FCC DTS RF TEST REPORT

Vista Labs
TEST • CERTIFY • COMPLY

Test Report Number……	**HME-19081321-LC-FCC-DTS**
Applicant……	**HM Electronics Inc**
Applicant Address……	**2848 Whiptail Loop, Carlsbad, CA 92010 USA**
Product Name……	Wireless Beltpack
Model Number……	1409
Family Product/Model……	N/A
FCC ID……	BYM1409
Date of EUT received……	09/27/2019
Date of Test……	09/27/2019 – 12/30/2019
Report Issue Date……	05/12/2020
Test Standards……	**47CFR Part 15.247**
Test Result……	Pass

Issued By:

Vista Laboratories

1261 Puerta Del Sol, San Clemente, CA 92673 USA

www.vista-compliance.com

Tested by:	**Approved By:**
David Zhang/Test Engineer	**Yuna Yin/Engineering Reviewer**

Laboratory Introduction

Vista Labs is an A2LA accredited 17025 compliant regulatory compliance testing laboratories (Cert. number: 4848-01) strategically located in Orange County, providing services in the electrical and telecommunication industries. Vista labs is also recognized testing facility for Australia (ACMA), Chinese Taipei (BSMI), Chinese Taipei (NCC), Hong Kong (OFCA), Israel (MOC), Korea (RRA), Singapore (IMDA), Vietnam (MIC), etc.

Our comprehensive testing services include EMC emission and susceptibility testing, RF and wireless testing (including DFS).
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VISTA LABORATORIES, INC.

San Clemente, CA

for technical competence in the field of

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Presented this 21st day of June 2018.

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For the Accreditation Council
Certificate Number 4848.01
Valid to July 31, 2020

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17025 Product Testing Accreditation Certificate

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A2LA has accredited

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This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This product certification body also meets the A2LA R308 – Specific Requirements – ISO-IEC 17065 – Telecommunication Certification Body Accreditation Program and R322 – Specific Requirements – Notified Body Accreditation Requirements. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 1st day of October 2018.

President and CEO
For the Accreditation Council
Certificate Number 4848.02
Valid to July 31, 2020

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

17065 Product Certification Accreditation Certificate

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REVISION HISTORY

Revision	Issue Date	Description	Note
Original	05/12/2020	Original release	N/A

1 General Information

1.1 Applicant

Applicant:	HM Electronics Inc
Applicant address:	2848 Whiptail Loop, Carlsbad, CA 92010 USA
Manufacturer:	HM Electronics Inc
Manufacturer Address:	2848 Whiptail Loop, Carlsbad, CA 92010 USA

1.2 Product information

Product Name	Wireless Beltpack
Model Number	1409
Family Model Number	N/A
Serial Number	42YYF083 (Conducted), 42YYF084 (Radiated)
Frequency Band	BLE: 2402-2480MHz 5Ghz-20Mhz: 5180-5240Mhz, 5260-5320Mhz, 5500-5720Mhz, 5745-5825Mhz
Type of modulation	BLE: GFSK 5GHz: OFDM
Equipment Class/ Category	DTS, UNII
Maximum output power	See test result
Antenna Information	BLE: Internal chip antenna, 2.5 dBi gain 5GHz: 2 x External omni-directional antenna, 3 dBi gain
Clock Frequencies	N/A
Port/Connectors	USB-C
Input Power	3.6VDC (battery), 5V/3A (USB-C adapter)
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BLE and 5GHz can transmit simultaneously
Additional Info	EUT has two 5GHz antennas, but these two antennas do not transmit simultaneous.

1.3 Test standard and method

Test standard	47CFR Part 15.247
Test method	ANSI C63.10: 2013 558074 D01 15.247 Meas Guidance v05r02

1.4 Test Purpose and statement

The purpose of this test report is intended to demonstrate the compliance of product listed in section 1.2, received from company listed in section 1.1, to the requirements of standard and method listed in section 1.3. Based on our test results, we conclude that the product tested complies with the requirements of the standards indicated.

2 Test site information

Lab performing tests	**Vista Laboratories**
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www. Vista-compliance.com

Test condition	Test Engineer	Test Environment	Test Date
RF conducted	David Zhang	23.5°C / 58.2%/996 mbar	09/27/2019 – 12/30/2019
Radiated	David Zhang	23.5°C / 58.2%/996 mbar	09/27/2019 – 12/30/2019

3 Modification of EUT

The EUT is an engineering test sample loaded with RF testing firmware specifically designed to support the RF TX/RX measurement in different aspects.

4 Test configuration and operation

4.1 EUT test configuration

EUT can be powered by battery or external USB-C adapter. The external power source is not port of EUT but will be used during the testing as supporting equipment. EUT's RF antenna port is connected to spectrum analyzer through RF test cable for measurement. The test software is used to set EUT to different transmission mode in terms of radio mode (5GHz, BLE), test channel, modulation on/off, etc.

4.2 EUT test mode

Radio	Channel	Frequency (MHz)
BLE	0	2402
BLE	20	2442
BLE	39	2480

4.3 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	USB-C adapter	TC0003	N/A	CHOETECH	-
2	Laptop	P29G	34917771602	ASUS	Remote access

4.4 EUT setup diagram

4.5 EUT operation

Other than normal operational mode, the EUT has test software is used to set EUT to different transmission mode in terms of radio mode (5GHz, BLE), test channel, data rate, etc.

4.6 Test software

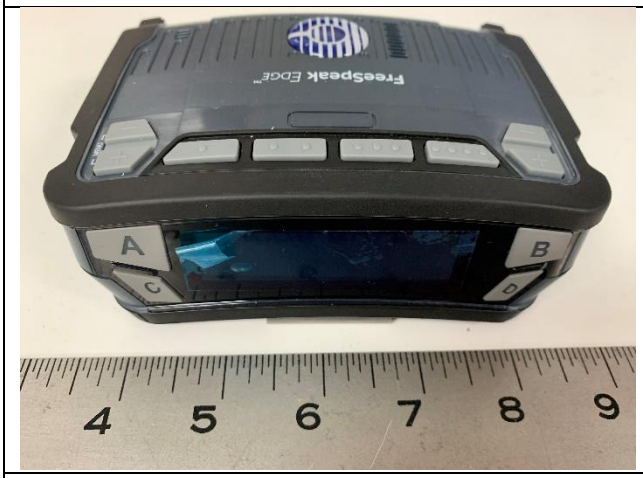
Index	Description	Remark
1	Putty.exe 0.63	Set Wi-Fi radio to different test mode
2	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing

