

# CyMedica Orthopedics, Inc. **TEST REPORT**

**SCOPE OF WORK**

FCC 15.247 AND RSS-247 TESTING – E-VIVE II

**REPORT NUMBER**

103922224LAX-007

**ISSUE DATE**

July 30, 2019

**LAST REVISION DATE**

March 3, 2020

**PAGES**

43

**DOCUMENT CONTROL NUMBER**

Non-Specific Radio Report Shell Rev. December 2017  
© 2017 INTERTEK



## EMC TEST REPORT (FULL COMPLIANCE)

**Report Number:** 103922224LAX-007

**Project Number:** G103922224

**Report Issue Date:** July 30, 2019

**Last Report Revision Date:** March 3, 2020

**Model(s) Tested:** e-vive II

**Standards:** FCC CFR47 Part 15 Subpart C, July 2019

Intentional Radiator

§15.247, Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

**ISED RSS-247 Issue 2, February 2017**

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

**ISED RSS-Gen Issue 5, April 2018**

General Requirements for Compliance of Radio Apparatus

Tested by:

Intertek

25791 Commercentre Drive

Lake Forest, CA 92630

USA

Client:

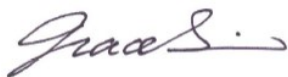
CyMedica Orthopedics, Inc.

19120 N Pima Rd, Suite 135

Scottsdale, AZ 85255-5398

USA

Report prepared by



Grace Lin

EMC Staff Engineer

Report reviewed by



Suresh Kondapalli

Sr. Staff Engineer

*This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.*

## Table of Contents

<b><i>CyMedica Orthopedics, Inc.</i></b> .....	<b>1</b>
<b>1    <i>Introduction and Conclusion</i></b> .....	<b>4</b>
<b>2    <i>Test Summary</i></b> .....	<b>4</b>
<b>3    <i>Client Information</i></b> .....	<b>5</b>
<b>4    <i>Description of Equipment Under Test and Variant Models</i></b> .....	<b>5</b>
<b>5    <i>System Setup and Method</i></b> .....	<b>7</b>
<b>6    <i>DTS (6 dB) Bandwidth and 99% Bandwidth</i></b> .....	<b>8</b>
<b>7    <i>Maximum Peak Conducted Output Power at Antenna Terminals</i></b> .....	<b>14</b>
<b>8    <i>Maximum Power Spectral Density</i></b> .....	<b>18</b>
<b>9    <i>Conducted Spurious Emissions</i></b> .....	<b>23</b>
<b>10    <i>Radiated Spurious Emissions</i></b> .....	<b>28</b>
<b>11    <i>AC Mains Conducted Emissions</i></b> .....	<b>40</b>
<b>12    <i>Revision History</i></b> .....	<b>43</b>

## 1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

## 2 Test Summary

Section	Test full name	Result
3	Client Information	-
4	Description of Equipment Under Test and Variant Models	-
5	System Setup and Method	-
6	6 dB Bandwidth and 99% Bandwidth (FCC §15.247(a)(2), ISED RSS-247 §5.2a; ISED RSS-Gen §6.7)	Compliant
7	Maximum Peak Conducted Output Power at Antenna Terminals (FCC §15.247(b)(3), ISED RSS-247 §5.4d)	Compliant
8	Maximum Power Spectral Density (FCC §15.247(e), ISED RSS-247 §5.2b)	Compliant
9	Conducted Spurious Emissions (FCC §15.247(d), ISED RSS-247 §5.5)	Compliant
10	Radiated Spurious Emissions (FCC §15.247(d), §15.209, §15.205, ISED RSS-247 §5.5, ISED RSS-Gen §8.9)	Compliant
11	AC Mains Conducted Emissions (FCC §15.207, ISED RSS-Gen §8.8)	Not Applicable*
12	Revision History	-

\*: The EUT is battery powered under normal operation.

### 3 Client Information

This EUT was tested at the request of:

**Client:** CyMedica Orthopedics, Inc.  
19120 N Pima Rd, Suite 153  
Scottsdale, AZ 85255-5398  
USA

**Contact:** Ryan Fig  
**Telephone:** 602 790 4324  
**Email:** ryan.f@cymedicaortho.com

### 4 Description of Equipment Under Test and Variant Models

**Manufacturer:** CyMedica Orthopedics, Inc.  
19120 N Pima Rd, Suite 153  
Scottsdale, AZ 85255-5398  
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Electrotherapy Device	CyMedica Orthopedics, Inc.	e-vive II	P02-0519-0006 (Conducted), P02-0519-0009 (Radiated)
Receive Date:	07/22/2019	Test Started	07/22/2019
Received Condition:	Good	Test Ended	03/03/2020
Type:	Production		

#### Description of Equipment Under Test (provided by client)

The equipment under test (EUT) is an electrotherapy device, model: e-vive II, containing a Bluetooth Low Energy (BLE) transmitter. The EUT is a prescription device in the USA and is intended for use under the direction of a medical provider.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
DC (built-in battery)	-	-	-

**Operating modes of the EUT:**

No.	Descriptions of EUT Exercising
1	Test Mode – The EUT transmits continuously.

**Software used by the EUT:**

No.	Descriptions of EUT Exercising
1	Under test mode, the EUT was programmed to transmit continuously during testing. The EUT was programmed per instructions CY-0020-029 Rev A_e-vive II Intentional Radiator Setup Instructions. Tx power was set to 0 dBm.

Radio/Receiver Characteristics	
Frequency Band(s)	2402 MHz – 2480 MHz
Modulation Type(s)	GFSK
Maximum Output Power	-1.1 dBm (0.7762 mW)
Test Channels	2402 MHz, 2440 MHz, 2480 MHz
Occupied Bandwidth	743.3 kHz (6 dB), 1062.9 (99%)
Frequency Hopper: Number of Hopping Channels	Not Applicable
Frequency Hopper: Channel Dwell Time	Not Applicable
Frequency Hopper: Max interval between two instances of use of the same channel	Not Applicable
MIMO Information (# of Transmit and Receive antenna ports)	Not Applicable
Equipment Type	Standalone
Antenna Type and Gain	Permanent attached antenna. Peak Antenna Gains*: 1.1 dBi (XY plane), 3.3 dBi (XZ plane), 1.6 dBi (YZ plane)

\* : Peak antenna gains were provided by CyMedica. Intertek takes no responsibility for the accuracy of the values provided.

**Variant Models:**

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

➤ None

## 5 System Setup and Method

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	USB Power Adapter	1.8	No	No	Yes

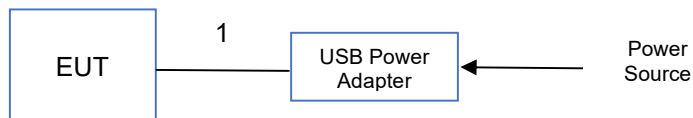
Support Equipment			
Description	Manufacturer	Model Number	Serial Number
USB Power Adapter	Emerson	DCH3-050US-0002	-

### 5.1 Method:

Configuration as required by ANSI C63.10-2013.

### 5.2 Test Setup Block Diagram:

Conducted Measurement:



Radiated Measurement:



## **6 DTS (6 dB) Bandwidth and 99% Bandwidth**

### **6.1 Requirement(s)**

The minimum DTS (6 dB) bandwidth shall be at least 500 kHz.

### **6.2 Method**

- A. The procedure described in Subclause 11.8 of ANSI C63.10-2013 was utilized to determine the DTS (6 dB) bandwidth.
  - a) Set RBW = 100 kHz.
  - b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
  - c) Detector = Peak.
  - d) Trace mode = max hold.
  - e) Sweep = auto couple.
  - f) Allow the trace to stabilize.
  - g) 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.
- B. The following procedure was used for measuring 99% power bandwidth.
  - a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
  - b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
  - c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (\text{OBW}/\text{RBW})]$  below the reference level.
  - d) Step a) through step c) might require iteration to adjust within the specified range.
  - e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
  - f) Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

#### **TEST SITE:**

The test is performed in the EMC laboratory located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. ISED test site registration number is 2042T and wireless device testing laboratory CAB identifier is US0092.

#### **Measurement Uncertainty**

The expanded uncertainty ( $k=2$ ) is 1.3 dB.



**6.3 Test Equipment Used:**

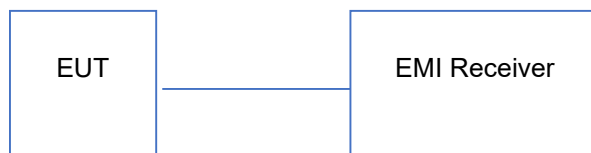
Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	08/15/2018	08/15/2019
1016	Barometer Temp/Humidity	Omega	IBTHX-W	18300406	08/18/2018	08/18/2019

**Software Utilized:**

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

**6.4 Results:**

The sample tested was found to Comply.

**6.5 Setup Diagram:****6.6 Plots/Data:**

Frequency (MHz)	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)
2402	711.3	1054.9
2440	719.3	1048.9
2480	743.3	1062.9

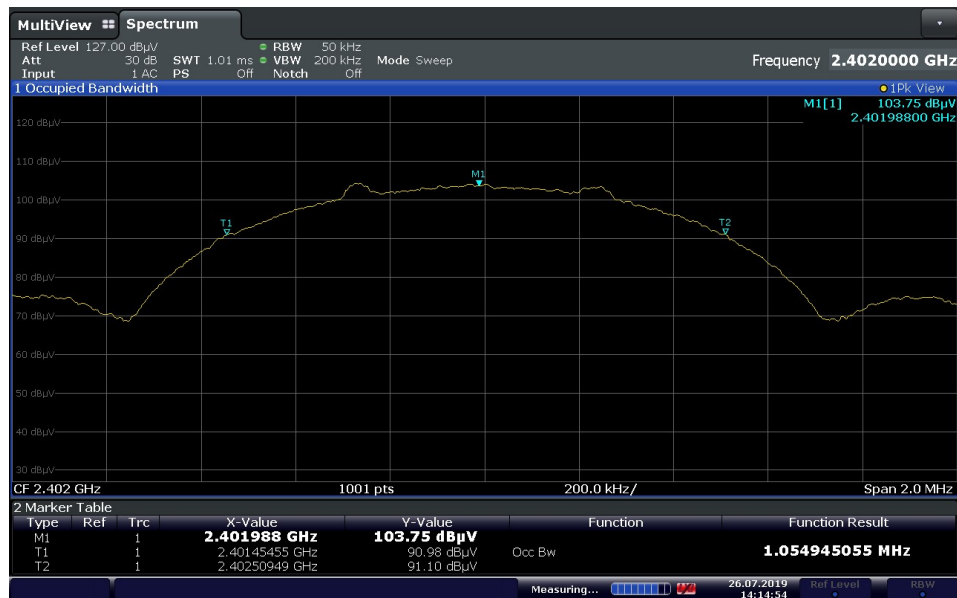
Note: The antenna port of the EUT was connected directly to the input of the measuring EMI receiver.  
The RF level in the plots is relative and is not the indication of RF output power.

