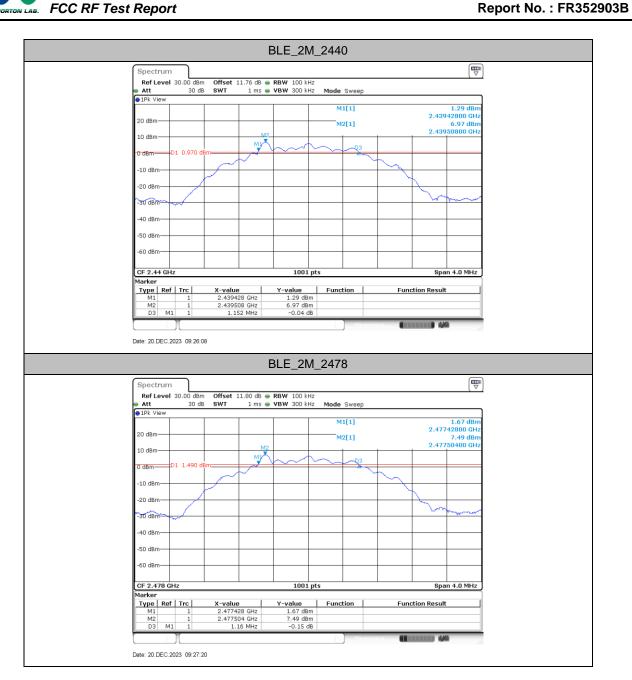
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L

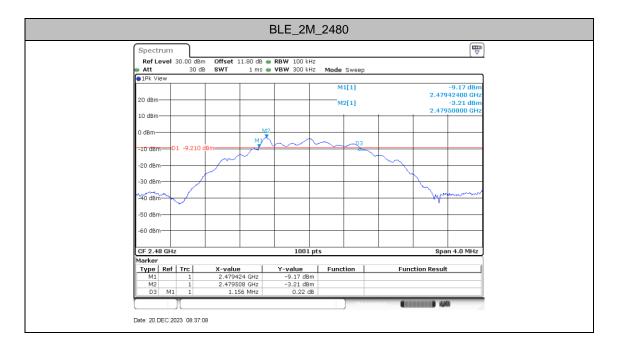
Test Graphs



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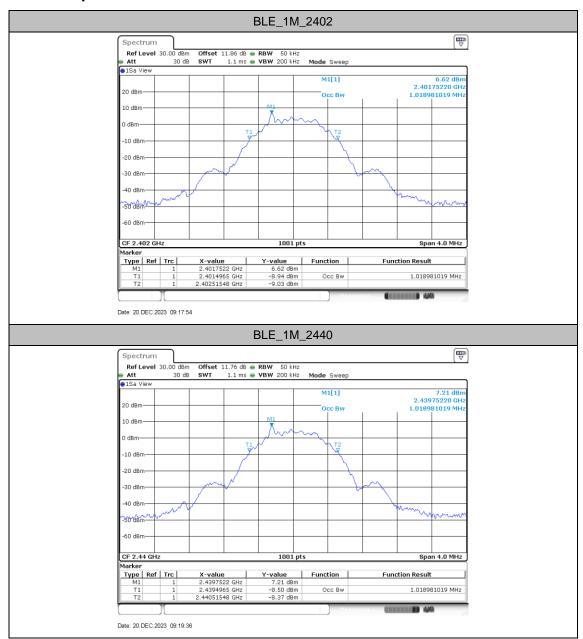
Occupied Channel Bandwidth

Test Result

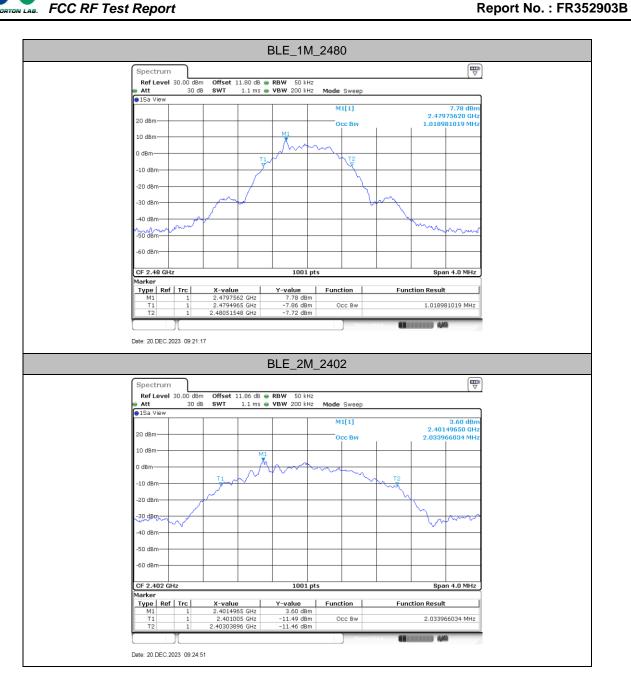
TestMode	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]
BLE_1M	2402	1.019	2401.4965	2402.5155
	2440	1.019	2439.4965	2440.5155
	2480	1.019	2479.4965	2480.5155
BLE_2M	2402	2.034	2401.0050	2403.0390
	2440	2.038	2439.0010	2441.0390
	2478	2.042	2477.0010	2479.0430
	2480	2.034	2479.0050	2481.0390

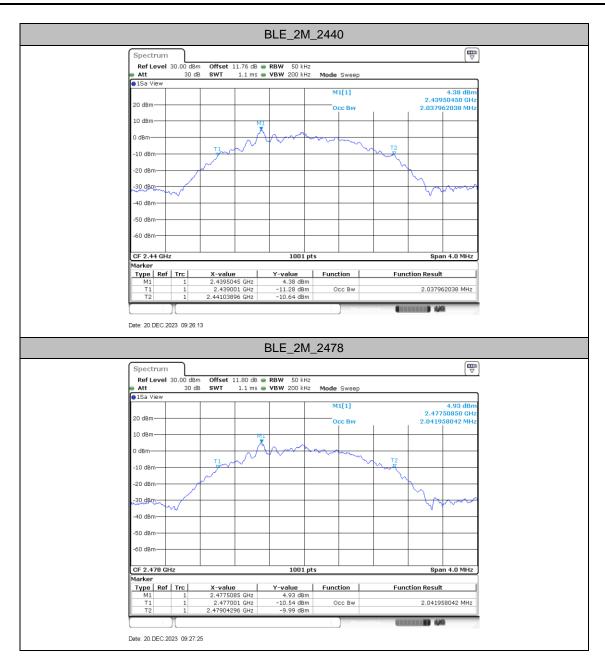
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L

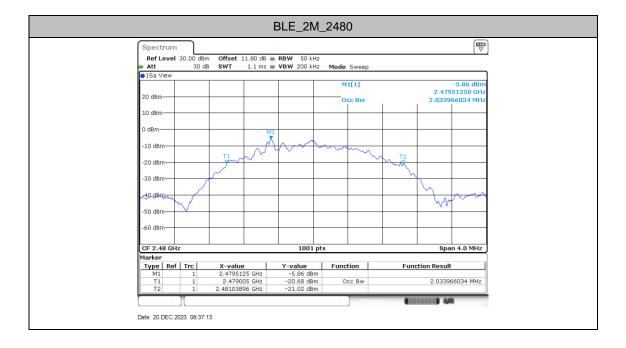
Test Graphs



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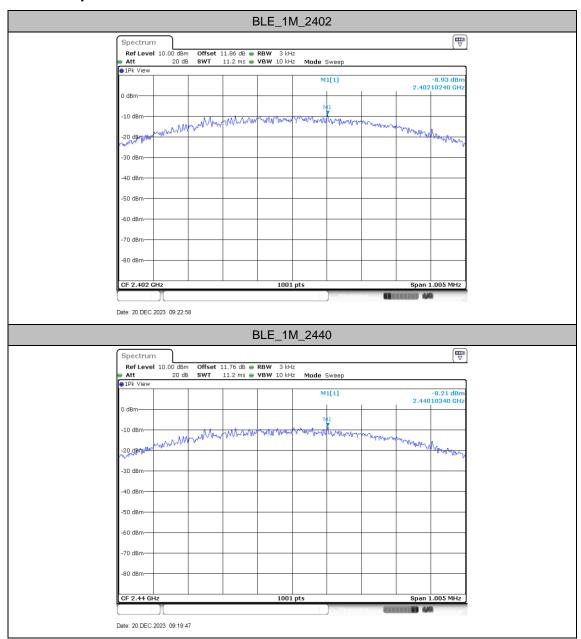
Maximum power spectral density

