FCC & ISED CANADA CERTIFICATION

TEST REPORT

for the

FREDERICK ENERGY PRODUCTS, LLC

FCC ID: QUI-FS-PAD

IC ID: 11625A-FSPAD

WLL REPORT# 16860-01 REV 2

Prepared for:

Frederick Energy Products, LLC

1769 Jeff Road

Huntsville, Alabama 35806

Prepared By:

Washington Laboratories, Ltd.

4840 Winchester Boulevard

Frederick, Maryland 21703

Testing Certificate AT-1448

FCC & ISED Canada Certification

Test Report

for the

Frederick Energy Products, LLC

Personal Alarm Device (PAD) or 1329196

FCC ID: QUI-FS-PAD

ISED ID: 11625A-FSPAD

February 17, 2021

WLL Report# 16860-01 Rev 2

Prepared by

Richard Quarcoo

Compliance Engineer

Reviewed by:

Samuel B. Violette
Vice President of Operations

Abstract

This report has been prepared on behalf of Frederick Energy Products, LLC to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.231 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Innovation, Science and Economic Development Canada. This Certification Test Report documents the test configuration and test results for the Frederick Energy Products, LLC Personal Alarm Device (PAD) or 1329196. The information provided on this report is only applicable to device herein documented.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 4840 Winchester Boulevard, Frederick MD 21703. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The ISED Canada number is 3035A for Washington Laboratories, Ltd. Site 1 and Site 2, respectively.

Washington Laboratories, Ltd. Has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

The Frederick Energy Products, LLC Personal Alarm Device (PAD) or 1329196 complies with the limits for an Intentional Radiator device under FCC Part 15.231 and RSS-210 of Innovation, Science and Economic Development Canada (ISED).

Revision History	Description of Change	Date
Rev 0	Initial Release	2/17/21
Rev 1	ACB Comments	5/7/21
Rev 2	ACB Comments	5/11/21

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Compliance Statement

The Frederick Energy Products, LLC Personal Alarm Device (PAD) or 1329196 complies with the limits for an Intentional Radiator device under FCC Part 15.231 and ISED Canada RSS-210.

TX Test Summary (Low Power Transmitter)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.231 (a)	RSS-210	Transmission Length	Pass
15.231 (b)	RSS-210	Field Strength Limits	Pass
15.231 (c)	RSS-210	20dB Bandwidth	Pass
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Pass

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance with ANSI C63.10. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Frederick Energy Products, LLC
Purchase Order Number:	9119
Quotation Number:	72358

1.4 Test and Support Personnel

Washington Laboratories, LTD	Richard Quarcoo
Customer Representative	Andrew Nichols

2 Equipment Under Test

2.1 EUT Identification & Description

Table 1: Device Summary

Manufacturer:	Frederick Energy Products, LLC
FCC ID:	QUI-FS-PAD
ISED ID:	11625A-FSPAD
Model:	Personal Alarm Device (PAD) or 1329196
FCC Rule Parts:	§15.231
ISED Rule Parts:	RSS-210
Modulation:	FM
Occupied Bandwidth (20dB):	194.2 kHz
FCC Emission Designator:	F1D
ISED Emissions Designators:	F1D
Number of Channels:	1
Power Output Level	Fixed
Antenna Connector	PCB
Antenna Type	Monopole
Interface Cables:	N/a
Maximum Data Rate	N/a
Power Source & Voltage:	(Typical) 3.7Vdc Lithium-Ion Battery; 120VAC @ 60Hz Charging Voltage

The Frederick Energy Products, LLC Personal Alarm Device (PAD) or 1329196 was configured as shown in Figure 1.

2.2 Test Configuration

The Personal Alarm Device (PAD) or 1329196 was configured in a stand-alone configuration.

