RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_IC_SL19040501-SEV-802 -BLE
Supersede Report No.: None

Applicant	:	Xirgo Technologies, LLC
Product Name	:	XT6264
Model No.	:	XT6264
Test Standard	:	47 CFR 15.247 RSS 247 Issue 2, February 2017
Test Method	:	ANSI C63.10: 2013 RSS Gen Issue 5, April 2018 558074 D01 15.247 Meas Guidance v05r01
FCC ID	:	GKM-XT6264
IC ID	:	10281A-XT6264
Dates of test	:	06/13/2019-06/20/2019
Issue Date	:	06/20/2019
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
Gary Chou	
Gary Chou	**Chen Ge**
Test Engineer	**Engineer Reviewer**

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA
ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & RED
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_IC_SL19040501-SEV-802-BLE	None	Original	06/20/2019

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Xirgo Technologies, LLC
Product: XT6264
Model: XT6264

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	Xirgo Technologies, LLC
Applicant Address	188 Camino Ruiz, Camarillo CA 93012
Manufacturer Name	Xirgo Technologies, LLC
Manufacturer Address	188 Camino Ruiz, Camarillo CA 93012

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	540430
IC Test Site No.	4842D
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	XT6264
Model No.	XT6264
Trade Name	Xirgo
Serial No.	MD191700019
Host Model No.	N/A
Input Power	24 Vac, 60Hz
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	06/08/2019
Equipment Class/ Category	DTS
Port/Connectors	N/A

6.2 Spec for BT Radio

Radio Type	Bluetooth
Operating Frequency	2402MHz-2480MHz
Modulation	GFSK
Channel Spacing	2 MHz
Antenna Type	CHIP
Antenna Gain	1.5 dBi
Antenna Connector Type	N/A

Type	Channel No.	Frequency (MHz)	Power Setting
Bluetooth(BLE) 2402-2480MHz	0	2402	-15
	19	2440	-15
	39	2480	-15

6.3 EUT test modes/configuration Description

Mode	Note
Bluetooth	BLE (GFSK)

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	PP01L Latitude E5440	F1WPF12	Dell	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
USB-RS232	LAPTOP	USB	EUT	RS232	1	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	PUTTY	Set the EUT to transmit continuously in diferent test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Antenna Requirement	FCC	15.203	ANSI C63.10 - 2013 558074 D01 15.247 Meas. Guidance v05	☒ Pass ☐ N/A
	IC	-		
AC Conducted Emissions Voltage	FCC	15.207	ANSI C63.10:2013 RSS Gen Issue 5: 2018	☒ Pass ☐ N/A
	IC	RSS Gen		

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Occupied Bandwidth	-	-	-	-	☒ Pass ☐ N/A
	IC	RSS Gen 6.6	IC	RSS Gen Issue 5: 2018	
6dB Bandwidth	FCC	15.247(a)(2)	FCC	ANSI C63.10:2013 558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.2.1)	IC		
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.5)	IC		
Output Power	FCC	15.247(b)	FCC	ANSI C63.10:2013 558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.4.4)	IC		
Receiver Spurious Emissions	IC	RSS Gen (4.8)	IC	RSS Gen Issue 5: 2018	☐ Pass ☒ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
	IC	-	IC	-	
Power Spectral Density	FCC	15.247(e)	FCC	ANSI C63.10:2013 558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.2.2)	IC		
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
	IC	RSS Gen(5.5)	IC	RSS Gen Issue 5: 2018	
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.				

9 Measurement Uncertainty

Emissions			
Test Item	**Frequency Range**	**Description**	**Uncertainty**
AC Conducted Emissions	150KHz – 30MHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±3.5dB
RF conducted measurement	150KHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±0.95dB
Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	±6dB
Radiated Spurious Emissions	1GHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	±6dB