## 6 dB Bandwidth, 2402 MHz:



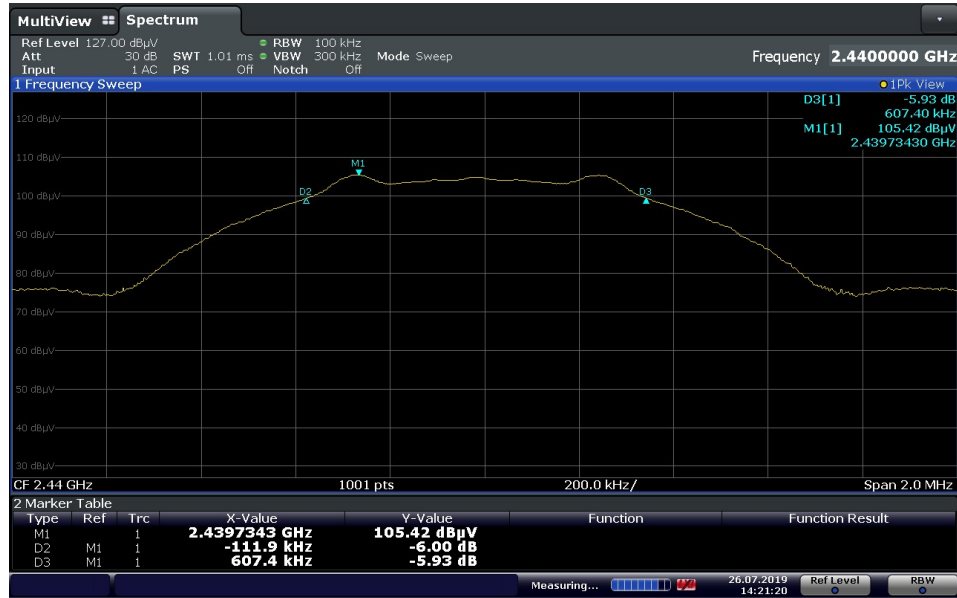
14:07:43 26.07.2019

## 99% Bandwidth, 2402 MHz:



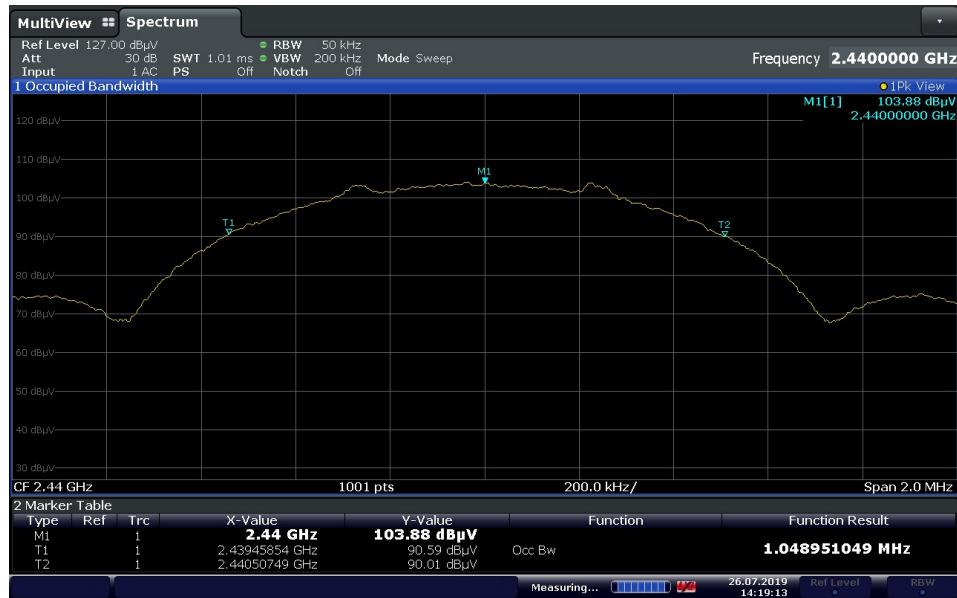
14:14:54 26.07.2019

6 dB Bandwidth, 2440 MHz:



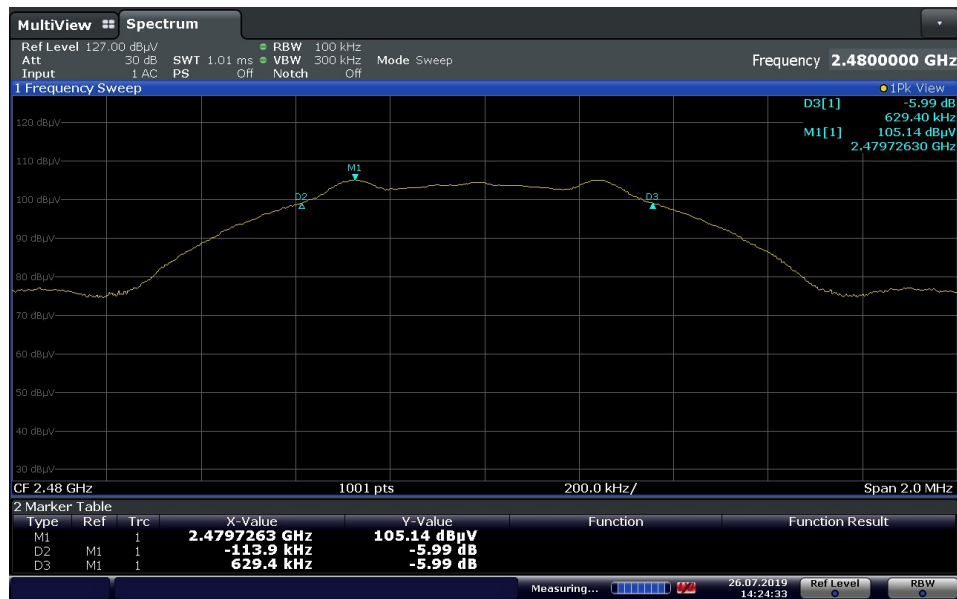
14:21:21 26.07.2019

99% Bandwidth, 2440 MHz:



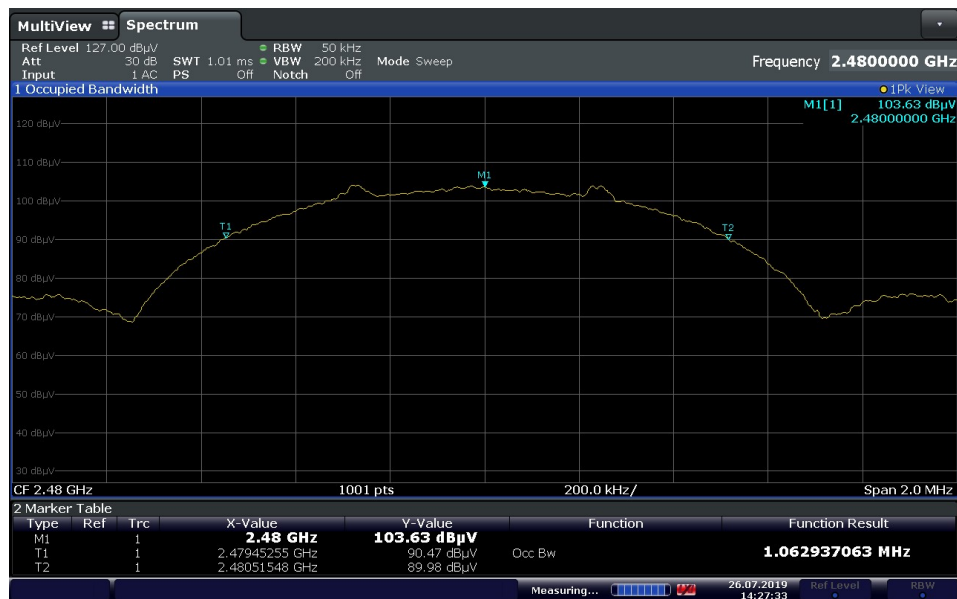
14:19:13 26.07.2019

## 6 dB Bandwidth, 2480 MHz:



14:24:33 26.07.2019

## 99% Bandwidth, 2480 MHz:



14:27:34 26.07.2019

Test Personnel:	Grace Lin	Test Date:	07/26/2019
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	120 Vac (USB Power Adapter)	Ambient Temperature:	23.2 °C
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	55.9 %
		Atmospheric Pressure:	991.6 mbars

Deviations, Additions, or Exclusions: None

## 7 Maximum Peak Conducted Output Power at Antenna Terminals

### 7.1 Requirement(s)

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt or 30 dBm. For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 7.2 Method

The procedure described in Subclause 11.9.1.1 of ANSI C63.10-2013 was utilized as the spectrum analyzer's resolution bandwidth was greater than the DTS bandwidth.

- a) Set the RBW  $\geq$  DTS Bandwidth
- b) Set the VBW  $\geq 3 \times$  RBW
- c) Set the span  $\geq 3 \times$  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 SITE:

The test is performed in the EMC laboratory located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. ISED test site registration number is 2042T and wireless device testing laboratory CAB identifier is US0092.

#### Measurement Uncertainty

The expanded uncertainty ( $k=2$ ) is 1.3 dB.

