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

Larry Finn Chief Technical Officer Written by

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

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, <u>2400-2483.5 MHz</u> , 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.



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		
47 CFK	Subpart C -Intentional Radiators		
RSS-247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-		
N33-247 ISSUE 2	Exempt Local Area Network (LE-LAN) Devices		
RSS-Gen Issue 4 General Requirements and Information for the Certification of Radio Apparatus			
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed		
ANSI C05.10.2013	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

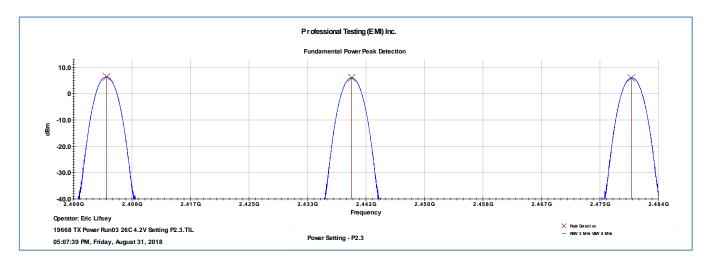
47 CFR (USA) // IC (Canada)				
Section Reference Parameter				
	Fundamental Power			
15.247(a)(3) //	Conducted Limits	21 Aug 2019		
RSS-247 5.2	1 W	31 Aug 2018		
	Limit Restated as Field: 125.23 dBμV/m @ 3 m			

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.

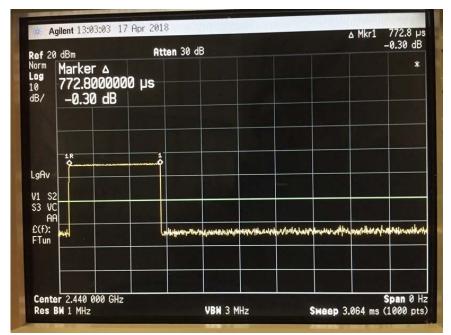


2.4 Test Results, Duty Cycle

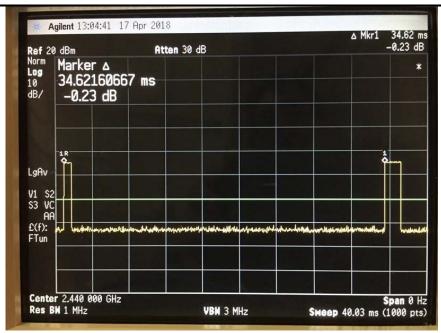
Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. 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 msec / 34.6 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 msec / 34.6 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	Date						
15.247(e) // RSS-247, 5.2	Power Spectral Density, Conducted Limit: 8 dBm / 3 kHz Restated as field strength limit: 103.23 dBμV/m at 3 m	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.

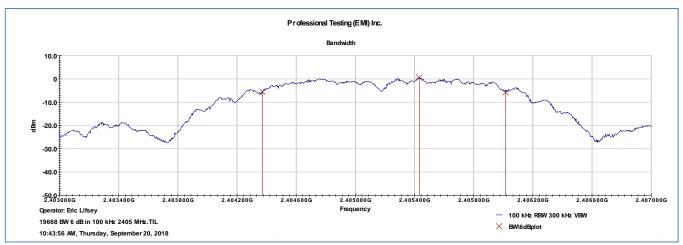
The EUT was found to be in compliance with applicable requirements.

Table 4.3.1								
Bandwidth 6 dB, Minimum 500 kHz in 100 kHz RBW								
Low Channel	Mid Channel	High Channel	Reported					
Measured BW	Measured BW	Measured BW	Minimum BW					
(kHz)	(kHz)	(kHz)	(kHz)					
1644	1800	1792	1644					
Bandwidth 20 d	B, Measure and R	eport						
Low Channel	Mid Channel	High Channel	Reported					
Measured BW	Measured BW	Measured BW	Maximum BW					
(kHz)	(kHz)	(kHz)	(kHz)					
2664	2672	2708	2708					
Bandwidth 99%	, Measure and Re	port						
Low Channel	Mid Channel	High Channel	Reported					
Measured BW	Measured BW	Measured BW	Maximum BW					
(kHz)	(kHz)	(kHz)	(kHz)					
2443	2565	2542	2565					

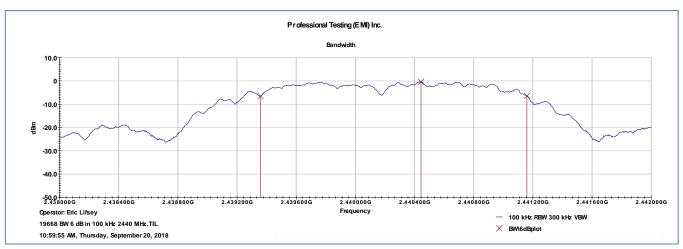
Plotted measurements appear on the following pages.

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.

