

User Manual

Timekeeper + Wireless Accelerometer

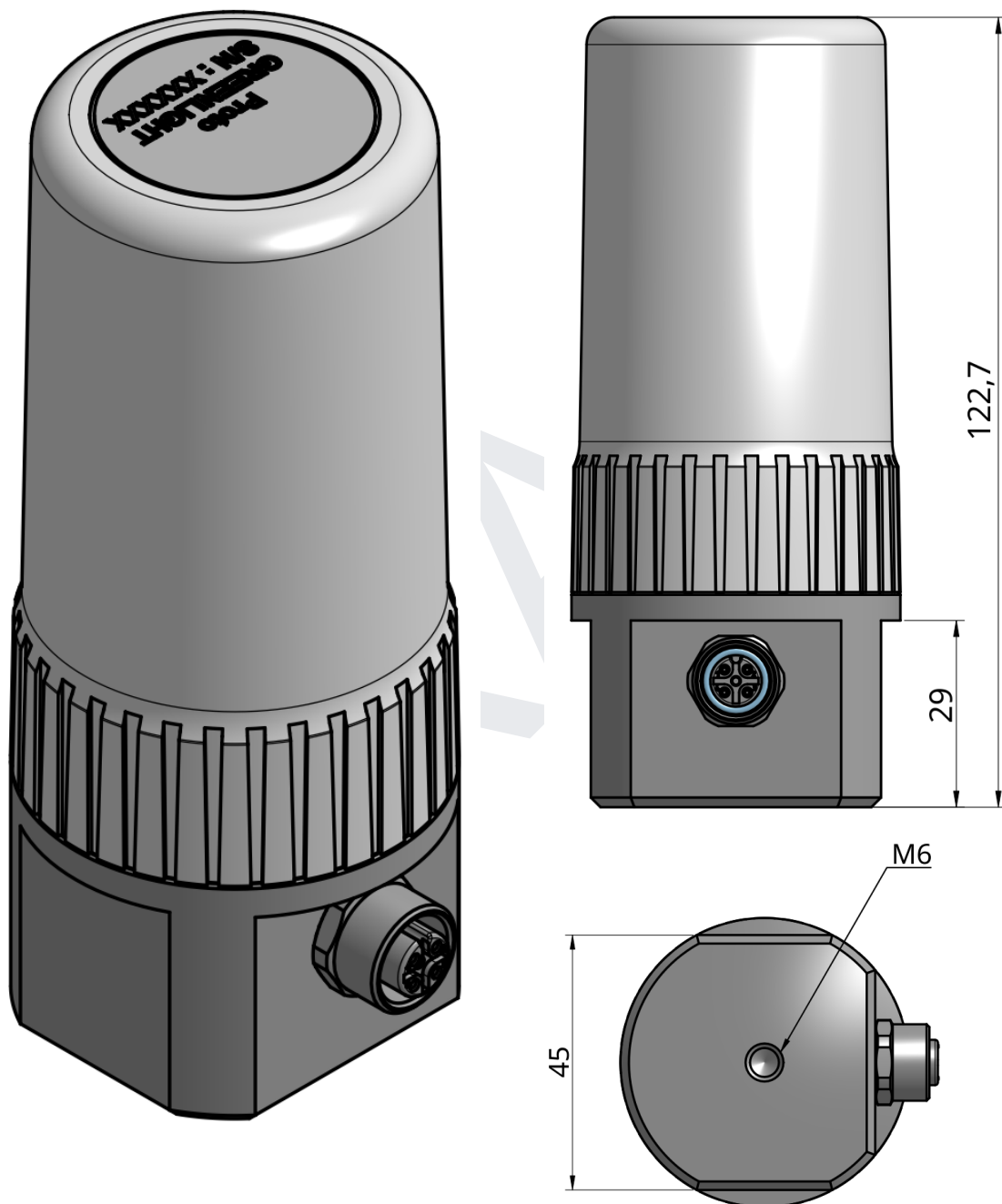
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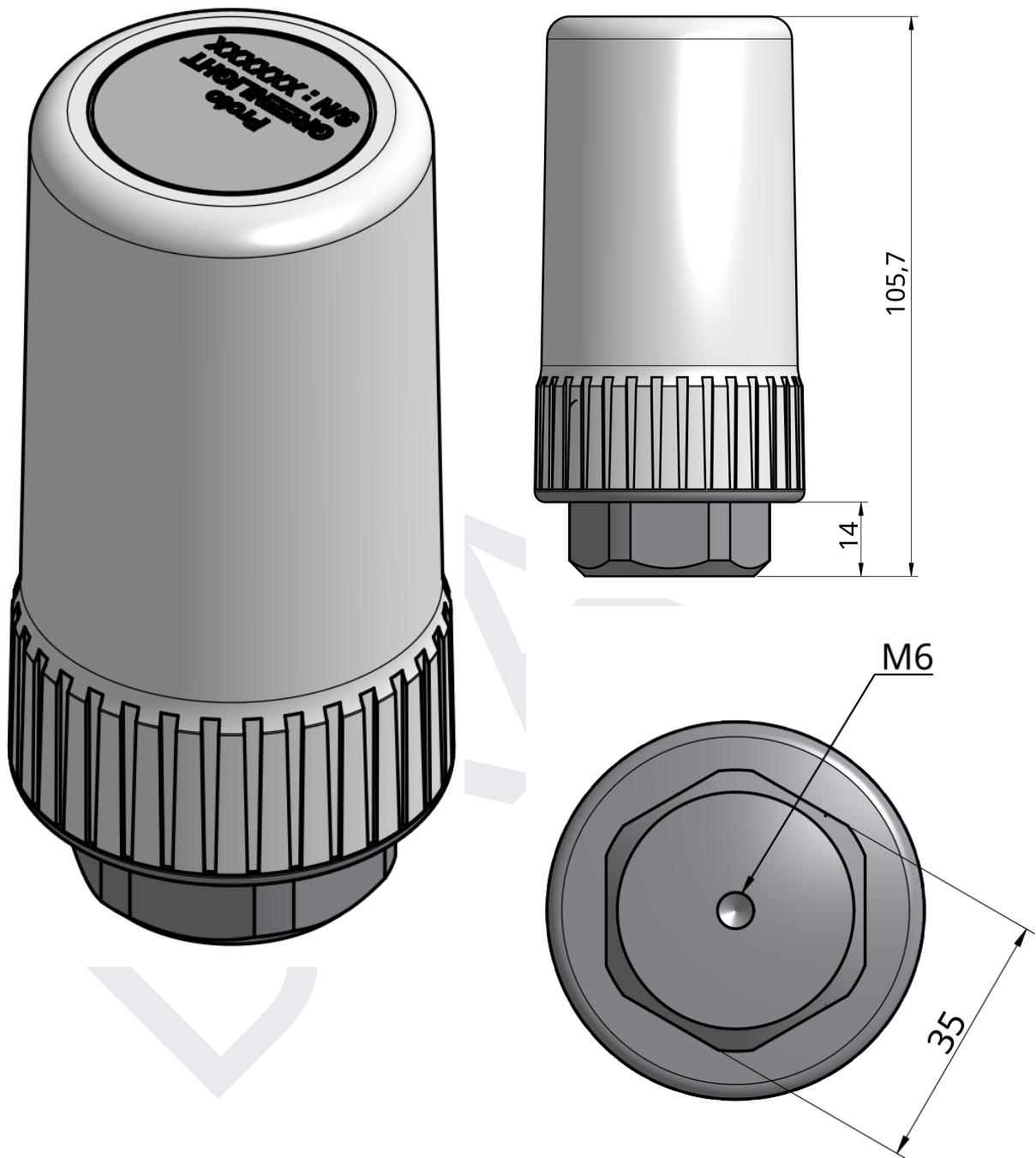
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What is in the box?

