

# RF TEST REPORT





Report No.: FCC\_IC\_RF\_SL18052903-ALT-003

Supersede Report No.: None

Applicant	:	Altierre Corporation
Product Name	:	Wireless Large display tag
Model No.	:	ATH100ES
Test Standard	:	FCC 15.247 RSS247 Issue 2, 2017
Test Method	:	ANSI C63.10: 2013 RSS-Gen Issue 5, April 2018 FCC Public Notice DA 00-705
FCC ID	:	W22-ATH
IC	:	9005A-ATH
Dates of test	:	08/14/2018-08/20/2018
Issue Date	:	08/28/2018
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
RF Test Engineer	Engineer Reviewer

Issued By:  
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## Laboratory Introduction

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### 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_SL18052903-ALT-003	None	Original	08/28/2018

## 2 Executive Summary

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

Company: Altierre Corporation  
Product: Wireless Large display tag  
Model: ATH100ES

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

## 3 Customer information

Applicant Name	:	Altierre Corporation
Applicant Address	:	1980 Concourse Drive San Jose, CA 95131 USA
Manufacturer Name	:	Altierre Corporation
Manufacturer Address	:	1980 Concourse Drive San Jose, CA 95131 USA

## 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	Wireless Large display tag
Model No.	ATH100ES
Trade Name	Altierre Corporation
Serial No.	N/A
Input Power	3.0Vdc
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	06/27/2018
Equipment Class/ Category	FHSS
Clock Frequencies	N/A
Port/Connectors	N/A

### 6.2 Spec for BT Radio

Radio Type	FHSS
Operating Frequency	2401.5MHz-2479.5MHz
Modulation	FHSS
Channel Spacing	1MHz
Antenna Type	PIFA Antenna
Antenna Gain	0
Antenna Connector Type	-

#### Channel List

Type	Channel No.	Frequency (MHz)	Power Setting
2401.5-2479.5MHz	0	2401.5	Software default
	39	2440.5	Software default
	78	2479.5	Software default

### 6.3 EUT test modes/configuration Description

Mode	Note
-	-
-	-

## 7 Supporting Equipment/Software and cabling Description

### 7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Wireless AP	AAP400	-	Altierre Corporation	-
2	Procurve Switch	J9077A	-	HP	-
3	Power Injectort	SMCPWR-INJ3	T17420031	EliteConnect™	-
4	Laptop	Z61e	-	Lenovo	-

### 7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
USB Cable	Laptop	USB	EUT	USB	1.8	-	-

### 7.3 Test Software Description

Test Item	Software	Description
RF Testing	CC tag GUI	Set the EUT to transmit continuously in diferent test mode
RF Testing	Factory Test tool	Set the EUT to transmit FHSS mode

## 8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Antenna Requirement	FCC	15.203	FCC	ANSI C63.10 – 2013	<input checked="" type="checkbox"/> Pass
	IC	-	IC	558074 D01 DTS Meas. Guidance v03r02	<input type="checkbox"/> N/A
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10: 2013 Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen 8.10	IC	RSS-Gen Issue 5, April 2018	<input type="checkbox"/> N/A
AC Conducted Emissions Voltage	FCC	15.207(a)	FCC	ANSI C63.10: 2013	<input type="checkbox"/> Pass
	IC	RSS Gen 8.8	IC	RSS-Gen Issue 5, April 2018	<input checked="" type="checkbox"/> N/A*

### DSS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Channel Separation	FCC	15.247 (a)(1)	FCC	Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.1.5)	IC	-	<input type="checkbox"/> N/A
20dB Occupied Bandwidth	FCC	15.247(a)(1)	FCC	Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.1.2)	IC	-	<input type="checkbox"/> N/A
99% Occupied Bandwidth	FCC	15.247(a)(2)	FCC		<input checked="" type="checkbox"/> Pass
	IC	RSS Gen 6.6	IC	RSS Gen Issue 4: 2014 -	<input type="checkbox"/> N/A
Number of Hopping Channels	FCC	15.247(a)(1)	FCC	Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.1.5)	IC	-	<input type="checkbox"/> N/A
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS247(5.5)	IC	-	<input type="checkbox"/> N/A
Time of Occupancy	FCC	15.247(a)(1)	FCC	Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.1.5)	IC	-	<input type="checkbox"/> N/A
Output Power	FCC	15.247(b)	FCC	Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.4.2)	IC	-	<input type="checkbox"/> N/A
Receiver Spurious Emissions	FCC	15.247(d)	FCC	-	<input type="checkbox"/> Pass
	IC	RSS Gen (7.1)	IC	RSS Gen (7.1)	<input checked="" type="checkbox"/> N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	Public Notice DA 00-705	<input type="checkbox"/> Pass
	IC	RSS247 (5.4.6)	IC	-	<input checked="" type="checkbox"/> N/A
Power Spectral Density	FCC	15.247(e)	FCC	Public Notice DA 00-705	<input type="checkbox"/> Pass
	IC	RSS247 (5.2.2)	IC	-	<input checked="" type="checkbox"/> N/A
Hybrid System Requirement	FCC	15.247(f)	FCC	Public Notice DA 00-705	<input type="checkbox"/> Pass
	IC	RSS247 (5.3)	IC	-	<input checked="" type="checkbox"/> N/A
Hopping Capability	FCC	15.247(g)	FCC	Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS247 (5.1.5)	IC	-	<input type="checkbox"/> N/A
RF Exposure requirement	FCC	15.247(i)	FCC	Public Notice DA 00-705	<input type="checkbox"/> Pass
	IC	RSS Gen(3.2)	IC	-	<input checked="" type="checkbox"/> N/A

