
Project 19668-15

**Hetronic
ERGO-S**

Wireless Certification Report

Prepared for:

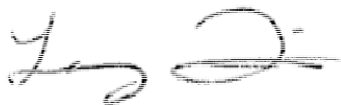
Hetronic Malta
A Division of Methode Electronics Malta Ltd.
Mriehel Industrial Estate
Mriehel BKR3000, Malta

By

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

5 Oct 2018

Reviewed by

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

Larry Finn
Chief Technical Officer

Written by

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

Eric Lifsey
EMC Engineer

Revision History

Revision Number	Description	Date
Final02	Revised model to ERGO-S.	19 Feb 2019

Errata:

All citations of models MFS ERGO S or ERGO S MFS apply to the model ERGO-S.

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Compliance Certificate

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

Applicant	Device & Test Identification
Hetronic Malta A Division of Methode Electronics Malta Ltd. Mriehel Industrial Estate Mriehel BKR3000, Malta Certificate Date: 5 Oct 2018	FCC ID: LW9-ERGOS2G4 Industry Canada ID: 2119B-ERGOS2G4 Model(s): ERGO-S Laboratory Project ID: 19668-15

The device named above was tested utilizing the following documents and found to be in compliance with the required criteria:

Requirement	Reference	Detail
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
KDB 558074 D01	DR01	DTS Measurement Guidance v03r02
KDB 412172	D01	Guidelines for Determining the ERP and EIRP of an RF Transmitting System
OET Bulletin 65*	Edition 97-01, and Supplement C, Ed. 01-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
RSS-247	Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-Gen	Issue 4	General Requirements and Information for the Certification of Radio Apparatus
RSS-102	Issue 5	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

*MPE is reported separately from this document. **Corresponding RSS references are listed in the body of the report.

I, Eric Lifsey, for Professional Testing (EMI), Inc., being familiar with the above requirements and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Eric Lifsey
EMC Engineer

This report has been reviewed and accepted by the Applicant. The undersigned is responsible for ensuring that this device will continue to comply with the requirements listed above.

Representative of Applicant

1.0 Introduction

1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of the United States and Canada.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing.

1.2 EUT Description

Table 1.2.1: Equipment Under Test		
Manufacturer / Model	Serial #	Description
Hetronic Model: ERGO-S	none	2400-2483.5 MHz DTS transceiver; using Zigbee style protocol.

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

This device is a hand-held remote control for industrial systems such as cranes and lifts. It is powered by a removable 3.7 V Li-Ion battery pack that is removed to be recharged by a separate charger.

The EUT is composed of a main board which contains the “MFS” radio circuitry being tested. Optional daughter radio modules can be populated for other radio bands and are certified separately. The EUT is user-controlled by a variety of push buttons arranged on the front and 3 sides.

1.3 EUT Operation

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

1.4 Modifications to Equipment

The EUT was adjusted for an internal power setting of “+2.3 dBm” for the desired power level.

1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

1.6 Radiated Measurements

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

Additionally, measurement distance extrapolation factors (such as $1/d$ above 30 MHz) are applied and documented where used.

1.7 Applicable Documents and Clauses

Table 1.7.1: Applicable Documents	
Document	Title
47 CFR	Part 15 – Radio Frequency Devices Subpart C -Intentional Radiators
RSS-247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 4	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Table 1.7.2: Applicable Clauses		
Parameter	FCC Part 15 Rule Paragraphs	IC RSS References
Transmitter Characteristics	15.247	RSS-247 5.2 (DTS) & 5.4, RSS-Gen
Bandwidth	15.247(a)(1), 2.1049, KDB 558074 D01	RSS-Gen 4.6
Spurious Emission	15.247, 15.209, 15.205	RSS-247 5.5, RSS-GEN 4.9, 4.10
Band Edge	15.247, 15.205	RSS-247 5.5, RSS-Gen 4.9
Antenna Requirement	15.247, 15.203	RSS-Gen 8.3

2.0 Fundamental Power

2.1 Test Procedure

Peak power is measured using conducted means and without modulation.

2.2 Test Criteria

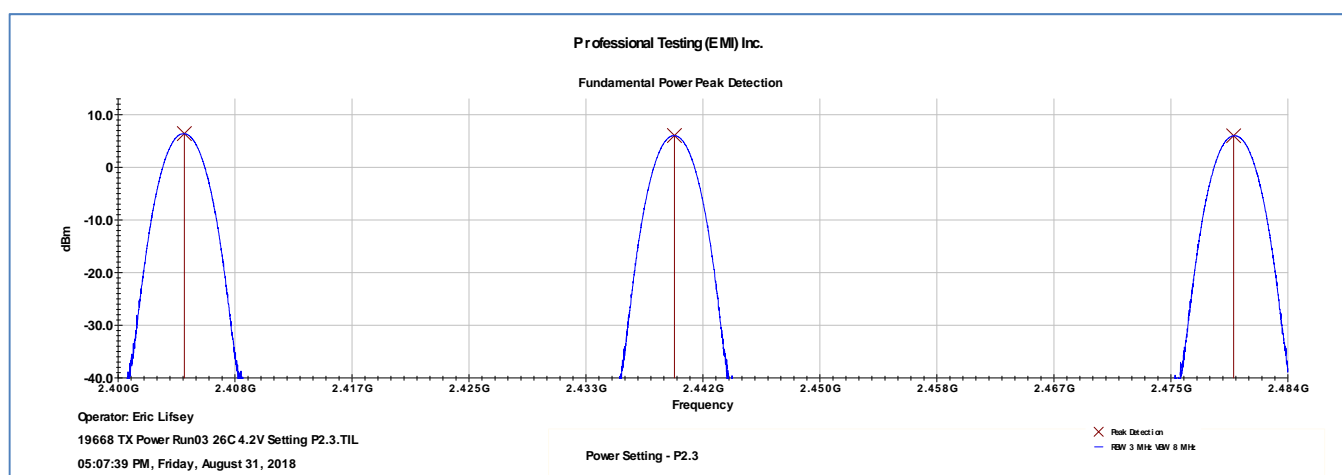
47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(a)(3) // RSS-247 5.2	Fundamental Power Conducted Limits 1 W Limit Restated as Field: 125.23 dBμV/m @ 3 m	31 Aug 2018

2.3 Test Results, Peak Power

Table 2.3.1 Power, Peak, Measured Conducted		
Frequency MHz	Measured Peak Power dBm	Measured Peak Power Restated mW
2405	6.4	4.4
2440	6.0	4.0
2480	6.0	4.0

Measured in 3 MHz RBW, 8 MHz VBW.

The EUT satisfied the requirement.



2.4 Test Results, Duty Cycle

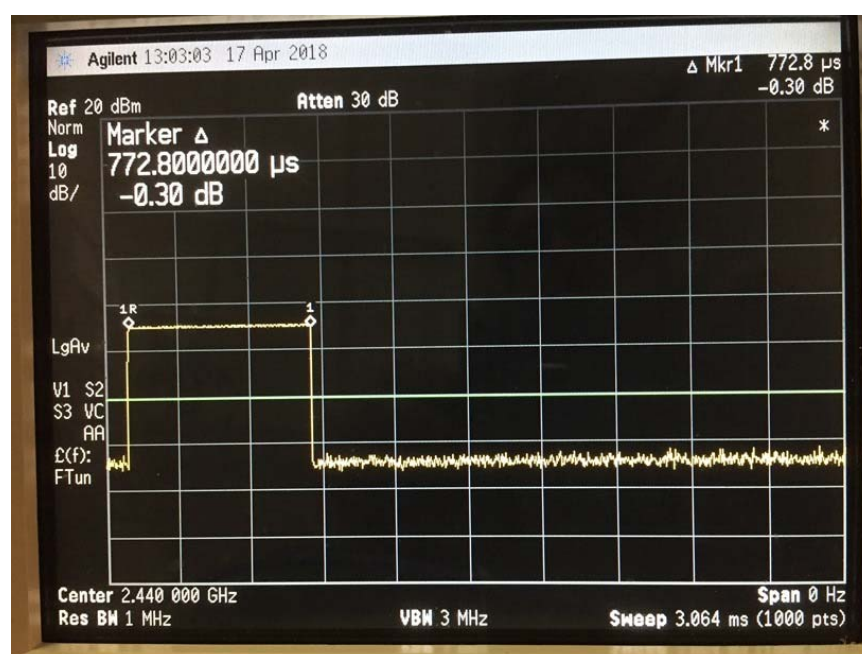
Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power.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

Table 2.4.1 Duty Cycle with Average Duty Cycle Factor

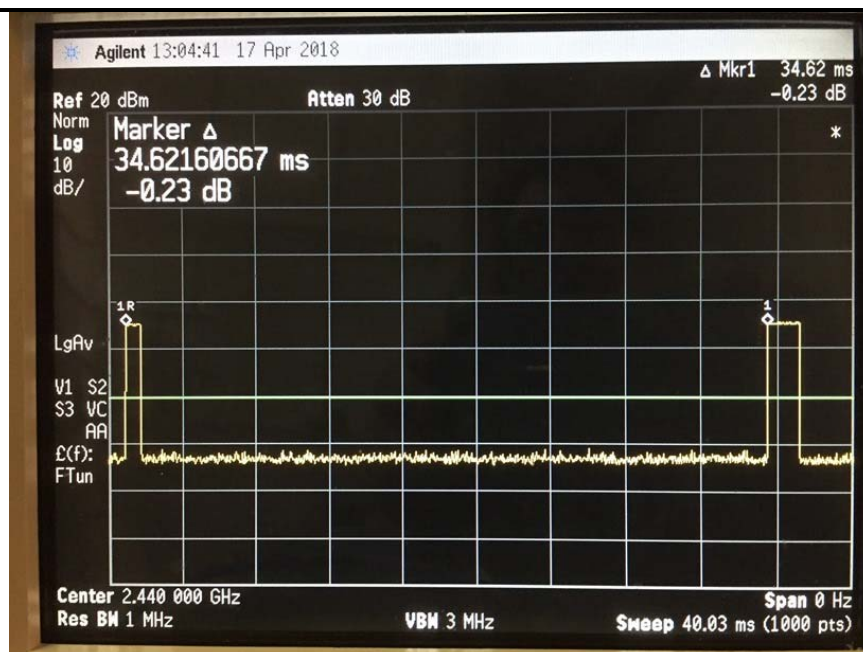
Total Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
0.773	34.6	$= 20 * \log_{10} (0.773 \text{ msec} / 34.6 \text{ msec})$	-33.0	-20.0

Table 2.4.2 Duty Cycle with Weighted Averaging Factor for Exposure

Total Measured On Time (msec)	Measured Time Interval (msec)	Averaging Factor Calculation	Result for Averaging Factor (dB)
0.773	34.6	$= 10 * \log_{10} (0.773 \text{ msec} / 34.6 \text{ msec})$	-16.5



Transmit Event



Transmit Interval

3.0 Power Spectral Density

3.1 Test Procedure

A spectrum analyzer is either connected directly to the EUT or used by radiated means to measure the fundamental emission. It is adjusted to measure the power spectral density in the specified resolution bandwidth.

