ENCARDIO RITE
METASENSING FOR MEGA STRUCTURES

# USERS MANUAL

## NEXAWAVE VIBRALINK
### (Solo/Quint/Hex/Deca)

*Model EWN-01/05/06/10V*


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TUNNELS | HYDROELECTRIC | CONSTRUCTION | STRUCTURAL | METRO & RAIL | BRIDGES | MINING

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## IMPORTANT NOTE

Please read the following cautions carefully before using the wireless system:

- **Battery and Power Supply**: Always place the internal batteries (2 x 3.6 V) and the 12V external power supply into the gateway before use.
- **Correct Polarity**: Ensure correct polarity of batteries and the external power supply before connecting.
- **Do Not Power On Without Batteries**: Do not switch power ON without placing the internal batteries in the Gateway.
- **Set Scan Interval and Next Scan Time Simultaneously**: During the configuration of the Gateway, always set the scan interval and next scan time simultaneously every time whenever required to avoid any time lag during scanning.
- **Battery Specifications**: Always use 3.6V lithium batteries suitable for -40°C operating temperatures. (Refer to section 10 for a recommendation of batteries)

# 1 INTRODUCTION

## 1.1 NexaWave VibraLink overview

NexaWave vibraLink series of wireless vibrating wire nodes are designed to expand the data collection possibilities from vibrating wire geotechnical sensors via a wireless RF LoRa network, eliminating the need for running lengthy cables. It is a reliable integrated system capable of exciting and sampling vibrating wire sensors and reporting measurements through a wireless communications network to the Gateway.

One of the significant advantages of vibrating wire wireless nodes is their ability to provide accurate and reliable measurements in remote or inaccessible locations. By eliminating the need for physical wiring connections, these nodes can be deployed in challenging environments where traditional wired sensors would be impractical or impossible to install. With their wireless connectivity, these nodes offer convenience, scalability, and cost-effectiveness, empowering industries to gather real-time critical data and make informed decisions based on accurate measurements.

## 1.2 Wireless network

Wireless sensors are vital in monitoring construction sites, large structures, and landslide areas. They are extensively used in applications where geotechnical and other sensors are used for data collection and transfer to a central server for access by multiple users. Encardio Rite offers an innovative network solution that allows real-time monitoring of wireless vibrating wire sensors and other geotechnical and structural sensors in challenging conditions with reliable data transfer without any delay.

In an end-to-end wireless monitoring system from Encardio-rite, the vibrating wire nodes are interfaced with the long-range, low-power radio frequency network to Gateway. The vibrating wire nodes send recorded data to the Gateway through the RF network with utmost reliability. The Gateway then uploads the collected data from nodes to the central/cloud server.

The system operates on ISM sub 1 GHz operating frequency bands adjustable to the requirement of each territory. The system can be adjusted to different frequency bands; for example:

| | |
|---|---|
| India | 865 – 867 MHz |
| Europe | 868 MHz |
| USA/Canada/Singapore/Australia | 915 MHz |

A detailed reference for frequency bands allowed in different Countries is available at:

https://www.thethingsnetwork.org/docs/lorawan/frequencies-by-country.html

The Gateway also has a provision to set the frequency band, depending on the Country.

## 1.3 Conventions used in this manual

**WARNING!** Warning messages call attention to a procedure or practice that could cause personal injury if not correctly followed.

**CAUTION:** Caution messages call attention to a procedure or practice, which, if not correctly followed, may result in data loss or equipment damage.

**NOTE:** Note contains essential information from the regular text to draw the user's attention.

### 1.4 How to use this manual

This users' manual is intended to provide sufficient information for optimum use of vibrating wire nodes in your applications.

To make the manual more useful, we invite valuable comments and suggestions regarding any additions or enhancements. We also request you, please let us know of any errors that are found while going through the manual.

**NOTE:** Installation personnel must have a background of good installation practices and knowledge of fundamentals of geotechnics. Novices may find it very difficult to carry on installation work. The intricacies involved in installation are such that even if a single essential but minor requirement is ignored or overlooked, the most reliable instruments will be rendered useless.

A lot of effort has been made in preparing this instruction manual. However, best instruction manuals cannot provide for every condition in a field that may affect the sensor's performance. Also, blindly following the instruction manual will not guarantee success. Sometimes, depending upon field conditions, installation personnel will have to consciously depart from written text and use their knowledge and common sense to find solution to a particular problem.

**NOTE:** The sensor is normally used to monitor site conditions and will record even a minor change that may affect behaviour of structure being monitored. Some of these factors amongst others, are, seasonal weather changes, temperature, rain, barometric pressure, nearby landslides, earthquakes, traffic, construction activity around site including blasting, tides near sea coasts, fill levels, excavation, sequence of construction and changes in personnel etc. These factors must always be observed and recorded as they help in correlating data later on and also may give an early warning of potential danger or problems.

# 2 GENERAL DESCRIPTION

## 2.1 NexaWave VibraLink

NexaWave VibraLink VW nodes consist of a compact, self-contained unit equipped with a sensor module that excites the vibrating wire sensor and reads the resonance frequencies. The unit also includes a radio transceiver with an antenna, a processor that controls both modules and a power source.

The VW node collects and transmits the sensor data wirelessly to the Gateway. The unit is housed in a compact, weatherproof enclosure, ensuring durability in various environmental conditions. Data transmission occurs through the long-range (LoRa), low-power radio frequency network, ensuring no signal degradation.

The NexaWave VibraLink series is available in the following variants, each with an inbuilt thermistor:

**VibraLink Solo**: 1 channel

**VibraLink Quint**: 5 channels

**VibraLink Deca**: 10 channels

The NexaWave VibraLink series has also introduced the **VibraLink Hex**, specially designed for tunnel segments, accommodating up to six sensors in a monitoring array.

**Figure 2-1 VibraLink Hex installed in tunnel segment monitoring array**

The complete range of vibrating wire sensors that can be connected to a wireless Node includes:

- Piezometers and water level sensors
- Strain gauges
- Pressure cells
- Temperature meters
- Displacement sensors, extensometers, crack meters, joint meters
- Settlement monitoring sensors

Depending on site requirements, the nodes can be configured to scan and transmit data at intervals ranging from 2 minutes to 2 hours. The system automatically mitigates common wireless issues such as signal blockages and interference, ensuring reliable data transmission to the Gateway. Each radio transmission within the system is secured using AES-128 encryption, maximizing the security of the sensor data gathered.

### 2.2 Nexawave Hub

NexaWave Hub (wireless gateway) is the main networking hardware, which uploads data gathered from all the VW nodes (connected to vw geotechnical sensors) to the Encardio Rite cloud server or a third-party server. In addition, it passes control messages through the network to ensure seamless operation.

The Gateway is ideally installed at a location with the cellular network, in line of sight of the installed nodes. It serves as an exit point/central hub for wireless data obtained from the sensors as the readings pass through or communicate with the Gateway before being routed to an FTP or cloud server.

### 2.3 System components

Provided by Encardio Rite

- VibraLink node with antenna
- NexaWave Hub (wireless gateway )with antenna
- Gateway and Node mounting accessories
- RS-232 Bluetooth modem/ USB to RS-232 FTDI cable
- Application software for Android Smartphones
- Application software for Windows

To be arranged by the Client

- Android Smartphone
- Activated data SIM card (for Gateway)
- D-Cell Li-SOCl2 3.6 V 14.5 Ah batteries nominal Voltage - 2 no. per Node and 2 no. for Gateway
- Power supply unit 9-30 V, 1 A for Gateway (12 V, 1 A power supply readily available can be used)

# 3 TECHNICAL SPECIFICATION

| | | | |
|---|---|---|---|
| **Basic** | | | |
| **Internal Battery** | 2X3.6V Li-Ion Battery (D-cell ER34615M) | | |
| **External Power** | 9V Standard adaptor or EBS-01(available on order) | | |
| **Operating Current** | 25 mA (max) | | |
| **Dimension** | 120X100X81.5(LXWXH) without antenna<br>159X100X187(LXWXH) with antenna | | |
| **Weight** | 0.807 Kg (Without Battery)<br>1.0045 Kg(With Battery) | | |
| **Storage** | 3 Million data points | | |
| **Primary Sensor** | | | |
| **Sensor Type** | Vibrating Wire Sensor | | |
| **No. of VW Channel** | 01, 05, 10 | | |
| **Accuracy** | ± 0.1% FS | | |
| **Sensor Excitation Freq** | 400-6000 Hz | | |
| **Excitation Voltage** | 5V | | |
| **Temperature Sensor** | | | |
| **Sensor Type** | 3K thermistor | | |
| **Accuracy** | 0.1°C | | |
| **Range** | -20°C to +70°C | | |
| **Enclosure** | | | |
| **Material** | Aluminium-Alloy Die casting 12(Epoxy Polyester Powder Coating) | | |
| **Fire Proof** | Approved | | |
| **Protocol** | | | |
| **ER Protocol** | Proprietary Encardio Protocol | | |
| **Radio** | | | |
| **LoRa Chipset** | SX1276 Global Sat | | |
| **Frequency** | EU | US | ROA |
| | 863-870 MHz | 902-928 MHz | 920-928 MHz |
| **Transmit Power** | 863-870 MHz (EU) | 902-928 MHz(US) | 920-928 MHz(ROA) |
| | 14 dBm | 20 dBm | 20 dBm |
| **Baud Rate** | 9600 bps(Max) | | |
| **Receiver Sensitivity** | -132 dBm | | |
| **Transmission Distance** | (1 ~ 15 KM )* | | |

* 800 meter in urban areas

# 4 PRE-INSTALLATION PREPARATIONS

## 4.1 Pre-installation checks

- Before installation, please check the VW node and Gateway for any physical damage.
- Open the Node and gateway box to check if the internal wirings are intact.

