

RF TEST REPORT



Report No.: FCC_IC_RF_SL18091002-RUC-050_BLE Rev_2.0

Supersede Report No.: FCC_IC_RF_SL18091002-RUC-050_BLE Rev_1.0

Applicant	:	Ruckus Wireless, Inc.
Product Name	:	R750 Access Point
Model No.	:	R750
Test Standard	:	47 CFR 15.247 RSS 247 Issue 2, February 2017
Test Method	:	ANSI C63.10: 2013 RSS Gen Issue 5, March 2019 558074 D01 15.247 Meas Guidance v05r01
FCC ID	:	S9GR750
IC	:	5912A-R750
Dates of test	:	02/20/2019-04/08/2019
Issue Date	:	05/31/2019
Test Result	:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Equipment complied with the specification	[X]	
Equipment did not comply with the specification	[]	

This Test Report is Issued Under the Authority of:

Deon Dai	Chen Ge
Test Engineer	Engineer Reviewer

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



775 Montague Expressway, Milpitas, CA 95035, USA • Phone: (+1) 408 526 1188 • Facsimile: (+1) 408 526 1088



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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 & R&TTE Directive
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_RF_SL18091002-RUC-050_BLE	None	Original	04/09/2019
FCC_IC_RF_SL18091002-RUC-050_BLE Rev_1.0	Rev_1.0	Update Antenna Gain	05/24/2019
FCC_IC_RF_SL18091002-RUC-050_BLE Rev_2.0	Rev_2.0	Update Per Review	05/31/2019

2 Executive Summary

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

Company:	Ruckus Wireless, Inc.
Product:	R750 Access Point
Model:	R750

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	:	Ruckus Wireless, Inc.
Applicant Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A
Manufacturer Name	:	Ruckus Wireless, Inc.
Manufacturer Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A

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	R750 Access Point
Model No.	R750
Trade Name	Ruckus
Serial No.	431806000043
Host Model No.	N/A
Input Power	Power Adapter: 48VDC 0.75A, or 48VDC (PoE)
Power Adapter Manu/Model	Ruckus / 740-64277-001
Power Adapter SN	N/A
Date of EUT received	02/18/2019
Equipment Class/ Category	DTS, UNII
Port/Connectors	Power Port, Ethernet*2, USB

6.2 Radio Description

Spec for BLE:

Radio Type	BLE
Operating Frequency	2402MHz-2480MHz
Modulation	GFSK
Channel Spacing	2 MHz
Antenna Type	PIFA Antenna
Antenna Gain	2.0 dBi
Antenna Connector Type	U.FL Connector

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	-
2	POE Adapter	740-64211-001	133279963	Ruckus	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
RJ45	EUT	RJ45	POE	RJ45	2	Unshielded	-
RJ45	POE	RJ45	Laptop	RJ45	2	Unshielded	-

7.3 Test Software Description

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

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen 8.10	IC		<input type="checkbox"/> N/A
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013 RSS Gen Issue 5: 2019	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen 8.8	IC		<input type="checkbox"/> N/A

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Occupied Bandwidth	-	-	-	-	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen 6.7	IC	RSS Gen Issue 5: 2019	<input type="checkbox"/> N/A
6dB Bandwidth	FCC	15.247(a)(2)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.2.a)	IC		<input type="checkbox"/> N/A
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.5)	IC		<input type="checkbox"/> N/A
Output Power	FCC	15.247(b)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.4.d)	IC		<input type="checkbox"/> N/A
Receiver Radiated Emissions	IC	RSS Gen (7.3)	IC	RSS Gen Issue 5: 2019	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	<input type="checkbox"/> Pass
	IC	-	IC	-	<input checked="" type="checkbox"/> N/A
Power Spectral Density	FCC	15.247(e)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.2.b)	IC		<input type="checkbox"/> N/A
RF Exposure requirement	FCC	15.247(i)	FCC	-	<input type="checkbox"/> Pass
	IC	RSS Gen(3.4)	IC	RSS Gen Issue 5: 2019	<input checked="" type="checkbox"/> N/A
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

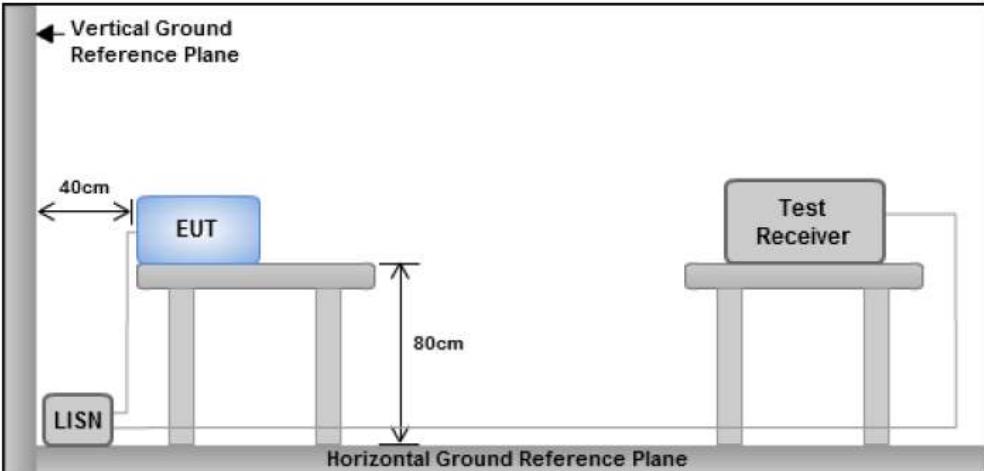
Emissions			
Test Item	Frequency Range	Description	Uncertainty
AC Conducted Emissions	150KHz – 30MHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±3.5dB
RF conducted measurement	150KHz – 40GHz	Confidence level of approximately 95% (in 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 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
FCC 15.207 RSS-GEN Section 8.8	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 μ H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	<input checked="" type="checkbox"/>
Test Setup		 <p>Note:</p> <ol style="list-style-type: none"> 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		<ul style="list-style-type: none"> - 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		EUT was tested at 120VAC, 60Hz	
Result		<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

