Project 17733-15

Triax Technologies
AP

Wireless Certification Report

Prepared for:

Justin Morgenthau
Triax Technologies
66 Fort Point Street
Norwalk, CT 06855

By

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

14 Sep 2016

Reviewed by	Written by
	
Larry Finn Chief Technical Officer	Eric Lifsey EMC Engineer

Revision History

Revision Number	Description	Date
00	Draft for review.	14 Sep 2016
01	Final	5 Jul 2017

Corrections:

None.

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Compliance Certificate

Applicant	Device & Test Identification	
Triax Technologies (Justin Morgenthau)	FCC ID:	2AGHIAP
66 Fort Point Street	Industry Canada ID:	21358-AP
Norwalk, CT 06855	Model(s):	AP
Certificate Date: 14 Sep 2016	Laboratory Project ID:	17733-15

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, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.107, 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 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 AP	none	915 MHz FHSS transceiver.

Table 1.2.2: Support Equipment		
Manufacturer / Model	**Serial #**	**Description**
Samsung	Q430	Laptop computer s/n ZRSG93CZ607388Z

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. It is powered by a USB port.

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:

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

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

Raw Measured Level + Attenuator Factor + Cable Losses = Corrected Level

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 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 conducted 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	11 Apr 2016

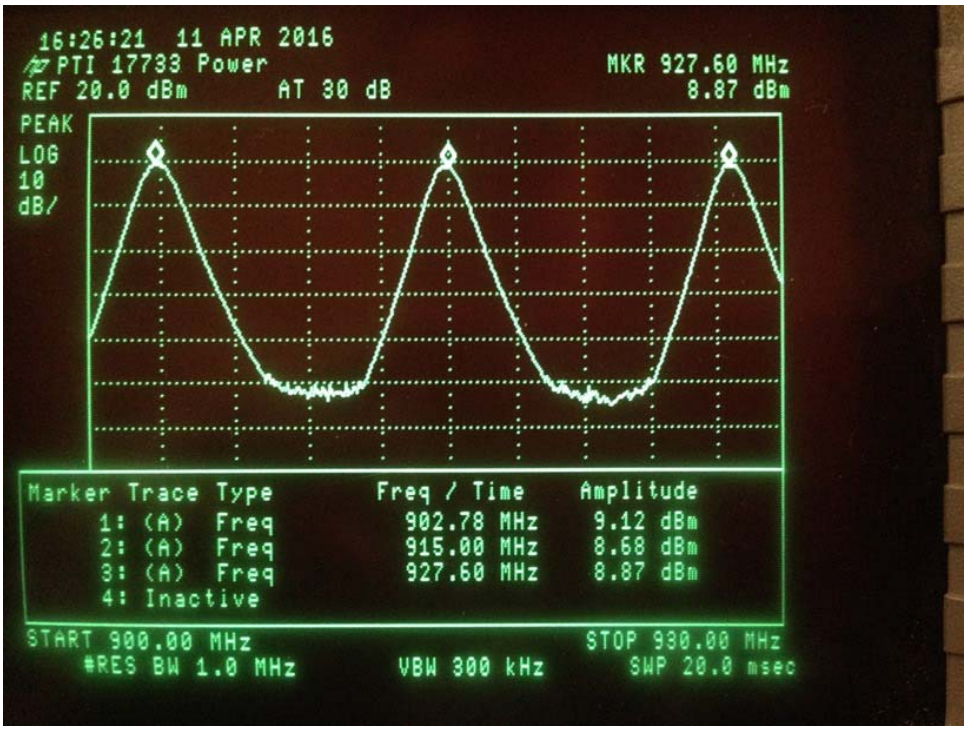
2.3 Test Results, Peak Power

Table 2.3.1 Power, Peak, Conducted, Unmodulated

Frequency MHz	Maximum Measured Peak Power Restated as dBm	Maximum Antenna Gain dBi	Maximum Measured Peak Power Restated as EIRP dBm	Maximum Measured Peak Power Restated as EIRP mW
903	9.12	3	12.12	16.3
915	8.68	3	11.68	14.7
927	8.87	3	11.87	15.4

Measured in 1 MHz RBW, 300 kHz VBW.

The EUT was 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

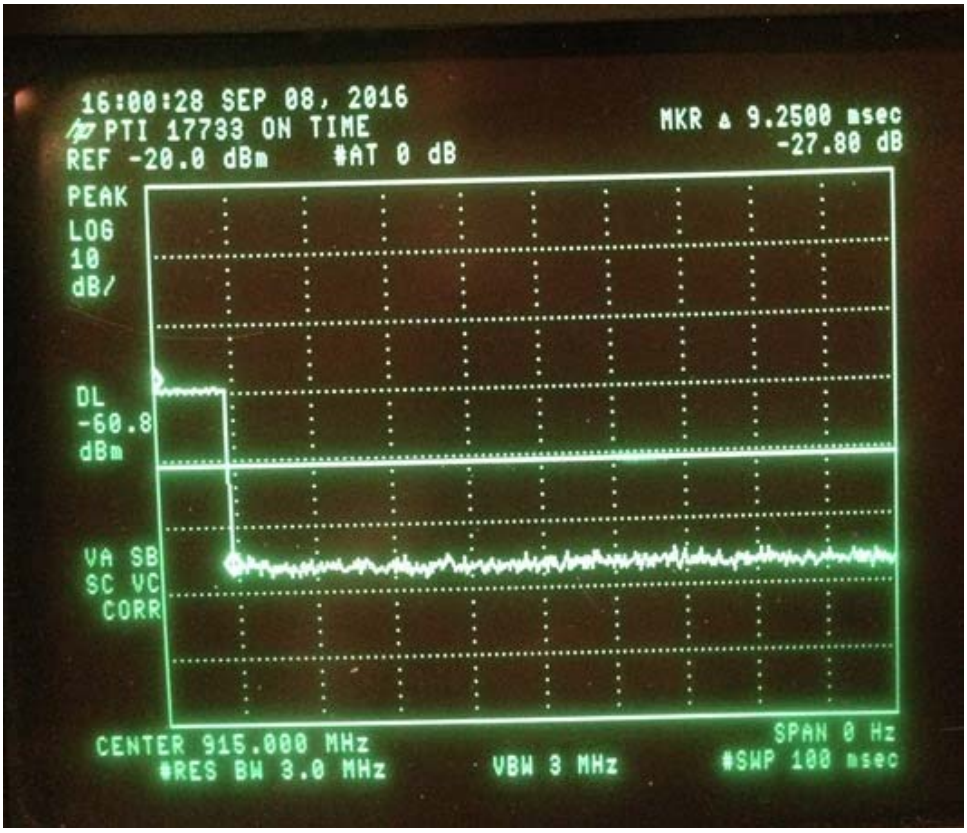
Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
9.25	100 assumed	= 20 * Log_{10} (9.25 msec / 100 msec)	-20.7	-20.0

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)
9.25	100 assumed	= 10 * Log_{10} (9.25 msec / 100 msec)	10.3	10.3

Plotted results appear below.



Transmit On Time in 100 msec

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

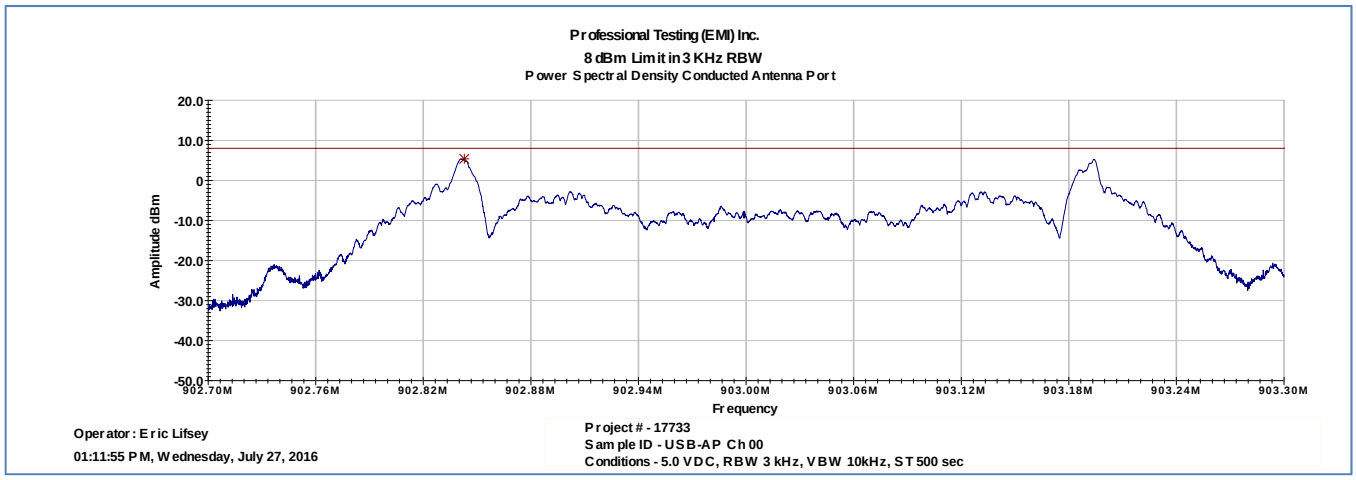
47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(e) // RSS-247, 5.2	Power Spectral Density, Conducted Limit: 8 dBm / 3 kHz	27 Jul 2016

