


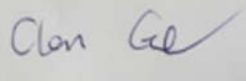
RF TEST REPORT



Report No.: FCC IC_RF_SL16040101-AER-001_BLE_Rev. 1.0
Supersede Report No.: None

Applicant	:	Aerohive Networks, Inc.
Product Name	:	Access Point
Model No.	:	AP245X
Test Standard	:	47 CFR 15.247 RSS 247 Iss.1 : May 2015
Test Method	:	ANSI C63.10: 2013 RSS Gen Iss 4: Nov 2014 558074 D01 DTS Meas Guidance v03r04
FCC ID	:	WBV-AP245
IC ID	:	7774A-AP245
Dates of test	:	05/12/2016 – 05/23/2016
Issue Date	:	06/16/2016
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:

	
Rachana Khanduri	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/RRR, 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_SL16040101-AER-001_BLE	None	Original	06/10/2016
FCC IC_RF_SL16040101-AER-001_BLE_Rev. 1.0	Rev. 1.0	Updated Internal Photos and Test Instruments information	06/16/2016

2 Executive Summary

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

Company: Aerohive Networks, Inc.
Product: Access Point
Model: AP245X

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	:	Aerohive Networks, Inc.
Applicant Address	:	1011 McCarthy Blvd, Milpitas, CA 95035, California, United States
Manufacturer Name	:	Aerohive Networks, Inc.
Manufacturer Address	:	1011 McCarthy Blvd, Milpitas, CA 95035, California, United States

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	:	Access Point
Model No.	:	AP245X
Trade Name	:	Aerohive
Serial No.	:	N/A
Host Model No.	:	N/A
Input Power	:	100-240V, 50/60Hz
Power Adapter Manu/Model	:	Microsemi 9001GR
Power Adapter SN	:	C15336594000002605
Product Hardware version	:	1
Product Software version	:	HIVEOS 7.0r1
Radio Hardware version	:	1
Radio Software version	:	HIVEOS 7.0r1
Date of EUT received	:	05/07/2016
Equipment Class/ Category	:	DTS
Port/Connectors	:	PoE, Ethernet,USB

6.2 Spec for BT Radio

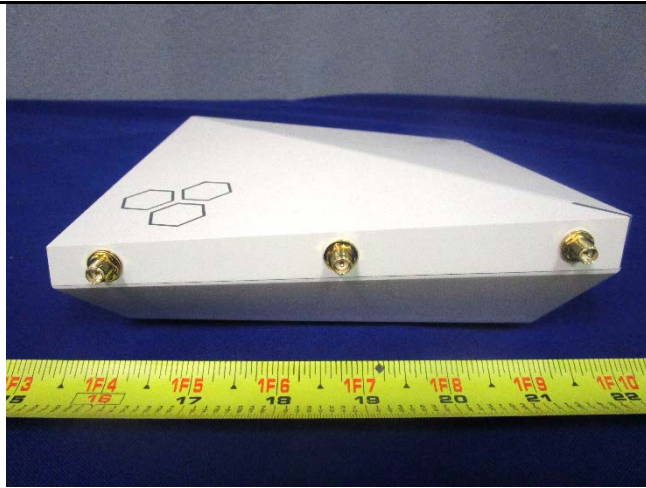
Radio Type	Bluetooth
Operating Frequency	2402MHz-2480MHz
Modulation	GFSK (LE)
Channel Spacing	2MHz (LE)
Antenna Type	PIFA Antenna
Antenna Gain	4.57 dBi (BTLE)
Antenna Connector Type	U.FL connector

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

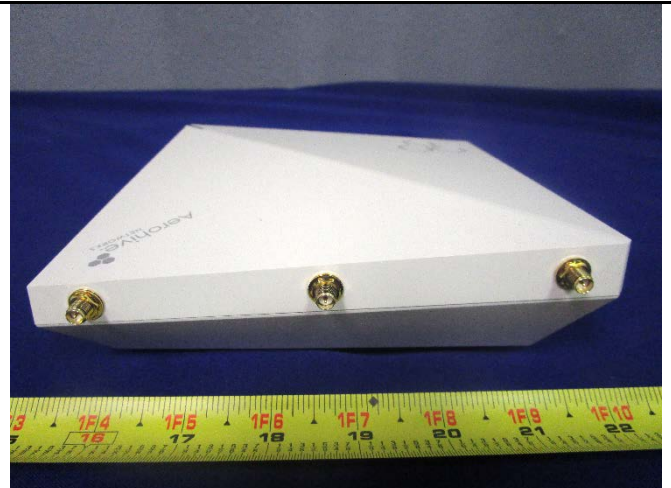
6.3 EUT test modes/configuration Description

Mode	Note
Bluetooth	BLE (GFSK)

