EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 103052943BOX-008
Project Number: G103052943

Report Issue Date: 11/01/2017
Report Revised Date: 01/07/2018

Model(s) Tested: 950-000026
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

Naga Suryadevara/Project Engineer, EMC

Report reviewed by

Michael F Murphy/Supervisor, EMC

Table of Contents

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, Duty Cycle measurements, and Human RF Exposure (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	950-000026	WTA1 2134 00DC

Receive Date:	05/24/2017, 10/28/2017
Received Condition:	Good
Type:	Prototype

Description of Equipment Under Test (provided by client)
Remote wireless temperature sensor module. Device was tested without water proof plastic enclosure and pre-scans were done with water proof plastic enclosure.

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: 3.29 dBm Mid Channel: 3.62 dBm High Channel: 4.01 dBm
Test Channels	Low Channel: 902.500 MHz Mid Channel: 903.844 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

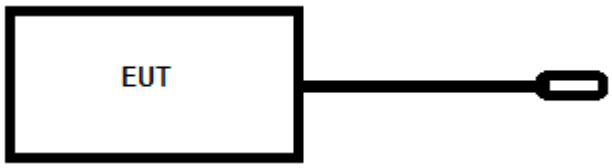
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	Temperature Sensor	0.5	None	None	Sensor

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

Testing on 10/30/2017

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	07/25/2017	07/25/2018
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:

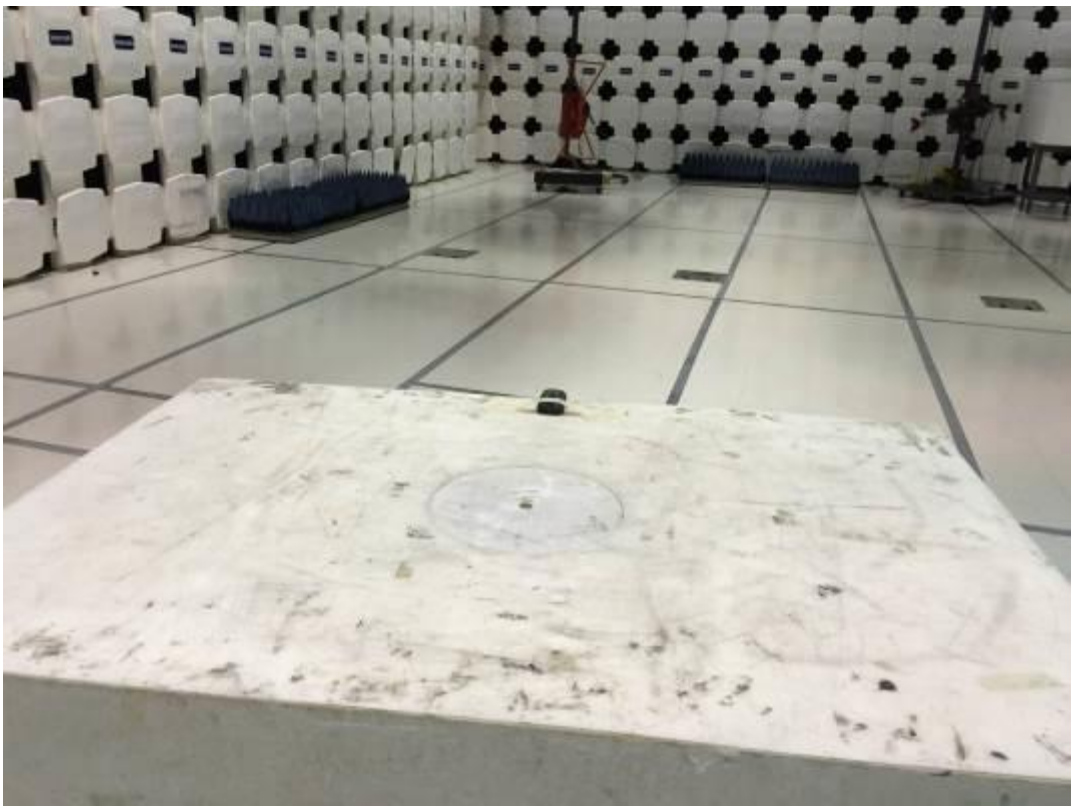
The sample tested was found to Comply. For systems operating in the 902-928 MHz band the maximum peak output power is 1 watt (30 dBm).

6.4 Setup Photographs:

X-axis

Y-axis

Z-axis



6.5 Test Data:

Low Channel Output Power - Radiated Emissions

Intertek

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): 05/24/17 05/25/17
Standard: FCC Part 15.247 | Temp/Humidity/Pressure: 21C 54% 997mbar
Receiver: 145-128 | Limit Distance (m): 10 | 20C 53% 1000mbar
PreAmp: NONE. | Test Distance (m): 10
PreAmp Used? (Y or N): N | Voltage/Frequency: 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-84.8 dB. Y-axis: EUT sits straight up (V, worst-case), Low channel											
MaxPK	V	902.500	54.45	29.00	4.41	0.00	0.00	3.06	30.00	-26.94	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8 dB. Z-axis: EUT sits on its back (H, worst-case), Low channel											
MaxPK	H	902.500	55.03	28.65	4.41	0.00	0.00	3.29	30.00	-26.71	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8 dB. X-axis: EUT sits on its long side (H, worst-case), Low channel											
MaxPK	H	902.500	54.99	28.65	4.41	0.00	0.00	3.25	30.00	-26.75	120/300 kHz

Mid Channel Output Power - Radiated Emissions

Intertek

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): 05/24/17 05/25/17
Standard: FCC Part 15.247 | Temp/Humidity/Pressure: 21C 54% 997mbar
Receiver: 145-128 | Limit Distance (m): 10 | 20C 53% 1000mbar
PreAmp: NONE. | Test Distance (m): 10
PreAmp Used? (Y or N): N | Voltage/Frequency: 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-84.8 dB. Y-axis: EUT sits straight up (V, worst-case), Mid Channel											
MaxPK	V	903.844	54.36	29.00	4.42	0.00	0.00	2.98	30.00	-27.02	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8 dB. Z-axis: EUT sitS on its back (H, worst-case), Mid Channel											
MaxPK	H	903.844	55.40	28.60	4.42	0.00	0.00	3.62	30.00	-26.38	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8 dB. X-axis: EUT sits on its long side (H, worst-case), Mid Channel											
MaxPK	H	903.844	54.52	28.60	4.42	0.00	0.00	2.74	30.00	-27.26	120/300 kHz

Hi Channel Output Power - Radiated Emissions

Intertek

High 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): 05/24/17 05/25/17
Standard: FCC Part 15.247 | Temp/Humidity/Pressure: 21C 54% 997mbar
Receiver: 145-128 | Limit Distance (m): 10 | 20C 53% 1000mbar
PreAmp: NONE. | Test Distance (m): 10
PreAmp Used? (Y or N): N | Voltage/Frequency: 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-84.8 dB. Y-axis: EUT sits straight up (V, worst-case), High channel											
MaxPK	V	905.300	55.36	29.00	4.42	0.00	0.00	3.98	30.00	-26.02	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8 dB. Z-axis: EUT sits on its back (H, worst-case), High channel											
MaxPK	H	905.300	55.64	28.60	4.42	0.00	0.00	3.86	30.00	-26.14	120/300 kHz
E = EIRP-20*LOG(Distance) +104.8 or at 10m, EIRP = E-84.8 dB. X-axis: EUT sits on its long side (H, worst-case), High channel											
MaxPK	H	905.300	55.79	28.60	4.42	0.00	0.00	4.01	30.00	-25.99	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	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142\ f^{0.3417}$	$0.008335\ f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000/f^{1.2}$

Note: f 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:

Conducted $Power_{mW} = 10^{ConductedPower(dBm)/10}$

Power Density = [Conducted $Power_{mW}$ x Ant.Gain] / [4π x $(20_{cm})^2$] or [EIRP] / [4π x $(20_{cm})^2$]

Results:

Maximum Output $Power_{mW} = 10^{(4.01/10)}$ or 2.517677 mW

Antenna gain numeric = 10^(0.9/10) = 1.230

Power Density = (2.517677*1.230) / 5025.6 or 0.000616 mW/cm^2

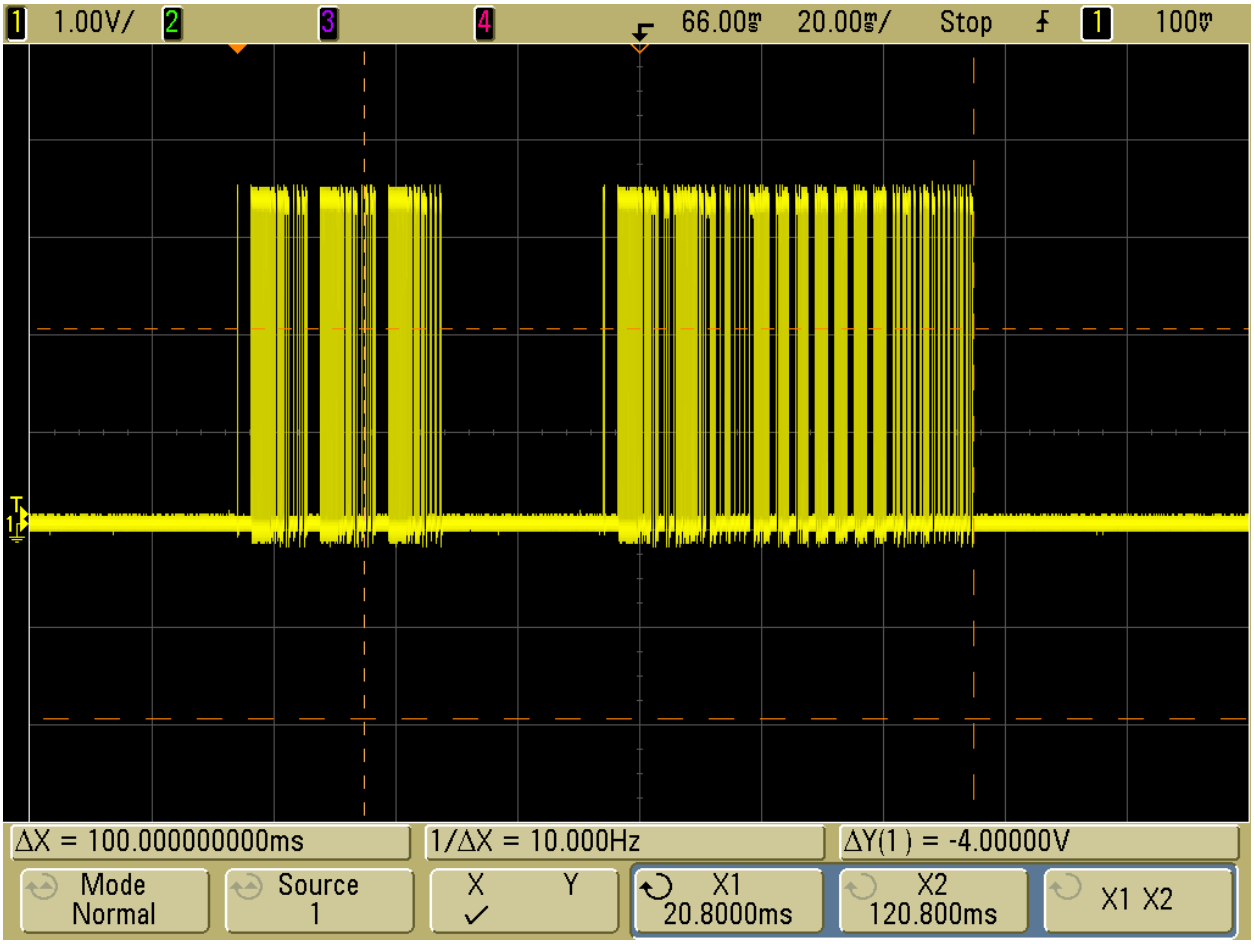
Limit at 905.3 MHz = 0.604 mW/cm^2

RSS-102 Issue 5 Exposure Limit at 905.3 MHz = 2.747 W/m^2

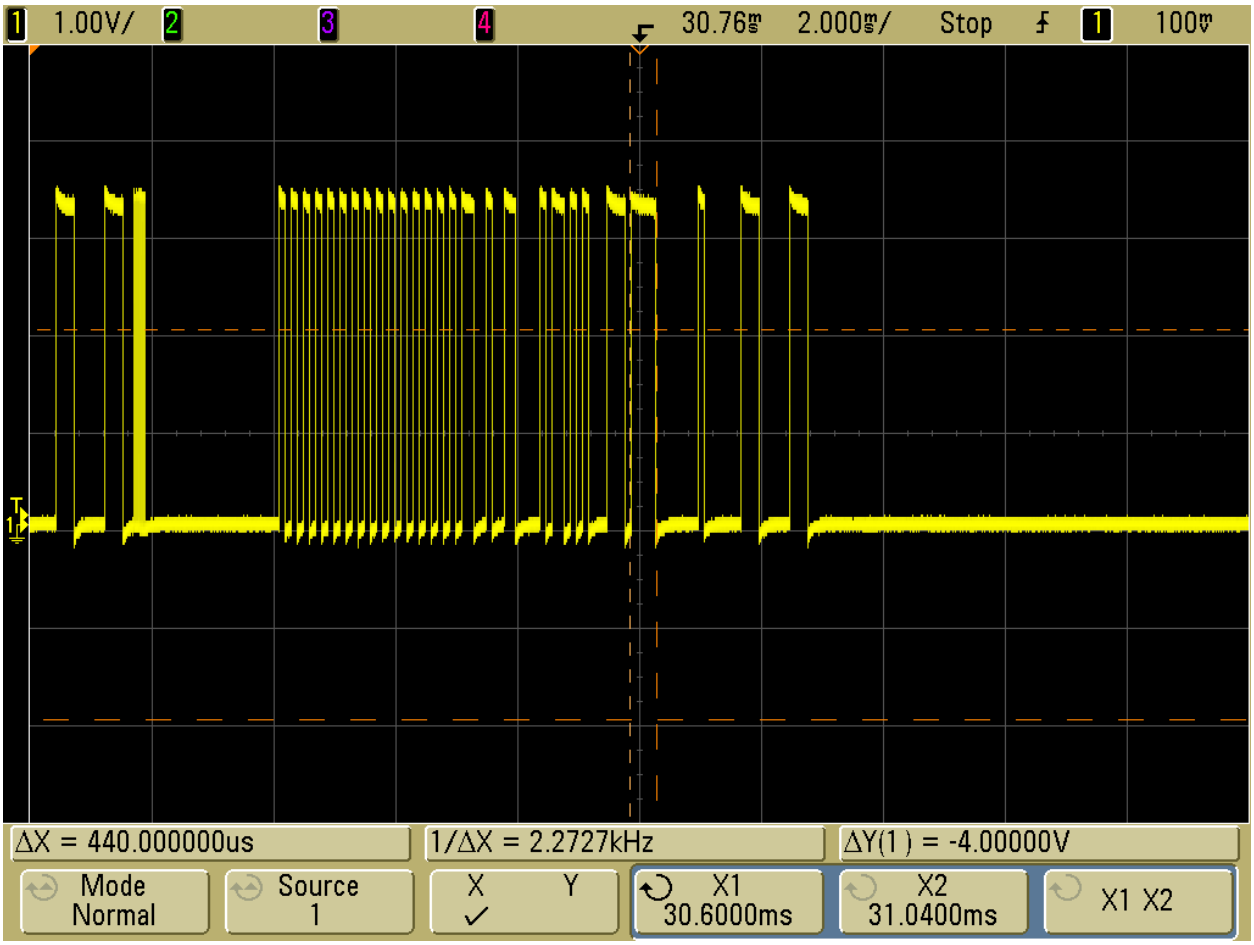
Power Density = 0.00616 W/m^2

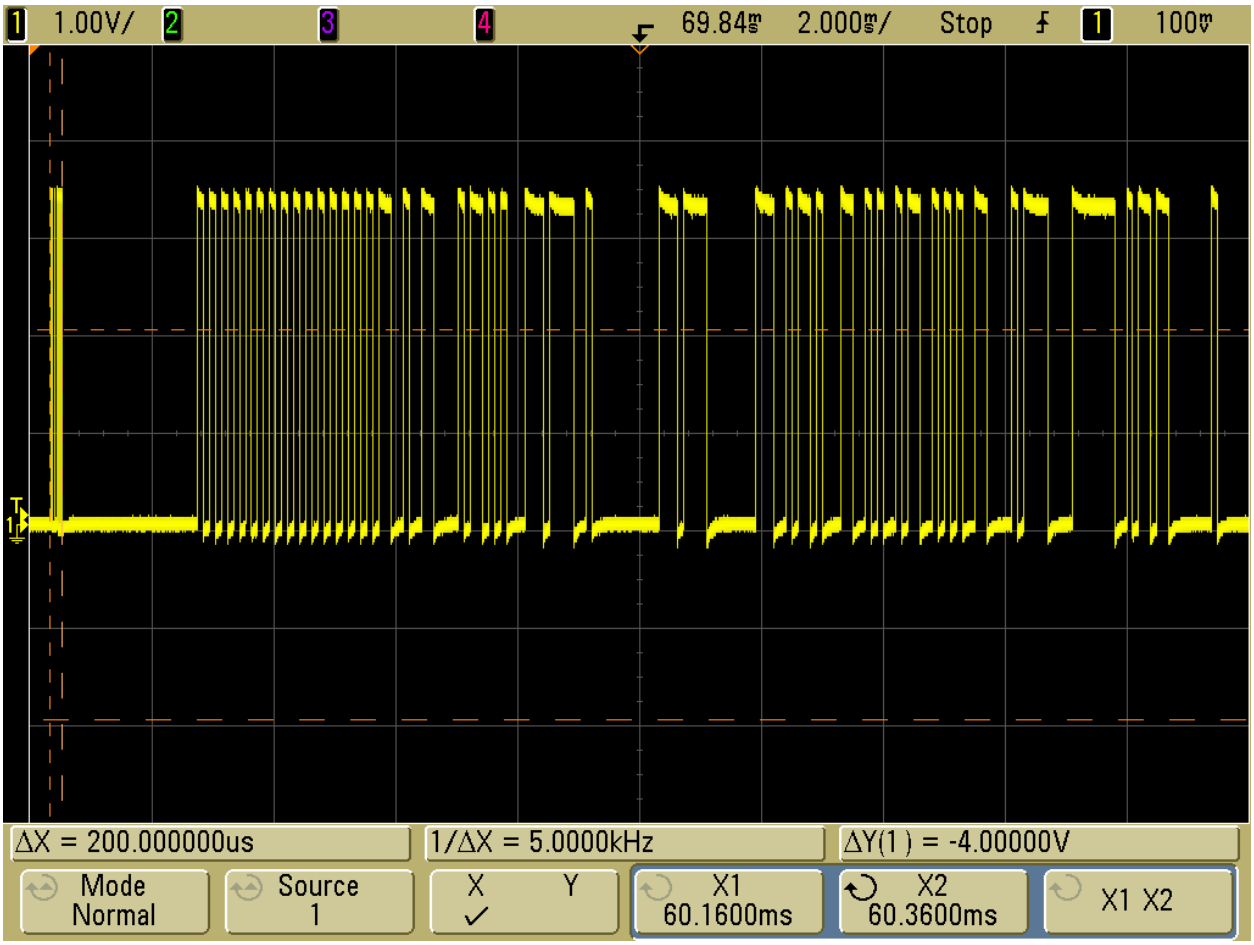
The calculated maximum power density at 20 cm distance is less than the limit for general population / uncontrolled exposure.

