

1601 North A.W. Grimes Blvd., Suite B Round Rock, TX 78665

e-mail: info@ptitest.com

(512) 244-3371 Fax: (512) 244-1846

April 11, 2014

Gregory Fisher, Jimmy Li c/o Hitron Technologies Inc. 304 Inverness Way South, Suite 480 Englewood CO 80113 USA

Gentlemen:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Hitron Technologies. Enclosed is the Wireless Certification Report for the HT-DW1. This report can be used to demonstrate compliance with requirements for wireless devices in the United States and Canada.

If you have any questions, please contact me.

Sincerely,

Jeffrey A. Lenk

President

Attachment

Project 15438-15

HT-DW1 Micro D/W Sensor Hardware Version 1.0

Wireless Certification Report

Prepared for:

Hitron Technologies Inc.

By

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

April 11, 2014

Reviewed by

Written by

Larry Finn
Product Development Engineer

Eric Lifsey Test Engineer

15438 Page 2 of 46

Revision History

Revision Number	Description	Date
00	Draft for review.	April 10, 2014
01	Revised per Larry Finn comments.	April 11, 2014

15438 Page 3 of 46

Table of Contents

Revision History	
Certificate of Compliance	<i>6</i>
1.0 Introduction	7
1.1 Scope	
1.2 EUT Description	
1.3 EUT Operation	
1.4 Modifications to Equipment	
1.5 Test Site	
2.0 Fundamental Power	
2.1 Test Procedure	
2.2 Test Criteria	
2.3 Test Results	
2.3.1 Vertical Polarity	
2.3.2 Horizontal Polarity	
3.0 Power Spectral Density	12
3.1 Test Procedure	12
3.2 Test Criteria	
3.3 Test Results	
3.3.1 Low Channel PSD.	
3.3.2 Middle Channel PSD.	
3.3.3 High Channel PSD	
4.0 Transmitter Duty Cycle	
4.1 Test Procedure	
4.2 Test Criteria	
4.3 Test Results	
5.0 Occupied Bandwidth	
5.1 Test Procedure	17
5.2 Test Criteria	17
5.3 Test Results	17
5.3.1 Bandwidth Plots, 6 dB	
5.3.2 Bandwidth Plots, 20 dB	
6.0 Band Edge	
6.1 Test Procedure	
6.2 Test Criteria	
6.3 Test Results	
6.3.1 High Channel Band Edge	
6.3.2 Low Channel Band Edge	
7.0 Radiated Spurious Emissions Below 1 GHz	
7.1 Test Procedure	
7.2 Test Criteria	
7.3 Test Results	27
8.0 Radiated Spurious Emissions Above 1 GHz	32
8.1 Test Procedure	32
8.2 Test Criteria	
8.3 Test Results	
9.0 Antenna Construction Requirements	
9.1 Procedure	
9.2 Criteria	
9.3 Results	
10.0 Equipment and Bandwidths	
10.1 Equipment for Spurious Radiated Emissions 30 MHz to 12 GHz	
10.2 Equipment for Timings, Bandwidth, and Spurious from 12 to 25 GHz	
10.3 Measurement Bandwidths	
Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty	44
End of Report	46

NOTICE: (1) This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST. (2) This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI),

Wireless Certification Report for the Hitron Technologies Inc. HT-DW1 Inc. (3) The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.

15438 Page 5 of 46



Certificate of Compliance

Applicant: Hitron Technologies

Applicant's Address: Hitron Technologies (Jimmy Li)

No. 1-8, LISING 1ST RD. HSINCHU SCIENCE PARK

HSINCHU 300

Taiwan

FCC ID: U4P-HTDW1 IC ID: 10778A-HTDW1

Model: HT-DW1 Project Number: 15438-15

The **HT-DW1** by **Hitron Technologies Inc.** was tested utilizing the following documents and found to be in compliance with the required criteria on the indicated test date.

Standard	Reference	Detail	
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.	
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.	
FCC 47 CFR Part 15 C	15.207	Conducted limits.	
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation	
KDB718828	DR01	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) Operating Under §15.247	
KDB412172	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	t Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofreque Electromagnetic Fields	
RSS-210	Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment	
RSS-Gen	Issue 3	General Requirements and Information for the Certification of Radio Apparatus	
RSS-102	Issue 4	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (A Frequency Bands)	

^{*}MPE is reported separately from this document.

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures, have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Jeffrey A. Lenk President

This report has been reviewed and accepted by Hitron Technologies Inc. The undersigned is responsible for ensuring that the HT-DW1 by Hitron Technologies Inc. will continue to comply with the applicable rules.

Representative of Hitron Technologies Inc.

15438 Page 6 of 46

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.

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. The procedures of ANSI C63.4: 2009 were used for making all radiated enclosure and mains emission measurements.

1.2 EUT Description

The EUT is the **HT-DW1** by **Hitron**. This device is a wireless transmitter that beacons data to a central receiver. The EUT as tested consisted of the following:

Table 1.2.1: Equipment Under Test

Manufacturer	Model	Serial #	Description
Hitron Technologies Inc.	HT-DW1	None	Wireless door/window security
The off reemlologies me.		None	sensor.

This device is used to detect intrusions for doors and windows of a structure.

The antenna is internal to a chip on the circuit board. There is no antenna connector. The EUT is powered by a 3 V coin type cell.

The EUT measures approximately 31 x 31 x 11 mm. A photograph of the EUT is provided below.



Photograph 1.2.1: EUT

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations. This is not a hand held device.

The EUT internal software operated the transmitter in a continuous modulated mode. It was programmed to change channels when the sensor first detected a magnet nearby. On each re-approach of the magnet the EUT would advance to the next channel and return to the low channel after the high channel. The channelization is by the commonly known Zigbee scheme.

15438 Page 7 of 46

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.

15438 Page 8 of 46

2.0 Fundamental Power

2.1 Test Procedure

EUT is placed on a non-conducting table and rotated to record the maximum emission. Bandwidth is first determined to select correct entire bandwidth for power measurement and the fundamental power is measured.

2.2 Test Criteria

47 CFR (USA) // IC (Canada)				
Section Reference	Parameter	Date		
15.247(a)(3) //	Fundamental Power			
	Conducted Limit: 1 Watt	2014-02-23		
RSS-210 Issue 8, A2.9	Restated as Field Strength 125.2 dBμV/m @ 3 m			

2.3 Test Results

The EUT bandwidth was found to be between 1 MHz and 3 MHz, the measurement resolution bandwidth was set to 3 MHz; video bandwidth was set to 3 MHz. Results are presented below:

Fundamental Power Measured as Field Strength Conducted Limit 1 Watt (30 dBm)

Limit Restated as Field Strength 125.2 dBμV/m @ 3 m

Vertical Polarity			
Frequency GHz	Corrected Measured Peak Power at 3 m dBµV/m		
2.405	76.8		
2.440	87.2		
2.480	76.8		

Measured in 3 MHz RBW, 3 MHz VBW.