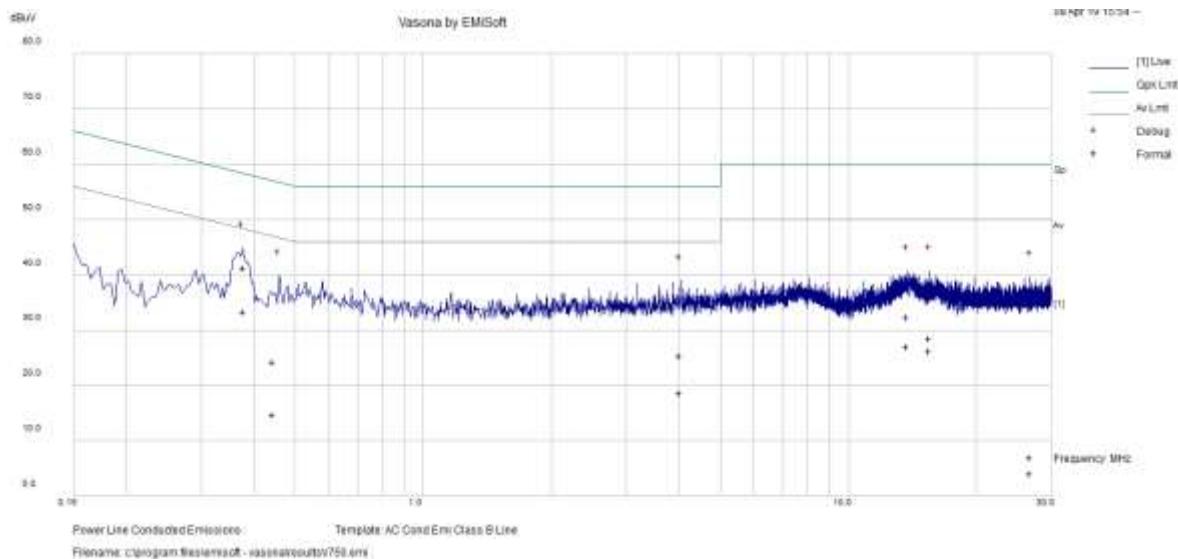
Test Data Yes N/A

Test Plot Yes (See below) N/A

Test was done by Deon Dai at Conducted Emission test site.

Conducted Emission Test Results

Test specification:		Conducted Emissions		
Environmental Conditions:	Temp(°C):	21	Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Deon Dai			
Test Date:	04/08/2019			
Remarks	POE, Live			

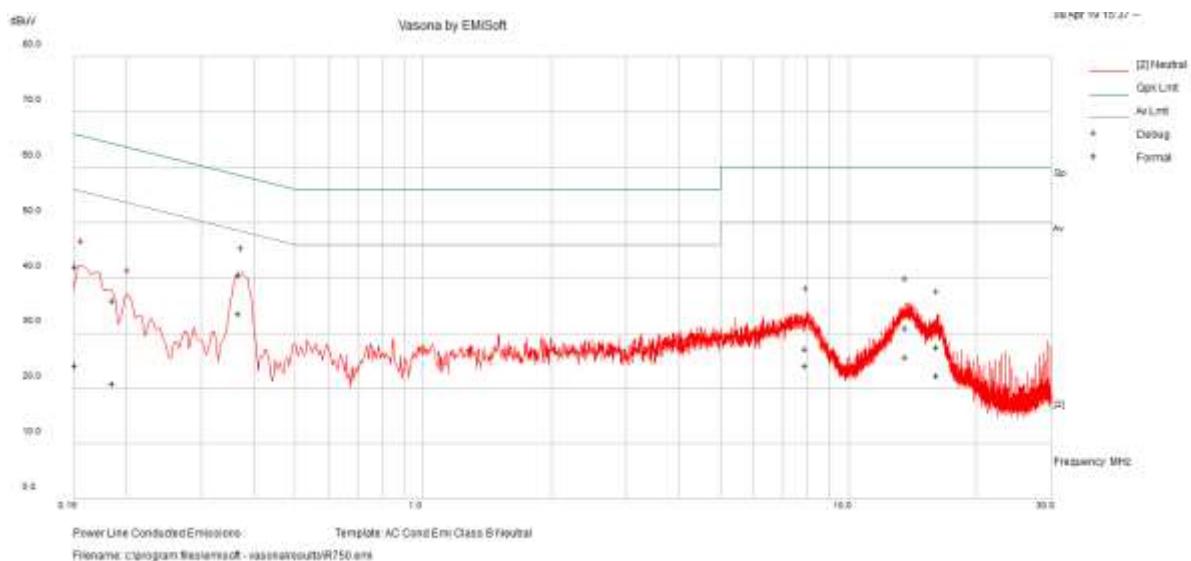


Live Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.38	33.89	7.29	0.04	41.22	Quasi Peak	Live	58.34	-17.11	Pass
0.44	16.82	7.33	0.04	24.19	Quasi Peak	Live	57	-32.82	Pass
4.02	17.3	8.03	0.07	25.4	Quasi Peak	Live	56	-30.6	Pass
13.76	23.14	8.83	0.33	32.3	Quasi Peak	Live	60	-27.7	Pass
15.51	19.2	8.93	0.37	28.5	Quasi Peak	Live	60	-31.5	Pass
26.78	-2.64	9.03	0.57	6.96	Quasi Peak	Live	60	-53.04	Pass
0.38	25.97	7.29	0.04	33.31	Average	Live	48.34	-15.03	Pass
0.44	7.28	7.33	0.04	14.64	Average	Live	47	-32.36	Pass
4.02	10.43	8.03	0.07	18.52	Average	Live	46	-27.48	Pass
13.76	17.91	8.83	0.33	27.07	Average	Live	50	-22.93	Pass
15.51	16.91	8.93	0.37	26.21	Average	Live	50	-23.79	Pass
26.78	-5.56	9.03	0.57	4.03	Average	Live	50	-45.97	Pass