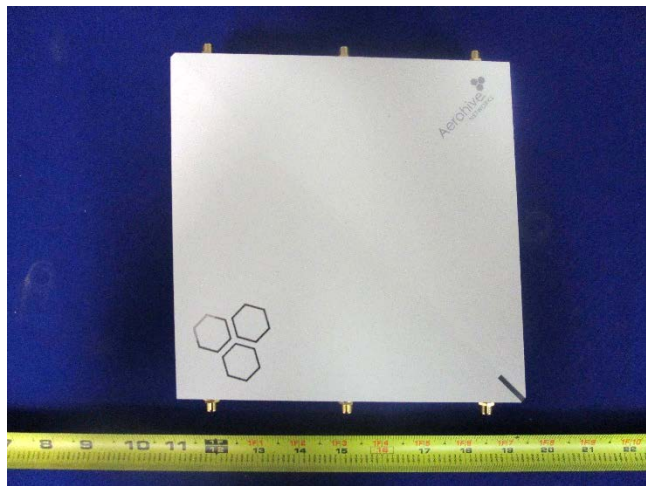
6.4 EUT Photos – External



EUT - Front View



EUT – Rear View



EUT - Top View



EUT – Bottom View



EUT – Left Side View



EUT – Right Side View

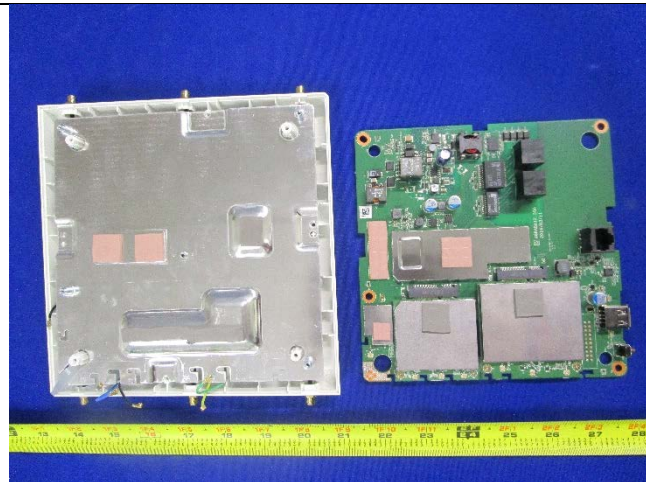


Support Equipment Power Supply Top View

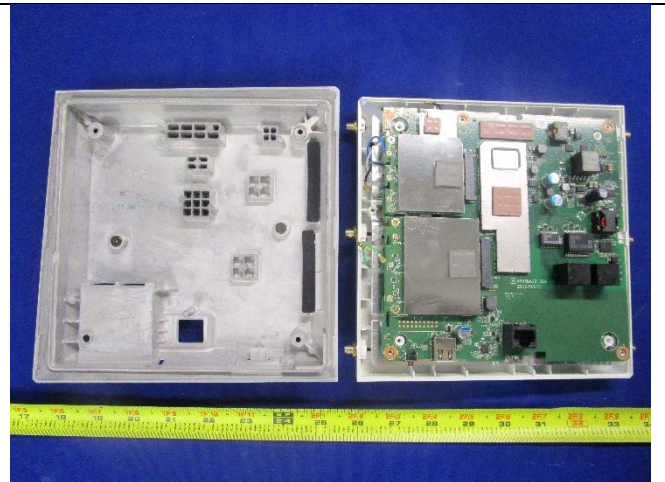


Support Equipment Power Supply Bottom View

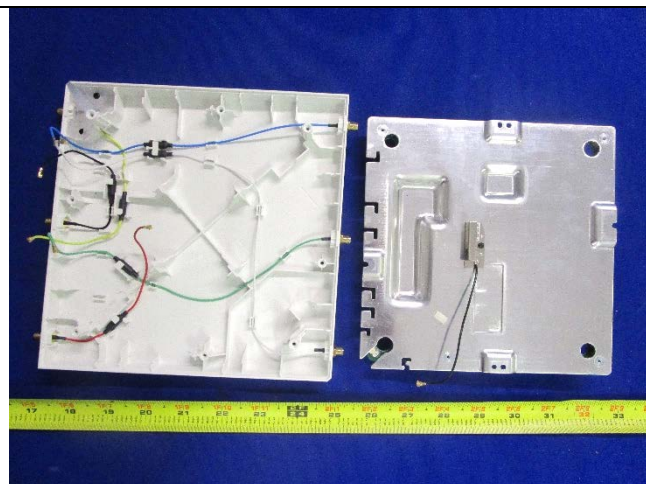
6.5 EUT Photos (Internal)



