
Project 20982-15

uAvionix

MicroLink

**Wireless Certification Report
FCC 15.247 & RSS-247**

Prepared for:

uAvionix LLC
300 Pine Needle Lane
Big Fork, MT 59911

By

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

30 Aug 2019

Reviewed by



Shakil Murad
Lead EMC Engineer

Written by



Eric Lifsey
EMC Engineer

Revision History

Revision Number	Description	Date
Draft 01	Draft for review.	2 Aug 2019
Final 04	Revised per TCB comments.	30 Aug 2019

Errata:

None.

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Compliance Certificate

Applicant	Device & Test Identification
uAvionix LLC 300 Pine Needle Lane Big Fork, MT 59911 Certificate Date: 22 Aug 2019	FCC ID: 2AFFTC2XISM Industry Canada ID: 25261-C2XISM Model(s): MicroLink Laboratory Project ID: 20982-15

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 <u>902-928 MHz</u> , 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 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
UAvionix Model: MicroLink	none	902 to 928 MHz transceiver; using 50 channel hopping scheme.

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

The EUT is DC powered over Ethernet (POE).

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.

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 Measurements

Radiated levels are determined as follows:

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

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

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

Conducted mains levels, when applicable, 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, Subpart B – Unintentional Radiators
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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
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

Table 1.7.2: Applicable Clauses		
Parameter	FCC Part 15 Rule Paragraphs	IC RSS References
Transmitter Characteristics	15.247	RSS-247 5.1 (FHS) & 5.4, RSS-Gen
Bandwidth	15.247(a)(2), 2.1049, KDB 558074 D01	RSS-247 6, RSS-Gen 6.6
Spurious Emission	15.247(d), 15.209, 15.205	RSS-247 5.5, RSS-GEN 6.13 & 8.10
Band Edge	15.247, 15.205	RSS-247 5.5, RSS-Gen 8.10
Antenna Requirement	15.247, 15.203	RSS-Gen 8.3

2.0 Fundamental Power

2.1 Test Procedure

Peak power is measured using conducted means and without modulation. The transmitter hopping sequence is disabled to operate on a single channel for the measurement.

2.2 Test Criteria

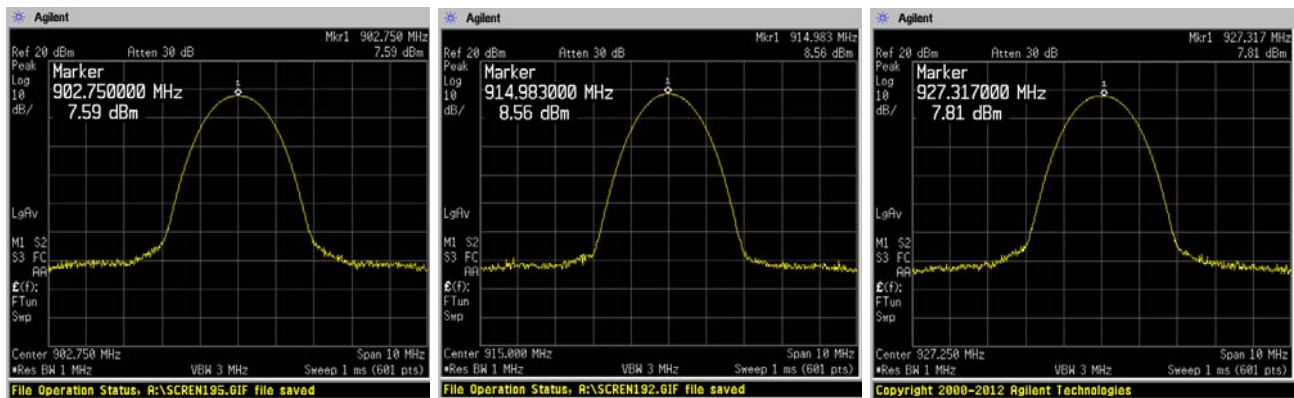
47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(b)(3) // RSS-247 5.1	Fundamental Power Conducted Limits 1 W or 30 dBm (50 or more hopping channels.) Limit Restated as Field: 125.23 dB μ V/m @ 3 m	20 Jun 2019

2.3 Test Results, Peak Power

Frequency MHz	Measured Peak Power At Antenna Port dBm*	External Attenuator Loss dB	Corrected Power to Antenna Port dBm
902.75	7.6	20.1	27.7
914.98	8.6	20.1	28.7
927.32	7.8	20.1	27.9

*Measured in 1 MHz RBW, 3 MHz VBW.

The EUT satisfied the requirements.



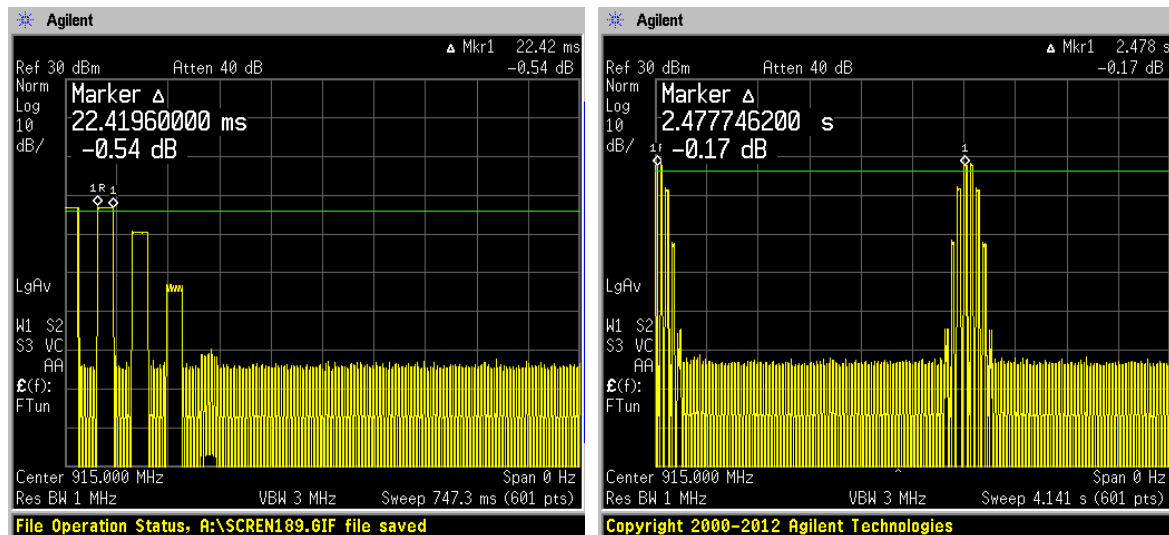
Uncorrected Measured Peak Power

2.4 Test Results, Duty Cycle

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 Results				
Total Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
22.4	2477 (100 max)	$= 20 * \text{Log}_{10} (22.4 \text{ msec} / 100 \text{ msec})$	-13.0	-13.0

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



Transmit Time and Transmit Interval (Return to Channel Time)

2.5 Test Results, Basic Hopping Parameters

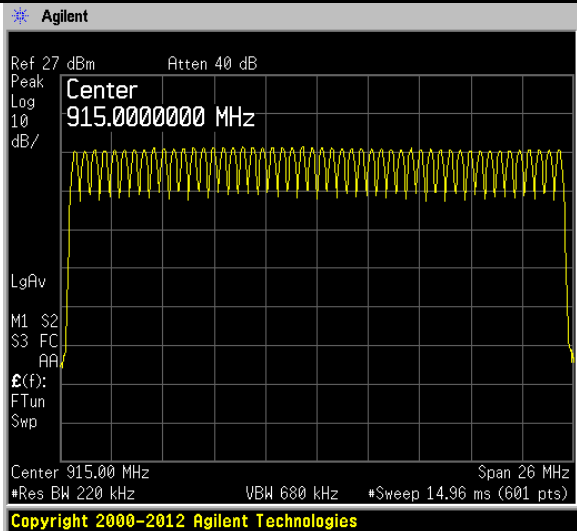
Channel separation is 473 kHz and satisfies minimum 25 kHz requirement.

Channel occupancy time in 20 second window:

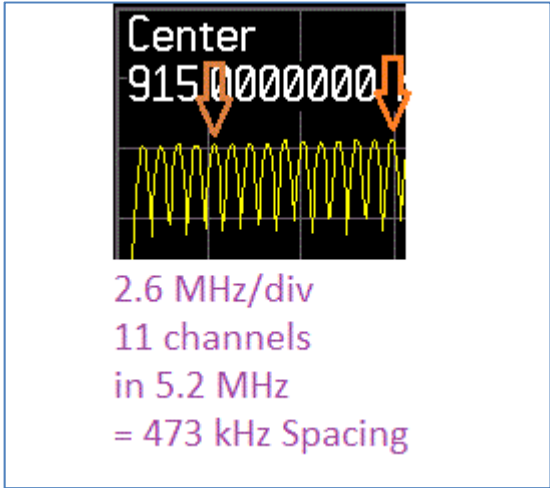
Number of transmissions in window = 9 transmissions

Time spent transmitting = 9 transmissions * 0.0224 s = 0.2016 s (Limit is 0.400 seconds)

Channel count is 50 and satisfies the requirement for 20 dB bandwidth under 250 kHz.



Hopping Channel Count = 50



Hopping Channel Spacing = 473 kHz

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	N/A

3.3 Test Results

This measurement is not applicable to hopping schemes.

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)
15.247(a)(2), 2.1049, KDB 558074 D01 // RSS-Gen 6.6	Bandwidth, 20 dB, 99%	22 Aug 2019

4.3 Test Results

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

The EUT satisfied the requirements.

