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

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None.

Table of Contents

	sion History	
	pliance Certificate	
	Introduction	
1.	1 Scope	
1.3	- I	
1.		
1.	1 I	
1	5 Test Site	6
1.		
1.	T F	
2.0	Fundamental Power	8
2.		
2.		
2.	3 Test Results, Peak Power	8
2.	4 Test Results, Duty Cycle	9
2.		
3.0	Power Spectral Density	11
3.	1 Test Procedure	11
3.	2 Test Criteria	11
3.	3 Test Results	11
4.0	Occupied Bandwidth	12
4.	1 Test Procedure	12
4.	2 Test Criteria	12
4.	3 Test Results	12
	4.3.1 Bandwidth Plots	13
5.0	Radiated Spurious Emissions, Receive Mode	
5.	1 Test Procedure	15
5.	2 Test Criteria	15
5.	3 Test Results	15
	5.3.1 Up to 1 GHz	16
	5.3.2 Up to 5 GHz	18
6.0	Radiated Spurious Emissions, Transmit Mode	20
6.	1 Test Procedure	20
6.	2 Test Criteria	20
6.	3 Test Results	20
	6.3.1 Up to 1 GHz, Bottom Channel	21
	6.3.2 Up to 10 GHz, Bottom Channel	23
	6.3.3 Up to 1 GHz, Middle Channel	25
	6.3.4 Up to 10 GHz, Middle Channel	26
	6.3.5 Up to 1 GHz, Top Channel	29
	6.3.6 Up to 10 GHz, Top Channel	31
	6.3.7 Band Edge, Low Channel, Non-hopping	33
	6.3.8 Band Edge, Top Channel, Non-hopping	
	6.3.9 Band Edge, Bottom Channel, Hopping, Conducted	35
	6.3.10 Band Edge, Top Channel, Hopping, Conducted	35
7.0	Antenna Construction Requirements	
7.	•	
7.	2 Criteria	36
7.		
8.0	Equipment	
8.		
8.		
9.0	Measurement Bandwidths	
Appe	endix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty	
	of Report	

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Compliance Certificate

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

Representati	ive 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:

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

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

Raw Measured Level + Attenuator Factor + Cable Losses = 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		
47 CFK	Subpart C - Intentional Radiators, Subpart B – Unintentional Radiators		
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed		
ANSI C05.10.2015	Wireless Devices		
ANSI C63.4:2014	American National Standard for Methods of Measurement of Radio- Noise Emissions		
ANSI C05.4.2014	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-		
N33-247 ISSUE 2	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

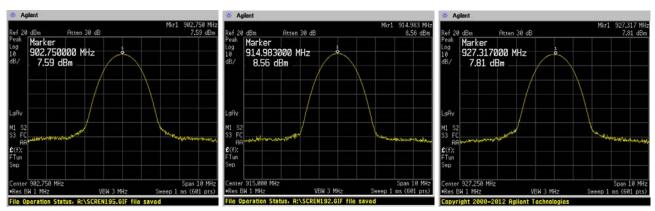
47 CFR (USA) // IC (Canada)				
Section Reference Parameter D				
15.247(b)(3) //	Fundamental Power Conducted Limits	20 Jun 2019		
RSS-247 5.1	1 W or 30 dBm (50 or more hopping channels.) Limit Restated as Field: 125.23 dBμV/m @ 3 m			

2.3 Test Results, Peak Power

Table 2.3.1 Power, Peak, Conducted, Unmodulated					
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.



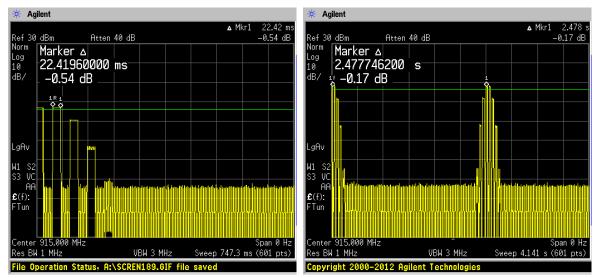
Uncorrected Measured Peak Power

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 * Log ₁₀ (22.4 msec / 100 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

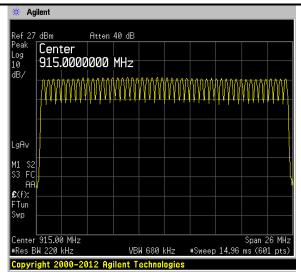
Channel separation is 473 kHz and satisfies minimum 25 kHz requirement.

Channel occupancy time in 20 second window:

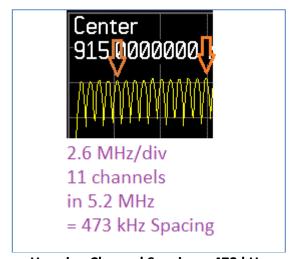
Number of transmissions in window = 9 transmissions

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 dBμV/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.

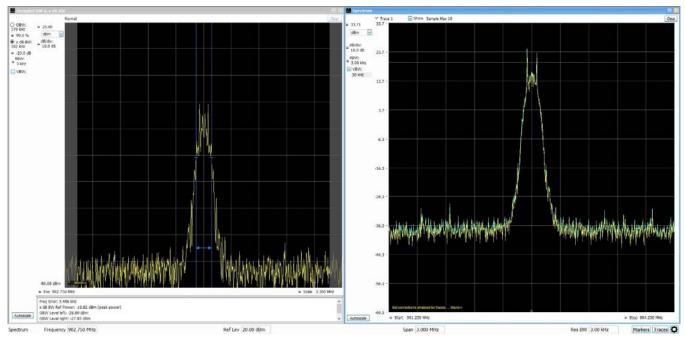
As this is a hopping radio, the 6 dB/100 kHz measurement for a 500 kHz minimum does not apply.