Table 2: System Configuration List

Name / Description	Model Number	Part Number	Serial Number	Revision
Raymond Pad	100	*Not Listed	*Not Listed	N/a

Table 3: Support Equipment

Item	Model/Part Number	Serial Number
73kHz Generator	N/a	N/a

Figure 1: Test Configuration

2.3 Interface Cables

Table 4: Cable Configuration

Port Identification	Connector Type	Cable Length	Shielded (Y/N)	Termination Point
EUT Power	NA	<3m	N	Mains/EUT Port

2.4 Testing Algorithm

The Personal Alarm Device (PAD) or 1329196 was tested was tested ina continuous tramsmit operation.

2.5 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Frederick, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The ISED Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

2.6 Measurements

2.6.1 References

ANSI C63.2 (Jan-2016) Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 (Jan 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

ANSI C63.10 (Jun 2013) American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

2.7 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 (R2002) with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + ...}$$

Where uc = standard uncertainty
a, b, c,.. = individual uncertainty elements
Diva, b, c = the individual uncertainty element divisor based on the probability distribution
Divisor = 1.732 for rectangular distribution
Divisor = 2 for normal distribution
Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where:
U = expanded uncertainty
k = coverage factor
k ≤ 2 for 95% coverage (ANSI/NCSL Z540-2 Annex G)
uc = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 5 below.

Table 5: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR32, CISPR14, FCC Part 15	±2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR32, CISPR14, FCC Part 15	±4.55 dB

3 Test Equipment

Table 6: Test Equipment List

Test Name:	**Conducted Emissions Voltage**	**Test Date:**	**02/17/2021**
Asset #	Manufacturer/Model	Description	Cal. Due
00125	SOLAR 8028-50-TS-24-BNC	LISN	9/10/2021
00126	SOLAR 8028-50-TS-24-BNC	LISN	9/10/2021
00823	AGILENT N9010A	EXA SPECTRUM ANALYZER	5/7/2021
00053	HP 11947A	LIMITER TRANSIENT	2/18/2022
Test Name:	**Radiated Emissions**	**Test Date:**	**02/17/2021**
Asset #	Manufacturer/Model	Description	Cal. Due
00066	B&Z (HP) BZ-01002650-401545-282525	HF PRE-AMPLIFIER 1-26.5GHZ (MODIFIED)	6/19/2021
00559	HP 8447D	AMPLIFIER	5/18/2021
00644	SUNOL SCIENCES CORPORATION JB1 925-833-9936	BICONALOG ANTENNA	11/9/2022
00626	ARA DRG-118/A	ANTENNA HORN	9/1/2021
00823	AGILENT N9010A	EXA SPECTRUM ANALYZER	5/7/2021

4 Test Results

4.1 Transmission Cessation from Time-of-Release (FCC Part §15.231(a), RSS210 A.1.1 (b)

FCC Part 15.231 states that a periodic intentional radiator shall cease transmission within a five second period from release of automatic or manual keying of operation.

Testing was done to verify that the Raymond Pad stopped transmitting within the required time. A 5 second sweep was made, during which the control toggle was activated and released, and the time to transmission end was measured Figure 2 shows the indicated time from un-keying the device until cessation of transmission. The EUT complies with the requirements for this section. See Figure 2

