RF TEST REPORT

Report No.: FCC_IC_RF_SL18091002-RUC-050_Zigbee Rev_2.0
Supersede Report No.: FCC_IC_RF_SL18091002-RUC-050_Zigbee 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, April 2018 558074 D01 15.247 Meas Guidance v05r01
FCC ID	:	S9GR750
IC	:	5912A-R750
Dates of test	:	02/20/2019-04/08/2019
Issue Date	:	06/03/2019
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:	
	
Deon Dai	**Chen Ge**
Test Engineer	Engineer Reviewer

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

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_Zigbee	None	Original	04/09/2019
FCC_IC_RF_SL18091002-RUC-050_Zigbee Rev_1.0	Rev_1.0	Update Antenna Gain	05/24/2019
FCC_IC_RF_SL18091002-RUC-050_Zigbee Rev_2.0	Rev_2.0	Update Per Review	06/03/2019

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 Zigbee:

Radio Type	Zigbee
Operating Frequency	2405MHz-2480MHz
Modulation	QPSK
Channel Spacing	5 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 diferent 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	☒ Pass ☐ N/A
	IC	RSS Gen 8.10	IC		
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A
	IC	RSS Gen 8.8	IC	RSS Gen Issue 5: 2018	

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Occupied Bandwidth	-	-	-	-	☒ Pass ☐ N/A
	IC	RSS Gen 6.7	IC	RSS Gen Issue 5: 2018	
6dB Bandwidth	FCC	15.247(a)(2)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.2.a)	IC		
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.5)	IC		
Output Power	FCC	15.247(b)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.4.d)	IC		
Receiver Spurious Emissions	IC	RSS Gen (7.3)	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 DTS Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS247 (5.2.b)	IC		
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
	IC	RSS Gen(3.4)	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

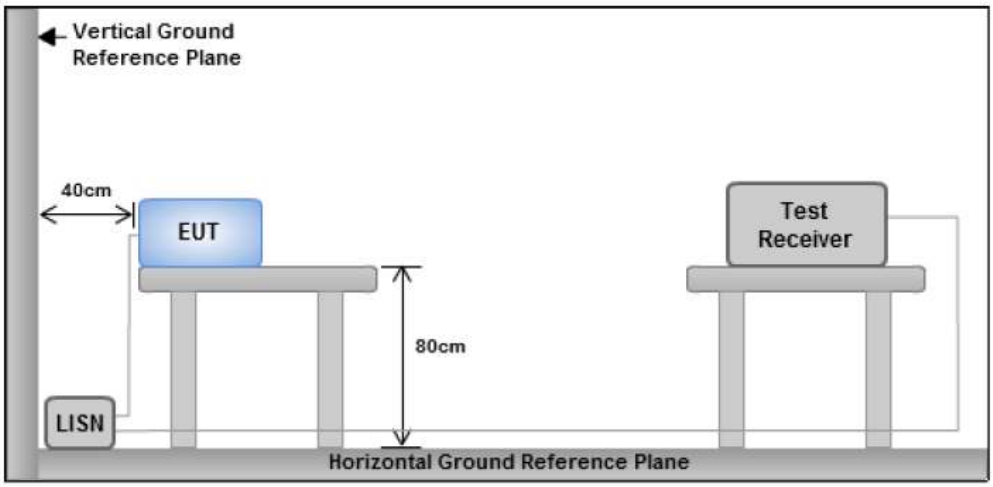
10.1 Conducted Emissions

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 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	EUT was tested at 120VAC, 60Hz
Result	☒ Pass ☐ Fail