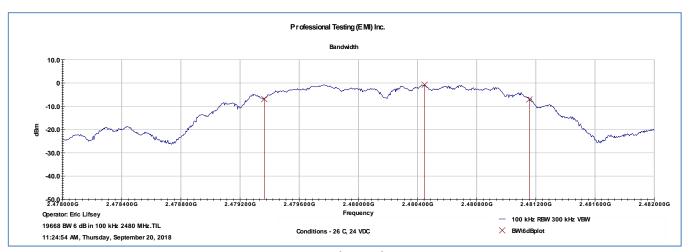
4.3.1 Bandwidth Plots, 6 dB



Bottom Channel

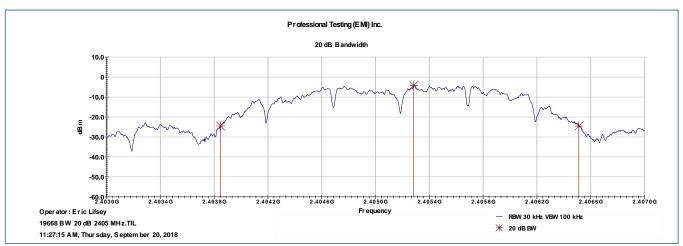


Middle Channel

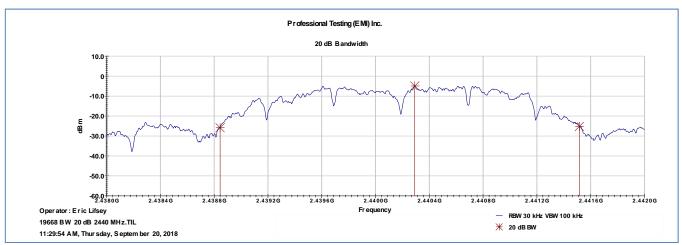


Top Channel

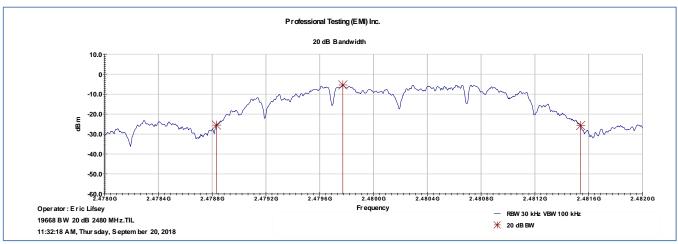
4.3.2 Bandwidth Plots, 20 dB



Bottom Channel

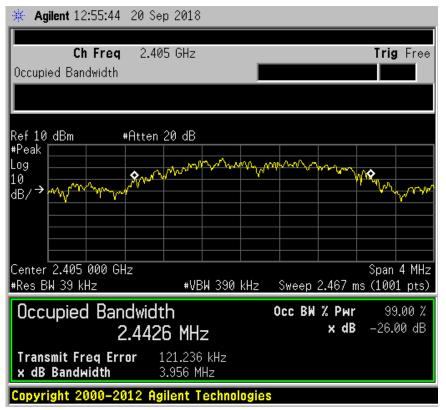


Middle Channel

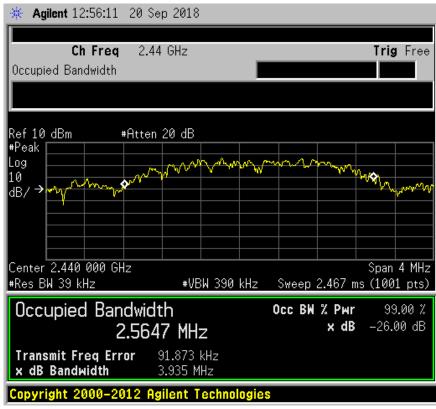


Top Channel

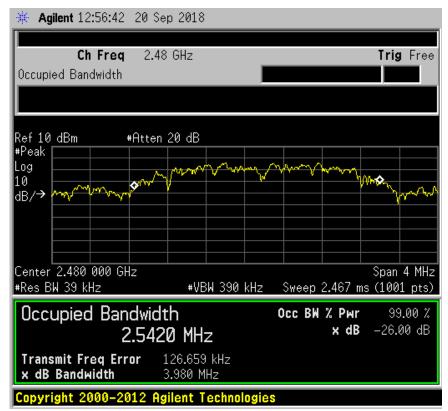
4.3.3 Bandwidth Plots, 99%



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

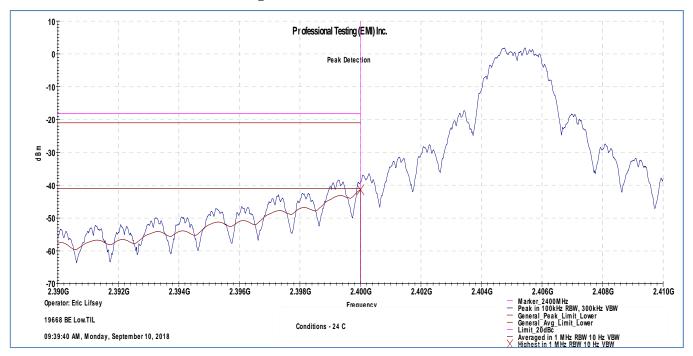
47 CFR (USA) // IC (Canada)								
Section Reference	Parameter	Date(s)						
15.247, 15.205 //	Unwanted Emissions Adjacent to Authorized	10 Sep 2018						
RSS-247 5.5, RSS-Gen 4.9	Band	10 2eh 2010						