## 4.2 Setting up the Gateway and vibrating wire nodes location

Selecting the correct locations for the Gateway and Node is essential, especially if more than one Node is installed at the site and connected to a single gateway.

The initial task involves placing the Gateway in a position where it has a clear line of sight to all installed Nodes or, at the very least, to most of the Nodes. The optimal placement should be decided on-site. It is advisable to ensure a robust connection between the Gateway and the Node to achieve optimal performance, ideally with a signal strength exceeding -100 dBm. It's important to emphasize that stronger signal strength will yield superior results.

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The initial task involves placing the Gateway in a position where it has a clear line of sight to all installed Nodes or, at the very least, to most of the Nodes. The optimal placement should be decided on-site. For best results, the link between the gateway and the Node should be strong, preferably better than -100 dBm. Please note, the stronger the link, the better the results. **When mounting the gateway's antenna, it's crucial to position it at least 6 feet (1.8 meters) away from any surface, including roofs, hills, or walls. This clearance helps ensure optimal signal propagation and minimizes interference.** It is advisable to ensure a robust connection between the Gateway and the Node to achieve optimal performance, ideally with a signal strength exceeding -100 dBm. It's important to emphasize that stronger signal strength will yield superior results.

## 4.3 Setting up the Gateway & Node

It is recommended that nodes and Gateway be set up and configured before mounting them at respective installation locations.

**The gateway configuration needs to be done before nodes are configured. Also when the Node is being configured, it must be ensured that the Gateway is in switched "ON" position.**

For setting up and configuring the Gateway, refer to User's Manual # WI6002.117 on Gateway.

The configuration of vibrating nodes is discussed in Section 5 of this manual.

For convenience, a "Quick Start Guide" is included in Section 1 to give a brief and quick idea.

## 4.4 Sampling Interval for Vibrating Wire Node

When configuring the Encardio Rite wireless system, it is crucial to select appropriate sampling intervals to ensure the network operates smoothly without any data loss.

The table below provides guidance on sampling interval selection for vw nodes based on the network size:

| Number of Nodes | Minimum Sampling interval(Minutes) |
|---|---|
| 1 | 4 |
| 10 | 6 |
| 50 | 16 |
| 100 | 28 |

| | |
|---|---|
| 150 | 41 |
| 200 | 53 |

The General formula to calculate the Sampling interval for the vibrating wire node is:

*Sampling Interval (Seconds) = (15*No. VW Node) + 180*

# 5 CONFIGURING VW NODE

We have explained the configuration using NexaWave VibrLink Solo as a reference. For VIbralink Quint, Hexa and Deca similar procedure will be followed.

## 5.1 Setting up the VW node

- Open the top cover with a screwdriver. A description of each part of the Node is given in the Figure 5-2

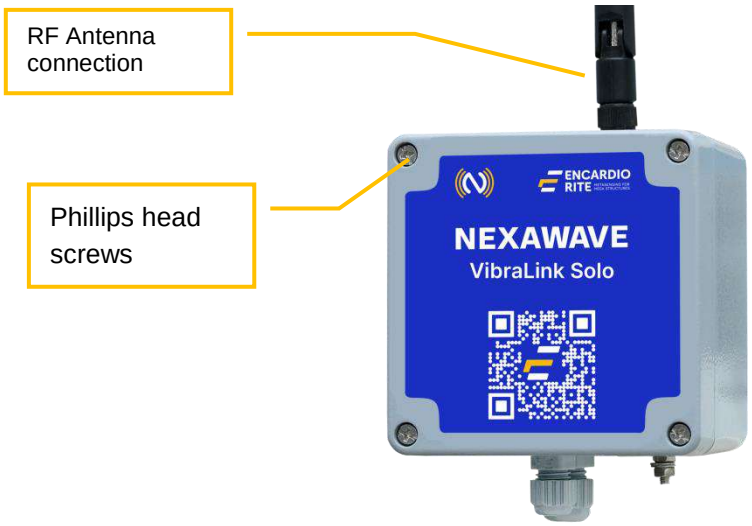



**Figure 5-1 VW node**

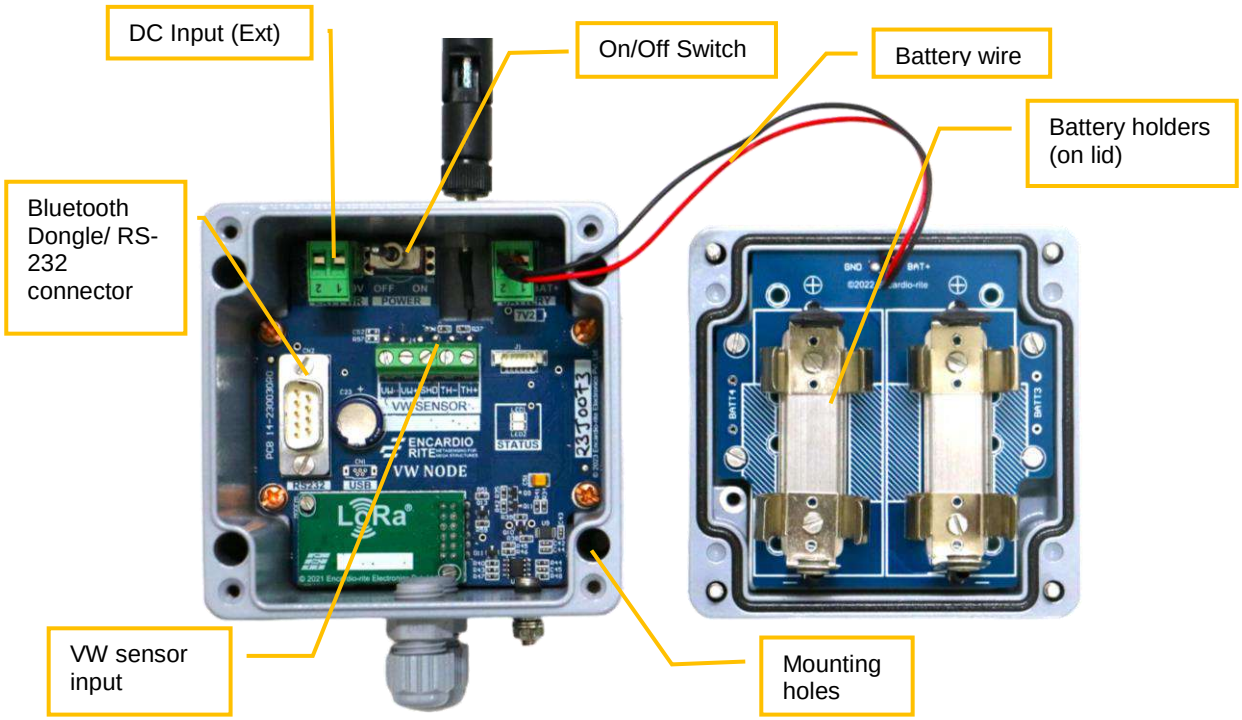



**Figure 5-2 Node details**

- Connect the RF antenna (provided with supply) to the Node properly.
- Connect the vibrating wire sensor cable to the designated Connector in Node as shown in Figure 5-3: VW+, VW-, SHD, T+, T-