Table 4.3.1 Bandwidth 20 dB, Measure and Report								
Low Channel	Mid Channel	High Channel	Reported					
Measured BW	Measured BW	Measured BW	Maximum BW					
(kHz)	(kHz)	(kHz)	(kHz)					
182	185	174	185					

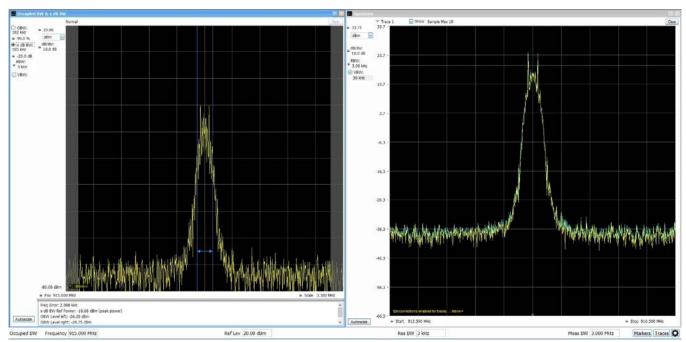
Table 4.3.2 Bandwidth 99%, Measure and Report								
Low Channel	Mid Channel	High Channel	Reported					
Measured BW	Measured BW	Measured BW	Maximum BW					
(kHz)	(kHz)	(kHz)	(kHz)					
179	182	172	182					

Plotted measurements appear on the following pages.

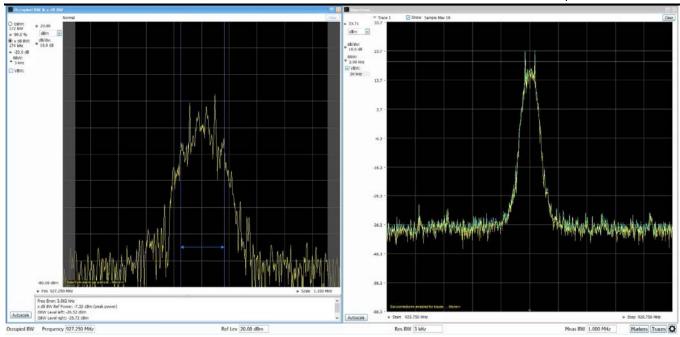
4.3.1 Bandwidth Plots



Bottom Channel



Middle Channel



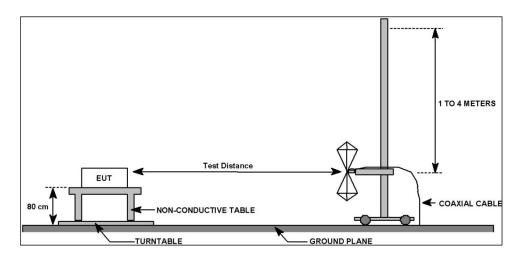
Top Channel

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.

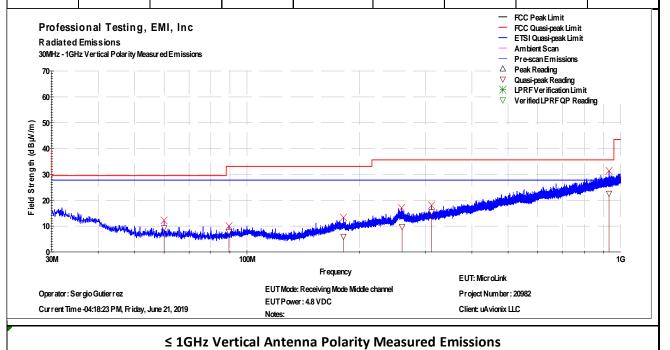
5.3.1 Up to 1 GHz

	Professional '	Testing, EMI, Inc.					
	ANSI C63.4: 2014, American Na	ational Standard for Methods of	Measurement of Radio-Noise				
Test Method:	Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz t						
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



			rofession						
Test Metho	od:		: 2014, America rom Low-Voltag						
In accordar	nce with:		.109 - Code of missions Limits	Federal Regulat	ions Part 47, S	Subpart	B - Ur	intentional R	adiators,
Section:		15.109			1				
Test Date(s	s):	6/21/201			EUT Serial			232419005	
Customer:		uAvionix	LLC		EUT Part #:		Micro		
Project Nui		20982			Test Techni		•		
Purchase O		N/A			Supervisor:			il Murad	
Equip. Und	er Test:	MicroLinl	(Witness' N	ame:	Jeff V	Valker	
		Ra	idiated Emiss	ions Test Res	sults Data Sh				
EUT Li	ine Voltage:	:	4.8 VDC			_	(N/A	
Antenna	a Orientatio	n:	Horizor	ntal	Frequen	-		30MHz to	1GHz
	EUT N	/lode of O	peration:		Rece	iving I	Mode	Middle cha	nnel
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	1	Detector Function	Corrected Level (dBµV/m)	Limit (dBµ\		Margin (dB)	Test Result
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
Radiated	onal Testing, Emissions Iz Horizontal Polarity N	·					— — — — △ ▼ *	FCC Peak Limit FCC Quasi-peak Limit ETSI Quasi-peak Limit Ambient Scan Pre-scan Emissions Peak Reading Quasi-peak Reading LPRF Ver ification Lim Ver ified LPRF QP Reading	it
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≤ 1GHz Horizontal Antenna Polarity Measured Emissions