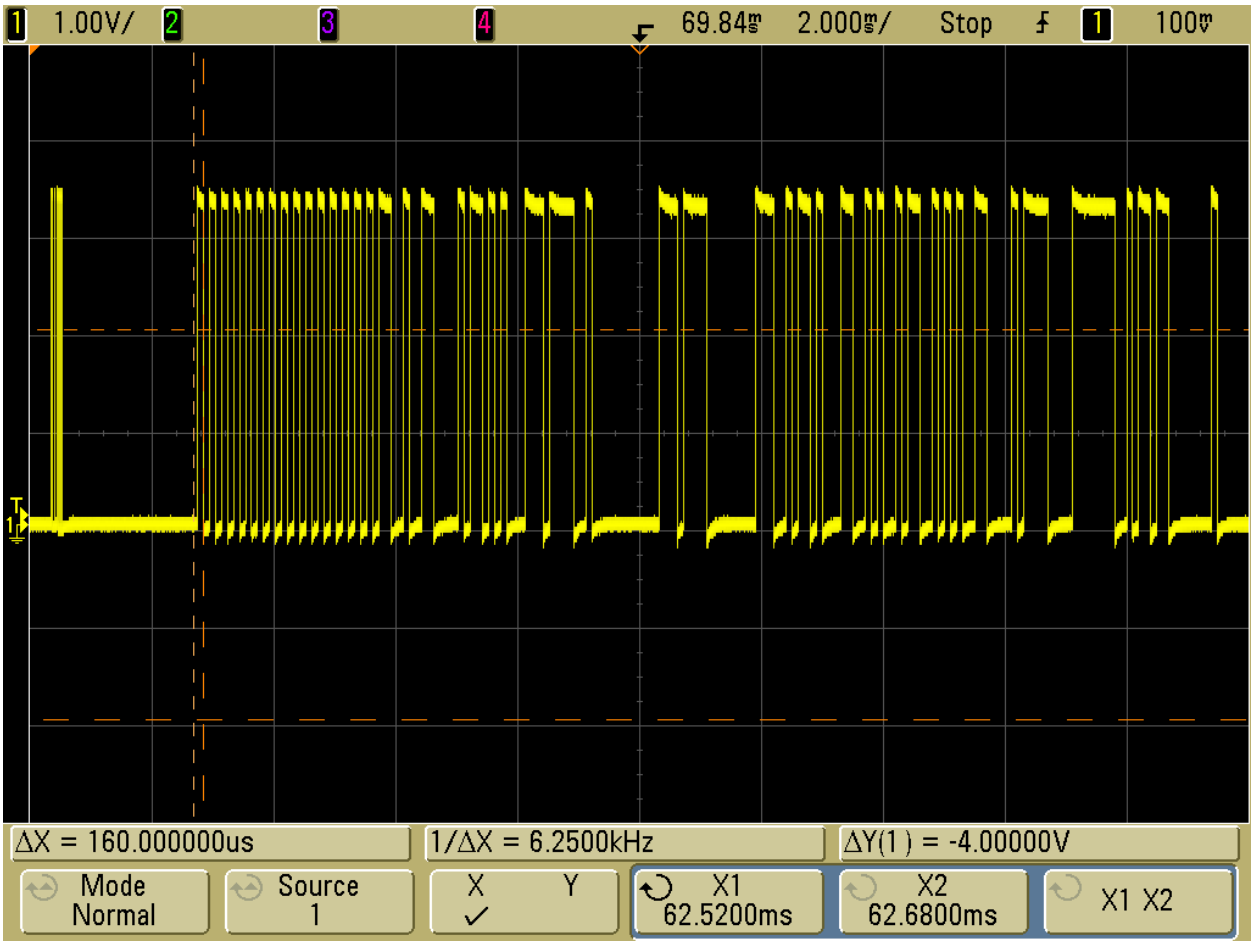
Duty cycle measurements

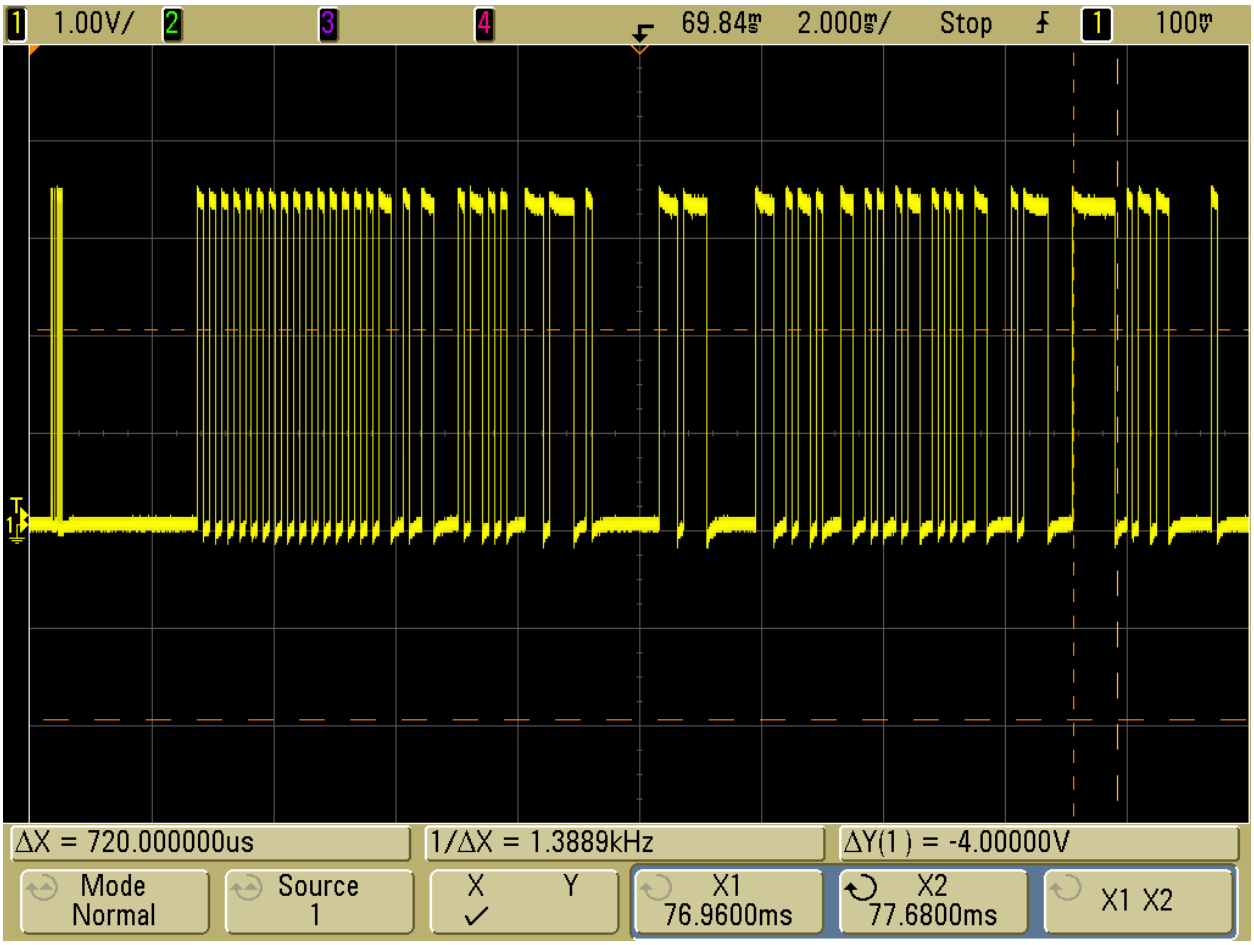


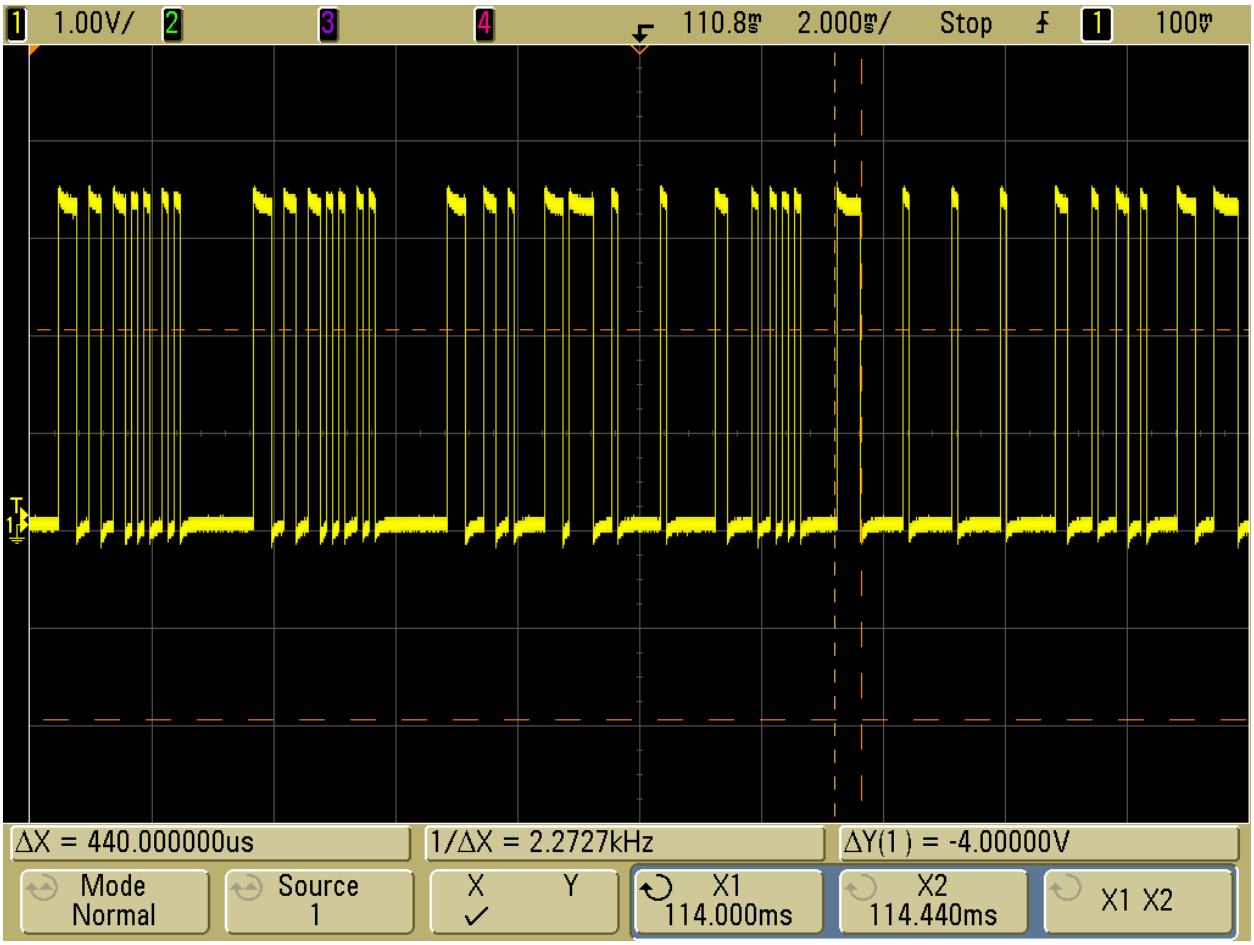
Burst extended beyond 100 ms


1 1.00V/ 2 3 4 30.76ms 2.000ms/ Stop 1 100mV
ΔX = 440.000000us
1/ΔX = 2.2727kHz
ΔY(1) = -4.00000V
Mode Normal
Source 1
X Y
X1 30.6000ms
X2 31.0400ms
X1 X2


1 1.00V/ 2 3 4 69.84ms 2.000ms/ Stop 1 100mV
ΔX = 200.000000us
1/ΔX = 5.0000kHz
ΔY(1) = -4.00000V
Mode Normal
Source 1
X Y
X1 60.1600ms
X2 60.3600ms
X1 X2


1 1.00V/ 2 3 4 69.84ms 2.000ms/ Stop 1 100mV
ΔX = 160.000000us
1/ΔX = 6.2500kHz
ΔY(1) = -4.00000V
Mode Normal
Source 1
X Y
X1 62.5200ms
X2 62.6800ms
X1 X2


1 1.00V/ 2 3 4 69.84ms 2.000ms/ Stop 1 100mV
ΔX = 720.000000us
1/ΔX = 1.3889kHz
ΔY(1) = -4.00000V
Mode Normal
Source 1
X Y
X1 76.9600ms
X2 77.6800ms
X1 X2



All bit 1's within 100ms were measured and duty cycle calculation is as follow.

Duty cycle = 18 pulses with width of 0.44ms + 80 pulses with width of 0.16ms + 2 pulsed with width of 0.72 ms + 1 pulse with width of 0.2 ms

Duty cycle = 18*0.44ms + 80*0.16ms + 2*0.72ms+0.2ms = 22.36 ms or 22.36% or 0.2236
Average factor = 20*LOG(0.2236) = -13 dB

Test Personnel:	Kouma Sinn KPS Vathana Ven VSV	Test Date:	05/26/2017 10/30/2017
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.247, RSS 247	Limit Applied:	As specified in section 6.3
Input Voltage:	Internal Battery		
Pretest Verification w/ Ambient Signals or BB Source:	Yes- Signal Generator	Ambient Temperature:	20, 22 ºC
		Relative Humidity:	56, 46 %
		Atmospheric Pressure:	998, 1005 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:

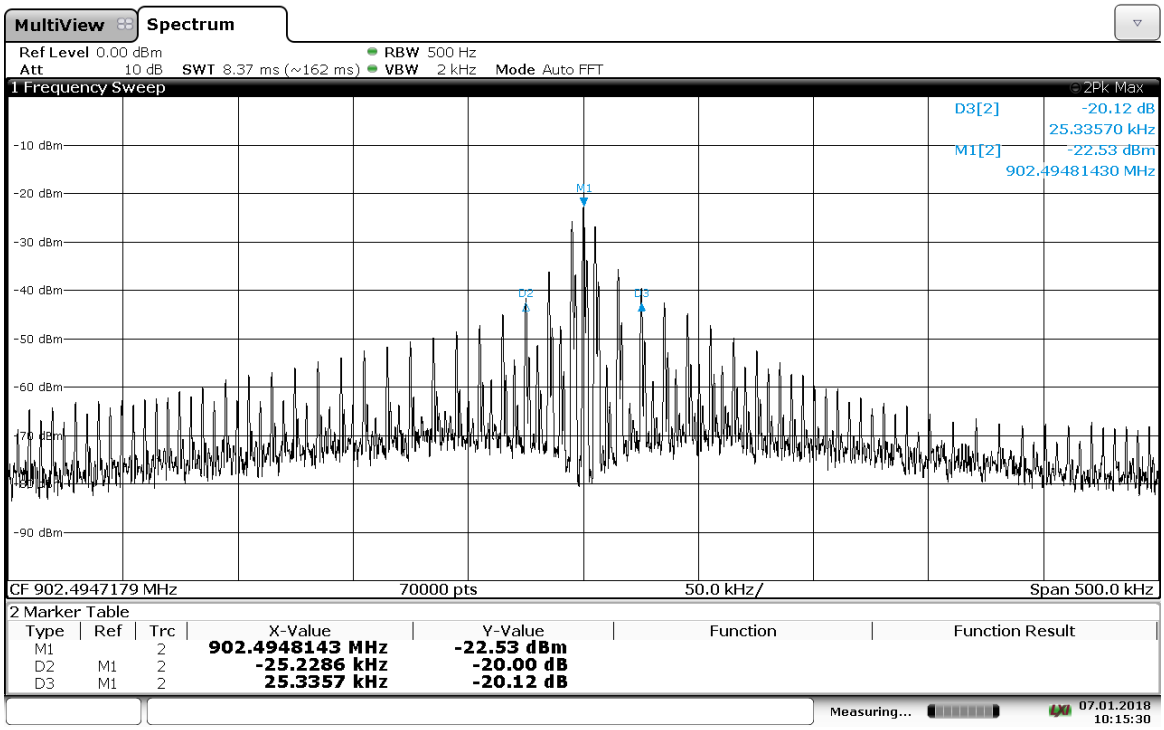
The sample tested was found to Comply. The 20dB BW is lower than 500 kHz.

The maximum allowed 20 dB is greater than 25 kHz or channel spacing, whichever is higher**.**

7.4 Setup Photograph:

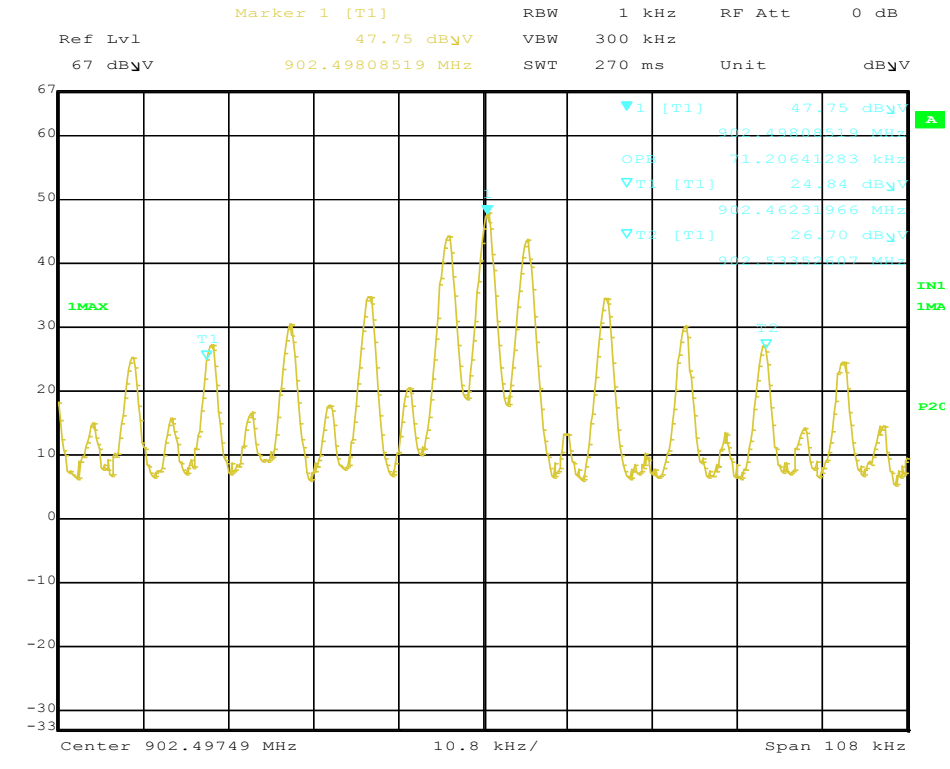
7.5 Plots/Data:

Low Channel 20 dB Bandwidth: 50.5643 kHz



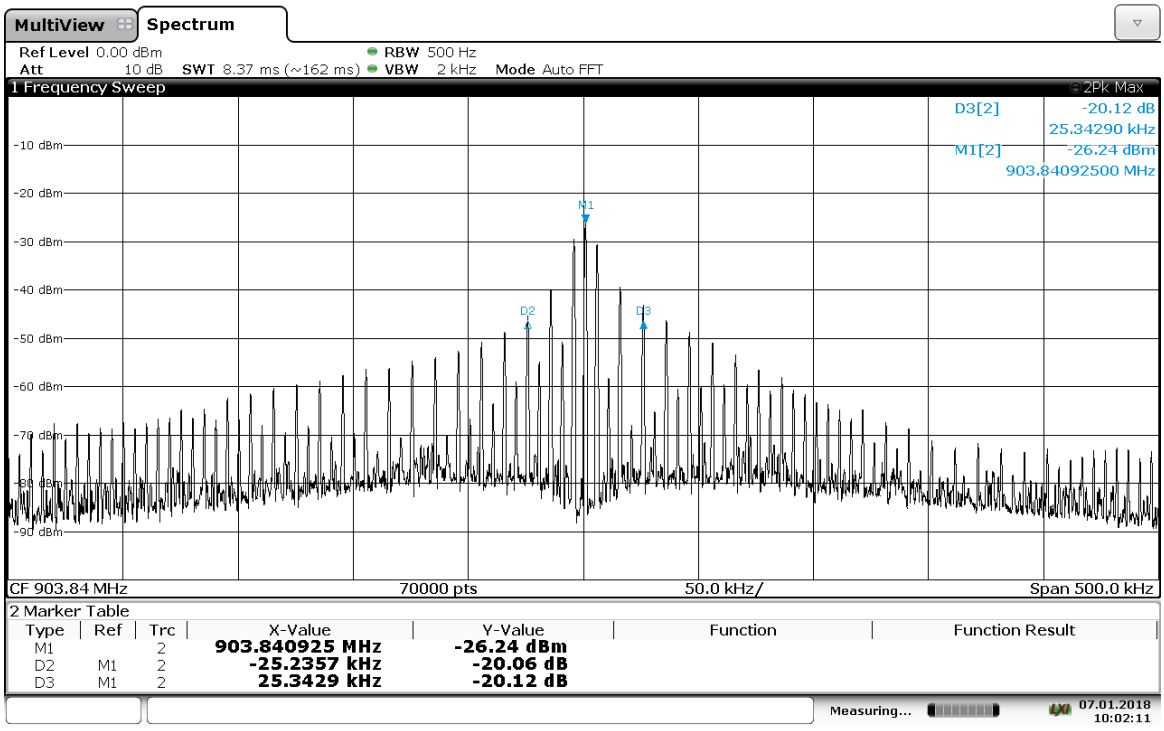
10:15:31 07.01.2018

Low Channel Occupied Bandwidth: 71.206 kHz



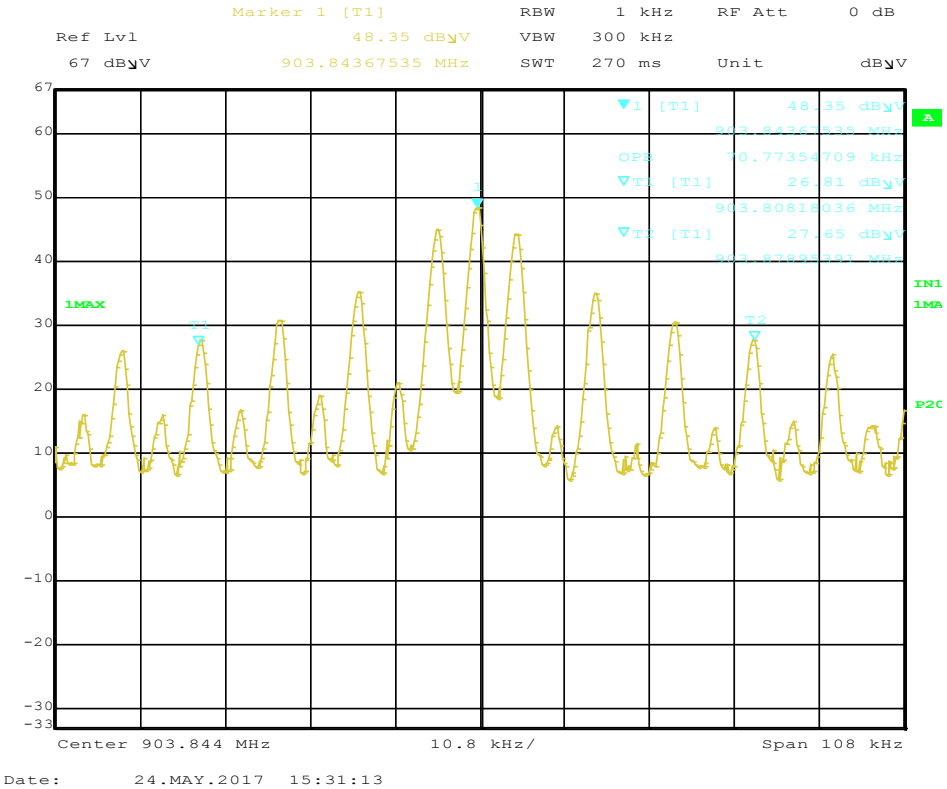
Date: 24.MAY.2017 14:40:07

Mid Channel 20 dB Bandwidth: 50.57 kHz

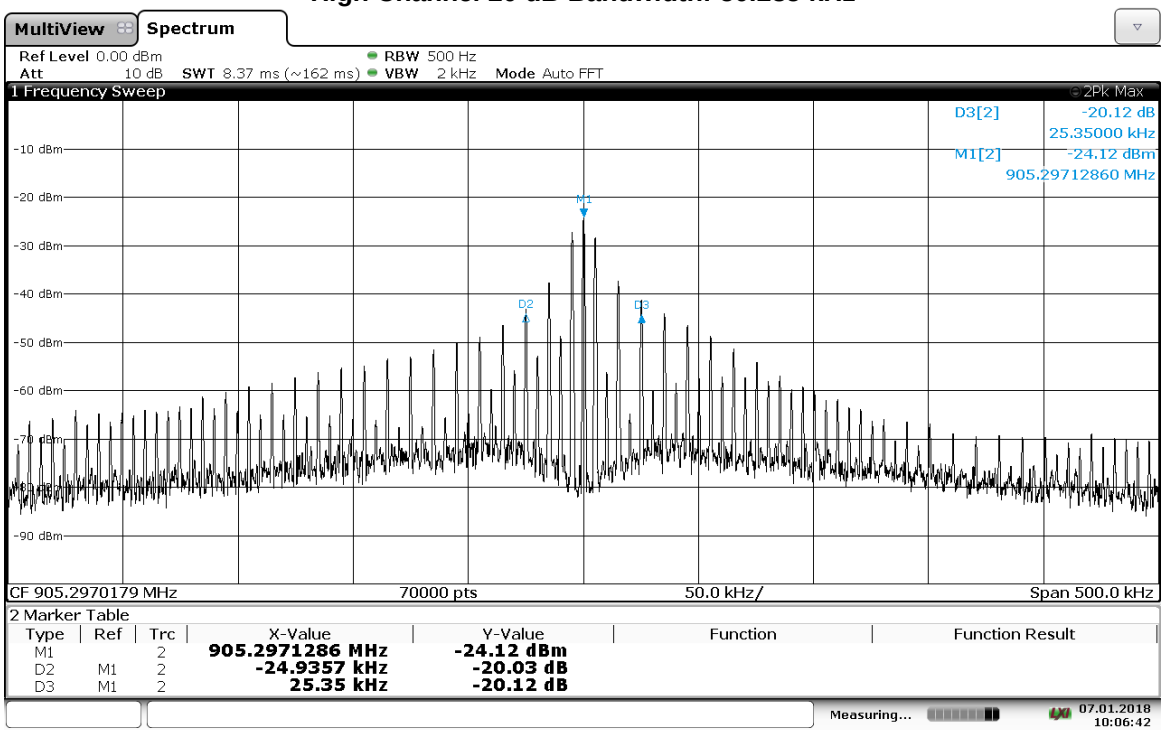


10:02:12 07.01.2018

Mid Channel Occupied Bandwidth: 70.774 kHz

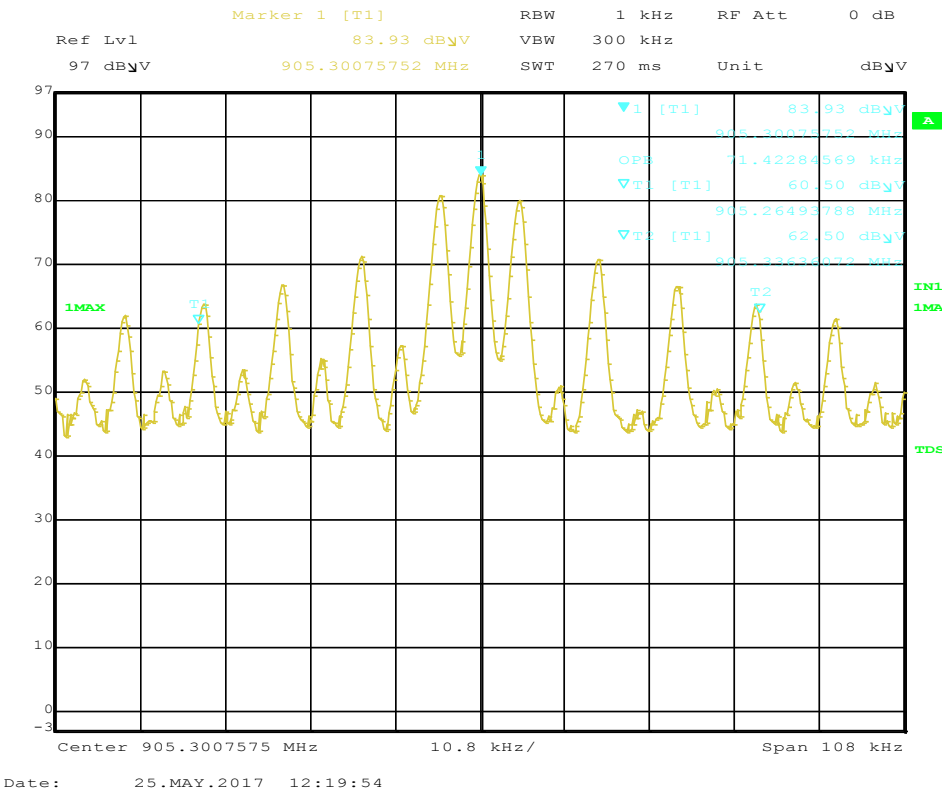


High Channel 20 dB Bandwidth: 50.285 kHz



10:06:43 07.01.2018

High Channel Occupied Bandwidth: 71.423 kHz



Test Personnel:	Kouma Sinn KPS Naga Suryadevara N.S	Test Date:	05/25/2017 01/07/2017
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.247, RSS 247	Limit Applied:	As specified in section 7.3
Input Voltage:	Internal Battery		
Pretest Verification w/ Ambient Signals or BB Source:	Yes- Signal Generator	Ambient Temperature:	21 ºC
		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:

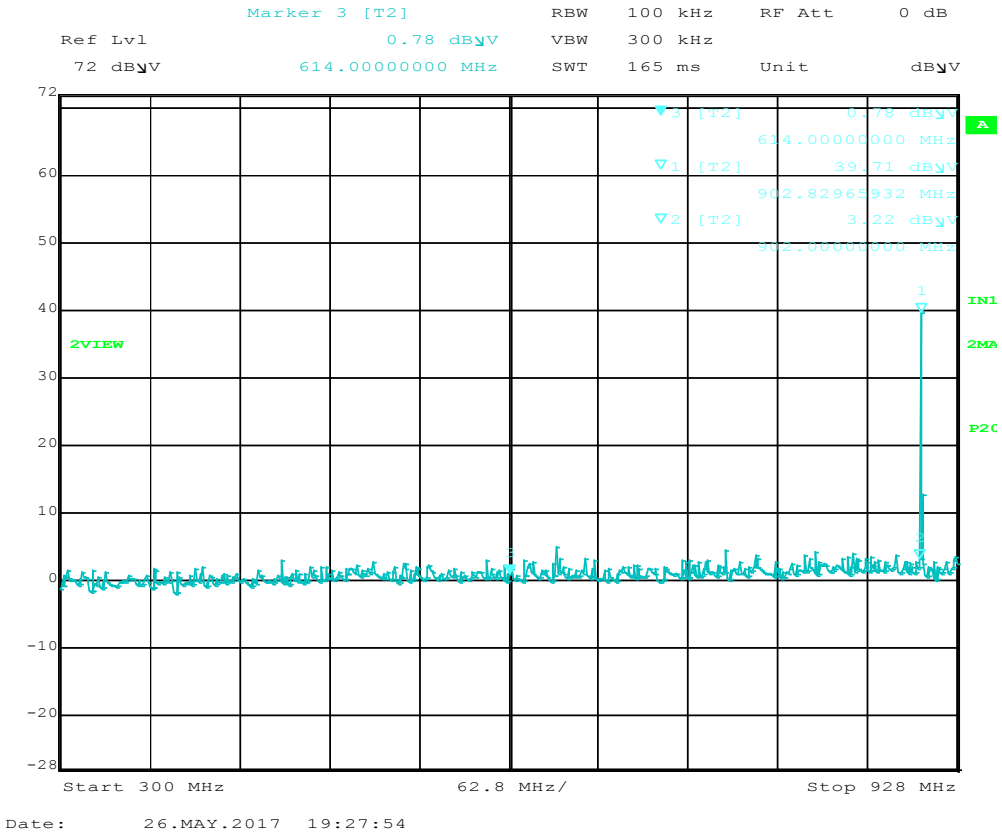
Name	Manufacturer	Version
None	--	--

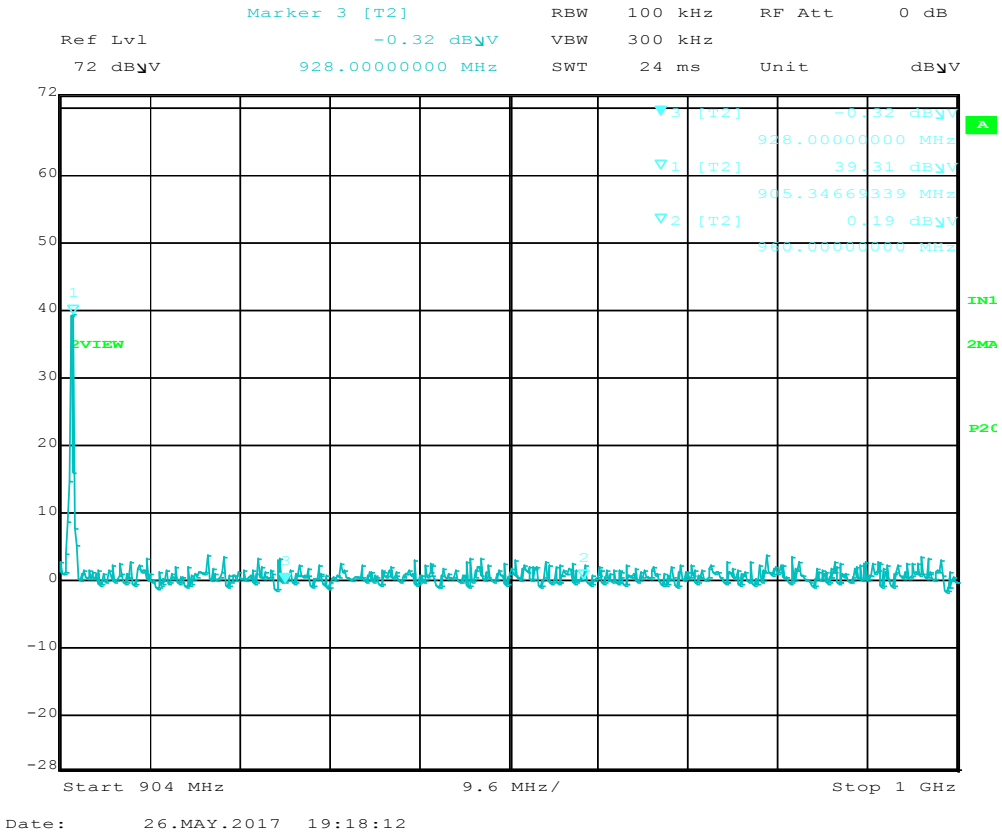
8.3 Results:

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. Antenna & Cables: N Bands: N, LF, HF, SHF
Model #: 950-000026 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: Vathana Ven Location: 10M Barometer: DAV003 Filter: NONE
Project #: G103052943 Date(s): 05/26/17
Standard: FCC Part 15/Cispr22 Class B Temp/Humidity/Pressure: 20 deg C 56% 998 mB
Receiver: R&S ESI (145-128) 10-01-2014 Limit Distance (m): 10
PreAmp: NONE. Test Distance (m): 10
PreAmp Used? (Y or N): N Voltage/Frequency: 2 AA Batteries Frequency Range: See frequencies
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(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 Test Date: 05/26/2017
Supervising/Reviewing Engineer: (Where Applicable) N/A

Product Standard: FCC 15.247, RSS 247 Limit Applied: As specified in section 8.3
Input Voltage: Internal Battery

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

Ambient Temperature: 20 ºC
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	--	--

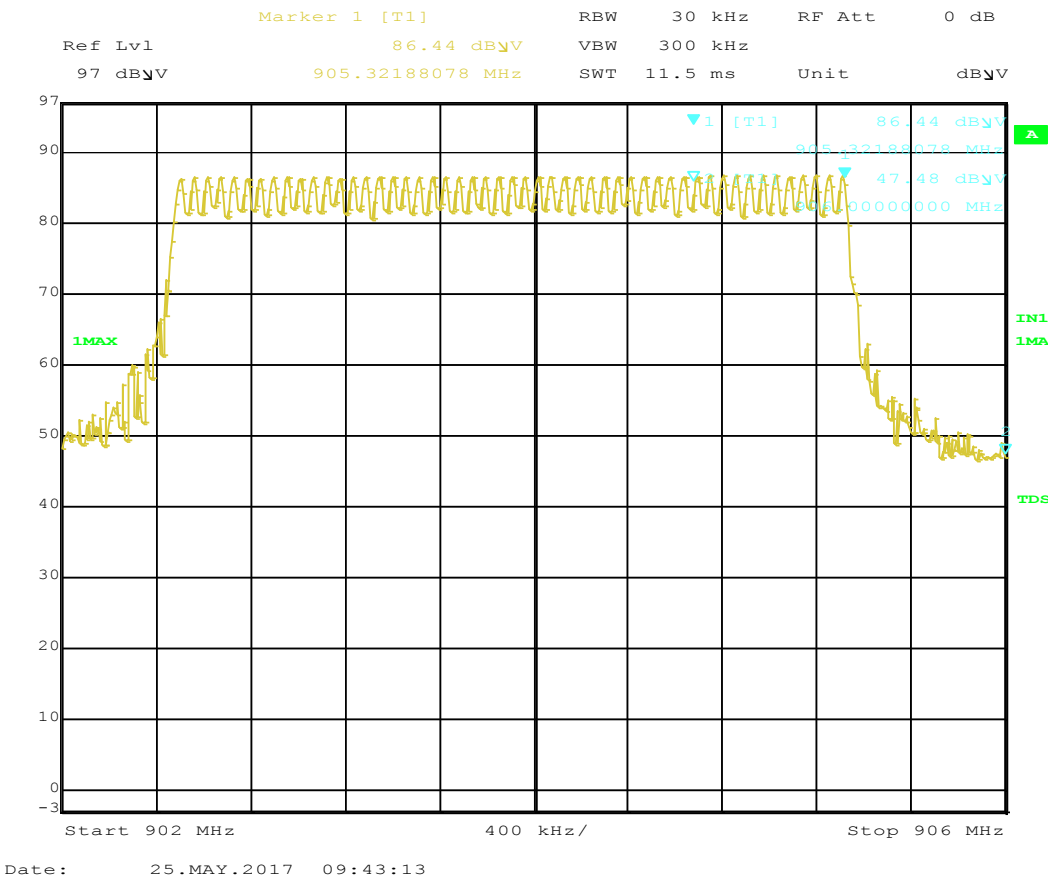
9.3 Results:

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	Test Date:	05/25/2017
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.247, RSS 247	Limit Applied:	As specified in section 9.3
Input Voltage:	Internal Battery		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	20 ºC
		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	--	--

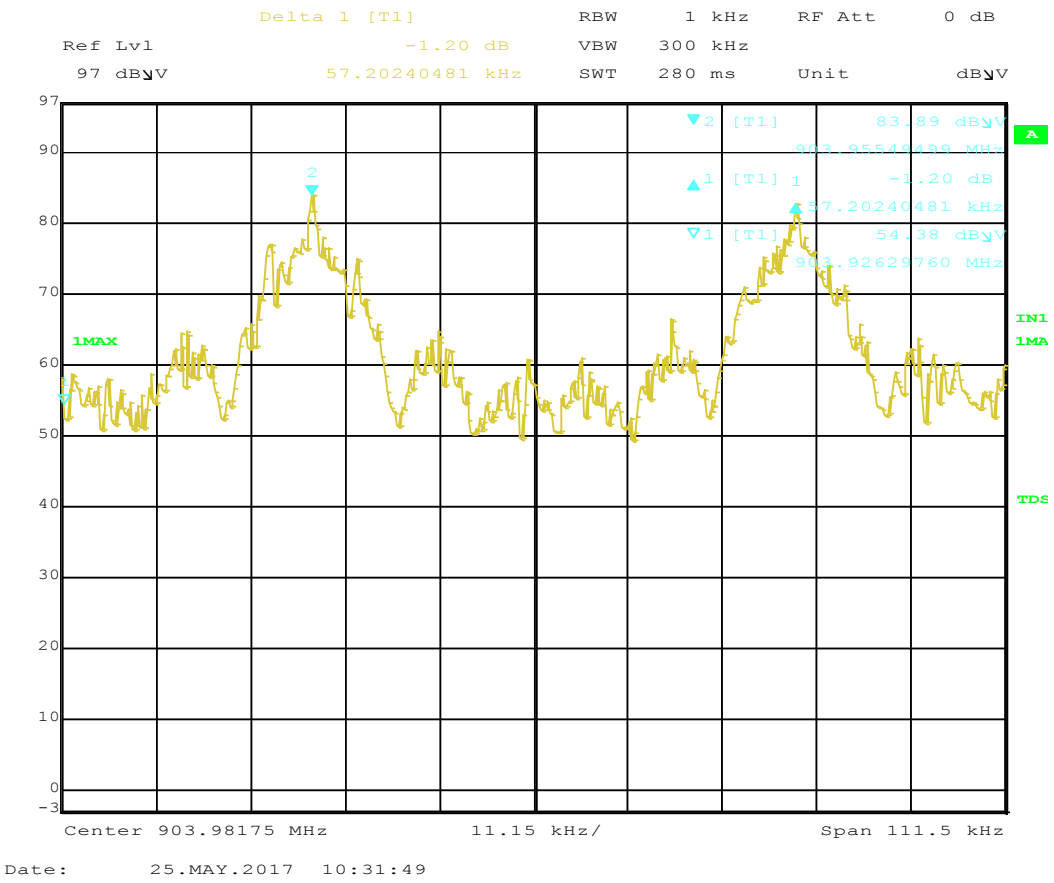
10.3 Results:

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	Test Date:	05/25/2017
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.247, RSS 247	Limit Applied:	As specified in section 10.3
Input Voltage:	Internal Battery		
Pretest Verification w/ Ambient Signals or BB Source:	Yes- Signal Generator	Ambient Temperature:	20 ºC
		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	--	--

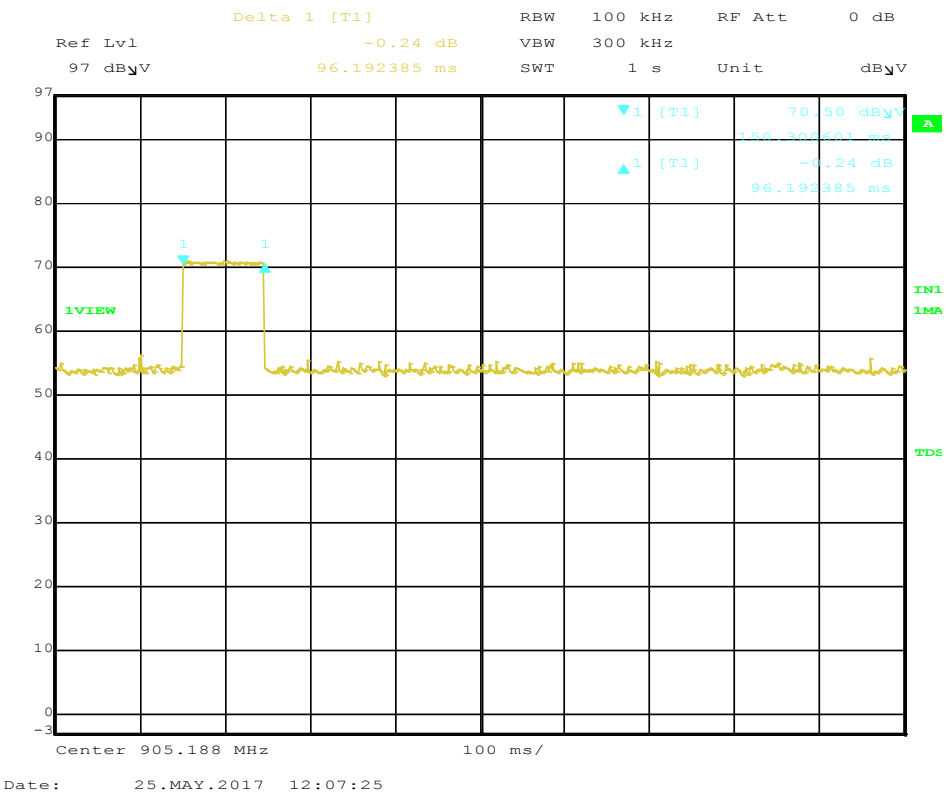
11.3 Results:

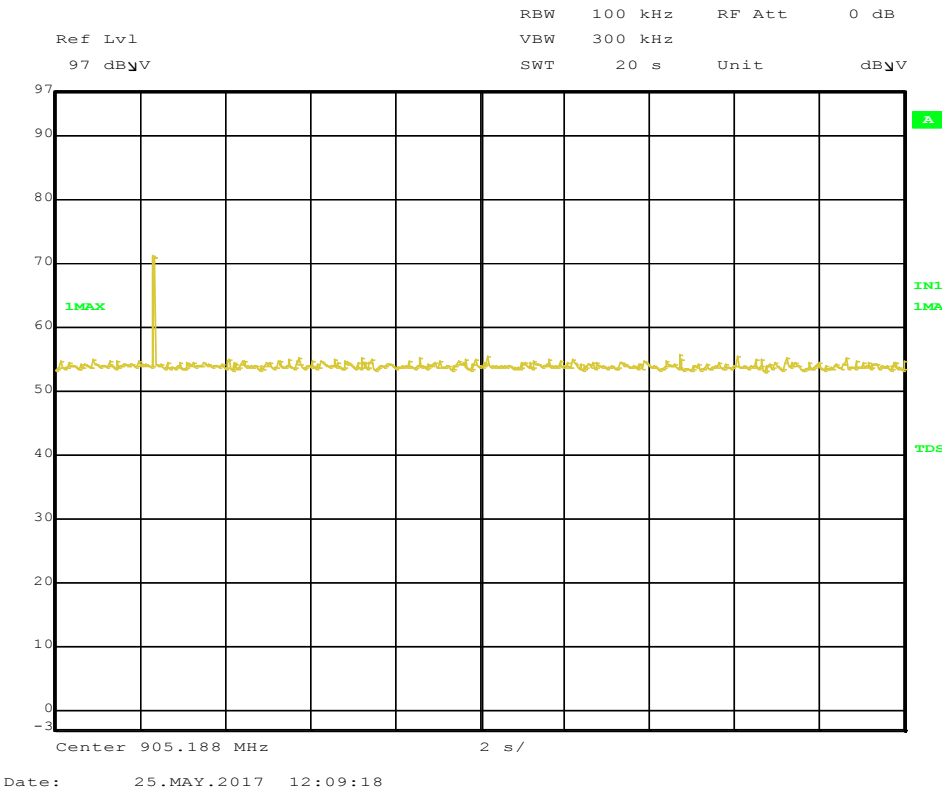
The sample tested was found to Comply. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

11.4 Setup Photograph:

11.5 Plots/Data

Channel time of occupancy: 0.247 seconds





Test Personnel:	Kouma Sinn KPS	Test Date:	05/25/2017
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.247, RSS 247	Limit Applied:	As specified in section 11.3
Input Voltage:	Internal Battery		
Pretest Verification w/ Ambient Signals or BB Source:	Yes- Signal Generator	Ambient Temperature:	20 ºC
		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)	Ucispr
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 dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
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 dBμV 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 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

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

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

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

Testing on 10/25/2017 and 10/26/2017

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	07/25/2017	07/25/2018
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 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018

Software Utilized:

Name	Manufacturer	Version
BAT-EMC Emissions	Nexio	3.16.0.69

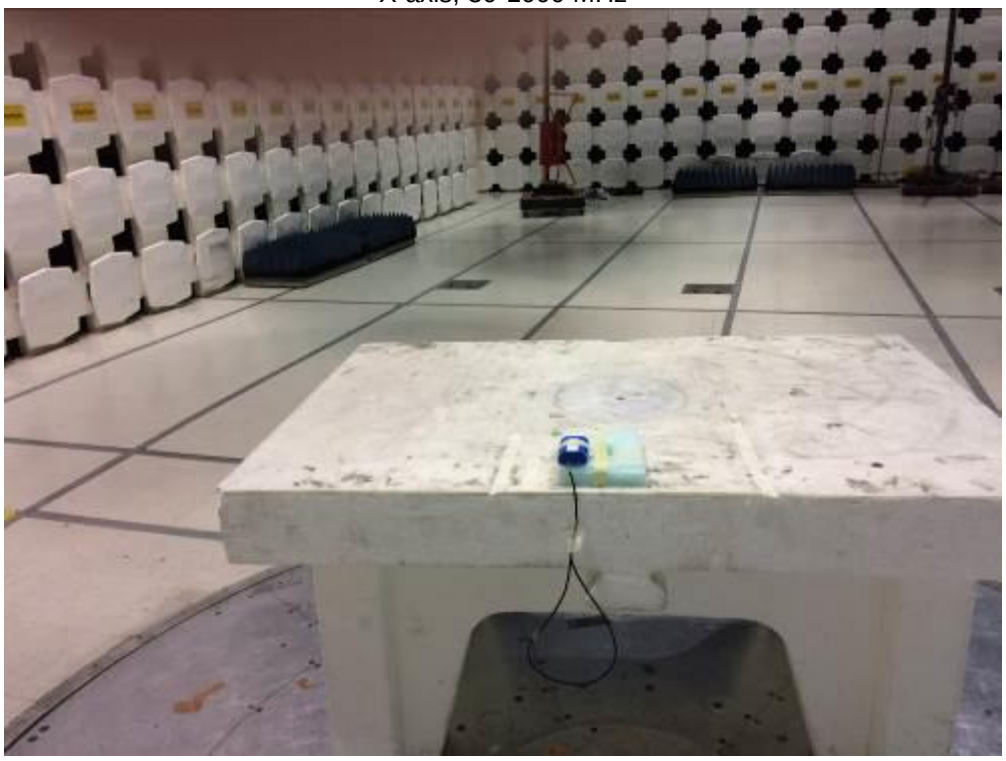
12.3 Results:

The sample tested was found to comply.

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

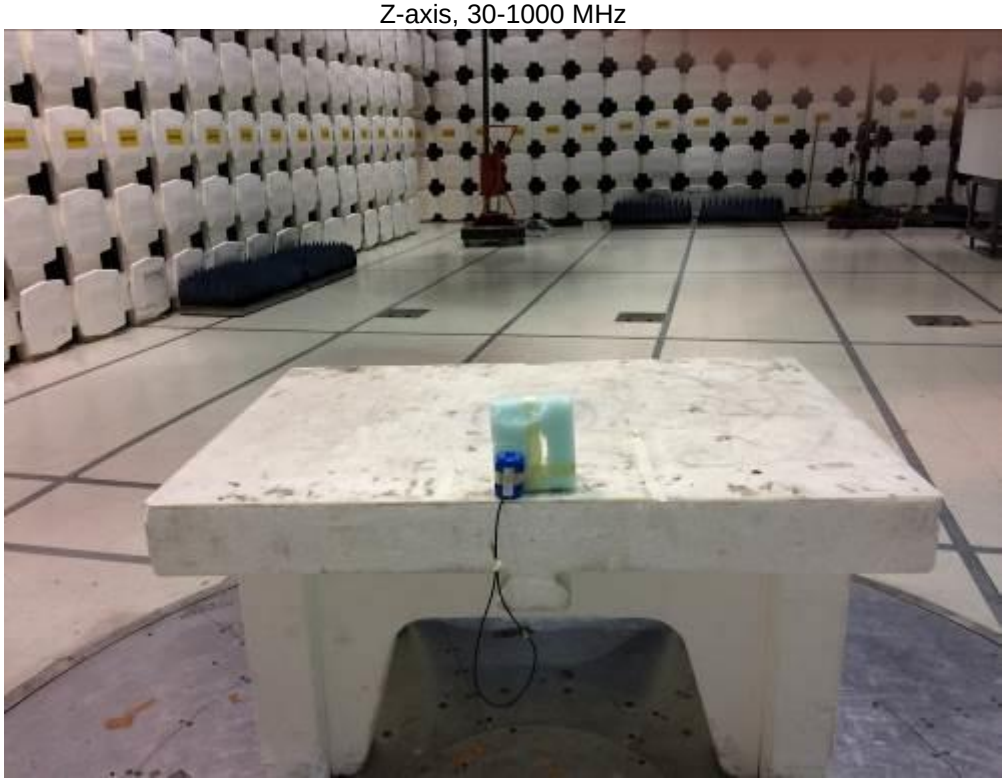
12.4 Setup Photographs:

X-axis, 30-1000 MHz

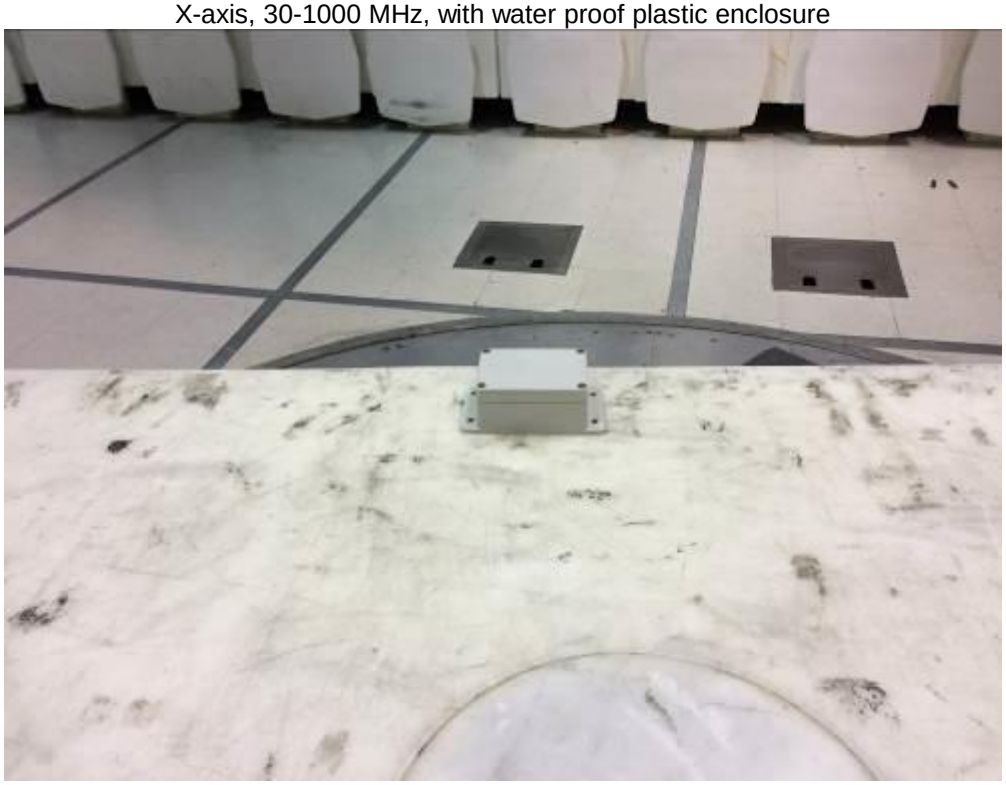


Y-axis, 30-1000 MHz

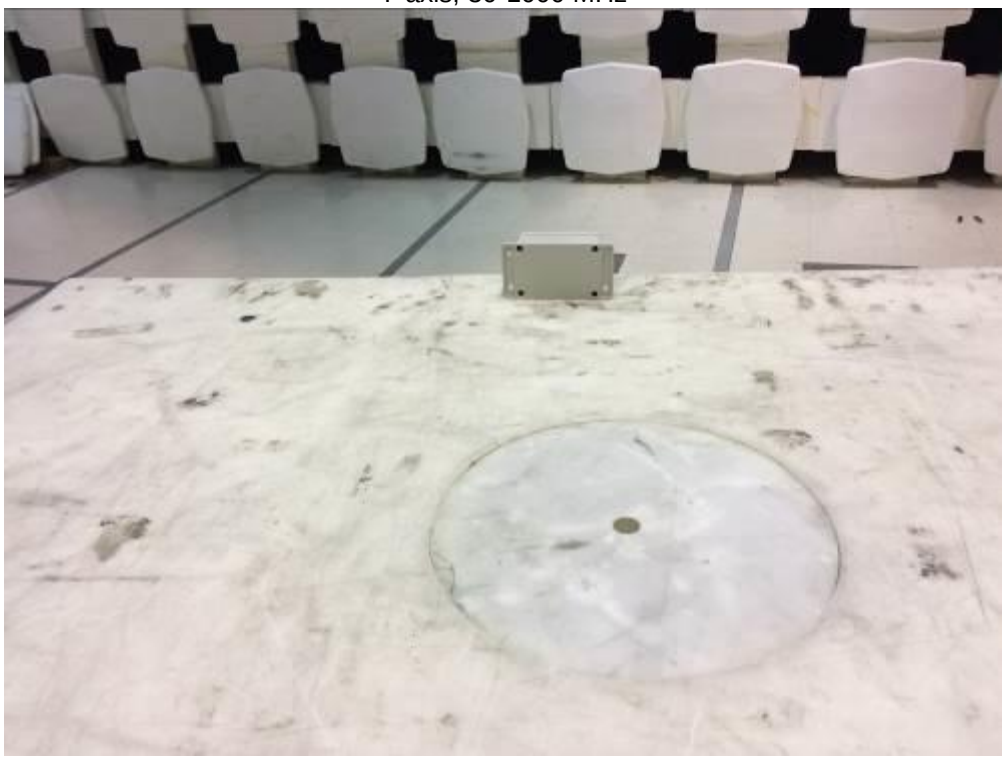
Z-axis, 30-1000 MHz



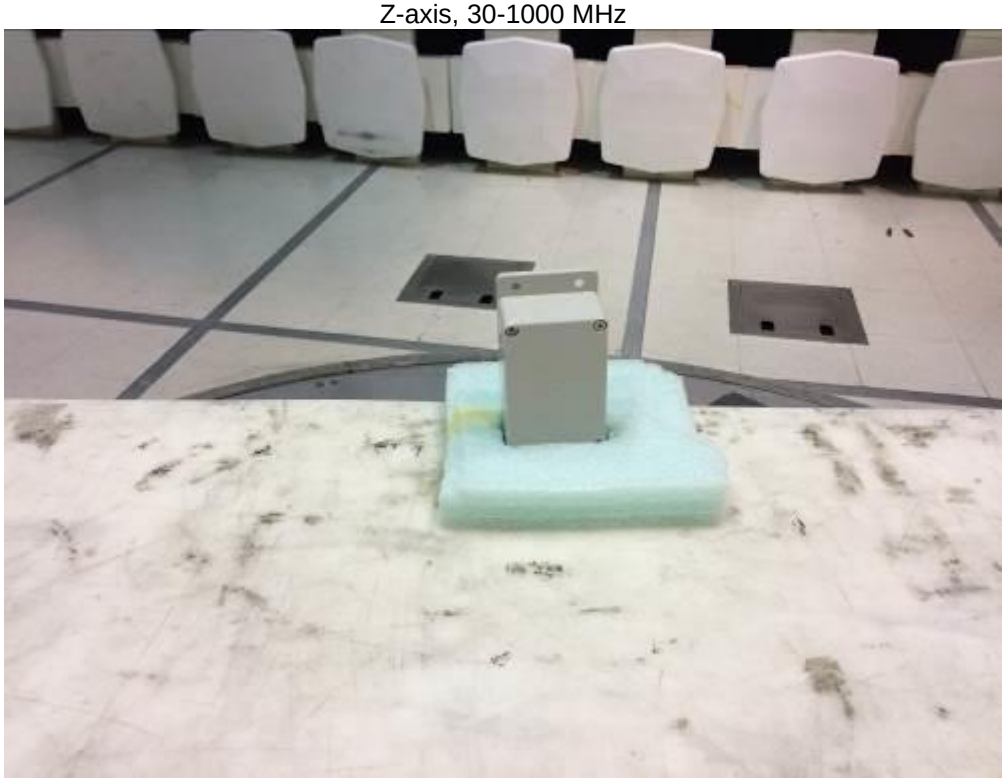
X-axis, 30-1000 MHz, with water proof plastic enclosure



