

# AMPT L.L.C. TEST REPORT

**SCOPE OF WORK**

FCC §15.247 & ISED RSS-247 TESTING – STRING OPTIMIZER, MODEL: 31570012-600

**REPORT NUMBER**

103475745LAX-001

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Non-Specific Radio Report Shell Rev. December 2017

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## EMC TEST REPORT

(FULL COMPLIANCE)

**Report Number:** 103475745LAX-001

**Project Number:** G103475745

**Report Issue Date:** May 30, 2018

**Model Tested:** 31570012-600

**Standards:** **FCC CFR47 Part 15 Subpart C, May 2018**

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 License-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:

AMPT L.L.C.

4850 Innovation Drive  
Fort Collins, CO 80525  
USA

Report prepared by



Martin Liu  
EMC Engineer

Report reviewed by



Grace Lin  
EMC Staff Engineer

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## 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
6	Occupied Bandwidths (FCC §15.247(a)(1); ISED RSS-247 §5.1, RSS-Gen §6.7)	Compliant
7	Conducted Output Power at Antenna Terminal (FCC §15.247(b)(1); ISED RSS-247 §5.4)	Compliant
8	Carrier Frequency Separation (FCC §15.247(a)(1); ISED RSS-247 §5.1)	Compliant
9	Number of Hopping Frequencies (FCC §15.247(a)(1); ISED RSS-247 §5.1)	Compliant
10	Time of Occupancy (Dwell Time) (FCC §15.247(a)(1); ISED RSS-247 §5.1)	Compliant
11	Conducted Spurious Emissions (FCC §15.247(d); ISED RSS-247 §5.5)	Compliant
12	Radiated Spurious Emissions (FCC §15.247(d), §15.209, §15.205; ISED RSS-Gen §§8.9, 8.10)	Compliant
-	AC Mains Conducted Emissions (FCC §15.247(d), FCC §15.207; ISED RSS-Gen §8.8)	*Not Applicable

\*: The equipment under test is DC powered.

### 3 Client Information

This EUT was tested at the request of:

**Client:** AMPT  
4850 Innovation Drive  
Fort Collins, CO 80525  
USA

**Contact:** Robin Richardson  
**Telephone:** 970-372-6960  
**Fax:** 970-225-0483  
**Email:** robin.richardson@ampt.com

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

**Manufacturer:** AMPT  
4850 Innovation Drive  
Fort Collins, CO 80525  
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
String Optimizer	AMPT	31570012-600	3514K000664 (for radiated measurement)
String Optimizer	AMPT	31570012-600	2617K000004 (for conducted measurement)

Receive Date:	05/07/2018	Test Started	05/14/2018
Received Condition:	Good	Test Ended	05/17/2018
Type:	Production		

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

The equipment under test is an Ampt String Optimizer, a DC/DC converter that is used to lower the cost and improve performance of new PV systems, upgrade existing systems to produce more energy, enable low-cost DC-coupled solar & storage systems, and provide string-level data for improved O&M.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
600VDC	11A	DC	N/A

#### Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Test Mode – Continuously Transmitting

**Software used by the EUT:**

No.	Descriptions of EUT Exercising
1	Under test mode, the EUT was programmed to transmit continuously during testing.

Radio/Receiver Characteristics	
<b>Operating Frequency Range</b>	2410 MHz – 2474.5 MHz
<b>Modulation Type(s)</b>	FSK (FHSS)
<b>Number of Channels</b>	FHSS: 255 (only 25 used at any given time)
<b>Test Channels</b>	2410 MHz, 2442 MHz, 2474.5 MHz
<b>Equipment Type</b>	Standalone
<b>Antenna Type and Gain</b>	Integral Trace Antenna

**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.

31570012-xxxx where -xxxx equals the voltage of the unit (max 600V).

## 5 System Setup and Method

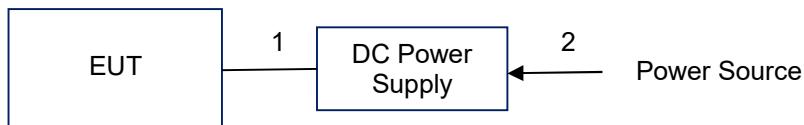
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	DC Power Wires (EUT-DC Power Supply)	2.2	No	Yes	Yes
2	Power Cord (DC Power Supply – Power Source)	1.5	No	No	Yes

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
DC Power Supply	Meanwell	RS-25-48 (supplies 96 Vdc to EUT for testing)	EB38704136, EB38704293
Computer (initial setup)	DELL	P08S	Service Tag: FXJK5L1
AC/DC Adapter (for computer)	DELL	DA130PE1-00	CN-0JU012-48661-036-AW6T-A03

### 5.1 Method:

Configuration as required by ANSI C63.10-2013.

### 5.2 EUT Setup Block Diagram:



## 6 Occupied Bandwidths

### 6.1 Requirement(s)

The 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated

### 6.2 Method

The procedure described in Section 6.9.2 of ANSI C63.10-2013 was used.

#### 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. IC test site registration number is 2042T.

### 6.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	Rhode & Schwarz	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

#### Software Utilized:

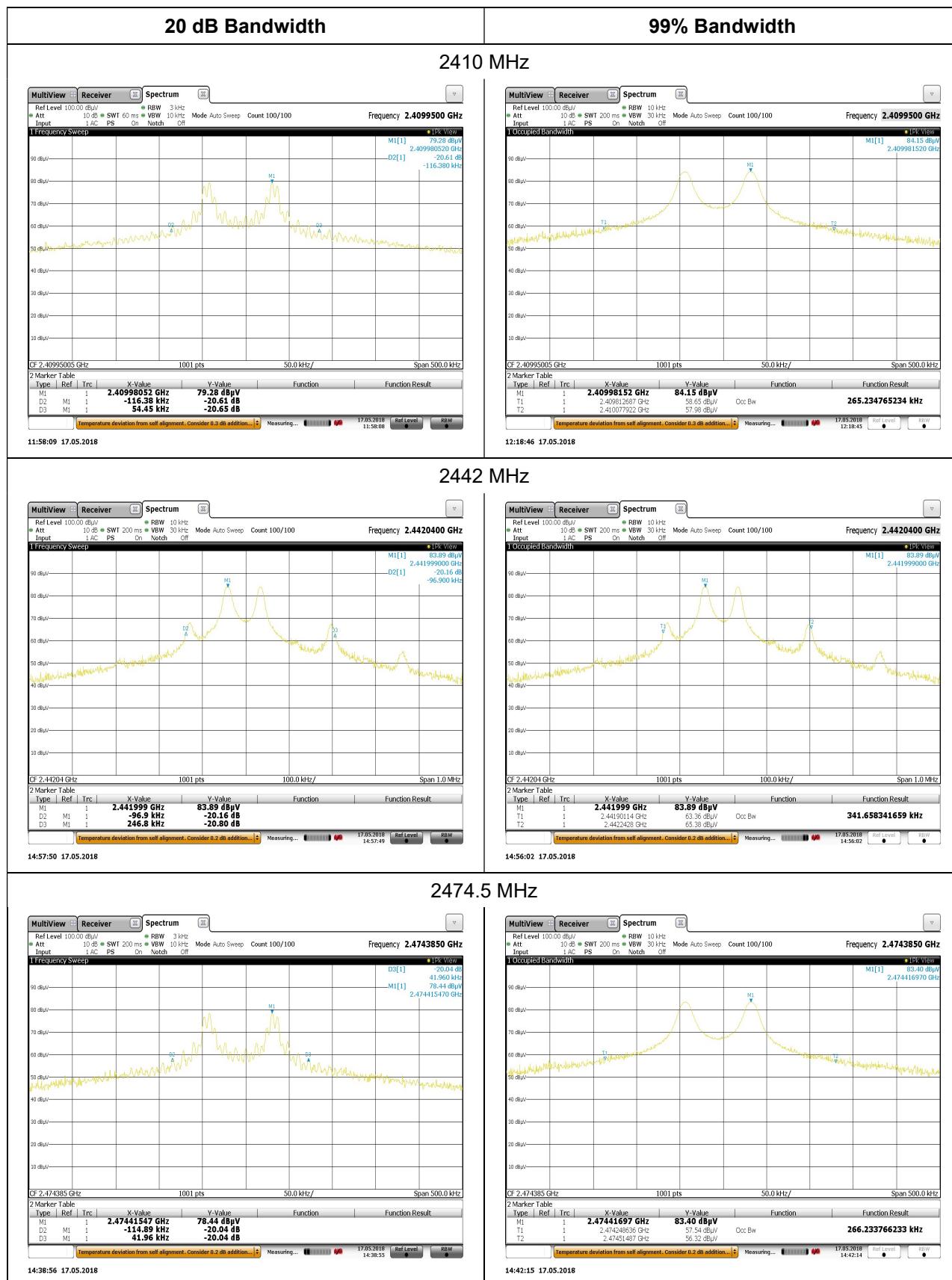
Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

