# TEST REPORT

## Test Report No. : UL-RPT-RP14876167-1716A

| | | |
|---|---|---|
| **Manufacturer** | : | Radiodetection Ltd |
| **Model No.** | : | RD8200SG |
| **Contains FCC ID** | : | K68-CLASSIC & SQGBL652 |
| **Contains ISED Certification No.** | : | IC: 3893A-CLASSIC & IC: 3147A-BL652 |
| **Technology** | : | *Bluetooth* – BDR & EDR |
| **Test Standard(s)** | : | FCC Parts 15.207, 15.209(a) & 15.247<br>Innovation, Science and Economic Development Canada<br>RSS-247 Issue 2 February 2017<br>RSS-Gen Issue 5 February 2021 |
| **Test Laboratory** | : | UL International (UK) Ltd, Basingstoke, Hampshire, RG24 8AH, United Kingdom |

1. This test report shall not be reproduced except in full, without the written approval of UL International (UK) Ltd.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

**Date of Issue:** 23 November 2023

**Checked by:**

Ben Mercer
Lead Project Engineer, Radio Laboratory

**Company Signatory:**

Sarah Williams
RF Operations Leader, Radio Laboratory

5772

## Customer Information

| | |
|---|---|
| **Company Name:** | Radiodetection Ltd |
| **Address:** | Western Drive<br>Bristol<br>BS14 0AF<br>United Kingdom |

## Report Revision History

| Version Number | Issue Date | Revision Details | Revised By |
|---|---|---|---|
| 1.0 | 24/10/2023 | Initial Version | Ben Mercer |
| 2.0 | 23/11/2023 | FCC ID & ISED IC numbers updated | Ben Mercer |

# Table of Contents

# 1 Attestation of Test Results

## 1.1 Description of EUT

The equipment under test was a handheld precision cable and pipe locator, containing 2 identical *Bluetooth* modules (FCC ID: K68-CLASSIC, ISED IC: 3893A-CLASSIC) and 2 identical *Bluetooth* LE modules (FCC ID: SQGBL652, ISED IC: 3147A-BL652).

## 1.2 General Information

| | |
|---|---|
| **Specification Reference:** | 47CFR15.247 |
| **Specification Title:** | Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.247 |
| **Specification Reference:** | 47CFR15.207 and 47CFR15.209 |
| **Specification Title:** | Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.207 and 15.209 |
| **Specification Reference:** | RSS-Gen Issue 5 February 2021 |
| **Specification Title:** | General Requirements for Compliance of Radio Apparatus |
| **Specification Reference:** | RSS-247 Issue 2 February 2017 |
| **Specification Title:** | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices |
| **Site Registration:** | FCC: 685609, ISEDC: 20903 |
| **FCC Lab. Designation No.:** | UK2011 |
| **ISEDC CABID:** | UK0001 |
| **Location of Testing:** | Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom |
| **Test Dates:** | 18 September 2023 to 25 September 2023 |

## 1.3 Summary of Test Results

| FCC Reference (47CFR) | ISED Canada Reference | Measurement | Result |
|---|---|---|---|
| Part 15.247(d) & 15.209(a) | RSS-Gen 6.13 / RSS-247 5.5 | Transmitter Radiated Emissions | Complied |

## 1.4 Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

# 2 Summary of Testing

## 2.1 Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| | |
|---|---|
| Site 1 | X |
| Site 2 | - |
| Site 17 | X |

UL International (UK) Ltd is accredited by the United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. The tests reported herein have been performed in accordance with its terms of accreditation.

## 2.2 Methods and Procedures

| | |
|---|---|
| **Reference:** | ANSI C63.10-2013 |
| **Title:** | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| **Reference:** | KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019 |
| **Title:** | Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules |

## 2.3 Calibration and Uncertainty

### Measuring Instrument Calibration

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

### Measurement Uncertainty & Decision Rule

#### Overview

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

#### Decision Rule

Measurement system instrumentation shall be used with an accuracy specification meeting the accuracy specification limits according to IEC/IECEE OD-5014.

As applicable, unless specified otherwise in this report, the compliance “Decision Rule” is based on Simple Acceptance. If the measured value is on the limit, the result is defined as a pass. In this case the risk of a false positive is 50%. For further information regarding risk assessment refer to ILAC G8:09/2019.