3.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(e) // RSS-247, 5.2	Power Spectral Density, Conducted Limit: 8 dBm / 3 kHz Restated as field strength limit: 103.23 dB μ V/m at 3 m	31 Aug 2018

3.3 Test Results

Full bandwidth peak power (6.4 dBm) measured lower than the power spectral density limit. Measurement is not required.

4.0 Occupied Bandwidth

4.1 Test Procedure

Bandwidth is measured by radiated means. A recording of the results is included.

4.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
14.247(a)(2), 2.1049, KDB 558074 D01 // RSS-Gen 4.6	Bandwidth, 6 dB, 20 dB, 99%	20 Sep 2018

4.3 Test Results

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

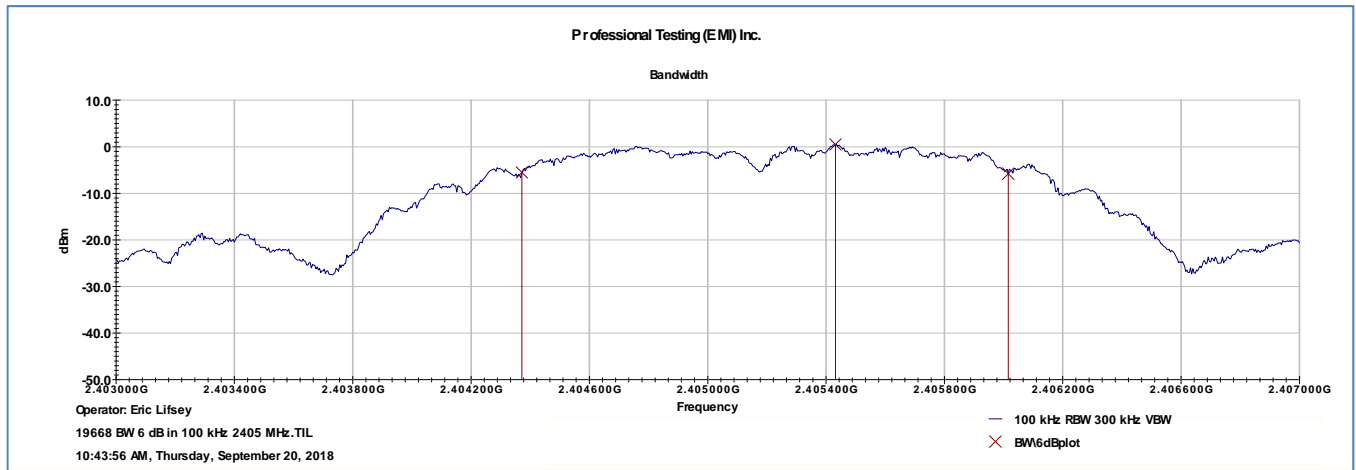
The EUT was found to be in compliance with applicable requirements.

Table 4.3.1			
Bandwidth 6 dB, Minimum 500 kHz in 100 kHz RBW			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Minimum BW (kHz)
1644	1800	1792	1644
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)
2664	2672	2708	2708
Bandwidth 99%, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
2443	2565	2542	2565

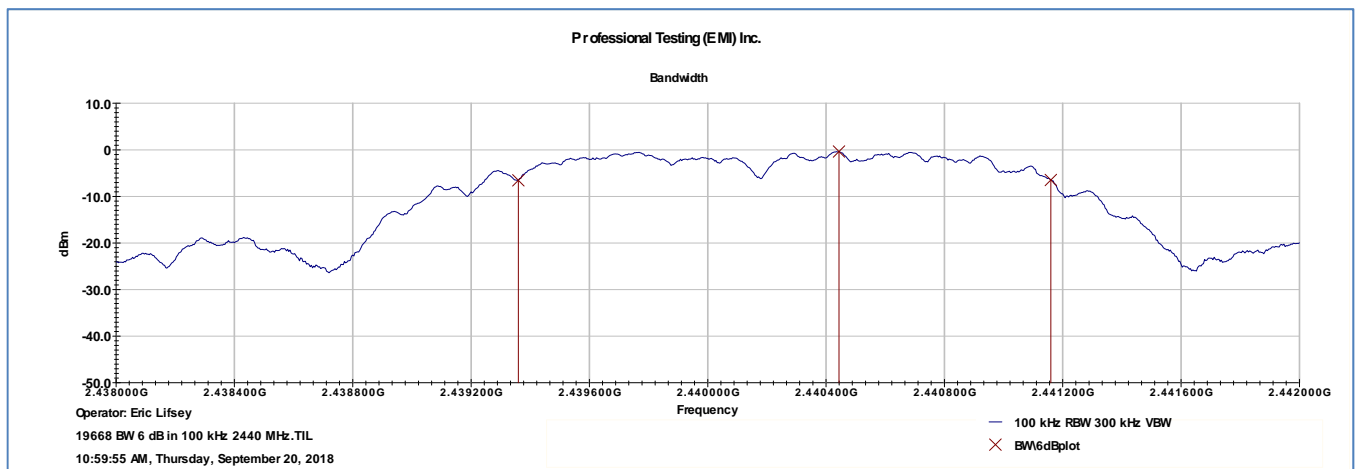
Plotted measurements appear on the following pages.

In cases where the software function failed to find/mark the correct edge of the modulated envelope, a manual measurement (marker-delta over display line) was taken with the same spectrum analyzer settings.

