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EMC testing of the Tektelic Communication Inc. Seal/Seal Ex in accordance with FCC Part 15.247 and ANSI C63.10: 2013 as referenced by FCC OET KDB 558074 D01 15.247 Meas Guidance v05r02.

# FCC ID: 2ALEPT0007705

Test Dates: 2023-09-22 to 2023-09-27

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Prepared for:

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# **REVISION RECORD**

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| DRAFT 2   | 2023-10-16 | I. Akram | Added serial#, antennas information, FCC ID. |
| Release 1 | 2023-10-17 | I. Akram | Sign Off                                     |
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|           |            |          | Sign Off                                     |

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| Seal/Seal Ex         |
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# 1.0 INTRODUCTION

#### 1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with FCC Part 15.247 and ANSI C63.10-2013 to gain FCC Authorization for Low-Power License-Exempt transmitters. All test procedures, limits, criteria, and results described in this report apply only to the Tektelic Communication Inc. Seal/Seal Ex test sample, referred to herein as the EUT (Equipment Under Test).

This report does not imply product endorsement by the Electronics Test Centre, A2LA, nor any Canadian Government agency.

#### 1.2 Applicant

This test report has been prepared for Tektelic Communication Inc., located in Calgary, Alberta, Canada.

#### 1.3 Test Sample Description

As provided to ETC (Airdrie) by Tektelic Communication Inc.:

| Product Name:            |                                   | Seal/Seal Ex   |  |  |  |
|--------------------------|-----------------------------------|--|--|--|--|
| LoRa                     | Frequency Band                    | 902 – 928 MHz  |  |  |  |
|                          | Frequency Range                   | 902.3 – 914.9 MHz  |  |  |  |
| Radio                    | Mode of Operation                 | Hybrid 125KHz  |  |  |  |
| Radio                    | Max Transmit<br>Power (Conducted) | 0.023 W (13.58 dBm)  |  |  |  |
| Associated LoRa Antennas |                                   | RUN mXTEND <sup>™</sup> Model# NN02-224 operating ISM band (863 – 928 MHz)<br>Peak Gain = 2.2 dBi, Polarization = Linear |  |  |  |
| Model# (T                | -Code)                            | T0008769   |  |  |  |
| Serial#                  |                                   | 2341K0001, 2341K0002, 2338K0003  |  |  |  |
| Power supply:            |                                   | Battery Powered  |  |  |  |
|                          |                                   |  |  |  |  |

**Note:** There are two variant of the EUT named as <u>Seal</u> and <u>Seal Ex</u>. There is no difference in radio circuitry/enclosure between two variant except Seal variant powered by three batteries and Seal Ex powered by two batteries and ATEX certified. The seal variant was chosen as a worst-case condition for emission testing. Both variant tested for emission profile and found no difference in emission. Detail differences between the models are given in <u>EUT description exhibit</u>. All three channels (LOW, MID, High) on each axis (X, Y & Z) are analyzed to determine the worse channel. Full emission scan is performed on worse channel at worse axis.

#### 1.4 General Test Conditions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated. In order to meet the operational requirements during testing as per KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10-2013 clause 5.11 the device was programmed with a special firmware to transmit at a continuous transmit mode (100% duty cycle). Special firmware is strictly for testing purpose only and not available to end user. This special test case represents the worst-case duty cycle. For antenna port conducted emission SMA connector is soldered to the circuit board at the output of the radio to provide direct access to the radio output to connect the spectrum analyzer and power cable to battery terminals to connect DC power supply.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report. The environmental conditions are recorded during each test, and are reported in the relevant sections of this document.

# 1.5 Reference Standards

| Standards                                 | Description   |
|---|---|
| FCC, title 47 CFR § 15.247                | Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.   |
| FCC, title 47 CFR § 15.207                | Conducted limits for an intentional radiator that is designed to be connected to the public utility (AC) power line.  |
| FCC, title 47 CFR § 15.107                | Conducted limits for equipment that is designed to be connected to the public utility (AC) power line.  |
| FCC, title 47 CFR § 15.209                | Radiated emission limits; general requirements  |
| FCC, title 47 CFR § 15.109                | Radiated emission limits; from unintentional radiators digital devices.   |
| ANSI C63.10-2013                          | American National Standard of Procedures for Compliance Testing of<br>Unlicensed Wireless Devices   |
| ANSI C63.4-2014                           | American National Standard for Methods of Measurement of Radio –<br>Noise Emissions from Low-Voltage Electrical and Electronic<br>Equipment in the range of 9 KHz to 40 GHz                       |
| 558074 D01 15.247 Meas<br>Guidance v05r02 | Guidance For Compliance Measurements On<br>Digital Transmission System, Frequency Hopping Spread Spectrum<br>System, And Hybrid System Devices Operating Under Section 15.247<br>Of The FCC Rules |

# 1.6 Test Methodology

Test methods are specified in the Basic Standard as referenced and/or modified by the Product Standard in the part of Section 2 of this report associated with each particular test case. EUT tested for RX mode to cover FCC Part 15 subpart B (digital Circuitry).

# 1.6.1 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

# **1.6.2 Test Sample Verification, Configuration & Modifications**

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

# **1.6.3 Uncertainty of Measurement:**

The factors contributing to measurement uncertainty are identified and calculated in accordance with CISPR 16-4-2: 2011.

This uncertainty estimate represents an expended uncertainty expressed at approximately 95% confidence using a coverage factor of k = 2.

| Test Method                                   | Uncertainty |
|---|-------------|
| Radiated Emissions Level (9 KHz – 1 GHz)      | ±5.8 dB     |
| Radiated Emissions Level (1 GHz – 18 GHz)     | ±4.9 dB     |
| Radiated Emissions Level (18 GHz – 26.5 GHz)  | ±5.0 dB     |
| Conducted Emissions Level (150 KHz – 30 MHz)  | ±3.0 dB     |
| Uncertainty Conducted Power level             | ±0.5 dB     |
| Uncertainty Conducted Spurious emission level | ±0.6 dB     |
| Uncertainty for Bandwidth test                | ±1.5 %      |

# 2.0 TEST CONCLUSION

### STATEMENT OF COMPLIANCE

# The customer equipment referred to in this report was found to comply with the requirements, as summarized below.

The EUT was subjected to the following tests. Compliance status is reported as **Compliant** or **Non-compliant**. **N/A** indicates the test was Not Applicable to the EUT.

The measurement uncertainty is not accounted for determination of the statement of compliance. The statement of compliance is based only on the measurement value recorded.

**Note:** Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

| Test<br>Case | Test Type   | Specification                  | Test Sample  | Modifications | Config.    | Result    |
|--------------|---|--------------------------------|--------------|---------------|------------|-----------|
| 2.1          | AC Main Conducted<br>Emissions                                    | 15.207 /<br>15.109             | Seal/Seal Ex | none          | see § 2.1  | N/A       |
| 2.2          | Occupied Bandwidth  | 15.247(a)(1)<br>15.247(2)(2)   | Seal/Seal Ex | none          | see § 2.2  | Compliant |
| 2.3          | Max Output Average Power  | 15.247(b)                      | Seal/Seal Ex | none          | see § 2.3  | Compliant |
| 2.4          | Power Spectral Density  | 15.247(e)<br>15.247(f)         | Seal/Seal Ex | none          | see § 2.4  | Compliant |
| 2.5          | Band Edge   | 15.247(d)                      | Seal/Seal Ex | none          | see § 2.5  | Compliant |
| 2.6          | Conducted Spurious<br>Emission<br>(Non-Restricted Band Operation) | 15.247(d)                      | Seal/Seal Ex | none          | see § 2.6  | Compliant |
| 2.7          | Minimum channel separation  | 15.247(a)(1)                   | Seal/Seal Ex | none          | see § 2.7  | Compliant |
| 2.8          | Average time of Occupancy<br>for hybrid System                    | 15.247(f)                      | Seal/Seal Ex | none          | see § 2.8  | Compliant |
| 2.9          | EUT Position  | ANSI C63.4                     | Seal/Seal Ex | none          | see § 2.9  | Y-Axis    |
| 2.10         | Radiated Spurious Emission<br>(Restricted Band)                   | 15.205,<br>15.209<br>15.247(d) | Seal/Seal Ex | none          | see § 2.10 | Compliant |
| 2.11         | Radiated Emission   | 15.109                         | Seal/Seal Ex | none          | see § 2.11 | Compliant |
| 2.12         | RF Exposure   | 15.247(i)                      | Seal/Seal Ex | none          | see § 2.12 | Exempt    |

Refer to the test data for applicable test conditions.

# 2.1 AC Main Power Line Conducted Emissions: N/A

| Test Lab: Electronics Test Centre, Airdrie                                  | EUT: Seal/Seal Ex   |  |  |  |
|---|---|--|--|--|
|   | Standard: FCC Part 15.207, FCC Part 15.107                            |  |  |  |
|   | Basic Standard: ANSI C63.10: 2013<br>Basic Standard: ANSI C63.4: 2014 |  |  |  |
| EUT stat  | us: N/A   |  |  |  |
| Comments: EUT is Battery Powered. No Direct/indirect connection to AC main. |   |  |  |  |

# 2.2 Occupied Bandwidth

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Brendan Van Hee

Date: 2023-09-22 (21.7°C, 22.8% RH)

EUT: Seal/Seal Ex

Standard: FCC PART 15.247

Basic Standard: ANSI C63.10-2013 FCC OET KDB 558074

# **EUT status: Compliant**

# Specification: FCC Part 15.247 (a, 1, i)

Criteria: The maximum allowed 20 dB bandwidth of the hopping channel is 250 kHz.

# 2.2.1 Test Guidance: ANSI C63.10-2013, Clause 6.9.2 & 6.9.3/ FCC OET KDB 558074

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following spectrum analyzer setting:  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|
| Span  | Between two time and five times the channel center frequency OBW |  |  |  |  |  |
| RBW   | 1% to 5% of the OBW  |  |  |  |  |  |
| VBW Approximately three times of RBW  |  |  |  |  |  |  |
| Sweep   | Auto Couple  |  |  |  |  |  |
| Detector Function Peak  |  |  |  |  |  |  |
| Trace Max Hold  |  |  |  |  |  |  |
| Allow the trace to stabilize. The automated 99% BW function of the spectrum analyzer is engaged, 20dB bandwidth is measured with the X dB function. |  |  |  |  |  |  |

# 2.2.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

# 2.2.3 Test Equipment

Testing was performed with the following equipment:

| Equipment              | Manufacturer | Model #                | Asset # | Cal. Date   | Cal. Due   |
|------------------------|--------------|------------------------|---------|-------------|------------|
| EMI receiver           | Agilent      | N9038A<br>(FW A.22.08) | 6906    | 2022-12-20  | 2023-12-20 |
| Temp/Humidity          | Extech       | 42270                  | 5871    | 2023-04-14  | 2024-04-14 |
| Attenuator             | PCB          | BWS102W263             | 6932    | 2022-12-10  | 2025-12-10 |
| Coaxial Cables<br>(RF) | Huber+Suhner | Enviroflex 400         | -       | Cal. before | each use   |
| DC Blocker             | Centric RF   | C0927 SMA              | 6987    | Cal. before | e each use |

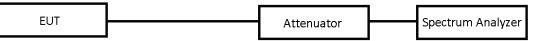
# 2.2.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

#### Test setup diagrams for Occupied Bandwidth testing:

#### **Conducted:**



# 2.2.5 Channel Occupied Bandwidth Data:

| Mode of operation | Channel | Freq.<br>[MHz] | Occupied BW<br>[kHz] | 20 dB BW<br>[kHz] | Limit<br>20dB BW<br>[KHz] |  |
|-------------------|---------|----------------|----------------------|-------------------|---------------------------|--|
|                   | Low     | 902.3          | 127.99               | 138.1             |                           |  |
| 125KHz Hybrid     | Mid     | 908.7          | 128.00               | 138.8             | ≤ 250                     |  |
|                   | High    | 914.9          | 127.93               | 138.3             |                           |  |