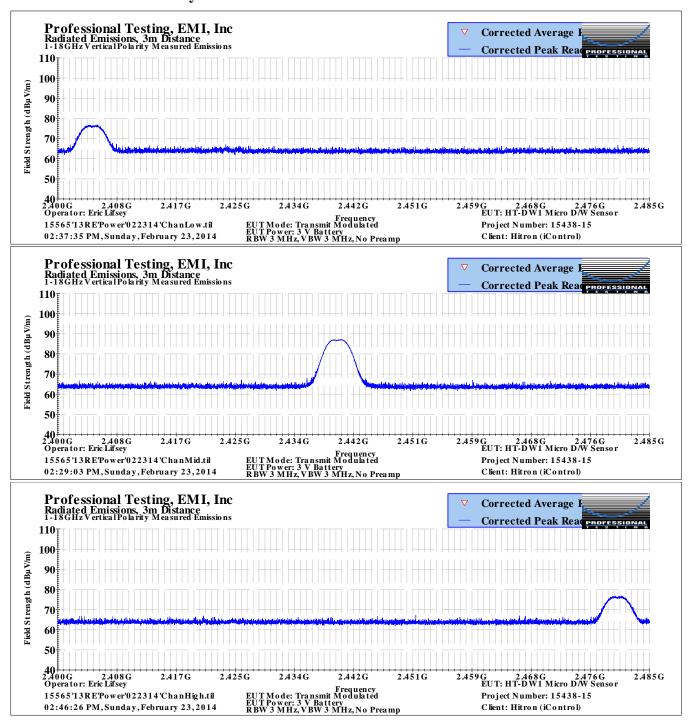
Horizontal Polarity			
Frequency GHz	Corrected Measured Peak Power at 3 m dBµV/m		
2.405	82.8		
2.440	91.6		
2.480	83.2		

Measured in 3 MHz RBW, 3 MHz VBW.

Note that power on the lowest and highest channels is reduced in the design to insure band edge compliance. The EUT was found to be in compliance with the applicable criteria. Plotted measurement appears below.

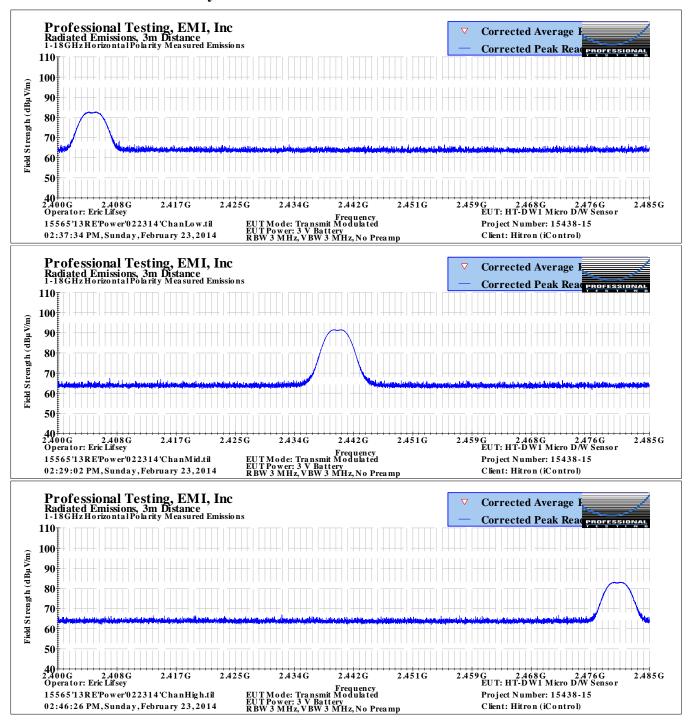
15438 Page 9 of 46

2.3.1 Vertical Polarity



15438 Page 10 of 46

2.3.2 Horizontal Polarity



15438 Page 11 of 46

3.0 Power Spectral Density

3.1 Test Procedure

The EUT is placed on a non-conductive table and oriented for maximum signal. A spectrum analyzer is then adjusted to encompass the highest signals and allowed to record in max-hold mode for a time sufficient to capture all transmit products.

3.2 Test Criteria

47 CFR (USA) // IC (Canada)				
Section Reference	Parameter	Date		
15.247e // RSS-210 Issue 8, A2.9	Power Spectral Density Conducted Limit: 8 dBm / 3 kHz Restated as Field Strength 103.2 dBμV/m @ 3 m Restated as Field Strength 112.7 dBμV/m @ 1 m	2014-02-20		

3.3 Test Results

Power Spectral Density	
Conducted Limit 8 dBm, Measured Radiated	
Polarity Per Highest Measured for Peak Power	

Frequency GHz	Polarity	Antenna Factor dB	Cable Loss dB	Corrected* Measured Peak PSD at 1 m dBµV/m
2.405	Н	28.2	1.6	82.10
2.440	Н	28.2	1.6	91.51
2.480	Н	28.2	1.6	81.29

^{*}Factors were added to spectrum analyzer amplitude offset to obtain a direct corrected measurement.

Sweep time 500 seconds.

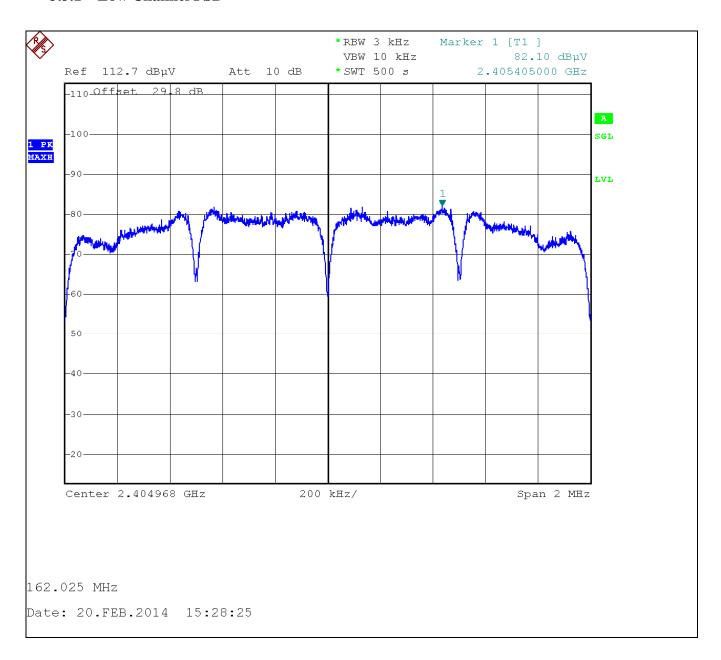
Note that power on the lowest and highest channels is reduced in the design to insure band edge compliance.

The EUT was found to be in compliance with the applicable criteria.

Plotted measurements appear below.