#### Measurement Uncertainty

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Measurement Type | Range | Confidence Level (%) | Calculated Uncertainty |
|---|---|---|---|
| Radiated Spurious Emissions | 9 kHz to 30 MHz | 95% | ±5.32 dB |
| Radiated Spurious Emissions | 30 MHz to 1 GHz | 95% | ±3.30 dB |
| Radiated Spurious Emissions | 1 GHz to 25 GHz | 95% | ±3.16 dB |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

## 2.4 Test and Measurement Equipment

### Test Equipment Used for Transmitter Radiated Emissions Tests

| Asset No. | Instrument | Manufacturer | Type No. | Serial No. | Date Calibration Due | Cal. Interval (Months) |
|---|---|---|---|---|---|---|
| M2040 | Thermohygrometer | Testo | 608-H1 | 45124934 | 09 Dec 2023 | 12 |
| K0001 | 3m RSE Chamber | Rainford EMC | N/A | N/A | 05 Sep 2024 | 12 |
| M236226 | Test Receiver | Rohde & Schwarz | ESW26 | 103134 | 21 Apr 2024 | 12 |
| A3165 | Magnetic Loop Antenna | ETS-Lindgren | 6502 | 00224383 | 13 Apr 2024 | 12 |
| M2003 | Thermohygrometer | Testo | 608-H1 | 45046641 | 09 Dec 2023 | 12 |
| K0017 | 3m RSE Chamber | Rainford EMC | N/A | N/A | 08 Nov 2023 | 12 |
| M1995 | Test Receiver | Rohde & Schwarz | ESU40 | 100428 | 02 Nov 2023 | 12 |
| A2863 | Pre-Amplifier | Agilent | 8449B | 3008A02100 | 07 Nov 2023 | 12 |
| A223628 | Pre-Amplifier | Atlantic Microwave | A-LNAKX-380116-S5S5 | 210837001 | 03 Nov 2023 | 12 |
| A3265 | Pre-Amplifier | Schwarzbeck | BBV 9721 | 9721-069 | 31 Oct 2023 | 12 |
| A3167 | Pre Amplifier | Com-Power | PAM-103 | 18020010 | 02 Nov 2023 | 12 |
| A2889 | Antenna | Schwarzbeck | BBHA 9120 B | 00653 | 02 Nov 2023 | 12 |
| A2890 | Antenna | Schwarzbeck | HWRD 750 | 014 | 02 Nov 2023 | 12 |
| A2892 | Antenna | Schwarzbeck | BBHA 9170 | 9170-727 | 31 Oct 2023 | 12 |
| A490 | Antenna | Chase | CBL6111A | 1590 | 06 Oct 2023 | 12 |
| A2148 | Attenuator | AtlanTecRF | AN18-06 | 090202-06 | 06 Oct 2023 | 12 |
| A2916 | Attenuator | AtlanTecRF | AN18W5-10 | 832827#2 | 25 Jan 2024 | 12 |
| A3036 | Low Pass Filter | AtlanTecRF | AFL-02000 | 15062902848 | 25 Jan 2024 | 12 |
| A2914 | High Pass Filter | AtlanTecRF | AFH-03000 | 2155 | 25 Jan 2024 | 12 |
| A2947 | High Pass Filter | AtlanTecRF | AFH-07000 | 1601900001 | 25 Jan 2024 | 12 |

# 3 Equipment Under Test (EUT)

## 3.1 Identification of Equipment Under Test (EUT)

| | |
|---|---|
| **Brand Name:** | Radiodetection Ltd |
| **Model Name or Number:** | RD8200SG |
| **Test Sample Serial Number:** | 10/82SG-FCC-991014 |
| **Hardware Version:** | P2 |
| **Software Version:** | 4000 |
| **Contains FCC ID:** | K68-CLASSIC & SQGBL652 |
| **Contains ISED Canada Certification No:** | IC: 3893A-CLASSIC & IC: 3147A-BL652 |

## 3.2 Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

## 3.3 Additional Information Related to Testing

| | | | |
|---|---|---|---|
| **Tested Technology:** | *Bluetooth* | | |
| **Power Supply Requirement:** | Nominal | 3.7 VDC | |
| **Type of Unit:** | Transceiver | | |
| **Channel Spacing:** | 1 MHz | | |
| **Mode:** | Basic Rate | Enhanced Data Rate | |
| **Modulation:** | GFSK | π/4-DQPSK | 8DPSK |
| **Packet Type: (Maximum Payload)** | DH5 | 2DH5 | 3DH5 |
| **Data Rate (Mbps):** | 1 | 2 | 3 |
| **Transmit Frequency Range:** | 2402 MHz to 2480 MHz | | |
| **Transmit Channels Tested:** | **Channel ID** | **Channel Number** | **Channel Frequency (MHz)** |
| | Hopping | 0-78 | 2402-2480 |