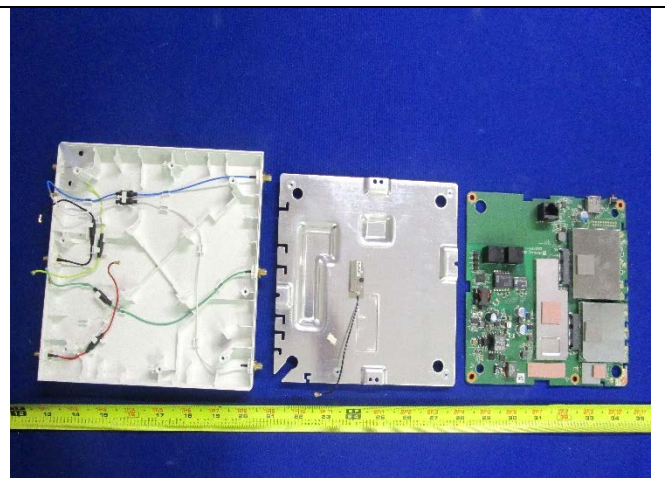
EUT: Cover Off View 1



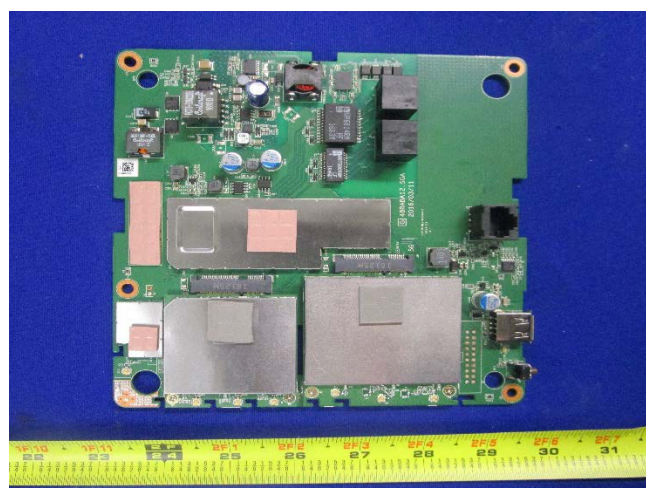
EUT: Cover Off View 2



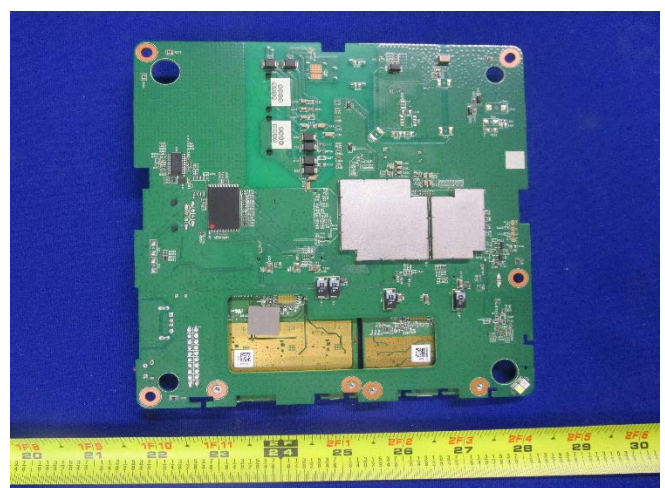
EUT: Cover Off View 3



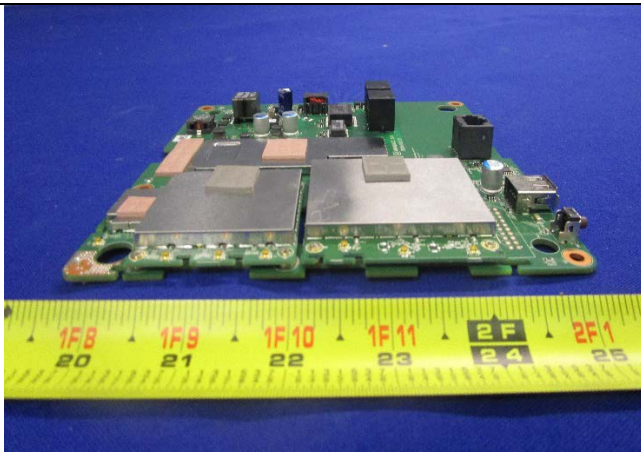
EUT: Cover Off View 4



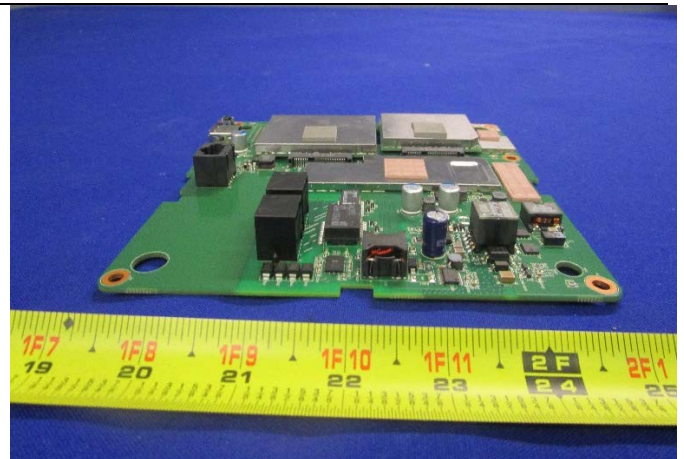
PCBA Top View



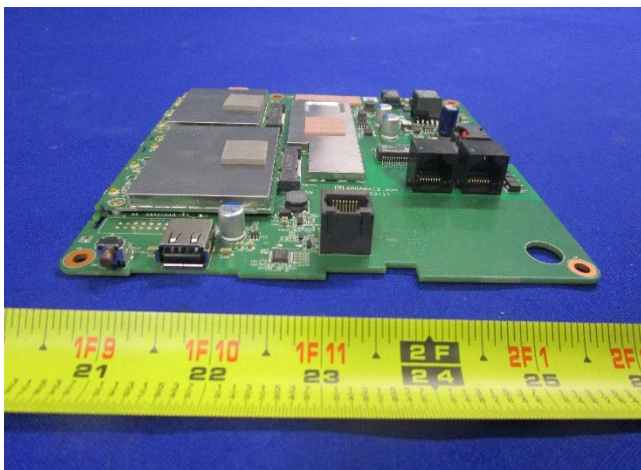
PCBA Bottom View



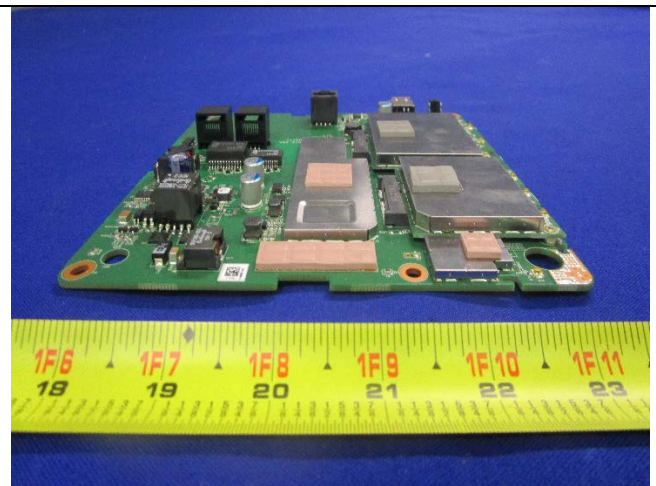
PCBA Front View



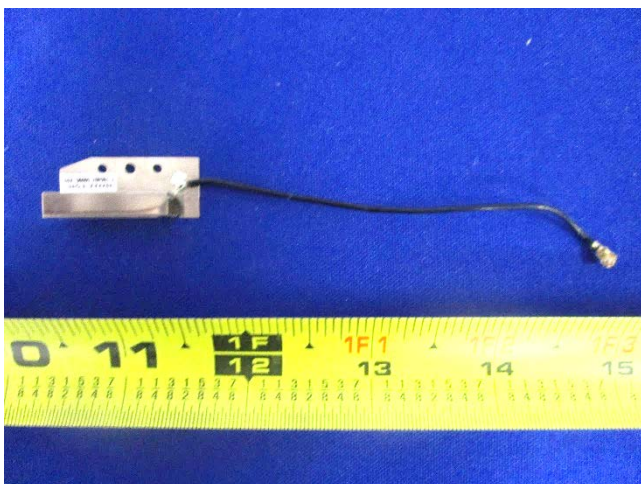
PCBA Rear View



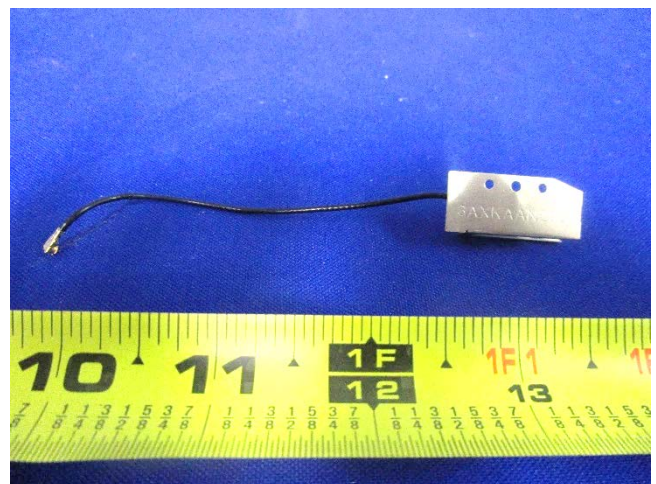
PCBA Left-Side View



PCBA Right-Side View

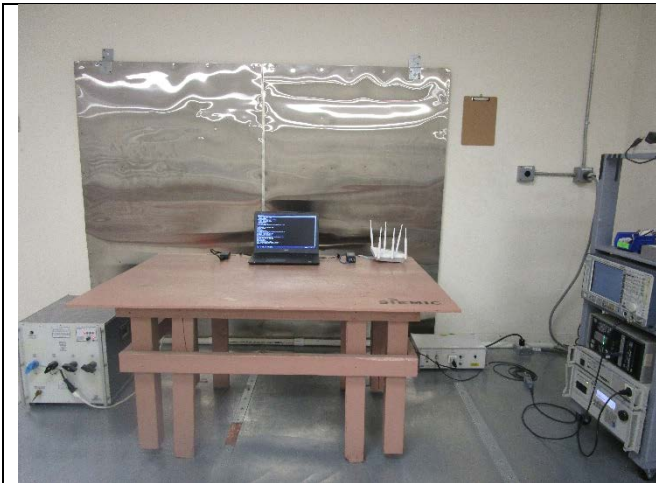


Antenna Top View

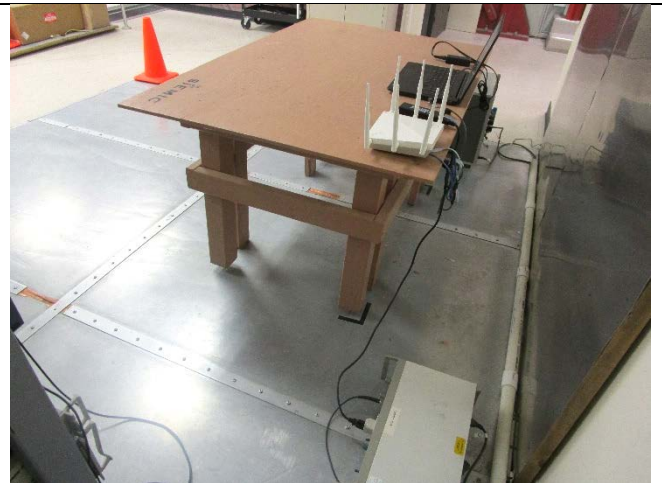


Antenna Bottom View

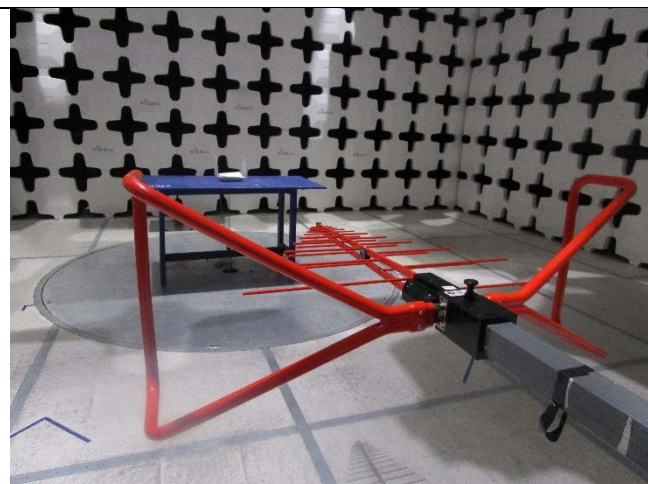
6.6 EUT Test Setup Photos



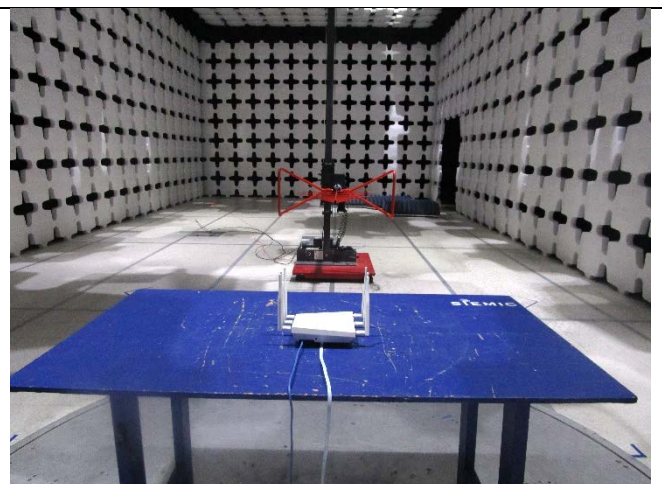
AC Line Conducted Emissions – Front View



AC Line Conducted Emissions – Rear View



Radiated Emissions (<1GHz) – Front View



Radiated Emissions (<1GHz) – Rear View



Radiated Emissions (>1GHz) – Front View



Radiated Emissions (>1GHz) – Rear View

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	Latitude 3550	N/A	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	
RJ45	EUT	RJ45	POE	RJ45	2	Unshielded	-
RJ45	EUT	RJ45	Laptop	USB	3	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Tera Term	Set the EUT to transmit continuously in diferent test mode