Test Result

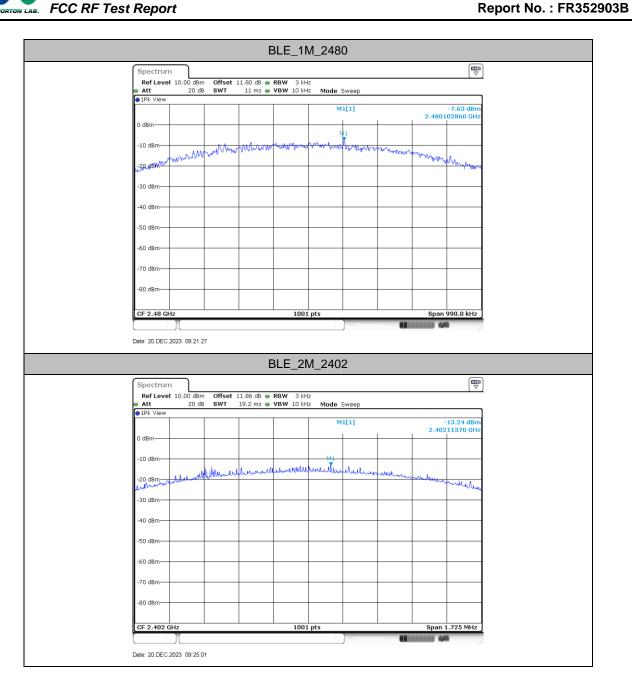
TestMode	Freq(MHz)	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	2402	-8.93	≤8.00	PASS
	2440	-8.21	≤8.00	PASS
	2480	-7.63	≤8.00	PASS
	2402	-13.24	≤8.00	PASS
BLE 2M	2440	-12.69	≤8.00	PASS
DLC_ZIVI	2478	-12.15	≤8.00	PASS
	2480	-21.82	≤8.00	PASS

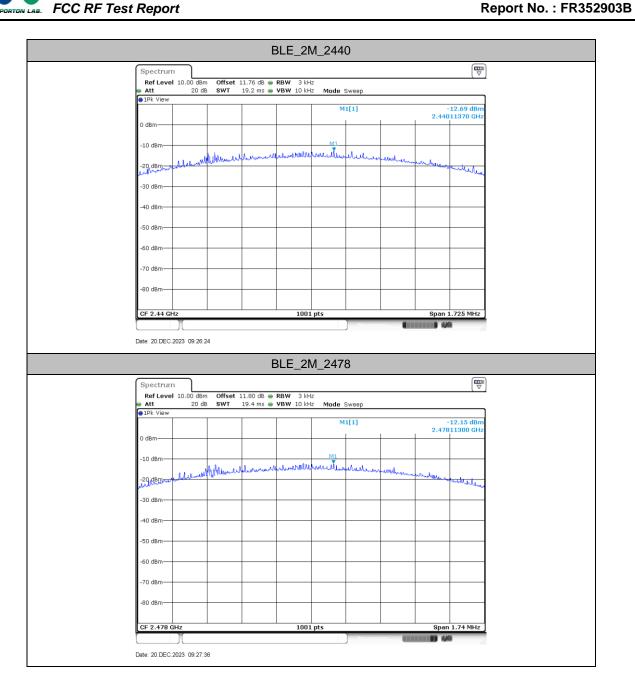
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L

Test Graphs



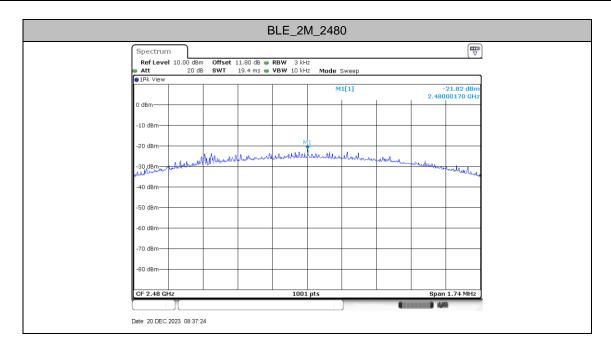
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L





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Reference level measurement

Test Result

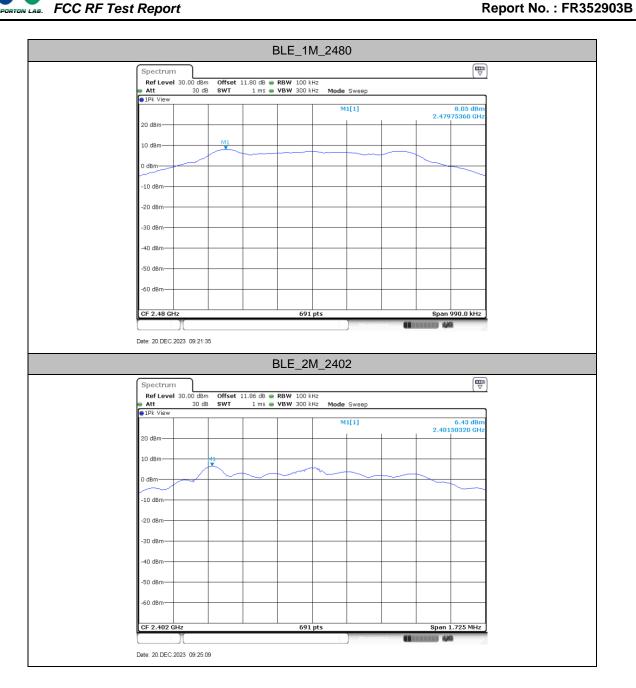
TestMode	Freq(MHz)	Max.Point[MHz]	Result[dBm/100KHz]
	2402	2401.75	6.87
BLE_1M	2440	2439.76	7.45
	2480	2479.75	8.05
BLE_2M	2402	2401.50	6.43
	2440	2439.50	6.94
	2478	2477.51	7.55
	2480	2479.50	-3.18

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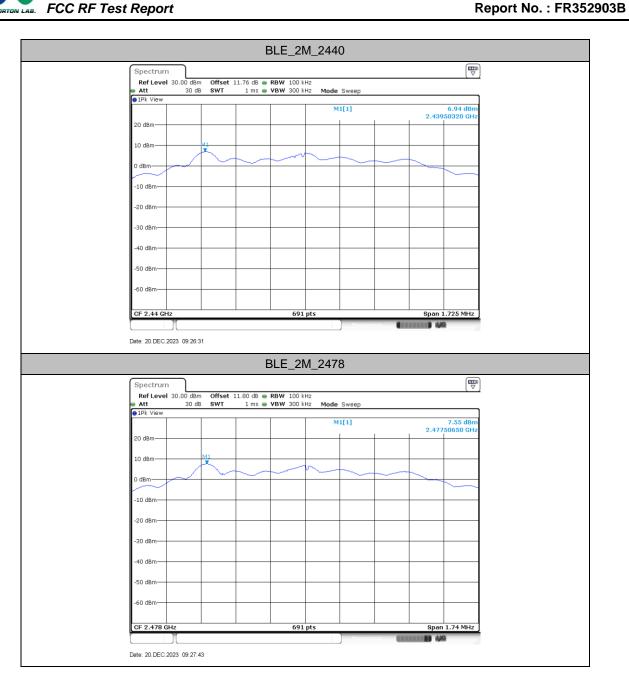
Test Graphs



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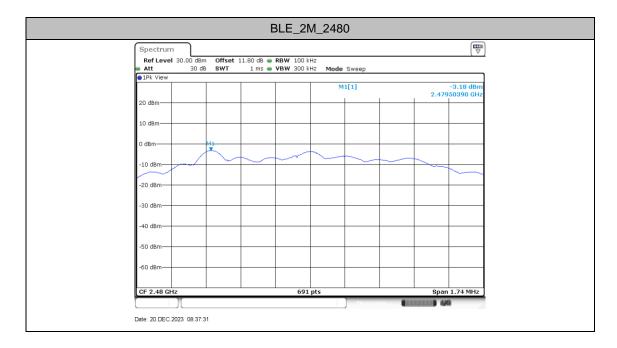






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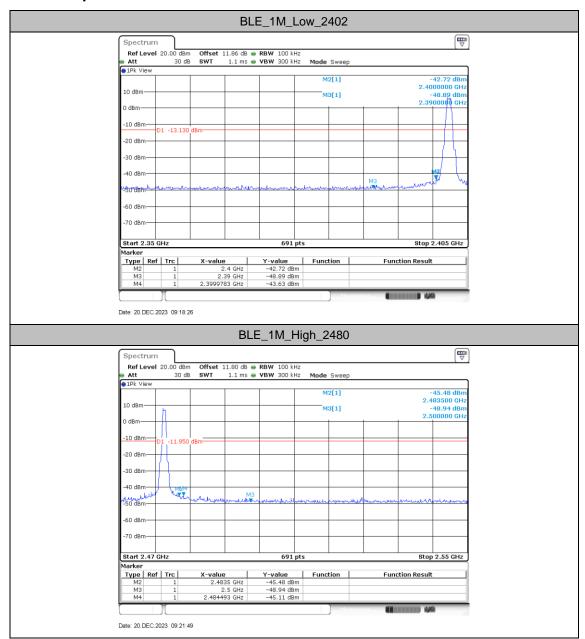
Band edge measurements

