### Project 17650A-15

### OMNI V001 2.4 GHz Aggregator Gazell Radio Section

### **Wireless Certification Report**

Prepared for:

Virtuix 1826 Kramer Lane, Suite H Austin, TX 78758

By

Professional Testing (EMI), Inc. 1601 North A.W. Grimes Blvd., Suite B Round Rock, Texas 78665

21 Mar 2016

Reviewed by

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Eric Lifsey EMC Engineer

Written by

Larry Finn Chief Technical Officer

### **Revision History**

Revision Number	Description	Date
00	Draft Release for review.	25 Feb 2016
01	Revised per reviewer comments.	29 Feb 2016
02	Revised and final.	21 Mar 2016
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### Corrections:

The name Brian Olinger is correctly spelled as Bryan Olinger.

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# **Certificate of Compliance**

Applicant	Device & Test Identification	
Virtuix, Inc. (Doug Shuffield)	FCC ID:	2AHFN-OMNIV001
1826 Kramer Lane, Suite H	Industry Canada ID:	21168-OMNIV001
Austin, TX 78758	Model(s):	OMNI V001
Certificate Date: 21 Mar 2016	Laboratory Project ID:	17650A-15

The device model(s) listed above were tested utilizing the following documents and found to be in compliance with the required criteria.

Requirement**	Reference	Detail
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, <u>2400-2483.5 MHz</u> , and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.207	Conducted emission limits.
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
KDB 558074 D01	DR01	DTS Measurement Guidance v03r02
KDB 412172	D01	Guidelines for Determining the ERP and EIRP of an RF Transmitting System
OET Bulletin 65*	Edition 97-01, and Supplement C, Ed. 01-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
RSS-247	Issue 1	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices
RSS-Gen	Issue 4	General Requirements and Information for the Certification of Radio Apparatus
RSS-102	Issue 4	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

<sup>\*</sup>MPE is reported separately from this document. \*\*Corresponding RSS references are listed in the body of the report.

I, Eric Lifsey, for Professional Testing (EMI), Inc., being familiar with the above requirements have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Eric Lifsey EMC Engineer

This report has been reviewed and accepted by the Applicant. The undersigned is responsible for ensuring that this device will continue to comply with the requirements listed above.

Representative of Applicant	

### 1.0 Introduction

### 1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of the United States and Canada.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing.

### 1.2 EUT Description

The EUT is a part of a virtual reality system and known on the design level as Gazell. This radio is part of a board with a fixed location in a large floor-mounted base. The board contains two functional radios; Gazell, and the other is a Bluetooth radio. This radio takes wireless reports of user foot movement data from remote POD radios. The Bluetooth radio test results are reported separately.

Table 1.2.1: Equipment Under Test			
Manufacturer / Model Serial # Description			
Virtuix, Inc.	None	2400-2483.5 MHz transceiver for collecting data from POD devices.	
OMNI V001	None	2400-2465.5 IVID2 transcerver for collecting data from POD devices.	

The device employs a chip antenna. The EUT board is powered from the mains by a wall-wart style power supply with 12 VDC output. The circuit board which comprises the bulk of the system measures approximately 10 x 9 cm.

The overall OMNI system measures approximately 1.2 x 1.2 x 1.1 m and consists of a shallow bowl-like platform and a semi-rigid torso retainer. In normal operation the user occupies the center and is loosely restrained such that movement of torso/legs/feet is allowed though the person does not leave the platform. The OMNI collects user position data of torso using internal hall effect sensors and feet by communication with the POD device on each shoe.

### **1.3** EUT Operation

The EUT was exercised in a manner consistent with normal operations.

### 1.4 Modifications to Equipment

No internal/radio modifications were made to the EUT during the performance of the test program. During the test external ferrites were added to USB and DC power cables to suppress radiated broadband switching noise.

- 1. Ferrite added to USB cable, Laird 23A0434-0A2
- 2. Ferrite added to power cable, Laird 28A0392-0A2

#### 1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located

at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

### 1.6 Radiated Measurements

Radiated levels are determined as follows:

### Raw Measured Level + Antenna Factor + Cable Losses - Amplifier Gain = Corrected Level

Conducted RF levels are determined as follows:

Conducted mains levels are determined as follows:

### Raw Measured Level + LISN Factor + Cable/Filter/Limiter Losses = Corrected Level

Additionally, measurement distance extrapolation factors are applied and documented where used.

### 1.7 Applicable Documents and Clauses

Table 1.7.1: Applicable Documents			
Document	Title		
47 CFR	Part 15 – Radio Frequency Devices		
47 CFK	Subpart C -Intentional Radiators		
RSS-247 Issue 1	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-		
K33-247 ISSUE 1	Exempt Local Area Network (LE-LAN) Devices		
RSS-Gen Issue 4	General Requirements and Information for the Certification of Radio Apparatus		
ANCI C62 4 2000	American National Standard for Methods of Measurement of Radio-Noise Emissions		
ANSI C63.4 2009	from Low Voltage Electrical and Electronic Equipment		

Table 1.7.2: Applicable Clauses				
Parameter	FCC Part 15 Rule Paragraphs	IC RSS References		
Transmitter Characteristics	15.247(a)(2)	RSS-247 5.2 (DTS) & 5.4, RSS-Gen 6		
Power Spectral Density	15.247(e)	RSS-247 5.2 (DTS)		
Bandwidth	15.247(a)(2), 2.1049, KDB 558074 D01	RSS-247 5.2 (DTS), RSS-Gen 6.6		
Spurious Emission	15.247, 15.209, 15.205	RSS-247 5.5, RSS-GEN 6.13, 7.1		
Band Edge	15.247, 15.205	RSS-247 5.5, RSS-Gen 6.13		
Antenna Requirement	15.203	RSS-Gen 8.3		
Conducted Emissions, Mains	15.207	RSS-Gen 8.8		

### 2.0 Fundamental Power

#### 2.1 Test Procedure

Bandwidth is first determined to select correct entire bandwidth for power measurement and the fundamental field strength is then measured.

### 2.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
	Fundamental Power	
15.247(a)(2) //	Conducted Limit: 1 Watt	25 Jan 2016
RSS-247 5.2	Desired Power Limit: 10 mW	25 Jan 2016
	Restated as Radiated Limit @ 3 m: 105.23 dBμV/m	

#### 2.3 Test Results

Maximum polarity as indicated. This device is floor-mounted.

Table 2.3.1 Radiated Power at 3 meters, Maximum Polarity				
Frequency MHz	Measured Radiated Peak Power dBμV/m @ 3m	Maximum Polarity		
2402	94.7	Н		
2441	98.5	Н		
2481	97.1	V		

Measured in 3 MHz RBW, 3 MHz VBW.

The EUT satisfied the requirement. Plotted measurements appear below.