5.3.2 Up to 5 GHz

		F	rofession	al Testin	g, EMI, I	nc.		
Test Metho	od:		.4: 2014, America from Low-Volta					
In accorda	nce with:		15.109 - Code of Emissions Limits	_	tions Part 47, S	Subpart B - l	Inintentional F	Radiators,
Section:		15.109						
Test Date(•	6/21/20			EUT Serial	·· <u></u> -	1232419005	
Customer:		uAvioni	x LLC		EUT Part #:		roLink	
Project Nu		20982					io Gutierrez	
Purchase C		N/A MicroLir			Supervisor: Witness' N		kil Murad	
quip. Und	ier rest:	IVIICIOLII	1K		withess in	ame: Jen	vvaiker	
		F	Radiated Emiss	sions Test Re				
EUT L	ine Voltage	•	4.8 VDC		EUI POW	_	0 N/A	
Antenn	a Orientatio	n:	Vertic	cal	Frequen	-	Above 1	GHz
	EUT N	/lode of (Operation:				e Middle ch	annel
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degree	'	Detector Function	Corrected Level (dBµV/m)	Limit Leve	'	Test Resul
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
Radiated 1-18GHz Ve	ional Testing, Emissions ortical Polarity Measured						FCC Peak Limit ETSI Peak Limit FCC Average Limit Ambient Scan Pre-scan Emissions Peak Reading Average Reading	
Field Strength (d B JV/m) 60 69 69 69 69 69 69 69 69 69 69 69 69 69		Marie L. Lillian	and the second s				A second	
			—	<u> </u>				
30								
				•				5G
30				Frequency de: Receiving Mode Middle		EUT: MicroLink		5G

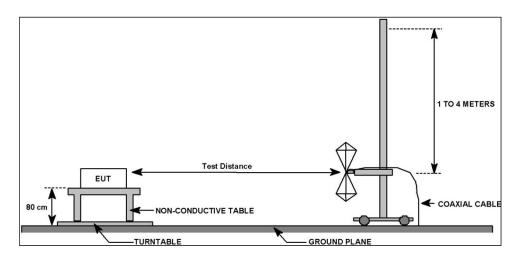
							uAv	ionix Corpor	ation – Micro
		Pr	ofession	al Testin	g, EMI, I	nc.			
Test Metho	ndard for Metl d Electronic Eq								
In accordan	ice with:		109 - Code of I nissions Limits	Federal Regula	tions Part 47,	Subpart	B - Un	intentional R	adiators,
Section:		15.109							
Test Date(s):	6/21/2019			EUT Serial	#:	G201	232419005	
Customer:		uAvionix L	LC		EUT Part #:		Micro	Link	
Project Nur		20982			Test Techn	1			
Purchase O		N/A			Supervisor	-		l Murad	
Equip. Und	er Test:	MicroLink			Witness' N	ame:	Jeff V	Valker	
		Rad	diated Emiss	ions Test Re					
EUT Li	ne Voltage:	: 4	1.8 VDC		EUI POV	_	(N/A	
Antenna	Orientatio	on:	Horizor	ntal	Frequen	•		Above 1	GHz
	EUT N	/lode of Op	eration:				Mode	Middle cha	annel
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit (dBµ\		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		-24.6	Pass
4476.02	3	299	2.29	Average	31.92	54	.0	-22.0	Pass
Radiated	onal Testing, Emissions izontal Polarity Measur						— I — I — A — A	FCC Peak Limit ETSI Peak Limit FCC Average Limit Ambient Scan Pre-scan Emissions Peak Reading Average Reading	
Field Strength (d BµV/m) 70 70 70 70 70 70 70 70 70 7		la de la constante de la const	a de la	Frequency	and the state of t	×		V	
•	rgio Gutierrez e-05:24:32 PM, Friday, .	June 21, 2019		le: Receiving Mode Middle ver : 4.8 VDC	channel	Project	icroLink : Number : 2 uAvionix LLI		

> 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

		Pı	rofession	al Testing	g, EMI, I	nc.			
Test Metho	od:		l0: 2013: Amerio d Wireless Devic		andard of Prod	edures	for Co	mpliance Tes	ting of
In accordar	nce with:		5.209 - Code of I missions Limits	Federal Regulat	ions Part 47,	Subpart	t C - Int	entional Radi	ators,
Section:		15.209							
Test Date(s	s):	6/20/201	L9		EUT Serial		G201	232419005	
Customer:		uAvionix	LLC		EUT Part #:		Micro		
Project Nui		20982			Test Techn			o Gutierrez	
Purchase O		N/A			Supervisor		_	l Murad	
quip. Und	er Test:	MicroLin	k		Witness' N	ame:	Jeff V	Valker	
		Ra	adiated Emiss	ions Test Res					
EUT Li	ine Voltage	:	4.8 VDC		EUT Pov	_	(N/A	
Antenna	a Orientatio	n:	Vertic	al	Frequen	•		30MHz to	1GHz
	EUT N	/lode of O	peration:		Ranga		ow C	hannel	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees		Detector Function	Corrected Level (dBµV/m)	Limit (dBµ	Level V/m)	Margin (dB)	Test Resul
312.009	10	135	1.28	Quasi-peak	16.325	35	5.6	-19.3	Pass
540.018	10	21	1.26	Quasi-peak	19.113	35	5.6	-16.5	Pass
Radiated 30MHz-1GH 70 60	onal Testing, Emissions Iz Vertical Polarity Mea	•					— — — — Ф	FCC Peak Limit FCC Quasi-peak Limit FCS Quasi-peak Limit Ambient Scan Pre-scan Emissions Peak Reading Quasi-peak Reading LPRF Verification Limit Verified LPRF QP Rea	
20 Len 34 (d B Iv / W) 30 10 10 10 10 10 10 10 10 10 10 10 10 10	No of the latest the l	Mallin Stranger	100M					A section to the section of the sect	1G
	ergio Gutierrez		EUTMoo	Frequency de: Transmitting Low chann	el		/licroLink t Number:2	2000	