Timekeeper



Wireless Accelerometer (2x)



Each device requires two 14500 batteries, so in total, six batteries. (NOT included) For more information, see **Battery Recommendations**

General Description

The Timekeeper (TM)¹ is designed to synchronize the time of two Wireless Accelerometers (WAs)² and retrieve momentary acceleration values - from them - for various applications requiring precise acceleration data.

Key Features

1. Time Synchronization: The TM ensures both WAs are time-synchronized for accurate data collection.
2. Acceleration Data Retrieval: The TM collects acceleration data from the WAs for further analysis and application.

Optional Trigger Feature, no accessories supplied

The TM includes an optional feature to receive a trigger signal, enabling the correlation of acceleration data with external events. This feature requires:

- Connection: The trigger signal can be connected via the designated signal input on the M12 connector.
- User Responsibility: It is up to the user to ensure the trigger signal is synchronized with the external event and is a square wave with a frequency between 1 and 100 Hz, and a voltage level between 0 and 5.0V.
- Cable length should be limited to ≤ 50 cm
- DO NOT SUPPLY POWER to this connector

Wireless Accelerometers (WAs)

- Placement: The WAs are placed as needed to measure acceleration in various environments.
- Data Transmission: The WAs, synchronized with the TM, send their acceleration data to the TM.
- Data Utilization: The TM uses the collected acceleration data for the intended application.