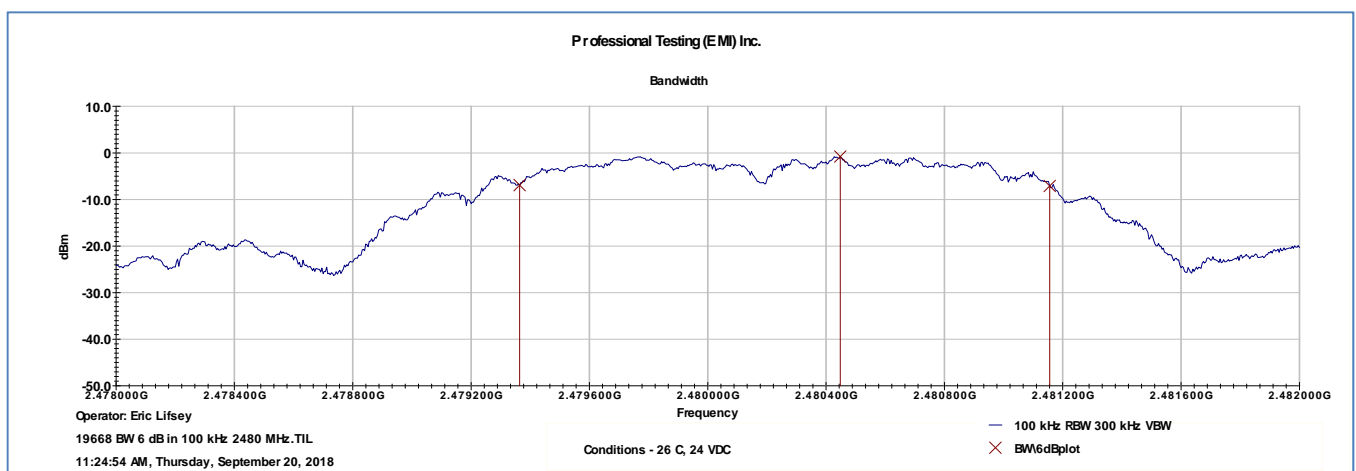
4.3.1 Bandwidth Plots, 6 dB



Bottom Channel

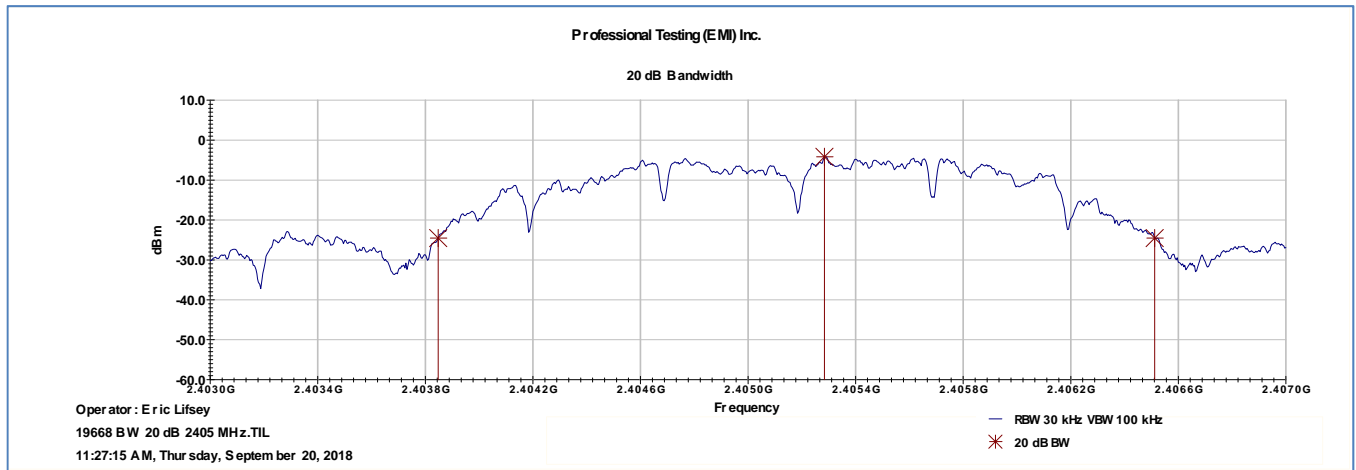


Middle Channel

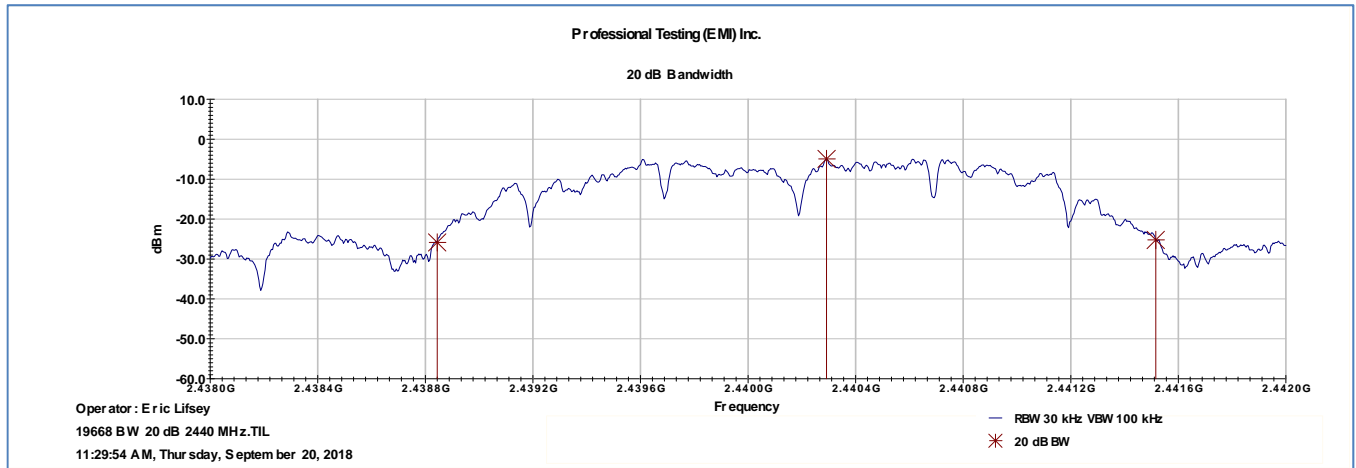


Top Channel

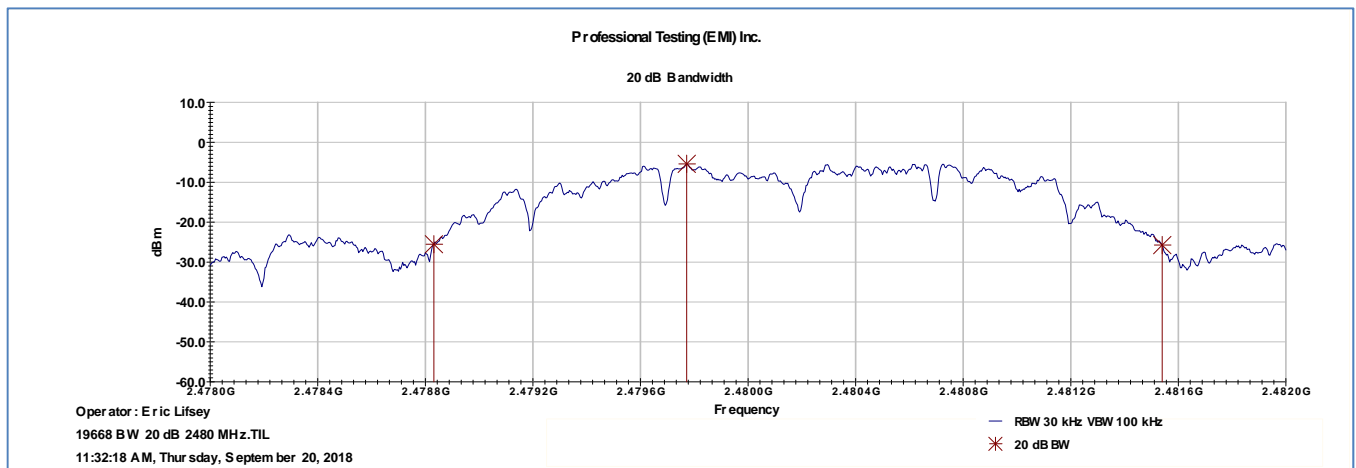
4.3.2 Bandwidth Plots, 20 dB



Bottom Channel

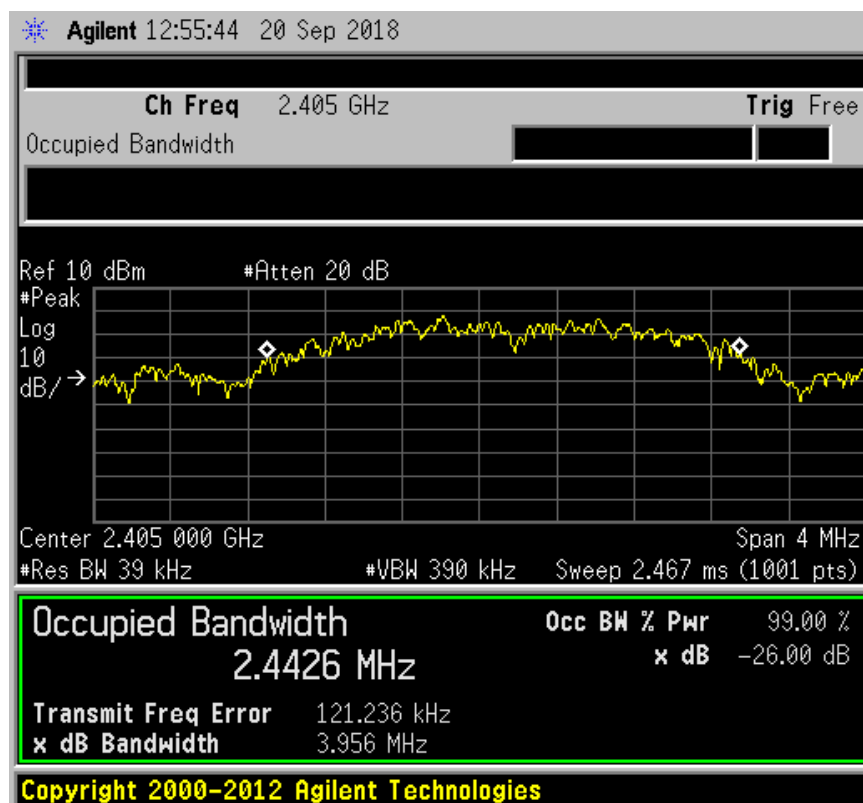


Middle Channel

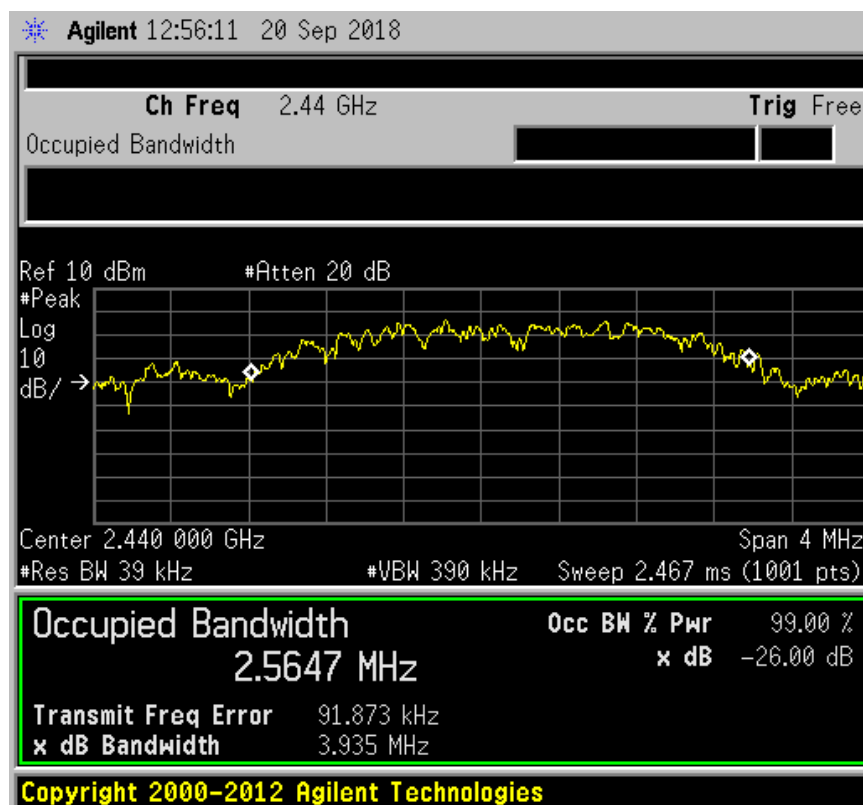


Top Channel

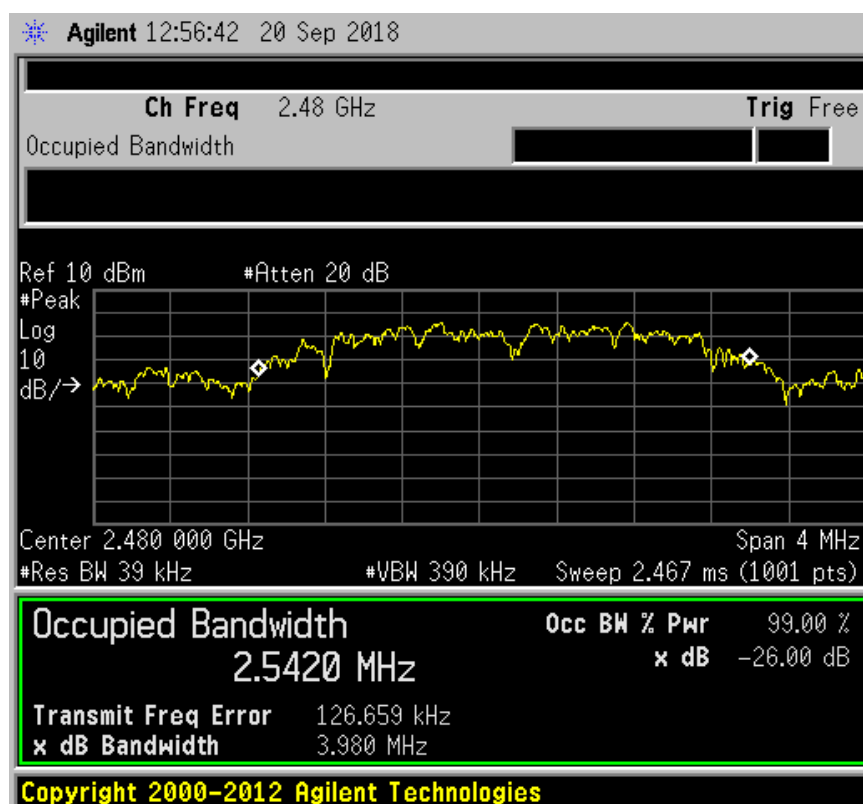
4.3.3 Bandwidth Plots, 99%



Bottom Channel



Middle Channel



Top Channel

5.0 Band Edge

5.1 Test Procedure

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

5.2 Test Criteria

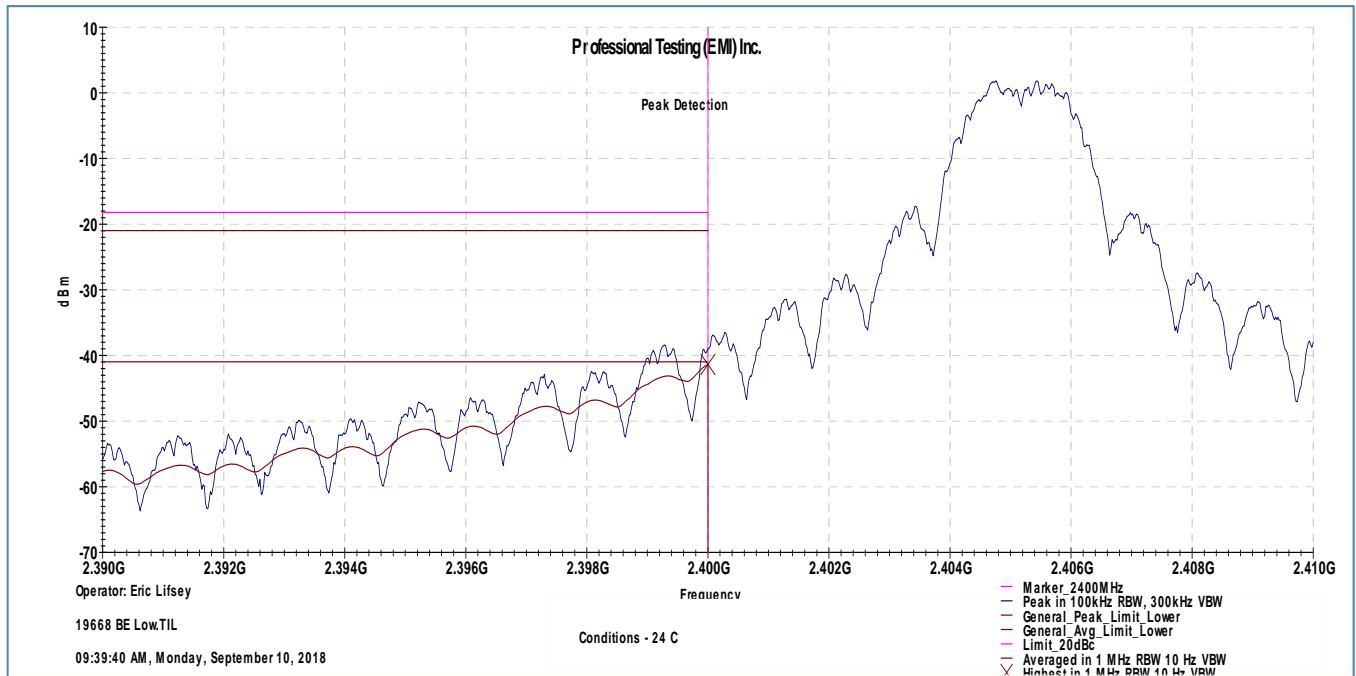
47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.205 // RSS-247 5.5, RSS-Gen 4.9	Unwanted Emissions Adjacent to Authorized Band	10 Sep 2018

5.3 Test Results

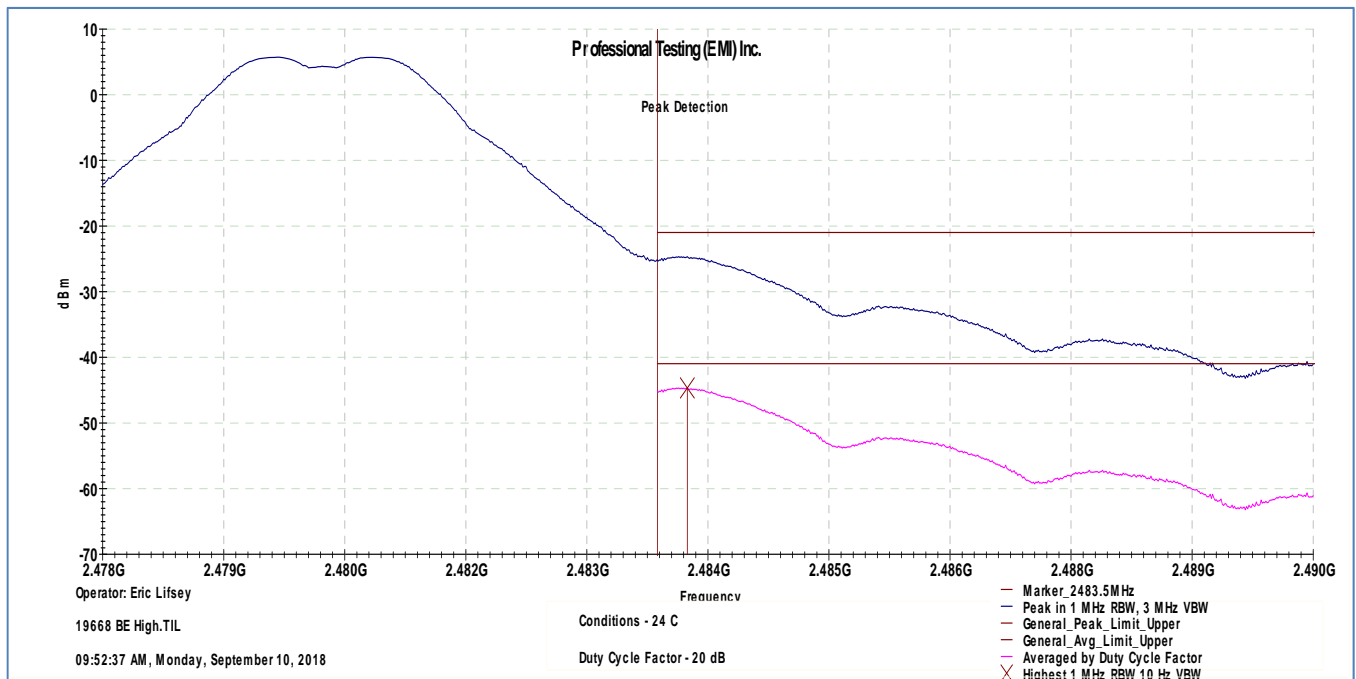
Measurements included fundamental and more than 2 standard bandwidths (standard bandwidth 1 MHz) beyond the band edges to provide a clear view of the fundamental and the declining emission levels.

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

5.3.1 Bottom Channel Band Edge



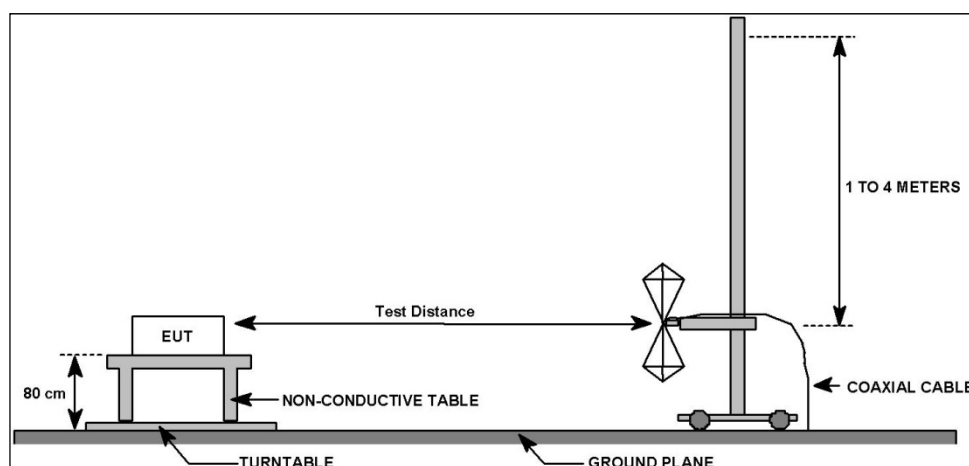
5.3.2 Top Channel Band Edge



6.0 Radiated Spurious Emissions, Transmit Mode

6.1 Test Procedure

