

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 103052943BOX-001

Project Number: G103052943

Report Issue Date: 05/29/2017

Model(s) Tested: 950-000027

Model(s) Partially Tested: None

Model(s) Not Tested but declared equivalent by the client: None

Standards: FCC 47CFR Part 15 Subpart C: 2017,
FCC 47CFR Part 15 Subpart B: 2017,
RSS-247 Issue 2 February 2017,
RSS-247 Issue 1 May 2015,
ICES-003 Issue 6 January 2016,
RSS102 Issue 5 March 19 2015

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
PowerHouse Dynamics Inc
1 Bridge St Fl 3
Suite 301
Newton, MA 02458-1132
USA

Report prepared by



Kouma Sinn / Staff Engineer, EMC

Report reviewed by



Michael F Murphy / Technical Team Lead

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

1	<i>Introduction and Conclusion</i>	3
2	<i>Test Summary</i>	3
3	<i>Client Information</i>	4
4	<i>Description of Equipment Under Test and Variant Models.....</i>	4
5	<i>System Setup and Method</i>	6
6	<i>Output Power and Human RF Exposure.....</i>	7
7	<i>Occupied and 20 dB Bandwidth</i>	15
8	<i>Band Edge Emissions</i>	21
9	<i>Number of Hopping Frequencies</i>	25
10	<i>Channel Separation.....</i>	28
11	<i>Channel Occupancy Time.....</i>	31
12	<i>Transmitter Spurious Emissions</i>	35
13	<i>Digital Electronics Spurious Emissions.....</i>	49
14	<i>Revision History</i>	55

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 was found compliant 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	Output Power (FCC 47CFR Part 15 Subpart C 15.247:2017, RSS-247 Issue 2 February 2017)	Pass
7	Occupied and 20 dB Bandwidth (FCC 47CFR Part 15 Subpart C 15.247:2017, RSS-247 Issue 2 February 2017)	Pass
8	Band Edge Emissions (FCC 47CFR Part 15 Subpart C 15.247:2017, RSS-247 Issue 2 February 2017)	Pass
9	Number of Hopping Frequencies (FCC 47CFR Part 15 Subpart C 15.247:2017, RSS-247 Issue 2 February 2017)	Pass
10	Channel Separation (FCC 47CFR Part 15 Subpart C 15.247:2017, RSS-247 Issue 2 February 2017)	Pass
11	Channel Occupancy Time (FCC 47CFR Part 15 Subpart C 15.247:2017, RSS-247 Issue 2 February 2017)	Pass
12	Transmitter Spurious Emissions (FCC 47CFR Part 15 Subpart C 15.247:2017, FCC 47CFR Part 15 Subpart B 15.109:2016, RSS-247 Issue 1 May 2015, ICES-003 Issue 6 January 2016)	Pass
13	Digital Electronic Spurious Emissions (FCC 47CFR Part 15 Subpart B 15.109:2016, ICES-003 Issue 6 January 2016)	Pass
14	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: PowerHouse Dynamics Inc
1 Bridge St Fl 3
Suite 301
Newton, MA 02458-1132
USA

Contact: Peter Dodd
Telephone: (585) 419-9538
Email: peter@powerhousedynamics.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: PowerHouse Dynamics Inc
1 Bridge St Fl 3
Suite 301
Newton, MA 02458-1132
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Remote wireless temperature sensor module.	PowerHouse Dynamics Inc	950-000027	AG01044917130121

Receive Date:	05/24/2017
Received Condition:	Good
Type:	Prototype

Description of Equipment Under Test (provided by client)
Remote wireless temperature sensor module.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
2 AA Batteries	N/A	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting at Low, Mid, and High Channels

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Radio/Receiver Characteristics	
Frequency Band(s)	902.5-905.3 MHz
Modulation Type(s)	OOK
Data rates	10kbit
Maximum Output Power	Low Channel: -6.76 dBm Mid Channel: -7.62 dBm High Channel: -6.53 dBm
Test Channels	Low Channel: 902.500 MHz Mid Channel: 90.844 MHz High Channel: 905.300 MHz
Occupied Bandwidth	Low Channel: 71.206 kHz Mid Channel: 70.774 kHz High Channel: 71.423 kHz
Frequency Hopper: Number of Hopping Channels	51
Frequency Hopper: Channel Dwell Time	0.247 second
MIMO Information (# of Transmit and Receive antenna ports)	N/A
Equipment Type	DSS
ETSI LBT/Adaptivity	N/A
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	N/A
Antenna Type and Gain	Integral, 0.9 dBi

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

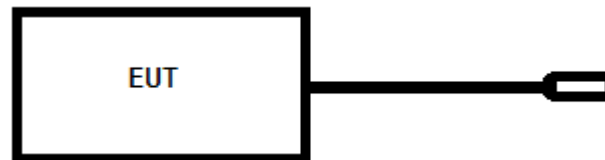
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	Temperature Sensor	0.5	None	None	Sensor

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	--	--	--

5.1 Method:

Configuration as required by FCC 15.247, FCC 15.209, FCC 15.109, RSS-247, ICES-003, ANSI C63.4:2014, and ANSI C63.10:2013.

5.2 EUT Block Diagram:



6 Output Power and Human RF Exposure

6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.247) and RSS 247.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018

Software Utilized:

Name	Manufacturer	Version
None	--	--

6.3 Results:

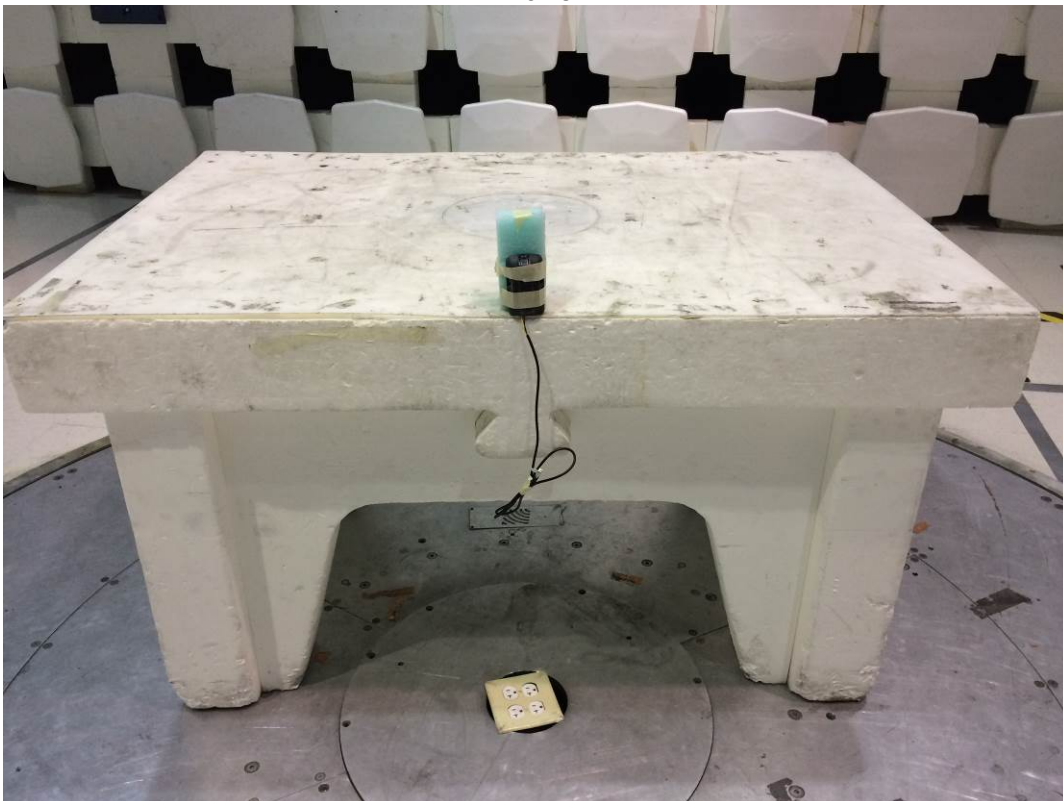
The sample tested was found to Comply. For systems operating in the 902-928 MHz band the maximum peak output power is 1 watt (30 dBm).

6.4 Setup Photographs:

X-axis



Y-axis



Z-axis



6.5 Test Data:

Low Channel Output Power - Radiated Emissions

Company: PowerHouse Dynamics, Inc. Antenna & Cables: N Bands: N, LF, HF, SHF
 Model #: 950-000027 Antenna: 145-145_10mV_05-03-18.txt 145-145_10mH_05-03-18.txt
 Serial #: AG01044917130121 Cable(s): 10M track A__7-30-2017.txt NONE.
 Engineers: Kouma Sinn Location: 10m Ch. Barometer: DAV003 Filter: NONE
 Project #: G103052943 Date(s): 05/26/17
 Standard: FCC Part 15.247 Temp/Humidity/Pressure: 20C 56% 998mbar
 Receiver: 145-128 Limit Distance (m): 10
 PreAmp: NONE. Test Distance (m): 10
 PreAmp Used? (Y or N): N Voltage/Frequency: 2 AA Internal Batteries Frequency Range: Fundamental
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(m)	Limit dB(m)	Margin dB	Bandwidth
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. Y-axis: straight up (V, worst-case), Low CH, 0 dBm											
MaxPK	V	902.500	41.93	29.00	4.41	0.00	0.00	-9.46	30.00	-39.46	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. Z-axis: sit on its back (H, worst-case), Low CH, 0 dBm											
MaxPK	H	902.500	44.98	28.65	4.41	0.00	0.00	-6.76	30.00	-36.76	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. X-axis: sit on its long side (H, worst-case), Low CH, 0 dBm											
MaxPK	H	902.500	42.66	28.65	4.41	0.00	0.00	-9.08	30.00	-39.08	120/300 kHz

Mid Channel Output Power - Radiated Emissions

Company: PowerHouse Dynamics, Inc. Antenna & Cables: N Bands: N, LF, HF, SHF
 Model #: 950-000027 Antenna: 145-145_10mV_05-03-18.txt 145-145_10mH_05-03-18.txt
 Serial #: AG01044917130121 Cable(s): 10M track A__7-30-2017.txt NONE.
 Engineers: Kouma Sinn Location: 10m Ch. Barometer: DAV003 Filter: NONE
 Project #: G103052943 Date(s): 05/26/17
 Standard: FCC Part 15.247 Temp/Humidity/Pressure: 20C 56% 998mbar
 Receiver: 145-128 Limit Distance (m): 10
 PreAmp: NONE. Test Distance (m): 10
 PreAmp Used? (Y or N): N Voltage/Frequency: 2 AA Internal Batteries Frequency Range: Fundamental
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(m)	Limit dB(m)	Margin dB	Bandwidth
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. No pre-amp or filter. Y-axis: straight up (V, worst-case), Mid CH, 0 dBm											
MaxPK	V	903.844	42.12	29.00	4.42	0.00	0.00	-9.26	30.00	-39.26	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. Z-axis: sit on its back (H, worst-case), Mid CH, 0 dBm											
MaxPK	H	903.844	44.16	28.60	4.42	0.00	0.00	-7.62	30.00	-37.62	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. X-axis: sit on its long side (H, worst-case), Mid CH, 0 dBm											
MaxPK	H	903.844	42.71	28.60	4.42	0.00	0.00	-9.07	30.00	-39.07	120/300 kHz

High Channel Output Power - Radiated Emissions

Company: PowerHouse Dynamics, Inc.

Model #: 950-000027

Serial #: AG01044917130121

Engineers: Kouma Sinn

Project #: G103052943

Standard: FCC Part 15.247

Receiver: 145-128

PreAmp: NONE.

PreAmp Used? (Y or N): N

Location: 10m Ch.

Date(s): 05/26/17

Limit Distance (m): 10

Test Distance (m): 10

Antenna & Cables: N Bands: N, LF, HF, SHF

Antenna: 145-145_10mV_05-03-18.txt 145-145_10mH_05-03-18.txt

Cable(s): 10M track A_7-30-2017.txt NONE.

