LSR
a Laird Business
ACCREDITED
TESTING CERT #1255.01
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TEST REPORT #: TR 316054A
LSR Job #: C- 2401

Compliance Testing of:
RM191-SM

Test Date(s):
2/17/16 – 3/18/16

Prepared For:
N. Zach Hogya
Laird
11160 Thompson Ave
Lenexa, KS 66219

CFR 47 15.249
RSS 210 Annex 2.9

This Test Report is issued under the Authority of:
Shane Dock, EMC Engineer

Signature: Shane Dock Date: 4-8-16

Test Report Reviewed by:	Project Engineer:
Adam Alger, Quality Systems Engineer	Shane Dock, EMC Engineer.
Signature: Adam O Alger Date: 4-7-16	Signature: Shane Dock Date: 4-8-16

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EXHIBIT 1. INTRODUCTION

1.1 - Scope

References:	FCC Part 15, Subpart C, Section 15.249 RSS 210 issue 8 Annex 2, Section A2.9
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15. IC : Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-Power License-Exempt Transmitters.
Test Procedures:	ANSI C63.10
Environmental Classification:	Residential

1.2 – Normative References

Publication	Year	Title
FCC CFR Parts 0-15	2016	Code of Federal Regulations – Telecommunications
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.
RSS-210 Issue 4 Annex 8	2010	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I Equipment
ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
RSS-GEN Issue 4	2014	General Requirements and Information for the Certification of Radio Apparatus

1.3 - LS Research, LLC Test Facility

TESTING CERT #1255.01

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) as conforming to ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted.

1.4 – Location of Testing

All testing was performed at the following location utilizing the facilities listed below, unless otherwise noted.

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA,

List of Facilities Located at LS Research, LLC:

Semi-Anechoic Chamber

1.5 – Test Equipment Utilized

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated by a calibration laboratory accredited to the requirements of ISO/IEC 17025, and traceable to the SI standard.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 – Client Information

Manufacturer Name:	Laird Technologies, Inc.
Address:	11160 Thompson Ave Lenexa, KS 66219
Contact Name:	N. Zach Hogya

2.2 - Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	RM191-SM
Model Number:	RM191-SM
Serial Number:	LEN DVT 20 (Conducted Testing) LEN DVT 1 (Radiated Testing) LEN DVT 13 (Colocation Testing)

2.3 - Associated Antenna Description

The antenna included on the product is a built-in AT5020 monolithic chip antenna with a gain of 0 dBi.

2.4 - EUT'S Technical Specifications

EUT Frequency Range (in MHz)	2402MHz to 2480MHz
Field Strength at 3m (dBµV/m)	☐ *Conducted Measurement* ☒ *EIRP*
Minimum:	50.3 dBuV at 2402 MHz
Maximum:	52.0 dBuV at 2480 MHz
Occupied Bandwidth	99%: 1.071 MHz
Type of Modulation	GFSK
Emission Designator	1M07F1D
Transmitter Spurious (worst case) at 3 meters	34.9 dBµV/m at 2514.35 MHz (Measured with an average detector)
Stepped (Y/N)	No
Step Value:	N/A
Frequency Tolerance %, Hz, ppm	Better than 100ppm
Microprocessor Model # (if applicable)	nRF51822-QFAC-R/T (Nordic BLE chip)
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	Chip
Gain	0
EUT will be operated under FCC Rule Part(s)	*Title 47 part 15.249*
EUT will be operated under RSS Rule Part(s)	*RSS 210, Annex 2*
Modular Filing	☒ *Yes* ☐ *No*

2.5 - Product Description

The RM191-SM module is designed to enable OEMs to add a long range LoRa radio link as well as central role Bluetooth Low Energy (BLE) to small, portable, power-conscious devices. The RM191-SM module is enabled with Laird's smart BASIC, an event-driven programming language that enables OEMs to make their product development quicker and simpler, significantly reducing time to market. smartBASIC enables customers to develop a complete embedded application inside the compact RM191 hardware, connecting to a wide array of external sensors via its I2C, SPI, UART, ADC or GPIO interfaces. The module is based on the world-leading Nordic Semiconductor nRF51822 (BLE) and Semtech Sx1272 (LoRa) chipsets, the RM191-SM module provides ultra-low power consumption with outstanding wireless range using the LoRa radio link and local BLE connections. "Whisper Mode" is a BLE mode that is characterized by an extremely low output power, and can be powered by 1.8 – 3.6 VDC.

