
Project 20425-15

**Atlas Wearables
Multi-Trainer 3
A103**

Wireless Certification Report

Prepared for:

Atlas Wearables, Inc.
The Coporation Trust Company
1209 Orange Street
Wilmington DE 19801

By

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

1 Apr 2019

Reviewed by

A handwritten signature in black ink, appearing to read 'Larry Finn'.

Larry Finn
Chief Technical Officer

Written by

A handwritten signature in black ink, appearing to read 'Eric Lifsey'.

Eric Lifsey
EMC Engineer

Revision History

Revision Number	Description	Date
Final02	Revise model to match HVIN A103.	17 Apr 2019

Errata:

None.

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Compliance Certificate

FCC MRA Designation Number: US5270 NVLAP Accreditation Number: 200062-0

Applicant	Device & Test Identification
Atlas Wearables, Inc. The Coporation Trust Company 1209 Orange Street Wilmington DE 19801 Certificate Date: 1 Apr 2019	FCC ID: 2AMCA-A103 Industry Canada ID: 24501-A103 Model(s): A103 Laboratory Project ID: 20425-15

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	15.205	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 5	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
Atlas Wearables Multi-Trainer 3 Model: A103	none	2400-2483.5 MHz DTS transceiver; using BTLE style protocol.

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

This device is a hand-held remote control for industrial systems such as cranes and lifts. It is powered by an internal 3.7 V Li-Ion battery that is recharged via cable to a USB power source.

1.3 EUT Operation

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

1.4 Modifications to Equipment

None.

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

Table 1.6 1 Measurement Corrections	
Parameter	From Sums Of
Radiated Field Strength	Raw Measured Level + Antenna Factor + Cable Losses – Amplifier Gain
Conducted Antenna Port	Raw Measured Level + Attenuator Factor + Cable Losses
Conducted Mains Port	Raw Measured Level + LISN Factor + Cable/Filter/Limiter Losses

Additionally, measurement distance extrapolation factors (such as $1/d$ above 30 MHz) 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	15.247, 15.203	RSS-Gen 8.3

2.0 Fundamental Power

2.1 Test Procedure

Peak power is measured using radiated method and without modulation.

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 dB μ V/m @ 3 m	3 Jan 2019

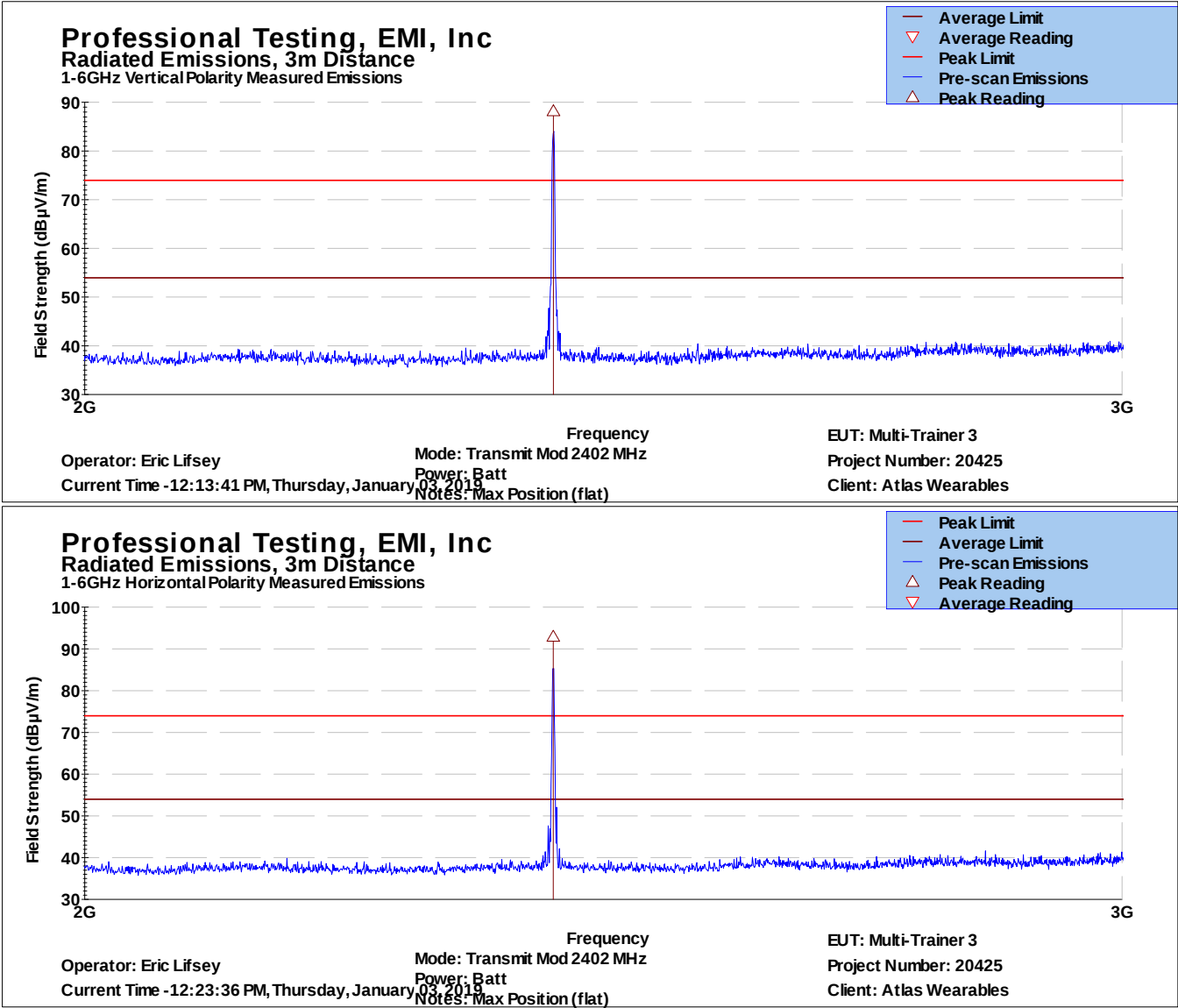
2.3 Test Results, Peak Power

Table 2.3.1 Power, Peak, Measured Radiated		
Frequency MHz	Measured Peak Field Strength Vertical dB μ V/m @ 3m	Measured Peak Field Strength Horizontal dB μ V/m @ 3m
2402	88.2	92.9
2442	84.0	93.1
2480	85.5	90.0

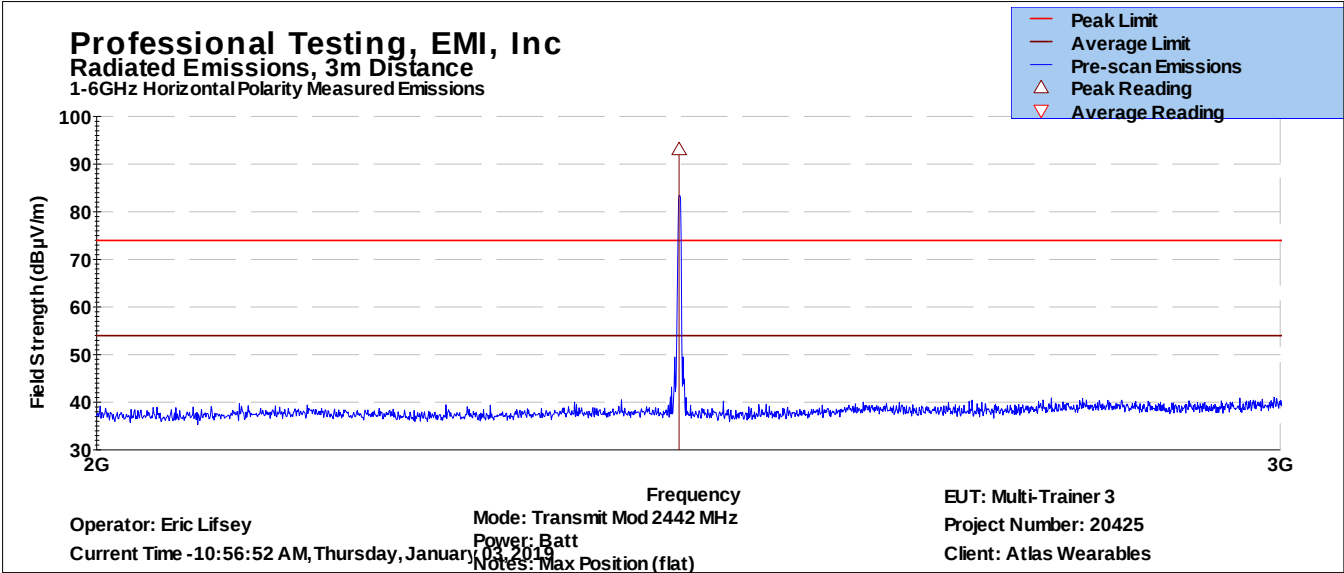
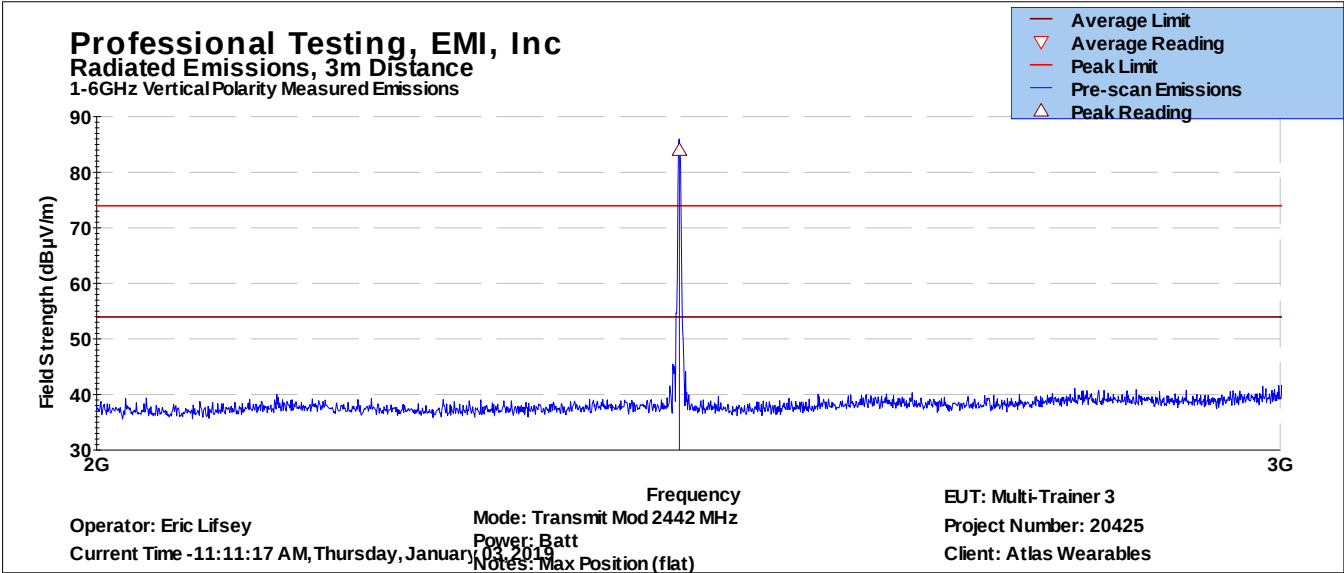
Measured in 1 MHz RBW, 3 MHz VBW.

The EUT satisfied the requirement.