3.3 Test Results

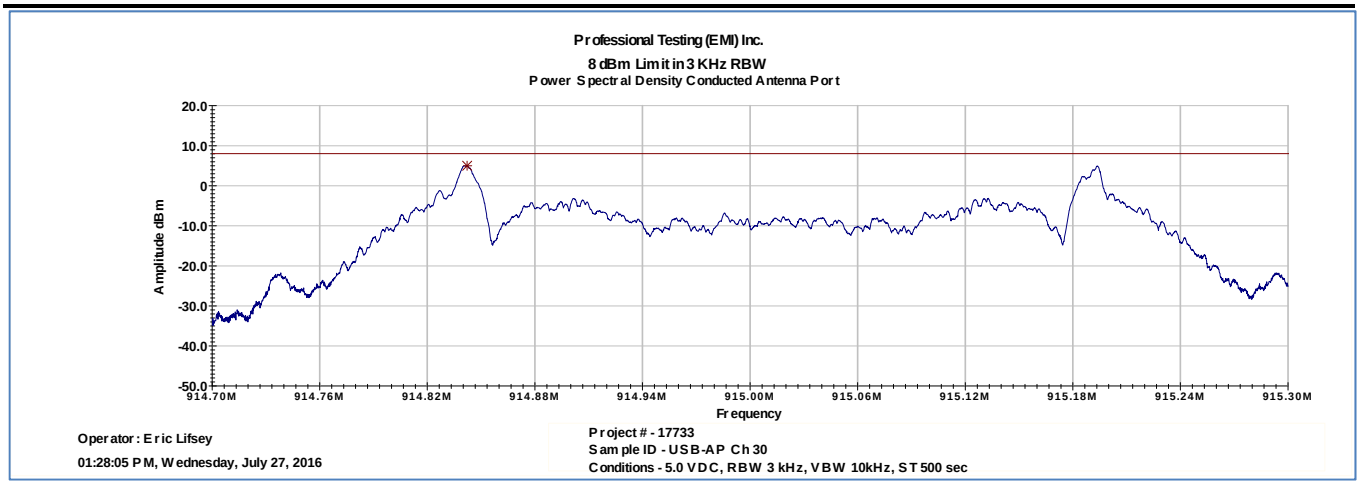
Table 3.3.1 Power Spectral Density, Conducted	
Frequency MHz	**Measured Peak Power**
903	5.38
915	4.98
927	5.34

Measured in 3 kHz RBW, 10 kHz VBW.

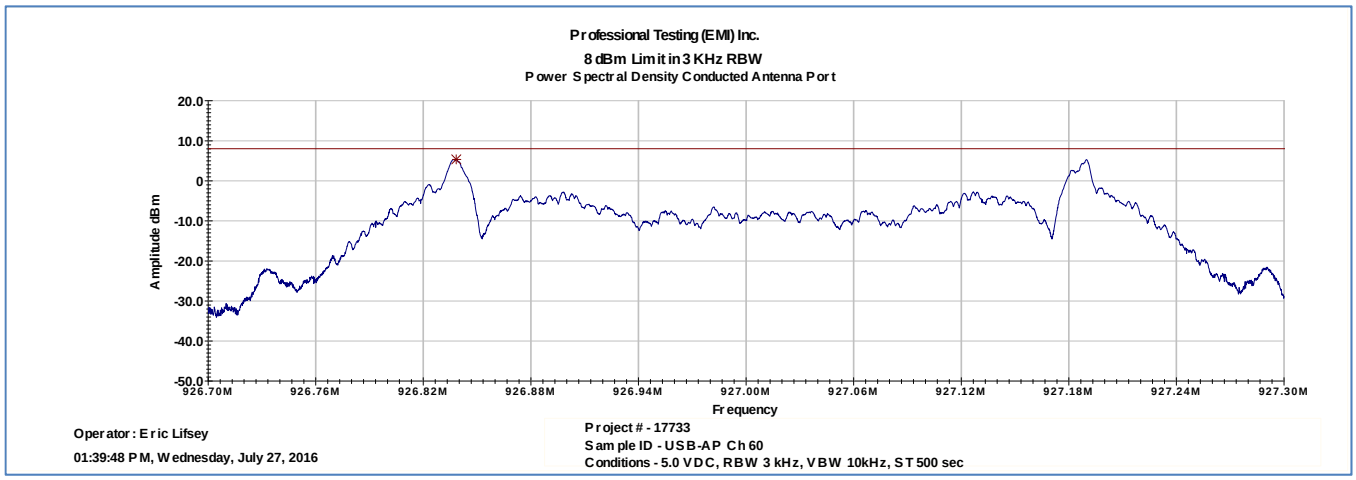
Plotted results included below.



Low Channel



Middle Channel



High Channel

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	

4.3 Test Results

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

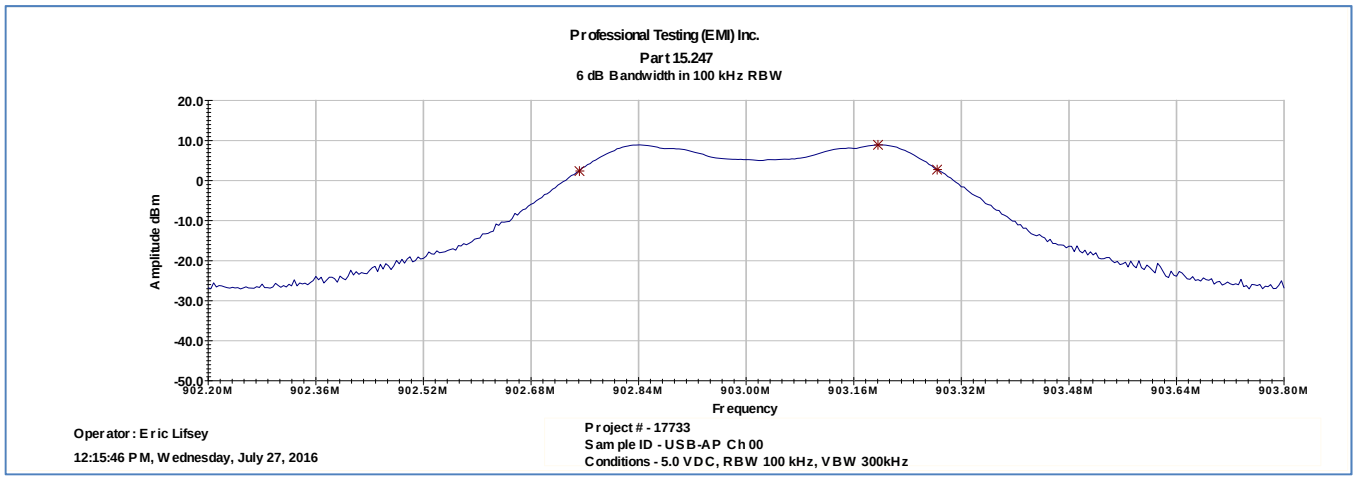
The EUT was found to be in compliance with applicable requirements.

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)**
532	528	528	**528**

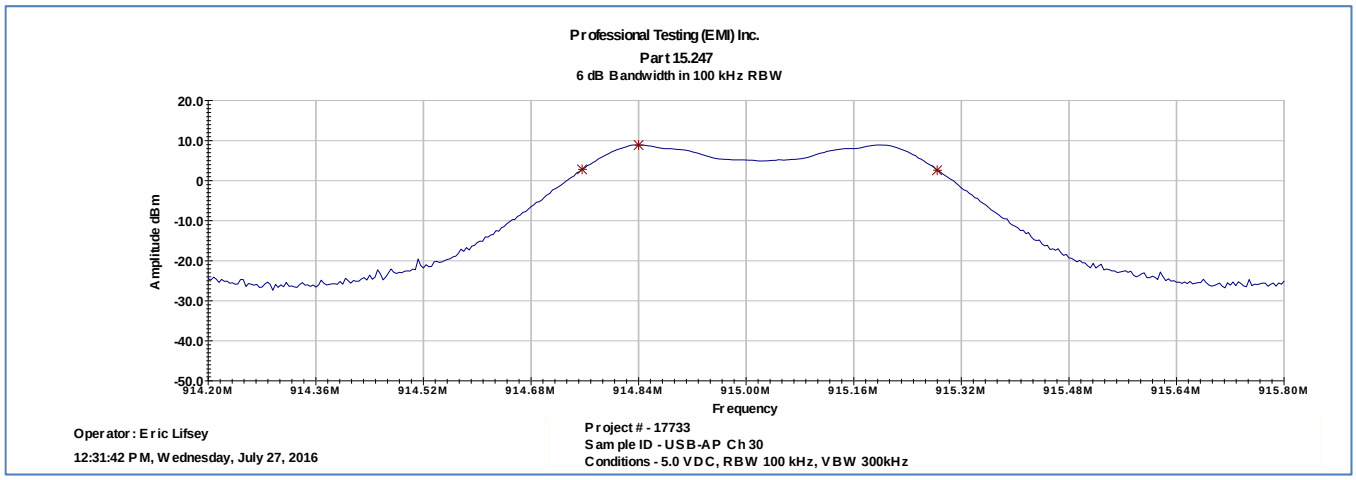
Table 5.3.2 Bandwidth 20 dB, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	**Reported Maximum BW (kHz)**
476	476	472	**476**

Plotted measurements appear on the following pages.