## <u>Hybrid (125 KHz) Mode</u>

Screen Captures from the spectrum analyzer: Low Channel



Screen Captures from the spectrum analyzer: MID Channel



| Keysight Spectrum Analyzer - Occupied BW              |                                       |  |          |                   |                                      |                       | - P                       | x          |
|---|---------------------------------------|--|----------|-------------------|--------------------------------------|-----------------------|---------------------------|------------|
| x RF 50Ω AC<br>Center Freq 914.900000 M               | – – – – – – – – – – – – – – – – – – – | SENSE:INT<br>Center Freq: 914.90<br>Trig: Free Run<br>Atten: 30 dB |          | IGN AUTO<br>10/10 | 11:18:08 A<br>Radio Std<br>Radio Dev |                       | Frequency                 |            |
| Ref Offset 10.22 dl<br>10 dB/div Ref 49.77 dBm<br>Log | 3                                     |  |          |                   |                                      |                       |                           |            |
| 29.8  |                                       |  |          |                   |                                      |                       | Center Fr<br>914.900000 N |            |
| 9.77  |                                       |  |          |                   |                                      |                       |                           |            |
| -10.2   |                                       |  |          |                   |                                      |                       |                           |            |
| -30.2   |                                       |  |          |                   | Varse and a series                   | and wat               |                           |            |
| Center 914.9000 MHz<br>#Res BW 3 kHz                  |                                       | #VBW 10 k  | ίHz      |                   |                                      | 300.0 kHz<br>31.67 ms | CF St<br>30.000           | kHi        |
| Occupied Bandwidth                                    | 27.93 kHz                             |  | Power    | 29.9              | dBm                                  |                       |                           | Mar        |
| Transmit Freq Error                                   | 357 Hz                                |  | BW Power | 99                | .00 %                                |                       | Freq Off<br>0             | se<br>) Ha |
| x dB Bandwidth  | 138.3 kHz                             | z x dB   |          | -20.              | 00 dB                                |                       |                           |            |
|   |                                       |  |          |                   |                                      |                       |                           |            |
| ISG 🧼 File < OBW.png> saved                           |                                       |  |          | STATUS            | 3                                    |                       |                           |            |

# Screen Captures from the spectrum analyzer: High Channel

#### 2.3 Max Average Output Power

| Test Lab: Electronics T | est Centre, Airdrie |
|-------------------------|---------------------|
|-------------------------|---------------------|

Test Personnel: Brendan Van Hee

Date: 2023-09-22 (21.7°C, 22.8% RH)

EUT: Seal/Seal Ex

Standard: FCC PART 15.247

Basic Standard: ANSI C63.10: 2013 FCC OET KDB 558074

# **EUT status: Compliant**

#### Specification: FCC Part 15.247(b, 2)

**Criteria** For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels

# 2.3.1 Test Guidance: ANSI C63.10-2013, Clause 11.9.2.2.2 Clause 7.8.5 / FCC OET KDB 558074

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Output Power Method AVGSA-1 For DTS |   |  |  |  |  |  |
|-------------------------------------|---|--|--|--|--|--|
| Span                                | ≥ 1.5 times the OBW   |  |  |  |  |  |
| RBW                                 | $1 - 5$ % of the OBW, $\leq 1$ MHz  |  |  |  |  |  |
| VBW                                 | ≥ 3 x RBW   |  |  |  |  |  |
| Number of Points in sweep           | ≥ 2 x Span / RBW  |  |  |  |  |  |
| Sweep time                          | Auto Couple   |  |  |  |  |  |
| Detector                            | RMS (Power Averaging)   |  |  |  |  |  |
| Sweep trigger                       | Free Run (Duty Cycle ≥98%)  |  |  |  |  |  |
| Trace Average                       | Minimum 100 traces in power Averaging (RMS)   |  |  |  |  |  |
| Power measured                      | Integrated the spectrum across the OBW of the signal using the S/A band power measurement function, with band limit set equal to the OBW band edge. |  |  |  |  |  |

# 2.3.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

# 2.3.3 Test Equipment

Testing was performed with the following equipment:

| Equipment              | Manufacturer | Model #                | Asset # | Cal. Date            | Cal. Due   |
|------------------------|--------------|------------------------|---------|----------------------|------------|
| EMI receiver           | Agilent      | N9038A<br>(FW A.22.08) | 6906    | 2022-12-20           | 2023-12-20 |
| Temp/Humidity          | Extech       | 42270                  | 5871    | 2023-04-14           | 2024-04-14 |
| Attenuator             | PCB          | BWS102W263             | 6932    | 2022-12-10           | 2025-12-10 |
| Coaxial Cables<br>(RF) | Huber+Suhner | Enviroflex 400         | -       | Cal. before each use |            |
| DC Blocker             | Centric RF   | C0927 SMA              | 6987    | Cal. before each use |            |

# 2.3.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

# Test setup diagrams for Power testing:

#### Conducted:

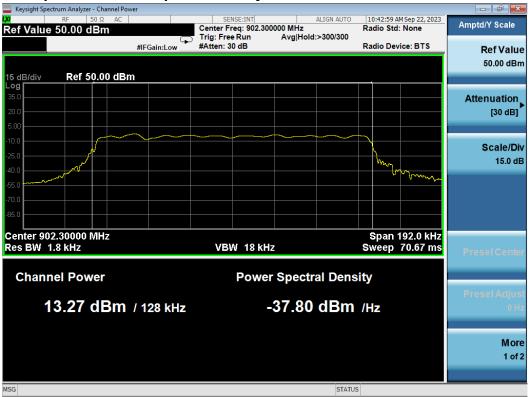


# 2.3.5 Max Output Power Data: DSS

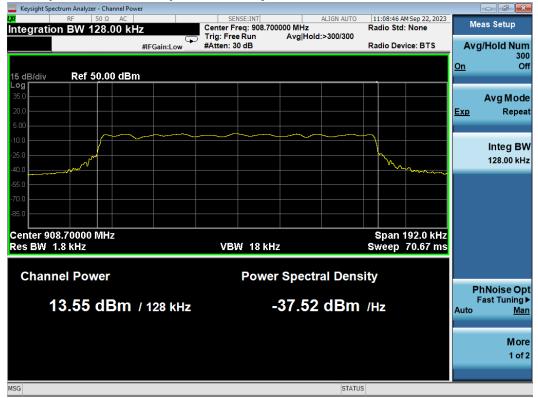
| Mode of operation | Channel | Freq.<br>[MHz] | Max Average<br>Power<br>[dBm] | Limit<br>Power<br>[dBm] |
|-------------------|---------|----------------|-------------------------------|-------------------------|
|                   | Low     | 902.3          | 13.27                         |                         |
| 125KHz Hybrid     | Mid     | 908.7          | 13.55                         | ≤ 30 (1Watt)            |
|                   | High    | 914.9          | 13.58                         |                         |

#### Hybrid (125 KHz) Mode

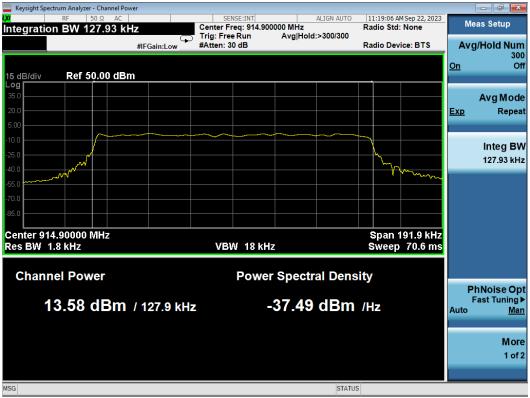
Screen Captures from the spectrum analyzer Low Channel



#### Screen Captures from the spectrum analyzer: MID Channel



#### Screen Captures from the spectrum analyzer: High Channel



### 2.4 **Power Spectral Density**

Test Lab: Electronics Test Centre, AirdrieEUT: Seal/Seal ExTest Personnel: Brendan Van HeeStandard: FCC PAR

Date: 2023-09-22 (21.7°C, 22.8% RH)

Standard: FCC PART 15.247 Basic Standard: ANSI C63.10: 2013

# **EUT status: Compliant**

#### Specification: FCC Part 15.247(f)

**Criteria** The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### 2.4.1 Test Guidance: ANSI C63.10-2013, Clause 11.10.3 / FCC OET KDB 558074

This measurement is performed at low, mid and high frequencies, in continuous transmission, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following Spectrum Analyzer settings  |  |  |  |  |  |
|---|--|--|--|--|--|
| Span  | At least 1.5 times the OBW of channel center Frequency             |  |  |  |  |
| RBW   | 3 KHz  |  |  |  |  |
| VBW   | ≥ 3 x VBW  |  |  |  |  |
| Sweep   | Auto Couple  |  |  |  |  |
| Detector Function   | Power averaging (RMS) or Sample detector (when RMS not available.  |  |  |  |  |
| Trace   | Employ trace average (rms) mode over a minimum of 100 traces.      |  |  |  |  |
| Ensure that the number of measurement points in the sweep $\geq$ [ 2 x span / RBW]. Allow the |  |  |  |  |  |
| trace to stabilize. Use   | the peak marker function to determine the maximum amplitude level. |  |  |  |  |

#### 2.4.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

#### 2.4.3 Test Equipment

Testing was performed with this equipment:

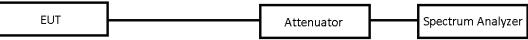
| Equipment           | Manufacturer | Model #                | Asset # | Cal. Date   | Cal. Due   |
|---------------------|--------------|------------------------|---------|-------------|------------|
| EMI receiver        | Agilent      | N9038A<br>(FW A.22.08) | 6906    | 2022-12-20  | 2023-12-20 |
| Temp/Humidity       | Extech       | 42270                  | 5871    | 2023-04-14  | 2024-04-14 |
| Attenuator          | PCB          | BWS102W263             | 6932    | 2022-12-10  | 2025-12-10 |
| Coaxial Cables (RF) | Huber+Suhner | Enviroflex 400         | -       | Cal. before | e each use |
| DC Blocker          | Centric RF   | C0927 SMA              | 6987    | Cal. before | e each use |

# 2.4.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

# Test setup diagrams for Power Spectral Density testing: Conducted:



# 2.4.5 Average PSD Data

| Mode of operation | Channel | Freq.<br>[MHz] | PSD<br>(dBm) | PSD Limit<br>(dBm |
|-------------------|---------|----------------|--------------|-------------------|
|                   | Low     | 902.3          | -1.551       |                   |
| LoRa 125 KHz      | Mid     | 908.7          | -1.519       | ≤ 8 3KHz          |
|                   | High    | 914.9          | -1.506       |                   |

# Screen Capture from Spectrum Analyzer: Low Channel





#### Screen Capture from Spectrum Analyzer: MID Channel





#### 2.5 Band Edge Attenuation

| Test Lab: Electronics Test Centre, Airdrie | EUT: Seal |
|--|-----------|
| Test Personnel: Brendan Van Hee            | Standard: |

Date: 2023-09-22 (21.7°C, 22.8% RH)

EUT: Seal/Seal Ex Standard: FCC PART 15.247 Basic Standard: ANSI C63.10: 2013

# **EUT status: Compliant**

#### Specification: FCC Part 15.247(d)

**Criteria:** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.209(a) (see §15.205(c)).

# 2.5.1 Test Guidance: ANSI C63.10-2013 Clause 6.10.4 & 7.8.6, 6.10.6 / FCC OET KDB 558074

This measurement is performed at the low and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following spectrum analyzer settings:   |  |  |  |  |  |
|---|--|--|--|--|--|
| Span  | Wide enough to capture the peak level of the emission operating on |  |  |  |  |
|   | the channel closest to the band edge, as well as any modulation    |  |  |  |  |
|   | products that fall outside of the authorized band of operation.    |  |  |  |  |
| Attenuation   | Auto (at least 10 dB preferred).                                   |  |  |  |  |
| RBW   | 100 kHz  |  |  |  |  |
| VBW   | 300 kHz  |  |  |  |  |
| Sweep   | Coupled  |  |  |  |  |
| Detector function   | peak   |  |  |  |  |
| Trace   | max hold   |  |  |  |  |
| Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the  |  |  |  |  |  |
| highest modulation product outside of the band, if this level is greater than that at the |  |  |  |  |  |
| band edge. Enable the marker-delta function, and then use the marker-to-peak function     |  |  |  |  |  |
| to move the marke   | er to the peak of the in-band emission.                            |  |  |  |  |

# 2.5.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

# 2.5.3 Test Equipment

Testing was performed with the following equipment:

| Equipment           | Manufacturer | Model #                | Asset # | Cal. Date            | Cal. Due   |
|---------------------|--------------|------------------------|---------|----------------------|------------|
| EMI receiver        | Agilent      | N9038A<br>(FW A.22.08) | 6906    | 2022-12-20           | 2023-12-20 |
| Temp/Humidity       | Extech       | 42270                  | 5871    | 2023-04-14           | 2024-04-14 |
| Attenuator          | PCB          | BWS102W263             | 6932    | 2022-12-10           | 2025-12-10 |
| Coaxial Cables (RF) | Huber+Suhner | Enviroflex 400         | -       | Cal. before each use |            |
| DC Blocker          | Centric RF   | C0927 SMA              | 6987    | Cal. before          | e each use |