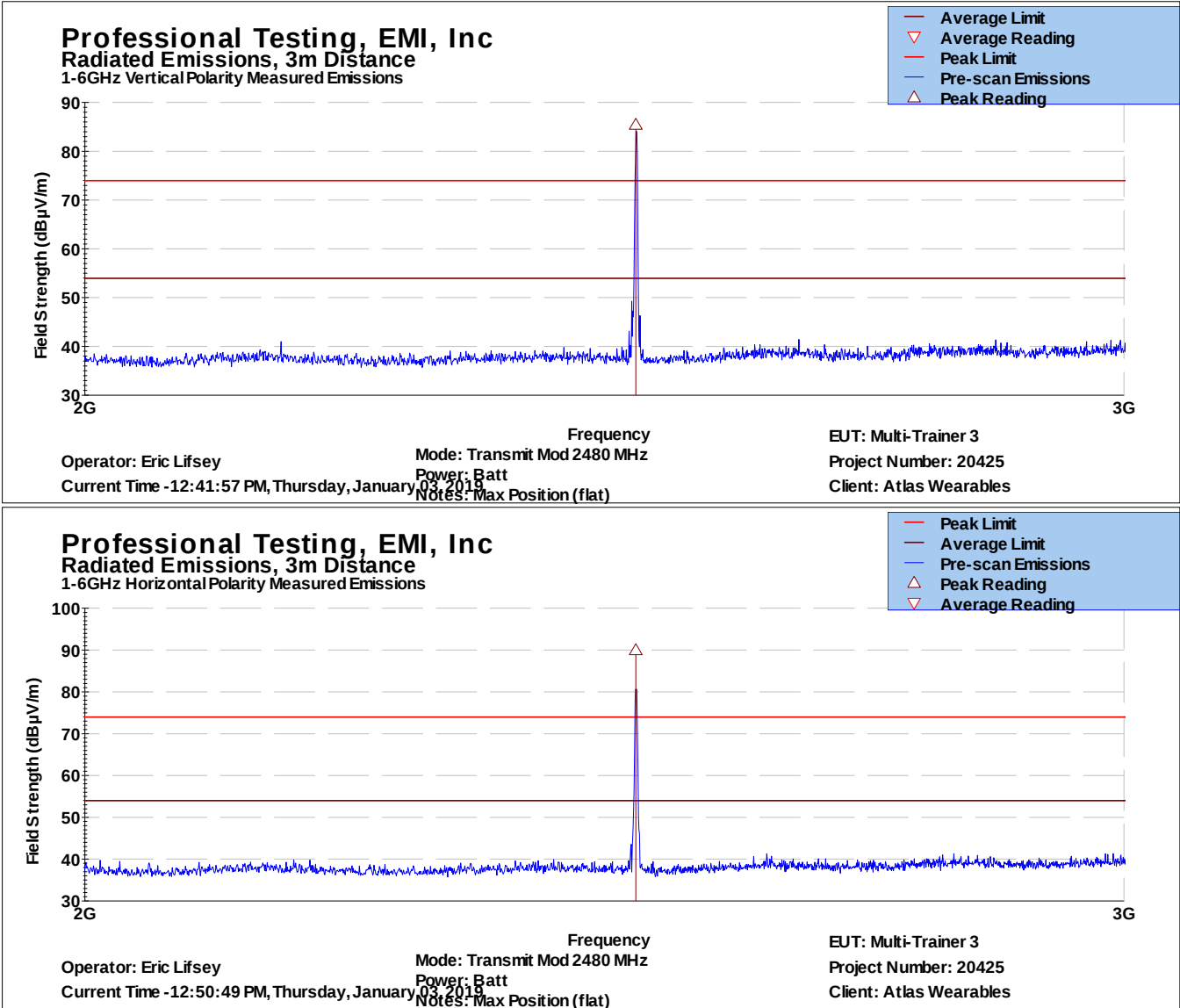
2.3.1 Bottom Channel



2.3.2 Middle Channel



2.3.3 Top Channel



2.4 Test Results, Duty Cycle

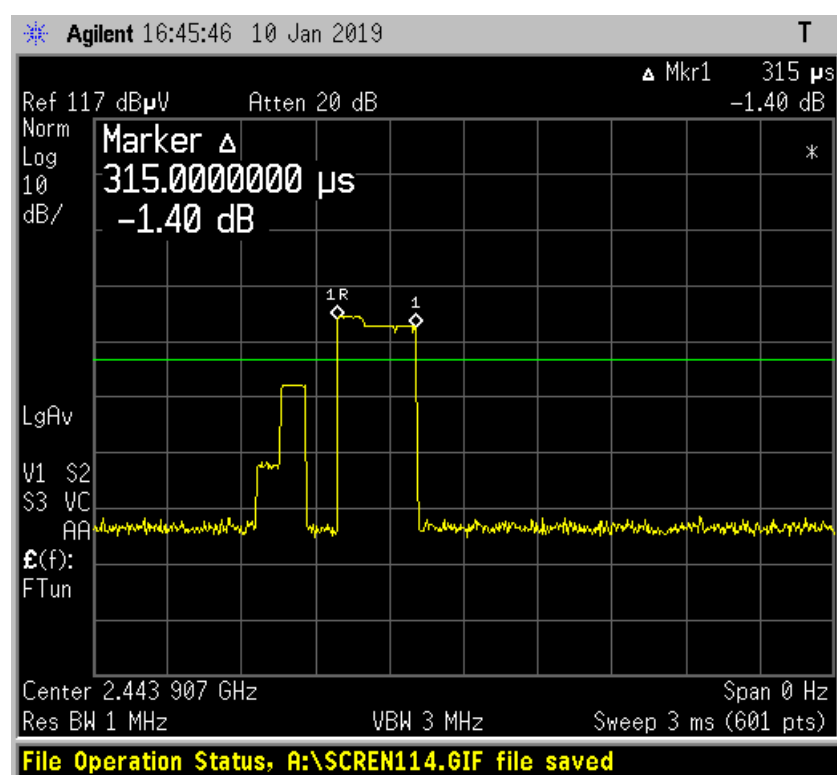
Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power.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

Table 2.4.1 Duty Cycle with Average Duty Cycle Factor

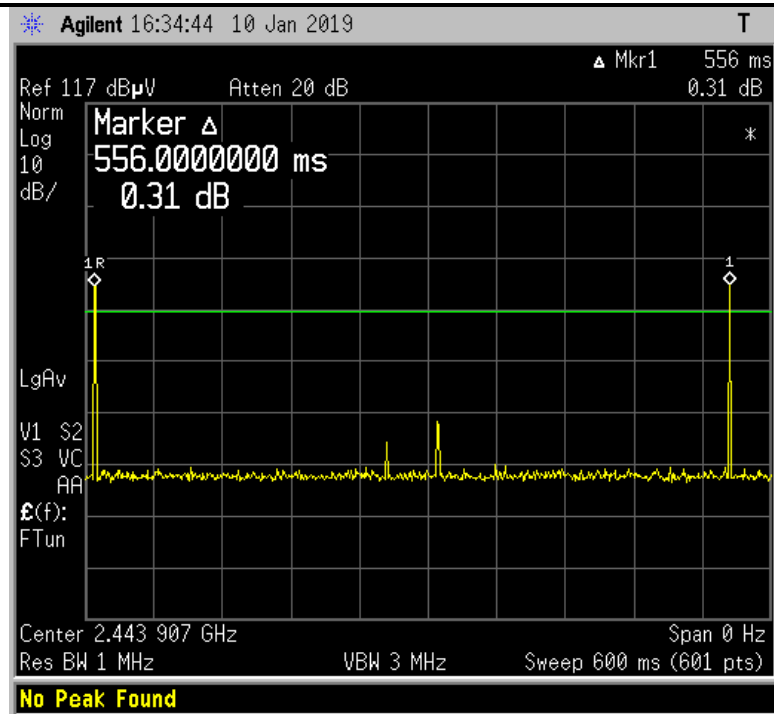
Total Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
0.315	100	$= 20 * \text{Log}_{10} (0.315 \text{ msec} / 100 \text{ msec})$	-50	-20.0

Table 2.4.2 Duty Cycle with Weighted Averaging Factor for Exposure

Total Measured On Time (msec)	Measured Time Interval (msec)	Averaging Factor Calculation	Result for Averaging Factor (dB)
0.315	556	$= 10 * \text{Log}_{10} (0.315 \text{ msec} / 556 \text{ msec})$	-32.5



Transmit Event



Transmit Interval

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	3 Jan 2019

3.3 Test Results

Full bandwidth unmodulated peak power measured ~10 dB lower than the power spectral density limit. Measurement is not required.

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, 99%	10 Jan 2019

4.3 Test Results

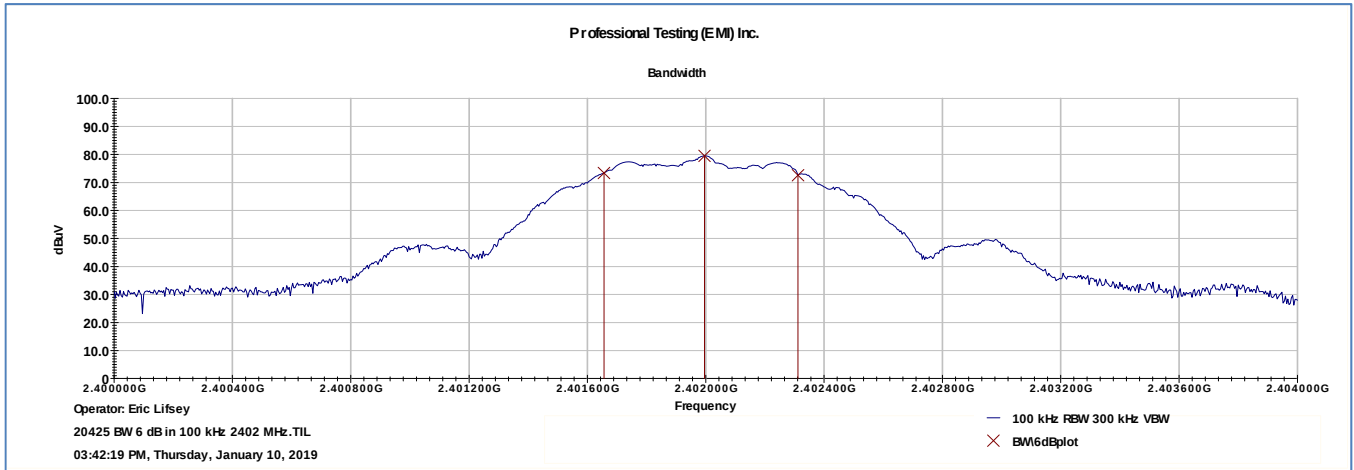
The bandwidth measurement is used to verify DTS characteristics and/or for general reporting for agency application.