### 7.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	08/15/2018	08/15/2019
1016	Barometer Temp/Humidity	Omega	IBTHX-W	18300406	08/18/2018	08/18/2019

#### Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

### 7.4 Results:

The sample tested was found to Comply.

## 7.5 Setup Diagram:

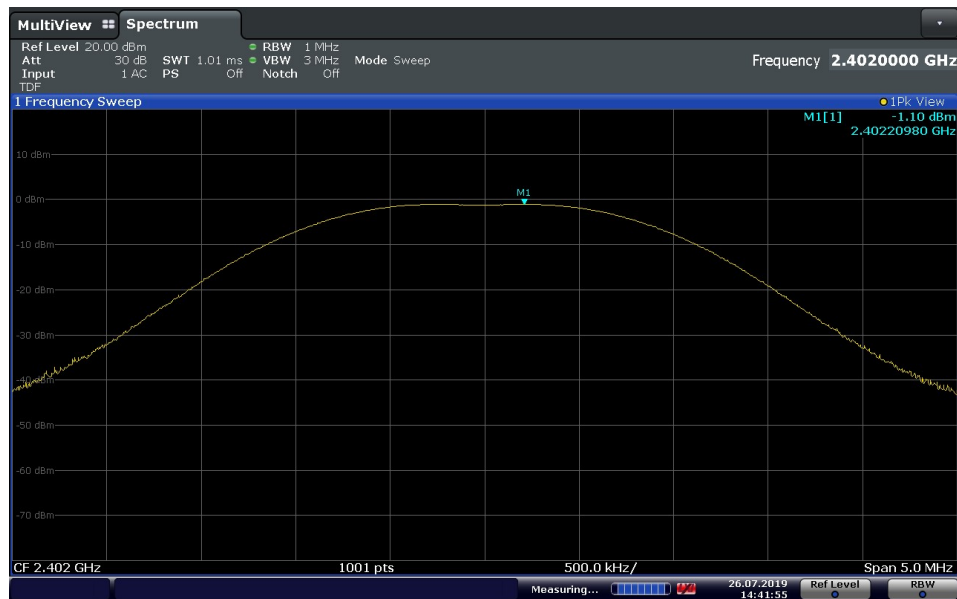


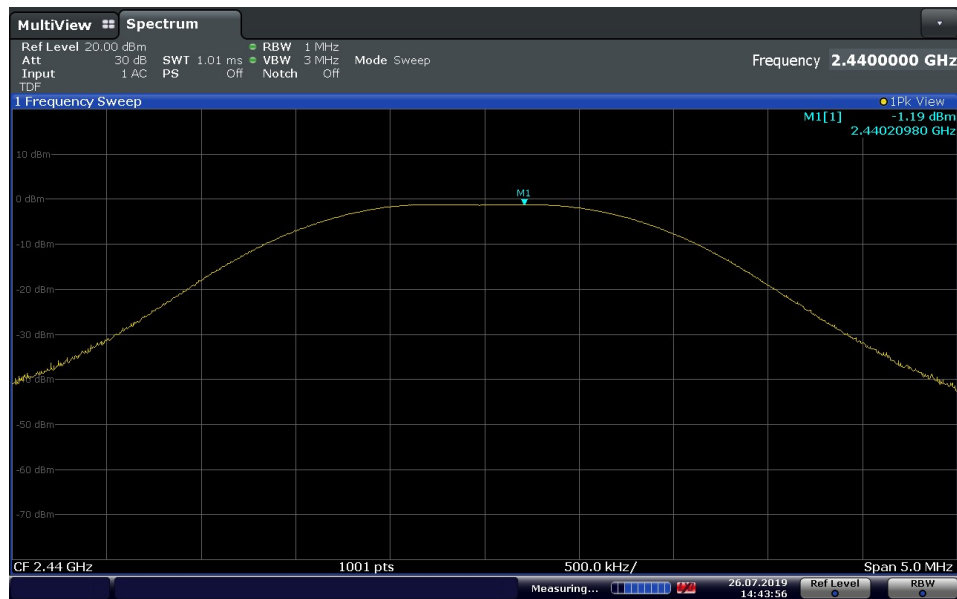
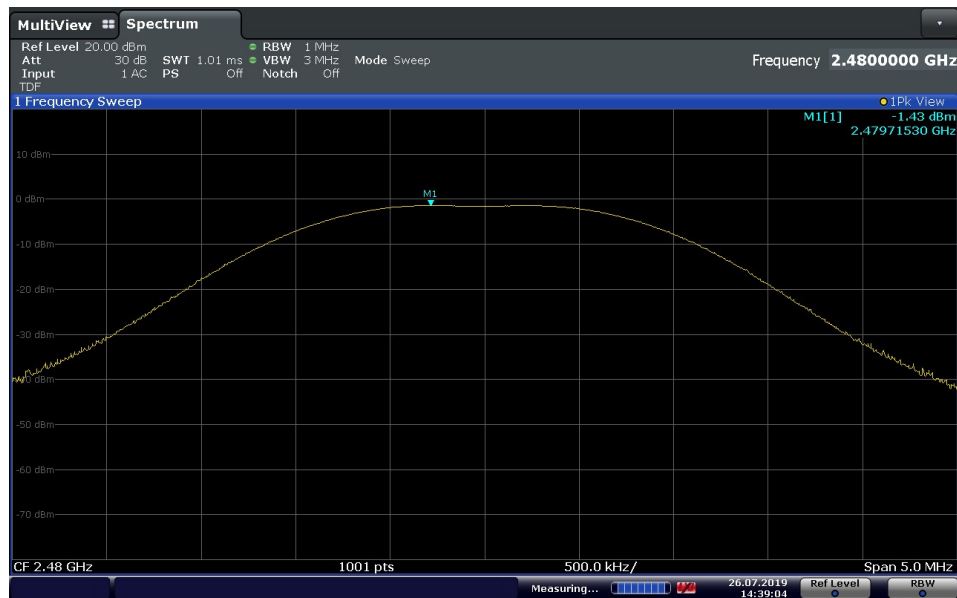
## 7.6 Plots/Data:

Frequency (MHz)	Peak Conducted Output Power	
	dBm	mW
2402	-1.10	0.7762
2440	-1.19	0.7603
2480	-1.43	0.7194

Note: The antenna port of the EUT was connected directly to the input of the measuring EMI receiver.  
The insertion loss was compensated for in the receiver

## Output Power, 2402 MHz:



**Output Power, 2440 MHz:****Output Power, 2480 MHz:**



Test Personnel:	Grace Lin	Test Date:	07/26/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	120 Vac (USB Power Adapter)	Ambient Temperature:	23.2 °C
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	55.9 %
		Atmospheric Pressure:	991.6 mbars

Deviations, Additions, or Exclusions: None

## 8 Maximum Power Spectral Density

### 8.1 Requirement(s)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 8.2 Method

The procedure described in Subclause 11.10 of ANSI C63.10-2013, specifically Subclause 11.10.2 *Method PKPSD*, was utilized.

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the *DTS bandwidth*.
- Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- Set the VBW  $\geq 3 \times \text{RBW}$ .
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = 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 SITE:

The test is performed in the EMC laboratory located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. ISED test site registration number is 2042T and wireless device testing laboratory CAB identifier is US0092.

#### Measurement Uncertainty

The expanded uncertainty ( $k=2$ ) is 1.3 dB.

### 8.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	08/15/2018	08/15/2019
1016	Barometer Temp/Humidity	Omega	IBTHX-W	18300406	08/18/2018	08/18/2019

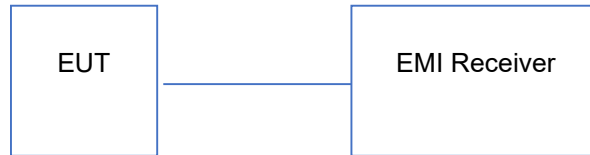
#### Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

### 8.4 Results:

The sample tested was found to Comply.