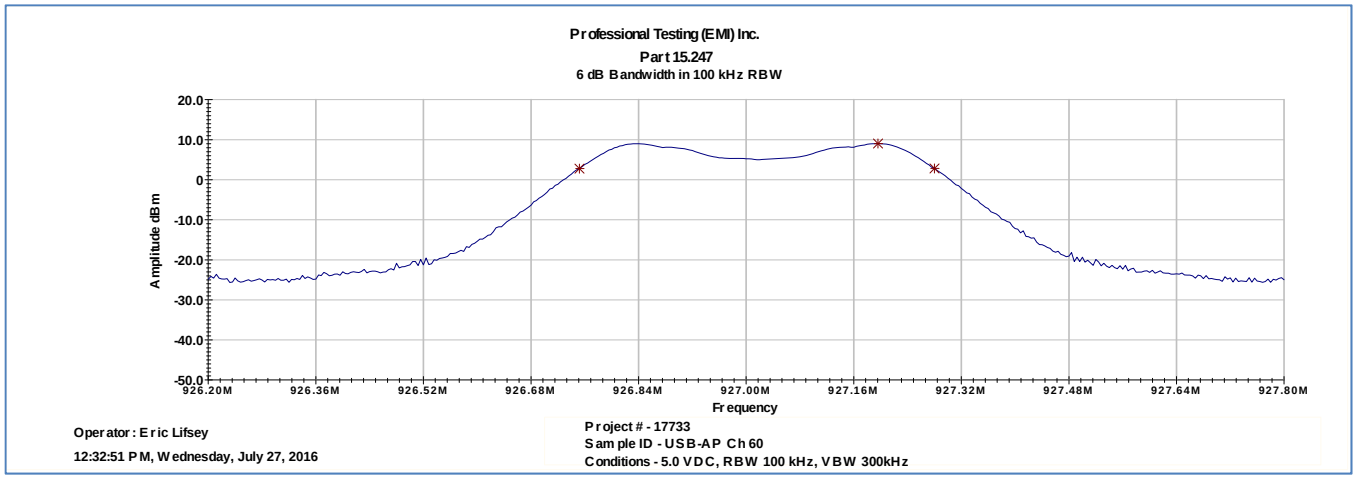
4.3.1 Bandwidth Plots, 6 dB



6 dB, Low Channel

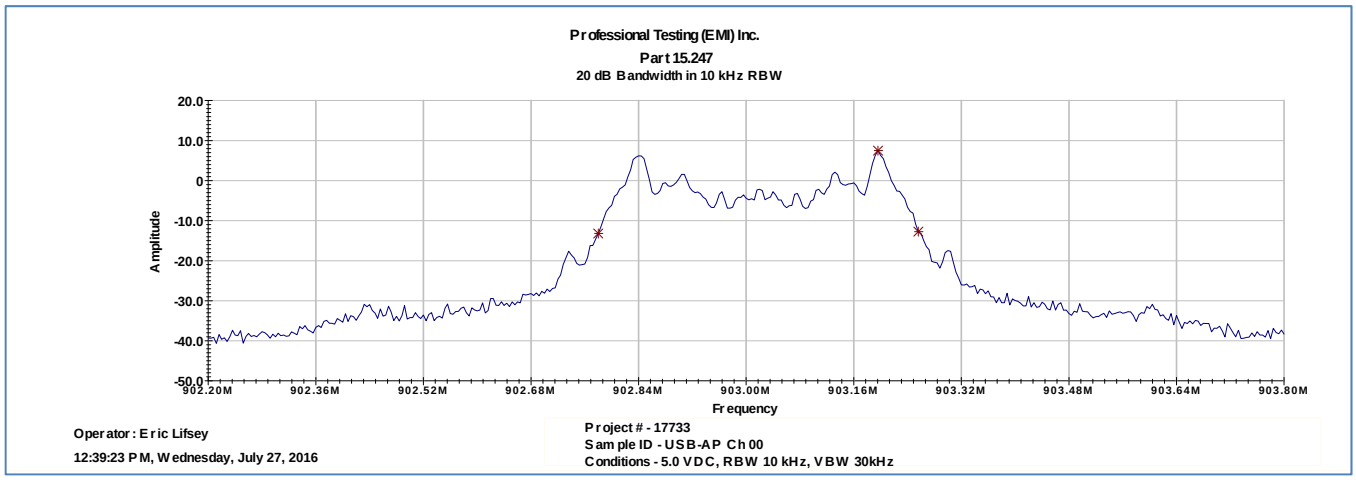


6 dB, Middle Channel

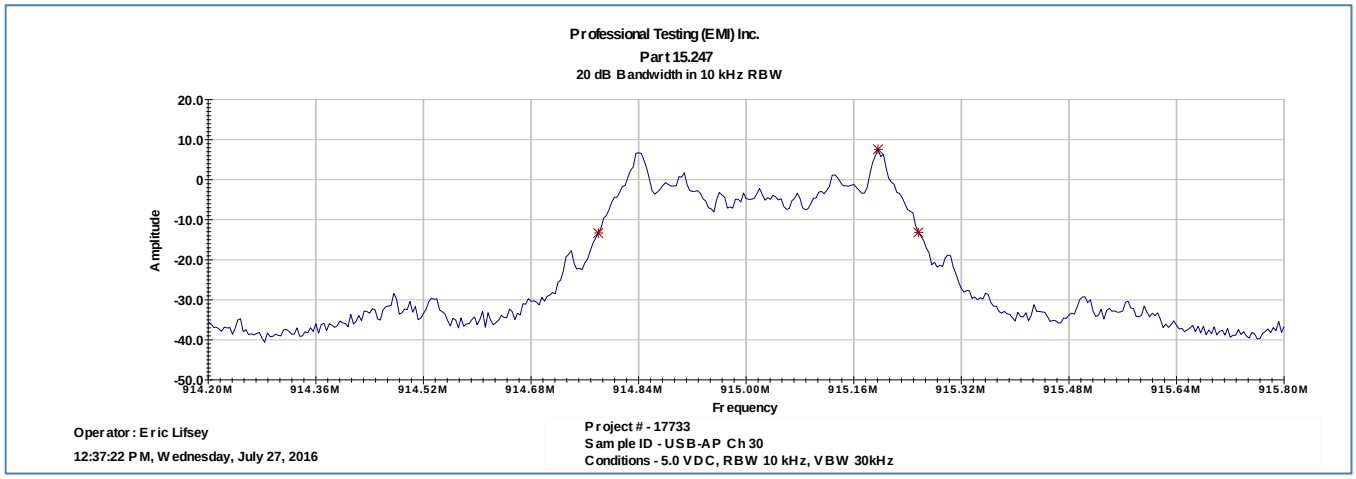


6 dB, High Channel

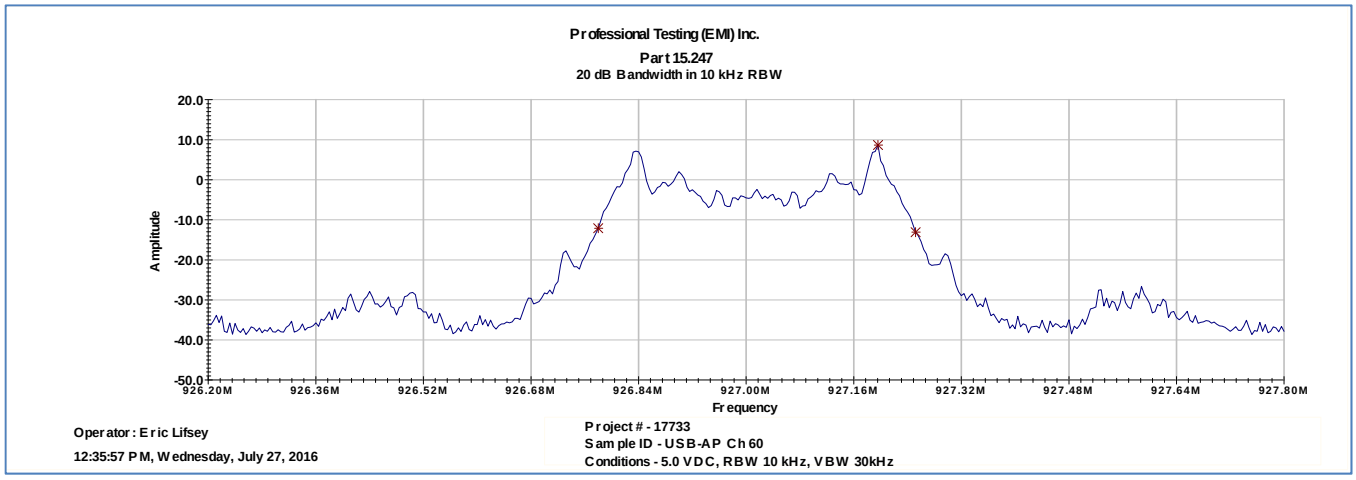
4.3.2 Bandwidth Plots, 20 dB



20 dB, Low Channel



20 dB, Middle Channel



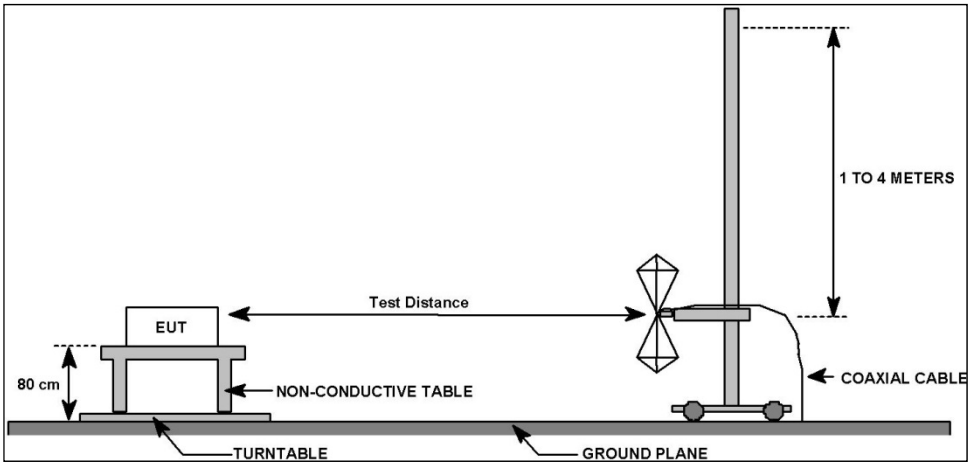
20 dB, High Channel

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.