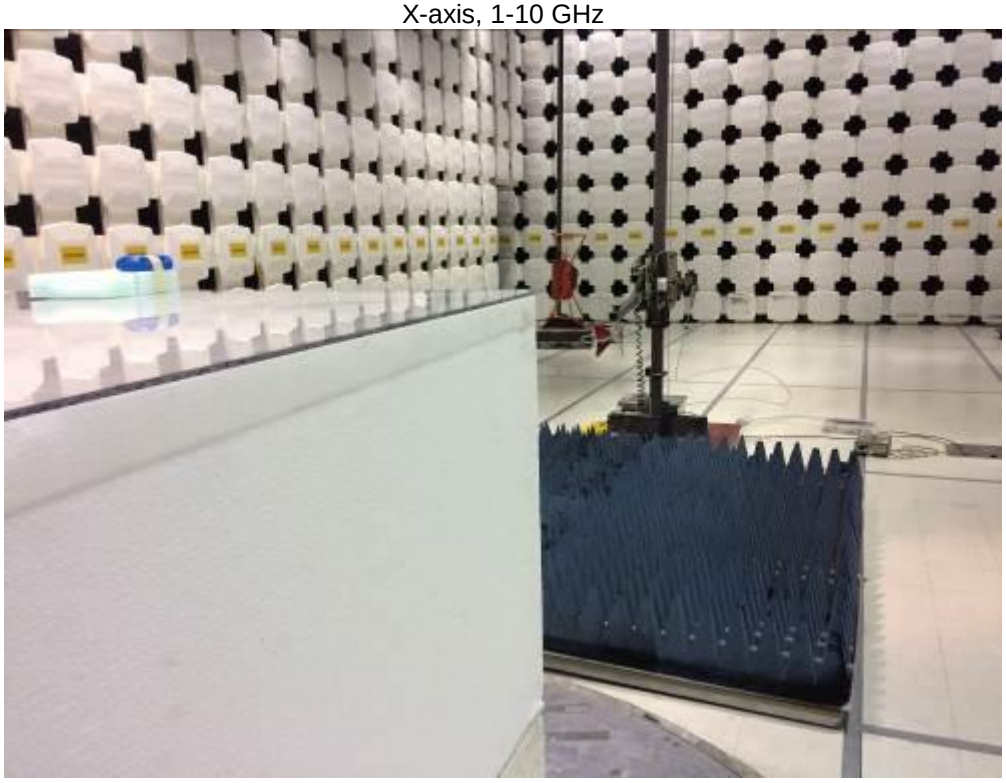
Y-axis, 30-1000 MHz



Z-axis, 30-1000 MHz

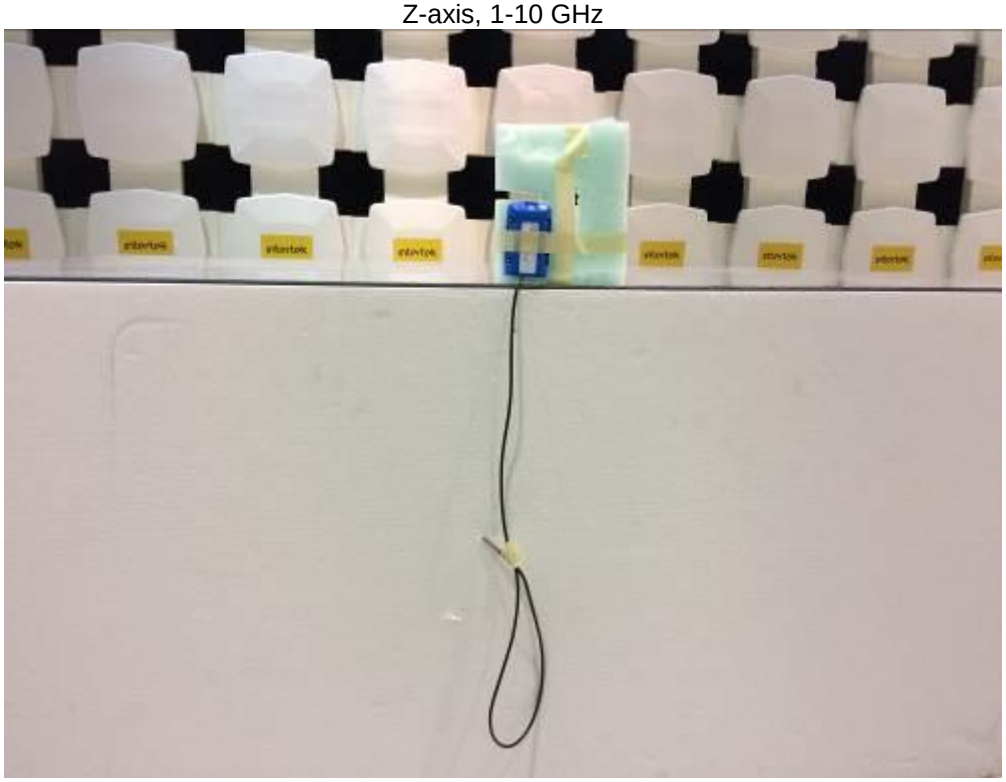


X-axis, 1-10 GHz

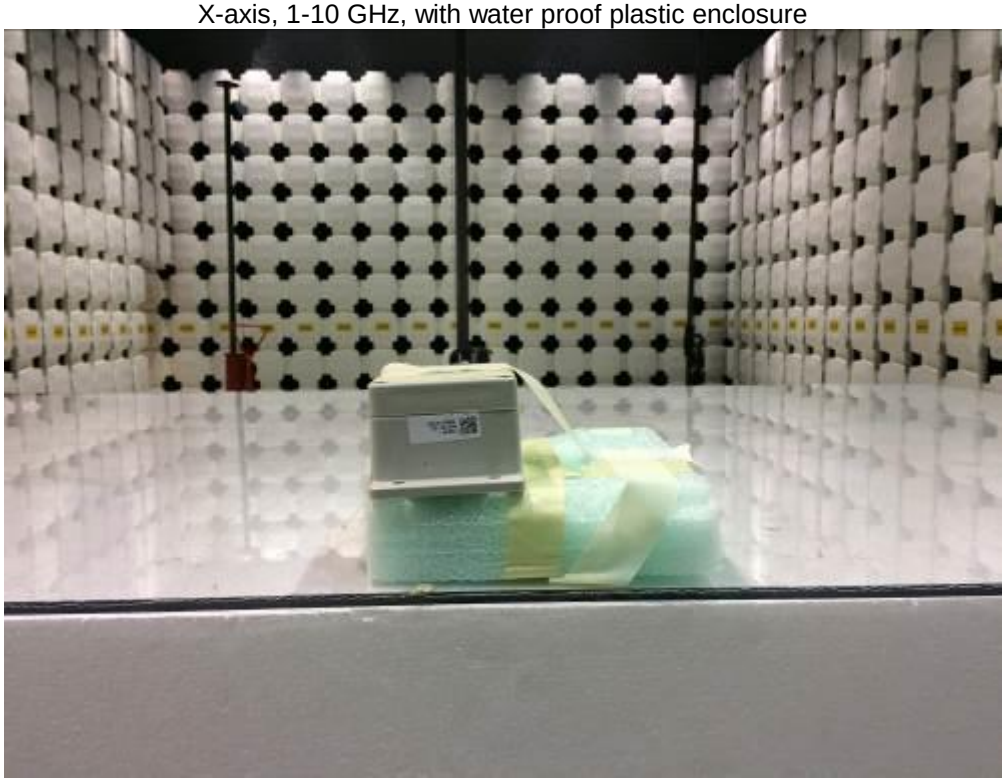


Y-axis, 1-10 GHz

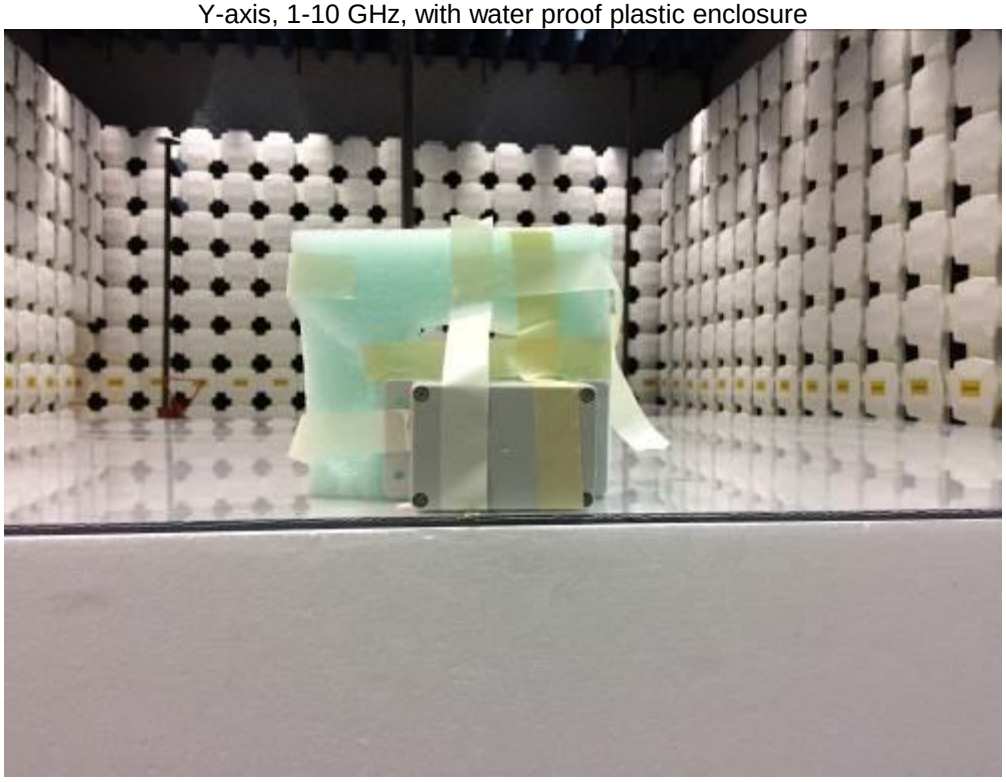
Z-axis, 1-10 GHz



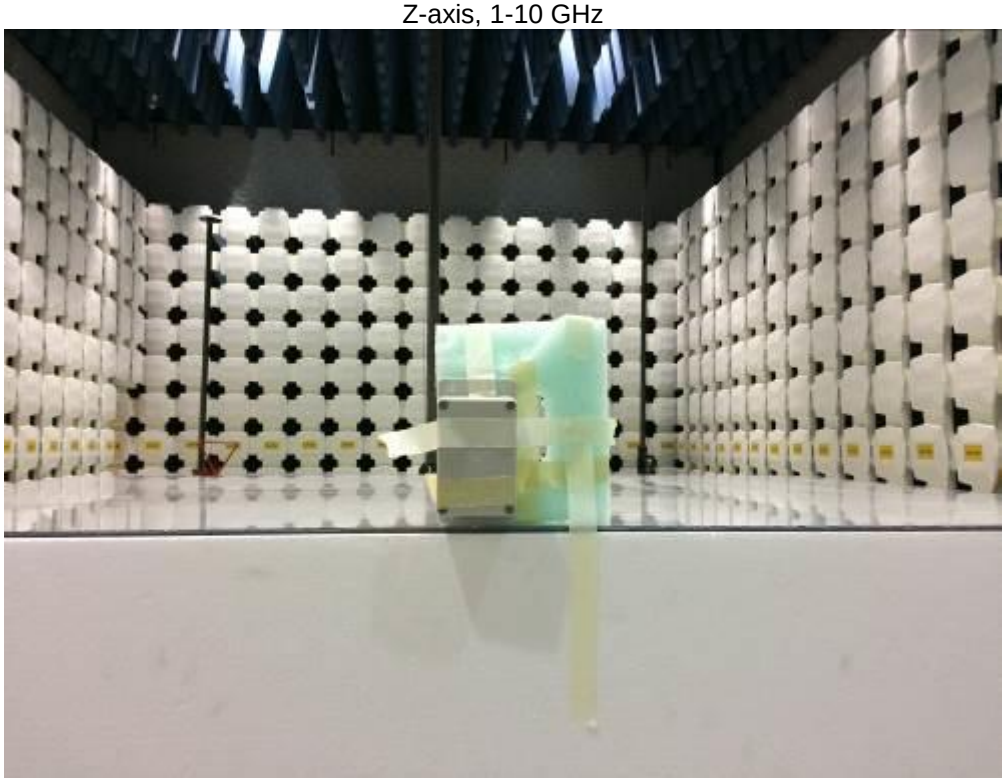
X-axis, 1-10 GHz, with water proof plastic enclosure



Y-axis, 1-10 GHz, with water proof plastic enclosure



Z-axis, 1-10 GHz



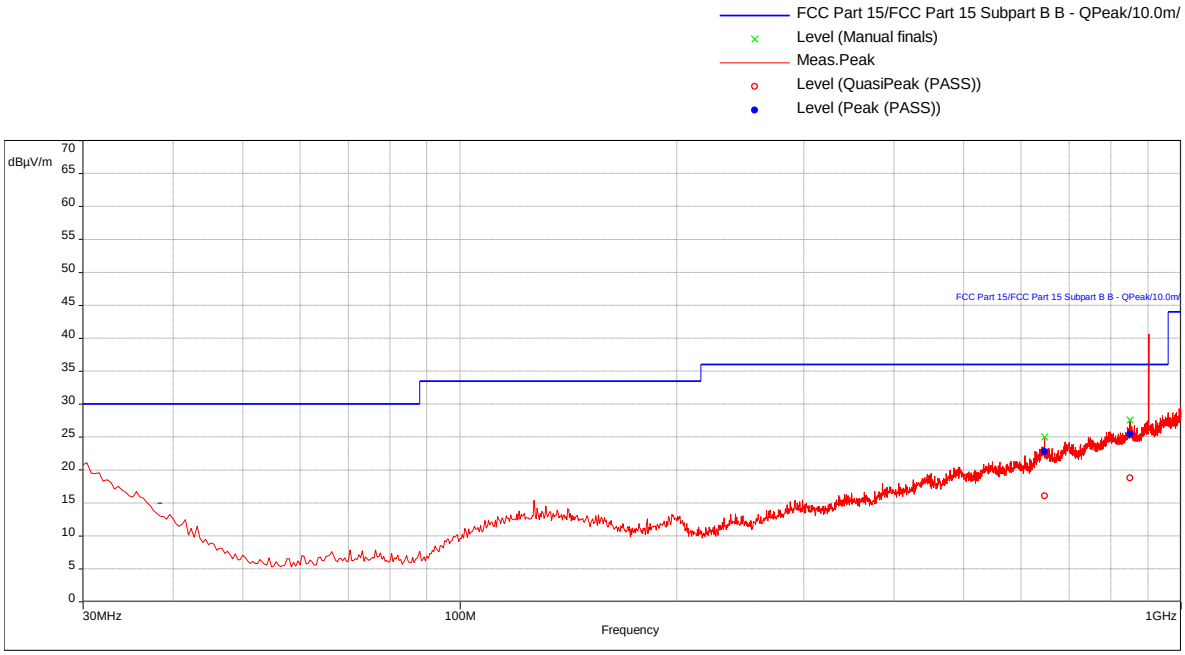
12.5 Plots/Data:

Transmit at Low Channel: 902.5 MHz, 30-1000 MHz, X-axis

Test Information:

Date and Time	10/27/2017 2:32:53 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Lo channel X-axis (EUT on its back), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
647.2	36.00	-19.94	278.00	2.95	Horizontal	120000.00	-10.18
850.2210526	36.00	-17.25	303.00	2.05	Vertical	120000.00	-7.12

Transmit at Low Channel: 902.5 MHz, 1-10 GHz, X-axis

Test Information:

Date and Time	10/26/2017 11:10:02 PM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 1 to 10 GHz_Tx @ Lo channel X-axis (EUT on its back), power set to 10 dBm

Graph:

Note : Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Average (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1805	46.53	54.00	-7.47	275.00	3.60	Vertical	1000000.00	3.32
2707.368421	36.53	54.00	-17.47	32.00	1.00	Vertical	1000000.00	5.49
3610	37.52	54.00	-16.48	79.00	3.39	Vertical	1000000.00	6.74
5422.631579	34.99	54.00	-19.01	37.00	2.31	Vertical	1000000.00	10.28
7220	42.38	54.00	-11.62	191.00	3.08	Vertical	1000000.00	11.99
1353.684211	48.01	54.00	-5.99	266.00	1.23	Horizontal	1000000.00	0.42
4512.368421	50.88	54.00	-3.12	326.00	3.08	Vertical	1000000.00	10.11

Peak (PASS)

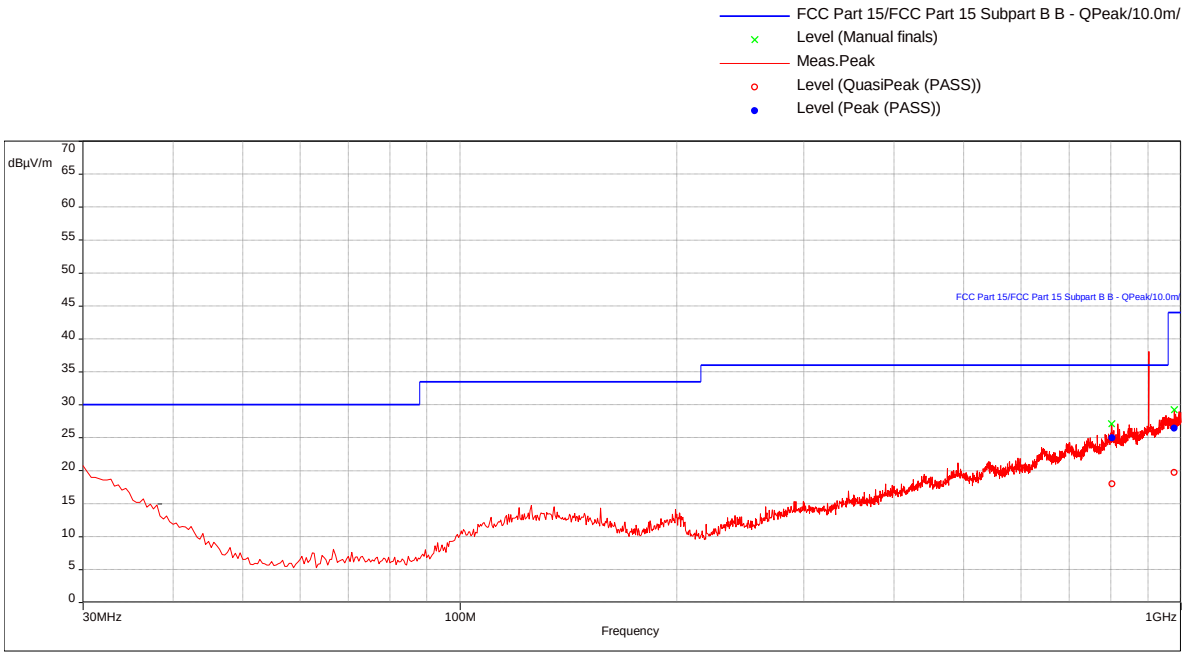
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1353.684211	61.01	74.00	-12.99	266.00	1.23	Horizontal	1000000.00	0.42
1805	59.53	74.00	-14.47	275.00	3.60	Vertical	1000000.00	3.32
2707.368421	49.53	74.00	-24.47	32.00	1.00	Vertical	1000000.00	5.49
3610	50.52	74.00	-23.48	79.00	3.39	Vertical	1000000.00	6.74
4512.368421	63.88	74.00	-10.12	326.00	3.08	Vertical	1000000.00	10.11
5422.631579	47.99	74.00	-26.01	37.00	2.31	Vertical	1000000.00	10.28
7220	55.38	74.00	-18.62	191.00	3.08	Vertical	1000000.00	11.99

Transmit at Low Channel: 902.5 MHz, 30-1000 MHz, Y-axis

Test Information:

Date and Time	10/27/2017 2:13:57 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Lo channel Y-axis (EUT on its long side), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
802.2210526	36.00	-18.06	289.00	2.58	Horizontal	120000.00	-7.93
979.3263158	44.00	-24.28	209.00	1.61	Vertical	120000.00	-5.22

Transmit at Low Channel: 902.5 MHz, 1-10 GHz, Y-axis

Test Information:

Date and Time	10/26/2017 11:46:15 PM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 1 to 10 GHz_Tx @ Lo channel Y-axis (EUT on its long side), power set to 10 dBm

Graph:

Note : Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Average (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
2707.368421	38.26	54.00	-15.74	317.00	1.00	Vertical	1000000.00	5.49
3610	37.13	54.00	-16.87	289.00	1.00	Vertical	1000000.00	6.74
4963.684211	37.00	54.00	-17.00	79.00	3.18	Vertical	1000000.00	9.40
1353.684211	48.01	54.00	-5.99	191.00	1.23	Horizontal	1000000.00	0.42
1805	50.51	54.00	-3.49	327.00	1.00	Vertical	1000000.00	3.32
4512.631579	50.88	54.00	-3.12	14.00	1.00	Vertical	1000000.00	10.11
5415	49.55	54.00	-4.45	79.00	1.26	Vertical	1000000.00	10.24

Peak (PASS)

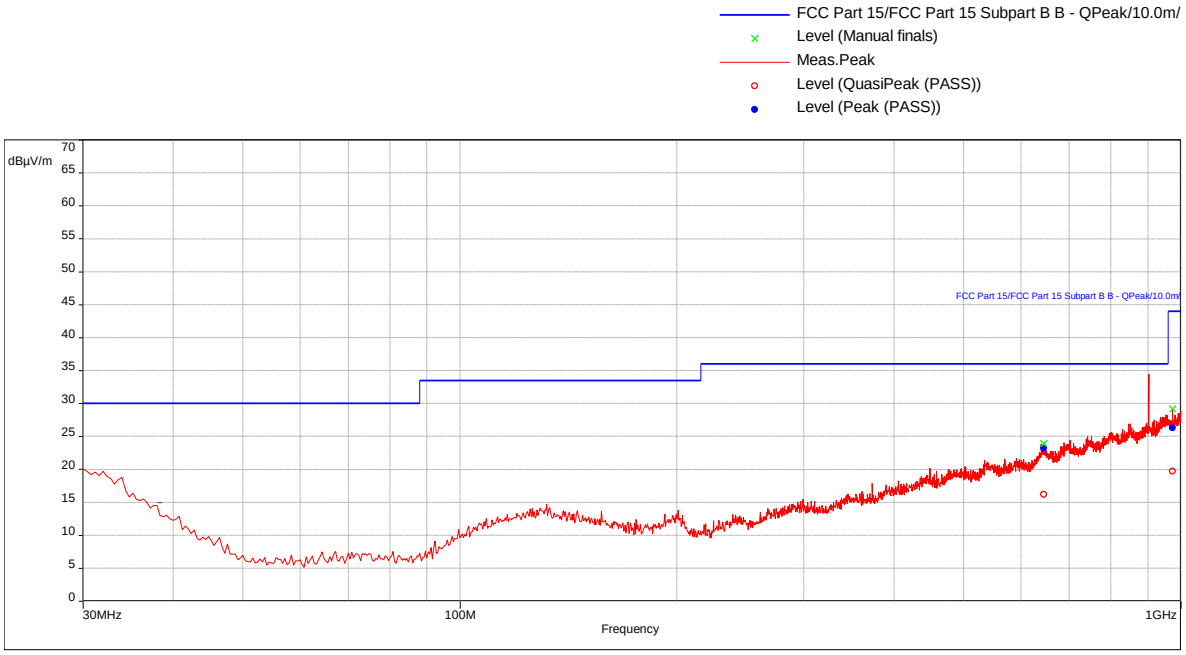
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1353.684211	61.01	74.00	-12.99	191.00	1.23	Horizontal	1000000.00	0.42
1805	63.51	74.00	-10.49	327.00	1.00	Vertical	1000000.00	3.32
2707.368421	51.26	74.00	-22.74	317.00	1.00	Vertical	1000000.00	5.49
3610	50.13	74.00	-23.87	289.00	1.00	Vertical	1000000.00	6.74
4512.631579	63.88	74.00	-10.12	14.00	1.00	Vertical	1000000.00	10.11
4963.684211	50.00	74.00	-24.00	79.00	3.18	Vertical	1000000.00	9.40
5415	62.55	74.00	-11.45	79.00	1.26	Vertical	1000000.00	10.24

Transmit at Low Channel: 902.5 MHz, 30-1000 MHz, Z-axis

Test Information:

Date and Time	10/27/2017 1:55:31 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Lo channel Z-axis (EUT on its back), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

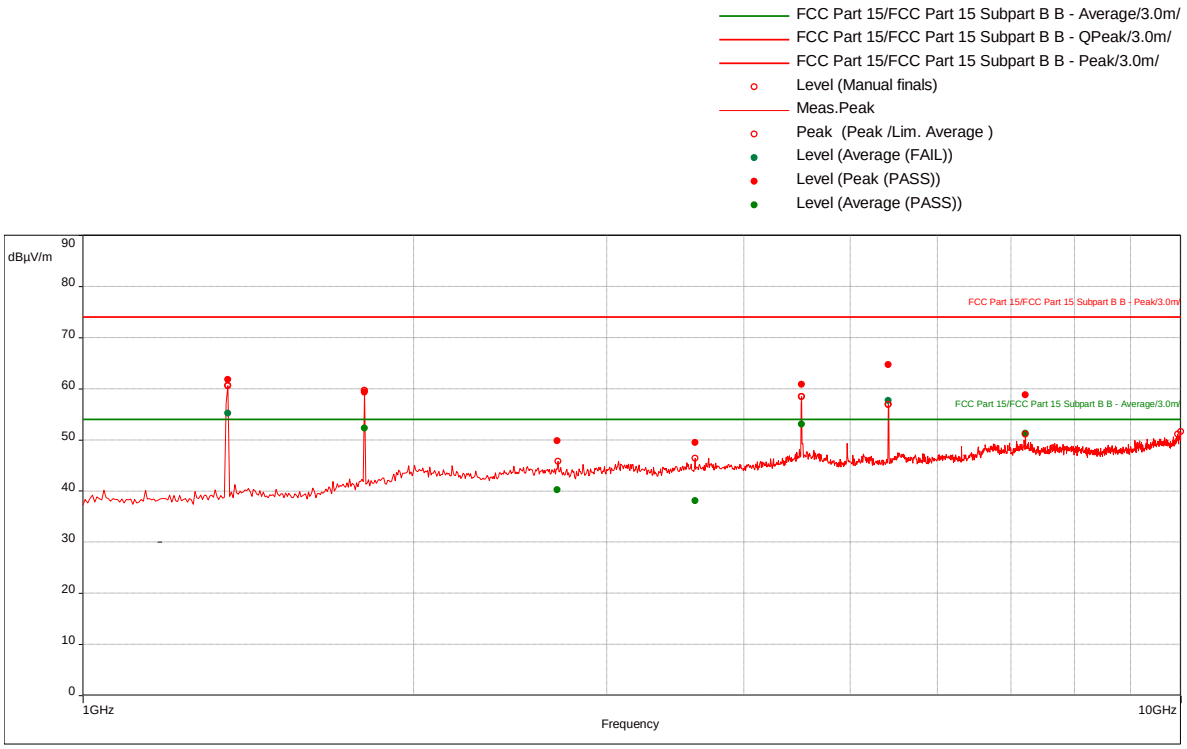
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
645	36.00	-19.82	88.00	2.47	Vertical	120000.00	-10.19
973.5684211	44.00	-24.31	275.00	2.50	Horizontal	120000.00	-5.16