5 EUT and test setup pictures

5.1 EUT external pictures

EUT Top View

EUT Bottom View



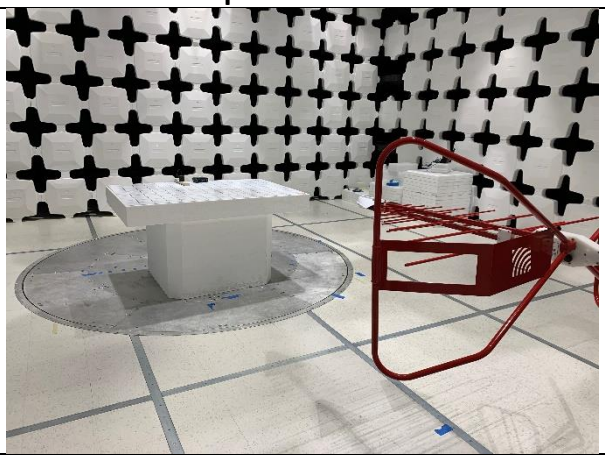
EUT Front View

EUT Rear View

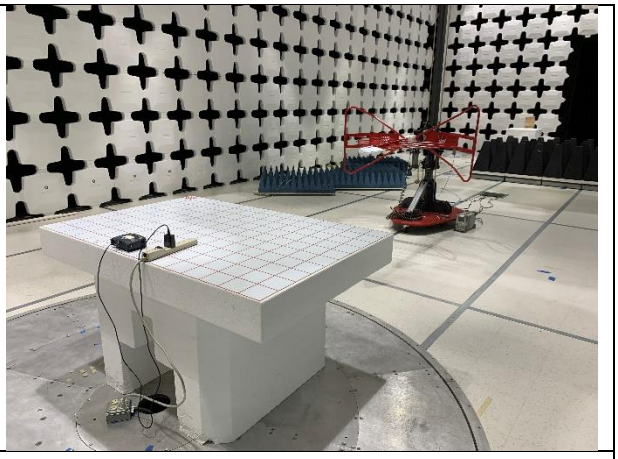
EUT Left View

EUT Right View

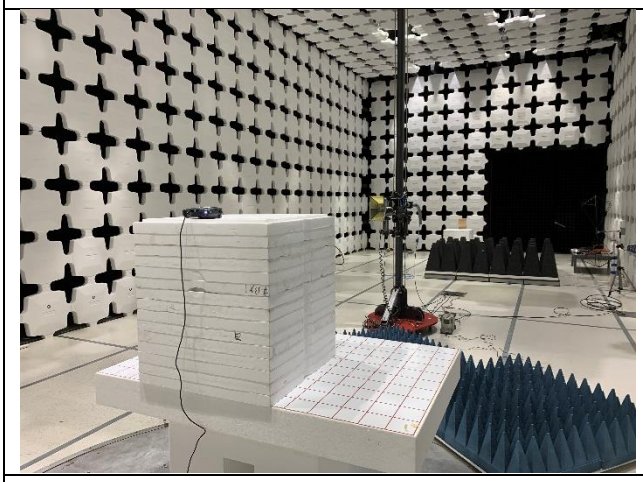
5.2 EUT test setup



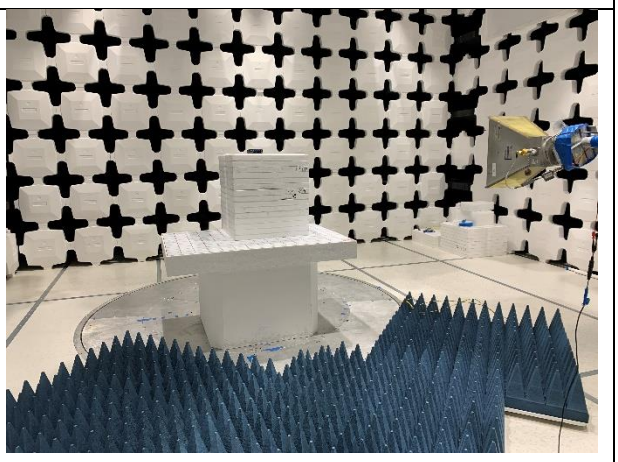
RE Below 1GHz – Front View



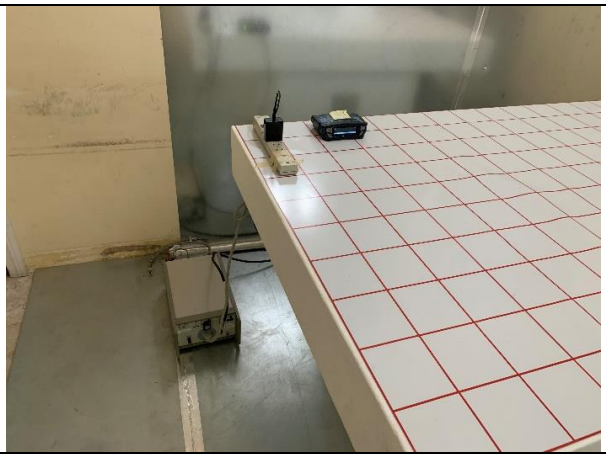
RE Below 1GHz – Rear View



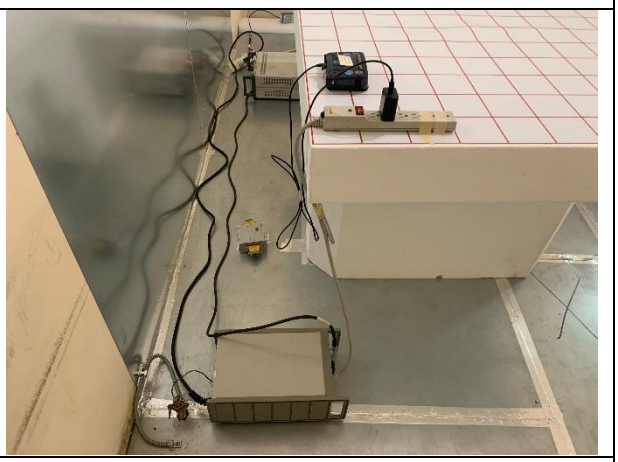
RE Above 1GHz – Front View



RE Above 1GHz – Rear View



AC Line CE – Front View



AC Line CE – Rear View

6 Test Summary

FCC Rules	Test Item	Section	Verdict
§15.203	Antenna Requirement	8.1	Pass
§15.247 (a)(2)	DTS (6 dB) Channel Bandwidth	8.2	Pass
§15.247(b)(3)	Conducted Maximum Output Power	8.3	Pass
§15.247(e)	Power Spectral Density	8.4	Pass
§15.247(d)	Conducted Band-Edge & Unwanted Emissions	8.5	Pass
§15.205, §15.209	Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	8.6	Pass
§15.207 (a)	AC Power Line Conducted Emissions	8.7	Pass

7 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

8 Test summary and result

8.1 Antenna Requirement

8.1.1 Requirement

Per § 15.203, 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.

8.1.2 Result

Analysis:

EUT has an internal BLE chip antenna. No standard RF connector or coupling is used.

Conclusion:

EUT complies with antenna requirement in § 15.203.

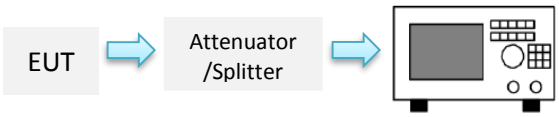
8.2 DTS (6 dB) Bandwidth

8.2.1 Requirement

§ 15.247 (a)(2)

Systems using digital modulation techniques may operate in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands. The minimum 6 dB bandwidth shall be at least 500 KHz.

8.2.2 Test setup



8.2.3 Test Procedure

According to section 8.2, option 2, in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.8 of ANSI C63.10-2013:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

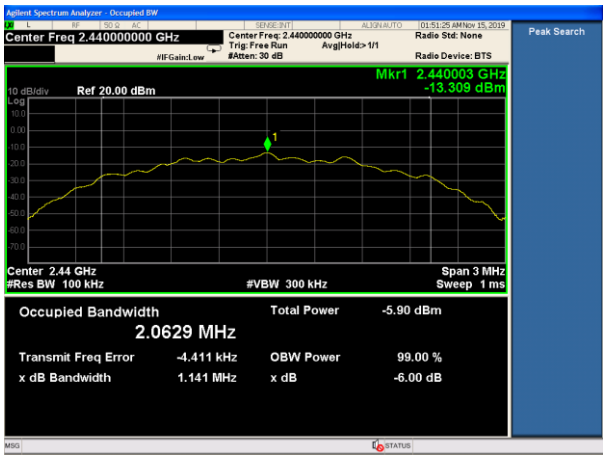
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Use automatic bandwidth measurement capability on instrument to obtain BW result.

8.2.4 Test Result

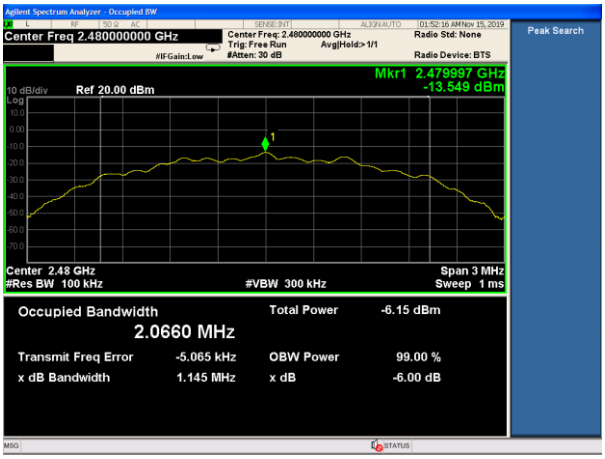
Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
BLE	2402	1Mbps	1147	500	Pass
BLE	2440	1Mbps	1141	500	Pass
BLE	2480	1Mbps	1145	500	Pass

8.2.5 Test Plots

BLE-6 dB BW-Low



BLE-6 dB BW-Mid



BLE-6 dB BW-High

8.3 Maximum Output Power

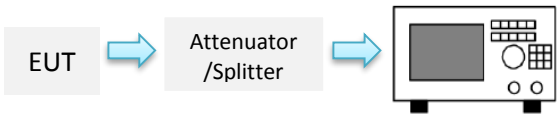
8.3.1 Requirement

§ 15.247 (b)(3)

or systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: the maximum output power is 1 Watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.3.2 Test setup



8.3.3 Test Procedure

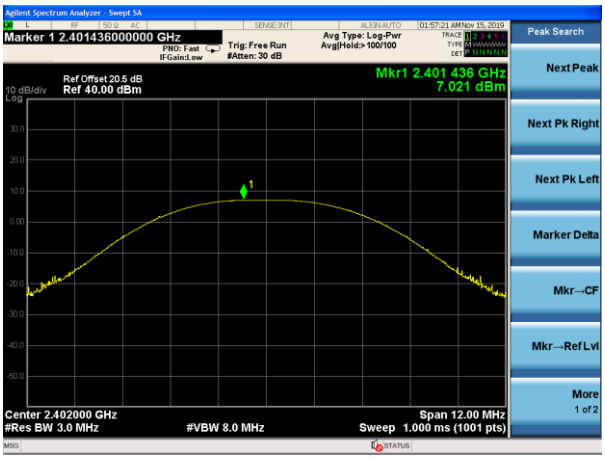
For BLE, power measurement is according to subclause 11.9.1.1 of ANSI C63.10-2013:

1. Set the RBW ≥ DTS bandwidth
2. Set VBW ≥ 3 X RBW.
2. Set SPAN ≥ 3 X RBW.
3. Sweep time = auto couple.
4. Detector = peak.
5. Trace mode = max hold
6. Allow trace to fully stabilize.
7. Use peak marker function to determine the peak amplitude level.

