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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,

A handwritten signature in black ink, appearing to read 'Jeffrey A. Lenk', is written over a light grey circular stamp.

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



Larry Finn
Product Development Engineer

Written by



Eric Lifsey
Test Engineer

Revision History

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

Table of Contents

Revision History..... 3

Certificate of Compliance 6

1.0 Introduction..... 7

 1.1 Scope..... 7

 1.2 EUT Description 7

 1.3 EUT Operation..... 7

 1.4 Modifications to Equipment..... 8

 1.5 Test Site 8

2.0 Fundamental Power 9

 2.1 Test Procedure 9

 2.2 Test Criteria 9

 2.3 Test Results..... 9

 2.3.1 Vertical Polarity 10

 2.3.2 Horizontal Polarity 11

3.0 Power Spectral Density..... 12

 3.1 Test Procedure 12

 3.2 Test Criteria 12

 3.3 Test Results..... 12

 3.3.1 Low Channel PSD 13

 3.3.2 Middle Channel PSD..... 14

 3.3.3 High Channel PSD 15

4.0 Transmitter Duty Cycle..... 16

 4.1 Test Procedure 16

 4.2 Test Criteria 16

 4.3 Test Results..... 16

5.0 Occupied Bandwidth 17

 5.1 Test Procedure 17

 5.2 Test Criteria 17

 5.3 Test Results..... 17

 5.3.1 Bandwidth Plots, 6 dB..... 18

 5.3.2 Bandwidth Plots, 20 dB..... 21

6.0 Band Edge..... 24

 6.1 Test Procedure 24

 6.2 Test Criteria 24

 6.3 Test Results..... 24

 6.3.1 High Channel Band Edge 25

 6.3.2 Low Channel Band Edge..... 26

7.0 Radiated Spurious Emissions Below 1 GHz..... 27

 7.1 Test Procedure 27

 7.2 Test Criteria 27

 7.3 Test Results..... 27

8.0 Radiated Spurious Emissions Above 1 GHz 32

 8.1 Test Procedure 32

 8.2 Test Criteria 32

 8.3 Test Results..... 32

9.0 Antenna Construction Requirements 41

 9.1 Procedure 41

 9.2 Criteria 41

 9.3 Results..... 41

10.0 Equipment and Bandwidths 42

 10.1 Equipment for Spurious Radiated Emissions 30 MHz to 12 GHz 42

 10.2 Equipment for Timings, Bandwidth, and Spurious from 12 to 25 GHz..... 43

 10.3 Measurement Bandwidths 43

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty 44

End of Report 46

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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.



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 Systems (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	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency 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 (All 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.

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 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.

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.

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) // RSS-210 Issue 8, A2.9	Fundamental Power Conducted Limit: 1 Watt Restated as Field Strength 125.2 dB μ V/m @ 3 m	2014-02-23

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 dB μ V/m @ 3 m
--

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

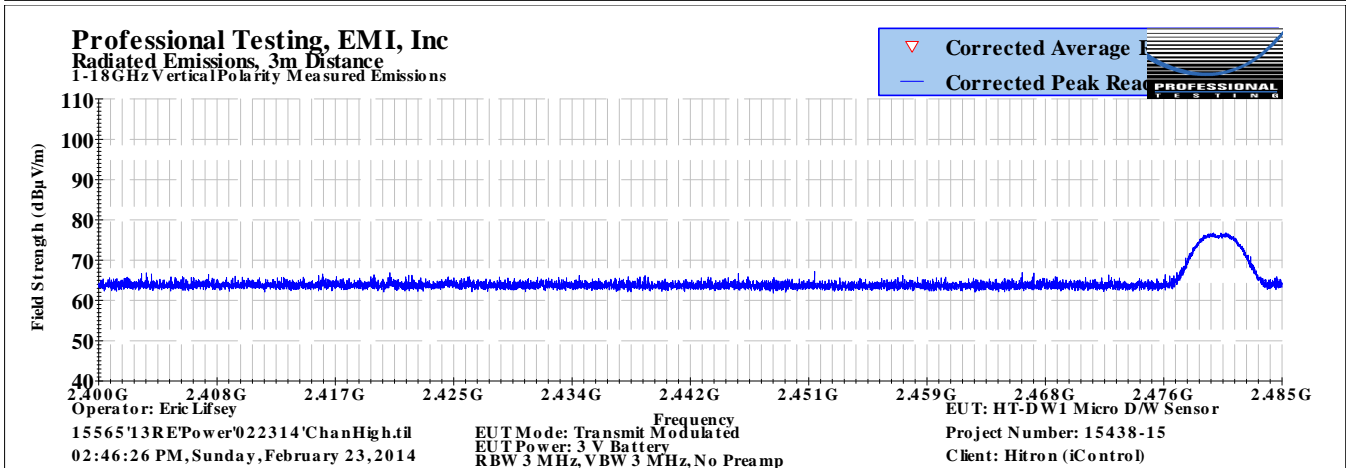
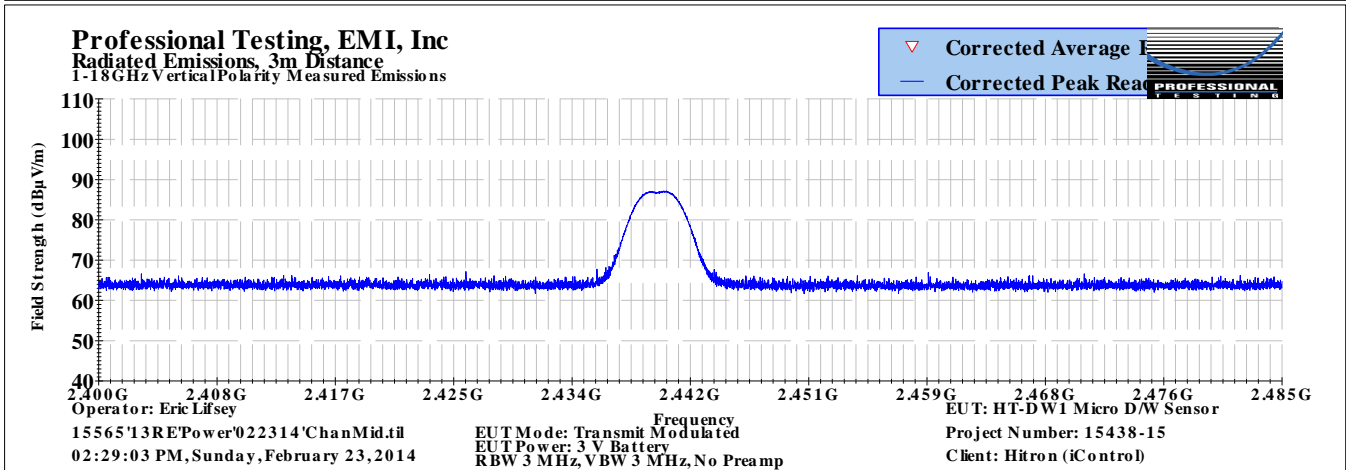
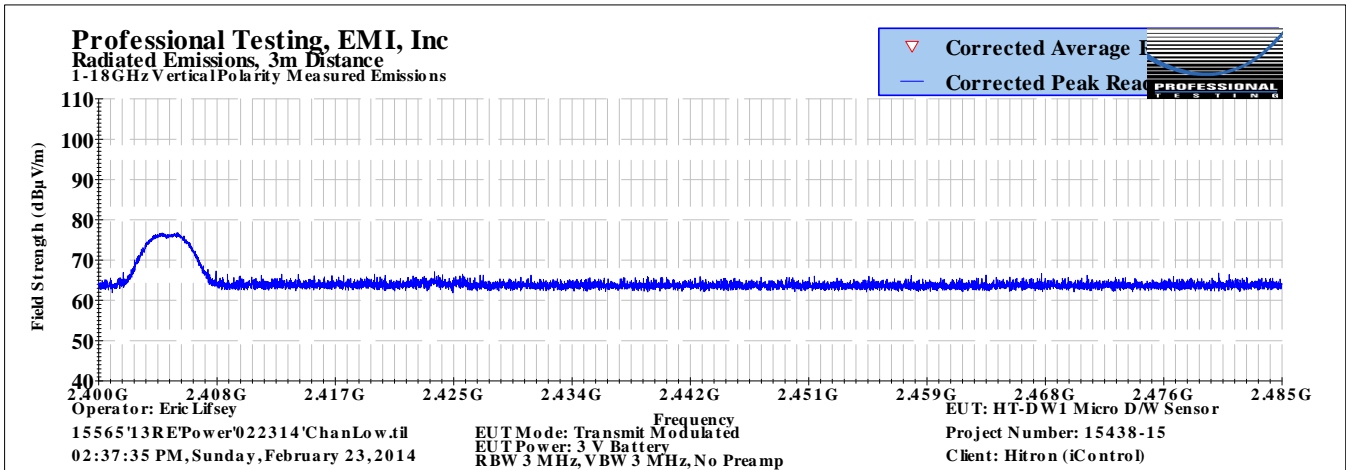
Measured in 3 MHz RBW, 3 MHz VBW.