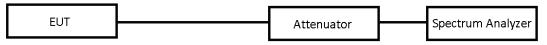
#### 2.5.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

#### Test setup diagrams for Band Edge Attenuation testing:

#### Conducted:



# 2.5.5 Band Edge Data

#### Worse Case Data

| Mode of operation | Channel | Attenuation<br>at Band Edge | Attenuation Limit<br>at Band Edge |
|-------------------|---------|-----------------------------|-----------------------------------|
| Lora 125KHz       | 902.3   | 66.151 dBc                  |                                   |
| (Non-Hopping)     | 914.9   | 49.137 dBc                  |                                   |
| Lora 125KHz       | 902.3   | 52.615 dBc                  | ≥30 dBc                           |
| (Hopping)         | 914.9   | 66.135 dBc                  |                                   |

#### Screen Capture from the spectrum analyzer: Lower Band Edge (Non-Hopping)

| 🚾 Keysight Spectrum Analyzer - Swept SA                    |  |   |                    |
|--|--|---|--------------------|
| ₩ RF 50 Ω AC<br>Marker 2 317.800000 kHz                    | PNO: Wide Trig: Free Run<br>IFGain:Low #Atten: 30 dB                   | ALIGN AUTO 10:46:52 AM Sep 22,<br>Avg Type: Log-Pwr TRACE 1 2 3<br>Avg Hold:>100/100 TYPE MWW<br>DET P NN | 456<br>Peak Search |
| Ref Offset 10.22 dB<br>10 dB/div Ref 30.22 dBm             | IFGain:Low #Atten: 30 dB   | ΔMkr2 317.8 k<br>49.137   | HZ NextPeak<br>dB  |
| 20.2<br>10.2<br>0.220                                      |  | 2   | Next Pk Right      |
| -9.78<br>-19.8<br>-29.8                                    |  | 1.16.73   | Next Pk Left       |
| -39.8<br>-49.8<br>-59.8                                    |  | ~~~^\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\  | Marker Delta       |
| Start 900.000 MHz<br>#Res BW 100 kHz<br>MKR MODE TRC SCL X | #VBW 300 kHz   | Stop 902.300 N<br>Sweep 1.000 ms (1001 )<br>TION FUNCTION WIDTH FUNCTION VALUE                            | IHz<br>ots) Mkr→CF |
| <b>2</b> Δ3 <b>1</b> f (Δ)                                 | 67 8 MHz 13.318 dBm<br>317.8 kHz (Δ) 49.137 dB<br>50 0 MHz -35.820 dBm |   | Mkr→RefLv          |
| 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9                    |  |   | More<br>1 of 2     |
| MSG  |  | STATUS  |                    |

#### Screen Capture from the spectrum analyzer: Upper Band Edge (Non-Hopping)

| Keysight Spectrum Analyzer - Swept SA         | -            | -                                   |  | <u> </u>   |                    |
|---|--------------|-------------------------------------|--|--|--------------------|
| RF 50 Ω AC<br>arker 2 Δ -13.150000000         |              | SENSE:INT                           | ALIGN AUTO<br>Avg Type: Log-Pwr<br>Avg Hold:>300/300 | 11:24:45 AM Sep 22, 2023<br>TRACE <b>1 2 3 4 5 6</b><br>TYPE <b>M</b> WWWW | Marker             |
| Ref Offset 10.22 dB<br>0 dB/div Ref 30.22 dBm |              | Atten: 30 dB                        | <b>.</b>   | -13.150 0 MHz<br>66.151 dB   | Select Marker<br>2 |
| οg<br>2Δ3<br>10.2<br>220                      |              |                                     |  |  | Norm               |
| 9.8   |              |                                     |  | DL1 -16.42 dBm   | Delt               |
| 9.8   | harmon       |                                     | - Andrew and and polymour                            | X3   | Fixed              |
| tart 914.900 MHz<br>Res BW 100 kHz            | #VBW 30      |                                     | Sweep 1  | Stop 930.000 MHz<br>467 ms (1001 pts)                                      | c                  |
| 2 Δ3 1 f (Δ) -13.1                            | 50 0 MHz (Δ) | 8.620 dBm<br>66.151 dB<br>8.526 dBm |  |  | Properties         |
| 7<br>8<br>9<br>9<br>0<br>1                    |              |                                     |  | v  | Moi<br>1 of        |
| G   |              |                                     | STATUS   |  |                    |

# Screen Capture from the spectrum analyzer: Lower Band Edge (Hopping)

| ₩ RF 50 Ω AC<br>Marker 2 Δ 497.500000 kH       |  | ALIGN AUTO         01:26:39 PM Sep 22, 2023           Avg Type: Log-Pwr         TRACE         1 2 3 4 5 6           Avg Hold:>300/300         TYPE         Mwwwww | Peak Search    |
|--|--|---|----------------|
| Ref Offset 10.22 dB<br>10 dB/div Ref 30.22 dBm | PNO: Wide Trig: Free Run<br>IFGain:Low #Atten: 30 dB                   | ΔMkr2 497.5 kHz<br>52.615 dB  | NextPeak       |
| 20.2<br>10.2<br>0.220                          |  | 243   | Next Pk Right  |
| -9.78<br>-19.8<br>-29.8                        |  | DL1 -16.73 dBm  | Next Pk Left   |
| -39.8<br>-49.8<br>-59.8                        | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~                                 | man Martin  | Marker Delta   |
| Start 900.000 MHz<br>#Res BW 100 kHz           | #VBW 300 kHz   | Stop 902.500 MHz<br>Sweep 1.000 ms (1001 pts)   | Mkr→CF         |
| <b>2</b> Δ3 <b>1 f</b> (Δ)                     | 47 5 MHz 13.337 dBm<br>497.5 kHz (Δ) 52.615 dB<br>50 0 MHz -39.278 dBm |   | Mkr→RefLvl     |
| 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9        |  | · · · · · · · · · · · · · · · · · · ·   | More<br>1 of 2 |
| MSG  |  | STATUS  |                |

#### Screen Capture from the spectrum analyzer: Upper Band Edge (Hopping)

|   |  |  |  | - 5 💌          |
|---|--|--|--|----------------|
| ₩ RF 50 Ω AC<br>Marker 2 Δ -13.280600000                                    | MHz<br>PNO: Wide C Trig: Free Run                | ALIGN AUTO<br>Avg Type: Log-Pwr<br>Avg Hold:>300/300 | 01:30:27 PM Sep 22, 2023<br>TRACE 1 2 3 4 5 6<br>TYPE MWWWWW   | Peak Search    |
| Ref Offset 10.22 dB<br>10 dB/div Ref 30.22 dBm                              | IFGain:Low #Atten: 30 dB                         | <u> </u>   | -13.280 6 MHz<br>66.135 dB   | NextPeak       |
| 20.2 2Δ3<br>10.2<br>0.220   |  |  |  | Next Pk Right  |
| -9.78   |  |  | DL1 -16.42 dBm   | Next Pk Left   |
| -39.8   | ······································           | agrant and alway and and                             | unigeti al freezense and a second | Marker Delta   |
| Start 914.600 MHz<br>#Res BW 100 kHz<br>MKR MODE TRC SCL X<br>1 N 1 5 914.7 | #VBW 300 kHz                                     | Sweep 1.   | Stop 930.000 MHz<br>533 ms (1001 pts)<br>FUNCTION VALUE  | Mkr→CF         |
| <b>2</b> Δ3 <b>1</b> f (Δ) -13.2  | 836 6 MHz (Δ) 66.135 dB<br>150 0 MHz -52.474 dBm |  |  | Mkr→RefLvl     |
| 7<br>8<br>9<br>10<br>11   |  |  |  | More<br>1 of 2 |
| MSG   |  | STATUS   |  |                |

| 2.6 | Conducted S | purious Emissions (N | on- Restricted Band) |
|-----|-------------|----------------------|----------------------|
|     |             |                      |                      |

| Test Lab: Electronics Test Centre, Airdrie | EUT: Seal/Seal Ex   |
|--|---|
| Test Personnel: Brendan Van Hee            | Standard: FCC PART 15.247                                     |
| Date: 2023-09-22 (21.7°C, 22.8% RH)        | Basic Standard: ANSI C63.4-2014<br>FCC OET KDB 558470 v04 DTS |

# **EUT status: Compliant**

#### Specification: FCC Part 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

#### 2.6.1 Test Guidance: ANSI C63.10-2013, Clause 6.7, 7.8.8 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed at the low, mid and high frequencies, with modulation. The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following s | spectrum analyzer settings:  |
|---------------------|--|
| Span                | Set the center frequency and span to encompass frequency range to be measured. |
| RBW                 | 100 kHz  |
| VBW                 | 300 kHz  |
| Sweep               | Auto Coupled   |
| Detector function   | peak   |
| Trace               | max hold   |
| Allow the trace to  | stabilize. Use the peak marker function to determine the maximum               |

Allow the trace to stabilize. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in

# 2.6.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

# 2.6.3 Test Equipment

Testing was performed with the following equipment:

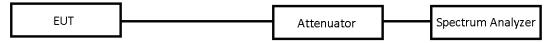
| Equipment           | Manufacturer | Model #                | Asset # | Cal. Date            | Cal. Due   |  |  |  |  |  |
|---------------------|--------------|------------------------|---------|----------------------|------------|--|--|--|--|--|
| EMI receiver        | Agilent      | N9038A<br>(FW A.22.08) | 6906    | 2022-12-20           | 2023-12-20 |  |  |  |  |  |
| Temp/Humidity       | Extech       | 42270                  | 5871    | 2023-04-14           | 2024-04-14 |  |  |  |  |  |
| Attenuator          | PCB          | BWS102W263             | 6932    | 2022-12-10           | 2025-12-10 |  |  |  |  |  |
| Coaxial Cables (RF) | Huber+Suhner | Enviroflex 400         | -       | Cal. before each use |            |  |  |  |  |  |
| DC Blocker          | Centric RF   | C0927 SMA              | 6987    | Cal. before each use |            |  |  |  |  |  |