The unit has the capability to operate on 3 channels, controllable via a proprietary software provided by the manufacturer (UWTerminalX v1.01) and was run continuously with a modulated transmission. For this EUT:
Low Channel: 2402 MHz
Mid Channel: 2440 MHz
High Channel: 2480 MHz

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 - Climate Test Conditions

Temperature:	70 -74° F
Humidity:	30-42%
Pressure:	728-741mmHg

3.2 - Applicability & Summary Of EMC Emission Test Results

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
FCC : 15.207 IC : RSS GEN sect. 8.8	Power Line Conducted Emissions Measurements	Yes
FCC: 2.202 IC : RSS GEN Section 6.6	99% Bandwidth	Yes
FCC : 15.249(a) – (c) IC : RSS 210 A2.9 (a)	Field Strength	Yes
FCC : 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes
FCC :15.249 (d) IC : RSS 210 A2.9 (b)	Spurious Emissions	Yes
FCC : 15.249(a) – (c) IC : RSS 210 A2.9 (a)	Harmonics	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices (RSS GEN) and the associated Radio Receiver has also been tested and found to comply with Part 15, Subpart B – Radio Receivers (RSS GEN). The Receiver Test Report is available upon request.		

3.3 - Modifications Incorporated In The EUT For Compliance Purposes

☒ None ☐ Yes (explain below)

3.4 - Deviations & Exclusions From Test Specifications

☒ None ☐ Yes (explain below)

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.249, and Industry Canada RSS-210, Issue 8 (2010), Annex 2.

Note: If some emissions are seen to be within 3 dB of their respective limits; as these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST: FUNDAMENTAL, HARMONICS AND SPURIOUS EMISSIONS

5.1 - Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.4-2014. The EUT was placed on an 80cm (150cm above 1GHz) high non-conductive pedestal, centered on a flush mounted turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The unit has the capability to operate on 3 channels, controllable via a proprietary software provided by the manufacturer (UWTerminalX v1.01) and was run continuously with a modulated transmission.

The applicable limits apply at a 3 meter distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: low (2402MHz), middle (2440MHz) and high (2480MHz) to comply with FCC Part 15.31(m).

5.2 - Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 25000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 18 GHz and a standard gain horn antenna used between 18 GHz to 25 GHz. The maximum radiated RF emissions between 30MHz to 25 GHz were found by raising and lowering the sense antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities. For measurements above 1GHz, a tilting gear was used to maintain the EUT in the cone of radiation, and absorbers were placed on the ground plane.

The EUT was positioned in 3 orthogonal orientations.

5.3 - Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at a calibration laboratory accredited to ISO 17025, and are traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 3 MHz, with average measurements using 10 Hz).

5.4 - Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.249 and Canada RSS-210, Issue 8 (2010), Annex 2.9. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 - Calculation of Radiated Emissions Limits and reported data.

The limits below are obtained from Title 47 CFR, Part 15.249 (a) (RSS 210 A2.9 (a)), for radiated emissions measurements. These limits were applied to the fundamental and harmonics:

Frequency (MHz)	Fundamental Limit mV/m	Fundamental Limit (dBμV/m)	Harmonic Limit μV/m	Harmonic Limit (dBμV/m)
902-928	50	94.0	500	54.0
2400-2483.5	50	94.0	500	54.0
5725-5875	50	94.0	500	54.0
24000-24250	250	107.9	2500	67.9

The limits below are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any emissions outside the specified bands:

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

Reported data:

For both fundamental and spurious emissions measurement, the data reported includes all necessary correction factors. These correction factors are loaded onto the EMI receiver when measurements are performed.

Reported Measurement data = Raw receiver measurement (dBμV/m) + Antenna correction Factor + Cable factor (dB) + Miscellaneous factors when applicable (dB) – amplification factor when applicable (dB).

Generic example of reported data at 200 MHz:

Reported Measurement data = 18.2 (raw receiver measurement) + 15.8 (antenna factor) + 1.45 (cable factor) = 35.45 (dBμV/m).