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

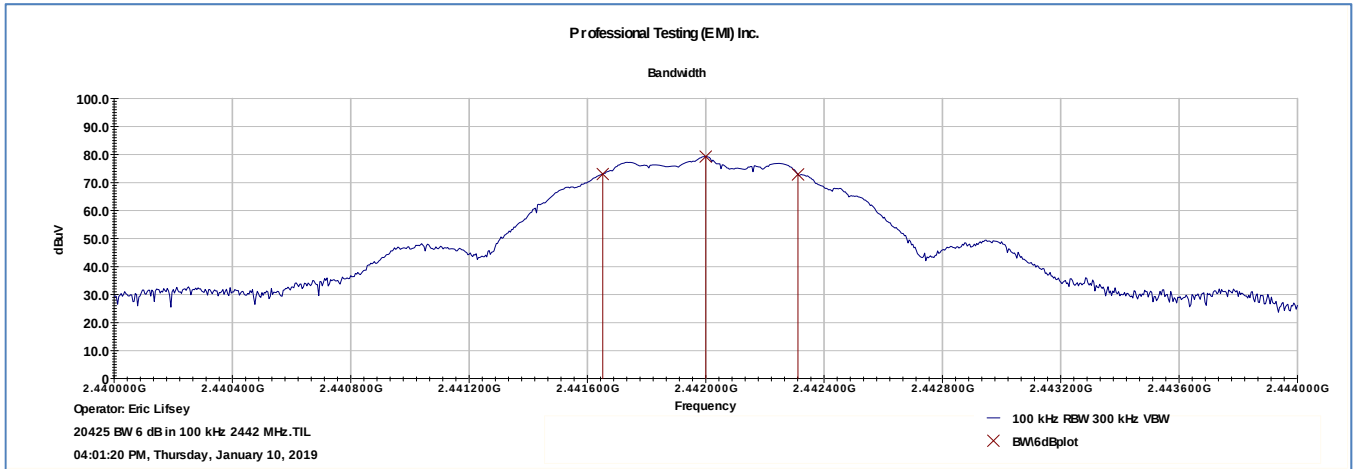
Table 4.3.1			
Bandwidth 6 dB, Minimum 500 kHz in 100 kHz RBW			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Minimum BW (kHz)
656	660	656	656
Bandwidth 20 dB, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
1104	1108	1108	1108
Bandwidth 99%, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
1032	1037	1037	1037

Plotted measurements appear on the following pages.