# 2.6.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

#### Test setup diagram for Conducted Spurious Emissions testing:



# 2.6.5 Conducted Emissions Data:

### Low Channel



| Keysight Spe                |                     | - Spurious Emissions  |                              |                |  |              |   | Keysight Sp                 |   | - Spurious Emissions       |            |   |  |                     |   |
|-----------------------------|---------------------|-----------------------|------------------------------|----------------|--|--------------|---|-----------------------------|---|----------------------------|------------|---|--|---------------------|---|
|                             |                     | 0 Ω 🚹 DC              | SENSE:INT<br>Center Freq: 90 |                | N AUTO 10:57:46 AM Se<br>Radio Std: No |              | Range Table                             |                             |   | 50 Ω AC                    |            | NSE:INT<br>reg: 902.300000 MHz  |  | AM Sep 22, 2023     | Range Table                             |
| Res BW '                    | 10.000 KI           | HZ                    | Talas Francis                | 12.300000 WITZ | Radio Stu. No                          | me           |   | Ret Offs                    | et 10.12  | αB                         | Takes Day  |   | Radio S  | ta. None            | <u> </u>                                |
| PASS                        |                     | IFGain:               |                              |                | Radio Device                           | BTS          | Range                                   | FAIL                        |   | IFGain:L                   |            |   | Radio D  | evice: BTS          | Range                                   |
|                             |                     | ii Gain.              | Low Ministerio and           |                |  |              | 1                                       |                             |   | II Gam.c                   | .04        |   |  |                     | 2                                       |
| 15 dB/div                   |                     | set 10 dB<br>9.78 dBm |                              |                | 5.0959<br>-60.052                      |              | <u>On</u> Off                           | 15 dB/div                   |   | fset 10.12 dB<br>9.90 dBm  |            |   |  | 2.31 MHz<br>192 dBm | <u>On</u> Off                           |
| Log<br>34.8<br>19.8<br>4.78 |                     |                       |                              |                |  |              | Start Freq<br>30.000 kHz                | Log<br>34.9<br>19.9<br>4.90 |   | FAIL (F) cor<br>fundamenta | •          |   |  | •1                  | Start Freq<br>30.000000 MHz             |
| -10.2<br>-25.2<br>-40.2     |                     | 1                     |                              |                |  |              | Stop Freq<br>30.000000 MHz              | -10.1<br>-25.1<br>-40.1     |   |                            |            |   |  |                     | Stop Freq<br>1.000000000 GHz            |
| -55.2<br>-70.2              | n <mark>a th</mark> |                       |                              |                |  | Maria        | Res BW<br>10.000 kHz<br>Auto <u>Man</u> | -70.1 <b>-70.14</b>         | yan da ka ya ka |                            |            | ni lännan op av og falst men stat og som en stat<br>i påne Mit i fanne ålskelde som en stat og som en stat<br>i påne Mit i fanne ålskelde som en stat og som en stat og | <mark>na, na kao 1970, amin'ny dia kaodim-paositra dia kaominina dia kaominin</mark> |                     | Res BW<br>100.00 kHz<br>Auto <u>Man</u> |
| Start 30 k                  | (Hz                 |                       |                              |                | Stop 3                                 | 0 MHz<br>FFT | Video BW<br>30.000 kHz                  | Start 30                    | MHz   |                            |            |   |  | Stop 1 GHz          | Video BW<br>300.00 kHz                  |
| Spur                        | Range               | Frequency             | Amplitude                    | Limit          | <b>∆</b> Limit                         |              | Auto <u>Man</u>                         | Spur                        | Range   | Frequency                  | Amplitude  | Limit   | Δ Limit  |                     | Auto <u>Man</u>                         |
| 1                           | 1                   | 95.95 kHz             | -54.52 dBm                   | -16.73 dBm     | -37.79 dB                              | ^            |   | 1                           | 2   | 902.3 MHz                  | 13.21 dBm  | F -16.73 d  | 3m 29.94 dB  | ^                   |   |
| 2                           | 1                   | 173.9 kHz             | -55.71 dBm                   | -16.73 dBm     | -38.98 dB                              |              | Filter Type                             | 2                           | 2   | 900.6 MHz                  | -51.45 dBm | -16.73 di   | 3m -34.72 dB   |                     | Filter Type                             |
|                             |                     |                       |                              |                |  |              | Gaussian                                |                             |   |                            |            |   |  |                     | Gaussian                                |
| 3                           | 1                   | 113.9 kHz             | -56.07 dBm                   | -16.73 dBm     | -39.34 dB                              |              | Guuddhin                                | 3                           | 2   | 717.2 MHz                  | -52.55 dBm |   |  |                     | Guadolan                                |
| 4                           | 1                   | 191.9 kHz             | -56.99 dBm                   | -16.73 dBm     | -40.26 dB                              |              |   | 4                           | 2   | 956.7 MHz                  | -52.87 dBm | -16.73 di   | 3m -36.14 dB   |                     |   |
| 5                           | 1                   | 5.096 MHz             | -59.49 dBm                   | -16.73 dBm     | -42.76 dB                              |              |   | 5                           | 2   | 851.0 MHz                  | -53.15 dBm | -16.73 d  | 3m -36.42 dB   |                     |   |
| 6                           | 1                   | 275.8 kHz             | -60.86 dBm                   | -16.73 dBm     | -44.13 dB                              |              | More                                    | 6                           | 2   | 954.8 MHz                  | -53.35 dBm |   |  |                     | More                                    |
|                             |                     |                       |                              |                |  |              | 1 of 3                                  |                             |   |                            |            |   |  |                     | 1 of 3                                  |
| /                           | 1                   | 6.277 MHz             | -64.02 dBm                   | -16.73 dBm     | -47.29 dB                              | $\sim$       |   | /                           | 2   | 977.8 MHz                  | -53.36 dBm | -16.73 di   | 3m -36.63 dB   | ~                   |   |
| 1100                        |                     |                       |                              |                |  |              |   |                             |   |                            |            |   | 074710   |                     |   |
| MSG                         |                     |                       |                              |                | STATUS 1 DC Couple                     | ea           |   | MSG                         |   |                            |            |   | STATUS   |                     |   |

| 🔤 Keysight Spi         | ectrum Analyzer     | - Spurious Emissions                 |                          |  |  |                          |  |           | - 6 <b>.</b>                  |
|------------------------|---------------------|--------------------------------------|--------------------------|--|--|--------------------------|--|-----------|-------------------------------|
| V<br>Points 20         |                     | 0Ω AC                                |                          | SE:INT<br>eq: 902.300000 MHz   | ALIGN AUTO   | 11:04:00 A               | 4 Sep 22, 2023   | Rai       | nge Table                     |
| PASS                   | 5001                | IFGain:                              | Trig: Free               | Run  |  | Radio Dev                | ice: BTS   |           | Range                         |
| 15 dB/div              |                     | set 10.89 dB<br>0.67 dBm             |                          |  |  |                          | 46 GHz<br>09 dBm   | <u>On</u> | 3<br>Off                      |
| Log<br>35.7<br>20.7    |                     |                                      |                          |  |  |                          |  | 1.00      | Start Freq                    |
| 5.67<br>-9.33<br>-24.3 |                     |                                      |                          |  |  |                          |  |           | Stop Freq                     |
|                        |                     | dada ati o shi birilara ay filika ay |                          | a Baran an an Arika Alika Anaran ang tao ang kana kana kana kana ang<br>Mang tao ang kana kana ang tao | ale contra la contra de contra<br>Especia de contra de c | alian ang santa sa sa sa | a sek anti-a sec a a a basil<br>Mana a a constanti a basil | 10.00     | Res BW                        |
| -69.3                  |                     |                                      |                          |  |  |                          |  | Auto      | 100.00 kHz<br><u>Man</u>      |
| Start 1 G              | Hz                  |                                      |                          |  |  | Sto                      | p 10 GHz   | Auto      | Video BW<br>300.00 kHz<br>Man |
| Spur                   | Range               | Frequency                            | Amplitude                | Limit  | Δ  | Limit                    |  | Auto      | Ivian                         |
| 1<br>2                 | <mark>3</mark><br>3 | 1.805 GHz<br>3.038 GHz               | -42.58 dBm<br>-47.88 dBm | -16.73 dE<br>-16.73 dE   | im -31   | 5.85 dB<br>I.15 dB       | ^  | F         | ilter Type                    |
| 3                      | 3<br>3              | 3.111 GHz<br>6.151 GHz               | -47.97 dBm<br>-48.04 dBm | -16.73 dE<br>-16.73 dE   |  | I.24 dB<br>I.31 dB       |  |           | Gaussian                      |
| 5                      | 3                   | 6.036 GHz                            | -48.19 dBm               | -16.73 dE  |  | .46 dB                   |  |           | More                          |
| 6<br>7                 | 3<br>3              | 3.058 GHz<br>3.141 GHz               | -48.26 dBm<br>-48.33 dBm | -16.73 dE<br>-16.73 dE   |  | 1.53 dB<br>1.60 dB       | ~  |           | 1 of 3                        |
| MSG                    |                     |                                      |                          |  | STATUS   | 5                        |  |           |                               |

#### **MID Channel**



| Keysight Sp             |                  | - Spurious Emissions                             |  |   |  |  | - đ 🔀                                   | Keysight S              |                      | - Spurious Emissions                             |   |  |   |      | - 0 ×                                  |
|-------------------------|------------------|--|--|---|--|--|---|-------------------------|----------------------|--|---|--|---|------|--|
| Ref Offse               |                  | 50 Ω <u>A</u> DC<br>B                            | Takes Days D   | 908.700000 MHz  | GN AUTO 11:16:02 AMS<br>Radio Std: N             |  | Range Table                             | Start Lir               | nit -16.45           | 50 Ω AC<br>dBm                                   |   | 908.700000 MHz   | Radio Std: None   | 2023 | Range Table                            |
| PASS                    |                  | IFGain:  |  |   | Radio Devic                                      | e: BTS                                   | Range                                   | FAIL                    |                      | IFGain:Lo  |   |  | Radio Device: BT  | s    | Range                                  |
| 15 dB/div               |                  | set 10 dB<br>0.45 dBm                            |  |   | 5.095<br>-59.14                                  | 9 MHz<br>9 dBm                           | 0n Off                                  | 15 dB/div               |                      | fset 10.12 dB<br>0.57 dBm                        |   |  | 908.71 N<br>13.332 d  |      | 2<br>D Off                             |
| 20.5                    |                  |  |  |   |  |  | Start Freq<br>30.000 kHz                | 20.6                    |                      | FAIL (F) co<br>fundamenta                        | orrespond to<br>al TX = 908.                        |  |   |      | Start Freq<br>30.000000 MHz            |
| -9.55<br>-24.6<br>-39.6 |                  | 1  |  |   |  |  | Stop Freq<br>30.000000 MHz              | -9.43<br>-24.4<br>-39.4 |                      |  |   |  |   |      | Stop Freq<br>1.000000000 GHz           |
| -54.6<br>-69.6<br>-84.6 |                  |  | <u>han tan</u> un tan                                | teritoria anti-teritoria terretta<br>1919 - Las Anti-terretta (h. 1919)<br>1919 - Las Anti-terretta (h. 1919) |  | n de la circi de<br>La circi de la circi | Res BW<br>10.000 kHz<br>Auto <u>Man</u> | -69.4 -114.154<br>-84.4 | n Algel (an ann an t |  |   |  | n i her en der er her en her er fille en fille en er en | Au   | Res BW<br>100.00 kHz<br>ito <u>Man</u> |
| Start 30                | kHz              |  |  |   | Stop   | 30 MHz<br>FFT                            |   | Start 30                | MHz                  |  |   |  | Stop 1 0  | SHZ  | Video BW<br>300.00 kHz                 |
| Spur                    | Range            | Frequency  | Amplitude  | Limit   | Δ Limit  |  | Auto <u>Man</u>                         | Spur                    | Range                | Frequency  | Amplitude   | Limit  | Δ Limit   | Au   | to <u>Man</u>                          |
| 1<br>2<br>3<br>4        | 1<br>1<br>1<br>1 | 119.9 kHz<br>203.9 kHz<br>5.096 MHz<br>179.9 kHz | -49.11 dBm<br>-58.13 dBm<br>-58.26 dBm<br>-58.94 dBm | -16.45 dBm<br>-16.45 dBm<br>-16.45 dBm<br>-16.45 dBm  | -32.66 dB<br>-41.68 dB<br>-41.81 dB<br>-42.49 dB | <b>^</b>                                 | Filter Type<br>Gaussian                 | 1<br>2<br>3<br>4        | 2<br>2<br>2<br>2     | 908.7 MHz<br>907.6 MHz<br>907.0 MHz<br>906.2 MHz | 13.35 dBm<br>-51.55 dBm<br>-52.64 dBm<br>-53.05 dBm | <ul> <li>-16.45 dBm</li> <li>-16.45 dBm</li> <li>-16.45 dBm</li> <li>-16.45 dBm</li> </ul> | 29.80 dB<br>-35.10 dB<br>-36.19 dB<br>-36.60 dB   | *    | Filter Type<br>Gaussian                |
| 5<br>6<br>7             | 1<br>1<br>1      | 317.8 kHz<br>227.8 kHz<br>8.885 MHz              | -60.15 dBm<br>-63.57 dBm<br>-64.96 dBm               | -16.45 dBm<br>-16.45 dBm<br>-16.45 dBm  | -43.70 dB<br>-47.12 dB<br>-48.51 dB              | ~  | More<br>1 of 3                          | 5<br>6<br>7             | 2<br>2<br>2          | 857.8 MHz<br>862.2 MHz<br>914.0 MHz              | -53.16 dBm<br>-53.17 dBm<br>-53.17 dBm              | -16.45 dBm<br>-16.45 dBm<br>-16.45 dBm   | -36.72 dB<br>-36.72 dB<br>-36.72 dB   | ~    | More<br>1 of 3                         |
| MSG                     |                  |  |  |   | STATUS 1 DC Cour                                 | led                                      |   | MSG                     |                      |  |   |  | STATUS  |      |  |

| Keysight Sp                 | ectrum Analyzer    | - Spurious Emissions     |                          |   |            |                                       |                          |           | - 0 ×                              |
|-----------------------------|--------------------|--------------------------|--------------------------|---|------------|---------------------------------------|--------------------------|-----------|------------------------------------|
|                             | RF 5<br>et 10.89 c | 50Ω AC                   |                          | SE:INT<br>eq: 908.700000 MHz<br>Run       | ALIGN AUTO | 11:12:05 A<br>Radio Std               | M Sep 22, 2023<br>: None | Ra        | nge Table                          |
| PASS                        |                    | IFGain                   |                          |   |            | Radio Dev                             | rice: BTS                |           | Range                              |
| 15 dB/div                   |                    | set 10.89 dB<br>1.34 dBm |                          |   |            |                                       | 72 GHz<br>68 dBm         | <u>On</u> | 3<br>Off                           |
| Log<br>36.3<br>21.3<br>6.34 |                    |                          |                          |   |            |                                       |                          | 1.00      | Start Freq<br>0000000 GHz          |
| -8.66<br>-23.7<br>-38.7     | •1                 |                          |                          |   |            |                                       |                          | 10.00     | Stop Freq<br>0000000 GHz           |
| -53.7 (1993) -68.7<br>-68.7 |                    |                          |                          | and the conjugate data with an algorithm. |            | hanna a lan daran<br>mengan dara dara |                          | Auto      | Res BW<br>100.00 kHz<br><u>Man</u> |
| Start 1 G                   | Hz                 |                          |                          |   |            | Sto                                   | p 10 GHz                 |           | Video BW<br>300.00 kHz             |
| Spur                        | Range              | Frequency                | Amplitude                | Limit                                     | Δ          | Limit                                 |                          | Auto      | Man                                |
| 1                           | 3                  | 1.817 GHz                | -40.57 dBm               | -16.45 dE                                 | im -24     | .12 dB                                | ^                        |           |                                    |
| 2                           | 3                  | 3.615 GHz                | -47.51 dBm               | -16.45 dE                                 |            | .06 dB                                |                          | 1         | ilter Type                         |
| 3                           | 3                  | 2.453 GHz                | -47.52 dBm               | -16.45 dE                                 |            | .07 dB                                |                          |           | Gaussian                           |
| 4                           | 3                  | 3.602 GHz                | -47.75 dBm               | -16.45 dE                                 |            | .30 dB                                |                          |           |                                    |
| 5                           | 3                  | 3.655 GHz                | -48.24 dBm               | -16.45 dE                                 |            | .79 dB                                |                          |           | More                               |
| 6<br>7                      | 3<br>3             | 6.158 GHz<br>2.998 GHz   | -48.24 dBm<br>-48.24 dBm | -16.45 dE<br>-16.45 dE                    |            | .79 dB<br>.79 dB                      |                          |           | 1 of 3                             |
|                             |                    | 2,390,0112               | -40724-010111            | -10.45 uE                                 | -51        |                                       | ~                        |           |                                    |
| ISG                         |                    |                          |                          |   | STATUS     |                                       |                          |           |                                    |