### 6.4 Results:

The sample tested was found to comply.

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

Channel Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
2410	171	265
2442	344	342
2474.5	157	266



Test Personnel:	Martin Liu	Test Date:	05/17/2018
Product Standard:	FCC §15.247; ISED RSS-247	Limit Applied:	FCC §15.247; ISED RSS-247
Input Voltage:	120 Vac, 60 Hz	Ambient Temperature:	21.4 °C
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	39.7 %
		Atmospheric Pressure:	994.5 mbars

Deviations, Additions, or Exclusions: None

## 7 Maximum Peak Conducted Output Power at Antenna Terminals

### 7.1 Requirement(s)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, the maximum peak output power is 1 watt (30 dBm). For all other frequency hopping systems operating in the 2400-2483.5 MHz band, the maximum peak output power is 0.125 watts.

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 Section 7.8.5 of ANSI C63.10-2013 was used.

#### 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. IC test site registration number is 2042T.

### 7.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1140	EMI Test Receiver	R&S	ESCI7	100825	02/28/2018	02/28/2019
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

#### Software Utilized:

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

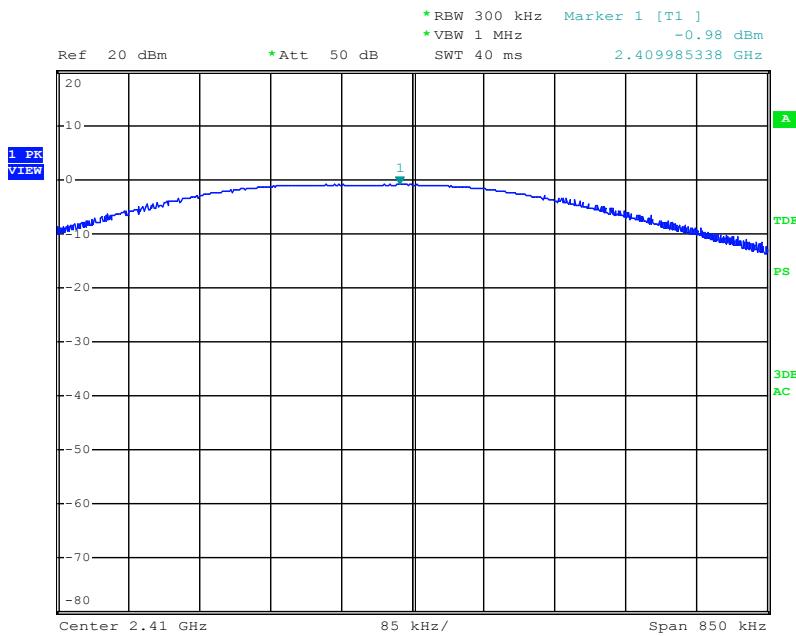
### 7.4 Results:

The sample tested was found to Comply with the limit of 0.125 Watt.

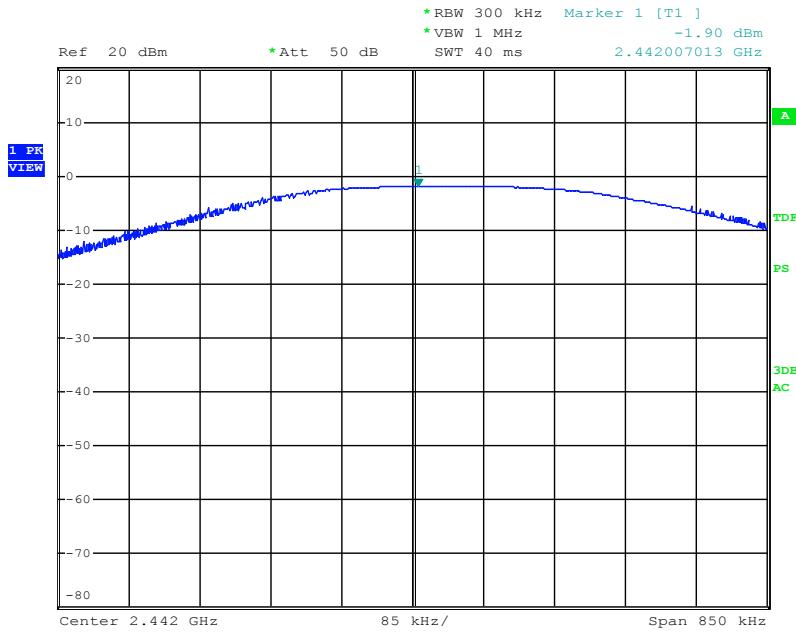
**7.5 Setup Diagram:****7.6 Plots/Data:**

Channel Frequency (MHz)	Peak Conducted Output Power	
	dBm	mW
2410	-0.98	0.798
2442	-1.90	0.646
2474.5	-2.30	0.589