5.3 Test Results

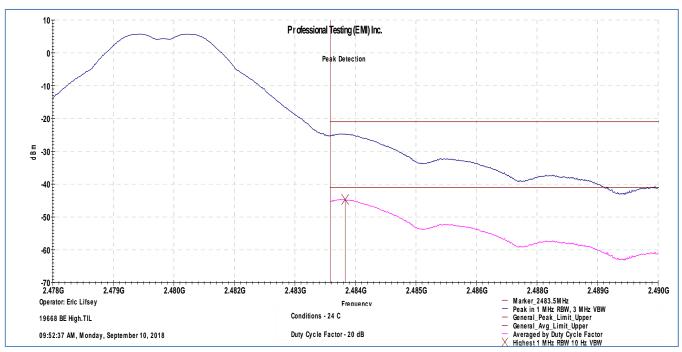
Measurements included fundamental and more than 2 standard bandwidths (standard bandwidth 1 MHz) beyond the band edges to provide a clear view of the fundamental and the declining emission levels.

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

5.3.1 Bottom Channel Band Edge



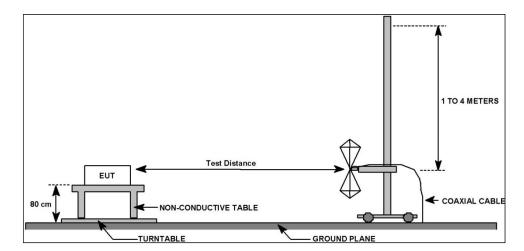
5.3.2 Top Channel Band Edge



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	2 to 1 GHz 1 GHz to 18 GHz 18 GHz to 25						
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

0.5.1			, 00 10	Inz to 25 G.							
Test Meth	nod:	ANSI C Device		2013: Ameri	can National Sta	andard of Proc	edures for Co	mpliance Tes	ting of Unlice	nsed Wir	eless
In accorda	ance with:	FCC Pa	rt 15.2	209 - Code of	Federal Regulat	ions Part 47, S	Subpart C - Int	tentional Radi	ators, Radiate	d Emissi	ons
Section:		15.209	9								
Test Date	(s):	9/17/	<mark>2018</mark>			EUT Serial	#:	Sample G (<u>@</u> +2.3 dBm		
Customer		Hetro				EUT Part #:		0			
Project No		19668	3			Test Techn		Eric Lifsey			
Purchase		0				Supervisor:		Lisa Arndt			
Equip. Un	der Test:	MFS	ERGO-	<u>-S</u>		Witness' N	ame:	none			
		Radiat	ed Em	issions Test	Results Data	a Sheet		Pa	ge: 1	of	1
EUT	Line Volta	ge:	4	.2 VDC		EUT Pow	ver Frequen	cy:	0 N/A		
Anteni	na Orienta	tion:		Vertic	al	Frequ	ency Range		30MHz to	1GHz	
	FII	Γ Mode o	of One	eration:		•		nsmit 2440	MH ₇		
Frequency		EL		Antenna	Detector	Recorded	Corrected	Limit Level	Margin		
Measured				Height	Function	Amplitude	Level	(dBµV/m)	(dB)	Test Re	sults
(MHz)	(Meters) (Deg	rees)	(Meters)		(dBµV)	(dBµV/m)				
60.005	10	6		3.74	Quasi-peak	29.277	9.466	29.5	-20.0	Pas	S
174.968	10	15		1.31	Quasi-peak	23.197	7.736	33.1	-25.4	Pas	
312.003	10	9		3.38	Quasi-peak	29.284	18.914	35.6	-16.7	Pas	
336.007	10	30		1.25	Quasi-peak	<u> </u>	17.431	35.6	-18.2	Pas	
789.081	10	15		4.01	Quasi-peak		22.681	35.6	-12.9	Pas	
936.804	10	6	6	2.51	Quasi-peak	20.975	25.296	35.6	-10.3	Pas	S
20MH Field Strength (dB µV/m) 200 200 200 200 200 200 200 200 200 20	ator: Eric Lifse	ical Polarity	Measu	I, EMI, Ir istance red Emissions	Free	quency	×× ×	× I	Quasi-peak Lim Ambient Scan Tre-scan Emiss Quasi-peak Res Quasi-peak Res PRF Verificatio Perified Low-PR	t ons iding n Limit FQPRea	
19668 Curre	8'091718'R E'R nt Time -07:0	un02'P2.3'2 3:45 AM, Mo	2440MH onday,S	z'GHzMM2:He: Power: eptembe:17,29 Notes:	Tx 2440 MHz Battery)18 continuous unm	odulated		Project Number Client: Hetronic			