Conducted Emission Test Results

Test specification:	Conducted Emissions		
Environmental Conditions:	Temp(°C):	21	Result:
	Humidity (%):	42	
	Atmospheric(mbar):	1021	
	Mains Power:	120Vac, 60Hz	
Tested by:	Deon Dai		<input checked="" type="checkbox"/> Pass
Test Date:	04/08/2019		<input type="checkbox"/> Fail
Remarks	POE, Neutral		

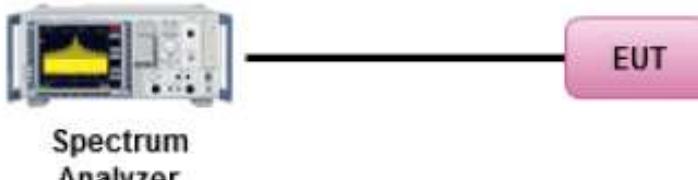


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.37	33.3	7.29	0.03	40.61	Quasi Peak	Neutral	58.54	-17.93	Pass
0.15	34.86	7.11	0.04	42.02	Quasi Peak	Neutral	65.9	-23.89	Pass
13.69	21.71	8.83	0.33	30.88	Quasi Peak	Neutral	60	-29.12	Pass
7.97	18.74	8.27	0.17	27.18	Quasi Peak	Neutral	60	-32.82	Pass
0.19	28.74	7.16	0.04	35.94	Quasi Peak	Neutral	64.19	-28.25	Pass
16.20	18.23	8.96	0.38	27.56	Quasi Peak	Neutral	60	-32.44	Pass
0.37	26.08	7.29	0.03	33.4	Average	Neutral	48.54	-15.14	Pass
0.15	16.96	7.11	0.04	24.11	Average	Neutral	55.9	-31.79	Pass
13.69	16.51	8.83	0.33	25.68	Average	Neutral	50	-24.32	Pass
7.97	15.6	8.27	0.17	24.05	Average	Neutral	50	-25.95	Pass
0.19	13.72	7.16	0.04	20.91	Average	Neutral	54.19	-33.28	Pass
16.20	13.01	8.96	0.38	22.34	Average	Neutral	50	-27.66	Pass

10.2 6dB & 99% Bandwidth

Requirement(s):

Spec	Requirement	Applicable
§ 15.247 RSS247 (5.2.a)	6dB BW \geq 500KHz;	<input checked="" type="checkbox"/>
RSS Gen 6.7	For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level 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 (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).	<input checked="" type="checkbox"/>
Test Setup	 <p>Spectrum Analyzer</p>	
Test Procedure	<p>558074 D01 DTS Meas Guidance v05r01, 8.2 DTS bandwidth ANSI C63.10, 11.8</p> <p><u>Measurement procedure</u></p> <ul style="list-style-type: none"> - Set RBW = 100 kHz. - Set the video bandwidth (VBW) $\geq 3 \times$ 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	03/09/2019	<p>Environmental condition</p> <p>Temperature 23°C Relative Humidity 42% Atmospheric Pressure 1021mbar</p>
Remark	N/A	
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

Test Data Yes N/A
 Test Plot Yes N/A

Test was done by Deon Dai at RF test site.

BLE:

Channel	Channel Frequency (MHz)	OBW	
		99% (MHz)	6dB(MHz)
Low	2402	1.052	0.708
Mid	2440	1.054	0.699
High	2480	1.054	0.706

6dB & 99% Bandwidth Test Plots





10.3 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.4.4)	a)	FHSS in 2400-2483.5MHz with \geq 75 channels: \leq 1 Watt	<input type="checkbox"/>
	b)	FHSS in 5725-5850MHz: \leq 1 Watt	<input type="checkbox"/>
	c)	For all other FHSS in the 2400-2483.5MHz band: \leq 0.125 Watt.	<input type="checkbox"/>
	d)	FHSS in 902-928MHz with \geq 50 channels: \leq 1 Watt	<input type="checkbox"/>
	e)	FHSS in 902-928MHz with \geq 25 & $<$ 50 channels: \leq 0.25 Watt	<input type="checkbox"/>
	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: \leq 1 Watt	<input checked="" type="checkbox"/>
Test Setup		 <p>Spectrum Analyzer</p>	
Test Procedure		<p>558074 D01 DTS Meas Guidance v05r01, 8.3.2.2 ANSI C63.10, 11.9.1.1</p> <p>The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:</p> <ol style="list-style-type: none"> Set the RBW DTS bandwidth. Set VBW [3 \times RBW]. Set span [3 \times RBW]. Sweep time = auto couple. Detector = peak. Trace mode = max hold. Allow trace to fully stabilize. Use peak marker function to determine the peak amplitude level. 	
Test Date	03/09/2019	Environmental condition	Temperature 23°C Relative Humidity 44% Atmospheric Pressure 1021mbar
Remark	NONE		
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	