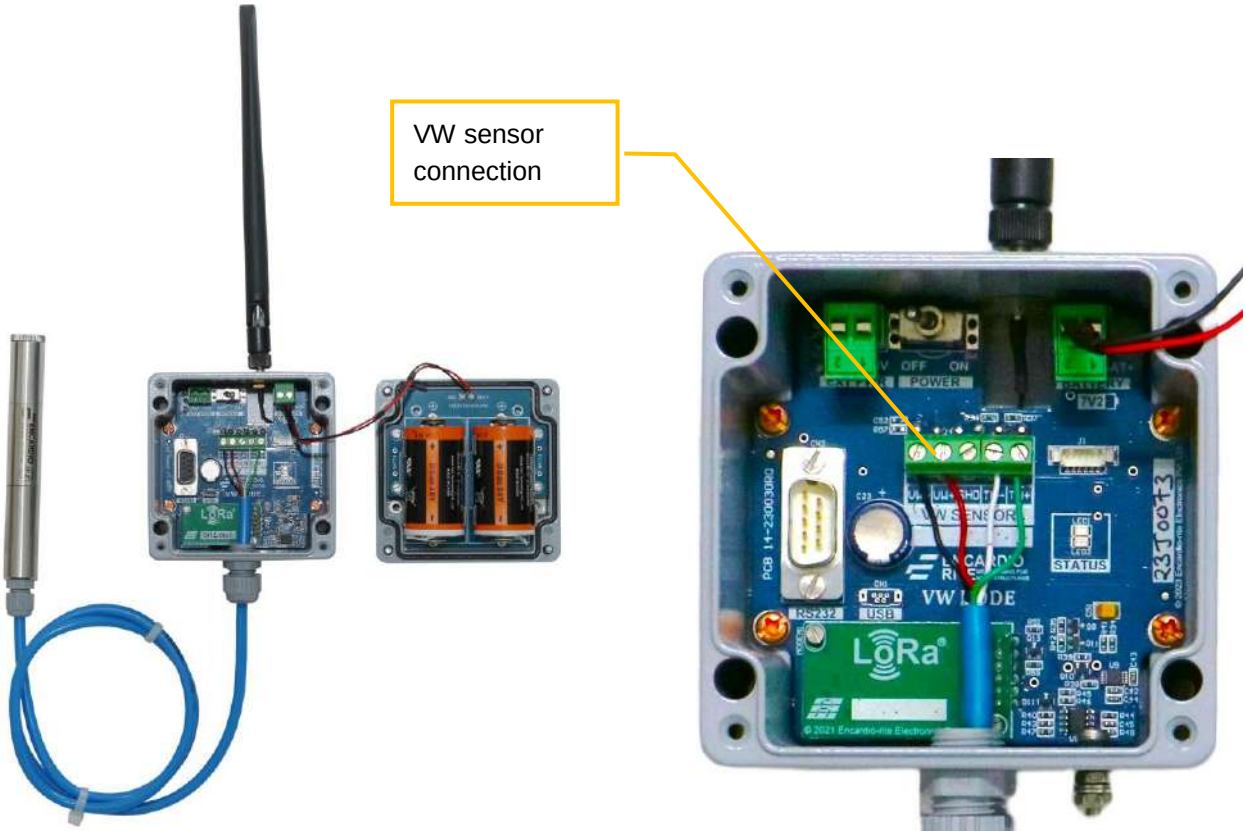



**Figure 5-3 VW sensor connection to single channel VW node (Solo)**

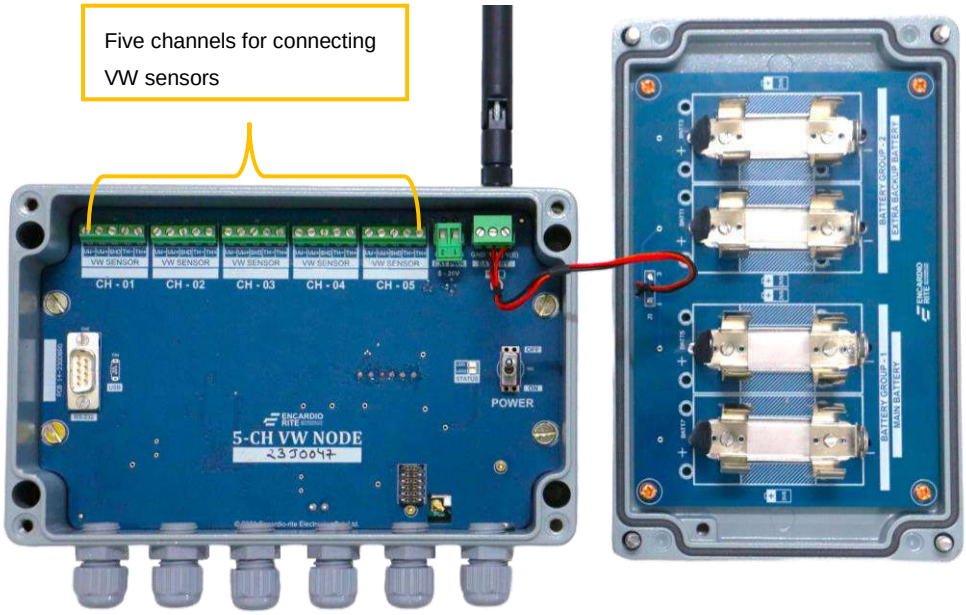



**Figure 5-4 Five channel VW node (Quint)**

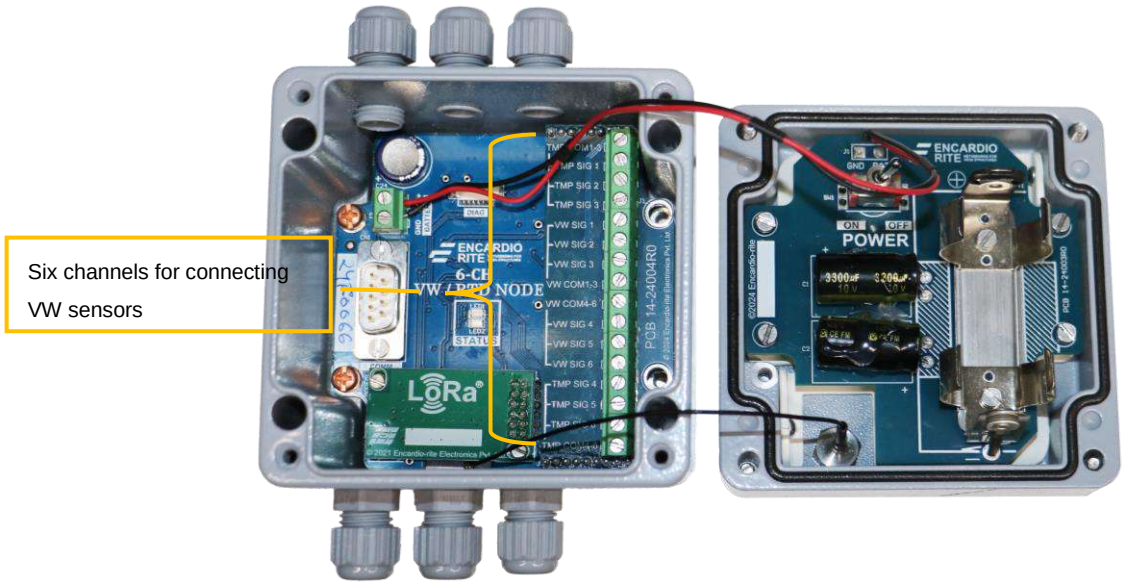



**Figure 5-5 Six channel VW node (Hex)**

## 5.2 Battery Installation

- Open the device by unscrewing the four Phillips head screws on the front of the enclosure.

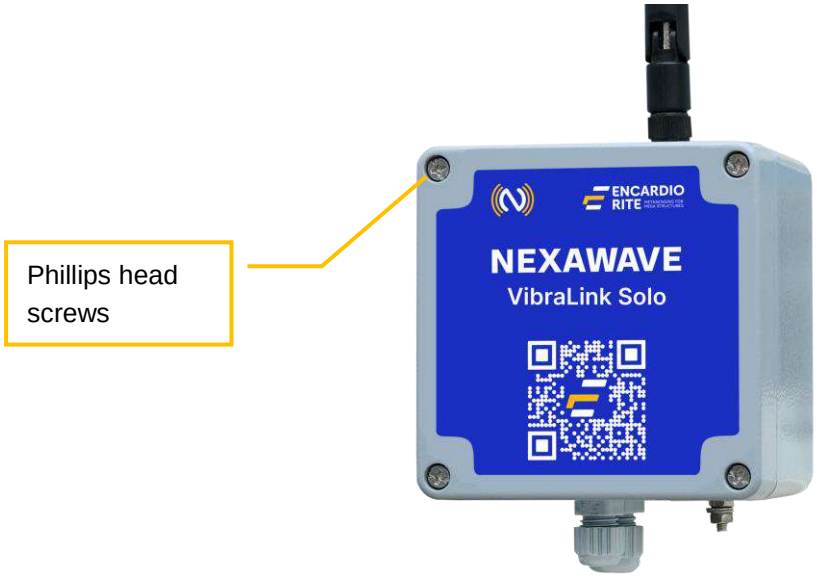



**Figure 5-6**

- Check for any looseness in the positive and negative clip terminals of the holder. If they are loose, press them down to ensure proper contact with the battery.

Figure 5-7

- Align the positive (+) side of the batteries with the + indicator in the battery holder.