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10:2013	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen 8.10	IC	558074 D01 DTS Meas Guidance v03r04	<input type="checkbox"/> N/A
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen 8.8	IC	RSS Gen Issue 4: 2014	<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 6.6	IC	RSS Gen Issue 4: 2014 -	<input type="checkbox"/> N/A
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v03r04	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.2.1)	IC		<input type="checkbox"/> N/A
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.5)	IC	558074 D01 DTS Meas Guidance v03r04	<input type="checkbox"/> N/A
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v03r04	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.4.4)	IC		<input type="checkbox"/> N/A
Receiver Spurious Emissions	IC	RSS Gen (4.8)	IC	RSS Gen Issue 4: 2014	<input type="checkbox"/> Pass <input checked="" 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	558074 D01 DTS Meas Guidance v03r04	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.2.2)	IC		<input type="checkbox"/> N/A
RF Exposure requirement	FCC	15.247(i)	FCC	-	<input type="checkbox"/> Pass
	IC	RSS Gen(5.5)	IC	RSS Gen Issue 4: 2014	<input checked="" type="checkbox"/> N/A
Remark	<ol style="list-style-type: none"> All measurement uncertainties do not take into consideration for all presented test results. 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. The device is operating at near 98% duty cycle. 				

9 Measurement Uncertainty

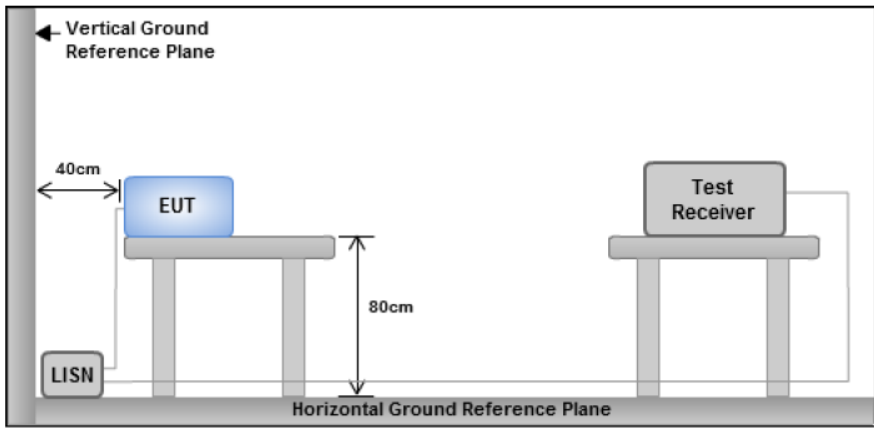
Emissions			
Test Item	Frequency Range	Description	Uncertainty
AC Conducted Emissions	150KHz – 30MHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±3.5dB
Band Edge and Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Band Edge and 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)	+4.3dB/-4.1dB

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
47CFR§15.207	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: 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</p>	
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 tested with AC 120V 60Hz	
Result		<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

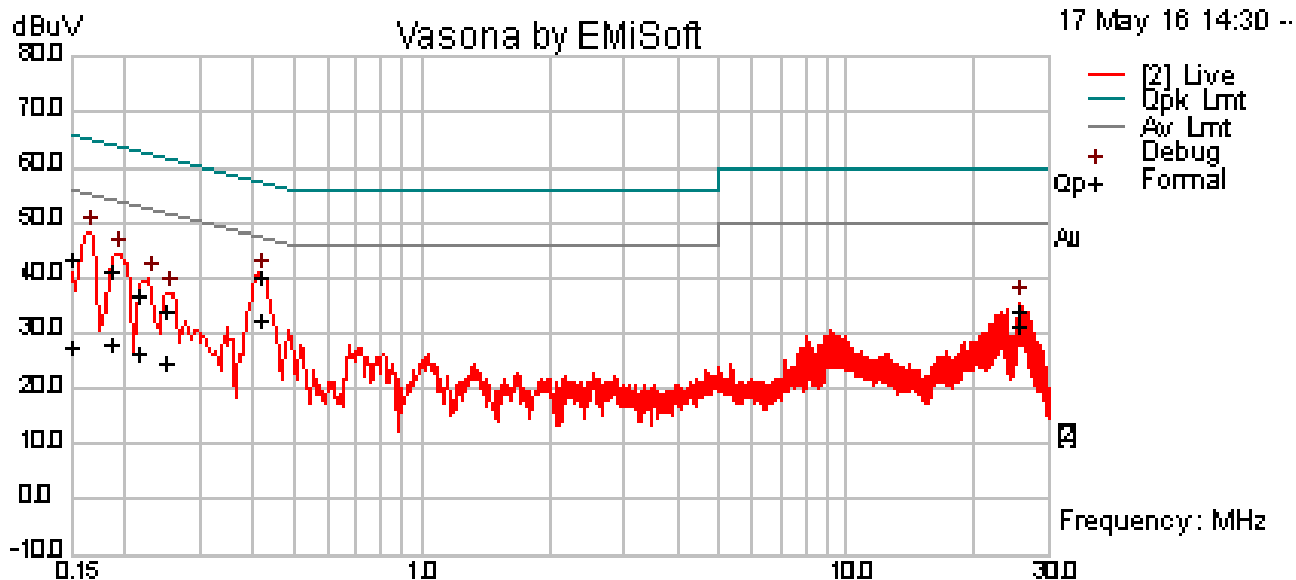
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Rachana Khanduri 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:	Rachana Khanduri			
Test Date:	05/17/2016			
Remarks	AC Line @ Line			



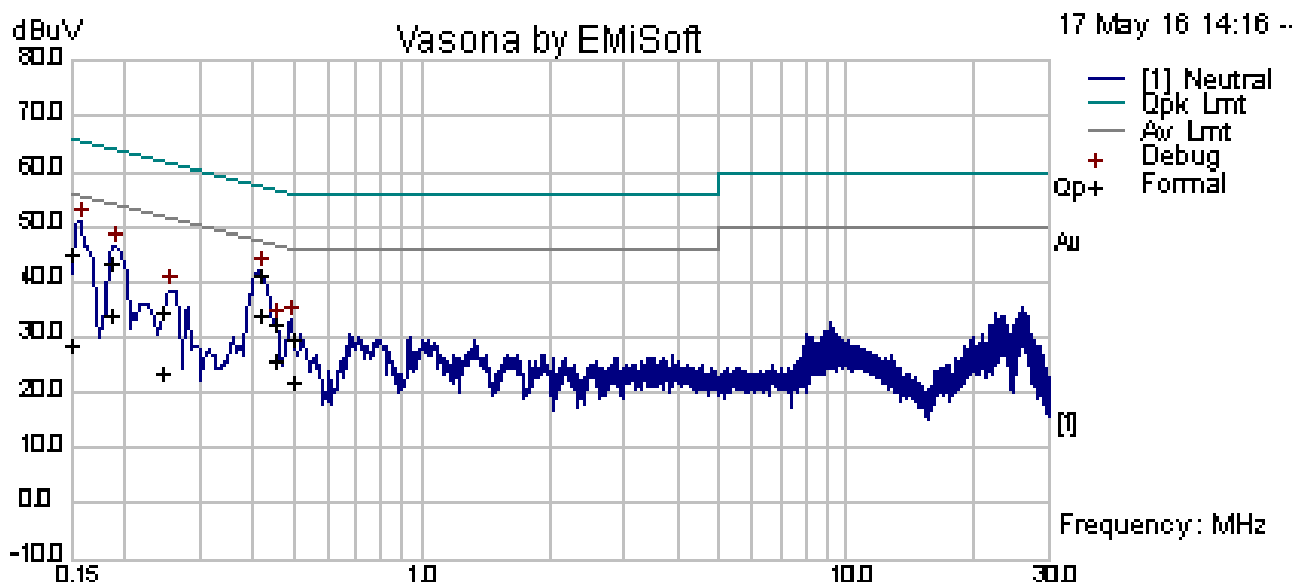
Line Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.41	29.36	10.01	0.74	40.11	Quasi Peak	Live	57.55	-17.44	Pass
0.15	31.48	10.00	1.80	43.28	Quasi Peak	Live	66.00	-22.72	Pass
0.18	29.71	10.00	1.43	41.15	Quasi Peak	Live	64.29	-23.14	Pass
0.21	25.52	10.00	1.23	36.75	Quasi Peak	Live	63.02	-26.27	Pass
0.25	23.32	10.00	1.06	34.38	Quasi Peak	Live	61.77	-27.39	Pass
25.49	23.16	10.08	0.78	34.01	Quasi Peak	Live	60.00	-25.99	Pass
0.41	21.97	10.01	0.74	32.72	Average	Live	47.55	-14.83	Pass
0.15	15.49	10.00	1.80	27.30	Average	Live	56.00	-28.70	Pass
0.18	16.43	10.00	1.43	27.86	Average	Live	54.29	-26.43	Pass
0.21	15.37	10.00	1.23	26.60	Average	Live	53.02	-26.42	Pass
0.25	13.55	10.00	1.06	24.61	Average	Live	51.77	-27.16	Pass
25.49	20.47	10.08	0.78	31.33	Average	Live	50.00	-18.67	Pass