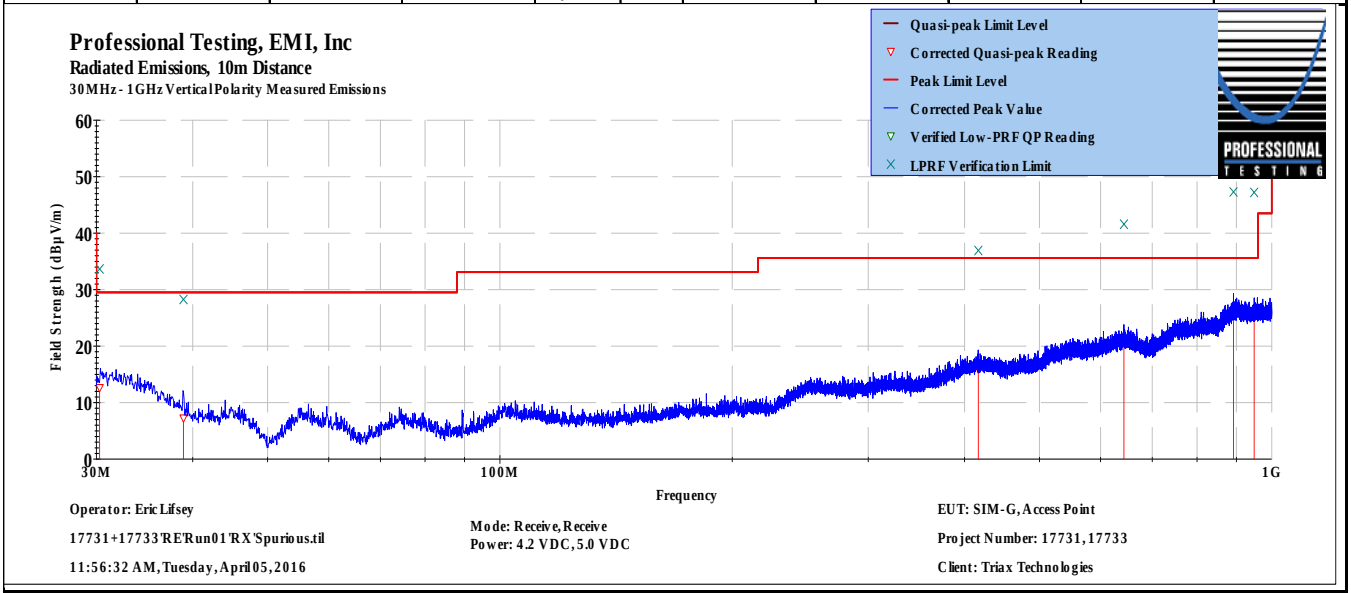
The EUT satisfied the criteria. Recorded data is presented below.

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



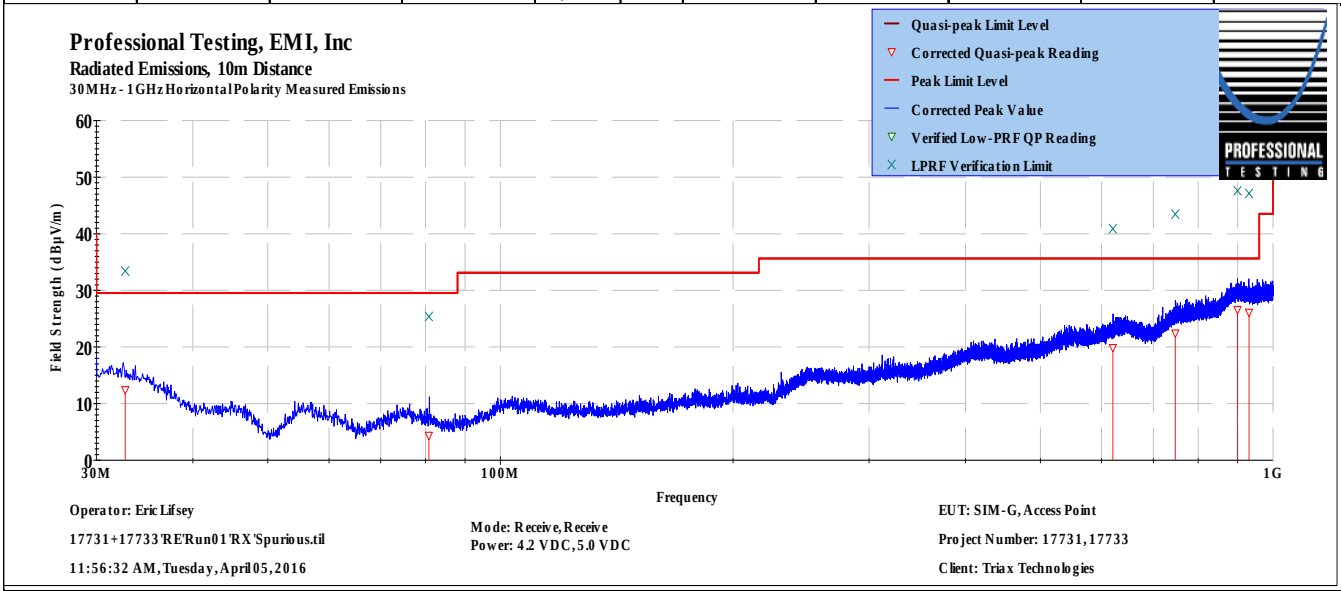
≤ 1GHz Vertical Antenna Polarity Measured Emissions

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



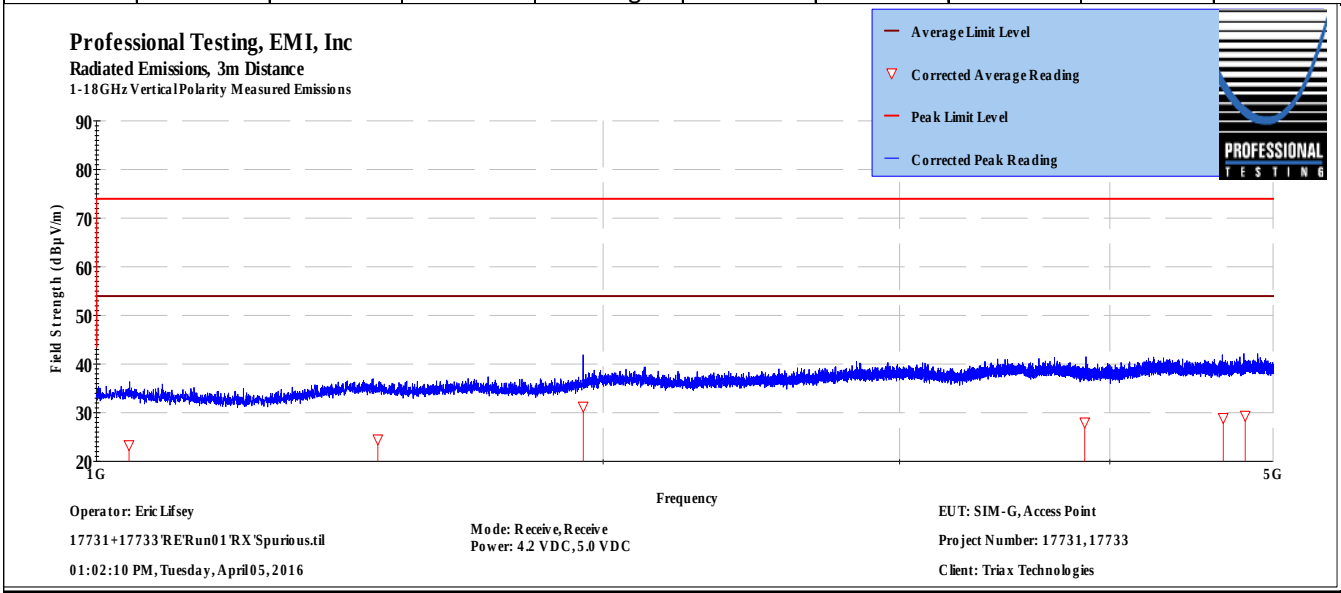
≤ 1GHz Horizontal Antenna Polarity Measured Emissions

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
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



