
Project 17731-15

**Triax Technologies
SIM-G**

Wireless Certification Report

Prepared for:

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By

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23 Sep 2016

Reviewed by



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Written by



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Revision History

Revision Number	Description	Date
00	Draft for review.	14 Sep 2016
01	Final; revised per internal review.	23 Sep 2016
02	Revised.	18 May 2017

Corrections:

None.

Table of Contents

Revision History..... 2

Compliance Certificate..... 4

1.0 Introduction..... 5

 1.1 Scope..... 5

 1.2 EUT Description 5

 1.3 EUT Operation..... 5

 1.4 Modifications to Equipment..... 5

 1.5 Test Site 5

 1.6 Radiated Measurements 6

 1.7 Applicable Documents and Clauses..... 6

2.0 Fundamental Power 7

 2.1 Test Procedure 7

 2.2 Test Criteria 7

 2.3 Test Results, Peak Power 7

 2.4 Test Results, Duty Cycle..... 7

3.0 Power Spectral Density 10

 3.1 Test Procedure 10

 3.2 Test Criteria 10

 3.3 Test Results..... 10

4.0 Occupied Bandwidth..... 12

 4.1 Test Procedure 12

 4.2 Test Criteria 12

 4.3 Test Results..... 12

 4.3.1 Bandwidth Plots, 6 dB..... 13

 4.3.2 Bandwidth Plots, 20 dB..... 14

5.0 Radiated Spurious Emissions, Receive Mode..... 15

 5.1 Test Procedure 15

 5.2 Test Criteria 15

 5.3 Test Results..... 15

6.0 Radiated Spurious Emissions, Transmit Mode 20

 6.1 Test Procedure 20

 6.2 Test Criteria 20

 6.3 Test Results..... 20

7.0 Antenna Construction Requirements 33

 7.1 Procedure 33

 7.2 Criteria 33

 7.3 Results..... 33

8.0 Equipment..... 34

 8.1 Radiated Emissions 30 MHz to 10 GHz 34

 8.2 Bandwidth and Duty Cycle..... 35

9.0 Measurement Bandwidths..... 36

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty 37

End of Report 38

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Compliance Certificate

Applicant	Device & Test Identification
Triax Technologies (Justin Morgenthau) 66 Fort Point Street Norwalk, CT 06855 Certificate Date: 23 Sep 2016	FCC ID: 2AGHISIM-G Industry Canada ID: 21358-SIMG Model(s): SIM-G Laboratory Project ID: 17731-15

The device named above was 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	15.205	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 2	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)

*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 and test procedures 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

Table 1.2.1: Equipment Under Test		
Manufacturer / Model	Serial #	Description
Triax Technologies SIM-G	none	915 MHz FHSS transceiver.

Table 1.2.2: Support Equipment		
Manufacturer / Model	Serial #	Description
none		none

The EUT part of a wireless network for collecting data on a proprietary sensor network.

The EUT measures approximately 65 mm x 27 mm x 10 mm not including the integral antenna whip. It is powered by a rechargeable battery. There are no I/O or RF connectors. The EUT is recharged by any USB source.

1.3 EUT Operation

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

1.4 Modifications to Equipment

No modifications were made to the EUT during the performance of the test program. For testing purposes, the EUT had wires added to allow external input of power, and the firmware was modified to operate on the desired channels with modulation to facilitate testing.

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:

$$\text{Raw Measured Level} + \text{Antenna Factor} + \text{Cable Losses} - \text{Amplifier Gain} = \text{Corrected Level}$$

Conducted RF levels, if applicable, are determined as follows:

$$\text{Raw Measured Level} + \text{Attenuator Factor} + \text{Cable Losses} = \text{Corrected Level}$$

Conducted mains levels are determined as follows:

$$\text{Raw Measured Level} + \text{LISN Factor} + \text{Cable/Filter/Limiter Losses} = \text{Corrected Level}$$

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 Subpart C -Intentional Radiators
RSS-247 Issue 2	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
ANSI C63.10 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Table 1.7.2: Applicable Clauses		
Parameter	FCC Part 15 Rule Paragraphs	IC RSS References
Transmitter Characteristics	15.247	RSS-247 5.2 (DTS) & 5.4, RSS-Gen
Bandwidth	15.247(a)(1), 2.1049, KDB 558074 D01	RSS-Gen 4.6
Spurious Emission	15.247, 15.209, 15.205	RSS-247 5.5, RSS-GEN 4.9, 4.10
Band Edge	15.247, 15.205	RSS-247 5.5, RSS-Gen 4.9
Antenna Requirement	15.203	RSS-Gen 8.3

2.0 Fundamental Power

2.1 Test Procedure

Peak power is measured using radiated means with modulation. The transmitter hopping sequence is disabled to operate on a single channel for the measurement.

2.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(a)(3) // RSS-247 5.2	Fundamental Power Conducted Limits 1 W Limit Restated as Field: 125.23 dBμV/m @ 3 m 114.78 dBμV/m @ 10 m	23 Aug 2016

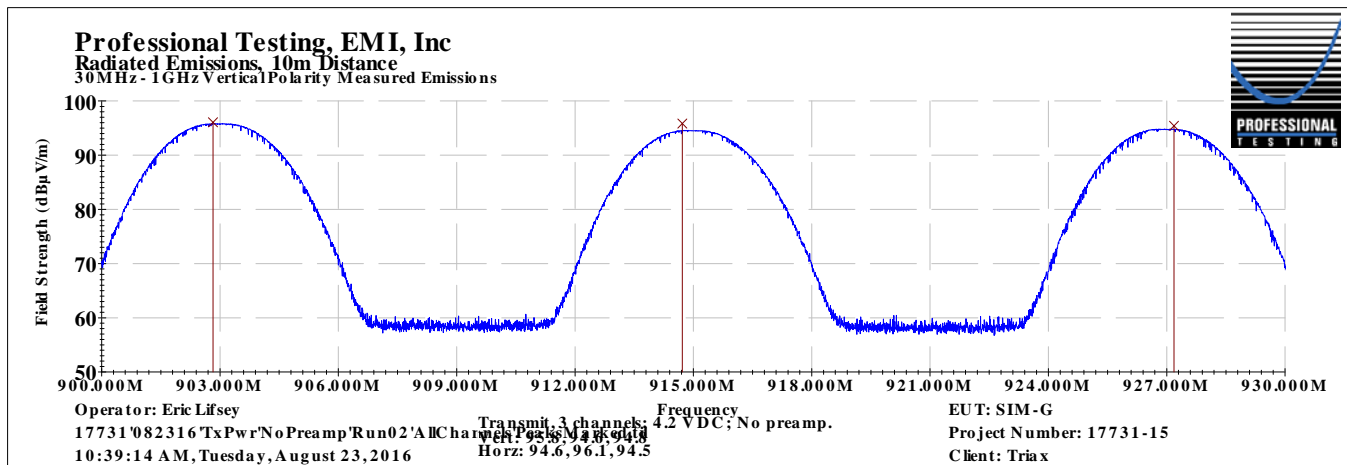
2.3 Test Results, Peak Power

The EUT was measured for radiated power in three orthogonal orientations.

Frequency MHz	Measured Peak Power dBμV/m @ 10 m Vertical Polarity	Maximum Measured Peak Power Restated as EIRP in dBm	Maximum Measured Peak Power Restated as EIRP in mW
903	96.1	11.3	13.6
915	95.8	11.0	12.7
927	95.4	10.6	11.6

Measured in 3 MHz RBW, 3 MHz VBW.

The EUT satisfied the requirements. Plotted measurements appear below.



2.4 Test Results, Duty Cycle

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

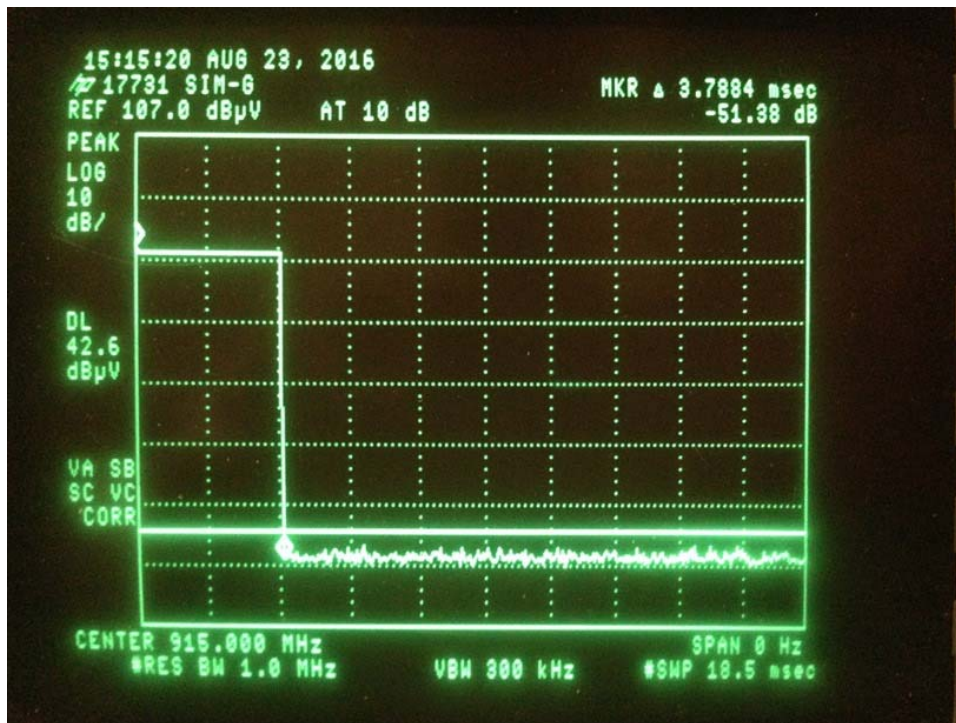
converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

Table 2.5.1 Duty Cycle Results and Average Duty Cycle Factor Result				
Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
3.79	305.4	$= 20 * \text{Log}_{10} (3.79 \text{ msec} / 305.4 \text{ msec})$	-38.1	-20.0