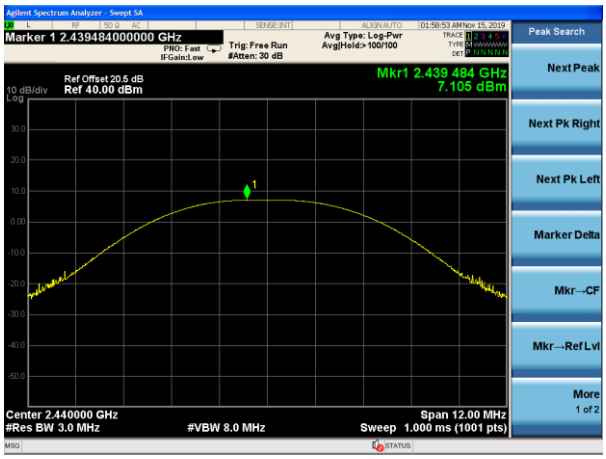
8.3.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Output Power (dBm)	Max Output Power (dBm)	Result
BLE	2402	1Mbps	7.021	30	Pass
BLE	2440	1Mbps	7.105	30	Pass
BLE	2480	1Mbps	6.835	30	Pass

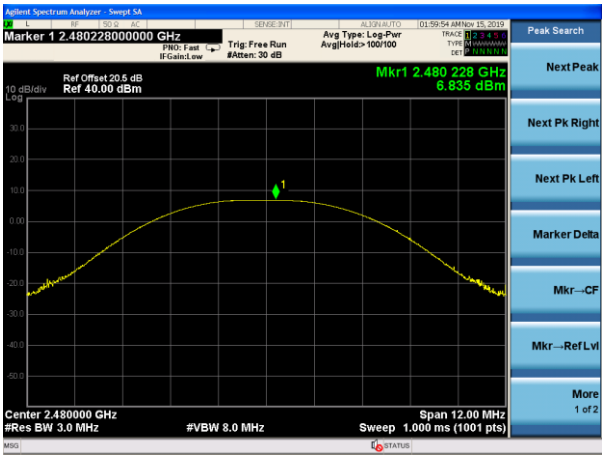
8.3.5 Test Plots



BLE-PWR-Low



BLE-PWR-Mid



BLE-PWR-High

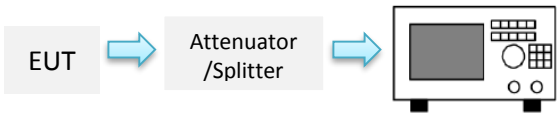
8.4 Power Spectral Density

8.4.1 Requirement

§ 15.247 (e)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power is used to determine the power spectral density.

8.4.2 Test setup



8.4.3 Test Procedure

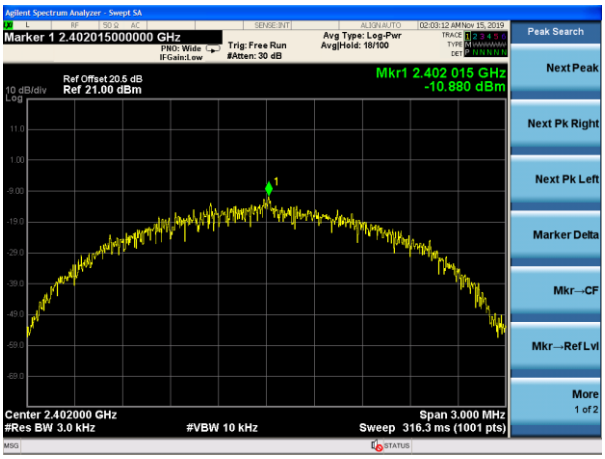
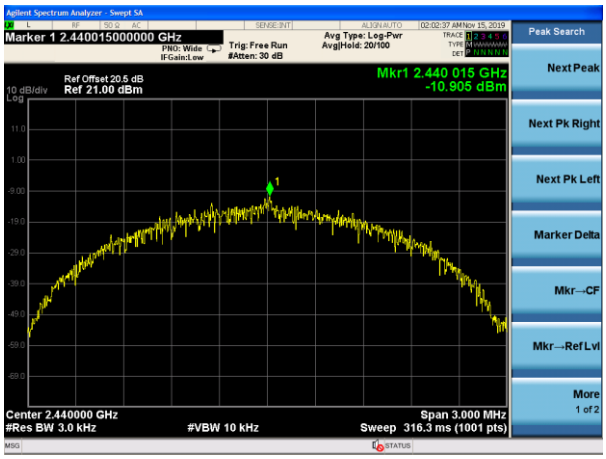
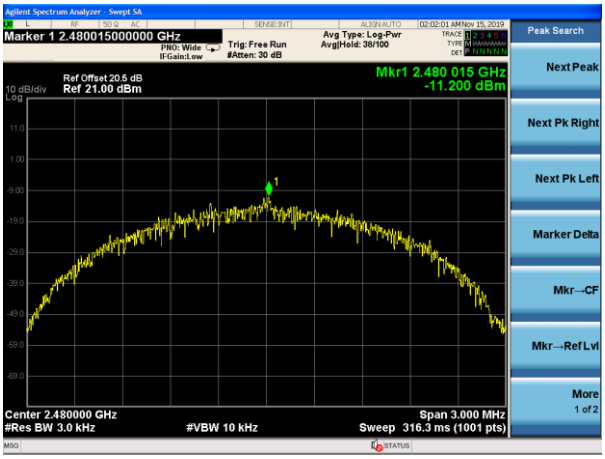
According to section 8.4 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.10.2 PKPSD of ANSI C63.10-2013:

1. Set analyser centre frequency to DTS channel centre frequency.
2. Set the span to 1.5 X DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

8.4.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured PSD (dBm/3KHz)	Max PSD (dBm/3KHz)	Result
BLE	2402	1Mbps	-10.88	8	Pass
BLE	2440	1Mbps	-10.905	8	Pass
BLE	2480	1Mbps	-11.200	8	Pass

8.4.5 Test Plots

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>BLE-PSD-Low</td><td>BLE-PSD-Mid</td></tr>
<tr><td> 
</td><td></td></tr>
<tr><td>BLE-PSD-High</td><td></td></tr>
</table>

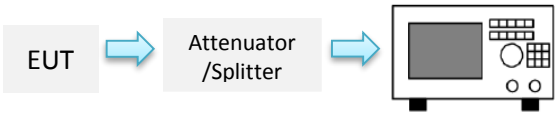
8.5 Conducted Band-Edge & Unwanted Emissions Measurement

8.5.1 Requirement

§ 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

8.5.2 Test setup



8.5.3 Test Procedure

According to section 8.5 Emission level measurement, in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.11.3 in ANSI C63.10-2013:

1. Set the centre frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ 3 X RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