By utilizing the synchronized time and accurate acceleration measurements provided by the TM and WAs, users can effectively gather and analyze acceleration data for a wide range of purposes.

¹ Has **LBUA5QJ2AB** module installed

² Has **LBUA5QJ2AB** module installed

First-time use instructions.

Step 1: Download the Bluefruit Application

To begin, download the Bluefruit Application on your Android or iOS device:

Android: [Download from Google Play Store](#)

iOS: [Download from Apple App Store](#)

Step 2: Setting Up the Devices

1. Insert batteries into the Timekeeper.
2. Insert batteries into the 1st Wireless Accelerometer.
3. Insert batteries into the 2nd Wireless Accelerometer.

	Caution - Please ensure to insert recommended batteries (see battery recommendations) with the correct polarity: the + side should be pointing upwards and the - side should be pointing downwards for both batteries.
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The devices will automatically form a network, synchronize the time, and begin communicating sensor values.

Step 3: Verify Application Functionality

To ensure the application is running correctly, follow these steps:

1. Open the Bluefruit Connect application.
2. Locate a device named TM-xxxxx and connect to it.
3. Navigate to the UART section.
4. Type **app status**.

Step 4: Checking Sensor Values

After typing app status, you should see values similar to the following:

- WA 1: 0.599402 -9.231111 0.934797
- WA 2: 0.245681 -9.867213 0.875429

These values represent the x, y, and z accelerations measured in meters per second squared (m/s^2). These values are updated regularly until the devices run out of battery or the batteries are removed.

Intended Use

Our handheld wireless time synchronization system ensures precise, reliable synchronization for vibration measurements, which is ideal for industrial assets. The system supports two Wireless Accelerometers and a Timekeeper.

Operating frequencies:

- BLE: 2400 - 2483.5 MHz
- UWB: 6240 - 6740 MHz

RF output power:

- BLE: -1.68 dBm
- UWB: -39.43 dBm/MHz (Bandwidth $\geq$ 500 MHz)

Rated antenna Gain

- BLE: -4.7 dBi
- UWB: 3.9 dBi

Operational Voltages / Current:

- $V_{\min}$ 2.8V
- V_{nom} 3.7V at 125 mA
- $V_{\max}$ 4.5V

Intended environmental conditions:

- $-20\text{ }^{\circ}\text{C} \dots +60\text{ }^{\circ}\text{C}$

Placement of Devices

1. **Stability:** Ensure that the devices are placed on a stable surface. Secure them either by screwing them into place, by using the M6 threaded hole in the bottom, or using appropriate magnetic feet to prevent movement.

2. **Vibration Path:** The devices should be positioned so that their vibration path is short and well-defined, directly reaching the area that needs to be monitored.
3. **Distance from Body:** When operating the Timekeeper from a mobile device, maintain a minimum distance of 20 cm between the devices and your body to ensure optimal performance and safety.
4. Please follow the operating instructions provided to ensure compliance with all applicable limits and regulations. Adhering to these guidelines is crucial for meeting relevant standards and ensuring the safe and effective use of the devices.

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Battery Recommendations

Overview

For optimal performance and longevity of your Timekeeper and Wireless Accelerometers, we recommend using 14500 lithium batteries.

Specifications of 14500 Lithium Batteries

- Type: Rechargeable Lithium-Ion Battery
- Size: 14500 (similar in size to AA batteries)
- Voltage: 3.7V nominal
- Capacity: Typically ranges from 600mAh to 1000mAh
- Dimensions: 14mm in diameter and 50mm in length

Safety Precautions

- Do not overcharge or over-discharge: Use a quality charger designed for lithium-ion batteries to prevent damage.
- Avoid short circuits: Ensure that the battery terminals do not come into contact with metal objects.
- Do not expose to high temperatures: Store batteries in a cool, dry place to prevent overheating and potential hazards.
- Inspect regularly: Check for signs of damage or swelling and replace batteries if any issues are detected.

Using 14500 lithium batteries ensures that your Timekeeper and Wireless Accelerometers operate efficiently and reliably, providing you with accurate and consistent data.