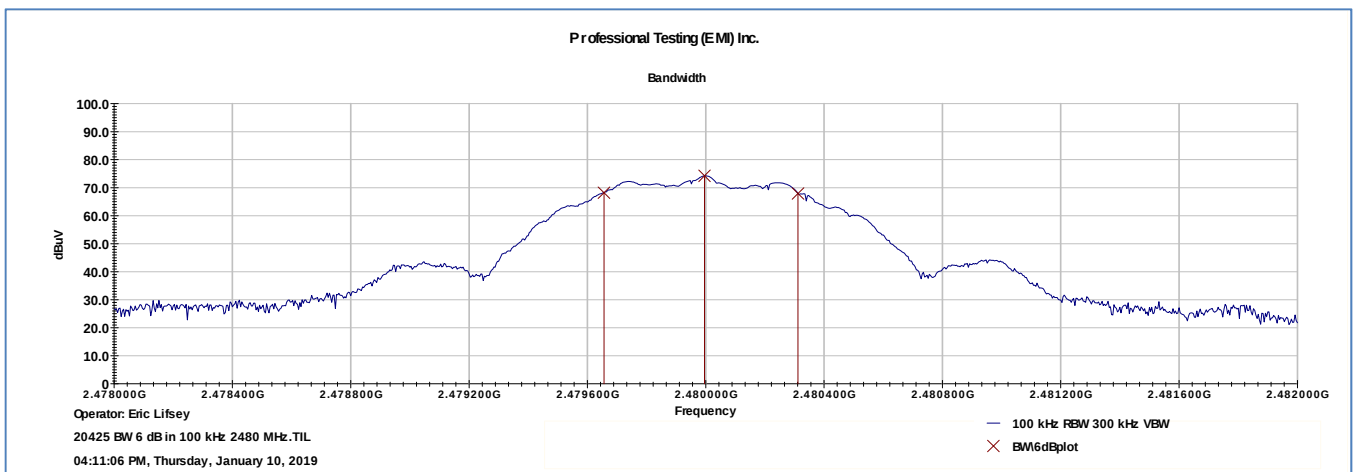
4.3.1 Bandwidth Plots, 6 dB



Bottom Channel

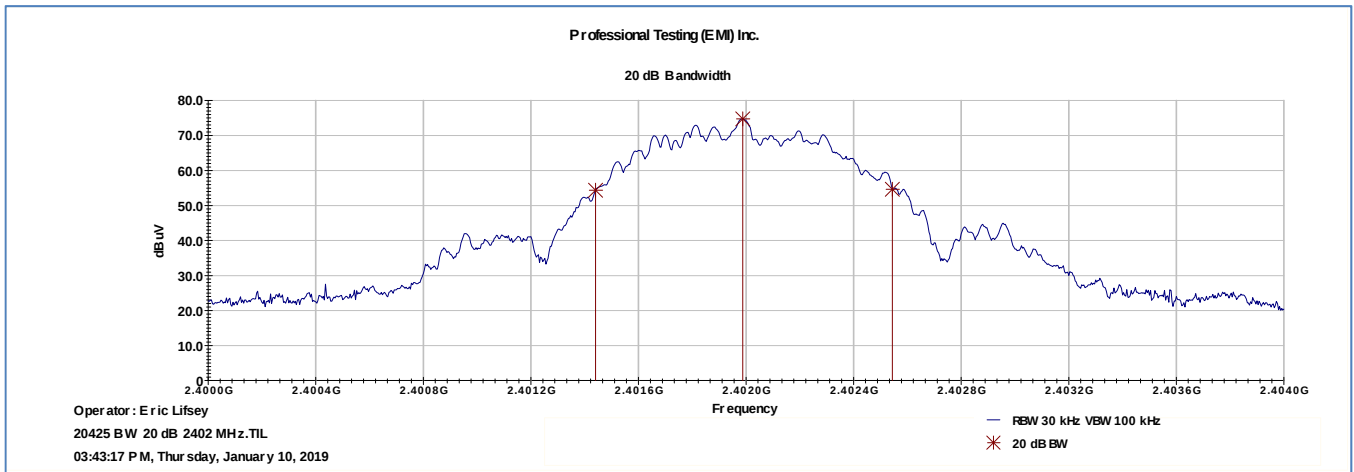


Middle Channel

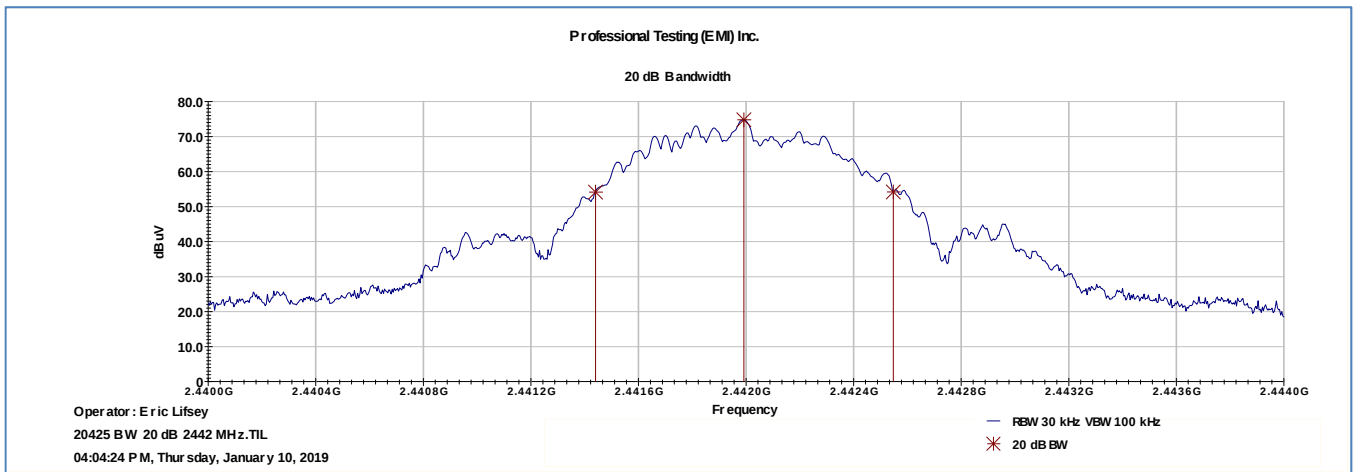


Top Channel

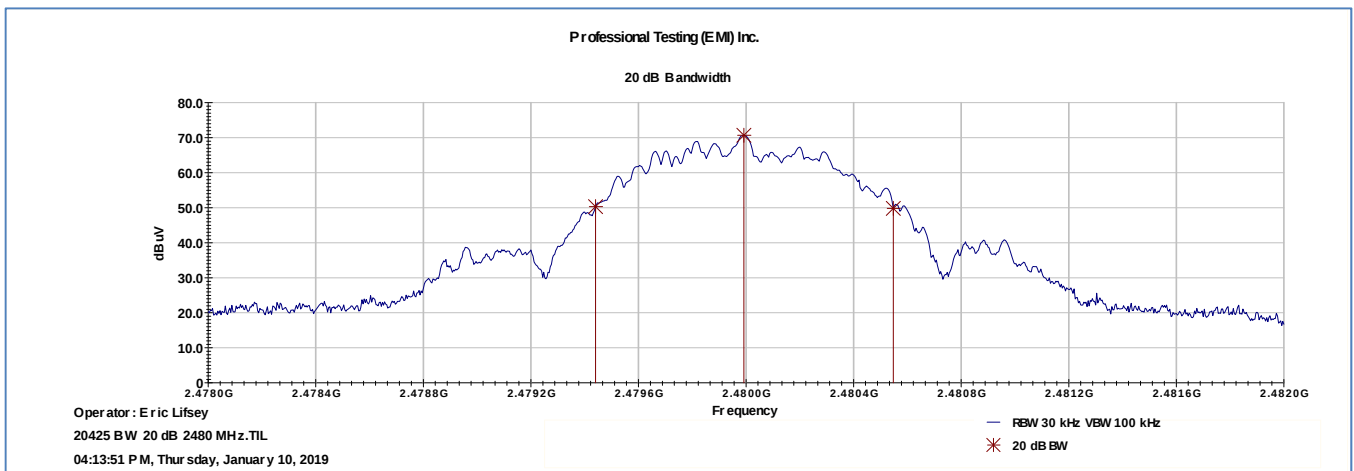
4.3.2 Bandwidth Plots, 20 dB



Bottom Channel

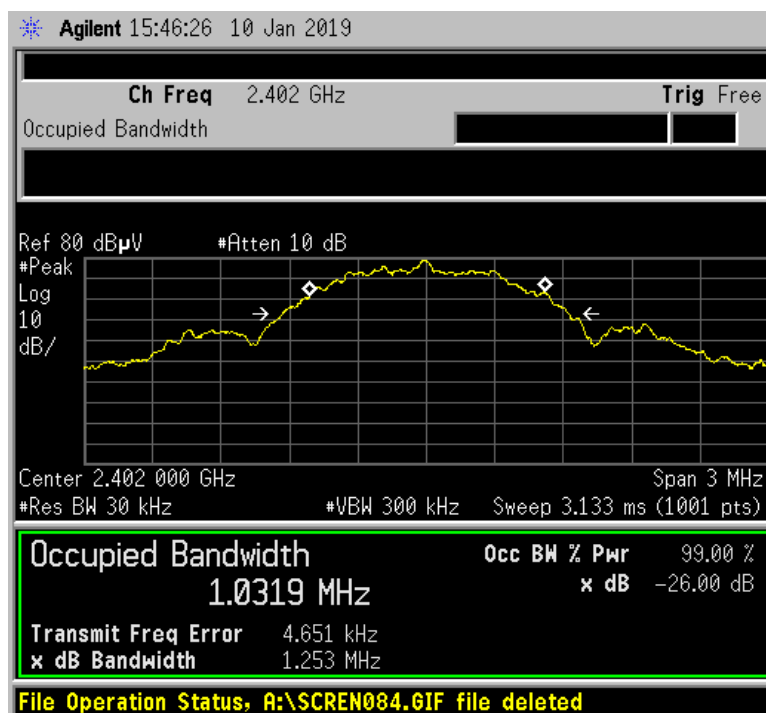


Middle Channel

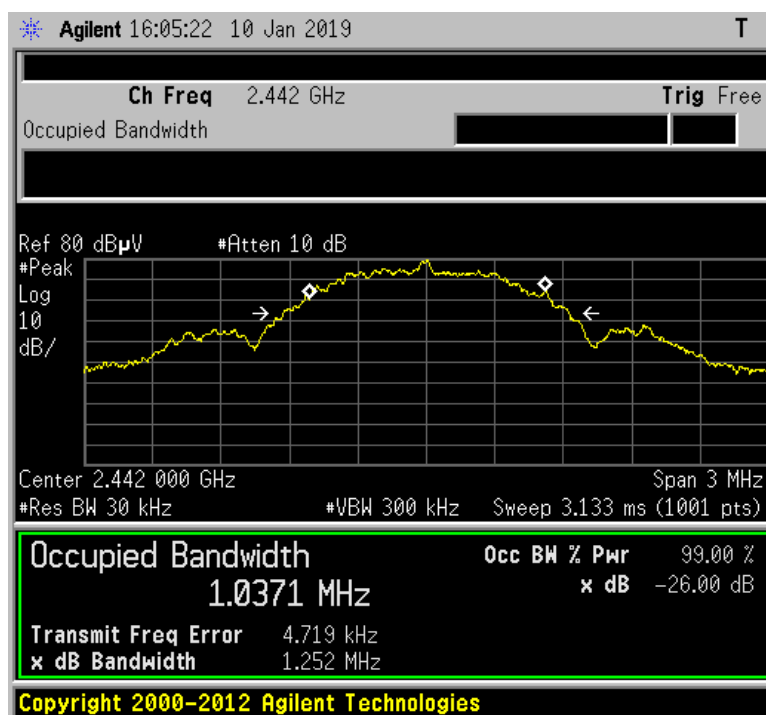


Top Channel

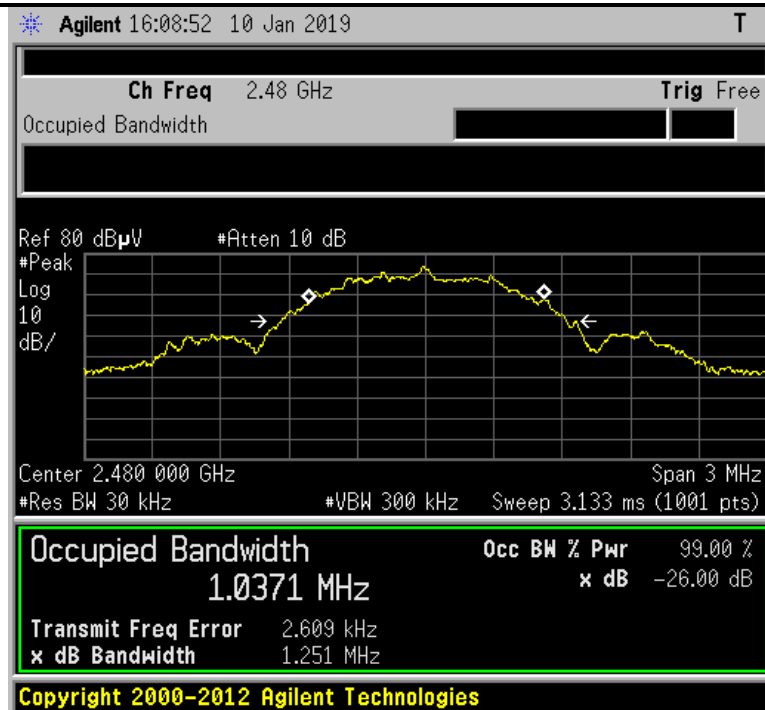
4.3.3 Bandwidth Plots, 99%



Bottom Channel



Middle Channel



Top Channel

5.0 Band Edge

5.1 Test Procedure

EUT is placed into normal transmit operation on the nearest band edge channel. The spectrum analyzer is approximately centered on the band edge frequency with span sufficient to include the peak of the adjacent fundamental signal. Measurement includes at least two standard bandwidths from the respective band edge. If required, the band-edge marker-delta method is utilized.

5.2 Test Criteria

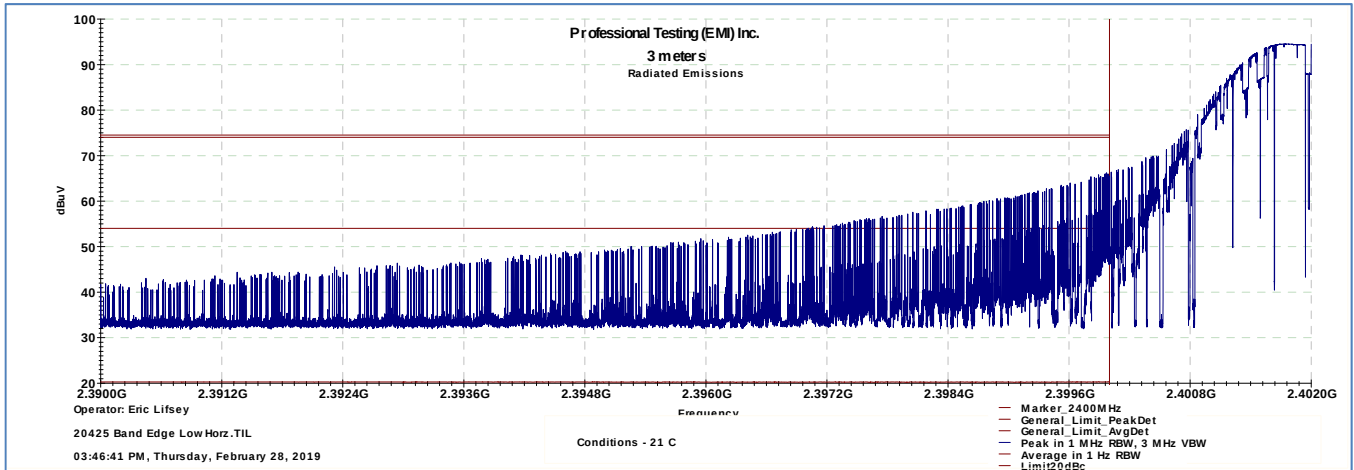
47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.205 // RSS-247 5.5, RSS-Gen 4.9	Unwanted Emissions Adjacent to Authorized Band	28 Feb 2019

5.3 Test Results

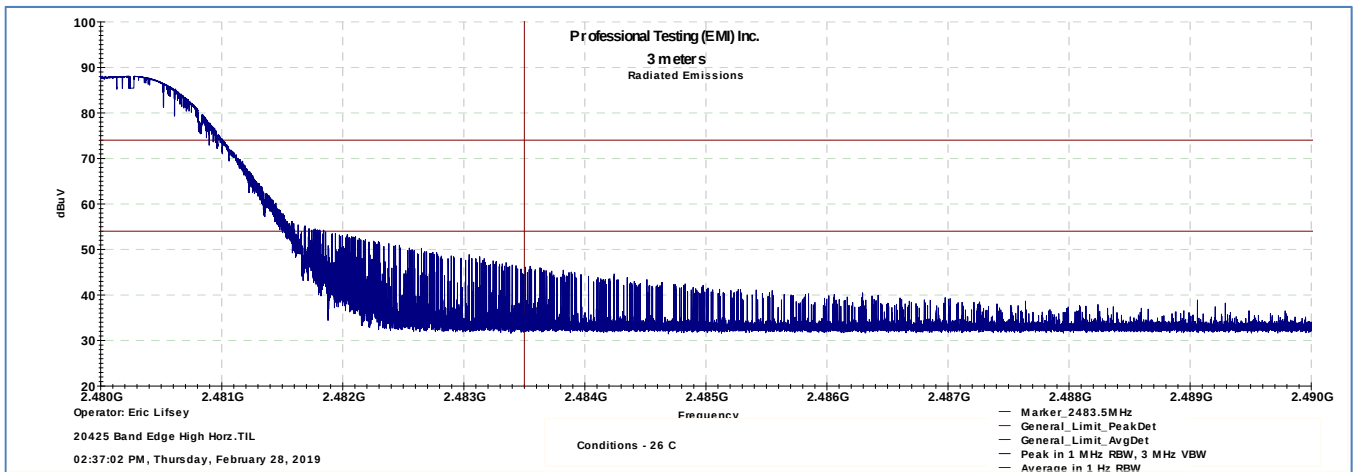
Measurements included fundamental and more than 2 standard bandwidths (standard bandwidth 1 MHz) beyond the band edges to provide a clear view of the fundamental and the declining emission levels.

The EUT satisfied the criteria. Plotted results appear on the following pages.

5.3.1 Bottom Channel Band Edge



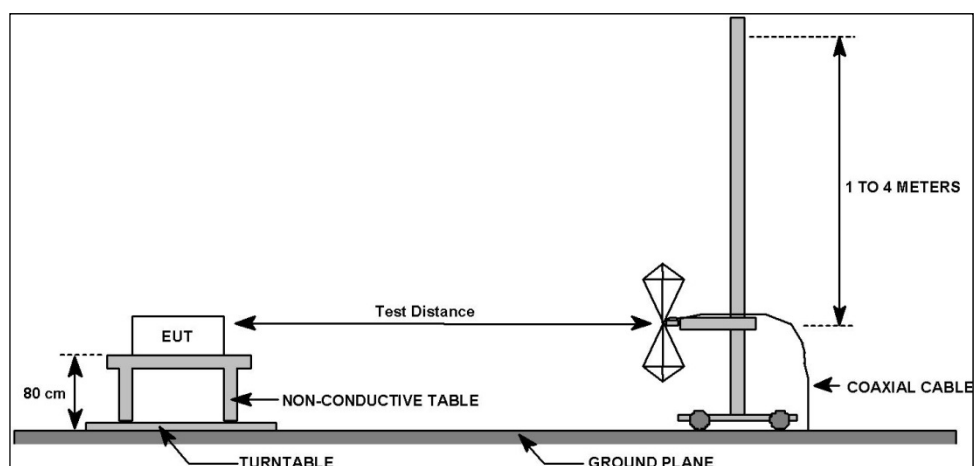
5.3.2 Top Channel Band Edge



6.0 Radiated Spurious Emissions, Transmit Mode

6.1 Test Procedure

Radiated emissions are measured with the EUT transmitting on the required frequencies.



6.1.1 Test Distance and Detection Method

30 MHz to 1 GHz	1 GHz to 18 GHz	18 GHz to 25 GHz
10 m	3 m	1 m
Quasi-peak	Peak & Average	Peak & Average

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	3 Jan 2019 4 Jan 2019

6.3 Test Results

Three channels were tested. EUT was transmitting continuously and unmodulated.

The EUT satisfied the requirement. Graphical and tabular data appears below.

6.3.1 Center Channel, 30 MHz to 25 GHz

Professional Testing, EMI, Inc.

