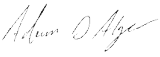
# Test Report TR3664C BL5340

| | |
|---|---|
| **Equipment Under Test:** | BL5340 |
| **Requirement(s):** | FCC 2.1091<br>RSS-102 |
| **Test Date(s):** | 3/9/2023 – 3/21/2023 |
| **Prepared for:** | Laird Connectivity<br>Attn: Jonathan Kaye<br>W66 N220 Commerce Ct.<br>Cedarburg, WI 53012 |

**Report Issued by:** Anthony Smith, EMC Engineering Specialist

Signature:  Date: 7/12/2023

**Report Reviewed by:** Adam Alger, Laboratory Manager

Signature:  Date: 06/16/2023

**Report Constructed by:** Anthony Smith, EMC Engineering Specialist

Signature:  Date: 7/12/2023

# CONTENTS

## 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:


**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*

---

**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 **March 9th, 2023 to March 21st, 2023** the Equipment Under Test (EUT), **BL5340**, as provided by **Laird Connectivity** was tested to the following requirements for the purpose of a Class 2 Permissive Change to add an antenna:

| Requirements | Description | Method | Compliant |
|---|---|---|---|
| FCC 1.1307, 2.1091, 2.1093 | Radiofrequency Radiation Exposure Limits | FCC KDB 447498 | Yes |
| ISED Canada: RSS-102 | Radiofrequency Radiation Exposure Limits | RSS-102 § 2.5.2 | Yes |

**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** | Laird Connectivity |
| **Contact Person** | Jonathan Kaye |
| **Address** | W66N220 Commerce Court<br>Cedarburg, WI, 53012 |

## 2.1 Equipment Under Test (EUT) Information

*The following information has been supplied by the client*

| | |
|---|---|
| **Product Name** | BL5340 |
| **Model Number** | BL5340 |
| **Serial Number** | BLE: 00068<br>802.15.4: 00037 |
| **FCC ID** | SQGBL5340 |
| **IC ID** | 3147A-BL5340 |

## 2.2 Product Description

Bluetooth and 802.15.4 Module operating in the 2.4 GHz range.

## 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

USB to Serial connection to program radio utilizing Tera Term v4.105 terminal simulation software. Zigbee 802.15.4 250kbit signal utilizing channels 11 (2405 MHz), 18 (2440 MHz), 25 (2475 MHz), and 26 (2480 MHz). nRF Connect for Desktop v4.0.0 – Direct Test Mode v2.0.4 used to program EUT. Bluetooth LE (Low Energy) 125k, 500k, 1Mbps, 2Mbps. Channels tested: 37 (2402 MHz), 17 (2440 MHz), and 39 (2480 MHz). Dell Latitude 5480 Laptop used to program radio.

## 2.6 Additional Information

This testing is for a permissive change to add the iFlex-Pifa Antenna, with an antenna gain of 3.1 dBi, to the list of antennas usable by the BL5340. EUT tested via Cabinet Radiation method.

# 3 REFERENCES

| Publication | Edition | Date | AMD 1 |
|---|---|---|---|
| eCFR | - | 2023 | - |
| RSS-247 | 2 | 2017 | - |
| RSS-GEN | 5 | 2018 | 2019 |
| ANSI C63.10 | - | 2013 | - |
| KDB 178919 D01 | 6 | 2015 | - |
| RSS-102 | 5 | 2015 | 2021 |
| KDB 447498 | - | 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 |