Test Data Yes N/A

Test Plot Yes (See below) N/A

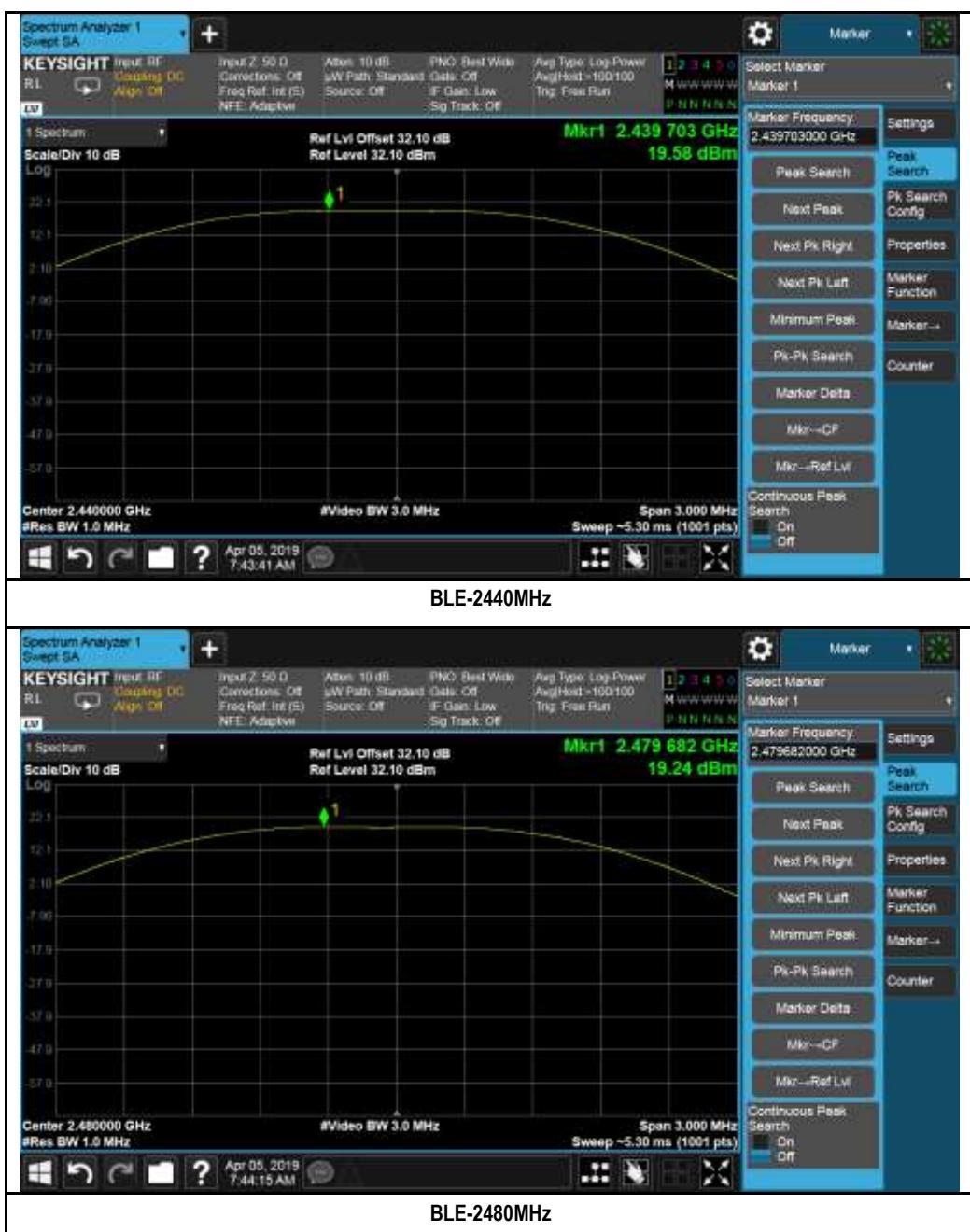
Test was done by Deon Dai at RF test site.

Output Power measurement results for BLE:

Type	Freq (MHz)	Test mode	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2402	BLE	Low	19.81	≤30	Pass
	2440	BLE	Mid	19.58	≤30	Pass
	2480	BLE	High	19.24	≤30	Pass

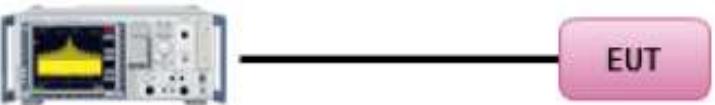
Test Plots:





10.4 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 <input checked="" type="checkbox"/> 20 dB down <input type="checkbox"/> 30 dB down	<input checked="" type="checkbox"/>
Test Setup		 <p>Spectrum Analyzer ————— EUT</p>	
Test Procedure		<p>558074 D01 DTS Meas Guidance v05r01 ANSI C63.10</p> <p><u>Band Edge measurement procedure</u></p> <ol style="list-style-type: none"> 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 measured. The attenuation shall 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	03/09/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	-		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

Test Data Yes N/A

Test Plot Yes (See below) N/A

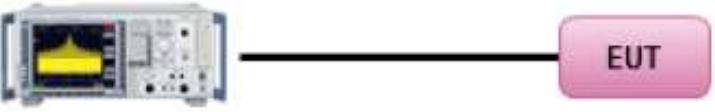
Test was done by Deon Dai at RF test site.

Test Plots:



10.5 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e) RSS247 (5.2.b)	e) f)	DSSS: $\leq 8\text{dBm}/3\text{KHz}$ DSSS in hybrid sys with FH turned off: $\leq 8\text{dBm}/3\text{KHz}$	<input checked="" type="checkbox"/> <input type="checkbox"/>
Test Setup	 <p>Spectrum Analyzer</p>		
Test Procedure	<p>558074 D01 DTS Meas Guidance v05r01, 8.4 ANSI C63.10:2013, 11.10.2</p> <p><u>Peak spectral density measurement procedure</u></p> <ul style="list-style-type: none"> - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: $3\text{ kHz} \leqslant \text{RBW} \leqslant 100\text{ kHz}$. - Set the VBW $\geqslant 3 \times \text{RBW}$. - 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	03/09/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	