#### **High Channel**



| 🔤 Keysigh                   |                   | - Spurious Emissions                             |  |  |  |        |   | 🛄 Keysight Sp               | pectrum Analyzer | - Spurious Emissions  |  |  |  |                                 |   |
|-----------------------------|-------------------|--|--|--|--|--------|---|-----------------------------|------------------|---|--|--|--|---------------------------------|---|
| x<br>Ref Of                 | R⊧<br>set 10.00 ( | 50 Ω <u>Λ</u> DC                                 |  | 22.450000 MHz  | N AUTO 11:26:14 AM Sep 22<br>Radio Std: None     | , 2023 | Range Table                             | .×<br>Start Lin             | RF   16.42       | 50Ω AC<br>dBm   |  | q: 922.450000 MHz  | ALIGN AUTO 11:27:<br>Radio                                   | 23 AM Sep 22, 2023<br>Std: None | Range Table                             |
| PASS                        |                   | IFGain   | Low Trig: Free Run<br>#Atten: 30 dB                  |  | Radio Device: B1                                 | s      | Range                                   | FAIL                        |                  | IFGain:   | Low Trig: Free I<br>#Atten: 30   |  | Radio I  | Device: BTS                     | Range                                   |
| 15 dB/di                    |                   | fset 10 dB<br>0.23 dBm                           |  |  | 5.0959 N<br>-59.479 d                            |        | 0n Off                                  | 15 dB/div                   | Ref Of<br>Ref 5  | fset 10.12 dB<br>0.35 dBm   |  |  |  | 4.92 MHz<br>.495 dBm            | 2<br><u>On</u> Off                      |
| Log<br>35.2<br>20.2<br>5.23 |                   |  |  |  |  |        | Start Freq<br>30.000 kHz                | Log<br>35.4<br>20.4<br>5.35 |                  |   | orrespond to<br>al TX = 914.   | 9 MHz  |  | 1                               | Start Freq<br>30.000000 MHz             |
| -9.77<br>-24.8<br>-39.8     |                   |  |  |  |  |        | Stop Freq<br>30.000000 MHz              | -9.65<br>-24.7<br>-39.7     |                  |   |  |  |  |                                 | Stop Freq<br>1.000000000 GHz            |
| -54.8<br>-69.8<br>-84.8     |                   |  | des applications, et all pro-                        |  |  |        | Res BW<br>10.000 kHz<br>Auto <u>Man</u> | -84.7                       |                  | er anna hannan in in 1993 anna<br>Salada (Kostijia) ya nisia di salad | se to from the source of the form of the source of the sou | <mark>n de la del de la del</mark><br>La del de la | a na ma parte de la comencia<br>Anna ma parte de la comencia |                                 | Res BW<br>100.00 kHz<br>Auto <u>Man</u> |
| Start 3                     | 0 kHz             |  |  |  | Stop 30  <br>F                                   | FT     | Video BW<br>30.000 kHz                  | Start 30                    | MHz              |   |  |  |  | Stop 1 GHz                      | 300.00 kHz                              |
| Spu                         | r Range           | Frequency  | Amplitude  | Limit  | Δ Limit  | 4      | luto <u>Man</u>                         | Spur                        | Range            | Frequency   | Amplitude  | Lim  | it ∆ Limit   |                                 | Auto <u>Man</u>                         |
| 1<br>2<br>3                 | 1<br>1<br>1       | 83.96 kHz<br>131.9 kHz<br>5.096 MHz<br>185.9 kHz | -49.77 dBm<br>-55.38 dBm<br>-59.14 dBm<br>-59.31 dBm | -16.42 dBm<br>-16.42 dBm<br>-16.42 dBm<br>-16.42 dBm | -33.35 dB<br>-38.96 dB<br>-42.72 dB<br>-42.89 dB | ^      | Filter Type<br>Gaussian                 | 1<br>2<br>3                 | 2<br>2<br>2<br>2 | 914.9 MHz<br>913.8 MHz<br>916.1 MHz<br>916.7 MHz                      | 13.50 dBm<br>-50.13 dBm<br>-50.18 dBm<br>-50.38 dBm  | F -16.42 c<br>-16.42 c<br>-16.42 c<br>-16.42 c   | IBm -33.71 dE<br>IBm -33.76 dE                               | 3                               | Filter Type<br>Gaussian                 |
| 4<br>5<br>6<br>7            | 1<br>1<br>1       | 197.9 kHz<br>227.8 kHz<br>251.8 kHz              | -61.07 dBm<br>-61.48 dBm<br>-62.65 dBm               | -16.42 dBm<br>-16.42 dBm<br>-16.42 dBm<br>-16.42 dBm | -42.69 dB<br>-44.65 dB<br>-45.06 dB<br>-46.23 dB | Ŷ      | More<br>1 of 3                          | 5<br>6<br>7                 | 2<br>2<br>2<br>2 | 926.5 MHz<br>841.7 MHz<br>982.5 MHz                                   | -53.13 dBm<br>-53.15 dBm<br>-53.25 dBm   | -16.42 c<br>-16.42 c<br>-16.42 c   | IBm -36.71 dE<br>IBm -36.73 dE                               | 3                               | More<br>1 of 3                          |
| MSG                         |                   |  |  |  | STATUS 1 DC Coupled                              |        |   | MSG                         |                  |   |  |  | STATUS   |                                 |   |

| 🛄 Keysight Spi              | ectrum Analyzer | - Spurious Emissions     |   |   |            |                           |                          |           | - 6 -                              |
|-----------------------------|-----------------|--------------------------|---|---|------------|---------------------------|--------------------------|-----------|------------------------------------|
| X<br>Start Lim              |                 | ioΩ AC<br>dBm            |   | e:INT<br>q: 922.450000 MHz<br>Rup                 | ALIGN AUTO | 11:28:09 Al<br>Radio Std: | None                     | Ra        | nge Table                          |
| PASS                        |                 | IFGain:                  |   |   |            | Radio Dev                 | ice: BTS                 |           | Range                              |
| 15 dB/div                   |                 | set 10.89 dB<br>1.12 dBm |   |   |            |                           | 98 GHz<br>12 dBm         | <u>On</u> | 3<br>Off                           |
| Log<br>36.1<br>21.1<br>6.12 |                 |                          |   |   |            |                           |                          | 1.00      | Start Freq<br>0000000 GHz          |
| -8.88<br>-23.9<br>-38.9     | 1               |                          |   |   |            |                           |                          | 10.00     | Stop Freq<br>0000000 GHz           |
| -53.9<br>-68.9<br>-83.9     |                 |                          | and and an a first of the angular difference of the | l yazı, yı İnferinte Den in Lean, sonal film redi |            |                           | Conference of the second | Auto      | Res BW<br>100.00 kHz<br><u>Man</u> |
| Start 1 G                   | Hz              |                          |   |   |            | Sto                       | p 10 GHz                 |           | Video BW<br>300.00 kHz             |
| Spur                        | Range           | Frequency                | Amplitude   | Limit   | Δ          | Limit                     |                          | Auto      | Man                                |
| 1<br>2                      | 3<br>3          | 1.830 GHz<br>3.687 GHz   | -38.85 dBm<br>-47.02 dBm                            | -16.42 dE<br>-16.42 dE                            | im -30     | 2.43 dB<br>).60 dB        | ^                        | F         | ilter Type<br>Gaussian             |
| 3                           | 3<br>3          | 3.186 GHz<br>3.178 GHz   | -47.16 dBm<br>-47.27 dBm                            | -16.42 dE<br>-16.42 dE                            |            | ).74 dB<br>).85 dB        |                          |           | Gaussian                           |
| 5                           | 3               | 6.189 GHZ                | -47.67 dBm  | -16.42 dE   |            | .25 dB                    |                          |           | Marr                               |
| 6<br>7                      | 3<br>3          | 3.135 GHz<br>6.119 GHz   | -47.72 dBm<br>-47.95 dBm                            | -16.42 dE<br>-16.42 dE                            | im -31     | .30 dB<br>.53 dB          | ~                        |           | More<br>1 of 3                     |
| MSG                         |                 |                          |   |   | STATUS     |                           |                          |           |                                    |

# 2.7 Channel Separation (Hybrid Mode)

| <b>Test Lab: Electronics</b> | Test Centre, Airdrie |
|------------------------------|----------------------|
|------------------------------|----------------------|

Test Personnel: Brendan Van Hee

EUT: Seal/Seal Ex Standard: FCC Part 15.247

Date: 2023-09-22 (21.7°C, 22.8% RH) Basic Standard: ANSI C63.10: 2013

# **EUT status: Compliant**

# Specification: FCC Part 15.247(a, 1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

# 2.7.1 Test Guidance: ANSI 63.10 Clause 7.8.2 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed with the EUT transmitter frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The spectrum analyzer is set for a frequency span wide enough to capture at least two adjacent channels. The RBW is set to at least 1% of the span. The Peak detector is used, with the trace set to Max Hold. Channel Separation is displayed with the Marker Delta function.

# 2.7.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

# 2.7.3 Test Equipment

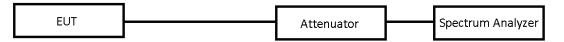
Testing was performed with the following equipment:

| Equipment           | Manufacturer | Model #                | Asset # | Cal. Date   | Cal. Due   |
|---------------------|--------------|------------------------|---------|-------------|------------|
| EMI receiver        | Agilent      | N9038A<br>(FW A.22.08) | 6906    | 2022-12-20  | 2023-12-20 |
| Temp/Humidity       | Extech       | 42270                  | 5871    | 2023-04-14  | 2024-04-14 |
| Attenuator          | PCB          | BWS102W263             | 6932    | 2022-12-10  | 2025-12-10 |
| Coaxial Cables (RF) | Huber+Suhner | Enviroflex 400         | -       | Cal. before | e each use |
| DC Blocker          | Centric RF   | C0927 SMA              | 6987    | Cal. before | e each use |

# 2.7.4 Test Sample Verification, Configuration & Modifications

SMA connector is soldered to the circuit board at the output of the radio to provide direct access to the radio output

# EUT configuration for Channel Separation testing:



# 2.7.5 Channel Separation Data:

The channel separation is **Compliant** for this device.