									uAv	ionix Corp
			Pro	fession	al Testing	g, EMI, I	nc.			
Test Meth	od:			2013: Amerio ireless Devic	can National Sta	andard of Pro	edures	for Co	mpliance Tes	ting of
n accorda	nce with:			09 - Code of I ssions Limits	Federal Regulat	ions Part 47,	Subpart	C - Int	tentional Radi	ators,
Section:		15.209)							
Test Date(s):	6/20/	2019			EUT Serial	#:	G201	232419005	
ustomer:		uAvio		<u> </u>		EUT Part #		Micro		
Project Nu		20982	<u> </u>				4		o Gutierrez	
Purchase (N/A				Supervisor		_	il Murad	
quip. Un	der Test:	Micro	Link			Witness' N	ame:	Jeff V	Valker	
			Radi	ated Emiss	ions Test Res	ults Data S	heet			
EUT I	Line Voltage	:	4.	8 VDC		Frequer		(D N/A	
Antenn	a Orientatio	on:		Horizor	ntal	Pange	-		30MHz to	1GHz
	EUT I	Mode o	f Ope	ration:				ow C	hannel	
Frequency Measured (MHz)	Test Distance (Meters)	EU Direct (Degr	tion	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)		Limit Level Marg (dBμV/m) (dB		Test Result
336.01	10	22	.7	1.25	Quasi-peak	19.628	35.6		-16.0	Pass
467.986	10	35	7	1.25	Quasi-peak	23.699	35	.6	-11.9	Pass
491.992	10	20	7	1.25	Quasi-peak	24.879	35	5.6 -10.7		Pass
503.994	10	20	7	1.25	Quasi-peak	24.674	35	.6	-10.9	Pass
Radiate 30MHz - 1G 70 — 60	sional Testing. d Emissions Hz Horizontal Polarity							— — — — △ ▼ ※	FCC Peak Limit FCC Quasi-peak Limit FCS Quasi-peak Limit Ambient Scan Pre-scan Emissions Peak Reading Quasi-peak Reading UPRFVerification Lim Verified LPRF QP Rea	it
en gth (d BµV/m)					and the sales	Market Market Control	X	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	la l	
Per 10	Andrew Charles and Address and	Marika Japani	Manage de prime	A PARTY NAME OF THE PARTY NAMED IN	The state of the s					
0 30M	Gergio Gutierrez me-01:22:24 P.M. Thursc	Manhalatayetal	Haster Australia		Fr equency de: Tr ansmitting Low chans wer: 4.8 VDC	nel	Projec	/licroLink t Number: uAvionix Li		1 G

6.3.2 Up to 10 GHz, Bottom Channel

		Pro	ofession	al Testin	g, EMI, I	nc.		
Test Metho	od:		: 2013: Americ Vireless Device	can National St es	andard of Prod	cedures for Co	mpliance Tes	ting of
n accordar	nce with:		209 - Code of I issions Limits	Federal Regula	tions Part 47,	Subpart C - Int	entional Rad	iators,
Section:		15.209						
Test Date(s	s):	6/20/2019			EUT Serial	#: G201	232419005	
Customer:		uAvionix L	LC		EUT Part #	Micro	Link	
Project Nui	mber:	20982			Test Techn	ician: Sergio	o Gutierrez	
Purchase O	rder #:	N/A			Supervisor	Shaki	il Murad	
Equip. Und	er Test:	MicroLink			Witness' N	ame: ['] Jeff V	Valker	
		Rad	liated Emiss	ions Test Re	sults Data Sl	neet		
EUT Li	ine Voltage	: 4	.8 VDC		EUI POV		N/A	
Antenna	orientation	n:	Vertic	al	Frequen		Above 1	GHz
	EUT N	/lode of Op	eration:		Ranga		hannel	
Frequency Measured	Test Distance	EUT Direction	Antenna Height	Detector Function	Corrected Level	Test Result		
(MHz)	(Meters)	(Degrees)	(Meters)		(dBµV/m)	(dBµV/m)	(dB)	
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
							CC Peak Limit	
Radiated	onal Testing, Emissions tical Polarity Measured	,				— Е — Р — Р — А	TSI Peak Limit CC Average Limit Ambient Scan Pre-scan Emissions Peak Reading Average Reading	
Field Strength (dB µV/m)							A A	
30				A straight and a stra				
	ergio Gutierrez e-02:58:03 PM, Friday, v	June 21, 2019		Frequency e: Transmitting Low chann ver: 4.8 VDC	nel	EUT: MicroLink Project Number: 2 Client: uAvionix LLC		10G

		Dro	nfession	al Testin	σ FMI I	nc		uAv	vionix Corpo
Test Metho	od:	ANSI C63.10		can National St	<u> </u>		for Co	mpliance Tes	ting of
In accordar	nce with:	FCC Part 15.2		Federal Regula	tions Part 47,	Subpart	C - Int	entional Radi	ators,
Section:		15.209							
Test Date(s	a):	6/20/2019			EUT Serial	#:	G201	232419005	
Customer:	7-	uAvionix LI			EUT Part #:		Micro		
Project Nur	mber:	20982			Test Techn	ician: 1	Sergi	o Gutierrez	
Purchase O		N/A			Supervisor			il Murad	
Equip. Und		MicroLink			Witness' N	-			
		Rad	iated Emiss	ions Test Res	sults Data Sl	neet			
EUT Li	ine Voltage	: 4	.8 VDC		EUI POW	_	(N/A	
Antenna	orientation of the state of the	n:	Horizor	ntal	Frequen	•		Above 10	GHz
	EUT N	Node of Ope	eration:		Randa		ow Cl	hannel	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit (dBµ\		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
Radiated	sional Testir d Emissions Horizontal Polari	I ng, EMI, Inc ity Measured Emis	ssions					FCC Peak Limi ETSI Peak Limi FCC Average Ambient Scan Pre-scan Emis Peak Reading Average Read	t Limit sions
eld Strength (dB µV/m)	and the little and th								
20 1G Operator	: Sergio Gutierre:	z //, Friday, June 21	2010 EUTP	Frequency lode: Transmitting ower: 4.8 VDC	Low channel	Proje		ink ber: 20982 onix LLC	10G
- Carrent I		•	Notes	:: tenna Polarit	y Measured				