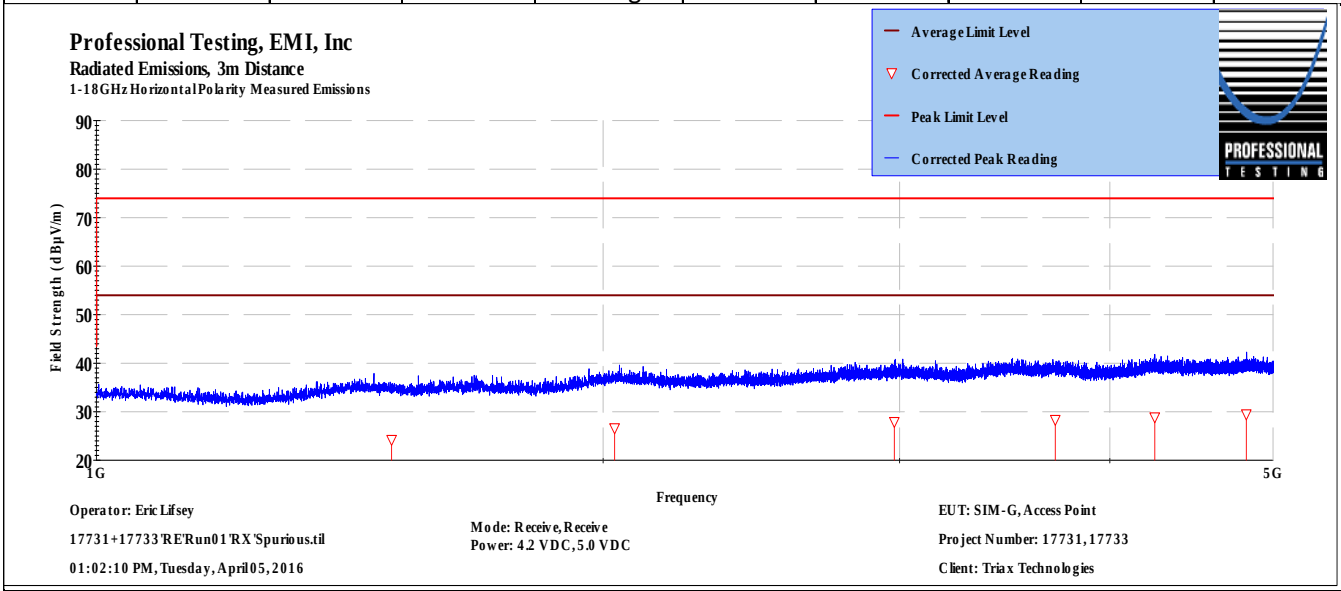
> 1GHz Vertical Antenna Polarity Measured Emissions

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



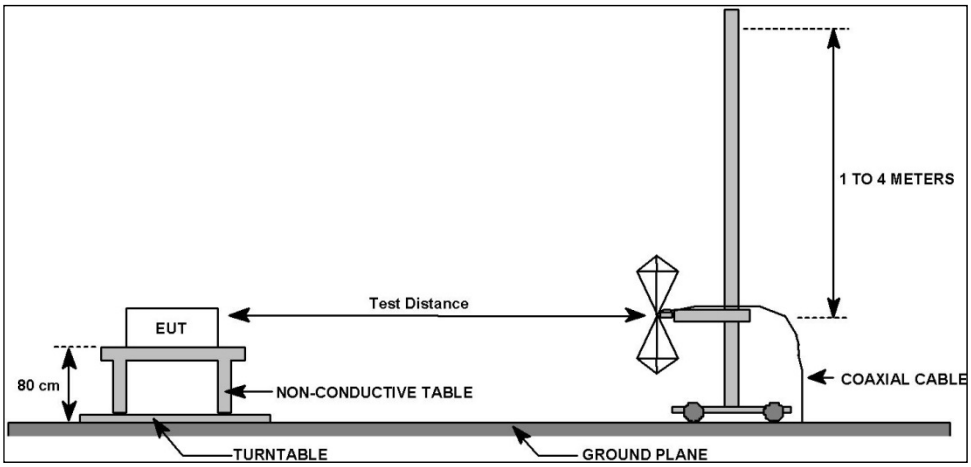
> 1GHz Horizontal Antenna Polarity Measured Emissions

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	8 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.

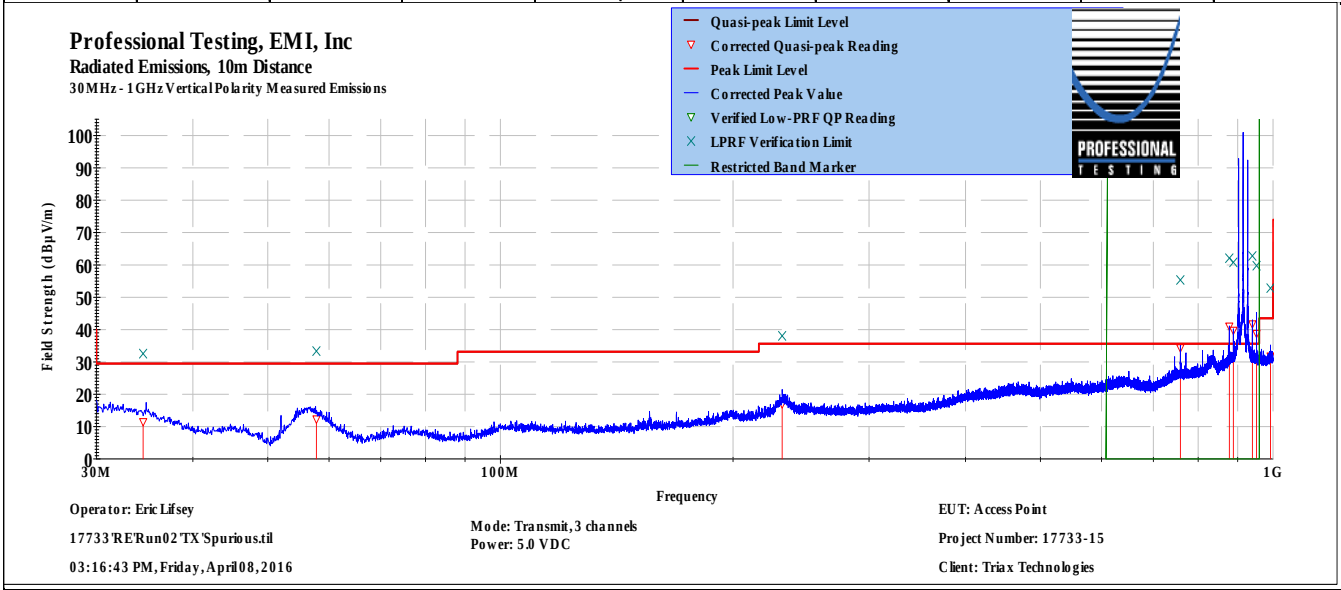
All measurements used peak detection.

Table 7.3.1: TX Mode, Three Channels, 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):	4/8/2016	EUT Serial #:	None
Customer:	Triax Technologies	EUT Part #:	Access Point
Project Number:	17731-15, 17733-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	Access Point	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	5 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Transmit; 3 Channels	

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
34.4859	10	115	1.43	Quasi-peak	23.1	11.539	29.5	-18.0	Pass
57.7947	10	145	2.84	Quasi-peak	30.3	12.334	29.5	-17.2	Pass
231.602	10	290	1.72	Quasi-peak	30.2	17.012	35.6	-18.6	Pass
758.852	10	110	1.71	Quasi-peak	33.4	34.32	35.6	-1.3	Pass
878.063	10	217	2.54	Quasi-peak	36.9	41.044	90.0	-49.0	Pass
888.824	10	130	3.28	Quasi-peak	35	39.761	90.0	-50.2	Pass
940.459	10	183	2.62	Quasi-peak	36.7	41.745	90.0	-48.3	Pass
952.368	10	103	1.49	Quasi-peak	33.5	38.744	90.0	-51.3	Pass
992.824	10	217	1.33	Quasi-peak	26.4	31.792	43.5	-11.7	Pass



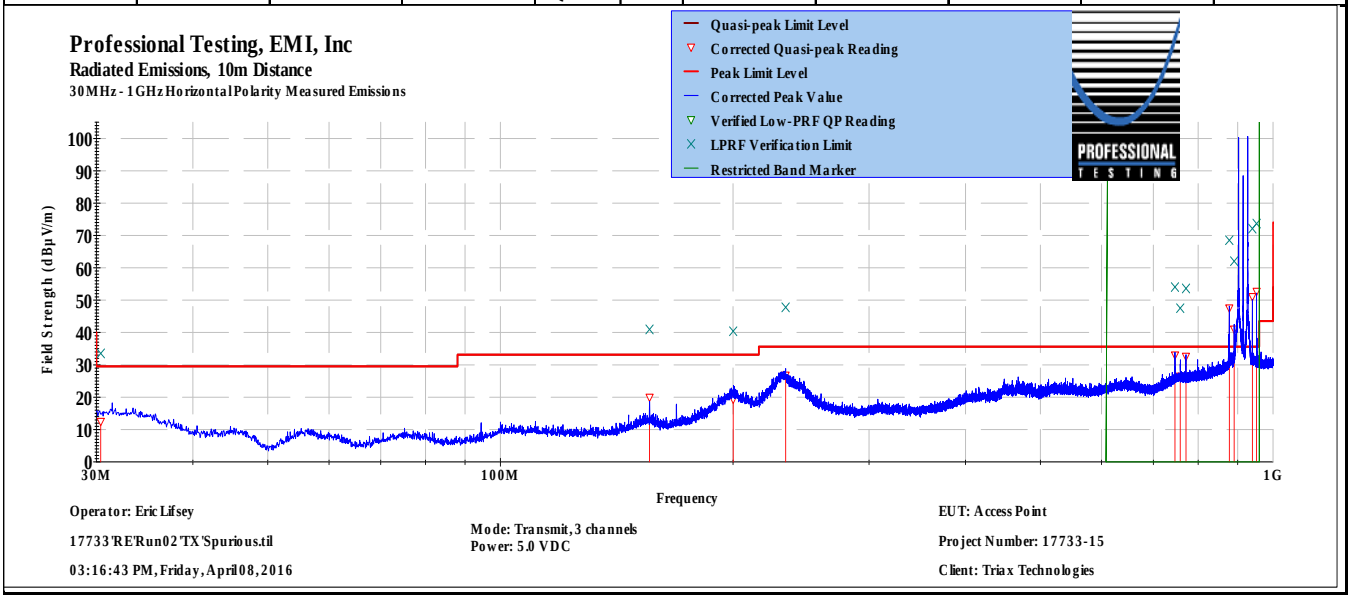
≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: TX Mode, Three Channels, 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):	4/8/2016	EUT Serial #:	None
Customer:	Triax Technologies	EUT Part #:	Access Point
Project Number:	17731-15, 17733-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	Access Point	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	5 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Transmit; 3 Channels	