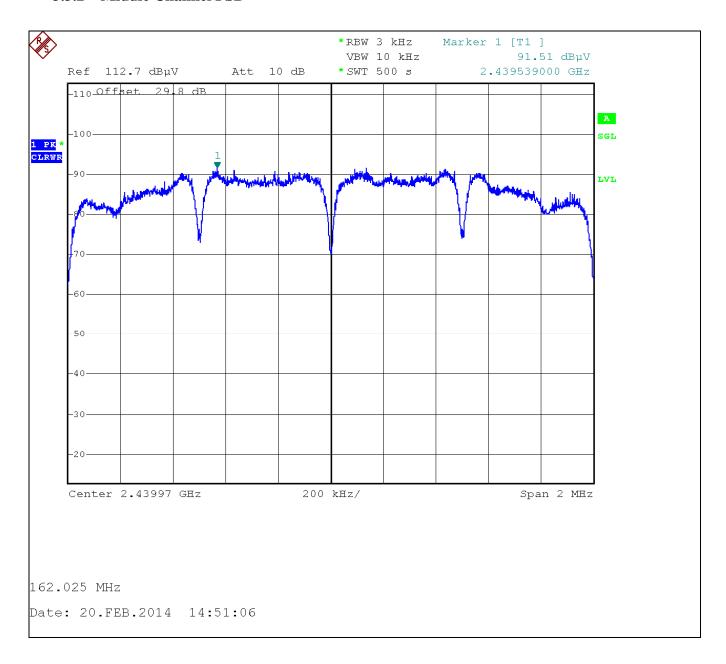
15438 Page 12 of 46

3.3.1 Low Channel PSD



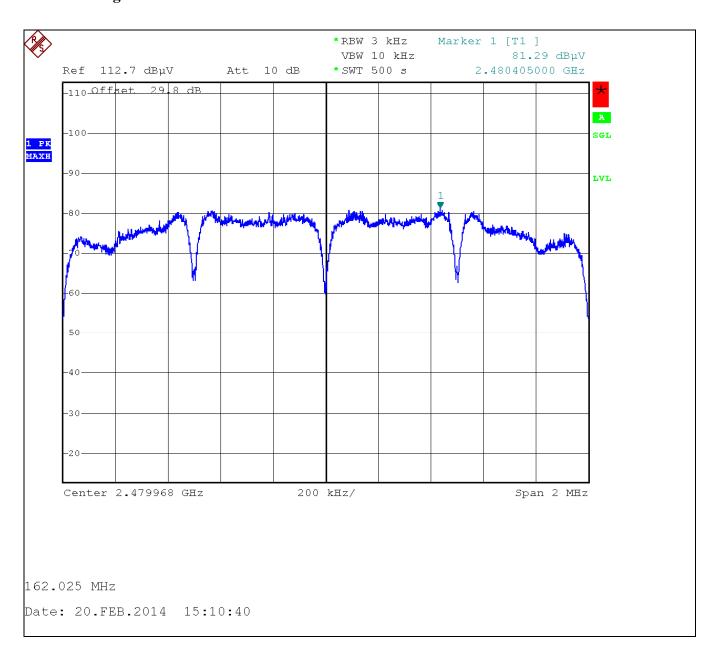
15438 Page 13 of 46

3.3.2 Middle Channel PSD



15438 Page 14 of 46

3.3.3 High Channel PSD



15438 Page 15 of 46

4.0 Transmitter Duty Cycle

Measurements of transmitter on time and intervals between transmissions were made to determine the duty cycle factor.

4.1 Test Procedure

EUT is placed into normal transmit operation to observe and record transmitter time domain performance.

4.2 Test Criteria

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

4.3 Test Results

Due to the low peak power of the fundamental and spurious emissions, the duty cycle was not measured.

15438 Page 16 of 46

5.0 Occupied Bandwidth

5.1 Test Procedure

The EUT is configured for best signal/power and the bandwidth then is measured. A recording of the results is included.

5.2 Test Criteria

47 CFR (USA) // IC (Canada)			
Section Reference	Parameter	Date(s)	
14.247(a)(2), 2.1049 // RSS-Gen Issue 3, 4.6	Bandwidth, 6 dB, 20 dB	2014-02-20	

5.3 Test Results

EUT was found to be in compliance with applicable requirements.

Bandwidth 6 dB Minimum 500 kHz

Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Minimum BW (kHz)
1825.0	1510.0	1817.5	1510.0

Bandwidth 20 dB Measure and Report

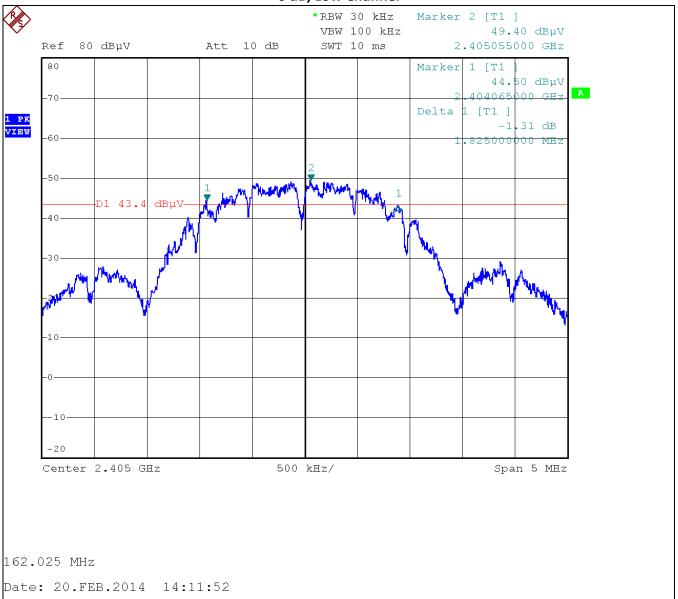
Low Channel	Mid Channel	High Channel	Reported
Measured BW	Measured BW	Measured BW	Maximum BW
(kHz)	(kHz)	(kHz)	(kHz)
2595.0	2580.0	2617.5	2617.5

Plotted measurements appear on the following pages.

15438 Page 17 of 46

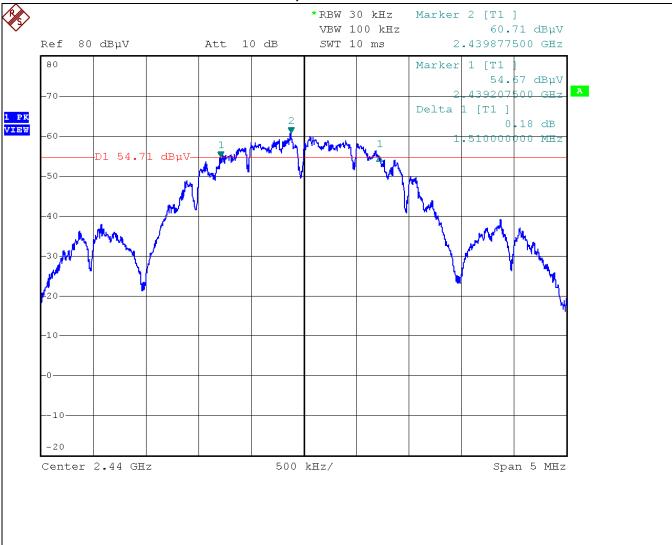
5.3.1 Bandwidth Plots, 6 dB

6 dB, Low Channel



15438 Page 18 of 46

6 dB, Middle Channel



162.025 MHz

Date: 25.FEB.2014 10:32:04

15438 Page 19 of 46

6 dB, High Channel



162.025 MHz

Date: 20.FEB.2014 14:06:01

15438 Page 20 of 46

5.3.2 Bandwidth Plots, 20 dB

20 dB, Low Channel



15438 Page 21 of 46

20 dB, Middle Channel



15438 Page 22 of 46

20 dB, High Channel



15438 Page 23 of 46

6.0 Band Edge

Measurements of transmitter emissions at the top and bottom band edge.

6.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 3 meters from the measurement antenna.

EUT is placed into normal transmit operation on the nearest band edge channel. The spectrum analyzer is centered on the band edge frequency with span sufficient to include the peak of the adjacent fundamental signal. Measurement includes two standard bandwidths from the respective band edge. If required, the band-edge marker-delta method of C63.4 is utilized.