≤ 1GHz Vertical Antenna Polarity Measured Emissions

								Hetro	nic – ERGO-S
Test Meth	od:	ANSI C63.10 Devices	: 2013: Ameri	can National St	andard of Prod	edures for Co	ompliance Test	ting of Unlice	nsed Wireless
In accorda	nce with:	FCC Part 15.	209 - Code of	Federal Regulat	tions Part 47,	Subpart C - Int	tentional Radi	ators, Radiate	ed Emissions
Section:		15.209							
Test Date(s):	9/17/2018			EUT Serial	#:	Sample G (മ +2.3 dBm	
Customer:		Hetronic			EUT Part #:		0		
Project Nu	mber:	19668			Test Techn	ician:	Eric Lifsey		
Purchase (Order #:	0			Supervisor		Lisa Arndt		
Equip. Und	ler Test:	MFS ERGO	-S		Witness' N	ame:	none		
	ı	Radiated Er	nissions Tes	t Results Data	a Sheet		Pa	ge: 1	of 1
EUT I	ine Voltage	: 4	.2 VDC		EUT Pov	ver Frequen	су:	0 N/A	
Antenn	a Orientatio	on:	Horizoi	ntal	Frequ	ency Range	•	30MHz to	1GHz
	EUT N	Mode of Op	eration:			Trai	nsmit 2440 l	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
Pro Radia 30MHz	fessiona ated Emissi -1GHz Horizon	I Testingions, 10m I	g, EMI, Ir Distance asured Emission	nc as			— F	Quasi-peak Lim Ambient Scan Pre-scan Emiss Quasi-peak Res PRF Verificatio /erified Low-PR .imit ETSITX	ions ading on Limit
50					 				-
(m/ 40 And 80				_					
Field Strength (dBµV	Maada da hardiik da cada madda da	tają vety, o maite o ceta		on and depart only a single state of the sta	the state of the s			te late the same of the same o	
0 30M		A 1 . A shannanda bilan	100M	- Luli and training and I , i.e.					1G

Frequency

EUT: ERGO-S

Project Number: 19668 Client: Hetronic

Operator: Eric Lifsey

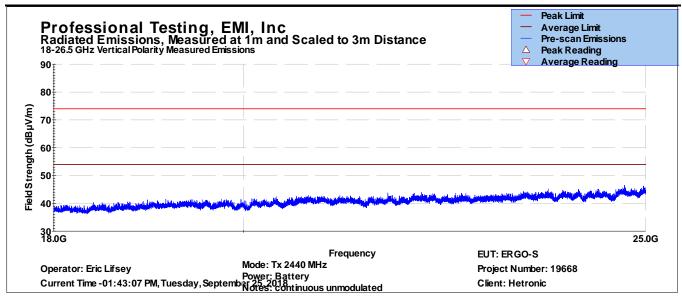
19668'091718'R ER un02'P2.3'2440MHz'GHzMMode: Tx 2440 MHz
Power: Battery
Current Time -07:13:53 A M, Monday, September Notes: Continuous unmodulated

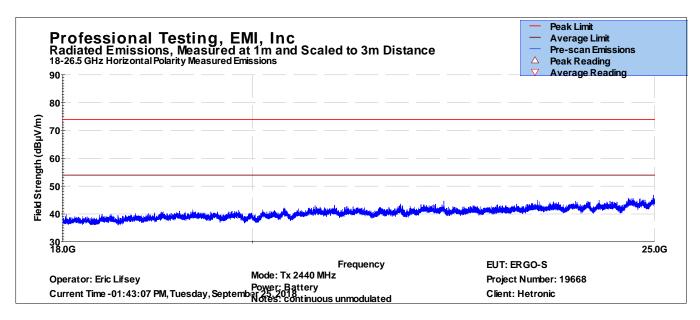
Test Metho	od:	ANSI C63.10: Devices	: 2013: Ameri	can National St	andard of Proc	cedures for Co	ompliance Test	ing of Unlice	nsed Wirel	ess
n accorda	nce with:	FCC Part 15.2 Limits	209 - Code of I	Federal Regulat	tions Part 47, S	Subpart C - In	tentional Radi	ators, Radiato	ed Emissio	ns
Section:		15.209								
Test Date(s):	9/17/2018			EUT Serial	#:	Sample G (9 +2.3 dBm		
Customer:		Hetronic			EUT Part #:		0			
Project Nu		19668			Test Techn		Eric Lifsey			
Purchase C		O PAGE EDGG	<u> </u>		Supervisor:		Lisa Arndt			
Equip. Und	ier rest:	MFS ERGO	-5		Witness' N	ame:	none			_
	F	Radiated Em	nissions Test	Results Dat	a Sheet		Pa	ge: 1	of :	1
EUT L	ine Voltage	: 4	.2 VDC		EUT Pow	ver Frequen	icy: (N/A		
Antenn	a Orientatio	n:	Vertic	al	Frequ	ency Range	:	Above 1	GHz	
	EUT N	/lode of Ope	eration:			Trai	nsmit 2440 I	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 Resu	ults
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	
										_
Prot Radia 1-18GH	fessiona ated Emissi Iz Vertical Polar	I Testing ons, 3m Dis ity Measured Er	J, EMI, Ir stance missions	ic				verage Limit verage Readir eak Limit re-scan Emiss eak Reading imit ETSITX		
80										
€ 70				-			_			
∯ 60										
ੂ ਜੂ ਹ		<u> </u>								
ag 50					ما المالية الم		A STATE OF THE STA			
Field Strength (dBµV)	deposite the best translability and	A CONTRACTOR OF THE PARTY OF TH	Industry of the land of the la							
20 1G									100	
Onerat	or: Eric Lifsey t Time -06:31:0	5 AM. Monday. S		Fred Tx 2440 MHz Battery 1881 Battery 1881 Battery	quency	I	10G EUT: ERGO-S Project Number: Client: Hetronic		18G	

