RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_RF_SL18021402-CRT-005-BT LE
Supersede Report No.: None

Applicant	:	CURRANT,INC. (PALO ALTO)
Product Name	:	SMART OUTLET
Model No.	:	WALL02
Test Standard	:	47 CFR 15.247
Test Method	:	ANSI C63.10: 2013 558074 D01 DTS Meas Guidance v04
FCC ID	:	2ALKS-WALL02
Dates of test	:	05/02/2018-05/22/2018
Issue Date	:	05/22/2018
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:	
	
Vijay Chaudhary	**Chen Ge**
RF Test Engineer	Engineer Reviewer

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

ilac-MRA
ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

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

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

Accreditations for Conformity Assessment

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

Accreditations for Product Certifications

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

CONTENTS

1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC IC_RF_SL18021402-CRT-005-BT LE	None	Original	05/23/2018

2 Executive Summary

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

Company: CURRANT,INC. (PALO ALTO)
Product: SMART OUTLET
Model: WALL02

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	CURRANT,INC. (PALO ALTO)
Applicant Address	195 Page Mill Road, Suite # 111, Palo Alto, CA - 94306, USA
Manufacturer Name	CURRANT,INC. (PALO ALTO)
Manufacturer Address	195 Page Mill Road, Suite # 111, Palo Alto, CA - 94306, 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	SMART OUTLET
Model No.	WALL02
Trade Name	CURRANT
Serial No.	N/A
Host Model No.	N/A
Input Power	120V 60Hz
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	05/02/2018
Equipment Class/ Category	DTS

6.2 Radio Description

Bluetooth LE:

Radio Type	Bluetooth LE
Operating Frequency	2402MHz-2480MHz
Modulation	GFSK
Channel Spacing	2MHz
Antenna Type	Integral
Antenna Gain	0.5 dBi
Antenna Connector Type	N/A
Note	N/A

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	T430	N/A	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	Laptop	USB	EUT	Connection	1	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	nRFgo	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 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
Remark	1. All measurement uncertainties do not take into consideration for all presented test results.				

9 Measurement Uncertainty

9.1 Radiated Emissions (100kHz to 30MHz)

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

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.10	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.45	Rectangular	1.732	1	0.2598152
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.935
Expanded Uncertainty (K=2)					**1.87**

The total derived measurement uncertainty is +/- 1.87 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.

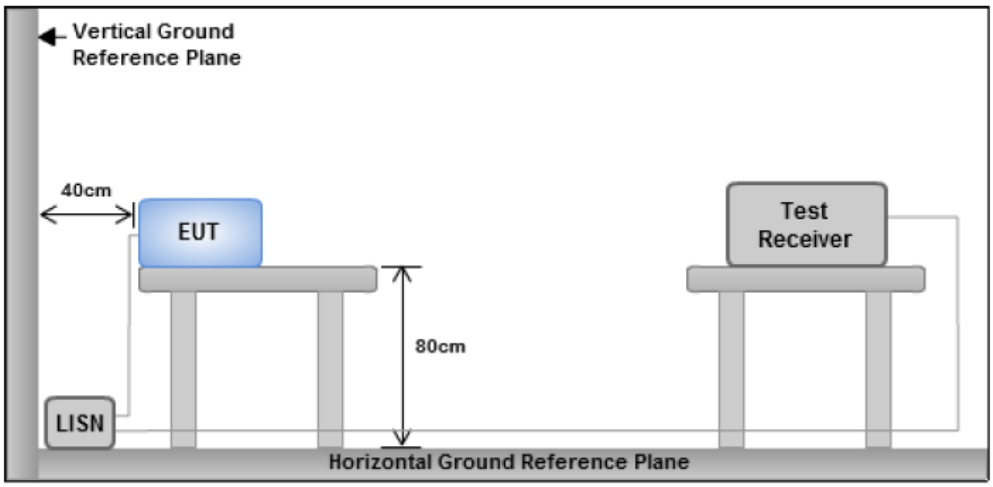
10 Measurements, Examination and Derived Results

10.1 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 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

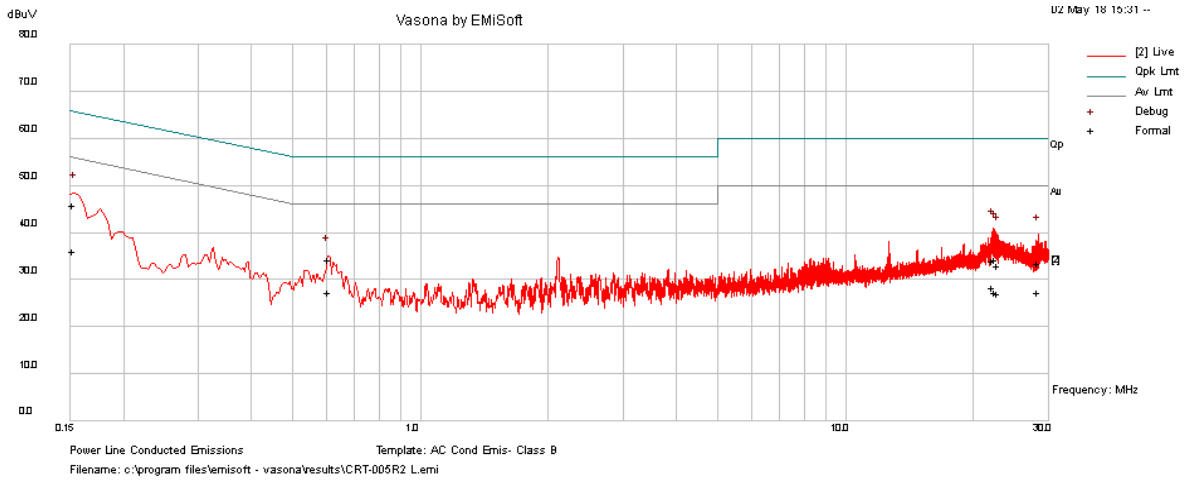
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Vijay Chaudhary 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:	Vijay Chaudhary			
Test Date:	05/02/2018			
Remarks	Conducted @ Live			