Maintenance and Care

Proper maintenance and care of your Timekeeper and Wireless Accelerometers are essential to ensure their longevity and optimal performance. Follow these guidelines to keep your devices in good working condition.

General Care

1. **Keep Clean:** Regularly clean your devices with a soft, dry cloth to remove dust and debris. Avoid using liquids or harsh chemicals, which can damage the device's exterior and internal components.
2. **Avoid Extreme Conditions:** Do not expose the devices to extreme temperatures, humidity, or direct sunlight for extended periods. Ideal operating temperatures are between -20°C and 60°C (-4°F and 140°F).

3. **Handle with Care:** Avoid dropping or subjecting the devices to strong physical shocks, which can damage the internal circuitry and sensors.

Battery Care

1. **Proper Insertion:** Always ensure batteries are inserted correctly, observing the correct polarity (+ and -).
2. **Regular Checks:** Periodically check battery levels and replace or recharge batteries as needed. Using low battery levels for prolonged periods can affect device performance.
3. **Use Recommended Batteries:** Use only recommended batteries (e.g., 14500 lithium batteries) to ensure compatibility and optimal performance.
4. **Remove When Not in Use:** If the devices will not be used for an extended period, remove the batteries to prevent leakage and corrosion.

Storage

1. **Cool, Dry Place:** When not in use, store your devices in a cool, dry place. Avoid storage in high-humidity areas, which can lead to condensation and potential damage.
2. **Protective Case:** If possible, store the devices in a protective case to shield them from dust, moisture, and accidental damage.

Periodic Maintenance

1. **Software Updates:** Check for firmware or software updates from the manufacturer regularly. Keeping your devices updated ensures they have the latest features and security enhancements.
2. **Inspection:** Periodically inspect your devices for any signs of wear or damage. Look for cracks, loose parts, or other signs that might indicate the need for repair or replacement.

Handling and Usage

1. **Follow Instructions:** Always follow the manufacturer's instructions for operating and maintaining the devices. Misuse can lead to damage or void warranties.
2. **Avoid Liquid Exposure:** Do not immerse the devices in water or expose them to heavy rain. If the device gets wet, dry it immediately and thoroughly.
3. **Disconnect When Not in Use:** Turn off and disconnect the devices from any connected systems when not in use to conserve battery life and prevent potential damage.

Adhering to these maintenance and care guidelines can extend the lifespan of your Timekeeper and Wireless Accelerometers and ensure they continue to provide accurate and reliable performance.

Troubleshooting Guide

If you encounter any issues with your Timekeeper and Wireless Accelerometers, refer to the following troubleshooting advice to resolve common problems.

Problem: Device Not Syncing

1. **Check Battery Levels:** Ensure that the batteries in all devices are properly inserted and have sufficient charge. Replace or recharge batteries if necessary.
2. **Verify Connections:** Make sure the devices are within range and that no obstructions are interfering with the wireless signal.
3. **Restart Devices:** To reset the connection, turn off all devices, wait for a few seconds, and then turn them back on.
4. **Check App Settings:** Ensure the Bluefruit Connect application is installed and configured on your device. Follow the setup instructions carefully.

Problem: No Sensor Data

1. **Reconnect Devices:** Disconnect and then reconnect to the TM-xxxxx device in the Bluefruit Connect application.
2. **Verify UART Connection:** Ensure you are in the UART section of the application and have typed app status correctly.
3. **Inspect Devices:** Check the physical condition of the devices for any signs of damage or wear that could affect performance.
4. **Update Firmware:** Ensure that your devices have the latest firmware installed. Check the manufacturer's website for any updates.

Problem: Inconsistent or Erratic Sensor Readings

1. **Calibrate Sensors:** Perform a calibration. Refer to the user manual for calibration instructions.
2. **Stable Surface:** Ensure that the accelerometers are placed on a stable surface and are not subject to unintended vibrations or movements during measurements.
3. **Environmental Factors:** Consider environmental factors such as temperature and humidity, which might affect sensor readings. Ensure that the devices are used within the specified operating conditions.

Problem: The application Crashes or Freezes

1. **Restart the App:** Close the Bluefruit Connect application completely and then reopen it.
2. **Update the App:** Check for updates to the Bluefruit Connect application on the Google Play Store or Apple App Store and install the latest version.
3. **Reinstall the App:** Uninstall the Bluefruit Connect application and then reinstall it to resolve any potential software issues.