> 1GHz Vertical Antenna Polarity Measured Emissions

Test Metho	od:	ANSI C63.10 Devices	: 2013: Ameri	can National Sta	andard of Proc	cedures for Co	ompliance Test	ting of Unlice	nsed Wire	less
In accorda	nce with:	FCC Part 15.2 Limits	209 - Code of I	Federal Regulat	tions Part 47, S	Subpart C - In	tentional Radi	ators, Radiato	ed Emissio	ons
Section:		15.209								
Test Date(s):	9/17/2018			EUT Serial	#:	Sample G (9 +2.3 dBm		
Customer:		Hetronic			EUT Part #:		0			
Project Nu		19668			Test Techn		Eric Lifsey			
Purchase (NATE EDGO	<u> </u>		Supervisor:		Lisa Arndt			
Equip. Und	ier rest:	MFS ERGO	-5		Witness' N	ame:	none			
	F	Radiated Em	nissions Test	Results Data	a Sheet		Pa	ge: 1	of	1
	ine Voltage		.2 VDC		EUT Pow	ver Frequen	icy: (N/A		
Antenn	a Orientatio	on:	Horizor	ntal	Frequ	ency Range	:	Above 1	GHz	
	EUT N	/lode of Ope	eration:			Trai	nsmit 2440 I	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 Res	ults
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	;
-										
Pro Radia 1-18GH	fessiona ated Emissi Iz Horizontal Po	l Testino ons, 3m Dis plarity Measured	j, EMI, Ir stance l Emissions	ıc			— A — P △ P	eak Limit verage Limit re-scan Emiss leak Reading verage Readir imit ETSITX		
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ap 20							A STATE OF THE PARTY OF THE PAR			
Field Strength (dBµV)	des ellektiles falled by any	the state of the s	All Children Landson							
20 1G							10G		18G	
Operat	or: Eric Lifsey t Time -06:31:0	5 AM, Monday, S		Fred Tx 2440 MHz Battery 1801 Battery 1801 Battery	quency	I	10G EUT: ERGO-S Project Number: Client: Hetronic		18G	