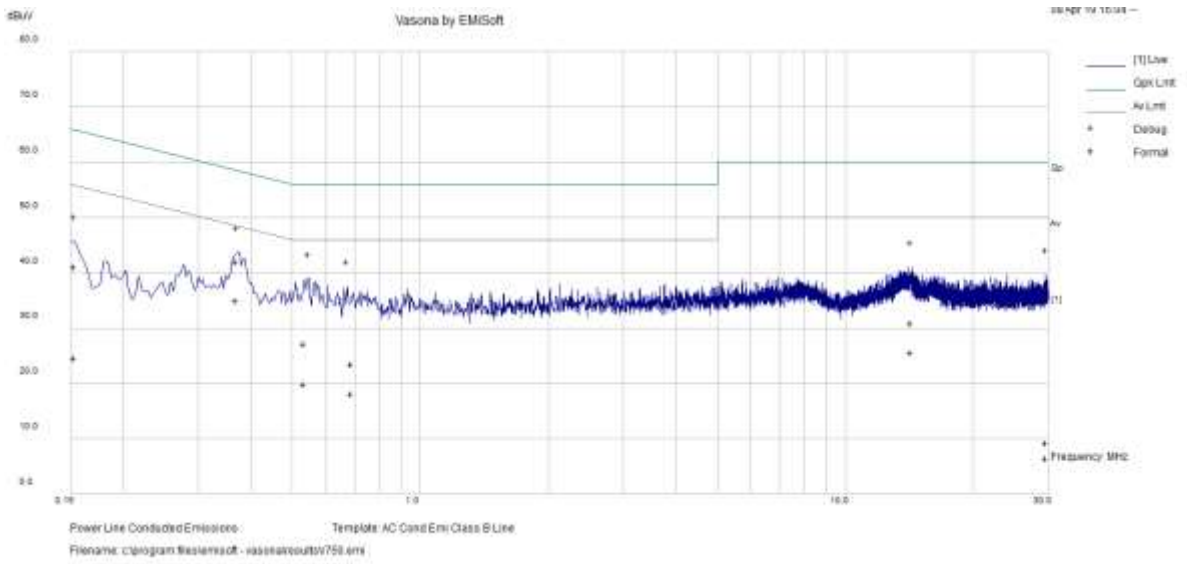
Test Data ☒ Yes ☐ N/A

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:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Deon Dai			
Test Date:	04/08/2019			
Remarks	POE, Live			

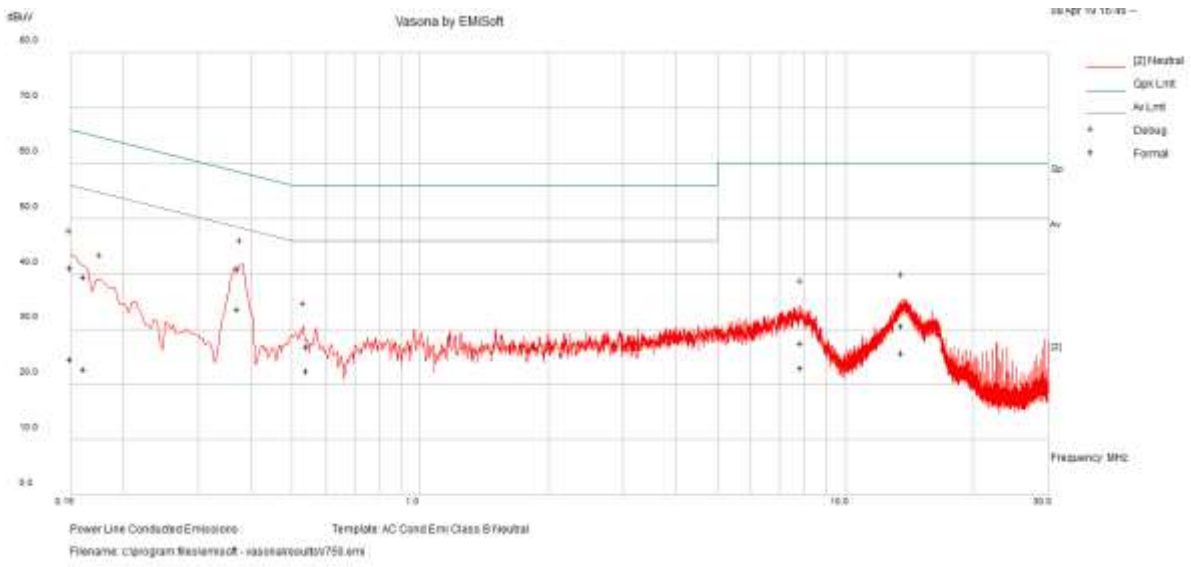


Live Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.37	34.65	7.29	0.04	41.98	Quasi Peak	Live	58.53	-16.55	Pass
0.53	19.79	7.38	0.04	27.21	Quasi Peak	Live	56	-28.79	Pass
0.69	15.92	7.51	0.04	23.47	Quasi Peak	Live	56	-32.53	Pass
14.30	21.66	8.86	0.34	30.86	Quasi Peak	Live	60	-29.14	Pass
0.15	33.93	7.12	0.05	41.1	Quasi Peak	Live	65.83	-24.74	Pass
29.65	-0.45	9.05	0.61	9.21	Quasi Peak	Live	60	-50.79	Pass
0.37	27.53	7.29	0.04	34.86	Average	Live	48.53	-13.67	Pass
0.53	12.51	7.38	0.04	19.93	Average	Live	46	-26.07	Pass
0.69	10.61	7.51	0.04	18.15	Average	Live	46	-27.85	Pass
14.30	16.4	8.86	0.34	25.6	Average	Live	50	-24.4	Pass
0.15	17.39	7.12	0.05	24.56	Average	Live	55.83	-31.28	Pass
29.65	-3.28	9.05	0.61	6.38	Average	Live	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:	120Vac, 60Hz			
Tested by:	Deon Dai			
Test Date:	04/08/2019			
Remarks	POE, Neutral			