10 Measurements, Examination and Derived Results

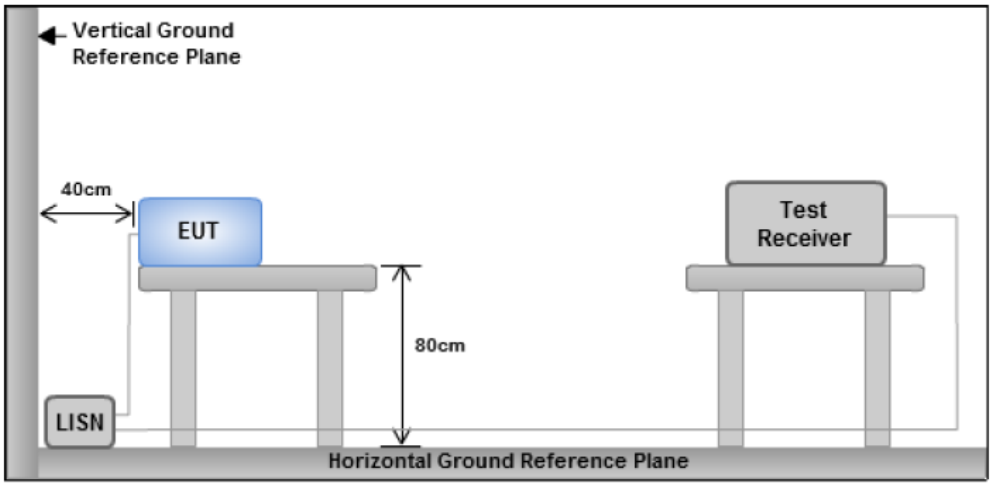
10.1 Antenna Requirement

Spec	Requirement	Applicable
§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. Antenna requirement must meet at least one of the following: a) Antenna must be permanently attached to the device. b) The antenna must use a unique type of connector to attach to the device. c) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.	☒
Remark	Antenna is permanently attached.	
Result	☒ PASS ☐ FAIL	

10.2 Conducted Emissions

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

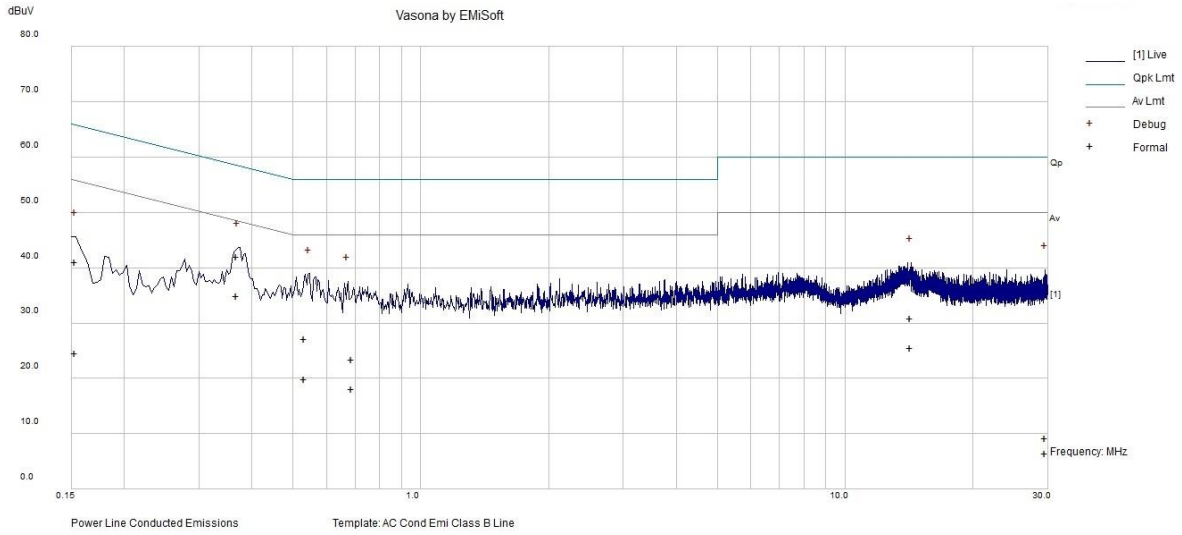
Spec	Item	Requirement	Applicable
RSS247(A8.1)	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☒
Test Setup	 Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes		
Procedure	- 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, as shown in Annex B. - The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply.		
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒Yes (See below) ☐ N/A