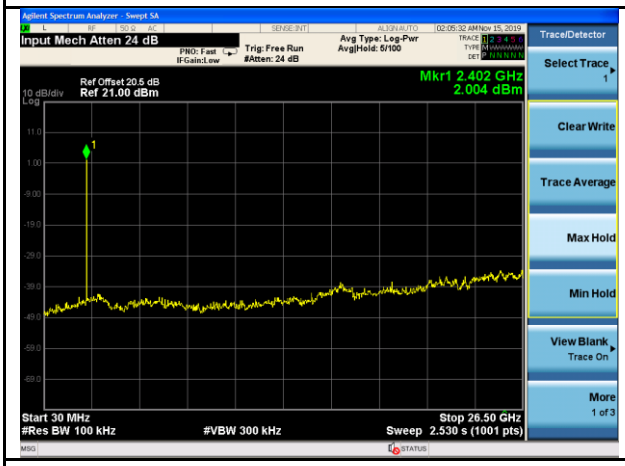
8.5.4 Test Result

See test plots

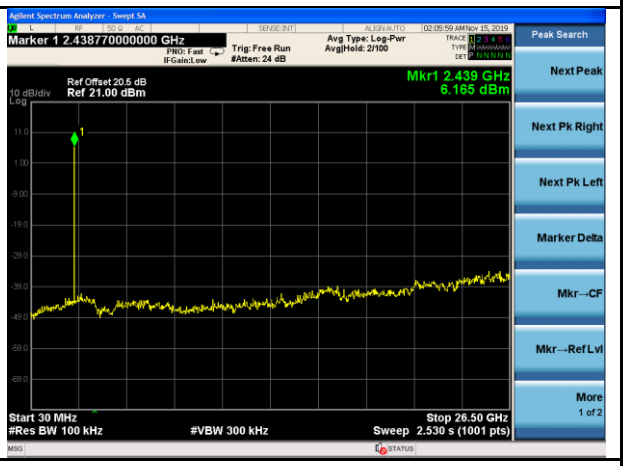
8.5.5 Test Plots

BLE-Band Edge-Low

BLE-Band Edge-High



BLE-Out Of Band Emission-Low



BLE-Out Of Band Emission-Mid

BLE-Out Of Band Emission-High

8.6 Radiated Band-Edge & Spurious Emissions into Restricted Frequency Bands

8.6.1 Requirement

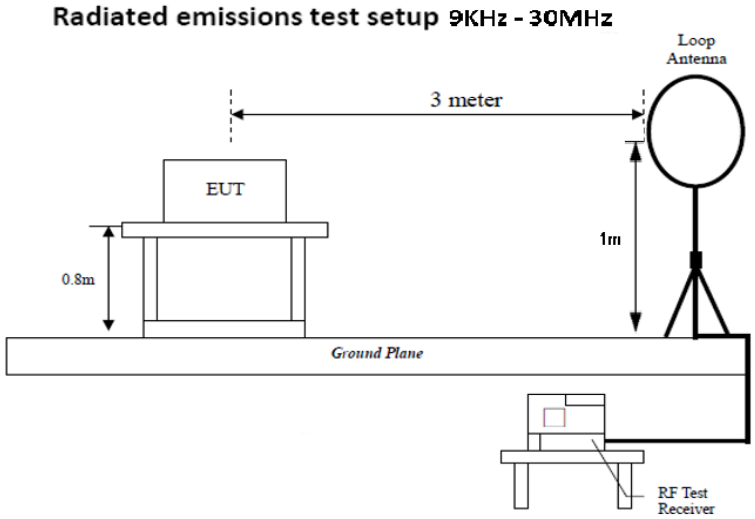
§ 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

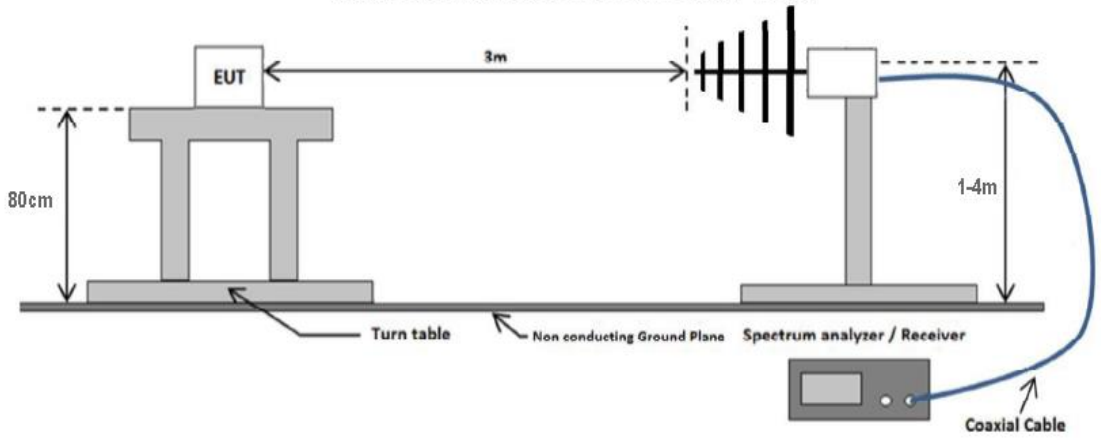
Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency range (MHz)	Field Strength (µV/m)
0.009~0.490	2400/F(KHz)
0.490~1.705	24000/F(KHz)
1.705~30.0	30
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

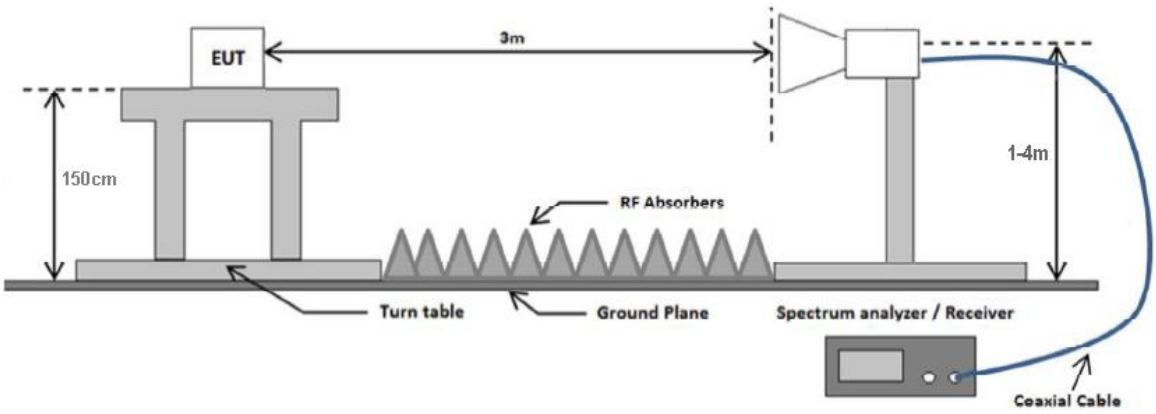
8.6.2 Test setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



8.6.3 ***Test Procedure***

According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.12.2.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

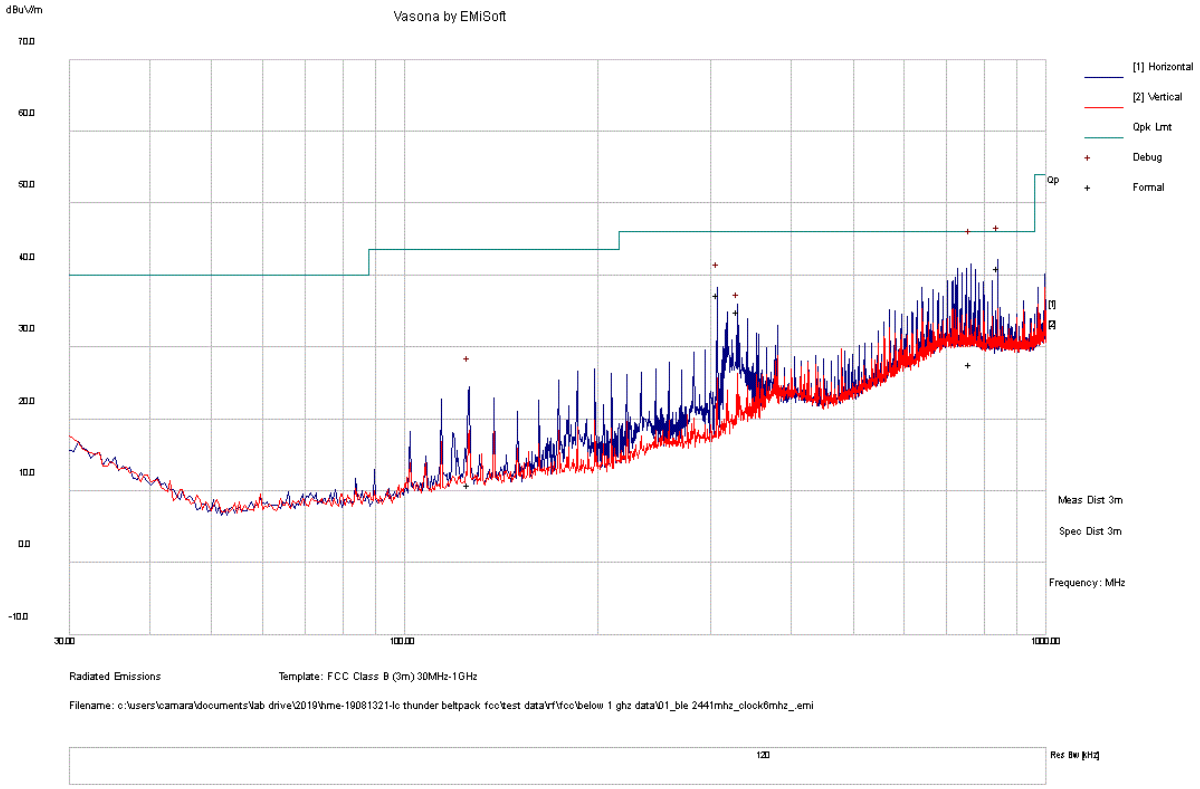
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