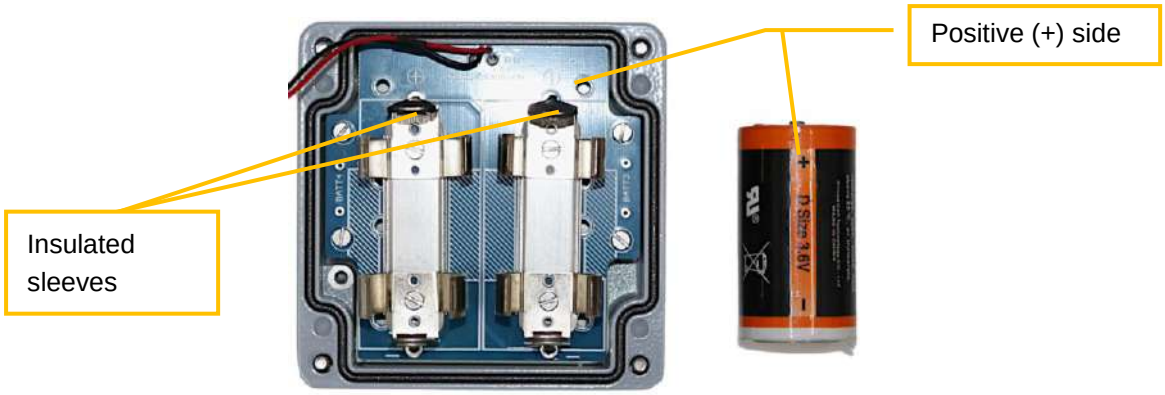



Figure 5-8

- Slide the positive end of the battery inside the compartment first. Installing the positive end first allows the battery to slide into the compartment more easily. Just push the positive end of the battery into the lever, flattening it down into the holder. Apply a bit more pressure, if necessary, to snap the negative end of the battery securely into place.

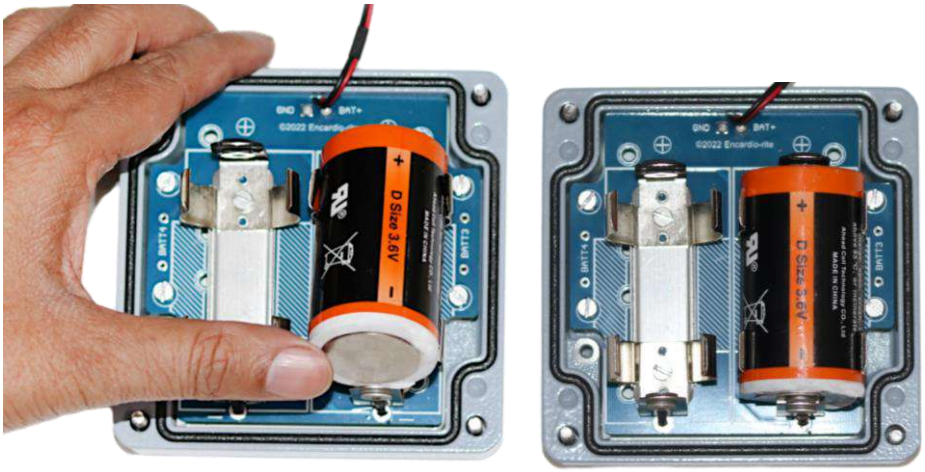


Figure 5-9

- In case fast scanning is required, connect any standard DC power adaptor (9 V, 1 A) to "DC Input".
- Or, Encardio rite make solar battery charger can also be used (available against order).
- After power up, wait for 30 seconds as during this time tilt meter performs internal operations.

## 5.3 Connection VW Node to phone

Install the apk file (provided with the supply) for the "EWA-01" app on the phone. App shortcuts will be available in the list of application software, Open the application and allow all the permissions required for proper functioning.

### *5.3.1 Connection through Bluetooth*

The VW node can be connected with mobile by using Bluetooth. Plug Bluetooth modem (provided with supply) at 9 pins D-sub connector of the Node. Ensure that the modem is configured for 115200 baud rate and hardware flow must be OFF. Verify DIP switch settings with the following Figure 5-10.


**Figure 5-10 Bluetooth modem DIP switch settings**

- Turn on the Bluetooth modem by pressing the ON/OFF switch located near the modem's battery compartment. The power indicator of the Bluetooth modem will glow in GREEN color to ensure that the Bluetooth modem is ON.
- Turn on Bluetooth of the Android phone and go to Bluetooth settings. Click on the "scan" button. The phone will show the list of Bluetooth devices found. Find the Node Name and serial number on the phone screen and click for pairing the phone with Node. Once the pairing button is pressed, it will ask to enter the passkey for authentication.
- Enter pairing code "698269" and then press OK. On successful authentication, it will show that the device is paired. Now, the phone is paired with Node.

### *5.3.2 Connection through OTG*

- Switch on the Node and connect it to the Smartphone using the FTDI to OTG adaptor provided with the supply, as shown in Figure 5-11 below.

**Figure 5-11 EWN-01V VW node connected to Android phone with FTDI cable via OTG adaptor**

## 5.4 VibraLink Node configuration

The VibraLink node is configured using the EWA-01 Android application. Ensure the Hub (Gateway) is configured and powered on before configuring the VibraLink nodes. Configuration can be done via Bluetooth or USB OTG. The following subsections detail the configuration process.

- Open the "EWA-01" apk installed on an Android phone. It will show the list of paired Nodes as shown in Figure 5-12. Select the Node that you paired earlier from the list. It will take you to the home screen of the Node, as shown in Figure 5-13 (a).

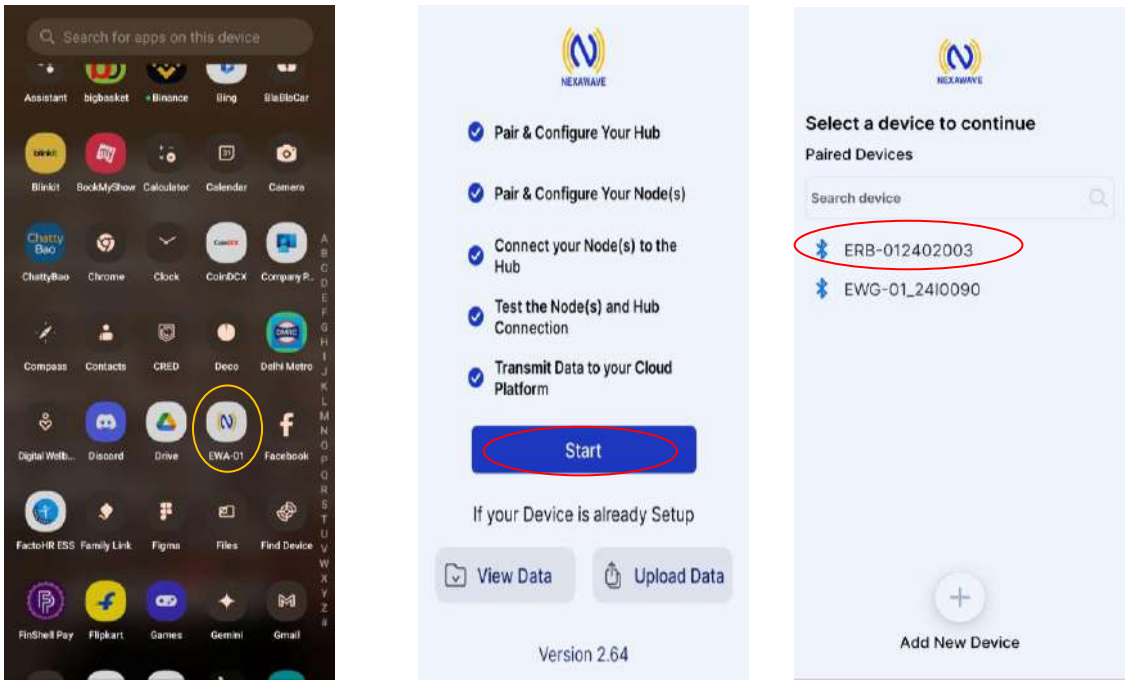
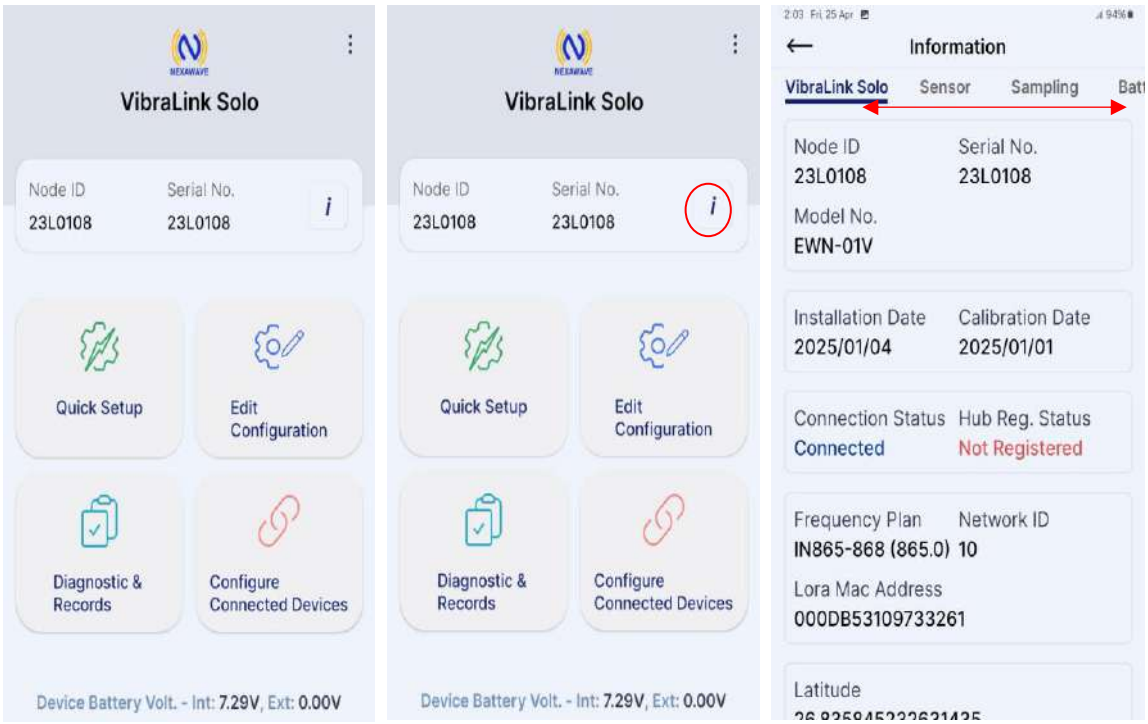