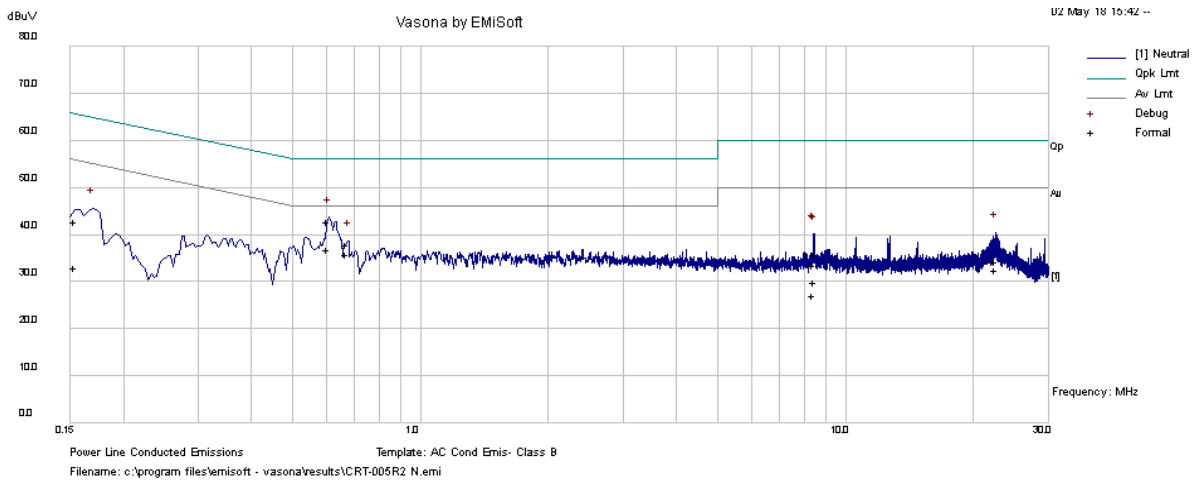


Live Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.152693	36.58	9.33	0.05	45.96	Quasi Peak	Live	65.85	-19.89	Pass
22.326244	24.07	9.39	0.5	33.96	Quasi Peak	Live	60	-26.04	Pass
22.53277	24.4	9.39	0.5	34.3	Quasi Peak	Live	60	-25.7	Pass
28.402557	23.37	9.41	0.59	33.37	Quasi Peak	Live	60	-26.63	Pass
22.915319	23.14	9.39	0.51	33.04	Quasi Peak	Live	60	-26.96	Pass
0.606974	24.84	9.33	0.06	34.23	Quasi Peak	Live	56	-21.77	Pass
0.152693	26.65	9.33	0.05	36.03	Average	Live	55.85	-19.83	Pass
22.326244	18.57	9.39	0.5	28.46	Average	Live	50	-21.54	Pass
22.53277	17.55	9.39	0.5	27.44	Average	Live	50	-22.56	Pass
28.402557	17.38	9.41	0.59	27.38	Average	Live	50	-22.62	Pass
22.915319	17.18	9.39	0.51	27.08	Average	Live	50	-22.92	Pass
0.606974	18.03	9.33	0.06	27.41	Average	Live	46	-18.59	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:	Vijay Chaudhary			
Test Date:	05/02/2018			
Remarks	Conducted @ Neutral			

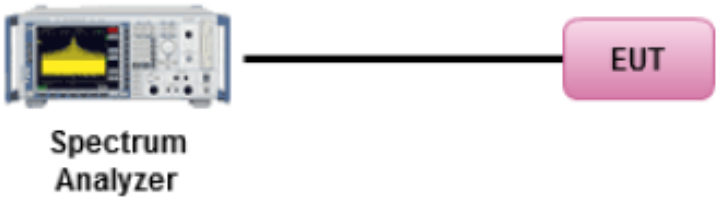


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.604725	33.39	9.33	0.06	42.78	Quasi Peak	Neutral	56	-13.22	Pass
0.669222	28.49	9.33	0.05	37.87	Quasi Peak	Neutral	56	-18.13	Pass
0.15315	33.43	9.33	0.05	42.81	Quasi Peak	Neutral	65.83	-23.01	Pass
22.564603	24.49	9.39	0.5	34.38	Quasi Peak	Neutral	60	-25.62	Pass
8.380317	23.51	9.73	0.17	33.4	Quasi Peak	Neutral	60	-26.6	Pass
8.427691	26	9.73	0.17	35.9	Quasi Peak	Neutral	60	-24.1	Pass
0.604725	27.35	9.33	0.06	36.74	Average	Neutral	46	-9.26	Pass
0.669222	26.37	9.33	0.05	35.74	Average	Neutral	46	-10.26	Pass
0.15315	23.58	9.33	0.05	32.96	Average	Neutral	55.83	-22.87	Pass
22.564603	22.51	9.39	0.5	32.41	Average	Neutral	50	-17.59	Pass
8.380317	17.24	9.73	0.17	27.14	Average	Neutral	50	-22.86	Pass
8.427691	20.07	9.73	0.17	29.97	Average	Neutral	50	-20.03	Pass

10.2 6dB & 99% Bandwidth

Requirement(s):

Spec	Requirement	Applicable
§ 15.247	6dB BW≥500KHz;	☒
	The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual. The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth	☒
Test Setup		
Test Procedure	558074 D01 DTS Meas Guidance v04, 8.1 DTS bandwidth 6dB Emission bandwidth measurement procedure - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ⩾ 3 x RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. - Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.	