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

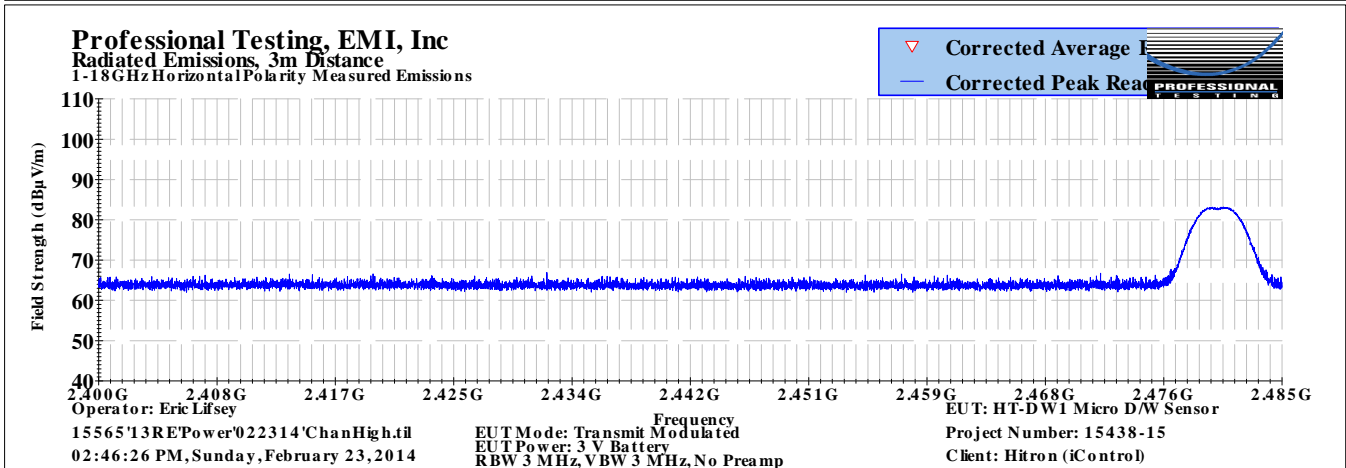
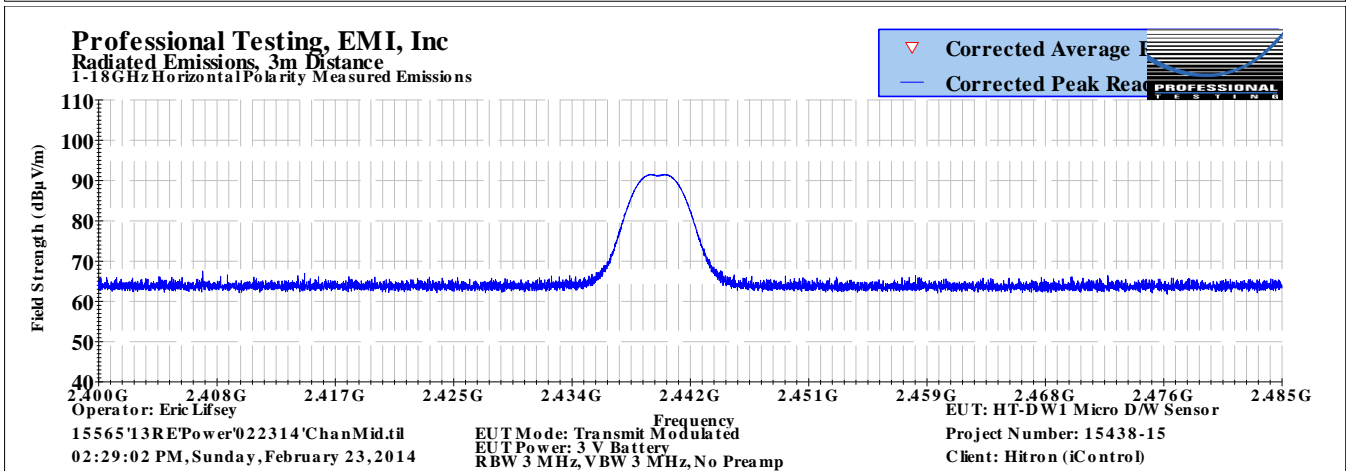
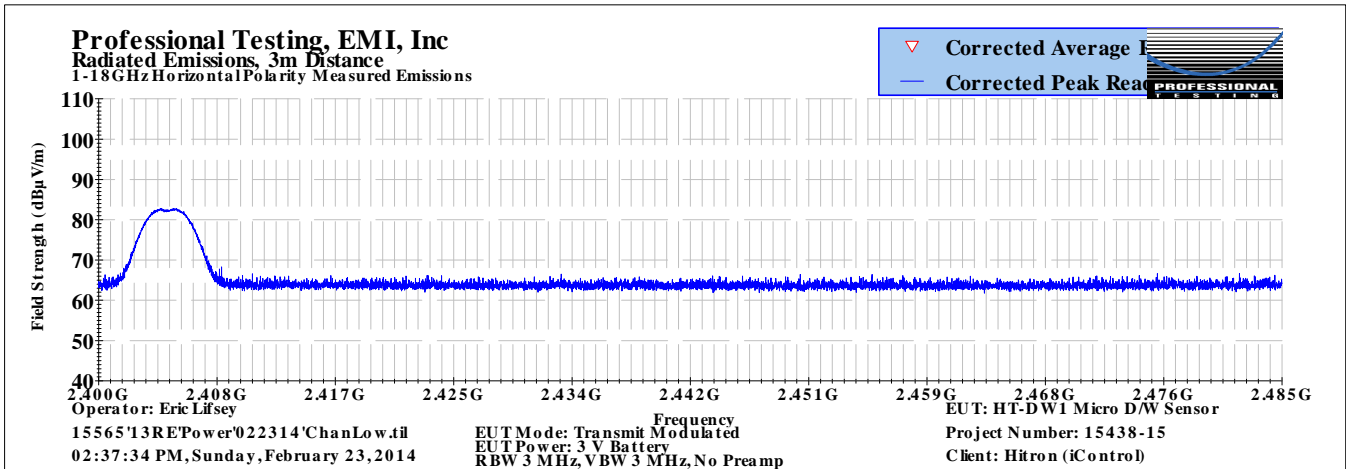
Measured in 3 MHz RBW, 3 MHz VBW.

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.

2.3.1 Vertical Polarity



2.3.2 Horizontal Polarity



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 dB μ V/m @ 3 m Restated as Field Strength 112.7 dB μ V/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 dB μ V/m
2.405	H	28.2	1.6	82.10
2.440	H	28.2	1.6	91.51
2.480	H	28.2	1.6	81.29