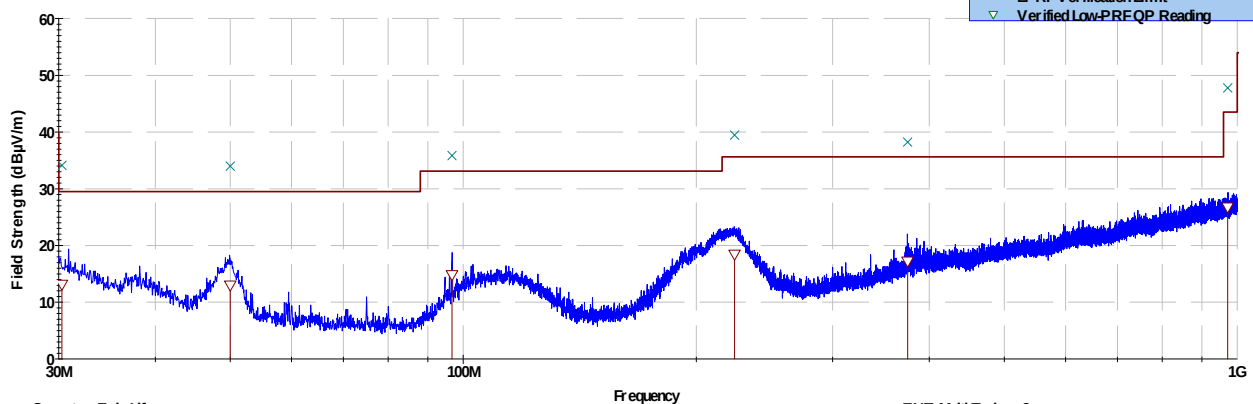
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		3VDC			EUT Power Frequency:		0N/A		
Antenna Orientation:		Vertical			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit Modulated 2442 MHz				
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
30.299	10	189	1.47	Quasi-peak	24.275	13.116	29.5	-16.4	Pass
49.995	10	57	1.18	Quasi-peak	31.853	12.975	29.5	-16.5	Pass
96.712	10	77	1.17	Quasi-peak	33.209	14.815	33.1	-18.3	Pass
224.176	10	16	1.44	Quasi-peak	31.602	18.431	35.6	-17.2	Pass
375.071	10	66	1.18	Quasi-peak	25.548	17.212	35.6	-18.4	Pass
972.011	10	212	3.36	Quasi-peak	21.551	26.762	43.5	-16.7	Pass

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



Operator: Eric Lifsey

20425'RE:T7V1.2'Run01'ChanMid'MHz'GHz - FCC.til

Current Time -09:06:21 AM, Thursday, January 03, 2019

Mode: Transmit Mod 2442 MHz

Power: Batt

Notes: Max Position (flat)

EUT: Multi-Trainer 3

Project Number: 20425

Client: Atlas Wearables

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

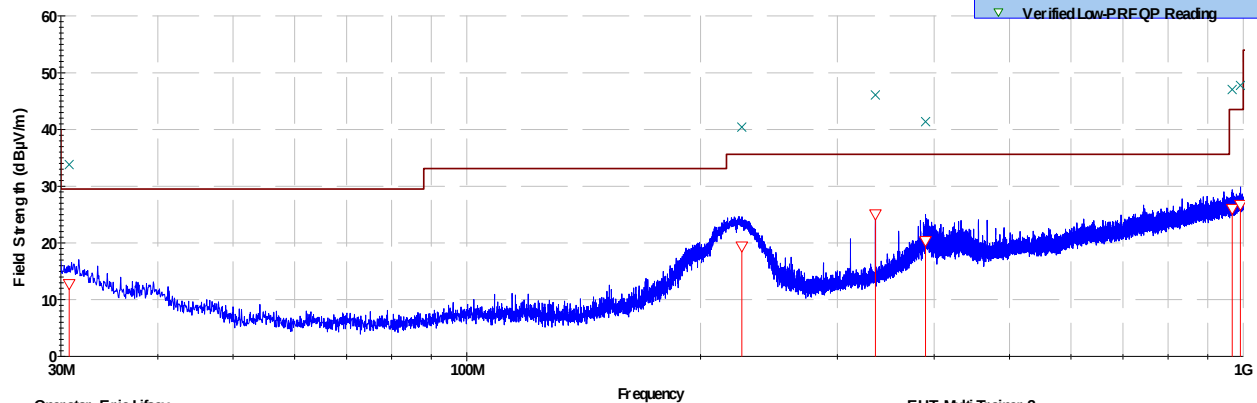
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		3VDC			EUT Power Frequency:		0N/A		
Antenna Orientation:		Horizontal			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit Modulated 2442 MHz				
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
30.745	10	74	2.71	Quasi-peak	24.136	12.794	29.5	-16.7	Pass
226.058	10	275	3.71	Quasi-peak	32.472	19.413	35.6	-16.2	Pass
336.001	10	32	2.08	Quasi-peak	34.778	25.075	35.6	-10.5	Pass
389.84	10	97	2.15	Quasi-peak	28.53	20.369	35.6	-15.2	Pass
967.851	10	193	2.37	Quasi-peak	20.928	26.033	43.5	-17.5	Pass
991.91	10	139	2.53	Quasi-peak	21.031	26.741	43.5	-16.8	Pass

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



Operator: Eric Lifsey

20425'RE:T7V1.2'Run01'ChanMid'MHz'GHz - FCC.ttl

Current Time -09:18:16 AM, Thursday, January 03, 2019

Mode: Transmit Mod 2442 MHz

Power: Batt

Notes: Max Position (flat)

EUT: Multi-Trainer 3

Project Number: 20425

Client: Atlas Wearables

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

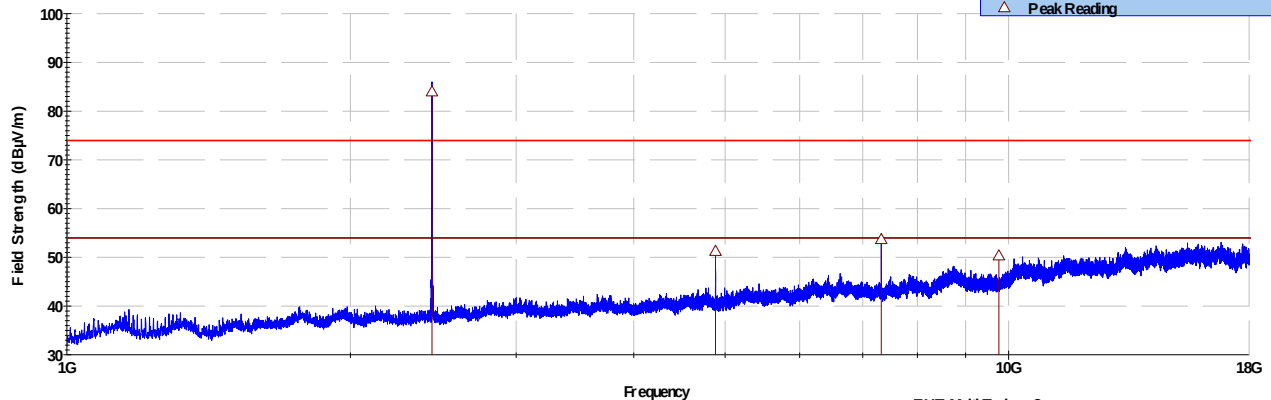
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		3VDC			EUT Power Frequency:		0N/A		
Antenna Orientation:		Vertical			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit Modulated 2442 MHz				
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
2441.96	3	65	0.95	Peak	92.9	83.973			
4883.45	3	154	3.03	Peak	55.2	51.262	74.0	-22.7	Pass
7325.11	3	37	2.54	Peak	50	53.671	74.0	-20.3	Pass
9765.55	3	2	3.97	Peak	41.8	50.332	74.0	-23.6	Pass

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



Operator: Eric Lifsey

Mode: Transmit Mod 2442 MHz

EUT: Multi-Trainer 3

Current Time -11:11:17 AM, Thursday, January 03, 2019

Power: Batt

Project Number: 20425

Notes: Max Position (flat)

Client: Atlas Wearables

> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

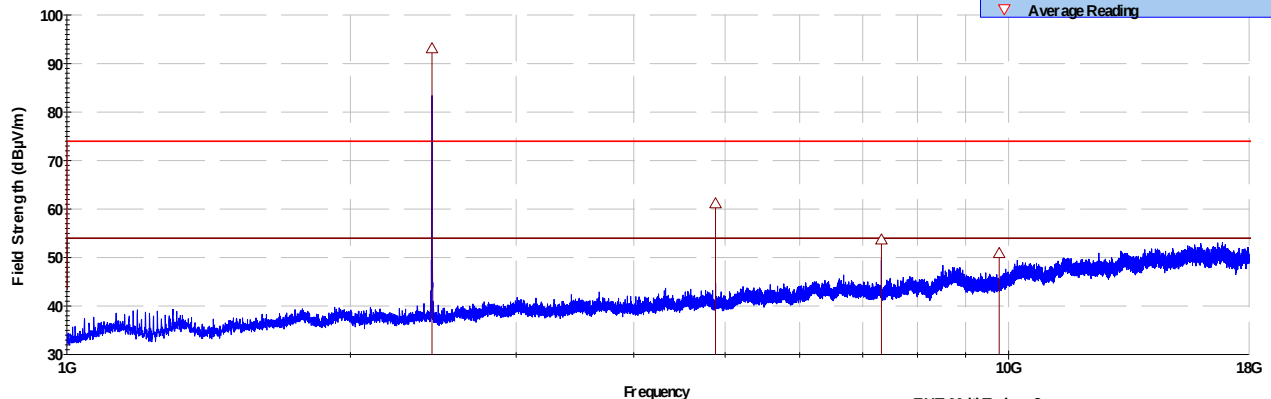
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		3VDC			EUT Power Frequency:		0N/A		
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit Modulated 2442 MHz				
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
2441.76	3	111	3.87	Peak	102	93.087			
4883.54	3	118	3.71	Peak	65.1	61.128	74.0	-12.8	Pass
7326.47	3	53	1.09	Peak	49.9	53.653	74.0	-20.3	Pass
9772.27	3	250	1.1	Peak	42.3	50.857	74.0	-23.1	Pass

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



Operator: Eric Lifsey

Mode: Transmit Mod 2442 MHz

EUT: Multi-Trainer 3

Current Time: 10:56:52 AM, Thursday, January 03, 2019

Power: Batt

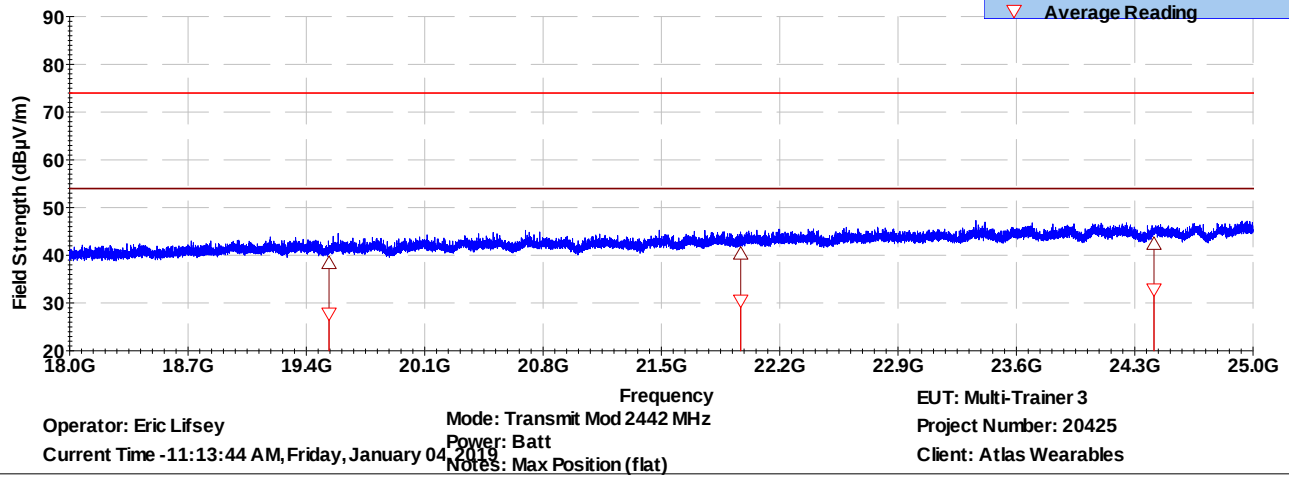
Project Number: 20425

Notes: Max Position (flat)