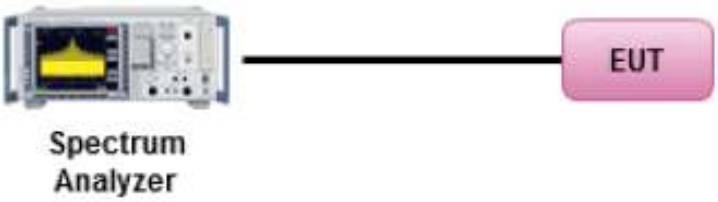


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.37	33.46	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

10.2 6dB & 99% Bandwidth

Requirement(s):

Spec	Requirement	Applicable
§ 15.247 RSS247 (5.2.a)	6dB BW≥500KHz;	☒
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).	☒
Test Setup		
Test Procedure	558074 D01 DTS Meas Guidance v05r01, 8.2 DTS bandwidth ANSI C63.10, 11.8 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	03/09/2019	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 Deon Dai at RF test site.

Zigbee:

Channel	Channel Frequency (MHz)	OBW	
		99% (MHz)	6dB(MHz)
Low	2405	2.236	1.808
Mid	2440	2.241	1.794
High	2480	2.233	1.819

6dB & 99% Bandwidth Test Plots

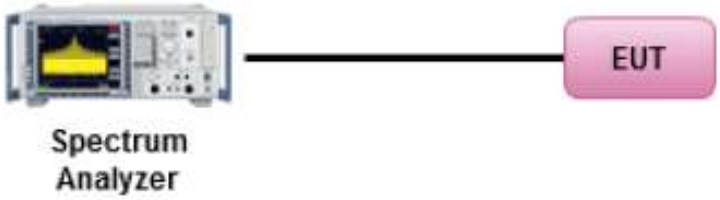
Zigbee-2405MHz

Zigbee-2440MHz

Zigbee-2480MHz

10.3 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.4.4)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤1 Watt	☐
	b)	FHSS in 5725-5850MHz: ≤1 Watt	☐
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤0.125 Watt.	☐
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤1 Watt	☐
	e)	FHSS in 902-928MHz with ≥ 25 & <50 channels: ≤0.25 Watt	☐
	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 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: a. Set the RBW DTS bandwidth. b. Set VBW [3 × RBW]. c. Set span [3 × RBW]. d. Sweep time = auto couple. e. Detector = peak. f. Trace mode = max hold. g. Allow trace to fully stabilize. h. Use peak marker function to determine the peak amplitude level.		
Test Date	03/09/2019	Environmental condition	Temperature 23ºC Relative Humidity 44% Atmospheric Pressure 1021mbar
Remark	NONE		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

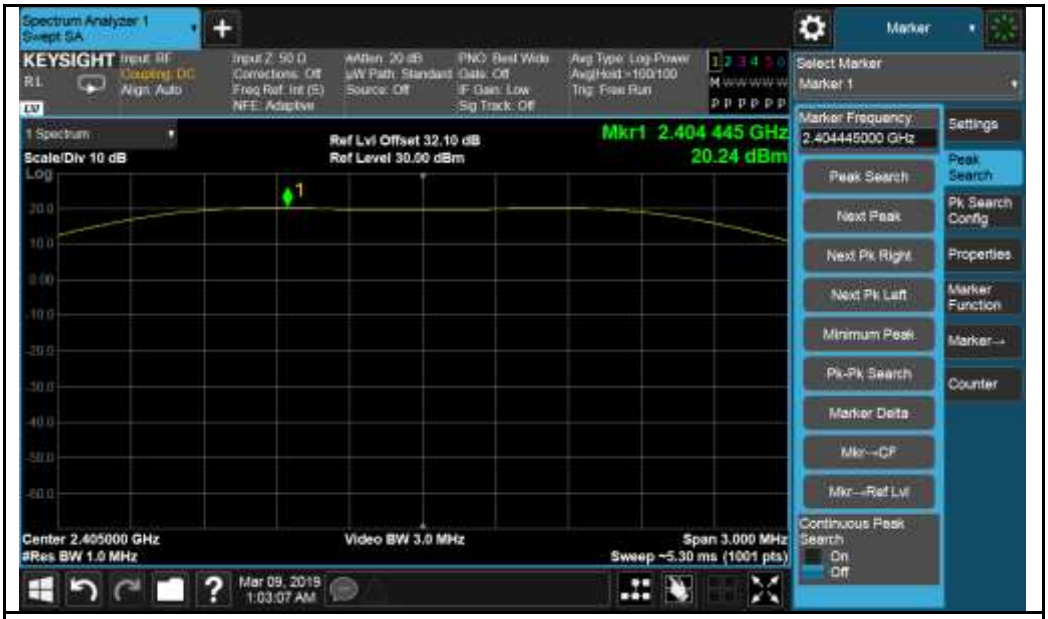
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Deon Dai at RF test site.