> 1GHz Horizontal Antenna Polarity Measured Emissions





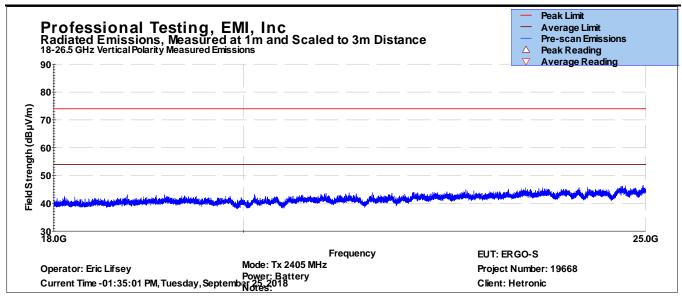
6.3.2 Bottom Channel 1 GHz to 25 GHz

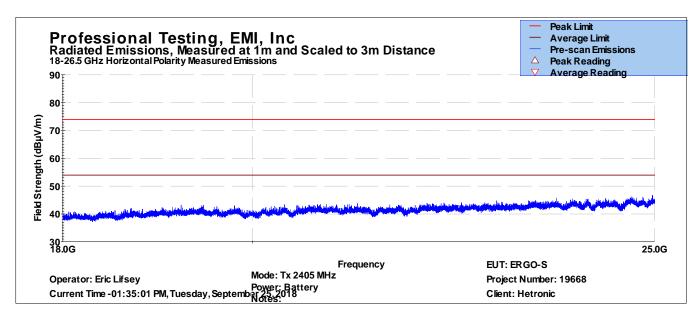
est Metho	od:	ANSI C63.10: Devices	: 2013: Americ	can National Sta	andard of Proc	edures for Co	empliance Test	ting of Unlice	nsed Wireless
n accordan	nce with:	FCC Part 15.2 Limits	209 - Code of F	ederal Regulat	tions Part 47, S	Subpart C - In	tentional Radi	ators, Radiato	ed Emissions
ection:		15.209							
est Date(s	s):	9/17/2018			EUT Serial	# :	Sample G (ற +2.3 dBm	
Customer:		Hetronic			EUT Part #:		0		
roject Nur	mber:	19668			Test Techni	ician:	Eric Lifsey		
urchase O	rder #:	0			Supervisor:		Lisa Arndt		
quip. Und	er Test:	MFS ERGO	-S		Witness' N	ame:	none		
	F	Radiated Em	nissions Test	Results Data	a Sheet		Pa	ge: 1	of 1
EUT Li	ine Voltage:	: 4	.2 VDC		EUT Pow	er Frequen	icy:	N/A	
Antenna	a Orientatio	n:	Vertic	al	Freque	ency Range		Above 1	GHz
	EUT N	/lode of Ope	eration:			Trai	nsmit 2405 I	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 Result
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
					,				
Prof Radia 1-18GH	essiona Ited Emissi Iz Vertical Polar	I Testing ons, 3m Dis	g, EMI, Instance	IC				verage Limit verage Readir leak Limit re-scan Emiss leak Reading imit ETSITX	_
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Field Strength (dBµV	same interior in the later in t	Market Handard				A STATE OF THE STA			
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20 <u>[≟]</u> 1G							10G		18G
				Fred	quency		EUT: ERGO-S		

> 1GHz Vertical Antenna Polarity Measured Emissions

Test	Metho	od:	ANSI C63.10	2013: Americ	can National Sta	andard of Proc	edures for Co	ompliance Te	sting of Unli	censed Wireles
In ac	cordar	nce with:	FCC Part 15.2 Limits	209 - Code of I	ederal Regulat	tions Part 47, S	Subpart C - Int	tentional Rac	liators, Radi	ated Emissions
Secti	on:		15.209							
Test	Date(s	s):	9/17/2018			EUT Serial	#:	Sample G	@ +2.3 dE	im .
	omer:		Hetronic			EUT Part #:		0		
Project Number: 19668						Test Techn		Eric Lifsey		
		order #:	0			Supervisor:		Lisa Arndt		
Equi	o. Una	er Test:	MFS ERGO	-5		Witness' N	ame:	none		
		F	Radiated Em	issions Test	Results Data	a Sheet		P	age: 1	l of 1
	EUT L	ine Voltage	: 4	.2 VDC		EUT Pow	ver Frequen	icy:	0 N/	Α
Α	ntenna	a Orientatio	on:	Horizor	ital	Frequ	ency Range	:	Above	1GHz
		EUT N	/lode of Ope	eration:			Trai	nsmit 2405	MHz	
Mea	uency sured IHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Leve		Test Result
480	9.24	3	244	1.88	Peak	53.4	49.485	74.0	-24.5	Pass
721	4.06	3	248	1.21	Peak	43.6	46.919	74.0	-27.0	Pass
			-					-		
	Prof Radia 1-18GH	essiona ted Emissi z Horizontal Po	I Testing ons, 3m Dis plarity Measured	, EMI, Instance	ıc			$\frac{}{\triangle}$	Peak Limit Average Limi Pre-scan Emi Peak Readin Average Rea Limit ETSITX	issions a
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ج	70									
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ength	50					→				
Field Strength (dBµV/	30		A particular de la constitución de		mental for him the principal delication and					
	20 1G									
	Operate	or: Eric Lifsey : Time -06:05:1	3 AM,Monday,S		Гх 2405 MHz	quency	Ī	10G EUT: ERGO-S Project Numbe Client: Hetron		18 G