Channel separation measured = 200 KHz

#### Screen Captures from the spectrum analyzer:

| Keysight Spectrum Analyzer - Swept SA          |  |                                 |   |                |
|--|--|---------------------------------|---|----------------|
| ₩ RF 50 Ω AC<br>Marker 2 Δ 200.000000 kH       | SENSE:INT  | ALIGN AUTO<br>Avg Type: Log-Pwr | 01:01:44 PM Sep 22, 2023<br>TRACE 1 2 3 4 5 6 | Marker         |
|  | PNO: Wide Trig: Free Run<br>IFGain:Low #Atten: 30 dB                 | Avg Hold:>300/300               | TYPE MWWWW<br>DET PNNNNN                      | Select Marker  |
| Ref Offset 10.22 dB<br>10 dB/div Ref 30.22 dBm |  | ,                               | ΔMkr2 200 kHz<br>0.008 dB                     | 2              |
| 20.2<br>10.2<br>0.220                          | ×3   |                                 |   | Normal         |
| -9.78<br>-19.8<br>-29.8                        |  |                                 |   | Delta          |
| -39.8<br>-49.8<br>-59.8                        |  |                                 |   | Fixed⊳         |
| Center 908.7000 MHz<br>#Res BW 51 kHz          | #VBW 300 kHz   |                                 | Span 1.000 MHz<br>.000 ms (1001 pts)          | Off            |
| 1 N 1 f 908<br>2 Δ3 1 f (Δ)                    | 8.700 MHz 13.443 dBm<br>200 kHz (Δ) 0.008 dB<br>8.500 MHz 13.435 dBm | FUNCTION FUNCTION WIDTH         | FUNCTION VALUE                                | Properties►    |
| 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9        |  |                                 | ~   | More<br>1 of 2 |
| MSG  |  | STATUS                          | 3   |                |

# 2.8 Time of Occupancy (Hybrid Mode)

| Test Lab: Electronics Test Centre, Airdrie | EUT: Seal/Seal Ex                  |
|--|------------------------------------|
| Test Personnel: Brendan Van Hee            | Standard: FCC PART 15.247          |
| Date: 2023-09-22 (21.7°C, 22.8% RH)        | Basic Standard: ANSI C63.10: 20013 |

# **EUT status: Compliant**

#### Specification: FCC Part 15.247 (f)

The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

# 2.8.1 Test Guidance: ANSI 63.10 Clause 7.8.4 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed with the EUT frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The spectrum analyzer is set for Peak detection over a 0 Hz frequency span (time domain) centered on a hopping channel. The RBW shall be  $\leq$  Channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel. VBW  $\geq$  RBW. The sweep time is adjusted to clearly capture one transmission. The Dwell time is measured with the Marker Delta function.

Another sweep is set to capture enough transmission events to calculate the number of events within the specified period of time. The Peak detector is used, with the trace set to Max Hold.

#### 2.8.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

#### 2.8.3 Test Equipment

| Equipment           | Manufacturer | Model #                | Asset # | Cal. Date   | Cal. Due   |
|---------------------|--------------|------------------------|---------|-------------|------------|
| EMI receiver        | Agilent      | N9038A<br>(FW A.22.08) | 6906    | 2022-12-20  | 2023-12-20 |
| Temp/Humidity       | Extech       | 42270                  | 5871    | 2023-04-14  | 2024-04-14 |
| Attenuator          | PCB          | BWS102W263             | 6932    | 2022-12-10  | 2025-12-10 |
| Coaxial Cables (RF) | Huber+Suhner | Enviroflex 400         | -       | Cal. before | e each use |
| DC Blocker          | Centric RF   | C0927 SMA              | 6987    | Cal. before | e each use |

Testing was performed with the following equipment:

# 2.8.4 Test Sample Verification, Configuration & Modifications

The EUT was operating in normal mode.

The EUT met the requirements without modification.

# EUT configuration for Dwell Time testing:

| EUT | Attenuator | Spectrum Analyzer |
|-----|------------|-------------------|
|-----|------------|-------------------|

#### 2.8.5 Dwell Time Data:

| Measured Dwell time | Limit   |
|---------------------|---------|
| 370.8ms             | ≤ 400ms |

Window of measurement is equal to number of hopping channels multiple by 400ms =

**0.4 x 64** = 25.6 Sec

Number of events in 25.6 Sec = 1 = 370.8 ms

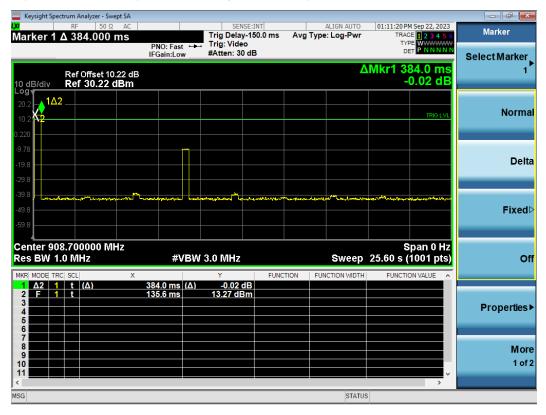
Measure numbers OF Channels= 64

|               |                              |                       |                                      |         |        |                       |                        |                     | trum Analyzer          | Keysight Spec              |
|---------------|------------------------------|-----------------------|--------------------------------------|---------|--------|-----------------------|------------------------|---------------------|------------------------|----------------------------|
| Marker        | RACE 1 2 3 4 5 6             | TRA                   | ALIGN AUTO<br>: Log-Pwr<br>:>300/300 |         | SE:INT |                       |                        | 0Ω AC<br>5000000    |                        | rker 2                     |
| Select Marker | DET                          | D                     | .~300/300                            | Avgino  |        | #Atten: 30            | PNO: Wide G            |                     |                        |                            |
| 2             | .795 MHz<br>-2.973 dB        |                       | ΔΜκ                                  |         |        |                       |                        | : 10.22 dB<br>2 dBm | Ref Offset<br>Ref 30.2 | dB/div                     |
| Norma         | יייייא <mark>ז אייייי</mark> | ┲┲┲┲┲                 | ᡝᢇ᠂᠋᠇ᢛᡳᢧ                             | ┱╺┰┲┙┲  |        | ┑┙┼╱┑╱┎╻              |                        | ѵ┰┲┶╆╱┲⋎            | 2∆3<br>√1771711        | <b>g</b><br>.2<br>.2<br>.2 |
| Delt          |                              |                       |                                      |         |        |                       |                        |                     |                        | .8                         |
| Fixed         | 1<br>                        |                       |                                      |         |        |                       |                        |                     | ]                      | .8<br>.8<br>.8             |
| 0             | 16.000 MHz<br>s (1001 pts)   | Stop 916<br>.400 ms ( | Sweep 5.                             |         |        | / 300 kHz             | #VBV                   |                     | 000 MHz<br>51 kHz      | art 901.0<br>es BW :       |
|               | CTION VALUE                  | FUNCTI                | ICTION WIDTH                         | CTION F |        | Y<br>8.849 dE         | 95 MHz                 | X<br>902 ·          | C SCL                  | N 1                        |
| Properties    |                              |                       |                                      |         | B      | -2.973 (<br>11.822 dE | 795 MHz (Δ)<br>000 MHz | -12.                | f (Δ)<br>f             | Δ3 1<br>F 1                |
| Mor<br>1 of   |                              |                       |                                      |         |        |                       |                        |                     |                        |                            |
| 1 01          |                              |                       |                                      |         |        |                       |                        |                     |                        |                            |
|               | >                            |                       | STATUS                               |         | _      |                       |                        |                     |                        |                            |
|               |                              | <u> </u>              | 514105                               |         |        |                       |                        |                     |                        |                            |

#### Screen Capture from the spectrum analyzer: sweep Time in 600ms

| 🔤 Keysight Sp         | ectrum Analyzer - Sw              |            |                        |                        |          |              |          |   |                |
|-----------------------|-----------------------------------|------------|------------------------|------------------------|----------|--------------|----------|---|----------------|
| Marker 1              | RF 50 Ω<br>Δ 370.800              |            |                        | SENSE:<br>Trig Delay-1 |          | g Type: Log- |          | 8:05 PM Sep 22, 2023<br>TRACE 1 2 3 4 5 6<br>TYPE WWWWWWW | Marker         |
|                       |                                   |            | NO: Fast ↔<br>Gain:Low | #Atten: 30 dl          | 3        |              |          | DET   | Select Marker  |
| 10 dB/div             | Ref Offset 10<br>Ref 30.22 (      |            |                        |                        |          |              | ΔMkr     | 1 370.8 ms<br>-0.44 dB                                    | 1              |
| 20.2                  |                                   | X~         |                        |                        |          |              |          |   | Normal         |
| 0.220                 |                                   |            |                        |                        |          |              |          |   |                |
| -9.78<br>-19.8        |                                   |            |                        |                        |          |              |          |   | Delta          |
| -29.8                 |                                   |            |                        |                        |          |              |          |   |                |
| -39.8                 | understift, Andry angestift, same | L Marine M |                        |                        |          |              |          | alan managan and and and and and and and and and a        | Fixed⊳         |
| -59.8                 |                                   |            |                        |                        |          |              |          |   |                |
| Center 90<br>Res BW 1 | 08.700000 MI<br>I.0 MHz           | Hz         | #VBV                   | V 3.0 MHz              |          | Swee         | ep 600.0 | Span 0 Hz<br>ms (1001 pts)                                | Off            |
|                       |                                   | X<br>37    | 0.8 ms (Δ)             | ۲<br><b>-0.44 dB</b>   | FUNCTION | FUNCTION     | WIDTH F  | UNCTION VALUE   |                |
| 2 F 1<br>3 4<br>5 6   |                                   | 14         | 8.8 ms                 | 12.20 dBm              |          |              |          |   | Properties►    |
| 7<br>8<br>9<br>10     |                                   |            |                        |                        |          |              |          |   | More<br>1 of 2 |
| 11<br><               |                                   |            |                        |                        |          |              | CTATUC   | >   |                |
| MSG                   |                                   |            |                        |                        |          |              | STATUS   |   |                |

Screen Capture from the spectrum analyzer: sweep Time in 25.6 Sec



### 2.9 EUT Positioning Assessment

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Janet Mijares

Date: 2023-09-22 (21.7°C, 22.8% RH)

Standard: FCC PART 15.247

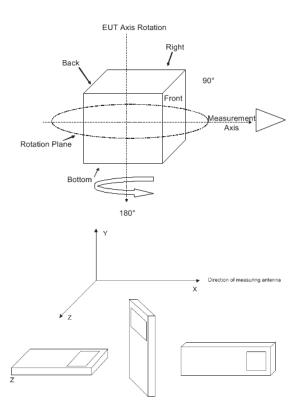
Basic Standard: ANSI C63.4-2014

EUT: Seal/Seal Ex

**Comments**: Y-Axis is worse axis.

#### Specification: ANSI C63.4-2014, Clause 6.3.2.1

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it may be larger or smaller to accommodate various sized EUTs (see Figure 6, Figure 7, and Figure 9). For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.



#### 2.10 Radiated Spurious Emissions within restricted band

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Brendan Van Hee/Janet Mijares I. Akram EUT: Seal/Seal Ex Standard: FCC PART 15.247/15.209 Basic Standard: ANSI C63.10-2013

Date: 2023-09-22/25/27 (21.9° C,24.9 % RH)