**Figure 5-12**

- It will take you to the home screen of the VibraLink, as shown in Figure 5-13 (a). Clicking on the 'i' button (Figure 5-13 (b)) will open the information window. Within this window, you can scroll to view information about the VibraLink, sensor, sampling, battery, bluetooth, and the phone (Figure 5-13(c)).




(a) (b) (c)

**Figure 5-13**

- **Resetting Your Vibralink Node: Factory Default and Memory Erase Procedures**

  To access the reset options, navigate to the Advanced Settings menu. This is achieved by clicking the three dots located in the top left corner of the screen.

  **Factory Default**

  The Factory Default reset restores the VibraLink node to its original factory configuration, erasing all user-defined settings and data.

  **Important:** While user-configured data will be lost, any settings configured at the factory will be retained. This reset is useful for troubleshooting, preparing the device for a new user, or if other configuration changes have led to unexpected behavior.

  **Caution: All user-generated data will be permanently erased. It is strongly recommended to back up any critical data before performing a factory reset. Data lost through this process cannot be recovered.**

  To reset the Node, click on the "Rest VibraLink to Factory Default" tab from the advance setting. A prompt window asking for a reset password will appear.

  Enter the password "**4TfZ9q7X**" and click on the "OK" button to reset the Node.

  **Erase Node Memory**

  The "Erase Node Memory" function clears all previously stored logs on the VibraLink node. This is often performed to clear old logs, free up storage space, or as part of a security or privacy protocol.

  **Caution:** Erasing the node memory is irreversible. **Ensure you have archived any necessary logs before proceeding**, as they cannot be recovered after deletion.

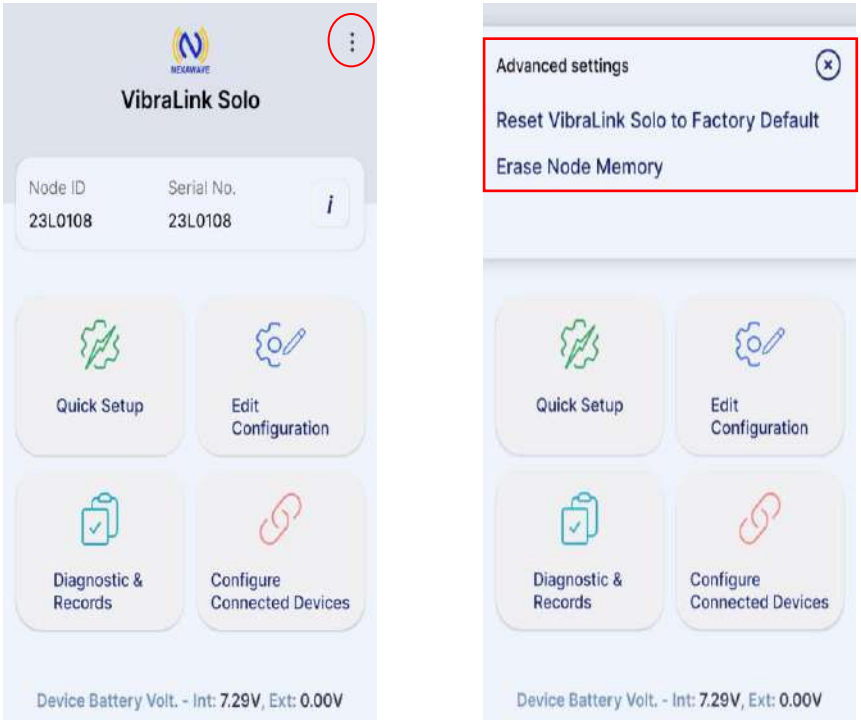



**Figure 5-14**

On the home screen, click on "QUICK SETUP" to configure the VibraLink. This simple five-step process guides you through the setup. A brief, step-by-step guide is provided below:

### *5.4.1 Quick Setup*

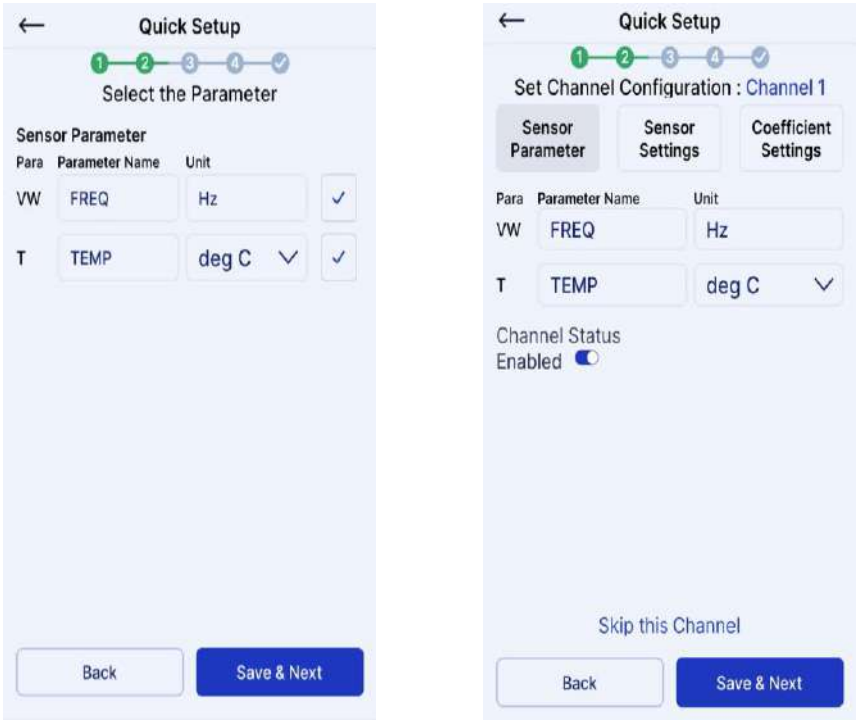
**Step 1: Set the Configuration** (As shown in Figure 5-15)

- **VibraLink ID:** Input "VibraLink ID" of their choice. Try to input some meaningful ID so that it becomes convenient for other users also.
- **Installation Date:** Click on the "Calendar Icon" to enter the installation date of the gateway.
- **Relay Hopes:** Select the relay hopes from drop-down menu which is closer the node.
- **Frequency Plan:** Select the "Frequency Plan" from the drop down. This depends on the installation location, to comply with the local regulations. User can select the region and associated frequency by tapping on the search icon.
- **Network ID:** User can select any of the Network ID from the "Network ID" drop-down menu. It is important to remember that the network ID should remain consistent throughout the entire network, including all nodes and the gateway. Note down the configured Gateway Network ID as it will be necessary for node configuration.
- **Location:** For setting Latitude and Longitude of respective installation location:
- If user knows the installation location coordinates, enter the Latitude and Longitude information manually.
- If user does not know the installation location coordinates, select the button "Select on map" for automatic location setup. This needs to be done at the installation site location only. Ensure that the internet connectivity is there in the phone during this process.
- **Device Date & Time:** To set the RTC (date and time) of VibraLink, click on the "Calendar" and "Clock" icons given in line with "VibraLink date" and "VibraLink time". Click on the "Update Date/Time" tab to save it. To synchronize the VibraLink RTC with phone's RTC, click on the "Sync with phone" tab. Make sure that the phone's RTC is up to date and correct.
- Click on the Save & Next button to move step-2.