Conducted Emission Test Results

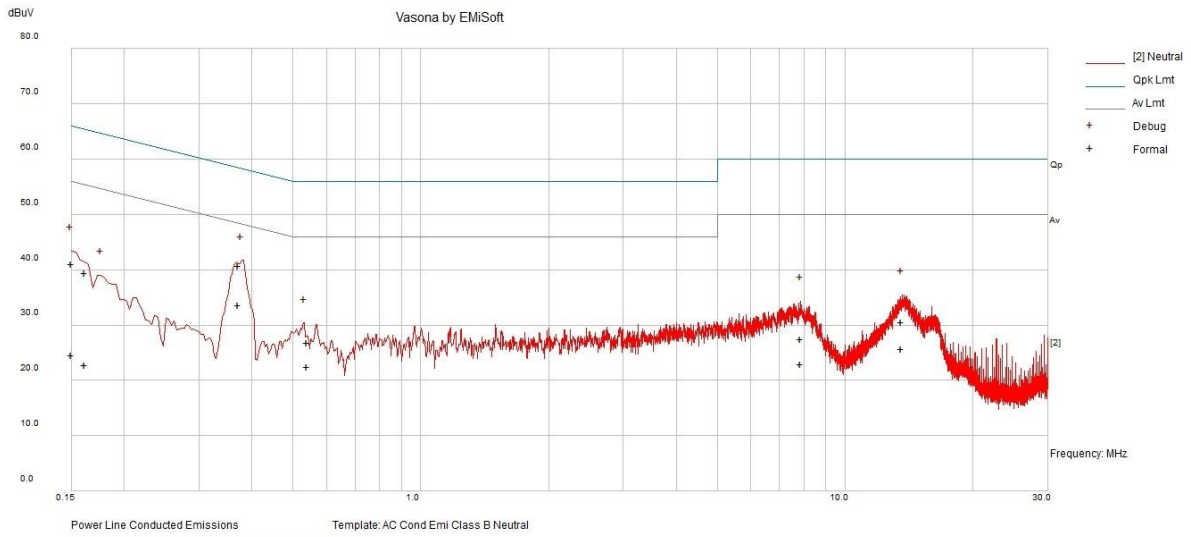
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	24Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	06/13/2019			
Remarks	Line			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.37	34.65	7.29	0.04	41.98	Quasi Peak	Line	58.53	-16.55	Pass
0.53	19.79	7.38	0.04	27.21	Quasi Peak	Line	56	-28.79	Pass
0.69	15.92	7.51	0.04	23.47	Quasi Peak	Line	56	-32.53	Pass
14.30	21.66	8.86	0.34	30.86	Quasi Peak	Line	60	-29.14	Pass
0.15	33.93	7.12	0.05	41.1	Quasi Peak	Line	65.83	-24.74	Pass
29.65	-0.45	9.05	0.61	9.21	Quasi Peak	Line	60	-50.79	Pass
0.37	27.53	7.29	0.04	34.86	Average	Line	48.53	-13.67	Pass
0.53	12.51	7.38	0.04	19.93	Average	Line	46	-26.07	Pass
0.69	10.61	7.51	0.04	18.15	Average	Line	46	-27.85	Pass
14.30	16.4	8.86	0.34	25.6	Average	Line	50	-24.4	Pass
0.15	17.39	7.12	0.05	24.56	Average	Line	55.83	-31.28	Pass
29.65	-3.28	9.05	0.61	6.38	Average	Line	50	-43.62	Pass

Conducted Emission Test Results

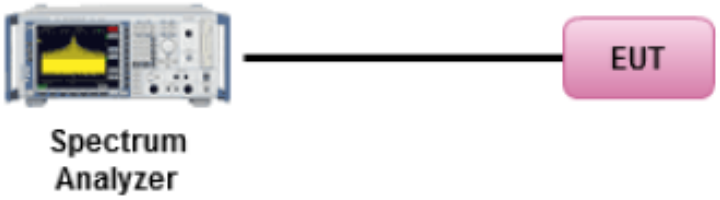
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	24Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	06/13/2019			
Remarks	Neutral			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.37	33.46	7.29	0.03	40.78	Quasi Peak	Neutral	58.47	-17.69	Pass
0.15	33.9	7.11	0.04	41.05	Quasi Peak	Neutral	65.98	-24.93	Pass
13.62	21.44	8.83	0.33	30.6	Quasi Peak	Neutral	60	-29.4	Pass
0.54	19.37	7.39	0.03	26.79	Quasi Peak	Neutral	56	-29.21	Pass
0.16	32.32	7.13	0.04	39.49	Quasi Peak	Neutral	65.35	-25.87	Pass
7.88	19.1	8.27	0.17	27.55	Quasi Peak	Neutral	60	-32.45	Pass
0.37	26.39	7.29	0.03	33.71	Average	Neutral	48.47	-14.76	Pass
0.15	17.34	7.11	0.04	24.49	Average	Neutral	55.98	-31.48	Pass
13.62	16.51	8.83	0.33	25.67	Average	Neutral	50	-24.33	Pass
0.54	15.13	7.39	0.03	22.54	Average	Neutral	46	-23.46	Pass
0.16	15.68	7.13	0.04	22.85	Average	Neutral	55.35	-32.5	Pass
7.88	14.48	8.27	0.17	22.92	Average	Neutral	50	-27.08	Pass

10.3 6dB & 99% Bandwidth

Requirement(s):

Spec	Requirement	Applicable
§ 15.247 RSS247 (5.2.1)	6dB BW≥500KHz;	☒
RSS Gen 4.6.1	The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual. The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth	☒
Test Setup		
Test Procedure	558074 D01 DTS Meas Guidance v05r01, 8.2 DTS bandwidth ANSI C63.10, 11.8 6dB Emission bandwidth measurement procedure - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ⩾ 3 x RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. - Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.	
Test Date	06/15/2019	Environmental condition: Temperature 23°C; Relative Humidity 42%; Atmospheric Pressure 1021mbar
Remark	N/A	
Result	☒ Pass ☐ Fail	

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

Test was done by Gary Chou at RF test site.