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

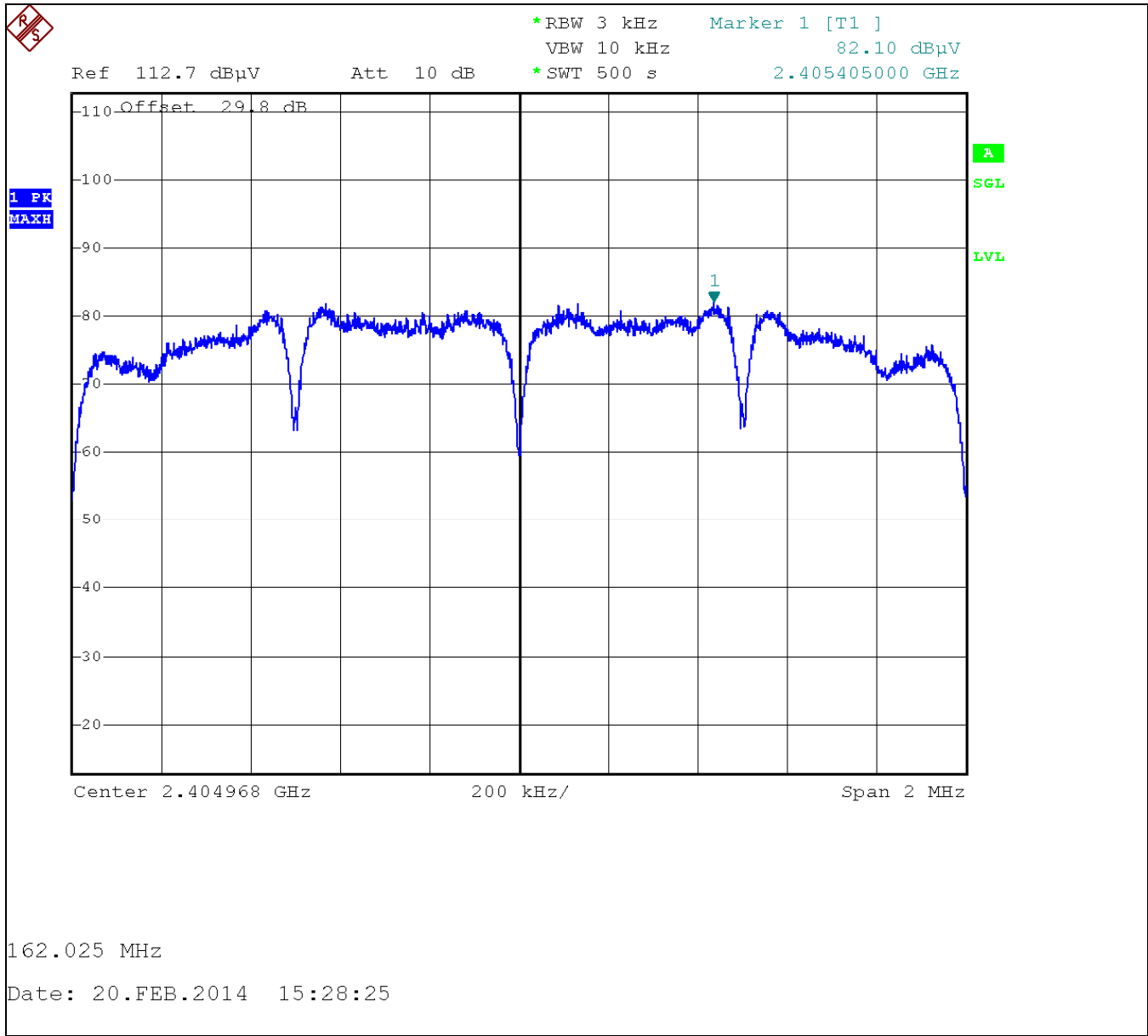
Sweep time 500 seconds.

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

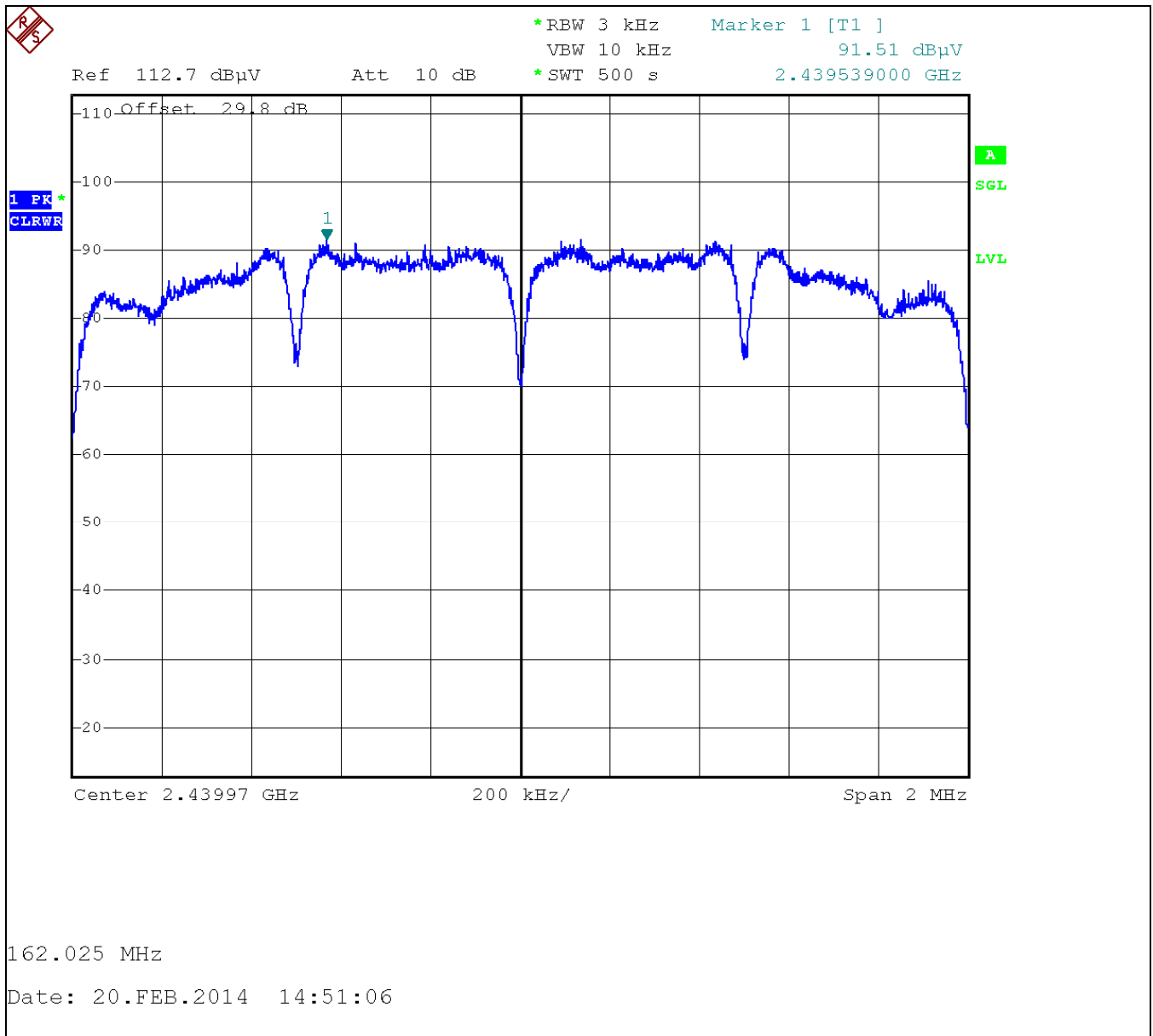
The EUT was found to be in compliance with the applicable criteria.

Plotted measurements appear below.

3.3.1 Low Channel PSD



3.3.2 Middle Channel PSD



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.