Problem: Devices Not Powering On

1. Check Battery Installation: Ensure the batteries are correctly inserted with the correct polarity.
2. Replace Batteries: If the batteries are old or depleted, replace them with new ones.
3. Inspect Battery Contacts: Check the battery contacts for signs of corrosion or debris. If necessary, clean them gently.

Problem: Weak or No Wireless Signal

1. Reduce Interference: Ensure that no other electronic devices or physical obstructions causing interference with the wireless signal.
2. Move Closer: Bring the devices closer to each other to improve signal strength.
3. Check Antennas: If your devices have external antennas, ensure they are properly attached and oriented for optimal signal reception.

If the above troubleshooting steps do not resolve your issue, please contact customer support for further assistance. Include detailed information about the problem and any steps you have already taken to resolve it.

Glossary

Accelerometer: A device that measures the acceleration forces acting on it, typically in three axes (x, y, and z). These measurements are used to determine the movement and orientation of the device.

Battery Polarity: The direction in which the battery is installed, indicated by positive (+) and negative (-) terminals. Correct polarity is essential for the proper functioning of electronic devices.

Bluefruit Connect: An application for Android and iOS devices that allows users to connect, monitor, and control Bluetooth-enabled devices.

Calibration: The process of adjusting the readings of a device to match a known standard or set of conditions, ensuring accuracy and reliability.

Firmware: A type of software embedded in a hardware device, providing low-level control for the device's specific hardware.

Lithium-Ion Battery: A rechargeable battery known for its high energy density and long cycle life, commonly used in portable electronics, including 14500 lithium batteries.

Synchronization: The process of aligning the time and data of multiple devices to ensure they operate in unison.

Timekeeper: A device that maintains and synchronizes the time across a network of connected devices.

X, Y, and Z Axes: The three-dimensional coordinate system used to describe the orientation and movement of a device. The x-axis typically represents the horizontal direction, the y-axis represents the vertical direction, and the z-axis represents the depth.

14500 Lithium Battery: A size of lithium-ion battery similar in dimensions to an AA battery, commonly used in portable electronic devices for its high energy density and rechargeability.

Disclaimer

As an **OEM supplier**, we provide the hardware and firmware necessary for the device's operation. However, it is the customer's responsibility to develop, integrate, and maintain the user application. This includes, but is not limited to, application-specific code, user interfaces, and any other software required to utilize the hardware effectively.

We do not assume responsibility for any issues arising from the implementation of the user application. Customers are recommended to thoroughly test their applications to ensure compatibility and functionality with our hardware.

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Regulatory Statements

In accordance with the EU Radio Equipment Directive (RED)

Maximum Rated EIRP for BLE Bluetooth Low Energy:

The maximum rated EIRP for this BLE device, based on FCC/ISED standards used as a state-of-the-art comparison for the EU, is 9.80 dBm.

Maximum Rated EIRP for UWB Ultra Wideband:

The maximum rated EIRP for this UWB device, based on FCC/ISED standards used as a state-of-the-art comparison for the EU, is -39.43 dBm.

In accordance with the FCC

Maximum Rated EIRP for BLE Bluetooth Low Energy:

The maximum rated EIRP for this BLE device, based on FCC/ISED standards, is -1.68 dBm.

United States

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance voids the user's authority to operate this equipment.

This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un Environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

Ce transmetteur ne doit pas être placé au même endroit ou utilisé simultanément avec un autre transmetteur ou antenne.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canada

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- 1) L'appareil ne doit pas produire de brouillage;
- 2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

Ce transmetteur ne doit pas être placé au même endroit ou utilisé simultanément avec un autre transmetteur ou antenne.

Contact Information for RF Exposure and Compliance (Canada)

If you require information regarding RF exposure and compliance in Canada, please contact the appropriate authorities listed below:

Canadian Government Contact:

Office: Industry Canada (IC)

Department: Spectrum Management and Telecommunications

Website: <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/home>

Address:

Industry Canada
Spectrum Management and Telecommunications
235 Queen Street
Ottawa, Ontario
K1A 0H5
Canada

Contact du Gouvernement Canadien:

Bureau : Industrie Canada (IC)

Département : Gestion du spectre et télécommunications

Site web : <https://ised-isde.canada.ca/site/gestion-spectre-telecommunications/fr>

Adresse :

Industrie Canada
Gestion du spectre et télécommunications
235, rue Queen
Ottawa, Ontario
K1A 0H5
Canada