6dB Bandwidth measurement result

Type	Test mode	Freq (MHz)	CH	Result (kHz)	Limit (kHz)	Result
6dB BW	BT-LE	2402	Low	712.2	≥500	Pass
6dB BW	BT-LE	2440	Mid	741.4	≥500	Pass
6dB BW	BT-LE	2480	High	705.1	≥500	Pass

99% OBW measurement result for 2.4GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)
99% OBW	BT-LE	2402	Low	1.0873
99% OBW	BT-LE	2440	Mid	1.0895
99% OBW	BT-LE	2480	High	1.0752

6dB & 99% Bandwidth Test Plots

6dB BW –Bluetooth LE 2402MHz

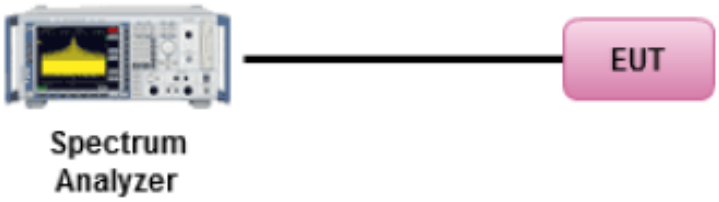
6dB BW –Bluetooth LE 2440MHz

6dB BW –Bluetooth LE 2480MHz

10.4 Output Power (Bluetooth LE)

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.4.4)	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤1 Watt	☒

Test Setup	
Test Procedure	558074 D01 DTS Meas Guidance v05r01, 8.3.2.2 ANSI C63.10, 11.9.1.1 Measurement using a Spectrum Analyzer (SA) (a) Set span to at least 1.5 times the OBW (b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz. (c) Set VBW ≥ 3 x RBW. (d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) (e) Sweep time = auto. (f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode. (g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”. (h) Trace average at least 100 traces in power averaging (i.e., RMS) mode (i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Test Date	06/15/2019	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23ºC 44% 1021mbar
Remark	-			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

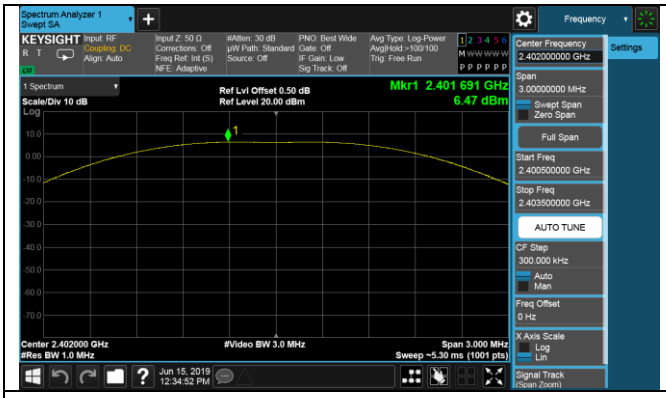
Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Gary Chou at RF test site.

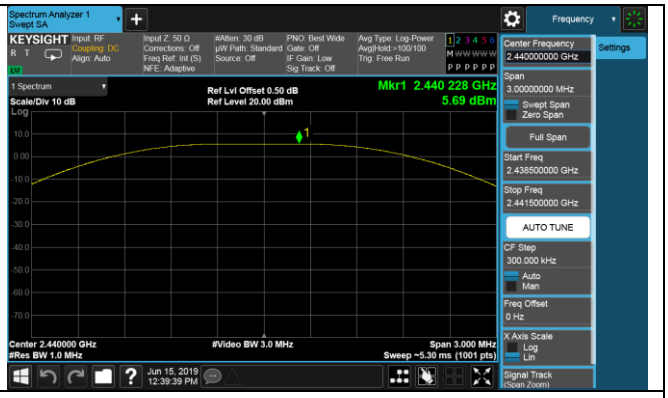
Output Power measurement result

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	Bluetooth LE	2402	Low	6.47	30	Pass
Output power	Bluetooth LE	2440	Mid	5.69	30	Pass
Output power	Bluetooth LE	2480	High	5.07	30	Pass

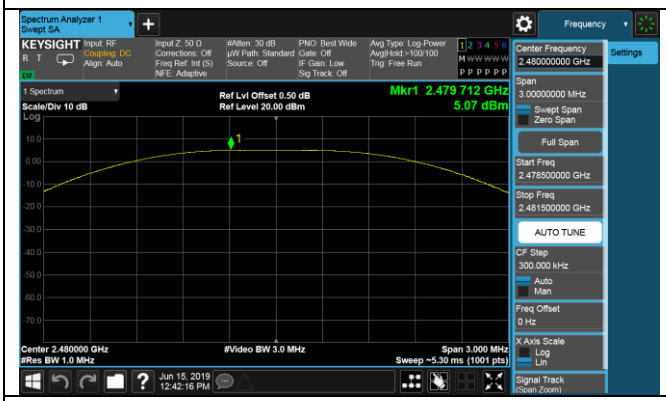
Test Plots



Output Power –Bluetooth LE 2402MHz



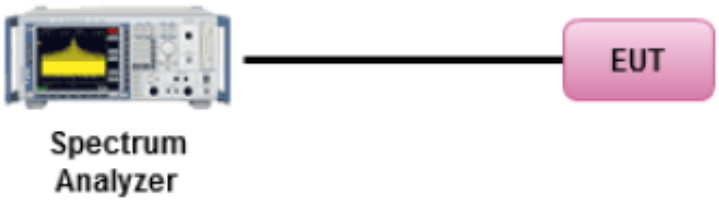
Output Power –Bluetooth LE 2440MHz



Output Power –Bluetooth LE 2480MHz

10.5 Band Edge

Requirement(s):