**Figure 5-15**

**Step 2: Select the parameter**, (As shown in Figure 5-16)

- This screen allows users to select the sensor parameters for monitoring. For a vibrating wire sensor, choose FREQ (Frequency) in Hz, and for temperature sensors, select TEMP (Temperature) in deg C. After selecting the required parameters, tap Save & Next to proceed. Repeat this process for each channel you will be using for vibrating wire measurements. Once you have confirmed the parameter and unit for all desired vibrating wire channels, you can proceed to the next step.

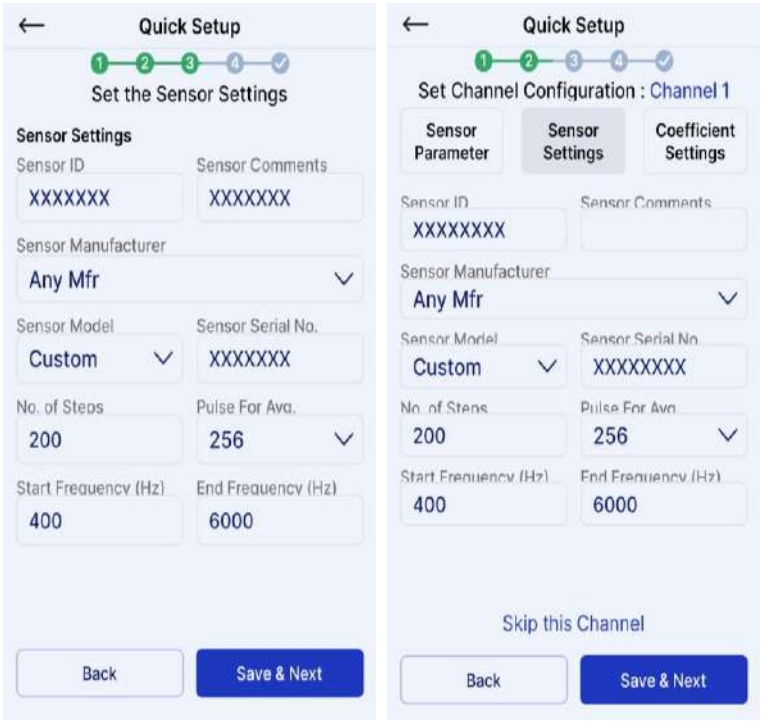



(Single Channel) (Multiple channel)

**Figure 5-16**

**Step 3: Set the Sensor Settings**, (As shown in Figure 5-17)

- This screen allows users to configure specific settings for the connected sensor. Enter the Sensor ID, Sensor Manufacturer, and Sensor Model. Provide the Sensor Serial No. and any relevant Sensor Comments. Set the Number of Steps, Pulse for Average, Start Frequency (Hz), and End Frequency (Hz) as required for the sensor's operation. Repeat this process for each channel you will be using for vibrating wire measurements. Once you have confirmed the parameter and unit for all desired vibrating wire channels, you can proceed to the next step. Once done, tap Save & Next to proceed.

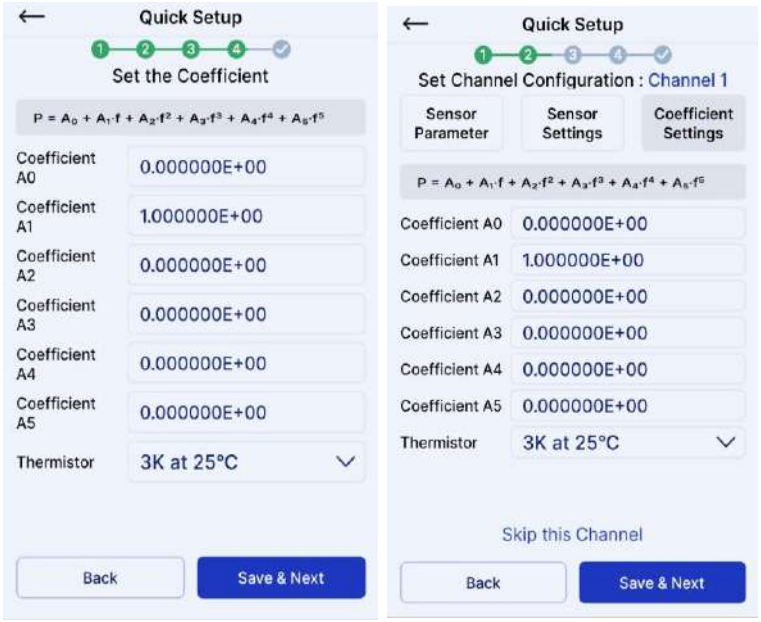



(Single Channel) (Multiple channel)

**Figure 5-17**

**Step 4: Set the Coefficient**, (As shown in Figure 5-18)

- This screen allows users to input the coefficients for the sensor's calculation formula. Enter the values for Coefficient A0, A1, A2, A3, A4, and A5 based on the sensor's specifications. These coefficients are used in the equation:
  $P = A0 + A1 \cdot f + A2 \cdot f^2 + A3 \cdot f^3 + A4 \cdot f^4 + A5 \cdot f^5$, where f represents the frequency.
- Additionally, set the Thermistor value, typically 3K at 25°C. After entering the required data, tap Save & Next to proceed. Repeat this process for each channel you will be using for vibrating wire measurements.




(Single Channel) (Multiple channel)

**Figure 5-18**

**Test Sensor Reading**, (As shown in Figure 5-19 & Figure 5-20 )

- In this step, user can test the sensor readings for FREQ (Frequency) and TEMP (Temperature). The last read values for each parameter will be displayed, along with Noise and Period. Tap Take Reading to get real-time data from the sensor. Ensure the Noise remains below Max 1 Hz for accurate readings. If needed, you can also adjust Advanced Settings. Once the test is complete, tap Back or Save & Next to proceed.