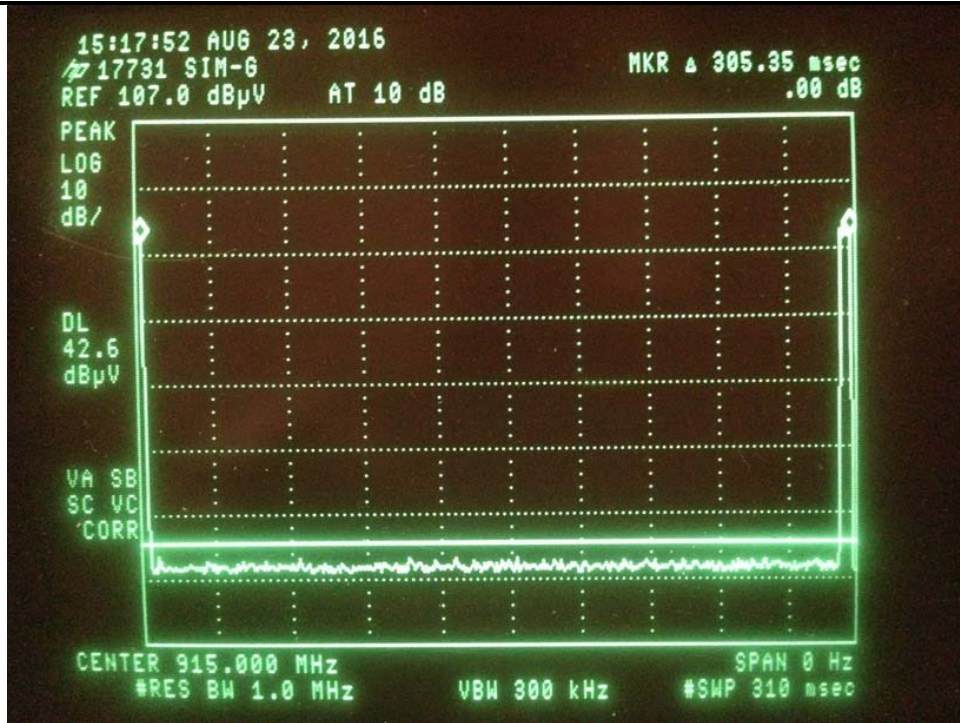
The allowed duty cycle factor is applied to peak measured harmonic signals to find average levels.

Table 2.5.2 Source Averaging Factor (for exposure)				
Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
3.79	305.4	$= 10 * \text{Log}_{10} (3.79 \text{ msec} / 305.4 \text{ msec})$	-19.1	-19.1

Plotted results appear below.



Transmit On Time



Transmit Period

3.0 Power Spectral Density

3.1 Test Procedure

A spectrum analyzer is either connected directly to the EUT or used by radiated means to measure the fundamental emission. It is adjusted to measure the power spectral density in the specified resolution bandwidth.

3.2 Test Criteria

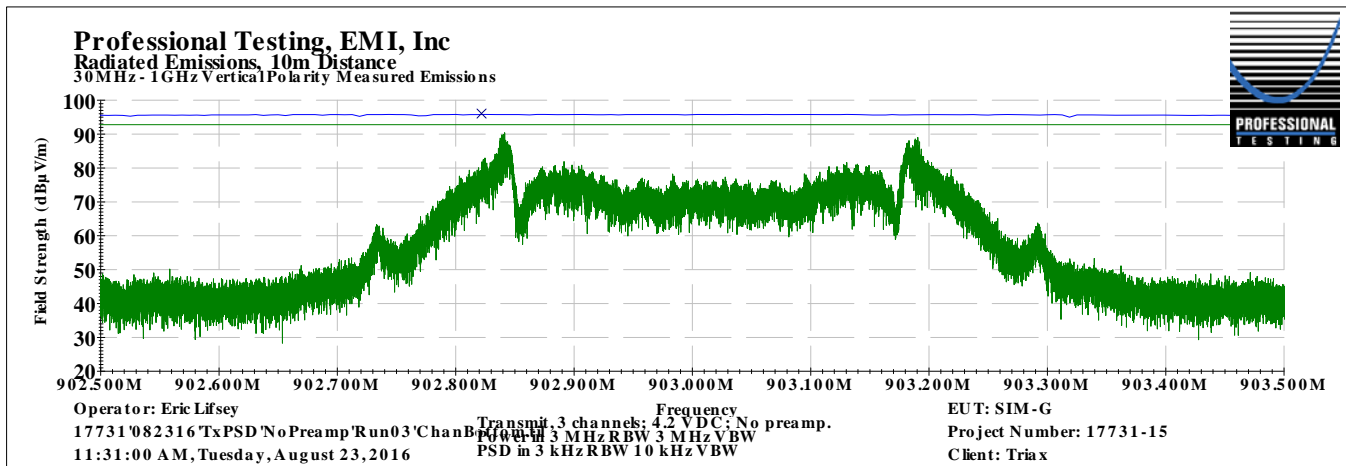
47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(e) // RSS-247, 5.2	Power Spectral Density, Conducted Limit: 8 dBm / 3 kHz Restated as field strength limit: 103.23 dB μ V/m at 3 m, 92.8 dB μ V/m at 10 m	23 Aug 2016

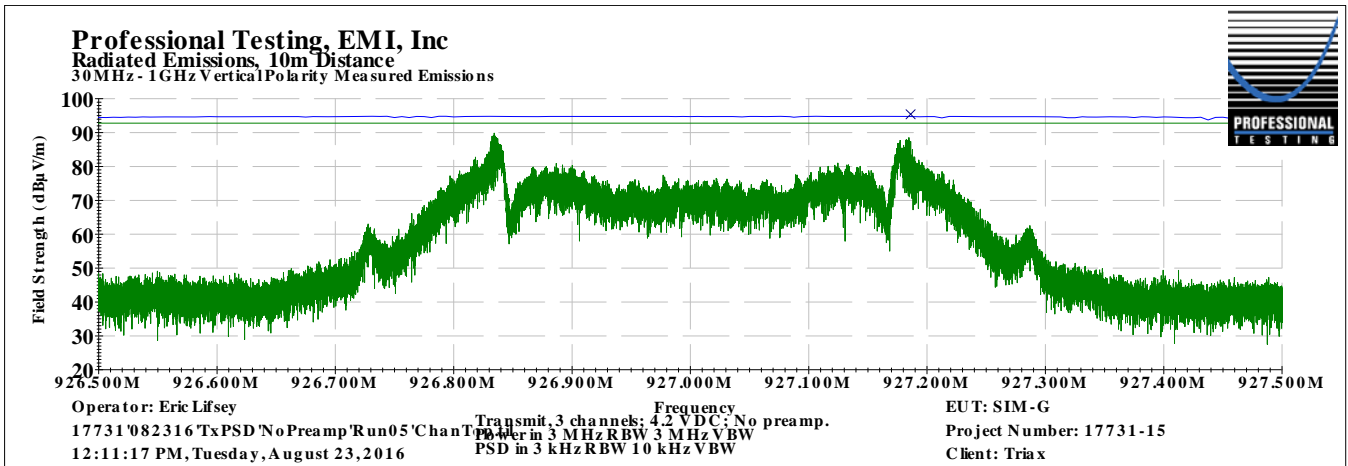
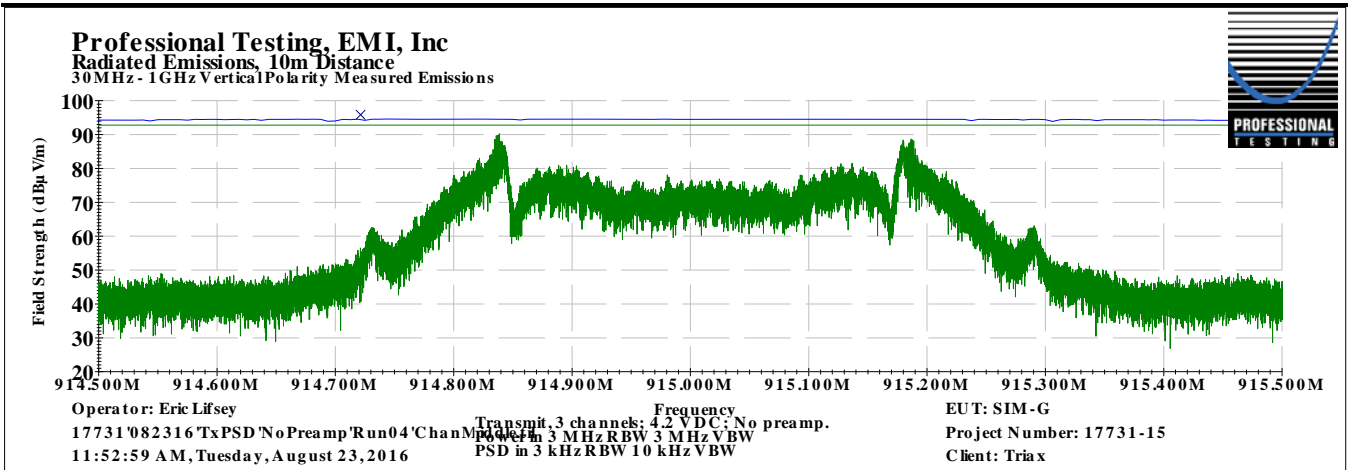
3.3 Test Results

Table 3.3.1 Power Spectral Density, Radiated, at 10 m (Worse case: flat and vertical polarity.)		
Frequency MHz	Measured Peak Power dB μ V/m @ 10 m Vertical Polarity	Maximum Measured Peak Power Restated as EIRP in dBm
903	90.3	5.5
915	90.2	5.4
927	89.8	5.0

Measured in 3 kHz RBW, 10 kHz VBW.

Plotted results included below.





4.0 Occupied Bandwidth

4.1 Test Procedure

Bandwidth is measured by radiated means. A recording of the results is included.

4.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
14.247(a)(2), 2.1049, KDB 558074 D01 // RSS-Gen 4.6	Bandwidth, 6 dB, 20 dB	25 Jul 2016

4.3 Test Results

The bandwidth measurement is used to verify DTS characteristics and/or for general reporting for agency application.