8.6.4 Test Result

RADIATED EMISSIONS < 1 GHZ

Test Standard:	15.209, 15.247	Mode:	BLE 2441 MHz
Frequency Range:	30 - 1000 MHz	Test Date:	12/09/2019 - 12/30/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	David Zhang
Remark:	N/A	Test Result:	Pass

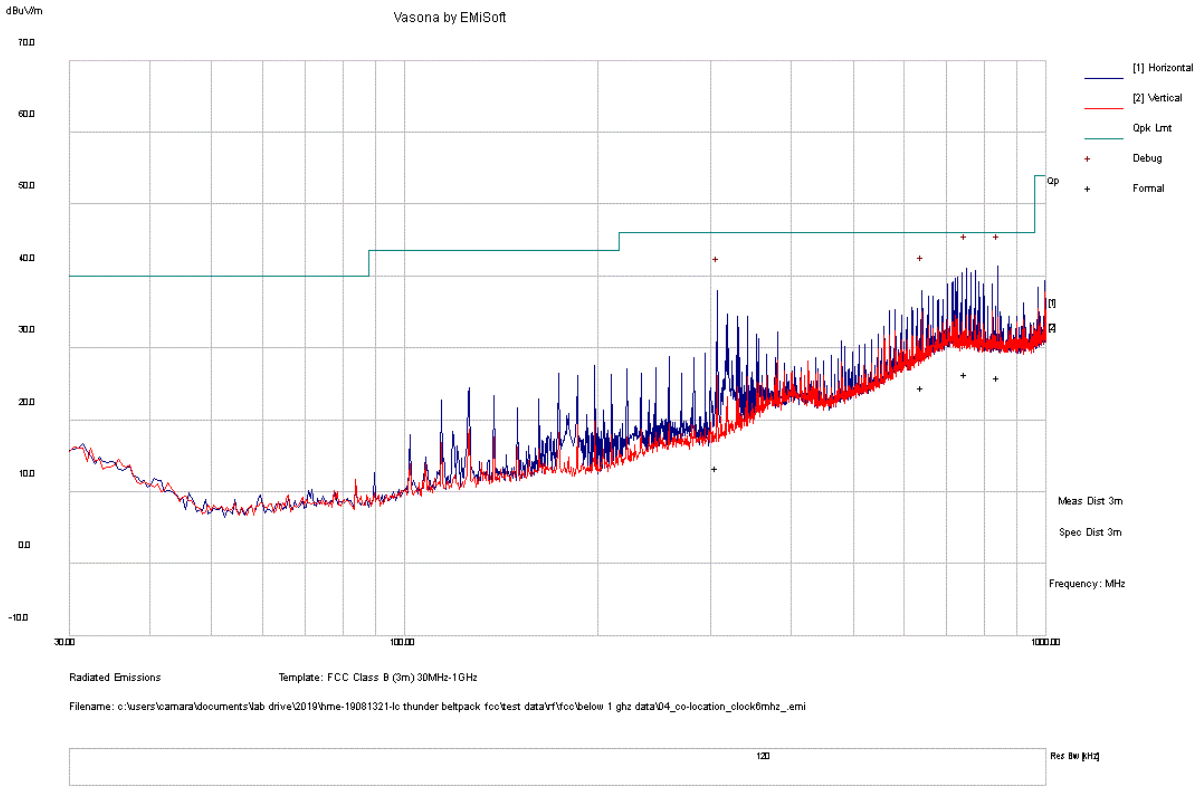
BLE 2441 MHz



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
839.99	40.60	7.40	-7.00	41.00	Quasi-Peak	H	100	212	46.00	-5.00	Pass
762.10	27.00	7.30	-6.60	27.70	Quasi-Peak	H	110	180	46.00	-18.30	Pass
307.21	49.90	5.70	-18.30	37.30	Quasi-Peak	H	109	35	46.00	-8.70	Pass
330.00	46.10	5.90	-17.10	34.90	Quasi-Peak	H	100	264	46.00	-11.10	Pass
125.74	30.00	3.90	-23.00	10.90	Quasi-Peak	H	269	274	43.50	-32.60	Pass

Test Standard:	15.209, 15.407	Mode:	BLE + 5GHz co-located
Frequency Range:	30 - 1000 MHz	Test Date:	12/09/2019 - 12/30/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	David Zhang
Remark:	N/A	Test Result:	Pass

BLE + 5GHz co-located

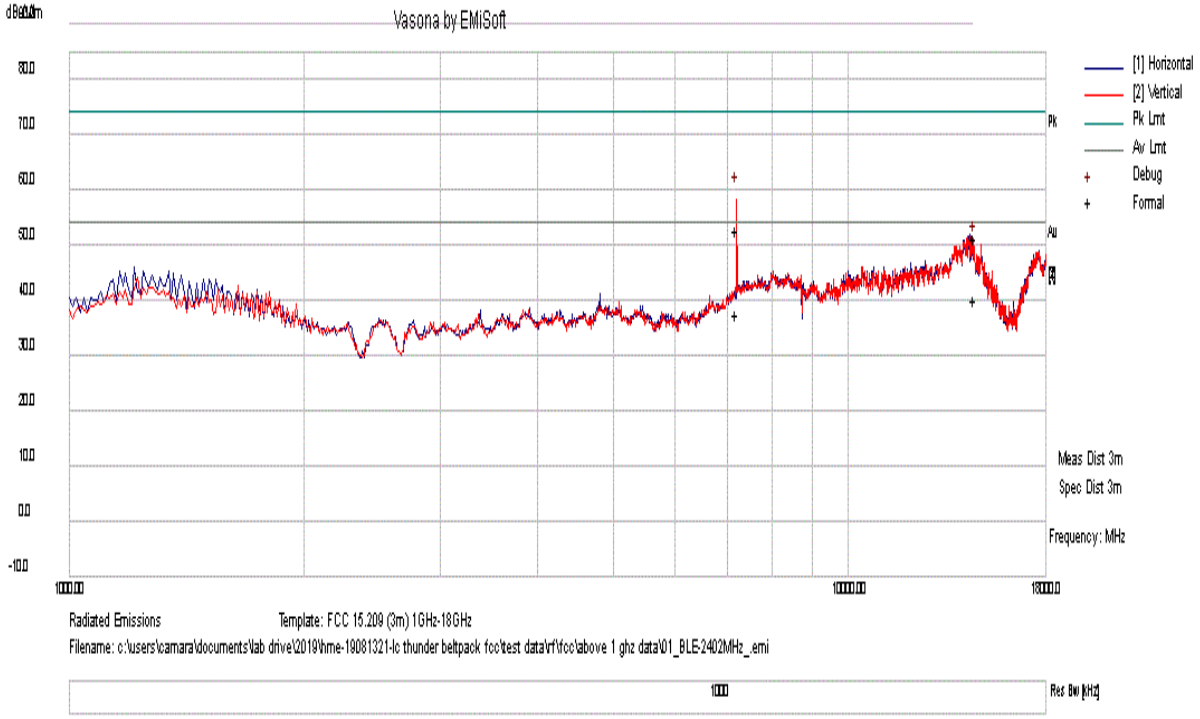


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
750.01	25.70	7.30	-6.60	26.40	QP	H	105	344	46.00	-19.60	Pass
839.89	25.60	7.40	-7.00	26.00	QP	H	169	238	46.00	-20.00	Pass
640.01	25.80	7.20	-8.50	24.60	QP	H	100	201	46.00	-21.40	Pass
306.89	25.90	5.70	-18.30	13.30	QP	H	364	326	46.00	-32.70	Pass

RADIATED EMISSIONS > 1 GHZ

Test Standard:	15.209, 15.247	Mode:	BLE 2402 MHz
Frequency Range:	1 - 18 GHz	Test Date:	12/09/2019 - 12/30/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	David Zhang
Remark:	N/A	Test Result:	Pass