Barometer: DAV003

Filter: NONE

Temp/Humidity/Pressure: 20C

56%

998mbar

Voltage/Frequency: 2 AA Internal Batteries

Frequency Range: Fundamental

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(m)	Limit dB(m)	Margin dB	Bandwidth
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. Y-axis: straight up (V, worst-case), High CH, 0 dBm											
MaxPK	V	905.300	41.60	29.00	4.42	0.00	0.00	-9.78	30.00	-39.78	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. Z-axis: sit on its back (H, worst-case), High CH, 0 dBm											
MaxPK	H	905.300	43.29	28.60	4.42	0.00	0.00	-8.49	30.00	-38.49	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8dB. X-axis: sit on its long side (H, worst-case), High CH, 0 dBm											
MaxPK	H	905.300	45.25	28.60	4.42	0.00	0.00	-6.53	30.00	-36.53	120/300 kHz

Human RF Exposure

The EUT was measured in a radiated fashion. The RF output power was measured using a resolution bandwidth which encompassed the entire emission bandwidth. The data obtained was adjusted for equipment losses and converted from a field strength reading to a power reading using the provisions of FCC KDB 558074 and RSS-Gen 4.6. .

§1.1310 The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices shall be evaluated according to the provisions of §2.1093 of this chapter.

Part §1.1310 Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for *transient* persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase *exercise control* means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

RSS-102 Issue 5 Exposure Limits:**Table 4: RF Field Strength Limits for Devices Used by the General Public
(Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

Test Procedure

An MPE evaluation was performed in order to show that the device was compliant with §2.1091. The maximum power density was calculated for each transmitter at a separation distance of 20 cm.

For each transmitter the maximum power RF exposure at a 20 cm distance using the formula:

$$\text{Conducted Power}_{\text{mW}} = 10^{\text{ConductedPower(dBm)}/10}$$

$$\text{Power Density} = [\text{Conducted Power}_{\text{mW}} \times \text{Ant.Gain}] / [4\pi \times (20_{\text{cm}})^2] \text{ or } [\text{EIRP}] / [4\pi \times (20_{\text{cm}})^2]$$

Results:

$$\text{Maximum Output Power}_{\text{mW}} = 10^{(-6.53/10)} \text{ or } 0.217 \text{ mW}$$

$$\text{Antenna gain numeric} = 10^{(0.9/10)} = 1.230$$

$$\text{Power Density} = (0.217 \times 1.230) / 5025.6 \text{ or } 5.311\text{E-}05 \text{ mW/cm}^2$$

$$\text{Limit at 905.3 MHz} = 0.604 \text{ mW/cm}^2$$

$$\text{RSS-102 Issue 5 Exposure Limit at 905.3 MHz} = 2.747 \text{ W/m}^2$$

$$\text{Power Density} = 0.0005311 \text{ W/m}^2$$

The calculated maximum power density at 20 cm distance is less than the limit for general population / uncontrolled exposure.

Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing
 Engineer:
 (Where Applicable) N/A

Test Date: 05/26/2016

Product Standard: FCC 15.247, RSS 247
 Input Voltage: Internal Battery

Limit Applied: As specified in section 6.3

Pretest Verification w/
 Ambient Signals or
 BB Source: Yes- Signal Generator

Ambient Temperature: 20 °C

Relative Humidity: 56 %

Atmospheric Pressure: 998 mbars

7 Occupied and 20 dB Bandwidth

7.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.247) and RSS 247.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 GHz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018

Software Utilized:

Name	Manufacturer	Version
None	--	--

7.3 Results:

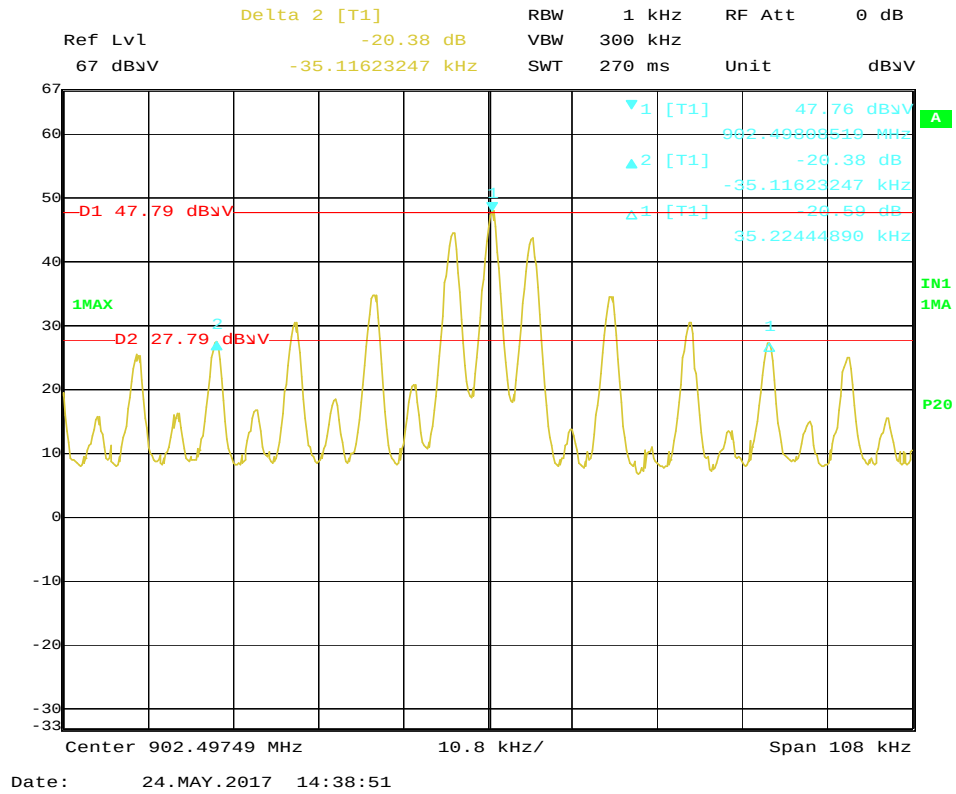
The sample tested was found to Comply. The 20dB BW is lower than 500 kHz.

§15.247 (a) (1) (i) The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

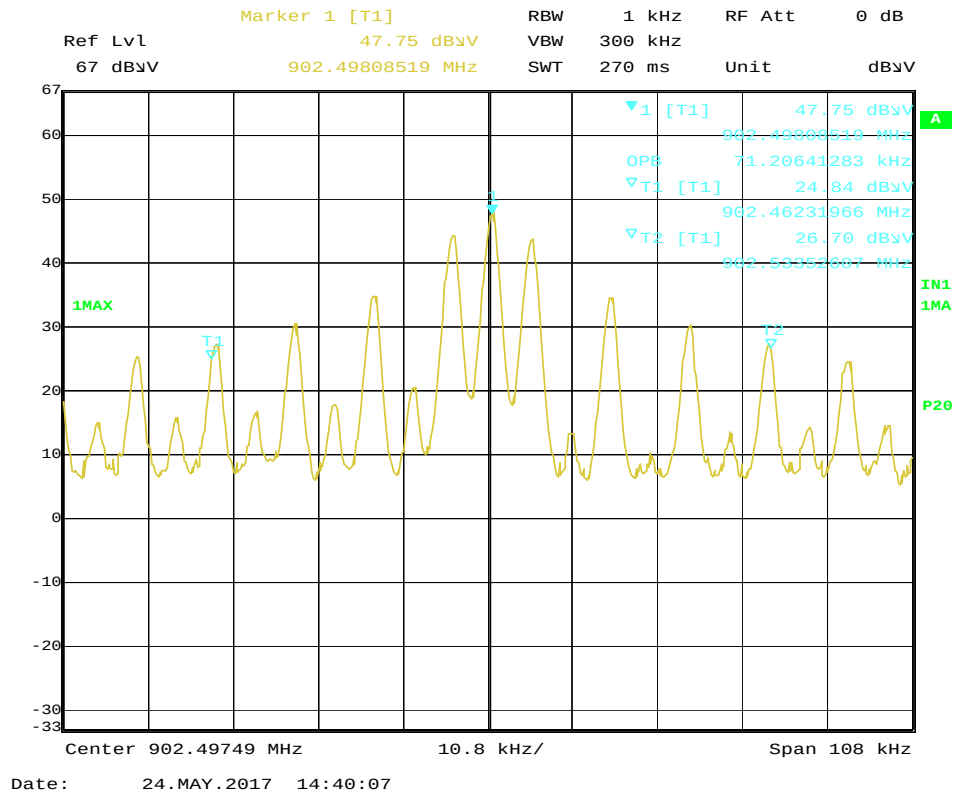
7.4 Setup Photograph:

7.5 Plots/Data:

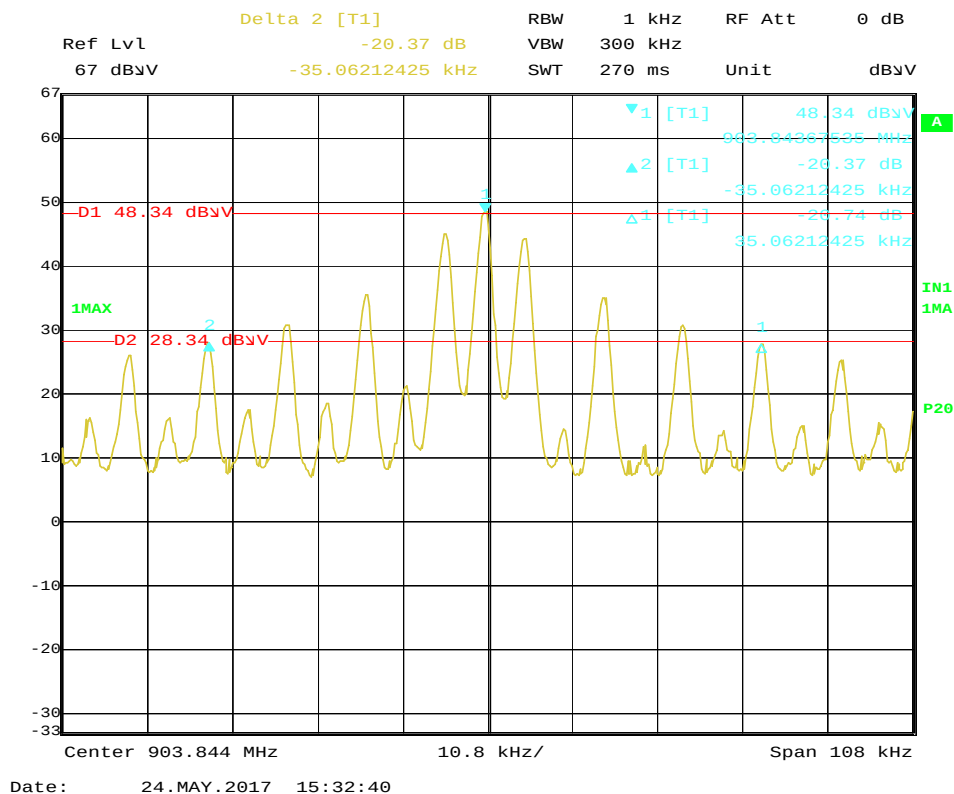
Low Channel 20 dB Bandwidth: 70.341 kHz



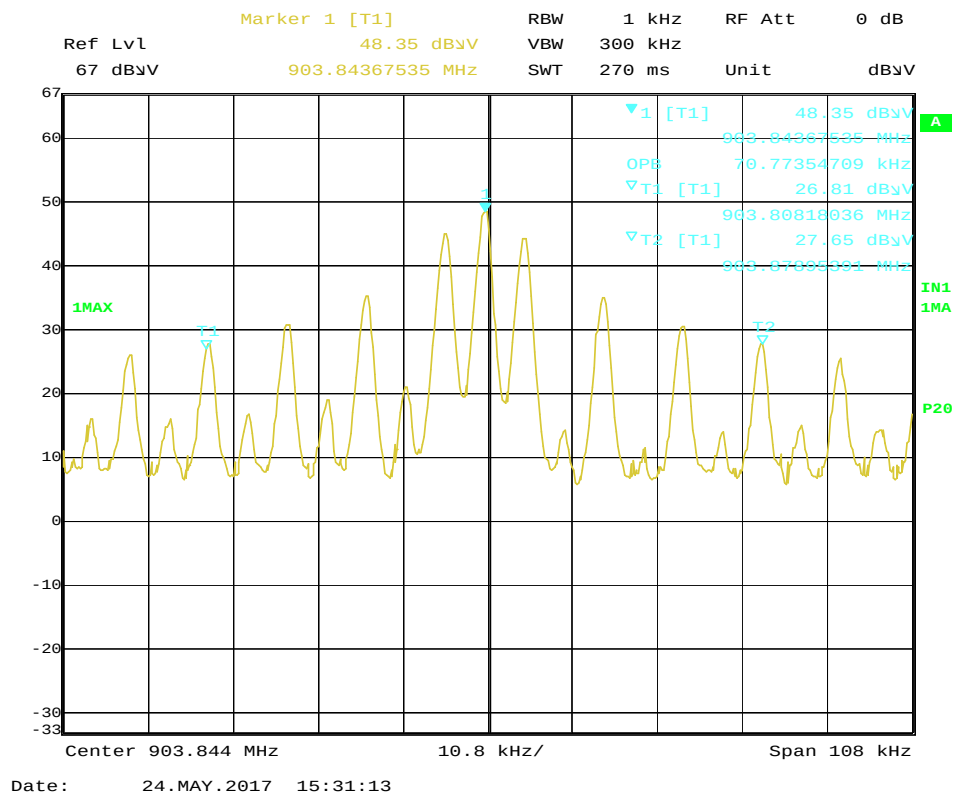
Low Channel Occupied Bandwidth: 71.206 kHz

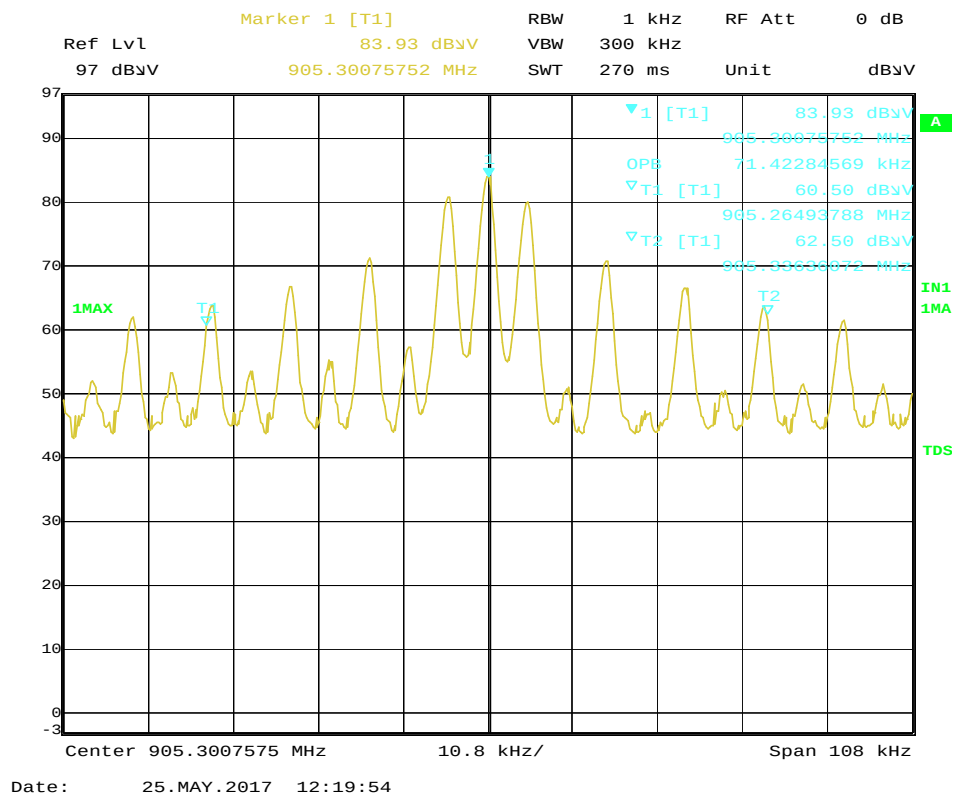
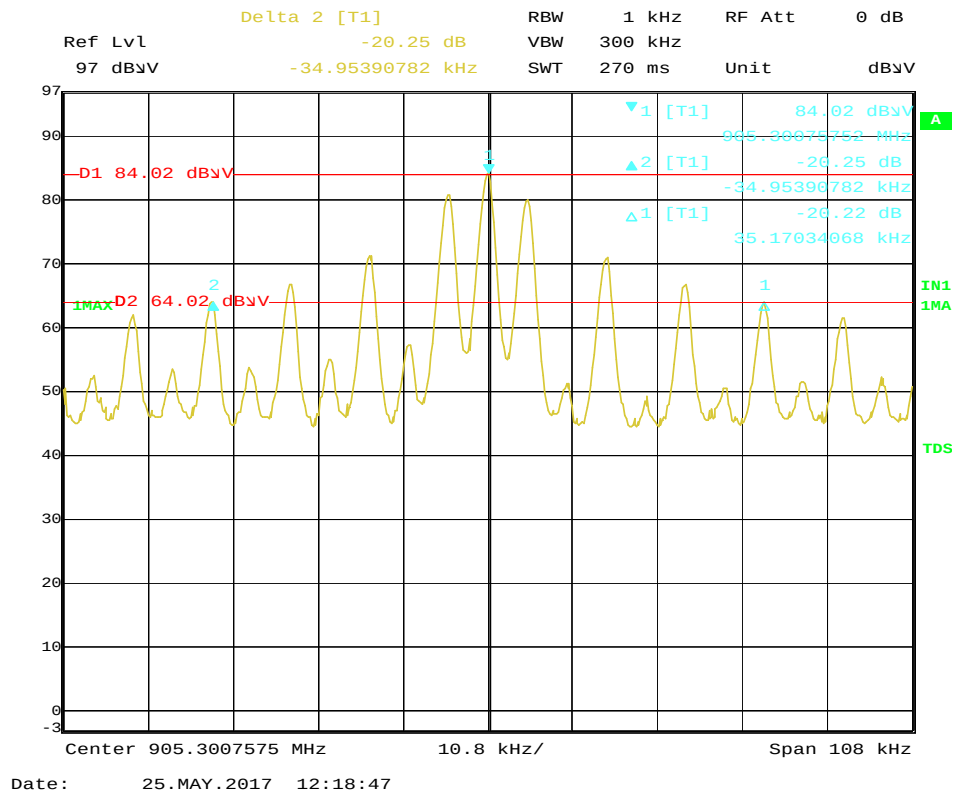


Mid Channel 20 dB Bandwidth: 70.124 kHz



Mid Channel Occupied Bandwidth: 70.774 kHz





Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing
Engineer:
(Where Applicable) N/A

Test Date: 05/25/2017

Product Standard: FCC 15.247, RSS 247
Input Voltage: Internal Battery

Limit Applied: As specified in section 7.3

Pretest Verification w/
Ambient Signals or
BB Source: Yes- Signal Generator

Ambient Temperature: 21 °C

Relative Humidity: 54 %

Atmospheric Pressure: 997 mbars

8 Band Edge Emissions

8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.247) and RSS 247.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 GHz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018

Software Utilized:

Name	Manufacturer	Version
None	--	--

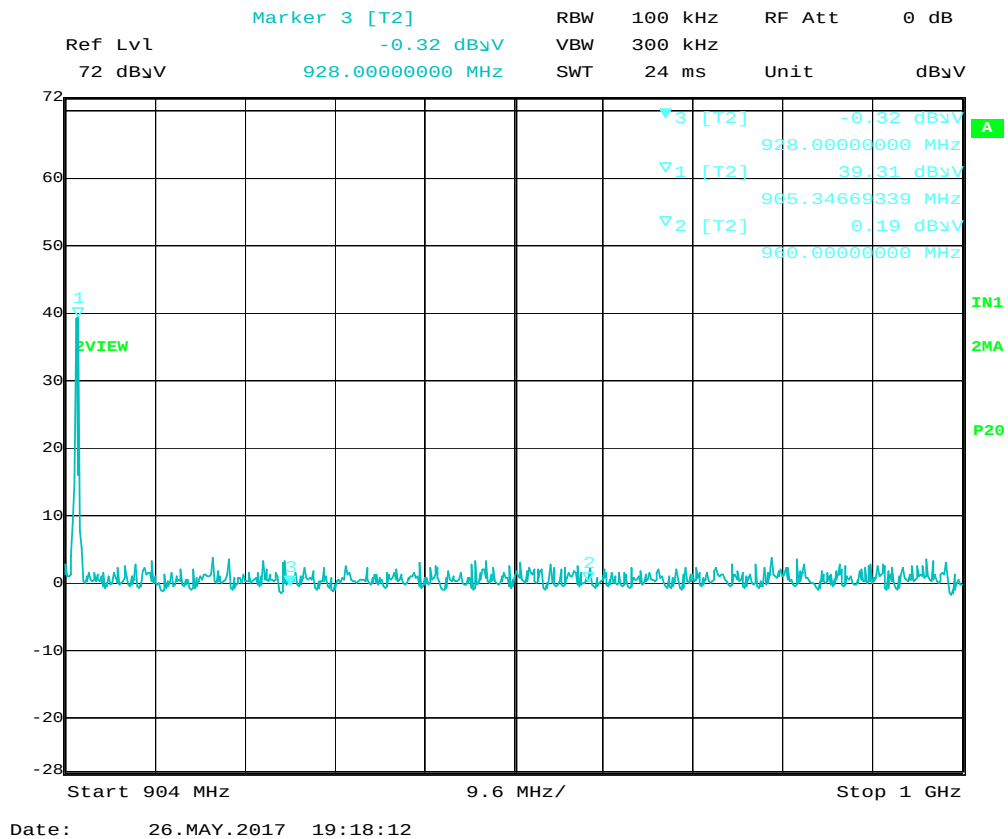
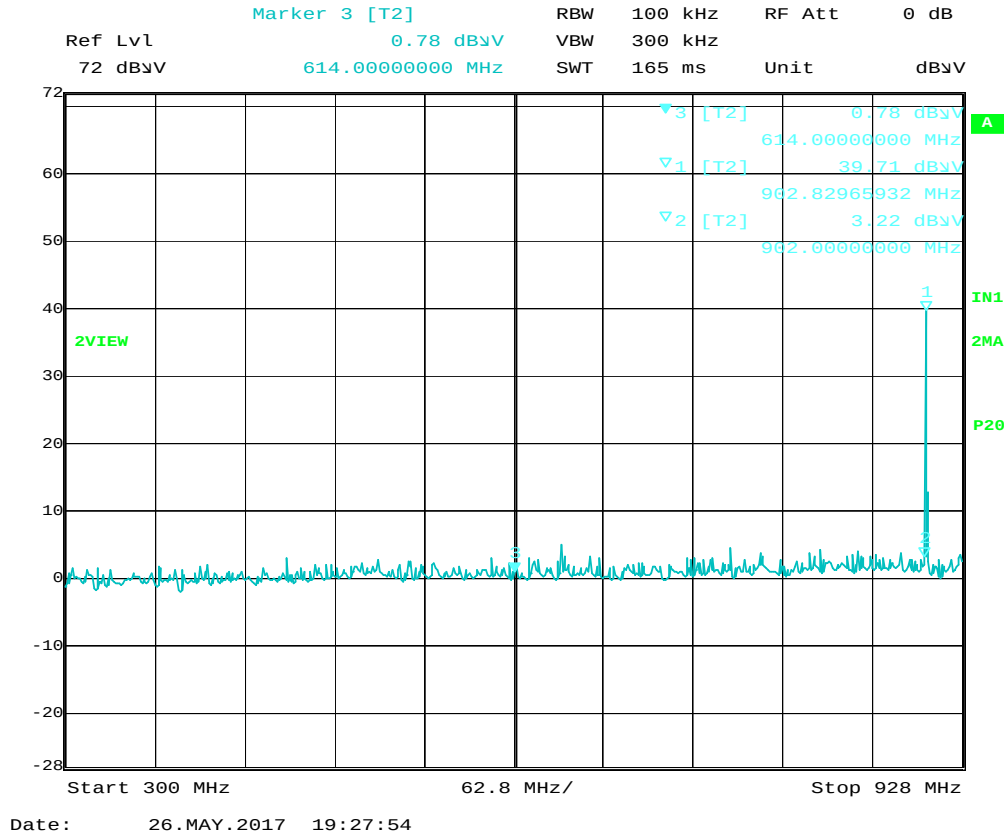
8.3 Results:

The sample tested was found to Comply. Conducted Spurious Emissions in a 100 kHz bandwidth are 20 dB below the fundamental.