## 8.5 Setup Diagram:

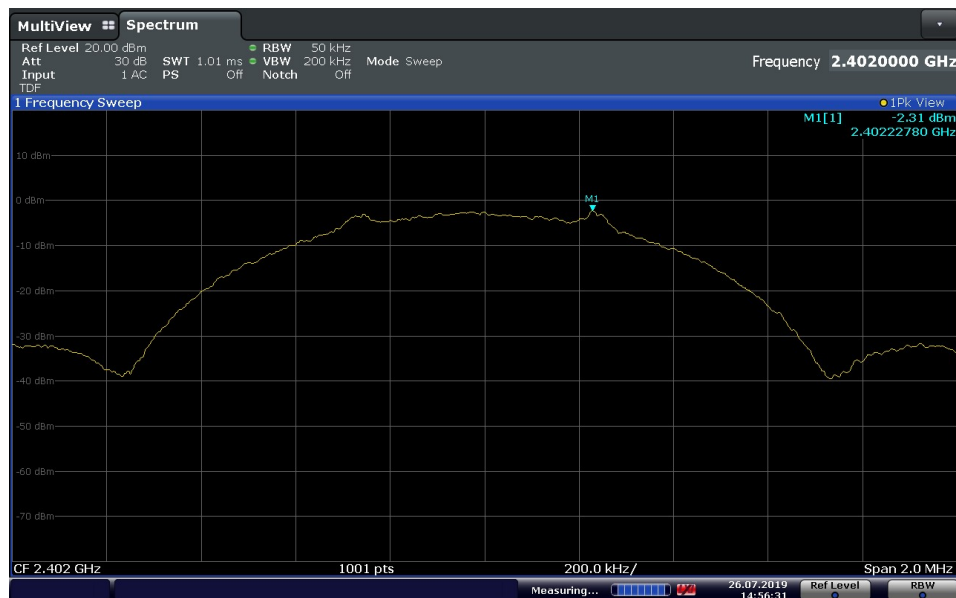


## 8.6 Plots/Data:

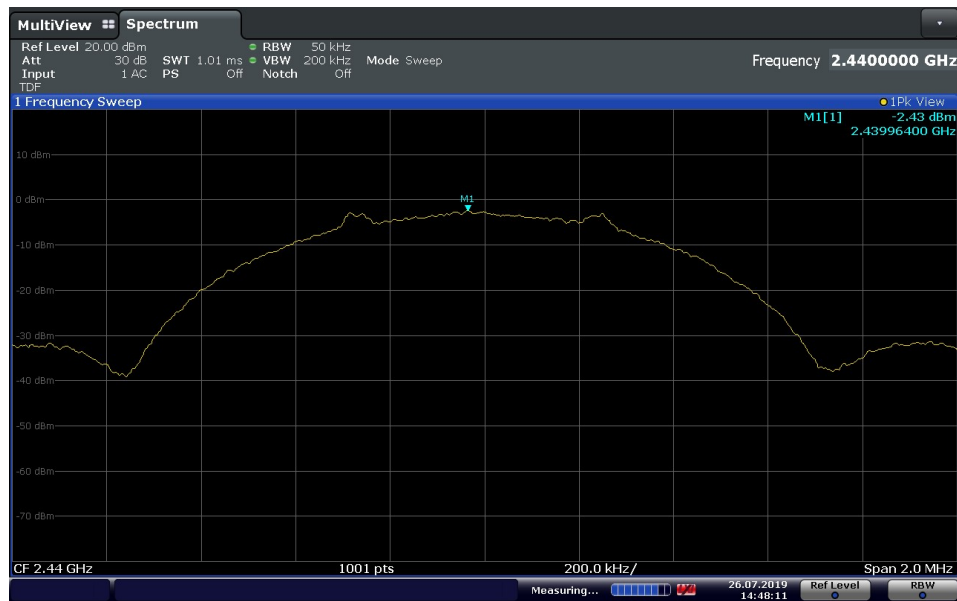
Frequency (MHz)	Maximum Power Spectral Density (dBm)
2402	-2.31
2440	-2.43
2480	-2.65

Note: The antenna port of the EUT was connected directly to the input of the measuring EMI receiver.  
The insertion loss was compensated for in the receiver

## PSD, 2402 MHz:

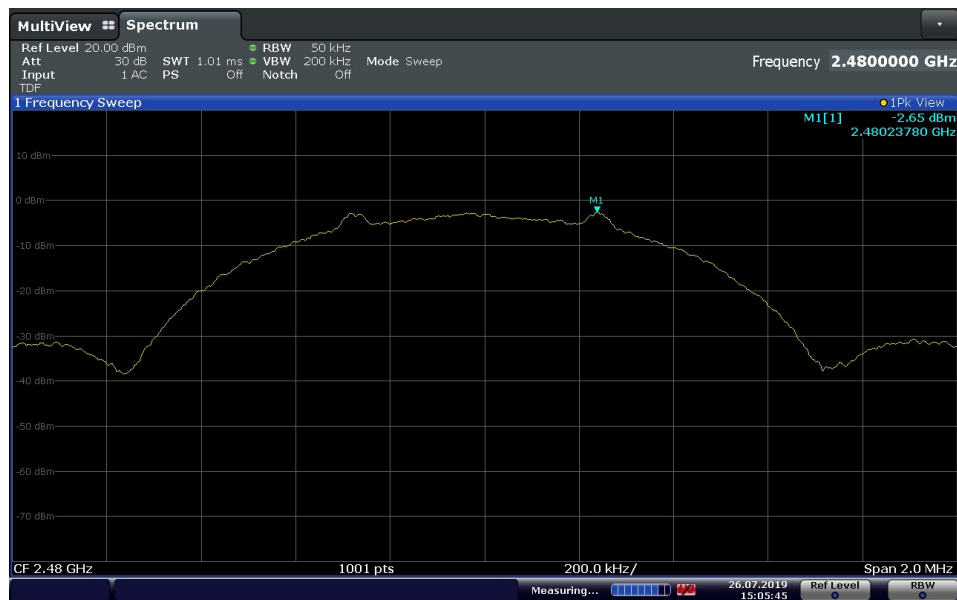


PSD, 2440 MHz:



14:48:11 26.07.2019

PSD, 2480 MHz:



15:05:45 26.07.2019

Test Personnel:	Grace Lin	Test Date:	07/26/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	120 Vac (USB Power Adapter)	Ambient Temperature:	23.2 °C
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	55.9 %
		Atmospheric Pressure:	991.6 mbars

Deviations, Additions, or Exclusions: None

## 9 Conducted Spurious Emissions

### 9.1 Requirement(s)

In any 100 kHz bandwidth outside the frequency band, the radio frequency power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of the RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), shall comply with the radiated emission limits specified in § 15.209(a)

### 9.2 Method

The procedure described in FCC Publication 558074 D01 15.247 Meas Guidance v05, August 24, 2018. Specifically, Section 8.5 DTS emissions in non-restricted frequency bands was utilized.

A spectrum analyzer was connected to the antenna port of the transmitter.

- a) Set the RBW = 100 kHz.
- b) Set the VBW  $\geq 3 \times$  RBW.
- c) Detector = peak.
- d) Sweep time = auto couple.
- e) Trace mode = max hold.
- f) Allow trace to fully stabilize.
- g) Use the peak marker function to determine the maximum amplitude level.

The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits. The RF level in the plots is relative and is not the indication of RF output power.

#### TEST SITE:

The test is performed in the EMC laboratory located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. ISED test site registration number is 2042T and wireless device testing laboratory CAB identifier is US0092.

#### Measurement Uncertainty

The expanded uncertainty (k=2) is 1.3 dB.

### 9.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	R&S	ESW44	101636	08/15/2018	08/15/2019
1016	Barometer Temp/Humidity	Omega	IBTHX-W	18300406	08/18/2018	08/18/2019

## Software Utilized:

Name	Manufacturer	Version	Profile
-	-	-	-

## 9.4 Results:

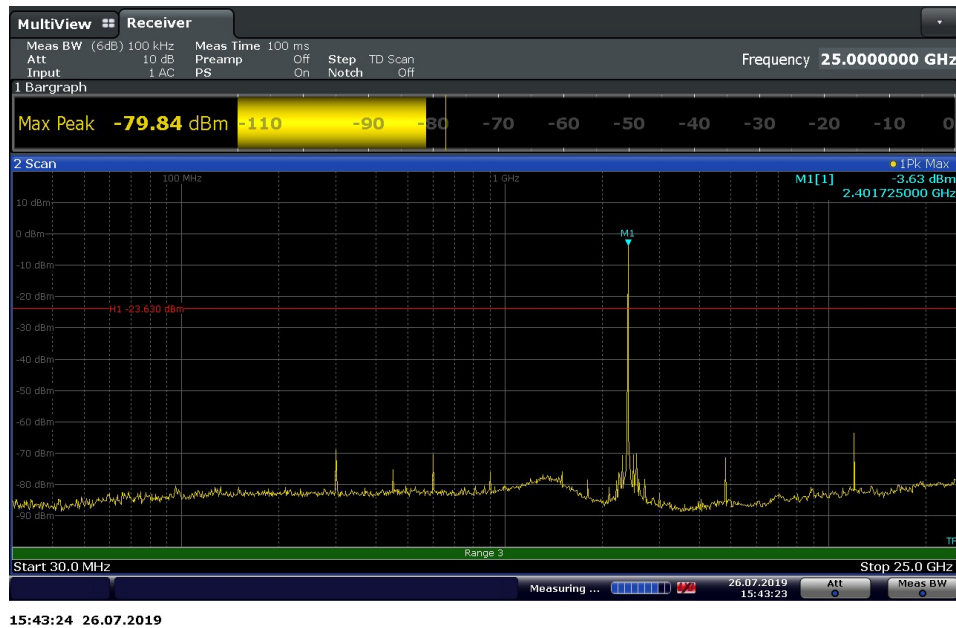
The sample tested was found to Comply. All the emissions outside of the frequency band were at least 20 dB below the carrier power level.

## 9.5 Setup Diagram:



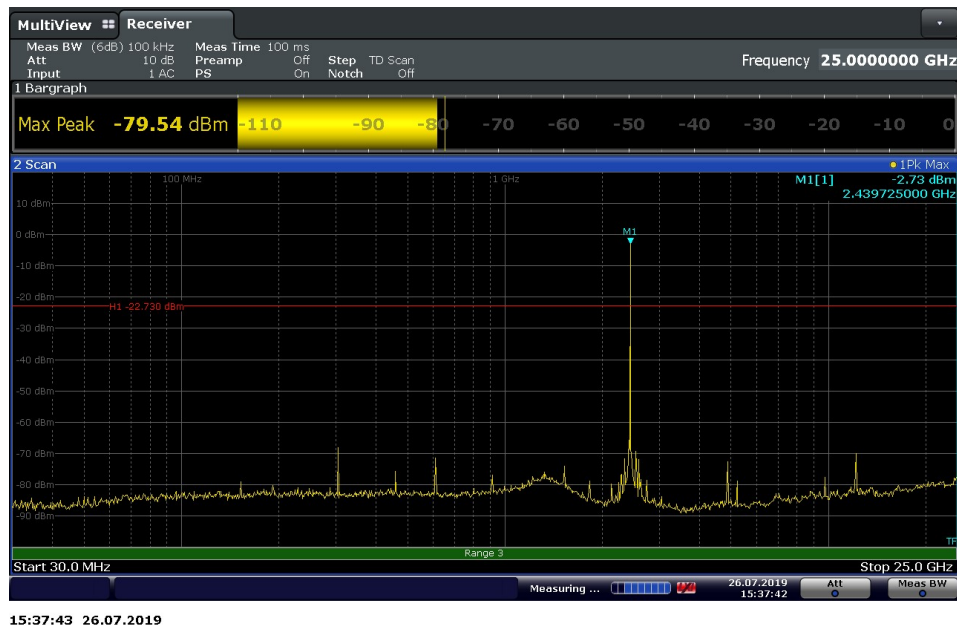
## 9.6 Plots/Data:

### Conducted Spurious Emissions, 2402 MHz:

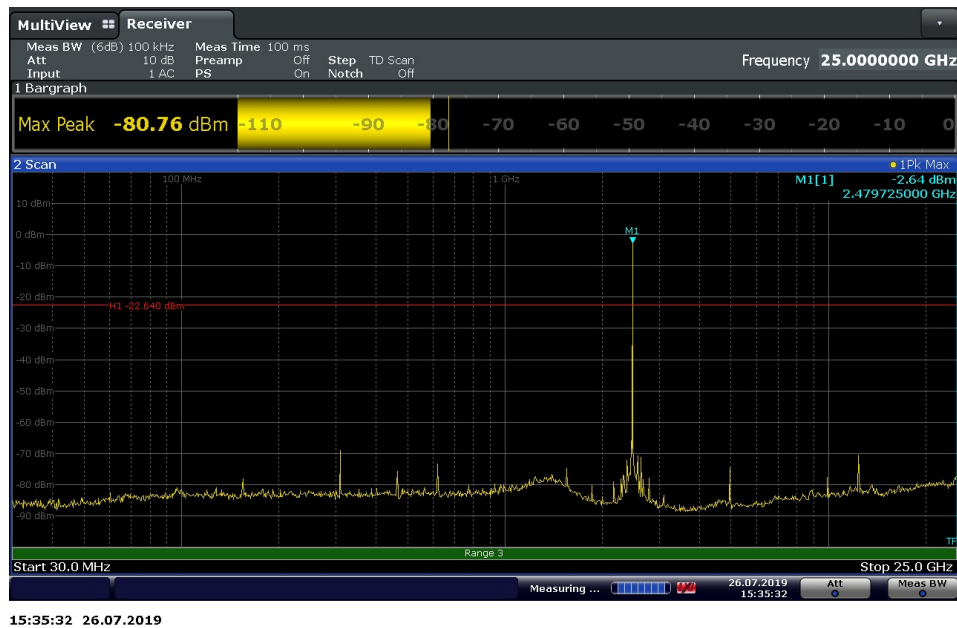




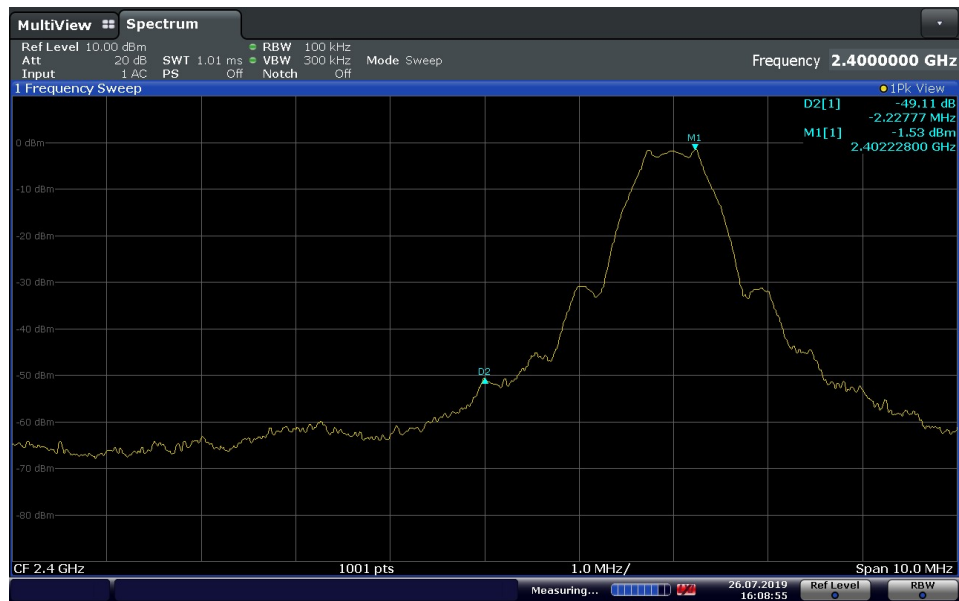
Conducted Spurious Emissions, 2440 MHz:



Conducted Spurious Emissions, 2480 MHz:



## Bandedge, Low Channel:



16:08:56 26.07.2019

## Bandedge, High Channel:



16:11:20 26.07.2019

Test Personnel:	Grace Lin	Test Date:	07/26/2018
Product Standard:	FCC §15.247, ISED RSS-247	Limit Applied:	FCC §15.247, ISED RSS-247
Input Voltage:	120 Vac (USB Power Adapter)	Ambient Temperature:	23.2 °C
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	55.9 %
		Atmospheric Pressure:	991.6 mbars

Deviations, Additions, or Exclusions: None

## 10 Radiated Spurious Emissions

### 10.1 Requirement(s)

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), shall comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

In any 100 kHz bandwidth outside the frequency band, the radio frequency power shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of the RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

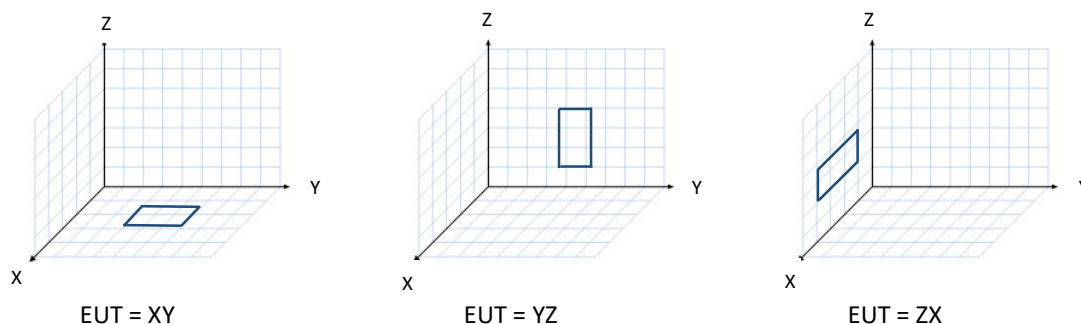
### 10.2 Method

EUT was configured to transmit continuously. Radiated emission measurements were performed from 30 MHz to 10 GHz according to the procedure described in ANSI C64.10. Spectrum analyzer resolution bandwidth is 120 kHz for frequencies 30 MHz to 1000 MHz. Above 1 GHz, both Peak and Average measurements were performed. The peak level of radiated emissions was measured with a resolution bandwidth (RBW) of 1 MHz, a video bandwidth (VBW) of 3 MHz, and a peak detector. The average level of radiated emissions was measured with a resolution bandwidth (RBW) of 1 MHz, a video bandwidth (VBW) of 3 MHz, and an RMS detector with trace averaging.

The EUT is placed 80 cm in height for frequencies 30 MHz to 1 GHz and 1.5 meters in height for frequency above 1 GHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated spurious emissions measurement is performed at 3 meters distance for frequencies below 18 GHz and 1 meter for frequencies above 18 GHz.

EUT was tested at two normal operation orientations: XY and YZ planes. Data included is representative of the worst-case configuration (the configuration which resulted in the highest emission levels). Plots below are corrected for distance, cables, preamp, filters and antenna factors then compared to the limits.



#### TEST SITE:

The test is performed in the 3-meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. ISED

test site registration number is 2042T and wireless device testing laboratory CAB identifier is US0092.

**Measurement Uncertainty**

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 3m	30-1000 MHz	4.2 dB	6.3 dB (SAC)
Radiated Emissions, 3m	1-6 GHz	5.1 dB	5.2 dB (FAR)
Radiated Emissions, 3m	6-18 GHz	5.5 dB	5.5 dB (FAR)
Radiated Emissions, 3m	18-26.5 GHz	5.5 dB	-

As shown in the table above our radiated emissions  $U_{lab}$  is less than the corresponding  $U_{CISPR}$  reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

**Sample Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

FS = Field Strength in dB $\mu$ V/m

RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in dB}\mu\text{V}$$

**Example:**

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

**10.3 Test Equipment Used:**

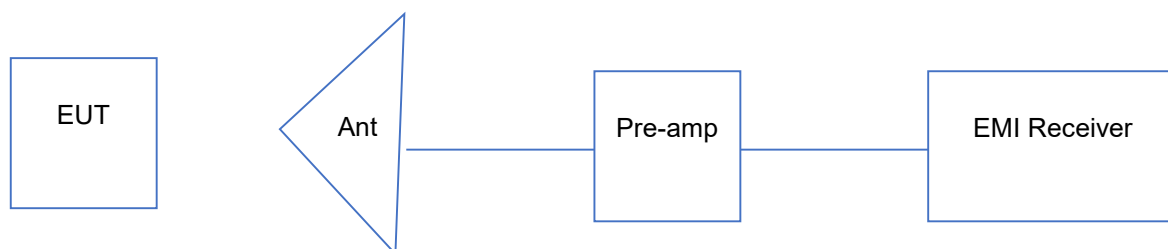
Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
637	3m Semi-anechoic Chamber	Panashield	3 meter	25 331-D-Z	December 2018	December 2021
1669	EMI Test Receiver	R&S	ESW44	101636	09/03/2019	09/03/2020
1707	Bilog Antenna	sunAR	JB6	A110618	09/26/2019	09/26/2020
1576	Pre-amp	R&S	TS-PR1	102068	01/13/2020	01/13/2021
1515	Horn Antenna	ETS-Lindgren	3115	00161631	04/17/2019	04/17/2020
1556	Pre-amp	R&S	TS-PR18	102144	01/13/2020	01/13/2021
880	Horn Antenna	ETS-Lindgren	3116	00153521	04/18/2018	04/18/2020
1557	Pre-amp	R&S	TS-PR1840	100054	01/13/2020	01/13/2021
1418	Filter	Reactel	7HSX-3G/18G-S11	14-2	01/13/2020	01/13/2021
1517	Cable	R&S	TSPR-B7	101528	01/13/2020	01/13/2021
1518	Cable	R&S	TSPR-B7	101529	01/13/2020	01/13/2021
1412	Barometer Pressure/ Humidity/ Temperature Datalogger	EXTECH	SD700	Q769038	01/22/2020	01/22/2021

**Software Utilized:**

Name	Manufacturer	Version	Profile
BAT-EMC	Nexio	3.18.0.16	LAX Intertek Emissions Template 03-30-2018