5.6 - Radiated Emissions Test Data Chart

Manufacturer:	Laird Technologies					
Date(s) of Test:	2/17/16 – 3/17/16					
Project Engineer(s):	Shane Dock					
Test Engineer(s):	Shane Dock					
Voltage:	3.6V and 1.8V (DC)					
Operation Mode:	Continuously transmitting and modulated.					
Environmental Conditions in the Lab:	Temperature: 71° F Relative Humidity: 30%					
EUT Power:		Single Phase 120VAC		3 Phase ___VAC		
		Battery	X	Other: 3.6/1.8 VDC		
EUT Placement:	X	80cm non-conductive pedestal	X	150cm non-conductive pedestal		
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

Fundamental Emissions

Channel (MHz)	Antenna	EUT	Height (cm)	Azimuth (°)	Peak Field strength (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Average Field strength (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2402.0	Horizontal	Vertical	300.0	278	66.5	114.0	47.5	50.3	94.0	43.7
2440.0	Horizontal	Vertical	208.0	371	65.5	114.0	48.6	51.4	94.0	42.6
2480.0	Horizontal	Vertical	257.8	271	66.4	114.0	47.6	52.0	94.0	42.0

Notes:

1. Refer to exhibit 5.5 on explanation of how data is reported.

Harmonic Emissions

No harmonic emissions were observed above the system noise floor. Emissions seen below are all noise floor measurements.

Channel	Frequency (MHz)	Antenna Polarization	Peak (dBuV)	P Limit (dBuV)	P Margin (dBuV)	Average (dBuV)	A Limit (dBuV)	A Margin (dBuV)
Low	4804	H	46.22	74.00	27.78	33.88	54.00	20.12
		V	45.98	74.00	28.02	33.87	54.00	20.13
Mid	4880	H	46.48	74.00	27.52	33.71	54.00	20.29
		V	46.42	74.00	27.58	33.70	54.00	20.30
High	4960	H	45.12	74.00	28.88	33.22	54.00	20.78
		V	45.83	74.00	28.17	33.23	54.00	20.77

Spurious Emissions

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
2514.35	100.6	344.3	59.8	34.9	54.0	19.1	H	F
2584.39	100.6	345.8	56.8	34.5	54.0	19.5	H	F

Notes:

1. H: Horizontal, V: Vertical, S: Side, F: Flat.
2. Refer to exhibit 5.5 on explanation of how data is reported

Band Edge Emissions

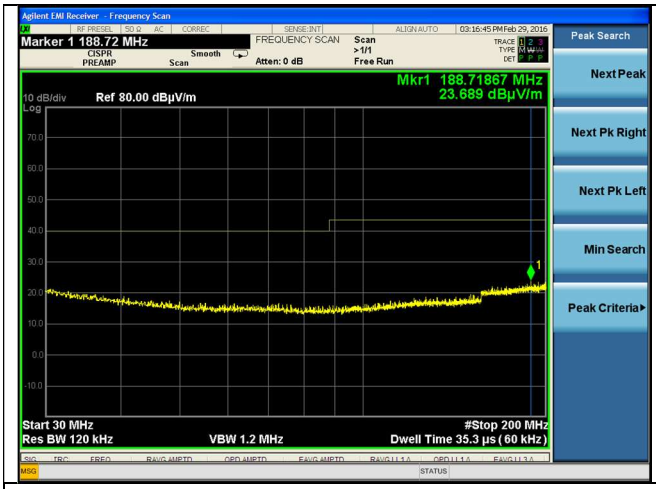
Frequency (MHz)	Peak Field strength (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
2391.6	57.2	74.0	16.8
2483.6	51.2	74.0	22.8

Frequency (MHz)	Average Field strength (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2391.2	35.0	54.0	19.0
2499.9	35.1	54.0	18.9