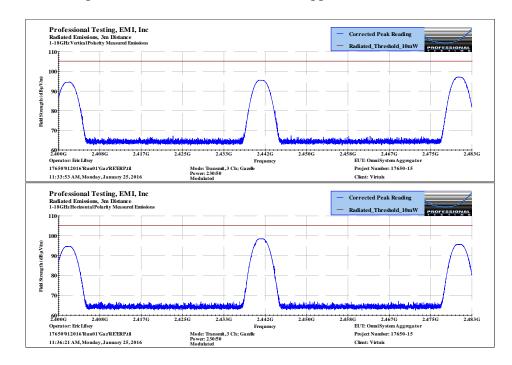


Table 2.3.2 Summary of All Power Measurements			
Frequency MHz	Polarity of Measurement	Measured Radiated Peak Power dBμV/m @ 3m	
2401	Н	94.7	
2401	V	94.6	
2441	Н	98.5	
2441	V	95.6	
2481	Н	95.7	
2481	V	97.1	

# 3.0 Power Spectral Density

### 3.1 Test Procedure

The EUT fundamental field strength is measured a spectrum analyzer and is then adjusted to record in max-hold mode for an extended time sufficient to capture all transmit products.

### 3.2 Test Criteria

47 CFR (USA) // IC (Canada)			
Section Reference	Parameter	Date	
15 247(a) //	Power Spectral Density		
15.247(e) // RSS-247 5.2	Conducted Limit: 8 dBm / 3 kHz	25 Jan 2016	
K33-247 3.2	Restated as Radiated Limit @ 3 m: 103.23 dBμV/m		

### 3.3 Test Results

The fundamental peak power in 3 MHz measured to be below the PSD power limit. Therefore EUT satisfied the PSD limit without need for measurement.

### 4.0 Transmitter Duty Cycle

#### 4.1 Test Procedure

EUT is placed into worse-case transmit operation to observe and record transmitter time domain performance.

### 4.2 Test Criteria

Section Reference	Parameter	Date(s)
15.247 // RSS-247, RSS- Gen 6.10	Transmit Duty Cycle	26 Jan 2016

Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

#### 4.3 Test Results

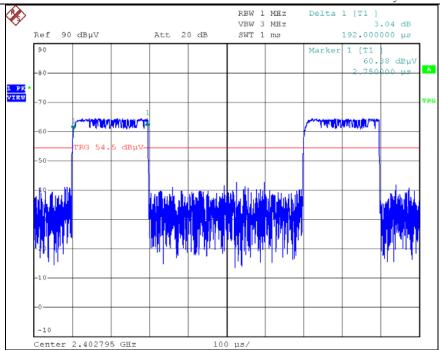
Table 4.3.1 Duty Cycle Factor Result								
Measured On Time (msec)	Measured Time Period (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)				
0.384*	3.597	20 * Log <sub>10</sub> (0.384 msec / 3.597 msec ) =	-19.41	-19.41				

<sup>\*</sup>Paired transmit events, each 192 ms long, were summed then the period as measured for the paired transmissions.

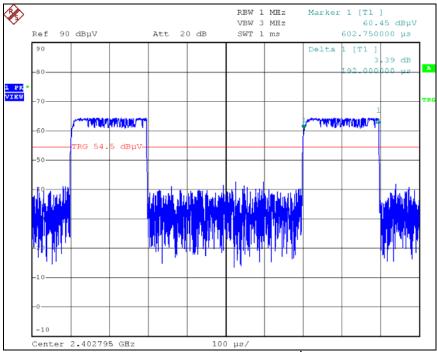
The allowed duty cycle factor is applied to peak measured harmonic signals to find average levels.

The source based factor for exposure is half of the above or: -9.7 dB

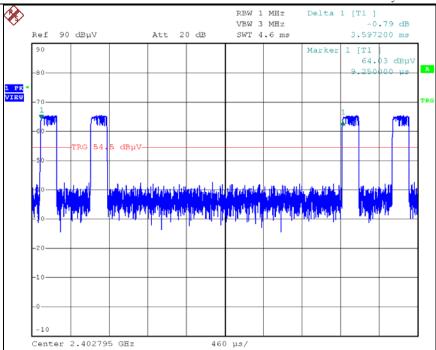
Plotted results appear below.



Two Transmit Events: Measurement of 1<sup>st</sup> Event = 0.192 ms



Two Transmit Events: Measurement of 2<sup>nd</sup> Event = 0.192 ms



**Time Period** 

## 5.0 Occupied Bandwidth

### **5.1** Test Procedure

The EUT is directly connected to a spectrum analyzer and bandwidth then is measured. A recording of the results is included.

### 5.2 Test Criteria

47 CFR (USA) // IC (Canada)						
Section Reference	Parameter	Date(s)				
14.247(a)(2), 2.1049 //	Bandwidth	21 Jan 2016				
RSS-Gen 5.2, RSS-Gen 6.6	6 dB, 20 dB	21 Jan 2010				

### 5.3 Test Results

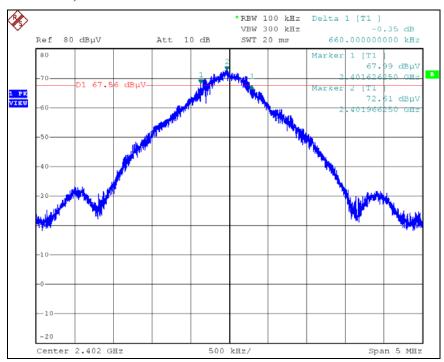
EUT was found to be in compliance with applicable requirements.

Table 5.3.1 Bandwidth 6 dB, Minimum 500 kHz							
Low Channel	Mid Channel	High Channel	Minimum BW				
Measured BW	Measured BW	Measured BW	(kHz)				
(kHz)	(kHz)	(kHz)	(КП2)				
660	810	801.3	660				

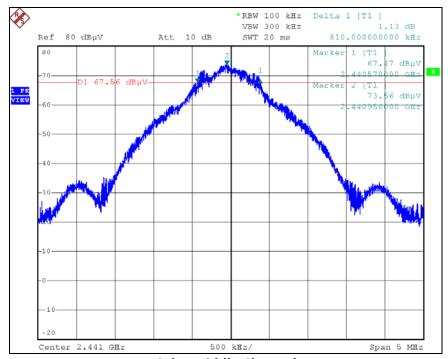
Table 5.3.2 Bandy	Table 5.3.2 Bandwidth 20 dB, Measure and Report									
Low Channel Mid Channel High Channel Reported										
Measured BW	Measured BW	Measured BW	Maximum BW							
(kHz)	(kHz)	(kHz)	(kHz)							
1494	1570	1581	1581							

Plotted measurements appear on the following pages.