8.4 Setup Photograph:



8.5 Plots/Data:



Band Edge Radiated Emissions

Company: PowerHouse Dynamics, Inc.

Model #: 950-000027

Serial #: AG01044917130121

Engineers: Vathana Ven

Project #: G103052943

Date(s): 05/26/17

Standard: FCC Part 15/Cispr22 Class B

Receiver: R&S ESI (145-128) 10-01-2014

PreAmp: NONE.

PreAmp Used? (Y or N):

N

Limit Distance (m): 10

Test Distance (m): 10

Voltage/Frequency: 2 AA Batteries

Cables: N

Bands: N, LF, HF, SHF

Antenna: 145-145 10mV 05-03-18.txt 145-145 10mH 05-03-18.txt

Cable(s): 10M track A 7-30-2017.txt NONE

Barometer: DAV003

Filter: NONE

Temp/Humidity/Pressure: 20 deg C 56% 998 mB

$$\text{Net} = \text{Reading (dBuV/m)} + \text{Antenna Factor (dB1/m)} + \text{Cable Loss (dB)} - \text{Preamplifier Factor (dB)} - \text{Distance Factor (dB)}$$

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/BW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC	Harmonic?
Lower Band Edge														
QP	H	614.000	0.78	25.00	3.61	0.00	0.00	29.39	37.00	-7.61	120/300 kHz	RB	RB	Noise Floor
Upper Band Edge														
QP	H	960.000	0.19	29.90	4.52	0.00	0.00	34.61	37.00	-2.39	120/300 kHz	RB	RB	Noise Floor

Test Personnel: Vathana F. Ven *VFV*
Supervising/Reviewing Engineer:
(Where Applicable) N/A

Test Date: 05/26/2015

Product Standard:	FCC 15.247, RSS 247
Input Voltage:	Internal Battery

Limit Applied: As specified in section 8.3

Pretest Verification w/
Ambient Signals or
BB Source: Yes- Signal Generator

Ambient Temperature: 20 °C

Relative Humidity: 56 %

Atmospheric Pressure: 998 mbars

9 Number of Hopping Frequencies

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.247) and RSS 247.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018

Software Utilized:

Name	Manufacturer	Version
None	--	--

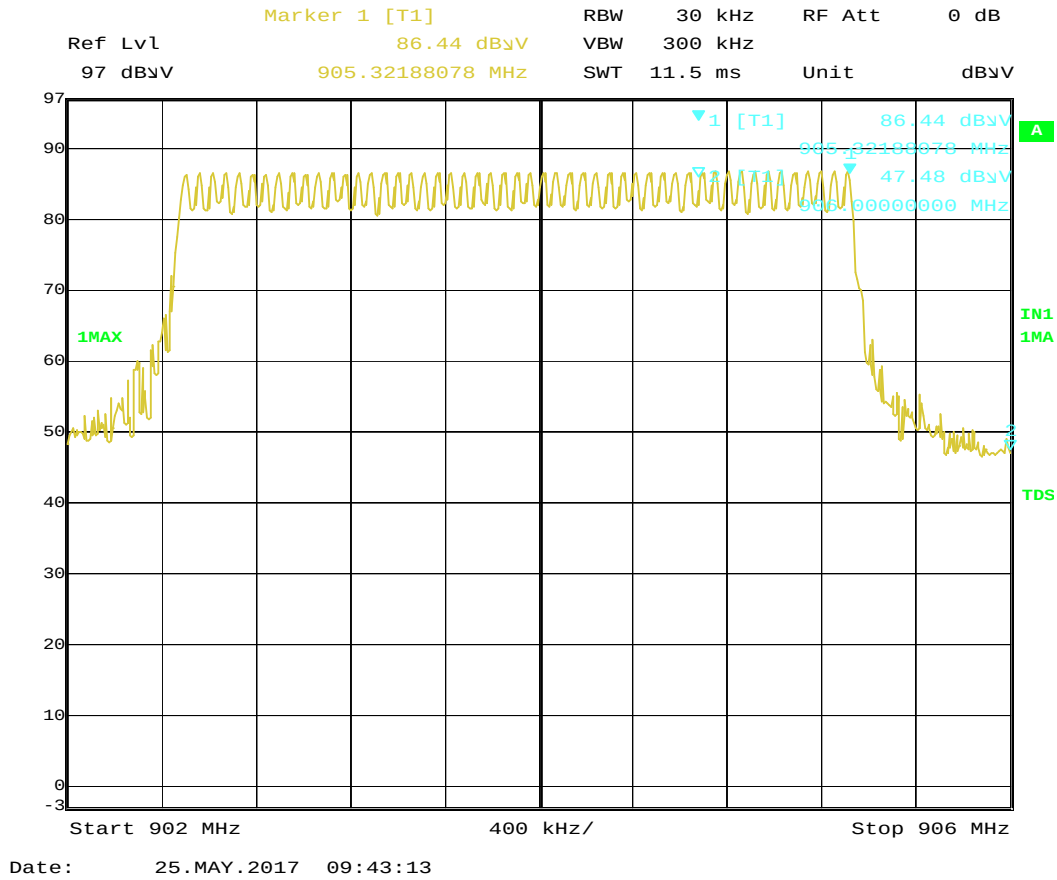
9.3 Results:

The sample tested was found to Comply. It uses 51 hopping channels which is the minimum requirement for device with 20 dB bandwidth less than 250 kHz.

9.4 Setup Photograph:

9.5 Plots/Data

Channel number: 51



Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing Engineer:
 (Where Applicable) N/A

Test Date: 05/25/2017

Product Standard: FCC 15.247, RSS 247
 Input Voltage: Internal Battery

Limit Applied: As specified in section 9.3

Pretest Verification w/
 Ambient Signals or
 BB Source: BB Source

Ambient Temperature: 20 °C

Relative Humidity: 53 %

Atmospheric Pressure: 1000 mbars

10 Channel Separation

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.247) and RSS 247.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 GHz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018

Software Utilized:

Name	Manufacturer	Version
None	--	--

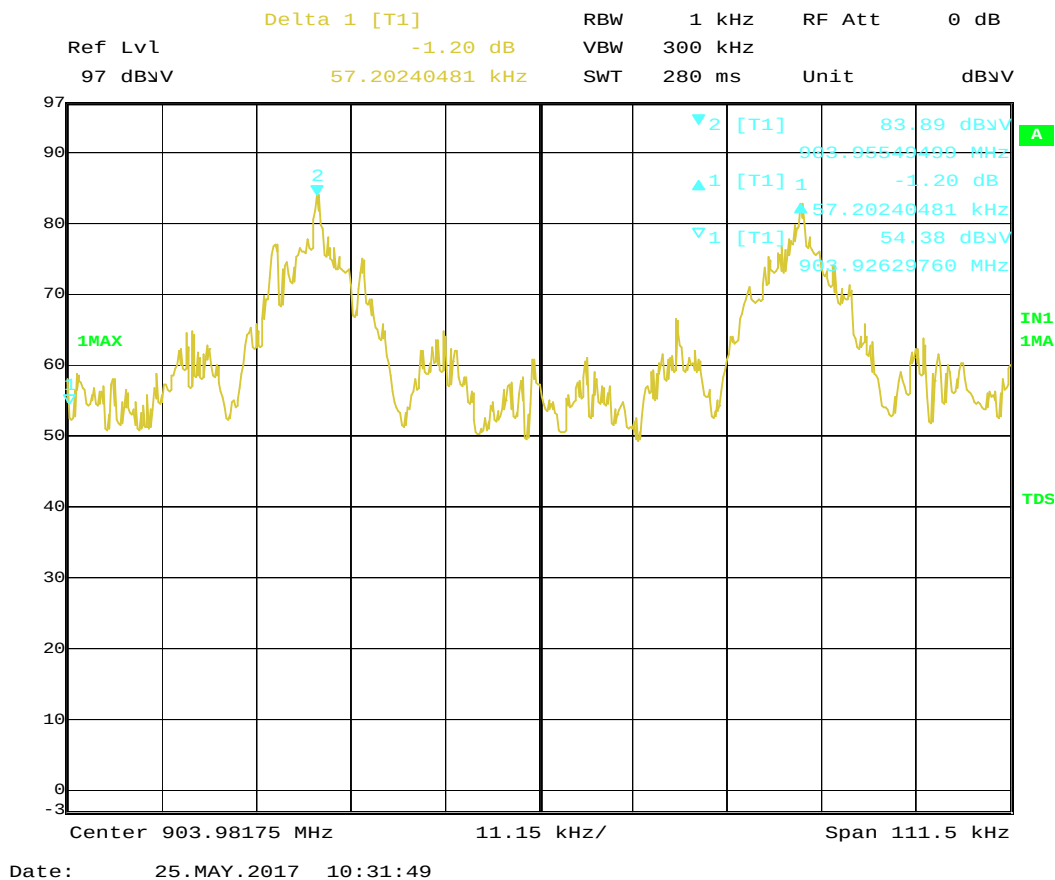
10.3 Results:

The sample tested was found to Comply. It has 57.202 kHz channel separation. Channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

10.4 Setup Photograph:

10.5 Plots/Data

Channel Separation: 57.202 kHz



Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing Engineer:
 (Where Applicable) N/A

Test Date: 05/25/2017

Product Standard: FCC 15.247, RSS 247
 Input Voltage: Internal Battery

Limit Applied: As specified in section 10.3

Pretest Verification w/
 Ambient Signals or
 BB Source: Yes- Signal Generator

Ambient Temperature: 20 °C

Relative Humidity: 53 %

Atmospheric Pressure: 1000 mbars

11 Channel Occupancy Time

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.247) and RSS 247.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 380, and 440 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018

Software Utilized:

Name	Manufacturer	Version
None	--	--

11.3 Results:

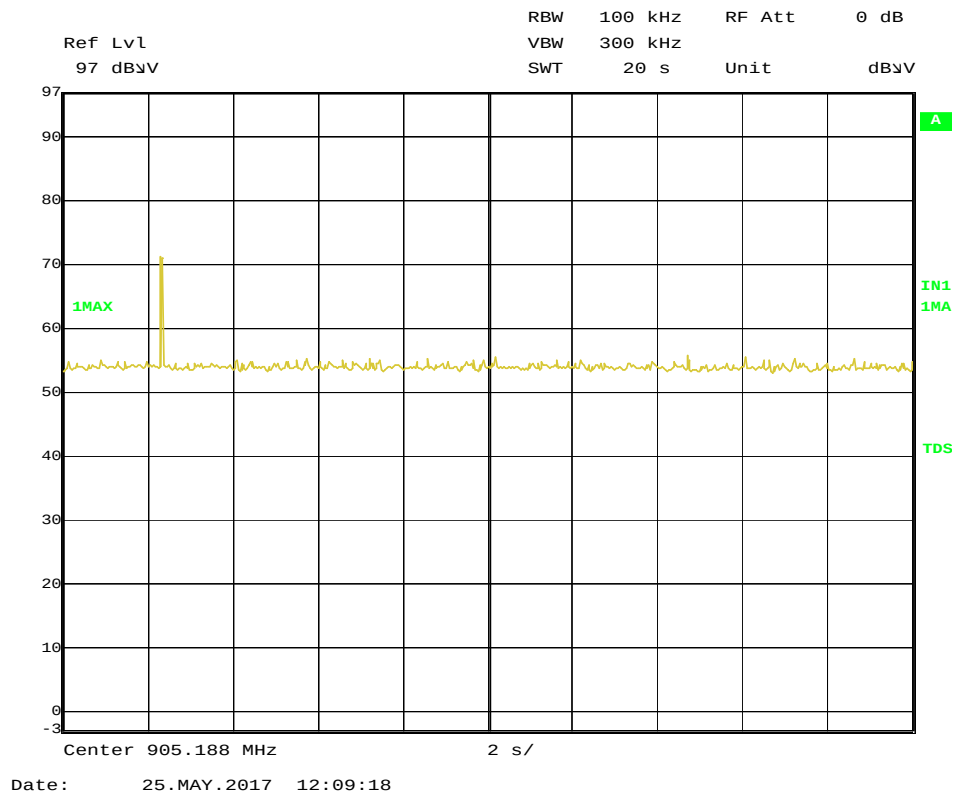
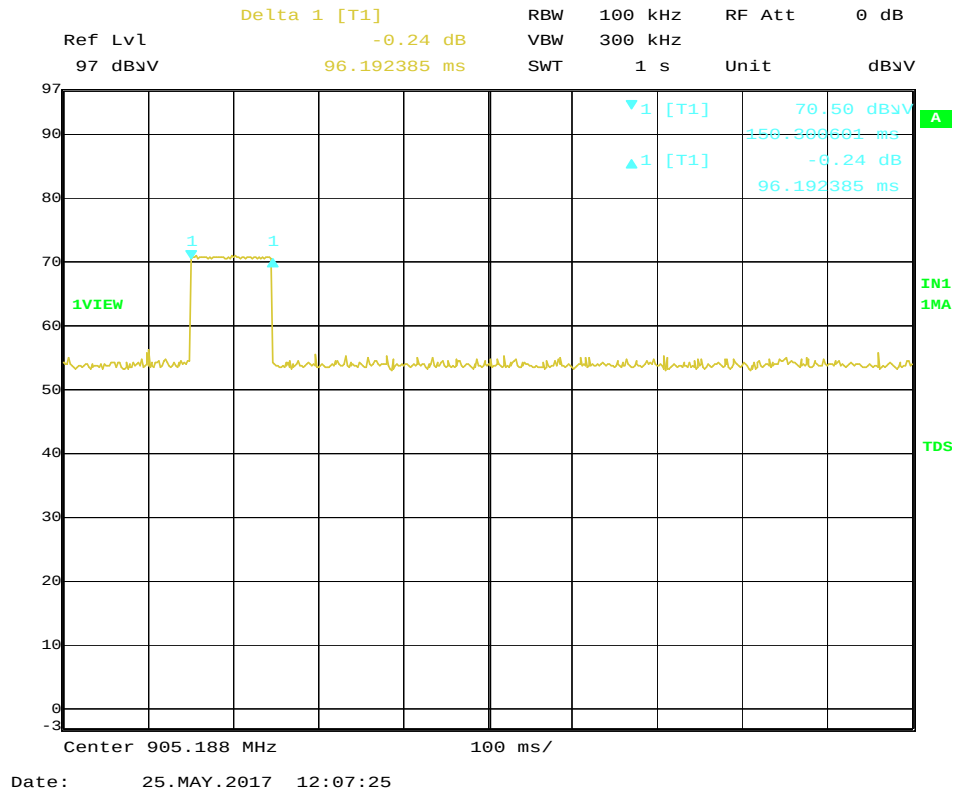
The sample tested was found to Comply. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

11.4 Setup Photograph:



11.5 Plots/Data

Channel time of occupancy: 0.247 seconds



Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing
Engineer:
(Where Applicable) N/A

Test Date: 05/25/2017

Product Standard: FCC 15.247, RSS 247
Input Voltage: Internal Battery

Limit Applied: As specified in section 11.3

Pretest Verification w/
Ambient Signals or
BB Source: Yes- Signal Generator

Ambient Temperature: 20 °C

Relative Humidity: 53 %

Atmospheric Pressure: 1000 mbars

12 Transmitter Spurious Emissions

12.1 Method

Tests are performed in accordance with FCC 15.247, FCC 15.209, FCC 15.209, RSS-247, ANSI C63.4:2014, and ANSI C63.10:2013.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisprr
Radiated Emissions, 10m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	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 μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ 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 μ 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 μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ 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 μ V

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

Alternately, when BAT-EMC Emission Software is used, the "Level" includes all losses and gains and is compared directly in the "Margin" column to the "Limit". The "Correction" includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the "Level" column.

12.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 GHz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
PRE10'	30-1000MHz pre-amp	ITS	PRE10	PRE10	12/16/2016	12/16/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	06/03/2017	06/03/2018
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	02/13/2017	02/13/2018
145-416'	Cables 145-420 145-423 145-424 145-408	Huber + Suhner	3m Track B cables	multiple	07/30/2016	07/30/2017

Software Utilized:

Name	Manufacturer	Version
BAT-EMC Emissions	Nexio	3.16.0.69

12.3 Results:

The sample tested was found to comply.

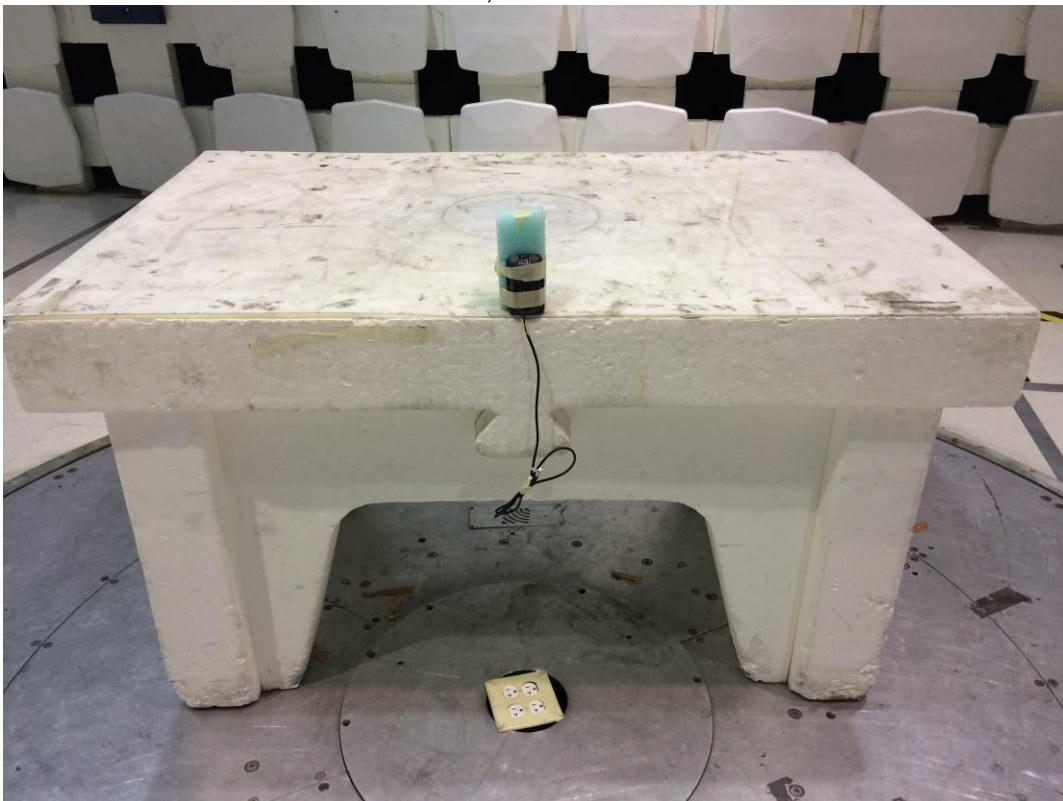
§15.209 Radiated emission limits; general requirements applied to all emissions.