Test Result

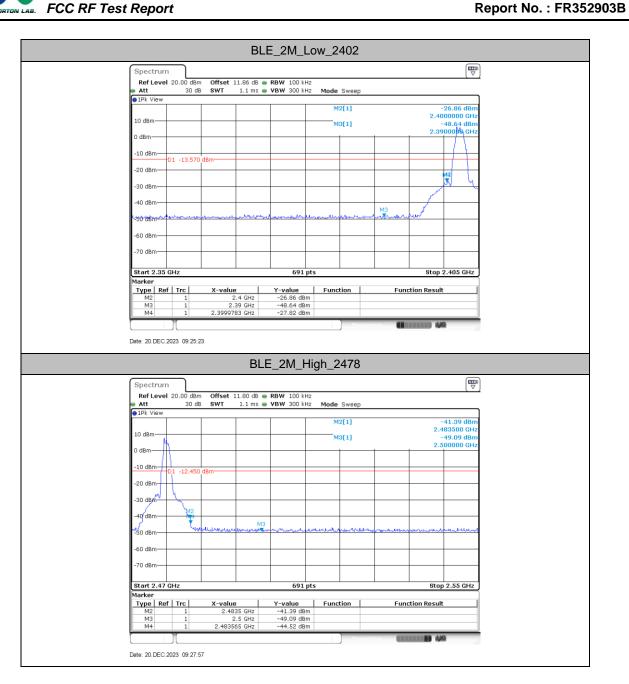
TestMode	ChName		RefLevel	Result	Limit	Verdict
		Freq(MHz)	[dBm/100KHz]	[dBm/100KHz]	[dBm/100KHz]	
DIE 4M	Low	2402	6.87	-43.63	≤-13.13	PASS
BLE_1M	High	2480	8.05	-45.11	≤-11.95	PASS
	Low	2402	6.43	-27.82	≤-13.57	PASS
BLE_2M	High	2478	7.55	-44.52	≤-12.45	PASS
		High	2480	-3.18	-42.1	≤-23.18

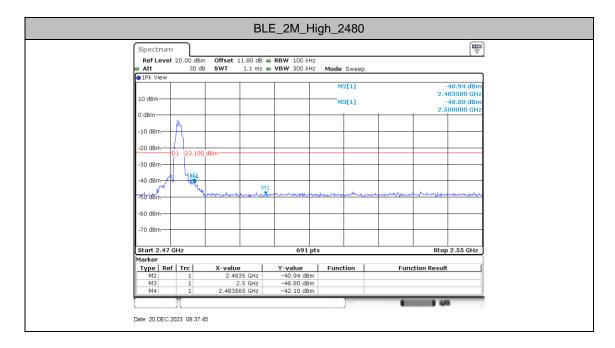
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L

Test Graphs



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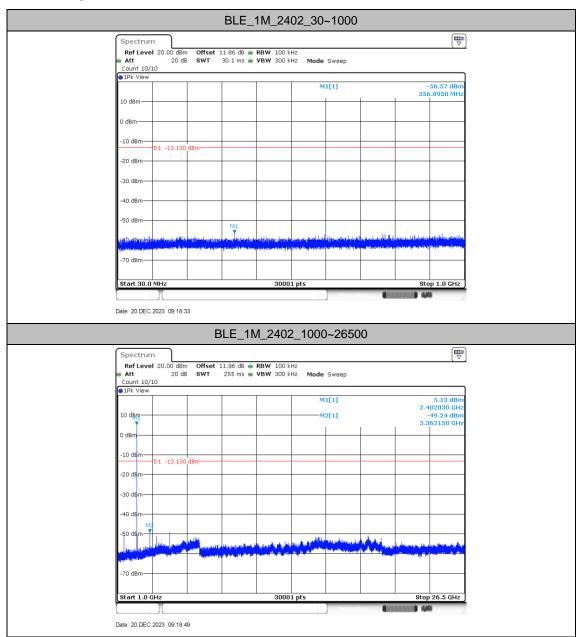
Conducted Spurious Emission

Test Result

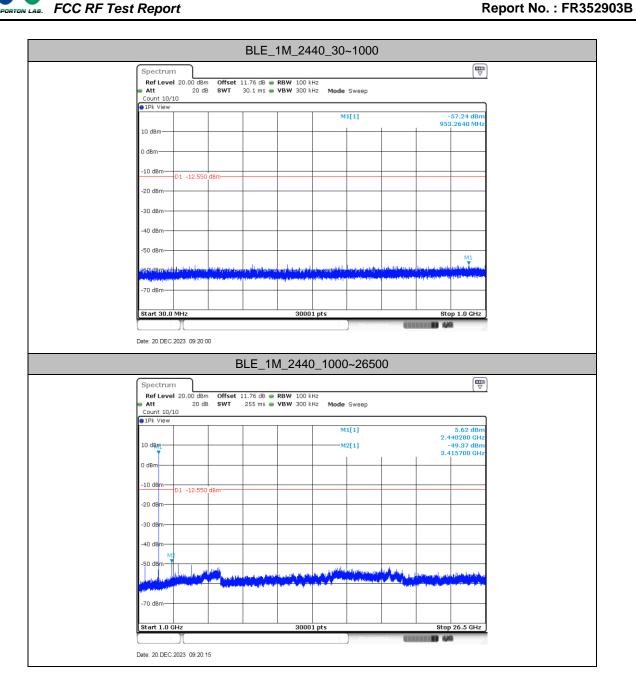
TestMode	Freq(MHz)	FreqRange	RefLevel	Result	Limit	Verdict	
restiviode	rieq(IVITZ)	[MHz]	[dBm/100KHz]	[dBm/100KHz]	[dBm/100KHz]	verdict	
	2402	30~1000	6.87	-56.57	≤-13.13	PASS	
	2402	1000~26500	6.87	-49.24	≤-13.13	PASS	
BLE 1M	2440	30~1000	7.45	-57.24	≤-12.55	PASS	
DLE_TIVI	2440	1000~26500	7.45	-49.37	≤-12.55	PASS	
	2480	30~1000	8.05	-56.19	≤-11.95	PASS	
		1000~26500	8.05	-49.05	≤-11.95	PASS	
	2402	30~1000	6.43	-56.06	≤-13.57	PASS	
	2402	1000~26500	6.43	-48.47	≤-13.57	PASS	
	2440	30~1000	6.94	-57.59	≤-13.06	PASS	
DIE OM	2440	1000~26500	6.94	-50.05	≤-13.06	PASS	
BLE_2M	2478	30~1000	7.55	-56.39	≤-12.45	PASS	
	2410	1000~26500	7.55	-49.68	≤-12.45	PASS	
	2490	30~1000	-3.18	-57.01	≤-23.18	PASS	
	2480	1000~26500	-3.18	-51.22	≤-23.18	PASS	

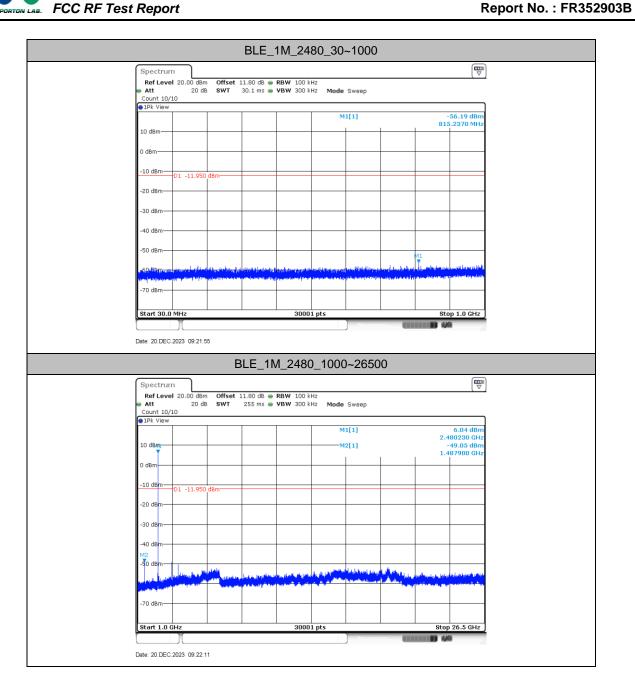
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L