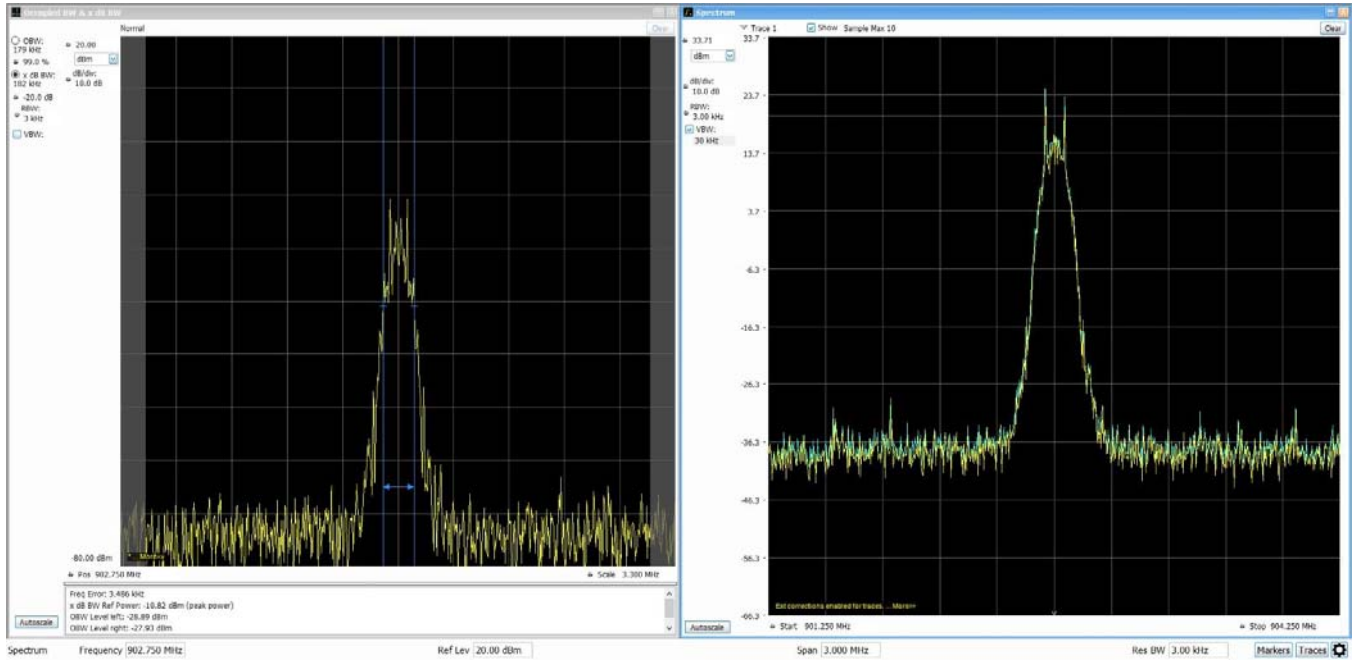
As this is a hopping radio, the 6 dB/100 kHz measurement for a 500 kHz minimum does not apply.

Table 4.3.1 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)
182	185	174	185

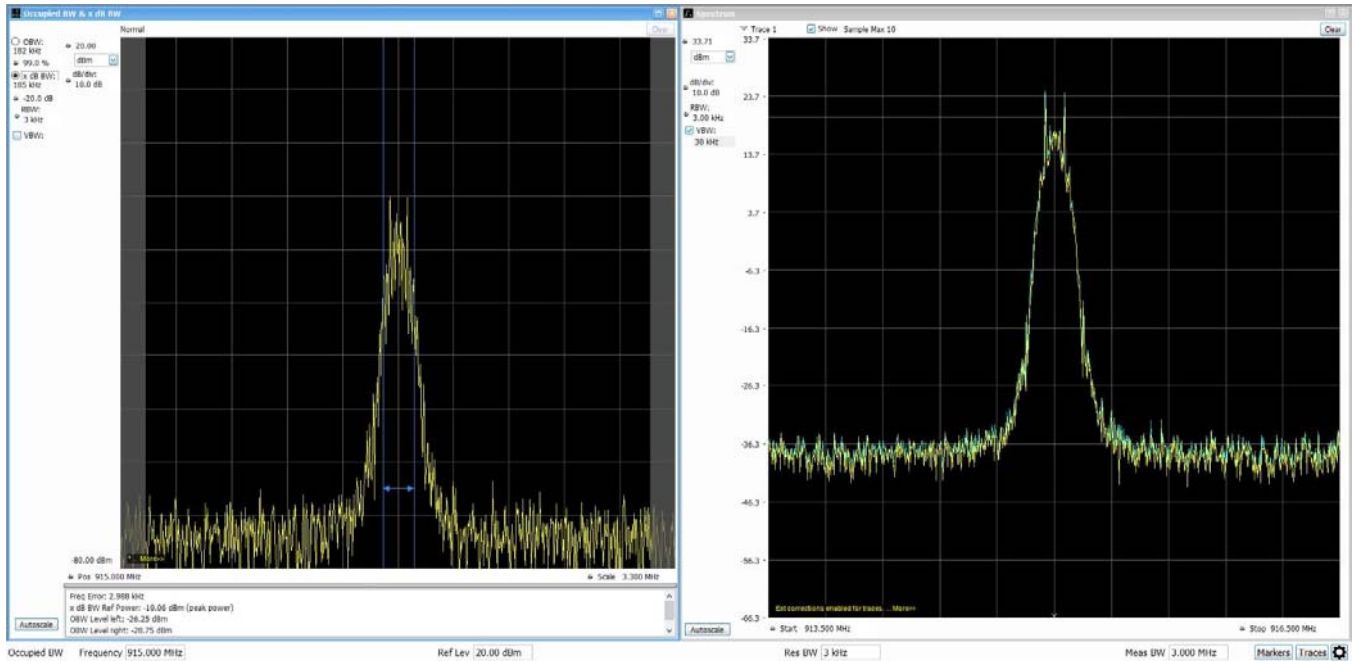
Table 4.3.2 Bandwidth 99%, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
179	182	172	182

Plotted measurements appear on the following pages.

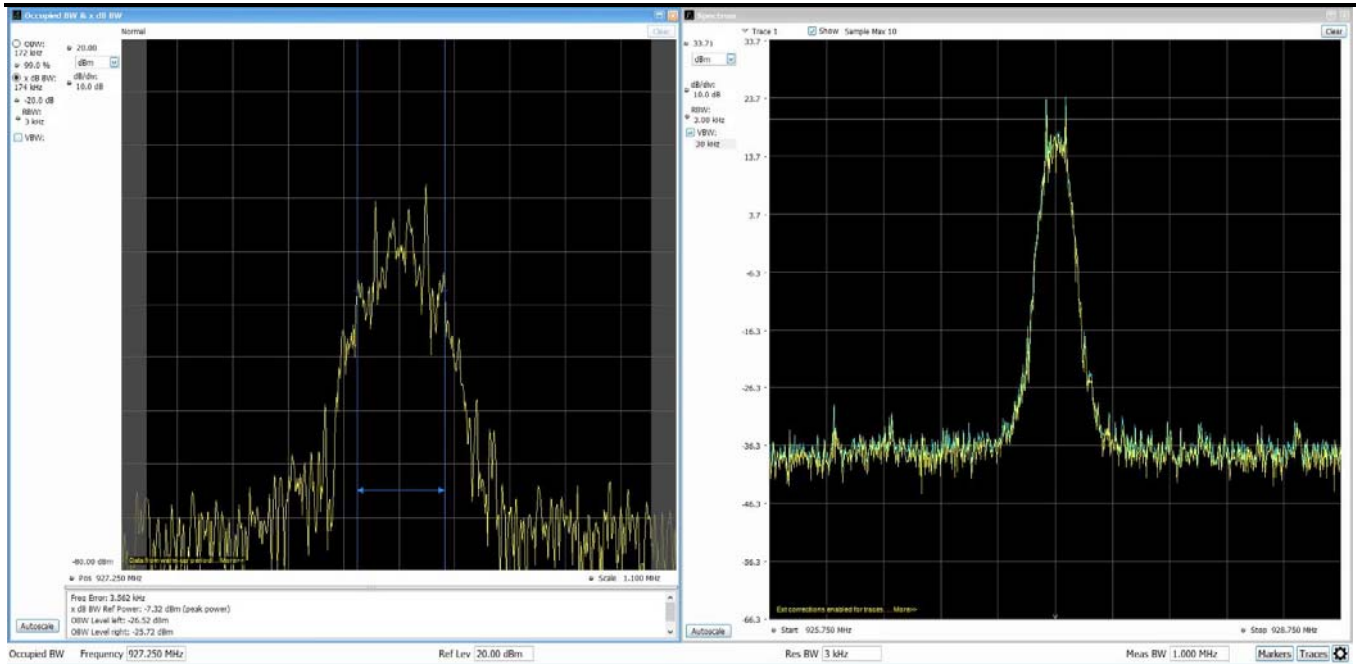
4.3.1 Bandwidth Plots



Bottom Channel



Middle Channel



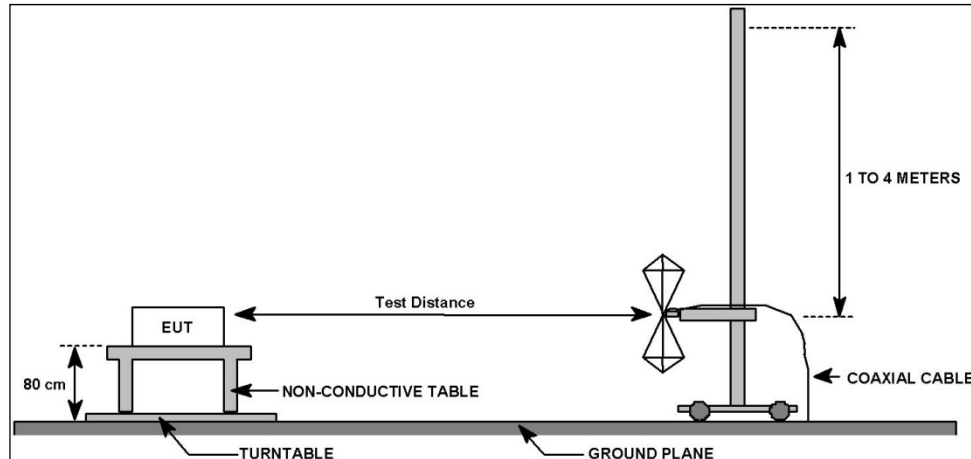
Top Channel

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(d), 15.209, 15.205 // RSS-247 5.5, RSS-Gen 6.13 & 8.10	Field Strength of Radiated Spurious/Harmonic Emissions Receive Mode	21 Jun 2019