> 1GHz Horizontal Antenna Polarity Measured Emissions





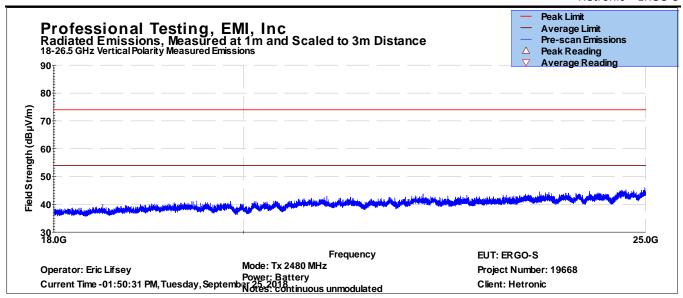
6.3.3 Top Channel, 1 GHz to 25 GHz

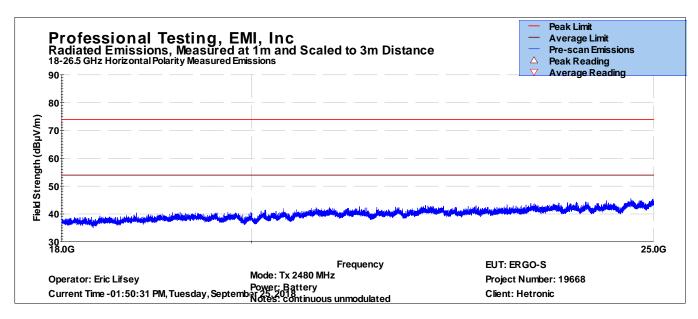
est Meth	od:	ANSI C63.10	: 2013: Americ	can National St	andard of Proc	edures for Co	mpliance Test	ting of Unlice	nsed Wireless
n accorda	nce with:	FCC Part 15.2 Limits	209 - Code of I	Federal Regulat	tions Part 47, S	Subpart C - Int	entional Radi	ators, Radiate	ed Emissions
ection:		15.209							
est Date	(s):	9/17/2018			EUT Serial	# :	Sample G (ു +2.3 dBm	
Customer		Hetronic			EUT Part #:		0		
Project Nu	ımber:	19668			Test Techn	ician:	Eric Lifsey		
urchase		0			Supervisor		Lisa Arndt		
quip. Un	der Test:	MFS ERGO	-S		Witness' N	ame:	none		
	F	Radiated Em	nissions Test	Results Dat	a Sheet		Pa	ge: 1	of 1
EUT	Line Voltage	: 4	.2 VDC		EUT Pow	ver Frequen	cy: (N/A	
Antenr	a Orientatio	n:	Vertic	al	Frequ	ency Range		Above 1	GHz
	EUT N	/lode of Ope	eration:			Trai	nsmit 2480 I	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 Result
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
Pro Radi 1-18G 90	fessiona ated Emissi Hz Vertical Polar	I Testing ons, 3m Dis ity Measured Er	j, EMI, Ir stance nissions	ic				Average Limit Average Readin Peak Limit Pre-scan Emiss Peak Reading Imit ETSITX	_
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20									
20 [±] 1G Opera	tor: Eric Lifsey nt Time -07:37:2	·		Tx 2480 MHz	quency		10G EUT: ERGO-S Project Number	: 19668	18G

> 1GHz Vertical Antenna Polarity Measured Emissions

Test	Metho	d:	ANSI C63.10: Devices	2013: Americ	can National Sta	andard of Proc	edures for Co	ompliance Test	ting of Unlice	nsed Wireless
In ac	cordar	ice with:	FCC Part 15.2 Limits	209 - Code of I	ederal Regulat	tions Part 47, S	Subpart C - In	tentional Radi	ators, Radiate	ed Emissions
Secti	on:		15.209							
	Date(s):	9/17/2018			EUT Serial		Sample G (9 +2.3 dBm	
	omer:		Hetronic			EUT Part #:		0		
	ect Nur		19668			Test Techn		Eric Lifsey		
		rder #: er Test:	MFS ERGO-	. c		Supervisor: Witness' N		Lisa Arndt none		
Lqui	p. Ona					•	anic.			
		ı	Radiated Em	issions Test	Results Data	a Sheet		Pa		of 1
	EUT Li	ne Voltage	: 4	.2 VDC		EUT Pov	ver Frequen	icy: (N/A	
A	ntenna	Orientation	on:	Horizor	ital	Frequ	ency Range	:	Above 1	GHz
		EUT N	/lode of Ope	eration:			Tra	nsmit 2480 I	MHz	
Mea	uency sured 1Hz)	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
495	9.27	3	305	1.55	Peak	55	51.029	74.0	-22.9	Pass
743	9.33	3	176	1.37	Peak	44.1	48.143	74.0	-25.8	Pass
	Prof Radia 1-18GH	essiona ted Emissi z Horizontal Po	l Testing ons, 3m Dis plarity Measured	J, EMI, Ir stance Emissions	ıc			— A — P △ F	Peak Limit Average Limit Pre-scan Emiss Peak Reading Average Readir Imit ETSITX	
	80 -									
(m/	70									
dBµ∖	60									
gth (50 -				-		+ + -	<u> </u>	and the second designation of the second sec	
Field Strength (dBμV/m)	40 - 30 -	hadificalizate distribution	Market		A STATE OF THE STA	aliku, pris Helik				
	t									
	20 IG Operato	or: Eric Lifsey Time -07:37:2	8 AM, Monday, S		Fred Tx 2480 MHz Battery Continuous unm	quency		10G EUT: ERGO-S Project Number Client: Hetronic		18G

> 1GHz Horizontal Antenna Polarity Measured Emissions

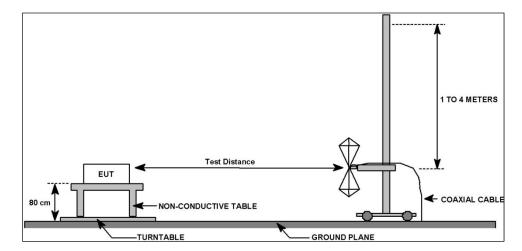




7.0 Radiated Spurious Emissions, Receive Mode

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.