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

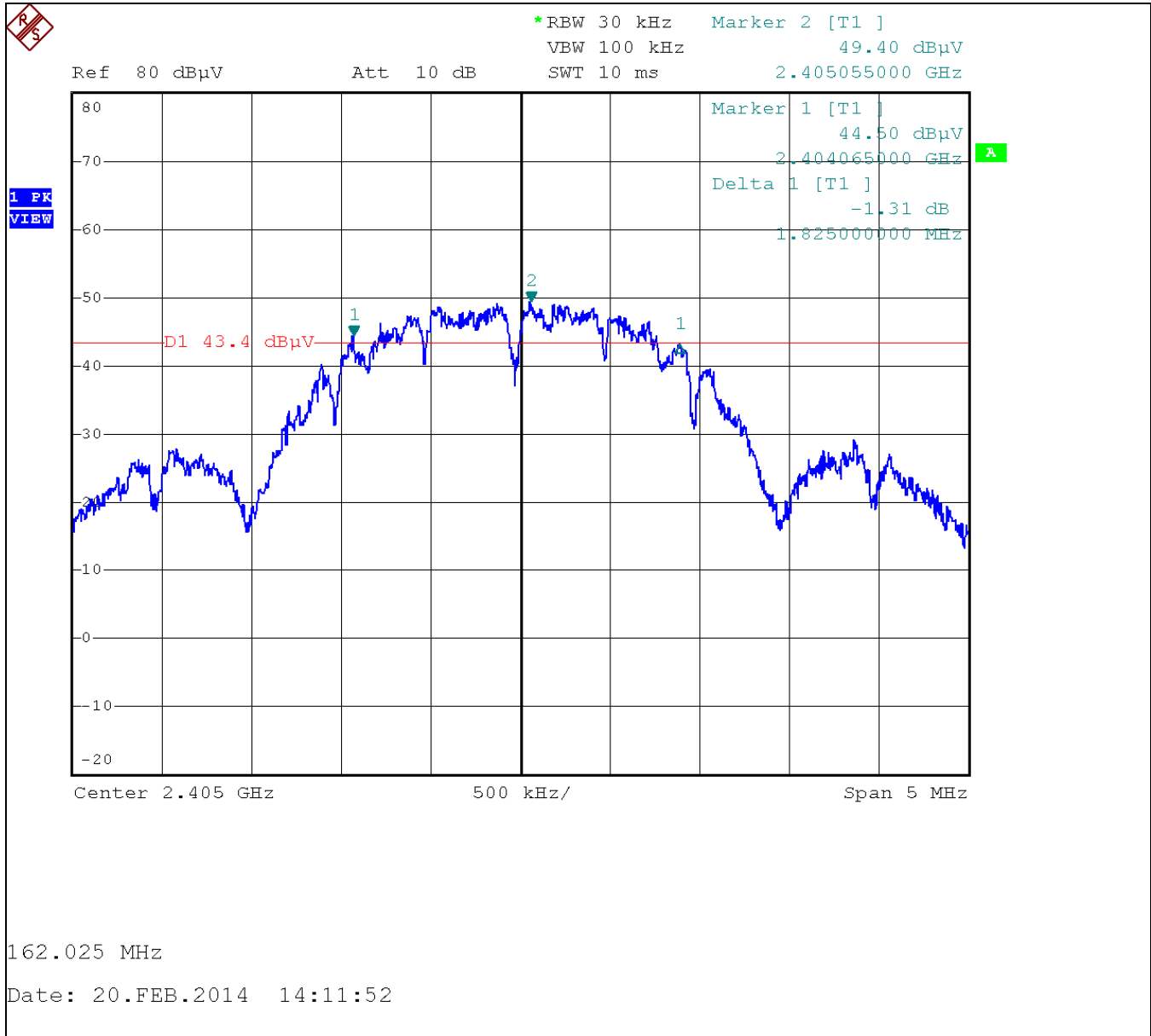
Bandwidth 20 dB Measure and Report

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

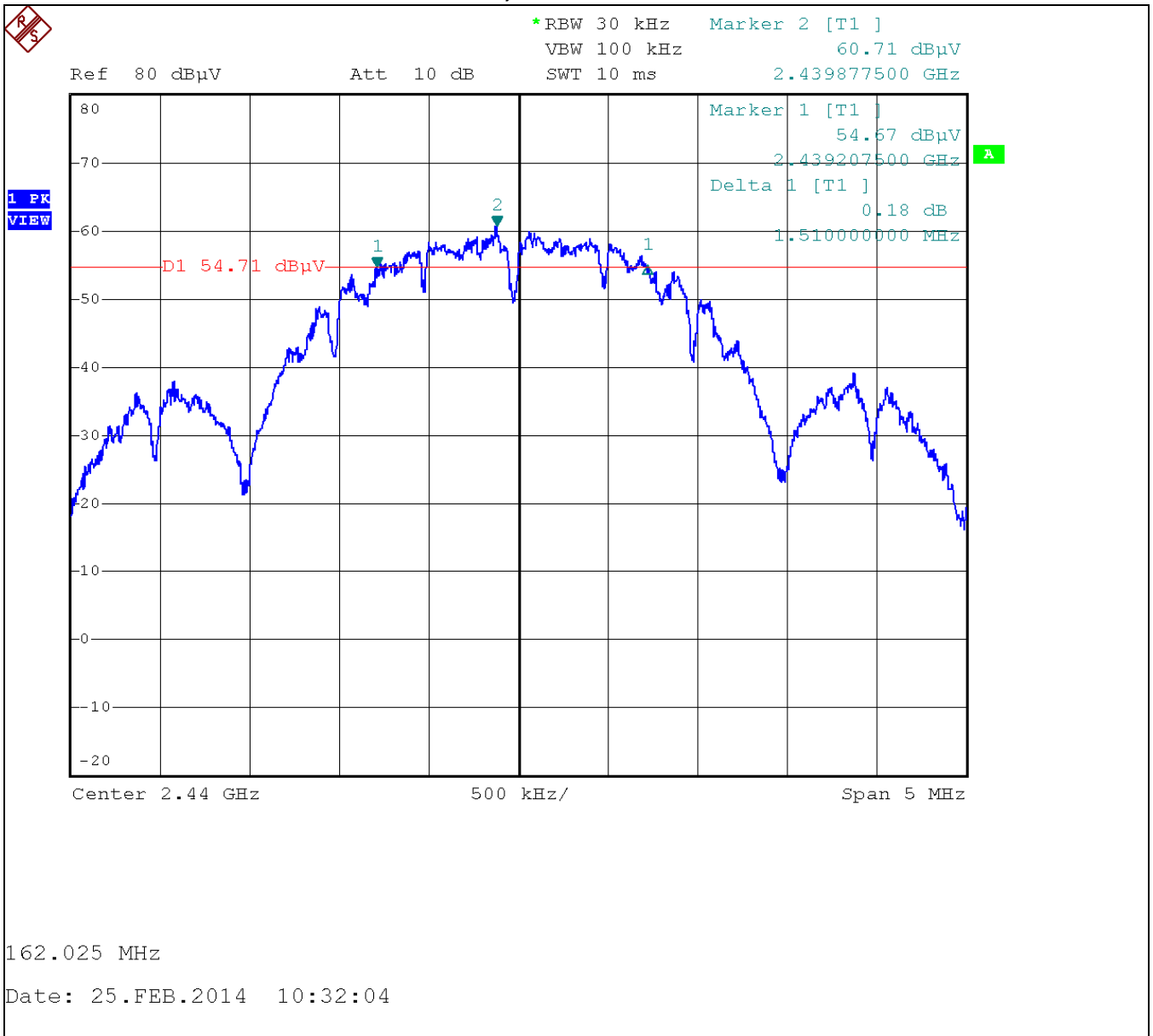
Plotted measurements appear on the following pages.

5.3.1 Bandwidth Plots, 6 dB

6 dB, Low Channel



Wireless Certification Report for the Hitron Technologies Inc. HT-DW1
6 dB, Middle Channel