5.3 Test Results

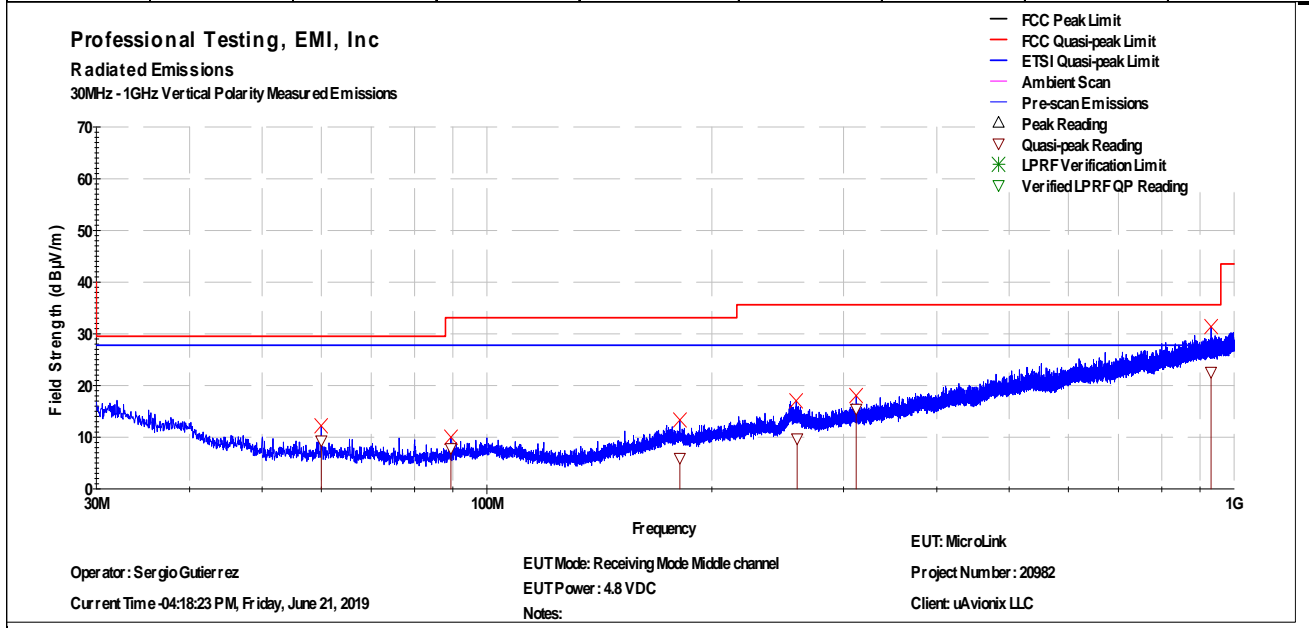
The EUT was tuned to the middle channel and placed in receive mode.

The EUT satisfied the criteria.

5.3.1 Up to 1 GHz

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):	6/21/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet								
EUT Line Voltage:			4.8 VDC	EUT Power		0 N/A		
Antenna Orientation:			Vertical	Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Receiving Mode Middle channel			
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
60.014	10	191	1.29	Quasi-peak	9.349	29.5	-20.2	Pass
89.455	10	167	1.27	Quasi-peak	7.874	33.1	-25.2	Pass
181.154	10	5	1.25	Quasi-peak	5.974	33.1	-27.1	Pass
260.118	10	3	1.28	Quasi-peak	9.743	35.6	-25.9	Pass
312.029	10	136	1.26	Quasi-peak	15.476	35.6	-20.1	Pass
931.213	10	273	1.25	Quasi-peak	22.619	35.6	-13.0	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

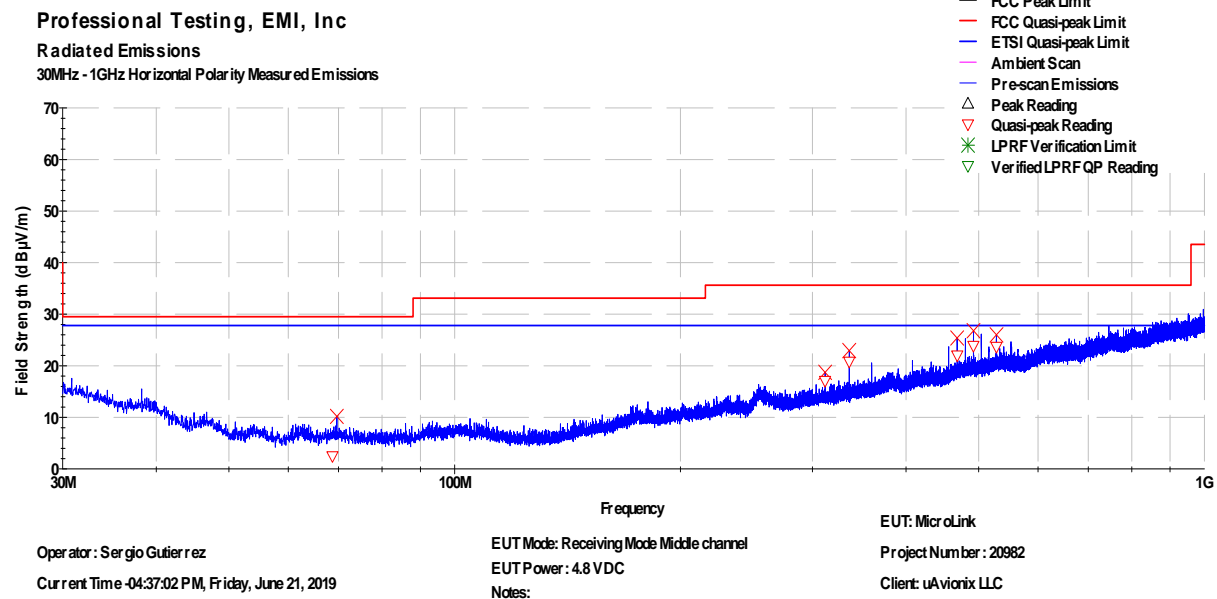
Professional Testing, EMI, Inc.

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):	6/21/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage:	4.8 VDC	EUT Power	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Receiving Mode Middle channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
68.708	10	357	1.25	Quasi-peak	2.462	29.5	-27.0	Pass
311.991	10	68	2.71	Quasi-peak	17.073	35.6	-18.5	Pass
335.996	10	2	1.26	Quasi-peak	20.78	35.6	-14.8	Pass
468.033	10	96	1.49	Quasi-peak	21.974	35.6	-13.6	Pass
491.978	10	18	1.26	Quasi-peak	23.851	35.6	-11.7	Pass
527.987	10	340	1.49	Quasi-peak	23.666	35.6	-11.9	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

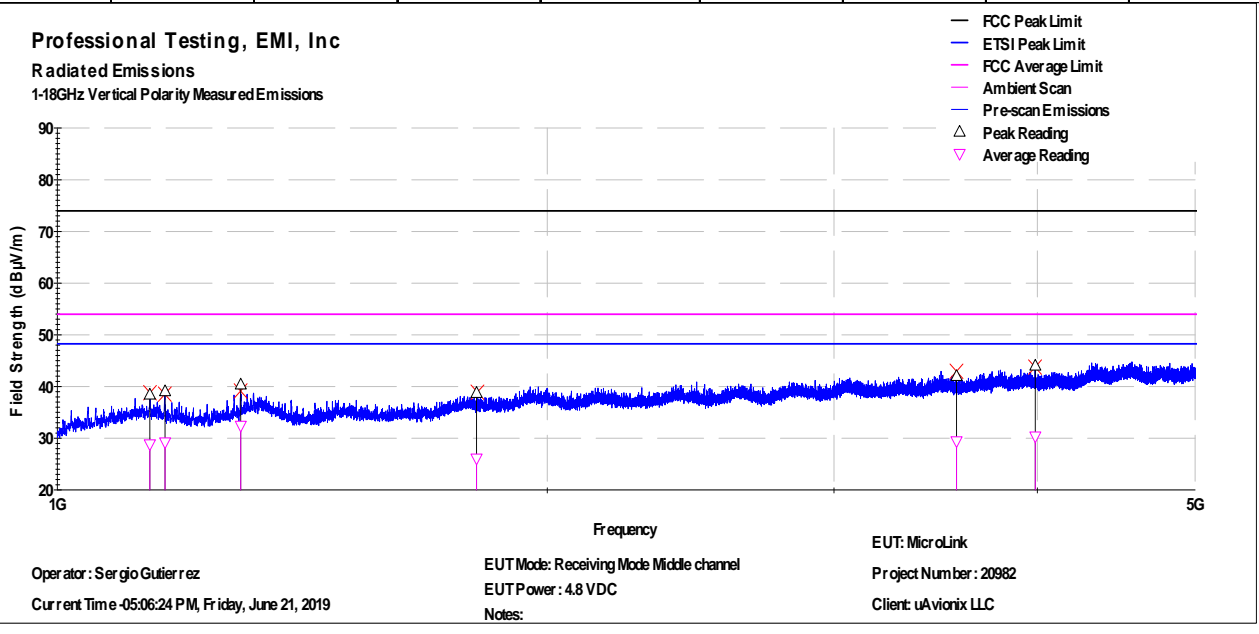
5.3.2 Up to 5 GHz

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):	6/21/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage:	4.8 VDC	EUT Power	0 N/A					
Antenna Orientation:	Vertical	Frequency	Above 1GHz					
EUT Mode of Operation:		Receiving Mode Middle channel						
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1139.92	3	97	1.02	Average	28.788	54.0	-25.2	Pass
1164.63	3	3	3.46	Average	29.156	54.0	-24.8	Pass
1296.28	3	20	1.26	Average	32.393	54.0	-21.6	Pass
1809.61	3	242	1.24	Average	26.046	54.0	-27.9	Pass
3568.08	3	123	1.4	Average	29.397	54.0	-24.6	Pass
3988.28	3	179	2.67	Average	30.329	54.0	-23.6	Pass



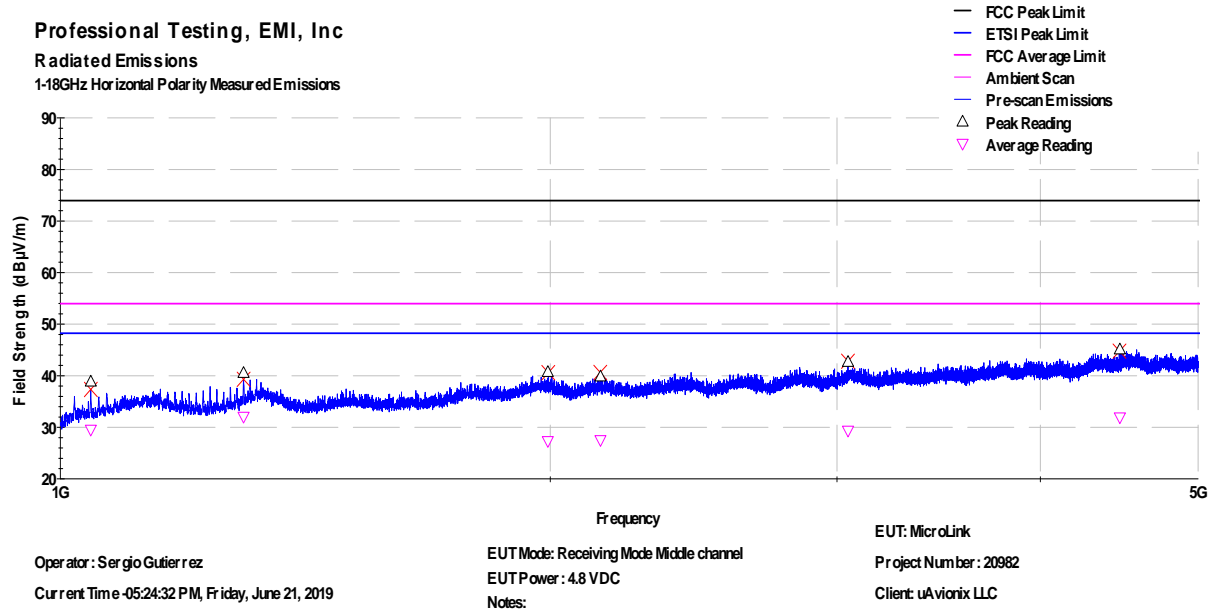
> 1GHz Vertical Antenna Polarity Measured Emissions

