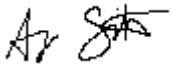
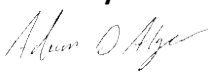
Test Report TR3609D

Equipment Under Test:	Latch PCB
Requirement(s):	FCC 15.203
Test Date(s):	4/10/2023 – 12/4/2023
Prepared for:	Eberhard Attn: Rob Pliml 21944 Drake Road Strongsville, OH 44149

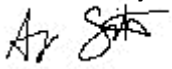
Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 12/11/2023

Report Reviewed by: Adam Alger, Laboratory Manager

Signature:  Date: 12/11/2023

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 12/5/2023

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Laird Connectivity Test Services in Review

The Laird Connectivity LLC laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

Certificate #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein unless otherwise noted

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Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers

Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

1 TEST REPORT SUMMARY

During **April 10th, 2023 to December 4th, 2023** the Equipment Under Test (EUT), **Latch PCB**, as provided by **Eberhard** was tested to the following requirements:

Antenna Requirements

Requirements	Description	Method	Result
FCC 15.203	Antenna Requirement	ANSI C63.10	Pass

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Eberhard
Contact Person	Rob Pliml
Address	21944 Drake Road Strongsville, OH 44149

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Latch PCB
Model Number	17240-25
Serial Number	Engineering Sample
FCC ID	2BATJ-1724058

2.2 Product Description

Latch PCB

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Additional Information

Device programmed via USB micro to UART board to UART serial connection to PCB utilizing “YAT” terminal emulation software version 2.5.0. Device powered via 12V Battery. Device uses Bluetooth Low Energy with 1M data rate. Power Setting 2 used for final compliance.

2.6 Additional Information

Tested device to compare radiated field strength levels against conducted output power measurements to ascertain antenna gain. Antenna is a PCB trace antenna. Peak Gain found to be 3.2 dBi.

3 REFERENCES

Publication	Edition	Date
FCC eCFR	-	2023
ANSI C63.10	-	2015

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References
CISPR 16-4-1
CISPR 16-4-2
CISPR 32
ANSI C63.23
A2LA P103
A2LA P103c
ETSI TR 100-028

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

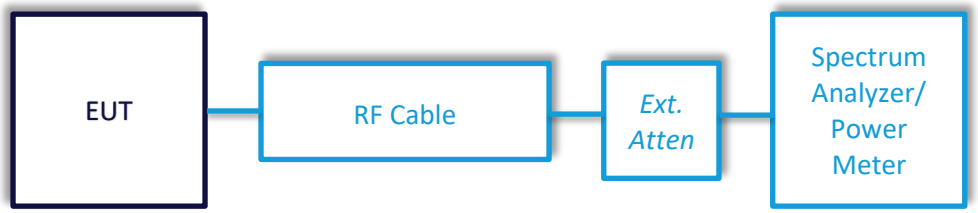
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	3/22/2023	3/22/2024	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/11/2023	4/11/2024	Active Calibration
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/13/2023	4/13/2024	Active Calibration

5.1.1 Antenna Port Conducted Emissions – Max Conducted Output Power

Operator	Anthony Smith	**QA**	Adam Alger
Temperature	21.9, 22.5, 22.9°C	**R.H. %**	31.8, 34.3, 39.9%
Test Date	4/10/2023, 4/12/2023, 4/13/2023	**Location**	Chamber 3
Requirement	FCC: 15.247 (b)(3)	**Method**	ANSI C63.10 §11.9

Limits: <30 dBm

Test Parameters

Frequency	2402, 2440, 2480 MHz	**Setup**	Conducted
RBW	3 MHz	**VBW**	50 MHz
Detector(s)	Max Peak Hold	**Sweep Time**	Auto

EUT Parameters

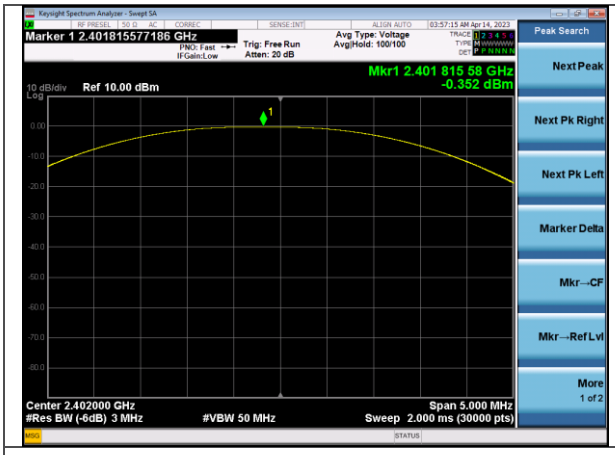
Input Power	12VDC (Battery)	**Mode**	BLE Transmit
Frequency	2402, 2440, 2480 MHz	**Channel**	37, 17, 39
Data Rate / Modulation	BLE 1Mbps	**Transmit Power Setting**	2