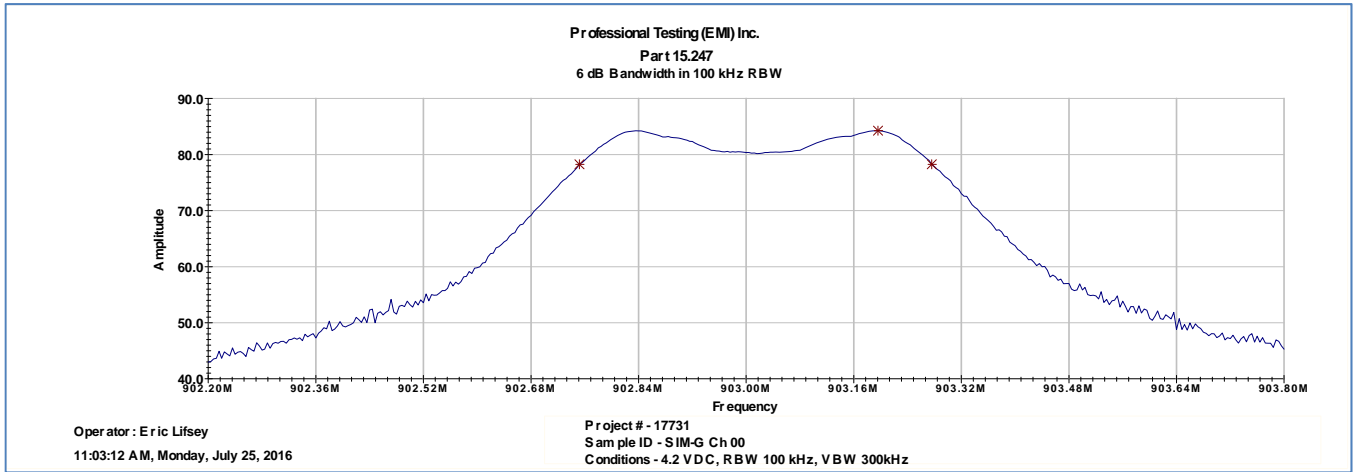
The EUT was found to be in compliance with applicable requirements.

Table 5.3.1 Bandwidth 6 dB, Minimum 500 kHz in 100 kHz RBW			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Minimum BW (kHz)
524	528	528	524

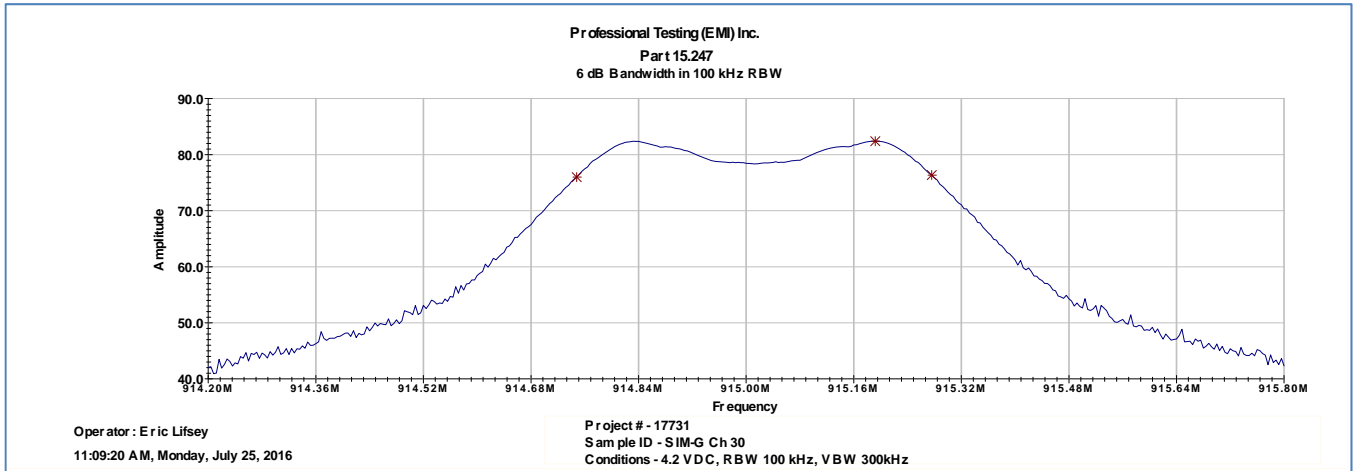
Table 5.3.2 Bandwidth 20 dB, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
480	472	472	480

Plotted measurements appear on the following pages.