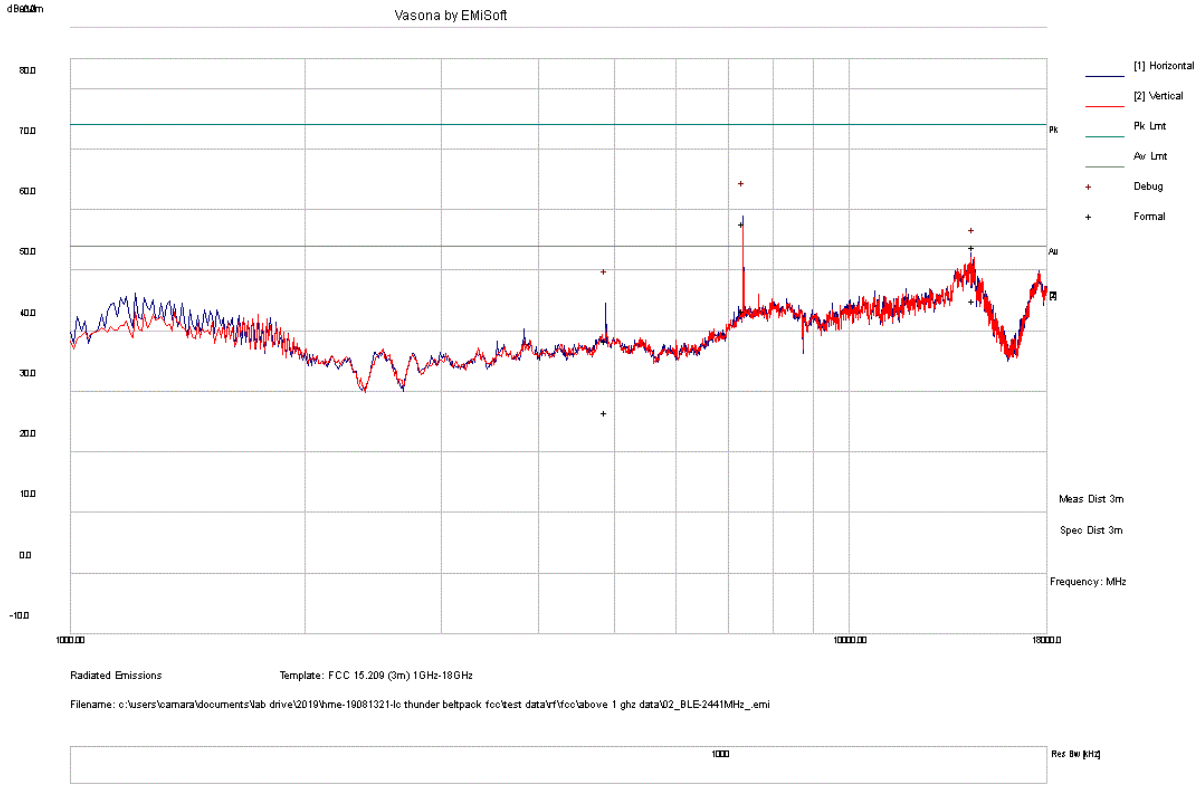
BLE 2402 MHz



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
7205.99	40.80	20.50	-8.30	52.90	Peak Max	V	223	31	74.00	-21.10	Pass
14552.95	23.40	27.20	0.90	51.50	Peak Max	V	324	31	74.00	-22.50	Pass
7205.99	25.70	20.50	-8.30	37.80	Average Max	V	223	31	54.00	-16.20	Pass
14552.95	12.20	27.20	0.90	40.30	Average Max	V	324	31	54.00	-13.70	Pass

Test Standard:	15.209, 15.247	Mode:	BLE 2441 MHz
Frequency Range:	1 - 18 GHz	Test Date:	12/09/2019 - 12/30/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	David Zhang
Remark:	N/A	Test Result:	Pass

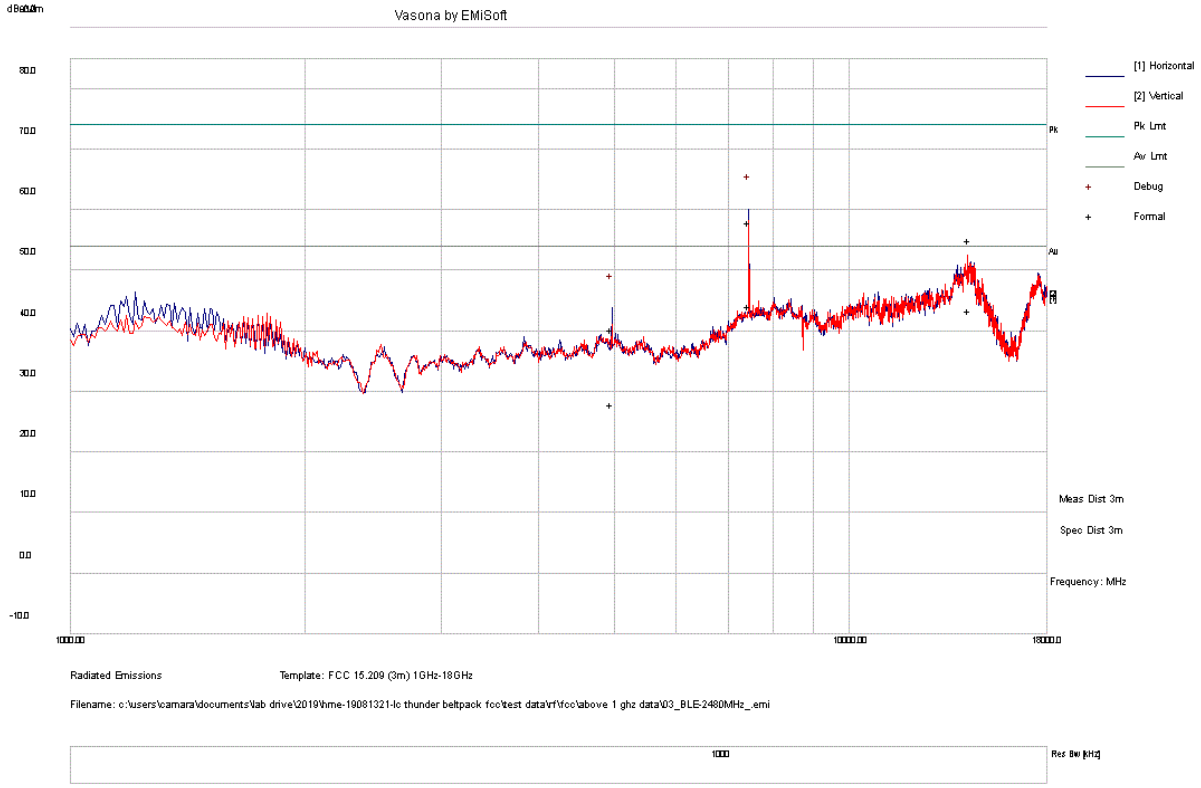
BLE 2441 MHz



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
7321.56	45.10	20.70	-7.90	57.80	Peak Max	V	100	214	74.00	-16.20	Pass
14490.02	25.40	27.00	1.50	53.90	Peak Max	V	268	328	74.00	-20.10	Pass
4876.13	34.40	17.40	-13.30	38.50	Peak Max	V	362	71	74.00	-35.50	Pass
7321.56	30.70	20.70	-7.90	43.40	Average Max	V	100	214	54.00	-10.60	Pass
14490.02	16.50	27.00	1.50	45.00	Average Max	V	268	328	54.00	-9.00	Pass
4876.13	22.50	17.40	-13.30	26.60	Average Max	V	362	71	54.00	-27.40	Pass

Test Standard:	15.209, 15.247	Mode:	BLE 2480 MHz
Frequency Range:	1 - 18 GHz	Test Date:	12/09/2019 - 12/30/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	David Zhang
Remark:	N/A	Test Result:	Pass