Test Date	05/02/2018-05/22/2018	Environmental condition	Temperature 23°C Relative Humidity 42% Atmospheric Pressure 1021mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

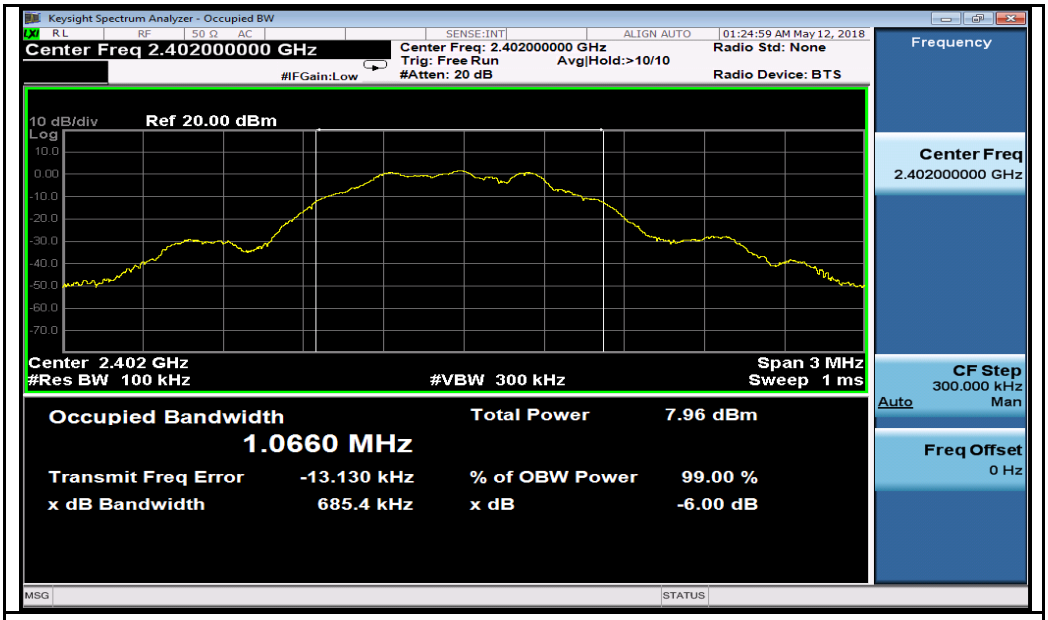
Test Data ☒ Yes ☐ N/A
Test Plot ☒ Yes ☐ N/A

Test was done by Vijay Chaudhary at RF test site.

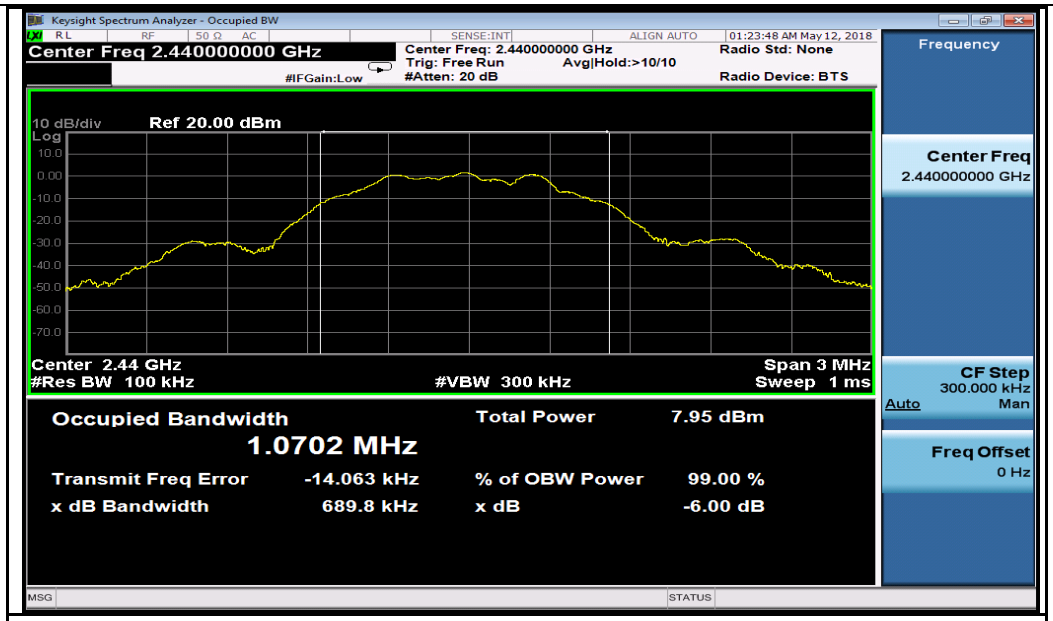
BLE:

Channel	Channel Frequency (MHz)	OBW	
		99% (MHz)	6dB(KHz)
Low	2402	1.066	685.4
Mid	2440	1.07	689.8
High	2480	1.069	681.6