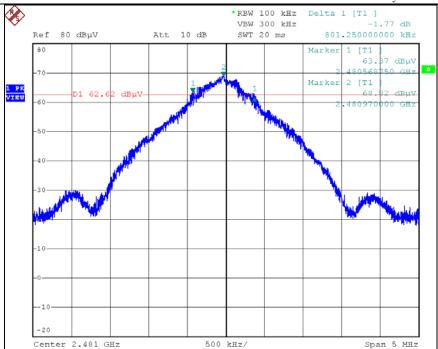
### 5.3.1 Bandwidth Plots, 6 dB



6 dB, Low Channel

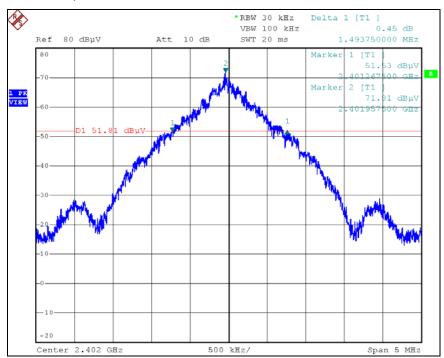


6 dB, Middle Channel

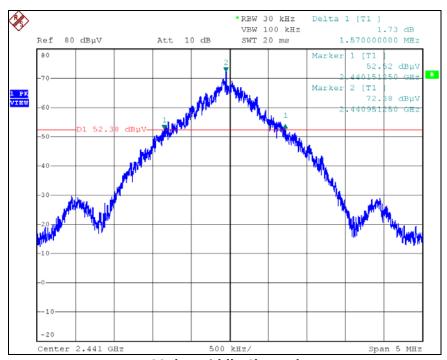


6 dB, High Channel

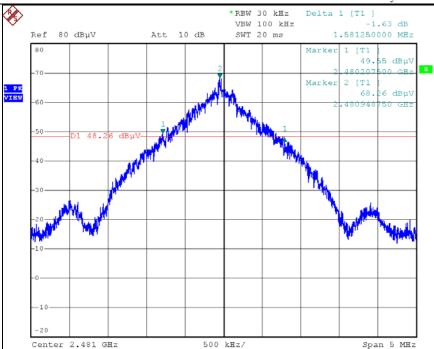
### 5.3.2 Bandwidth Plots, 20 dB



20 dB, Low Channel



20 dB, Middle Channel



20 dB, High Channel

### 6.0 Band Edge

### **6.1** Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 3 meters from the measurement antenna.

EUT is placed into normal transmit operation on the nearest band edge channel. The spectrum analyzer is centered on the band edge frequency with span sufficient to include the peak of the adjacent fundamental signal. Using peak detection, the analyzer measured emissions in max-hold mode. The measurement range includes two standard bandwidths from the respective band edge and some beyond to see the emission profile clearly. If required, the band-edge marker-delta method of C63.4 is utilized.

### 6.2 Test Criteria

47 CFR (USA) // IC (Canada)						
Section Reference	Date(s)					
15.205, 15.209 //	Unwanted Emissions Adjacent to Authorized	25 Jan 2016				
RSS-247 5.5, RSS-Gen 6.13	Band, Radiated	23 Jail 2010				

### 6.3 Test Results

The measurement was in the worse-case polarization for the high channel; the same polarization used for the low channel where the difference in polarization was only 0.1 dB (per Table 2.3.2).

Peak detection emissions at band edges were below the applicable general emission peak limits or the -20 dBc limit. (Note that the green limit line is for an unrelated limit for Europe.)

The EUT satisfied the requirements.

### 6.3.1 Low Channel Band Edge

			Profess	sional Te	sting, EN	VII, Inc.					
Test Meth	od:			ds of Measure e Range of 9 kH					_		d
In accorda	nce with:	FCC Part 15. Limits	209 - Code of I	Federal Regula	tions Part 47, S	Subpart C - Int	ention	al Radia	tors, Radia	ated Emis	sions
Section:		15.209									
Test Date(	•	1/25/2016	<u> </u>		EUT Serial		NA				
Customer:		Virtuix			EUT Part #:		NA				
Project Nu		17650-15			Test Techni		Eric Li				
Purchase (		NA			Supervisor:		Lisa A				
Equip. Un	ier Test:	Omni Syst	em Aggregat	or	Witness' Na	ame:	Bryan	Oling	er		
	F	Radiated En	nissions Test	Results Dat	a Sheet			Pag	ge: 1	of	1
EUT I	ine Voltage	: 2	30 VAC		EUT Pow	er Frequen	су:	50	0 Hz		
Antenn	a Orientatio	al	Freque	ency Range:			Above	1GHz			
E	UT Side Pos	ition; Mod	e of Operation	on:	Trans	mit Mode, I	Modul	ated,	3 Channe	els/EUTs	;
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit (dBµ\		Margin (dB)	Test R	Resul
2397.51	3	41	1	Peak	64.6	55.903	74	1.0	-18.1	Pa	iss
2397.51	3	41	1	Average	38.2	29.586	54	1.0	-24.4		iss
Radiate	ssional Testing, I Emissions, 3m Dis Vertical Polarity Measu	tance			In this beautiful to the second secon	CO LIN ETI Bai	rected Po I Y Class	verage Reeak Readi 8 B Peak 8 B OP P 11 Spurio	ng VC	ESSIONAL	
30											