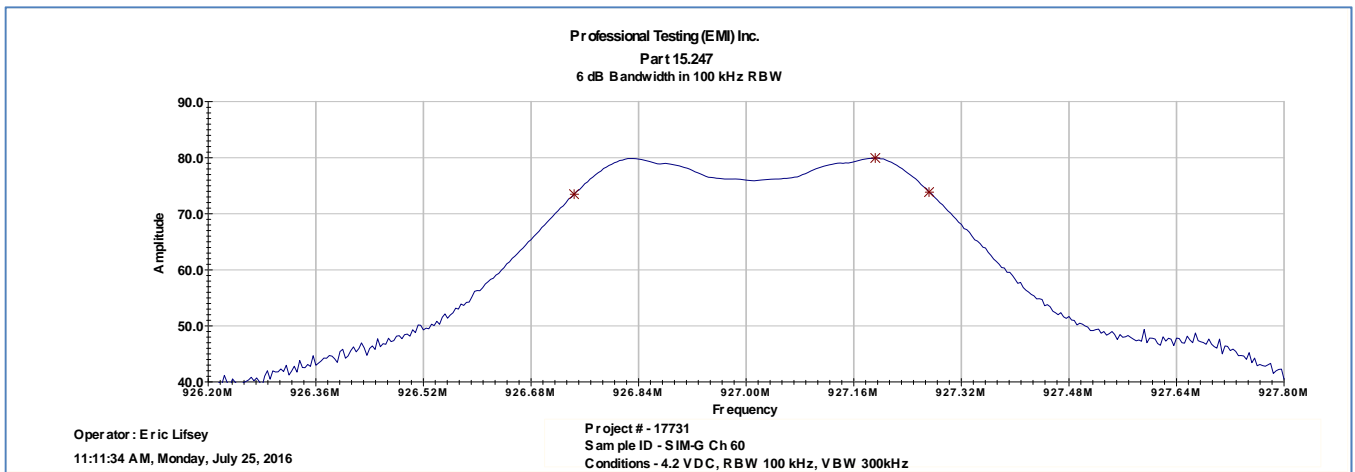
4.3.1 Bandwidth Plots, 6 dB



6 dB, Low Channel

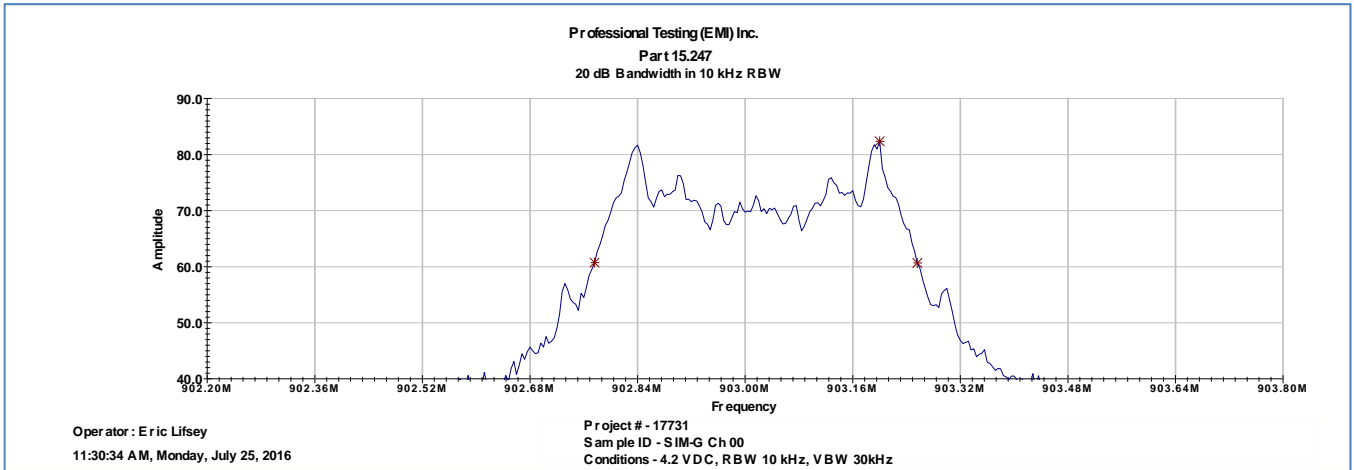


6 dB, Middle Channel

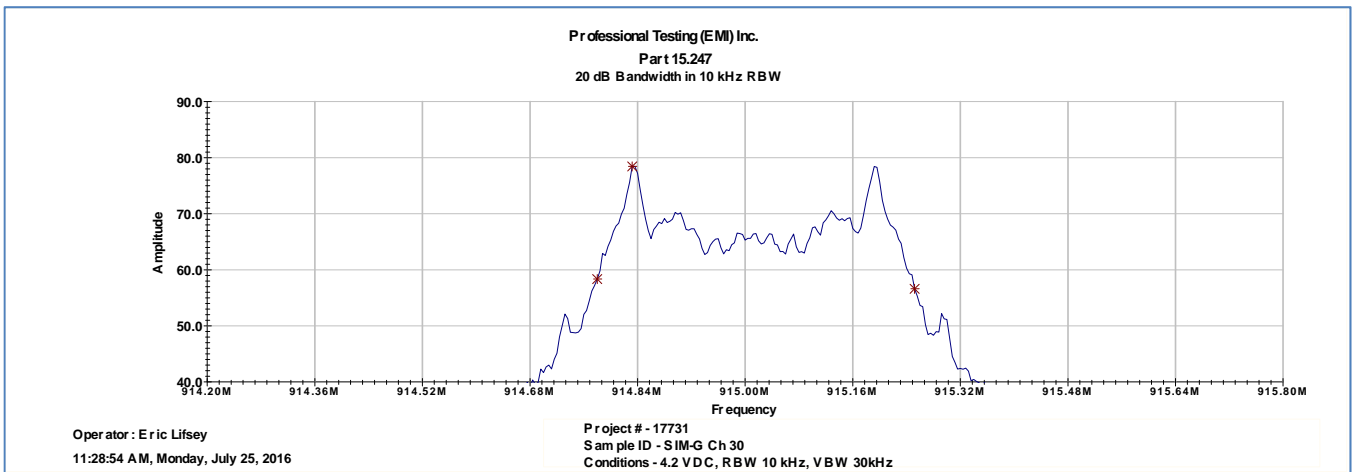


6 dB, High Channel

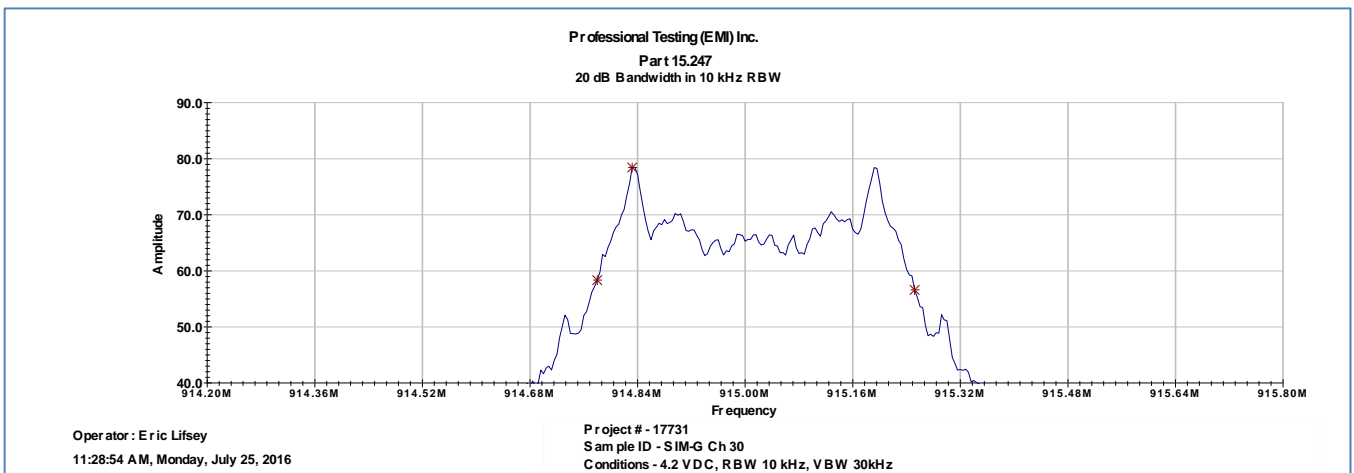
4.3.2 Bandwidth Plots, 20 dB



20 dB, Low Channel



20 dB, Middle Channel



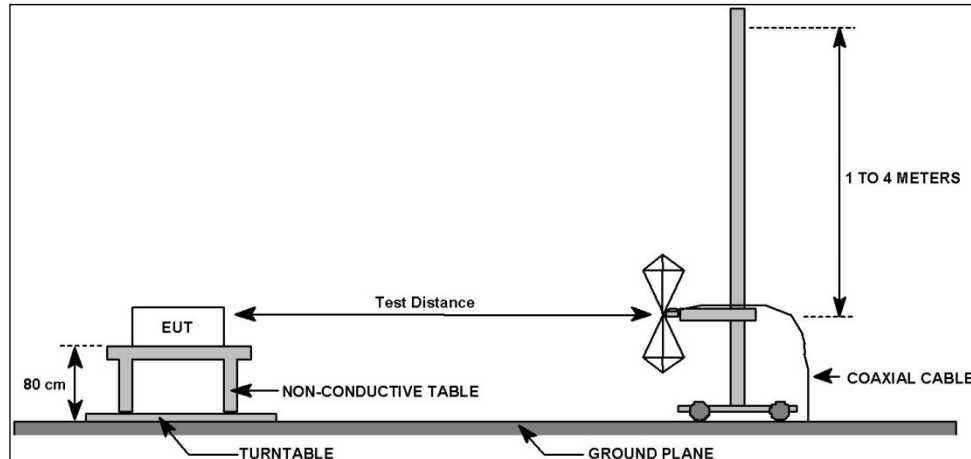
20 dB, High Channel

5.0 Radiated Spurious Emissions, Receive Mode

5.1 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. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate and 1 MHz resolution bandwidth. A diagram showing the test setup appears below.



5.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-247 5.5, RSS-Gen 4.9 & 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Receive Mode	5 Apr 2016

5.3 Test Results

The EUT was tuned to the middle channel and placed in receive mode.

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

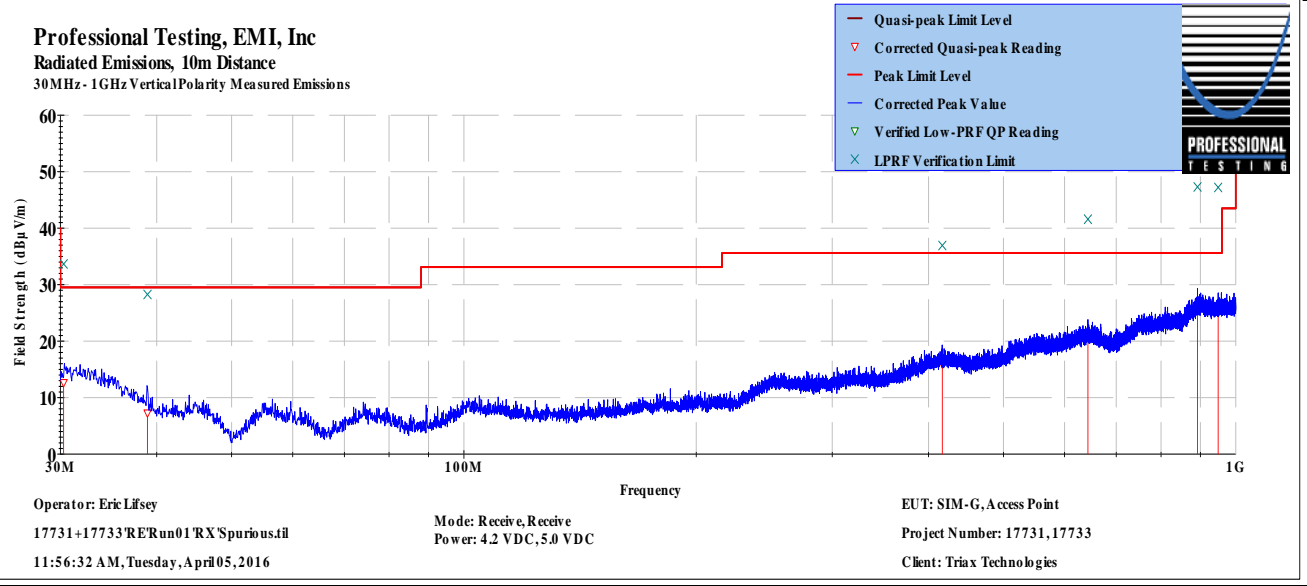
Table 6.3.1: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	4/5/2016	EUT Serial #:	None
Customer:	Triax Technologies	EUT Part #:	SIM-G, Access Point
Project Number:	17731-15, 17733-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G, Access Point	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2, 5.0	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Receiving						
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
30.2978	10	46	1.47	Quasi-peak	24.1	12.651	29.5	-16.8	Pass
38.908	10	324	3.03	Quasi-peak	24	7.243	29.5	-22.3	Pass
416.708	10	202	3.81	Quasi-peak	22.3	15.926	35.6	-19.7	Pass
643.354	10	3	4.12	Quasi-peak	22	20.581	35.6	-15.0	Pass
892.314	10	227	1.68	Quasi-peak	21.4	26.28	35.6	-9.3	Pass
949.202	10	165	2.03	Quasi-peak	21	26.199	35.6	-9.4	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 6.3.2: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Horizontal Polarity

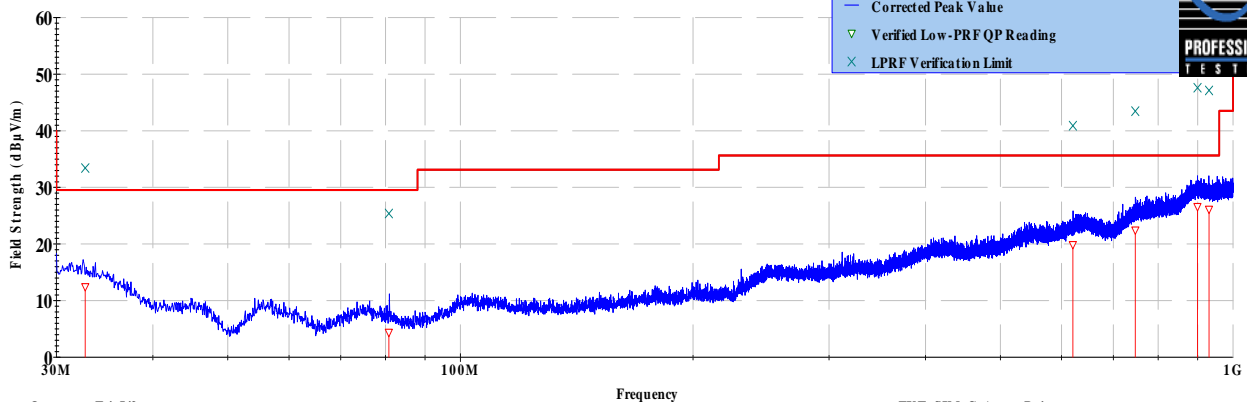
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	4/5/2016	EUT Serial #:	None
Customer:	Triax Technologies	EUT Part #:	SIM-G, Access Point
Project Number:	17731-15, 17733-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G, Access Point	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2, 5.0	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Receiving						
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
32.6942	10	327	3.97	Quasi-peak	23.9	12.419	29.5	-17.1	Pass
80.8125	10	284	1.29	Quasi-peak	23.3	4.37	29.5	-25.1	Pass
620.515	10	13	1.61	Quasi-peak	22	19.89	35.6	-15.7	Pass
747.454	10	269	3.57	Quasi-peak	21.7	22.444	35.6	-13.2	Pass
899.912	10	249	1.85	Quasi-peak	21.3	26.594	35.6	-9.0	Pass
931.088	10	5	3.5	Quasi-peak	21.1	26.111	35.6	-9.5	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey
17731+17733'RERun01'RX'Spurious.tif
11:56:32 AM, Tuesday, April 05, 2016