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



6.1.1 Test Distance and Detection Method

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

6.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-247 5.5, RSS-Gen 4.9 & 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Transmit Mode	17 Sep 2018

6.3 Test Results

Three channels were tested. EUT was transmitting continuously and unmodulated. EUT internal power setting was +2.3 dBm.

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

6.3.1 Center Channel, 30 MHz to 25 GHz

Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetronic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

Radiated Emissions Test Results Data Sheet

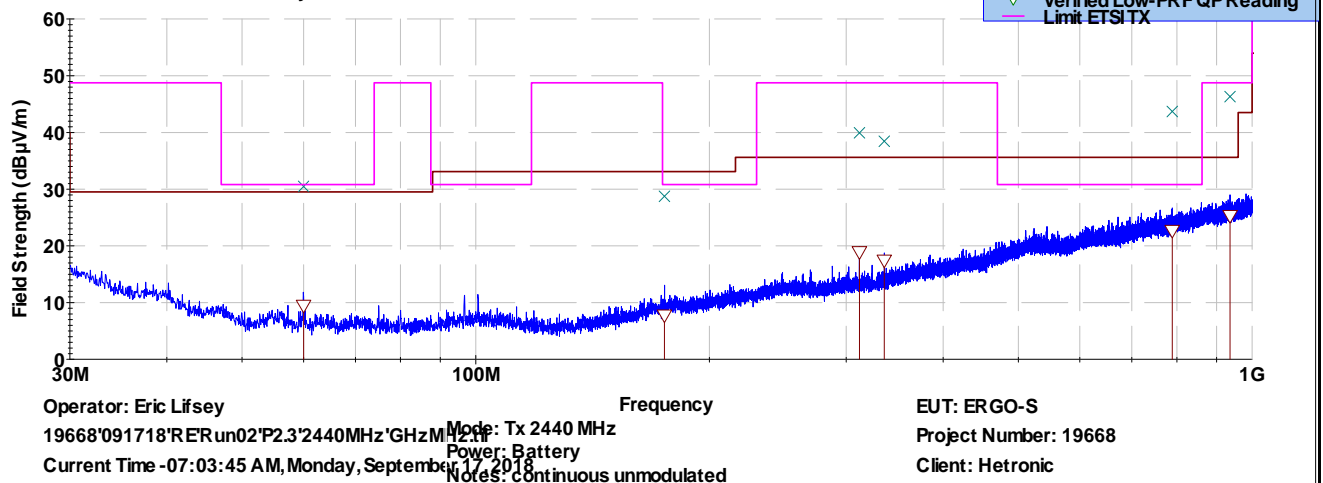
Page: 1 of 1

EUT Line Voltage:		4.2 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Vertical			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit 2440 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
60.005	10	68	3.74	Quasi-peak	29.277	9.466	29.5	-20.0	Pass
174.968	10	154	1.31	Quasi-peak	23.197	7.736	33.1	-25.4	Pass
312.003	10	9	3.38	Quasi-peak	29.284	18.914	35.6	-16.7	Pass
336.007	10	305	1.25	Quasi-peak	27.134	17.431	35.6	-18.2	Pass
789.081	10	159	4.01	Quasi-peak	21.383	22.681	35.6	-12.9	Pass
936.804	10	66	2.51	Quasi-peak	20.975	25.296	35.6	-10.3	Pass