- |        |  |
|--------|--|
| Remark | <ol style="list-style-type: none"> <li>All measurement uncertainties are not taken into consideration for all presented test result.</li> <li>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.</li> <li>N/A* EUT is battery powered only.</li> </ol> |
|--------|--|

## 9 Measurement Uncertainty

### 9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
LISN Insertion Loss	0.40	Normal	2	1	0.20
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch LISN - Receiver	0.25	U-Shape	1.414	1	0.1768033
LISN Impedance	2.5	Triangular	2.449	1	1.0208248
Combined Standard Uncertainty					1.928133
Expanded Uncertainty (K=2)					3.856266

The total derived measurement uncertainty is +/- 3.86 dB.

### 9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					6.0118262

The total derived measurement uncertainty is +/- 6.00 dB.

### 9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					8.4726

The total derived measurement uncertainty is +/- 8.47 dB.

### 9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

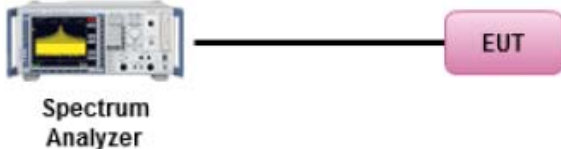
Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					0.952174

The total derived measurement uncertainty is +/- 0.95 dB.

## 10 Measurements, Examination and Derived Results

### 10.1 Channel Separation

Requirement(s):

Spec	Item	Requirement	Applicable
47 CFR §15.247 (e) RSS-247 (A2.6)	1	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.	<input checked="" type="checkbox"/>
Test Setup			
Test Procedure	<u>Channel Separation procedure</u> <ul style="list-style-type: none"> <li>- The EUT must have its hopping function enabled.</li> <li>- Span = wide enough to capture the peaks of two adjacent channels</li> <li>- RBW = Start with the RBW set to approximately 30% of the channel spacing; adjust necessary to best identify the center of each individual channel.</li> <li>- Video (or Average) Bandwidth (VBW) ≥ RBW.</li> <li>- Sweep = Auto</li> <li>- Detector = Peak.</li> <li>- Trace mode = max hold.</li> <li>- Allow the trace to stabilize.</li> <li>- Use the marker-delta function to determine the separation between the peaks of the adjacent channels.</li> </ul>		
Test Date	08/17/2018	Environmental condition	Temperature 21°C Relative Humidity 46% Atmospheric Pressure 1019mbar
Remark	Limit for Channel Separation 2/3 20MHz BW can be found in section 10.3		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

Test Data    ☒ Yes (See below)      ☐ N/A

Test Plot    ☒ Yes (See below)      ☐ N/A

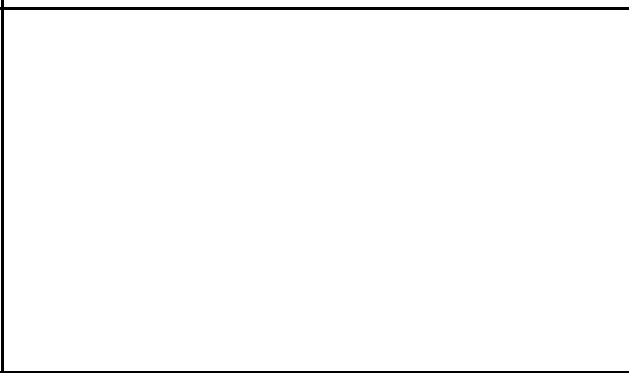
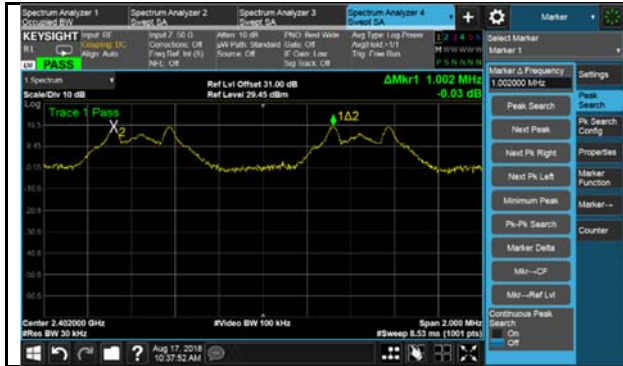
Test was done by Deon Dai at *RF Test Site*.