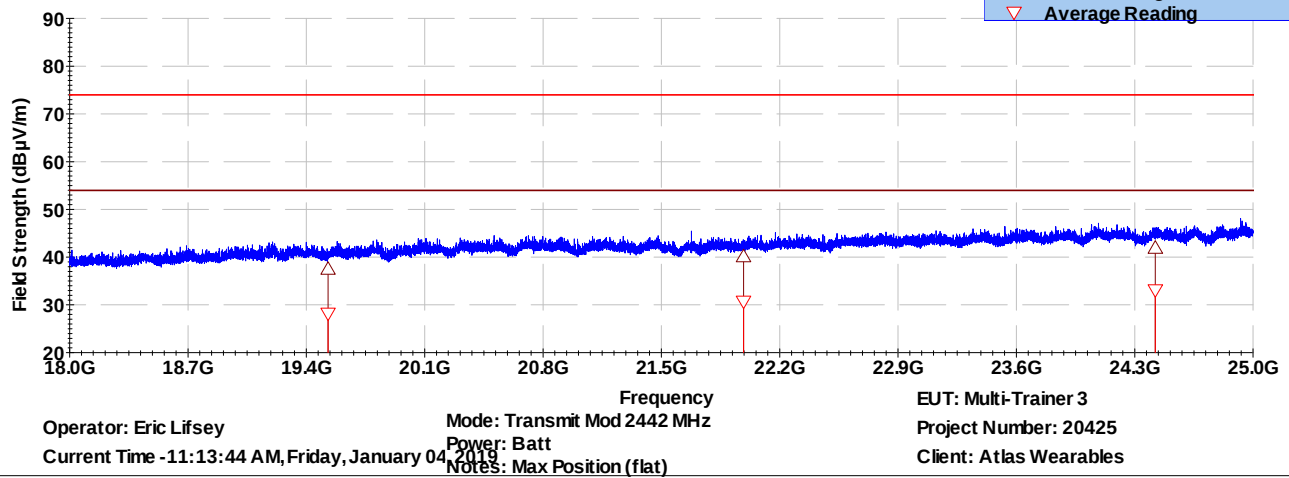
Client: Atlas Wearables

> 1GHz Horizontal Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc
Radiated Emissions, Measured at 1m and Scaled to 3m Distance
18-26.5 GHz Vertical Polarity Measured Emissions



Professional Testing, EMI, Inc
Radiated Emissions, Measured at 1m and Scaled to 3m Distance
18-26.5 GHz Horizontal Polarity Measured Emissions



6.3.2 Bottom Channel 1 GHz to 25 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):		1/3/2019			EUT Serial #:		none		
Customer:		Atlas Wearables			EUT Part #:		none		
Project Number:		20425			Test Technician:		Eric Lifsey		
Purchase Order #:		0			Supervisor:		Lisa Arndt		
Equip. Under Test:		Multi-Trainer 3			Witness' Name:		Mike Kasparian		
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		3 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Vertical			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit Modulated 2402 MHz				
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
2402.16	3	230	2.65	Peak	97.2	88.17			
4803.46	3	241	2.51	Peak	60.4	56.459	74.0	-17.5	Pass
7204.79	3	104	2.51	Peak	50.8	54.108	74.0	-19.8	Pass
9603.03	3	167	3.28	Peak	45.5	54.078	74.0	-19.9	Pass
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions The graph displays field strength measurements from 1 GHz to 18 GHz. A blue line represents the measured emissions, which are mostly below 50 dBμV/m. A red line at approximately 74 dBμV/m indicates the average limit. A dashed red line at approximately 88 dBμV/m indicates the peak limit. A single sharp peak is visible at 2.4 GHz, reaching nearly 90 dBμV/m. A legend in the top right corner identifies the lines: Average Limit (red), Average Reading (red triangle), Peak Limit (dashed red), Pre-scan Emissions (blue), and Peak Reading (red triangle). Operator: Eric Lifsey Current Time: 12:13:41 PM, Thursday, January 03, 2019 Mode: Transmit Mod 2402 MHz Power: Batt Notes: Max Position (flat) EUT: Multi-Trainer 3 Project Number: 20425 Client: Atlas Wearables									

> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

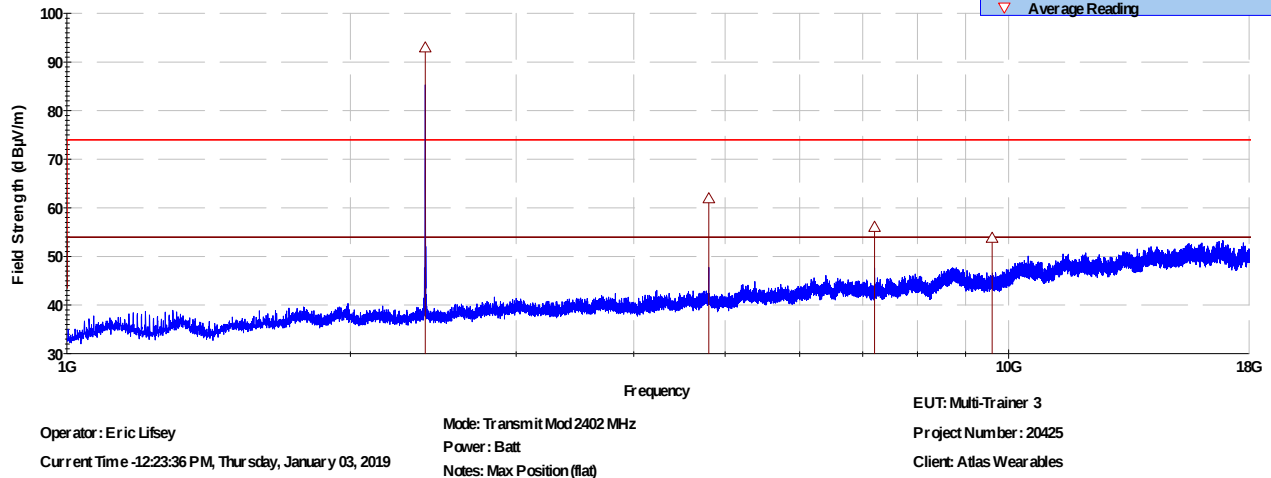
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

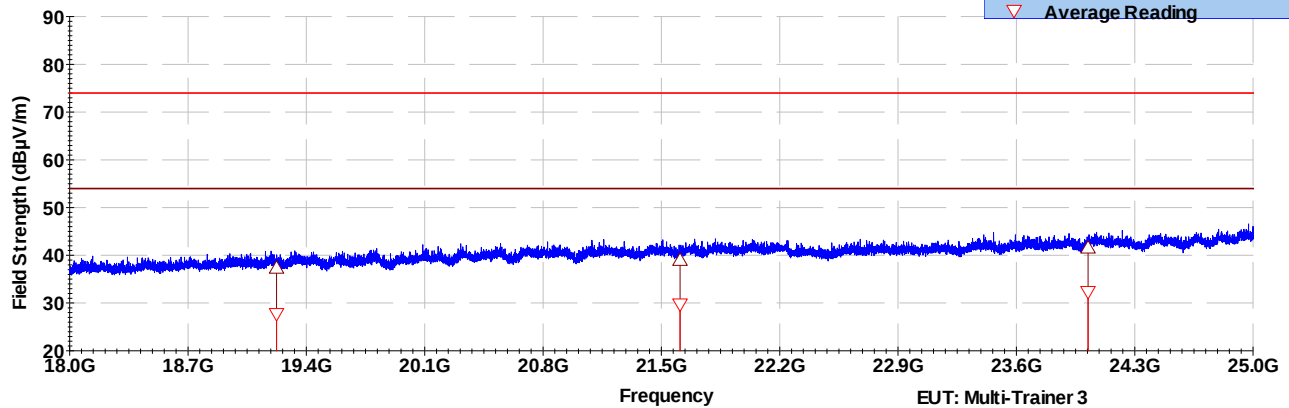
EUT Line Voltage:		3VDC			EUT Power Frequency:		0N/A		
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit Modulated 2402 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
2401.98	3	148	3.37	Peak	102	92.943			
4804.55	3	148	3.31	Peak	65.8	61.887	74.0	-12.1	Pass
7205.35	3	155	1.51	Peak	52.7	56.023	74.0	-17.9	Pass
9604.15	3	283	1.47	Peak	45.2	53.774	74.0	-20.2	Pass

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



> 1GHz Horizontal Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc
Radiated Emissions, Measured at 1m and Scaled to 3m Distance
18-26.5 GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey

Mode: Transmit Mod 2402 MHz

EUT: Multi-Trainer 3

Project Number: 20425

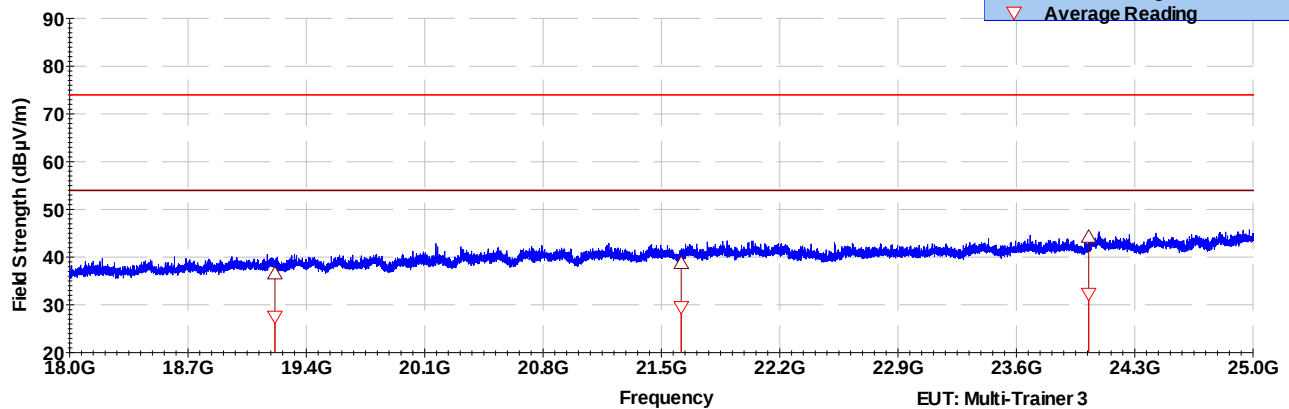
Current Time -11:39:29 AM, Friday, January 04, 2019

Power: Batt

Client: Atlas Wearables

Notes: Max Position (flat)

Professional Testing, EMI, Inc
Radiated Emissions, Measured at 1m and Scaled to 3m Distance
18-26.5 GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey

Mode: Transmit Mod 2402 MHz

EUT: Multi-Trainer 3

Project Number: 20425

Current Time -11:39:29 AM, Friday, January 04, 2019

Power: Batt

Client: Atlas Wearables

Notes: Max Position (flat)

6.3.3 Top Channel, 1 GHz to 25 GHz

Professional Testing, EMI, Inc.