# EUT status: Compliant

#### Specification: FCC PART 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

| 940000 16<br>620000 - 25<br>660000 25<br>762500 - 37 | 5.804250 -<br>5.804750<br>5.500000 -<br>5.670000<br>7.500000 -   | 162.01250 -<br>167.17000<br>167.72000 -<br>173.20000  | 1660.0000 -<br>1710.0000<br>1718.8000 -   | 3.6000000 -<br>4.4000000<br>4.5000000 -  | 14.470000 -<br>14.500000<br>15.350000 -  |
|--|--|---|---|--|--|
| 660000         25           762500 -         37      | 5.670000   |   |   | 4.5000000 -  | 15 350000  |
|  | 7 500000   |   | 1722.2000   | 5.1500000  | 16.200000  |
| 501000 00  | 3.250000 -<br>3.250000   | 240.00000 –<br>285.00000  | 2200.0000 –<br>2300.0000  | 5.3500000 –<br>5.4600000   | 17.700000 –<br>21.400000   |
|  | 3.000000 -<br>4.600000   | 322.00000 -<br>335.40000  | 2310.0000 -<br>2390.0000  | 7.2500000 –<br>7.7500000   | 22.010000 –<br>23.120000   |
|  |  | 399.90000 –<br>410.00000  | 2483.5000 –<br>2500.0000  | 8.0250000 –<br>8.5000000   | 23.600000 –<br>24.000000   |
|  |  | 608.00000 -<br>614.00000  | 2655.0000 -<br>2900.0000  | 9.0000000 –<br>9.2000000   | 31.200000 –<br>31.800000   |
|  |  | 960.00000 –<br>1240.0000 <mark>***</mark>   | 32600000 -<br>3267.0000   | 9.3000000 –<br>9.5000000   | 36.430000 -<br>36.500000   |
|  |  | 1300.0000 –<br>1427.0000 <mark>***</mark>   | 3332.0000 –<br>3339.0000  | 10.600000 –<br>12.700000   | Above<br>38.600000   |
|  |  | 1435.0000 –<br>1626.5000  | 3345.8000 –<br>3358.0000  | 13.250000 –<br>13.400000   |  |
|  |  | 1645.5000 –<br>1646.5000  | 3500.0000 –<br>3600.0000  |  |  |
| 1 22 55 55 34 44 5                                   | 47500       74         190000 -       74         193000       75         19750 -       10         120250       12         176750 -       12         176750 -       12         170000 -       14         10000 -       14         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         120000 -       15         13000 -       15         14000 -       15         1500 -       15         1500 -       15         1500 -       15         1500 -       15         1500 -       15         1500 -       15 | 47500       74.600000         990000 -       74.800000 -         93000       75.200000         19750 -       108.00000 -         121.94000 **         376750 -       123.00000 -         177250       138.00000 -         10000 -       149.90000 -         10000 -       156.52475-         1230000 -       156.52525         194750 -       156.70000 -         156.90000 -       156.90000 - | 47500 $74.600000$ $335.40000$ $990000$ $74.800000$ $399.90000$ $93000$ $75.200000$ $410.00000$ $319750$ $108.00000$ $608.00000$ $320250$ $121.94000$ $614.00000$ $376750$ $123.00000$ $960.00000$ $3777250$ $138.00000$ $1240.0000$ $370000$ $149.90000$ $1300.0000$ $320000$ $156.52475$ $1435.0000$ $320000$ $156.52475$ $1435.0000$ $320000$ $156.72000$ $1645.5000$ | 47500       74.600000       335.40000       2390.0000         990000 -       74.800000 -       399.90000 -       2483.5000 -         93000       75.200000       410.00000       2500.0000         19750 -       108.00000 -       608.00000 -       2655.0000 -         120250       121.94000 **       614.00000       2900.0000         17750 -       123.00000 -       960.00000 -       32600000 -         177250       138.00000 **       1240.0000 ***       3332.0000 -         160000 -       149.90000 -       1300.0000 -       3332.0000 -         120000 -       156.52475 -       1435.0000 -       3345.8000 -         120000 -       156.52525       1626.5000       358.0000         194750 -       156.70000 -       1646.5000 -       3600.0000 - | 47500 $74.600000$ $335.40000$ $2390.0000$ $7.7500000$ $990000$ $74.800000$ $399.90000$ $2483.5000$ $8.0250000$ $990000$ $75.200000$ $410.00000$ $2500.0000$ $8.0250000$ $3979.90000$ $2483.5000$ $8.0250000$ $8.5000000$ $3979.90000$ $2500.0000$ $8.0250000$ $8.5000000$ $319750$ $108.00000$ $608.00000$ $2655.0000$ $9.00000000$ $376750$ $123.00000$ $614.00000$ $3260.0000$ $9.3000000$ $377250$ $138.00000$ $1240.0000$ $3267.0000$ $9.5000000$ $410000$ $1300.0000$ $3332.0000$ $12.700000$ $420000$ $156.52475$ $1435.0000$ $3345.8000$ $13.250000$ $420000$ $156.52475$ $1435.0000$ $3345.8000$ $13.400000$ $4750$ $156.70000$ $1645.5000$ $3500.0000$ $3600.0000$ $495250$ $156.90000$ $1646.5000$ $3600.0000$ $3600.0000$ |

#### **Restricted Bands of Operation:**

# 2.10.1 Test Guidance: ANSI C63.10-2013, Clause 13.4.2

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna (as per KDB 460108).

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz The EUT is raised to 150 cm above the ground plane, and the area between the EUT and the antenna mast is covered with RF absorbent material.

The scan is performed at discreet increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 - 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

# 2.10.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

| Equipment                            | Manufacturer         | Model #                         | Asset #        | Cal. Date<br>(yyyy-mm-dd) | Cal. Due<br>(yyyy-mm-dd) |
|--------------------------------------|----------------------|---------------------------------|----------------|---------------------------|--------------------------|
| EMC Software                         | UL                   | Ver. 9.5                        | ETC-SW-EMC 2.1 | N/A                       |                          |
| EMI receiver                         | Agilent              | N9038A<br>(FW A.22.08)          | 6906           | 2022-12-12                | 2023-12-12               |
| Loop Antenna<br>(9KHz – 30MHz)       | Electro-Metrics      | ALP-70                          | 3703           | 2022-01-05                | 2025-01-05               |
| Biconilog Antenna<br>(30 – 1000 MHz) | AR                   | JB1                             | 6905           | 2021-10-29                | 2023-10-29               |
| DRG Horn<br>(1000 – 18000 MHz)       | EMCO                 | 3115                            | 19357          | 2022-10-05                | 2024-10-05               |
| Humidity/Temp<br>Logger              | Extech Ins.<br>Corp. | 42270                           | 5892           | 2023-04-14                | 2024-04-14               |
| Pre-Amplifier<br>(30 – 1400 MHz)     | HP                   | 8447D                           | 9291           | 2023-05-11                | 2024-05-11               |
| Low Noise Amplifier<br>(1 – 18 GHz)  | MITEQ                | JS43-01001800-21-<br>5P         | 4354           | 2023-05-11                | 2024-05-11               |
| RE Cable below<br>1GHz               | Insulated Wire Inc.  | KPS-1501A-3600-<br>KPA-01102006 | 4419           | 2023-05-11                | 2024-05-11               |
| Re Cable Above 1<br>GHz              | A.H. System<br>Inc.  | SAC-26G-8.23                    | 6187           | 2023-05-11                | 2024-05-11               |
| 0.9GHz Notch Filter                  | Microtronics         | BRM20784                        | 6947           | 2023-05-11                | 2024-05-11               |

Testing was performed with the following equipment:

## 2.10.4 Test Sample Verification, Configuration & Modifications

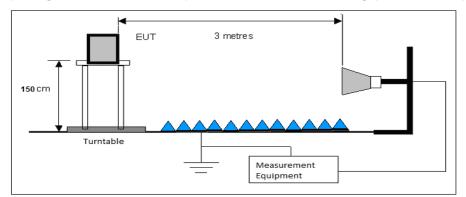
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation. LoRa radio is transmitting at mid channel in ingle carrier configuration and high channel in dual carrier configurations.

The EUT met the requirements without modification. Power cable is soldered to the battery terminal to connect the DC power supply during radiated emission.

## Electrical Centre of Antenna EUT 3 metres 80 cm Ground Plane Turntable Measurement Equipment

#### Test setup diagram for Radiated Spurious Emissions testing (below 1GHz):

#### Test setup diagram for Radiated Spurious Emissions testing (above 1GHz):



### 2.10.5 Radiated Emissions Data: Hybrid (125 KHz)

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

#### Meter Reading in dBμV + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dbμV/m. Delta = Field Strength – Limit

Notes:

When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss. Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discreet increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission. Preliminary scans were performed for all channels in Transmit modes. The LOW band channel 902.3 MHz was selected as the worst-case condition for detailed examination. In Transmit mode, the EUT was assessed up to 10.0 GHz.

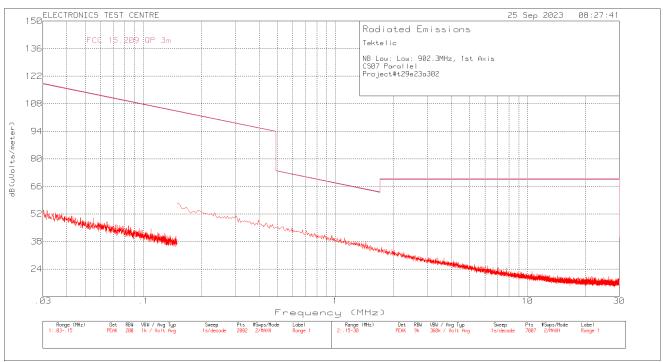
| Freq.<br>Marker | Freq.<br>[GHz] | Raw<br>reading[<br>dBµv] | Det | Antenna<br>Factor<br>[dB/m] | Pre amp<br>Gain [dB] | Corrected<br>Reading<br>[dBµv/m] | FCC 15.209<br>Limit<br>[dBµv/m] | Delta<br>[dB] | Azimuth<br>[Deg] | Height<br>[cm] | Polarization |
|-----------------|----------------|--------------------------|-----|-----------------------------|----------------------|----------------------------------|---------------------------------|---------------|------------------|----------------|--------------|
| 1               | 1.8045         | 50.87                    | РК  | 27.5                        | -34                  | 44.37                            | 74                              | -29.63        | 169              | 400            | Horizontal   |
| 1               | 1.8045         | 47.7                     | AV  | 27.5                        | -34                  | 41.2                             | 54                              | -12.80        | 169              | 400            | Horizontal   |
| 2               | *5.4139        | 41.44                    | PK  | 33.9                        | -30                  | 45.34                            | 74                              | -28.66        | 62               | 199            | Horizontal   |
| 2               | *5.4139        | 35.64                    | AV  | 33.9                        | -30                  | 39.54                            | 54                              | -14.46        | 62               | 199            | Horizontal   |
| 4               | *9.0229        | 37.34                    | PK  | 37.2                        | -25.1                | 49.44                            | 74                              | -24.56        | 93               | 219            | Horizontal   |
| 4               | *9.0229        | 29.58                    | AV  | 37.2                        | -25.1                | 41.68                            | 54                              | -12.32        | 93               | 219            | Horizontal   |
| 5               | 1.8047         | 52.09                    | PK  | 27.5                        | -34                  | 45.59                            | 74                              | -28.41        | 78               | 255            | Vertical     |
| 5               | 1.8047         | 49.28                    | AV  | 27.5                        | -34                  | 42.78                            | 54                              | -11.22        | 78               | 255            | Vertical     |
| 6               | *5.4138        | 40.95                    | РК  | 33.9                        | -30                  | 44.85                            | 74                              | -29.15        | 67               | 115            | Vertical     |
| 6               | *5.4138        | 34.55                    | AV  | 33.9                        | -30                  | 38.45                            | 54                              | -15.55        | 67               | 115            | Vertical     |
| 8               | 7.2182         | 38.81                    | PK  | 36.1                        | -26.6                | 48.31                            | 74                              | -25.69        | 321              | 228            | Vertical     |
| 8               | 7.2182         | 31.35                    | AV  | 36.1                        | -26.6                | 40.85                            | 54                              | -13.15        | 321              | 228            | Vertical     |
| 9               | *9.0232        | 37.09                    | РК  | 37.2                        | -25.1                | 49.19                            | 74                              | -24.81        | 334              | 391            | Vertical     |
| 9               | *9.0232        | 28.59                    | AV  | 37.2                        | -25.1                | 40.69                            | 54                              | -13.31        | 334              | 391            | Vertical     |

#### Negative values for Delta indicate compliance.

**PK: Peak Detector** 

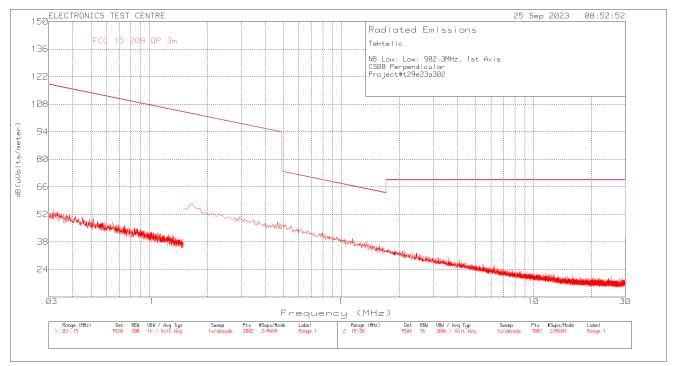
AV: Average Detector.