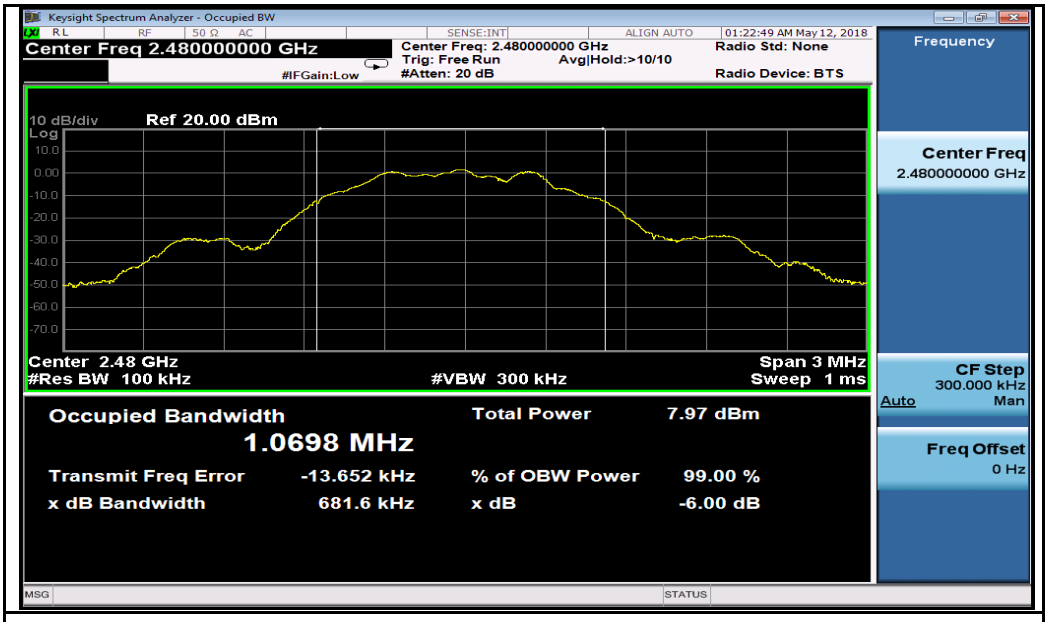
6dB & 99% Bandwidth Test Plots



BLE-2402MHz



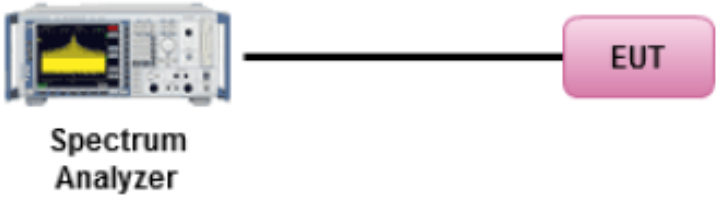
BLE-2440MHz



BLE-2480MHz

10.3 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247	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 v04, 9.1.1 Measurement using a Spectrum Analyzer (SA) This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth. (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	05/02/2018-05/22/2018	Environmental condition	Temperature 23°C Relative Humidity 44% Atmospheric Pressure 1021mbar
Remark	NONE		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

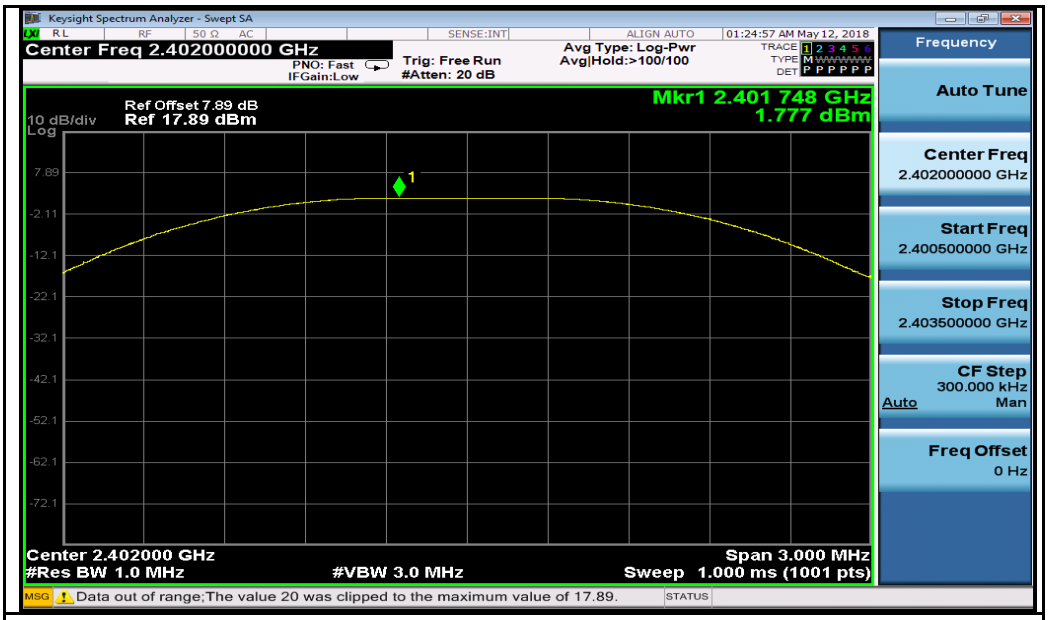
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Vijay Chaudhary at RF test site.