Configuration : Bluetooth Mode , BDR Mode

Channel	Channel Frequency (MHz)	Channel Separation (MHz)	>2/3 20dB Bandwidth (MHz)	Pass/Fail
Low	2401.5	1.002	>659.73	Pass
Mid	2440.5	1.003	>576.13	Pass
High	2479.5	1.002	>621.20	Pass

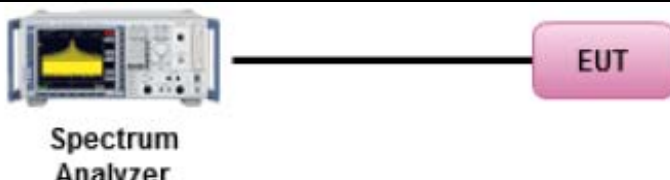
Note: The results of 20dB BW can be found in section 10.3.

### Channel Separation Test Plot (Bluetooth BDR/EDR)



## 10.2 20dB and 99% Occupied Bandwidth

Requirement(s):

Spec	Requirement	Applicable
47 CFR §15.247	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 2/3 of 20 dB bandwidth of the hopping channel, whichever is greater.	<input checked="" type="checkbox"/>
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		
Procedure	<p><u>20dB Emission bandwidth measurement procedure</u></p> <ul style="list-style-type: none"> <li>- Set RBW <math>\geq</math> 1% of 20dB Bandwidth</li> <li>- Set the video bandwidth (VBW) <math>\geq</math> RBW.</li> <li>- Detector = Peak.</li> <li>- Trace mode = max hold.</li> <li>- Sweep = auto couple.</li> <li>- Allow the trace to stabilize.</li> <li>- 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.</li> </ul> <p><u>99% bandwidth measurement procedure</u></p> <ol style="list-style-type: none"> <li>1. EUT was set for low , mid, high channel with modulated mode and highest RF output power.</li> <li>2. The spectrum analyzer was connected to the antenna terminal.</li> </ol>	
Test Date	08/17/2018	Environmental condition Temperature 23oC Relative Humidity 47% Atmospheric Pressure 1019mbar
Remark	The result of 20dB BW measurement is for reference only.	
Result	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

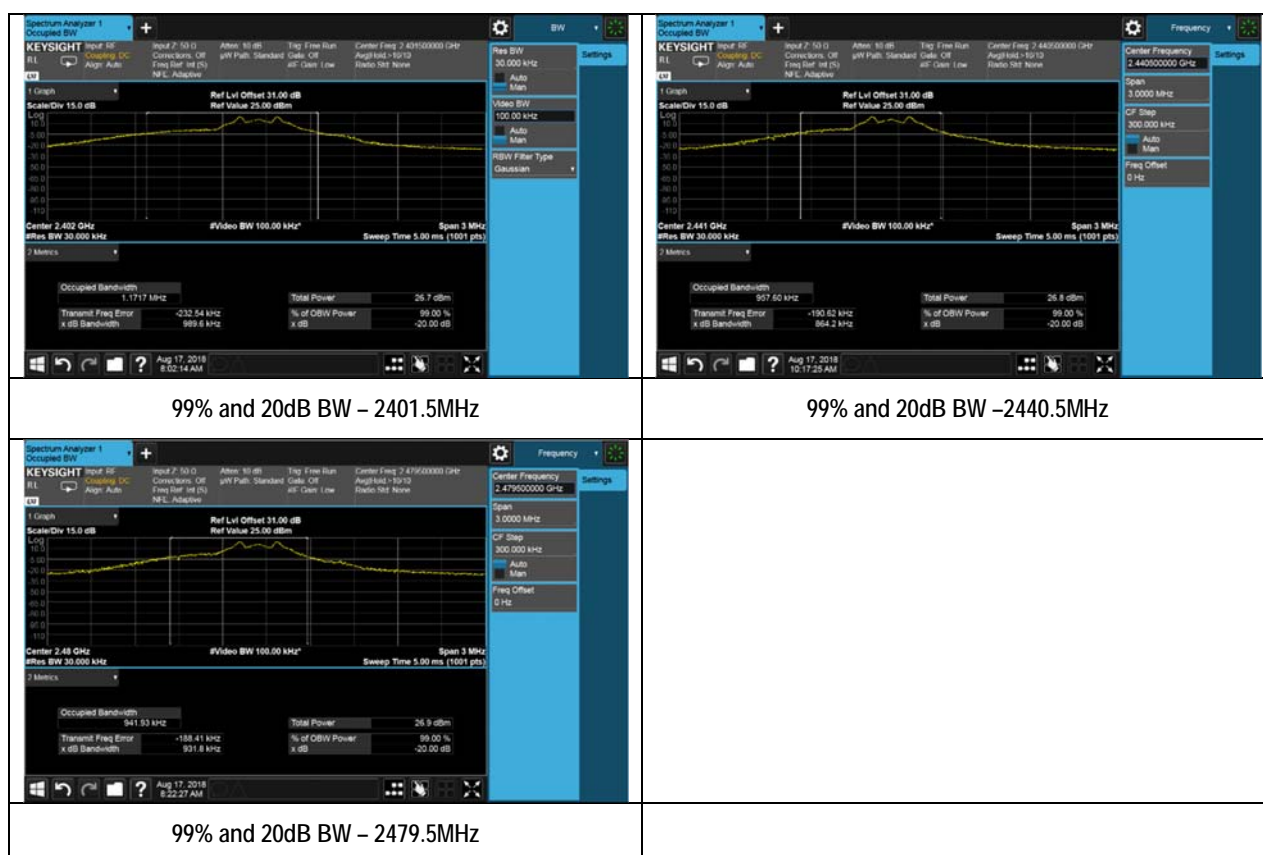
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Deon Dai at *RF Test Site*.