Test Graphs

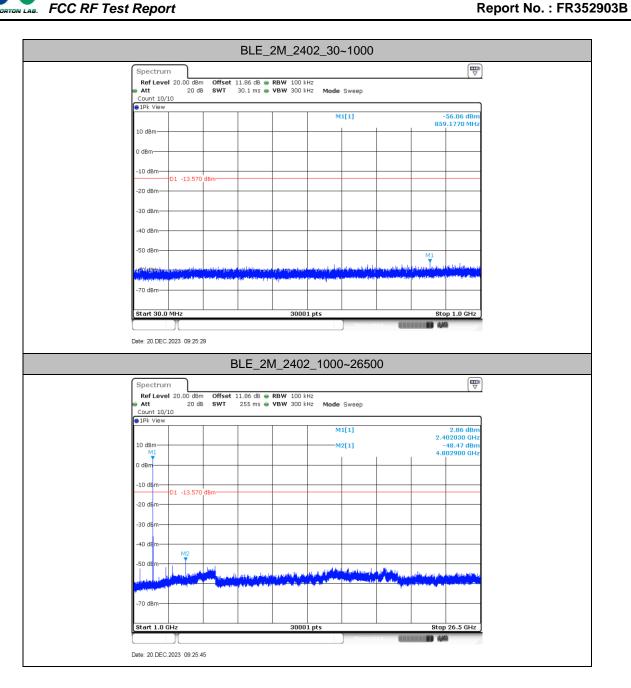


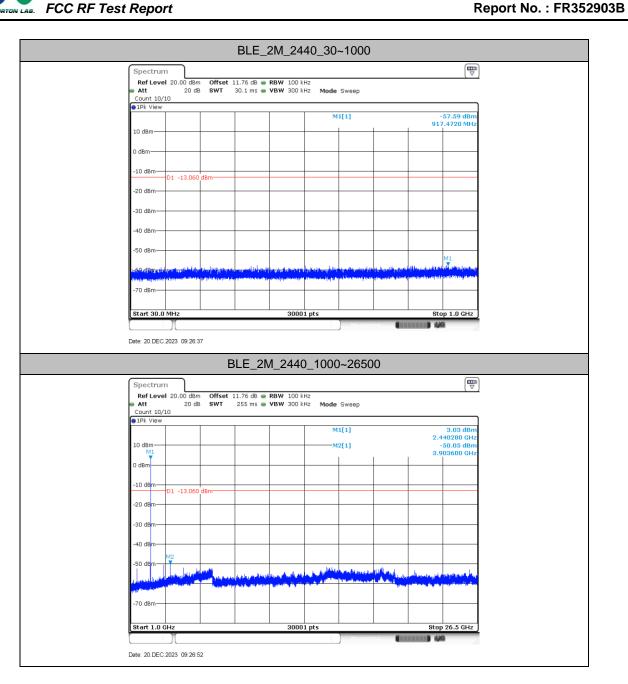
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L

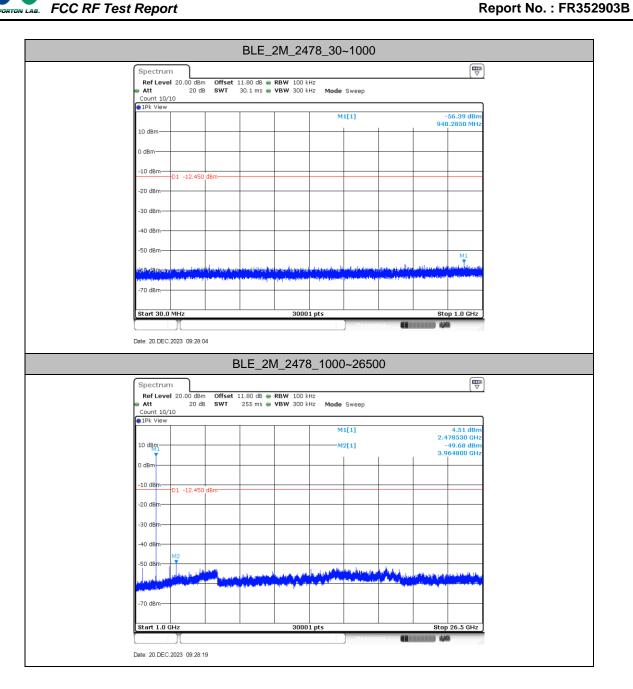


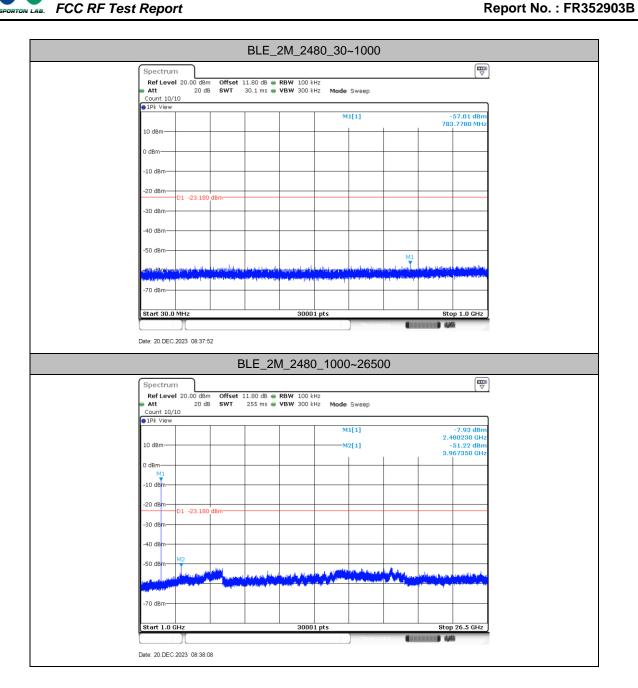


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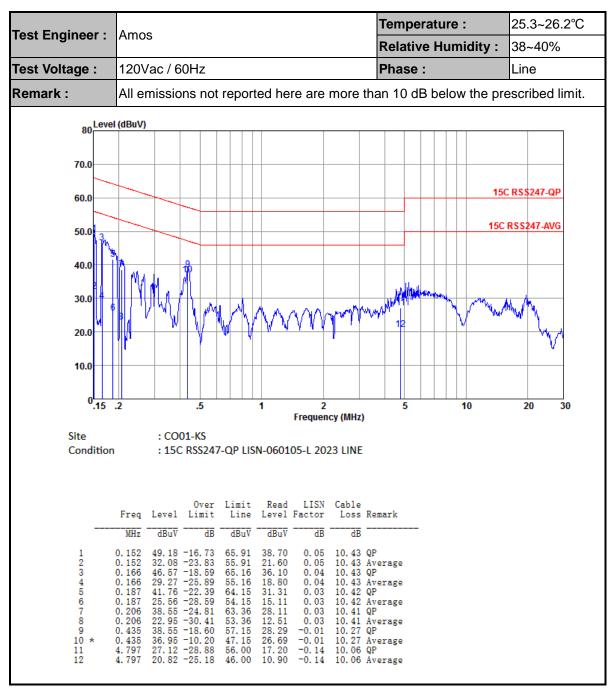






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Appendix B. AC Conducted Emission Test Results



TEL: +86-512-57900158 FCC ID: XMR2023FCE860L

Test Engineer: Amos

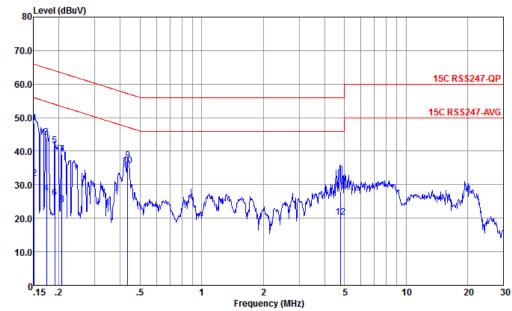
Temperature: 25.3~26.2°C

Relative Humidity: 38~40%

Test Voltage: 120Vac / 60Hz

Phase: Neutral

Remark: All emissions not reported here are more than 10 dB below the prescribed limit.