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):	6/21/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage:	4.8 VDC	EUT Power	0 N/A					
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz					
EUT Mode of Operation:		Receiving Mode Middle channel						
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1044.08	3	18	1.74	Average	29.515	54.0	-24.4	Pass
1295.91	3	2	1.26	Average	32.048	54.0	-21.9	Pass
1992.77	3	19	2.29	Average	27.335	54.0	-26.6	Pass
2146.95	3	2	3.21	Average	27.496	54.0	-26.5	Pass
3046.83	3	19	1.02	Average	29.339	54.0	-24.6	Pass
4476.02	3	299	2.29	Average	31.92	54.0	-22.0	Pass

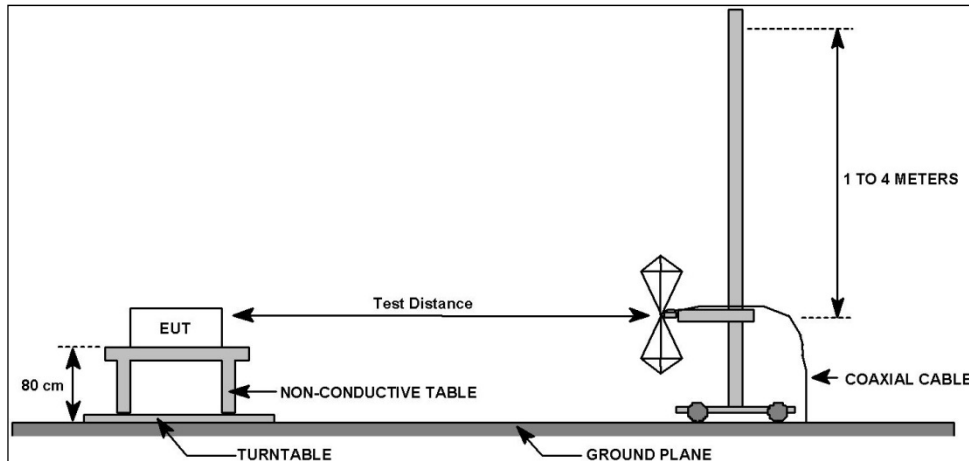


> 1GHz Horizontal Antenna Polarity Measured Emissions

6.0 Radiated Spurious Emissions, Transmit Mode

6.1 Test Procedure

Radiated emissions are measured with the EUT transmitting on the required frequencies. The EUT height was 80 cm below 1 GHz and 150 cm above 1 GHz.



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(d), 15.205 // RSS-247 5.5, RSS-Gen 6.13 & 8.10	Field Strength of Radiated Spurious/Harmonic Emissions Transmit Mode	20 Jun 2019

6.3 Test Results

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

Lowest fundamental power measured 28.7 dBm; subtracting 20 dBc yields limit for unrestricted bands of 8.7 dBm. For field strength at 3 meters (> 1 GHz) the limit calculates to 115 dB μ V/m. Band-edge emissions detected were more than -40 dBc for ± 10 MHz outside the operating band.

The duty cycle averaging factor applies -13.0 dB to the peaks recorded for the harmonics. The highest peak measurement of the harmonics is also shown as average using the averaging factor.

6.3.1 Up to 1 GHz, Bottom Channel

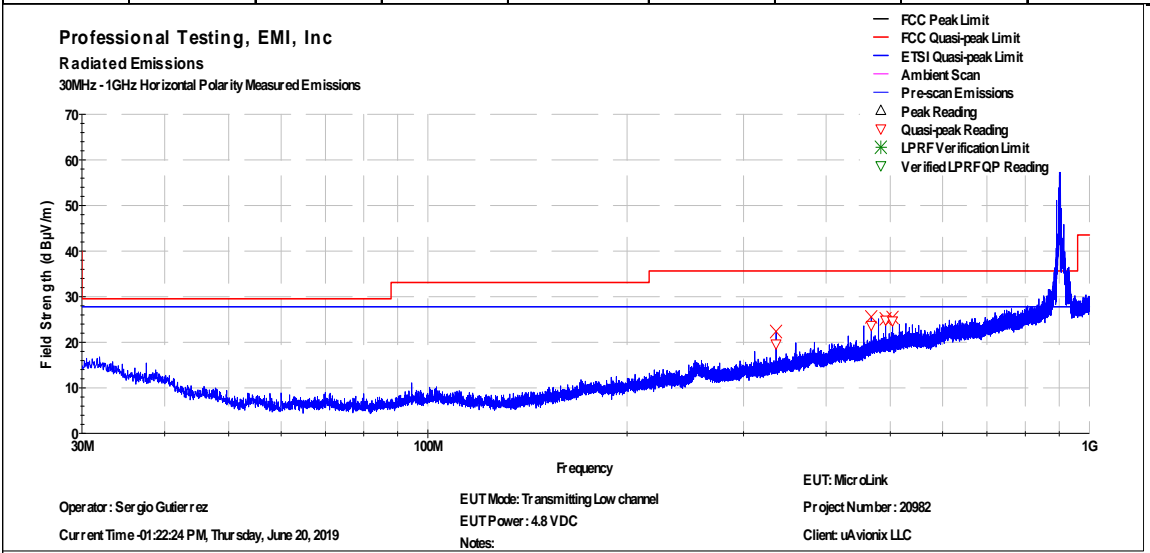
Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		6/20/2019		EUT Serial #:		G201232419005			
Customer:		uAvionix LLC		EUT Part #:		MicroLink			
Project Number:		20982		Test Technician:		Sergio Gutierrez			
Purchase Order #:		N/A		Supervisor:		Shakil Murad			
Equip. Under Test:		MicroLink		Witness' Name:		Jeff Walker			
Radiated Emissions Test Results Data Sheet									
EUT Line Voltage:				4.8 VDC		EUT Power		0 N/A	
Antenna Orientation:				Vertical		Frequency Range:		30MHz to 1GHz	
EUT Mode of Operation:					Low Channel				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results	
312.009	10	135	1.28	Quasi-peak	16.325	35.6	-19.3	Pass	
540.018	10	21	1.26	Quasi-peak	19.113	35.6	-16.5	Pass	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions 30MHz - 1GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%;"> <ul style="list-style-type: none"> — FCC Peak Limit — FCC Quasi-peak Limit — ETSI Quasi-peak Limit — Ambient Scan — Pre-scan Emissions △ Peak Reading ▽ Quasi-peak Reading * LPRF Verification Limit ▽ Verified LPRF QP Reading </div> </div> <p>Operator: Sergio Gutierrez Current Time - 01:09:48 PM, Thursday, June 20, 2019</p> <p>EUT Mode: Transmitting Low channel EUT Power: 4.8 VDC Notes:</p> <p>EUT: MicroLink Project Number: 20982 Client: uAvionix LLC</p>									
≤ 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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage:	4.8 VDC	EUT Power	0 N/A					
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:		Low Channel						
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
336.01	10	227	1.25	Quasi-peak	19.628	35.6	-16.0	Pass
467.986	10	357	1.25	Quasi-peak	23.699	35.6	-11.9	Pass
491.992	10	207	1.25	Quasi-peak	24.879	35.6	-10.7	Pass
503.994	10	207	1.25	Quasi-peak	24.674	35.6	-10.9	Pass

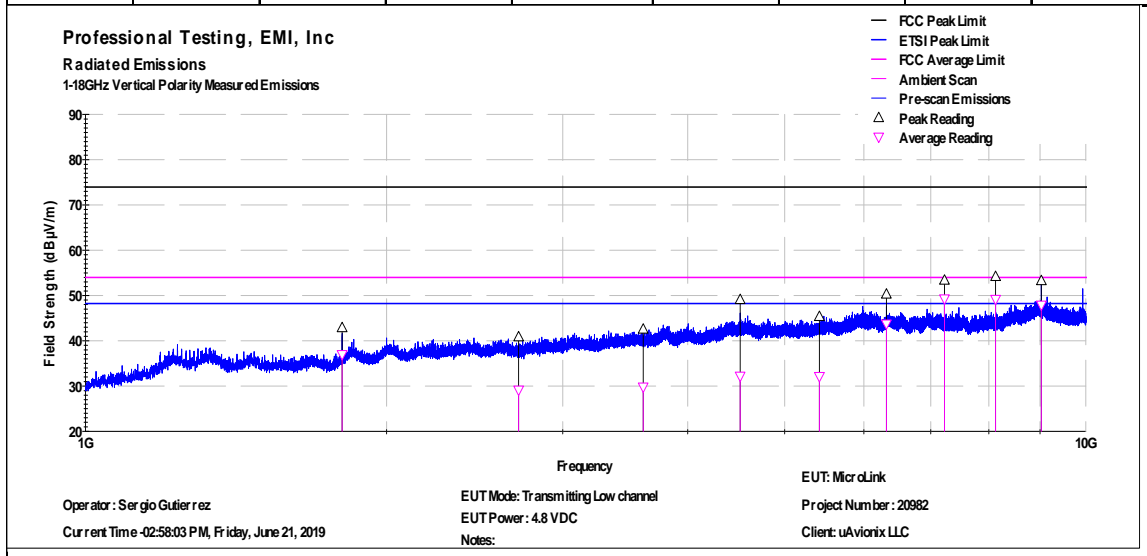


≤ 1GHz Horizontal Antenna Polarity Measured Emissions

6.3.2 Up to 10 GHz, Bottom Channel

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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet								
EUT Line Voltage:			4.8	VDC		EUT Power		0 N/A
Antenna Orientation:			Vertical		Frequency Range:		Above 1GHz	
EUT Mode of Operation:					Low Channel			
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1805.58	3	144	1.02	Peak	42.869	74.0	-31.1	Pass
2710.49	3	114	1.02	Peak	40.841	74.0	-33.1	Pass
3610.71	3	18	1.51	Peak	42.566	74.0	-31.4	Pass
4513.82	3	63	1.02	Peak	49.064	74.0	-24.9	Pass
5416.23	3	18	2.12	Peak	45.345	74.0	-28.6	Pass
6319.08	3	65	1.51	Peak	50.273	74.0	-23.7	Pass
7222.01	3	33	1.65	Peak	53.363	74.0	-20.6	Pass
8124.75	3	74	1.65	Peak	54.188	74.0	-19.8	Pass
9027.6	3	71	1.52	Peak	53.256	74.0	-20.7	Pass
8124.75	3	74	1.65	Average	41.188	54.0	-12.8	Pass