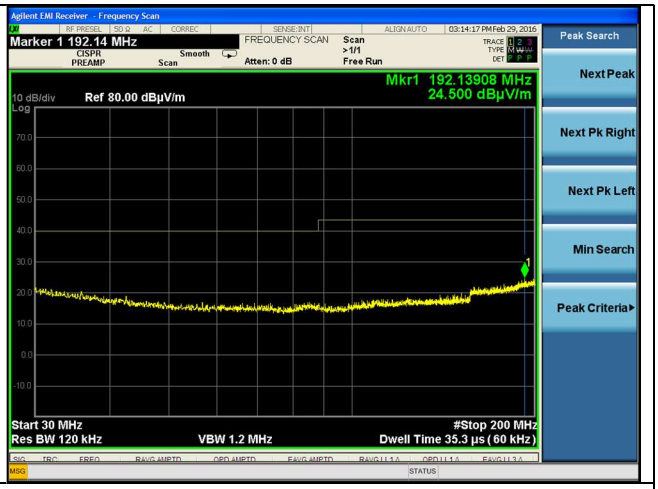
5.7 – Screen Captures.

The screen captures below are those using the Peak detector of the analyzer.

30 to 200 MHz, 3m distance.



Horizontal



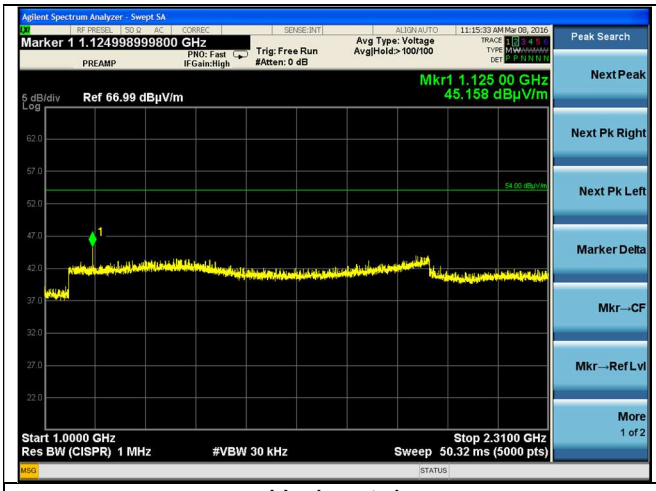
Vertical

200 to 1000 MHz, 3m distance.

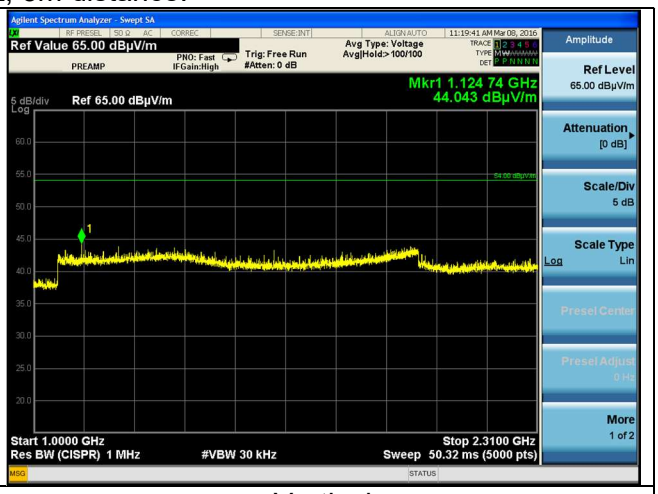
Horizontal

Vertical

1000 to 2310 MHz, 3m distance.



Horizontal



Vertical

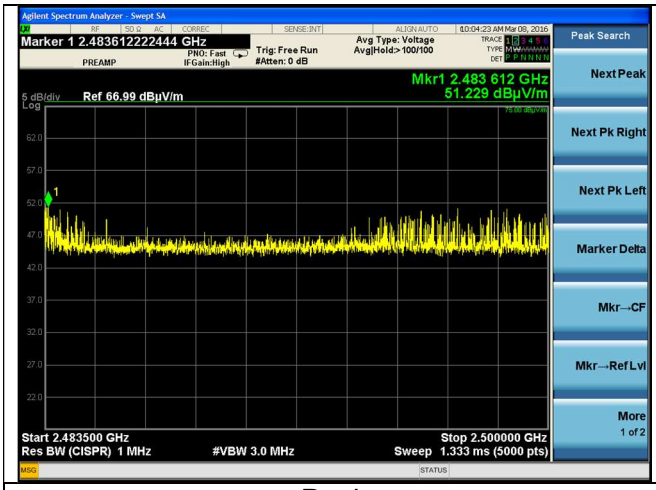
Note: Emission at 1.125 GHz is not a function of the EUT.