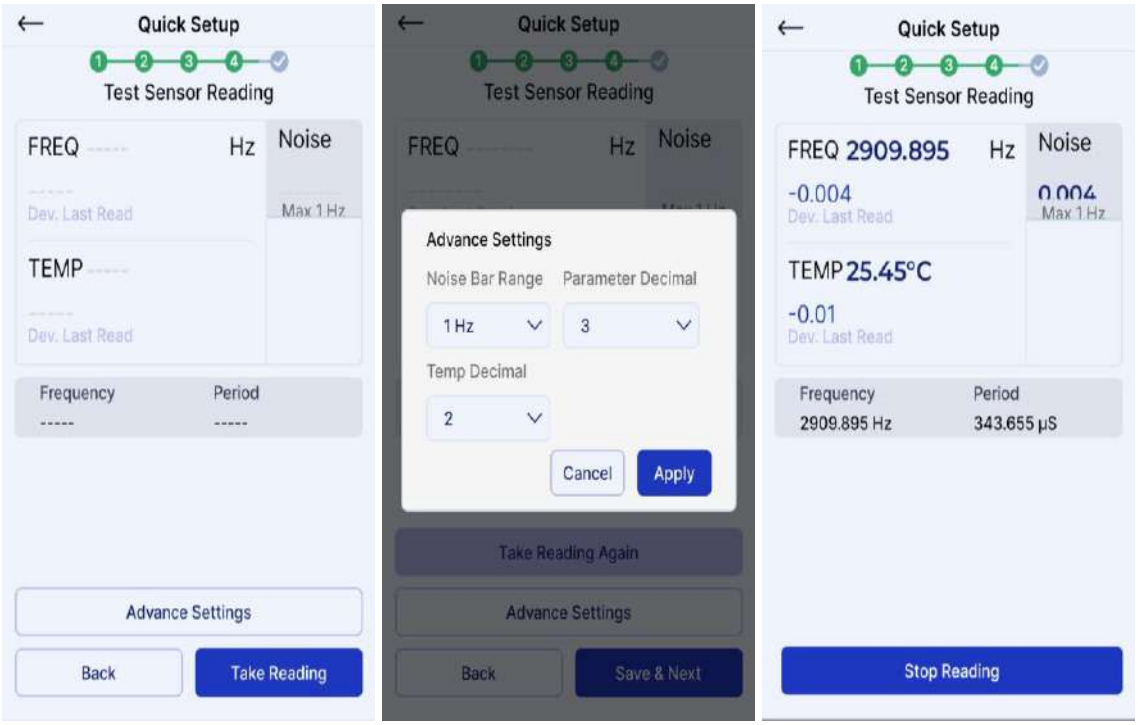



**Figure 5-19 (Single channel)**

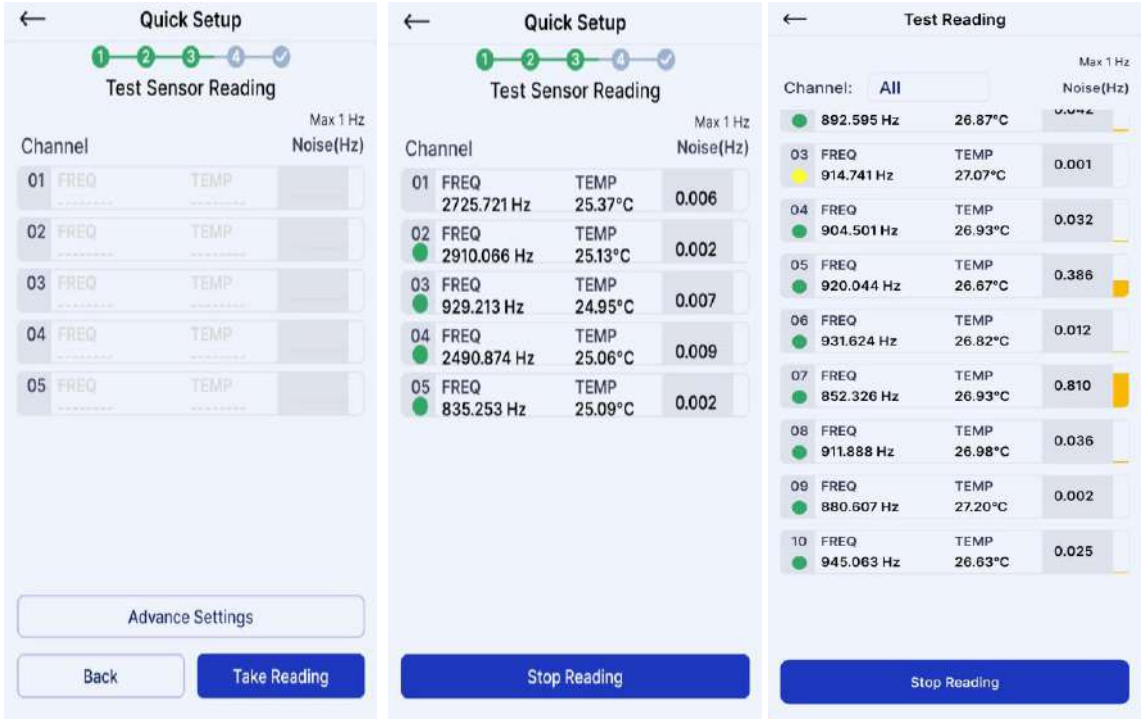



**Figure 5-20 (Multiple channel)**

**Test Hub & VibraLink Connection** , (As shown in Figure 5-21)

- In this step, users can test the connection between the VibraLink Solo and the Hub. The Network ID, Frequency, and Tx Power are displayed. The screen shows real-time data for RSSI, dBm, and µW for both the VibraLink Solo and Hub.
- To start the test, tap Start Test. The Test Packet Status will show the number of received packets and the pass/fail percentage. If the connection is successful, user will see GOOD to Go!. Once the test is complete, tap Stop Test to end the process.

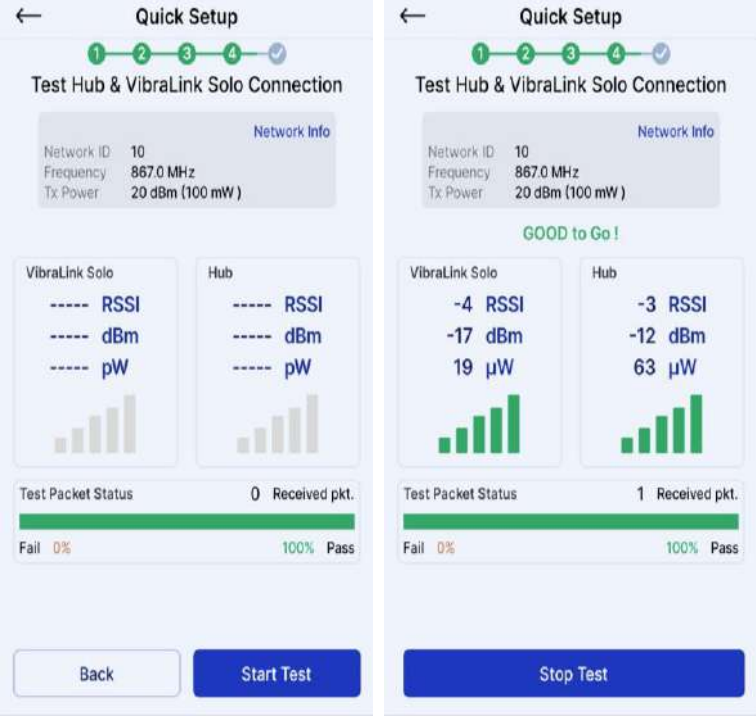



**Figure 5-21**

**Test Hub & Vibralink Connection (Register) screen** (As shown in Figure 5-22)

- After successfully testing the connection, tap **Register With Hub** to register the **VibraLink** node with the Hub. A progress bar will appear, showing the registration process. Once completed, user will see a **Node has been registered to Gateway successfully!!** message indicating that the node is successfully connected to the gateway.
- If needed, you can tap **Test Again** to re-run the connection test or **Cancel** to exit. The **Test Packet Status** will show real-time data for the connection, including received packets and pass/fail status.

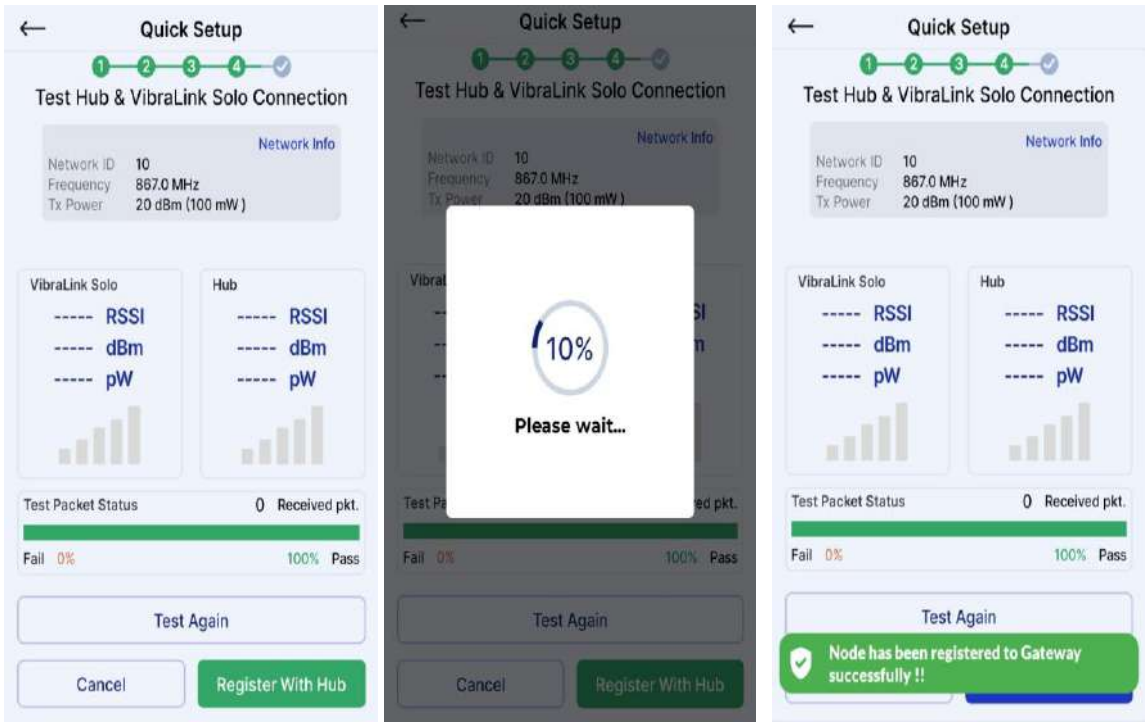



**Figure 5-22**

**Finish setup** (As shown in Figure 5-23)

- Once the **Test Hub & VibraLink Solo Connection** is successfully completed, tap **Finish Setup** to finalize the configuration. This will complete the process of connecting the node to the network. User will see a **Setup Complete** message confirming that the node has been successfully set up.
- If user'd like to set up another device, tap **Setup Another Device**. To return to the home screen, tap **Back to the Setup Home**.