Transmit at Low Channel: 902.5 MHz, 1-10 GHz, Z-axis

Test Information:

Date and Time	10/27/2017 12:22:41 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 1 to 10 GHz_Tx @ Lo channel Z-axis (EUT on its short side), power set to 10 dBm

Graph:



Note : Average factor of 13 dB is applied to peak readings to obtain average readings

Results:

Average (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1805	46.28	54.00	-7.72	325.00	1.50	Horizontal	1000000.00	3.32
2707.368421	36.80	54.00	-17.20	162.00	2.82	Horizontal	1000000.00	5.49
3610	36.47	54.00	-17.53	88.00	1.47	Horizontal	1000000.00	6.74
4512.631579	47.84	54.00	-6.16	349.00	2.52	Vertical	1000000.00	10.11
7220	45.77	54.00	-8.23	33.00	2.13	Vertical	1000000.00	11.99
1353.684211	48.77	54.00	-5.23	32.00	1.00	Vertical	1000000.00	0.42
5415	51.64	54.00	-2.36	1.00	2.97	Vertical	1000000.00	10.24

Peak (PASS) (7)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1353.684211	61.77	74.00	-12.23	32.00	1.00	Vertical	1000000.00	0.42
1805	59.28	74.00	-14.72	325.00	1.50	Horizontal	1000000.00	3.32
2707.368421	49.80	74.00	-24.20	162.00	2.82	Horizontal	1000000.00	5.49
3610	49.47	74.00	-24.53	88.00	1.47	Horizontal	1000000.00	6.74
4512.631579	60.84	74.00	-13.16	349.00	2.52	Vertical	1000000.00	10.11
5415	64.64	74.00	-9.36	1.00	2.97	Vertical	1000000.00	10.24

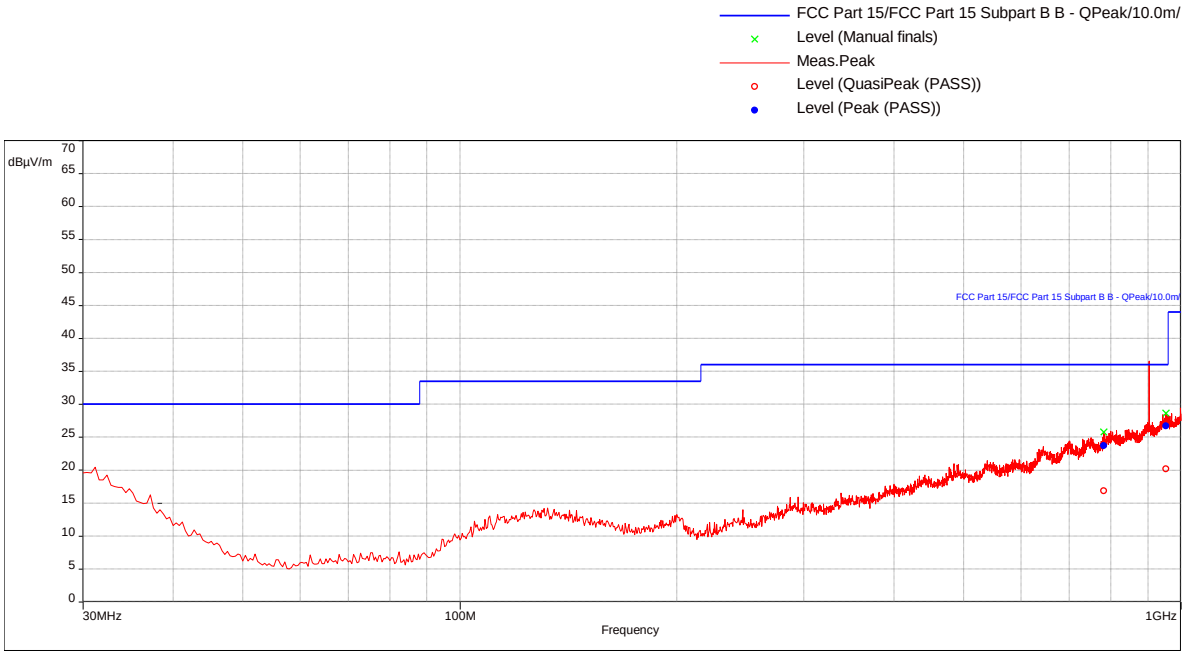
7220	58.77	74.00	-15.23	33.00	2.13	Vertical	1000000.00	11.99

Transmit at Mid Channel: 903.844 MHz, 30-1000 MHz, X-axis

Test Information:

Date and Time	10/27/2017 2:57:14 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Mid channel X-axis (EUT on its back), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
781.7263158	36.00	-19.18	354.00	2.64	Horizontal	120000.00	-8.12
953.3894737	36.00	-15.82	359.00	2.86	Horizontal	120000.00	-5.62

Transmit at Mid Channel: 903.844 MHz, 1-10 GHz, X-axis

Test Information:

Date and Time	10/25/2017 10:51:10 PM
Client and Project Number	PowerHouse Dynamics Inc_G103052943
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	57%
Atmospheric Pressure	994 mB
Comments	RE 1 to 10 GHz_Tx @ Mid channel X-axis (EUT on its back), power set to 10 dBm

Graph:

Note : Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Average (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1807.631579	44.36	54.00	-9.64	107.00	1.00	Horizontal	1000000.00	3.34
2713.157895	34.82	54.00	-21.82	154.00	3.19	Horizontal	1000000.00	5.48
3615.263158	36.38	54.00	-23.38	168.00	1.00	Vertical	1000000.00	6.77
4519.210526	48.47	54.00	-35.47	219.00	3.00	Vertical	1000000.00	10.10
5422.894737	39.61	54.00	-26.61	121.00	3.14	Vertical	1000000.00	10.28
1355.789474	48.14	54.00	-5.86	218.00	1.22	Horizontal	1000000.00	0.43

Peak (PASS) (6)

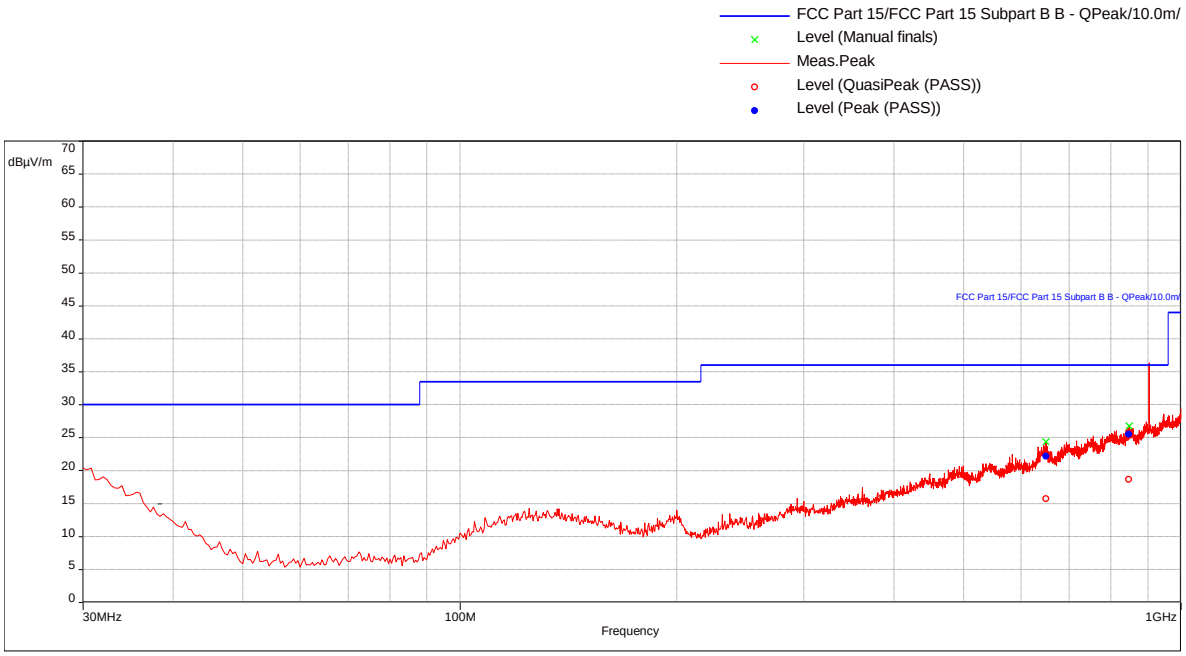
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1355.789474	61.14	74.00	-12.86	218.00	1.22	Horizontal	1000000.00	0.43
1807.631579	57.36	74.00	-16.64	107.00	1.00	Horizontal	1000000.00	3.34
2713.157895	47.82	74.00	-26.18	154.00	3.19	Horizontal	1000000.00	5.48
3615.263158	49.38	74.00	-24.62	168.00	1.00	Vertical	1000000.00	6.77
4519.210526	61.47	74.00	-12.53	219.00	3.00	Vertical	1000000.00	10.10
5422.894737	52.61	74.00	-21.39	121.00	3.14	Vertical	1000000.00	10.28

Transmit at Mid Channel: 903.844 MHz, 30-1000 MHz, Y-axis

Test Information:

Date and Time	10/27/2017 3:15:16 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	Copy RE 30-1000MHz_Tx @ Mid channel Y-axis (EUT on its long side), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

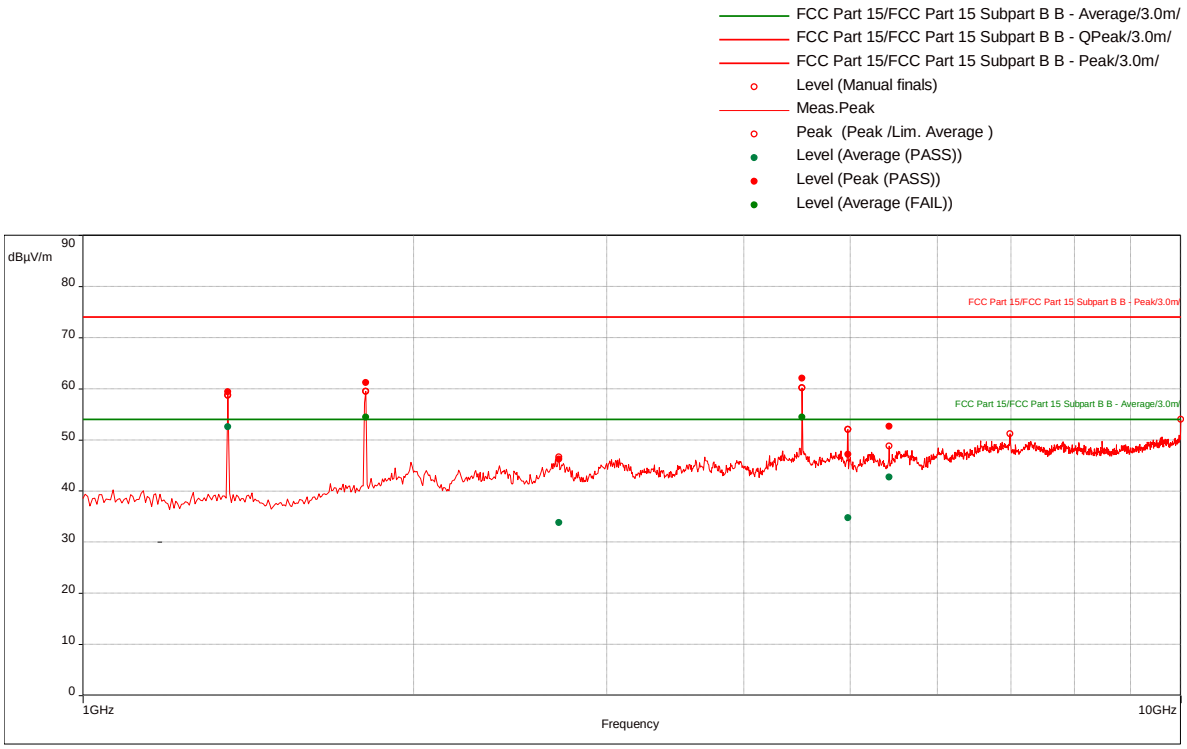
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
650.4315789	36.00	-20.28	22.00	3.38	Vertical	120000.00	-10.16
847.2210526	36.00	-17.36	219.00	2.21	Vertical	120000.00	-7.24

Transmit at Mid Channel: 903.844 MHz, 1-10 GHz, Y-axis

Test Information:

Date and Time	10/25/2017 10:16:31 PM
Client and Project Number	PowerHouse Dynamics Inc_G103052943
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	57%
Atmospheric Pressure	994 mB
Comments	RE 1 to 10 GHz_Tx @ Mid channel Y-axis (EUT on its long side), power set to 10 dBm

Graph:



Note : Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Average (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
1807.631579	48.19	54.00	-5.81	144.00	1.22	Vertical	1000000.00	3.34
4519.210526	49.00	54.00	-5.00	218.00	1.00	Vertical	1000000.00	10.10
1355.789474	46.38	54.00	-7.62	19.00	1.00	Horizontal	1000000.00	0.43
2715.263158	33.24	54.00	-20.76	219.00	2.30	Vertical	1000000.00	5.48
4975	34.13	54.00	-19.87	79.00	1.42	Vertical	1000000.00	9.42
5423.157895	39.61	54.00	-14.39	261.00	1.22	Vertical	1000000.00	10.28

Peak (PASS) (6)

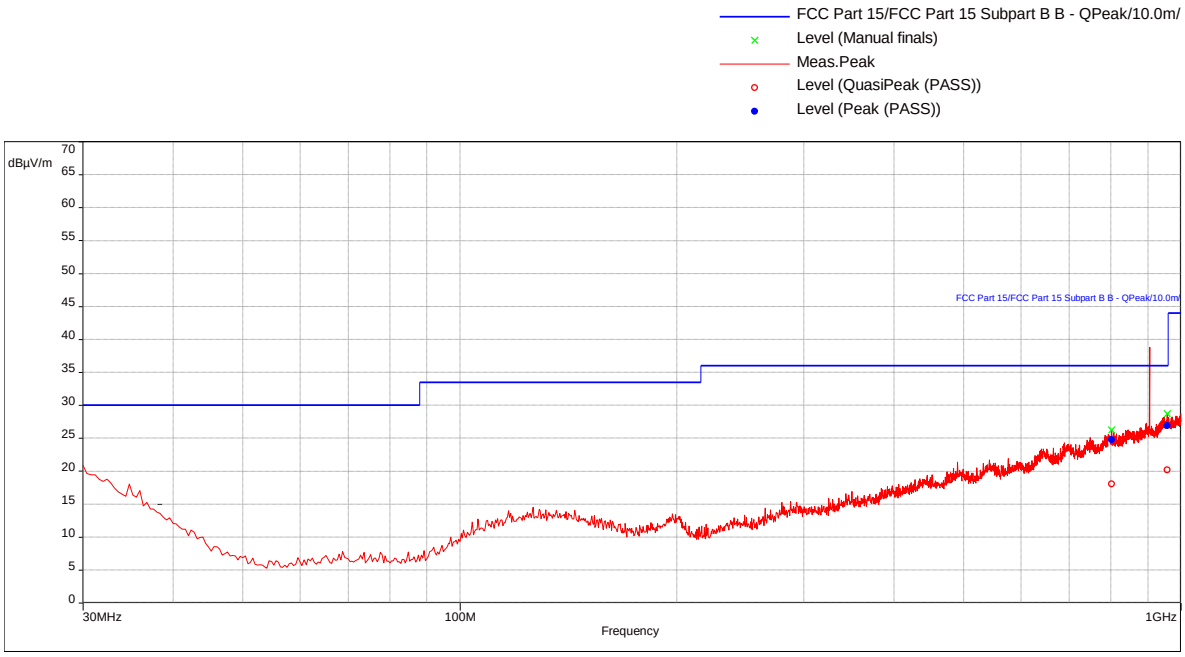
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1355.789474	59.38	74.00	-14.62	19.00	1.00	Horizontal	1000000.00	0.43
1807.631579	61.19	74.00	-12.81	144.00	1.22	Vertical	1000000.00	3.34
2715.263158	46.24	74.00	-27.76	219.00	2.30	Vertical	1000000.00	5.48
4519.210526	62.00	74.00	-12.00	218.00	1.00	Vertical	1000000.00	10.10
4975	47.13	74.00	-26.87	79.00	1.42	Vertical	1000000.00	9.42
5423.157895	52.61	74.00	-21.39	261.00	1.22	Vertical	1000000.00	10.28

Transmit at Mid Channel: 903.844 MHz, 30-1000 MHz, Z-axis

Test Information:

Date and Time	10/27/2017 4:44:17 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Hi channel Z-axis (EUT on its short side), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

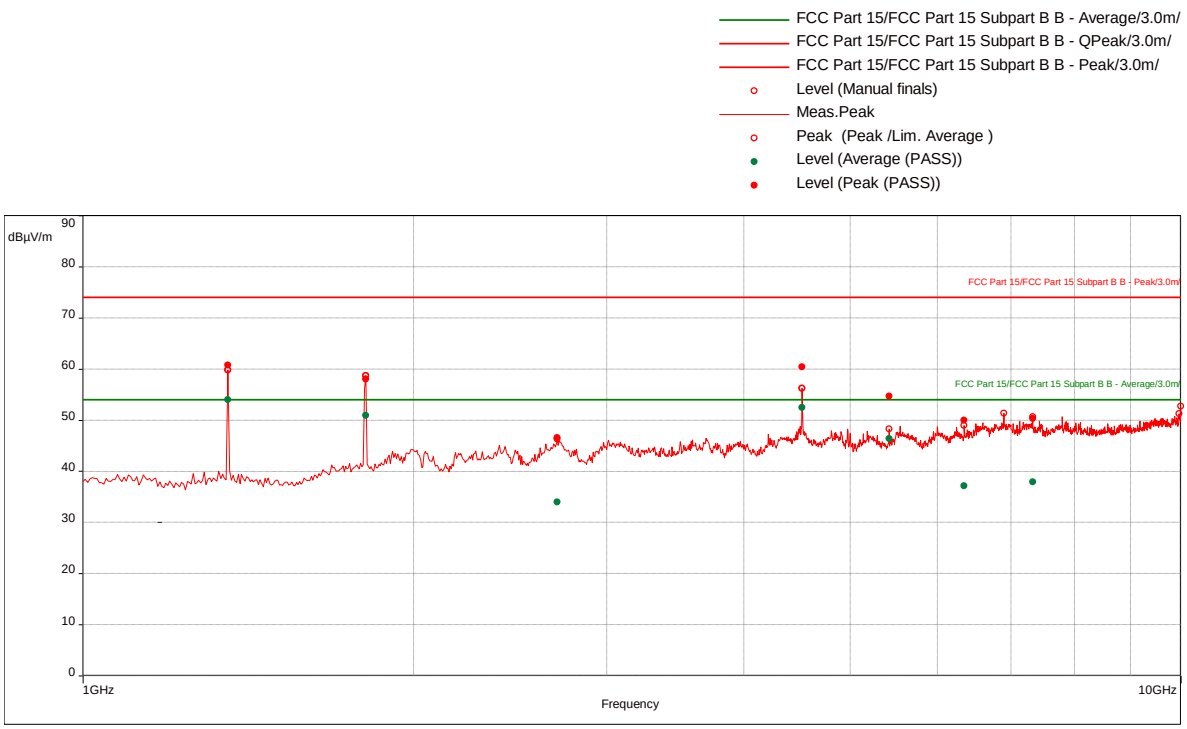
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
801.5052632	36.00	-17.99	293.00	2.12	Horizontal	120000.00	-7.93
957.1052632	36.00	-15.86	331.00	3.97	Horizontal	120000.00	-5.51

Transmit at Mid Channel: 903.844 MHz, 1-10 GHz, Z-axis

Test Information:

Date and Time	10/25/2017 9:22:02 PM
Client and Project Number	PowerHouse Dynamics Inc_G103052943
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	57%
Atmospheric Pressure	994 mB
Comments	RE 1 to 10 GHz_Tx @ Mid channel Z-axis (EUT on its short side), power set to 10 dBm

Graph:



Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Peak (PASS) (7)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1355.789474	60.75	74.00	-13.25	349.00	1.00	Vertical	1000000.00	0.43
1807.631579	58.01	74.00	-15.99	148.00	1.33	Horizontal	1000000.00	3.34
2707.368421	46.54	74.00	-27.46	46.00	3.54	Vertical	1000000.00	5.49
4519.210526	60.43	74.00	-13.57	182.00	2.23	Vertical	1000000.00	10.10
5423.157895	54.71	74.00	-19.29	218.00	2.59	Vertical	1000000.00	10.28
6347.105263	50.01	74.00	-23.99	293.00	2.30	Vertical	1000000.00	10.94
7329.473684	50.32	74.00	-23.68	60.00	1.50	Horizontal	1000000.00	11.94