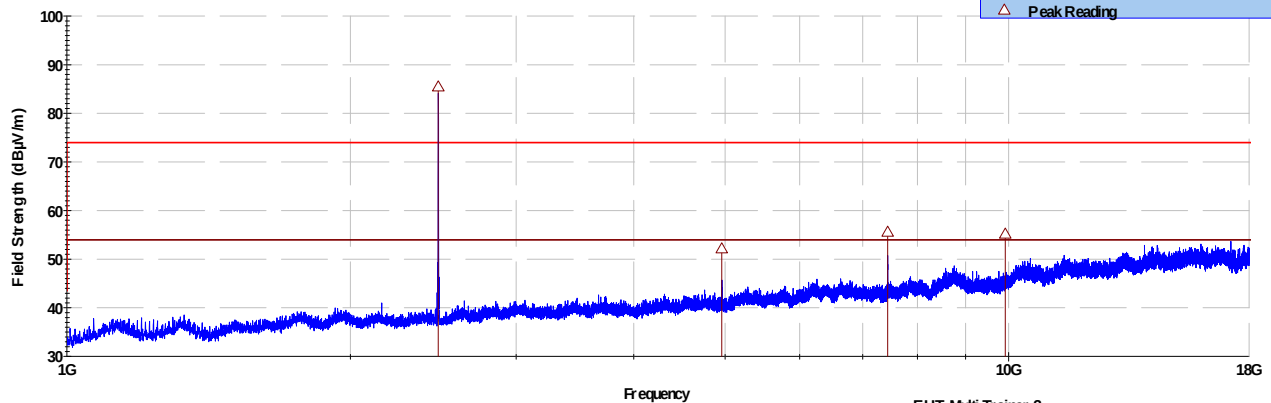
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:			3VDC		EUT Power Frequency:		0N/A		
Antenna Orientation:			Vertical		Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit Modulated 2480 MHz				
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
2479.69	3	228	3.33	Peak	94.4	85.449			
4959.39	3	228	3.11	Peak	56.1	52.142	74.0	-21.8	Pass
7440.28	3	27	1.08	Peak	51.5	55.593	74.0	-18.4	Pass
9920.16	3	352	3.58	Peak	46.3	55.177	74.0	-18.8	Pass

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



Operator : Eric Lifsey

Mode: Transmit Mod 2480 MHz

EUT: Multi-Trainer 3

Power: Batt

Project Number : 20425

Current Time :12:41:57 PM, Thursday, January 03, 2019

Notes: Max Position (flat)

Client: Atlas Wearables

> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

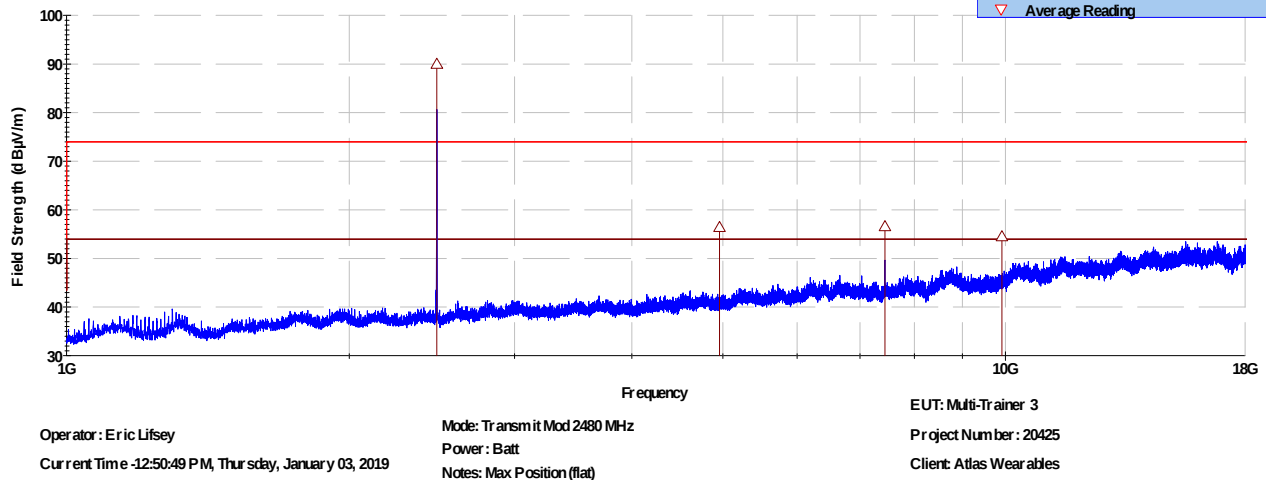
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

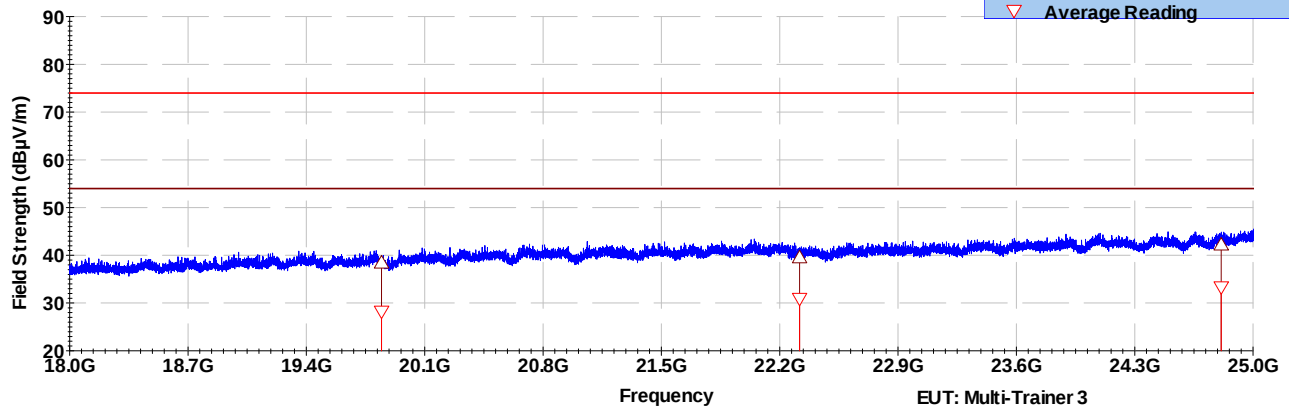
EUT Line Voltage:		3VDC			EUT Power Frequency:		0N/A		
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit Modulated 2480 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
2479.63	3	97	3.39	Peak	98.9	89.967			
4960.16	3	104	3.31	Peak	60.3	56.379	74.0	-17.6	Pass
7439.79	3	52	1.23	Peak	52.5	56.567	74.0	-17.4	Pass
9914.4	3	332	3.28	Peak	45.6	54.477	74.0	-19.5	Pass

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



> 1GHz Horizontal Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc
Radiated Emissions, Measured at 1m and Scaled to 3m Distance
18-26.5 GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey

Mode: Transmit Mod 2480 MHz

Project Number: 20425

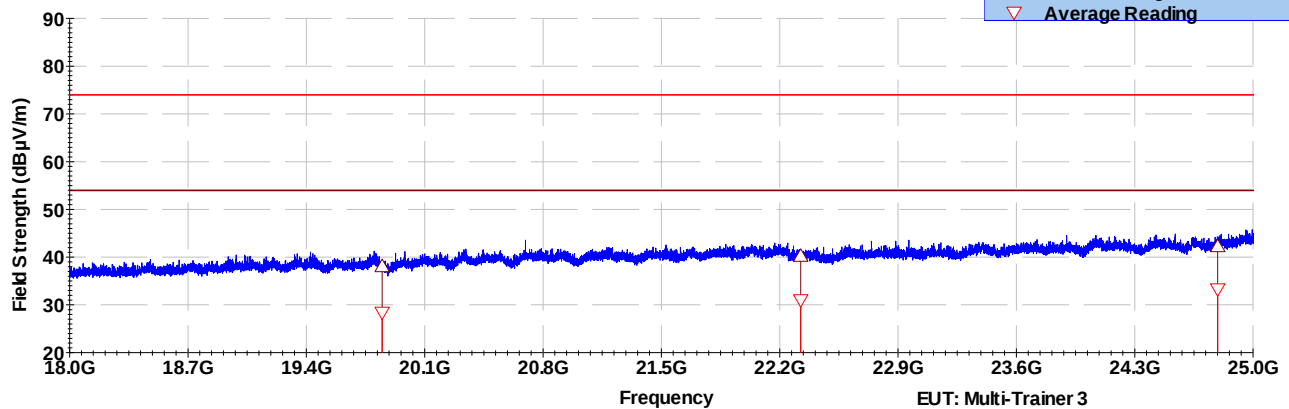
Current Time -12:12:12 PM, Friday, January 04, 2019

Power: Batt

Client: Atlas Wearables

Notes: Max Position (flat)

Professional Testing, EMI, Inc
Radiated Emissions, Measured at 1m and Scaled to 3m Distance
18-26.5 GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey

Mode: Transmit Mod 2480 MHz

Project Number: 20425

Current Time -12:12:12 PM, Friday, January 04, 2019

Power: Batt

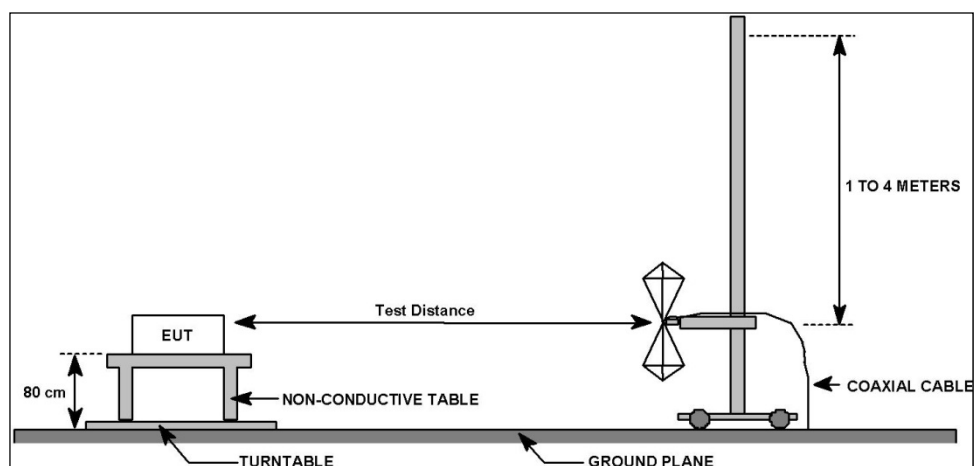
Client: Atlas Wearables

Notes: Max Position (flat)

7.0 Radiated Spurious Emissions, Receive Mode

7.1 Test Procedure

Radiated emissions are measured with the EUT receiving on the center channel.



7.1.1 Test Distance and Detection Method

30 MHz to 1 GHz	1 GHz to 18 GHz	18 GHz to 25 GHz
10 m	3 m	1 m
Quasi-peak	Peak & Average	Peak & Average

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	3 Jan 2019

7.3 Test Results

The EUT satisfied the requirement while in transmit mode below 1 GHz. Emissions were measured in receive mode above 1 GHz. Graphical and tabular data appears below.

Professional Testing, EMI, Inc.