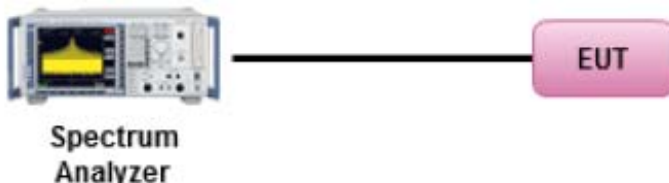
Channel	Channel Frequency (MHz)	OBW		2/3 20dB Bandwidth (KHz)
		99% (KHz)	20dB(KHz)	
Low	2401.5	1171.7	989.6	659.73
Mid	2440.5	957.60	864.2	576.13
High	2479.5	941.93	931.8	621.20

### 99% & 20dB Bandwidth Test Plots



### 10.3 Number of Hopping Channel

Requirement(s):

Spec	Requirement	Applicable
47 CFR §15.247 RSS247 (5.1.5)	For frequency hopping systems in the 2400-2483.5MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: below 1 Watt (inclusive).	<input checked="" type="checkbox"/>
Test Setup		
Procedure	<u>Number of hopping frequencies procedure</u> <ol style="list-style-type: none"> <li>1. The EUT must have its hopping function enabled</li> <li>2. Span = the frequency band of operation.</li> <li>3. Resolution (or IF) Bandwidth (RBW) <math>\geq 1\%</math> of the span.</li> <li>4. Video (or Average) Bandwidth (VBW) <math>\geq</math> RBW.</li> <li>5. Detector = peak.</li> <li>6. Sweep time = auto couple.</li> <li>7. Trace mode = max hold.</li> <li>8. Allow trace to fully stabilize.</li> <li>9. Save the plot</li> </ol>	
Test Date	08/14/2018	Environmental condition Temperature 23oC Relative Humidity 47% Atmospheric Pressure 1019mbar
Remark	-	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

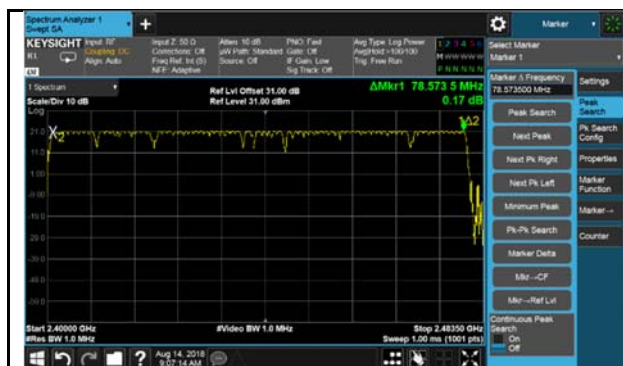
Test Data   ☒ Yes (See below)      ☐ N/A

Test Plot   ☒ Yes (See below)      ☐ N/A

Test was done by Deon Dai at *RF Test Site*.

Channel Number	Limit	Pass/Fail
79	>75	Pass

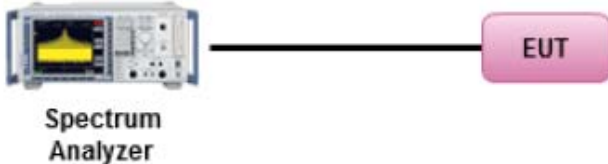
### Hopping Channel Test Plots( Bluetooth BDR, EDR)



FHSS

## 10.4 Time of Occupancy

Requirement(s):

Spec	Requirement	Applicable
47 CFR §15.247 RSS247 (5.1.5)	Frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds with in a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions.	<input checked="" type="checkbox"/>
Test Setup	 <p>Spectrum Analyzer</p>	
Test Procedure	<p>Measurement Guidelines for Frequency Hopping Spread Spectrum Systems</p> <p><u>Time of Occupancy procedure</u></p> <ul style="list-style-type: none"> <li>- The EUT must have its hopping function enabled.</li> <li>- Span = zero span</li> <li>- centered on a hopping channel</li> <li>- RBW = 1 MHz; VBW ≥ RBW</li> <li>- Sweep = as necessary to capture the entire dwell time per hopping channel.</li> <li>- Detector = Peak.</li> <li>- Trace mode = max hold.</li> <li>- If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.</li> </ul>	
Test Date	08/17/2018	<p>Environmental condition</p> <p>Temperature 21°C</p> <p>Relative Humidity 46%</p> <p>Atmospheric Pressure 1019mbar</p>
Remark	Dwell Time=Pulse time*Number of pulse/Measure time*Dwell time duration	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