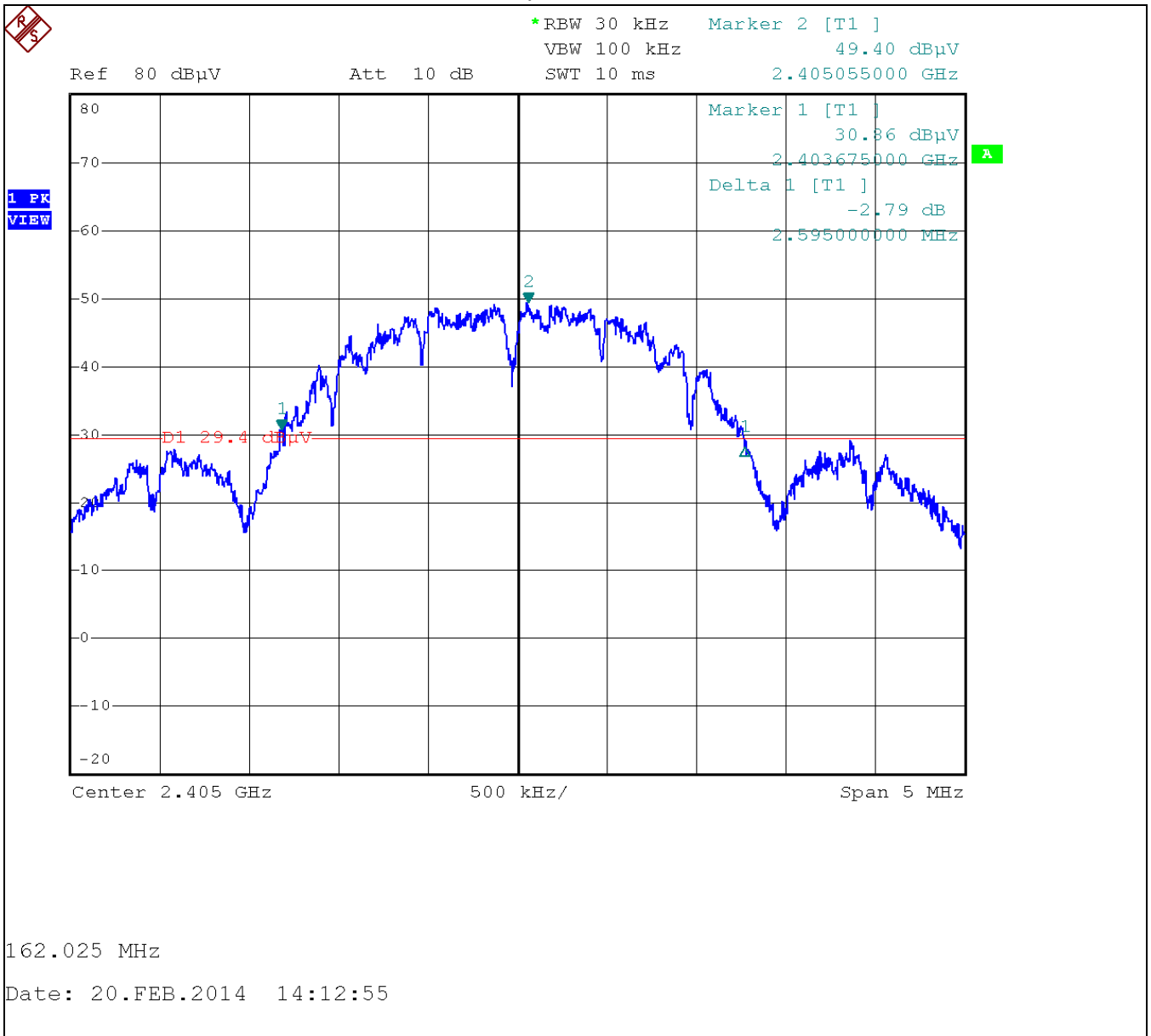


Wireless Certification Report for the Hitron Technologies Inc. HT-DW1
6 dB, High Channel



5.3.2 Bandwidth Plots, 20 dB

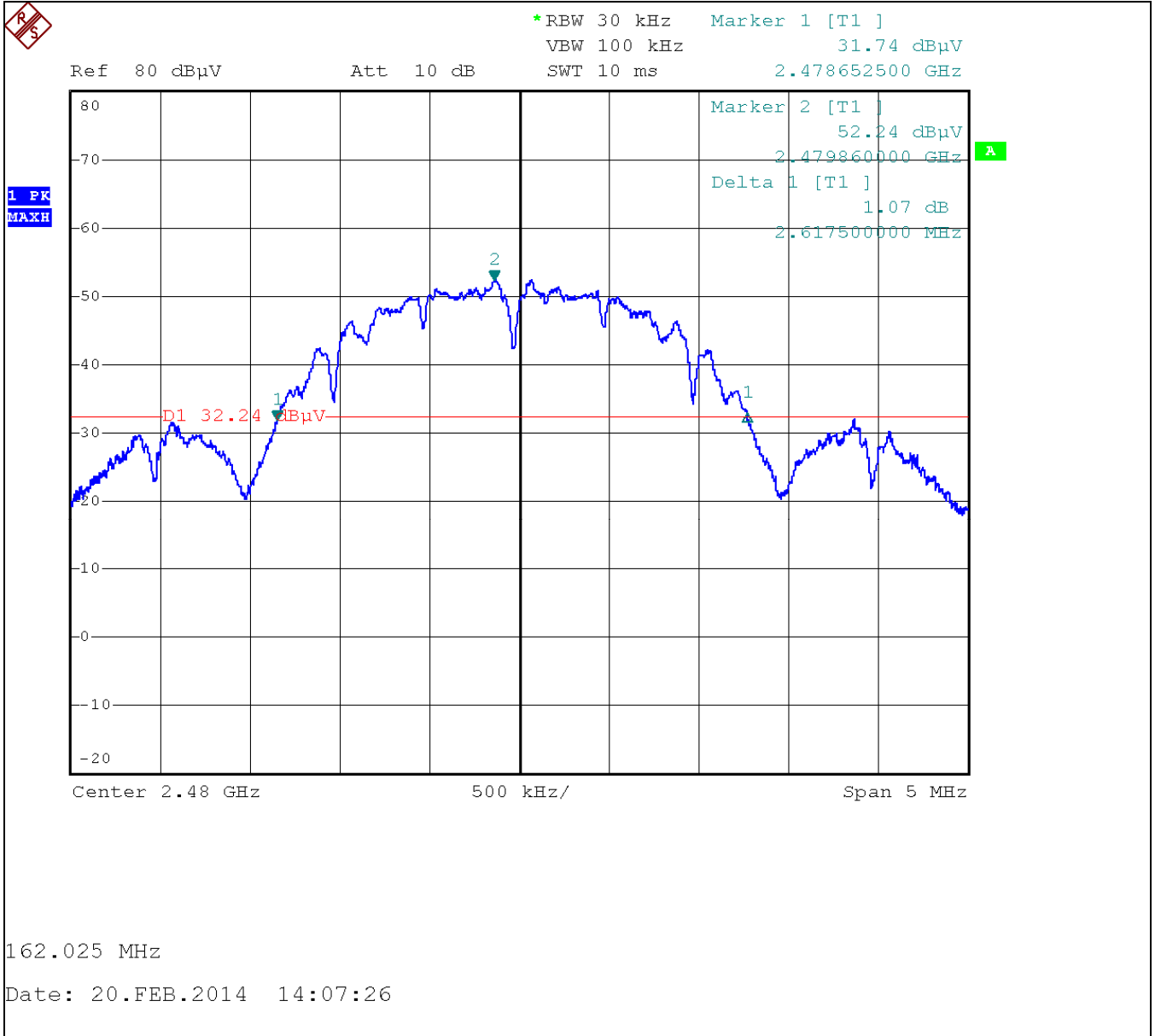
20 dB, Low Channel



20 dB, Middle Channel



20 dB, High Channel



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.