	d·		Profess	sional Te	ctina EN						
	d٠			nomai re	sung, Er	vII, Inc.					
	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 FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated										
n accordan	ce with:	FCC Part 15.2 Emissions Lir		ederal Regulat	tions Part 47, S	Subpart B - Un	intentional Ra	adiators, Rad	iated		
Section:		15.109									
Test Date(s)	:	4/30/2018			EUT Serial	# :	None				
Customer:		Hetronic			EUT Part #:		None				
Project Nun	nber:	19668			Test Techni	ician:	Eric Lifsey				
urchase O	rder #:	0			Supervisor:		Lisa Arndt				
quip. Unde	er Test:	ERGO S MI	:s		Witness' N	ame:	None				
	R	Radiated En	nissions Test	Results Data	a Sheet		Pa	ge: 1	of 1		
EUT Line Voltage: 5 VDC					EUT Pow	ver Frequen	cy: (N/A			
Antenna	Orientatio	n:	Vertic	al	Freque	ency Range:	1	Above 1	GHz		
	EUT N	lode of Op	eration:			Receiv	e Center Ch	annel			
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		
Radiated Er	onal Testing, E nissions, 3m Distar ical Polarity Measured	nce					✓ Aver— Peak— Pre-s△ Peak	age Limit age Reading I. Limit I. Can Emissions I. Reading I. Idle RX_Limit			
Field Strangth (dBµV/m) 20 40 30	and a substitution of the	and the second second second			A Control of the Cont						
20 <mark>1</mark> 1G				Frequ	ency			10G	13G		
Operator: Eric	: Lifsey -05:50:17 PM, Monda		Mode: Idle Power: 3.6			F	EUT: ERGOS (MFS) Project Number: 19668-1 Dient: Hetronic	15			

> 1GHz Vertical Antenna Polarity Measured Emissions

										He	etro	nic – ER	GO-9
			Prof	ession	al Te	sting, El	VII, Inc.						
Test Metho	od:		•			ndard for Meti pment in the				dio-Noise	e Em	issions f	rom
n accorda	nce with:	FCC Part Emission		e of Federa	al Regula	tions Part 47,	Subpart B - Ur	nintenti	onal Ra	idiators, I	Radi	ated	
Section:		15.109											
Test Date(s	s):	4/30/2				EUT Serial #		None					
Customer:								None	f				
Project Number: 19668 Purchase Order #: 0						Test Techn Supervisor:		Eric Li Lisa A					
Equip. Und		ERGO S	MFS			Witness' N		None	iiiat				
. читрт отго			l Emissions	Test Resu	ılts Dat			- TONIC	Pag	ge:	1	of	1
EUT L	ine Voltage	:	5 \	/DC		EUT Pov	ver Frequen	ıcy:	0		/A		
Antenn	a Orientatio	on:	Но	rizontal		Frequ	ency Range	•		Abov	e 10	3Hz	
	EUT N	/lode of	Operation:					e Cen	ter Ch	annel			
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degree	on Heig	ht De	tector nction	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit (dBµ\		Margi (dB)		Test Re	sults
11289.33	3	290	1.18	3 F	eak	39.7	50.061	74.0		-23.9)	Pas	SS
11523.94	3	95	2.98		eak	39.7	50.741	74		-23.2		Pas	SS
11776.5	3	348			eak	40.3	50.383	74		-23.6		Pas	
12493.57 12682.13	3	297 62	3.33 2.11		eak eak	40.4	50.546 50.212	74.0		-23.4 -23.7		Pas	
12883.07	3	177			eak	39.8	49.935	74.0 74.0		-23. <i>1</i> -24.0		Pas Pas	
12003.07			2.5.	<u> </u>	Cuit	7 33.0	13.333	, <u>, , , , , , , , , , , , , , , , , , </u>	.0				
Radiated I	sional Testing, E Emissions, 3m Dista orizontal Polarity Meas	nce							✓ Avera — Peak — Pre-se △ Peak	age Limit age Reading Limit can Emissions Reading IdleRX Limit	i		
Ste ngth (dBµV/m) 20 20 20 20 20 20 20 20 20 2										_ _			
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20 1G					Frequ	encv				10G	i	13G	i
Operator: E Current Tim	ric Lifsey ne -05:50:17 PM, Monda	ay, April 30, 201	Po	ode: Idle/RX ower: 3.6 VDC, exter			ļ	EUT: ERGO S (Project Numb Client: Hetron	er: 19668-1	5			
		>	1GHz Hori	zontal An	itenna I	Polarity Mea	sured Emis	sions					

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 Equipme

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

		2016	RE_ClassB - Boresite+Wast_LowPRF_	030017.111	
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	НР	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
	1		Г		

9.2 Fundamental Power, Bandwidth, Duty Cycle, Band Edge

Asset #	Asset # Manufacturer Model		Description	Calibration Due	
2295	2295 Agilent		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
radiated Emissions	1 to 18 GHz	3 m	5.7

End of Report