Site : CO01-KS

Condition : 15C RSS247-QP LISN-060105-N 2023 NEUTRAL

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 2 3 4 5 6 7 8 9 10 *	0. 152 0. 152 0. 174 0. 174 0. 191 0. 191 0. 207 0. 207 0. 207 0. 435 4. 772 4. 772	31. 77 44. 07 27. 37 41. 67 25. 97 38. 95 24. 05 37. 10 35. 60 28. 13	-17. 64 -24. 14 -20. 70 -27. 40 -22. 31 -28. 01 -24. 37 -29. 27 -20. 05 -11. 55 -27. 87 -25. 77	65. 91 55. 91 64. 77 54. 77 63. 98 53. 98 63. 32 53. 32 57. 15 47. 15 56. 00 46. 00	37. 80 21. 30 33. 60 16. 90 31. 20 15. 50 28. 50 13. 60 26. 89 25. 39 18. 20 10. 30	0. 04 0. 04 -0. 06	10. 42 10. 42 10. 42 10. 42 10. 41 10. 41 10. 27 10. 27 10. 06	Average QP Average QP Average QP Average QP Average

Note:

- 1. Level($dB\mu V$) = Read Level($dB\mu V$) + LISN Factor(dB) + Cable Loss(dB)
- 2. Over Limit(dB) = Level(dB μ V) Limit Line(dB μ V)



Appendix C Radiated Spurious Emission Test Data

Test Engineer :	Jerry Xu	Relative Humidity :	41~42%
		Temperature :	22~23℃

Radiated Spurious Emission Test Modes

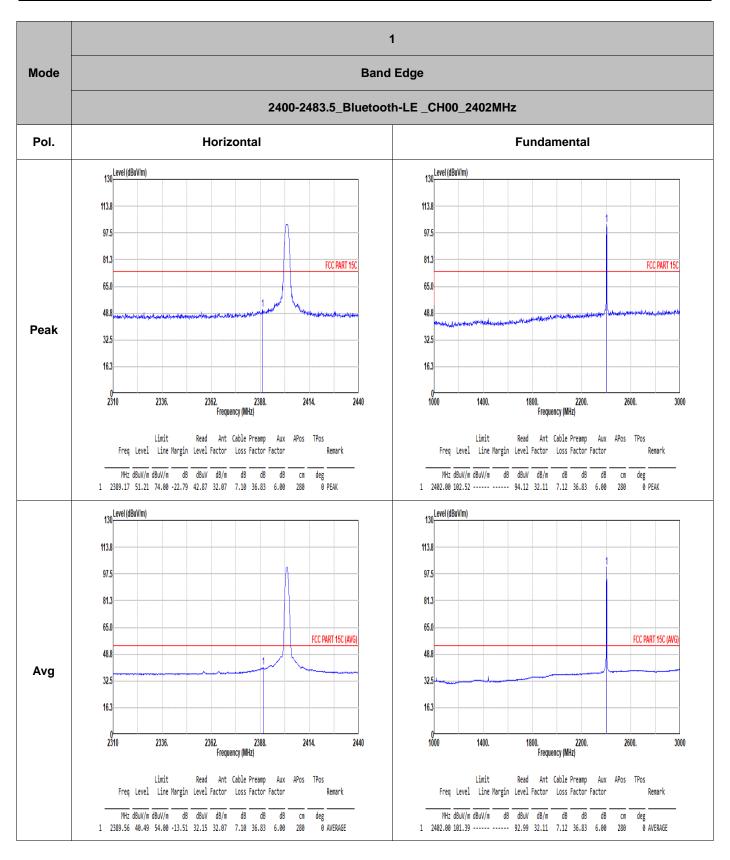
Mode	Band (MHz)	Modulation	Channel	Frequency	Data Rate	Remark
Mode 1	2400-2483.5	Bluetooth-LE	00	2402	1Mbps	-
Mode 2	2400-2483.5	Bluetooth-LE	19	2440	1Mbps	-
Mode 3	2400-2483.5	Bluetooth-LE	39	2480	1Mbps	-
Mode 4	2400-2483.5	Bluetooth-LE	00	2402	2Mbps	-
Mode 5	2400-2483.5	Bluetooth-LE	19	2440	2Mbps	-
Mode 6	2400-2483.5	Bluetooth-LE	38	2478	2Mbps	
Mode 7	2400-2483.5	Bluetooth-LE	39	2480	2Mbps	-

Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Bluetooth-LE	00	2389.56	40.49	54.00	-13.51	Н	AVERAGE	Pass	Band Edge
1	Bluetooth-LE	00	4804.00	50.80	54.00	-3.20	Н	AVERAGE	Pass	Harmonic
2	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
2	Bluetooth-LE	19	3967.50	45.52	74.00	-28.48	Н	Peak	Pass	Harmonic
3	Bluetooth-LE	39	2483.50	47.59	54.00	-6.41	Н	AVERAGE	Pass	Band Edge
3	Bluetooth-LE	39	3472.50	43.45	70.00	-26.55	V	Peak	Pass	Harmonic
4	Bluetooth-LE	00	2388.78	40.31	54.00	-13.69	Н	AVERAGE	Pass	Band Edge
4	Bluetooth-LE	00	4804.00	48.48	54.00	-5.52	Н	AVERAGE	Pass	Harmonic
5	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
5	Bluetooth-LE	19	4880.00	46.93	54.00	-7.07	Н	AVERAGE	Pass	Harmonic
6	Bluetooth-LE	38	2483.68	68.96	74.00	-5.04	Н	PEAK	Pass	Band Edge
6	Bluetooth-LE	38	4956.00	44.78	74.00	-29.22	Н	PEAK	Pass	Harmonic
7	Bluetooth-LE	39	2483.62	70.95	74.00	-3.05	Н	PEAK	Pass	Band Edge
7	Bluetooth-LE	39	7440.00	41.98	74.00	-32.02	Н	PEAK	Pass	Harmonic

Sporton International Inc.(Kunshan)
TEL: +86-512-57900158
FCC ID: XMR2023FCE860L







1 Mode **Band Edge** 2400-2483.5_Bluetooth-LE _CH00_2402MHz Pol. Vertical **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 48.8 **Peak** 32.5 32.5 16.3 16.3 2336. 1400. 3000 2362. 2388. 1800. 2200. Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2389.04 48.98 74.00 -25.02 40.64 32.07 7.10 36.83 6.00 1 2402.00 101.30 ----- 92.90 32.11 7.12 36.83 6.00 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG 48.8 48.8 Avg 32.5 32.5 16.3 16.3 1000 0<u>—</u> 2310 D. 2200. Frequency (MHz) 1400. 3000 2336. 2388. 2414. 2440 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 100.15 ----- 91.75 32.11 7.12 36.83 6.00 348 284 AVERAGE 1 2389.43 38.97 54.00 -15.03 30.63 32.07 7.10 36.83 6.00 348 284 AVERAGE

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1 Mode Harmonic 2400-2483.5_Bluetooth-LE _CH00_2402MHz Pol. Horizontal Vertical 100K Ref Limit Read Ant Cable Preamp Aux APos TPos
Freq Level Line Margin Level Factor Loss Factor Factor Remark Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 103.56 74.00 29.56 95.16 32.11 7.12 36.83 6.00 272 360 PEAK MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 93.13 74.00 19.13 84.73 32.11 7.12 36.83 6.00 300 307 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 97.5 97.5 81.3 FCC PART 15C FCC PART 150 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG **Peak** 32.5 Avg 16.3 3000 6000. 12000. 15000. 18000 3000 15000. 6000. 18000 Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m deg MHz dBuV/m dBuV/m dB dBuV dB/m 1 3363.00 46.85 83.56 -36.71 71.35 32.64 8.48 65.62 0.00 CM deg 1 3363.00 43.31 73.13 -29.82 67.81 32.64 8.48 65.62 0.00 -- Peak 3843.00 44.44 74.00 -29.56 67.96 33.39 9.11 66.02 0.00 -- Peak $2 \quad 4804.50 \quad 46.01 \quad 74.00 \quad -27.99 \quad 67.15 \quad 33.90 \quad 10.21 \quad 65.25 \quad \ 0.00$ -- Peak $3\quad 4804.00\quad 53.38\quad 74.00\ -20.62\quad 74.53\quad 33.90\quad 10.20\quad 65.25\quad 0.00$ 18 PEAK 3 6601.50 45.07 73.13 -28.06 63.34 35.50 12.10 65.87 0.00 18 AVERAGE 4 4804.00 50.80 54.00 -3.20 71.95 33.90 10.20 65.25 0.00 -- Peak