6.3.3 Up to 1 GHz, Middle Channel

			Pr	ofession	al Testing	g, EMI, I	lnc.		
Test Me	thod:			0: 2013: Ameri Wireless Devid	can National Sta es	andard of Pro	cedures for (Compliance Te	sting of
ln accor		with:	Radiated Er	.209 - Code of missions Limits	Federal Regulat	ions Part 47,	Subpart C - I	ntentional Rac	liators,
Section:			15.209			1			
Test Da	_ ` '		6/20/201			EUT Serial		1232419005	
Custom			uAvionix	LLC		EUT Part #		roLink	
Project			20982					gio Gutierrez	<u>!</u>
Purchas			N/A			Supervisor		kil Murad	
Equip. L	Inder T	est:	MicroLink			Witness' N	lame: Jeff	Walker	
			Ra	diated Emiss	sions Test Res	ults Data S			
EU	T Line \	/oltage:		4.8 VDC			_	0 N/A	
Ante	nna Ori	ientatio	n:	Vertic	al	Frequer		30MHz to	1GHz
		EUT N	lode of O	peration:		Range		e Channel	
Frequen Measur (MHz)	ed Di	Test stance leters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit Leve		Test Results
60.013	3	10	339	1.29	Quasi-peak	9.36	29.5	-20.1	Pass
89.512	2	10	28	1.27	Quasi-peak	9.524	33.1	-23.6	Pass
312.02	2	10	34	1.25	Quasi-peak	17.002	35.6	-18.6	Pass
527.87	2	10	322	1.28	Quasi-peak	16.327	35.6	-19.3	Pass
539.90	1	10	73	1.26	Quasi-peak	16.542	35.6	-19.1	Pass
551.99	5	10	21	2.22	Quasi-peak	23.255	35.6	-12.3	Pass
Radi 30MHz 70 60	ated Emiss		EMI, Inc					action pour reducing	it nit
ield Strength (d BμV/m)									100000000000000000000000000000000000000
10	and of the State o	- Indicate (4)	iil walle the state of the stat	Allah dalam da	A second of the		And the second s		
0 [±] — 30M				100M EUTMo	Frequency de: Transmitting Middle cha	annel	EUT: MicroLin		1G
Opera	tor:Sergio Gut	tier r ez			wer: 4.8 VDC		Project Numb	er: 20982	

6.3.4 Up to 10 GHz, Middle Channel

		Pro	ofession	al Testin	g, EMI, I	nc.		
Test Meth	od:		: 2013: Amerio Vireless Devic	can National St es	andard of Prod	cedures for Co	mpliance Tes	ting of
n accorda	nce with:		209 - Code of I issions Limits	Federal Regula	tions Part 47,	Subpart C - Int	entional Radi	iators,
Section:		15.209						
Test Date(s):	6/20/2019			EUT Serial	#: G201	232419005	
Customer:		uAvionix L	LC		EUT Part #	Micro	Link	
Project Nu	mber:	20982			Test Techn	ician: Sergi	Gutierrez	
Purchase (Order #:	N/A			Supervisor	: Shaki	l Murad	
Equip. Und	der Test:	MicroLink			Witness' N	ame: Jeff V	Valker	
		Rad	liated Emiss	ions Test Re	sults Data Sl	heet		
EUT I	ine Voltage	: 4	.8 VDC		EUI POV		N/A	
Antenn	a Orientatio	on:	Vertic	al	Frequen		Above 10	GHz
	EUT N	Mode of Op	eration:		Ranga		Channel	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Margin (dB)	Test Result		
1830.11	3	173	1.31	Peak	(dBμV/m) 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		45.908	74.0	-20.4	
6404.95	3	71	1.46	Peak Peak	49.465	74.0	-24.5	Pass Pass
7319.99	3	75	1.40	Peak	48.075	74.0	-24.3	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
Radiate	ional Testing, Emissions rtical Polarity Measure						FCC Peak Limit ETSI Peak Limit FCC Average Limit Ambient Scan Pre-scan Emissions Peak Reading Average Reading	_
Strength (d BµV/m) 66 09 04					<u></u>		A	
30	A CONTRACTOR OF THE PARTY OF TH	Harris Anna Paris	A Company of the Assessment of					
1G				Fr equency	1	EUT: MicroLink		10G
	ergio Gutierrez ne -12:58:56 PM, Friday,	June 21, 2019		de: Transmitting Middle ch wer: 4.8 VDC	ku 1191	Project Number: Client: uAvionix L		

		Pro	fession	al Testin	g, EMI, I	nc.	<u> </u>	vionix Corpo			
Test Metho	od:		2013: Americ /ireless Device	can National St es	andard of Proc	edures for C	ompliance Tes	sting of			
In accordar	nce with:	FCC Part 15.2 Radiated Emi		ederal Regula	tions Part 47, 9	Subpart C - Ir	ntentional Rad	iators,			
Section:		15.209									
Test Date(s	s):	6/20/2019			EUT Serial	#: G20	1232419005				
Customer:		uAvionix LL	.c		EUT Part #:	Mici	oLink				
Project Nui	mber:	20982			Test Techn	ician: Serg	io Gutierrez				
Purchase O	rder #:	N/A			Supervisor	Shal	cil Murad				
Equip. Und	er Test:	MicroLink			Witness' N	ame: Jeff	Walker				
		Rad	iated Emiss	ions Test Re							
EUT Li	ine Voltage	: 4.	.8 VDC		EUI POW	_	0 N/A				
Antenna	a Orientatio	n:	Horizon	ıtal	Frequen	-	Above 1	GHz			
	EUT N	/lode of Ope	eration:		Rango		Channel				
Frequency Measured	Test Distance	EUT Direction	Antenna Height (Meters)	Detector Function	Corrected Level	Limit Leve					
(MHz)	(Meters)	(Degrees)	,		(dBµV/m)	74.0	26.4				
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 74.0	-26.9	Pass			
5490.51 6405.33	3	112	1.02 1.34	Peak Peak	45.947 48.252	74.0	-28.0 -25.7	Pass Pass			
7318.32	3	0	2.26	Peak	46.336	74.0	-25.7	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			
3130.2	<u> </u>	132	2.07	reak	31.203	74.0	22.7	1 433			
8234.99	3	104	1.26	Average	42.512	54.0	-11.4	Pass			
R a diated 1-18GHz Hor 90	onal Testing, Emissions izontal Polarity Measur						FCC Peak Limit ETSI Peak Limit FCC Average Limit Ambient Scan Prescan Emissions Peak Reading Average Reading	_			
	ergio Gutier rez e-01:25:51 PM, Friday,	June 21, 2019		Frequency le: Transmitting Middle ch	arnel	EUT: MicroLink Project Number Client: uAvionix		10G			