**EUT Satisfies -20 dBc Criteria** 

### 6.3.2 High Channel Band Edge

Test Method:  ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).  In accordance with:  FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emission: Limits  Section:  15.209  Test Date(s):  1/25/2016  EUT Serial #:  NA  Project Number:  17650-15  Test Technician:  Fric Lifsey  Purchase Order #:  NA  Supervisor:  Uisa Arndt  Equip. Under Test:  Omni System Aggregator  Witness' Name:  Bryan Olinger  Radiated Emissions Test Results Data Sheet  Page:  1 of 1  EUT Line Voltage:  230 VAC  EUT Power Frequency:  50 Hz  EUT Side Position; Mode of Operation:  Transmit Mode, Modulated, 3 Channels/EUTs  Frequency  Test  Measured  (Meters)  Distance  (Meters)  Distance  (Meters)  Peak  59 50.674  74.0 -23.3 Pass  Professional Testing, EMI, Inc Rediated Emissions, In Detacer  1 18 GHz Vertical/bandy Measured Disbalance  1 18 GHz Vertical/bandy Measured Disbalance  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				Profess	sional Te	sting, EN	MI, Inc.						
Section: 15.209 Test Date(s): 1/25/2016 EUT Serial #: NA Project Number: 17650-15 Test Technician: Eric Lifsey Purchase Order #: NA Supervisor: Lisa Arndt Equip. Under Test: Omni System Aggregator Witness' Name: Bryan Olinger  Radiated Emissions Test Results Data Sheet Page: 1 of 1  EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz  Antenna Orientation: Vertical Frequency Range: Above 1GHz  EUT Side Position; Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Measured (Meters) (Degrees) (Meters) Pirection (Meters) (Meters) (Degrees) (Meters) Position; Mode of Operation: Transmit Mode, Nodulated, 3 Channels/EUTs  Professional Testing, EMI, Inc Rediated Emissions, 3m Distance 1:18GLV-Vertial Pokinty, Measured Emissions 3m Distance 1:18GLV-Vertial Pokinty Measured Emissions 3m Dist	Test Metho	od:		2003: "Metho	ds of Measurer	ment of Radio	Noise Emission			_			i
Test Date(s): 1/25/2016 EUT Serial #: NA  Project Number: 17650-15 Test Technician: Eric Lifsey  Purchase Order #: NA  Equip. Under Test: Omni System Aggregator Witness' Name: Bryan Olinger  Radiated Emissions Test Results Data Sheet Page: 1 of 1  EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz  Antenna Orientation: Vertical Frequency Range: Above 1GHz  EUT Side Position; Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Measured (MHz) Distance (Meters) (Degrees) (Meters) (Degrees) (Meters) (Degrees) (Meters) (Degrees) (Meters) (Degrees) (Meters) (Page 43) 34.634 54.0 -19.3 Pass  Professional Testing, EMI, Inc Radiated Emissions, 3th Distance 1-1-Sicit/Vertail/Plainty Measured Emissions.	In accordar	nce with:		209 - Code of I	Federal Regulat	tions Part 47, S	Subpart C - Int	tentiona	al Radia	ators, F	Radiate	ed Emiss	ions
Customer: Virtuix EUT Part #: NA Project Number: 17650-15 Purchase Order #: NA Supervisor: Lisa Arndt Equip. Under Test: Omni System Aggregator Witness' Name: Bryan Olinger  Radiated Emissions Test Results Data Sheet Page: 1 of 1  EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz  Antenna Orientation: Vertical Frequency Range: Above 1GHz  EUT Side Position; Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Test Distance (MHz) Distance (Meters) Direction (Height (Meters) (Meters) (Meters) (Meters) (Meters) 1 Page 1 Post Side Position (Meters) (Meters) 1 Page 2484.12 3 193 1 Peak 59 50.674 74.0 -23.3 Pass 2484.12 3 193 1 Average 43 34.634 54.0 -19.3 Pass  Professional Testing, EMI, Inc Radiated Emissions an Distance 1-18/GHz/Vertial Polarity Measured Emissions and Distance 1-18/GHz/Vertial Polarity Measured Emissions and Distance 1-18/GHz/Vertial Polarity Measured Emissions and Distance 1-18/GHz/Vertial Polarity Measured Emissions  100 90 90 90 90 90 90 90 90 90 90 90 90 9	Section:		15.209										
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Purchase Order #: NA       Supervisor: Lisa Arndt         Equip. Under Test: Omni System Aggregator       Witness' Name: Bryan Olinger         Radiated Emissions Test Results Data Sheet       Page: 1 of 1         EUT Line Voltage: 230 VAC       EUT Power Frequency: 50 Hz         Antenna Orientation: Vertical       Frequency Range: Above 1GHz         EUT Side Position; Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs         Frequency Test Measured (MHz) Direction (Meters) Uistance Uistanc	Customer:					EUT Part #:		_					
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EUT Line Voltage: 230 VAC  Antenna Orientation: Vertical  Frequency Range: Above 1GHz  EUT Side Position; Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Test EUT Antenna Direction Height (Meters) (Imit Level (MBµV)m) (Meters) (Imit Level (MBµV)m) (MBpV/m) (	Equip. Und	er Test:	Omni Syst	em Aggregat	or	Witness' N	ame:	Bryan	Oling	ger			
Antenna Orientation: Vertical Frequency Range: Above 1GHz  EUT Side Position; Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Measured (MHz) Test Direction (Degrees) Professional Testing, EM1, Inc Radiated Emissions Professional Testing, EM1, Inc Radiated Emissions Sm Distance 1.18 GHz Vertical Polarity Measured Emissions  Professional Testing, EM1, Inc Radiated Emissions Sm Distance 1.18 GHz Vertical Polarity Measured Emissions Sm Distance 1.18 GHz Ve		F	Radiated En	nissions Test	Results Data	a Sheet			Pag	ge:	1	of	1
EUT Side Position; Mode of Operation:  Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Test Distance (Measured (Meters) (Degrees) (Meters) (M	EUT Li	ine Voltage:	: 2	30 VAC		EUT Pow	ver Frequen	су:	5	0	Hz		
Frequency Measured Distance (MHz) Corrected (MHz) Punction (Degrees) Punction (Meters) Punction (Meter	Antenna Orientation: Vertical					Frequ	ency Range	:		Abo	ove 1	GHz	
Measured (MHz) (Meters) Direction (Degrees) (Meters) Punction (Meters) Punction (Meters) (Meters) Peak S9 S0.674 74.0 -23.3 Pass 2484.12 3 193 1 Average 43 34.634 54.0 -19.3 Pass Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions 100 Measur	E	UT Side Pos	ition; Mod	e of Operati	on:	Trans	mit Mode,	Modul	ated,	3 Cha	nnels	/EUTs	
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  100 90 100 90 40 30 40 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 40 40 40 40 40 40 40 40 40 40 40 40	Measured	Distance	Distance Direction Height Detector			Amplitude	Level					Test R	esults
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  100 90 40 30 40 30	2484.12	3	193	1	Peak	59	50.674	74	.0	-23	3.3	Pa	SS
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertial Polarity Measured Emissions  100 90 80 70 60 30	2484.12	3	193	1			_	_		-19	9.3		
Operator: Eric Lifsey Frequency EUT: Omni System Aggregator	Radiated 1-18GHz V 100	Emissions, 3m Dis	tance ured Emissions	2.483G	2.484G 2.4 Freq	185G 2.486 quency	G 2.487G	UT: OmniS	ak kead B Ge B Ge itt Spurid ow High	AVG Dus 2.			0G
17650 012016 Run 02 REGaz Tx Band Edge Mask Upper.til Mode: Transmit, 2 Ch; low/high; Gazelle Project Number: 17650-15 11:13:38 AM, Monday, January 25, 2016 Modulated; band-edge and OOB domain Client: Virtuix				Power: 23	0/50			-		-15			

EUT Satisfies -20 dBc Criteria and General Emission 15.209 Criteria Above 2.4835 GHz

### 7.0 Radiated Spurious Emissions, Receive Mode

#### 7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable. The measurement antenna is scanned from 1 to 4 meters in height.

Spurious emissions below 1 GHz were measured with peak and quasi-peak detection with a resolution bandwidth of 120 kHz at a distance of 10 meters. Above 1 GHz the measurement distance was 3 meters with resolution bandwidth of 1 MHz and using peak and average detection. A diagram showing the test setup is given in the figure below.

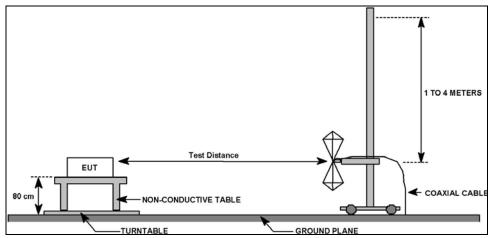


Figure 7.1.1: Field Strength of Spurious Emissions Test Setup

### 7.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 //	Field Strength of Radiated	20 Jan 2016
RSS-247 5.5, RSS-Gen 7.1	Spurious/Harmonic Emissions	20 3411 2010

### 7.3 Test Results

The EUT satisfied the criteria. Recorded data is presented below.