Note: The results above show only the worst case.

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	<div><input checked="" type="checkbox"/> Pass</div> <div><input type="checkbox"/> Fail</div>
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Rachana Khanduri			
Test Date:	05/17/016			
Remarks	AC Line @ Neutral			




Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	33.20	10.00	1.80	45.00	Quasi Peak	Neutral	66.00	-21.00	Pass
0.42	30.83	10.01	0.74	41.58	Quasi Peak	Neutral	57.54	-15.96	Pass
0.19	32.20	10.00	1.42	43.62	Quasi Peak	Neutral	64.21	-20.59	Pass
0.50	18.82	10.01	0.68	29.51	Quasi Peak	Neutral	56.04	-26.53	Pass
0.25	23.35	10.00	1.08	34.43	Quasi Peak	Neutral	61.91	-27.47	Pass
0.45	22.03	10.01	0.71	32.75	Quasi Peak	Neutral	56.85	-24.10	Pass
0.15	16.60	10.00	1.80	28.41	Average	Neutral	56.00	-27.59	Pass
0.42	23.29	10.01	0.74	34.03	Average	Neutral	47.54	-13.51	Pass
0.19	22.59	10.00	1.42	34.01	Average	Neutral	54.21	-20.21	Pass
0.50	11.38	10.01	0.68	22.07	Average	Neutral	46.04	-23.97	Pass
0.25	12.49	10.00	1.08	23.57	Average	Neutral	51.91	-28.33	Pass
0.45	15.2	10.01	0.71	25.92	Average	Neutral	46.85	-20.93	Pass

Note: The results above show only the worst case.

10.2 Output Power (Bluetooth LE)

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.4.2)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤ 1 Watt	<input type="checkbox"/>
	b)	FHSS in 5725-5850MHz: ≤ 1 Watt	<input type="checkbox"/>
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤ 0.125 Watt.	<input type="checkbox"/>
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤ 1 Watt	<input type="checkbox"/>
	e)	FHSS in 902-928MHz with ≥ 25 & < 50 channels: ≤ 0.25 Watt	<input type="checkbox"/>
	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤ 1 Watt	<input checked="" type="checkbox"/>
Test Setup	 <p>Power Meter</p>		
Test Procedure	<p>558074 D01 DTS Meas Guidance v03r04, 9.2.3.1</p> <p>Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.</p> <ul style="list-style-type: none"> - Connect EUT's RF output power to power meter - Set EUT to be continuous transmission mode - Measurement the average output power using power meter and record the result - Repeat above steps for different test channel and other modulation type. 		
Test Date	05/13/2016	Environmental condition	Temperature 23°C Relative Humidity 44% Atmospheric Pressure 1021mbar
Remark	-		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

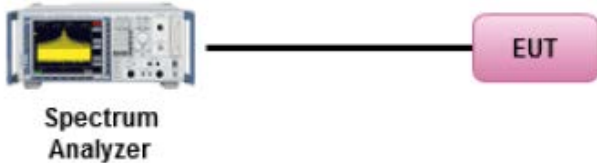
Test was done by *Rachana Khanduri* at *RF Test Site*.

Output Power measurement result (Bluetooth)

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	Bluetooth LE	2402	Low	4.72	30	Pass
		2440	Mid	5.21	30	Pass
		2480	High	5.06	30	Pass

10.3 Band Edge (Bluetooth LE)

Requirement(s):

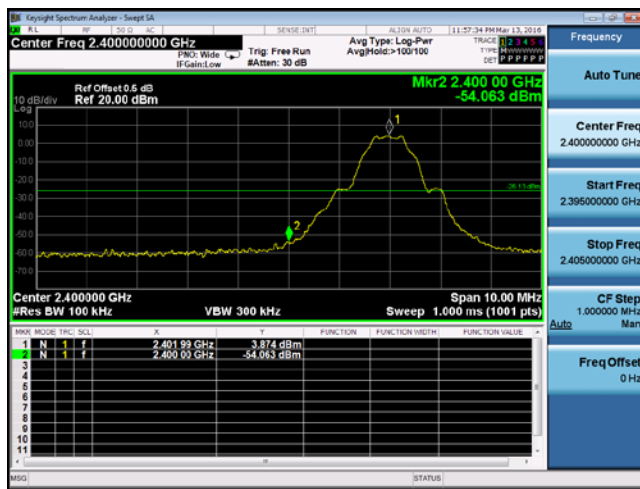
Spec	Item	Requirement	Applicable
§ 15.247 RSS247(5.5)	d)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be 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 type="checkbox"/> 20 dB down <input checked="" type="checkbox"/> 30 dB down	<input checked="" type="checkbox"/>
Test Setup			
Test Procedure	<p>558074 D01 DTS Meas Guidance v03r04</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 a 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	05/13/2016	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

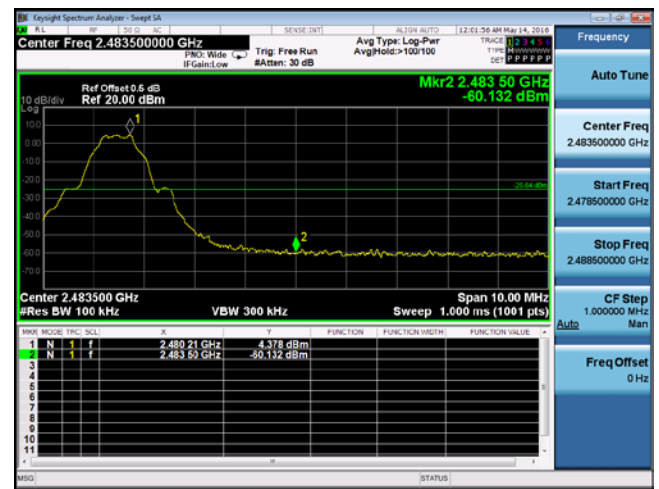
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *RF Test Site*.

Band Edge Test Plots (Bluetooth LE)



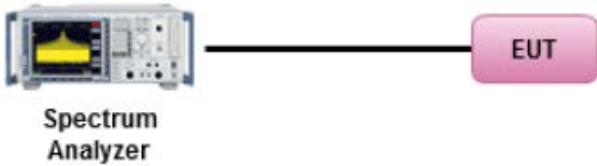
Band Edge-LE Low



Band Edge-LE High

10.4 6dB Bandwidth (Bluetooth LE)

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.2.1)	a)(2)	6dB BW \geq 500KHz;	<input checked="" type="checkbox"/>
Test Setup			
Test Procedure	<p>558074 D01 DTS Meas Guidance v03r04, 8.1 DTS bandwidth</p> <p><u>6dB Emission bandwidth 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	05/13/2016	Environmental condition	Temperature 23°C Relative Humidity 42% Atmospheric Pressure 1021mbar
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 *Rachana Khanduri* at *RF Test Site*.