Output Power measurement results for Zigbee:

Type	Freq (MHz)	Test mode	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2405	Zigbee	Low	20.24	≤30	Pass
	2440	Zigbee	Mid	19.98	≤30	Pass
	2480	Zigbee	High	19.84	≤30	Pass

Test Plots:



Zigbee-2405MHz

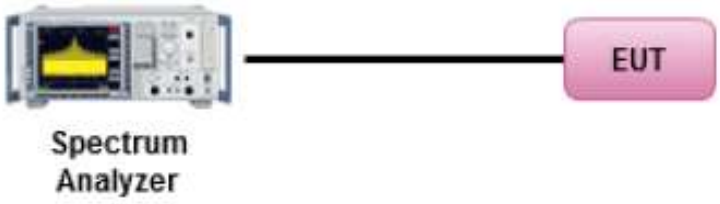
Zigbee-2440MHz

Zigbee-2480MHz

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 ☒ 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	03/09/2019	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22°C 46% 1020mbar
Remark	-			
Result	☒ Pass ☐ 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:

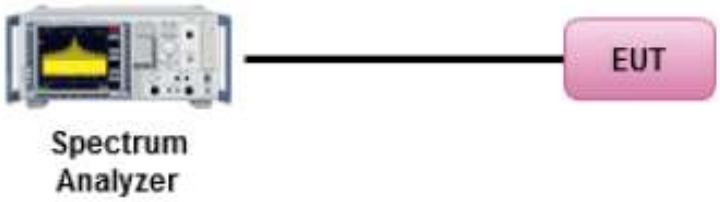
Zigbee-2405MHz

Zigbee-2480MHz

10.5 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e) RSS247 (5.2.b)	e)	DSSS: ≤8dBm/3KHz	☒
	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v05r01, 8.4 ANSI C63.10:2013, 11.10.2 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	03/09/2019	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22°C 46% 1020mbar
Remark	N/A			
Result	☒ Pass ☐ 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 Zigbee:

Type	Freq (MHz)	Test mode	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	2405	Zigbee	Low	4.88	8	Pass
	2440	Zigbee	Mid	4.93	8	Pass
	2480	Zigbee	High	4.61	8	Pass

Test Plots

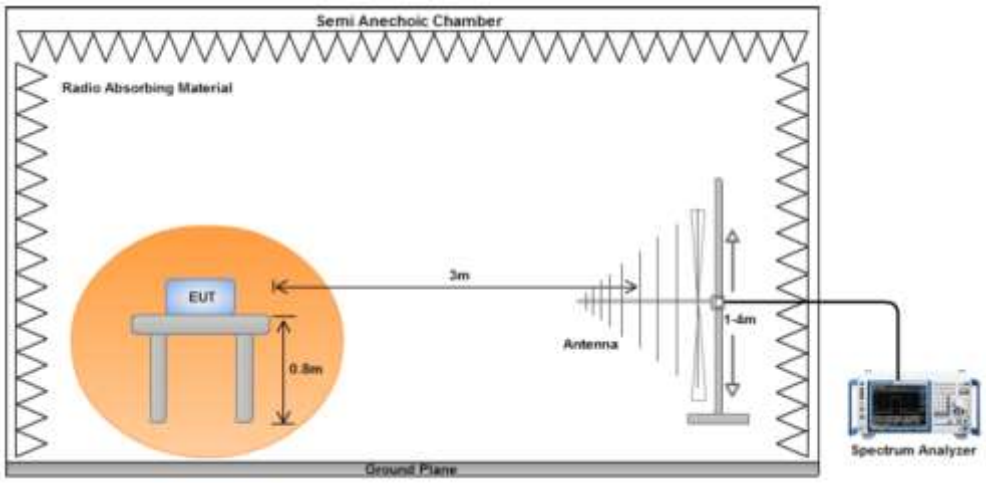
Zigbee-2405MHz

Zigbee-2440MHz

Zigbee-2480MHz

10.6 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d) RSS247 (A8.5)	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 **Frequency range (MHz) / Field Strength (uV/m)** 30 – 88 / 100 88 – 216 / 150 216 960 / 200 Above 960 / 500	☒
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. 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.	
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		☒ Pass ☐ Fail	