Test Data ☒ Yes (See below) ☐ N/A

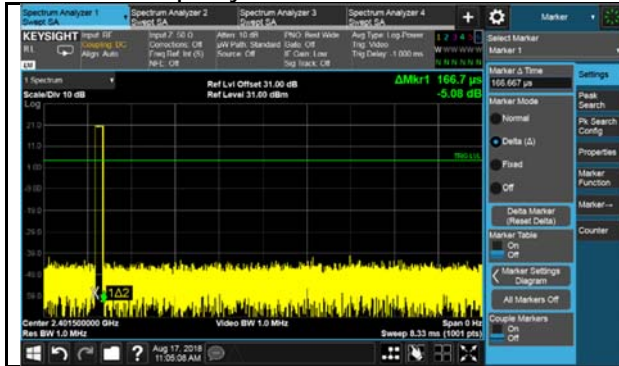
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Deon Dai at *RF Test Site*.

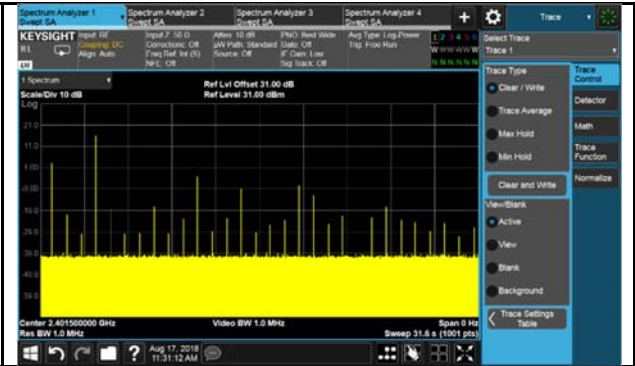
#### Bluetooth-BDR-EDR Dwell Time Measurements:

Type	CH	Pulse Width (ms)	Number of Pulses	Measure time (s)	Dwell time Duration (s)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	2401.5MHz	0.167	1	31.6	31.6	0.167	400	Pass
Dwell Time	2440.5 MHz	0.167	1	31.6	31.6	0.167	400	Pass
Dwell Time	2479.5 MHz	0.183	1	31.6	31.6	0.183	400	Pass
Dwell Time= Pulse time*Number of pulse/Measure time*Dwell time duration								

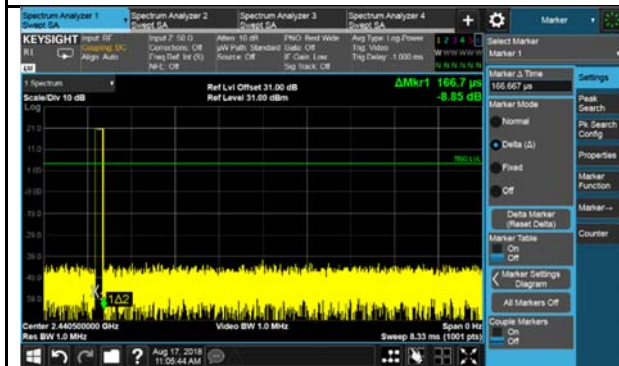
### Time of Occupancy Test Plot



Low Channel (On-Time)



Low Dwell Time-Number of Hopping



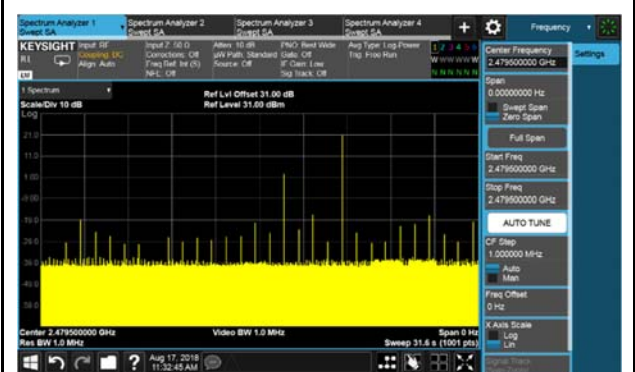
Middle Channel (On-Time)



Middle Dwell Time-Number of Hopping



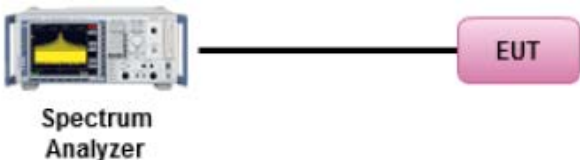
High Channel (On-Time)