Professional Testing, EMI, Inc

Radiated Emissions, 10m Distance

30MHz - 1GHz Vertical Polarity Measured Emissions



≤ 1GHz Vertical Antenna Polarity Measured Emissions

Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetronic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

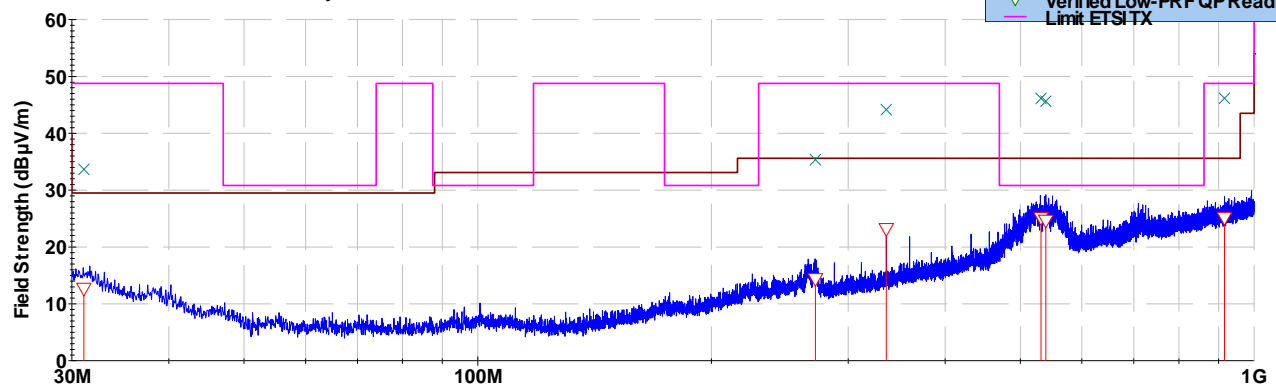
Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		4.2 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Horizontal			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Transmit 2440 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
31.095	10	68	2.23	Quasi-peak	24.148	12.651	29.5	-16.8	Pass
272.264	10	256	3.82	Quasi-peak	26.038	14.342	35.6	-21.3	Pass
336	10	18	1.31	Quasi-peak	32.864	23.161	35.6	-12.4	Pass
531.594	10	81	1.49	Quasi-peak	29.5	25.111	35.6	-10.5	Pass
539.304	10	87	1.37	Quasi-peak	29.006	24.638	35.6	-11.0	Pass
915.808	10	243	3.7	Quasi-peak	21.29	25.144	35.6	-10.5	Pass

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Radiated Emissions, 10m Distance

30MHz - 1GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey

19668'091718'RERun02'P2.3'2440MHz'GHzMHz2.11

Current Time -07:13:53 AM, Monday, September 17, 2018

Notes: continuous unmodulated

Frequency

Mode: Tx 2440 MHz

Power: Battery

EUT: ERGO-S

Project Number: 19668

Client: Hetronic

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetronic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

Radiated Emissions Test Results Data Sheet

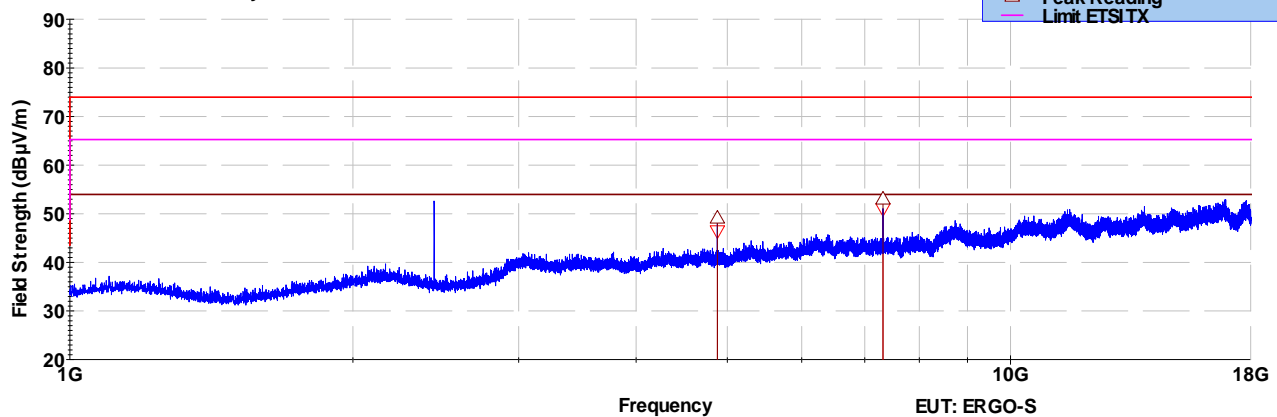
Page: 1 of 1

EUT Line Voltage:		4.2 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Vertical			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit 2440 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
4879.39	3	241	1.57	Peak	53.1	49.16	74.0	-24.8	Pass
7319.1	3	92	1.21	Peak	49.4	53.081	74.0	-20.9	Pass

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Radiated Emissions, 3m Distance

1-18GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey

Mode: Tx 2440 MHz

EUT: ERGO-S

Current Time -06:31:05 AM, Monday, September 17, 2018

Power: Battery

Project Number: 19668

Notes: continuous unmodulated

Client: Hetronic

> 1GHz Vertical Antenna Polarity Measured Emissions

Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetronic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

Radiated Emissions Test Results Data Sheet

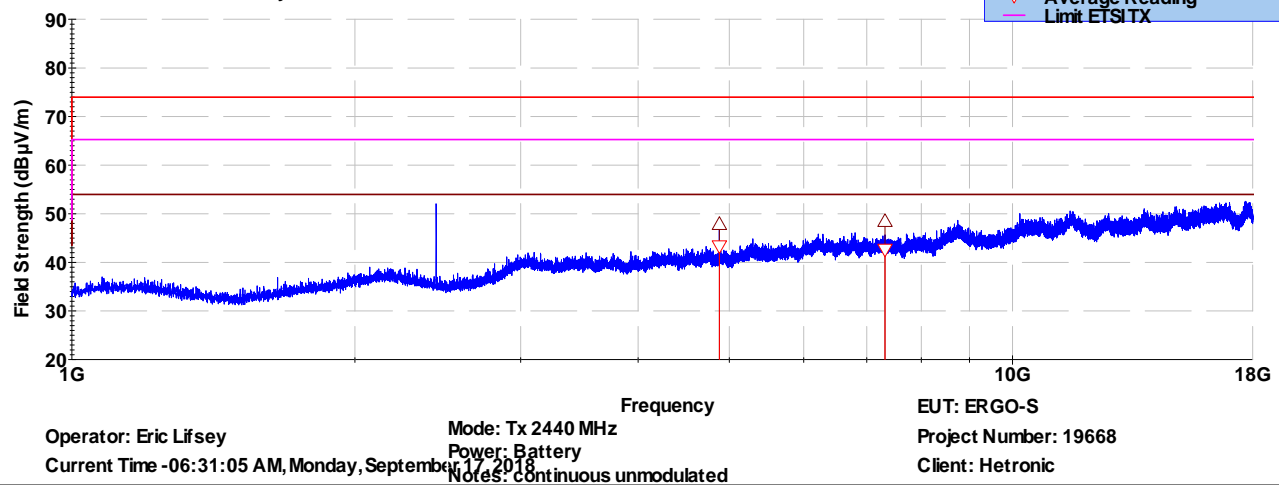
Page: 1 of 1

EUT Line Voltage:			4.2 VDC		EUT Power Frequency:		0 N/A		
Antenna Orientation:			Horizontal		Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit 2440 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
4879.35	3	249	2.92	Peak	51.8	47.853	74.0	-26.1	Pass
7319.18	3	331	1.87	Peak	44.8	48.457	74.0	-25.5	Pass

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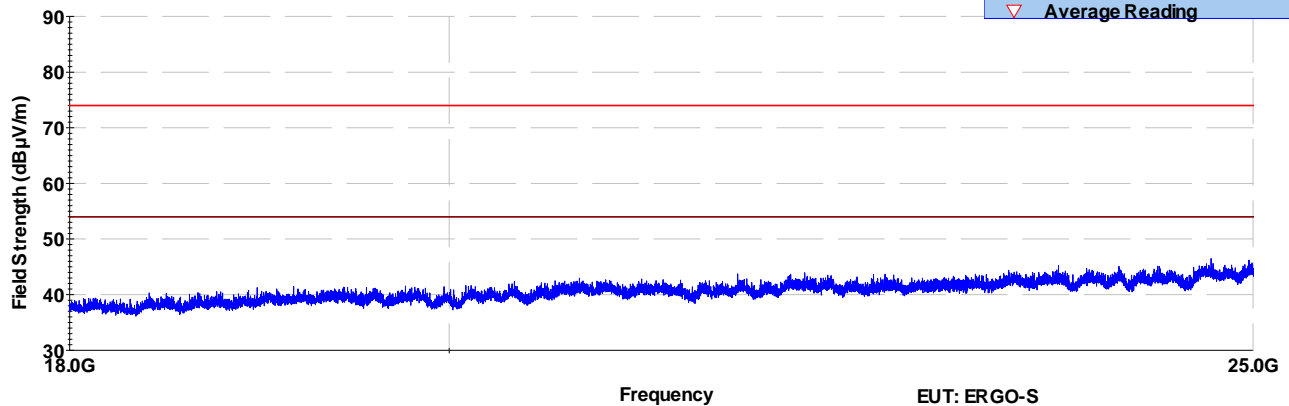
Radiated Emissions, 3m Distance