Note: The insertion loss was compensated for in the receiver

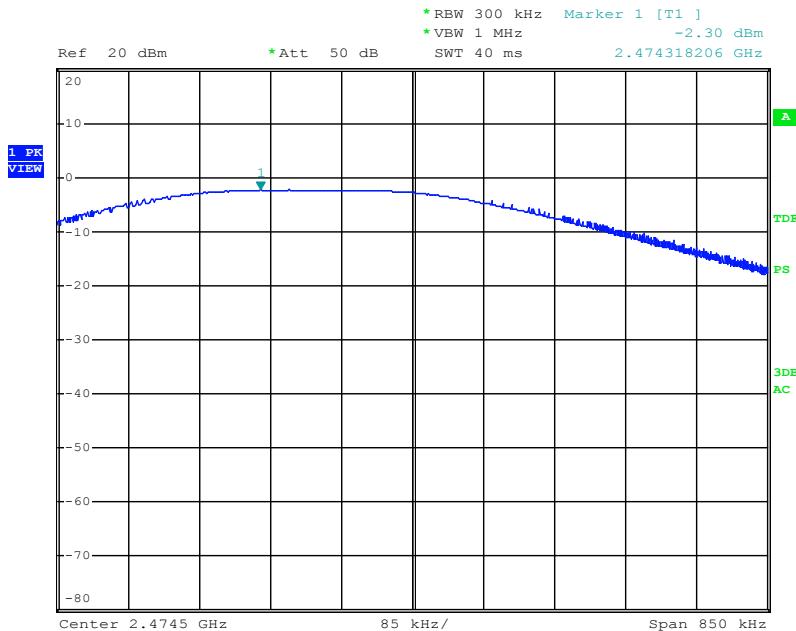
**Low Channel, 2410 MHz:**

Date: 16.MAY.2018 18:41:11

**Mid Channel, 2442 MHz:**

Date: 16.MAY.2018 19:05:56

## High Channel, 2474.5 MHz



Date: 16.MAY.2018 19:16:24

Test Personnel: Martin Liu  
 Product Standard: FCC §15.247;  
 ISED RSS-247  
 Input Voltage: 120 Vac, 60 Hz  
 Pretest Verification w/  
 BB Source: N/A

Test Date: 05/16/2018  
 Limit Applied: FCC §15.247;  
 ISED RSS-247  
 Ambient Temperature: 20.9 °C  
 Relative Humidity: 39.5 %  
 Atmospheric Pressure: 994.7 mbars

Deviations, Additions, or Exclusions: None

## 8 Carrier Frequency Separation

### 8.1 Requirement(s)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

### 8.2 Method

The procedure described in Section 7.8.2 of ANSI C63.10-2013 was used.

#### 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. IC test site registration number is 2042T.

### 8.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	Rhode & Schwarz	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

#### Software Utilized:

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

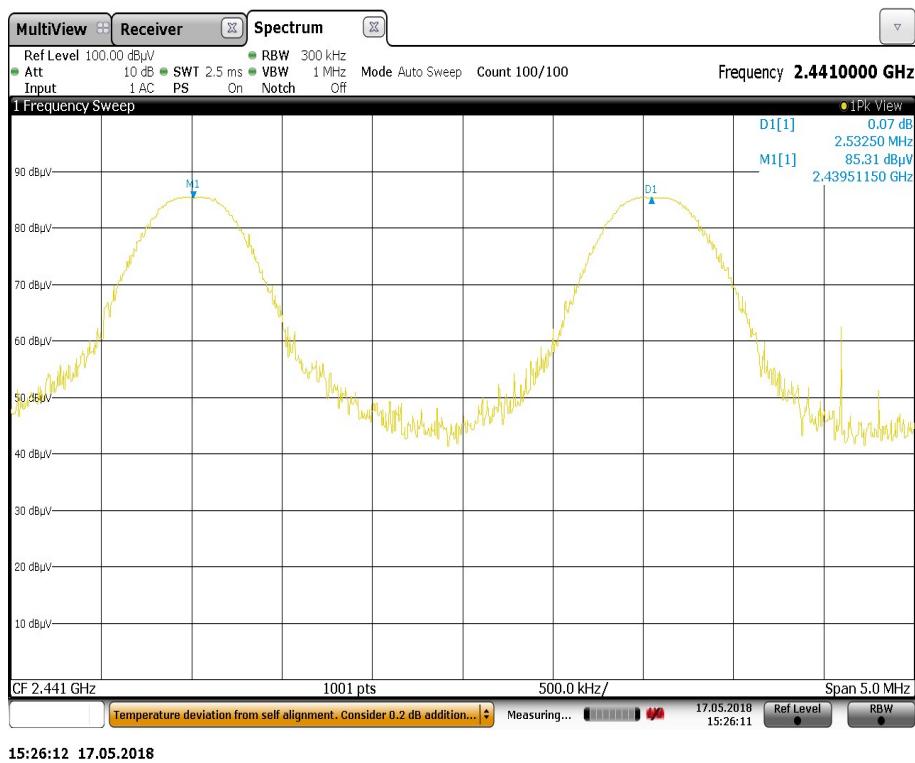
### 8.4 Results:

The sample tested was found to comply.

## 8.5 Setup Diagram:



## 8.6 Plots/Data:



Test Personnel: Martin Liu  
 Product Standard: FCC §15.247;  
 ISED RSS-247  
 Input Voltage: 120 Vac, 60 Hz  
 Pretest Verification w/  
 BB Source: N/A

Test Date: 05/17/2018  
 Limit Applied: FCC §15.247;  
 ISED RSS-247  
 Ambient Temperature: 21.4 °C  
 Relative Humidity: 39.7 %  
 Atmospheric Pressure: 994.5 mbars

Deviations, Additions, or Exclusions: None

## 9 Number of Hopping Frequencies

### 9.1 Requirement(s)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used

### 9.2 Method

The procedure described in Section 7.8.3 of ANSI C63.10-2013 was used.

#### 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. IC test site registration number is 2042T.

#### 9.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	Rhode & Schwarz	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

#### Software Utilized:

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

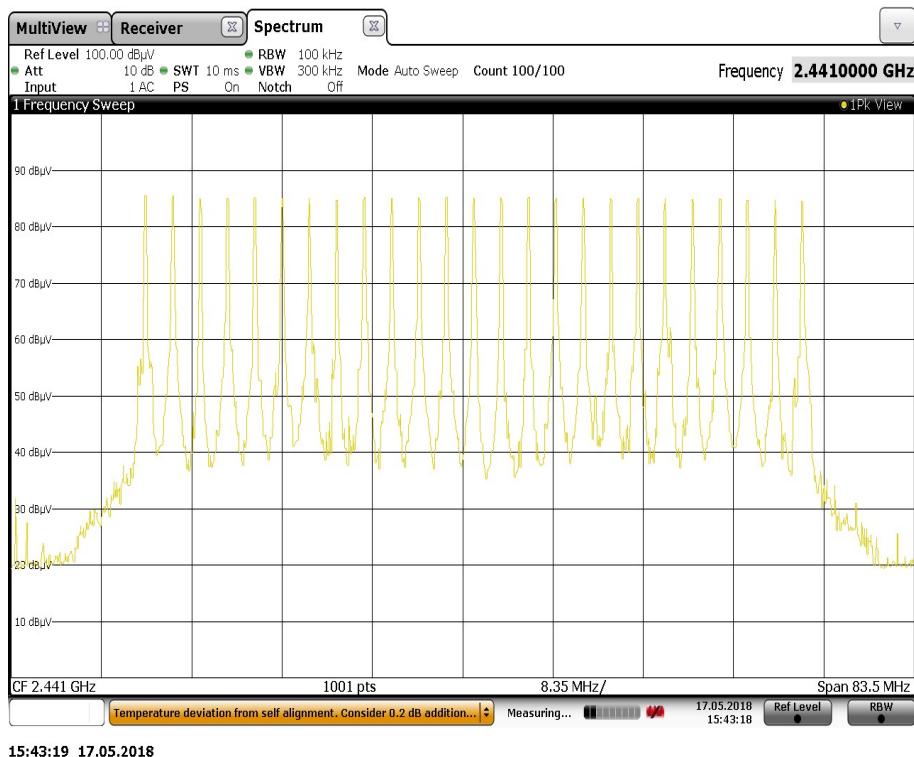
### 9.4 Results:

The sample tested was found to comply. The EUT uses 25 hopping channels.