Table 7.3.1: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Vertical Polarity

			Profes	sional Te	sting, EN	VII, Inc.			
Test Metho	od:			ds of Measurer e Range of 9 kH				•	
In accordar	nce with:	Limits	209 - Code of	Federal Regulat	ions Part 47, S	Subpart C - Int	tentional Radi	ators, Radiate	ed Emissions
Section:		15.209			l		<u>,                                      </u>		
Test Date(s	s):	1/20/2016			EUT Serial		0		
Customer:		Virtuix			EUT Part #:		0		
Project Nu		17650-15			Test Techni		Eric Lifsey		
Purchase O		NA PODS			Supervisor:		Lisa Arndt		
Equip. Und	er rest:	PODS			Witness' Na	ame:	Brian Oling	ger	
				t Results Data	1			ge: 1	of 1
	ne Voltage		30 VAC			ver Frequen		60 Hz	
Antenna	Orientatio		Vertic	al	Freque	ency Range:		30MHz to	1GHz
	EUT N	/lode of Ope	eration:			R	Receive Mod	le I	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
38.286	10	272	2.13	Quasi-peak	41.4	25.533	29.5	-4.0	Pass
42.521	10	185	1.21	Quasi-peak	44.6	27.299	29.5	-2.2	Pass
43.5621	10	353	1.46	Quasi-peak	45.1	28.12	29.5	-1.4	Pass
44.6313	10	278	1.22	Quasi-peak	45.7	29.046	29.5	-0.5	Pass
45.7031	10	263	1.51	Quasi-peak	45.4	28.093	29.5	-1.4	Pass
54.2631	10	85	1.22	Quasi-peak	43.9	25.573	29.5	-3.9	Pass
56.1785	10	68	2.17	Quasi-peak	43.6	25.808	29.5	-3.7	Pass
Radiated	sional Testing, Emissions, 10m D GHz Vertical Polarity	istance						Reading Readin	SIONAL
Field Strength (dB µV/m)  20  30  10  10  10  10  10  10  10  10  1	×	××		× ×					
E .107						Jaki (Lusis A			
Field Streng	1111911		100M						1G
10 0 30M Operator:		purious GAZRadio.til	100M Mode: Re Power: 23	ceive	uency		ZUT: Omni System Ag	_	1G

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.											
Test Method:		NSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and ectronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).									
In accordance with:	rdance with: FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits										
Section:	15.209										
Test Date(s):	1/20/2016	EUT Serial #:	0								
Customer:	Virtuix	EUT Part #:	0								
Project Number:	17650-15	Test Technician:	Eric Lifsey								
Purchase Order #:	NA	Supervisor:	Lisa Arndt								
Equip. Under Test:	PODS	Witness' Name:	Brian Olinger								
	Page:	1	of	1							

Radiated Emissions Test Results Data			a Sheet	Page:	1	of	1
EUT Line Voltage:	230 VAC		EUT Power Frequency:	50	Hz		
Antenna Orientation:	Horizontal		Frequency Range:	30N	1Hz to	1GHz	

# EUT Mode of Operation: Receive Mode

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
89.8975	10	96	3.66	Quasi-peak	46	26.37	33.1	-6.7	Pass
90.9217	10	290	3.21	Quasi-peak	46.8	27.314	33.1	-5.8	Pass
128.851	10	99	3.68	Quasi-peak	41.7	24.387	33.1	-8.7	Pass
129.908	10	119	2.73	Quasi-peak	41.1	23.777	33.1	-9.3	Pass
275.962	10	78	3.64	Quasi-peak	22.4	11.928	35.6	-23.7	Pass
957.516	10	273	2.1	Quasi-peak	21.1	26.337	35.6	-9.3	Pass

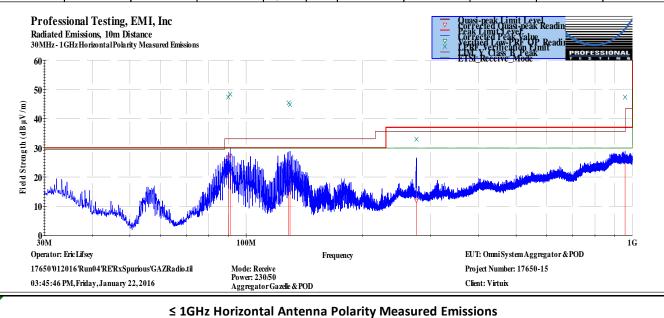


Table 7.3.3: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Middle Channel, Vertical Polarity

Polarity				D . (							
				Profess	sional Te	sting, El	VII, Inc.				
Test Metho	od:					ment of Radio Hz to 40 GHz"				•	
In accordai	nce with:	FCC Par Limits	rt 15.20	09 - Code of F	ederal Regula	tions Part 47, S	Subpart C - Int	entional	Radia	tors, Radiate	ed Emission
Section:		15.209				_					
Test Date(s	s):	1/20/2	2016			EUT Serial	#:	0			
Customer:		Virtui				EUT Part #:		0			
Project Nu		17650	-15			Test Techn		Eric Lif			
Purchase C		NA				Supervisor:		Lisa Ar			
Equip. Und	ier Test:	PODS				Witness' N	ame:	Brian (	Jlinge	er	
	F	Radiate	d Emi	issions Test	Results Dat	a Sheet			Pag	e: 1	of 1
EUT L	ine Voltage	:	23	0 VAC		EUT Pow	ver Frequen	cy:	50	Hz	
Antenn	a Orientatio	n:		Vertic	al	Frequ	ency Range:			Above 1	GHz
	EUT N	/lode o	f Ope	ration:			R	eceive	Mode	:	
Frequency Measured (MHz)	Test Distance (Meters)	EU' Direct (Degre	tion	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Lo		Margin (dB)	Test Resu
2442.5	3	202	2	0.6	Peak	44.4	35.843	74.0	0	-38.1	Pass
4316.35	3	27	7	0.6	Peak	42.6	38.011	74.0	0	-35.9	Pass
4874.21	3	24		0.6	Average	33.2	29.43	54.0	0	-24.5	Pass
9758.61	3	62	2 [	0.6	Average	26.5	33.41	54.0	0	-20.5	Pass
Radiated	sional Testing, Emissions, 3m Dis VerticalPolarity Meass	tance		Y			Ave	rage Limit rected Ave K Limit Le rected Pea Le Cass Le Cass Le Cass	K Reauli R Peak	ording light with the second s	SIONAL N. 6
20										10G	13G
20 1G Operator: 17650'012	Eric Lifsey 2016 Run04 RE'Rx Sp	ourious'GAZF	Radio.til	Mode: Rec Power: 23	eive	quency	Pi	UT: OmniSys roject Numbe lient: Virtuix		egator & POD 15	

Table 7.3.4: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Middle Channel, Horizontal Polarity

Polarity										
			Profess	sional Te	sting, El	VII, Inc.				
Test Metho	d:			ds of Measurer e Range of 9 kH					•	
In accordan	ice with:	FCC Part 15.2 Limits	209 - Code of I	ederal Regulat	tions Part 47, S	Subpart C - Int	tentional	Radia	tors, Radiate	ed Emissions
Section:		15.209								
Test Date(s	):	1/20/2016			EUT Serial	<b>#</b> :	0			
Customer:			EUT Part #:		0					
Project Nur		17650-15			Test Techn		Eric Lif			
Purchase O		NA			Supervisor:		Lisa Ar			
Equip. Und	er Test:	PODS			Witness' N	ame:	Brian (	Olinge	er	
	F	Radiated Em	issions Test	Results Data	a Sheet			Pag	ge: 1	of 1
EUT Li	ne Voltage:	23	30 VAC		EUT Pow	ver Frequen	су:	50	) Hz	
Antenna	Orientatio	n:	Horizor	ntal	Frequ	ency Range	:		Above 1	GHz
	EUT N	lode of Ope	eration:		Receive Mode					
Frequency Measured (MHz)	Test Distance (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Lo		Margin (dB)	Test Results		
2435.17	3	298	0.6	Peak	44	35.456	74.0	0	-38.5	Pass
4871.15	3	62	0.6	Peak	41.7	37.935	74.0	0	-36.0	Pass
7311.94	3	300	0.6	Average	28.9	32.28	54.0	0	-21.7	Pass
9757.21	3	72	0.6	Average	26.5	33.367	54.0	0	-20.6	Pass
Radiated 1-18GHzH 90 80	sional Testing, Emissions, 3m Dis forizontal Polarity Mo	tance				— Av — 2è — 11	erage Limit rrefted Ave ak Limit Le rrected Pes M V Class SI_Receive	ik Keadi B Peak	ading adding adding a second adding a second adding a second a second adding a	SIONAL
ld Strength (dB µV						And the behavior of the second				man district
30	30						— <del> </del>		-   <del>     </del>	
	Eric Lifsey 016 Run04 RERxSp PM, Friday, January 2		Mode: Rec Power: 23 Aggregato	eive	uency	I	ZUT: Omni Sys Project Numbe Client: Virtuix	er: 17650-	10G regator & POD	13G