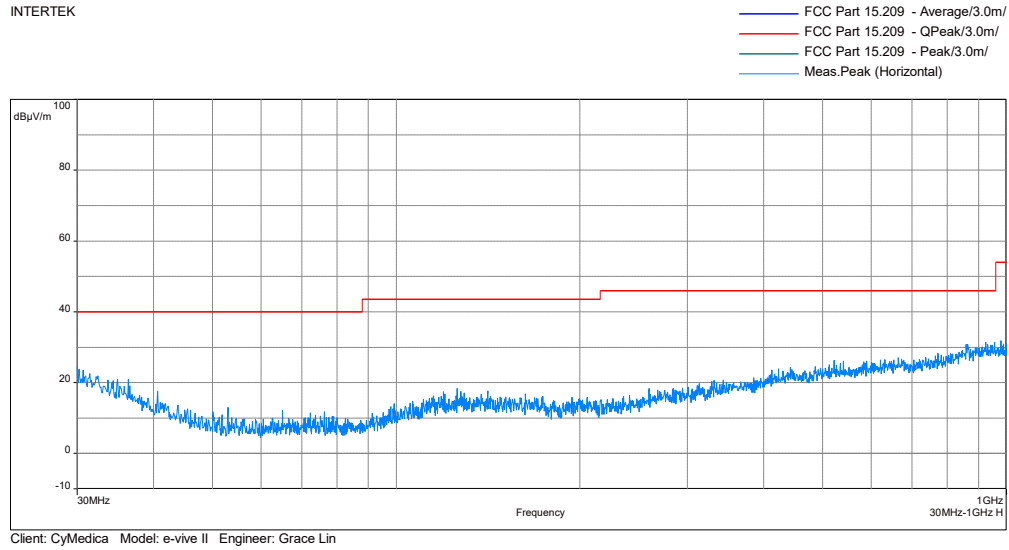
**10.4 Results:**

The sample tested was found to Comply.

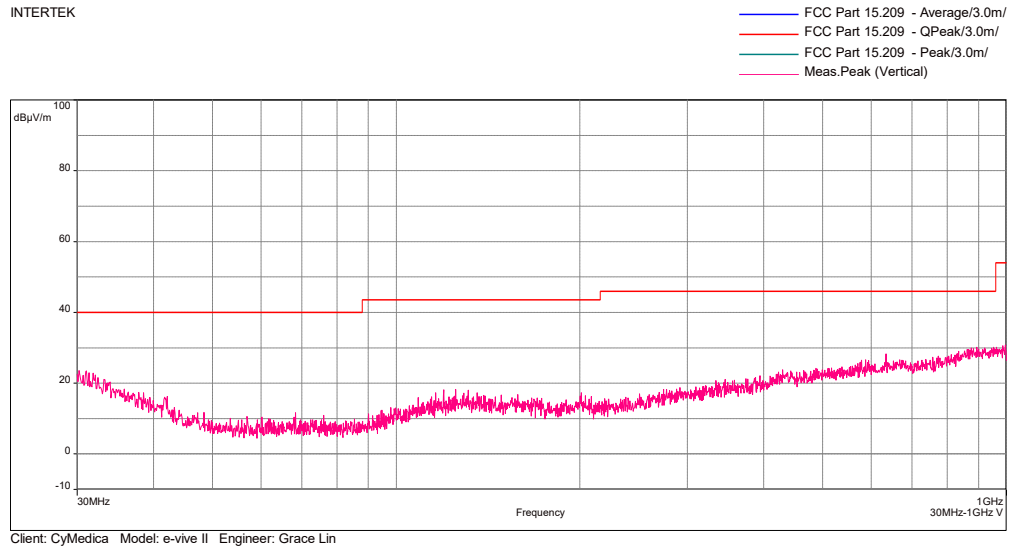
**10.5 Setup Diagram:**

## 10.6 Plots/Data:

### Radiated Spurious Emissions, 30 MHz – 1 GHz, Low Channel, Horizontal



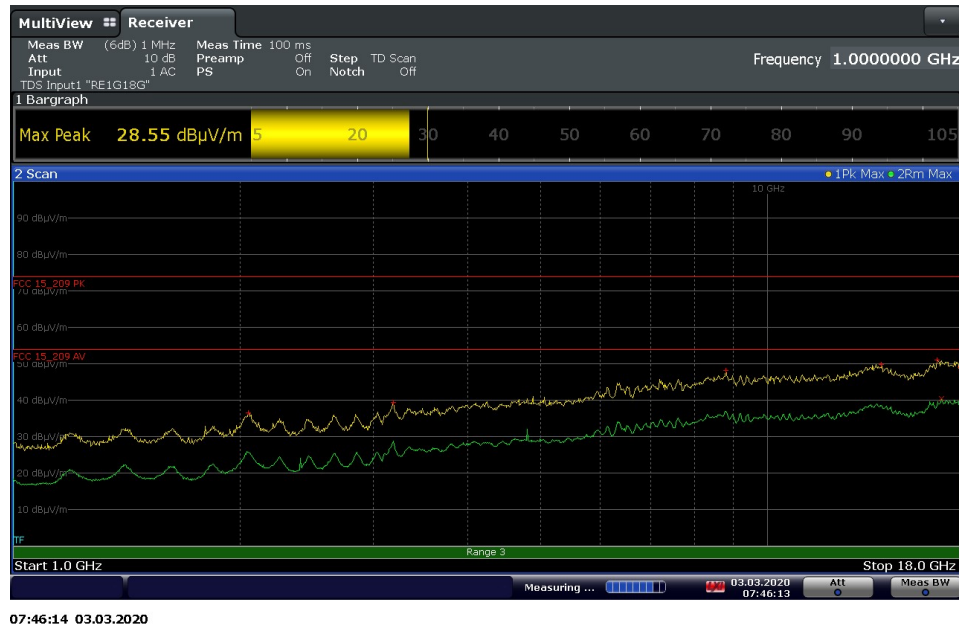
### Radiated Spurious Emissions, 30 MHz – 1 GHz, Low Channel, Vertical



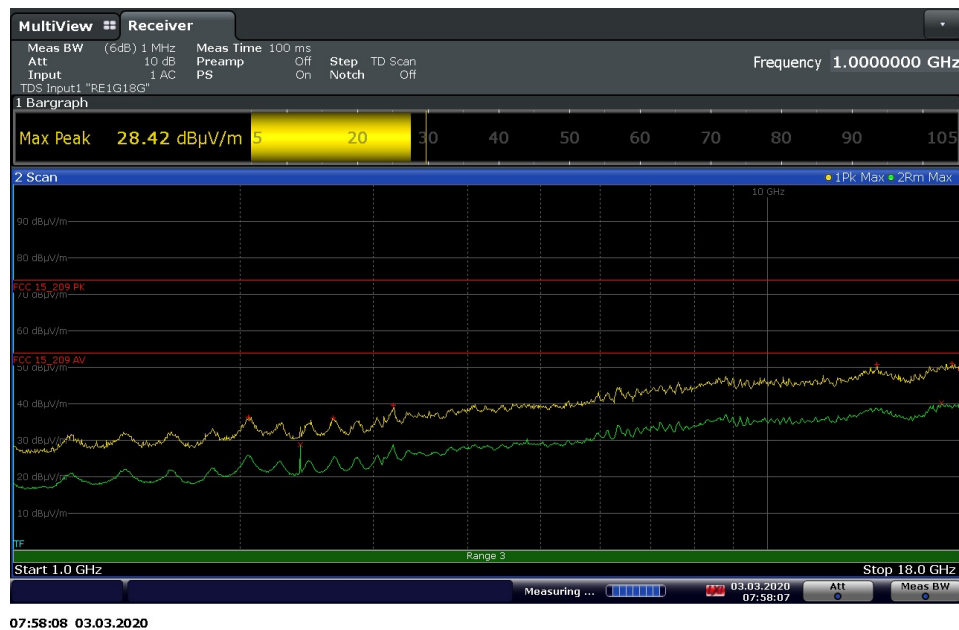


## 10.6 Plots/Data: (Continued)

### Radiated Spurious Emissions, 1-18 GHz, Low Channel, Horizontal



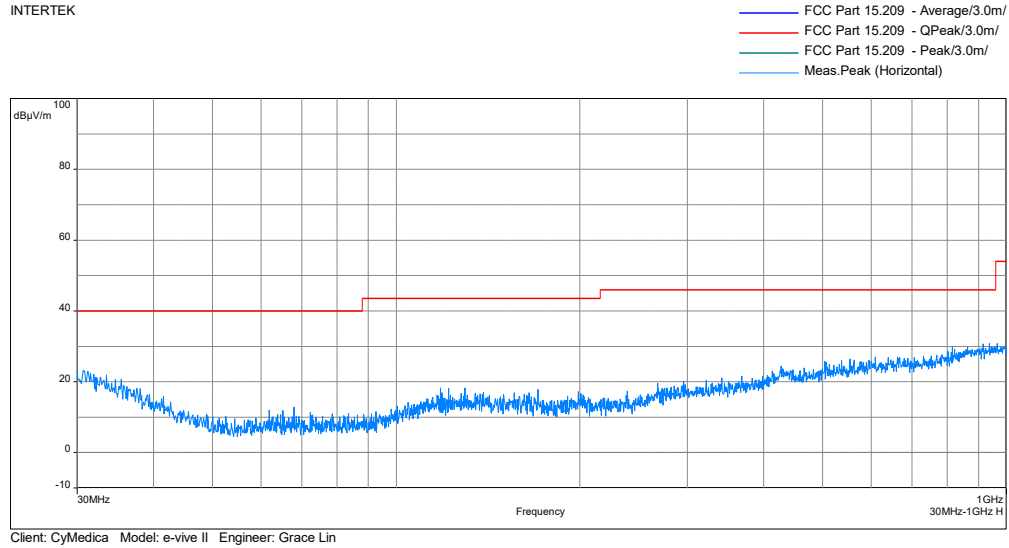
### Radiated Spurious Emissions, 1-18 GHz, Low Channel, Vertical