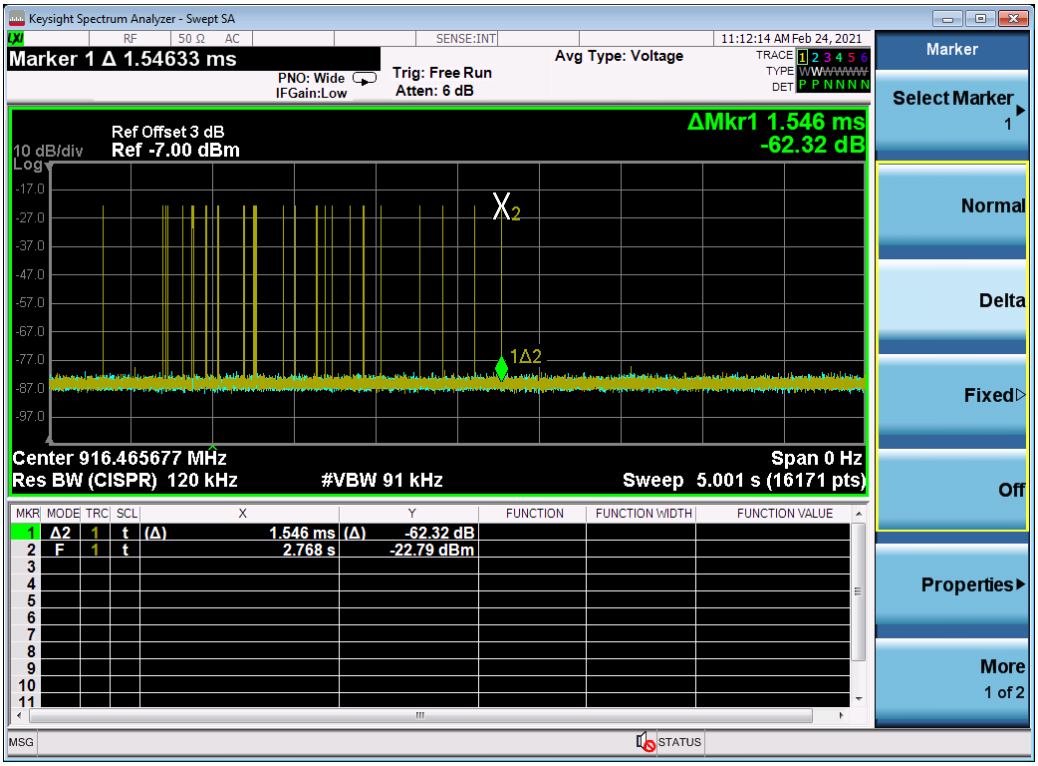


Figure 2 : Time Period: Release to Termination of Transmission

4.2 Occupied Bandwidth (FCC Part §2.1049 and RSS-Gen [4.6.1]):

According to FCC §15.231, periodic operation: c), the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier. Thus, the following are the data obtained.

Test Method: ANSI C63.10:2013

Test Procedure: Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer. Using the occupied bandwidth settings of the Spectrum Analyzer, at full modulation, the low channel OBW power at 99% was measured as shown in Figure 2. As required, the bandwidth limits are displayed at the points 20 dB down from the modulated carrier in Figure 2.

.