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
30.3978	10	247	1.73	Quasi-peak	23.9	12.495	29.5	-17.0	Pass
155.979	10	94	3.75	Quasi-peak	36.4	19.915	33.1	-13.2	Pass
200.123	10	348	3.91	Quasi-peak	33.7	19.343	33.1	-13.8	Pass
234.028	10	45	2.66	Quasi-peak	39.5	26.756	35.6	-8.8	Pass
746.809	10	356	1.12	Quasi-peak	32.4	33.008	35.6	-2.6	Pass
758.675	10	171	1.24	Quasi-peak	25.5	26.482	35.6	-9.1	Pass
771.607	10	175	2.73	Quasi-peak	31.5	32.585	35.6	-3.0	Pass
878.036	10	357	3.97	Quasi-peak	43.4	47.51	90.0	-42.5	Pass
890.791	10	352	3.86	Quasi-peak	36.2	40.996	90.0	-49.0	Pass
940.364	10	264	1.98	Quasi-peak	46	51.061	90.0	-38.9	Pass
952.485	10	269	2.01	Quasi-peak	47.4	52.656	90.0	-37.3	Pass



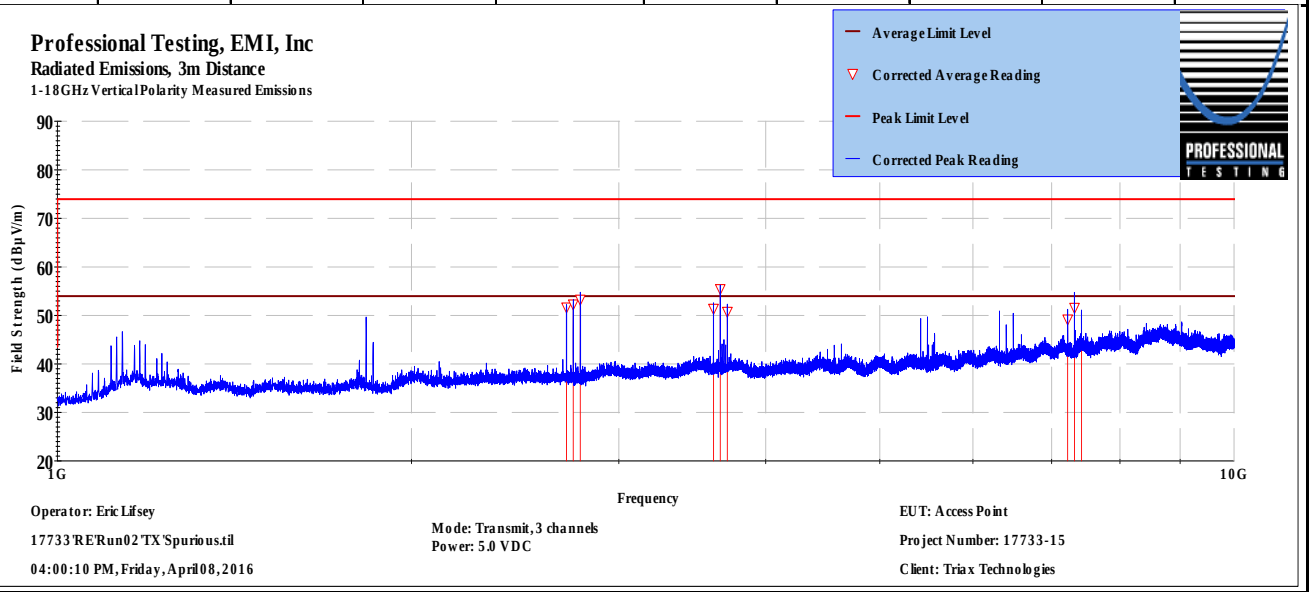
≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.3: TX Mode, Three Channels, 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):	4/8/2016	EUT Serial #:	None
Customer:	Triax Technologies	EUT Part #:	Access Point
Project Number:	17731-15, 17733-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	Access Point	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	5 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit; 3 Channels	

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
2708.36	3	52	1	Peak	61	53.068	74.0	-20.9	Pass
2744.46	3	80	1	Peak	61.7	53.825	74.0	-20.1	Pass
2782.81	3	273	1	Peak	62.4	54.693	74.0	-19.3	Pass
3611.2	3	51	1	Peak	58.7	52.648	74.0	-21.3	Pass
3659.37	3	253	1	Peak	62.6	56.58	74.0	-17.4	Pass
3710.32	3	236	1	Peak	58.5	52.487	74.0	-21.5	Pass
7222.24	3	254	1	Peak	48.8	51.945	74.0	-22.0	Pass
7318.6	3	234	1	Peak	51.3	54.702	74.0	-19.3	Pass
7420.96	3	261	1	Peak	46	49.859	74.0	-24.1	Pass



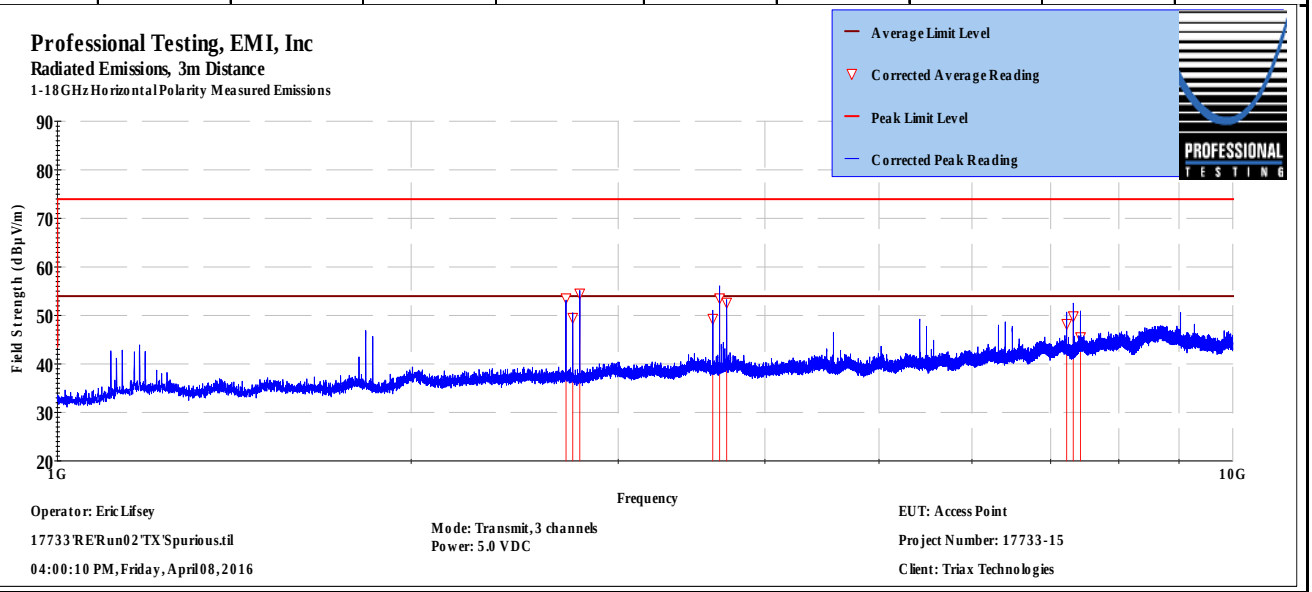
> 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.4: TX Mode, Three Channels, 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):	4/8/2016	**EUT Serial #:**	None
Customer:	Triax Technologies	**EUT Part #:**	Access Point
Project Number:	17731-15, 17733-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	Access Point	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	5 VDC	**EUT Power Frequency:**	0 N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
EUT Mode of Operation:		Transmit; 3 Channels	

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
2708.51	3	321	1	Peak	62.6	54.681	74.0	-19.3	Pass
2744.58	3	164	1	Peak	58.7	50.858	74.0	-23.1	Pass
2782.84	3	151	1	Peak	63.4	55.724	74.0	-18.2	Pass
3611.31	3	211	1	Peak	56.9	50.907	74.0	-23.1	Pass
3659.33	3	217	1	Peak	61	54.963	74.0	-19.0	Pass
3710.48	3	186	1	Peak	60	53.892	74.0	-20.1	Pass
7222.64	3	43	1	Peak	48.3	51.471	74.0	-22.5	Pass
7318.32	3	216	1	Peak	49.1	52.514	74.0	-21.4	Pass
7421.18	3	49	1	Peak	46.6	50.406	74.0	-23.6	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

7.0 Conducted Spurious Emissions, Transmit Mode

7.1 Test Procedure

Emissions are measured directly at the antenna port with the EUT in transmit mode. A resolution bandwidth of 100 kHz applies.