1-18GHz Horizontal Polarity Measured Emissions



> 1GHz Horizontal Antenna Polarity Measured Emissions

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



Operator: Eric Lifsey

Mode: Tx 2440 MHz

EUT: ERGO-S

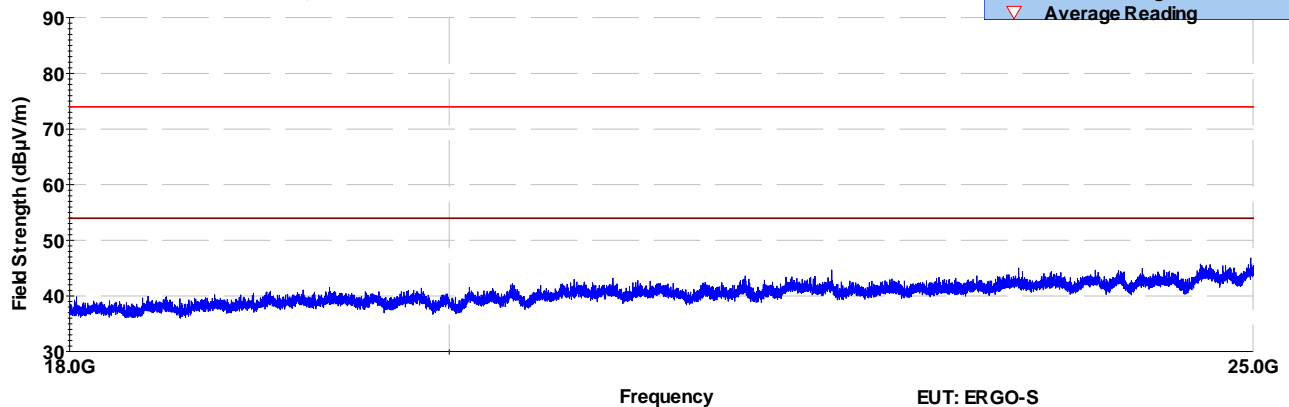
Current Time -01:43:07 PM, Tuesday, September 25, 2018
 Notes: continuous unmodulated

Power: Battery

Project Number: 19668

Client: Hetronic

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



Operator: Eric Lifsey

Mode: Tx 2440 MHz

EUT: ERGO-S

Current Time -01:43:07 PM, Tuesday, September 25, 2018
 Notes: continuous unmodulated

Power: Battery

Project Number: 19668

Client: Hetronic

6.3.2 Bottom Channel 1 GHz to 25 GHz

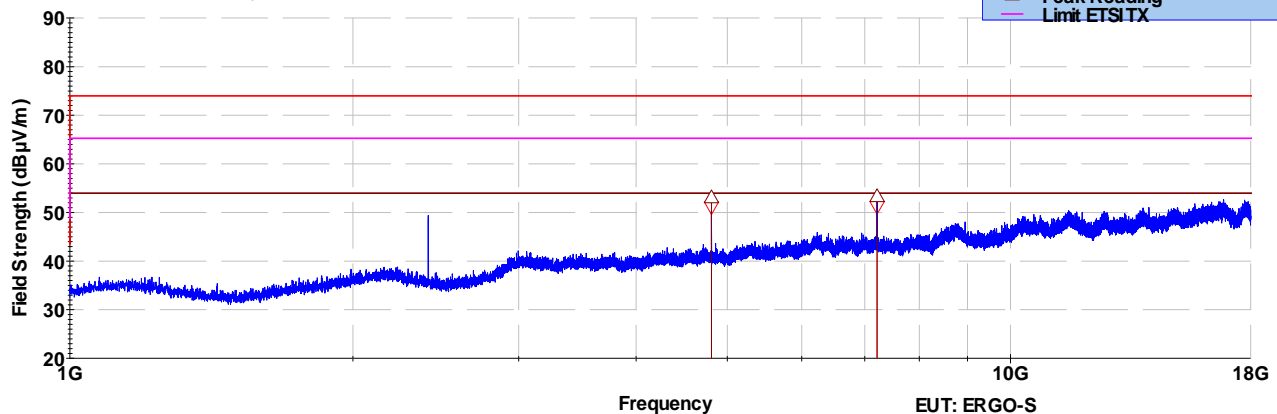
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetrionic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		4.2 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Vertical			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit 2405 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
4809.42	3	241	1.46	Peak	57	53.105	74.0	-20.9	Pass
7214.06	3	103	1.01	Peak	50	53.336	74.0	-20.6	Pass

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



Operator: Eric Lifsey

Mode: Tx 2405 MHz

EUT: ERGO-S

Current Time -06:05:13 AM, Monday, September 17, 2018
Power: Battery

Project Number: 19668

Client: Hetrionic

> 1GHz Vertical Antenna Polarity Measured Emissions

Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetronic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

Radiated Emissions Test Results Data Sheet

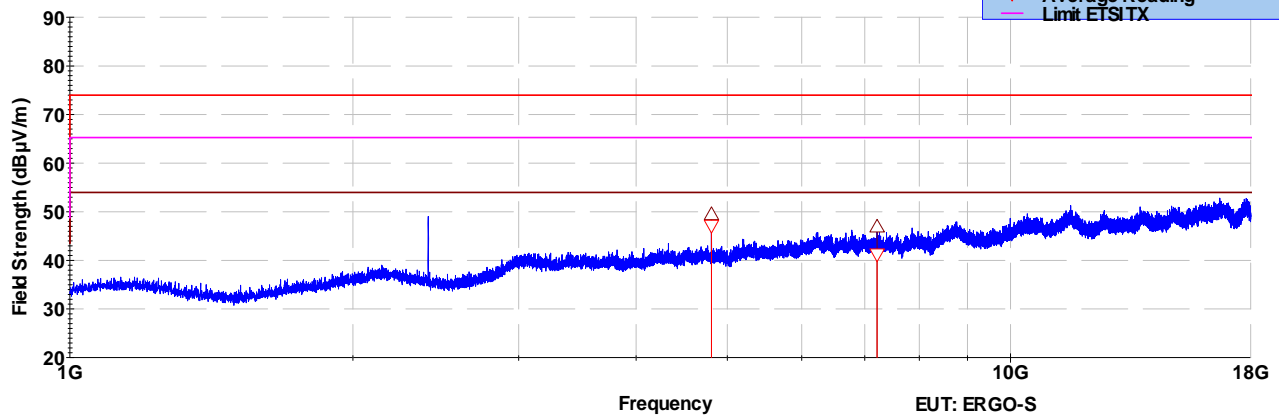
Page: 1 of 1

EUT Line Voltage:		4.2 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit 2405 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
4809.24	3	244	1.88	Peak	53.4	49.485	74.0	-24.5	Pass
7214.06	3	248	1.21	Peak	43.6	46.919	74.0	-27.0	Pass

Professional Testing, EMI, Inc

Radiated Emissions, 3m Distance

1-18GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey

Mode: Tx 2405 MHz

EUT: ERGO-S

Current Time -06:05:13 AM, Monday, September 17, 2018

Power: Battery

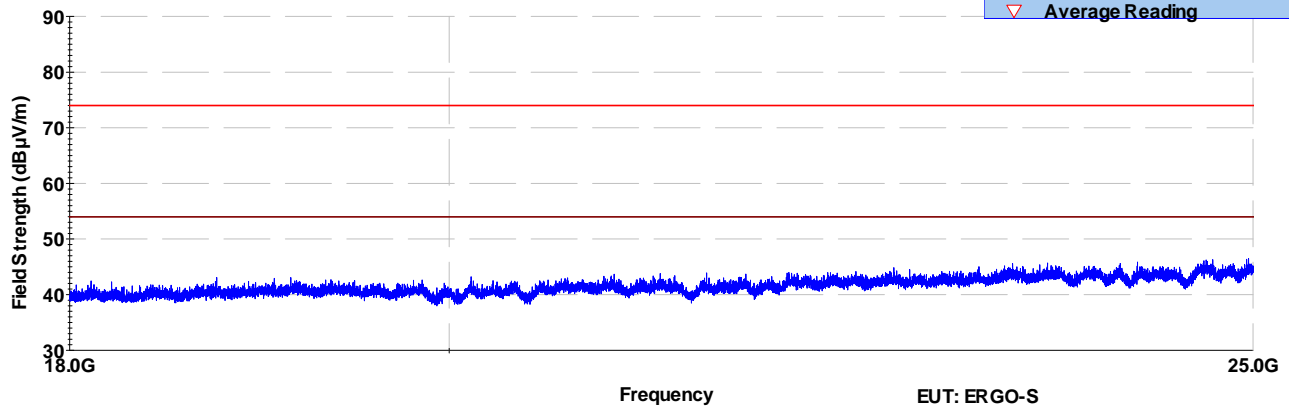
Project Number: 19668

Notes:

Client: Hetronic

> 1GHz Horizontal Antenna Polarity Measured Emissions

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



Operator: Eric Lifsey

Mode: Tx 2405 MHz

EUT: ERGO-S

Project Number: 19668

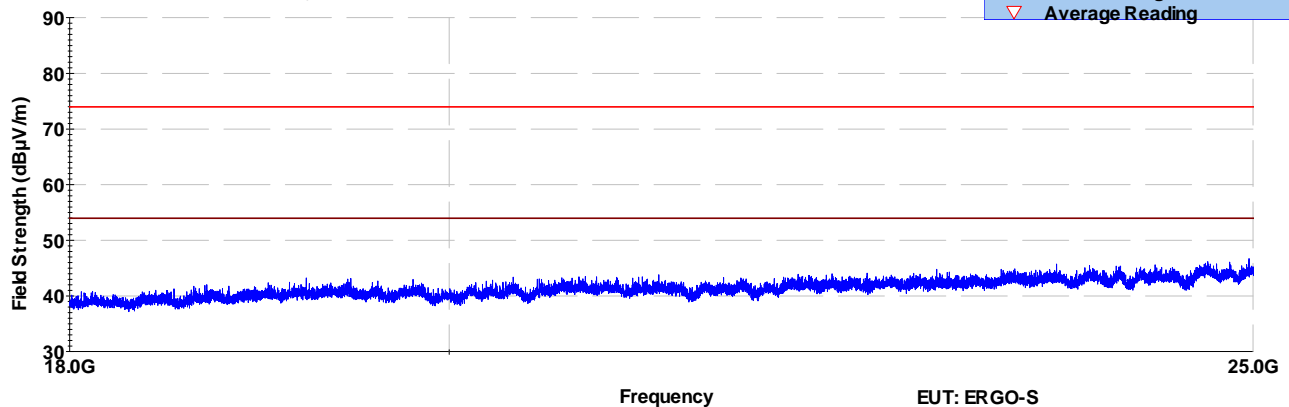
Current Time -01:35:01 PM, Tuesday, September 25, 2018