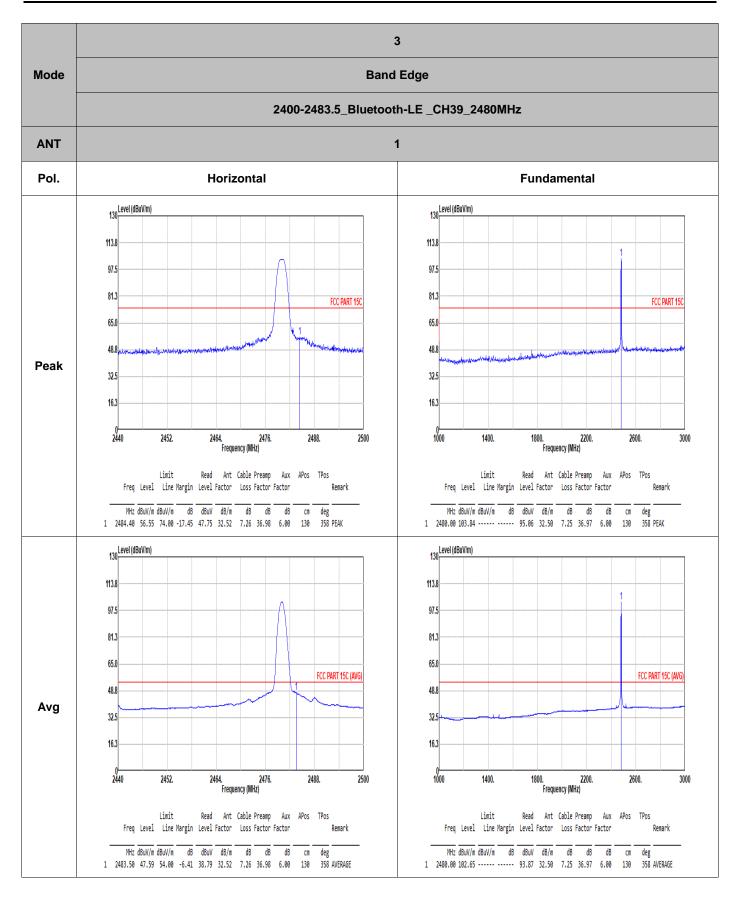
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L



2 Mode Harmonic 2400-2483.5_Bluetooth-LE _CH19_2440MHz Pol. Horizontal Vertical 45.0 45.0 100K 15.0 Ref Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark Limit Read Ant Cable Preamp Aux APos TPos
Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg
1 2440.00 104.53 74.00 30.53 95.96 32.30 7.19 36.92 6.00 299 360 PEAK | PHI dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg | 1 2440.00 97.50 74.00 23.50 88.93 32.30 7.19 36.92 6.80 300 306 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 81.3 FCC PART 15C 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG **Peak** 32.5 32.5 Avg 16.3 3000 6000. 12000. 15000. 18000 Frequency (MHz) 3000 15000. 6000. 12000. 18000 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m deg CM 1 3472.50 47.65 84.53 -36.88 71.99 32.60 8.61 65.55 0.00 deg MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB CM 3967.50 45.52 74.00 -28.48 68.92 33.43 9.26 66.09 0.00 -- Peak 1 4880.00 40.33 74.00 -33.67 61.41 33.90 10.30 65.28 0.00 -- PEAK 3 4880.00 40.80 74.00 -33.20 61.88 33.90 10.30 65.28 0.00 -- PEAK 2 7320.00 41.65 74.00 -32.35 59.70 35.70 12.72 66.47 0.00 4 7320.00 41.97 74.00 -32.03 60.02 35.70 12.72 66.47 0.00 -- PEAK -- PFAK

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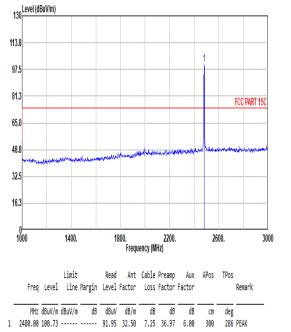
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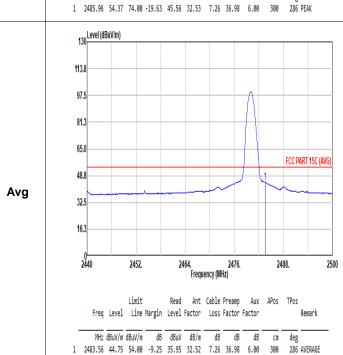


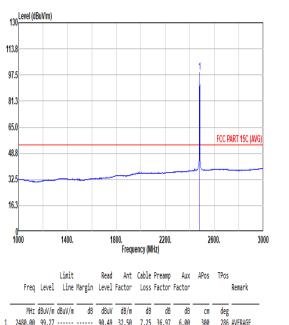
FCC RF Test Report Report No.: FR352903B 3 Mode **Band Edge**

2400-2483.5_Bluetooth-LE _CH39_2480MHz **ANT** Pol. Vertical **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 15C FCC PART 150 65.0 65.0

16.3 0<u>--</u> 2440 4. 2476. Frequency (MHz) 2452. 2500 Limit Read Ant Cable Preamp Aux APos TPos Remark Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB deg







Peak

32.5



3 Mode Harmonic 2400-2483.5_Bluetooth-LE _CH39_2480MHz Pol. Horizontal Vertical 100K Ref Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2480.00 100.18 74.00 26.18 91.40 32.50 7.25 36.97 6.00 284 360 PEAK MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg
1 2480.00 90.00 74.00 16.00 81.22 32.50 7.25 36.97 6.00 300 310 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 97.5 97.5 81.3 FCC PART 15C FCC PART 150 65.0 FCC PART 15C (AVG FCC PART 15C (AVG **Peak** 32.5 32.5 Avg 16.3 3000 6000. 12000. 15000. 18000 3000 15000. 6000. 18000 Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m deg MHz dBuV/m dBuV/m dB dBuV dB/m 1 3472.50 47.80 80.18 -32.38 72.14 32.60 8.61 65.55 0.00 CM deg 1 3472.50 43.45 70.00 -26.55 67.79 32.60 8.61 65.55 0.00 -- Peak 3967.50 45.16 74.00 -28.84 68.56 33.43 9.26 66.09 0.00 -- Peak 2 4960.00 42.87 74.00 -31.13 63.76 34.02 10.40 65.31 0.00 3 7440.00 42.08 74.00 -31.92 60.37 35.74 12.78 66.81 0.00 -- PEAK $3\quad 4960.00\quad 43.83\quad 74.00\quad -30.17\quad 64.72\quad 34.02\quad 10.40\quad 65.31\quad 0.00$ -- PEAK 4 7440.00 41.41 74.00 -32.59 59.70 35.74 12.78 66.81 0.00 -- PEAK -- PFAK

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Mode **Band Edge** 2400-2483.5_Bluetooth-LE _CH00_2402MHz Pol. Horizontal **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 48.8 **Peak** 32.5 32.5 16.3 16.3 1000 1400. 1800. 2200. Frequency (MHz) 2600. 2336. 3000 2362. 2388. Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB cm deg MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2402.00 102.60 ----- 94.20 32.11 7.12 36.83 6.00 275 1 2389.43 50.82 74.00 -23.18 42.48 32.07 7.10 36.83 6.00 275 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG 48.8 48.8 Avg 32.5 32.5 16.3 16.3 0<u>—</u> 2310 1000 1400. 3000 2336. 2388. 2414. 2440 Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 100.20 ----- 91.80 32.11 7.12 36.83 6.00 275 0 AVERAGE 1 2388.78 40.31 54.00 -13.69 31.97 32.07 7.10 36.83 6.00 275

TEL: +86-512-57900158 FCC ID: XMR2023FCE860L



Mode **Band Edge** 2400-2483.5_Bluetooth-LE _CH00_2402MHz Pol. Vertical **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 48.8 **Peak** 32.5 32.5 16.3 16.3 2336. 1400. 3000 2362. 2388. 2200. Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB dB 1 2388.65 50.23 74.00 -23.77 41.89 32.07 7.10 36.83 6.00 1 2402.00 100.98 ----- 92.58 32.11 7.12 36.83 6.00 347 281 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 97.5 97.5 81.3 81.3 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG 48.8 48.8 Avg 32.5 32.5 16.3 16.3 1000 1800. Frequency (MHz) 0<u>—</u> 2310 1400. 3000 2336. 2388. 2414. 2440 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2402.00 98.58 ----- 90.18 32.11 7.12 36.83 6.00 347 281 AVERAGE 1 2388.52 39.09 54.00 -14.91 30.75 32.07 7.10 36.83 6.00 347 281 AVERAGE