## 3.4 Description of Available Antennas

The radio utilizes an integrated antenna, with the following maximum gain:

| Frequency Range (MHz) | Antenna Gain (dBi) |
|---|---|
| 2400-2480 | 2.0 |

## 3.5 Description of Test Setup

### Support Equipment

The following support equipment was used to exercise the EUT during testing:

| | |
|---|---|
| **Description:** | Smartphone |
| **Brand Name:** | Samsung |
| **Model Name or Number:** | Galaxy S10 |
| **Serial Number:** | RF8M229VJJF |

| | |
|---|---|
| **Description:** | Smartphone |
| **Brand Name:** | Samsung |
| **Model Name or Number:** | Galaxy M23 |
| **Serial Number:** | RFCW210YF0F |

| | |
|---|---|
| **Description:** | AC to DC Power Adaptor |
| **Brand Name:** | Radiodetection Ltd |
| **Model Name or Number:** | 26/ER3223U17 |
| **Serial Number:** | 20224906463 |

## Operating Modes

The EUT was tested in the following operating mode(s):

- Continuously transmitting in hopping mode across all 79 channels, on both *Bluetooth* modules.

## Configuration and Peripherals

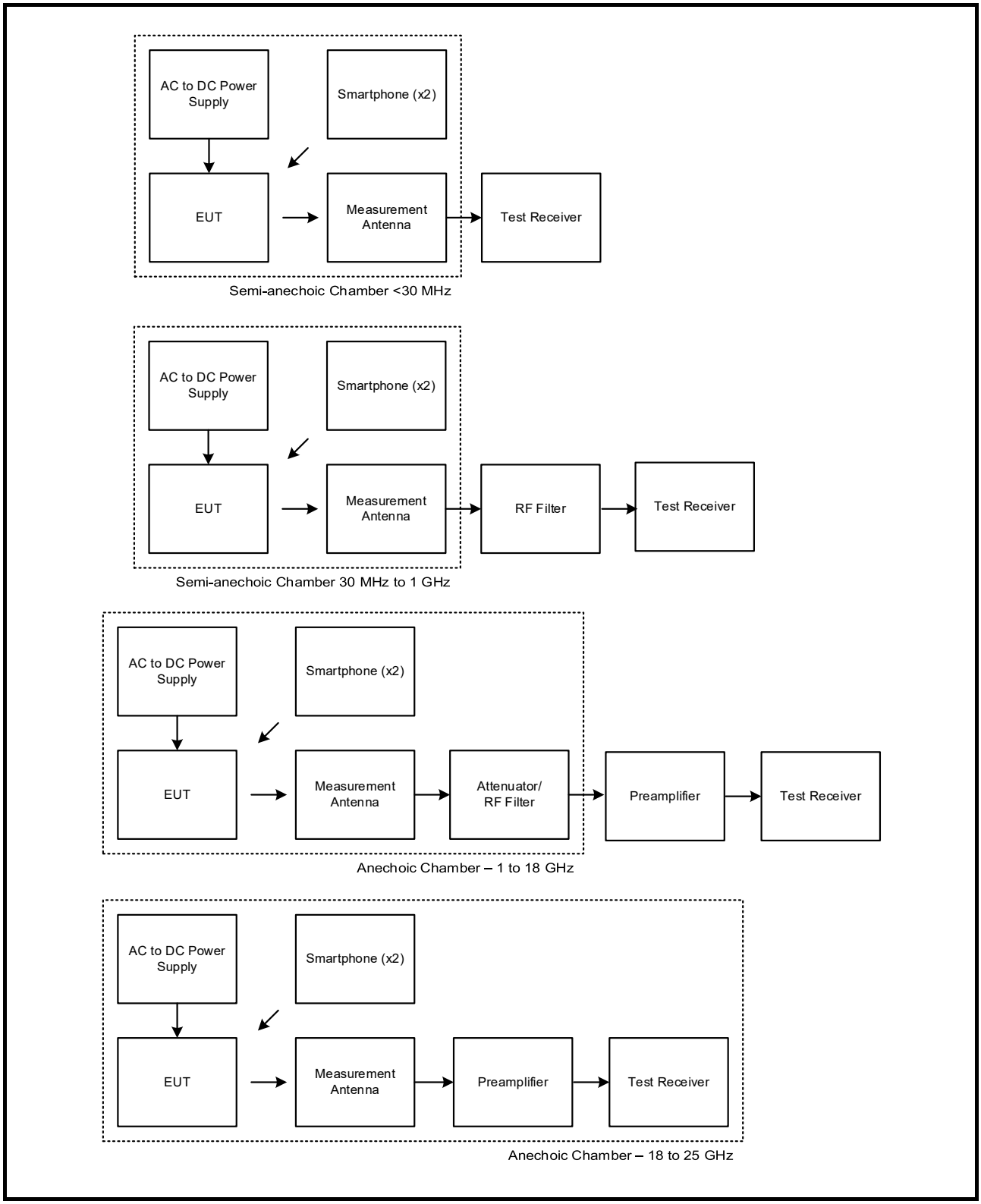
The EUT was tested in the following configuration(s):