Power: Battery

Client: Hetronic

Notes:

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



Operator: Eric Lifsey

Mode: Tx 2405 MHz

EUT: ERGO-S

Project Number: 19668

Current Time -01:35:01 PM, Tuesday, September 25, 2018

Power: Battery

Client: Hetronic

Notes:

6.3.3 Top Channel, 1 GHz to 25 GHz

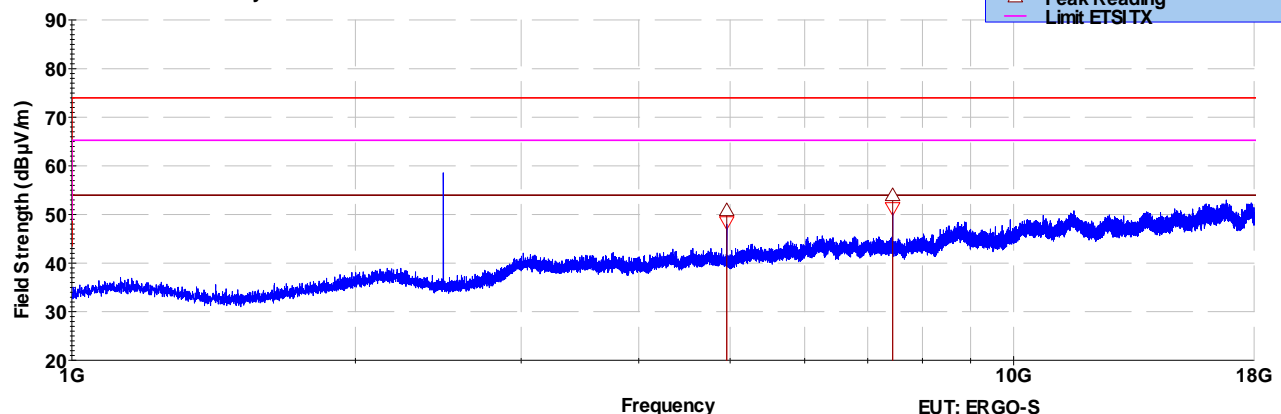
Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetricnic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:			4.2 VDC		EUT Power Frequency:		0 N/A		
Antenna Orientation:			Vertical		Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit 2480 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
4959.37	3	243	1.42	Peak	54.8	50.838	74.0	-23.1	Pass
7439.09	3	100	1.2	Peak	49.9	53.938	74.0	-20.0	Pass

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



Operator: Eric Lifsey

Mode: Tx 2480 MHz

EUT: ERGO-S

Current Time -07:37:28 AM, Monday, September 17, 2018

Power: Battery

Project Number: 19668

Notes: continuous unmodulated

Client: Hetricnic

> 1GHz Vertical Antenna Polarity Measured Emissions

Test Method:	ANSI C63.10: 2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/17/2018	EUT Serial #:	Sample G @ +2.3 dBm
Customer:	Hetronic	EUT Part #:	0
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	MFS ERGO-S	Witness' Name:	none

Radiated Emissions Test Results Data Sheet

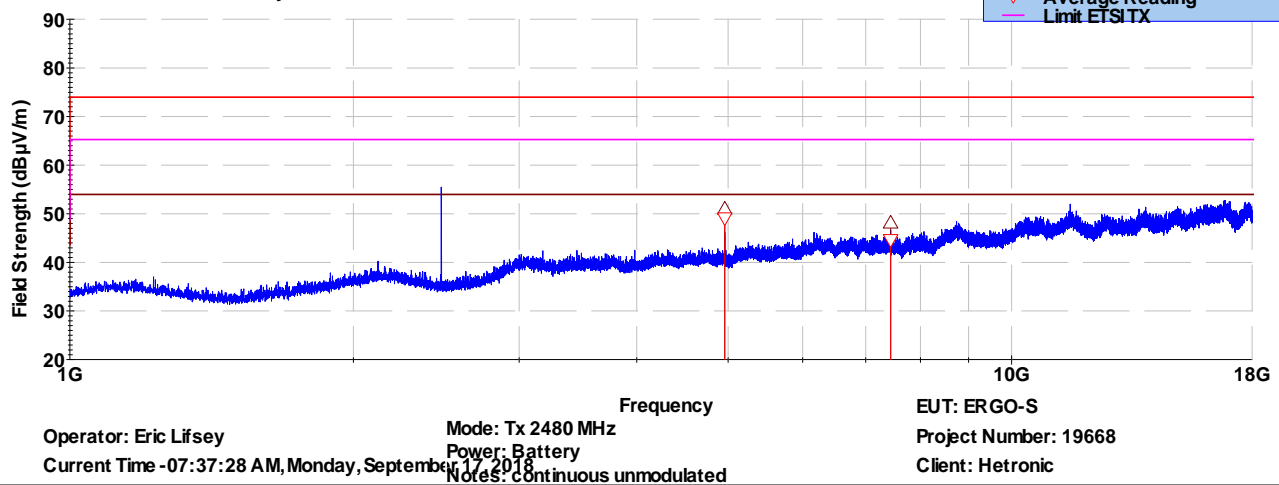
Page: 1 of 1

EUT Line Voltage:			4.2 VDC		EUT Power Frequency:		0 N/A		
Antenna Orientation:			Horizontal		Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Transmit 2480 MHz				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
4959.27	3	305	1.55	Peak	55	51.029	74.0	-22.9	Pass
7439.33	3	176	1.37	Peak	44.1	48.143	74.0	-25.8	Pass

Professional Testing, EMI, Inc

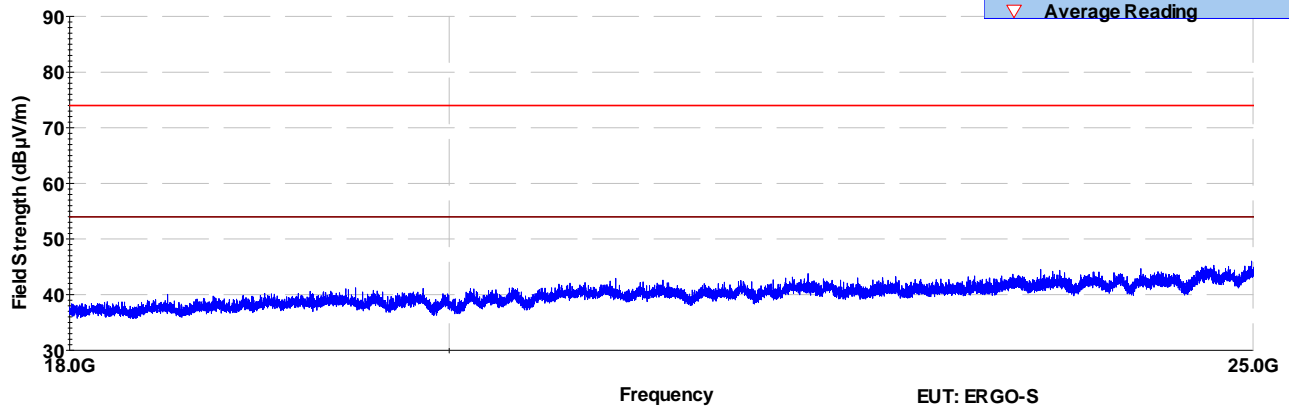
Radiated Emissions, 3m Distance

1-18GHz Horizontal Polarity Measured Emissions



> 1GHz Horizontal Antenna Polarity Measured Emissions

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



Operator: Eric Lifsey

Mode: Tx 2480 MHz

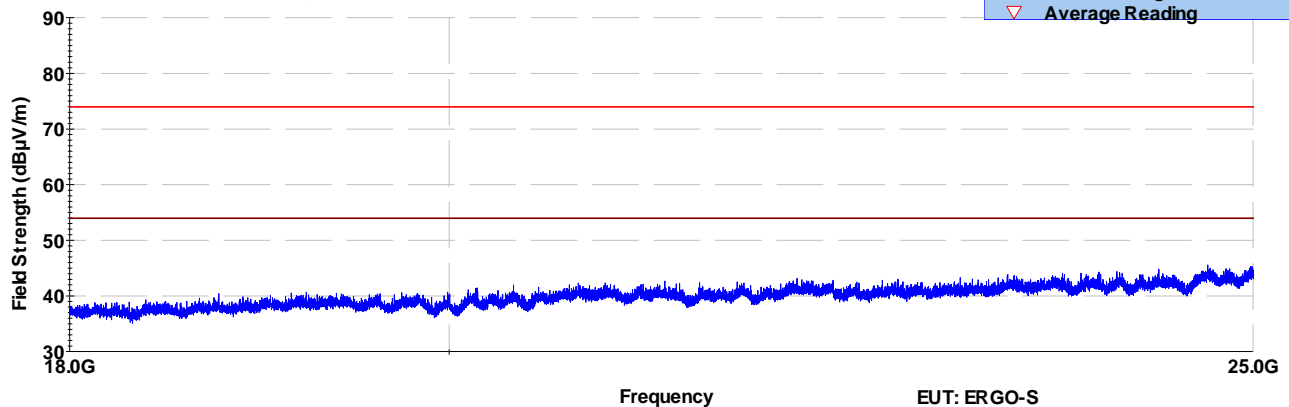
EUT: ERGO-S

Current Time -01:50:31 PM, Tuesday, September 25, 2018
 Power: Battery
 Notes: continuous unmodulated

Project Number: 19668

Client: Hetronic

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



Operator: Eric Lifsey

Mode: Tx 2480 MHz

EUT: ERGO-S

Current Time -01:50:31 PM, Tuesday, September 25, 2018
 Power: Battery
 Notes: continuous unmodulated