Data

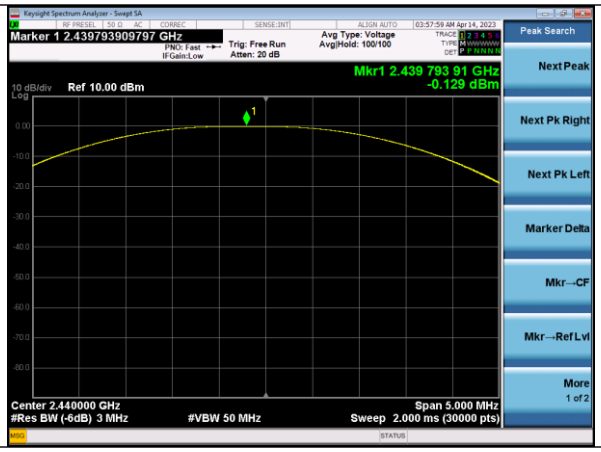
Table

Channel	Data Rate	Transmit Power Setting	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
37	BLE 1Mbps	2	-0.4	30.0	30.4
17	BLE 1Mbps	2	-0.1	30.0	30.1
39	BLE 1Mbps	2	0.1	30.0	29.9

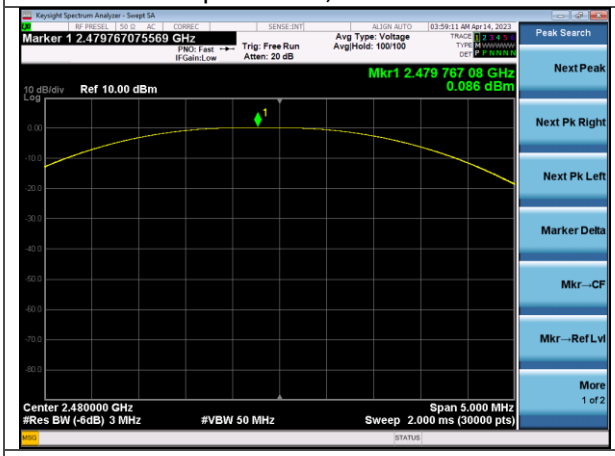
Plots



Output Power, Channel 37



Output Power, Channel 17

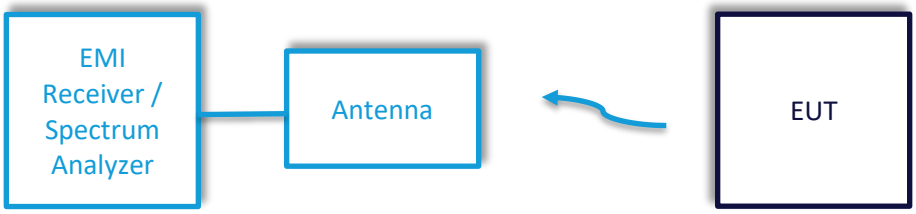


Output Power, Channel 39

5.2 Radiated Emissions

Description of Measurement	The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna. The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values. The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.
Example Calculations	Measurement (dBµV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBµV/m) Margin (dB) = Limit (dBµV/m) - Corrected Reading (dBµV/m) Example at 4000 MHz: Reading = 40 dBµV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBµV/m Average Limit = 20 log (500) = 54 dBµV/m Margin = 54 dBµV/m - 50.8 dBµV/m = 3.2 dB

Block Diagram



5.2.1 Radiated RF Output Power

Operator	Anthony Smith	**QA**	Adam Hauke
Temperature	23.1°C	**R.H. %**	29.5%
Test Date	12/4/2023	**Location**	Chamber 3
Requirement	FCC 15.247	**Method**	ANSI C63.10

Test Parameters

Frequency	2.4-2.48 GHz	**Distance**	3m
Detector(s)	Peak	**Table height**	150cm
RBW	3 MHz	**VBW**	50 MHz

EUT Parameters

Input Power	12VDC Battery	**Mode**	BLE Transmit
Data Rate	1Mbps	**Channels**	37, 17, 39
Notes	Transmit Power Setting 2		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	1/30/2023	1/30/2024	Active Calibration
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/13/2023	4/13/2024	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	4/26/2023	4/26/2024	Active Verification

Peak Emissions – Maximize Fundamental

Channel / Mode	Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	EUT Orientation
17/1M	2439.7	H	150	213	98.3	Horizontal
37/1M	2402.0	H	150	201	97.4	Horizontal
39/1M	2480.1	H	130	232	97.6	Horizontal

5.3 Antenna Gain

Example Calculation

Field Strength (dBµV/m) – 95.2 (Convert 3m Field Strength to dBm) – Conducted Peak Output Power (dBm) = Antenna Gain (dBi)

Data Table

Channel	Peak Reading (dBµV/m)	Conversion Factor	Peak RF Output Converted (dBm)	Conducted Peak Output Power (dBm)	Antenna Gain (dbi)
37	97.4	95.2	2.2	-0.4	2.6
17	98.3	95.2	3.1	-0.1	3.2
39	97.6	95.2	2.4	0.1	2.3

6 REVISION HISTORY

Version	Date	Notes	Person
1	8/11/2023	Initial Draft	Anthony Smith
2	8/17/2023	Revised Draft	Anthony Smith
3	12/5/2023	Revised Draft	Anthony Smith

END OF REPORT