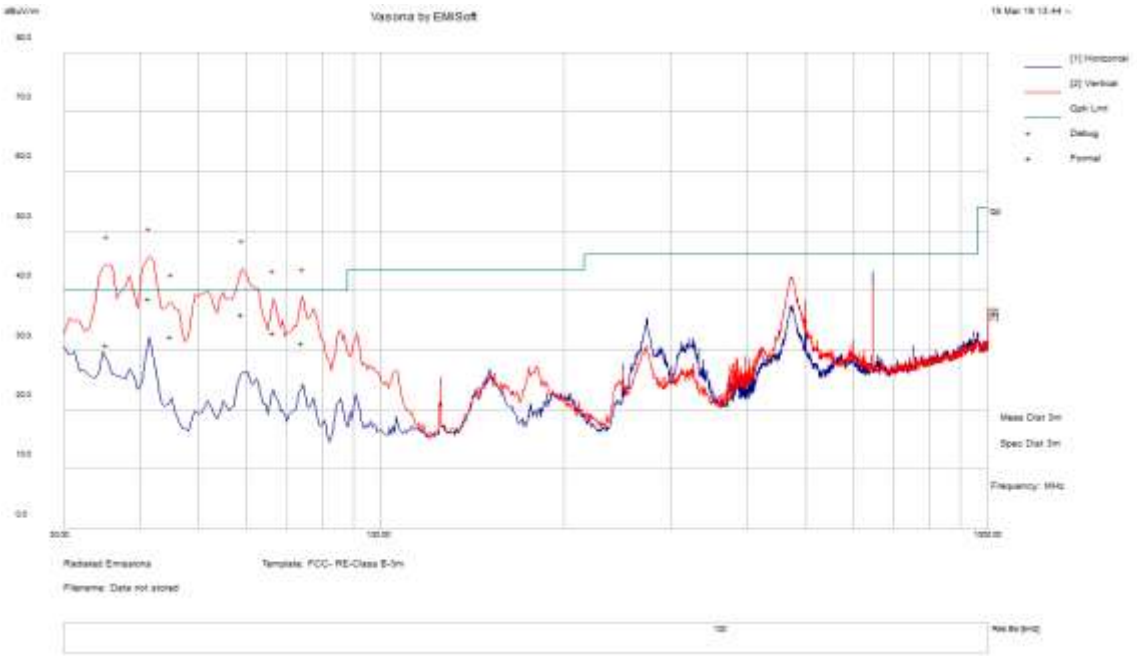
Test Data ☒ Yes (See below) ☐ N/A

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	Pass
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	120VAC, 60Hz			
Tested by:	Deon Dai			
Test Date:	03/19/2019			
Remarks:	Zigbee, 2440MHz			