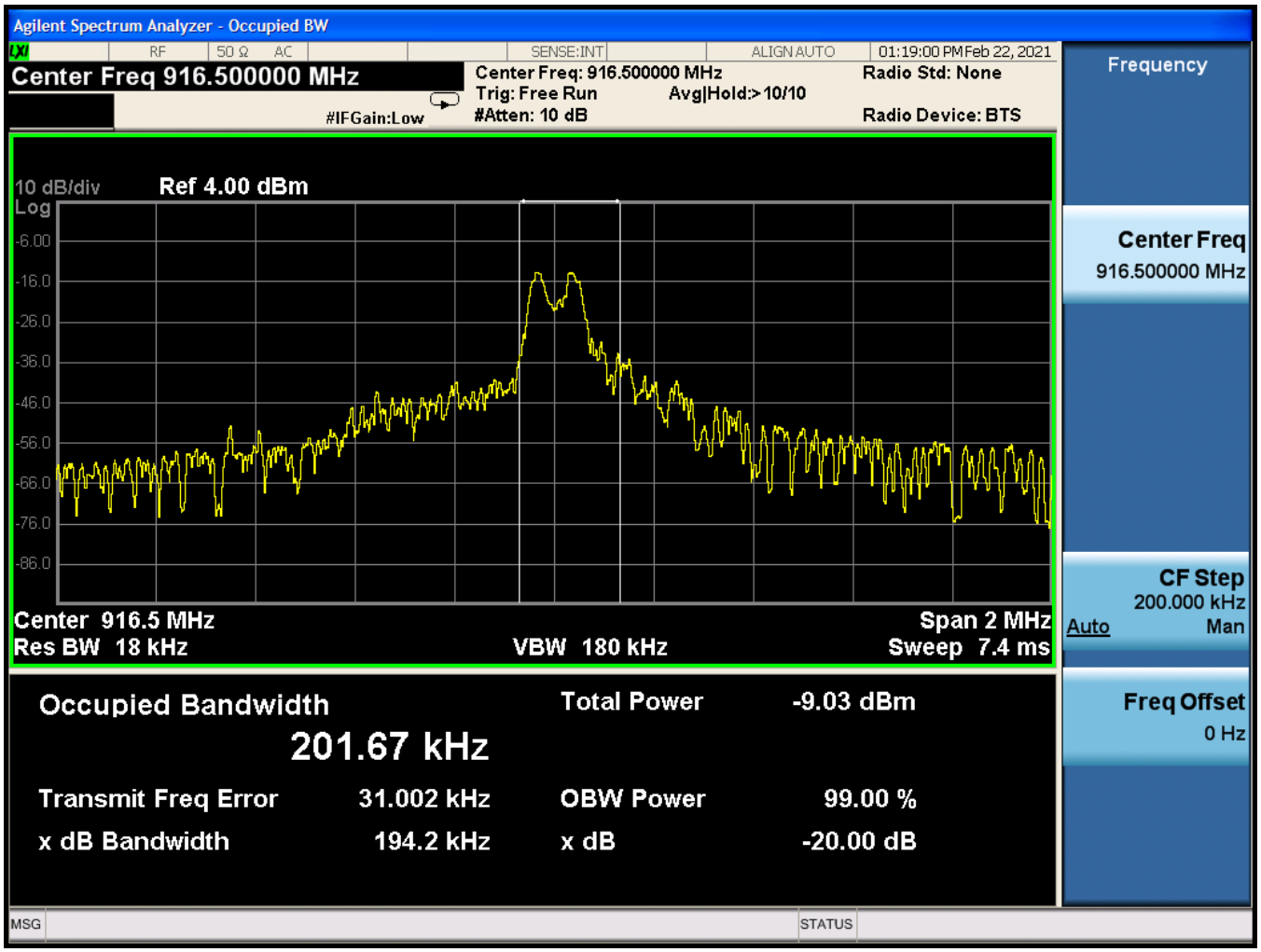
Table 7: Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
18 kHz	180 kHz

Table 8: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Result
(20dB) Fixed Channel: 916.48 MHz	194.2 kHz	4.58 MHz	Pass
(99%) Fixed Channel: 916.4 8MHz	201.67 kHz	N/a	N/a

Figure 3 : Occupied Bandwidth, Fixed Channel



4.3 Radiated Spurious Emissions: (FCC Part §15.231(b), RSS210 A.1.2)

4.3.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable.

Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2014. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. To account for the highest emission levels for all 3 orthogonal plane orientations of the EUT, the highest emission levels were initially determined for each orientation as specified above. Below are the radiated emissions test data for the EUT orientations with highest emission levels.

The emissions were measured using the following resolution bandwidths:

Table 9: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.), 1MHz (Peak)

Average measurements above 1GHz were made with the Spectrum analyzer set to the linear mode with a Video bandwidth of 10Hz, and the resultant reading mathematically converted to dBuV. Correct ion factors were then applied, and the resulting value was compared to the limit.