6dB Bandwidth measurement result for 2.4GHz

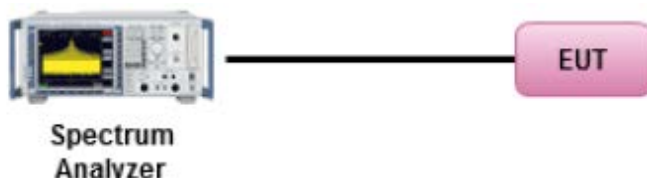
Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
6dB BW	BT-LE	2402	Low	0.711	≥ 0.5	Pass
		2440	Mid	0.711	≥ 0.5	Pass
		2480	High	0.713	≥ 0.5	Pass

Test Plots



10.5 99% Occupied Bandwidth (Bluetooth LE)

Requirement(s):

Spec	Requirement	Applicable						
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	<input checked="" type="checkbox"/>						
Test Setup	<div><p>The diagram illustrates the test setup. On the left is a Spectrum Analyzer with a yellow trace on its screen. A black line connects the Spectrum Analyzer to a pink rounded rectangle on the right labeled 'EUT'.</p></div>							
Procedure	<div><div>1. EUT was set for low , mid, high channel with modulated mode and highest RF output power.</div><div>2. The spectrum analyzer was connected to the antenna terminal.</div></div>							
Test Date	05/13/2016	<table><tr><td>Environmental condition</td><td>Temperature23oC</td></tr><tr><td></td><td>Relative Humidity47%</td></tr><tr><td></td><td>Atmospheric Pressure1019mbar</td></tr></table>	Environmental condition	Temperature23oC		Relative Humidity47%		Atmospheric Pressure1019mbar
Environmental condition	Temperature23oC							
	Relative Humidity47%							
	Atmospheric Pressure1019mbar							
Remark	-							
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail							

Test Data ☒ Yes (See below) ☐ N/A

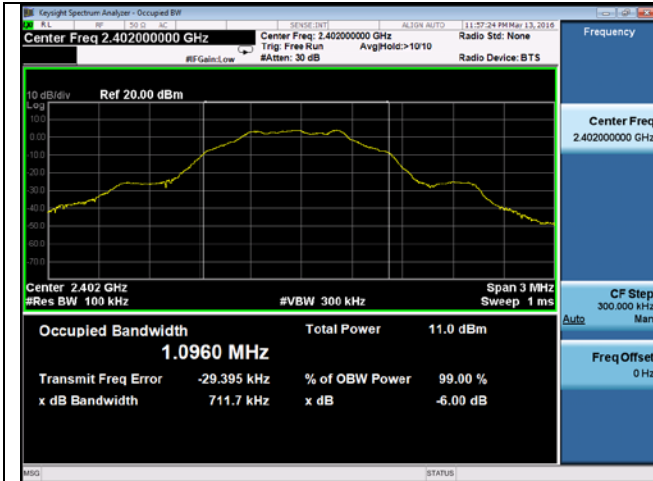
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *RF Test Site*.

99% Bandwidth measurement result for Bluetooth LE

Type	Test mode	Freq (MHz)	CH	Result (MHz)
99% OBW	BT-LE	2402	Low	1.0960
		2440	Mid	1.0980
		2480	High	1.0994

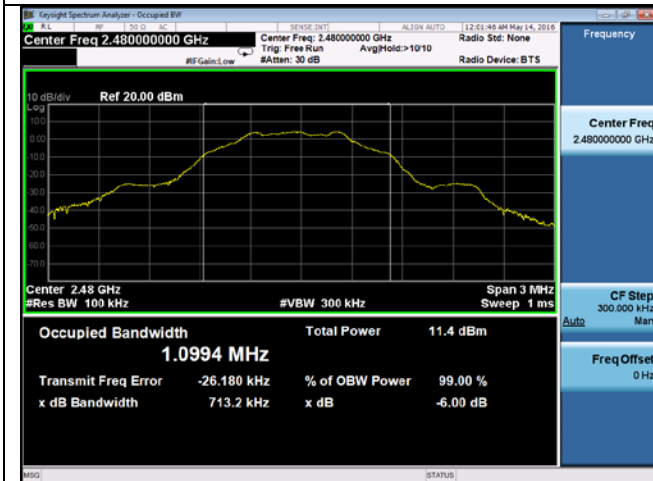
99dB Bandwidth Test Plot (Bluetooth LE)



99% BW –Bluetooth LE 2402MHz



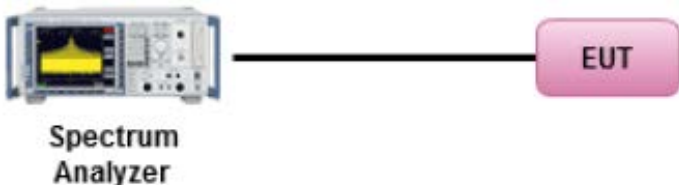
99% BW –Bluetooth LE 2440MHz



99% BW –Bluetooth LE 2480MHz

10.6 Peak Spectral Density (Bluetooth LE)

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e)	e)	DSSS: $\leq 8\text{dBm}/3\text{KHz}$	<input checked="" type="checkbox"/>
RSS247 (5.2.2)	f)	DSSS in hybrid sys with FH turned off: $\leq 8\text{dBm}/3\text{KHz}$	<input type="checkbox"/>
Test Setup			
Test Procedure	<p>558074 D01 DTS Meas Guidance v03r04, 10.2 Method PKPSD (peak PSD)</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: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$. - Set the VBW $\geq 3 \times \text{RBW}$. - Detector = Peak - Sweep time = auto couple. - Trace mode = Trace Max Hold over 100 traces - 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	05/13/2016	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

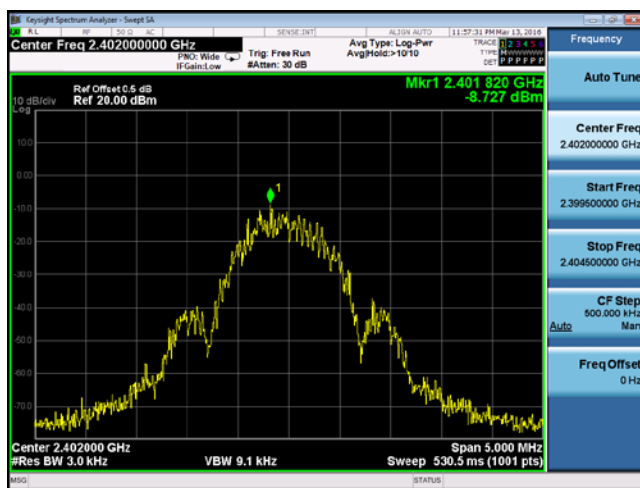
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *RF Test Site*.