Test Data Yes N/A

Test Plot Yes (See below) N/A

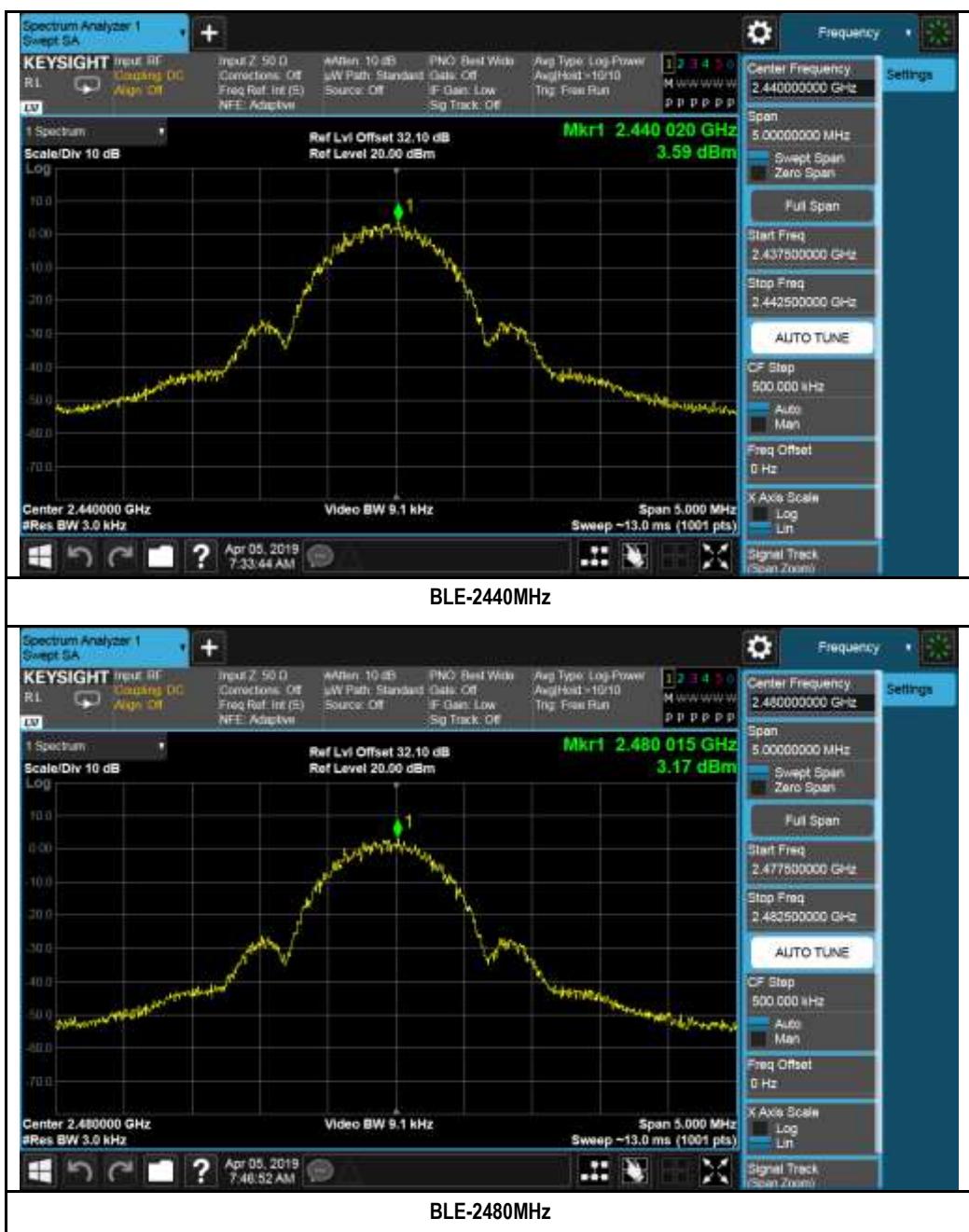
Test was done by Deon Dai at RF test site.

PSD measurement results for BLE:

Type	Freq (MHz)	Test mode	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	2402	BLE	Low	2.94	8	Pass
	2440	BLE	Mid	3.59	8	Pass
	2480	BLE	High	3.17	8	Pass

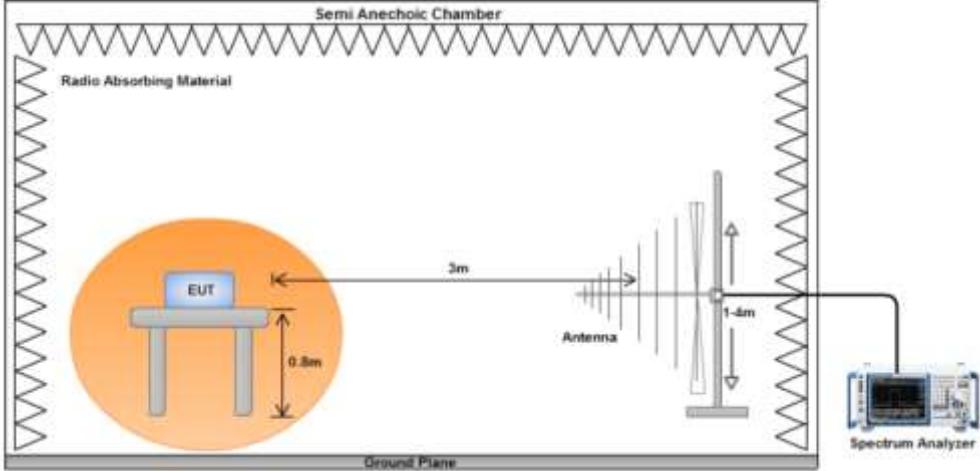
Test Plots





10.6 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable										
47CFR§15.247(d) RSS247 (A8.5)	a)	<p>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</p> <table border="1"> <thead> <tr> <th>Frequency range (MHz)</th> <th>Field Strength (uV/m)</th> </tr> </thead> <tbody> <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> </tbody> </table>	Frequency range (MHz)	Field Strength (uV/m)	30 – 88	100	88 – 216	150	216 – 960	200	Above 960	500	<input checked="" type="checkbox"/>
Frequency range (MHz)	Field Strength (uV/m)												
30 – 88	100												
88 – 216	150												
216 – 960	200												
Above 960	500												
Test Setup													
Procedure	1. 2. 3. 4.	<p>The EUT was switched on and allowed to warm up to its normal operating condition. 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:</p> <ol style="list-style-type: none"> Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. The EUT was then rotated to the direction that gave the maximum emission. Finally, the antenna height was adjusted to the height that gave the maximum emission. A Quasi-peak measurement was then made for that frequency point. <p>Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</p>											
Remark	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. The EUT was evaluated in each of three orthogonal axis positions, the orientation is the worst case, please refer to setup photos.												
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail												