12.4 Setup Photographs:

X-axis, 30-1000 MHz



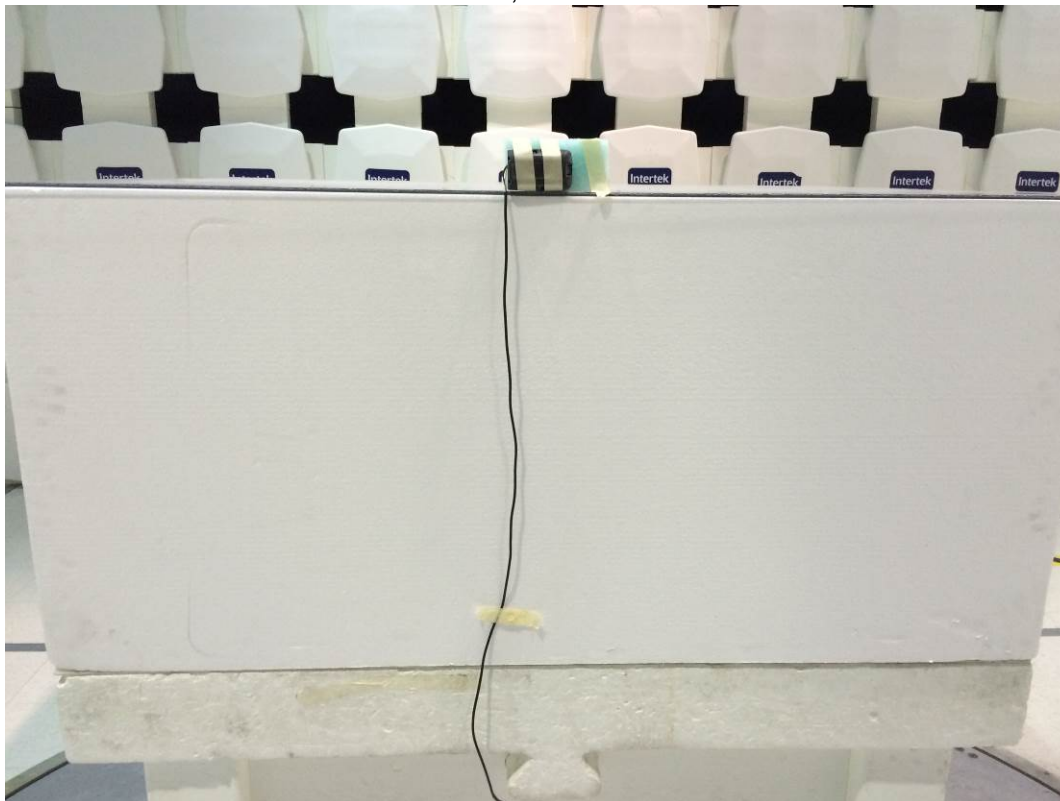
Y-axis, 30-1000 MHz



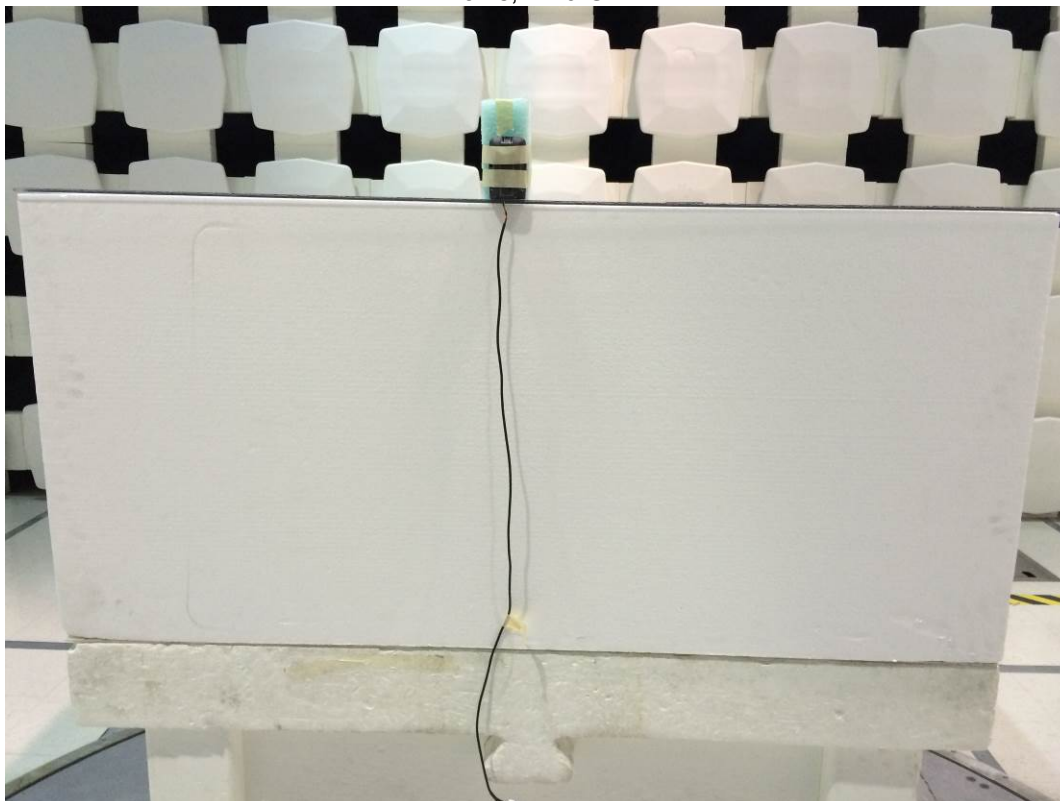
Z-axis, 30-1000 MHz



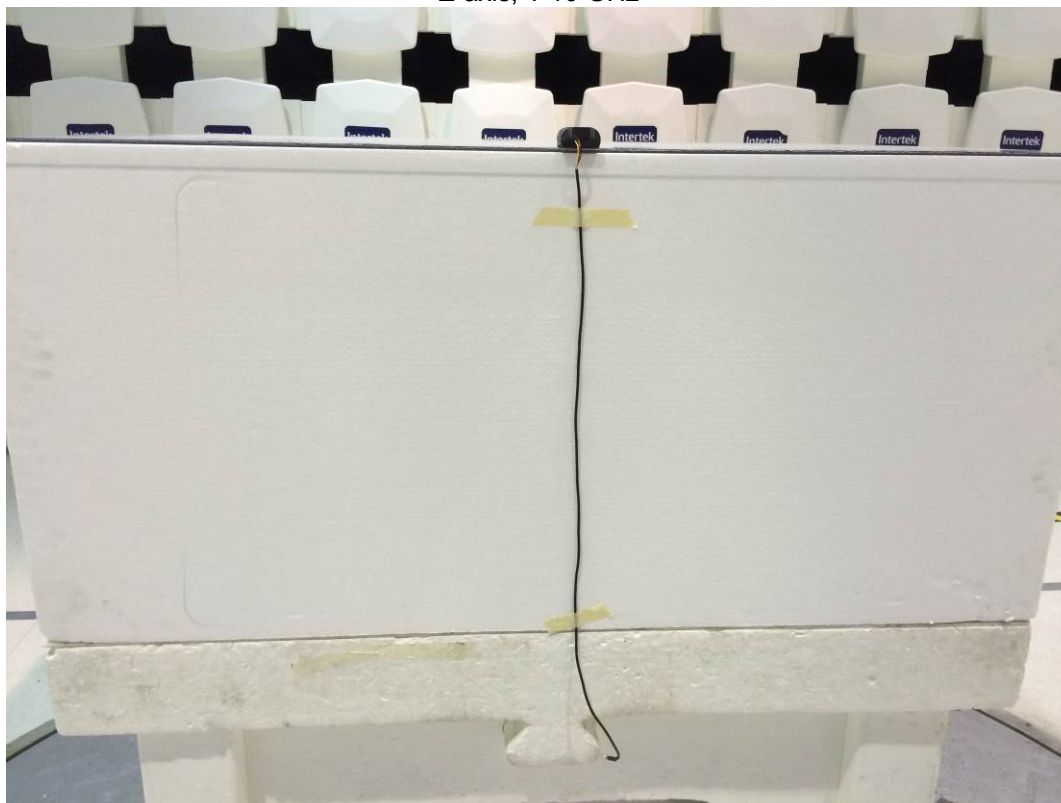
X-axis, 1-10 GHz



Y-axis, 1-10 GHz



Z-axis, 1-10 GHz

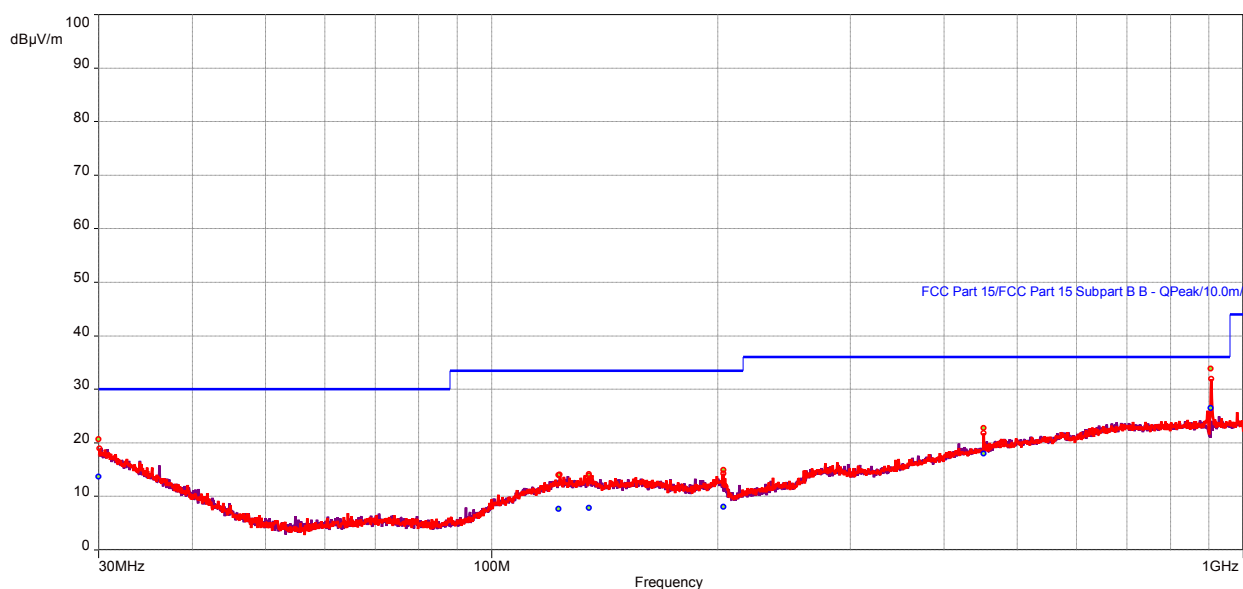


12.5 Plots/Data:

Transmit at Low Channel: 902.5 MHz, 30-1000 MHz (Y-axis – Worst case)

Test Information:

Date and Time	5/24/2017
Client and Project Number	PowerHouse Dynamics Inc
Engineer	Kouma Sinn
Temperature	21 C
Humidity	54 %
Atmospheric Pressure	997 mbar
Comments	Model: 950-000027, Tx @ Low Channel: 902.5 MHz

Graph:**Results:****Peak (PASS) (6)**

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
30	20.61	30.00	-9.39	237.00	3.95	Vertical	0.10	-12.48
122.76	13.98	33.50	-19.52	317.00	3.98	Vertical	0.10	-18.95
134.7	13.89	33.50	-19.61	96.00	3.47	Vertical	0.10	-19.30
203.34	14.88	33.50	-18.62	59.00	1.51	Vertical	0.10	-20.16
451.26	22.77	36.00	-13.23	201.00	3.97	Vertical	0.10	-14.57
906.06	33.81	36.00	-2.19	144.00	1.78	Vertical	0.10	-9.36

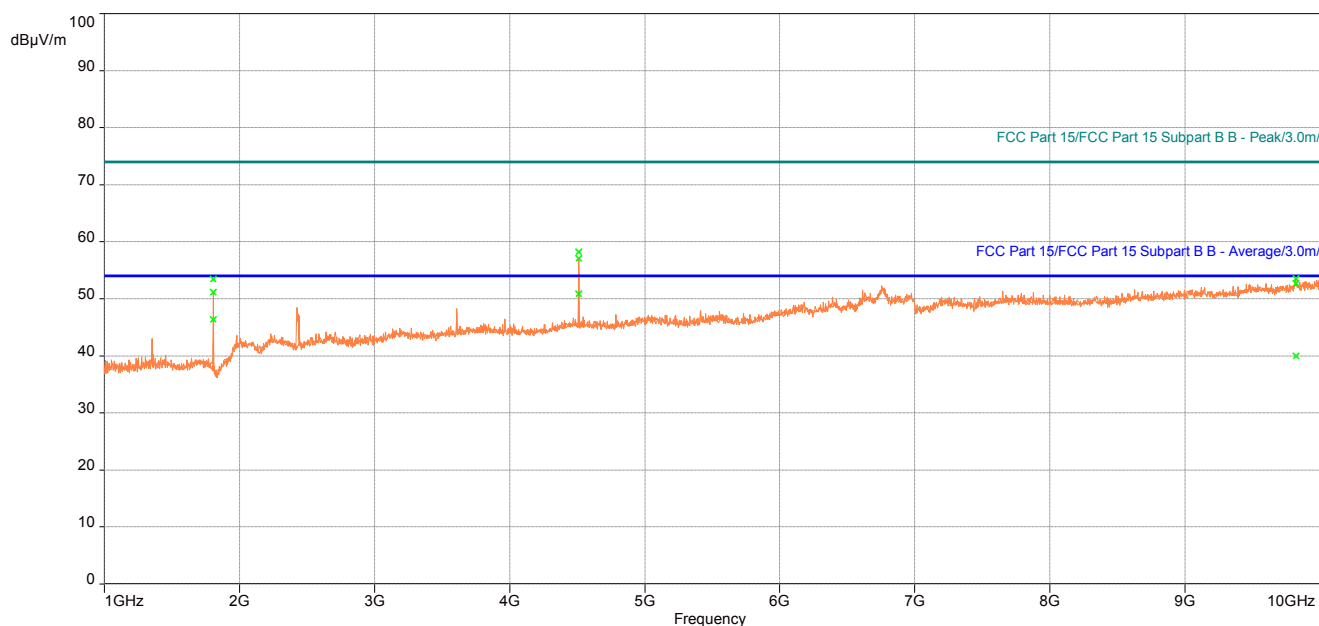
QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
30	13.68	30.00	-16.32	237.00	3.95	Vertical	0.10	-12.48
122.76	7.63	33.50	-25.87	317.00	3.98	Vertical	0.10	-18.95
134.7	7.87	33.50	-25.63	96.00	3.47	Vertical	0.10	-19.30
203.34	8.08	33.50	-25.42	59.00	1.51	Vertical	0.10	-20.16
451.26	17.96	36.00	-18.04	201.00	3.97	Vertical	0.10	-14.57
906.06	26.47	36.00	-9.53	144.00	1.78	Vertical	0.10	-9.36