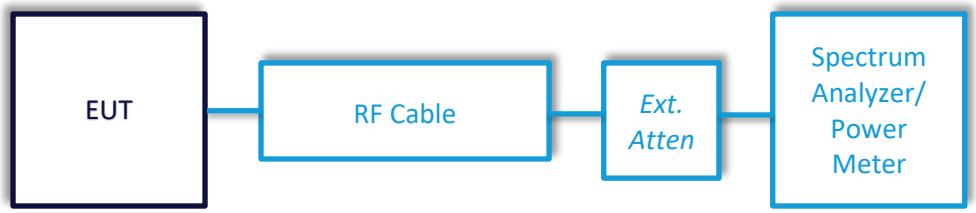
| Parameter | ETSI U.C. ± | U.C. ± |
|---|---|---|
| Radio Frequency, from F0 | $1x10^{-7}$ | $0.55x10^{-7}$ |
| Occupied Channel Bandwidth | 5 % | 2 % |
| RF conducted Power (Power Meter) | 1.5 dB | 1.2 dB |
| RF conducted emissions (Spectrum Analyzer) | 3.0 dB | 1.7 dB |
| All emissions, radiated | 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.<br><br>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)<br>Margin (dB) = Limit (dBm) – Corrected Reading (dBm) |

**Block Diagram**



### 5.1.1 Antenna Port Conducted Emissions – RF Output Power

| | | | |
|---|---|---|---|
| **Operator** | Anthony Smith | **QA** | Adam Alger |
| **Temperature** | 20.6°C | **R.H. %** | 29.6% |
| **Test Date** | 3/9/2023 | **Location** | RF Conducted Bench |
| **Requirement** | FCC 15.247<br>RSS-247 | **Method** | ANSI C63.10 |

**Limits: <30dBm**

**Test Parameters**

| | | | |
|---|---|---|---|
| **Frequency** | 2400-2483.5 MHz | **Setup** | Conducted |
| **RBW** | 3 MHz | **VBW** | 50 MHz |
| **Detector(s)** | Peak | **Settings** | Trace Max Hold |

**Instrumentation**

| Asset # | Description | Manufacturer | Model # | Serial # | Date | Due Date | Status |
|---|---|---|---|---|---|---|---|
| AA 960172 | Cable | A.H. Systems, Inc. | SAC-26G-1 | 387 | 3/22/2022 | 3/22/2023 | Active Verification |
| EE 960087 | Analyzer - Spectrum | Agilent | N9010A | MY53400296 | 4/12/2022 | 4/12/2023 | Active Calibration |

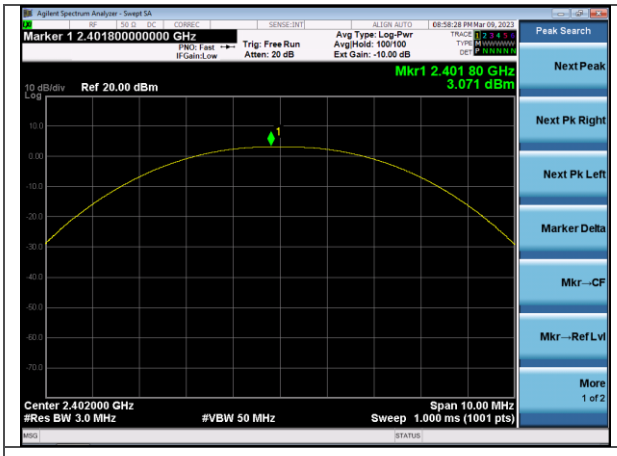
**EUT Parameters**

| | | | |
|---|---|---|---|
| **Input Power** | USB | **Mode** | BLE, 802.15.4 |
| **Frequency** | 2402, 2405 MHz | **Channel** | BLE: 37, 802.15.4: 11 |