\* Spurious Emission in Restricted Band

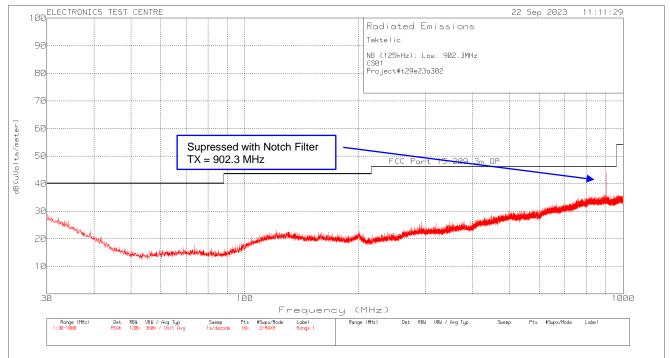


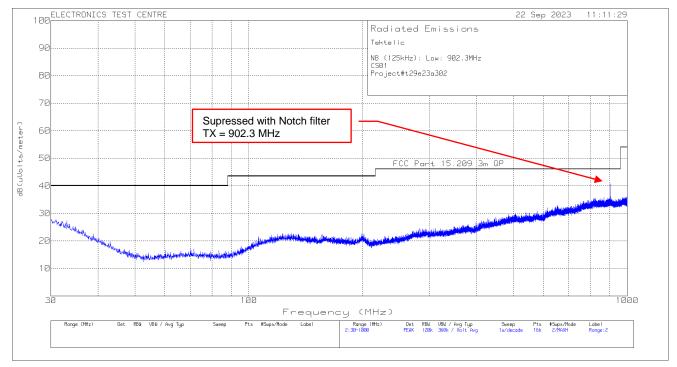
### Plot of Radiated Emissions: Parallel

### Plot of Radiated Emissions: Perpendicular

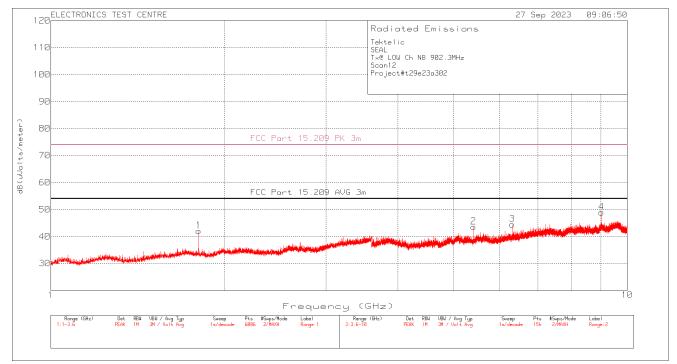


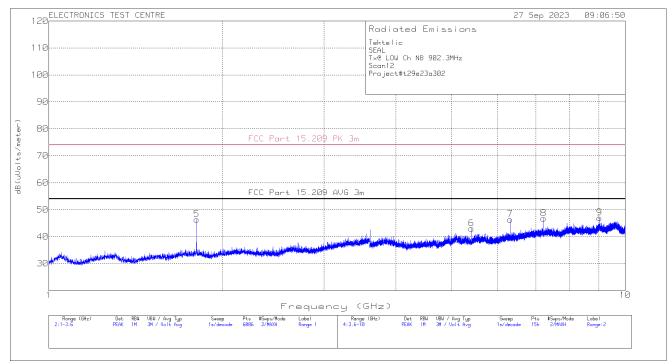












## 2.11 Radiated Emissions (RX Mode)

| Test Lab: Electronics Test Centre, Airdrie      | EUT: Seal/Seal Ex                |
|---|----------------------------------|
| Test Personnel: Brendan Van Hee / Janet Mijares | Standard: FCC Part 15.109        |
| Date: 2023-09-22/26 (25.4° C,22.2 % RH)         | Basic Standard: ANSI C63.4: 2014 |
|   | Class: B                         |

## EUT status: Compliant

| Frequency (MHz)   | FCC Part 15.109<br>Class B Limit (3m) |  |  |  |  |
|---|---------------------------------------|--|--|--|--|
| 30 – 88   | 40 (dBµV/m)                           |  |  |  |  |
| 88 – 216  | 43.52 (dBµV/m)                        |  |  |  |  |
| 216 – 960   | 46.02 (dBµV/m)                        |  |  |  |  |
| Above 960   | 53.98 (dBµV/m)                        |  |  |  |  |
| Criteria: The radiated emissions produced by a device, measured at a distance |                                       |  |  |  |  |

of 3 meters, shall not exceed the limits as specified.

#### 2.11.1 Test Guidance:

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz.

The scan is performed at discreet increments of turntable azimuth and stepped antenna height, with peak detector and Max Hold function which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

After the pre-scan is completed, the frequencies of interest are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 - 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. This may produce a different reading than the pre scan trace. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

## 2.11.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

## 2.11.3 Test Equipment

Testing was performed with the following equipment:

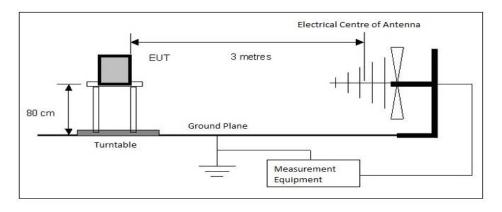
| Equipment                            | Manufacturer         | Model #                         | Asset #        | Cal. Date<br>(yyyy-mm-dd) | Cal. Due<br>(yyyy-mm-dd) |
|--------------------------------------|----------------------|---------------------------------|----------------|---------------------------|--------------------------|
| EMC Software                         | UL                   | Ver. 9.5                        | ETC-SW-EMC 2.1 | N                         | /A                       |
| EMI receiver                         | Agilent              | N9038A<br>(FW A.22.08)          | 6906           | 2022-12-12                | 2023-12-12               |
| Loop Antenna<br>(9KHz – 30MHz)       | Electro-Metrics      | ALP-70                          | 3703           | 2022-01-05                | 2025-01-05               |
| Biconilog Antenna<br>(30 – 1000 MHz) | AR                   | JB1                             | 6905           | 2021-10-29                | 2023-10-29               |
| DRG Horn<br>(1000 – 18000 MHz)       | EMCO                 | 3115                            | 19357          | 2022-10-05                | 2024-10-05               |
| Humidity/Temp<br>Logger              | Extech Ins.<br>Corp. | 42270                           | 5892           | 2023-04-14                | 2024-04-14               |
| Pre-Amplifier<br>(30 – 1400 MHz)     | HP                   | 8447D                           | 9291           | 2023-05-11                | 2024-05-11               |
| Low Noise Amplifier<br>(1 – 18 GHz)  | MITEQ                | JS43-01001800-21-<br>5P         | 4354           | 2023-05-11                | 2024-05-11               |
| RE Cable below<br>1GHz               | Insulated Wire Inc.  | KPS-1501A-3600-<br>KPA-01102006 | 4419           | 2023-05-11                | 2024-05-11               |
| Re Cable Above 1<br>GHz              | A.H. System<br>Inc.  | SAC-26G-8.23                    | 6187           | 2023-05-11                | 2024-05-11               |
| 0.9GHz Notch Filter                  | Microtronics         | BRM20784                        | 6947           | 2023-05-11                | 2024-05-11               |

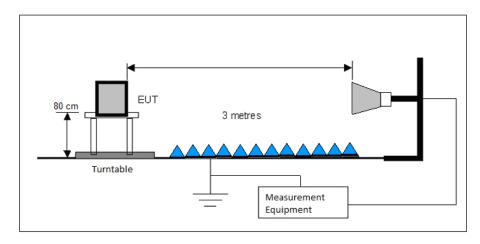
#### 2.11.4 Test Sample Verification, Configuration & Modifications

To cover the unintentional radiated emission. The EUT was configured in receive mode. Unit was placed at the center of turntable in semi-anechoic chamber 80cm above the ground plane and at a distance of 3m from the test receive antenna.

The EUT met the requirements without modification.

## EUT RX configuration Block Diagram for Radiated Emissions testing:





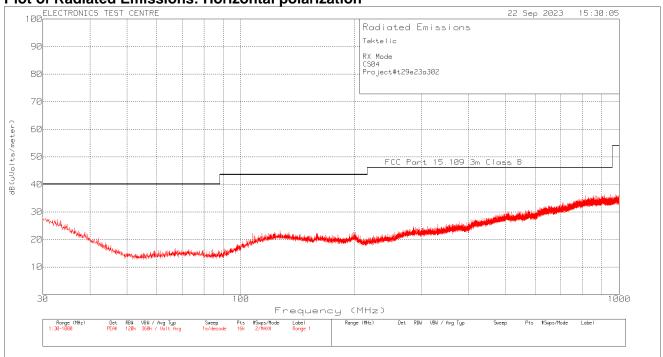
2.11.5 Radiated Emissions Data maximization:

No Emission observed within 10 dB from the specified limit

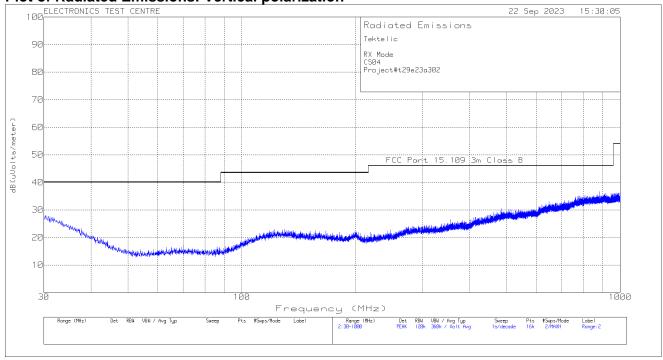
Meter Reading in dB $\mu$ V + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in db $\mu$ V/m.

- In receive mode, the EUT was assessed up to 12.5 GHz.

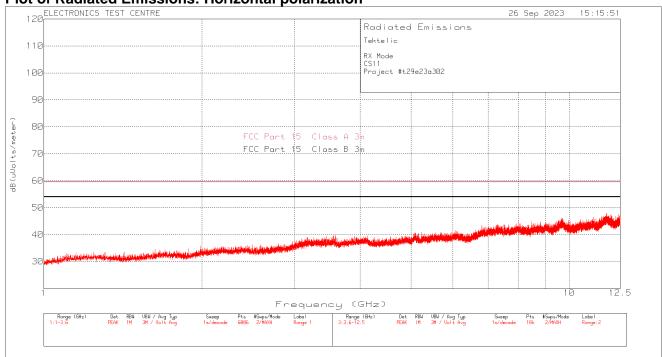
#### Test Sample: Seal/Seal Ex FCC ID:2ALEPT0007705

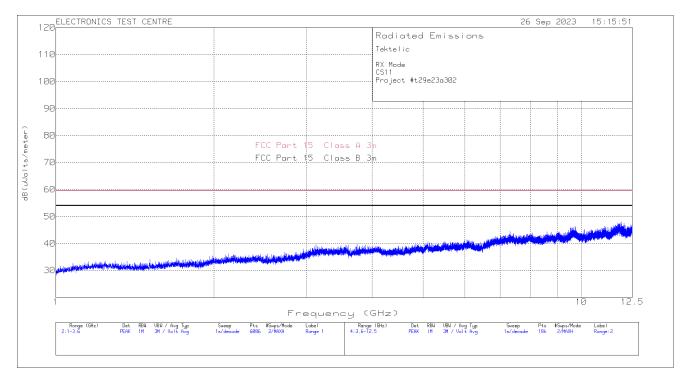


#### Plot of Radiated Emissions: Horizontal polarization









#### 2.12 RF Exposure

Test Lab: Electronics Test Centre, Airdrie

Test Personnel:

EUT: Seal/Seal Ex Standard: FCC PART 15.247

Date:

## **EUT status: Compliant**

**Compliant:** RF exposure assessment to be provided in a separate Exhibit.

### 3.0 TEST FACILITY

#### 3.1 Location

The Seal/Seal Ex was tested at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Anechoic Chamber (RFAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file # 2046A. This site is also listed with the FCC under Registration Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

#### 3.2 Grounding Plan

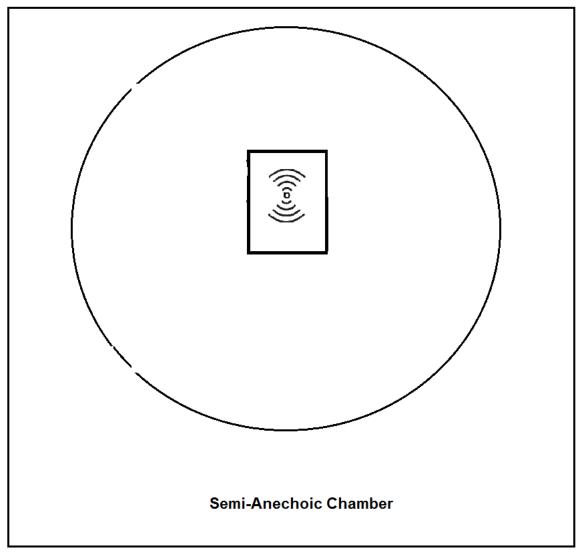
The Seal/Seal Ex was placed at the center of the test chamber turntable on top of an 80-cm high polystyrene foam table below 1GHz and at 1.5m high polystyrene foam table above 1 GHz for transmits mode and 80cm high for RX mode. Ground connection is provided as per customer specification. There is no external grounding.

#### 3.3 Power Supply

For radiated Emission new three AA batteries was used. For antenna port conducted emission power supplied via DC power supply.

## Appendix A – Test Setup Block Diagram





# **End of Document**