High Dwell Time-Number of Hopping

## 10.5 Peak Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
47 CFR §15.247 RSS247 (5.4)	1	For frequency hopping systems in the 2400-2483.5MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: below 1 Watt (inclusive).	<input checked="" type="checkbox"/>
	2	Power reduction (antenna gain > 6dBi)	<input type="checkbox"/>
Test Setup			
Test Procedure	<p><u>Maximum output power measurement procedure</u></p> <ul style="list-style-type: none"> <li>- Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.</li> <li>- RBW &gt; 20 dB bandwidth of the emission being measured;</li> <li>- VBW ≥ RBW.</li> <li>- Detector = peak.</li> <li>- Sweep time = auto couple.</li> <li>- Trace mode = max hold.</li> <li>- Allow trace to fully stabilize.</li> <li>- Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.</li> </ul>		
Test Date	08/17/2018	Environmental condition	Temperature 21°C Relative Humidity 46% Atmospheric Pressure 1019mbar
Remark	NONE		
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.

## Output Power measurement results

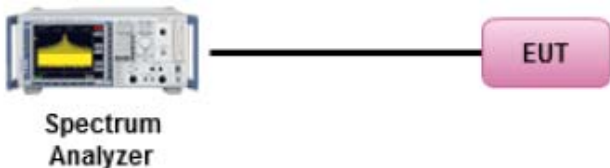
Type	Freq (MHz)	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2401.5	Low	19.96	≤30	Pass
	2440.5	Mid	19.91	≤30	Pass
	2479.5	High	19.91	≤30	Pass

## Peak Output Power Test Plot



## 10.6 Band Edge

Requirement(s):

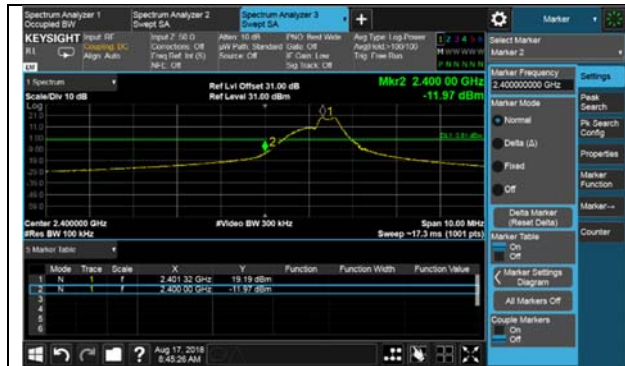
Spec	Item	Requirement	Applicable
47 CFR §15.247 RSS247 (5.5)	1	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall 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 section 2.8 is not required  <input type="checkbox"/> 20 dB down <input checked="" type="checkbox"/> 30 dB down	<input checked="" type="checkbox"/>
Test Setup			
Test Procedure	<u>Band Edge measurement procedure</u> <ol style="list-style-type: none"> <li>Set the EUT to maximum power setting and enable the EUT transmit continuously.</li> <li>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.</li> <li>Change modulation and channel bandwidth then repeat step 1 to 2.</li> <li>Measured and record the results in the test report.</li> </ol>		
Test Date	08/17/2018	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.

### Band Edge Test Plots



Band Edge -BDR 2401.5MHz

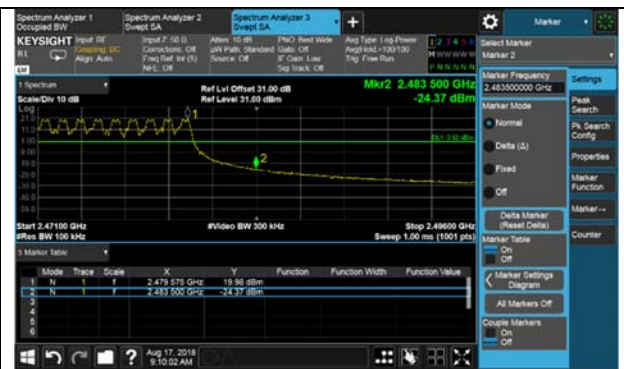


Band Edge -BDR 2479.5MHz

### Band Edge Hopping Test Plots



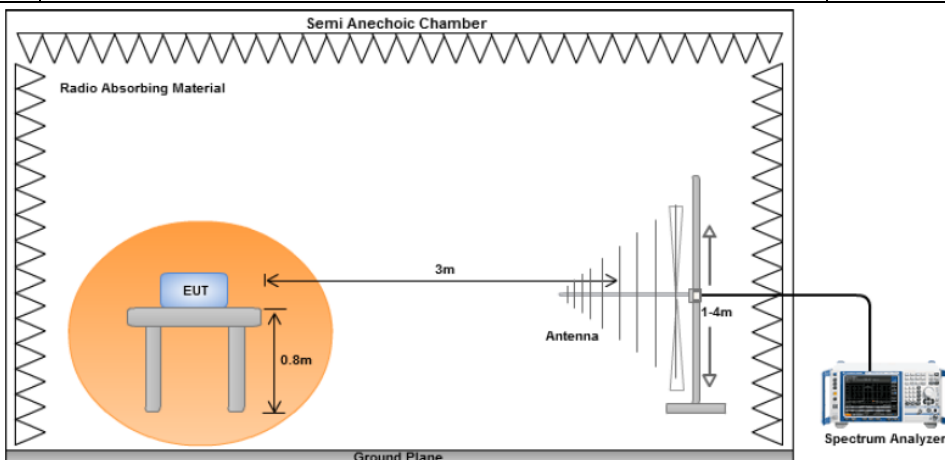
Band Edge-Hopping-2401.5MHz



Band Edge-Hopping - 2479.5MHz

## 10.7 Transmitter Radiated Spurious Emissions Below 1GHz

Requirement(s):