Average (PASS) (7)

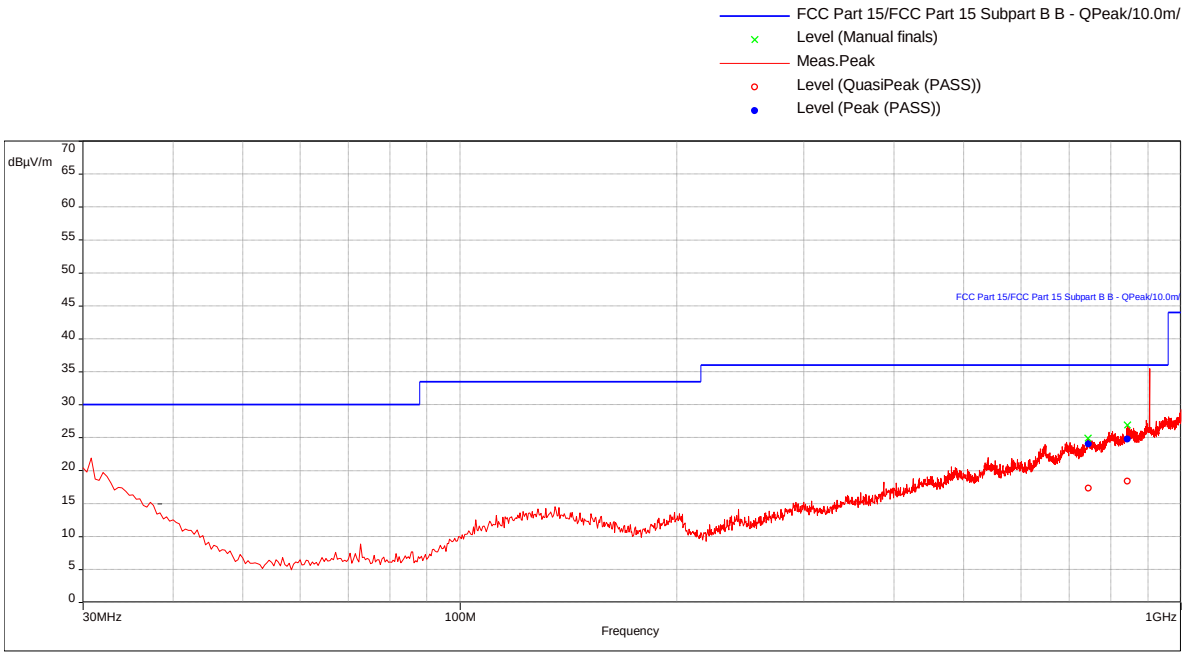
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1355.789474	47.75	54.00	-34.75	349.00	1.00	Vertical	1000000.00	0.43
1807.631579	45.01	54.00	-32.01	148.00	1.33	Horizontal	1000000.00	3.34
2707.368421	33.54	54.00	-20.54	46.00	3.54	Vertical	1000000.00	5.49
4519.210526	47.43	54.00	-34.43	182.00	2.23	Vertical	1000000.00	10.10
5423.157895	41.71	54.00	-28.71	218.00	2.59	Vertical	1000000.00	10.28
6347.105263	37.01	54.00	-16.99	293.00	2.30	Vertical	1000000.00	10.94
7329.473684	37.32	54.00	-16.68	60.00	1.50	Horizontal	1000000.00	11.94

Transmit at Hi Channel: 905.300 MHz, 30-1000 MHz, X-axis

Test Information:

Date and Time	10/27/2017 4:00:44 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Hi channel X-axis (EUT on its back), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

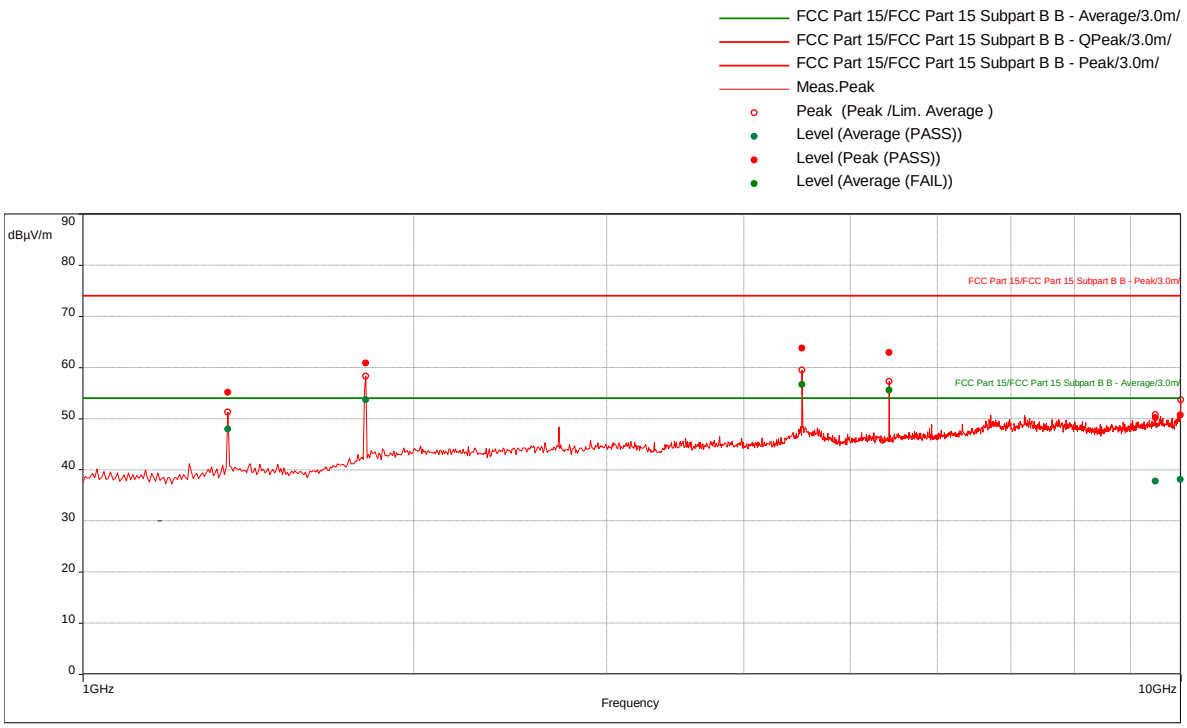
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
743.9157895	36.00	-18.68	33.00	3.00	Vertical	120000.00	-8.84
843.0105263	36.00	-17.63	303.00	2.58	Vertical	120000.00	-7.36

Transmit at Hi Channel: 905.300 MHz, 1-10 GHz, X-axis

Test Information:

Date and Time	10/25/2017 4:58:33 PM
Client and Project Number	PowerHouse Dynamics Inc_G103052943
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	57%
Atmospheric Pressure	994 mB
Comments	RE 1 to 10 GHz_Tx @ high channel X-axis (EUT on its back), power set to 10 dBm

Graph:



Note : Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1355.789474	55.09	74.00	-18.91	112.00	1.69	Horizontal	1000000.00	0.43
1807.631579	60.82	74.00	-13.18	256.00	1.22	Vertical	1000000.00	3.34
4519.210526	63.74	74.00	-10.26	139.00	3.61	Vertical	1000000.00	10.10
5423.157895	62.87	74.00	-11.13	46.00	3.05	Vertical	1000000.00	10.28
9482.631579	50.17	74.00	-23.83	78.00	3.17	Vertical	1000000.00	12.75
9995.394737	50.61	74.00	-23.39	326.00	2.91	Vertical	1000000.00	14.11

Average (FAIL)

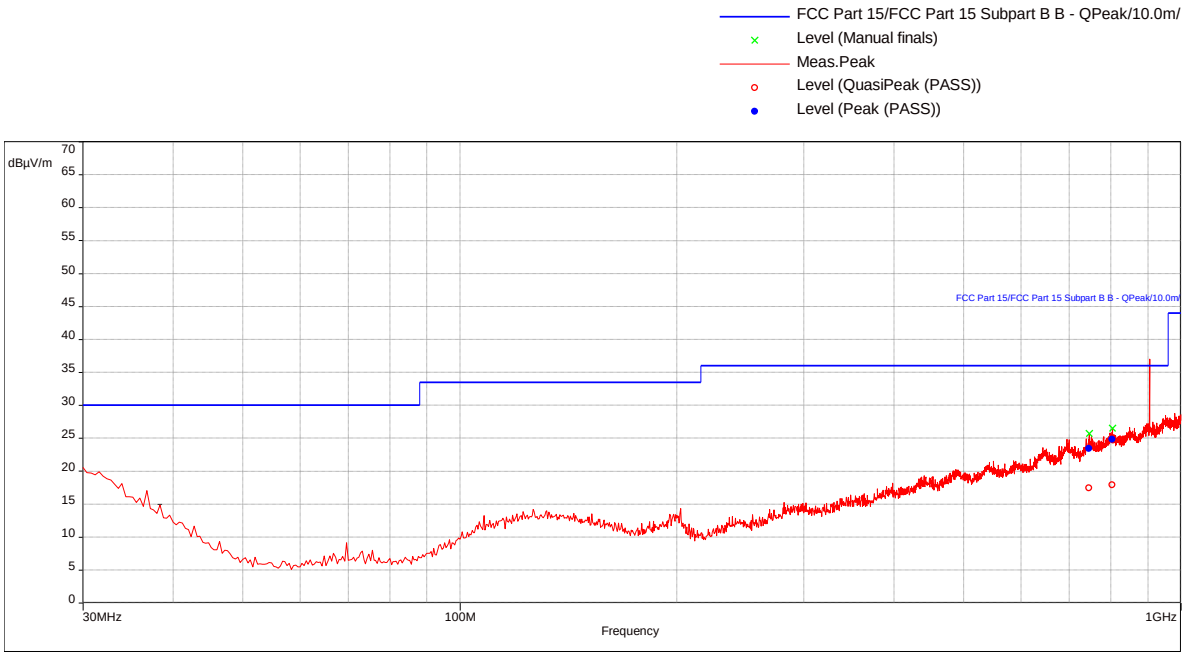
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1355.789474	42.09	54.00	-11.91	112.00	1.69	Horizontal	1000000.00	0.43
1807.631579	47.82	54.00	-6.18	256.00	1.22	Vertical	1000000.00	3.34
9482.631579	37.17	54.00	-16.83	78.00	3.17	Vertical	1000000.00	12.75
9995.394737	37.61	54.00	-16.39	326.00	2.91	Vertical	1000000.00	14.11
4519.210526	50.74	54.00	-3.26	139.00	3.61	Vertical	1000000.00	10.10
5423.157895	49.87	54.00	-4.13	46.00	3.05	Vertical	1000000.00	10.28

Transmit at Hi Channel: 905.300 MHz, 30-1000 MHz, Y-axis

Test Information:

Date and Time	10/27/2017 4:25:10 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Hi channel Y-axis (EUT on its long), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
746.0210526	36.00	-18.57	153.00	3.96	Vertical	120000.00	-8.73
803.3157895	36.00	-18.10	23.00	3.97	Vertical	120000.00	-7.90

Transmit at Hi Channel: 905.300 MHz, 1-10 GHz, Y-axis

Test Information:

Date and Time	10/25/2017 6:39:50 PM
Client and Project Number	PowerHouse Dynamics Inc_G103052943
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	57%
Atmospheric Pressure	994 mB
Comments	RE 1 to 10 GHz_Tx @ high channel Y-axis (EUT on its long side), power set to 10 dBm

Graph:

Note : Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Peak (PASS) (7)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1357.894737	60.63	74.00	-13.37	14.00	1.00	Horizontal	1000000.00	0.43
1810.526316	59.21	74.00	-14.79	144.00	1.23	Vertical	1000000.00	3.38
2715.526316	53.42	74.00	-20.58	326.00	1.00	Vertical	1000000.00	5.48
4526.578947	61.32	74.00	-12.68	218.00	1.30	Vertical	1000000.00	10.08
5431.842105	51.76	74.00	-22.24	162.00	2.78	Vertical	1000000.00	10.33
6574.736842	49.83	74.00	-24.17	228.00	2.73	Vertical	1000000.00	11.31
7310	50.36	74.00	-23.64	279.00	2.05	Horizontal	1000000.00	11.98

Average (FAIL)

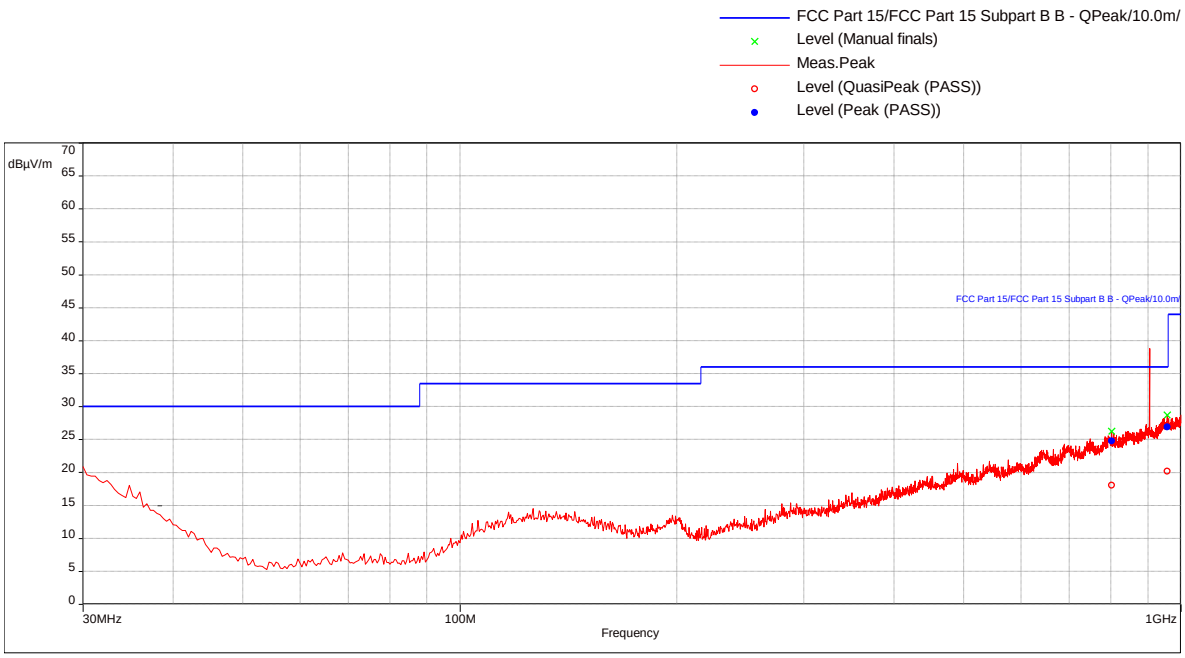
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1357.894737	47.63	54.00	-6.37	14.00	1.00	Horizontal	1000000.00	0.43
1810.526316	46.21	54.00	-7.79	144.00	1.23	Vertical	1000000.00	3.38
2715.526316	40.42	54.00	-13.58	326.00	1.00	Vertical	1000000.00	5.48
4526.578947	48.32	54.00	-5.68	218.00	1.30	Vertical	1000000.00	10.08
5431.842105	38.76	54.00	-15.24	162.00	2.78	Vertical	1000000.00	10.33
6574.736842	36.83	54.00	-17.17	228.00	2.73	Vertical	1000000.00	11.31
7310	37.36	54.00	-16.64	279.00	2.05	Horizontal	1000000.00	11.98

Transmit at Hi Channel: 905.300 MHz, 30-1000 MHz, Z-axis

Test Information:

Date and Time	10/27/2017 4:44:17 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Hi channel Z-axis (EUT on its short side), power set to 10 dBm

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Results:

QuasiPeak (PASS) (2)

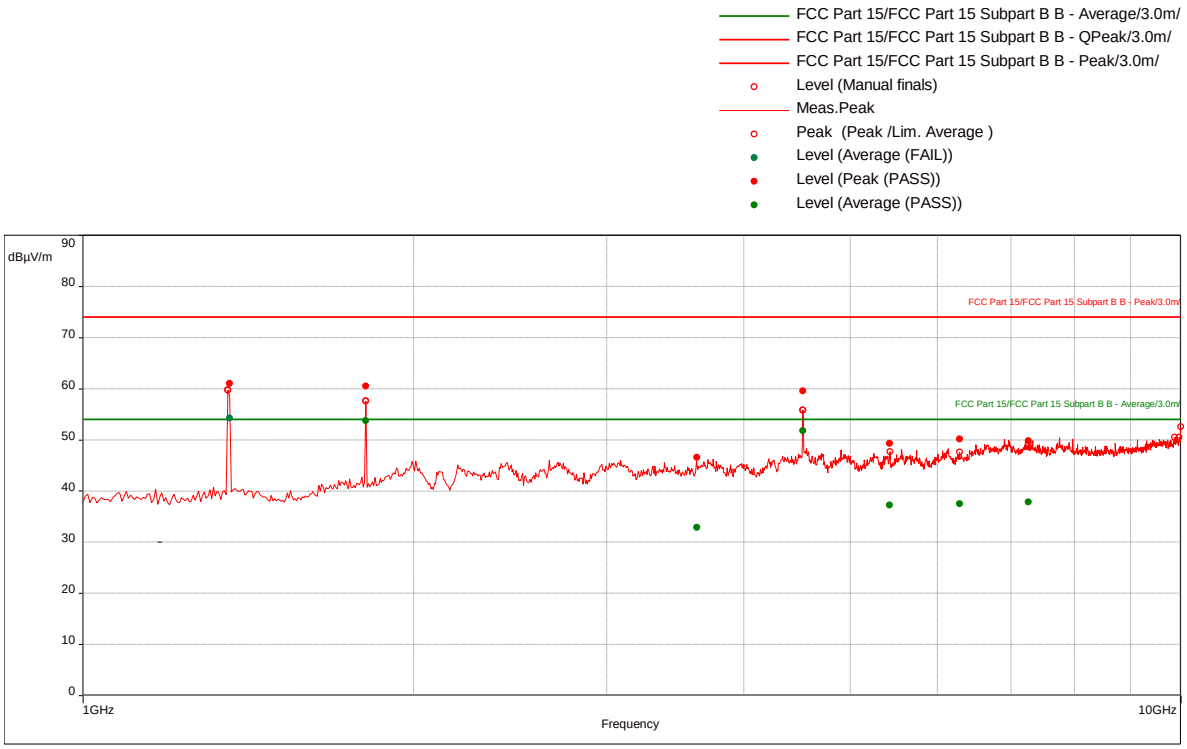
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
801.5052632	36.00	-17.99	293.00	2.12	Horizontal	120000.00	-7.93
957.1052632	36.00	-15.86	331.00	3.97	Horizontal	120000.00	-5.51

Transmit at Hi Channel: 905.300 MHz, 1-10 GHz, Z-axis

Test Information:

Date and Time	10/25/2017 5:42:32 PM
Client and Project Number	PowerHouse Dynamics Inc_G103052943
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	57%
Atmospheric Pressure	994 mB
Comments	RE 1 to 10 GHz_Tx @ high channel Z-axis (EUT on its short side), power set to 10 dBm

Graph:



Note : Average factor of 13 dB is applied to peak readings to obtain average readings.

Results:

Average (Pass)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1810.526316	47.48	54.00	-6.52	144.00	1.00	Horizontal	1000000.00	3.38
3625.789474	33.58	54.00	-20.42	288.00	3.88	Vertical	1000000.00	6.83
4526.578947	46.55	54.00	-7.45	154.00	2.19	Vertical	1000000.00	10.08
5431.842105	36.26	54.00	-17.74	28.00	1.38	Horizontal	1000000.00	10.33
6292.368421	37.18	54.00	-16.82	213.00	2.81	Horizontal	1000000.00	10.82
7262.894737	36.84	54.00	-17.16	89.00	3.38	Vertical	1000000.00	12.00
1357.894737	48.02	54.00	-5.98	42.00	2.62	Vertical	1000000.00	0.43

Peak (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1357.894737	61.02	74.00	-12.98	42.00	2.62	Vertical	1000000.00	0.43
1810.526316	60.48	74.00	-13.52	144.00	1.00	Horizontal	1000000.00	3.38
3625.789474	46.58	74.00	-27.42	288.00	3.88	Vertical	1000000.00	6.83
4526.578947	59.55	74.00	-14.45	154.00	2.19	Vertical	1000000.00	10.08
5431.842105	49.26	74.00	-24.74	28.00	1.38	Horizontal	1000000.00	10.33
6292.368421	50.18	74.00	-23.82	213.00	2.81	Horizontal	1000000.00	10.82

7262.894737	49.84	74.00	-24.16	89.00	3.38	Vertical	1000000.00	12.00

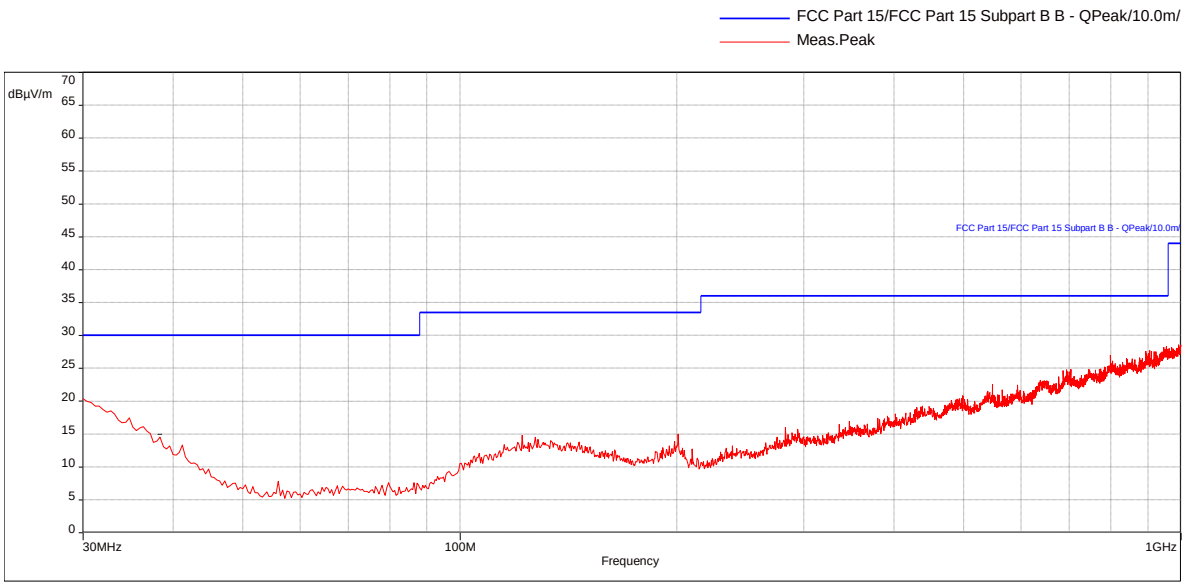
Transmit at Hi Channel: 905.300 MHz, 30-1000 MHz, X-axis (Pre-scan with water proof plastic enclosure)

Test Information:

Date and Time	10/27/2017 5:21:47 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Hi channel X-axis (EUT on its back), power set to 10 dBm_Water proof

Note : A big peak is a fundamental frequency. Band Reject Filter was used.