- The EUT was paired with 2 smartphones via *Bluetooth*. A bespoke application on the smartphones was used to request continuous data from the EUT to force *Bluetooth* transmission. The application did not provide control or monitoring of the data rate or output power.
- Once configured, the smartphones were place behind the receiving antenna.
- The EUT was powered via its removable battery pack. The battery pack was connected to a 120 VAC 60 Hz single phase mains supply via the supplied AC to DC power supply.
- Radiated spurious emissions tests were performed with the EUT in the worst-case orientation with respect to emissions. There were no active ports to terminate.

## Test Setup Diagrams

## Radiated Tests:

## Test Setup for Transmitter Radiated Emissions



# 4 Radiated Test Results

## 4.1 Transmitter Radiated Emissions <1 GHz

### Test Summary:

| | | | |
|---|---|---|---|
| **Test Engineers:** | Nicholas Steele & John Ferdinand | **Test Dates:** | 19 September 2023 & 25 September 2023 |
| **Test Sample Serial Number:** | 10/82SG-FCC-991014 | | |

| | |
|---|---|
| **FCC Reference:** | Parts 15.247(d) & 15.209(a) |
| **ISED Canada Reference:** | RSS-Gen 6.13 / RSS-247 5.5 |
| **Test Method Used:** | ANSI C63.10 Sections 6.3, 6.4 and 6.5 |
| **Frequency Range** | 9 kHz to 1000 MHz |

### Environmental Conditions:

| | |
|---|---|
| **Temperature (°C):** | 22 to 24 |
| **Relative Humidity (%):** | 49 to 52 |

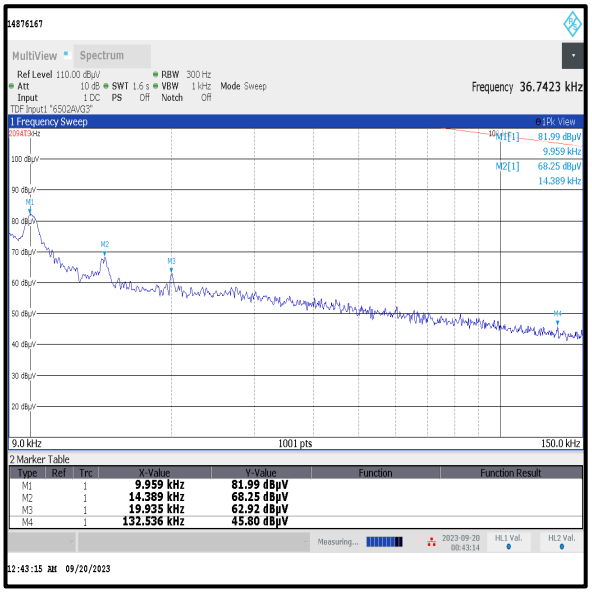
### Note(s):