6.2 Test Criteria

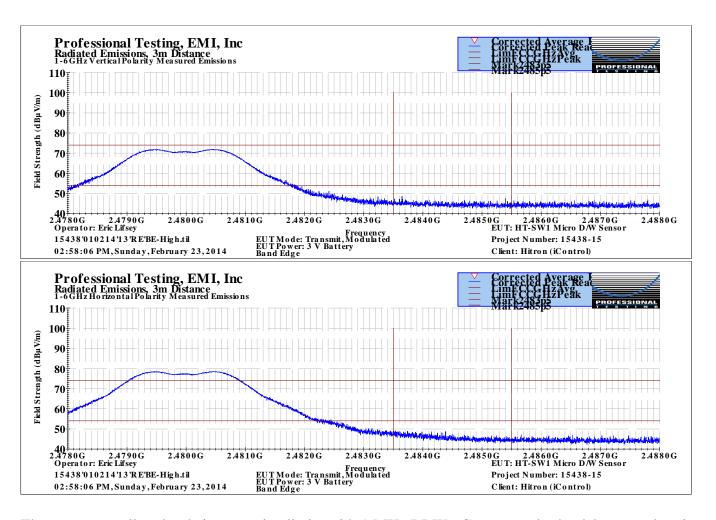
47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.205, 15.209 //	Unwanted Emissions Adjacent to Authorized	2014-02-23
RSS-Gen Issue 3, 4.9	Band, Radiated	2014-02-23

6.3 Test Results

Peak detection emissions at band edges were below the general emission average limits. The EUT satisfied the criteria. Recorded data is presented below.

15438 Page 24 of 46

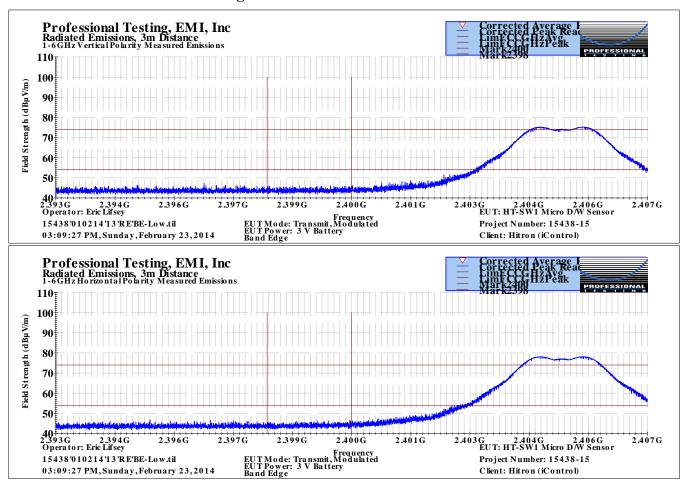
6.3.1 High Channel Band Edge



The curves are all under their respective limits with 1 MHz RBW. Consequently the delta procedure is not required.

15438 Page 25 of 46

6.3.2 Low Channel Band Edge



The curves are all under their respective limits with 1 MHz RBW. Consequently the delta procedure is not required.

15438 Page 26 of 46

7.0 Radiated Spurious Emissions Below 1 GHz

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. A diagram showing the test setup is given in the figure below.

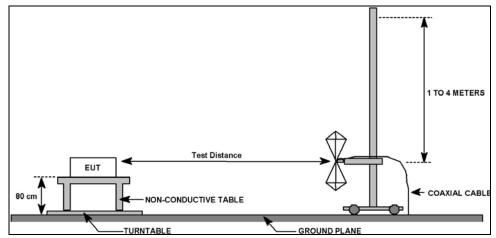


Figure 7.1.1: Field Strength of Spurious Emissions Test Setup

7.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 //	Field Strength of Radiated	2014-02-18
RSS-Gen Issue 3, 4.9, 4.10	Spurious/Harmonic Emissions	2014 02 10

7.3 Test Results

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

15438 Page 27 of 46

			Profess	sional Te	sting, El	MI, Inc.				
Test Metho	od:		1–2003: "Metho Equipment in th						•	
n accordai	nce with:	Emissions	5.109 - Code of I Limits	Federal Regulat	ions Part 47, S	Subpart B - Ur	nintentior	nal Radiat	ors, Radi	ated
Section:		15.109								
Test Date(s	s):	2/18/201			EUT Serial		None			
Customer:		_	echnologies In	ıc.	EUT Part #:		None			
roject Nu		15438-10			Test Techn		Larry Fu		_	
Purchase C		<u> </u>			Supervisor:		_	cCollou	gh	
quip. Und	ler Test:	HT-SW1	Micro D/W Se	ensor	Witness' N	ame:	Ken Eg	an		
	l	Radiated E	missions Test	t Results Data	Sheet			Page:	1	of 1
EUT L	ine Voltage	:	3 VDC		EUT Pow	ver Frequen	су:	N/A	N/A	
Antenn	a Orientatio	on:	Vertic	al	Frequ	ency Range	:	30	MHz to	1GHz
	EUT N	Mode of O	peration:			R	Receive 1	Mode		
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees		Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Le	-	/largin (dB)	Test Result
32.4582	10	298	3.88	Quasi-peak	23.8	11.457	29.5	5	-18.0	Pass
59.9926	10	3	3.92	Quasi-peak	31.9	10.504	29.5	5	-19.0	Pass
248.512	10	316	3.12	Quasi-peak	22.1	8.604	35.6	5	-27.0	Pass
500.263	10	42	1.5	Quasi-peak	22.3	14.379	35.6	5	-21.2	Pass
729.871	10	99	3.99	Quasi-peak	21.6	17.955	35.6	5	-17.6	Pass
905.722	10	7	2.27	Quasi-peak	21.3	21.081	35.6	5	-14.5	Pass
Radiated	sional Testing, Emissions, 10m D 1GHz Vertical F	istance	ed Emissions			 	asi-peak Lin rrected Qua ak Limit Le rrected Peal	si-peak Read vel	PROFES	SIONAL
(m / Nr - 1										
140 dg p) use with the distribution of the dis										
Id Strength (d.)	though any for which had been broaded by the later of the	A	مر منافق الماري		Washington and the second seco	and the state of t		The state of the s	V V	▼ I
Field Strength (dB)	White was a state of the same	hammad land administration	- to the second second second	Marine de la Companya				North and a state of the state	V V	The state of the s