Table 10: Radiated Emission Test Data, Transmitter (Below 1GHz)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Detector Type
48.23	V	180.0	2.1	48.6	-16.5	40.1	100.0	-7.9	QP
53.18	V	90.0	1.9	41.7	-17.8	15.6	100.0	-16.1	QP
78.08	V	180.0	1.9	44.2	-17.0	22.9	100.0	-12.8	QP
129.90	V	180.0	2.6	28.0	-11.0	7.1	150.0	-26.5	QP
215.07	V	135.0	2.8	29.8	-13.8	6.3	150.0	-27.5	QP
300.04	V	90.0	2.4	34.0	-10.6	14.7	200.0	-22.7	QP
916.50	V	90.0	2.4	74.8	0.3	5713.2	12500.0	-6.8	QP
48.23	H	180.0	1.9	39.1	-16.5	13.6	100.0	-17.3	QP
53.18	H	270.0	1.8	37.3	-17.8	9.4	100.0	-20.6	QP
78.08	H	270.0	2.1	32.7	-17.0	6.1	100.0	-24.3	QP
129.90	H	180.0	1.8	30.3	-11.0	9.2	150.0	-24.3	QP
215.07	H	90.0	2.2	37.7	-13.8	15.6	150.0	-19.7	QP
300.04	H	180.0	2.7	3.0	-10.6	0.4	200.0	-53.6	QP
916.50	H	90.0	2.4	77.3	0.3	7627.5	12500.0	-4.3	QP

Notes:

1.For fundamental TX (916.48MHz), a Quasi-Peak Detector was used.

2. For fundamental TX (916.48MHz), All three orthogonal planes were evaluated; maximum fundamental amplitude was recorded for reported horizontal and vertical polarities.

Table 11: Radiated Emission Test Data, Transmitter (Above 1GHz)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Detector Type
1833.00	V	90.0	2.7	47.4	-3.9	149.6	5000.0	-30.5	PK
1833.00	V	180.0	2.7	32.0	-3.9	25.5	500.0	-25.9	AVG
2749.50	V	180.0	2.7	46.2	0.5	216.5	5000.0	-27.3	PK
2749.50	V	180.0	2.7	31.7	0.5	40.8	500.0	-21.8	AVG
3666.00	V	180.0	2.4	43.1	2.8	197.7	5000.0	-28.1	PK
3666.00	V	180.0	2.4	30.4	2.8	45.7	500.0	-20.8	AVG
4582.50	V	180.0	2.4	48.5	5.8	522.3	5000.0	-19.6	PK
4582.50	V	180.0	2.4	30.9	5.8	68.5	500.0	-17.3	AVG
5499.00	V	180.0	2.4	42.3	8.5	346.7	5000.0	-23.2	PK
5499.00	V	180.0	2.4	30.2	8.5	86.6	500.0	-15.2	AVG
6415.50	V	180.0	2.4	43.7	9.5	454.4	5000.0	-20.8	PK
6415.50	V	180.0	2.4	30.6	9.5	100.9	500.0	-13.9	AVG
1833.00	H	90.0	2.4	44.5	-3.9	106.6	5000.0	-33.4	PK
1833.00	H	180.0	2.4	32.2	-3.9	26.0	500.0	-25.7	AVG
2749.50	H	180.0	2.2	46.6	0.5	225.9	5000.0	-26.9	PK
2749.50	H	135.0	2.2	31.8	0.5	41.1	500.0	-21.7	AVG
3666.00	H	180.0	2.2	45.2	2.8	251.5	5000.0	-26.0	PK
3666.00	H	90.0	2.2	30.6	2.8	46.7	500.0	-20.6	AVG
4582.50	H	180.0	2.2	49.5	5.8	584.7	5000.0	-18.6	PK
4582.50	H	135.0	2.2	31.3	5.8	72.3	500.0	-16.8	AVG
5499.00	H	180.0	2.2	49.5	8.5	796.0	5000.0	-16.0	PK
5499.00	H	90.0	2.2	31.1	8.5	96.1	500.0	-14.3	AVG
6415.50	H	180.0	2.2	43.1	9.5	425.0	5000.0	-21.4	PK
6415.50	H	90.0	2.2	30.6	9.5	101.0	500.0	-13.9	AVG