1 to 18 GHz Horizontal Antenna Polarity Measured Emissions

### 8.0 Radiated Spurious Emissions, Transmit Mode

#### **8.1** Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable.

Spurious emissions below 1 GHz were measured with peak and quasi-peak detection with a resolution bandwidth of 120 kHz at a distance of 10 meters. Above 1 GHz the measurement distance was 3 meters with resolution bandwidth of 1 MHz and using peak and average detection. A diagram showing the test setup is given in the figure below.

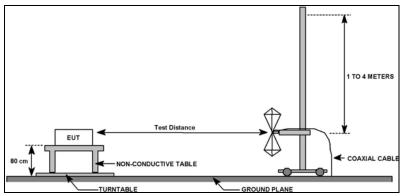


Figure 8.1.1: Field Strength of Spurious Emissions Test Setup

#### 8.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-247 5.5, RSS-Gen 6.13	Field Strength of Radiated Spurious/Harmonic Emissions	20 Jan 2016

#### 8.3 Test Results

In all cases detector mode is peak, RBW 1 MHz, VBW 3 MHz. All peak emissions can be seen as being below the average or QP limits.

The EUT satisfied the criteria. Recorded data is presented below.

Table 8.3.1: Radiated Spurious Emissions, Transmit Mode, Below 1 GHz, Three Channels, Vertical Polarity

Polarity												
				Profes	sional Te	sting, El	VII, Inc.					
Test Metho	od:				ds of Measurer e Range of 9 kH					_		t
In accordar	nce with:	FCC Pa	rt 15.2	09 - Code of	Federal Regulat	ions Part 47,	Subpart C - Int	entional R	adiators	, Radiate	ed Emiss	sions
Section:		15.209										
Test Date(s	):	1/20/	2016			EUT Serial	#:	0				
Customer:		Virtui	x			EUT Part #:		0				
Project Nur		17650	-15			Test Techn		Eric Lifse				
Purchase O		NA				Supervisor		Lisa Arn				
Equip. Und	er Test:	PODS				Witness' N	ame:	Brian Ol	inger			
	F	Radiate	ed Em	issions Tes	t Results Data	a Sheet			Page:	1	of	1
EUT Li	ne Voltage		23	0 VAC		EUT Pov	ver Frequen	cy:	50	Hz		
Antenna	orientation	n:		Vertic	al	Frequ	ency Range:		301	∕lHz to	1GHz	
	EUT N	/lode o	f Ope	ration:		Trans	mit Mode, I	Modulate	ed, 3 Ch	nannels	/EUTs	
Frequency Measured (MHz)	Test Distance (Meters)	EU Direc (Degr	tion	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Lev (dBµV/r	_	largin (dB)	Test R	esult
37.5511	10	18	3	1.4	Quasi-peak	40.8	25.917	29.5		-3.6	Pa	SS
41.4601	10	10	7	1.36	Quasi-peak	44.1	26.42	29.5		-3.1	Pa	ISS
43.5688	10	10	9	1.48	Quasi-peak	44.8	27.862	29.5		-1.6	Pa	SS
56.1636	10	18	1	3.14	Quasi-peak	43.6	25.787	29.5		-3.7	Pa	SS
Radiated 30MHz-1:	sional Testing, Emissions, 10m D GHz Vertical Polarity	istance							t Level peak Read Valup Read on Limit T eak Spurious	di	SSIONAL	
100 100 100 100 100 100 100 100 100 100			Mary HA	100M		Mitteld Mary Assessment	et en et et e				10	G
	Eric Lifsey 016 'Run07 'RE'TxSp PM, Wednesday, Janu			.til Mode: Tr Power: 23 Modulate	ansmit, 3 Channels 30/50	luency	I	EUT: Omni Syste Project Number: Client: Virtuix				
			≤ 10	GHz Vertica	l Antenna Po	larity Meas	ured Emissi	ons				

Table 8.3.2: Radiated Spurious Emissions, Transmit Mode, Below 1 GHz, Three Channels, Horizontal Polarity

Polarity											
				Profess	sional Te	sting, EN	VII, Inc.				
Test Metho	d:				ds of Measuren e Range of 9 kH					_	
In accordan	ice with:	FCC Pa	rt 15.2	09 - Code of I	Federal Regulat	ions Part 47, S	Subpart C - Int	entiona	l Radia	ators, Radiate	ed Emissions
Section:		15.209				T					
Test Date(s	):	1/20/				EUT Serial		0			
Customer:		Virtui				EUT Part #:		0	•		
Project Nur Purchase O		17650 NA	)-15			Test Techni		Eric Li Lisa A			
Equip. Und		PODS				Supervisor: Witness' Na		Brian		or	
Equip. Onu	ei iest.	FUDS	)			Withess IV	airie.	Dilaii	Onnig	CI	
	F	Radiate	ed Em	issions Test	Results Data	Sheet			Pag	ge: 1	of 1
EUT Li	ne Voltage:		23	0 VAC		EUT Pow	er Frequen	cy:	5	0 Hz	
Antenna	orientation of the contraction o	n:		Horizor	ntal	Frequ	ency Range:			30MHz to	1GHz
	EUT N	1ode c	of Ope	ration:		Trans	mit Mode, I	Modula	ated,	3 Channels	;/EUTs
Frequency Measured (MHz)	Test Distance (Meters)	EU Direc (Degr	tion	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit l (dΒμ\		Margin (dB)	Test Resul
88.8138	10	3.91	45	25.267	33.	.1	-7.8	Pass			
88.8138         10         106         3.91         Quasi-peak         45         25.267         33.1         -7.8         Pass           96.2834         10         113         3.68         Quasi-peak         45.5         27.294         33.1         -5.8         Pass									Pass		
121.44	10	27	76	1.31	Quasi-peak	28.6	11.283	33.	.1	-21.8	Pass
Radiated	sional Testing, Emissions, 10m Di GHz Horizontal Polari	stance			· — — -		Quadratic   Quad	asi-peak L rected Qi k Limit I rected Pe ifted Low RF Vering T V Class L Transm	mit Ley lass-peak evel value Legion Li afion Li B. Peak it_Spurie	Readir	SIONAL
(th (dB µV/m))					×						
S 20							hall the same the same of the	gayand Spelen			
0 ± 30M Operator: 1	Frie Lifee			100M	**			UT: Omni Sy	ectom		1G
=	eric Lirsey 016 Run07 RETxSpi	urious'3Ch'	'GAZRadio		nsmit,3 Channels	uency		roject Numb		-15	
	PM, Wednesday, Janu			Power: 23 Modulate				lient: Virtuis			
			≤ 1G	Hz Horizont	al Antenna P	olarity Mea	sured Emiss	sions			