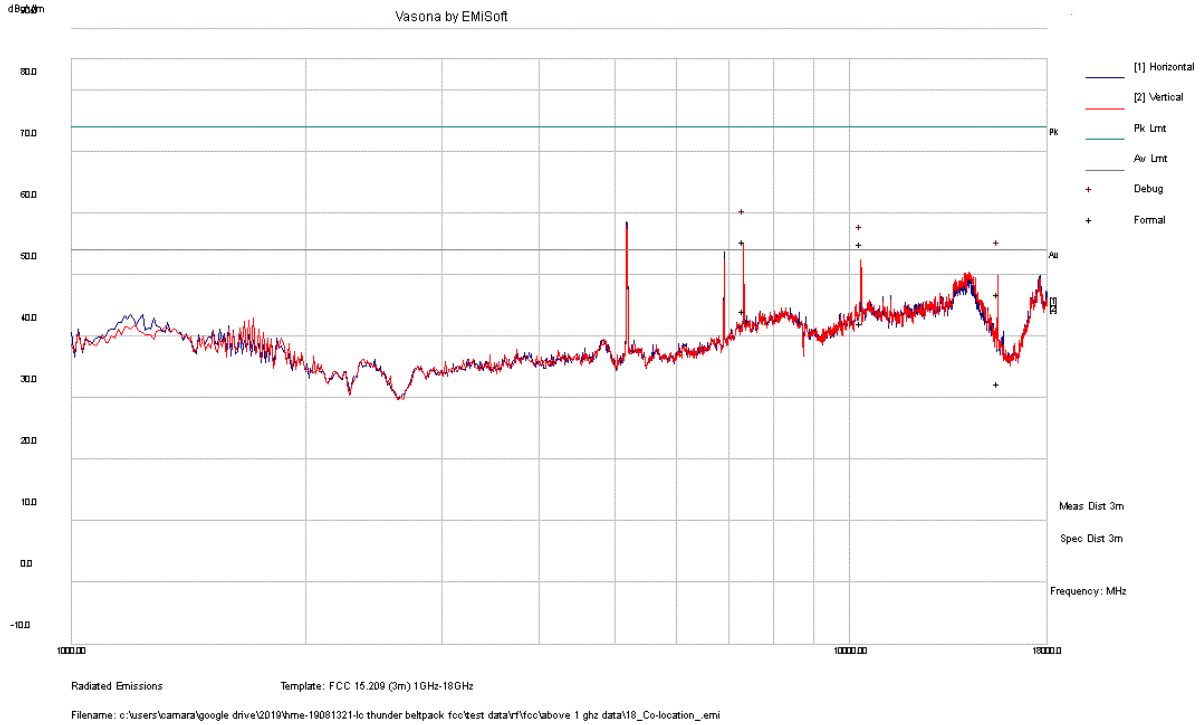
BLE 2480 MHz



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
7438.51	44.70	20.90	-7.60	58.00	Peak Max	V	167	95	74.00	-16.00	Pass
14263.93	26.30	26.30	2.30	55.00	Peak Max	V	141	177	74.00	-19.00	Pass
4961.48	36.00	17.40	-13.20	40.20	Peak Max	V	249	121	74.00	-33.80	Pass
7438.51	30.90	20.90	-7.60	44.20	Average Max	V	167	95	54.00	-9.80	Pass
14263.93	14.80	26.30	2.30	43.40	Average Max	V	141	177	54.00	-10.60	Pass
4961.48	23.80	17.40	-13.20	27.90	Average Max	V	249	121	54.00	-26.10	Pass

Test Standard:	15.209, 15.407	Mode:	BLE+5GHz co-located
Frequency Range:	1 - 18 GHz	Test Date:	12/09/2019 - 12/30/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	David Zhang
Remark:	N/A	Test Result:	Pass

BLE+5GHz co-located

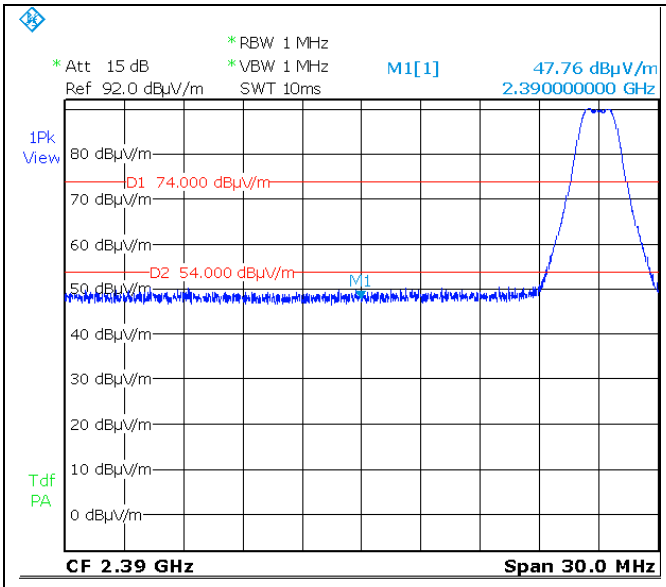


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
7320.06	42.60	20.70	-7.90	55.40	Peak Max	V	121	342	74.0	-18.60	Pass
10358.70	35.80	22.90	-3.60	55.10	Peak Max	V	113	96	74.0	-18.90	Pass
15546.43	23.10	28.10	-4.40	46.80	Peak Max	V	238	58	74.0	-27.20	Pass
7320.06	31.40	20.70	-7.90	44.20	Average Max	V	121	342	54.0	-9.80	Pass
10358.70	22.90	22.90	-3.60	42.20	Average Max	V	113	96	54.0	-11.80	Pass
15546.43	8.60	28.10	-4.40	32.30	Average Max	V	238	58	54.0	-21.70	Pass

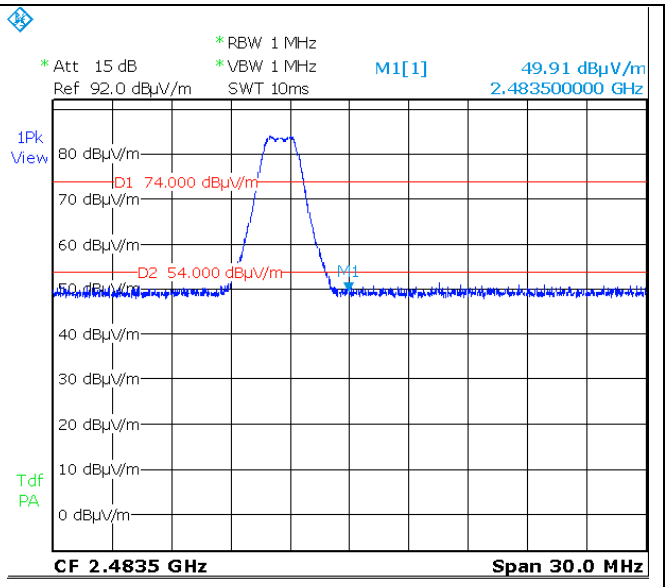
18GHz – 40GHz test result

Note: no substantial emission is found other than the noise floor. Different modes have been verified.

Restricted Band Measurement Result



BLE-2402MHz



BLE-2480MHz

8.7 Conducted Emissions

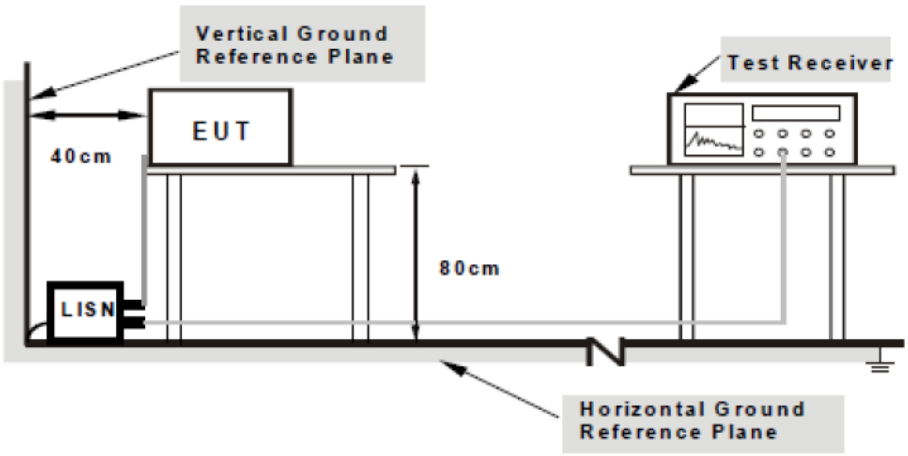
8.7.1 Requirement

Per § 15.207 (a), an intentional radiator 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, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limits for Conducted Emissions at the Mains Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 – 0.5	66 – 56	56 – 46
	0.5 – 5	56	46
	5 - 30	60	50
NOTE 1 The lower limit shall apply at the transition frequencies.			