Transmit at Low Channel: 902.5 MHz, 1-10 GHz (Z-axis – Worst case)

Test Information:

Date and Time	5/26/2017
Client and Project Number	PowerHouse Dynamics, Inc.
Engineer	Kouma Sinn
Temperature	20 C
Humidity	56 %
Atmospheric Pressure	998 mbar
Comments	Tx @ Low, EUT sits on its back_1-10GHz

Graph:**Results:**

Avg (PASS) (3)

Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
4512.5	1	50.83	54.00	-3.17	166.00	1.75	Vertical	0.10	7.93
1805	2	46.34	54.00	-7.66	106.00	1.36	Horizontal	0.10	1.61
9821.5	2	39.94	54.00	-14.06	185.00	1.36	Horizontal	0.10	15.16

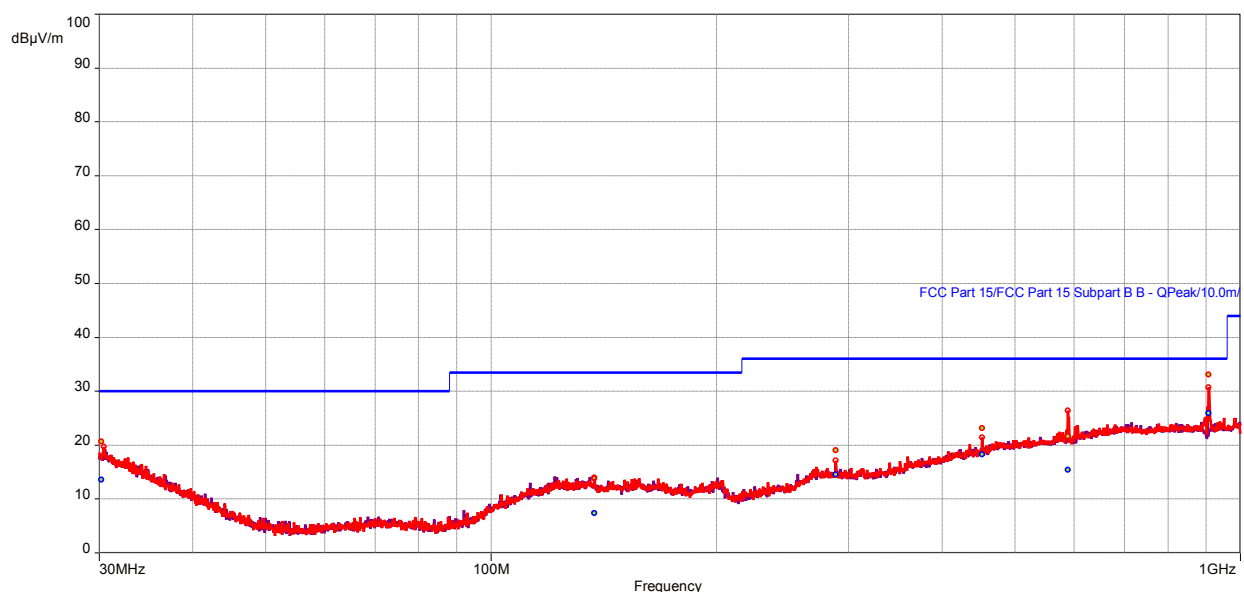
Peak (PASS) (3)

Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
4512.5	1	58.21	74.00	-15.79	166.00	1.75	Vertical	0.10	7.93
1805	2	53.46	74.00	-20.54	106.00	1.36	Horizontal	0.10	1.61
9821.5	2	52.68	74.00	-21.32	185.00	1.36	Horizontal	0.10	15.16

Notes: General limits applied to all emissions.

Transmit at Mid Channel: 903.844 MHz, 30-1000 MHz (Y-axis – Worst case)**Test Information:**

Date and Time	5/24/2017
Client and Project Number	PowerHouse Dynamics Inc
Engineer	Kouma Sinn
Temperature	21 C
Humidity	54 %
Atmospheric Pressure	997 mbar
Comments	Model: 950-000027, Tx @ Mid Channel: 903.844 MHz

Graph:**Results:****Peak (PASS) (6)**

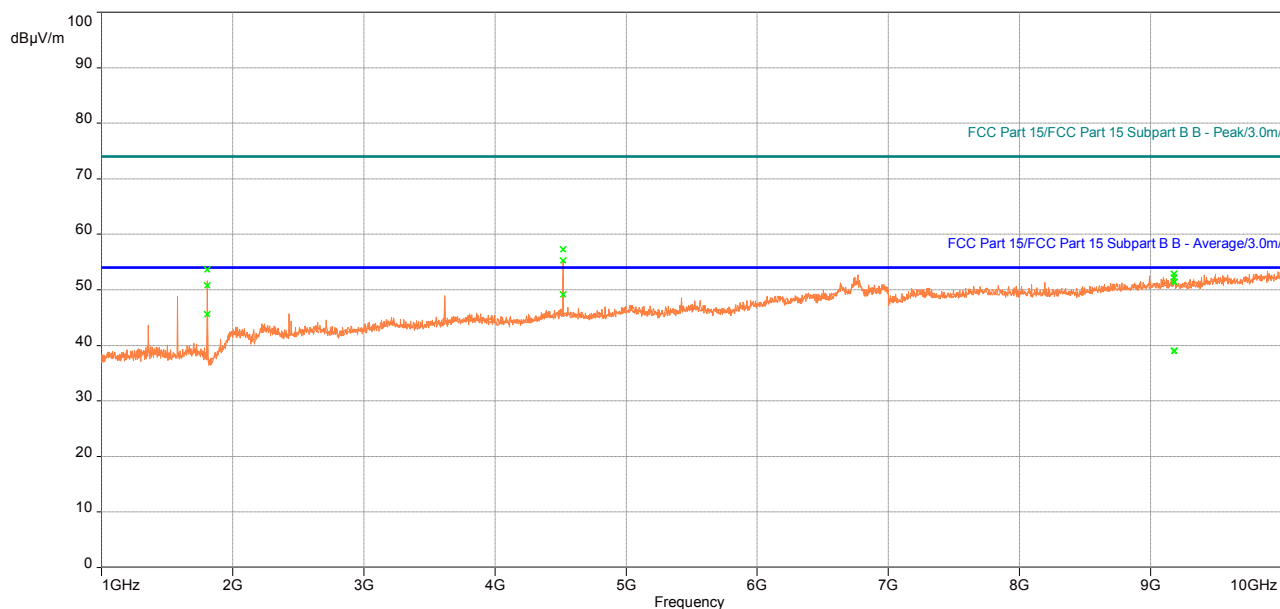
Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
30.18	1	20.62	30.00	-9.38	195.00	3.00	Vertical	0.10	-12.60
137.28	1	13.78	33.50	-19.72	257.00	2.35	Vertical	0.10	-19.50
288.54	1	19.06	36.00	-16.94	224.00	1.00	Vertical	0.10	-18.71
451.92	1	23.18	36.00	-12.82	99.00	3.77	Vertical	0.10	-14.57
588.96	1	21.59	36.00	-14.41	91.00	3.98	Vertical	0.10	-12.35
907.26	1	33.09	36.00	-2.91	46.00	2.00	Vertical	0.10	-9.35

QuasiPeak (PASS) (6)

Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
30.18	1	13.56	30.00	-16.44	195.00	3.00	Vertical	0.10	-12.60
137.28	1	7.35	33.50	-26.15	257.00	2.35	Vertical	0.10	-19.50
288.54	1	14.58	36.00	-21.42	224.00	1.00	Vertical	0.10	-18.71
451.92	1	18.30	36.00	-17.70	99.00	3.77	Vertical	0.10	-14.57
588.96	1	15.37	36.00	-20.63	91.00	3.98	Vertical	0.10	-12.35
907.26	1	25.91	36.00	-10.09	46.00	2.00	Vertical	0.10	-9.35

Transmit at Mid Channel: 903.844 MHz, 1-10 GHz (Z-axis – Worst case)**Test Information:**

Date and Time	5/26/2017
Client and Project Number	PowerHouse Dynamics, Inc.
Engineer	Kouma Sinn
Temperature	20 C
Humidity	56 %
Atmospheric Pressure	998 mbar
Comments	Tx @ Mid, EUT sits on its back_ 1-10GHz

Graph:**Results:****Avg (PASS) (4)**

Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
4519	1	49.11	54.00	-4.89	184.00	1.37	Vertical	0.10	7.95
9178	1	39.05	54.00	-14.95	300.00	4.00	Vertical	0.10	13.95
1807.5	2	45.61	54.00	-8.39	105.00	1.35	Horizontal	0.10	1.63
9183	2	39.05	54.00	-14.95	110.00	1.52	Horizontal	0.10	13.95

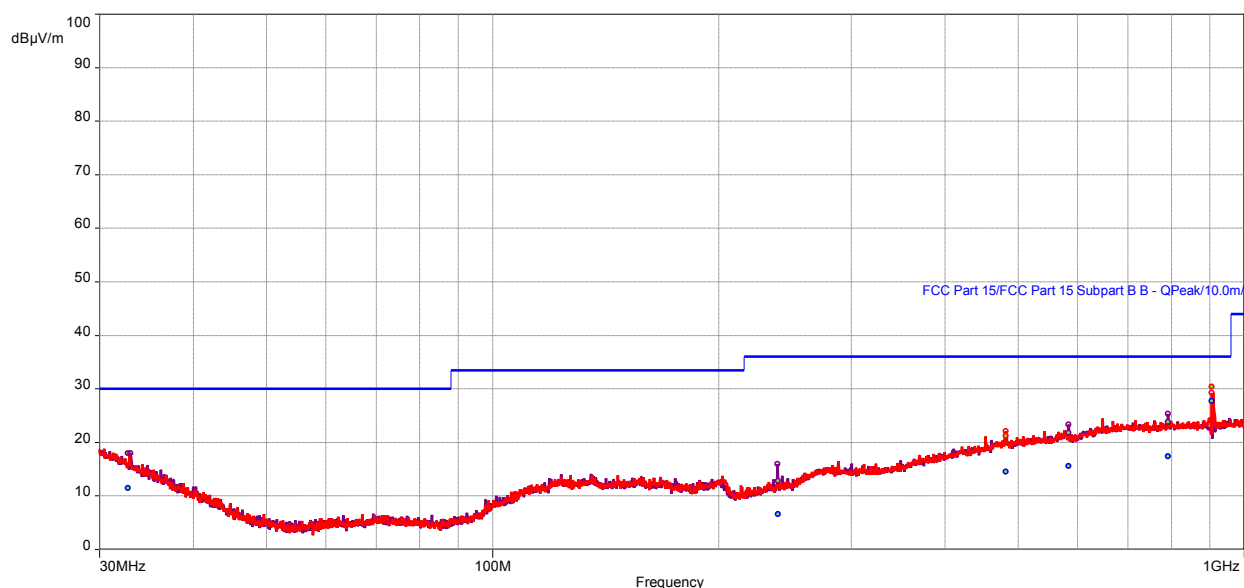
Peak (PASS) (4)

Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
4519	1	57.25	74.00	-16.75	184.00	1.37	Vertical	0.10	7.95
9178	1	51.46	74.00	-22.54	300.00	4.00	Vertical	0.10	13.95
1807.5	2	53.62	74.00	-20.38	105.00	1.35	Horizontal	0.10	1.63
9183	2	51.47	74.00	-22.53	110.00	1.52	Horizontal	0.10	13.95

Notes: General limits applied to all emissions.