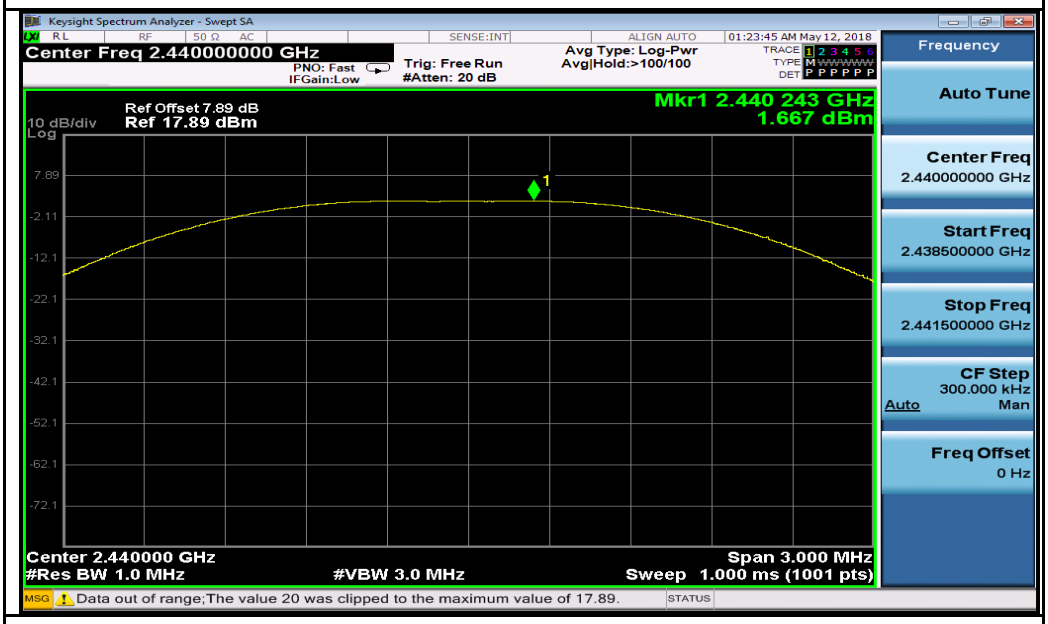
Output Power measurement results for BLE:

Type	Freq (MHz)	Test mode	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2402	Bluetooth LE	Low	1.77	≤30	Pass
	2440	Bluetooth LE	Mid	1.66	≤30	Pass
	2480	Bluetooth LE	High	1.67	≤30	Pass

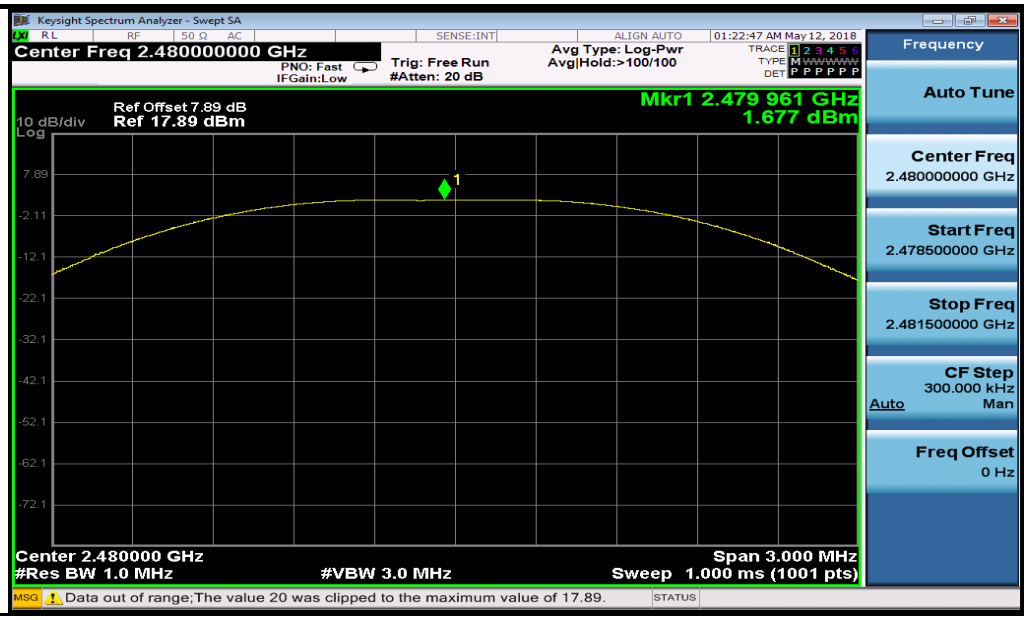
Test Plots:



BLE-2402MHz



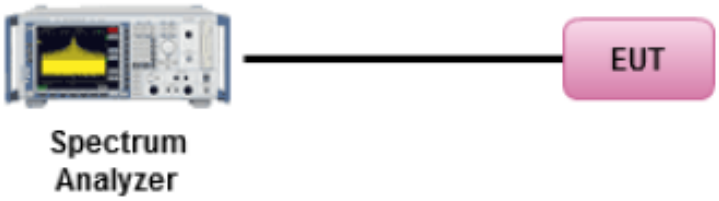
BLE-2440MHz


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
01:22:47 AM May 12, 2018
Ref Offset 7.89 dB
10 dB/div
Log
Ref 17.89 dBm
Mkr1 2.479 961 GHz
1.677 dBm
7.89
-2.11
-12.1
-22.1
-32.1
-42.1
-52.1
-62.1
-72.1
Center 2.480000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)
Data out of range;The value 20 was clipped to the maximum value of 17.89.
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.481500000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz

BLE-2480MHz

10.4 Band Edge and Conducted Spurious emissions

Requirement(s):