2310 to 2400 MHz, 3m distance.

Peak

Average

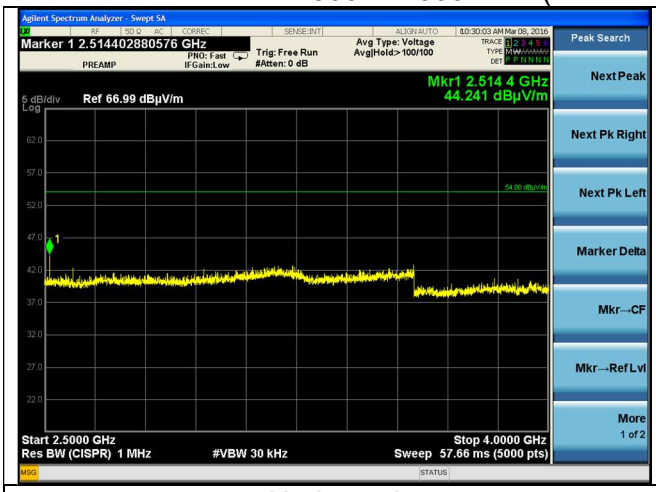
2483.5 to 2500 MHz, 3m distance.



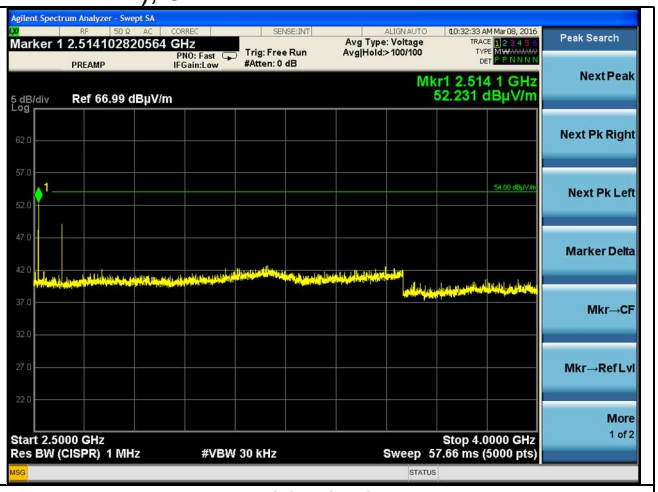
Peak

Average

2500 to 4000 MHz (Reduced Bandwidth), 3m distance.



Horizontal



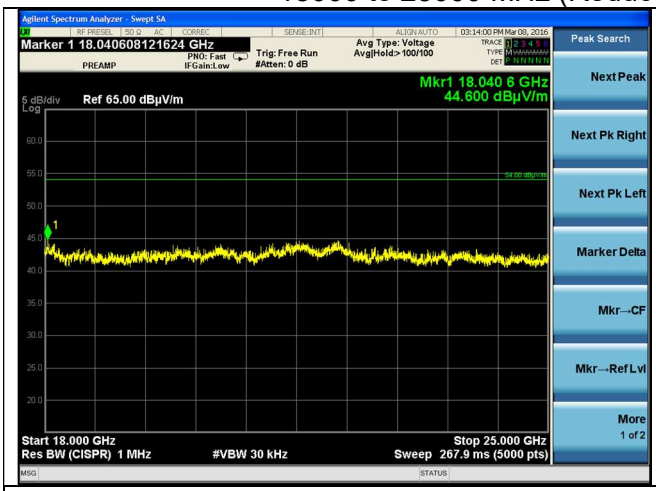
Vertical

4000 to 18000 MHz (Reduced Bandwidth), 3m distance.