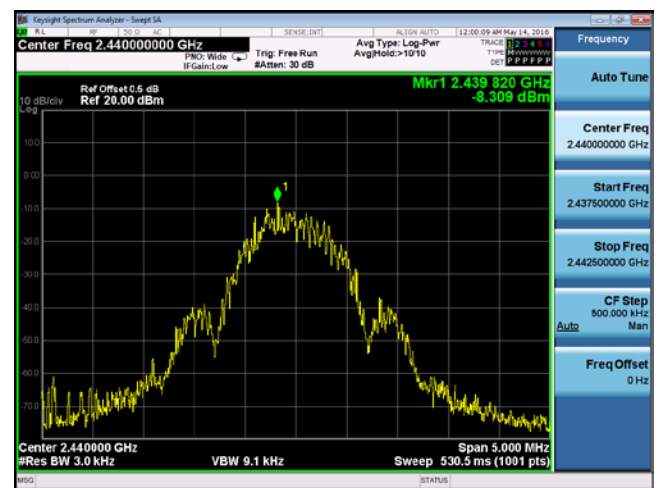
PSD measurement result (Bluetooth LE)

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	Bluetooth LE	2402	Low	-8.727	≤8	Pass
		2440	Mid	-8.309	≤8	Pass
		2480	High	-8.576	≤8	Pass

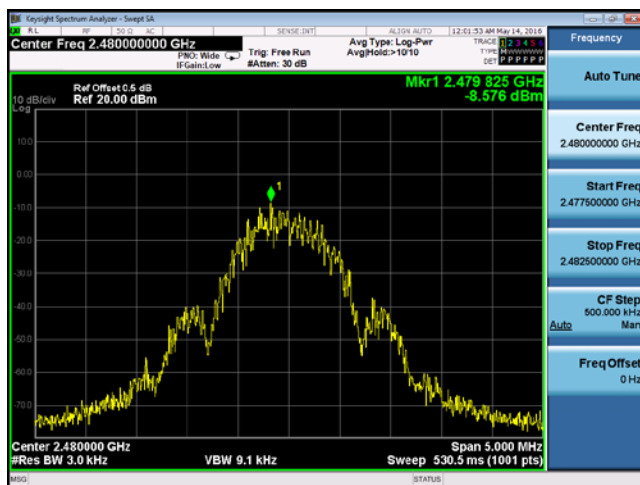
Test Plots (Bluetooth LE)



PSD -Bluetooth LE Low



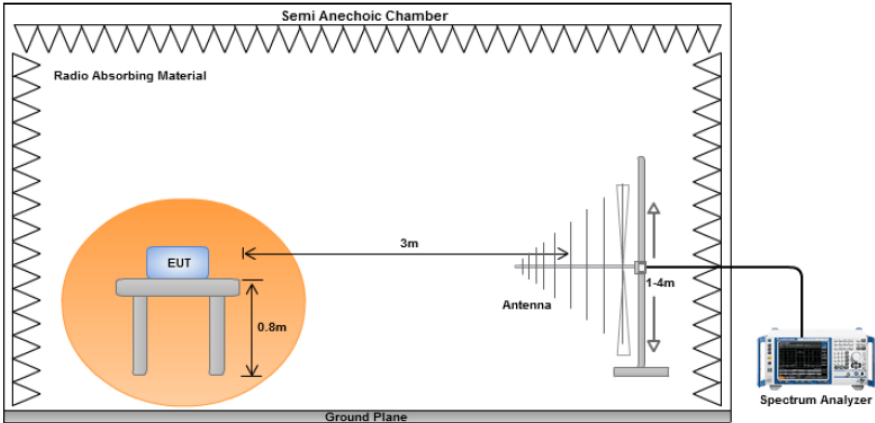
PSD -Bluetooth LE Mid



PSD -Bluetooth LE High

10.7 Transmitter Radiated Spurious Emissions Below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable							
47CFR§15.247(d), RSS247(5.5)	a)	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	<input checked="" type="checkbox"/>							
		<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>		Frequency range (MHz)	Field Strength (uV/m)	30 – 88	100	88 – 216	150	216 960
Frequency range (MHz)	Field Strength (uV/m)									
30 – 88	100									
88 – 216	150									
216 960	200									
Above 960	500									
Test Setup										
Procedure	<div>1. The EUT was switched on and allowed to warm up to its normal operating condition.</div> <div>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:<div>a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.</div><div>b. The EUT was then rotated to the direction that gave the maximum emission.</div><div>c. Finally, the antenna height was adjusted to the height that gave the maximum emission.</div></div> <div>3. A Quasi-peak measurement was then made for that frequency point.</div> <div>4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</div>									
Remark	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.									
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail									

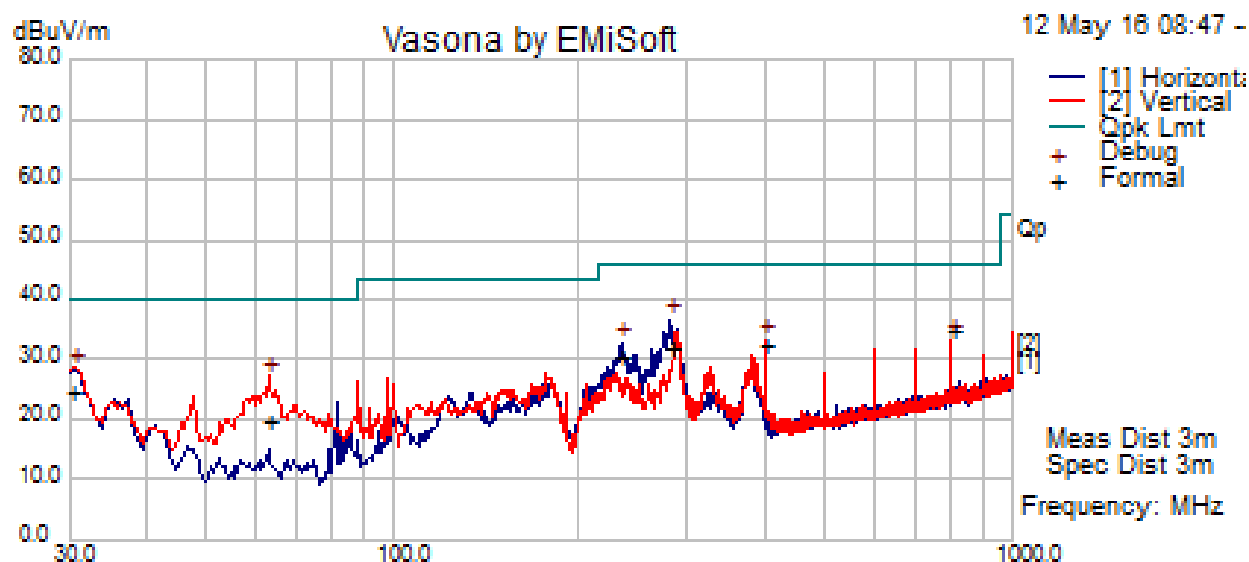
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *10m Chamber*.

Radiated Emission Test Results

Radiated Emission Test Results				
Test specification	Below 1GHz			
Environmental Conditions:	Temp (°C):	25.7	Result	
	Humidity (%)	29		
	Atmospheric (mPa):			
Mains Power:	110VAC, 60Hz			
Tested by:	Rachana Khanduri			
Test Date:	05/12/2016			
Remarks:	Bluetooth LE 2440MHz			



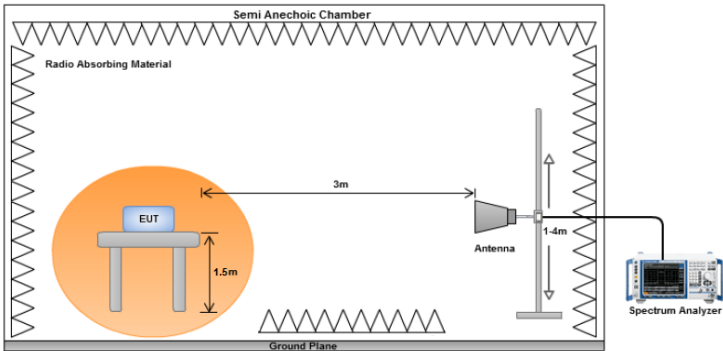
Quasi Max Measurement

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
280.14	55.69	2.57	-26.17	32.09	Quasi Max	H	120	255	46.02	-13.93	Pass
30.35	39.84	0.82	-15.95	24.71	Quasi Max	V	126	309	40.00	-15.29	Pass
799.99	47.60	4.51	-17.41	34.71	Quasi Max	V	116	186	46.02	-11.31	Pass
400.00	53.24	3.10	-23.86	32.49	Quasi Max	H	100	123	46.02	-13.53	Pass
63.21	49.53	1.21	-31.07	19.67	Quasi Max	V	102	164	40.00	-20.33	Pass
233.82	56.00	2.28	-27.82	30.46	Quasi Max	H	144	235	46.02	-15.56	Pass

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

10.8 Transmitter Radiated Spurious Emissions > 1GHz & Restricted band

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(5.5)	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 <input type="checkbox"/> 20 dB down <input checked="" type="checkbox"/> 30 dB down	<input checked="" type="checkbox"/>
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	<input checked="" type="checkbox"/>
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. An average measurement was then made for that frequency point. 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	<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 *Rachana Khanduri* at *3m Chamber*.