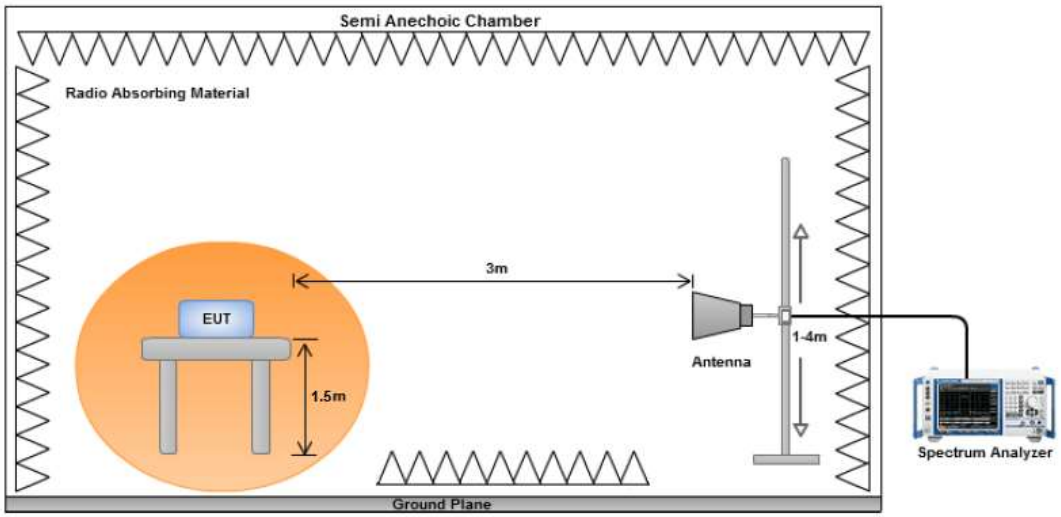


Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
41.36	48.71	11.33	-21.26	38.78	Quasi Max	V	105	292	40	-1.22	Pass
35.22	36.58	11.2	-16.72	31.06	Quasi Max	V	174	23	40	-8.94	Pass
58.92	51.88	11.5	-27.26	36.12	Quasi Max	V	104	159	40	-3.88	Pass
74.21	47.15	11.62	-27.45	31.32	Quasi Max	V	197	168	40	-8.68	Pass
66.42	48.74	11.55	-27.26	33.03	Quasi Max	V	132	184	40	-6.97	Pass
44.99	44.6	11.4	-23.62	32.37	Quasi Max	V	111	255	40	-7.63	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)	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			
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 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	☒ Pass ☐ Fail		

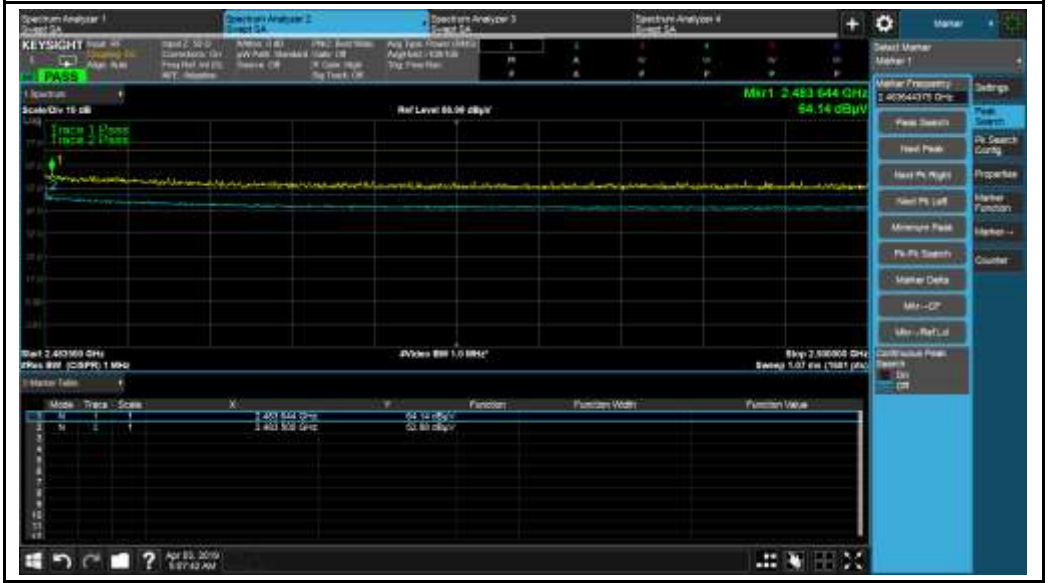
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Deon Dai at 10m chamber.

Restricted Band Measurement Plots:

Zigbee-2405MHz



Zige-2480MHz

Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz- Zigbee - 2405MHz

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
3457.82	47.32	3.56	-13.73	37.15	Peak Max	V	212	295	74	-36.85	Pass
4810.13	48.77	4.11	-10.91	41.97	Peak Max	V	220	26	74	-32.03	Pass
7324.48	49.99	5.15	-7.66	47.48	Peak Max	H	167	146	74	-26.52	Pass
3457.82	32.83	3.56	-13.73	22.66	Average Max	V	212	295	54	-31.34	Pass
4810.13	33.81	4.11	-10.91	27.01	Average Max	V	220	26	54	-26.99	Pass
7324.48	35.77	5.15	-7.66	33.26	Average Max	H	167	146	54	-20.74	Pass