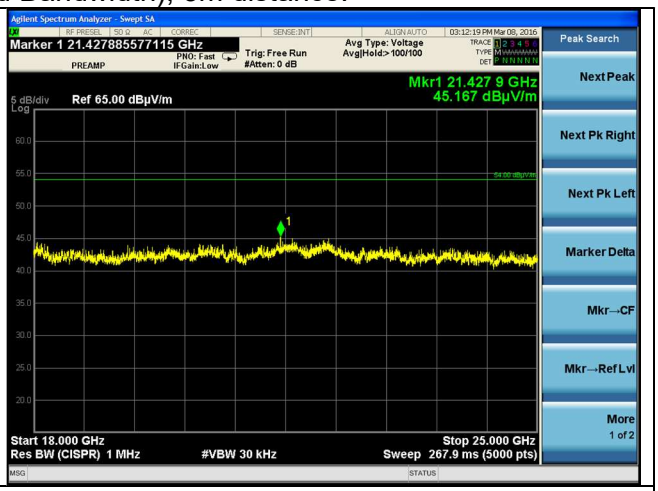
Horizontal

Vertical

18000 to 25000 MHz (Reduced Bandwidth), 3m distance.



Horizontal



Vertical

EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4 and with Title 47 CFR, FCC Part 15, Industry Canada RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), Line Impedance Stabilization Network (LISN). The AC power supply was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a and then to EMI receiver System. The LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

6.2 Test Procedure

The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1-1, Section 6, Table 8, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

6.3 Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. All cables are calibrated and checked periodically for conformance. The emissions are measured on the EMI System, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

6.4 Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 and RSS GEN for Conducted Emissions. See the Data Charts and Graphs for more details of the test results.

-

6.5 Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBµV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

6.6 CONDUCTED EMISSIONS TEST DATA CHART

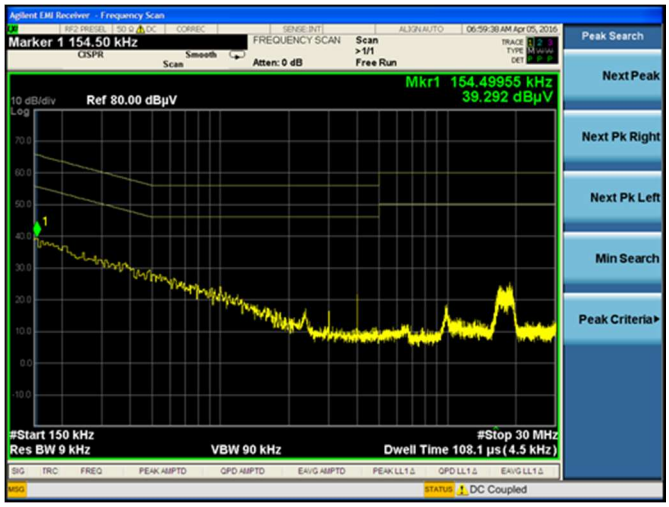
Manufacturer:	Laird Technologies					
Date(s) of Test:	3/10/16 – 3/11/16					
Project Engineer:	Shane Dock					
Test Engineer:	Shane Dock					
Voltage:	3.6/1.8 VDC					
Operation Mode:	Continuously Transmitting, Modulated					
Environmental Conditions in the Lab:	Temperature: 73° F Relative Humidity: 40 %					
Test Location:	X	AC Mains Test area				Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:		Peak	X	Quasi-Peak	X	Average

Line	Frequency (MHz)	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
1	0.154	36.6	65.8	29.2	17.9	55.8	37.9
1	0.208	32.6	63.3	30.7	15.3	53.3	38.0
1	0.379	27.9	58.3	30.4	13.2	48.3	35.1
2	0.150	36.9	66.0	29.1	18.2	56.0	37.8
2	0.199	33.2	63.6	30.4	15.5	53.6	38.1
2	0.334	28.6	59.3	30.7	13.6	49.3	35.7

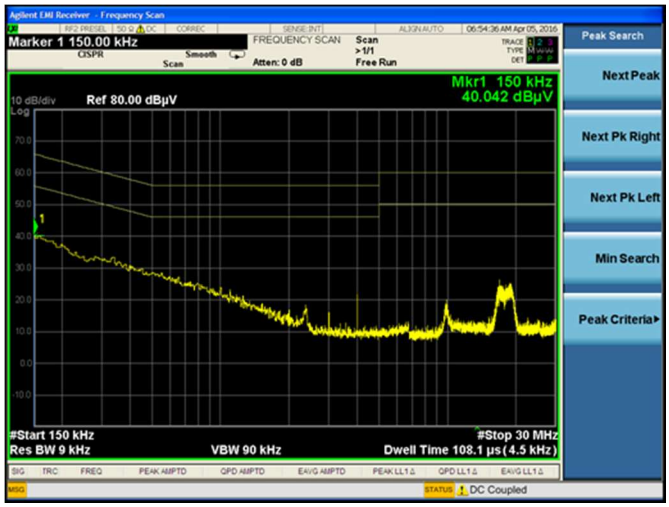
Notes:
1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

6.7 Screen Captures – Conducted Emissions Test

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.107 and RSS GEN.