Radiated Emission Test Results

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
4801.29	52.96	7.04	-17.3	42.69	Peak Max	V	153	125	74	-31.31	Pass
7205.49	52.25	7.36	-11.59	48.02	Peak Max	V	191	345	74	-25.98	Pass
9607.94	51.36	7.89	-10.41	48.84	Peak Max	V	219	76	74	-25.17	Pass
4801.29	41.00	7.04	-17.3	30.74	Average Max	V	153	125	54	-23.27	Pass
7205.49	39.96	7.36	-11.59	35.74	Average Max	V	191	345	54	-18.26	Pass
9607.94	39.49	7.89	-10.41	36.97	Average Max	V	219	76	54	-17.03	Pass

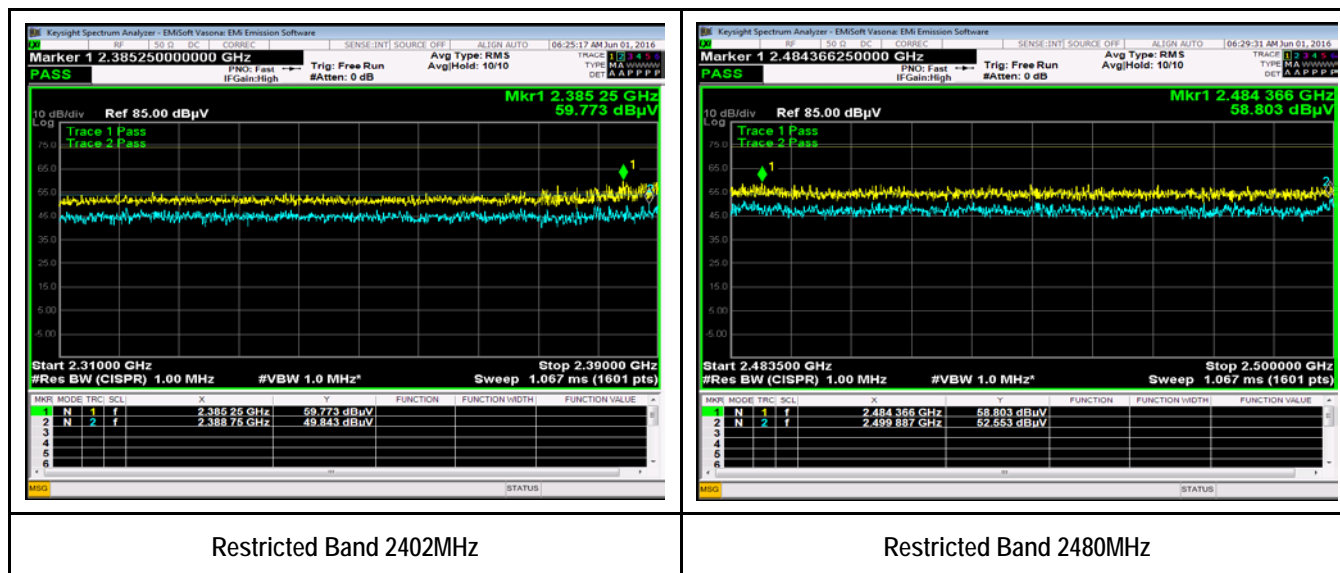
BLE – 2440MHz

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
7207.04	52.01	7.36	-11.58	47.79	Peak Max	H	211	211	74	-26.21	Pass
9606.58	51.35	7.89	-10.42	48.82	Peak Max	H	213	131	74	-25.18	Pass
1753.34	60.10	4.76	-28.64	36.22	Peak Max	H	199	74	74	-37.78	Pass
7207.04	39.97	7.36	-11.58	35.75	Average Max	H	211	211	54	-18.25	Pass
9606.58	39.27	7.89	-10.42	36.73	Average Max	H	213	131	54	-17.27	Pass
1753.34	45.75	4.76	-28.64	21.88	Average Max	H	199	74	54	-32.12	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
4798.97	52.35	7.04	-17.31	42.08	Peak Max	V	203	209	74	-31.92	Pass
7204.70	51.19	7.36	-11.59	46.97	Peak Max	V	187	240	74	-27.03	Pass
9607.80	51.05	7.89	-10.41	48.52	Peak Max	V	169	249	74	-25.48	Pass
4798.97	40.45	7.04	-17.31	30.17	Average Max	V	203	209	54	-23.83	Pass
7204.70	39.53	7.36	-11.59	35.31	Average Max	H	165	131	54	-18.69	Pass
9607.80	38.97	7.89	-10.41	36.44	Average Max	H	152	218	54	-17.56	Pass

Restricted Band Test plot



















Annex A. TEST INSTRUMENT






Instrument	Model	Manufacturer	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions							
R & S Receiver	ESIB 40	Rohde & Schwarz	100179	06/08/2016	1 Year	06/08/2017	<input checked="" type="checkbox"/>
CHASE LISN (9k-30MHz)	MN2050B	Chase	1018	08/07/2015	1 Year	08/07/2016	<input checked="" type="checkbox"/>
Radiated Emissions							
R & S Receiver	ESIB 40	Rohde & Schwarz	100179	06/08/2016	1 Year	06/08/2017	<input checked="" type="checkbox"/>
Spectrum Analyzer	N9010A	Keysight	10SL0219	08/20/2015	1 Year	08/20/2016	<input checked="" type="checkbox"/>
Pre-Amplifier (1-26.5GHz)	8449B	Hewlett Packard	3008A00715	03/30/2016	1 Year	03/30/2017	<input checked="" type="checkbox"/>
Preamplifier (100KHz-7GHz)	LPA-6-30	RF Bay, Inc.	11140711	02/10/2016	1 Year	02/10/2017	<input checked="" type="checkbox"/>
ETS-Lingren Loop Antenna	6512	ETS-Lingren	00049120	05/12/2015	1 Year	05/12/2016	<input type="checkbox"/>
Bi-Log antenna (30MHz~2GHz)	JB1	Sunol Sciences	A030702	08/15/2015	1 Year	08/15/2016	<input checked="" type="checkbox"/>
Horn Antenna (1-26.5GHz)	3115	EMCO	10SL0059	08/25/2015	1 Year	08/25/2016	<input checked="" type="checkbox"/>
3 Meters SAC	3M	ETS-Lingren	N/A	06/09/2016	1 Year	06/09/2017	<input checked="" type="checkbox"/>
10 Meters SAC	10M	ETS-Lingren	N/A	09/05/2015	1 Year	09/05/2016	<input checked="" type="checkbox"/>
RF Conducted Measurement							
Spectrum Analyzer	N9010A	Keysight	10SL0219	08/20/2015	1 Year	08/20/2016	<input checked="" type="checkbox"/>
USB RF Power Sensor	7002-006	ETS-Lingren	10SL0190	09/03/2015	1 Year	09/03/2016	<input checked="" type="checkbox"/>

Test Software Version

Test Item	Vendor	Software	Version
Radiated 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		<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>
Korea CAB Accreditation		<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> <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		<p>R-3083: Radiation 3 meter site</p> <p>C-3421: Main Ports Conducted Interference Measurement</p> <p>T-1597: Telecommunication Ports Conducted Interference Measurement</p>
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