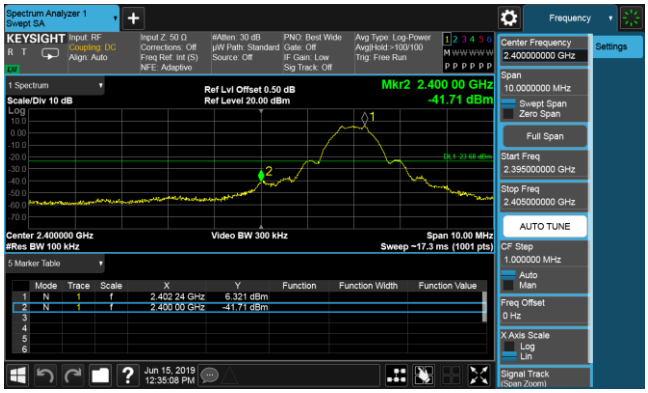
Spec	Item	Requirement	Applicable
§ 15.247 RSS247(5.5)	d)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209 (a) is not required ☐ 20 dB down ☒ 30 dB down	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v05r01 ANSI C63.10 Band Edge measurement procedure 1. Set the EUT to maximum power setting and enable the EUT transmit continuously. 2. Band edge emissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attunation shall be be 30 dB instead of 20 dB when Peak conducted output power procedure is used. 3. Change modulation and channel bandwidth then repeat step 1 to 2. 4. Measured and record the results in the test report.		
Test Date	06/15/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	-		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

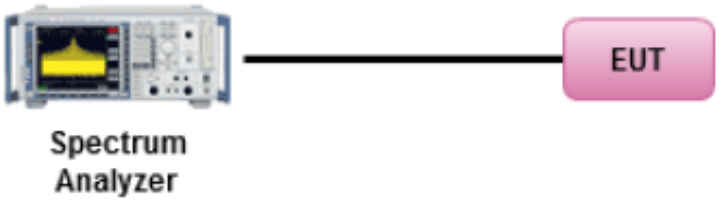
Test was done by Gary Chou at RF test site.

Band Edge Test Plots (Bluetooth LE)

	
Band Edge-LE Low	**Band Edge-LE High**

10.6 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e) RSS247 (5.2.2)	e)	DSSS: ≤8dBm/3KHz	☒
	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04, 10.2 Method PKPSD (peak PSD) Peak spectral density measurement procedure - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. - Set the VBW ≥ 3 x RBW. - Detector = Peak - Sweep time = auto couple. - Trace mode = Max Hold - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	06/15/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	-		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

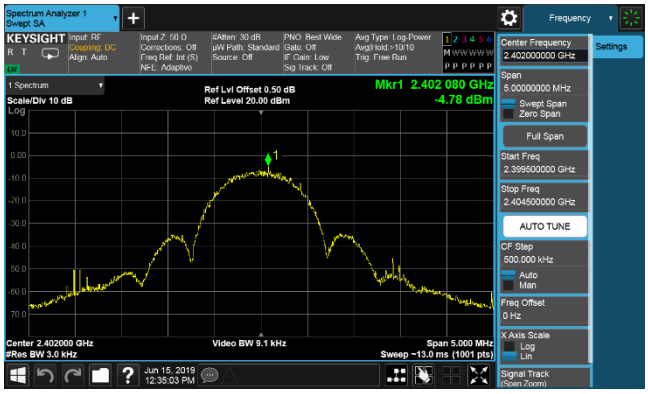
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at RF test site.

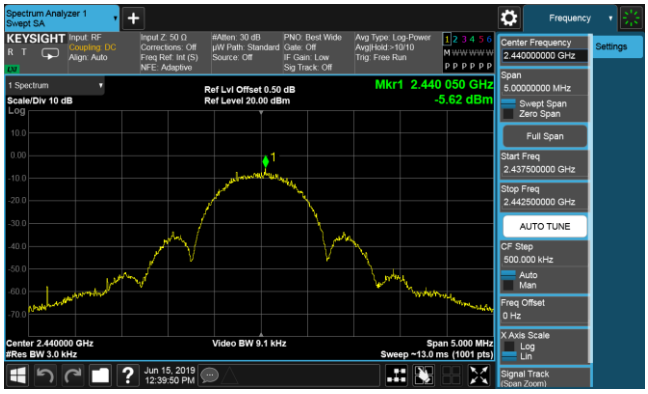
PSD measurement result (Bluetooth LE)