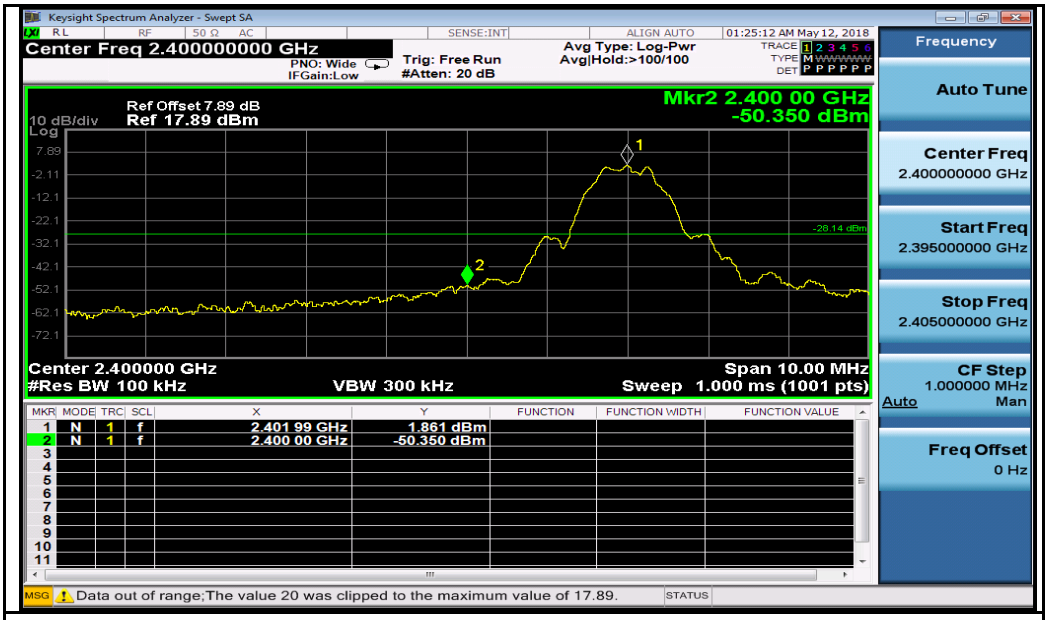
Spec	Item	Requirement	Applicable
§ 15.247	d)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 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 v04 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	05/02/2018-05/22/2018	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	-		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes ☒ N/A

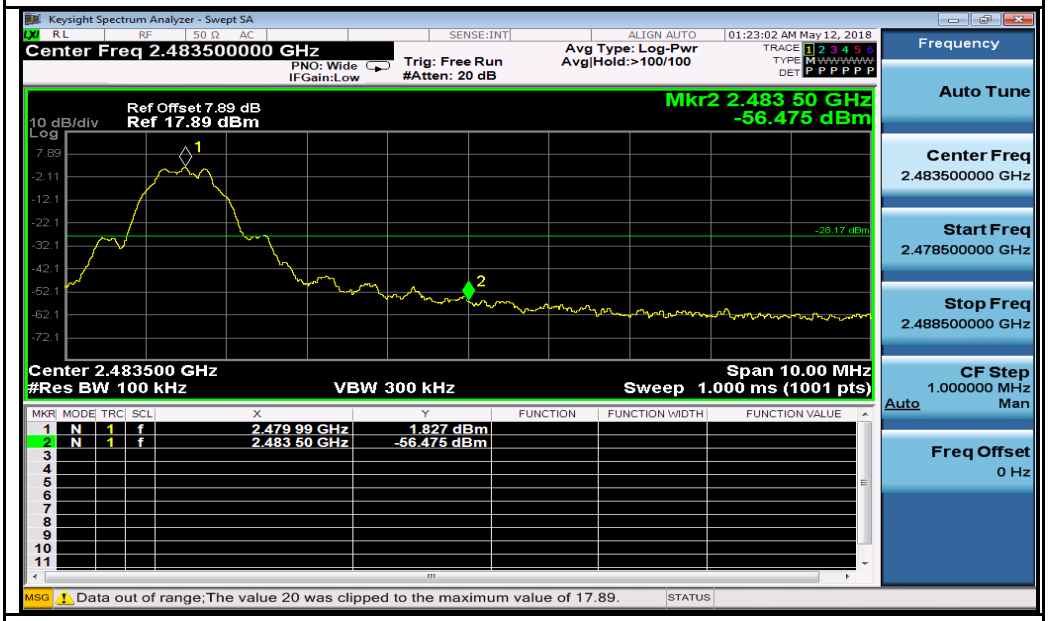
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Vijay Chaudhary at RF test site.

Test Plots:

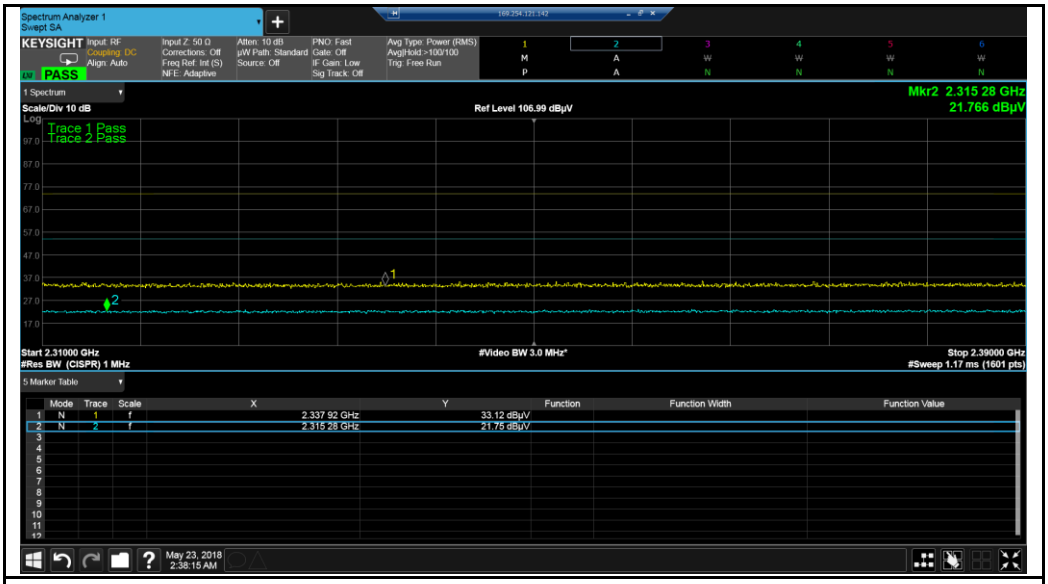


BLE-2402MHz



BLE-2480MHz

Restricted Band Measurement Plots:



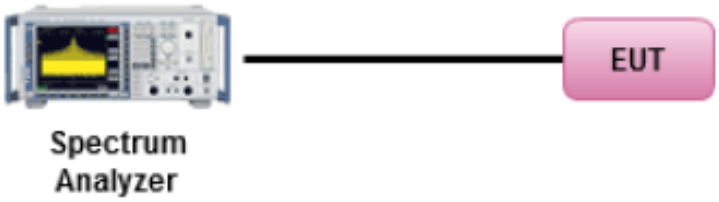
BLE-2402MHz

BLE-2402MHz

Note: Antenna gain was added to the offset.

10.5 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e)	e)	DSSS: ≤8dBm/3KHz	☒
	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04, 10.2 Method PKPSD (peak PSD) Peak spectral density measurement procedure - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. - Set the VBW ≥ 3 x RBW. - Detector = Peak - Sweep time = auto couple. - Trace mode = Max Hold - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	05/02/2018-05/22/2018	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Vijay Chaudhary at RF test site.

PSD measurement results for BLE:

Type	Freq (MHz)	Test mode	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	2402	Bluetooth LE	Low	-15.71	8	Pass
	2441	Bluetooth LE	Mid	-15.78	8	Pass
	2480	Bluetooth LE	High	-15.77	8	Pass

Test Plots

BLE-2402MHz

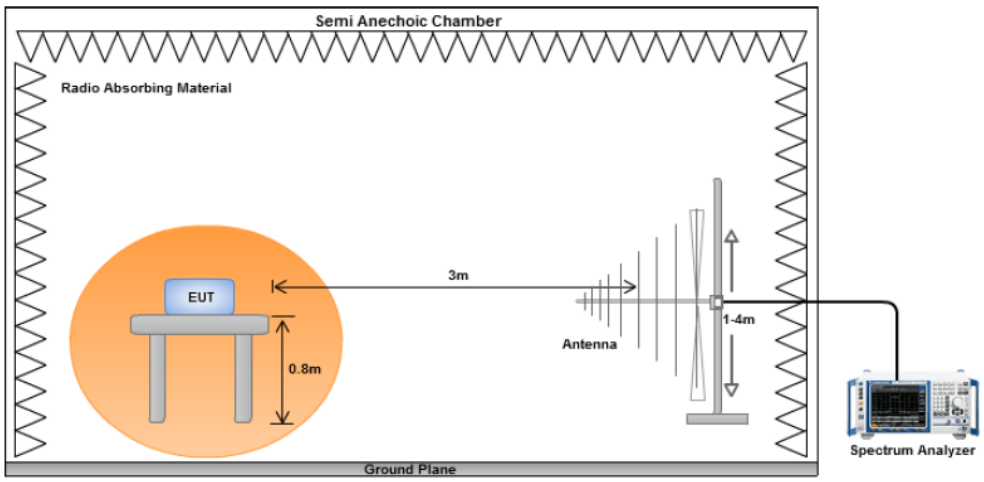
BLE-2440MHz


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>10/10
01:22:57 AM May 12, 2018
Ref Offset 7.89 dB
10 dB/div
Log
Ref 17.89 dBm
Mkr1 2.480 000 GHz
-15.778 dBm
7.89
-2.11
-12.1
-22.1
-32.1
-42.1
-52.1
-62.1
-72.1
Center 2.480000 GHz
#Res BW 3.0 kHz
VBW 9.1 kHz
Span 5.000 MHz
Sweep 530.5 ms (1001 pts)
Data out of range;The value 20 was clipped to the maximum value of 17.89.
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.477500000 GHz
Stop Freq
2.482500000 GHz
CF Step
500.000 kHz
Auto
Man
Freq Offset
0 Hz

BLE-2480MHz

10.6 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d)	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	

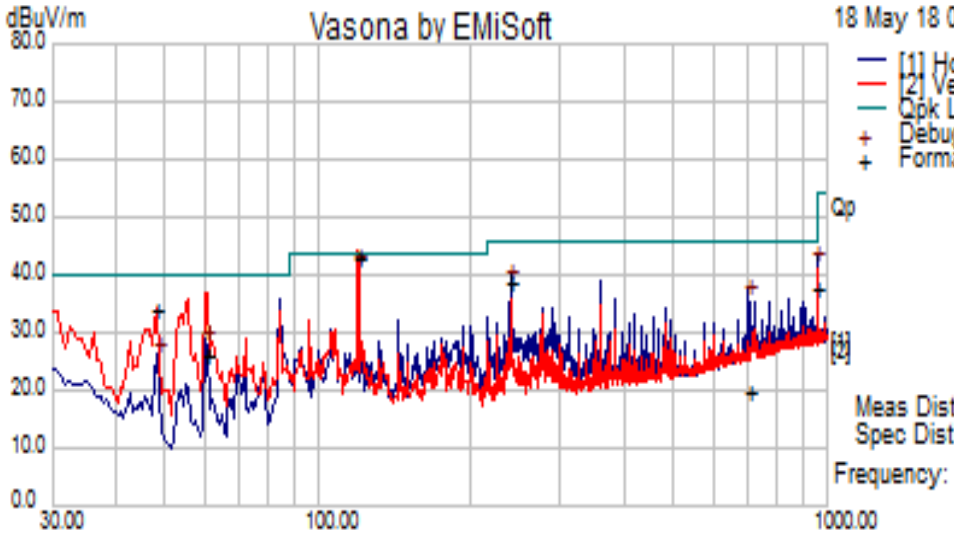
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Vijay Chaudhary at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26.1	Result	Pass
	Humidity (%)	47.5		
	Atmospheric (mbar):	1020		
Mains Power:	3VDC			
Tested by:	Vijay Chaudhary			
Test Date:	05/18/2018			
Remarks:	BLE, Mid			