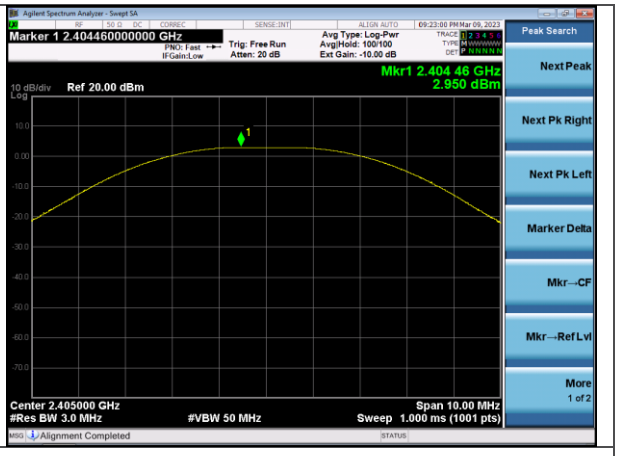
## Data Table

| Mode / Channel | Antenna Gain (dBi) | Output Power (dBm) | Limit (dBm) | Margin (dB) | Meas. Type |
|---|---|---|---|---|---|
| BLE 1M / 37 | 3.1 | 3.1 | 30.0 | 26.9 | Peak |
| 802.15.4 / 11 | 3.1 | 3.0 | 30.0 | 27.0 | Peak |

## Plots




BLE 1M Channel 37




802.15.4 Channel 11

# 6 FCC RF EXPOSURE

## 6.1 Calculations

BLE:

**Prediction of MPE limit at a given distance**

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | | |
|---|---|---|
| Maximum peak output power at antenna input terminal: | 3.10 | (dBm) |
| Tune-up tolerance: | 1.00 | (dB) |
| Maximum peak output power at antenna input terminal: | 2.570 | (mW) |
| Antenna gain: | 3.1 | (dBi) |
| Maximum antenna gain: | 2.042 | (numeric) |
| Prediction distance: | 20 | (cm) |
| Prediction frequency: | 2402 | (MHz) |
| MPE limit for uncontrolled exposure at prediction frequency: | 1.00 | (mW/cm²) |
| Power density at prediction frequency: | 0.00104 | (mW/cm²) |

802.15.4:

| | | |
|---|---|---|
| Maximum peak output power at antenna input terminal: | 3.00 | (dBm) |
| Tune-up tolerance: | 1.00 | (dB) |
| Maximum peak output power at antenna input terminal: | 2.512 | (mW) |
| Antenna gain: | 3.1 | (dBi) |
| Maximum antenna gain: | 2.042 | (numeric) |
| Prediction distance: | 20 | (cm) |
| Prediction frequency: | 2405 | (MHz) |
| MPE limit for uncontrolled exposure at prediction frequency: | 1.00 | (mW/cm²) |
| Power density at prediction frequency: | 0.00102 | (mW/cm²) |

# 7 ISED CANADA RF EXPOSURE

## 7.1 Calculations

BLE:

**Prediction of MPE limit at a given distance**

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | | |
|---|---|---|
| Maximum peak output power at antenna input terminal: | 3.10 | (dBm) |
| Maximum peak output power at antenna input terminal: | 0.002042 | (W) |
| Antenna gain(typical): | 3.1 | (dBi) |
| Maximum antenna gain: | 2.042 | (numeric) |
| Prediction distance: | 0.2 | (m) |
| Prediction frequency: | 2402 | (MHz) |
| MPE limit for uncontrolled exposure at prediction frequency: | 2.68 | (1.31x10^-2* $f$ ^(0.6834)) (W/m²) |
| Power density at prediction frequency: | 0.01 | (W/m²) |

802.15.4:

| | | |
|---|---|---|
| Maximum peak output power at antenna input terminal: | 3.00 | (dBm) |
| Maximum peak output power at antenna input terminal: | 0.001995 | (W) |
| Antenna gain(typical): | 3.1 | (dBi) |
| Maximum antenna gain: | 2.042 | (numeric) |
| Prediction distance: | 0.2 | (m) |
| Prediction frequency: | 2405 | (MHz) |
| MPE limit for uncontrolled exposure at prediction frequency: | 2.68 | (1.31x10^-2* $f$ ^(0.6834)) (W/m²) |
| Power density at prediction frequency: | 0.01 | (W/m²) |

# 8 REVISION HISTORY

| Version | Date | Notes | Person |
|---|---|---|---|
| 0 | 3/27/2023 | Initial Draft | Anthony Smith |
| 1 | 7/12/2023 | Revised Draft | Anthony Smith |

**END OF REPORT**