Line 1



Line 2

EXHIBIT 7. 99% BANDWIDTH

Test Engineer(s): Shane Dock

7.1 - Method of Measurements

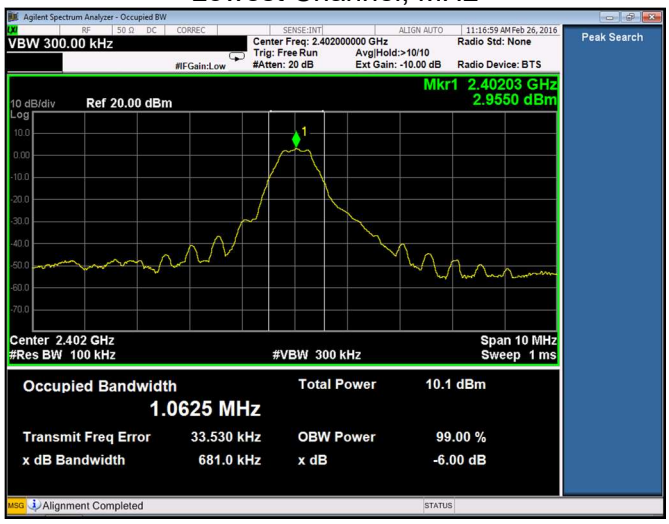
ANSI C63.10 2013 Section 11.8

7.2 - Test Data

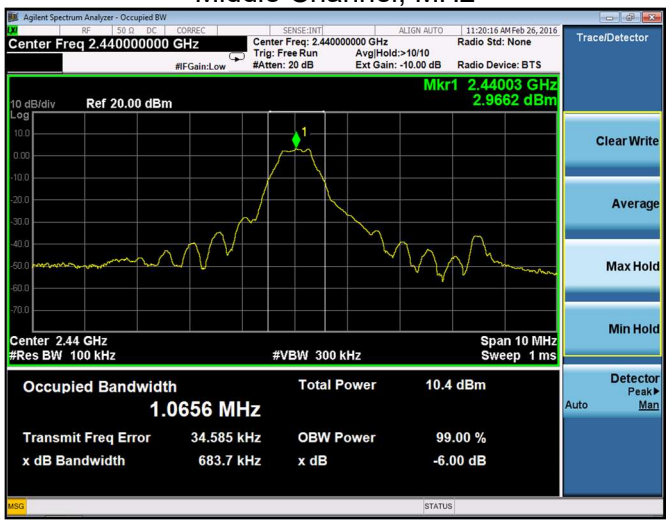
Channel (MHz)	99% Bandwidth (MHz)
2402.0	1.063
2440.0	1.066
2480.0	1.071

7.3 – Screen Captures

Lowest Channel, MHz



Middle Channel, MHz



Highest Channel, MHz

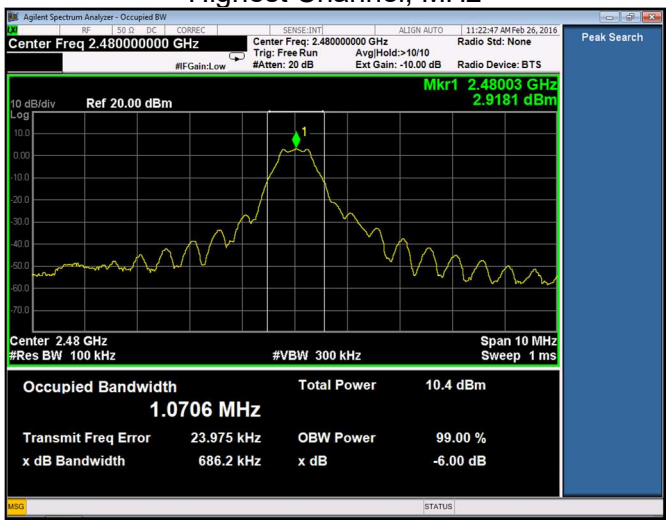


EXHIBIT 8. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

Test Engineer(s): Shane Dock

The power and frequency stability of the device was examined as a function of the input voltage available to the EUT using the procedure described in ANSI 63.10, section 6.8. A Spectrum Analyzer was used to measure the power and frequency at the appropriate frequency markers. Power was supplied by an external bench-type DC power supply and was varied between 1.8VDC to 3.6VDC. This range was specified by the manufacturer.