15438 Page 28 of 46

				Profess	sional Te	sting, El	MI, Inc.				
Test Metho	od:				ds of Measuren e Range of 9 kH					•	rical and
n accordai	nce with:	Emissio			Federal Regulat	ions Part 47, S	Subpart B - Ur	intentio	nal Radi	ators, Radi	ated
Section:		15.109						_			
est Date(s	s):	2/18/2				EUT Serial		None			
ustomer:				nologies In	С.	EUT Part #:		None			
roject Nu		15438-	10			Test Techn		Larry F			
urchase C		<u></u>		- 4		Supervisor:		Rob M		ugh	
quip. Und	ler Test:	HT-SW	1 Mi	cro D/W Se	nsor	Witness' N	ame:	Ken Eg	an		
		Radiate	d Em	issions Test	Results Data	Sheet			Page	: 1	of 1
EUT L	ine Voltag	e:	3	VDC		EUT Pow	ver Frequen	су:	N/A	N/A	
Antenn	a Orientat	ion:		Horizor	ntal	Frequ	ency Range:		3	0MHz to	1GHz
	EUT	Mode of	Оре	eration:			R	eceive	Mode		
Frequency Measured (MHz)	Test Distance (Meters)	EU1 Directi (Degre	ion	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Lo		Margin (dB)	Test Results
32.5919	10	20		2.54	Quasi-peak	23.8	11.406	29.	5	-18.1	Pass
59.9753	10	9		1.08	Quasi-peak	23.3	1.941	29.	5	-27.6	Pass
248.245	10	133	3	2.2	Quasi-peak	22.1	8.541	35.0	6	-27.1	Pass
500.399	10	326	ĵ	1.28	Quasi-peak	22.3	14.361	35.0	6	-21.2	Pass
729.768	10	174	1	1.32	Quasi-peak	21.6	17.942	35.0	6	-17.7	Pass
905.53	10	162	2	3.62	Quasi-peak	21.3	21.113	35.0	6	-14.5	Pass
Radiated 30MHz - 60	sional Testing Emissions, 10m 1GHz Horizon	Distance		d Emissions			 	asi-peak Lin rected Qua k Limit Le rected Pea	ısi-peak Rea vel	PROFESS	SIONAL I N 6
(iii / N 1 1 1 1 1 1 1 1 1											
ng do		 									1
ld Strength (d)	MV. an. doy, a har my har a shift a				i. H. side Marie	V TO THE RESIDENCE OF THE PARTY		the latest the same of the sam	V	Marine de	V
Field Strength (dBp	PANamakajia jiwa sanji yi ji atalika	Manuallanda, allowing	pr Mariyal La	policinal statements of the delication of the de	the section of the se	y V			. V		∀

15438 Page 29 of 46

			Profes	sional Te	sting, El	VII, Inc.				
Test Metho	od:								•	
	nce with:	Limits	209 - Code of	Federal Regulat	ions Part 47, S	Subpart C - Int	entional	Radiato	ors, Radiate	d Emissions
Section:		15.209					,			
est Date(s	s):									
ustomer:			nnologies In	ıc.			_			
		15438-10								
		LIT CIA/A DA	D /M C -		•				ugh	
quip. Und	er Test:	HI-SW1 IVI	cro D/W Se	ensor	Witness' N	ame:	Ken Eg	an		
	ı	Radiated Em	issions Test	t Results Data	Sheet			Page	: 1	of 1
EUT L	ine Voltage	: 3	3 VDC		EUT Pow	ver Frequen	су:	N/A	N/A	
Antenna	a Orientatio	on:	Vertic	al	Frequ	ency Range		3	OMHz to	1GHz
	EUT N	Node of Ope	eration:	1		Transmit N	Mode, N	/liddle	Channel	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)			Margin (dB)	Test Result
32.3078	10	342	3.63	Quasi-peak	23.9	11.656	29.5	5	-17.8	Pass
38.8715	10	221	1.33	Quasi-peak	24	8.14	29.5	5	-21.4	Pass
60.0196	10	49	3.74	Quasi-peak	34	12.687	29.5	5	-16.8	Pass
500.09	10	204	3.87	Quasi-peak	22.3	14.359	35.6	5	-21.2	Pass
729.61	10	5	1.3	Quasi-peak	21.7	18.019	35.6	ĵ	-17.6	Pass
905.609	10	209	1.49	Quasi-peak	21.3	21.135	35.6	5	-14.5	Pass
Radiated 30MHz - 60	Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38). FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emission: 15.209 Date(s): 2/18/2014		SIONAL							
V/n										
<u> </u>								To the latest the lat	Y	V V
ield Strei	1					and the second second		I .		
Field	ANALYSING HOME SHIP BEARING AND	halfy stade of baller of b	Leanne Lander	Margarita de Laberta de la Maria de Laberta de la Maria de Laberta de la Maria de la Maria de la Maria de la M La maria de la			_			
10	AND MANAGEMENT OF THE PROPERTY	Make and the Make the grade of the	A CAMPAINT AND A STATE OF THE AND A	they at his last plant the state of the state of	manufacture of the branch of the beautiful or the beautif					

Page 30 of 46 15438

			Profes	sional Te	sting, El	MI, Inc.					
Test Metho	od:			ods of Measurer e Range of 9 kH				_			
n accordai	nce with:	Limits	209 - Code of	Federal Regulat	tions Part 47, 9	Subpart C - In	tentional R	adiators, I	Radiate	ed Emissi	ons
Section:		15.209									
Test Date(s	s):	2/18/2014			EUT Serial		None				
Customer:		Hitron Tech	nnologies In	ıc.	EUT Part #:		None				
Project Nu		15438-10			Test Techn		Larry Fu				
Purchase C		·			Supervisor:		Rob Mc				
quip. Und	ler Test:	HT-SW1 Mi	cro D/W Se	ensor	Witness' N	ame:	Ken Ega	n			
	ı	Radiated Em	issions Test	t Results Data	a Sheet			Page:	1	of	1
EUT L	ine Voltage	: 3	3 VDC		EUT Pow	ver Frequen	cy:	N/A	N/A		
Antenna	a Orientatio	on:	Horizor	ntal	Frequ	ency Range	:	30M	Hz to	1GHz	
	EUT N	Mode of Operation: Transmit M						ddle Cha	nnel		
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Lev		rgin B)	Test Re	sult
32.4793	10	140	2.44	Quasi-peak	23.9	11.519	29.5	-1	8.0	Pas	 S
38.7885	10	178	1.8	Quasi-peak	23.9	8.054	29.5	-2	1.4	Pas	 s
59.7965	10	66	3.95	Quasi-peak	23.3	1.962	29.5	-2	7.5	Pas	s
500.445	10	133	3.05	Quasi-peak	22.3	14.41	35.6	-2	1.2	Pas	s S
729.469	10	130	3.69	Quasi-peak	21.7	17.991	35.6	-1	7.6	Pas	s
905.716	10	176	3.81	Quasi-peak	21.3	21.057	35.6	-1	4.5	Pas	s
Radiated 30MHz - 60 50 50 50 50 50 50 50 50 50 50 50 50 50	sional Testing, Emissions, 10m E - 1GHz Horizonta	,	ed Emissions			▽ C — Pe	uasi-peak Lim orrected Quas eak Limit Lev orrected Peak	i-peak Readin el	<u> </u>	SIONAL	
Field Strength (dBu	Marraphhadia		1000		to the state of th		The label to the l	The latest state of the la	V	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
10 0 30M	r: Larry Fuller	Mary Address of the State of th	100M	the plant of the second of the			EUT: HT-SW1	Mio Pay	Com	1G	

15438 Page 31 of 46

8.0 Radiated Spurious Emissions Above 1 GHz

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

8.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 1 meter from the measurement antenna.

Emissions from 1 GHz to 12 GHz are measured with peak detection, a resolution bandwidth of 1 MHz, and at a distance of 3 meters. If peak measurements exceeded average limits, the peak limit is applicable and duty cycle factor is then applied for average level calculation. For 12 GHz to 18 GHz, the measurement distance is 1 meter. Above 18 GHz, the measurement distance is 0.5 meters. Emissions are investigated up to 25 GHz to include the 10th harmonic of the transmitter fundamental.