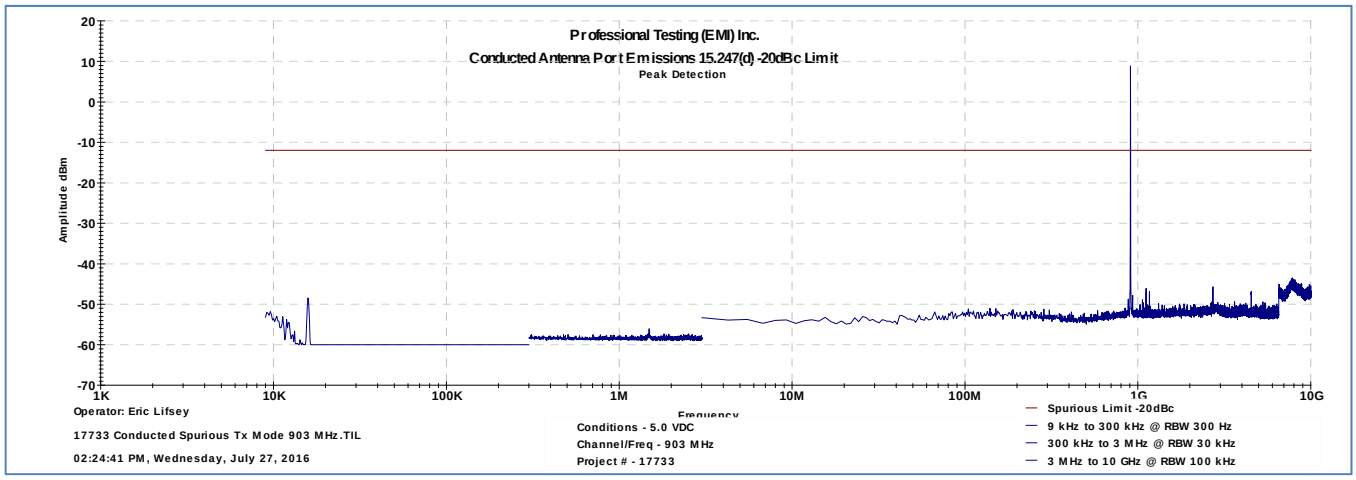
7.2 Test Criteria

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	27 Jul 2016

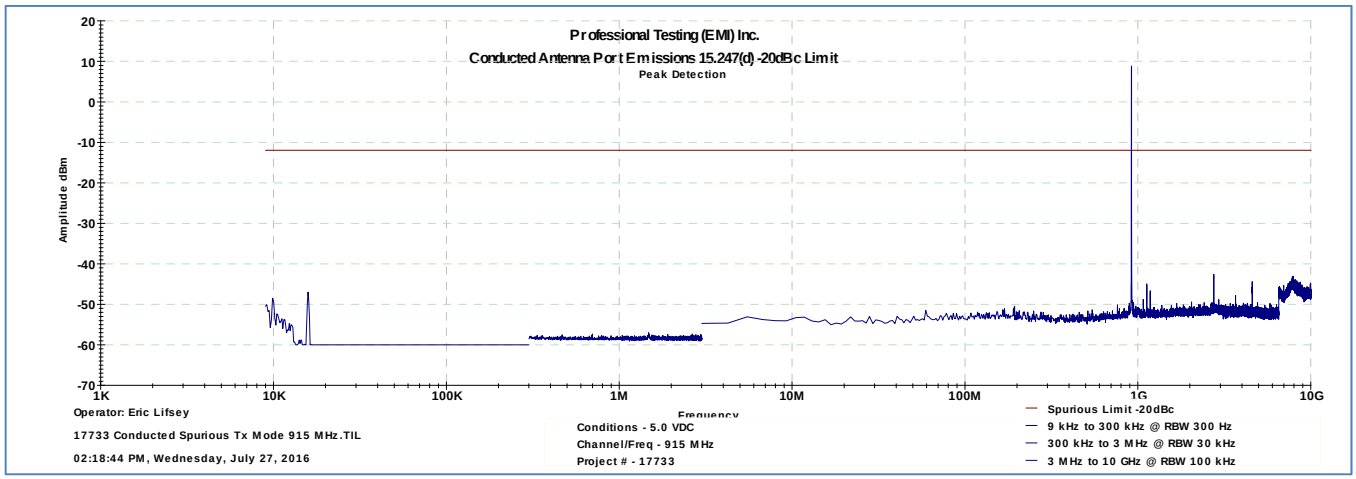
7.3 Test Results

Modulation was enabled for this test and the transmitter was placed into continuous transmit mode. The -20 dBc limit is shown.

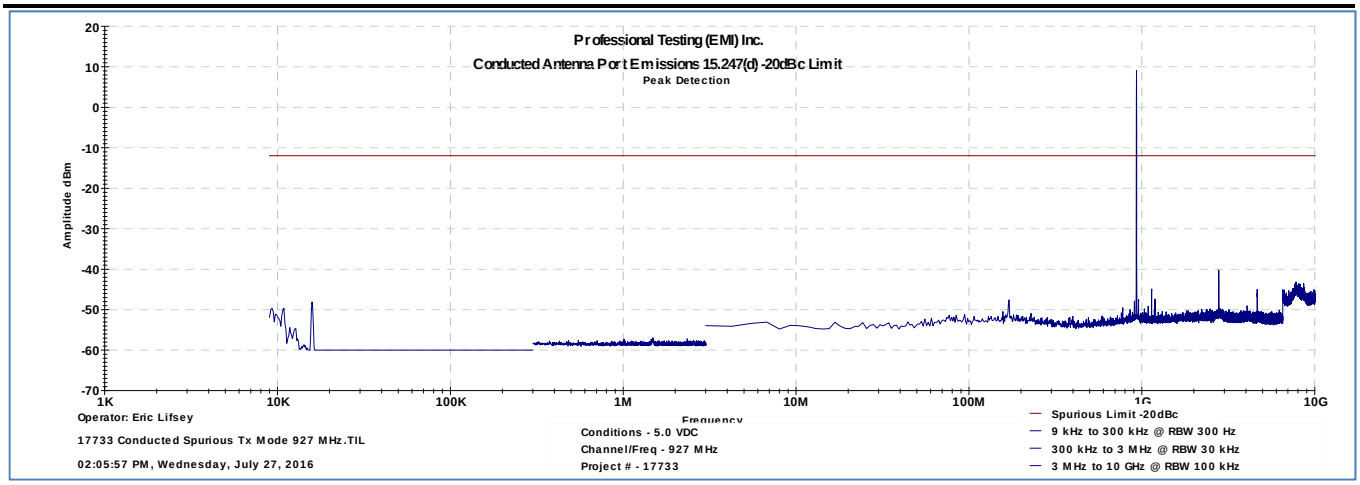
Plotted results are presented below.



Low Channel



Middle Channel



High Channel

8.0 Conducted Mains Emissions

8.1 Test Procedure

Measure mains emissions using LISN. EUT is attached directly to a USB port on the host device (laptop) and emissions from the combined system are measured.

8.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.107 // RSS-Gen	Conducted Emissions, Mains	29 Jul 2016

8.3 Test Results

The EUT satisfied the requirements. Graphical and tabular data appears on the following pages.

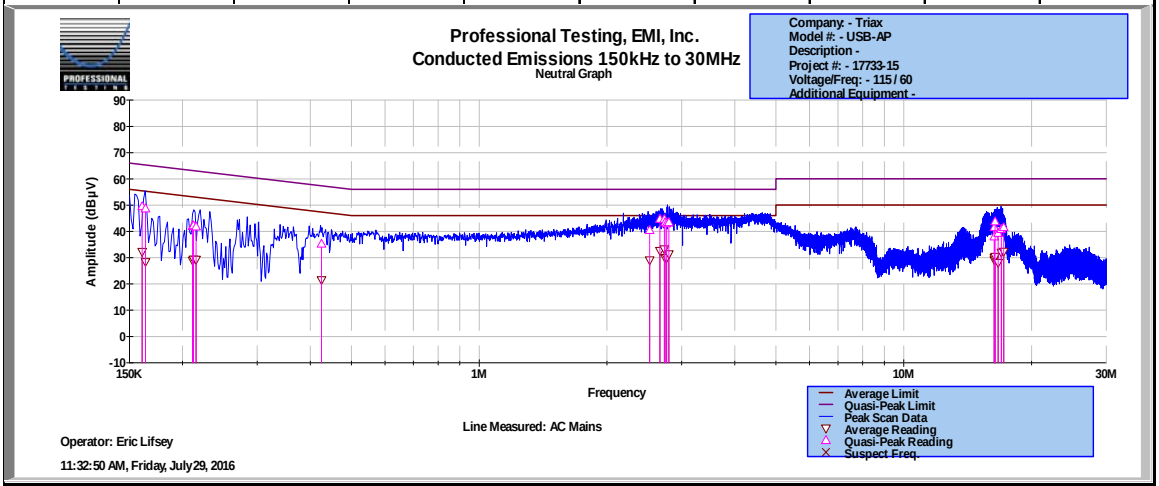
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	7/29/2016	**EUT Serial #:**	CH30
Customer:	Triax	**EUT Part #:**	0
Project Number:	17733-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	0	**Supervisor:**	Lisa Arndt
Equip. Under Test:	USB-AP	**Witness' Name:**	UW

Conducted Emissions Test Results Data Sheet - Neutral Lead; Transmit Mode **Page: 1 of 2**