### 9.5 Setup Diagram:



## 9.6 Plots/Data:



15:43:19 17.05.2018

Test Personnel: Martin Liu  
 Product Standard: FCC §15.247;  
 ISED RSS-247  
 Input Voltage: 120 Vac, 60 Hz  
 Pretest Verification w/  
 BB Source: N/A

Test Date: 05/17/2018  
 Limit Applied: FCC §15.247;  
 ISED RSS-247  
 Ambient Temperature: 21.4 °C  
 Relative Humidity: 39.7 %  
 Atmospheric Pressure: 994.5 mbars

Deviations, Additions, or Exclusions: None

## 10 Time of Occupancy (dwell time)

### 10.1 Requirement(s)

For frequency hopping systems operating in the 2400-2483.5 MHz band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 10.2 Method

The procedure described in Section 7.8.4 of ANSI C63.10-2013 was used.

The transmitter is employed 25 hopping channels. The Occupancy Time was calculated for the period of  $0.4 * 10 = 10$  sec.

#### 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. IC test site registration number is 2042T.

### 10.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	Rhode & Schwarz	ESW44	101636	07/14/2017	07/14/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

#### Software Utilized:

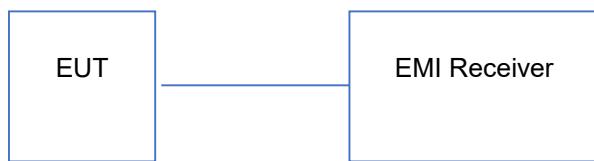
Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

### 10.4 Results:

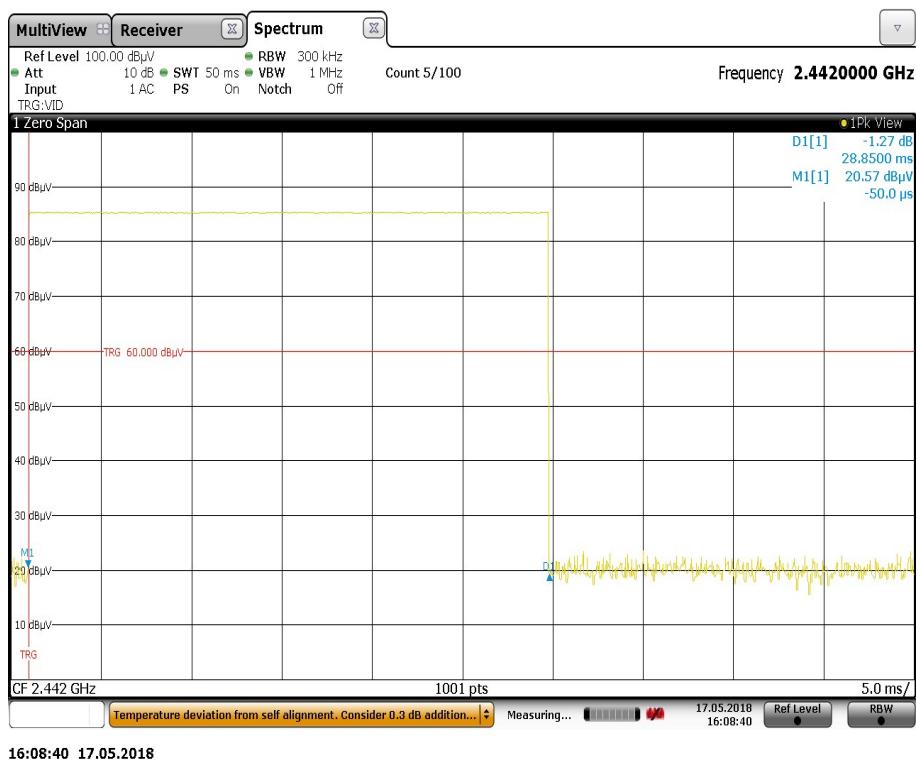
The sample tested was found to comply.

No. of Channels	Observation Period (s)	Burst On Time (ms) (Single)	No. of Burst	Dwell Time (ms)	Limit (ms)
25	10	29	1	29	400

### 10.5 Setup Diagram:



### 10.6 Plots/Data:





Test Personnel: Martin Liu

Product Standard: FCC §15.247;  
ISED RSS-247

Input Voltage: 120 Vac, 60 Hz

## Pretest Verification w/ BB Source:

Test Date: 05/17/2018

FCC §15.247;  
ISED RSS-247

Ambient Temperature: 21.4 °C

Relative Humidity: 39.7 %

Atmospheric Pressure: 994.5 mbars

Deviations, Additions, or Exclusions: None

## 11 Conducted Spurious Emissions

### 11.1 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.

### 11.2 Method

The procedure described in Sections 7.8.6 and 7.8.8 of ANSI C63.10-2013 was used.

#### 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. IC test site registration number is 2042T.

### 11.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1669	EMI Test Receiver	Rhode & Schwarz	ESW44	101636	07/14/2017	07/14/2018
690	Spectrum Analyzer	R&S	FSP	100027	02/28/2018	02/28/2019
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