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	Bluetooth LE	2402	Low	-4.78	≤8	Pass
PSD	Bluetooth LE	2440	Mid	-5.62	≤8	Pass
PSD	Bluetooth LE	2480	High	-6.50	≤8	Pass

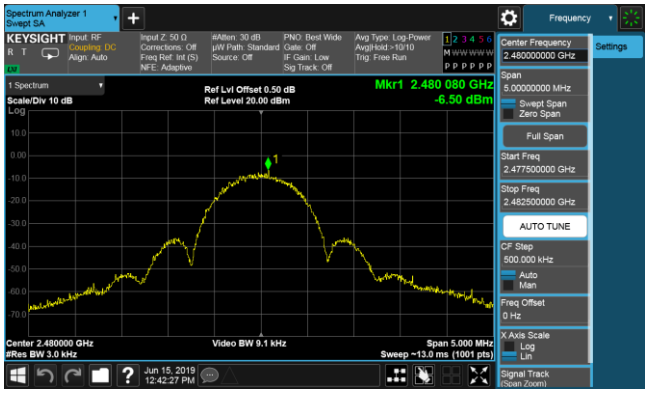
Test Plots (Bluetooth LE)



PSD -Bluetooth LE Low



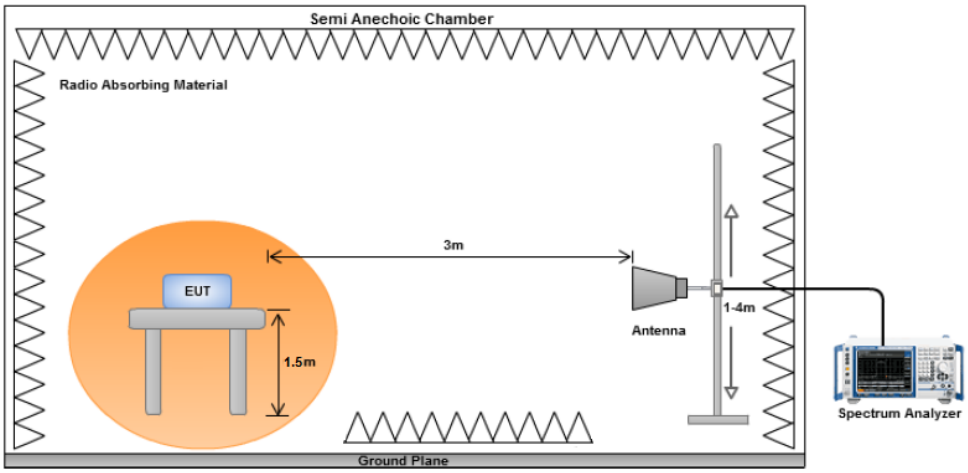
PSD -Bluetooth LE Mid



PSD -Bluetooth LE High

10.7 Radiated Spurious Emissions in restricted band

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(A8.5)	a)	For non-restricted band, 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 or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure	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 characterisation. 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 polarisation (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. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes (See below) ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

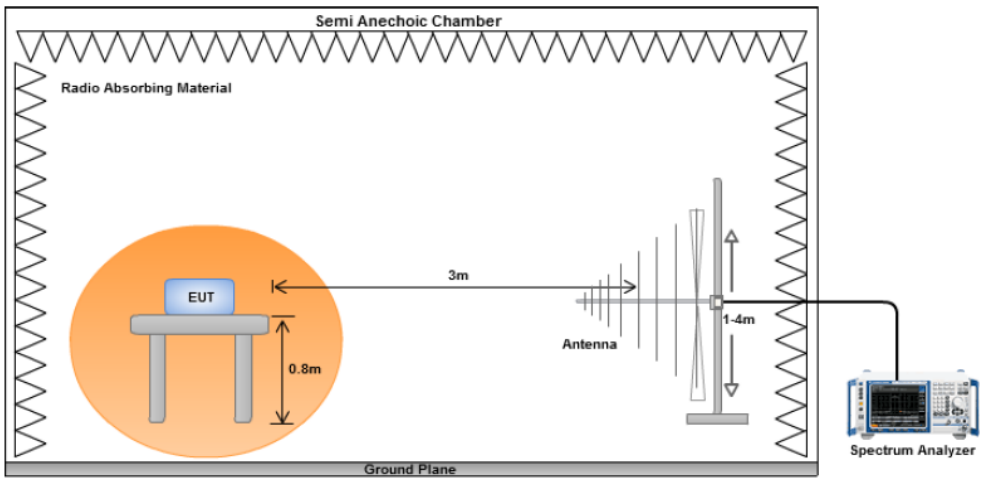
Restricted Band Measurement Plots:

Restricted Band 2402MHz

Restricted Band 2480MHz

10.8 Radiated Spurious Emissions below 1GHz

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§15.247(d)
RSS247 (5.5)</td><td>a)</td><td>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges
<table>
<tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr>
<tr><td>30 – 88</td><td>100</td></tr>
<tr><td>88 – 216</td><td>150</td></tr>
<tr><td>216 960</td><td>200</td></tr>
<tr><td>Above 960</td><td>500</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="3"> 
</td></tr>
<tr><td>Procedure</td><td colspan="3">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 characterisation. 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 polarisation (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. A Quasi-peak measurement was then made for that frequency point.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</td></tr>
<tr><td>Remark</td><td colspan="3">The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.</td></tr>
<tr><td>Result</td><td colspan="3">☒ Pass ☐ Fail</td></tr>
</table>

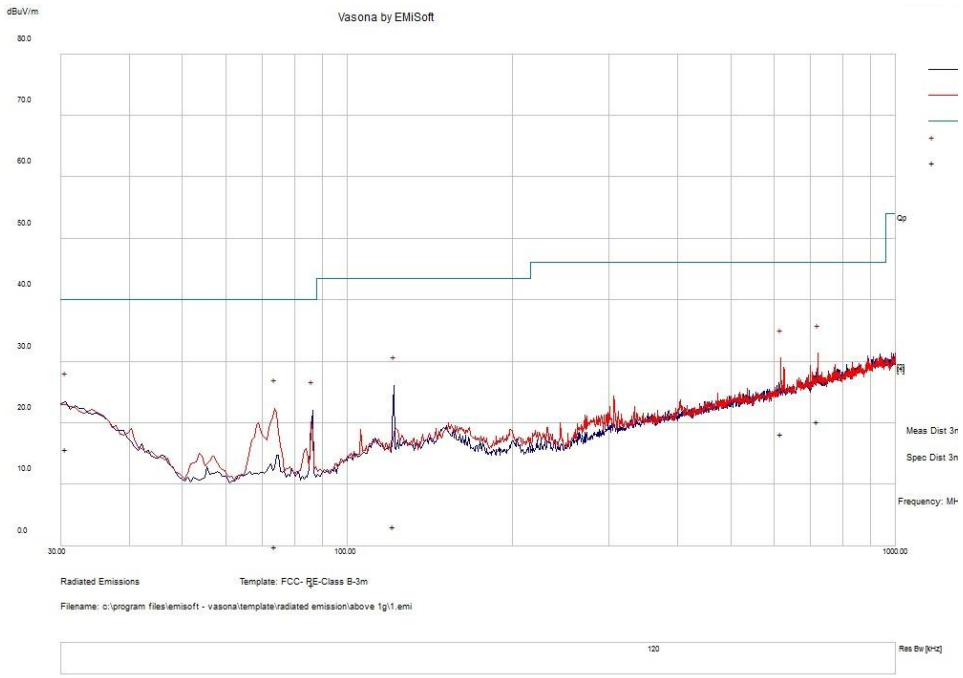
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26.1	Result	Pass
	Humidity (%)	47.5		
	Atmospheric (mbar):	1020		
Mains Power:	24Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	05/13/2019			
Remarks:	Bluetooth LE TX 2440MHz			