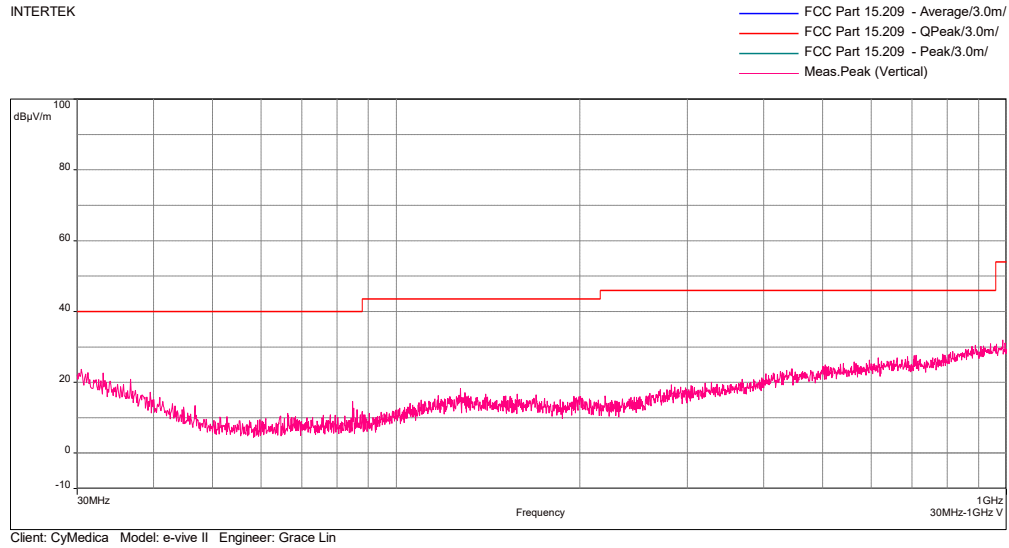
Note: Radiated spurious emissions measurements were performed from 30 MHz to 25 GHz.

## 10.6 Plots/Data: (Continued)

### Radiated Spurious Emissions, 30 MHz – 1 GHz, Middle Channel, Horizontal

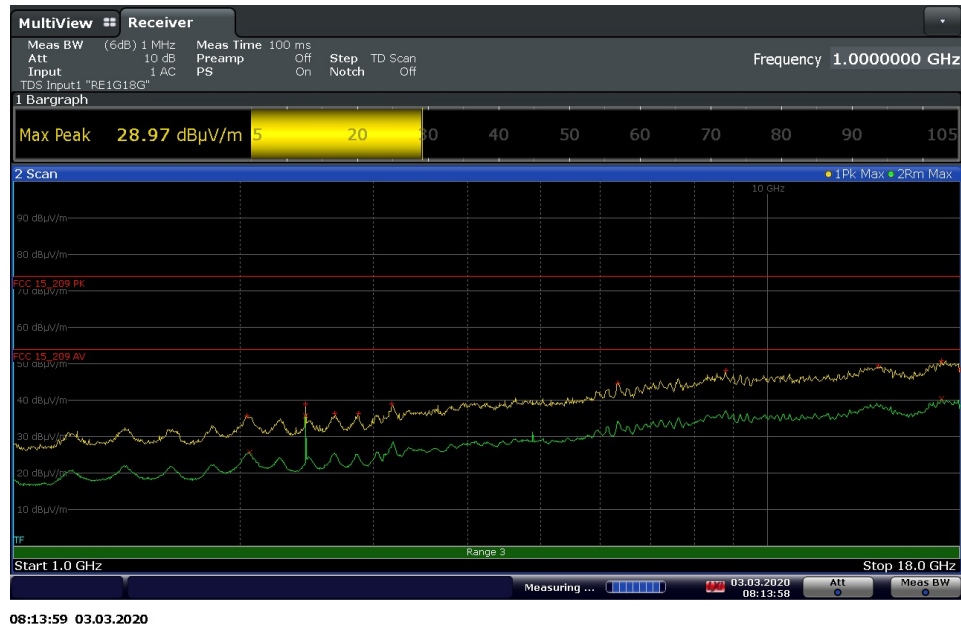


### Radiated Spurious Emissions, 30 MHz – 1 GHz, Middle Channel, Vertical

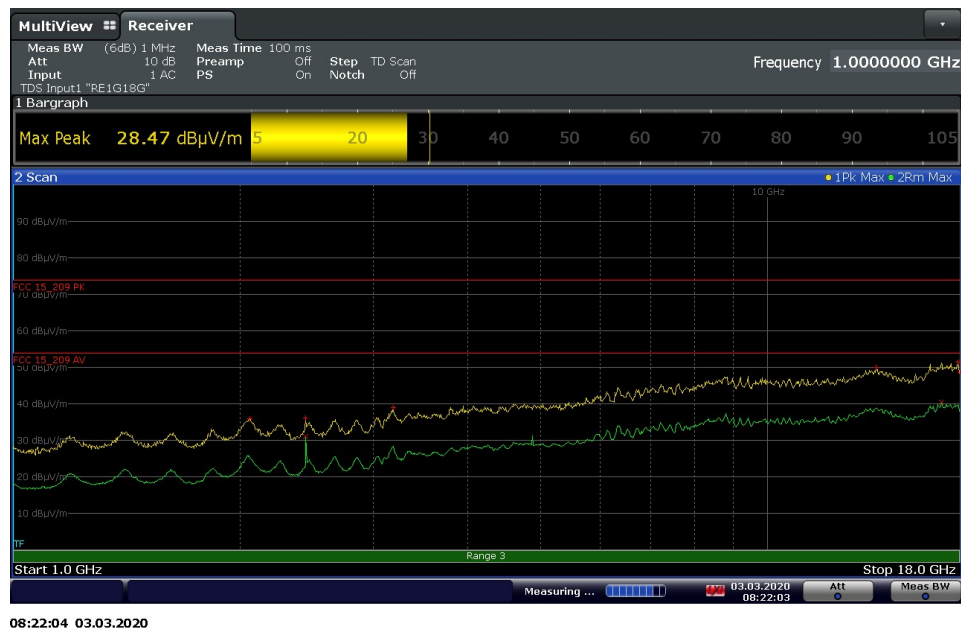


## 10.6 Plots/Data: (Continued)

## Radiated Spurious Emissions, 1-18 GHz, Middle Channel, Horizontal



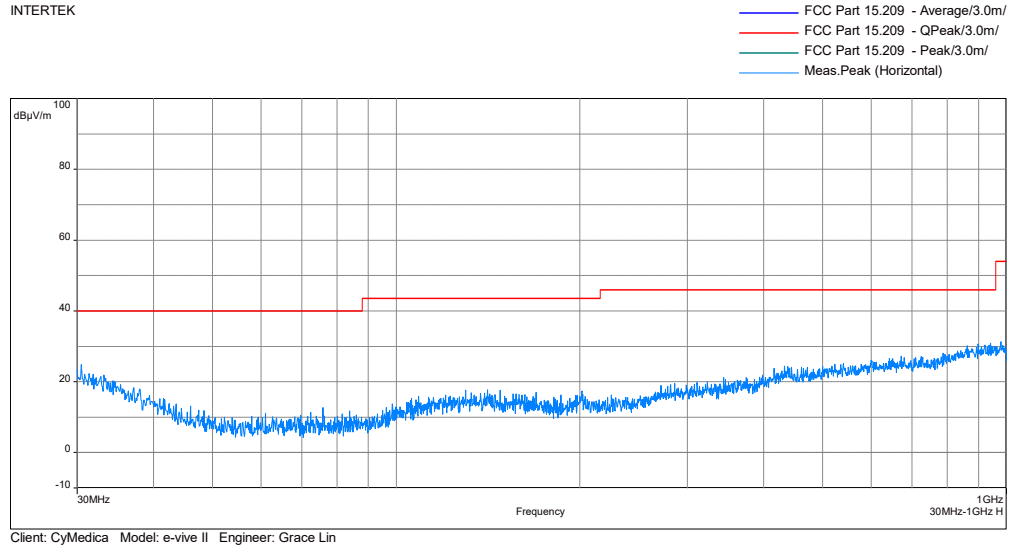
## Radiated Spurious Emissions, 1-18 GHz, Middle Channel, Vertical



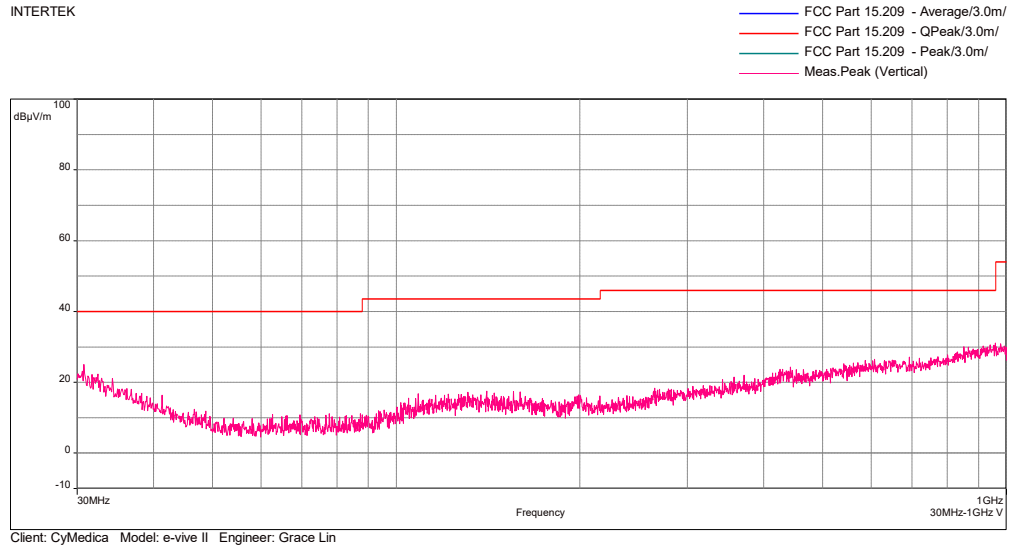
Note: Radiated spurious emissions measurements were performed from 30 MHz to 25 GHz.