								U. , 1.	ionix Corp
		P	rofession	al Testing	g, EMI, I	nc.			
Test Metho	od:		10: 2013: Ameri d Wireless Devic		andard of Prod	cedures	for Co	ompliance Tes	ting of
n accorda	nce with:		5.209 - Code of Emissions Limits	Federal Regulat	ions Part 47,	Subpar	t C - Int	tentional Rad	iators,
Section:		15.209			1				
est Date(s	s):	6/20/201			EUT Serial			232419005	
ustomer:		uAvionix 20982	LLC		EUT Part #		Micro	o Gutierrez	
Project Nu Purchase C		N/A			Supervisor			il Murad	
quip. Und		MicroLin	k		Witness' N				
- Чоль			adiated Emiss	ions Tost Pos	•		-		
EUT I	ine Voltage		4.8 VDC	ions rest kes	EUI POV			0 N/A	
					Frequer	icy:	'	-	4611-
Antenn	a Orientatio		Horizor	าtaı	Range		iddla	30MHz to Channel	1GHZ
		Mode of O	_			IVI	luule	Channel	
Frequency Measured (MHz)	Test Distance (Meters)	Direction (Degrees	"	Detector Function	Corrected Level (dBµV/m)	Limit (dBµ	Level V/m)	Margin (dB)	Test Result
336	10	329	1.26	Quasi-peak	21.171	35	5.6	-14.4	Pass
360.001	10	340	1.72	Quasi-peak	18.523	_	5.6	-17.1	Pass
468.004	10	39	1.26	Quasi-peak	24.332	_	5.6	-11.3	Pass
479.991 503.989	10 10	207 356	1.49	Quasi-peak Quasi-peak	23.913 24.103	_	5.6 -11.7 5.6 -11.5		Pass Pass
527.997	10	339	3.41	Quasi-peak Quasi-peak	24.103		5.6	-11.5 -11.5	Pass
327.337	10	333	3.41	Quusi peux	24.007			FCC Peak Limit	1 433
Radiated	ional Testing, Emissions Hz Horizontal Polarity N						— I — , — I ▼ (FCC Quasi-peak Limit ETSI Quasi-peak Limit Ambient Scan Pre-scan Emissions Peak Reading Quasi-peak Reading LPRF Verification Limi Verified LPRF QP Rea	
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<u>ဗ</u> 20						X July		Y I I par	
10	kupphilanda u		Let manhouse	The state of the s		and the last of th			
-	ergio Gutierrez			Frequency le: Transmitting Middle cha	nnel	Project	licroLink t Number: 2		1G
	e -12:23:23 PM, Friday,	June 21, 2019	Notes:			Client	uAvionix LL	C	

6.3.5 Up to 1 GHz, Top Channel

				Pro	fession	al Testing	g, EMI,	Inc.			
Test N	/letho	d:			2013: Amerio /ireless Devic	can National Sta es	andard of Pro	cedure	for Co	ompliance Tes	ting of
		ce with:	Radiat	ed Emi	09 - Code of I ssions Limits	Federal Regulat	ions Part 47,	Subpar	t C - Int	tentional Rad	iators,
Sectio			15.209	-					_		
	oate(s):	6/20/				EUT Serial			232419005	
Custo				nix LL	<u>.C</u>		EUT Part #		Micro		
	t Nun		20982	<u> </u>						o Gutierrez	
		rder #:	N/A				Superviso		_	il Murad	
Equip	. Und	er Test:	Micro	LINK			Witness' N	vame:	Jeff V	vaiker	
						ions Test Res	ults Data S				
E	UT Li	ne Voltage		4.	8 VDC			_	(0 N/A	
An	tenna	Orientatio	n:		Vertic	al	Freque			30MHz to	1GHz
		EUT N	/lode d	of Ope	ration:				ligh C	hannel	
Freque Meas	ured	Test Distance (Meters)	El Direc (Deg	tion	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)		Level V/m)	Margin (dB)	Test Results
60.0)11	10	26	54	1.28	Quasi-peak	9.065	29	9.5	-20.4	Pass
90.6	523	10	16	51	1.5	Quasi-peak	2.713	33	3.1	-30.4	Pass
174.0	633	10	26	64	1.28	Quasi-peak	5.83	33	3.1	-27.3	Pass
312.0	005	10	5	7	1.26	Quasi-peak	15.611	35	5.6	-20.0	Pass
551.9	951	10	2	1	1.25	Quasi-peak	18.28	35	5.6	-17.3	Pass
R : 300 70 60	adiated I	onal Testing, Emissions Vertical Polarity Mea	•						—————————————————————————————————————	FCC Peak Limit FCC Quasi-peak Limit ETSI Quasi-peak Limit Ambient Scan Pre-scan Emissions Peak Reading Quasi-peak Reading UPRFVerification Lim Verified LPRFQP Res	it
λď	0									Like the state of	
1	0	all of the last of		الدينيانية الدينية	V V	A CONTRACTOR OF THE PARTY OF TH	Jaka Jaka Jaka Jaka Jaka Jaka Jaka Jaka				
	0± 30M perator: Ser	gio Gutierrez	1	+ +		Frequency de: Transmitting High char wer: 4.8 VDC	nel		MicroLink ct Number:	20982	1G
		-10:00:32 AM, Friday,			EULFO						