8.7.2 Test setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

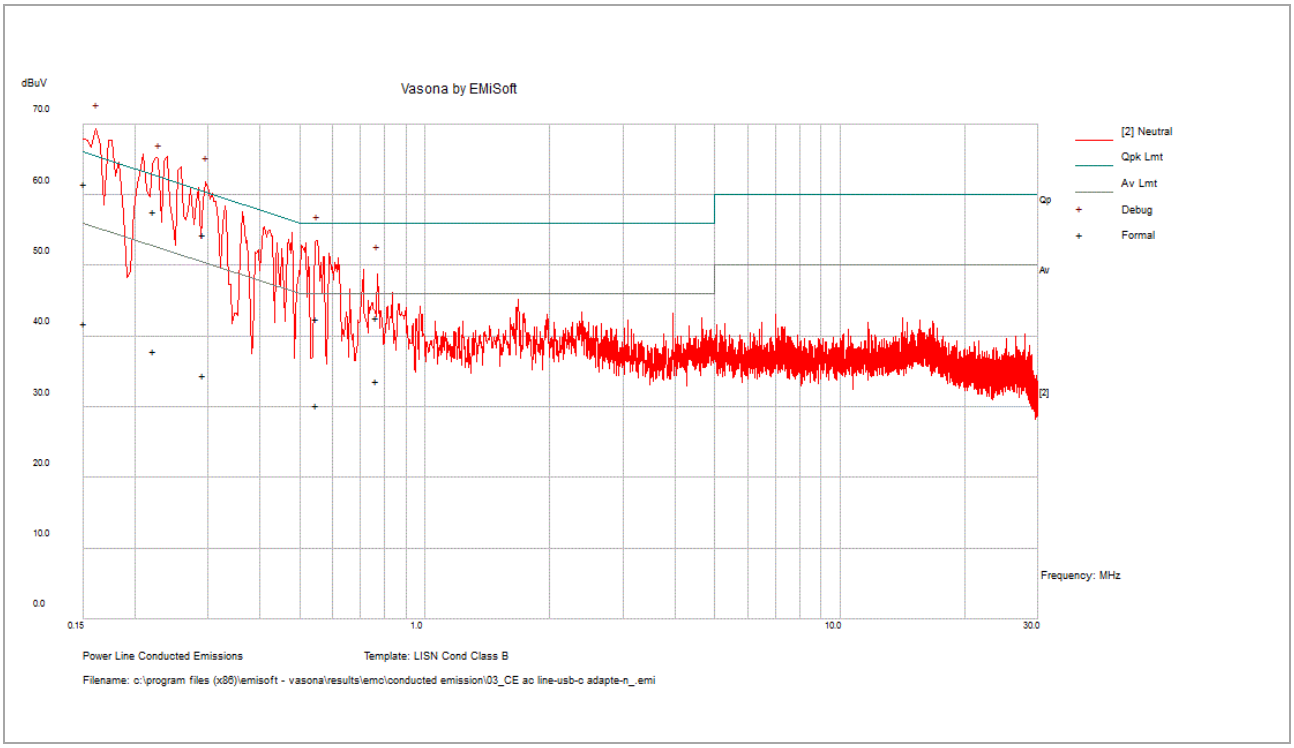
8.7.3 Test Procedure

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment was powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected.
8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made
9. All possible modes of operation were investigated. Only the worst case emissions were measured and reported. All other emissions were relatively insignificant.

8.7.4 Test Result

Neutral Line

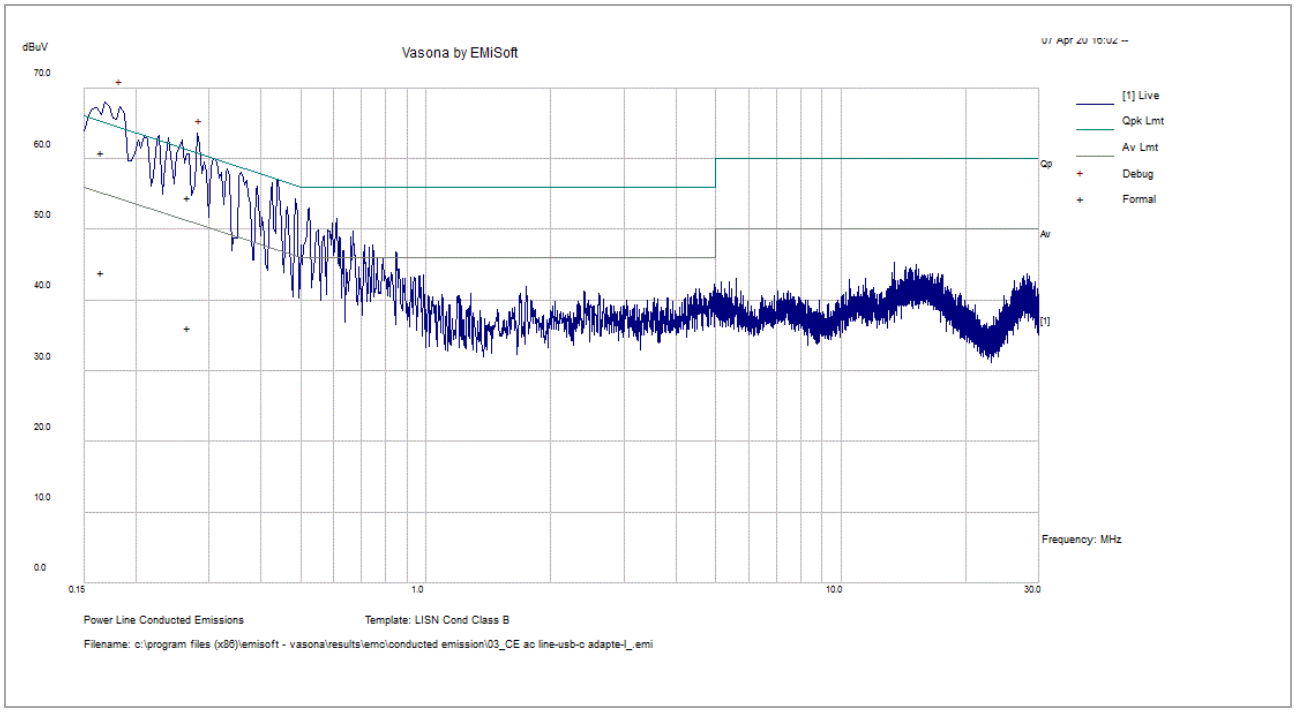
Test Standard:	**15.207**	**Mode:**	**Neutral, USB-C adapter**
Frequency Range:	**0.15-30MHz**	**Test Date:**	**11/20/2019**
Antenna Type/Polarity:	**N/A**	**Test Personnel:**	**David Zhang**
Remark:	**Class B, 120VAC 60Hz**	**Test Result:**	**Pass**



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Meas. Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	51.30	10.10	0.20	61.60	QP	Neutral	65.90	-4.30	Pass
0.29	44.20	10.10	0.10	54.40	QP	Neutral	60.40	-6.00	Pass
0.22	47.30	10.10	0.20	57.60	QP	Neutral	62.70	-5.10	Pass
0.55	32.20	10.10	0.10	42.40	QP	Neutral	56.00	-13.60	Pass
0.76	32.50	10.10	0.10	42.70	QP	Neutral	56.00	-13.30	Pass
0.15	31.60	10.10	0.20	41.90	AV	Neutral	55.90	-14.10	Pass
0.29	24.20	10.10	0.10	34.40	AV	Neutral	50.40	-16.00	Pass
0.22	27.60	10.10	0.20	37.90	AV	Neutral	52.70	-14.80	Pass
0.55	20.10	10.10	0.10	30.30	AV	Neutral	46.00	-15.70	Pass
0.76	23.40	10.10	0.10	33.60	AV	Neutral	46.00	-12.40	Pass

Live Line

Test Standard:	**15.207**	**Mode:**	**Line, USB-C adapter**
Frequency Range:	**0.15-30MHz**	**Test Date:**	**11/20/2019**
Antenna Type/Polarity:	**N/A**	**Test Personnel:**	**David Zhang**
Remark:	**Class B, 120VAC 60Hz**	**Test Result:**	**Pass**



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
0.17	50.60	10.10	0.20	60.90	QP	Live	65.20	-4.30	Pass
0.27	44.30	10.10	0.10	54.50	QP	Live	61.20	-6.70	Pass
0.17	33.60	10.10	0.20	43.90	AV	Live	55.20	-11.30	Pass
0.27	25.90	10.10	0.10	36.10	AV	Live	51.20	-15.10	Pass

9 Test instrument list

Equipment	Manufacturer	Model	Serial Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	5/11/2019	5/11/2020
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	5/4/2019	5/4/2020
EMC Test Receiver	R&S	ESL6	100230	5/7/2019	5/7/2020
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/2019	5/4/2020
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2019	11/15/2020
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/2/2019	5/2/2020
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	5/2/2019	5/2/2020
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	5/10/2019	5/10/2020
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/10/2019	5/10/2020
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/9/2019	5/9/2020
RF Attenuator	Pasternack	PE7005-3	VL061	5/10/2019	5/10/2020
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	5/10/2019	5/10/2020
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/9/2019	5/9/2020
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	5/10/2019	5/10/2020
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	5/10/2019	5/10/2020
RE test cable (>18GHz)	Sucoflex	104	344903/4	5/10/2019	5/10/2020
Pulse limiter	Com-Power	LIT-930A	531727	5/15/2019	5/15/2020
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	5/10/2019	5/10/2020
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	5/9/2019	5/9/2020
Wideband Communication	R&S	CMW500	147508	5/8/2019	5/8/2020