> 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

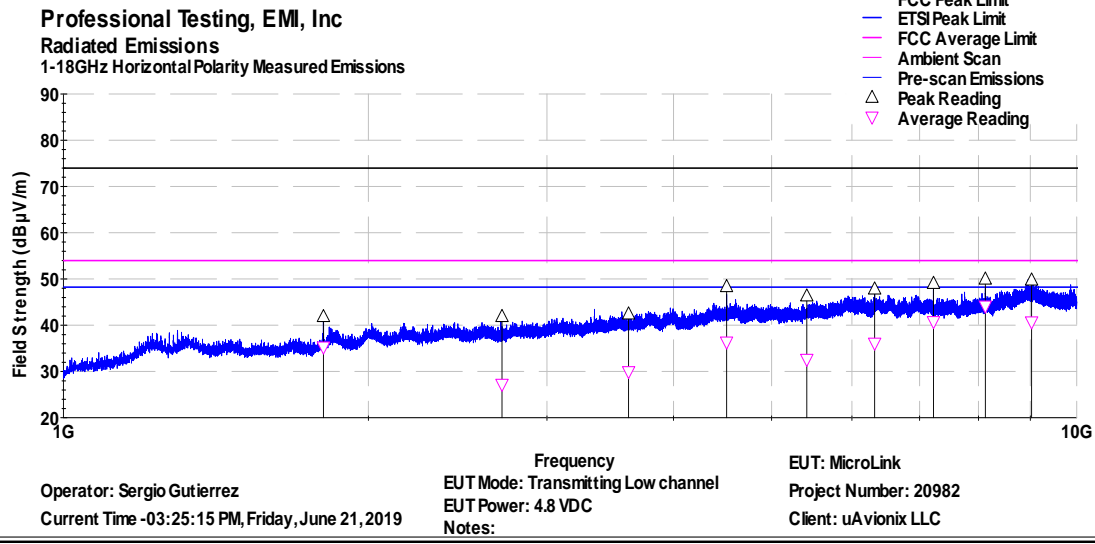
In accordance with: FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits

Section: 15.209

Test Date(s): 6/20/2019	EUT Serial #: G201232419005
Customer: uAvionix LLC	EUT Part #: MicroLink
Project Number: 20982	Test Technician: Sergio Gutierrez
Purchase Order #: N/A	Supervisor: Shakil Murad
Equip. Under Test: MicroLink	Witness' Name: Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage: 4.8 VDC		EUT Power: 0 W						
Antenna Orientation: Horizontal		Frequency Range: Above 1GHz						
EUT Mode of Operation: Low Channel								
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1805.4	3	3	1.73	Peak	41.879	74.0	-32.1	Pass
2708.88	3	330	2.13	Peak	41.904	74.0	-32.1	Pass
3612.3	3	298	1.43	Peak	42.455	74.0	-31.5	Pass
4513.64	3	357	1.54	Peak	48.366	74.0	-25.6	Pass
5415.78	3	357	1.26	Peak	46.352	74.0	-27.6	Pass
6319.17	3	31	1.24	Peak	47.855	74.0	-26.1	Pass
7222.04	3	92	1.26	Peak	49.057	74.0	-24.9	Pass
8124.67	3	3	2.09	Peak	49.993	74.0	-24.0	Pass
9027.41	3	36	1.96	Peak	49.793	74.0	-24.2	Pass
8124.67	3	3	2.09	Average	36.993	54.0	-17.0	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

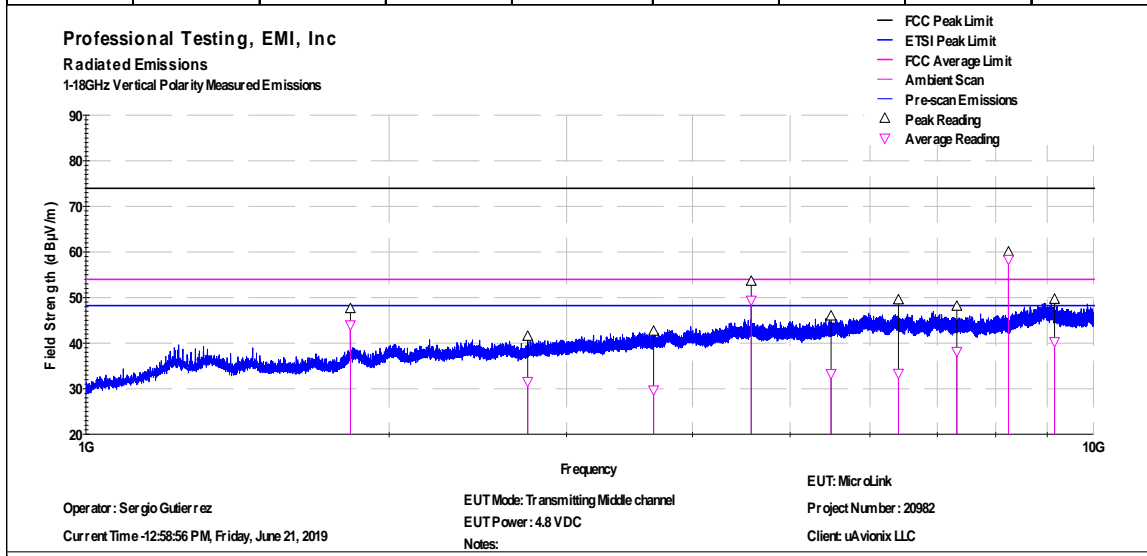
6.3.3 Up to 1 GHz, Middle Channel

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):		6/20/2019		EUT Serial #:		G201232419005		
Customer:		uAvionix LLC		EUT Part #:		MicroLink		
Project Number:		20982		Test Technician:		Sergio Gutierrez		
Purchase Order #:		N/A		Supervisor:		Shakil Murad		
Equip. Under Test:		MicroLink		Witness' Name:		Jeff Walker		
Radiated Emissions Test Results Data Sheet								
EUT Line Voltage:			4.8 VDC			EUT Power		0 N/A
Antenna Orientation:			Vertical			Frequency Range:		30MHz to 1GHz
EUT Mode of Operation:					Middle Channel			
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
60.013	10	339	1.29	Quasi-peak	9.36	29.5	-20.1	Pass
89.512	10	28	1.27	Quasi-peak	9.524	33.1	-23.6	Pass
312.022	10	34	1.25	Quasi-peak	17.002	35.6	-18.6	Pass
527.872	10	322	1.28	Quasi-peak	16.327	35.6	-19.3	Pass
539.901	10	73	1.26	Quasi-peak	16.542	35.6	-19.1	Pass
551.995	10	21	2.22	Quasi-peak	23.255	35.6	-12.3	Pass
Professional Testing, EMI, Inc Radiated Emissions 30MHz - 1GHz Vertical Polarity Measured Emissions			EUT Mode: Transmitting Middle channel EUT Power: 4.8 VDC Notes:			EUT: MicroLink Project Number: 20982 Client: uAvionix LLC		
Operator: Sergio Gutierrez Current Time: 12:05:22 PM, Friday, June 21, 2019								
≤ 1GHz Vertical Antenna Polarity Measured Emissions								

6.3.4 Up to 10 GHz, Middle Channel

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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet								
EUT Line Voltage:			4.8	VDC		EUT Power		0 N/A
Antenna Orientation:			Vertical		Frequency Range:		Above 1GHz	
EUT Mode of Operation:					Middle Channel			
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1830.11	3	173	1.31	Peak	47.535	74.0	-26.4	Pass
2744.66	3	19	3.04	Peak	41.481	74.0	-32.5	Pass
3659.89	3	2	3.6	Peak	42.591	74.0	-31.4	Pass
4574.93	3	64	1.26	Peak	53.547	74.0	-20.4	Pass
5490.23	3	2	2.37	Peak	45.908	74.0	-28.0	Pass
6404.95	3	71	1.46	Peak	49.465	74.0	-24.5	Pass
7319.99	3	75	1.93	Peak	48.075	74.0	-25.9	Pass
8234.98	3	331	1.02	Peak	59.956	74.0	-14.0	Pass
9150.05	3	48	1.02	Peak	49.599	74.0	-24.4	Pass
8234.98	3	331	1.02	Average	46.956	54.0	-7.0	Pass



> 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): 6/20/2019 **EUT Serial #:** G201232419005

Customer: uAvionix LLC **EUT Part #:** MicroLink

Project Number: 20982 **Test Technician:** Sergio Gutierrez

Purchase Order #: N/A **Supervisor:** Shakil Murad

Equip. Under Test: MicroLink **Witness' Name:** Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage: 4.8 VDC **EUT Power:** 0 W

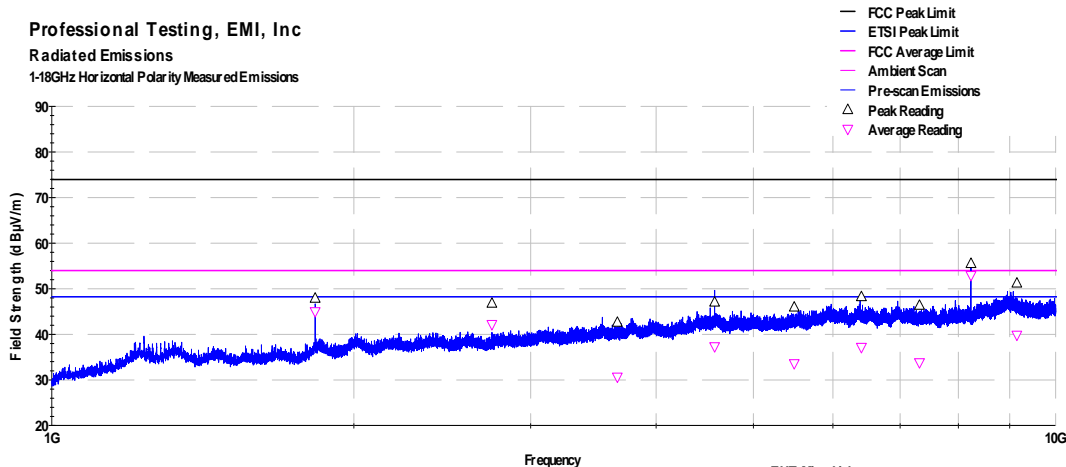
Antenna Orientation: Horizontal **Frequency Range:** Above 1GHz