10.6 Plots/Data: (Continued)

Radiated Spurious Emissions, 30 MHz – 1 GHz, High Channel, Horizontal

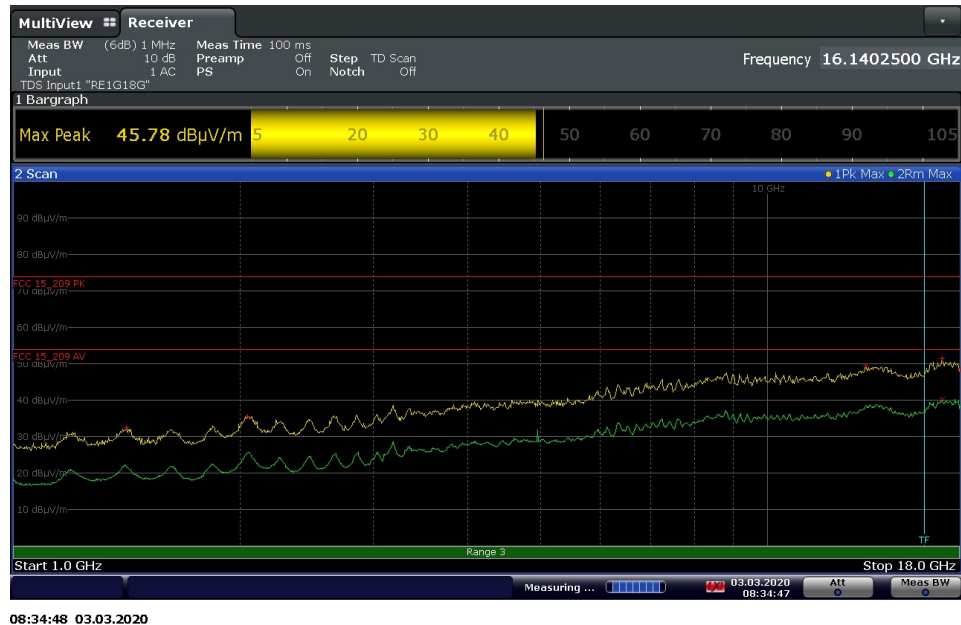


Radiated Spurious Emissions, 30 MHz – 1 GHz, High Channel, Vertical

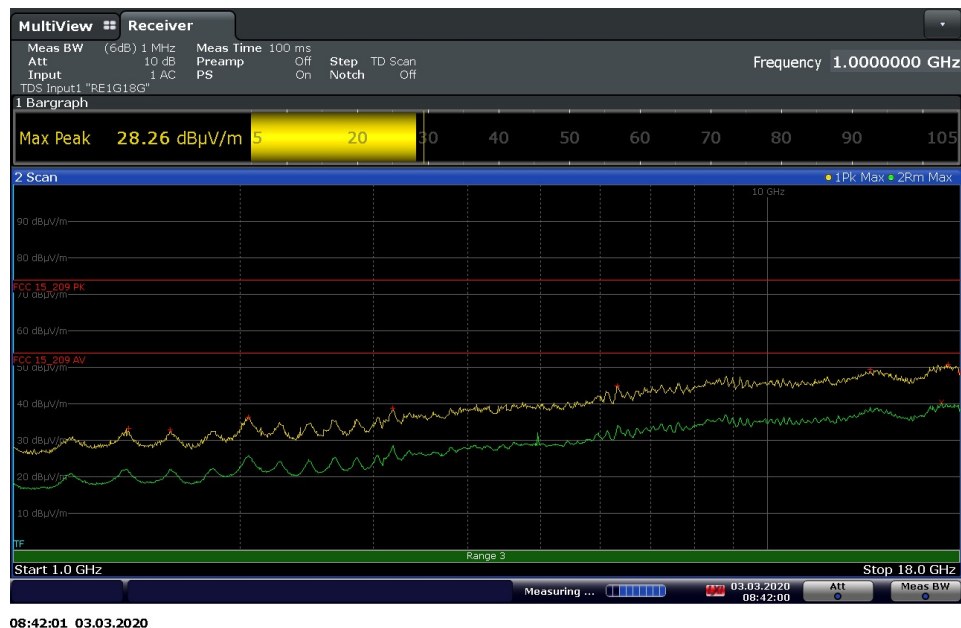


## 10.6 Plots/Data: (Continued)

## Radiated Spurious Emissions, 1-18 GHz, High Channel, Horizontal



## Radiated Spurious Emissions, 1-18 GHz, High Channel, Vertical



Note: Radiated spurious emissions measurements were performed from 30 MHz to 25 GHz.

**10.6 Plots/Data: (Continued)**

Radiated spurious emissions, Low Channel:

Frequency (MHz)	FS Level, PK (dBμV/m)	Limits, QP dBuV/m	Margin (dB)	Antenna Height (m)	Turntable Angle (°)	Antenna Polarization	Correction (dB)
30.00	24.61	40	-15.39	1.00	12.25	H	-4.16
859.06	30.74	46	-15.26	1.00	12.25	H	0.11
863.33	30.78	46	-15.22	1.00	12.25	H	0.23
924.44	31.43	46	-14.57	1.00	12.25	H	0.52
931.13	30.78	46	-15.22	1.00	12.25	H	0.60
955.77	31.42	46	-14.58	1.00	12.25	H	0.92

Radiated spurious emissions, Middle Channel:

Frequency (MHz)	FS Level, PK (dBμV/m)	Limits, QP dBuV/m	Margin (dB)	Antenna Height (m)	Turntable Angle (°)	Antenna Polarization	Correction (dB)
915.90	30.7	46	-15.34	1.02	11.75	H	0.38
937.53	30.8	46	-15.20	1.02	11.75	H	0.68
889.23	30.5	46	-15.52	3.98	0.00	V	0.32
916.97	30.3	46	-15.74	3.98	0.00	V	0.37
941.41	30.9	46	-15.13	3.98	0.00	V	0.76
958.10	30.3	46	-15.74	3.98	0.00	V	0.94

Radiated spurious emissions, High Channel:

Frequency (MHz)	FS Level, PK (dBμV/m)	Limits, QP dBuV/m	Margin (dB)	Antenna Height (m)	Turntable Angle (°)	Antenna Polarization	Correction (dB)
30.49	24.87	40	-15.13	1.00	9.75	H	-4.48
898.15	30.68	46	-15.32	1.00	9.75	H	0.40
941.99	30.88	46	-15.12	1.00	9.75	H	0.82
30.78	24.98	40	-15.02	3.98	0.00	V	-4.69
939.67	30.59	46	-15.41	3.98	0.00	V	0.71
959.07	31.13	46	-14.87	3.98	0.00	V	0.95

Note: Radiated spurious emissions measurements were performed from 30 MHz to 25 GHz.

**10.6 Plots/Data: (Continued)**

Radiated spurious emissions above 1 GHz:

Antenna Polarization	Frequency (MHz)	Channel Freq. (MHz)	EUT Power Setting	EUT Orientation	Final Field Strength (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Turttable Degree	Antenna Height (cm)	Detector
H	2390	2402	0	YZ	34.53	74.00	-39.47	354.75	399.00	PK
H	2390	2402	0	YZ	24.39	54.00	-29.61	354.75	399.00	RMS
V	2390	2402	0	YZ	35.04	74.00	-38.96	11.00	377.00	PK
V	2390	2402	0	YZ	24.73	54.00	-29.27	11.00	377.00	RMS
H	4880	2440	0	YZ	43.22	74.00	-30.78	347.75	139.00	PK
H	4880	2440	0	YZ	33.98	54.00	-20.02	347.75	139.00	RMS
V	4880	2440	0	YZ	42.13	74.00	-31.87	1.75	100.00	PK
V	4880	2440	0	YZ	31.91	54.00	-22.09	1.75	100.00	RMS
H	2483.5	2480	0	YZ	37.74	74.00	-36.26	360.00	274.00	PK
H	2483.5	2480	0	YZ	27.63	54.00	-26.37	360.00	274.00	RMS
V	2483.5	2480	0	YZ	39.19	74.00	-34.81	33.25	393.00	PK
V	2483.5	2480	0	YZ	29.20	54.00	-24.80	33.25	393.00	RMS

Note: Radiated spurious emissions measurements were performed from 30 MHz to 25 GHz.

Test Personnel: Grace Lin

Product Standard: FCC §15.247,  
ISED RSS-247

Input Voltage: DC (built-in battery)

Pretest Verification w/  
BB Source: Yes

Test Date: 03/02/2020 - 03/03/2020

Limit Applied: FCC §15.209,  
RSS-Gen §8.9

Ambient Temperature: 19.6 °C

Relative Humidity: 32.3 %

Atmospheric Pressure: 986.5 mbars

Deviations, Additions, or Exclusions: None

## 11 AC Mains Conducted Emissions

### 11.1 Performance Criterion

Frequency Band MHz	Conducted Limit dB( $\mu$ V)	
	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *
0.50-5.00	56	46
5.00-30.00	60	50

*Note: \*Decreases linearly with the logarithm of the frequency  
At the transition frequency the lower limit applies.*

### 11.2 Method

Tests are performed in accordance with ANSI C63.4-2014.

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

#### TEST SITE:

The test is performed in the 3-meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA. ISED test site registration number is 2042T and wireless device testing laboratory CAB identifier is US0092.



**Measurement Uncertainty**

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
AC Line Conducted Emissions	150 kHz - 30 MHz	2.5 dB	3.4 dB

As shown in the table above our conducted emissions  $U_{lab}$  is less than the corresponding  $U_{CISPR}$  reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

**Sample Calculations**

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB $\mu$ V

RF = Reading from receiver in dB $\mu$ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB $\mu$ V

**Example:**

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

**11.3 Test Equipment Used:**

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
-	-	-	-	-	-	-

**Software Utilized:**

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

**11.4 Results:**

This test is not applicable as the EUT, under normal operation, is battery powered.

**12 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	07/30/2019	103922224LAX-007	GL	SK	Initial Issue
1	08/27/2019	103922224LAX-007	GL	SK	Antenna gain disclaimer was added to Page 6, under Section 4
2	03/03/2020	103922224LAX-007	GL	SK	Updated §10.6 data with EUT docked in a garment and powered by the built-in battery.