4.3.2 AC Conducted Emissions

4.3.3 Requirements

Test Arrangement: Tabletop

Compliance Standard: FCC Part 15 (10/2014), Class B

FCC Compliance Limits		
Frequency	**Quasi-peak**	**Average**
0.15 - 0.5MHz	66 to 56dBµV	56 to 46dBµV
0.5 - 5MHz	56dBµV	46dBµV
5 - 30MHz	60dBµV	50dBµV

4.3.4 Test Procedure

The requirements of FCC Part 15 and RSS-Gen call for the EUT to be placed on an 80 cm high 1 X 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 µH Line Impedance Stabilization Network bonded to a 3 X 2-meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth. For average measurements, the post-detector filter was set to 10 Hz.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

4.3.5 Test Data

The EUT complied with the Class B Conducted Emissions requirements. Table 14 provides the test results for phase and neutral line power line conducted emissions.

4.3.6 Conducted Data Reduction and Reporting

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed. The Conducted emissions level to be compared to the FCC limit is calculated as shown in the following example.

Example:

Spectrum Analyzer Voltage:	VdBµV
LISN Correction Factor:	LISN dB
Cable Correction Factor:	CF dB
Voltage:	EdBµV = V dBµV + LISN dB + CF dB

4.3.7 Test Data

The EUT complied with the Class B Conducted Emissions requirements. This system typically runs on a battery when in operation. The following table provides the test results for phase and neutral line power line conducted emissions when the unit is in a charging state.

Conducted Emissions was tested while the EUT was transmitting.

Table 12 : Conducted Emission Test Data, Neutral and Phase

NEUTRAL										
Frequency (MHz)	**Level QP (dBµV)**	**Level AVG (dBµV)**	**Cable Loss (dB)**	**LISN Corr (dB)**	**Level QP Corr (dBµV)**	**Level Corr Avg (dBµV)**	**Limit QP (dBµV)**	**Limit AVG (dBµV)**	**Margin QP (dB)**	**Margin AVG (dB)**
0.156	50.0	25.7	10.2	0.8	61.0	36.6	65.7	55.7	-4.7	-19.0
0.314	31.1	20.0	10.2	0.8	42.0	30.9	59.9	49.9	-17.8	-18.9
0.417	34.2	18.5	10.2	0.8	45.1	29.5	57.5	47.5	-12.4	-18.0
0.524	31.4	21.9	10.2	0.8	42.4	32.9	56.0	46.0	-13.6	-13.1
0.628	26.8	19.3	10.3	0.8	37.8	30.3	56.0	46.0	-18.2	-15.7
0.730	22.2	14.6	10.3	0.8	33.2	25.7	56.0	46.0	-22.8	-20.3
0.935	22.2	14.2	10.3	0.7	33.2	25.2	56.0	46.0	-22.8	-20.8

PHASE										
Frequency (MHz)	**Level QP (dBµV)**	**Level AVG (dBµV)**	**Cable Loss (dB)**	**LISN Corr (dB)**	**Level QP Corr (dBµV)**	**Level Corr Avg (dBµV)**	**Limit QP (dBµV)**	**Limit AVG (dBµV)**	**Margin QP (dB)**	**Margin AVG (dB)**
0.158	46.9	25.0	10.2	1.5	58.6	36.7	65.6	55.6	-7.0	-18.9
0.260	27.3	20.6	10.2	1.1	38.6	31.8	61.4	51.4	-22.8	-19.6
0.314	28.8	21.7	10.2	1.0	39.9	32.8	59.9	49.9	-19.9	-17.0
0.417	21.9	14.7	10.2	1.0	33.0	25.9	57.5	47.5	-24.5	-21.7
0.522	25.1	17.3	10.2	0.9	36.2	28.4	56.0	46.0	-19.8	-17.6
0.629	22.4	19.9	10.3	0.9	33.6	31.1	56.0	46.0	-22.4	-14.9
0.733	19.1	12.5	10.3	0.9	30.3	23.7	56.0	46.0	-25.7	-22.3
0.941	17.0	10.6	10.3	0.9	28.2	21.8	56.0	46.0	-27.8	-24.2