EUT Mode of Operation: Middle Channel

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1829.97	3	50	1.02	Peak	47.902	74.0	-26.1	Pass
2744.98	3	331	1.6	Peak	46.79	74.0	-27.2	Pass
3659.41	3	17	1.26	Peak	42.624	74.0	-31.3	Pass
4574.93	3	19	1.24	Peak	47.047	74.0	-26.9	Pass
5490.51	3	2	1.02	Peak	45.947	74.0	-28.0	Pass
6405.33	3	112	1.34	Peak	48.252	74.0	-25.7	Pass
7318.32	3	0	2.26	Peak	46.336	74.0	-27.6	Pass
8234.99	3	104	1.26	Peak	55.512	74.0	-18.4	Pass
9150.2	3	192	2.07	Peak	51.209	74.0	-22.7	Pass
8234.99	3	104	1.26	Average	42.512	54.0	-11.4	Pass

Professional Testing, EMI, Inc

Radiated Emissions
1-18GHz Horizontal Polarity Measured Emissions



Operator: Sergio Gutierrez
Current Time: 01:25:51 PM, Friday, June 21, 2019

EUT Mode: Transmitting Middle channel
EUT Power: 4.8 VDC
Notes:

EUT: MicroLink
Project Number: 20982
Client: uAvionix LLC

> 1GHz Horizontal Antenna Polarity Measured Emissions

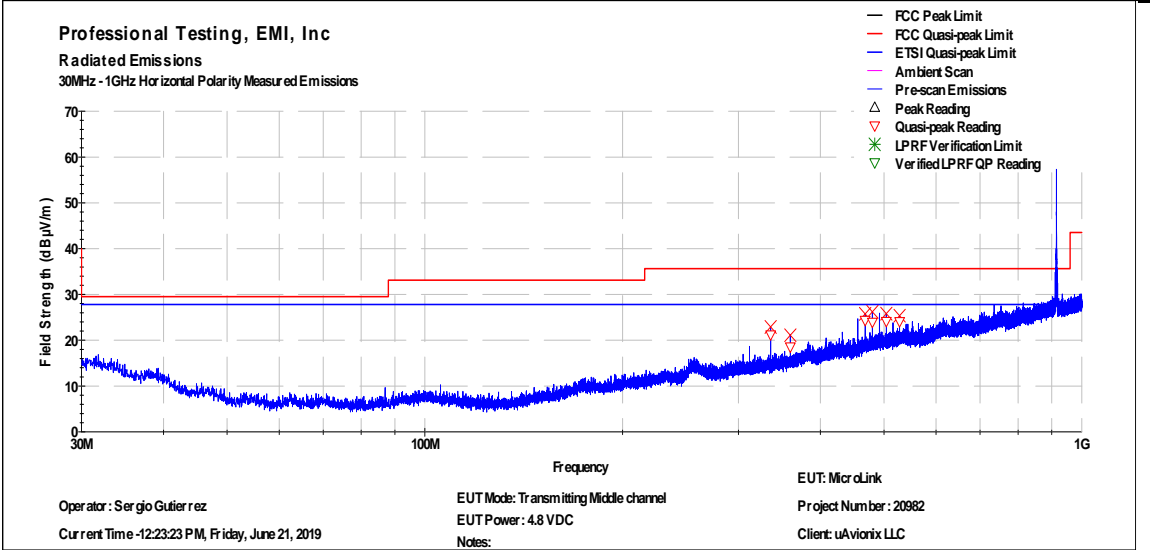
Professional Testing, EMI, Inc.

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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage:	4.8 VDC	EUT Power	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Middle Channel	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
336	10	329	1.26	Quasi-peak	21.171	35.6	-14.4	Pass
360.001	10	340	1.72	Quasi-peak	18.523	35.6	-17.1	Pass
468.004	10	39	1.26	Quasi-peak	24.332	35.6	-11.3	Pass
479.991	10	207	1.49	Quasi-peak	23.913	35.6	-11.7	Pass
503.989	10	356	1.26	Quasi-peak	24.103	35.6	-11.5	Pass
527.997	10	339	3.41	Quasi-peak	24.067	35.6	-11.5	Pass

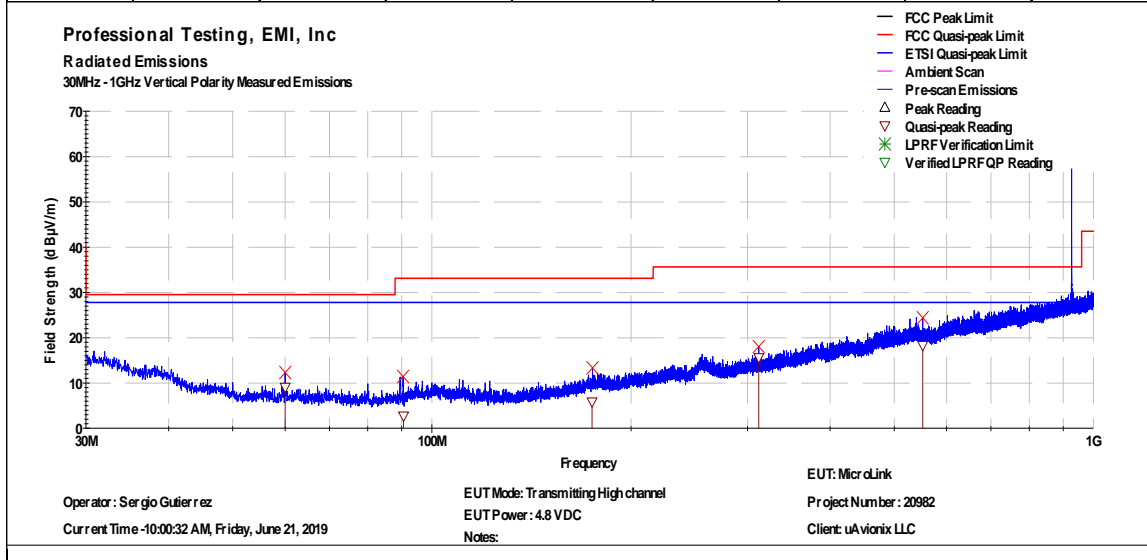


≤ 1GHz Horizontal Antenna Polarity Measured Emissions

6.3.5 Up to 1 GHz, Top Channel

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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet								
EUT Line Voltage: 4.8 VDC			EUT Power: 0 W			Frequency: N/A		
Antenna Orientation: Vertical			Frequency Range: 30MHz to 1GHz					
EUT Mode of Operation:					High Channel			
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
60.011	10	264	1.28	Quasi-peak	9.065	29.5	-20.4	Pass
90.623	10	161	1.5	Quasi-peak	2.713	33.1	-30.4	Pass
174.633	10	264	1.28	Quasi-peak	5.83	33.1	-27.3	Pass
312.005	10	57	1.26	Quasi-peak	15.611	35.6	-20.0	Pass
551.951	10	21	1.25	Quasi-peak	18.28	35.6	-17.3	Pass



≤ 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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

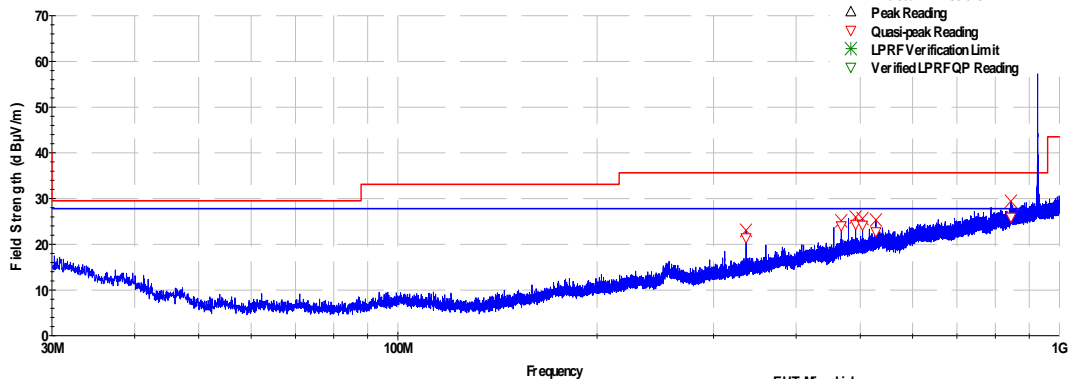
Radiated Emissions Test Results Data Sheet

EUT Line Voltage:	4.8 VDC	EUT Power	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz

EUT Mode of Operation: High Channel

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
336.012	10	143	2.14	Quasi-peak	21.433	35.6	-14.2	Pass
467.987	10	287	1.88	Quasi-peak	24.055	35.6	-11.5	Pass
491.985	10	215	1.31	Quasi-peak	24.386	35.6	-11.2	Pass
503.985	10	144	1.26	Quasi-peak	24.185	35.6	-11.4	Pass
527.968	10	3	1.69	Quasi-peak	22.742	35.6	-12.9	Pass
845.037	10	220	1.26	Quasi-peak	25.93	35.6	-9.7	Pass

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



Operator : Sergio Gutierrez
Current Time - 10:19:07 AM, Friday, June 21, 2019

EUT Mode: Transmitting High channel
EUT Power: 4.8 VDC
Notes:

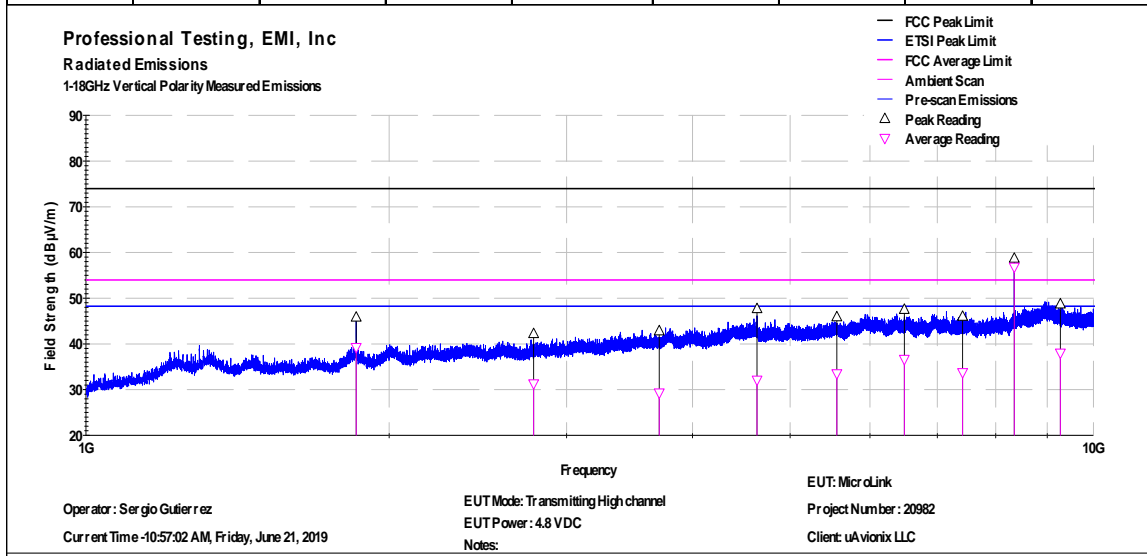
EUT: MicroLink
Project Number: 20982
Client: uAvionix LLC