Mode: Receive, Receive
Power: 4.2 VDC, 5.0 VDC

EUT: SIM-G, Access Point
Project Number: 17731, 17733
Client: Triax Technologies

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 6.3.3: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	4/5/2016	EUT Serial #:	None
Customer:	Triax Technologies	EUT Part #:	SIM-G, Access Point
Project Number:	17731-15, 17733-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G, Access Point	Witness' Name:	None

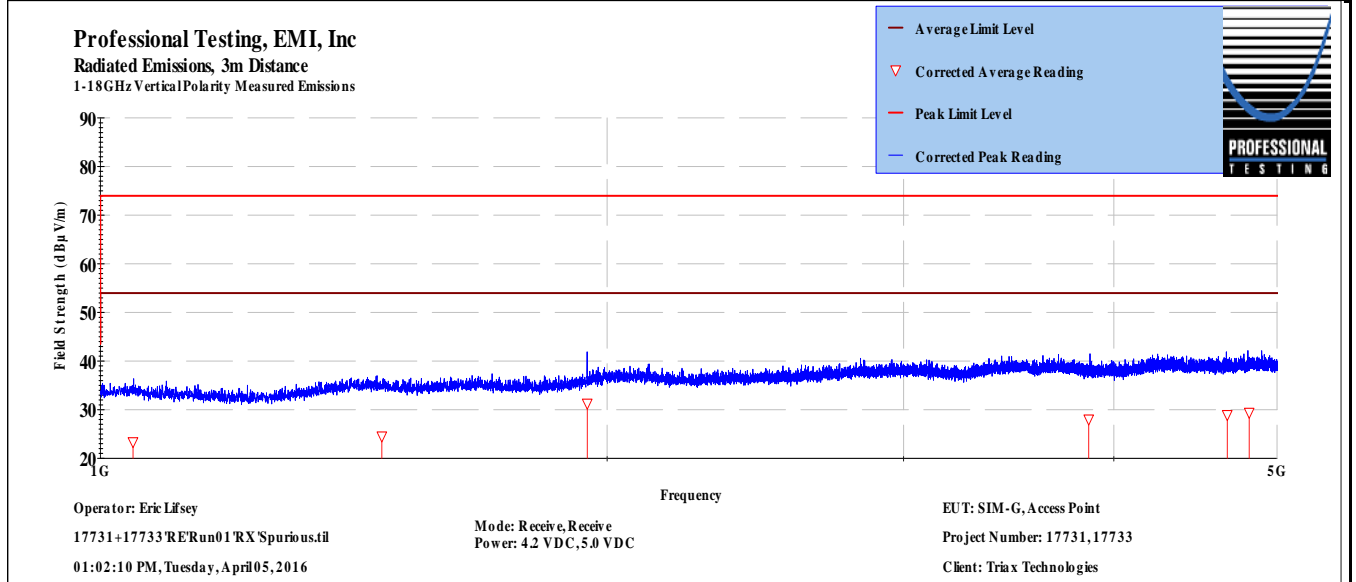
Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	4.2, 5.0 VDC	EUT Power Frequency:	0 N/A
--------------------------	--------------	-----------------------------	-------

Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
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EUT Mode of Operation: Receiving

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
1045.47	3	225	1	Average	35	23.36	54.0	-30.6	Pass
1469.52	3	280	1	Average	35.9	24.532	54.0	-29.4	Pass
1946.32	3	296	1	Average	40.3	31.27	54.0	-22.7	Pass
3864.83	3	332	1	Average	33.8	28.028	54.0	-25.9	Pass
4671.35	3	211	1	Average	33.1	28.936	54.0	-25.0	Pass
4814.04	3	65	1	Average	33.4	29.395	54.0	-24.6	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Table 6.3.4: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Horizontal Polarity

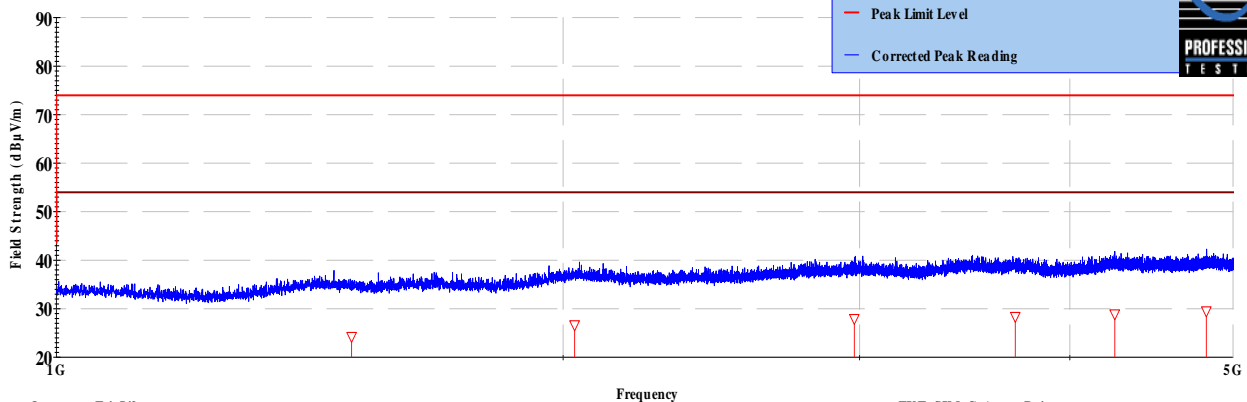
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	4/5/2016	EUT Serial #:	None
Customer:	Triax Technologies	EUT Part #:	SIM-G, Access Point
Project Number:	17731-15, 17733-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G, Access Point	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: **1** of **1**

EUT Line Voltage:	4.2, 5.0	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Receiving						
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
1497.48	3	352	1	Average	35.5	24.235	54.0	-29.7	Pass
2031.69	3	175	1	Average	35.3	26.633	54.0	-27.3	Pass
2978.64	3	208	1	Average	34.4	27.923	54.0	-26.0	Pass
3712.41	3	272	1	Average	34.4	28.346	54.0	-25.6	Pass
4253.29	3	217	1	Average	33.7	28.895	54.0	-25.1	Pass
4821.29	3	268	1	Average	33.5	29.502	54.0	-24.5	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 3m Distance
1-18GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey
17731+17733'RERun01'RX Spurious.tif
01:02:10 PM, Tuesday, April 05, 2016

Mode: Receive, Receive
Power: 4.2 VDC, 5.0 VDC

EUT: SIM-G, Access Point
Project Number: 17731, 17733
Client: Triax Technologies

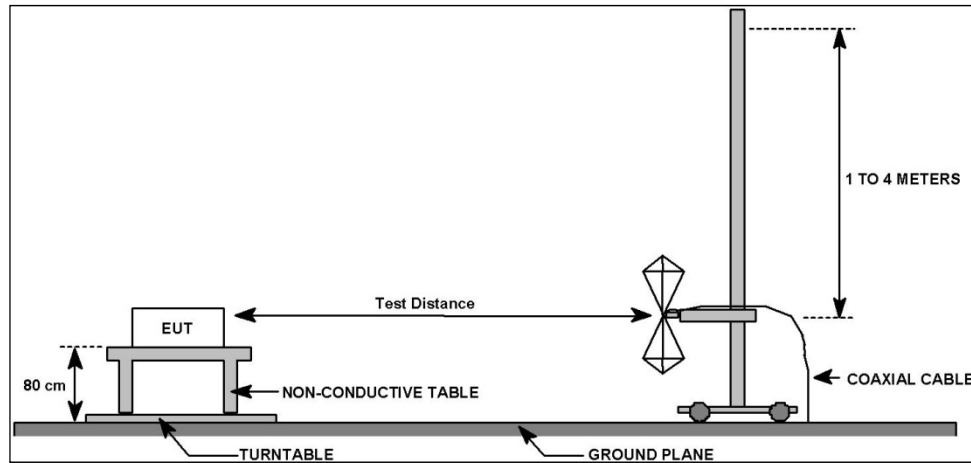
> 1GHz Horizontal Antenna Polarity Measured Emissions

6.0 Radiated Spurious Emissions, Transmit Mode

6.1 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. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate using 1 MHz resolution bandwidth. A diagram showing the test setup appears below.



6.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-247 5.5, RSS-Gen 4.9 & 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Transmit Mode	14 Apr 2016

6.3 Test Results

Modulation was enabled for this test and the transmitter was placed into continuous transmit mode.

The duty cycle averaging factor applies -20.0 dB to the peaks recorded for the harmonics. Therefore if the peak limit is satisfied, the average limit is also satisfied.

All measurements used peak detection.

Table 7.3.1: TX Mode, Low Channel, Below 1 GHz, Vertical Polarity

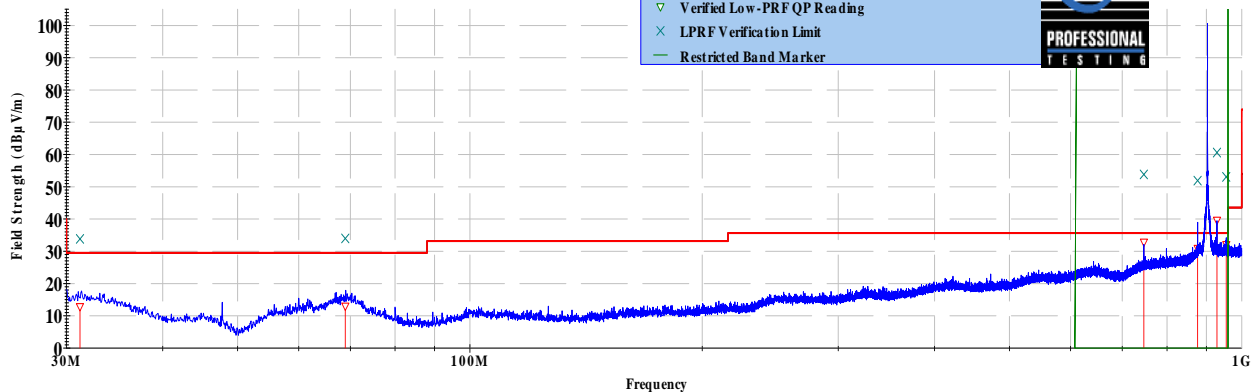
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Transmit; Channel:						
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
31.248	10	321	1.33	Quasi-peak	24.3	12.791	29.5	-16.7	Pass
68.9699	10	64	1.67	Quasi-peak	33.1	12.949	29.5	-16.6	Pass
746.783	10	248	2.26	Quasi-peak	32.1	32.773	35.6	-2.8	Pass
876.781	10	71	3.86	Quasi-peak	26.8	30.856	35.6	-4.7	Pass
928.841	10	251	1.74	Quasi-peak	34.6	39.581	80.0	-40.4	Pass
954.812	10	29	1.55	Quasi-peak	26.8	32.029	35.6	-3.6	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey

17731'RERun01'TX'Spurious'LowChan.tif

01:59:17 PM, Thursday, April 14, 2016

Mode: Transmit, Low Channel
Power: 4.2 VDC

EUT: SIM-G

Project Number: 17731-15

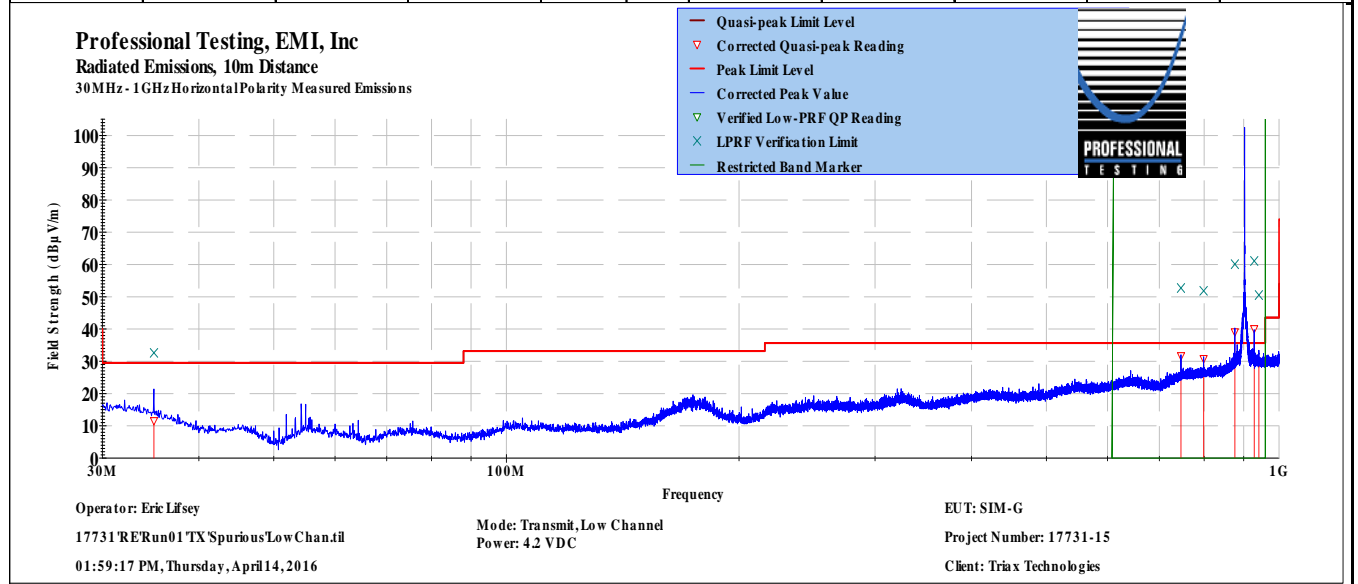
Client: Triax Technologies

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: TX Mode, Low Channel, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet								Page:	1	of	1
EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A						
Antenna Orientation:	Horizontal			Frequency Range:	30MHz to 1GHz						
EUT Mode of Operation:				Transmit; Channel:							
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		
34.9863	10	9	1.54	Quasi-peak	23.1	11.589	29.5	-17.9	Pass		
746.795	10	125	1.38	Quasi-peak	31	31.672	35.6	-3.9	Pass		
798.842	10	155	1.18	Quasi-peak	29.2	30.793	35.6	-4.8	Pass		
876.836	10	150	1.1	Quasi-peak	35	39.069	80.0	-40.9	Pass		
928.854	10	143	1.05	Quasi-peak	35.1	40.071	80.0	-39.9	Pass		
941.817	10	148	1.4	Quasi-peak	24.4	29.506	35.6	-6.1	Pass		



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.3: TX Mode, Low Channel, Above 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		4/14/2016			EUT Serial #:		Channel 2, 32, 64		
Customer:		Triax Technologies			EUT Part #:		SIM-G		
Project Number:		17731-15			Test Technician:		Eric Lifsey		
Purchase Order #:		NA			Supervisor:		Lisa Arndt		
Equip. Under Test:		SIM-G			Witness' Name:		None		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		4.2 VDC		EUT Power Frequency:		0 N/A			
Antenna Orientation:		Vertical			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit; Channel:				
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
3611.26	3	61	1	Peak	66.1	60.063	74.0	-13.9	Pass
5416.73	3	50	1	Peak	55.5	53.051	74.0	-20.9	Pass

Professional Testing, EMI, Inc
 Radiated Emissions, 3m Distance
 1-18GHz VerticalPolarity Measured Emissions

Operator: Eric Lifsey
 17731'RERun01TX'SpuriousLowChan.dil
 02:22:16 PM, Thursday, April 14, 2016

Mode: Transmit, Low Channel
 Power: 4.2 VDC

EUT: SIM-G
 Project Number: 17731-15
 Client: Triax Technologies

> 1GHz Vertical Antenna Polarity Measured Emissions

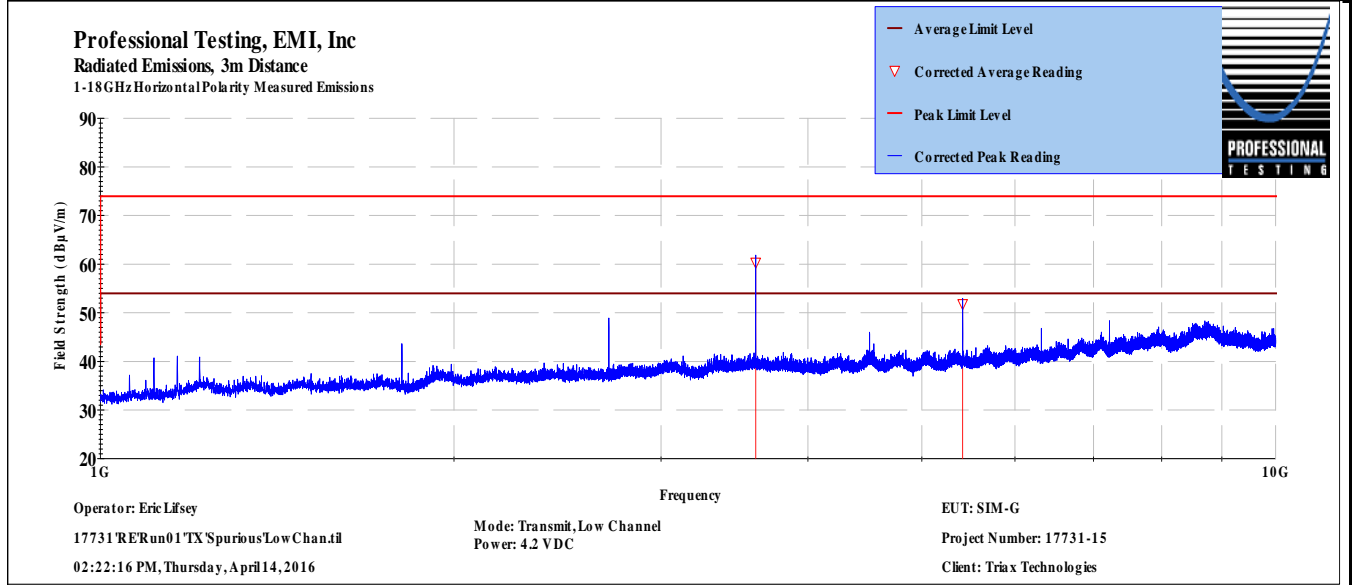
Table 7.3.4: TX Mode, Low Channel, Above 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz	
EUT Mode of Operation:			Transmit; Channel:		

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
3611.33	3	327	1	Peak	67.1	61.126	74.0	-12.8	Pass
5416.78	3	265	1	Peak	56.3	53.842	74.0	-20.1	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

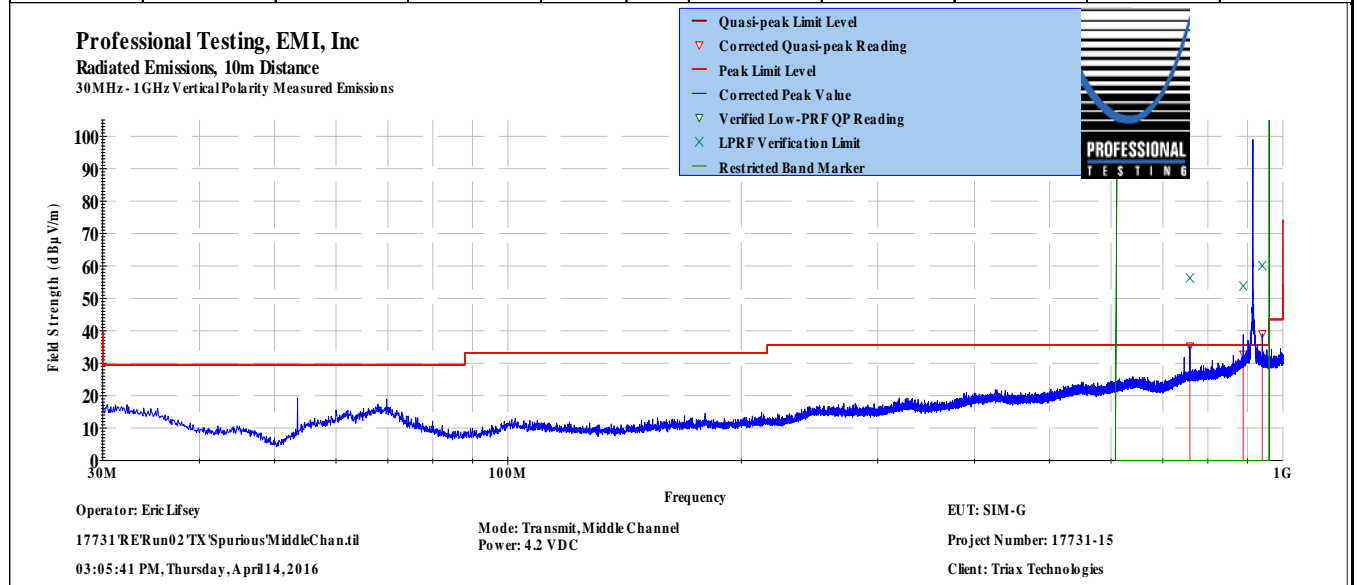
Table 7.3.5: TX Mode, Middle Channel, Below 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Transmit; Channel: Middle						
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
758.797	10	242	1.93	Quasi-peak	34.3	35.274	35.6	-0.3	Pass
888.813	10	74	4.06	Quasi-peak	28	32.775	35.6	-2.8	Pass
940.781	10	249	1.88	Quasi-peak	34	39.083	80.0	-40.9	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