							uAv	vionix Corp			
		Pr	ofession	al Testing	g, EMI, I	nc.					
Test Meth	od:		0: 2013: Ameri Wireless Devic	can National Sta es	andard of Prod	cedures for C	ompliance Tes	sting of			
n accorda	nce with:		.209 - Code of missions Limits	Federal Regulat	ions Part 47,	Subpart C - Ir	ntentional Rad	iators,			
Section:		15.209			1						
est Date(•	6/20/201			EUT Serial		1232419005				
ustomer:		uAvionix 20982	LLC		EUT Part #:	Part #: MicroLink Technician: Sergio Gutierrez					
Project Nu Purchase (N/A			Supervisor	Shakil Murad					
quip. Un		MicroLink			Witness' N						
-11				ions Test Res	•						
FUT	Line Voltage		4.8 VDC	nons reserves	EUT POV	ver	0 N/A				
	na Orientatio		Horizoi	ntal	Frequency:			1GHz			
Antein		Mode of O		1141	Range		Channel	10.112			
Frequency Measured (MHz)		EUT Direction (Degrees)	Antenna Height	Detector Function	Corrected Level (dBµV/m)	Limit Level (dBµV/m)		Test Result			
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			
527.968 845.037	10	3 220	1.69	Quasi-peak Quasi-peak	22.742 25.93	35.6 35.6	-12.9 -9.7	Pass Pass			
645.057	10	220	1.20	Quasi-peak	25.95	33.0	-9.7	Pass			
Radiate	sional Testing, d Emissions SHz Horizontal Polarity I	•				- Δ - Δ - Δ - Δ - Δ - Δ	FCC Peak Limit FCC Quasi-peak Limit ETSI Quasi-peak Limit Ambient Scan Pre-scan Emissions Peak Reading Quasi-peak Reading LPRF Verification Lim Verified LPRF QP Re	it			
Field Strength (d BµV/m)						× MY					
을 20 - - 10	Market			the state of the s	National Property lies		A STATE OF THE STA				
	A STATE OF THE PARTY OF THE PAR										
٦											
0 <u>↓</u> 30M			100M	Frequency de: Transmitting High char	'	EUT: MicroLink		1G			

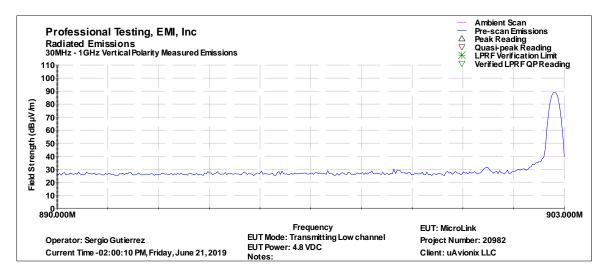
6.3.6 Up to 10 GHz, Top Channel

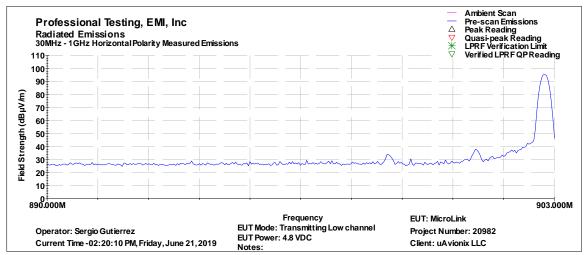
		Pro	ofession	al Testing	g, EMI, I	nc.			
Test Metho	od:		: 2013: Americ Vireless Device	can National Sta es	andard of Proc	edures for Co	mpliance Tes	ting of	
n accordar	nce with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s	s):	6/20/2019 EUT Serial #:							
Customer:		uAvionix LI	LC		EUT Part #: MicroLink				
Project Nui	mber:	20982			Test Technician: Sergio Gutierrez				
Purchase O	rder #:	N/A			Supervisor				
Equip. Und	er Test:	MicroLink			Witness' N	ame: Jeff V	Valker		
		Rad	iated Emiss	ions Test Res	ults Data Sl	heet			
EUT L	ine Voltage	: 4	.8 VDC		EUI Pov) N/A		
Antenna	orientation	n:	Vertic	al	Frequen		Above 10	GHz	
	EUT N	/lode of Ope	eration:		Range	High C	hannel		
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 Result	
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	
Radiated	onal Testing, Emissions tical Polarity Measured						FCC Peak Limit ETSI Peak Limit FCC Average Limit Ambient Scan Pre-scan Emissions Peak Reading Average Reading		
20 1G	ergio Gutierrez			Frequency de: Transmitting High chan wer: 4.8 VDC	nel	EUT: MicroLink Project Number:	20982	10G	
Operator. Ot						Client: uAvionix LL			