Non-harmonic spurious emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given in the figure below.

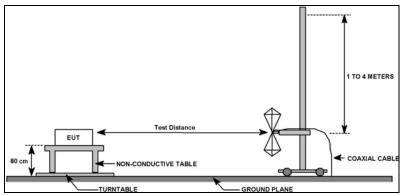


Figure 8.1.1: Field Strength of Spurious Emissions Test Setup

8.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 //	Field Strength of Radiated	2014-02-18
RSS-Gen Issue 3, 4.9, 4.10	Spurious/Harmonic Emissions	2014-02-16

8.3 Test Results

In all cases detector mode is peak, RBW 1 MHz, VBW 3 MHz. The applicable duty cycle factor for averaging is 0 dB. The EUT was receiving on the center channel or transmitting on the indicated channel. All peak emissions can be seen as below the average limit, meaning the average level would also be under the average limit.

A pre-scan of emissions from 12 GHz to 25 GHz found no measurable signals.

15438 Page 32 of 46

			Profess	sional Te	sting, El	VII, Inc.				
Test Metho	d:									i
n accordar	ce with:			ederal Regulat	ions Part 47, S	Subpart B - Ur	intentional	Radiators, Rad	liated	
Section:		15.109			1					
Test Date(s	<u>):</u>			_			_			
Customer:	mhor:		nnologies in	С.				\r		
		15456-10								
		HT-SW1 M	icro D/W Se	nsor				niougn		
<u>- qu.p. 0.1u</u>			-		•			age: 1	of	1
EUT Li	ne Voltage:	:	3 VDC		EUT Pow	er Frequen	cy: N	N/A N/A		
Antenna	Orientatio	n:	Vertic	al	Frequ	ency Range:		Above 1	LGHz	
	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits Distacle(s): 2/18/2014 EUT Serial #: None Test Technician: Larry Fuller Larry Fuller Larry Fuller Larry Fuller Rob McCollough Witness' Name: Ken Egan Radiated Emissions Test Results Data Sheet Radiated Emissions Test Results Data Sheet FUT Power Frequency: N/A									
Frequency Measured (MHz)	Distance	Direction	Height		Amplitude	Level			Test Re	esults
1202	3	263	1	Average	36.3	23.694	54.0	-30.3	Pas	SS
1948.95		308	1	Average	38.4	28.097	54.0	-25.9	Pas	SS
2790.84				Average					Pas	SS
3767.58								_		
5864.15			1				7	+		
8662.65 11569.2										
Radiated	Emissions, 3m Dis	tance	ons			▽ Coi — Pea	rrected Average ak Limit Level	Reading	SSIONAL	
Field Strength (dBµV/m) 00 00 00 00 00 00 00 00 00										
Field Stren 30	Marie Juliana		V	The state of the s			A STATE OF THE STA		digas de la constantina della	
Operator 2013 Rad	Emissions_ClassB_	_	EUT Mod EUT Pow	de: Standard	uency	P	roject Number:	cro D/W Sensor 15438-10	12G	

15438 Page 33 of 46

Table 8.3.2: Radiated Spurious Emissions, Receive Mode, 1 to 12 GHz, Horizontal Polarity

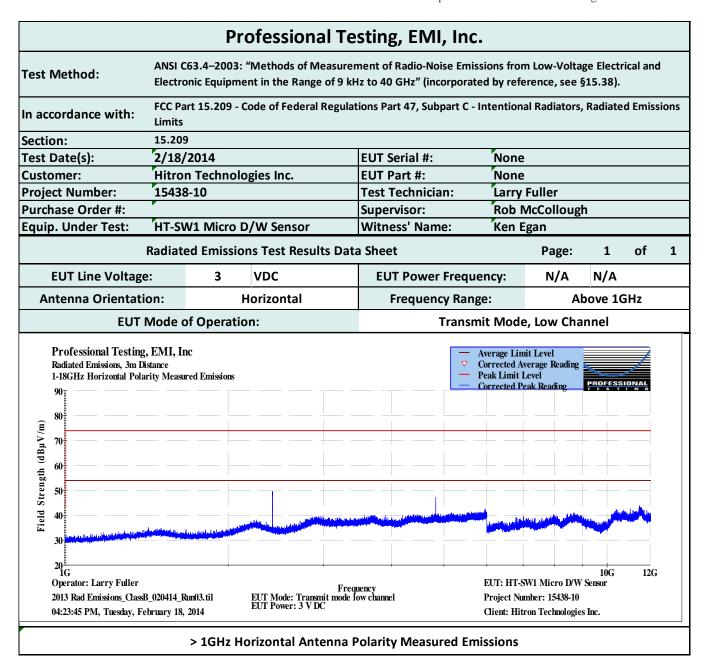
			Profess	sional Te	sting, El	MI, Inc.			
Test Metho	d:								
	Electronic Equipment in the Radiance with: FCC Part 15.109 - Code of Federmissions Limits 15.109 Ele(s): 2/18/2014 Er: Hitron Technologies Inc. Number: 15438-10 E Order #: Inder Test: HT-SW1 Micro D/W Sensor Radiated Emissions Test Re T Line Voltage: 3 VDC Inna Orientation: Horizontal EUT Mode of Operation: Cy Test EUT Antenna Height (Meters) Gistance (Meters) (Degrees) (Meters) 9 3 247 1 4 3 246 1 9 3 113 1 7 4 6 3 36 1 6 3 6 4 1 7 3 258 1 9 6 6 3 64 1 7 3 258 1 9 6 6 6 3 64 1 7 3 258 1 9 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6				tions Part 47,	Subpart B - Ur	nintentional	Radiators, Ra	diated
Section:									
Test Date(s	<u>):</u>	<u> </u>			EUT Serial		None		
Customer:			nnologies in	<u>C.</u>	EUT Part #:		None		
		15438-10			Test Techn		Larry Full		
		LIT CVA/1 N/I	oro D/M/Co		Supervisor: Witness' N		Rob McCo	ollougn	
equip. Ona					•	ame:	Ken Egan		
				Results Dat	1			age: 1	of 1
						ver Frequen		N/A N/A	
Antenna	Orientation	n:	Horizon	ıtal	Frequ	ency Range	:	Above :	1GHz
	EUT N	lode of Ope	eration:			F	Receive Mo	de	
Frequency Measured (MHz)	Distance	Direction	Height	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Leve (dBµV/m)		Test Results
1192.29	3	247	1	Average	36.2	23.602	54.0	-30.4	Pass
1956.54	3	246	1	Average	34.2	23.984	54.0	-30.0	Pass
2794.89		113	1	Average	33.8	26.174	54.0	-27.8	Pass
3765.47				Average	34.6	27.719	54.0	-26.2	Pass
5867.36				Average	31.4	30.342	54.0	-23.6	Pass
8659.26				Average	27.5	35.806	54.0	-18.2	Pass
11567.7	3	258	1	Average	27.1	38.094	54.0	-15.9	Pass
Radiated	Emissions, 3m Dis	tance	sions			 ∇ Co Pe 	erage Limit Lev rrected Average ak Limit Level rrected Peak Re	Reading	SSIONAL 7 N 6
Field Strength (d BµV/m) 00 00 00 00 00									
Eield Stren 30	11 destablished to the state of	a la	A STATE OF THE STA	A constitution of the state of	V	ung sallaig states states the	A Second of Second of		
2013 Rad	; Larry Fuller Emissions_ClassB PM, Tuesday, Feb	_020414_Run01.til oruary 18, 2014	EUI Mod EUI Pow	Freque: Standard wer: 3 V DC	quency	P	CUT: HT-SW1 M Project Number: Lient: Hitron Te		G 12G