#### Software Utilized:

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

### 11.4 Results:

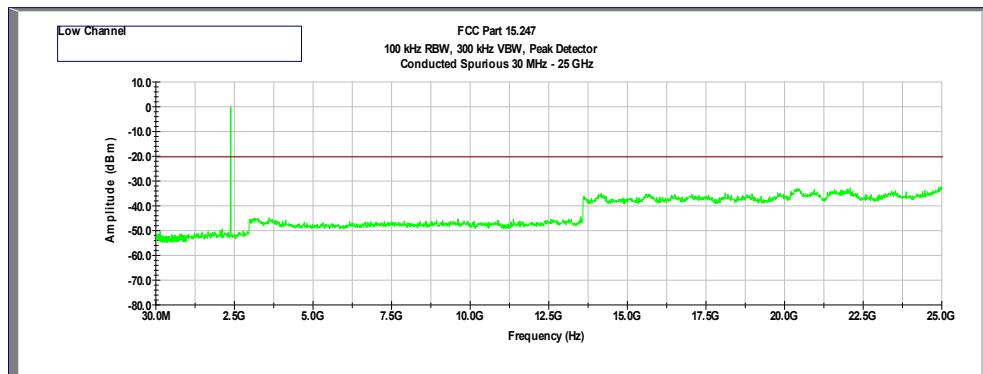
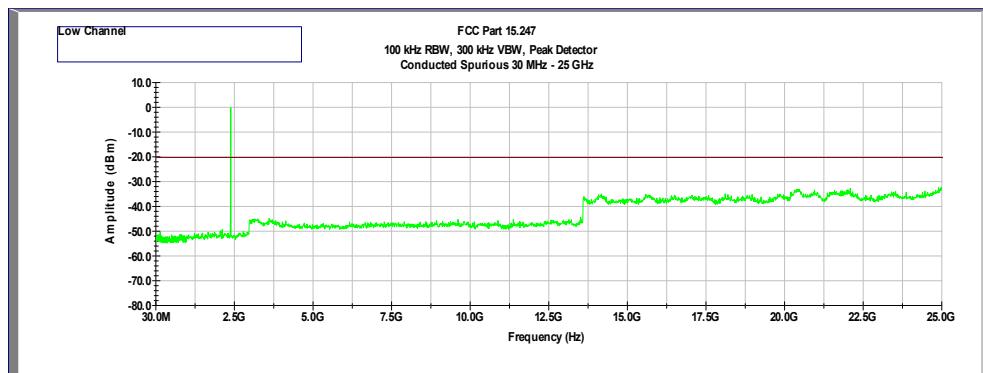
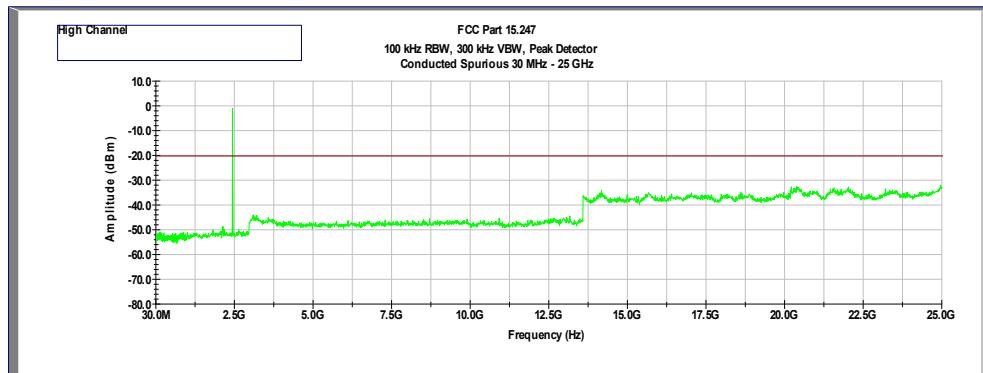
The sample tested was found to comply.

## 11.5 Setup Diagram:



## 11.6 Plots/Data:



**Low Channel, 2410 MHz:****Mid Channel, 2442 MHz:****High Channel, 2474.5 MHz:**

Test Personnel: Martin Liu

Test Date: 05/16/2018, 05/17/2018

Product Standard: FCC §15.247;  
ISED RSS-247Limit Applied: FCC §15.247;  
ISED RSS-247

Input Voltage: 120 Vac, 60 Hz

Ambient Temperature: 20.9 °C

Pretest Verification w/  
BB Source: N/ARelative Humidity: 39.5 %  
Atmospheric Pressure: 994.7 mbars

Deviations, Additions, or Exclusions: None

## 12 Radiated Spurious Emissions

### 12.1 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.

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

Unwanted emissions that fall into restricted frequency bands listed in Table 7 of ISED RSS-Gen Issue 5 shall comply with the limits specified in Tables 5-6 of ISED RSS-Gen Issue 5.

### 12.2 Method

The procedure described in Sections 6.5 and 6.6 of ANSI C63.10-2013 was used.

EUT was configured to transmit continuously. Radiated emission measurements were performed from 30 MHz to 25 GHz according to the procedure described in ANSI C63.10. 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 value of the radiated emissions was measured with resolution bandwidth (RBW) of 1 MHz, video bandwidth (VBW) of 3 MHz, and peak detector. The average value of the radiated emissions was determined by averaging over 0.1 seconds interval during which the field strength is at its maximum value.

The EUT is placed on a plastic turntable that is 80 cm in height for frequencies 30 MHz to 1000 MHz, 1.5 meters for frequency above 1000 MHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce the worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for the maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters for frequencies below 18 GHz and 1 meter for frequencies above 18 GHz. EUT was tested in its normal operation orientation as the end user would normally use.

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 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. IC test site registration number is 2042T.

**Measurement Uncertainty**

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U <sub>cispr</sub>
Radiated Emissions, 3m	30-1000 MHz	4.3	6.3 dB
Radiated Emissions, 3m	1-18 GHz	5.5	5.2 dB
Radiated Emissions, 1m	18-26.5 GHz	4.5	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, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