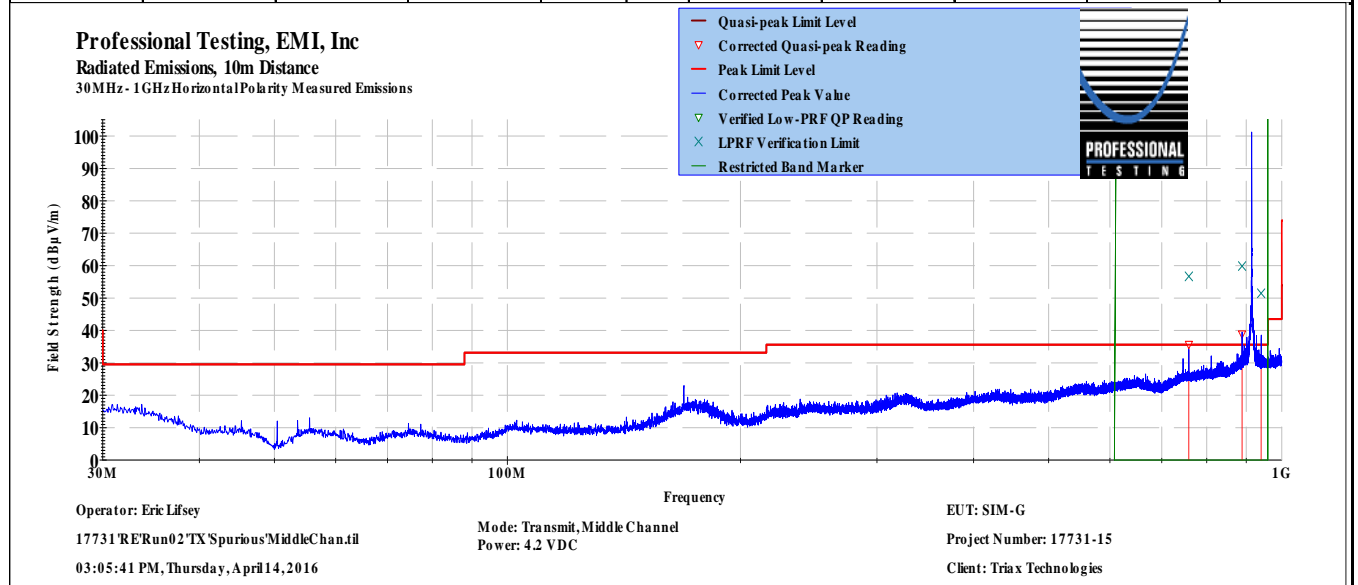
Table 7.3.5: TX Mode, Middle Channel, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Transmit; Channel: Middle						
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
758.808	10	128	1.17	Quasi-peak	34.7	35.665	80.0	-44.3	Pass
888.784	10	158	1.11	Quasi-peak	34.1	38.858	80.0	-41.1	Pass
940.792	10	139	3.89	Quasi-peak	25.4	30.461	35.6	-5.1	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

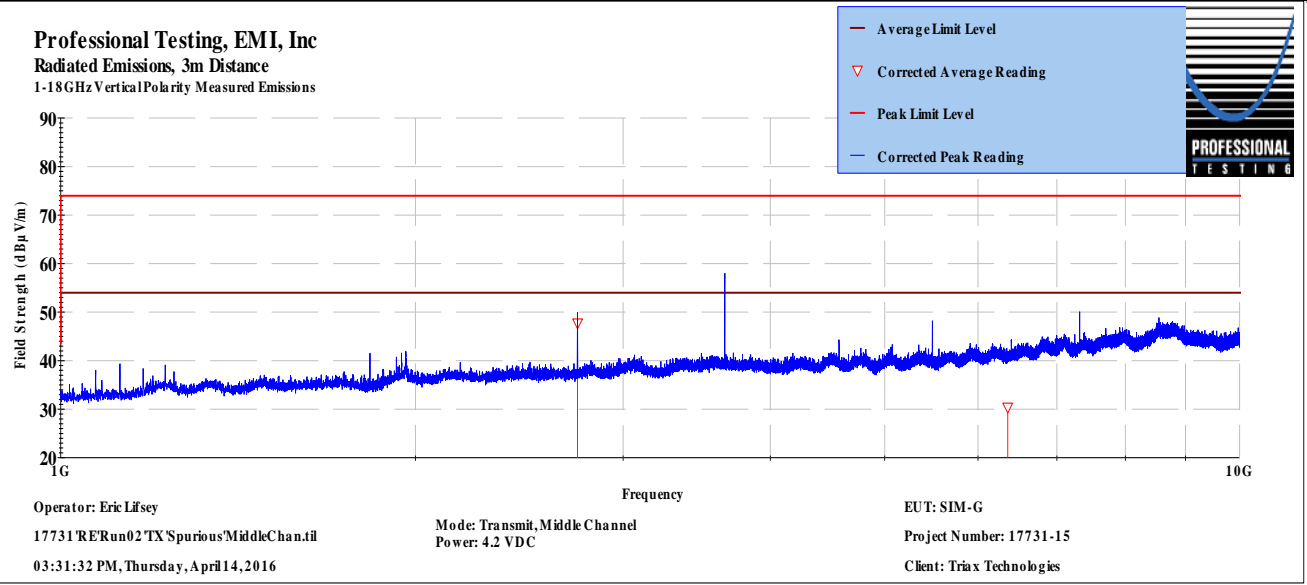
Table 7.3.6: TX Mode, Middle Channel, Above 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Transmit; Channel: Middle						
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
2744.56	3	97	1	Peak	58.3	50.424	74.0	-23.5	Pass
6358.65	3	56	1	Peak	39.4	39.934	74.0	-34.0	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.7: TX Mode, Middle Channel, Above 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		4/14/2016			EUT Serial #:		Channel 2, 32, 64		
Customer:		Triax Technologies			EUT Part #:		SIM-G		
Project Number:		17731-15			Test Technician:		Eric Lifsey		
Purchase Order #:		NA			Supervisor:		Lisa Arndt		
Equip. Under Test:		SIM-G			Witness' Name:		None		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		4.2 VDC		EUT Power Frequency:		0 N/A			
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit; Channel: Middle				
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
2744.53	3	199	1	Peak	57	49.115	74.0	-24.8	Pass
3659.39	3	33	1	Peak	63.9	57.84	74.0	-16.1	Pass

Professional Testing, EMI, Inc
 Radiated Emissions, 3m Distance
 1-18GHz Horizontal Polarity Measured Emissions

The graph displays the measured field strength in dBµV/m across a frequency range from 1 GHz to 10 GHz. Two horizontal red lines represent the Average Limit Level (at approximately 74 dBµV/m) and the Peak Limit Level (at approximately 55 dBµV/m). A blue line shows the corrected average reading, which remains below the average limit level. Two red triangles indicate corrected peak readings at 2744.53 MHz and 3659.39 MHz, both of which are below the peak limit level. The background shows a noisy signal with several peaks.

Operator: Eric Lifsey
 17731'RERun02TX'Spurious'MiddleChan.tif
 03:31:32 PM, Thursday, April 14, 2016

Mode: Transmit, Middle Channel
 Power: 4.2 VDC

EUT: SIM-G
 Project Number: 17731-15
 Client: Triax Technologies

> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.8: TX Mode, High Channel, Below 1 GHz, Vertical Polarity

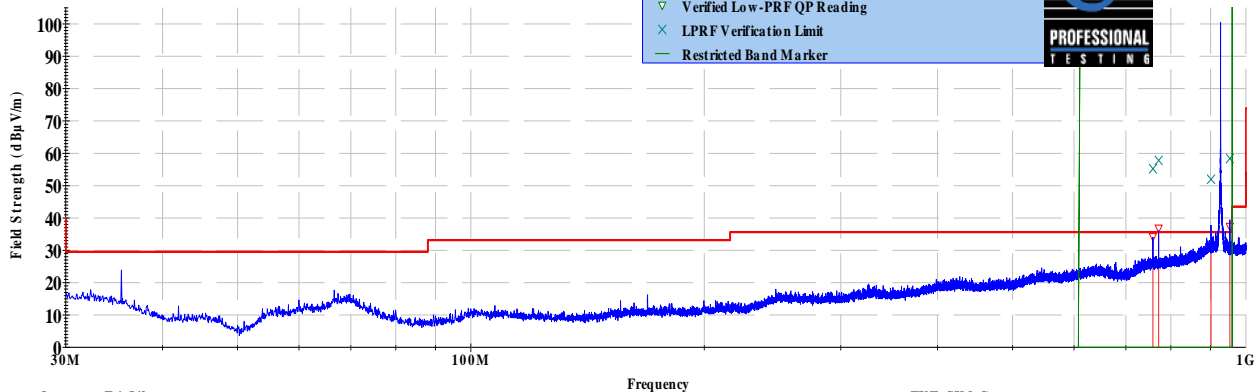
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Transmit; Channel: High						
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
758.568	10	249	2.35	Quasi-peak	33.2	34.172	35.6	-1.4	Pass
771.6	10	250	2.16	Quasi-peak	35.8	36.798	80.0	-43.2	Pass
901.586	10	73	4.08	Quasi-peak	25.7	30.93	35.6	-4.7	Pass
953.572	10	37	4.07	Quasi-peak	32.1	37.36	80.0	-42.6	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey
17731 RE'Run03 TX 'Spurious' High Chan.tif
04:17:12 PM, Thursday, April 14, 2016