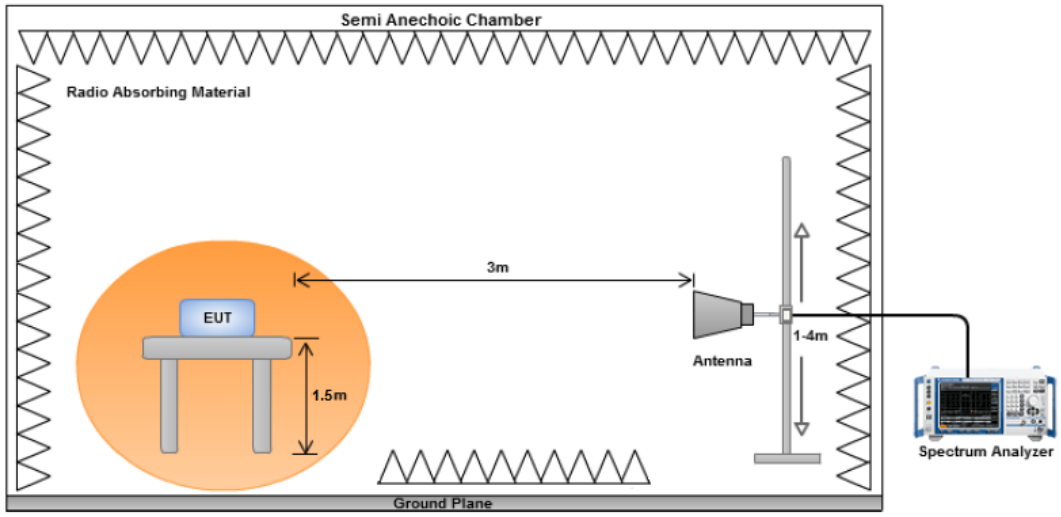
Quasi Max Measurement

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
720.972438	20.16	15.19	-15.09	20.26	Quasi Max	H	102	105	46	-25.74	Pass
616.83025	20.29	14.57	-16.58	18.28	Quasi Max	H	183	205	46	-27.72	Pass
30.627813	17.32	11.13	-12.69	15.76	Quasi Max	H	203	303	40	-24.24	Pass
121.358438	13.71	12.08	-22.6	3.19	Quasi Max	H	344	15	43.5	-40.31	Pass
73.7075	15.75	11.61	-27.42	-0.06	Quasi Max	V	163	36	40	-40.06	Pass
86.250625	9.7	11.75	-27.7	-6.26	Quasi Max	H	226	9	40	-46.26	Pass

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

10.9 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS210(A8.5)	a)	For non-restricted band, 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 or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure	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 characterisation. 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 polarisation (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. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	The EUT was scanned up to 26GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

BLE – 2402MHz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Measurement Type	Pol (V/H)	Hgt (cm)	Azt (Deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail
7207.5175	40.9	5.15	-0.45	45.59	Peak Max	H	127	236	74	-28.41	Pass
9604.7525	39.88	5.6	0.5	45.98	Peak Max	H	105	296	74	-28.02	Pass
4802.74	41.22	4.1	-0.93	44.4	Peak Max	V	122	214	74	-29.6	Pass
7207.5175	27	5.15	-0.45	31.69	Average Max	H	127	236	54	-22.31	Pass
9604.7525	26.18	5.6	0.5	32.28	Average Max	V	153	49	54	-21.72	Pass
4802.74	27.7	4.1	-0.93	30.87	Average Max	V	122	214	54	-23.13	Pass

BLE – 2440MHz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Measurement Type	Pol (V/H)	Hgt (cm)	Azt (Deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail
7319.2325	40.4	5.15	-0.49	45.06	Peak Max	V	145	221	74	-28.94	Pass
9761.9475	40.06	5.5	0.81	46.37	Peak Max	V	138	20	74	-27.63	Pass
4878.28	41.61	4.17	-0.99	44.79	Peak Max	V	100	241	74	-29.21	Pass
7319.2325	26.65	5.15	-0.49	31.31	Average Max	H	123	251	54	-22.69	Pass
9761.9475	26.21	5.5	0.81	32.52	Average Max	V	138	20	54	-21.48	Pass
4878.28	28.02	4.17	-0.99	31.2	Average Max	V	100	241	54	-22.8	Pass

BLE – 2480MHz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Measurement Type	Pol (V/H)	Hgt (cm)	Azt (Deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail
7438.9425	41.22	5.14	-0.53	45.83	Peak Max	V	125	255	74	-28.17	Pass
9921.3275	39.59	5.79	1.18	46.57	Peak Max	H	111	243	74	-27.43	Pass
4958.4725	40.37	4.25	-1.06	43.56	Peak Max	H	189	227	74	-30.44	Pass
7438.9425	26.68	5.14	-0.53	31.29	Average Max	V	125	255	54	-22.71	Pass
9921.3275	26.03	5.79	1.18	33.01	Average Max	V	123	256	54	-21	Pass
4958.4725	26.78	4.25	-1.06	29.96	Average Max	V	127	12	54	-24.04	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
50GHz Spectrum Analyzer	N9030B (PXA)	MY57140374	7/22/2018	1 Year	7/22/2019	☑
Hybrid Antenna (30MHz - 6GHz)	JB6	A111717	3/9/2019	1 Year	3/9/2020	☑
Pre-Amplifier (1GHz - 26.5GHz)	8449B	3008A00715	5/16/2019	1 Year	5/16/2020	☑
Horn Antenna	3115	10SL0059	01/26/2017	2 Year	01/26/2020	☑
RF Pre-Amplifier (9kHz - 6.5GHz)	LPA-6-30	11170601	7/23/2018	1 Year	7/23/2019	☑
RF Conducted Emission Measurement						
EMI Test Receiver	ESIB 40	100179	08/27/2018	1 Year	08/28/2019	☐
Transient Limiter (9 kHz - 100 MHz)	EM-7600-5	106	12/30/2018	1 Year	12/31/2019	☐
LISN	3816/2NM	214372	01/09/2019	1 Year	01/10/2020	☐
RF Conducted Measurement						
Agilent Spectrum Analyzer	N9010A	10SL0219	1/18/2018	1 Year	1/08/2020	☑

Test Software Version

Test Item	Vendor	Software	Version
Radiated Emission	EMISoft	EMISoft Vasona	V5.0
Conducted Emission	EMISoft	EMISoft Vasona	V5.0

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2