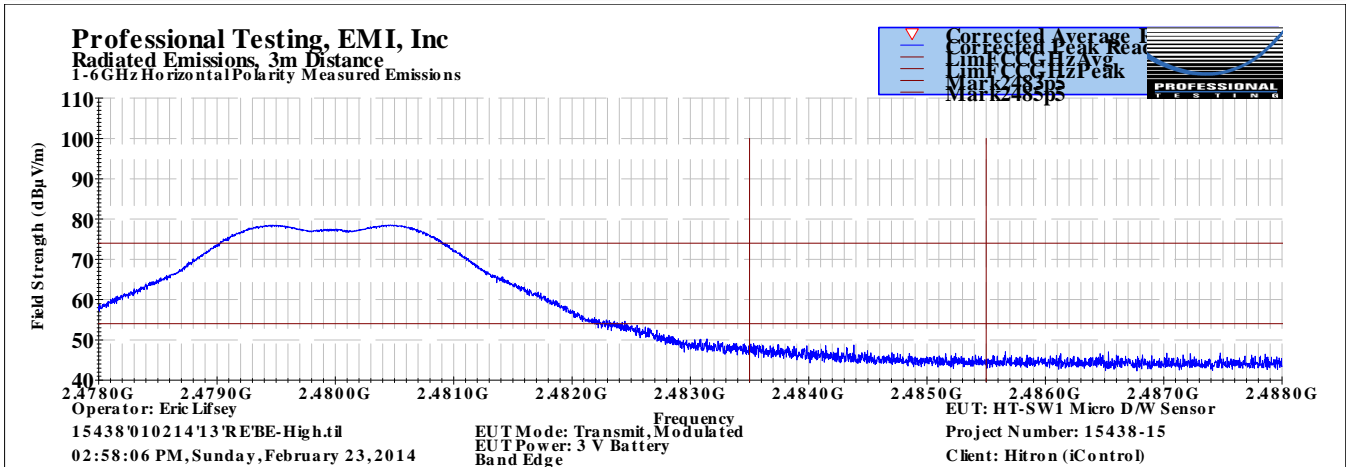
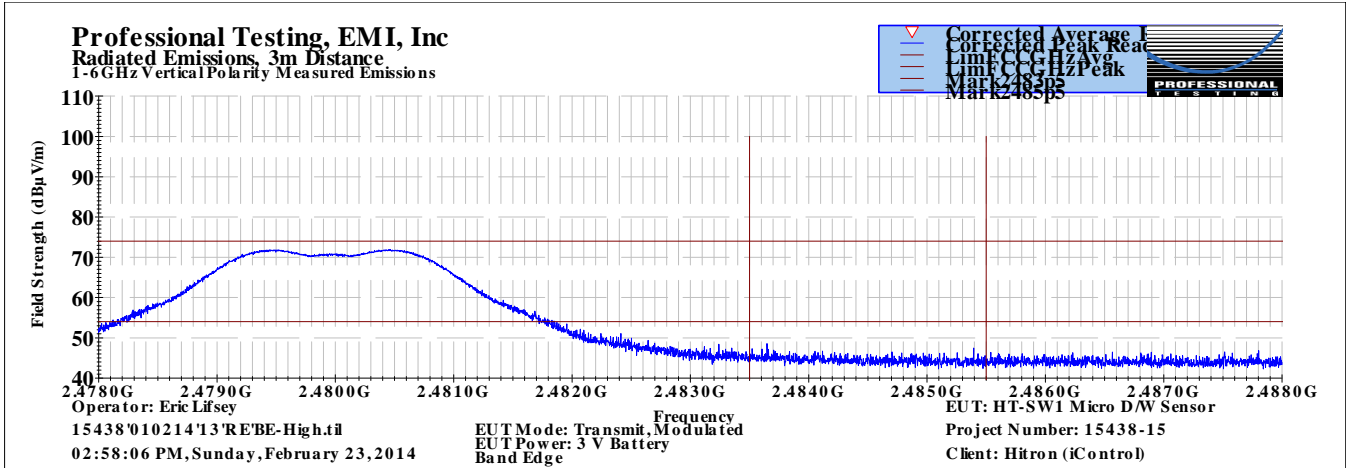
6.2 Test Criteria

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

6.3 Test Results

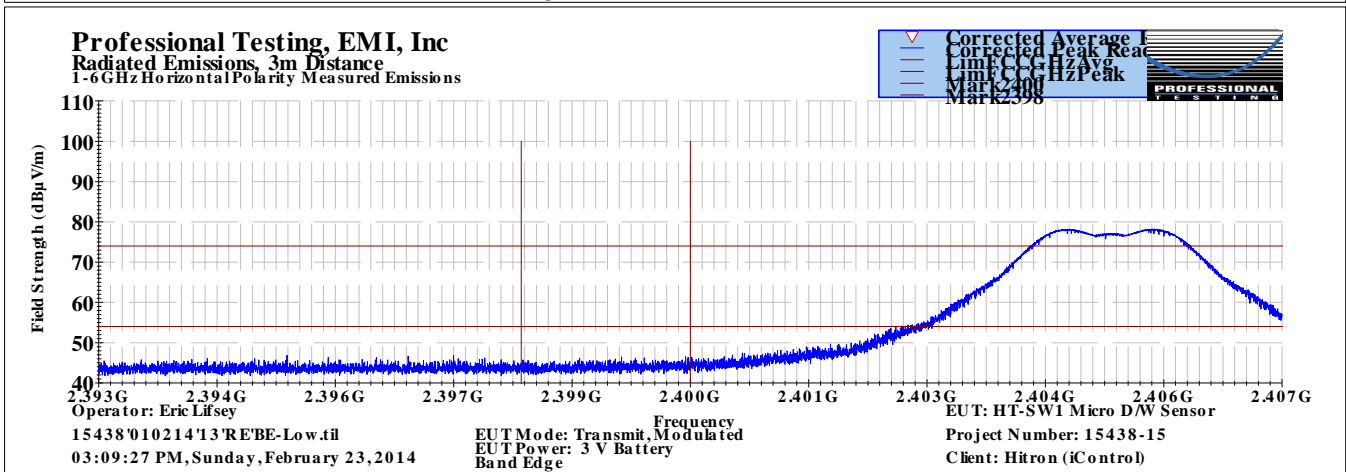
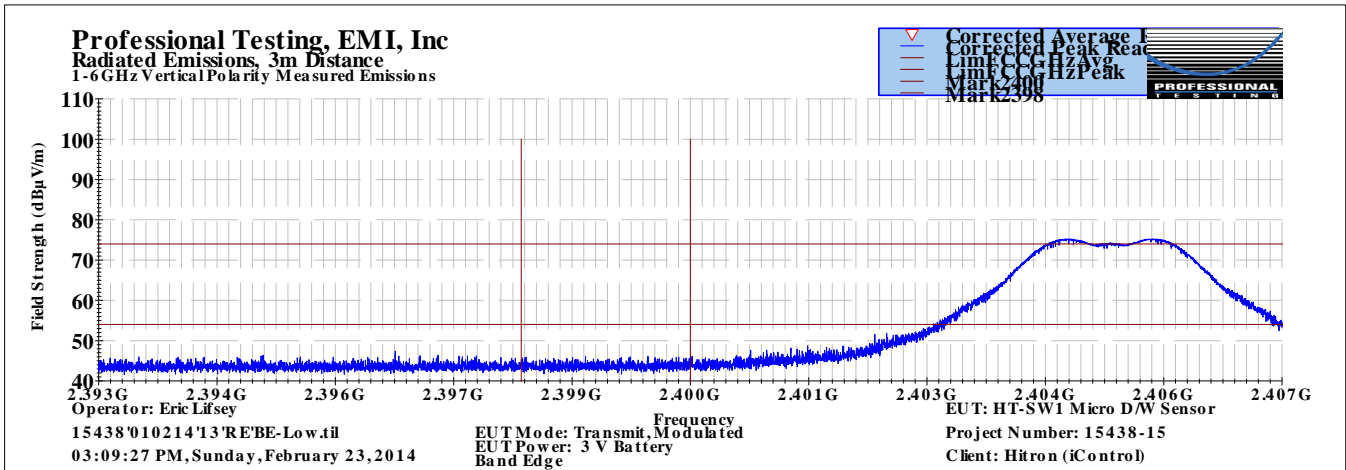
Peak detection emissions at band edges were below the general emission average limits. The EUT satisfied the criteria. Recorded data is presented below.

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.

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.

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.

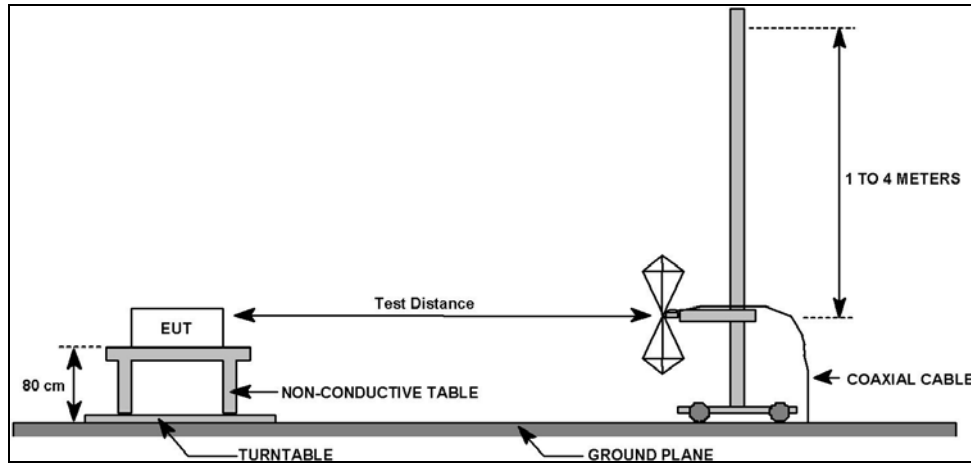


Figure 7.1.1: Field Strength of Spurious Emissions Test Setup

7.2 Test Criteria

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

7.3 Test Results

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

Table 7.3.1: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Vertical Polarity

Professional 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 Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, 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 Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3 VDC		EUT Power Frequency:		N/A		N/A	
Antenna Orientation:		Vertical		Frequency Range:		30MHz to 1GHz			
EUT Mode of Operation:					Receive Mode				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
32.4582	10	298	3.88	Quasi-peak	23.8	11.457	29.5	-18.0	Pass
59.9926	10	3	3.92	Quasi-peak	31.9	10.504	29.5	-19.0	Pass
248.512	10	316	3.12	Quasi-peak	22.1	8.604	35.6	-27.0	Pass
500.263	10	42	1.5	Quasi-peak	22.3	14.379	35.6	-21.2	Pass
729.871	10	99	3.99	Quasi-peak	21.6	17.955	35.6	-17.6	Pass
905.722	10	7	2.27	Quasi-peak	21.3	21.081	35.6	-14.5	Pass

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

Operator: Larry Fuller
 2013 Rad Emissions_ClassB_020414.ttl
 01:46:15 PM, Tuesday, February 18, 2014

EUT Mode: Standard
 EUT Power: 3 V DC

EUT: HT-SW1 Micro D/W Sensor
 Project Number: 15438-10
 Client: Hitron Technologies Inc.