**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:

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

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

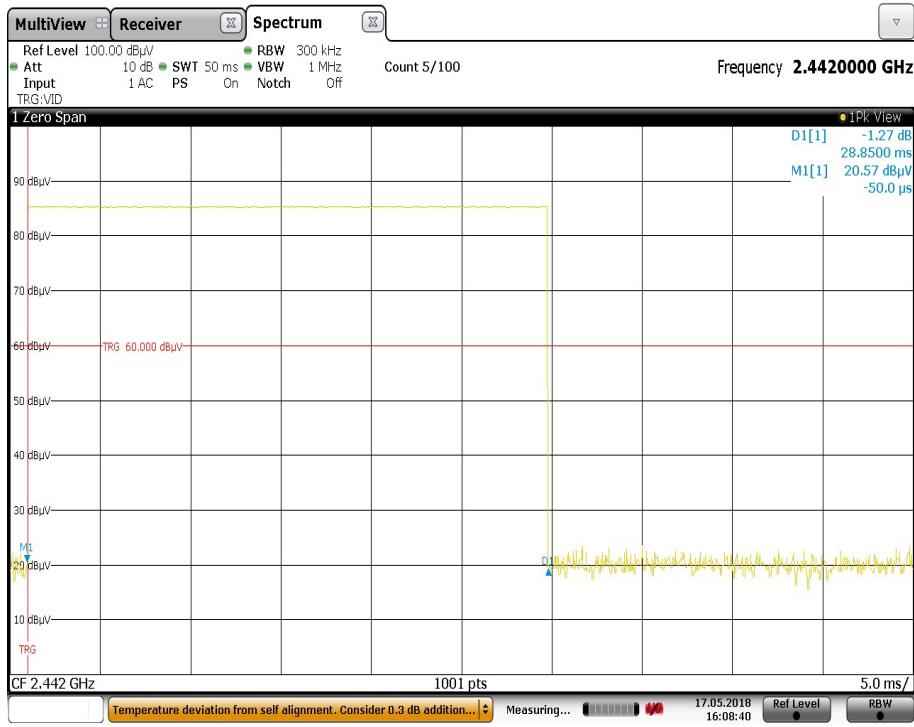
**Example:**

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

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

**Duty Cycle Correction Factor Calculation**

$$\text{DCCF} = 20 * \text{Log}(29/100) = -10.75$$



### 12.3 Test Equipment Used:

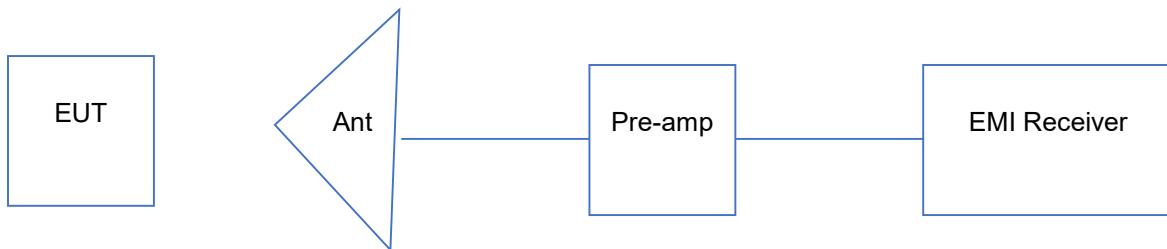
Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
637	3m Semi-anechoic Chamber	Panashield	3 meter	25 331-D-Z	December 2015	December 2018
1669	EMI Test Receiver	R&S	ESW44	101636	07/14/2017	07/14/2018
690	Spectrum Analyzer	R&S	FSP	100027	02/28/2018	02/28/2019
1140	EMI Test Receiver	R&S	ESCI7	100825	02/28/2018	02/28/2019
1147	Bilog Antenna	TESEQ GmbH	CBL 6112D	32852	11/16/2017	11/16/2018
1515	Horn Antenna	ETS-Lindgren	3115	00161631	03/28/2018	07/25/2018
880	Horn Antenna	ETS-Lindgren	3116C	00153521	04/18/2018	04/18/2018
1576	Pre-amp	R&S	TS-PR1	102068	06/20/2017	06/20/2018
1556	Pre-amp	R&S	TS-PR18	102144	07/29/2017	07/29/2018
1517	Cable	R&S	TS-PR-B7	101528	07/13/2017	07/13/2018
1518	Cable	R&S	TS-PR-B7	101529	07/13/2017	07/13/2018
1564	Cable	Micro-coax	UFB142A	226585-001	11/02/2017	11/02/2018
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	12/20/2017	12/20/2018

### Software Utilized:

Name	Manufacturer	Version	Profile
Tile	Quantum Change	4.1	FCC 15-209 at 3m 30 to 1000 FSP FCC Part 15-209 1-18GHz

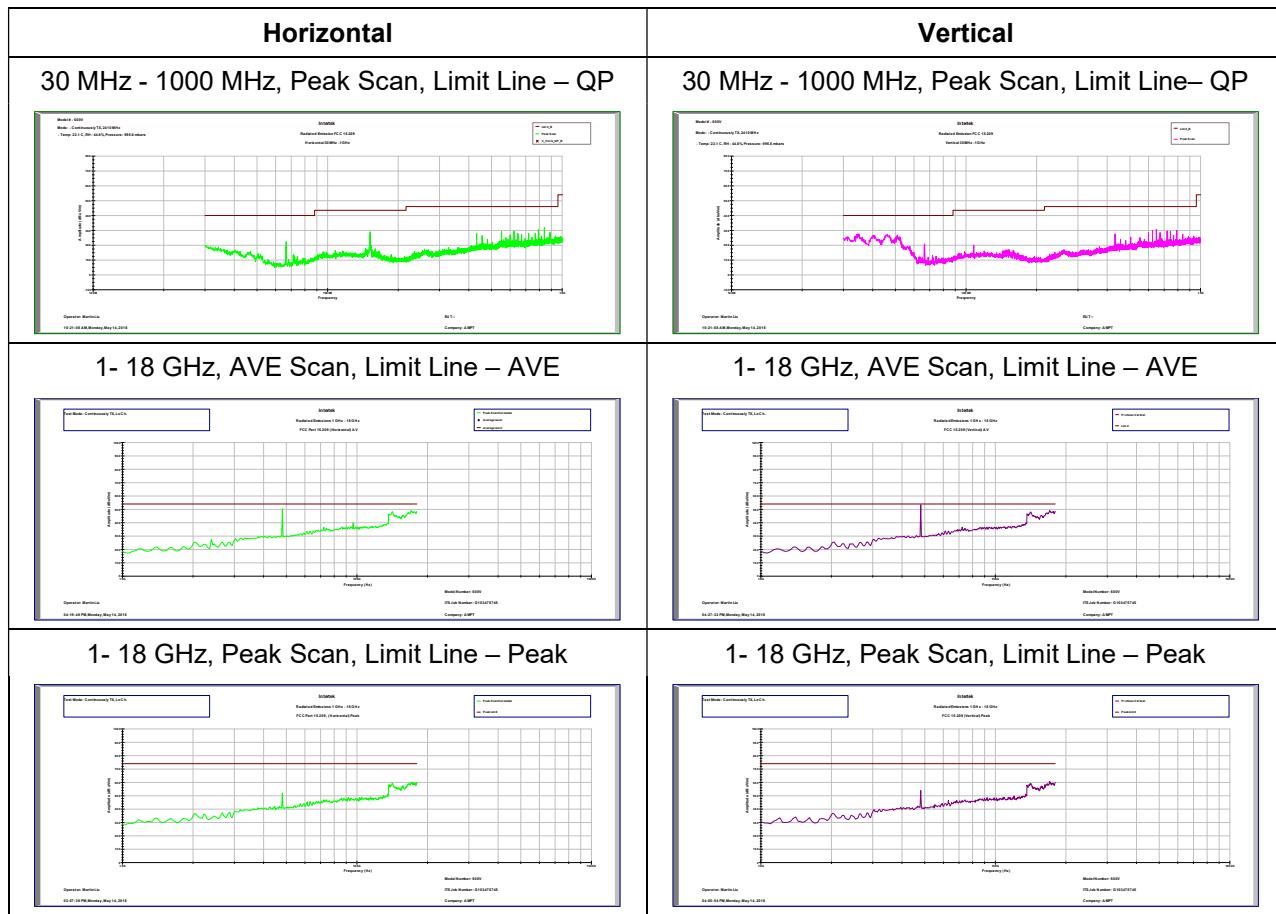
### 12.4 Results:

The sample tested was found to Comply.