			Prof	fession	al Testin	g, EMI, I	nc.		uAv	vionix Corpo
Test Me	thod:		263.10: 2		an National St	<u> </u>		for Co	mpliance Tes	ting of
In accor	dance with	•		9 - Code of F	ederal Regula	tions Part 47,	Subpart	C - Int	entional Rad	iators,
Section		15.209	9							
Test Da	te(s):	6/20/	6/20/2019 EUT Serial #: G201232419005							
Custom			uAvionix LLC EUT Part #: MicroLink							
Project	Number:	20982	2			Test Technician: Sergio Gutierrez				
	e Order #:	N/A				Supervisor: Shakil Murad Witness' Name: Jeff Walker				
	Jnder Test:	Micro	Link							
			Radia	ted Emiss	ions Test Res	sults Data Si	neet			
EU	T Line Volta	age:	4.8	VDC		EUI POV	_	(N/A	
Ante	nna Orient	ation:		Horizon	tal	Frequen	•		Above 1	GHz
	EU	T Mode o	of Oper	ation:		83000		igh C	hannel	
Frequer Measur (MHz	ed Distanc	ce Direc	JT ction rees)	Antenna Height (Meters)	Detector Function	Corrected Level (dBµV/m)	Limit (dBµ\		Margin (dB)	Test Results
1854.4	5 3	11	10	2.32	Peak	50.461	74	.0	-23.5	Pass
2782.0	06 3	3	3	1.02	Peak	41.757	74	.0	-32.2	Pass
3707.2		28	34	1.26	Peak	42.12	74	.0	-31.8	Pass
4636.3			7	2.96	Peak	45.628	74		-28.3	Pass
5560.3		_	12	1.65	Peak	46.338	74	_	-27.6	Pass
6490.4			22	1.38	Peak	47.475	74		-26.5	Pass
7418.1			28	3.2	Peak	45.605	74		-28.4	Pass
8345.2			38	1.26	Peak	49.788	74	_	-24.2	Pass
9272.		_	59	1.49	Peak	47.704	74	_	-26.3	Pass
8345.2	.9 3	18	38	1.26	Average	36.788	54	.0	-17.2	Pass
Rad	ofessional Te iated Emissio GHz Horizontal F	ns	•	ions					FCC Peak LimiteTSI Peak LimiteTSI Peak LimiteFCC Average Ambient Scan Pre-scan EmisePeak Reading Average Read	t Limit sions
Field Strength (dB µV/m) 09 09 09			+					کور در در در		
20 20 20 20 20	A particular de la constitución de			a jegi kantususususususususususususususususususus			Y		Y	100
Ope	rator: Sergio Gut ent Time -11:22:	39 AM, Friday,		019 EUT Po Notes	Frequency ode: Transmitting ower: 4.8 VDC :		Proje Clier	nt: uAvio	nk per: 20982 pnix LLC	10G

6.3.7 Band Edge, Low Channel, Non-hopping

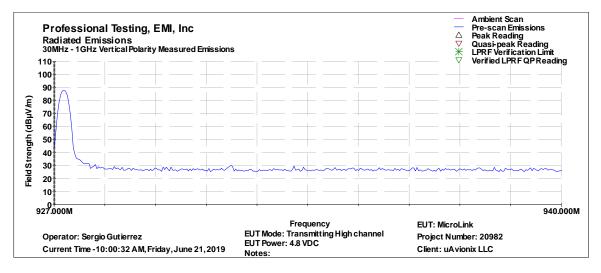
Measured in 120 kHz RBW with peak detection.

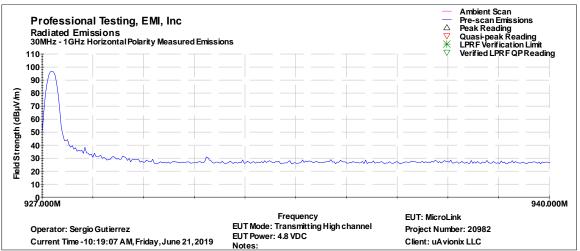




6.3.8 Band Edge, Top Channel, Non-hopping

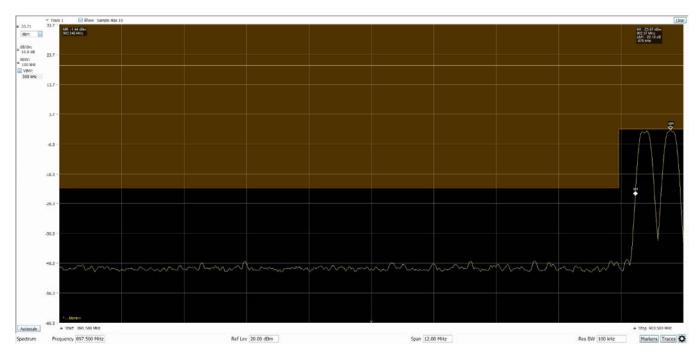
Measured in 120 kHz RBW with peak detection.





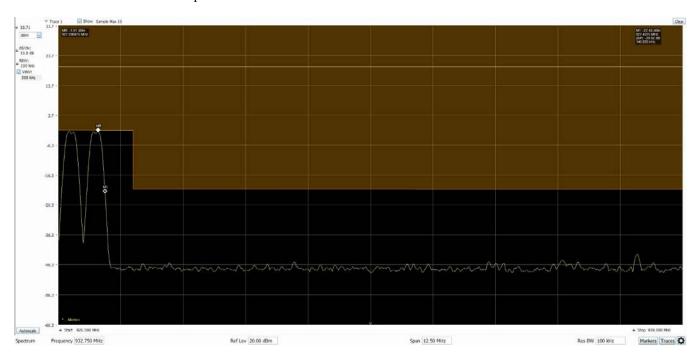
6.3.9 Band Edge, Bottom Channel, Hopping, Conducted

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

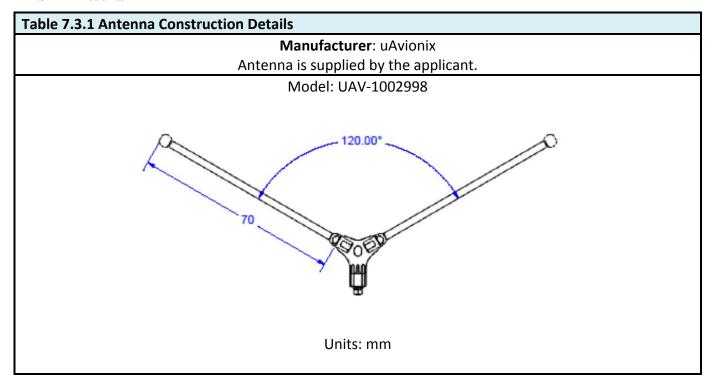
7.1 Procedure

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 //	Antenna Construction	2 Aug 2010				
RSS-Gen 8.3	Gain limited to 6 dBi.	2 Aug 2019				

7.3 Results



- 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								
Til	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 #	t # 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	НР	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	НР	11713A	11713A Attenuator/Switch Driver		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
Padiated Emissions	30 to 1,000 MHz	10 m	4.8
Radiated Emissions	1 to 18 GHz	3 m	5.7

End of Report