	1.8 VDC	3.3 VDC	3.6 VDC	
Channel	Frequency (Hz)	Frequency (Hz)	Frequency (Hz)	Frequency Drift (Hz)
Channel 2	2402032080	2402031750	2402030420	1660
Channel 40	2440029920	2440025920	2440029750	4000
Channel 80	2480032920	2480036420	2480030250	6170

The EUT has better than 100 PPM frequency stability.

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle.

APPENDIX A – Test Equipment List

LSR
a Laird Business

Date : 18-Feb-2016 Type Test : Conducted Emissions Job # : C-2401

Prepared By: Shane Customer : Laird Quote #: 316054

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/6/2015	5/6/2016	Active Calibration
2	EE 960162	LISN - 15A	COM-POWER	LI-215A	191969	7/24/2015	7/24/2016	Active Calibration
3	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	2/24/2016	2/24/2017	Active Calibration

LSR
a Laird Business

Date : 18-Feb-2016 Type Test : Occupied Bandwidth Job # : C-2401

Prepared By: Shane Dock Customer : Laird Quote #: 316054

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	Verification	Verification	System
2	EE 960087	44GHz EXA Spectrum Analyzer	Agilent	N9010A	MY53400296	12/18/2015	12/18/2016	Active Calibration

LSR
a Laird Business

Date : 18-Feb-2016 Type Test : Radiated Emissions Job # : C-2401

Prepared By: Shane Dock Customer : Laird Quote #: 316054

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	2/24/2016	2/24/2017	Active Calibration
2	AA 960005	Biconical Antenna	EMCO	93110B	9601-2280	1/14/2016	1/14/2017	Active Calibration
3	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	8/18/2015	8/18/2016	Active Calibration
4	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/6/2015	5/6/2016	Active Calibration
5	AA 960153	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-04	4/15/2015	4/15/2016	Active Calibration
6	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/26/2015	6/26/2017	Active Calibration
7	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	Verification	Verification	System
8	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	8/4/2015	8/4/2016	Active Calibration
9	EE 960160	0.8-21GHz LNA	Mini-Circuits	ZVA-213X-S+	977711030	8/4/2015	8/4/2016	Active Calibration
10	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	2/4/2016	2/4/2017	Active Calibration
11	AA 960162	EM Series Cable	MegaPhase	EM26-S1S1-120	12024301 001	6/30/2015	6/30/2016	Active Calibration
12	AA 960153	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-04	4/15/2015	4/15/2016	Active Calibration
13	RENTAL	Horn Antenna 18-40GHz	AH System	SAS-574	193	11/30/2015	11/30/2016	Active Calibration

Project Engineer: Shane Dock Quality Assurance: Adam Alger

APPENDIX B – Test Standards: CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2014		
ANSI C63.10	2013		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2016		
RSS GEN	2014		
RSS 210	2010		

APPENDIX C - Uncertainty Statement

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	*Particular Configuration*	*Uncertainty Values*
Radiated Emissions	*3 – Meter chamber, Biconical Antenna*	*4.82 dB*
Radiated Emissions	*3-Meter Chamber, Log Periodic Antenna*	*4.88 dB*
Radiated Emissions	*3-Meter Chamber, Horn Antenna*	*4.85 dB*
Radiated Emissions	*10-Meter OATS, Biconical Antenna*	*4.32 dB*
Radiated Emissions	*10-Meter OATS, Log Periodic Antenna*	*3.63 dB*
Absolute Conducted Emissions	*Agilent PSA/ESA Series*	*1.38 dB*
AC Line Conducted Emissions	*Shielded Room/EMCO LISN*	*3.20 dB*
Temperature/Humidity	*Thermo-hygrometer*	*0.64° / 2.88 %RH*