**12.5 Test Setup Diagram:**

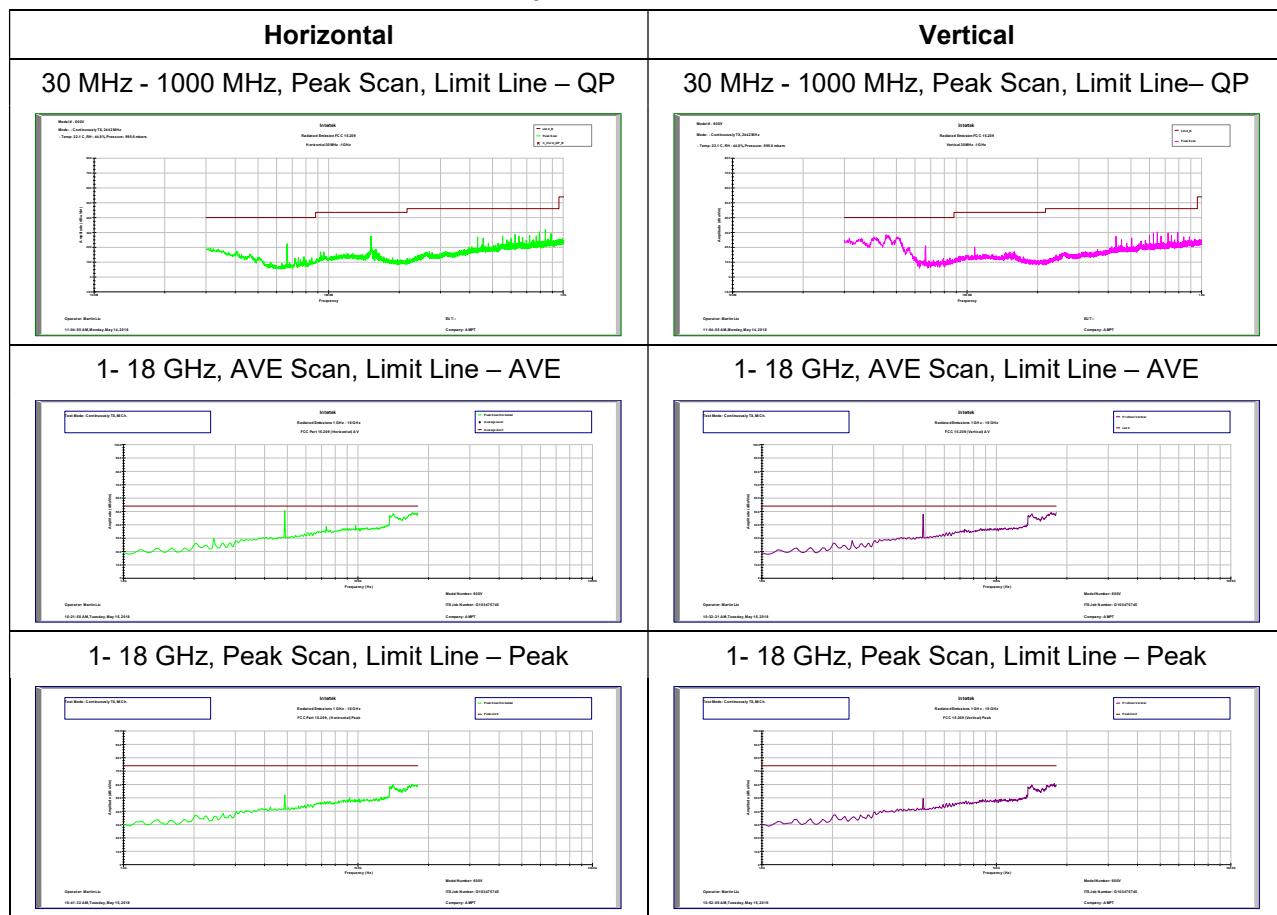
## 12.6 Plots/Data:

### Radiated Spurious Emissions 2410 MHz



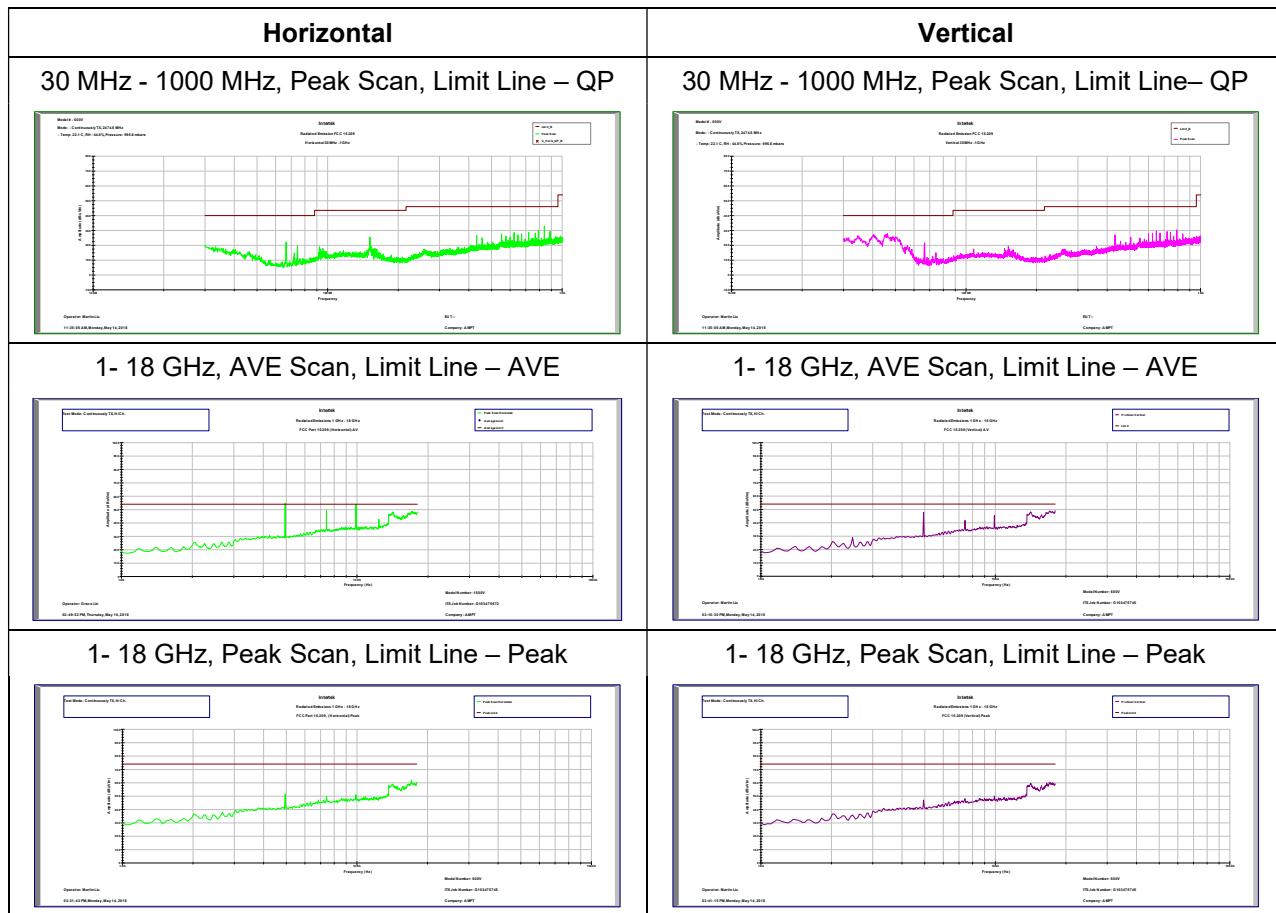
Note: Radiated emission measurements were performed up to 25 GHz. No emissions were identified when scanned from 18-25 GHz.

## Radiated Spurious Emissions 2442 MHz



Note: Radiated emission measurements were performed up to 25 GHz. No emissions were identified when scanned from 18-25 GHz.

## Radiated Spurious Emissions 2474.5 MHz



Note: Radiated emission measurements were performed up to 25 GHz. No emissions were identified when scanned from 18-25 GHz.