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

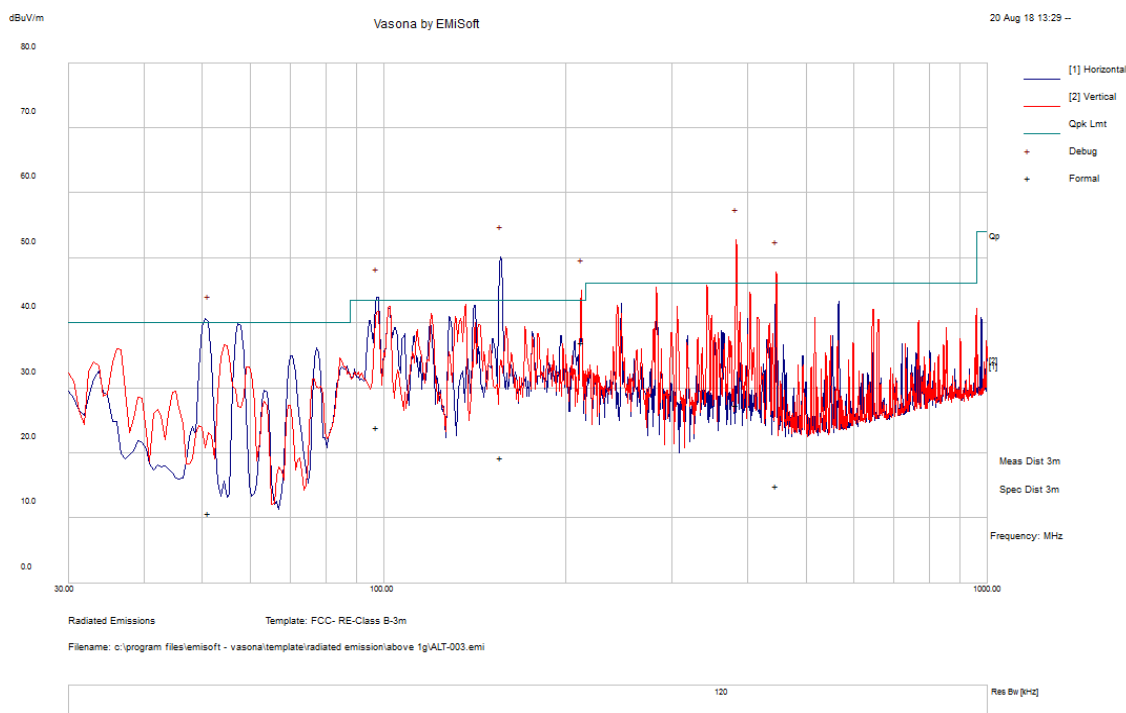
Test Data    ☒ Yes (See below)      ☐ N/A

Test Plot    ☒ Yes (See below)      ☐ N/A

Test was done by Deon Dai at 10m Chamber.

## Radiated Emission Test Results (Below 1GHz)

Test specification:	Radiated Spurious Emissions (30MHz – 1000MHz)			
Environmental Conditions:	Temp(°C):	22	Result :	<input checked="" type="checkbox"/> Pass  <input type="checkbox"/> Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	DC3.0V			
Tested by:	Deon Dai			
Test Date:	06/28/2018			
Remarks:	Transmit Mid CH			