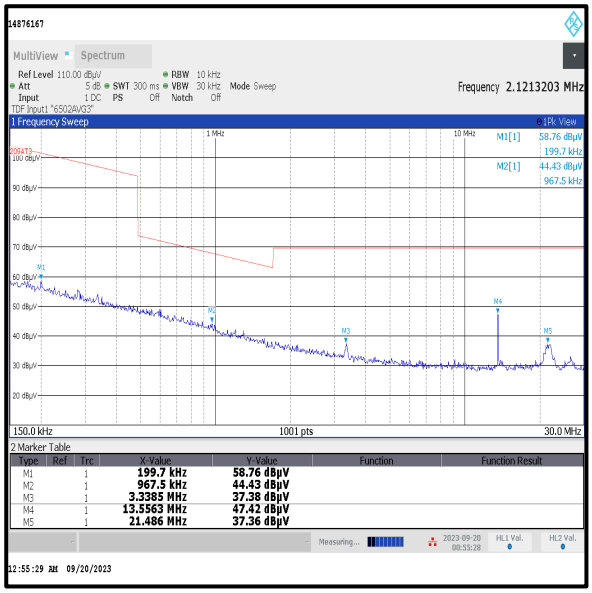
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001/ K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
4. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was configured as follows: For 9 kHz to 150 kHz, the resolution bandwidth was set to 300 Hz and video bandwidth 1 kHz. A peak detector was used and trace mode was Max Hold. For 150 kHz to 30 MHz, the resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz, trace mode was Max Hold. For 30 MHz to 1 GHz, the resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
5. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span wide enough to see the whole emission.
6. The emission at approximately 13.5 MHz originates from a passive NFC antenna incorporated in the *Bluetooth* module. The NFC functionality of the module is not active in the EUT; therefore, the emission is treated as spurious.

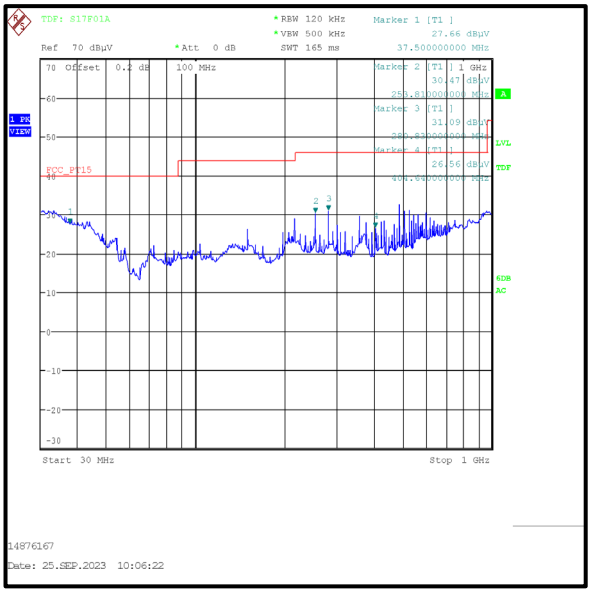
## Transmitter Radiated Emissions (continued)

## Results: Quasi-Peak / Middle Channel

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 37.500 | Vertical | 24.6 | 40.0 | 15.4 | Complied |
| 253.136 | Vertical | 29.2 | 46.0 | 16.8 | Complied |
| 281.246 | Horizontal | 30.4 | 46.0 | 15.6 | Complied |
| 403.648 | Vertical | 25.9 | 46.0 | 20.1 | Complied |




*Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.*

## 4.2 Transmitter Radiated Emissions >1 GHz

### Test Summary:

| | | | |
|---|---|---|---|
| **Test Engineers:** | John Ferdinand & Nicholas Steele | **Test Dates:** | 18 September 2023 to 19 September 2023 |
| **Test Sample Serial Number:** | 10/82SG-FCC-991014 | | |

| | |
|---|---|
| **FCC Reference:** | Parts 15.247(d) & 15.209(a) |
| **ISED Canada Reference:** | RSS-Gen 6.13 / RSS-247 5.5 |
| **Test Method Used:** | ANSI C63.10 Sections 6.3 and 6.6 |
| **Frequency Range** | 1 GHz to 25 GHz |

### Environmental Conditions:

| | |
|---|---|
| **Temperature (°C):** | 23 |
| **Relative Humidity (%):** | 49 to 51 |

### Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver; therefore, the highest peak and average noise floor readings of the measuring receiver were recorded in the tables below.
3. The emissions shown on the 1 GHz to 3 GHz plot are the EUT fundamentals.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
5. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with their respective detectors.