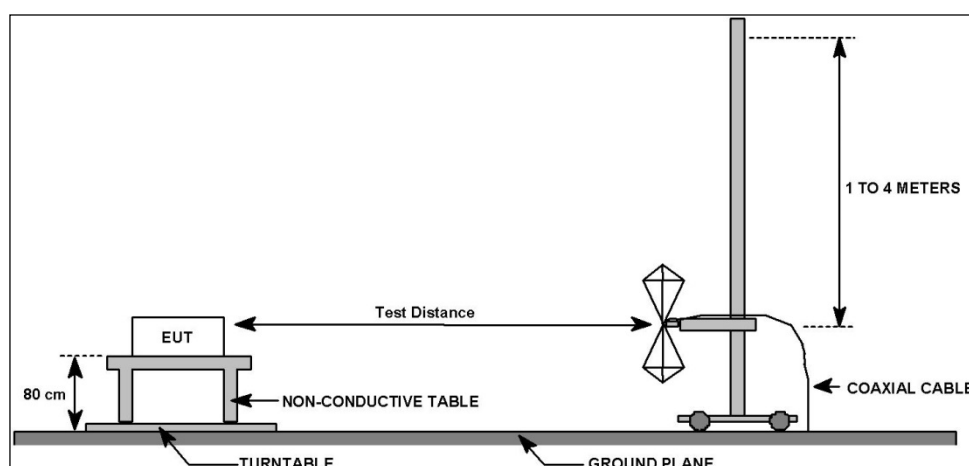
Project Number: 19668

Client: Hetronic

7.0 Radiated Spurious Emissions, Receive Mode

7.1 Test Procedure

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



7.1.1 Test Distance and Detection Method

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

7.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-247 5.5, RSS-Gen 4.9 & 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Transmit Mode	30 Apr 2018

7.3 Test Results

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

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	4/30/2018	EUT Serial #:	None
Customer:	Hetronic	EUT Part #:	None
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	ERGO S MFS	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

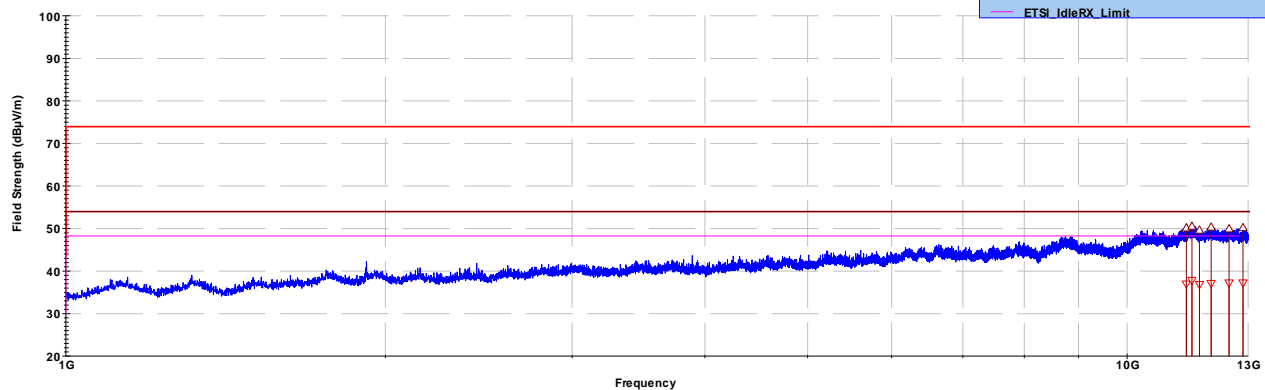
Page: 1 of 1

EUT Line Voltage:		5 VDC			EUT Power Frequency:		0 N/A		
Antenna Orientation:		Vertical			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Receive Center 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
11372.59	3	265	1.89	Peak	39.5	50.145	74.0	-23.8	Pass
11508.04	3	256	2.02	Peak	39.4	50.517	74.0	-23.4	Pass
11701.6	3	197	2.79	Peak	39.4	49.615	74.0	-24.3	Pass
11999.3	3	319	3.31	Peak	40	50.308	74.0	-23.6	Pass
12477.2	3	184	3.67	Peak	39.7	49.909	74.0	-24.0	Pass
12858.41	3	291	2.19	Peak	40.1	50.189	74.0	-23.8	Pass

Professional Testing, EMI, Inc

Radiated Emissions, 3m Distance

1-18GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey

Current Time -05:50:17 PM, Monday, April 30, 2018

Mode: Idle/RX

Power: 3.6 VDC, external battery pack wired on.

EUT: ERGO S (MFS)

Project Number: 19668-15

Client: Hetronic

> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	4/30/2018	EUT Serial #:	None
Customer:	Hetronic	EUT Part #:	None
Project Number:	19668	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	ERGO S MFS	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

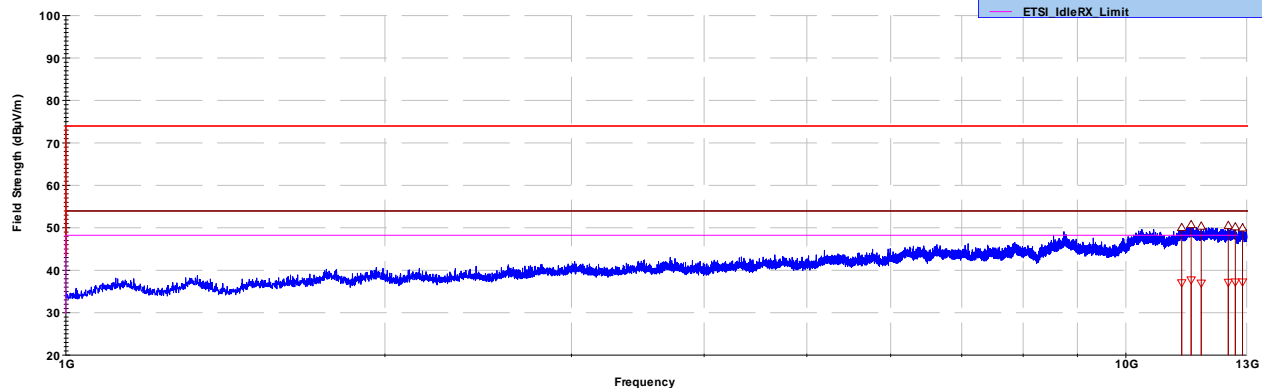
Page: 1 of 1

EUT Line Voltage:		5VDC			EUT Power Frequency:		0N/A		
Antenna Orientation:		Horizontal			Frequency Range:		Above 1GHz		
EUT Mode of Operation:					Receive Center 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
11289.33	3	290	1.18	Peak	39.7	50.061	74.0	-23.9	Pass
11523.94	3	95	2.98	Peak	39.7	50.741	74.0	-23.2	Pass
11776.5	3	348	2.69	Peak	40.3	50.383	74.0	-23.6	Pass
12493.57	3	297	3.33	Peak	40.4	50.546	74.0	-23.4	Pass
12682.13	3	62	2.11	Peak	40.2	50.212	74.0	-23.7	Pass
12883.07	3	177	2.55	Peak	39.8	49.935	74.0	-24.0	Pass

Professional Testing, EMI, Inc.

Radiated Emissions, 3m Distance

1-18GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey

Current Time -05:50:17 PM, Monday, April 30, 2018

Mode: Idle/RX

Power: 3.6 VDC, external battery pack wired on.

EUT: ERGO S (MFS)

Project Number: 19668-15

Client: Hetronic

> 1GHz Horizontal Antenna Polarity Measured Emissions

8.0 Antenna Construction

8.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevent wireless device antennas from being modified by end users.

8.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203, 15.247 // RSS-Gen 8.3	Antenna Construction	4 May 2017

8.3 Results

Table 8.3.1 Antenna Construction Details

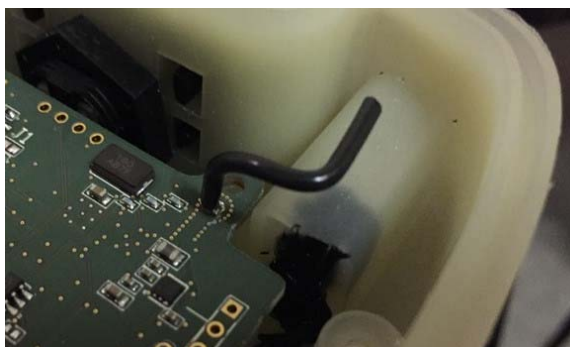
Manufacturer: Hetronic

Type: Monopole, insulated wire, formed with two 90 degree bends.

Gain 0.0 dBi

Construction: Soldered to circuit board and internal to system. No connector provided. Antenna is internal to device and not subject to user modification.

Drawing/Photo Detail:



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

9.0 Equipment

9.1 Radiated Emissions 30 MHz to 18 GHz

Radiated Emissions Test Equipment List					
Tile! Software Version:		4.2.A, May 23, 2010, 08:38:52 AM			
Test Profile:		2016 RE_ClassA - Boresite+Mast_LowPRF_030617.til or 2016 RE_ClassB - Boresite+Mast_LowPRF_030617.til			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	TDK 10M	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/10/2019
1890	HP	8447F-H64	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/10/2020
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz, Opt. AYZ	MY44808298	11/7/2018
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	135454	3/7/2019
C027D	PTI	None	Relay	none	N/A
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	TDK 10M	TDK 10M Chamber, sVSWR > 1 GHz	DAC-012915-005	11/16/2019
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	1/10/2020
C030	none	none	Cable Coax, N-N, 30m, 30 MHz - 18GHz	none	9/28/2018
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	110313	3/15/2019

9.2 Fundamental Power, Bandwidth, Duty Cycle, Band Edge

Asset #	Manufacturer	Model #	Description	Calibration Due
2295	Agilent	E4440A	Spectrum Analyzer	18 Dec 2018

9.3 Radiated Emissions 18-25 GHz

Asset #	Manufacturer	Model #	Description	Calibration Due
2295	Agilent	E4440A	Spectrum Analyzer	18 Dec 2018
1974	Agilent	83017A	Microwave Amplifier	17 Nov 2018
1542	A H Systems	SAS-572	Antenna, Horn, 18-26.5 GHz	20 Nov 2018
0524	EMCO	1060	Turntable controller	CNR

10.0 Measurement Bandwidths

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan				
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.009	0.15	0.3	2	Multiple Sweeps
0.15	30	9	6	Multiple Sweeps
30	1000	120	2	Multiple 800 mS Sweeps
1000	6000	1000	2	Multiple Sweeps
6000	18000	1000	2	Multiple Sweeps
18000	26500	1000	2	Multiple Sweeps
*Notes: 1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range. 2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz. 3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz. 4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz. 5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.				

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

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

1. Rationale and Summary of Expanded Uncertainty.

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

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

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

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

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

Table 1: Summary of Measurement Uncertainties for Site 45

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

End of Report