Table 8.3.3: Radiated Spurious Emissions, Transmit Mode, 1 to 18 GHz, Three Channels, Vertical Polarity

EUT Line Voltage: 230 VAC   EUT Power Frequency: 50 Hz				Profess	ional Te	sting, El	VII, Inc.			
In accordance with: Limits	Test Metho	od:								
Test Date(s): 1/20/2016 EUT Serial #: 0  Customer: Virtuix EUT Part #: 0  Project Number: 17650-15 Test Technician: Eric Lifsey  Purchase Order #: NA  Supervisor: Lisa Arndt  Equip. Under Test: PODS Witness' Name: Brian Olinger  Radiated Emissions Test Results Data Sheet Page: 1 of  EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz  Antenna Orientation: Vertical Frequency Range: Above 1GHz  Frequency Test EUT Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Range: Above 1GHz  Frequency Range: Above 1GHz  Frequency Range: Above 1GHz  Above 1GHz  Frequency Range: Ab	In accorda	nce with:		15.209 - Code of F	ederal Regula	tions Part 47, S	Subpart C - Int	entional Rad	ators, Radiat	ed Emissions
Customer: Virtuix EUT Part #: 0 Project Number: 17650-15 Test Technician: Eric Lifsey Purchase Order #: NA Supervisor: Lisa Arndt Equip. Under Test: PODS Witness' Name: Brian Olinger  Radiated Emissions Test Results Data Sheet Page: 1 of  EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz  Antenna Orientation: Vertical Frequency Range: Above 1GHz  EUT Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Test Distance (Metzers) Distance (Metzers) Height (Metzers) Punction (Metzers) Punction (Metzers) Punction (Metzers) Punction (Metzers) Punction (Metzers) Punction (Metzers) Possible (Apply) (Application Page Possible Page Page: Punction (Application Page Page: Punction Page Page: Page Page Page Page: Page Page Page: Page Page Page	Section:		15.209							
Project Number: 17650-15 Test Technician: Eric Lifsey Purchase Order #: NA Supervisor: Lisa Arndt Equip. Under Test: PODS Witness' Name: Brian Olinger  Radiated Emissions Test Results Data Sheet Page: 1 of  EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz  Antenna Orientation: Vertical Frequency Range: Above 1GHz  EUT Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs  Frequency Test EUT Antenna Direction (IDegrees) (MHz) Detector Function (IDegrees) (MHz) (Meters) (Met	Test Date(s	s):	1/20/20	16		EUT Serial	<b>#</b> :	0		
Purchase Order #: NA   Supervisor: Lisa Arndt	Customer:		Virtuix			EUT Part #:		0		
Radiated Emissions Test Results Data Sheet   Page: 1 of	Project Nu	mber:	17650-1	5		Test Techn	ician:	<b>Eric Lifsey</b>		
Radiated Emissions Test Results Data Sheet   Page: 1 of	Purchase C	Order #:	NA			Supervisor		Lisa Arndt		
EUT Line Voltage: 230 VAC   EUT Power Frequency: 50 Hz     Antenna Orientation: Vertical   Frequency Range: Above 1GHz     EUT Mode of Operation: Transmit Mode, Modulated, 3 Channels/EUTs	Equip. Und	ler Test:	PODS			Witness' N	ame:	Brian Oling	ger	
Antenna Orientation:   Vertical   Frequency Range:   Above 1GHz		F	Radiated	Emissions Test	Results Dat	a Sheet		Pa	ge: 1	of 1
Frequency   Test   EUT   Antenna   Measured (Meters)   Distance	EUT L	ine Voltage	:	230 VAC		EUT Pow	er Frequen	cy: 5	0 Hz	
Test   Distance   Direction   Height   (Meters)   Detector   Function   (Meters)   (M	Antenn	a Orientatio	n:	Vertic	al	Frequ	ency Range:		Above 1	.GHz
Test   Distance   Direction   Height   (Meters)   Detector   Function   (Meters)   (M		EUT N	/lode of (	Operation:		Trans	mit Mode, I	Modulated,	3 Channel	s/EUTs
Measured (MHz)   Distance (Meters)   Direction (Meters)   Height (Meters)   Function (dBμV/m) (dBμV/m) (dBμV/m) (dBμV/m) (dBμV/m)   Test Reside (MBμV/m) (dBμV/m)	Fraguancy							,		
(MHz)   (Meters)   (Degrees)   (Meters)   Function   (dBμV/m)	-		_	1 1110011110	Detector			Limit Level	Margin	Tost Result
9596.64 3 138 0.6 Peak 35 42.164 74.0 -31.8 Pass 4879.9 3 286 0.6 Average 32.8 28.986 54.0 -25.0 Pass 9596.64 3 138 0.6 Average 26.5 33.681 54.0 -20.3 Pass Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1.18GHz Vertical Polarity Measured Emissions 90 100 100 100 100 100 100 100 100 100				- 0	Function			(dBμV/m)	(dB)	Test Result
4879.9 3 286 0.6 Average 32.8 28.986 54.0 -25.0 Pass 9596.64 3 138 0.6 Average 26.5 33.681 54.0 -20.3 Pass Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions 90 Fast Professional Testing (Average Reading Fast Limit Level Control of the Control of th	4879.9	3	286	0.6	Peak	41.6	37.816	74.0	-36.1	Pass
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions  Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  Professional Testing, EMI, Inc Radiated Emissions  Professional Testing, EM					Peak	-	42.164		-31.8	Pass
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  90  100  100  100  100  100  100  100	•		286	0.6	Average	32.8	28.986	54.0	-25.0	Pass
Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions  90  80  80  60  70  40  30  10G  10G  18G	9596.64	3	138	0.6	Average	26.5	33.681	54.0	-20.3	Pass
Operator: Eric Lifsey Frequency EUT: Onni System  17650 '012016 'Run07' RETxSpurious' 3Ch'GAZRadio.til Mode: Transmit, 3 Channels Project Number: 17650-15	Radiated 1-18GHz 90 80	Emissions, 3m Dis	tance				→ AW → Per → H → H	Fage Jimit Leve Treefied Average I ik Limit Leve Treefied Page Read JV. Class B. Ligh S. Transant Spur	nng 📉	SSIONAL

Table 8.3.4: Radiated Spurious Emissions, Transmit Mode, 1 to 18 GHz, Three Channels, Horizontal Polarity

<del>-</del>									
			Profess	sional Te	sting, El	VII, Inc.			
Test Metho	d:			ds of Measurer Range of 9 kH				_	
In accordar	ice with:	FCC Part 15.2 Limits	09 - Code of F	ederal Regulat	tions Part 47, S	Subpart C - Int	entional Radi	ators, Radiate	ed Emissions
Section:		15.209			•				
Test Date(s	):	1/20/2016			EUT Serial		0		
Customer:		Virtuix			EUT Part #:		0		
Project Nur		17650-15			Test Techn	ician:	Eric Lifsey		
Purchase O		NA			Supervisor:		Lisa Arndt		
Equip. Und	er Test:	PODS			Witness' N	ame:	Brian Oling	er	
	F	Radiated Em	issions Test	Results Data	a Sheet		Pa	ge: 1	of 1
EUT Li	ne Voltage	: 23	30 VAC		EUT Pow	er Frequen	cy: 5	0 Hz	
Antenna	Orientatio	n:	Horizon	tal	Frequ	ency Range:	;	Above 1	GHz
	EUT N	/lode of Ope	ration:		Trans	mit Mode, I	Modulated,	3 Channels	/EUTs
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
4869.62	3	192	0.6	Peak	41.3	37.517	74.0	-36.4	Pass
9617.39	3	70	0.6	Peak		41.477			
				Peak	34.4	T TI.T/	74.0	-32.5	Pass
4869.62	3	192	0.6	Average	34.4	28.921	74.0 54.0	-32.5 -25.0	Pass Pass
	3	1			<del> </del>				