**30 MHz – 1GHz, Low Channel:**

Frequency	Peak FS	Limit@3m	Margin	RA	AG	AF	CF	Antenna Polarization
MHz	dB(uV/m)	dB(uV/m)	dB	dB	dB	dB	dB	
151.7	29.0	43.5	-14.5	40.1	29.9	16.4	2.4	H
552.1	29.2	46.0	-16.8	31.8	30.0	25.0	2.5	H
624.0	29.5	46.0	-16.6	32.1	30.2	25.1	2.5	H
792.1	30.4	46.0	-15.6	31.9	30.1	26.0	2.6	H
840.1	31.7	46.0	-14.3	32.0	29.3	26.4	2.7	H
888.1	28.6	46.0	-17.4	28.1	29.1	26.9	2.7	H
600.0	28.7	46.0	-17.3	31.6	30.2	24.7	2.5	V
624.0	30.0	46.0	-16.0	32.6	30.2	25.1	2.5	V
648.0	30.5	46.0	-15.5	32.6	30.1	25.4	2.6	V
720.0	29.5	46.0	-16.5	31.7	30.1	25.3	2.6	V
744.0	29.0	46.0	-17.0	30.8	30.2	25.8	2.6	V
792.1	29.9	46.0	-16.1	31.4	30.1	26.0	2.6	V

**30 MHz – 1GHz, Middle Channel:**

Frequency	Peak FS	Limit@3m	Margin	RA	AG	AF	CF	Antenna Polarization
MHz	dB(uV/m)	dB(uV/m)	dB	dB	dB	dB	dB	
624.0	28.7	46.0	-17.3	31.3	30.2	25.1	2.5	H
720.0	28.0	46.0	-18.0	30.2	30.1	25.3	2.6	H
768.0	27.7	46.0	-18.3	29.3	30.2	25.9	2.6	H
792.1	30.3	46.0	-15.7	31.8	30.1	26.0	2.6	H
840.1	31.8	46.0	-14.2	32.0	29.3	26.4	2.7	H
888.1	29.2	46.0	-16.8	28.7	29.1	26.9	2.7	H
45.2	28.4	40.0	-11.6	40.4	30.7	16.7	1.9	V
600.0	28.1	46.0	-17.9	31.1	30.2	24.7	2.5	V
624.0	29.7	46.0	-16.3	32.3	30.2	25.1	2.5	V
648.0	30.2	46.0	-15.8	32.3	30.1	25.4	2.6	V
720.0	29.6	46.0	-16.4	31.9	30.1	25.3	2.6	V
792.1	30.0	46.0	-16.0	31.5	30.1	26.0	2.6	V

**30 MHz – 1GHz, High Channel:**

Frequency	Peak FS	Limit@3m	Margin	RA	AG	AF	CF	Antenna Polarization
MHz	dB(uV/m)	dB(uV/m)	dB	dB	dB	dB	dB	
624.0	28.6	46.0	-17.5	31.2	30.2	25.1	2.5	H
720.0	28.5	46.0	-17.5	30.8	30.1	25.3	2.6	H
768.0	28.1	46.0	-17.9	29.8	30.2	25.9	2.6	H
792.1	30.1	46.0	-15.9	31.6	30.1	26.0	2.6	H
840.1	32.9	46.0	-13.1	33.2	29.3	26.4	2.7	H
888.1	29.4	46.0	-16.6	28.8	29.1	26.9	2.7	H
624.0	28.3	46.0	-17.8	30.9	30.2	25.1	2.5	V
648.0	29.4	46.0	-16.6	31.6	30.1	25.4	2.6	V
672.0	28.2	46.0	-17.8	30.7	30.1	25.0	2.6	V
720.0	29.1	46.0	-16.9	31.4	30.1	25.3	2.6	V
744.0	28.5	46.0	-17.5	30.2	30.2	25.8	2.6	V
792.1	30.3	46.0	-15.7	31.8	30.1	26.0	2.6	V

**Above 1 GHz:**

Antenna Polarization	Frequency (MHz)	Channel No.	EUT Orientation	Measured Field Strength (dBuV/m)	Duty Cycle Correction Factor	Final Field Strength (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Turntable Degree	Antenna Height (cm)	Detection
V	2390	2410	XY	60.92	0.00	60.92	74	-13.08	355	108	PK
V	2390	2410	XY	60.92	-10.75	50.17	54	-3.83	355	108	AV
V	4820	2410	XY	57.17	0.00	57.17	74	-16.83	251	162	PK
V	4820	2410	XY	57.17	-10.75	46.42	54	-7.58	251	162	AV
V	7230	2410	XY	48.23	0.00	48.23	74	-25.77	2	202	PK
V	7230	2410	XY	48.23	-10.75	37.48	54	-16.52	2	202	AV
H	9640	2410	XY	51.02	0.00	51.02	74	-22.98	335	102	PK
H	9640	2410	XY	51.02	-10.75	40.27	54	-13.73	335	102	AV
H	12050	2410	XY	47.75	0.00	47.75	74	-26.25	351	152	PK
H	12050	2410	XY	47.75	-10.75	37.00	54	-17.00	351	152	AV
V	4884	2442	XY	53.97	0.00	53.97	74	-20.03	248	157	PK
V	4884	2442	XY	53.97	-10.75	43.22	54	-10.78	248	157	AV
V	7326	2442	XY	45.83	0.00	45.83	74	-28.17	305	120	PK
V	7326	2442	XY	45.83	-10.75	35.08	54	-18.92	305	120	AV
H	9768	2442	XY	51.39	0.00	51.39	74	-22.61	328	119	PK
H	9768	2442	XY	51.39	-10.75	40.64	54	-13.36	328	119	AV
H	12210	2442	XY	49.71	0.00	49.71	74	-24.29	349	119	PK
H	12210	2442	XY	49.71	-10.75	38.96	54	-15.04	349	119	AV
H	2483.5	2474.5	XY	61.36	0.00	61.36	74	-12.64	358	146	PK
H	2483.5	2474.5	XY	61.36	-10.75	50.61	54	-3.39	358	146	AV
V	4949	2474.5	XY	55.50	0.00	55.50	74	-18.50	248	162	PK
V	4949	2474.5	XY	55.50	-10.75	44.75	54	-9.25	248	162	PK
H	7423.5	2474.5	XY	52.49	0.00	52.49	74	-21.51	325	238	PK
H	7423.5	2474.5	XY	52.49	-10.75	41.74	54	-12.26	325	238	AV
V	9898	2474.5	XY	54.68	0.00	54.68	74	-19.32	23	226	PK
V	9898	2474.5	XY	54.68	-10.75	43.93	54	-10.07	23	226	AV

Test Personnel: Martin Liu

Test Date: 05/14/2018, 05/15/2018

Product Standard: FCC §15.247;  
ISED RSS-247Limit Applied: FCC §15.247, FCC §15.209;  
ISED RSS-247, ISED RSS-Gen

Input Voltage: 120 Vac, 60 Hz

Ambient Temperature: 21.7 °C

Pretest Verification w/  
BB Source: N/ARelative Humidity: 39.4 %  
Atmospheric Pressure: 993.9 mbars

Deviations, Additions, or Exclusions: None

**13 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	May 30, 2018	1033475672LAX-001	ML	GL	Original Issue