Above 1GHz-25GHz- Zigbee - 2440MHz

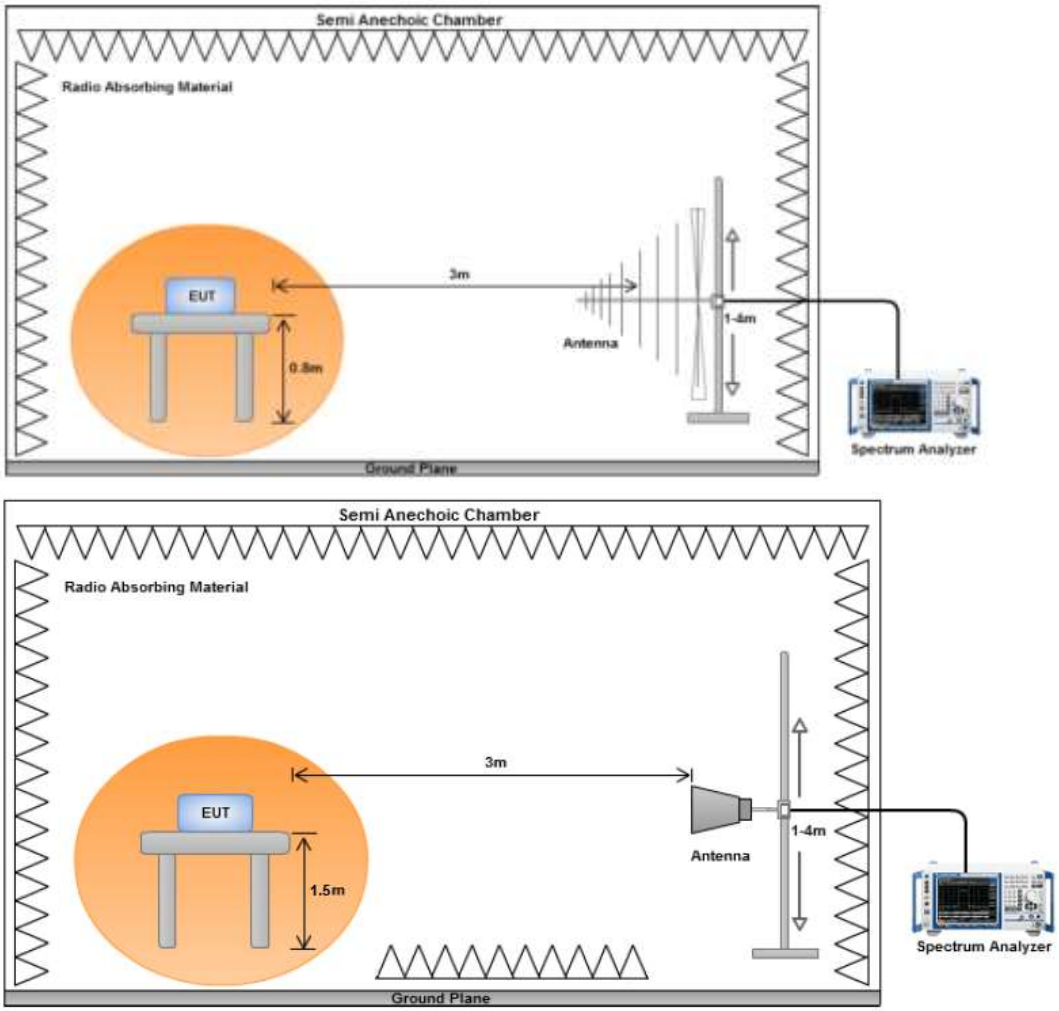
Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
3967.97	47.76	3.81	-12.69	38.88	Peak Max	H	207	294	74	-35.12	Pass
4879.79	48.26	4.17	-11.03	41.4	Peak Max	V	220	26	74	-32.6	Pass
7075.38	49.69	5.1	-7.78	47.01	Peak Max	H	169	154	74	-26.99	Pass
3967.97	33.27	3.81	-12.69	24.39	Average Max	H	207	294	54	-29.61	Pass
4879.79	33.27	4.17	-11.03	26.41	Average Max	V	220	26	54	-27.59	Pass
7075.38	35.01	5.1	-7.78	32.33	Average Max	H	169	154	54	-21.67	Pass

Above 1GHz-25GHz- Zigbee - 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
3947.70	48.3	3.79	-12.73	39.36	Peak Max	H	213	297	74	-34.64	Pass
4960.05	48.18	4.25	-11.16	41.27	Peak Max	V	215	26	74	-32.73	Pass
7048.06	49.8	5.1	-7.79	47.11	Peak Max	H	162	146	74	-26.89	Pass
3947.70	33.55	3.79	-12.73	24.61	Average Max	H	213	297	54	-29.39	Pass
4960.05	33.76	4.25	-11.16	26.85	Average Max	V	215	26	54	-27.15	Pass
7048.06	35.8	5.1	-7.79	33.11	Average Max	H	162	146	54	-20.89	Pass