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Horizontal Polarity

Professional 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 Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, 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 Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3 VDC		EUT Power Frequency:		N/A		N/A	
Antenna Orientation:		Horizontal		Frequency Range:		30MHz to 1GHz			
EUT Mode of Operation:					Receive Mode				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
32.5919	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	2.2	Quasi-peak	22.1	8.541	35.6	-27.1	Pass
500.399	10	326	1.28	Quasi-peak	22.3	14.361	35.6	-21.2	Pass
729.768	10	174	1.32	Quasi-peak	21.6	17.942	35.6	-17.7	Pass
905.53	10	162	3.62	Quasi-peak	21.3	21.113	35.6	-14.5	Pass

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

Operator: Larry Fuller
 2013 Rad Emissions_ClassB_020414.til
 01:46:15 PM, Tuesday, February 18, 2014

EUT Mode: Standard
 EUT Power: 3 V DC

EUT: HT-SW1 Micro D/W Sensor
 Project Number: 15438-10
 Client: Hitron Technologies Inc.

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.3: Radiated Spurious Emissions, Transmit Mode, Below 1 GHz, Middle Channel

Professional 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 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 #:		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 Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3 VDC		EUT Power Frequency:		N/A N/A			
Antenna Orientation:		Vertical		Frequency Range:		30MHz to 1GHz			
EUT Mode of Operation:					Transmit Mode, Middle Channel				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
32.3078	10	342	3.63	Quasi-peak	23.9	11.656	29.5	-17.8	Pass
38.8715	10	221	1.33	Quasi-peak	24	8.14	29.5	-21.4	Pass
60.0196	10	49	3.74	Quasi-peak	34	12.687	29.5	-16.8	Pass
500.09	10	204	3.87	Quasi-peak	22.3	14.359	35.6	-21.2	Pass
729.61	10	5	1.3	Quasi-peak	21.7	18.019	35.6	-17.6	Pass
905.609	10	209	1.49	Quasi-peak	21.3	21.135	35.6	-14.5	Pass

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

Operator: Larry Fuller
 2013 Rad Emissions_ClassB_020414_Rum02.til
 03:32:02 PM, Tuesday, February 18, 2014

EUT Mode: Transmit mode middle channel
 EUT Power: 3 V DC

EUT: HT-SW1 Micro D/W Sensor
 Project Number: 15438-10
 Client: Hitron Technologies Inc.

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Professional 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 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 #:		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 Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		3 VDC		EUT Power Frequency:		N/A N/A			
Antenna Orientation:		Horizontal		Frequency Range:		30MHz to 1GHz			
EUT Mode of Operation:				Transmit Mode, Middle Channel					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
32.4793	10	140	2.44	Quasi-peak	23.9	11.519	29.5	-18.0	Pass
38.7885	10	178	1.8	Quasi-peak	23.9	8.054	29.5	-21.4	Pass
59.7965	10	66	3.95	Quasi-peak	23.3	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

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

Operator: Larry Fuller
 2013 Rad Emissions_ClassB_020414_Rm02.til
 03:32:02 PM, Tuesday, February 18, 2014

EUT Mode: Transmit mode middle channel
 EUT Power: 3 V DC

EUT: HT-SW1 Micro D/W Sensor
 Project Number: 15438-10
 Client: Hitron Technologies Inc.

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

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.

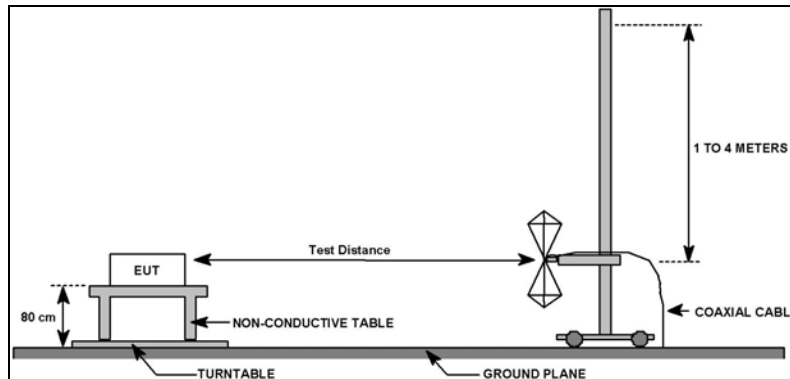


Figure 8.1.1: Field Strength of Spurious Emissions Test Setup

8.2 Test Criteria

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

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.

Table 8.3.1: Radiated Spurious Emissions, Receive Mode, 1 to 12 GHz, Vertical Polarity

Professional 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 Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, 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 Test Results Data Sheet							Page: 1 of 1			
EUT Line Voltage:		3 VDC		EUT Power Frequency:		N/A		N/A		
Antenna Orientation:		Vertical			Frequency Range:		Above 1GHz			
EUT Mode of Operation:					Receive Mode					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results	
1202	3	263	1	Average	36.3	23.694	54.0	-30.3	Pass	
1948.95	3	308	1	Average	38.4	28.097	54.0	-25.9	Pass	
2790.84	3	318	1	Average	34.7	27.081	54.0	-26.9	Pass	
3767.58	3	242	1	Average	34.4	27.561	54.0	-26.4	Pass	
5864.15	3	23	1	Average	31.3	30.249	54.0	-23.7	Pass	
8662.65	3	310	1	Average	27.2	35.537	54.0	-18.4	Pass	
11569.2	3	159	1	Average	27	38.025	54.0	-15.9	Pass	

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

Operator: Larry Fuller
 2013 Rad Emissions_ClassB_020414.til
 02:24:39 PM, Tuesday, February 18, 2014

EUT Mode: Standard
 EUT Power: 3 V DC

EUT: HT-SW1 Micro D/W Sensor
 Project Number: 15438-10
 Client: Hitron Technologies Inc.

> 1GHz Vertical Antenna Polarity Measured Emissions

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

Professional 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 Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, 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 Test Results Data Sheet							Page: 1 of 1			
EUT Line Voltage:		3 VDC			EUT Power Frequency:		N/A N/A			
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz			
EUT Mode of Operation:					Receive Mode					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results	
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	3	113	1	Average	33.8	26.174	54.0	-27.8	Pass	
3765.47	3	47	1	Average	34.6	27.719	54.0	-26.2	Pass	
5867.36	3	36	1	Average	31.4	30.342	54.0	-23.6	Pass	
8659.26	3	64	1	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	

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

Operator: Larry Fuller
 2013 Rad Emissions_ClassB_020414_Run01.til
 02:24:39 PM, Tuesday, February 18, 2014

EUT Mode: Standard
 EUT Power: 3 V DC

EUT: HT-SW1 Micro D/W Sensor
 Project Number: 15438-10
 Client: Hitron Technologies Inc.