15438 Page 34 of 46

Table 8.3.3: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, Low Channel

			Professiona	al Testir	ng, EMI	l, Inc.					
Test Method:			03: "Methods of Me						U	ical and	d
n accordance	with:	C Part 15.20 nits	9 - Code of Federal I	Regulations	Part 47, Sub	part C - Int	entiona	l Radiators	, Radiate	d Emis	sions
Section:	15	.209									
Test Date(s):	2/	18/2014		EUT	Serial #:		None				
Customer:	Hi	tron Techr	nologies Inc.	EUT	Part #:		None				
Project Numb	er: 15	438-10		Tes	Technicia	an:	Larry I	Fuller			
Purchase Ord	er #:			Sup	ervisor:		Rob N	1cColloug	h		
Equip. Under	Test: H1	Γ-SW1 Micι	ro D/W Sensor	Wit	ness' Nam	ne:	Ken E	gan			
	Rad	iated Emis	ssions Test Result	ts Data She	eet			Page:	1	of	1
EUT Line	Voltage:	3	VDC	E	UT Power	Frequen	cy:	N/A	N/A		
Antenna O	Antenna Orientation: Vertical			Frequen	cy Range:		Α	bove 10	6Hz		
	EUT Mod	le of Oper	ation:		Transmit Mode, Low Channel						
	ssions, 3m Distance tical Polarity Mea					— Pea	ık Limit L	erage Reading evel ak Reading	PROFESS	IONAL N 6	
30 mula hada	reign freichteilin, nie frestelle beiten	de de la production de la constitución de la consti							-		
~1G Operator: La	•	114 Dun(12 61	EUT Mode: Transm	Frequency nit mode low char	mel			V1 Micro D/W nber: 15438-10	10G Sensor	12G	ł
2013 Rad Emi	Tuesday, Februar	_	EUT Power: 3 V DO	C			lient: Hitr	on Technologie	s Inc.		

15438 Page 35 of 46



15438 Page 36 of 46

Table 8.3.4: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, Middle Channel

		Professional	Testing, EN	/II, Inc.				
Test Method:		03: "Methods of Mea pment in the Range o				U	ical and	d
In accordance with:	FCC Part 15.20 Limits	9 - Code of Federal Re	egulations Part 47, S	ubpart C - Intention	al Radiators	, Radiate	d Emis	sions
Section:	15.209							
Test Date(s):	2/18/2014		EUT Serial #	: None				
Customer:	Hitron Techr	nologies Inc.	EUT Part #:	None				
Project Number:	15438-10		Test Techni	cian: Larry	Fuller			
Purchase Order #:			Supervisor:	h				
Equip. Under Test:	HT-SW1 Mic	ro D/W Sensor	Witness' Na	me: Ken E	gan			
	Radiated Emis	ssions Test Results	Data Sheet		Page:	1	of	1
EUT Line Voltag	e: 3	VDC	EUT Pow	er Frequency:	N/A	N/A		
Antenna Orientat	ion:	Freque	ency Range:	A	bove 10	6Hz		
EUT	Mode of Oper	ation:		Transmit Mode,	Middle Ch	nannel		
Radiated Emissions, 3m L 1-18GHz Vertical Polari 90				Peak Limit 1 — Corrected P		PROFESS	IONAL	
20 IG Operator: Larry Fuller 2013 Rad Emissions_Class 04:00:04 PM, Tuesday, F	ebruary 18, 2014	EUT Mode: Transmit EUT Power: 3 V DC		Project Nu Client: Hit	SW1 Micro D/W mber: 15438-10 ron Technologie		126	;

15438 Page 37 of 46

			Drofos				ne Hitron T	echnologies l	Inc. HT-DW
		ANGLOGA 4		sional Te	<u></u>			Waltana Elan	. daalaa d
Test Metho	od:			ods of Measurer e Range of 9 kF				•	
In accordance with: FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits								liated	
Section:		15.109							
Test Date(s):	2/18/2014			EUT Serial		None		
Customer:		_	hnologies In	ıc.	EUT Part #:		None		
Project Nu		15438-10			Test Techn		Larry Full		
Purchase C					Supervisor:		Rob McC		
Equip. Und	ler Test:	HT-SW1 M	icro D/W Se	ensor	Witness' N	ame:	Ken Egan		
	F	Radiated En	nissions Tes	t Results Data	a Sheet		P	age: 1	of 1
EUT L	ine Voltage	:	3 VDC		EUT Pow	ver Frequen	cy:	N/A N/A	
Antenn	a Orientatio	on:	Horizoi	ntal	Frequ	ency Range		30MHz to	1GHz
	EUT N	Node of Op	eration:			Transmit N	Mode, Mid	ldle Channel	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Leve		Test Results
32.4793	10	140	2.44	Quasi-peak	23.9	11.519	29.5	-18.0	Pass
38.7885	10	178	1.8	Quasi-peak	_	8.054	29.5	-21.4	Pass
59.7965	10	66	3.95	Quasi-peak		1.962	29.5	-27.5	Pass
500.445	10	133	3.05	Quasi-peak	22.3	14.41	35.6	-21.2	Pass
729.469	10	130	3.69	Quasi-peak	21.7	17.991	35.6	-17.6	Pass
905.716	10	176	3.81	Quasi-peak	21.3	21.057	35.6	-14.5	Pass
Radiated	sional Testing, Emissions, 10m D - 1GHz Horizonta	istance	ed Emissions			- Pe	uasi-peak Limit orrected Quasi- eak Limit Level orrected Peak V	peak Readin	SSIONAL
Field Strength (dBµV/m)									
10 0 30M	r: Larry Fuller	Albert of the state of the stat	100M	the transport of the state of t	de la	the land of the la	EUT: HT-SWI N	Micro D/W Sensor	1G
	,	_020414_Run02.til		Free ode: Transmit mode	quency		Project Number		

Page 38 of 46 15438

Table 8.3.5: Radiated Spurious Emissions, Transmit Mode, 1 to 12 GHz, High Channel

		Р	rofessional 7	Testing, EMI,	Inc.				
Test Method:		ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:	FCC Pa	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:	15.20	9							
Test Date(s):	2/18/	/2014		EUT Serial #:	Non	e			
Customer:	Hitro	n Techno	logies Inc.	EUT Part #:	Non	e			
Project Number:	15438	8-10		Test Technician:	: Larr	y Fuller			
Purchase Order #:				Supervisor:	Rob	McColloug	h		
Equip. Under Test:	HT-S\	N1 Micro	D/W Sensor	Witness' Name:	Ken	Egan			
	Radiat	ed Emissi	ons Test Results D	ata Sheet		Page:	1	of	1
EUT Line Voltag	ge:	3	VDC	EUT Power Fi	requency:	N/A	N/A		
Antenna Orienta	tion:		Vertical	Frequency Range: Above 1GHz					
EUT	Mode o	of Operat	ion:	Tra	ansmit Mod	le. High Cha	annel		
Professional Testin Radiated Emissions, 3m		nc			— Average L∇ Corrected	imit Level Average Reading		1	
Radiated Emissions, 3m 1-18GHz Vertical Polar 90 80 80 60 45 60 50	Distance				∇ Corrected— Peak Limi	Average Reading	PROFESS	HONAL	
Radiated Emissions, 3m 1-18GHz Vertical Polar 90 80 80 60 90 90 90 90 90 90 90 90 90 90 90 90 90	Distance				∇ Corrected— Peak Limi	Average Reading t Level		IDNAL NO	