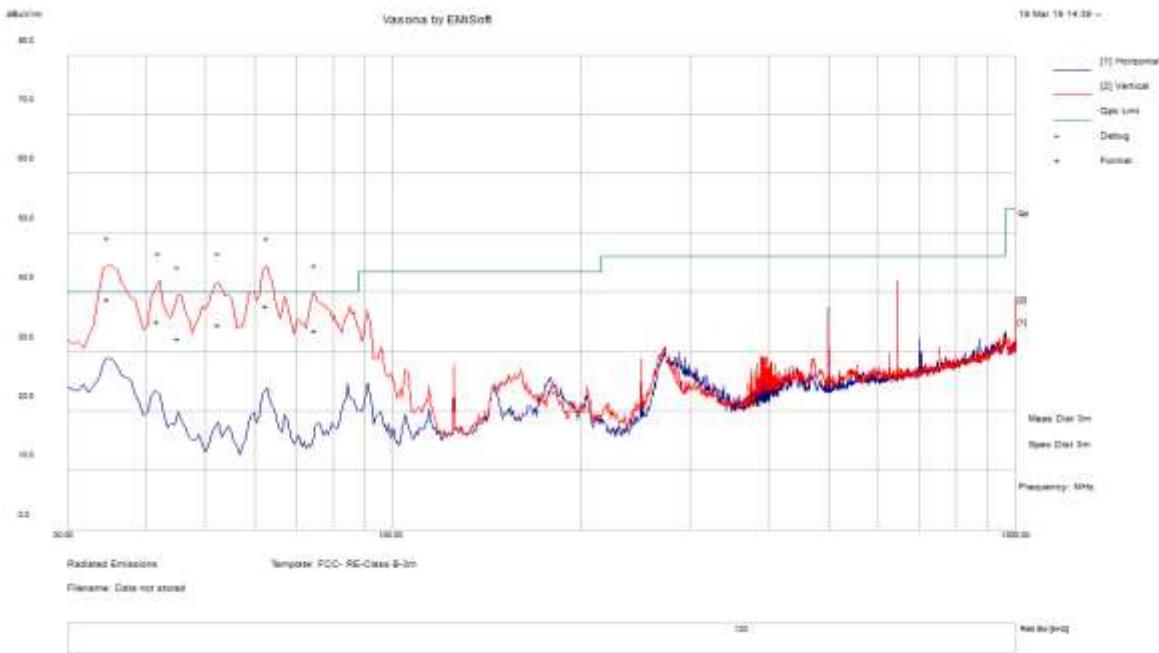
Test Data Yes (See below) N/A

Test Plot Yes (See below) N/A

Test was done by Deon Dai at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26	Result	
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	120VAC, 60Hz			
Tested by:	Deon Dai			
Test Date:	03/19/2019			
Remarks:	BLE, 2440MHz			

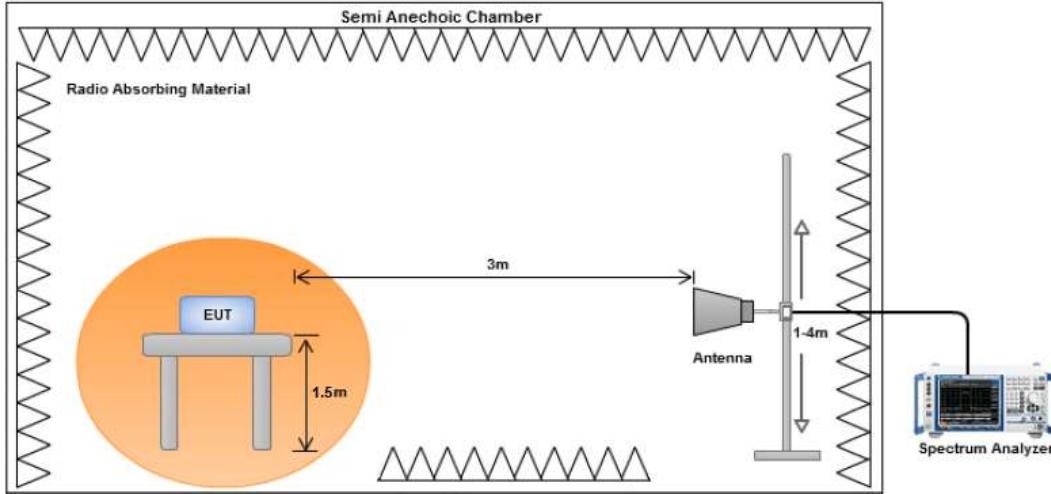


Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
34.89	43.97	11.19	-16.45	38.71	Quasi Max	V	123	102	40	-1.29	Pass
62.62	53.57	11.53	-27.31	37.79	Quasi Max	V	110	187	40	-2.21	Pass
41.99	45.5	11.34	-21.68	35.17	Quasi Max	V	118	234	40	-4.83	Pass
52.42	49.92	11.46	-26.74	34.64	Quasi Max	V	114	221	40	-5.37	Pass
75.08	49.5	11.63	-27.5	33.63	Quasi Max	V	107	229	40	-6.37	Pass
45.28	44.7	11.4	-23.8	32.31	Quasi Max	V	102	277	40	-7.69	Pass

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

10.7 Restricted band and Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(A8.5)	a)	<p>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</p> <p><input type="checkbox"/> 20 dB down <input checked="" type="checkbox"/> 30 dB down</p>	<input checked="" type="checkbox"/>
Test Setup			
Procedure	<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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	<p>The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. There isn't outstanding emission found at the edge of restricted frequency. The EUT was evaluated in each of three orthogonal axis positions, the orientation is the worst case, please refer to setup photos.</p>		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

Test Data Yes (See below) N/A

Test Plot Yes (See below) N/A

Test was done by Deon Dai at 10m chamber.