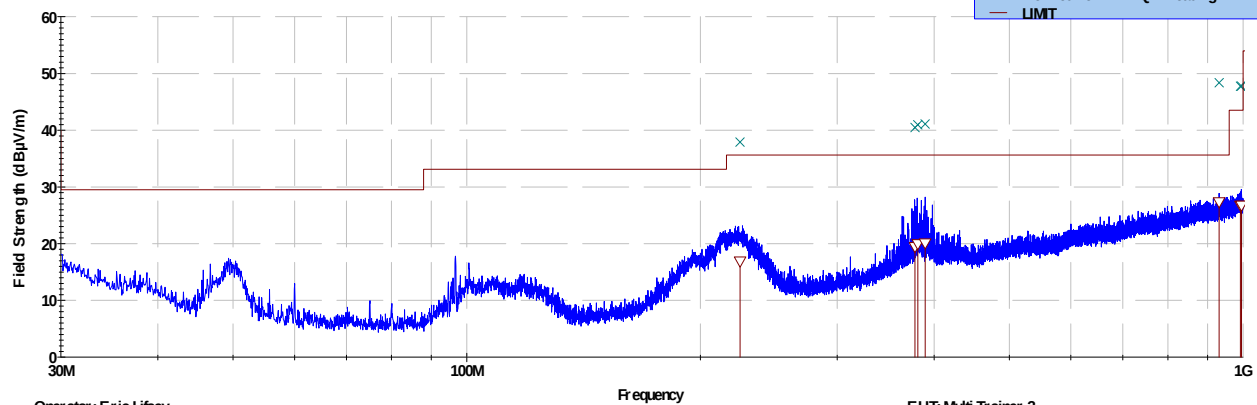
Test Method:	ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		3 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Vertical			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Receive 2442 MHz				
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
224.95	10	200	1.45	Quasi-peak	30.024	16.888	35.6	-18.7	Pass
377.98	10	46	1.18	Quasi-peak	27.754	19.454	35.6	-16.1	Pass
381.081	10	44	1.28	Quasi-peak	28.203	19.94	35.6	-15.7	Pass
389.419	10	36	1.18	Quasi-peak	28.261	20.095	35.6	-15.5	Pass
931.463	10	307	1.93	Quasi-peak	23.151	27.338	35.6	-8.3	Pass
992.332	10	284	3.93	Quasi-peak	21.008	26.729	43.5	-16.8	Pass
995.203	10	311	4.03	Quasi-peak	20.97	26.762	43.5	-16.7	Pass

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



Operator: Eric Lifsey

20425'RE:T7V1Z'Run06'ChanMid'RX Mode'FCC.til

Current Time -03:34:15 PM, Thursday, January 03, 2019

Mode: Rx 2442 MHz

Power: Batt

Notes:

EUT: Multi-Trainer 3

Project Number: 20425

Client: Atlas Wearables

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

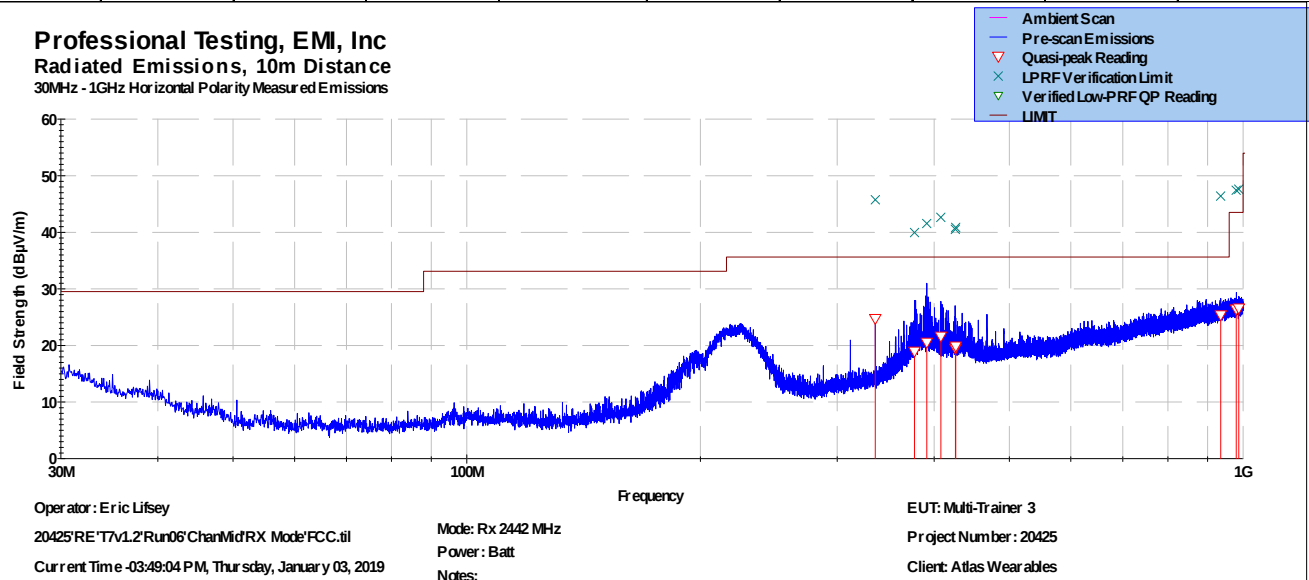
Test Method:	ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		3 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Horizontal			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Receive 2442 MHz				
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
336	10	313	2.02	Quasi-peak	34.434	24.731	35.6	-10.9	Pass
377.385	10	231	2.48	Quasi-peak	27.25	18.942	35.6	-16.7	Pass
391.313	10	242	2.05	Quasi-peak	28.677	20.534	35.6	-15.1	Pass
407.985	10	246	1.81	Quasi-peak	29.333	21.609	35.6	-14.0	Pass
426.04	10	93	2.37	Quasi-peak	26.524	19.491	35.6	-16.1	Pass
426.412	10	91	2.14	Quasi-peak	26.877	19.846	35.6	-15.8	Pass
935.675	10	10	3.36	Quasi-peak	21.09	25.383	35.6	-10.2	Pass
979.972	10	10	1.11	Quasi-peak	20.997	26.41	43.5	-17.1	Pass
987.484	10	268	2.48	Quasi-peak	20.994	26.594	43.5	-16.9	Pass

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



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

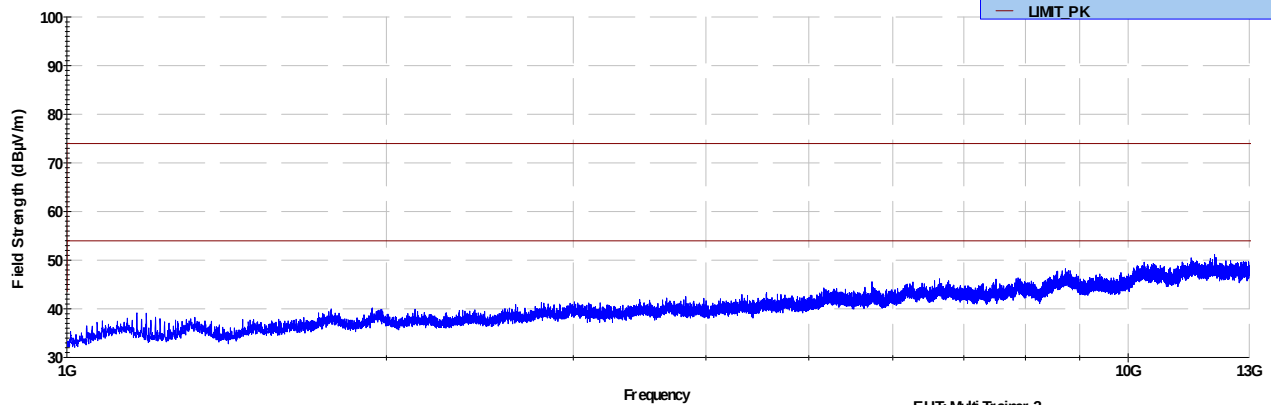
Test Method:	ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:	Receive 2442 MHz		

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



Operator: Eric Lifsey

Mode: Rx 2442 MHz

EUT: Multi-Trainer 3

Current Time -04:48:34 PM, Thursday, January 03, 2019

Power: Batt

Project Number: 20425

Notes:

Client: Atlas Wearables

> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

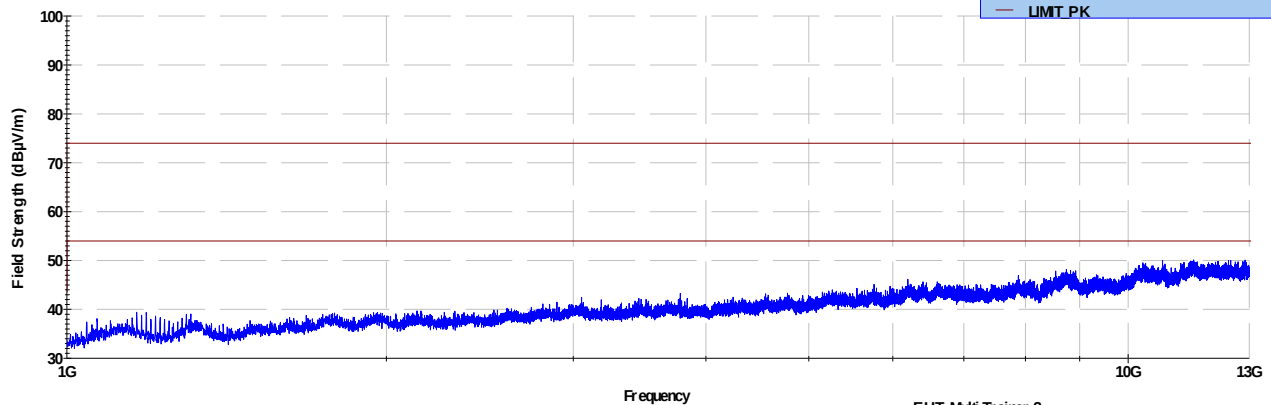
Test Method:	ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	1/3/2019	EUT Serial #:	none
Customer:	Atlas Wearables	EUT Part #:	none
Project Number:	20425	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Multi-Trainer 3	Witness' Name:	Mike Kasparian

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	3 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:	Receive 2442 MHz		

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



Operator: Eric Lifsey

Current Time: 04:52:42 PM, Thursday, January 03, 2019

Mode: Rx 2442 MHz

Power: Batt

Notes:

EUT: Multi-Trainer 3

Project Number: 20425

Client: Atlas Wearables

> 1GHz Horizontal Antenna Polarity Measured Emissions

8.0 Antenna Construction

8.1 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.

8.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203, 15.247 // RSS-Gen 8.3	Antenna Construction	28 Feb 2019

8.3 Results

Table 8.3.1 Antenna Construction Details
Manufacturer: JOHANSON TECHNOLOGY Part Number: 2450AT07A0100T Type: Surface mounted chip antenna. Gain 1.0 dBi peak Construction: Soldered to circuit board and internal to system. No connector provided. Antenna is internal to device and not subject to user modification.

The antenna system design above satisfies the requirements of the rules.

9.0 Equipment

9.1 Radiated Emissions 30 MHz to 18 GHz

Radiated Emissions Test Equipment List					
Tile! Software Version:		Version: 7.1.2.17 (Jan 08, 2016 - 02:12:48 PM) or 4.1.A.0, April 14, 2009, 11:01:00PM			
Test Profile:		2018_Radiated Emissions_TILE7_v1EL.til			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	TDK 10M	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/10/2019
1890	HP	8447F-H64	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/10/2020
1937	Agilent	E4440A - AYZ	PSA , 3 Hz - 26.5 GHz, Opt. AYZ	MY44808298	11/8/2019
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	135454	3/7/2019
C027D	NAD	NAD 2400	Amplifier, 100W, 3Hz-100kHz	11524464	N/A
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	TDK 10M	TDK 10M Chamber,sVSWR > 1 GHz	DAC-012915-005	11/16/2019
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	1/10/2020
C030	none	none	Cable Coax, N-N, 30m, 1 - 18GHz	none	9/21/2019
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	110313	3/15/2019

9.2 Fundamental Power, Bandwidth, Duty Cycle, Band Edge

Asset #	Manufacturer	Model #	Description	Calibration Due
2295	Agilent	E4440A	Spectrum Analyzer	6 Nov 2019

9.3 Radiated Emissions 18-25 GHz

Asset #	Manufacturer	Model #	Description	Calibration Due
2295	Agilent	E4440A	Spectrum Analyzer	6 Nov 2019
1974	Agilent	83017A	Microwave Amplifier	7 Nov 2020
1542	A H Systems	SAS-572	Antenna, Horn, 18-26.5 GHz	CNR
0524	EMCO	1060	Turntable controller	CNR

10.0 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