15438 Page 39 of 46

			Professional		ertification Repositing, EMI,		HILTON	1 ecnno.	logies II	іс. П І	-DW
Test Meth	od:		03: "Methods of Mea						U	rical and	t
In accorda	nce with:	FCC Part 15.209 Limits	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits								
Section:		15.209									
Test Date(s):	2/18/2014			EUT Serial #:	N	one				
Customer:		Hitron Techn	ologies Inc.		EUT Part #:	N	one				
Project Nu	ımber:	15438-10			Test Technician	ı: La	arry Fu	ıller			
Purchase (Order #:			:	Supervisor:	Ro	ob Mo	Colloug	h		
Equip. Und	der Test:	HT-SW1 Micr	o D/W Sensor	,	Witness' Name	: Ke	en Ega	n			
		Radiated Emis	sions Test Results	s Data	Sheet			Page:	1	of	1
EUT I	Line Voltage	:: 3	VDC		EUT Power F	requency	:	N/A	N/A		
Antenn	a Orientati	on:	Horizontal		Frequency	Range:		A	bove 10	GHz	
	EUT I	Mode of Opera	ation:		Tr	ransmit M	ode, I	High Cha	nnel		
Radiated 1-18GH (m/Nm) (m/Vum)	ssional Testing, d Emissions, 3m Di z Horizontal Polar		IIS	on publishmen		∇ Correc— Peak L	imit Lev	age Reading	PROFESS	HONAL	
2013 Ra	or: Larry Fuller d Emissions_ClassB 3 PM, Tuesday, Fe	3_020414_Run04.til bruary 18, 2014	EUT Mode: Transmit EUT Power: 3 V DC	Freque t mode hiş	ency gh channel	Proje	ect Numb	Micro D/W er: 15438-10 Technologie		120	ł
		> 1GH:	z Horizontal Anter	nna Po	olarity Measure	ed Emissio	ns				

15438 Page 40 of 46

9.0 Antenna Construction Requirements

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

9.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevent wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

9.2 Criteria

47 CFR (USA) // IC (Canada)						
Section Reference	Parameter	Date(s)				
15.203 // RSS-210 Issue 8, A2.9	Antenna Construction	2014-04-10				

9.3 Results

Antenna Manufacturer and Model	Specifications	
ANT CER CHIP 2.4-2.5GHz 2dBi 5	Gain	2 dBi
Chip antenna on circuit board.		

- The antenna is internal only to the device.
- The antenna is a soldered-on component on the transmitter circuit board.
- There is no antenna connector.

The antenna design meets the requirements of the rules.

15438 Page 41 of 46

10.0 Equipment and Bandwidths

10.1 Equipment for Spurious Radiated Emissions 30 MHz to 12 GHz

10.1	quipinent for 8	purious Radia	ted Ellissi						
Professional Testing, EMI, Inc.									
Test Metho	vd·			nent of Radio-Noise Emission Iz to 40 GHz" (incorporated	•				
In accordan	ice with:		ederal Regulat	ions Part 47, Subpart C - In	tentional Radiators, F	Radiated Emissions			
Section:									
Test Date(s	·			EUT Serial #:	None				
Customer:		n Technologies Ind	C	EUT Part #: Test Technician:	None				
Project Nur Purchase O		9-10		Supervisor:	Larry Fuller Rob McCollough				
Equip. Und		V1 Micro D/W Ser	nsor	Witness' Name:	Ken Egan				
	<u></u>	•		Test Equipment List					
Til	e! Software Version	on: 4.2.A,	May 23, 201	0, 08:38:52 AM					
	Test Profile:	Radia	ted Emission	s_Profile Version Octob	er 12, 2011				
Asset #	Manufacturer	Model	Equipm	ent Nomenclature	Serial Number	Calibration Due Date			
1509A	Braden	N/A	TDK 10M C	Chamber, NSA < 1 GHz	DAC-012915-005	7/29/2014			
1890	НР	8447F	Preamp/Amp, 9kHz-1300N 28/25dB		3313A05298	1/22/2015			
1937	Agilent	E4440A	E4440A Spectrum Analyze		MY44303298	12/2/2015			
1926	ETS-Lindgren	3142D	Antenna, Bio	conilog, 26 MHz - 6 GHz	00135454	7/29/2014			
C027	N/A	RG214	Cable Coax, N-N, 25m		none	9/26/2014			
1327	EMCO	1050	1050 Controller, Antenna		none	N/A			
0942	EMCO	11968D	Τι	urntable, 4ft.	9510-1835	N/A			
1969	НР	HP 11713A Atte		ator/Switch Driver	3748A04113	N/A			
1509B	Braden	N/A	TDK 10M C	namber, VSWR > 1 GHz	DAC-012915-005	7/16/2014			
2004	Miteq	AFS44-00101800- 2S-10P-44	Amplifi	Amplifier, 40dB, .1-18GHz		11/19/2014			
C030	N/A	0		e Coax, N-N, 30m	none	9/26/2014			
Loaner-ETS	ETS-Lindgren	3117	-	Double Ridged Guide ern, 1 - 18 GHz	135203	1/14/2015			
1325	EMCO	1050	Control	ler, Antenna Mast	9003-1461	N/A			

15438 Page 42 of 46

10.2 Equipment for Timings, Bandwidth, and Spurious from 12 to 25 GHz

Asset #	Manufacturer	Model #	Description	Calibration Due
0582	EMCO	3115	Ridge Guide Antenna	2014-03-14
1974	Agilent	83017A	Microwave Preamplifier (preamp 1)	2014-03-05
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29
C248	Pasternack	-	Cable, Low Loss	2014-03-12
1542	AH Systems	SAS-572	Horn Antenna, Standard Gain, 20 dB	Not Required

10.3 Measurement Bandwidths

Professional Testing, EMI, Inc.							
Test Method:	ANSI C63.4–2003: "Methods of	Measurement of Radio-N	oise Emissions from Low-Voltage				
rest Method.	Electrical and Electronic Equipn	nent in the Range of 9 kH	z to 40 GHz" (incorporated by reference				
	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators,						
In accordance with:	Radiated Emissions Limits						
Section:	15.109						
Test Date(s):	2/18/2014	EUT Serial #:	None				
Customer:	Hitron Technologies Inc.	EUT Part #:	None				
Project Number:	15438-10	Test Technician:	Larry Fuller				
Purchase Order #:		Supervisor:	Rob McCollough				
Equip. Under Test:	HT-SW1 Micro D/W Sensor	Witness' Name:	Ken Egan				

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	300	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 $1\,\mathrm{MHz}$ for average measurements from $1\text{-}18\,\mathrm{GHz}$.

15438 Page 43 of 46

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.

15438 Page 44 of 46

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
Radiated Efflissions	1 to 18 GHz	3 m	5.7

15438 Page 45 of 46

End of Report

(This page intentionally left blank.)

15438 Page 46 of 46