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

6.3.6 Up to 10 GHz, Top Channel

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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet								
EUT Line Voltage:			4.8	VDC		EUT Power		0 N/A
Antenna Orientation:			Vertical		Frequency Range:		Above 1GHz	
EUT Mode of Operation:					High Channel			
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1854.49	3	227	1.26	Peak	45.815	74.0	-28.1	Pass
2782.01	3	64	2.11	Peak	42.241	74.0	-31.7	Pass
3706.78	3	19	3.76	Peak	42.843	74.0	-31.1	Pass
4636.08	3	64	1.26	Peak	47.69	74.0	-26.3	Pass
5563.51	3	0	1.61	Peak	45.918	74.0	-28.0	Pass
6490.48	3	64	1.02	Peak	47.533	74.0	-26.4	Pass
7415.71	3	142	1.02	Peak	46.021	74.0	-27.9	Pass
8345.22	3	65	1.37	Peak	58.726	74.0	-15.2	Pass
9272.21	3	83	1.37	Peak	48.717	74.0	-25.2	Pass
8345.22	3	65	1.37	Average	45.726	54.0	-8.2	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

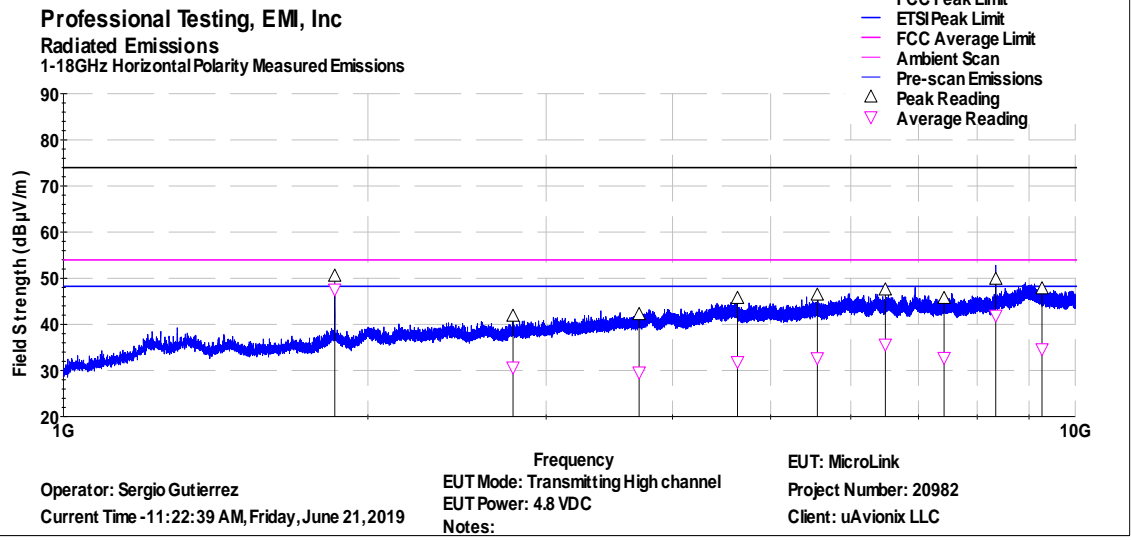
Professional Testing, EMI, Inc.

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):	6/20/2019	EUT Serial #:	G201232419005
Customer:	uAvionix LLC	EUT Part #:	MicroLink
Project Number:	20982	Test Technician:	Sergio Gutierrez
Purchase Order #:	N/A	Supervisor:	Shakil Murad
Equip. Under Test:	MicroLink	Witness' Name:	Jeff Walker

Radiated Emissions Test Results Data Sheet

EUT Line Voltage:	4.8 VDC	EUT Power	0 N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		High Channel	

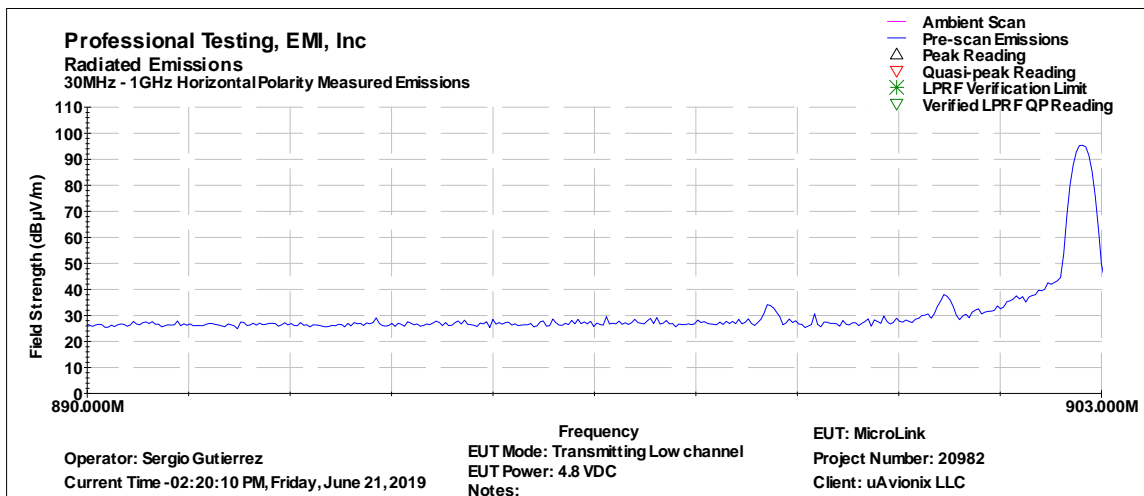
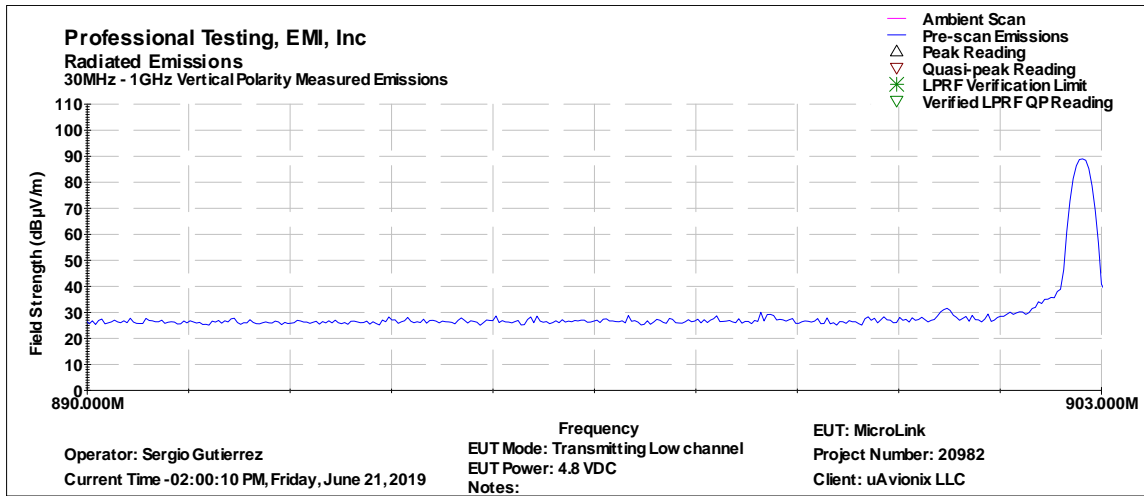
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1854.45	3	110	2.32	Peak	50.461	74.0	-23.5	Pass
2782.06	3	3	1.02	Peak	41.757	74.0	-32.2	Pass
3707.24	3	284	1.26	Peak	42.12	74.0	-31.8	Pass
4636.39	3	17	2.96	Peak	45.628	74.0	-28.3	Pass
5560.34	3	342	1.65	Peak	46.338	74.0	-27.6	Pass
6490.48	3	322	1.38	Peak	47.475	74.0	-26.5	Pass
7418.16	3	328	3.2	Peak	45.605	74.0	-28.4	Pass
8345.29	3	188	1.26	Peak	49.788	74.0	-24.2	Pass
9272.6	3	159	1.49	Peak	47.704	74.0	-26.3	Pass
8345.29	3	188	1.26	Average	36.788	54.0	-17.2	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