EUT Line Voltage:	**120**	**VAC**	**EUT Line Frequency:**	**60**	**Hz**

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.16079	53.8	49.5	65.4	-15.9	PASS	32.2	55.4	-23.2	PASS
0.16374	53.6	48.6	65.3	-16.6	PASS	28.4	55.3	-26.9	PASS
0.21124	45.9	42	63.2	-21.2	PASS	28.9	53.2	-24.3	PASS
0.21245	46.4	42.2	63.1	-20.9	PASS	29.3	53.1	-23.8	PASS
0.21541	46.4	41.8	63	-21.2	PASS	29.3	53	-23.7	PASS
0.4252	41.2	35.2	57.3	-22.1	PASS	21.5	47.3	-25.9	PASS
2.5208	49.4	40.4	56	-15.6	PASS	29	46	-17	PASS
2.6641	48.8	44.7	56	-11.3	PASS	32.6	46	-13.4	PASS
2.7297	49.8	44.7	56	-11.3	PASS	33.2	46	-12.8	PASS
2.7409	50.6	43.4	56	-12.6	PASS	29.9	46	-16.1	PASS
2.7638	50.2	43	56	-13	PASS	29.9	46	-16.1	PASS
2.7983	49.4	43.4	56	-12.6	PASS	31.4	46	-14.6	PASS
16.337	49	41.6	60	-18.4	PASS	29.1	50	-20.9	PASS
16.3435	50.2	38	60	-22	PASS	29.9	50	-20.1	PASS
16.4131	49.8	43.7	60	-16.3	PASS	30.3	50	-19.7	PASS
16.6834	47.3	39.4	60	-20.6	PASS	28	50	-22	PASS
16.9871	47.2	40.8	60	-19.2	PASS	31.9	50	-18.1	PASS
17.194	48.2	41.5	60	-18.5	PASS	32.3	50	-17.7	PASS



Measured Conducted Emissions - Neutral Lead

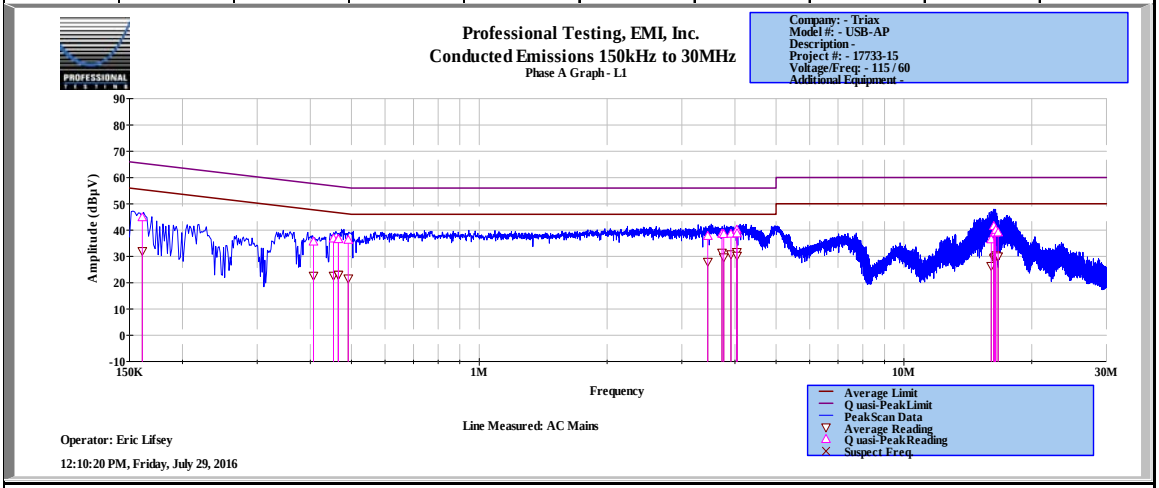
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.10–2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	7/29/2016	**EUT Serial #:**	CH30
Customer:	Triax	**EUT Part #:**	0
Project Number:	17733-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	0	**Supervisor:**	Lisa Arndt
Equip. Under Test:	USB-AP	**Witness' Name:**	UW

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1); Transmit Mode **Page: 2 of 2**

EUT Line Voltage:	**120**	**VAC**	**EUT Line Frequency:**	**60**	**Hz**

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.1608	49.4	44.8	65.4	-20.6	PASS	32.1	55.4	-23.3	PASS
0.40701	39.9	35.6	57.7	-22.1	PASS	22.7	47.7	-25	PASS
0.45351	40.8	36.7	56.8	-20.1	PASS	22.7	46.8	-24.1	PASS
0.46569	40.8	36.5	56.6	-20.1	PASS	23.1	46.6	-23.5	PASS
0.4658	41.3	36.5	56.6	-20.1	PASS	23	46.6	-23.6	PASS
0.49151	41.2	36.2	56.1	-19.9	PASS	21.7	46.1	-24.5	PASS
3.4532	42.4	37.7	56	-18.3	PASS	28	46	-18	PASS
3.7283	43.1	38.6	56	-17.4	PASS	31.4	46	-14.6	PASS
3.7645	43.2	38.5	56	-17.5	PASS	29.7	46	-16.3	PASS
3.9132	43.1	38.5	56	-17.5	PASS	30.9	46	-15.1	PASS
4.0427	43.8	40.1	56	-15.9	PASS	31.7	46	-14.3	PASS
4.045	42.5	38.7	56	-17.3	PASS	30.3	46	-15.7	PASS
16.0586	45.9	36.4	60	-23.6	PASS	26.4	50	-23.6	PASS
16.2898	46.4	41.5	60	-18.5	PASS	29.4	50	-20.6	PASS
16.3428	46	39.2	60	-20.8	PASS	29.7	50	-20.3	PASS
16.4199	46	39	60	-21	PASS	29.8	50	-20.2	PASS
16.4521	49.9	40	60	-20	PASS	30.5	50	-19.5	PASS
16.6678	46.9	39	60	-21	PASS	30.1	50	-19.9	PASS



Measured Conducted Emissions - Phase Lead (Line 1)

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	14 Sep 2016

9.3 Results

Table 9.3.1 Antenna Construction Details

Antenna Manufacturer and Model	Specifications
Manufacturer: Pulse Electronics Part Number: W1063 | Frequency: 900MHz | Max Gain (dBi): 3.0 | Mechanical Length [3]: 6.65 /169 | Application/Standard: ISM 868 & 915MHz	Construction: Monopole, RP-pin connector Gain: 3 dBi

- Antenna is externally pluggable.
- Manufacturer supplies the antenna.
- The external connector uses reverse polarized center pin conductor.

The antenna design above satisfies the requirements of the rules.

10.0 Equipment

10.1 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):	**4/8/2016**	**EUT Serial #:**	**None**
Customer:	**Triax Technologies**	**EUT Part #:**	**Access Point**
Project Number:	**17731-15, 17733-15**	**Test Technician:**	**Eric Lifsey**
Purchase Order #:	**NA**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**Access Point**	**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.

10.2 Bandwidth, Conducted Spurious, Fundamental Power 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

10.3 Mains Conducted Emission

In accordance with:	**FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits**		
Section:	**15.207**		
Test Date(s):	**7/29/2016**	**EUT Serial #:**	**CH30**
Customer:	**Triax**	**EUT Part #:**	**0**
Project Number:	**17733-15**	**Test Technician:**	**Eric Lifsey**
Purchase Order #:	**0**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**USB-AP**	**Witness' Name:**	**UW**

Conducted Emissions Test Equipment List

Tile! Software Version:	**4.1.A.0, April 14, 2009, 11:01:00PM**
Test Profile:	**CE_2015_TILE4_Ver2_050316.TIL or CE_Marine_050316.TIL**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1145	HP	8568B	Spectrum Analyzer 100Hz-1.5GHz	2517A01821	7/20/2017
1834	HP	85662A	Spec Anal Dsply, use with A/N 1145	2349A06182	N/A
0990	HP	85685A	RF Preselector	3010A01119	7/20/2017
0085	HP	85650A	Quasi-Peak Adapter CISPR	3033A01458	7/20/2017
1173	PTI	100k HPF	Filter, High Pass, 100kHz	none	2/2/2018
1088	PTI	PTI-ALF4	Attenuator Limiter Filter	none	10/6/2017
C176	HP	none	Cable, RF, BNC-BNC, 24", Grey	none	1/27/2018
C303	Coleman Cable	RG-58A/U	Cable, BNC-BNC, 36" Black	None	3/25/2018
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	8/6/2016
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	11/12/2016
1132	AilTech	91550-1M	Probe, Current, 10kHz-100MHz	1856	2/12/2017
0936	FCC	FCC-TLISN-T2	TLISN-T2, 9kHz-30MHz, CISPR 22	20152	3/4/2017
0935	FCC	FCC-TLISN-T4	TLISN-T4, 9kHz-30MHz, CISPR 22	20153	3/4/2017
1683	Teseq	ISN T800	ISN-T8, Impedance Stabilization Network	27091	6/15/2017
0027	EMCO	3825/2	LISN, 10kHz-100MHz	9010-1708	11/12/2016
0586	HP	8447D	Preamp, 0.1-1300MHz, 26dB	1726A01364	2/12/2018

11.0 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.

Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time				
Frequency Band Start (MHz)	**Frequency Band Stop (MHz)**	**6 dB Bandwidth (kHz)**	**Number of Ranges Used**	**Measurement Time per Range**
0.01	0.15	0.3	7	Five 1 second sweeps
0.15	30	9	20	Five 1 second sweeps

*Notes:
1. The settings above are specifically calculated for the HP856X series of spectrum analyzers, which have 1,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 10-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.

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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