Graph:



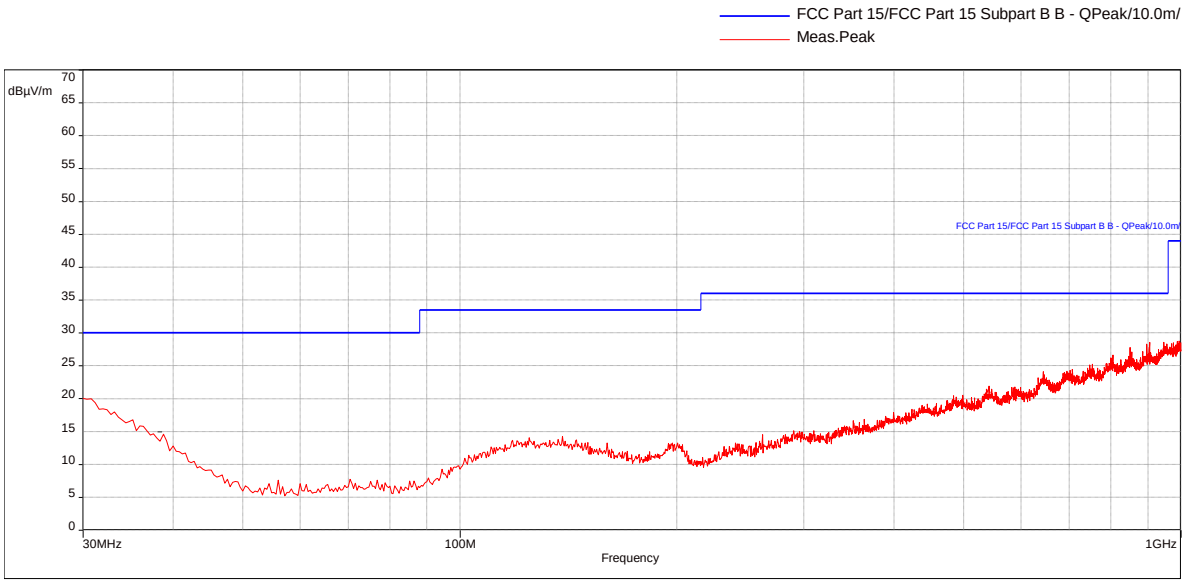
Results:

Transmit at Hi Channel: 905.300 MHz, 30-1000 MHz, Y-axis (Pre-scan with water proof plastic enclosure)

Test Information:

Date and Time	10/27/2017 5:47:48 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ hi channel Y-axis (EUT on its long), power set to 10 dBm_Water proof

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

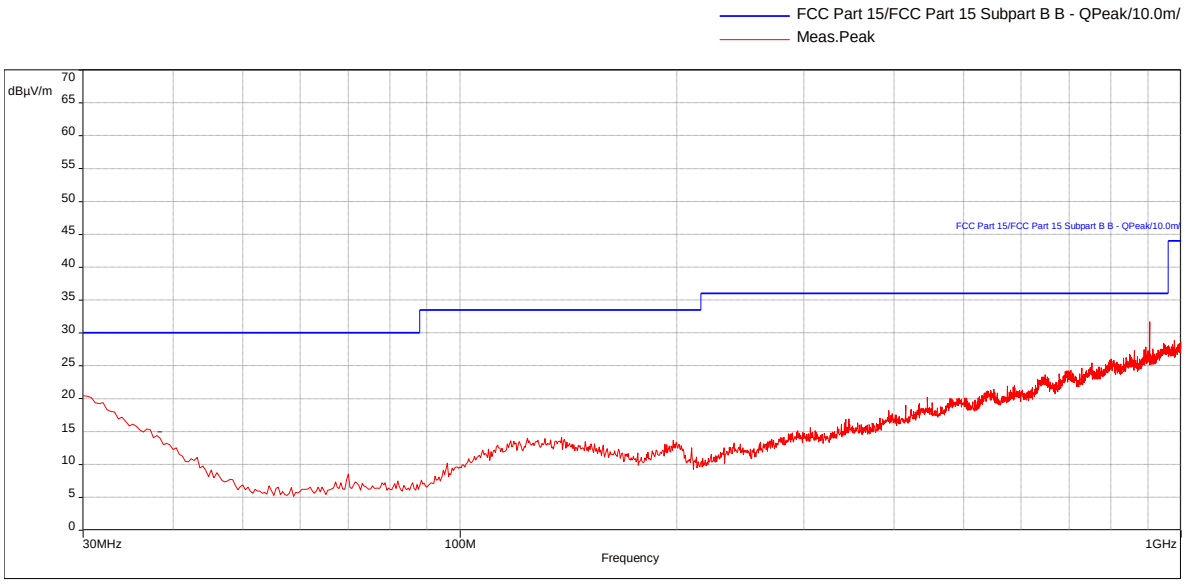
Results:

Transmit at Hi Channel: 905.300 MHz, 30-1000 MHz, Z-axis (Pre-scan with water proof plastic enclosure)

Test Information:

Date and Time	10/27/2017 5:07:52 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 30-1000MHz_Tx @ Hi channel Z-axis (EUT on its short side), power set to 10 dBm_Water proof

Graph:



Note : A big peak is a fundamental frequency. Band Reject Filter was used.

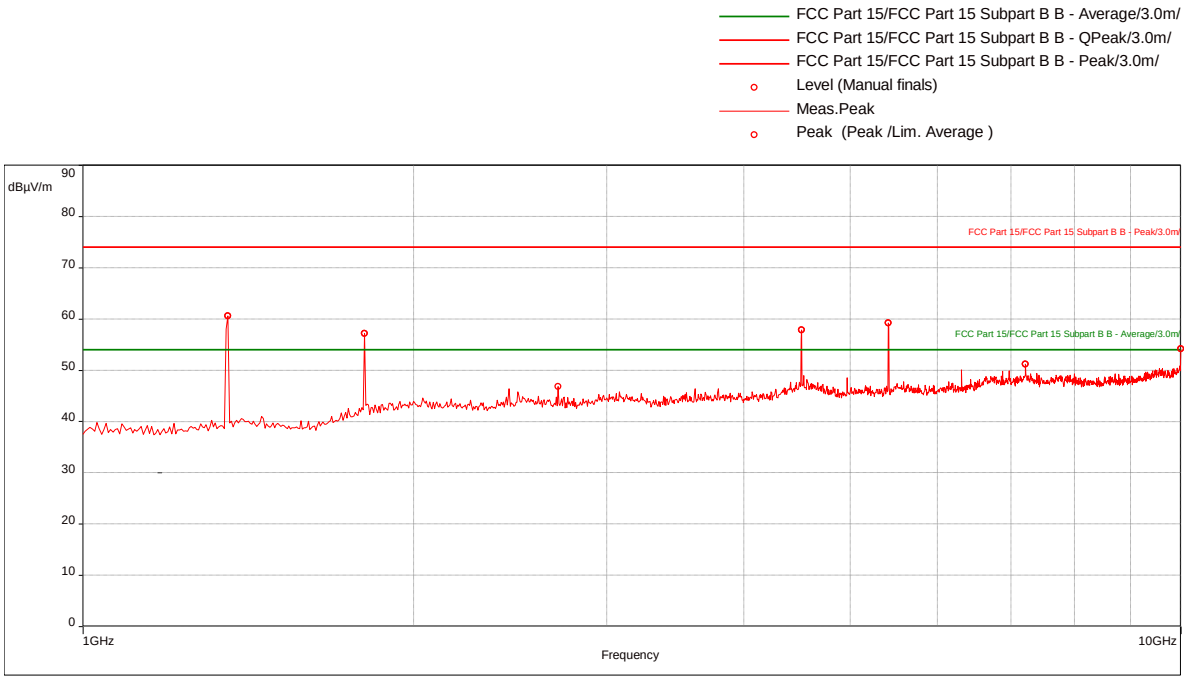
Results:

Transmit at Lo Channel: 902.5 MHz, 1-10 GHz, X-axis (Pre-scan with water proof plastic enclosure)

Test Information:

Date and Time	10/27/2017 1:02:26 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 1 to 10 GHz_Tx @ Lo channel X-axis (EUT on its back), power set to 10 dBm_water proof

Graph:



Results:

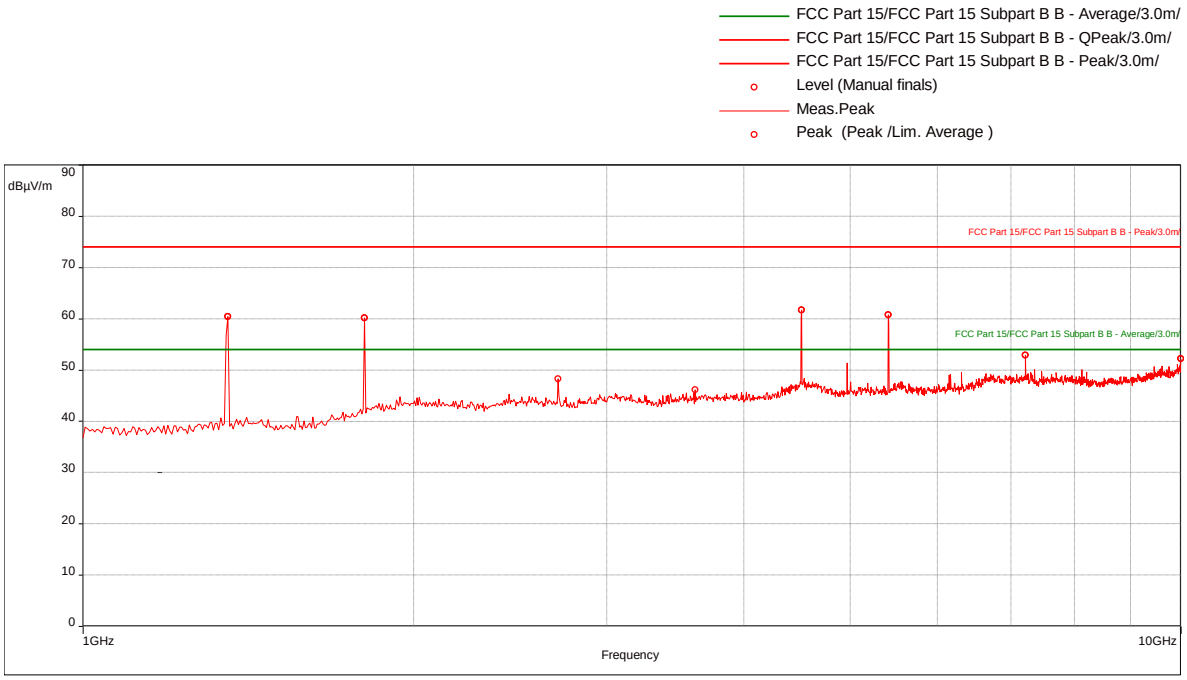
Manual finals (7)

Frequency (MHz)	SR	Level (dBµV/m)	Height (m)	Angle (°)	Position
1355	1	60.56	1.00	178.00	Horizontal
1805	1	57.14	1.02	212.00	Vertical
2710	1	46.77	1.02	141.00	Vertical
4515	1	57.85	1.02	220.00	Vertical
5415	1	59.21	1.02	187.00	Vertical
7220	1	51.21	1.02	240.00	Vertical
10000	1	54.18	1.00	317.00	Horizontal

Transmit at Lo Channel: 902.5 MHz, 1-10 GHz, Y-axis (Pre-scan with water proof plastic enclosure)
Test Information:

Date and Time	10/27/2017 1:13:20 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 1 to 10 GHz_Tx @ Lo channel Y-axis (EUT on its long side), power set to 10 dBm_water proof

Graph:



Results:

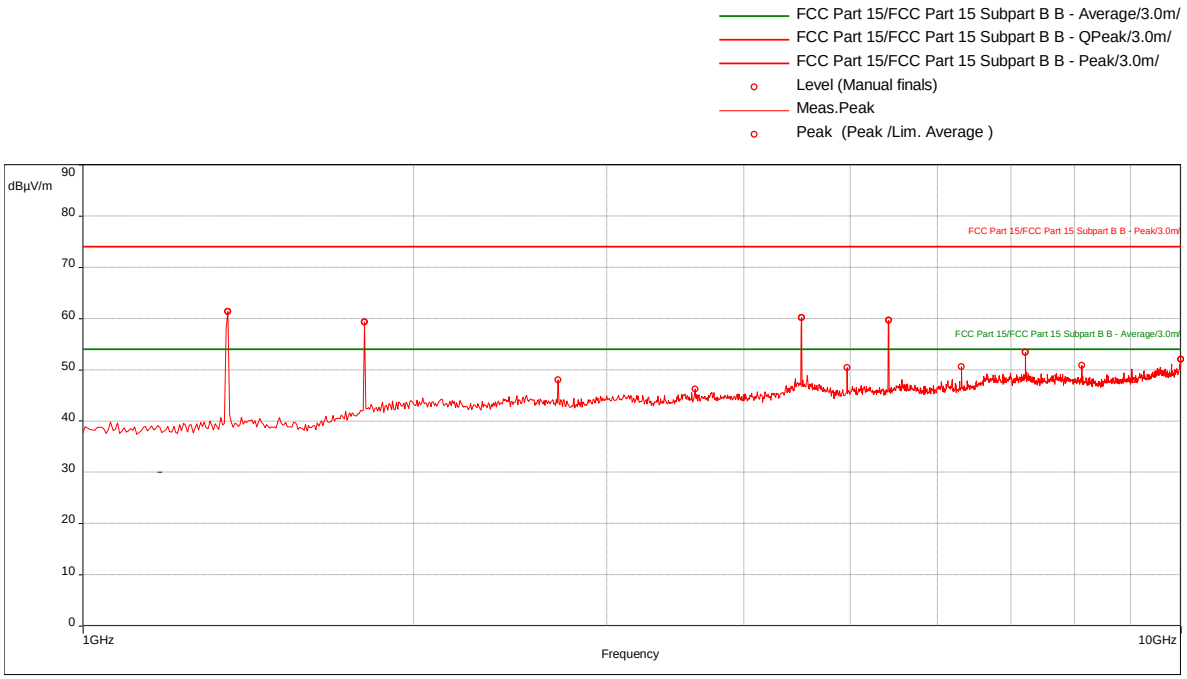
Manual finals (8)

Frequency (MHz)	SR	Level (dBµV/m)	Height (m)	Angle (°)	Position
1355	1	60.43	1.00	353.00	Horizontal
1805	1	60.15	1.00	0.00	Horizontal
2710	1	48.24	1.02	176.00	Vertical
3610	1	46.09	1.00	191.00	Horizontal
4515	1	61.70	1.00	171.00	Horizontal
5415	1	60.75	1.02	76.00	Vertical
7220	1	52.87	1.00	252.00	Horizontal
10000	1	52.19	1.00	187.00	Horizontal

Transmit at Lo Channel: 902.5 MHz, 1-10 GHz, Z-axis (Pre-scan with water proof plastic enclosure)
Test Information:

Date and Time	10/27/2017 1:25:00 AM
Client and Project Number	PowerHouse Dynamics_G103052943
Engineer	Vathana Ven
Temperature	20 deg C
Humidity	47%
Atmospheric Pressure	1014 mB
Comments	RE 1 to 10 GHz_Tx @ Lo channel Z-axis (EUT on its short side), power set to 10 dBm_water proof

Graph:



Results:

Manual finals (11)

Frequency (MHz)	SR	Level (dBµV/m)	Height (m)	Angle (°)	Position
1355	1	61.34	1.02	64.00	Vertical
1805	1	59.27	1.00	1.00	Horizontal
2710	1	47.97	1.00	145.00	Horizontal
3610	1	46.22	1.02	4.00	Vertical
4515	1	60.18	1.02	169.00	Vertical
4965	1	50.42	1.02	192.00	Vertical
5420	1	59.65	1.00	112.00	Horizontal
6315	1	50.60	1.02	173.00	Vertical
7220	1	53.40	1.02	173.00	Vertical
8125	1	50.80	1.00	207.00	Horizontal
10000	1	51.99	1.02	106.00	Vertical

Notes: General limits applied to all emissions. Worst-case pre-scans for the unit with water proof plastic enclosure are present here.

Test Personnel:	Vathana Ven VJV	Test Date:	10/25, 10/26, 10/27/2017
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.247, FCC 15.209, FCC 15.109, RSS-247, ICES-003	Limit Applied:	As specified in section 12.3
Input Voltage:	Internal Battery		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	22, 20, 20 ºC
		Relative Humidity:	57, 47, 1014 %
		Atmospheric Pressure:	994, 1014, 1014 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)	Ucispr
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 dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
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 dBμV 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 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

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

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

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

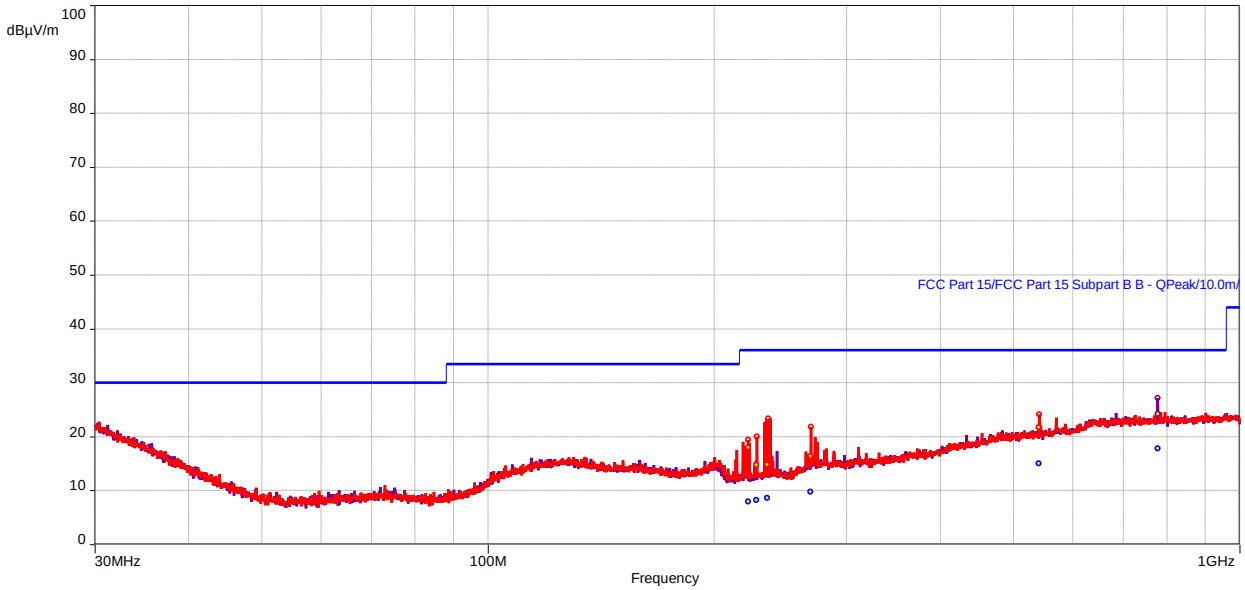
13.5 Plots/Data:

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: 950-000026, 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	Test Date:	05/24/2017
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC 15.247, FCC 15.209, FCC 15.109, RSS-247, ICES-003	Limit Applied:	As specified in section 13.3
Input Voltage:	Internal Battery		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	21 ºC
		Relative 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	11/01/2017	103052943BOX-008	VFV	MFM	Original Issue
1	01/07/2018	103052943BOX-008	NS	MFM	Updated 20dB bandwidth results.