Restricted Band Measurement Plots:



Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz- BLE - 2402MHz

Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
3409.04	47.15	3.54	-13.73	36.96	Peak Max	V	205	301	74	-37.04	Pass
4804.69	49.16	4.1	-10.91	42.35	Peak Max	H	219	31	74	-31.65	Pass
7595.07	50.04	5.16	-7.46	47.74	Peak Max	V	166	149	74	-26.26	Pass
3409.04	32.28	3.54	-13.73	22.09	Average Max	V	205	301	54	-31.91	Pass
4804.69	35.13	4.1	-10.91	28.32	Average Max	H	219	31	54	-25.68	Pass
7595.07	35.91	5.16	-7.46	33.61	Average Max	V	166	149	54	-20.39	Pass

Above 1GHz-25GHz- BLE - 2440MHz

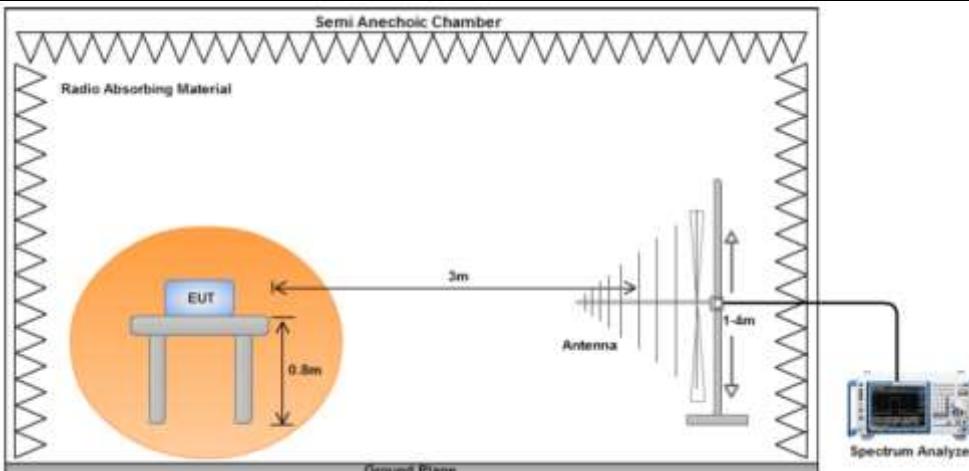
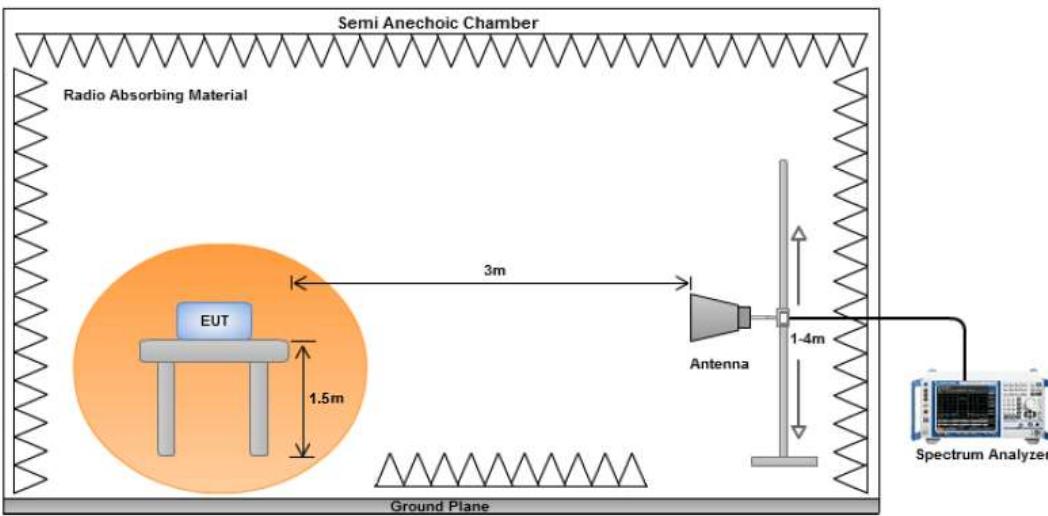
Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
3721.62	47.68	3.57	-13.18	38.07	Peak Max	V	213	296	74	-35.93	Pass
4881.52	48.24	4.18	-11.03	41.39	Peak Max	V	218	25	74	-32.61	Pass
7969.01	50.49	5.4	-7.06	48.83	Peak Max	H	168	153	74	-25.17	Pass
3721.62	33.04	3.57	-13.18	23.43	Average Max	V	213	296	54	-30.57	Pass
4881.52	34.03	4.18	-11.03	27.18	Average Max	V	218	25	54	-26.82	Pass
7969.01	36.11	5.4	-7.06	34.45	Average Max	H	168	153	54	-19.55	Pass

Above 1GHz-25GHz- BLE - 2480MHz

Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
3684.86	47.41	3.57	-13.28	37.7	Peak Max	V	209	300	74	-36.3	Pass
4960.21	48.2	4.25	-11.16	41.29	Peak Max	H	224	32	74	-32.71	Pass
7078.64	49.84	5.11	-7.78	47.17	Peak Max	H	163	149	74	-26.83	Pass
3684.86	32.7	3.57	-13.28	22.99	Average Max	V	209	300	54	-31.01	Pass
4960.21	34.03	4.25	-11.16	27.12	Average Max	H	224	32	54	-26.88	Pass
7078.64	35.46	5.11	-7.78	32.79	Average Max	H	163	149	54	-21.21	Pass

10.8 Receiver Radiated Emissions

Requirement(s):

Spec	Item	Requirement	Applicable										
RSS GEN (7.3)	a)	<p>Spurious emissions from receivers shall not exceed the radiated emissions limits shown in table 3.</p> <p>Table 3 – Receiver radiated emissions limits</p> <table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Field strength (μV/m at 3 metres)</th> </tr> </thead> <tbody> <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> </tbody> </table>	Frequency (MHz)	Field strength (μ V/m at 3 metres)	30-88	100	88-216	150	216-960	200	Above 960	500	<input checked="" type="checkbox"/>
Frequency (MHz)	Field strength (μ V/m at 3 metres)												
30-88	100												
88-216	150												
216-960	200												
Above 960	500												
Test Setup													
													
Procedure		<ol style="list-style-type: none"> The EUT was switched on and allowed to warm up to its normal operating condition. 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: <ol style="list-style-type: none"> Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. The EUT was then rotated to the direction that gave the maximum emission. Finally, the antenna height was adjusted to the height that gave the maximum emission. A Quasi-peak measurement was then made for that frequency point (Below 1G). An average measurement was then made for that frequency point (Above 1G). 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 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. There isn't outstanding emission found at the edge of restricted frequency. The EUT was evaluated in each of three orthogonal axis positions, the orientation is the worst case, please refer to setup photos.	
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