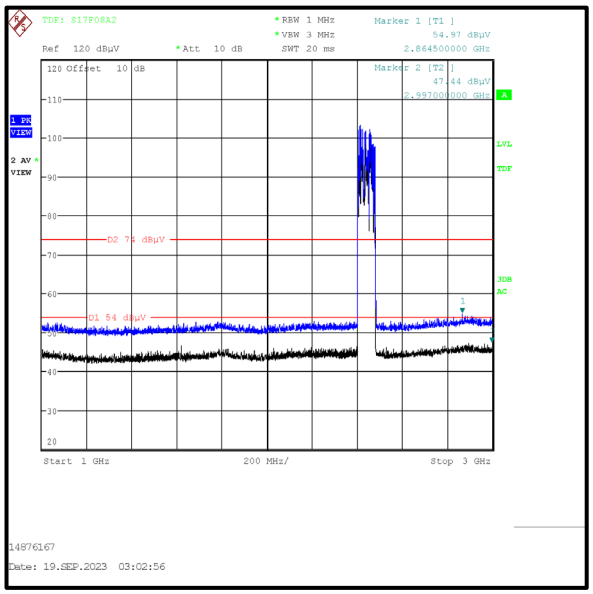
### Results: Peak / Hopping Mode

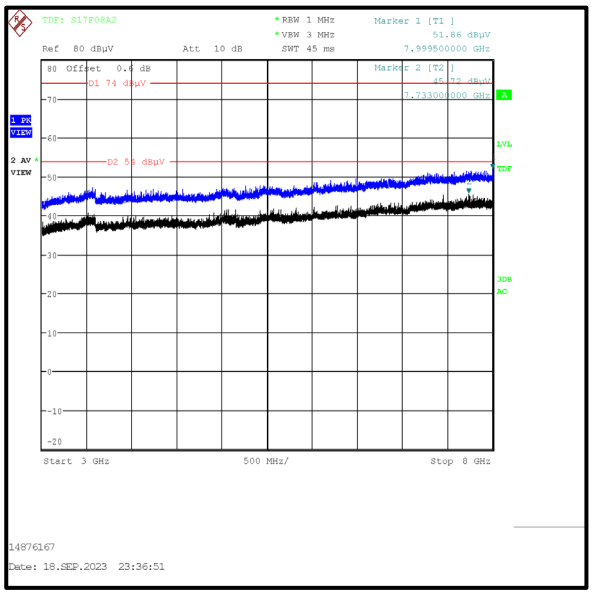
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2864.500 | Vertical | 55.0 | 74.0 | 19.0 | Complied |

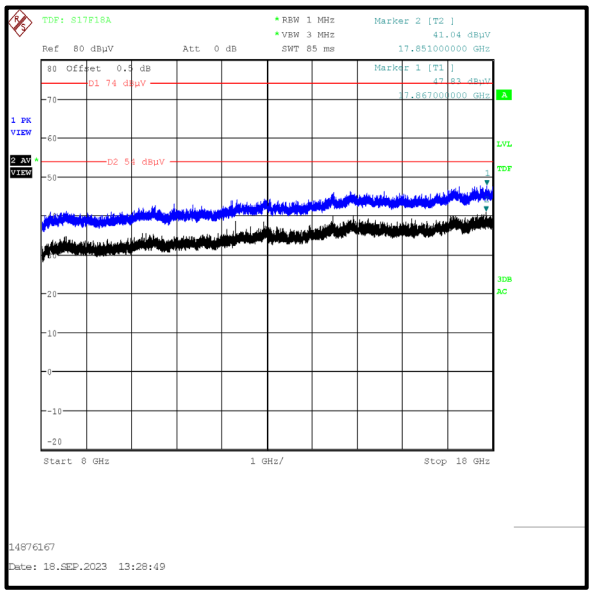
### Results: Average / Hopping Mode

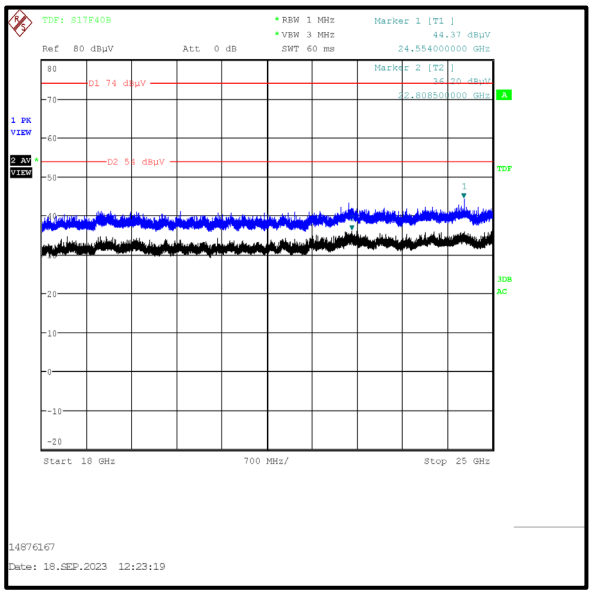
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2997.000 | Vertical | 47.4 | 54.0 | 6.6 | Complied |

## Transmitter Radiated Emissions (continued)

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