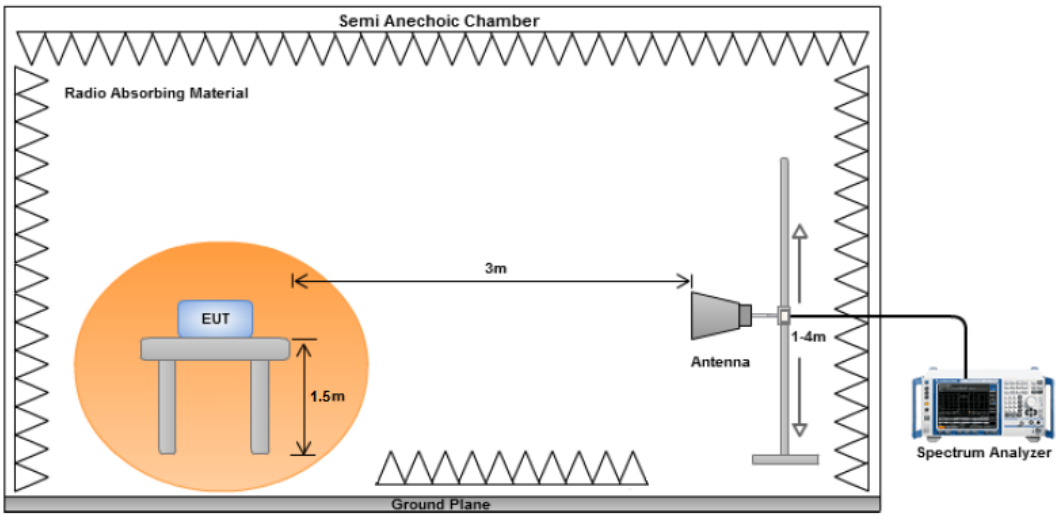


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV /m	Margin dB	Pass /Fail
120.00719	53.9	12.07	-22.87	43.1	Quasi Max	V	105	185	43.5	-0.4	Pass
240.00906	51.06	12.89	-25.09	38.86	Quasi Max	H	127	216	46	-7.14	Pass
703.18769	20.13	15.16	-15.43	19.86	Quasi Max	H	187	134	46	-26.15	Pass
59.9835	42.41	11.51	-27.74	26.18	Quasi Max	H	293	142	40	-13.83	Pass
960.03381	35.34	16.08	-13.55	37.87	Quasi Max	V	101	356	54	-16.13	Pass

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

10.7 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d),	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 40GHz. 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 Vijay Chaudhary at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz- BLE - 2402MHz

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
4803.9	49.21	4.1	-0.93	52.39	Peak Max	V	162	355	74	-21.61	Pass
7206.04	44.22	5.15	-0.45	48.92	Peak Max	V	121	259	74	-25.08	Pass
2041.22	39.17	2.76	-2.85	39.08	Peak Max	V	186	274	74	-34.92	Pass
4803.91	46.14	4.1	-0.93	49.32	Average Max	V	162	355	54	-4.68	Pass
7206.04	37.93	5.15	-0.45	42.63	Average Max	V	121	259	54	-11.38	Pass
2041.22	27.07	2.76	-2.85	26.98	Average Max	V	186	274	54	-27.02	Pass

Above 1GHz-25GHz- BLE - 2440MHz

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
4879.97	48.86	4.18	-1	52.04	Peak Max	V	132	252	74	-21.96	Pass
7319.82	43.62	5.15	-0.49	48.29	Peak Max	V	142	318	74	-25.72	Pass
2009.50	40.65	2.74	-2.47	40.93	Peak Max	V	188	85	74	-33.07	Pass
4879.97	45.45	4.18	-1	48.63	Average Max	V	132	252	54	-5.37	Pass
7319.82	37.76	5.15	-0.49	42.42	Average Max	V	142	318	54	-11.58	Pass
2009.50	28.58	2.74	-2.47	28.85	Average Max	V	188	85	54	-25.15	Pass

Above 1GHz-25GHz- BLE - 2480MHz

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
4964.56	39.71	4.26	-1.08	42.89	Peak Max	V	148	192	74	-31.11	Pass
7439.96	43.73	5.14	-0.53	48.34	Peak Max	V	103	314	74	-25.66	Pass
3143.69	40.70	3.38	-1.45	42.63	Peak Max	V	322	126	74	-31.37	Pass
4964.56	26.97	4.26	-1.08	30.15	Average Max	V	148	192	54	-23.85	Pass
7439.96	37.82	5.14	-0.53	42.43	Average Max	V	103	314	54	-11.57	Pass
3143.69	27.91	3.38	-1.45	29.84	Average Max	V	322	126	54	-24.16	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
Spectrum Analyzer	N9010B	10SL0219	08/20/2017	1 Year	08/20/2018	☑
RF Preamplifier	LPA-6-30	11140711	07/21/2017	1 Year	07/21/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2017	1 Year	08/12/2018	☑
Horn Antenna (1GHz~26GHz)	3115	100059	08/25/2017	1 Year	08/25/2018	☑
Pre-Amp (1-40GHz)	SAS-474	579	08/04/2017	1 Year	08/04/2018	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010B	10SL0219	08/20/2017	1 Year	08/20/2018	☑

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