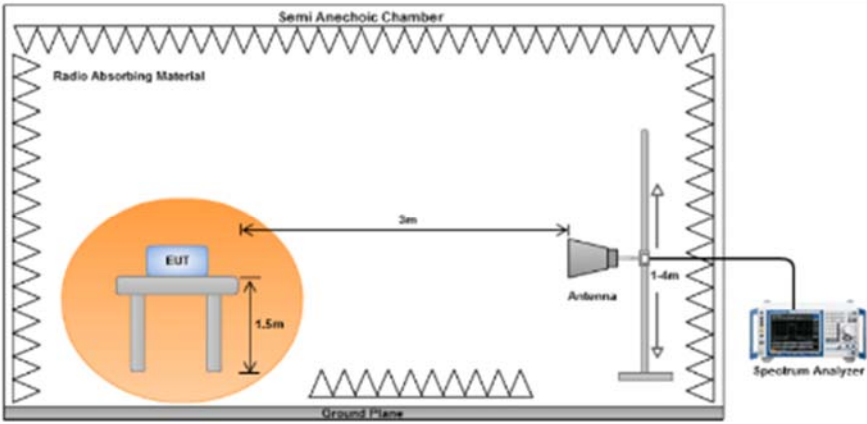


Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Measurement Type	Pol (V/H)	Hgt (cm)	Azt (Deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail
383.62	34.85	13.68	-21.04	27.49	Quasi Max	V	100	145	46	-18.51	Pass
156.11	30.8	12.23	-23.61	19.43	Quasi Max	H	200	243	43.5	-24.08	Pass
446.37	20.63	14.06	-19.64	15.05	Quasi Max	V	127	229	46	-30.95	Pass
212.41	50.1	12.74	-25.86	36.99	Quasi Max	V	203	69	43.5	-6.51	Pass
97.23	38.28	11.86	-26.08	24.06	Quasi Max	H	170	92	43.5	-19.44	Pass
51.31	26.69	11.45	-27.31	10.83	Quasi Max	H	281	105	40	-29.17	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 section 2.8 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 section 2.8	<input checked="" type="checkbox"/>
Test Setup			
Procedure	<ol style="list-style-type: none"> <li>The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>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"> <li>Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.</li> <li>The EUT was then rotated to the direction that gave the maximum emission.</li> <li>Finally, the antenna height was adjusted to the height that gave the maximum emission.</li> </ol> </li> <li>An average measurement was then made for that frequency point.</li> <li>Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</li> </ol>		
Remark	The EUT was scanned up to 26GHz. 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 *Deon Dai* at *3m Chamber*.

## Radiated Emission Test Results

### Bluetooth BDR – 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
4803.08	64.44	4.1	-10.91	57.63	Peak Max	H	110	356	74	-16.37	Pass
1989.2	55.33	2.73	-14.8	43.26	Peak Max	V	100	153	74	-30.74	Pass
1327.85	60.46	2.18	-18.9	43.74	Peak Max	H	268	118	74	-30.26	Pass
4803.08	51.04	4.1	-10.91	44.23	Average Max	H	110	356	54	-9.77	Pass
1989.2	40.52	2.73	-14.8	28.45	Average Max	V	100	153	54	-25.55	Pass
1327.85	38.57	2.18	-18.9	21.85	Average Max	H	268	118	54	-32.15	Pass

### Bluetooth BDR – 2441MHz

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
4880.11	64.85	4.18	-11.03	58	Peak Max	V	172	73	74	-16	Pass
1998.2	66.67	2.73	-14.73	54.67	Peak Max	V	170	340	74	-19.33	Pass
17990.48	41.74	7.87	2.58	52.19	Peak Max	H	278	351	74	-21.81	Pass
4880.11	50.09	4.18	-11.03	43.24	Average Max	V	172	73	54	-10.76	Pass
1998.2	43.11	2.73	-14.73	31.11	Average Max	V	170	340	54	-22.89	Pass
17990.48	28.79	7.87	2.58	39.24	Average Max	H	278	351	54	-14.76	Pass

### Bluetooth BDR – 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
4963.12	48.06	4.25	-11.17	41.14	Peak Max	V	159	218	74	-32.86	Pass
1998.4	68.1	2.73	-14.72	56.11	Peak Max	V	146	297	74	-17.89	Pass
16768.25	40.54	8.05	1.82	50.41	Peak Max	V	268	350	74	-23.59	Pass
4963.12	34.18	4.25	-11.17	27.26	Average Max	V	159	218	54	-26.74	Pass
1998.4	44.84	2.73	-14.72	32.85	Average Max	V	146	297	54	-21.15	Pass
16768.25	28.87	8.05	1.82	38.74	Average Max	V	268	350	54	-15.26	Pass

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
















## Restricted Band Test plot









## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
<b>Conducted Emissions</b>						
R & S Receiver	ESIB 40	100179	04/21/2018	1 Year	04/21/2019	<input type="checkbox"/>
CHASE LISN	MN2050B	1018	08/16/2018	1 Year	08/16/2019	<input type="checkbox"/>
<b>Radiated Emissions</b>						
Keysight EXA 44GHz Spectrum Analyzer	N9010A	MY51440112	11/02/2017	1 Year	11/02/2018	<input checked="" type="checkbox"/>
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	01/13/2018	1 Year	01/13/2019	<input checked="" type="checkbox"/>
Horn Antenna (1GHz~26GHz)	3115	100059	08/11/2018	1 Year	08/11/2019	<input checked="" type="checkbox"/>
Pre-Amplifier (1-40GHz)	SAS-574	579	05/04/2018	1 Year	05/04/2019	<input checked="" type="checkbox"/>
Preamplifier (100KHz-7GHz)	LPA-6-30	11140711	02/09/2018	1 Year	02/09/2019	<input checked="" type="checkbox"/>
<b>RF Conducted Measurement</b>						
Spectrum Analyzer	N9010A	10SL0219	11/16/2017	1 Year	11/16/2018	<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 Equipment: EN45011: EN ISO/IEC 17065
		Electromagnetic Compatibility: EN45011 – EN ISO/IEC 17065
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 Measuremet
Australia CAB Regocnition		EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4 Radiocommunications: 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