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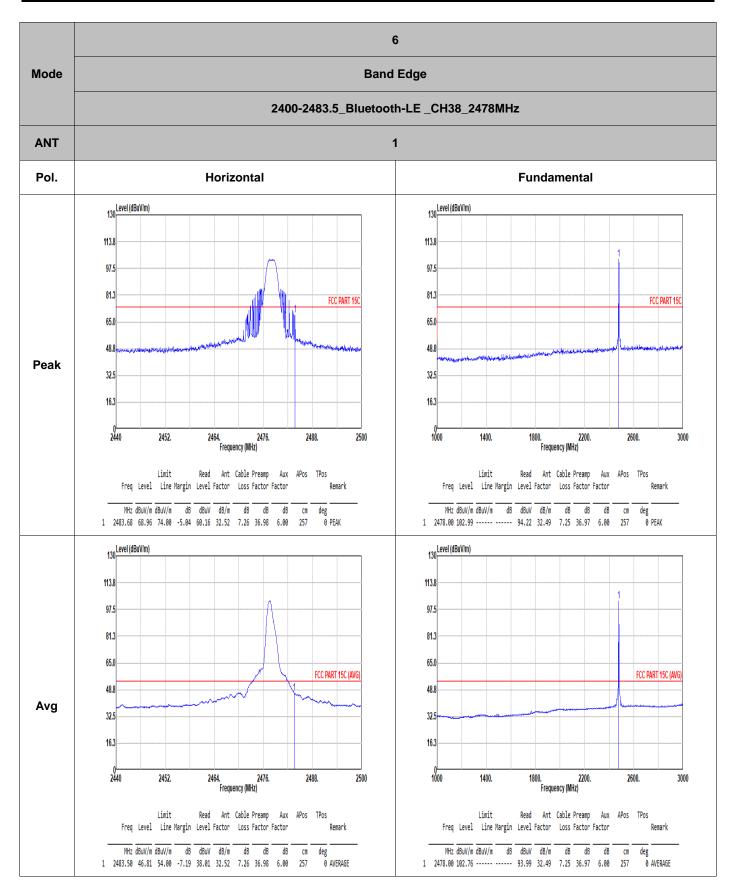
Mode Harmonic 2400-2483.5_Bluetooth-LE _CH00_2402MHz Horizontal Vertical Pol. 75.0 75.0 60.0 60.0 45.0 45.0 100K Ref 1800. 2200. Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos
Freq Level Line Margin Level Factor Loss Factor Factor Remark Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 101.54 74.00 27.54 93.14 32.11 7.12 36.83 6.00 300 360 PEAK | MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg | 1 2402.00 94.06 74.00 20.06 85.66 32.11 7.12 36.83 6.00 300 282 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 FCC PART 150 81.3 FCC PART 150 65.0 FCC PART 15C (AV) FCC PART 15C (AVG **Peak** Avg 6000. 15000. 18000 9000. 12000. Frequency (MHz) 3000 6000. 12000. 15000. 18000 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos Freq Level Line Margin Level Factor Loss Factor Factor Limit Read Ant Cable Preamp Aux APos TPos MHz dBuV/m dBuV/m dB dBuV dB/m Freq Level Line Margin Level Factor Loss Factor Factor Remark deg -- Peak -- Peak 3363.00 41.22 74.06 -32.84 65.72 32.64 8.48 65.62 0.00 MHz dBuV/m dBuV/m dB dBuV dB/m dB deg 3843.00 40.70 74.00 -33.30 64.22 33.39 9.11 66.02 0.00 4804.00 44.38 74.00 -29.62 65.53 33.90 10.20 65.25 0.00 CM 211 Peak 100 1 3363.00 44.80 81.54 -36.74 69.30 32.64 8.48 65.62 0.00 4804.00 40.46 54.00 -13.54 61.61 33.90 10.20 65.25 100 211 Average 3843.00 44.56 74.00 -29.44 68.08 33.39 9.11 66.02 0.00 -- Peak 6603.00 46.35 74.06 -27.71 64.62 35.50 12.10 65.87 0.00 9240.00 45.89 74.06 -28.17 61.85 36.48 14.49 66.93 0.00 -- Peak -- Peak 3 4804.00 52.99 74.00 -21.01 74.14 33.90 10.20 65.25 0.00 249 17 PEAK 17 AVERAGE 4 4804.00 48.48 54.00 -5.52 69.62 33.90 10.21 65.25 0.00



5 Mode Harmonic 2400-2483.5_Bluetooth-LE _CH19_2440MHz Horizontal Vertical Pol. 75.0 FCC PART 15 75.0 60.0 45.0 45.0 100K 15.0 15.0 Ref Limit Read Ant Cable Preamp Aux APos TPos
Freq Level Line Margin Level Factor Loss Factor Factor Remark Limit Read Ant Cable Preamp Aux APos TPos
Freq Level Line Margin Level Factor Loss Factor Factor Remark | MHz | dBuV/m | dBuV/m | dB | dBuV | dB/m | dB | dB | dB | cm | deg | 1 | 2440.00 | 103.17 | 74.00 | 29.17 | 94.60 | 32.30 | 7.19 | 36.92 | 6.00 | 108 | 360 | PEAK MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg
1 2440.00 91.94 74.00 17.94 83.37 32.30 7.19 36.92 6.00 300 306 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 97.5 97.5 81.3 81.3 FCC PART 150 65.0 FCC PART 15C (AVG FCC PART 15C (AVG **Peak** Avg 9000. 12000. Frequency (MHz) 6000. 15000. 15000. 18000 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB deg 1 3415.50 43.80 83.17 -39.37 68.25 32.60 8.54 65.59 0.00 1 3417.00 42.66 71.94 -29.28 67.10 32.60 8.55 65.59 0.00 -- Peak -- Peak 3904.50 43.85 74.00 -30.15 67.23 33.50 9.18 66.06 -- Peak 2 3904.50 41.50 74.00 -32.50 64.88 33.50 9.18 66.06 0.00 -- Peak 0.00 4880.00 51.90 74.00 -22.10 72.98 33.90 10.30 65.28 0.00 33 PEAK 4881.00 43.68 74.00 -30.32 64.76 33.90 10.30 65.28 0.00 4 4880.00 46.93 54.00 -7.07 68.01 33.90 10.30 65.28 0.00 5 7320.00 41.47 74.00 -32.53 59.52 35.70 12.72 66.47 0.00 33 AVERAGE 6603.00 44.59 71.94 -27.35 62.86 35.50 12.10 65.87 0.00 -- PFAK 5 7320.00 41.99 74.00 -32.01 60.04 35.70 12.72 66.47 0.00 -- PFAK

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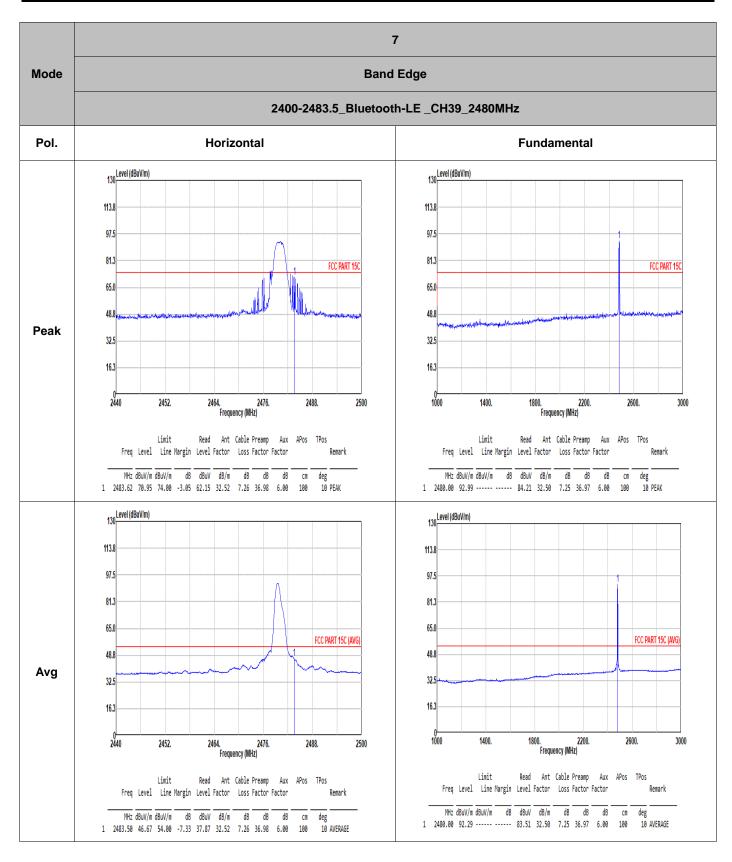
6 Mode **Band Edge** 2400-2483.5_Bluetooth-LE _CH38_2478MHz Pol. Vertical **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 Peak 32.5 32.5 16.3 16.3 0<u>—</u> 2440 1000 4. 2476. Frequency (MHz) 2452. 2488. 2500 1400. 2600. 3000 Frequency (MHz) Limit Limit Read Ant Cable Preamp Aux APos TPos Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor 367 274 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 48.8 Avg 32.5 32.5 16.3 16.3 1000 2440 4. 2476. Frequency (MHz) 1800. 2200. Frequency (MHz) 2452. 2488. 2500 1400. 3000 Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2483.56 42.91 54.00 -11.09 34.11 32.52 7.26 36.98 6.00 367 274 AVERAGE 1 2478.00 93.40 ----- 84.63 32.49 7.25 36.97 6.00 367 274 AVERAGE