Transmit at High Channel: 905.3 MHz, 30-1000 MHz (Y-axis – Worst case)**Test Information:**

Date and Time	5/24/2017
Client and Project Number	PowerHouse Dynamics Inc
Engineer	Kouma Sinn
Temperature	21 C
Humidity	54 %
Atmospheric Pressure	997 mbar
Comments	Model: 950-000027, Tx @ High Channel: 905.3 MHz

Graph:**Results:****Peak (PASS) (6)**

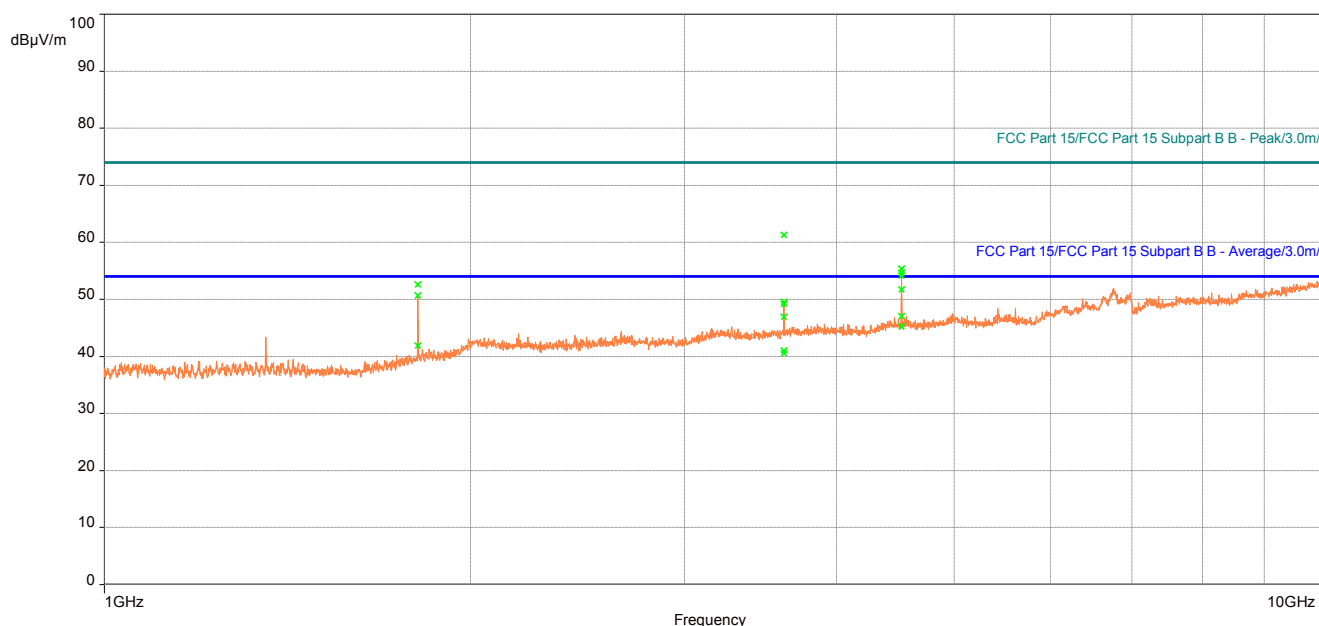
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
481.86	21.20	36.00	-14.80	156.00	1.99	Vertical	0.10	-13.58
905.28	30.36	36.00	-5.64	122.00	1.99	Vertical	0.10	-9.36
32.7	18.02	30.00	-11.98	295.00	1.00	Horizontal	0.10	-14.52
239.64	12.80	36.00	-23.20	175.00	1.35	Horizontal	0.10	-20.64
583.44	21.84	36.00	-14.16	47.00	2.73	Horizontal	0.10	-12.23
791.58	23.84	36.00	-12.16	271.00	3.00	Horizontal	0.10	-9.76

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
481.86	14.55	36.00	-21.45	156.00	1.99	Vertical	0.10	-13.58
905.28	27.72	36.00	-8.28	122.00	1.99	Vertical	0.10	-9.36
32.7	11.50	30.00	-18.50	295.00	1.00	Horizontal	0.10	-14.52
239.64	6.59	36.00	-29.41	175.00	1.35	Horizontal	0.10	-20.64
583.44	15.56	36.00	-20.44	47.00	2.73	Horizontal	0.10	-12.23
791.58	17.41	36.00	-18.59	271.00	3.00	Horizontal	0.10	-9.76

Transmit at High Channel: 905.3 MHz, 1-10 GHz (Y-axis – Worst case)**Test Information:**

Date and Time	05/25/2017
Client and Project Number	PowerHouse Dynamics Inc
Engineer	Kouma Sinn
Temperature	20 C
Humidity	53 %
Atmospheric Pressure	1000 mbar
Comments	Tx @ high channel_Y-axis (EUT sits straight up), 0 dBm

Graph:**Results:****Avg (PASS) (5)**

Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
1810.5	--	41.89	54.00	-12.11	119.00	1.35	Vertical	0.10	1.66
3621	--	40.50	54.00	-13.50	150.00	3.50	Vertical	0.10	6.05
4526.5	--	45.22	54.00	-8.78	338.00	2.48	Vertical	0.10	7.98
3621	--	40.98	54.00	-13.02	0.00	1.24	Horizontal	0.10	6.05
4526.5	--	47.04	54.00	-6.96	194.00	3.98	Horizontal	0.10	7.98

Peak (PASS) (5)

Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
1810.5	--	52.60	74.00	-21.40	119.00	1.35	Vertical	0.10	1.66
3621	--	49.51	74.00	-24.49	150.00	3.50	Vertical	0.10	6.05
4526.5	--	54.08	74.00	-19.92	338.00	2.48	Vertical	0.10	7.98
3621	--	61.32	74.00	-12.68	0.00	1.24	Horizontal	0.10	6.05
4526.5	--	55.35	74.00	-18.65	194.00	3.98	Horizontal	0.10	7.98

Notes: The general limit was applied for all emissions.

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing
Engineer:
(Where Applicable) N/A
Product Standard: FCC 15.247, FCC 15.209,
FCC 15.109, RSS-247, ICES-003
Input Voltage: Internal Battery
Pretest Verification w/
Ambient Signals or
BB Source: BB Source

Test Date: 05/24/2017, 05/25/2017

Limit Applied: As specified in section 12.3

Ambient Temperature: 21, 20 °C

Relative Humidity: 54, 53 %

Atmospheric Pressure: 997, 1000 mbars

Deviations, Additions, or Exclusions: None

13 Digital Electronics Spurious Emissions

13.1 Method

Tests are performed in accordance with FCC 15.109, RSS-247, ICES-003, and ANSI C63.4:2014.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	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 μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ 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 μ 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 μ V/m. This value in dB μ V/m was converted to its corresponding level in μ 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 μ V to μ 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:

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

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

Alternately, when BAT-EMC Emission Software is used, the "Level" includes all losses and gains and is compared directly in the "Margin" column to the "Limit". The "Correction" includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the "Level" column.

13.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV003'	Weather Station	Davis Instruments	7400	PE80529A39A	11/28/2016	11/28/2017
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/30/2016	07/30/2017
PRE10'	30-1000MHz pre-amp	ITS	PRE10	PRE10	12/16/2016	12/16/2017
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018

Software Utilized:

Name	Manufacturer	Version
BAT-EMC Emissions	Nexio	3.16.0.69

13.3 Results:

The sample tested was found to comply.

§15.109 (a) The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

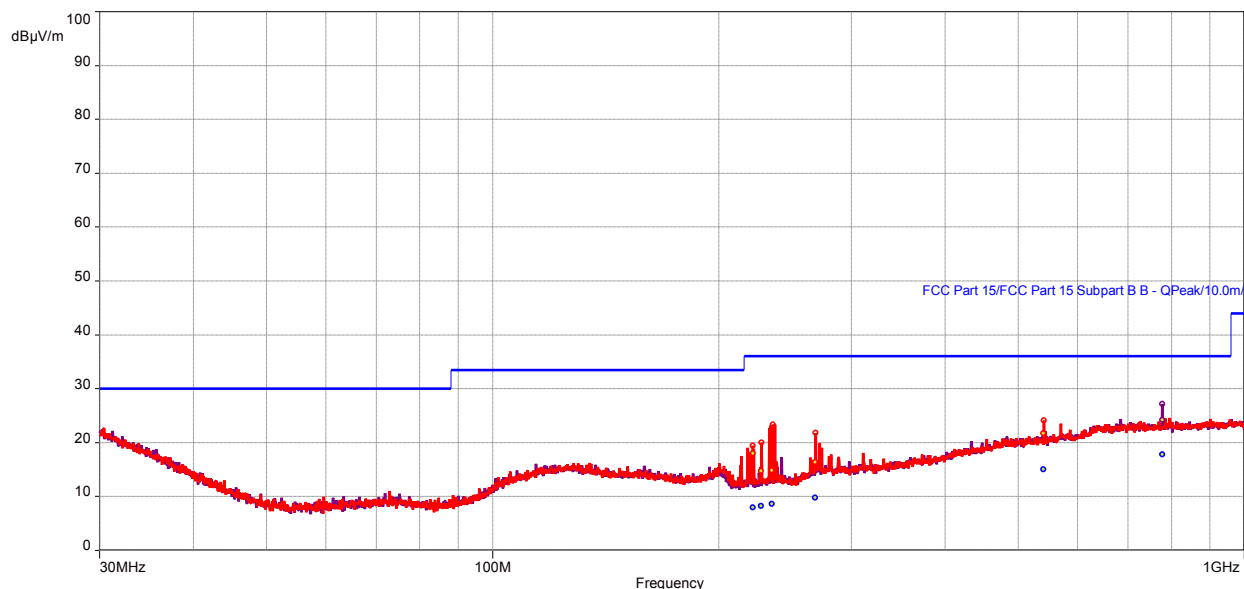
Frequency of emission (MHz)	Field strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

13.4 Setup Photograph:



13.5 Plots/Data:**Transmit in Idle****Test Information:**

Date and Time	5/24/2017
Client and Project Number	Powerhouse Dynamic
Engineer	Kouma Sinn
Temperature	21 C
Humidity	54 %
Atmospheric Pressure	997 mbar
Comments	Model: 950-000027, Tx @ idle

Graph:**Results:****Peak (PASS) (6)**

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
221.82	17.94	36.00	-18.06	122.00	1.36	Vertical	0.10	-21.32
227.58	14.70	36.00	-21.30	77.00	1.35	Vertical	0.10	-21.12
235.44	14.83	36.00	-21.17	0.00	1.35	Vertical	0.10	-20.78
268.74	16.31	36.00	-19.69	0.00	1.50	Vertical	0.10	-18.91
540.78	21.67	36.00	-14.33	98.00	1.78	Vertical	0.10	-12.78
777.54	24.16	36.00	-11.84	187.00	1.78	Horizontal	0.10	-9.82

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
221.82	7.92	36.00	-28.08	122.00	1.36	Vertical	0.10	-21.32
227.58	8.27	36.00	-27.73	77.00	1.35	Vertical	0.10	-21.12
235.44	8.61	36.00	-27.39	0.00	1.35	Vertical	0.10	-20.78
268.74	9.72	36.00	-26.28	0.00	1.50	Vertical	0.10	-18.91
540.78	15.06	36.00	-20.94	98.00	1.78	Vertical	0.10	-12.78
777.54	17.78	36.00	-18.22	187.00	1.78	Horizontal	0.10	-9.82

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing
Engineer:
(Where Applicable) N/A
Product Standard: FCC 15.247, FCC 15.209,
FCC 15.109, RSS-247, ICES-003
Input Voltage: Internal Battery
Pretest Verification w/
Ambient Signals or
BB Source: BB Source

Test Date: 05/24/2017Limit Applied: As specified in section 13.3Ambient Temperature: 21 °CRelative Humidity: 54 %Atmospheric Pressure: 997 mbars

Deviations, Additions, or Exclusions: None

14 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	05/29/2017	103052943BOX-001	KPS <i>KPS</i>	MFM <i>MFM</i>	Original Issue
1	08/04/2017	103052943BOX-001	KPS <i>KPS</i>	--	1. Added 1-10 GHz radiated emissions data on pages 40-43 2. Added 1-10GHz photos in section 12.4 3. Corrected equipment type to DSS on page 5