Mode: Transmit, High Channel
Power: 4.2 VDC

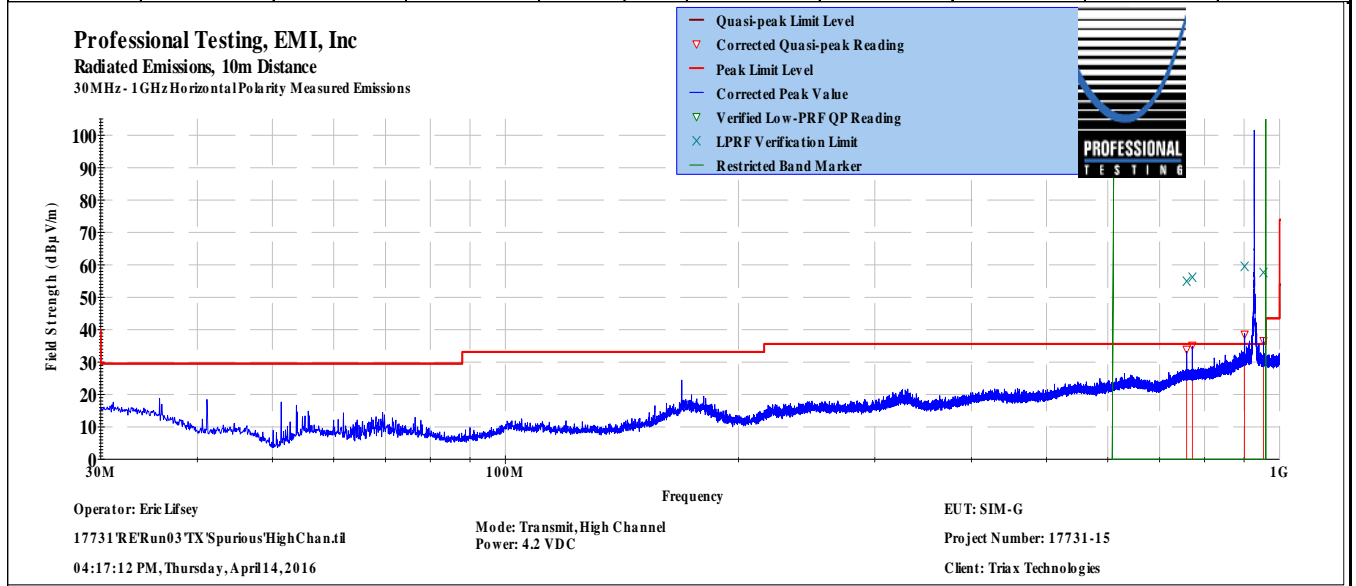
EUT: SIM-G
Project Number: 17731-15
Client: Triax Technologies

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.9: TX Mode, High Channel, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet						Page: 1 of 1			
EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal			Frequency Range:	30MHz to 1GHz				
EUT Mode of Operation:				Transmit; Channel: High					
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
758.643	10	130	1.07	Quasi-peak	33	33.919	35.6	-1.7	Pass
771.616	10	141	1.27	Quasi-peak	34.1	35.173	35.6	-0.4	Pass
901.579	10	155	1.08	Quasi-peak	33.3	38.548	80.0	-41.5	Pass
953.554	10	141	1.13	Quasi-peak	31.4	36.633	80.0	-43.4	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.11: TX Mode, High Channel, Above 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.											
Test Method:		ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices									
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits									
Section:		15.209									
Test Date(s):		4/14/2016			EUT Serial #:		Channel 2, 32, 64				
Customer:		Triax Technologies			EUT Part #:		SIM-G				
Project Number:		17731-15			Test Technician:		Eric Lifsey				
Purchase Order #:		NA			Supervisor:		Lisa Arndt				
Equip. Under Test:		SIM-G			Witness' Name:		None				
Radiated Emissions Test Results Data Sheet							Page: 1 of 1				
EUT Line Voltage:		4.2 VDC		EUT Power Frequency:		0 N/A					
Antenna Orientation:				Vertical		Frequency Range:				Above 1GHz	
EUT Mode of Operation:					Transmit; Channel: High						
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		
2782.83	3	41	1	Peak	63.7	56.011	74.0	-17.9	Pass		
3710.46	3	83	1	Peak	55.5	49.429	74.0	-24.5	Pass		

Professional Testing, EMI, Inc
Radiated Emissions, 3m Distance
1-18GHz Vertical Polarity Measured Emissions

The graph displays the measured field strength in dBµV/m across a frequency range from 1 GHz to 10 GHz. Two horizontal red lines represent the Average Limit Level (at approximately 74 dBµV/m) and the Peak Limit Level (at approximately 55 dBµV/m). A blue line shows the corrected average reading, which remains below the average limit level. Two red triangles indicate the corrected peak readings at 2782.83 MHz and 3710.46 MHz, both of which are below the peak limit level. The background shows a noisy blue line representing the measured emissions.

Operator: Eric Lifsey
17731'RERun03'TX'Spurious'HighChan.tif
04:49:25 PM, Thursday, April 14, 2016

Mode: Transmit, High Channel
Power: 4.2 VDC

EUT: SIM-G
Project Number: 17731-15
Client: Triax Technologies

> 1GHz Vertical Antenna Polarity Measured Emissions

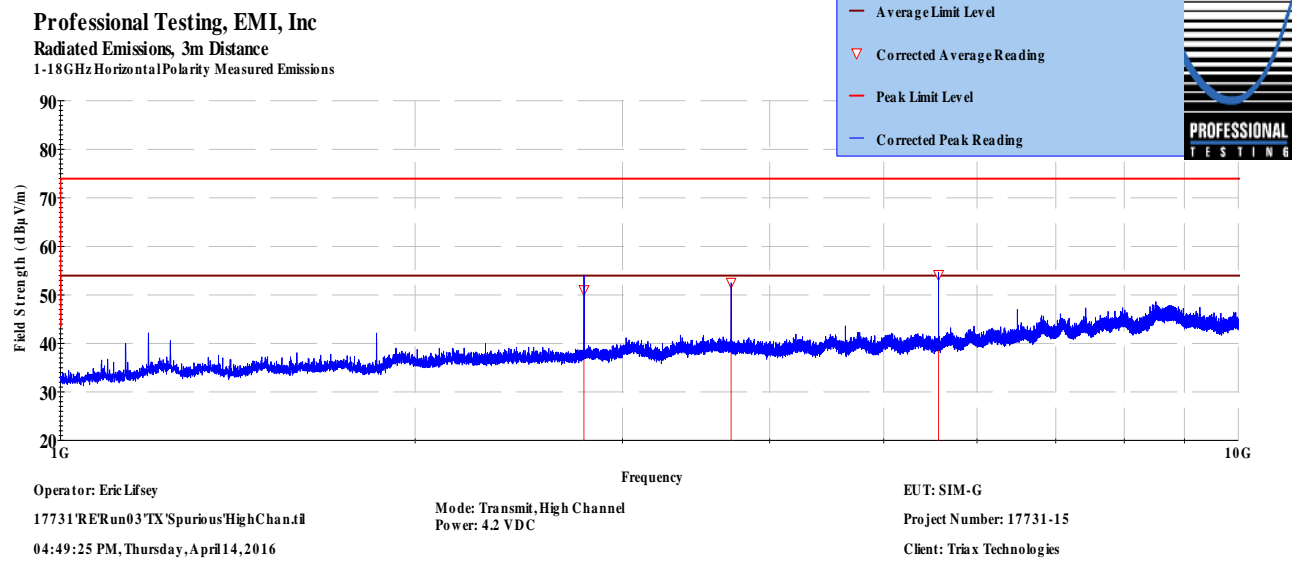
Table 7.3.12: TX Mode, High Channel, Above 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	4/14/2016	EUT Serial #:	Channel 2, 32, 64
Customer:	Triax Technologies	EUT Part #:	SIM-G
Project Number:	17731-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	SIM-G	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	4.2	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Transmit; Channel: High						
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
2782.86	3	147	1	Peak	60.5	52.808	74.0	-21.1	Pass
3710.21	3	161	1	Peak	59.5	53.46	74.0	-20.5	Pass
5565.75	3	269	1	Peak	57.7	55.504	74.0	-18.5	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

7.0 Antenna Construction Requirements

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

7.1 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.

7.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203 // RSS-Gen 8.3	Antenna Construction	14 Sep 2016

7.3 Results

Table 8.3.1 Antenna Construction Details	
Antenna Manufacturer and Model	Specifications
Manufacturer: Beldon (raw material, wire); Triax (in final form) Part Number: Triax 9976 010100	
Construction: 915MHz, 1/4wave wire, 3.5", 26ga, Solid, Black	

- Antenna is a wire antenna.
- The antenna is integral to the device.
- The device uses a molded enclosure.
- There is no external connector.

The antenna design above satisfies the requirements of the rules.

8.0 Equipment

8.1 Radiated Emissions 30 MHz to 10 GHz

Professional Testing, EMI, Inc.					
Test Method:		ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices			
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits			
Section:		15.209			
Test Date(s):		4/14/2016	EUT Serial #:	Channel 2, 32, 64	
Customer:		Triax Technologies	EUT Part #:	SIM-G	
Project Number:		17731-15	Test Technician:	Eric Lifsey	
Purchase Order #:		NA	Supervisor:	Lisa Arndt	
Equip. Under Test:		SIM-G	Witness' Name:	None	
Radiated Emissions Test Equipment List					
Tile! Software Version:		4.2.A, May 23, 2010, 08:38:52 AM			
Test Profile:		2015 Rad Emissions_ClassA - LowPRF_072715.til or 2015 Rad Emissions_ClassB - LowPRF_072715.til			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	2/5/2017
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	2/1/2018
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	3/14/2017
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

Applies also to power spectral density and receive spurious equipment list.

8.2 Bandwidth and Duty Cycle

Asset #	Manufacturer	Model #	Description	Calibration Due
2216	HP	8593E	Spectrum Analyzer	19 Jul 2017
None	B&K	1710	Adjustable Power Supply	CIU
0472	Tektronix	THS730A	DMM / Scope	7 Dec 2016

9.0 Measurement Bandwidths

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:

1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.
4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz.
5. 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
	1 to 18 GHz	3 m	5.7

End of Report

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