Mode: Transmit, 3 Channels Power: 230/50 Modulated

Frequency

20±

Operator: Eric Lifsey

17650'012016'Run07'RETxSpurious'3Ch'GAZRadio.til

03:12:59 PM, Saturday, January 23, 2016

18G

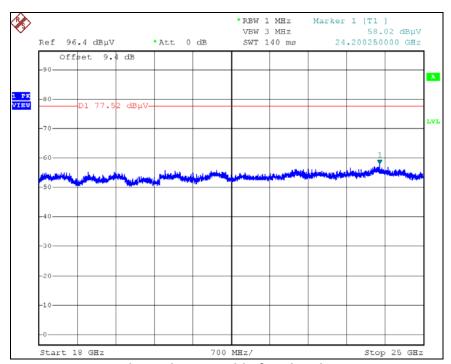
10G

Project Number: 17650-15

EUT: Omni System

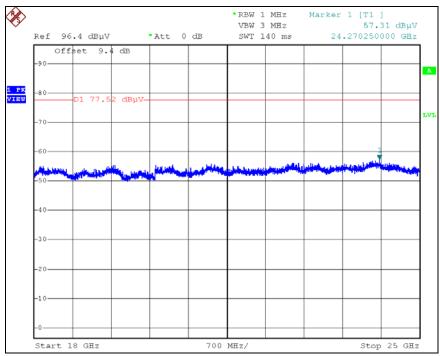
Client: Virtuix

Table 8.3.5: Radiated Spurious Emissions, Transmit Mode, 18 to 26 GHz, Bottom Channel, Vertical & Horizontal Polarity



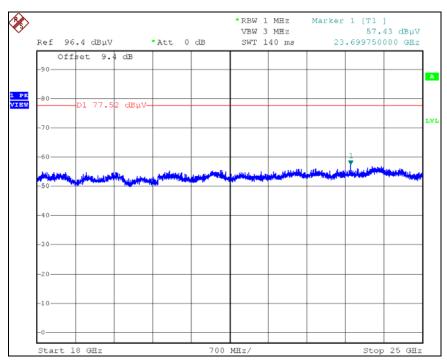
Low Channel, Max Hold of Both Polarities
Corrected for Gain/Loss, Limit as Shown for Distance 20 cm

Table 8.3.6: Radiated Spurious Emissions, Transmit Mode, 18 to 26 GHz, Middle Channel, Vertical & Horizontal Polarity



Middle Channel, Max Hold of Both Polarities
Corrected for Gain/Loss, Limit as Shown for Distance 20 cm

Table 8.3.7: Radiated Spurious Emissions, Transmit Mode, 18 to 26 GHz, Top Channel, Vertical & Horizontal Polarity



High Channel, Max Hold of Both Polarities
Corrected for Gain/Loss, Limit as Shown for Distance 20 cm

### 9.0 Antenna Construction Requirements

The design was investigated for meeting the antenna construction requirements of the applicable rules.

#### 9.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevent wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

### 9.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203 // RSS-Gen 8.3	Antenna Construction	25 Feb 2016

### 9.3 Results

Table 9.3.1 Antenna Construction Details	
Antenna Manufacturer and Model	Specifications
Manufacturer: MAG. LAYERS SCIENTIFIC- TECHNICS CO., LTD Model: P/N LTA-5320-2G4S3-A1-RU	Chip antenna. Peak gain: 0~1 dBi* *The effect of gain is captured in the radiated measurements.

- The antenna is internal only to the device.
- The antenna is soldered component on the circuit board.
- There is no antenna connector.

The antenna design above satisfies the requirements of the rules.

# 10.0 Equipment and Bandwidths

### 10.1 Equipment for Radiated Power, Band Edge and Spurious Emissions 30 MHz to 18 GHz

		Profess	ional Testing, EMI, Inc.		
Test Metho	q.		ls of Measurement of Radio-Noise Emission Range of 9 kHz to 40 GHz" (incorporated	_	
n accordan	ce with:		ederal Regulations Part 47, Subpart C - In	tentional Radiators, F	Radiated Emissio
Section:	15.209		I	<u>_</u>	
Test Date(s): 1/18/2016 Customer: Virtuix			EUT Serial #:  EUT Part #:	<u>'0</u> '0	
Project Number: 17649-15			Test Technician:	Eric Lifsey	
Purchase O			Supervisor:	Lisa Arndt	
Equip. Und	er Test: PODS		Witness' Name:	Brian Olinger, Pa	trick Herron
			d Emissions Test Equipment List		
Til	e! Software Version	on: 4.2.A,	May 23, 2010, 08:38:52 AM		
	Test Profile:		Rad Emissions_ClassA - LowPRF_0727 Rad Emissions_ClassB - LowPRF_0727		
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	2/5/2016
1890	НР	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	2/6/2016
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz, Opt. AYZ	MY44808298	12/15/2016
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	135454	1/25/2017
C027D	none	RG214	Cable Coax, N-N, 25m	none	10/1/2016
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	3/13/2016
2004	Miteq	AFS44-00101800- 2S-10P-44	Amplifier, 40dB, .1-18GHz	0	1/11/2018
C030	none	none	Cable Coax, N-N, 30m	none	10/1/2016
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	110313	2/25/2017

### 10.2 Equipment for Bandwidth and Duty Cycle Timings

Asset #	Manufacturer	Model #	Description	Calibration Due
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	16 Dec 2016

### 10.3 Equipment for 18 to 25 GHz Emission Measurement

Asset #	Manufacturer	Model #	Description	Calibration Due
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	16 Dec 2016
1974	Agilent	83017A	Microwave Amplifier	17 Dec 2017
1542	AH Systems	SAS-572	Horn Antenna, Standard Gain, 20 dB	CNR

### 10.4 Measurement Bandwidths, Radiated

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan							
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range			
0.009	0.15	0.3	2	Multiple Sweeps			
0.15	30	9	6	Multiple Sweeps			
30	1000	120	2	Multiple 800 mS Sweeps			
1000	6000	1000	2	Multiple Sweeps			
6000	18000	1000	2	Multiple Sweeps			
18000	26500	1000	2	Multiple Sweeps			

#### \*Notes:

<sup>1.</sup> The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range.

<sup>2.</sup> The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz.

<sup>3.</sup> The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.

<sup>4.</sup> The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz.

<sup>5.</sup> The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.

#### Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

#### 1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

**Table 1: Summary of Measurement Uncertainties for Site 45** 

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
Radiated Emissions	1 to 18 GHz	3 m	5.7

### **End of Report**

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