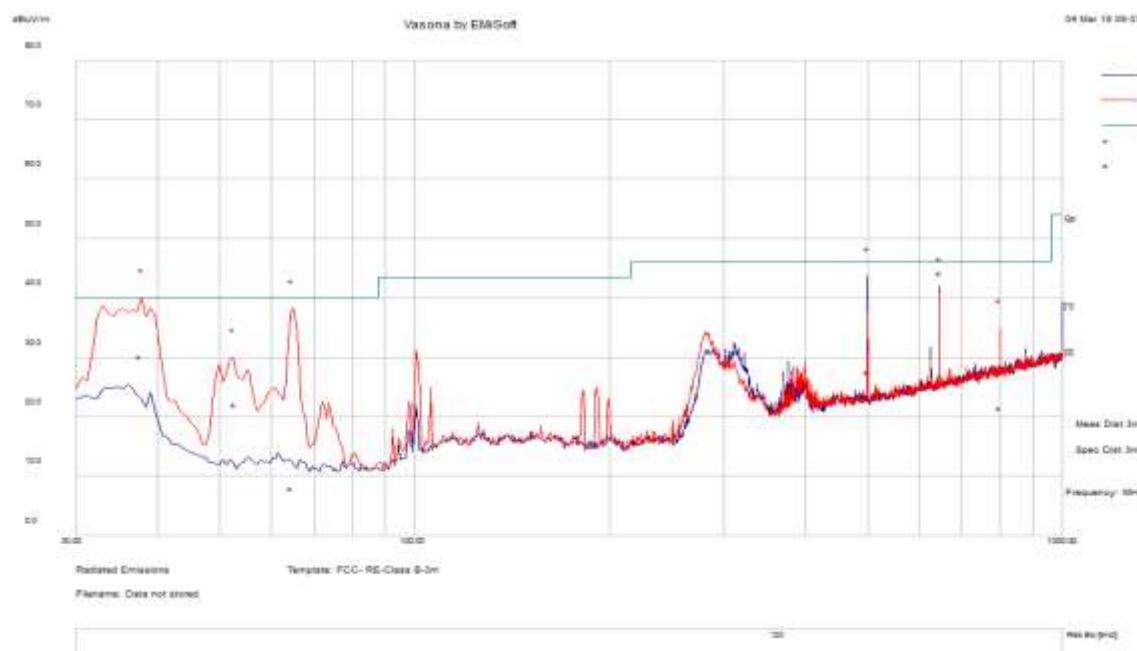
Test Data Yes (See below) N/A

Test Plot Yes (See below) N/A

Test was done by Deon Dai at 10m chamber.

Receiver Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz		
Environmental Conditions:	Temp (°C):	26	Result
	Humidity (%)	47	
	Atmospheric (mbar):	1020	
	Mains Power:	120VAC, 60Hz	
Tested by:	Deon Dai		Pass
Test Date:	03/04/2019		
Remarks:	Receiver Mode		



Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
37.66	37.57	11.26	-18.62	30.21	Quasi Max	V	107	324	40	-9.79	Pass
64.46	23.83	11.54	-27.29	8.08	Quasi Max	V	112	77	40	-31.92	Pass
500.01	31.71	14.17	-18.27	27.61	Quasi Max	H	162	34	46	-18.39	Pass
644.55	45.09	14.99	-15.86	44.23	Quasi Max	H	132	72	46	-1.77	Pass
52.59	37.48	11.46	-26.76	22.19	Quasi Max	V	103	198	40	-17.81	Pass
800.10	20.33	15.47	-14.27	21.53	Quasi Max	V	110	47	46	-24.47	Pass

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

Receiver Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz

Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
16586.98	38.49	8.08	1.66	48.23	Peak Max	H	135	244	74	-25.77	Pass
6016.56	44.06	4.83	-8.64	40.25	Peak Max	V	179	209	74	-33.75	Pass
1000	57.73	1.88	-20.13	39.48	Peak Max	H	127	351	74	-34.52	Pass
16586.98	25.51	8.08	1.66	35.25	Average Max	H	135	244	54	-18.75	Pass
6016.56	31.98	4.83	-8.64	28.17	Average Max	V	179	209	54	-25.83	Pass
1000	49.53	1.88	-20.13	31.28	Average Max	H	127	351	54	-22.72	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	08/28/2018	1 Year	08/29/2019	<input checked="" type="checkbox"/>
LISN	3816/2NM	214372	1/10/2019	1 Year	01/10/2020	<input checked="" type="checkbox"/>
Radiated Emissions						
50GHz Spectrum Analyzer	N9030B(PXA)	MY57140374	08/20/2018	1 Year	08/20/2019	<input checked="" type="checkbox"/>
Bi-Log antenna (30MHz~6GHz)	JB6	A111717	08/12/2018	1 Year	08/12/2019	<input checked="" type="checkbox"/>
Horn Antenna (1GHz~26GHz)	3115	100059	01/26/2019	1 Year	01/26/2020	<input checked="" type="checkbox"/>
Horn Antenna (26GHz~40GHz)	AH-840	101013	08/28/2018	1 Year	08/28/2019	<input checked="" type="checkbox"/>
Pre-Amplifier(0.3MHz-6.5GHz)	LPA-6-30	11170602	02/06/2019	1 Year	02/06/2020	<input checked="" type="checkbox"/>
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	08/16/2018	1 Year	08/16/2019	<input checked="" type="checkbox"/>
Pre-Amp (10MHz~50GHz)	RAMP00M50GA	17032300047	02/10/2019	1 Year	02/10/2020	<input checked="" type="checkbox"/>
RF Conducted Measurement						
50GHz Spectrum Analyzer	N9030B (PXA)	MY57140584	10/02/2018	1 Year	10/02/2019	<input checked="" type="checkbox"/>

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		<p>Radio: A1. Terminal equipment for purpose of calling</p> <p>Telecom: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law</p>
		<p>EMI: KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI</p> <p>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</p>
Korea CAB Accreditation		<p>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</p> <p>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</p>
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		<p>EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4</p> <p>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</p> <p>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</p>
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