10.8 Receiver Radiated Emissions

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>RSS GEN (7.3)</td><td>a)</td><td>Spurious emissions from receivers shall not exceed the radiated emissions limits shown in table 3.
<table>
<tr><th colspan="2">Table 3 – Receiver radiated emissions limits</th></tr>
<tr><th>Frequency (MHz)</th><th>Field strength (μV/m at 3 metres)</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 (Below 1G). An average measurement was then made for that frequency point (Above 1G).
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</td></tr>
</table>

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	☒ Pass ☐ Fail

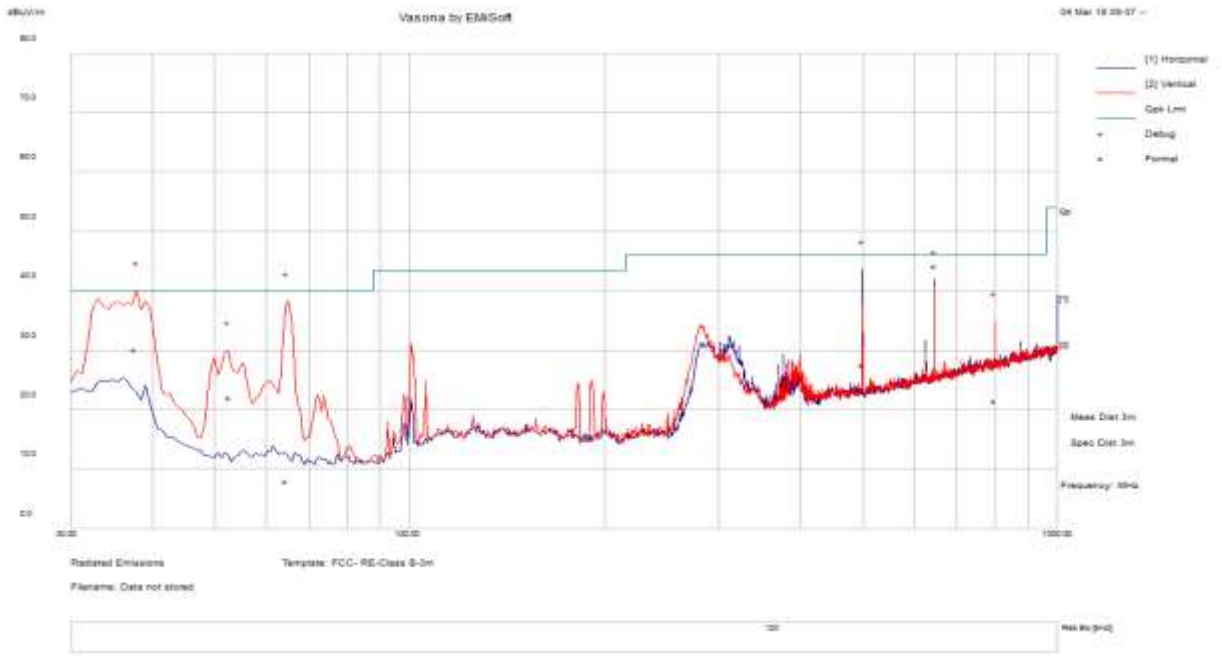
Test Data ☒ Yes (See below) ☐ N/A

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	Pass
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	120VAC, 60Hz			
Tested by:	Deon Dai			
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	☑
LISN	3816/2NM	214372	01/10/2019	1 Year	01/10/2020	☑
Radiated Emissions						
50GHz Spectrum Analyzer	N9030B(PXA)	MY57140374	08/20/2018	1 Year	08/20/2019	☑
Bi-Log antenna (30MHz~6GHz)	JB6	A111717	08/12/2018	1 Year	08/12/2019	☑
Horn Antenna (1GHz~26GHz)	3115	100059	01/26/2019	1 Year	01/26/2020	☑
Horn Antenna (26GHz~40GHz)	AH-840	101013	08/28/2018	1 Year	08/28/2019	☑
Pre-Amplifier(0.3MHz-6.5GHz)	LPA-6-30	11170602	02/06/2019	1 Year	02/06/2020	☑
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	08/16/2018	1 Year	08/16/2019	☑
Pre-Amp (10MHz~50GHz)	RAMP00M50GA	17032300047	02/10/2019	1 Year	02/10/2020	☑
RF Conducted Measurement						
50GHz Spectrum Analyzer	N9030B (PXA)	MY57140584	10/02/2018	1 Year	10/02/2019	☑

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