> 1GHz Horizontal Antenna Polarity Measured Emissions

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

Professional 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 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 #:	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 Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, Low Channel	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%; border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> — Average Limit Level ▽ Corrected Average Reading — Peak Limit Level — Corrected Peak Reading </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> <p>Operator: Larry Fuller 2013 Rad Emissions_ClassB_020414_Run03.fil 04:23:47 PM, Tuesday, February 18, 2014</p> </div> <div style="width: 35%; text-align: center;"> <p>Frequency</p> <p>EUT Mode: Transmit mode low channel EUT Power: 3 VDC</p> </div> <div style="width: 30%; text-align: right;"> <p>EUT: HT-SW1 Micro D/W Sensor Project Number: 15438-10 Client: Hitron Technologies Inc.</p> </div> </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Professional 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 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 #:	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 Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, Low Channel	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Horizontal Polarity Measured Emissions</p> </div> <div style="width: 35%; text-align: right;"> <p>— Average Limit Level — Corrected Average Reading — Peak Limit Level — Corrected Peak Reading</p> </div> </div>			
Operator: Larry Fuller 2013 Rad Emissions_ClassB_020414_Run03.til 04:23:45 PM, Tuesday, February 18, 2014		Frequency EUT Mode: Transmit mode low channel EUT Power: 3 VDC EUT: HT-SW1 Micro D/W Sensor Project Number: 15438-10 Client: Hitron Technologies Inc.	
> 1GHz Horizontal Antenna Polarity Measured Emissions			

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

Professional 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 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 #:	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 Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, Middle Channel	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%; text-align: right;"> <p>— Average Limit Level ▾ Corrected Average Reading — Peak Limit Level — Corrected Peak Reading</p> <p>PROFESSIONAL TESTING</p> </div> </div> <p style="font-size: small;">Operator: Larry Fuller 2013 Rad Emissions_ClassB_020414_Run02.fil 04:00:04 PM, Tuesday, February 18, 2014</p> <p style="font-size: small; text-align: center;">Frequency EUT Mode: Transmit mode middle channel EUT Power: 3 VDC</p> <p style="font-size: small; text-align: right;">EUT: HT-SW1 Micro D/W Sensor Project Number: 15438-10 Client: Hitron Technologies Inc.</p>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Professional Testing, EMI, Inc.

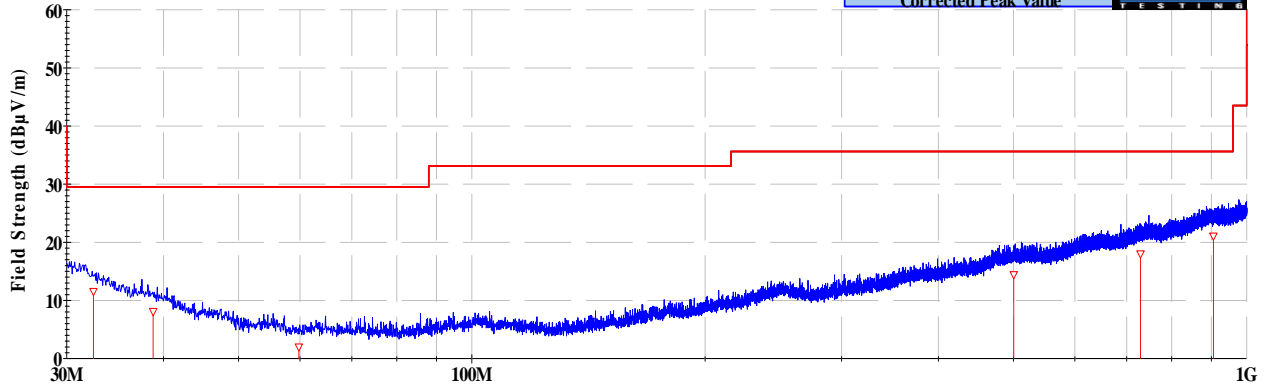
Test Method:	ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, 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 Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	3	VDC	EUT Power Frequency:	N/A	N/A				
Antenna Orientation:	Horizontal		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Transmit Mode, Middle Channel						
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
32.4793	10	140	2.44	Quasi-peak	23.9	11.519	29.5	-18.0	Pass
38.7885	10	178	1.8	Quasi-peak	23.9	8.054	29.5	-21.4	Pass
59.7965	10	66	3.95	Quasi-peak	23.3	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

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



Operator: Larry Fuller	EUT Mode: Transmit mode middle channel	EUT: HT-SW1 Micro D/W Sensor
2013 Rad Emissions_ClassB_020414_Run02.til	EUT Power: 3 V DC	Project Number: 15438-10
03:32:02 PM, Tuesday, February 18, 2014		Client: Hitron Technologies Inc.

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

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

Professional 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 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 #:	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 Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3 VDC	EUT Power Frequency:	N/A N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, High Channel	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%; text-align: right;"> <p>— Average Limit Level — Corrected Average Reading — Peak Limit Level — Corrected Peak Reading</p> </div> </div> <p style="font-size: small;">Operator: Larry Fuller 2013 Rad Emissions_ClassB_020414_Run04.fil 04:46:57 PM, Tuesday, February 18, 2014</p> <p style="font-size: small; text-align: center;">EUT Mode: Transmit mode high channel EUT Power: 3 VDC</p> <p style="font-size: small; text-align: right;">EUT: HT-SW1 Micro D/W Sensor Project Number: 15438-10 Client: Hitron Technologies Inc.</p>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

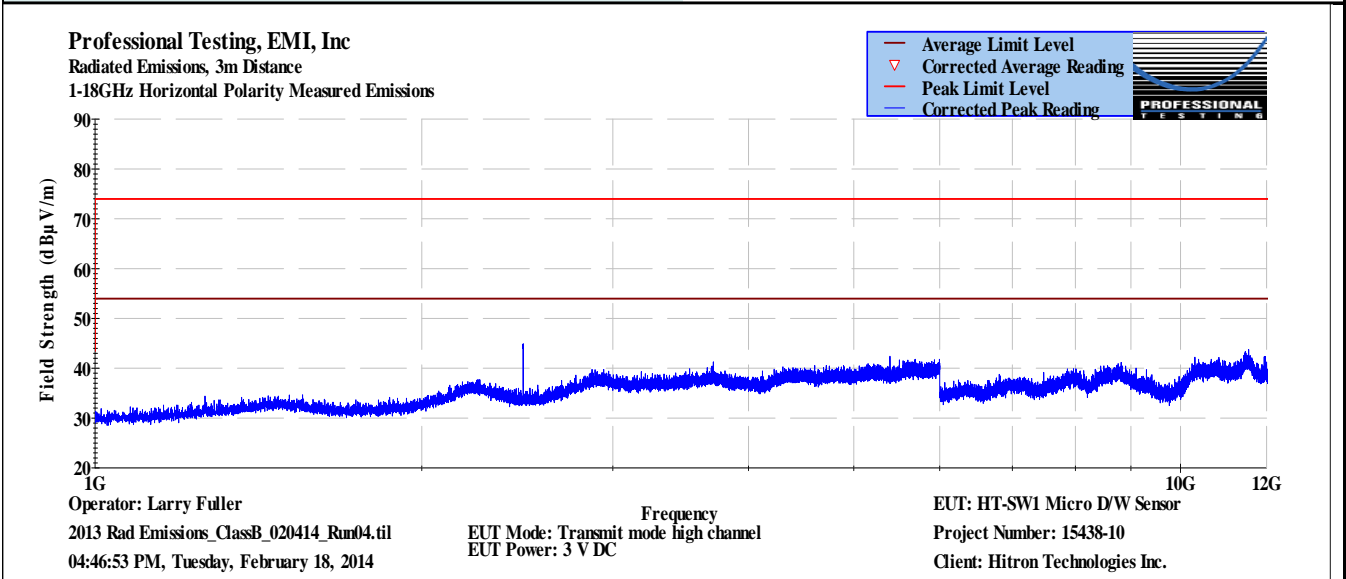
Professional Testing, EMI, Inc.

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 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 #:	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 Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	3	VDC	EUT Power Frequency:	N/A	N/A
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz	
EUT Mode of Operation:			Transmit Mode, High Channel		



> 1GHz Horizontal Antenna Polarity Measured Emissions

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.

10.0 Equipment and Bandwidths

10.1 Equipment for Spurious Radiated Emissions 30 MHz to 12 GHz

Professional 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 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 #:		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 Test Equipment List					
Tile! Software Version:		4.2.A, May 23, 2010, 08:38:52 AM			
Test Profile:		Radiated Emissions_Profile Version October 12, 2011			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/29/2014
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	12/2/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	7/29/2014
C027	N/A	RG214	Cable Coax, N-N, 25m	none	9/26/2014
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	7/16/2014
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/19/2014
C030	N/A	0	Cable Coax, N-N, 30m	none	9/26/2014
Loaner-ETS	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	135203	1/14/2015
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A

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-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits)			
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 MHz for average measurements from 1-18 GHz.				

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

End of Report

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