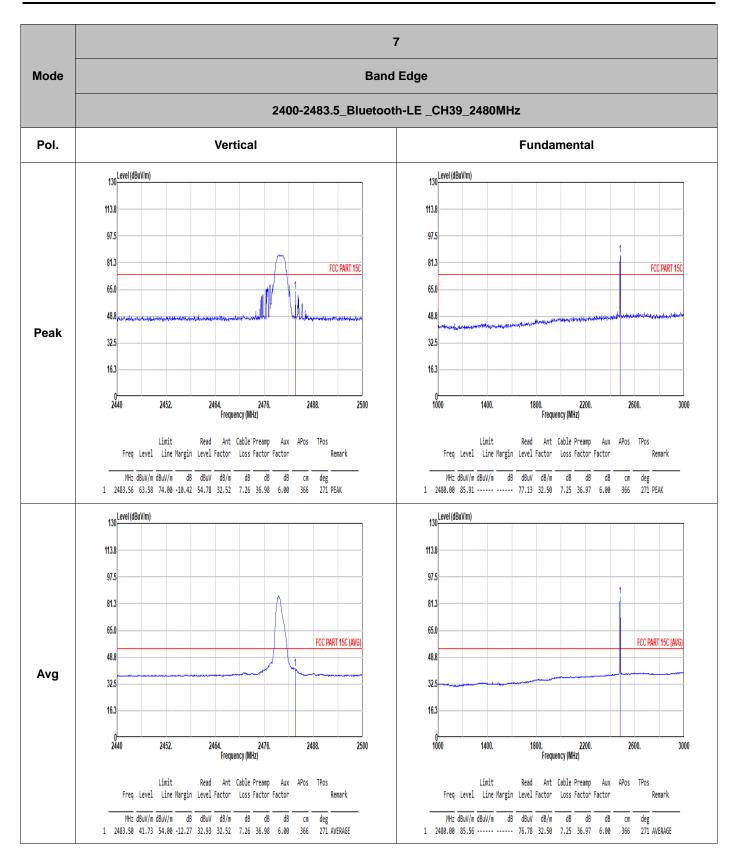
6 Mode Harmonic 2400-2483.5_Bluetooth-LE _CH38_2478MHz Horizontal Vertical Pol. 75.0 100K Ref Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2478.00 102.55 74.00 28.55 93.78 32.49 7.25 36.97 6.00 257 360 PEAK | MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg | 1 2478.00 97.00 74.00 23.00 88.23 32.49 7.25 36.97 6.00 300 272 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 81.3 FCC PART 150 81.3 FCC PART 150 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG 48.8 Peak 32.5 Avg 16.3 16.3 6000. 15000. 18000 3000 6000. 15000. 18000 Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB dB 1 3469.50 45.49 82.55 -37.06 69.83 32.60 8.61 65.55 0.00 deg MHz dBuV/m dBuV/m dB dBuV dB/m dB deg -- PEAK -- Peak 3964.50 44.17 74.00 -29.83 67.56 33.44 9.26 66.09 0.00 1 4956.00 42.95 74.00 -31.05 63.86 34.01 10.39 65.31 0.00 -- Peak 3 4956.00 44.78 74.00 -29.22 65.69 34.01 10.39 65.31 0.00 -- PEAK 2 6597.00 46.09 77.00 -30.91 64.36 35.50 12.09 65.86 0.00 -- Peak 7434.00 42.14 74.00 -31.86 60.42 35.73 12.78 66.79 0.00 3 7434.00 41.98 74.00 -32.02 60.26 35.73 12.78 66.79 0.00

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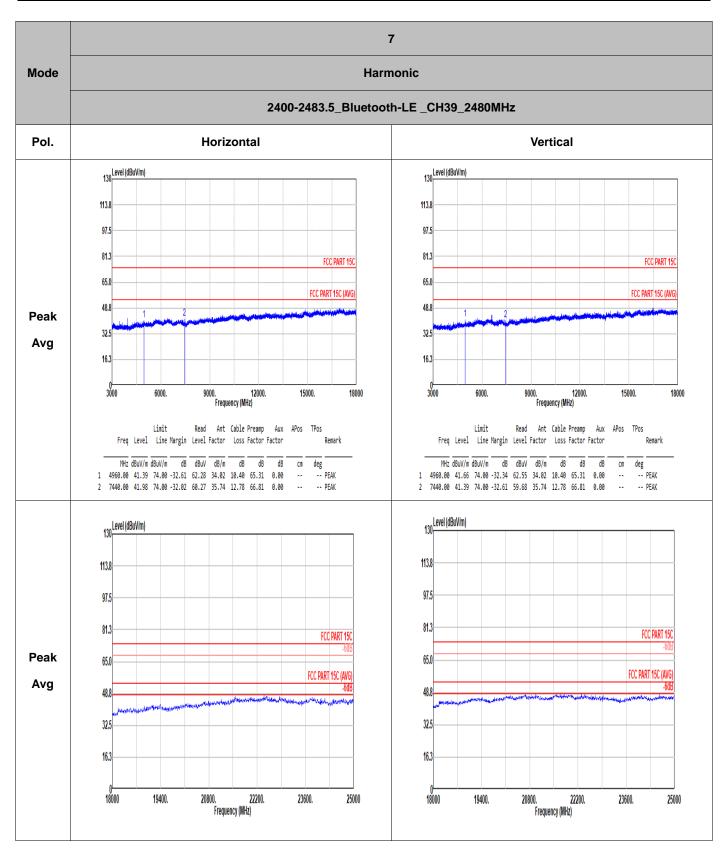
SPORTON LAB. FCC RF Test Report











7 LF Mode 2400-2483.5_Bluetooth-LE _CH39_2480MHz Pol. Vertical Horizontal 80 Level (dBuV/m) 80 Level (dBuV/m) 70.0 70.0 FCC PART 150 50.0 50.0 40.0 40.0 30.0 30.0 20.0 Peak 10.0 10.0 0.0 QP -10.0 -10.0 -2030 100 200. 300. 400. 500. 600. 700. 800. 900. 1000 100. 200. 600. Frequency (MHz) Frequency (MHz) Over Limit ReadAntenna Cable Preamp A/Pos T/Pos
Freq Level Limit Line Level Factor Loss Factor Remark Over Limit ReadAntenna Cable Preamp A/Pos T/Pos
Freq Level Limit Line Level Factor Loss Factor Remark Pol/Phas Pol/Phas dB dBuV/m dBuV dB/m dB dB cm deg dB dBuV/m dBuV dB/m dB MHz dBuV/m dB deg
 56.19
 25.73 - 14.27
 40.00
 44.26
 13.28
 1.11
 32.92

 174.53
 20.21 - 23.29
 43.59
 35.12
 15.92
 2.00
 32.83

 352.04
 30.60 - 15.40
 46.00
 40.19
 20.48
 2.66
 32.93

 484.93
 29.47 - 16.53
 46.00
 35.79
 23.28
 3.36
 32.96

 874.87
 31.39 - 14.61
 46.00
 32.34
 26.63
 45.92
 32.10
 --- Peak --- Peak --- Peak --- Peak --- Peak 33.88 19.70 - 209.30 40.00 29.28 22.56 29.28 29.29 29.28 29.29 29.28 29.29 29.28 29.29 29. --- Peak --- Peak --- Peak --- Peak --- Peak VERTICAL HORIZONT HORIZONT HORIZONT VERTICAL VERTICAL VERTICAL VERTICAL VERTICAL HORIZONT

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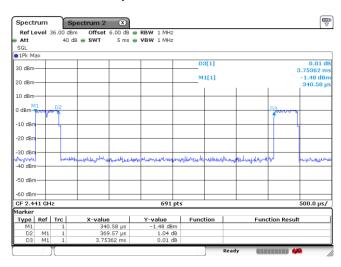
TEL: +86-512-57900158 FCC ID: XMR2023FCE860L



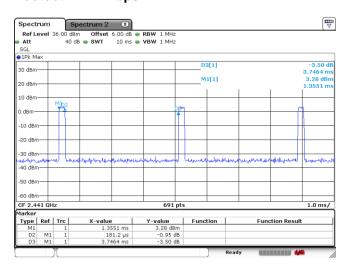
Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth LE 1Mbps	9.85	0.370	2.706	2.8KHz
Bluetooth LE 2Mbps	4.84	0.181	5.519	5.6KHZ

Bluetooth LE 1Mbps



Bluetooth LE 2Mbps



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