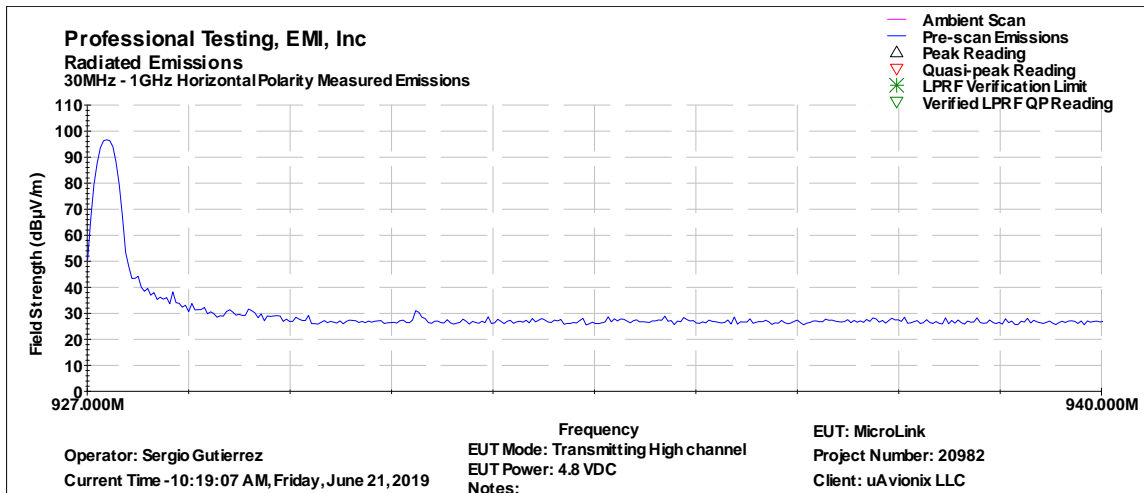
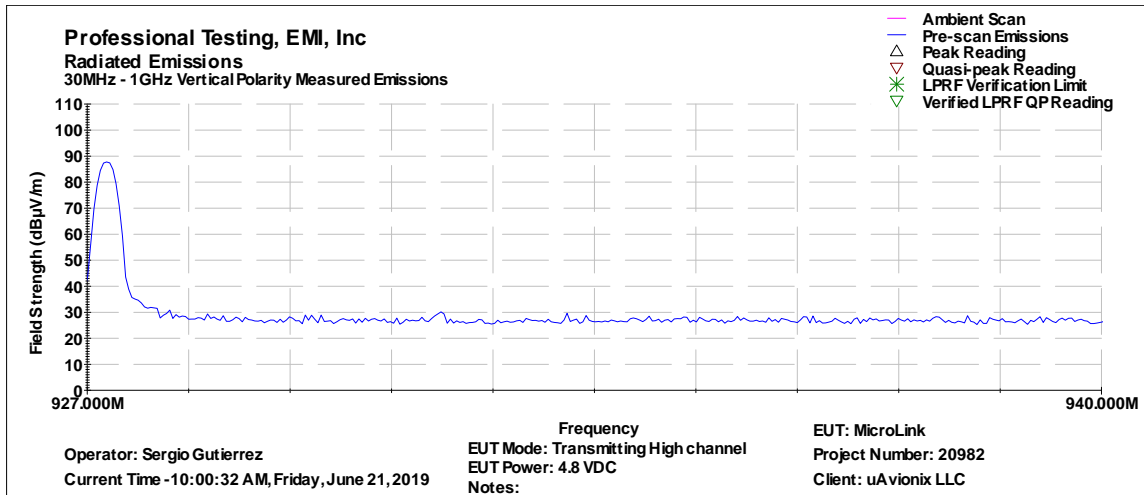
6.3.7 Band Edge, Low Channel, Non-hopping

Measured in 120 kHz RBW with peak detection.



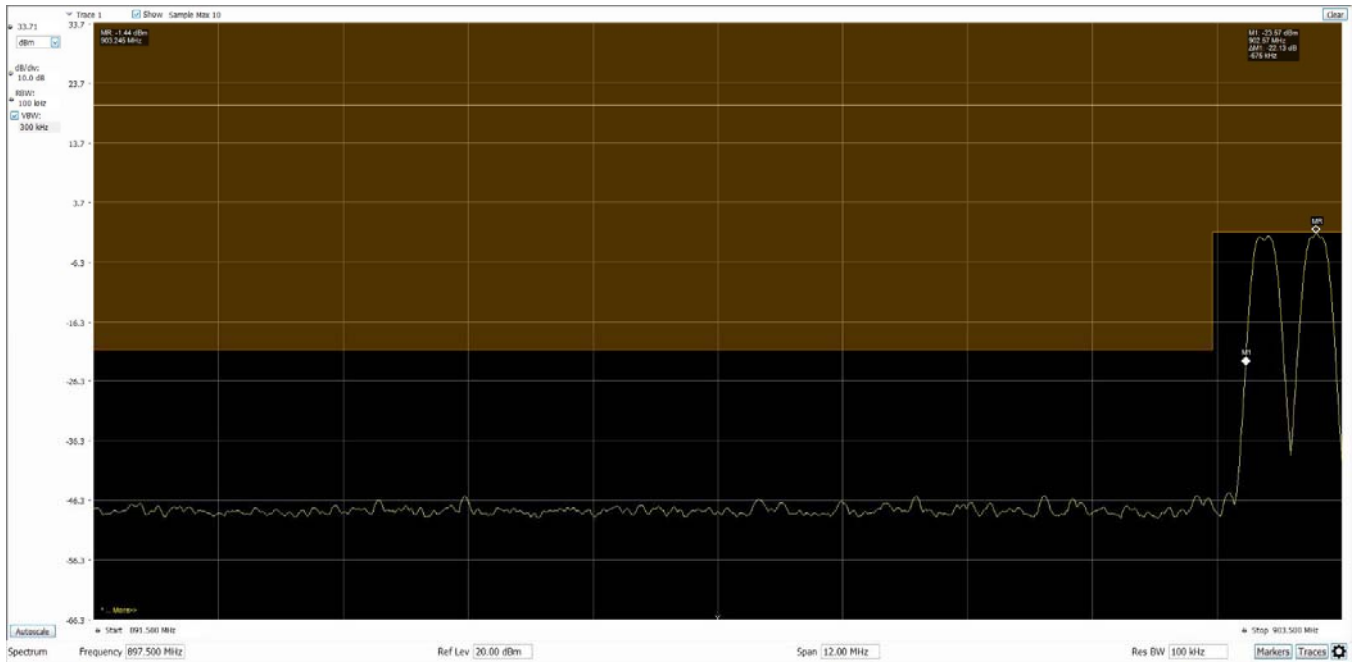
6.3.8 Band Edge, Top Channel, Non-hopping

Measured in 120 kHz RBW with peak detection.



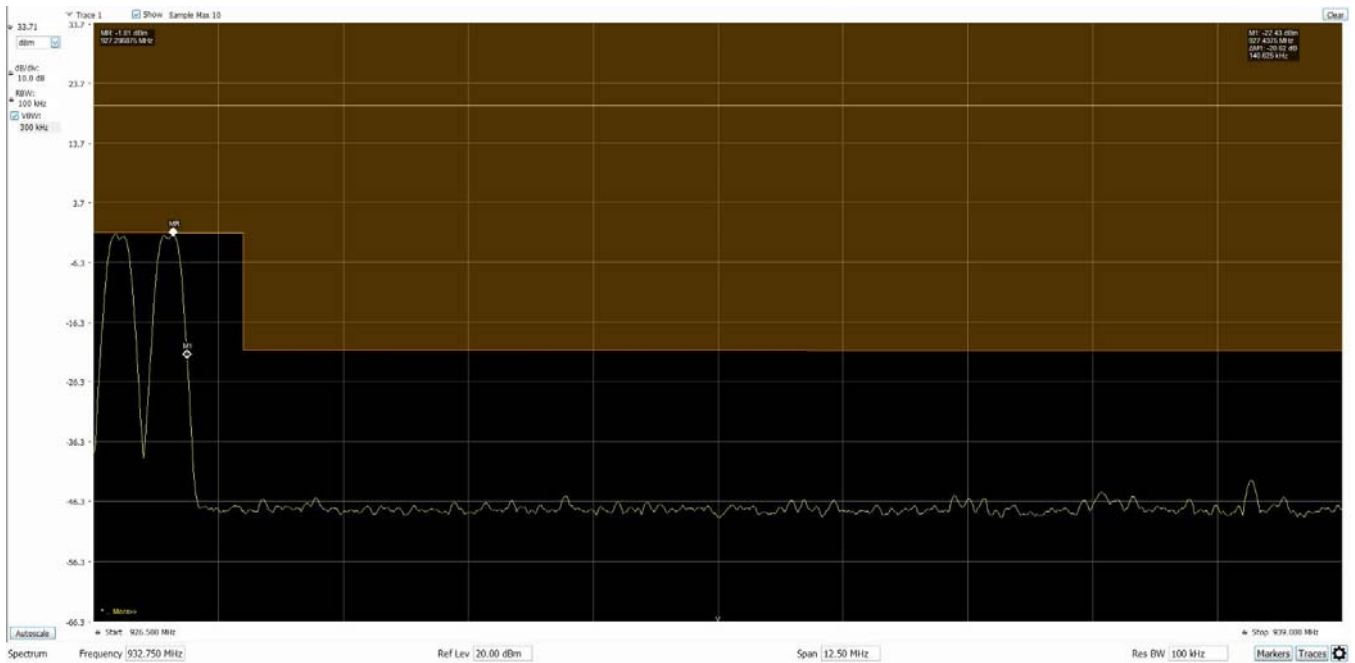
6.3.9 Band Edge, Bottom Channel, Hopping, Conducted

Measured in 100 kHz RBW with peak detection.



6.3.10 Band Edge, Top Channel, Hopping, Conducted

Measured in 100 kHz RBW with peak detection.



7.0 Antenna Construction Requirements

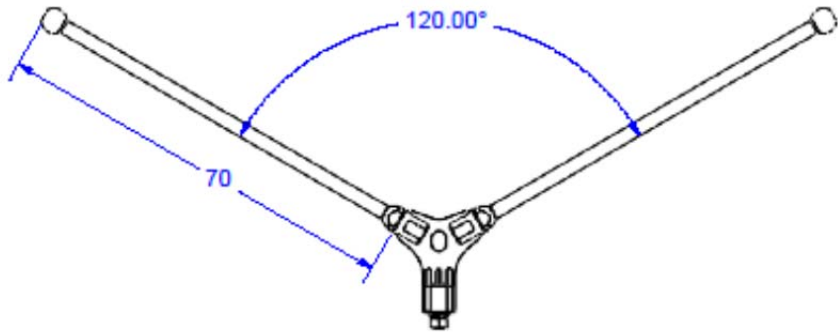
7.1 Procedure

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.

7.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203 // RSS-Gen 8.3	Antenna Construction Gain limited to 6 dBi.	2 Aug 2019

7.3 Results

Table 7.3.1 Antenna Construction Details
<p>Manufacturer: uAvionix Antenna is supplied by the applicant.</p> <p>Model: UAV-1002998</p>  <p>Units: mm</p>

- The antenna connector is MCX type.
- Antenna type is dipole.
- Peak gain is 2.1 dBi.

The antenna design above satisfies the requirements of the rules.

8.0 Equipment

8.1 Radiated Emissions, Transmit & Receive Mode

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	3/11/2021
C027	none	RG214	Cable Coax, N-N, 25m, 30MHz - 1GHz	None	9/21/2019
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	3/11/2021

8.2 Conducted Antenna Port Measurements of Power, PSD, Bandwidth, and Timings

Asset #	Manufacturer	Model #	Description	Calibration Due
2295	Agilent	E4440A	Spectrum Analyzer	6 Nov 2019
A105	Narda	768A-20	Attenuator, 20 dB, 20 W, DC to 11 GHz	23 Mar 2020

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.

Bandwidths above are for general emission measurements. Other bandwidths are used for specific wireless measurements and documented accordingly.

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