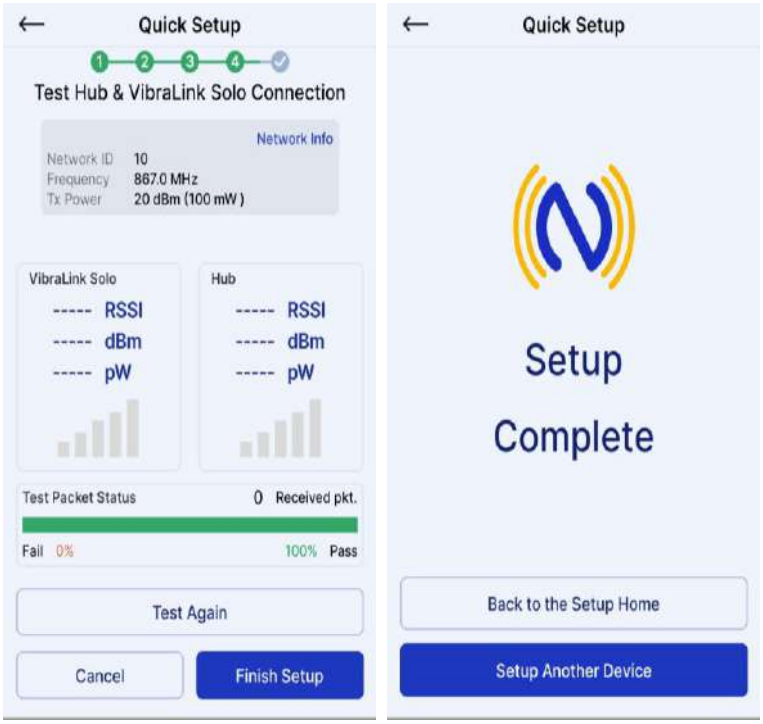



**Figure 5-23**

### *5.4.2 Configuring Sensor's Coefficients and information*

- To modify the **VibraLink Solo** settings after the initial or quick setup, tap **Edit Configuration** on the main screen to configure the sensor's parameters like model, coefficients, sensor serial number, sensor tag etc.

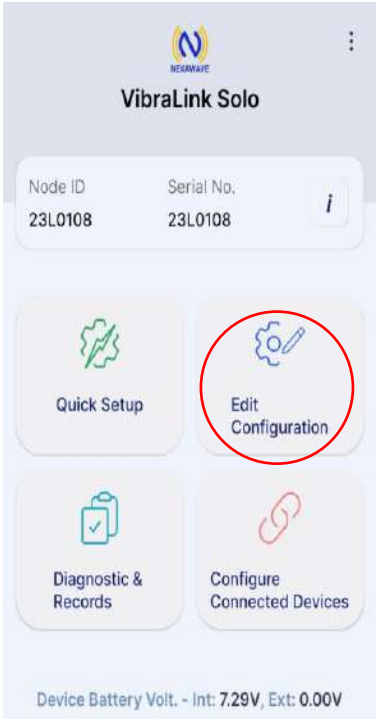



**Figure 5-24**

- After clicking **Edit**, users can modify several configuration settings for the **VibraLink Solo** node. This includes updating the **VibraLink Solo ID**, **Installation Date**, and **Relay Hopes** (e.g., selecting **No Relay**). You can also adjust the **Frequency Plan** (e.g., **IN865-868 (867.0)**), change the **Network ID**, and update the **Location** by modifying the **Latitude** and **Longitude** values. Additionally, the **Device Date & Time** can be corrected for accurate data logging. After making the necessary adjustments, tap **Save** to apply the changes or **Cancel** to discard them.


**Figure 5-25**

- After selecting Edit Configuration, user can configure the Channel settings for the VibraLink node. Choose the Sensor Parameter (e.g., VW (Frequency) in Hz and TEMP (Temperature) in °C) to specify the parameters you wish to monitor. The Channel Status (in multi-channel node) can be toggled to Enabled or Disabled based on your setup requirements. To customize the Sensor Settings, tap the Sensor Settings button. Once all the changes are made, tap **Save** to apply the new settings or **Cancel** to discard them.


(Single Channel) (Five channel) (Ten channel)

**Figure 5-26**

- When user tap **Edit Manufacturer/Sensor Model List**, user can add or remove manufacturers and sensor models associated with the **VibraLink Quint** node. To add a new sensor model, select the **Add** option, enter the **Manufacturer** name, and specify the **Sensor Model** details. User can also set the **Thermistor** value (e.g., **3K at 25°C**), and define the **Start Frequency (Hz)**, **End Frequency (Hz)**, and the **Number of Steps**. After filling in the required fields, tap **Add** to save the changes.
- If you wish to remove a manufacturer or sensor model, select the **Remove** option and proceed accordingly.
- Once done, tap **Save** to apply the changes.

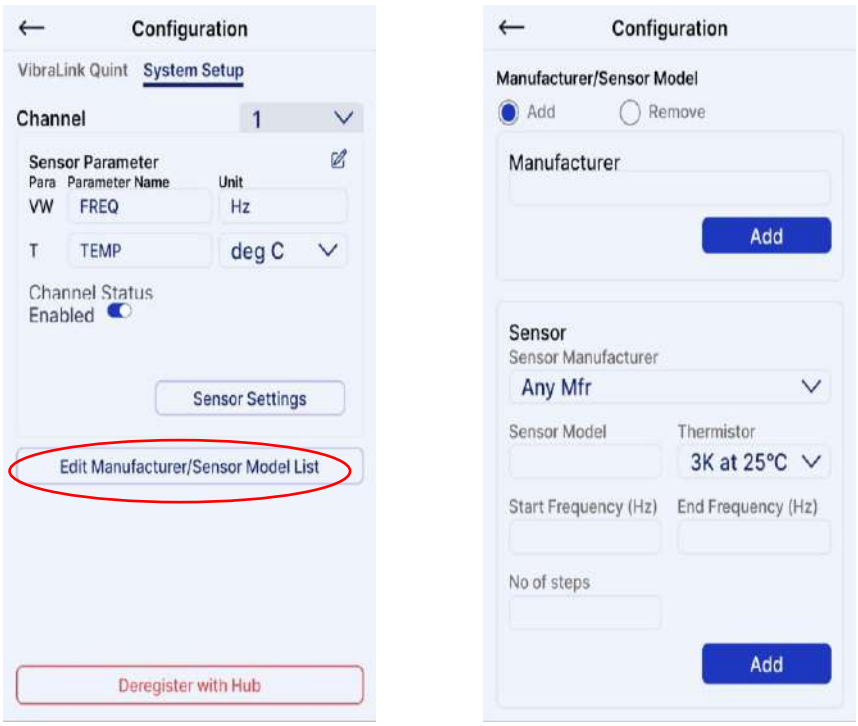



**Figure 5-27**

### *5.4.3 Diagnostic & Records*

- To access Diagnostic & Records, tap the corresponding icon on the main screen. This section allows user to test the Hub & VibraLink Solo connection to ensure proper communication. User can also check the Test Reading for real-time sensor data, such as frequency and temperature. Additionally, the Records option provides access to past diagnostic logs and performance data. Use these tools to monitor and troubleshoot the node's operation effectively.

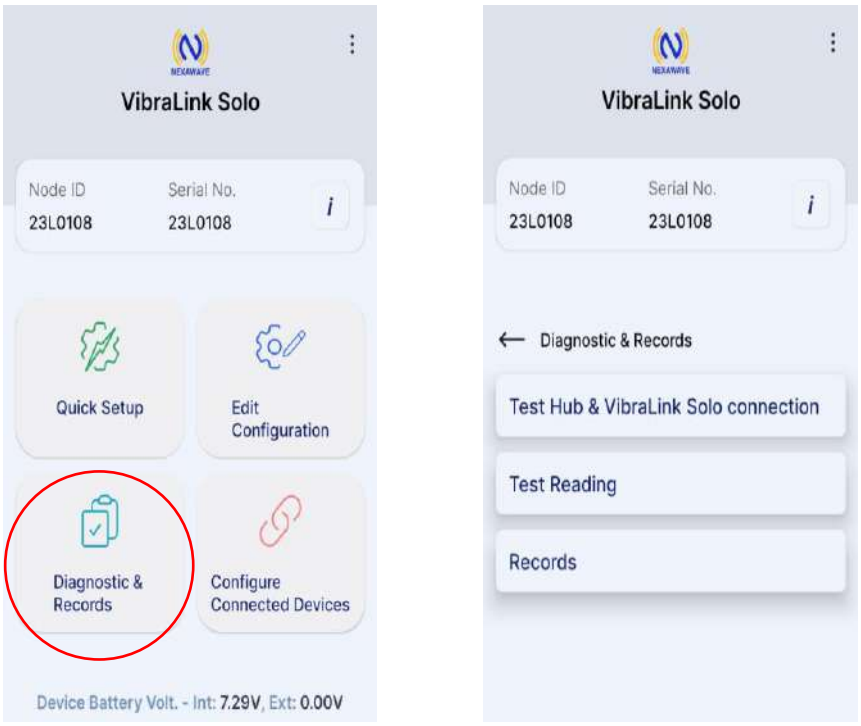



**Figure 5-28**

- To begin testing the connection between the **VibraLink Solo** and **Hub**, tap on **Test Hub & VibraLink Solo Connection** under the **Diagnostic & Records** section. This will initiate the test process to check the connection between the two devices. Once you tap Start Test, the system will test the connection between the VibraLink Solo and the Hub. The RSSI, dBm, and pW values for both the VibraLink Solo and the Hub will be displayed. The Test Packet Status will show the real-time progress of the test, including the number of packets received and the pass/fail status.
- If the test is successful, you will see a GOOD to Go! message. If the test fails, you can tap Test Again to retry the process. To stop the test at any time, tap Stop Test.

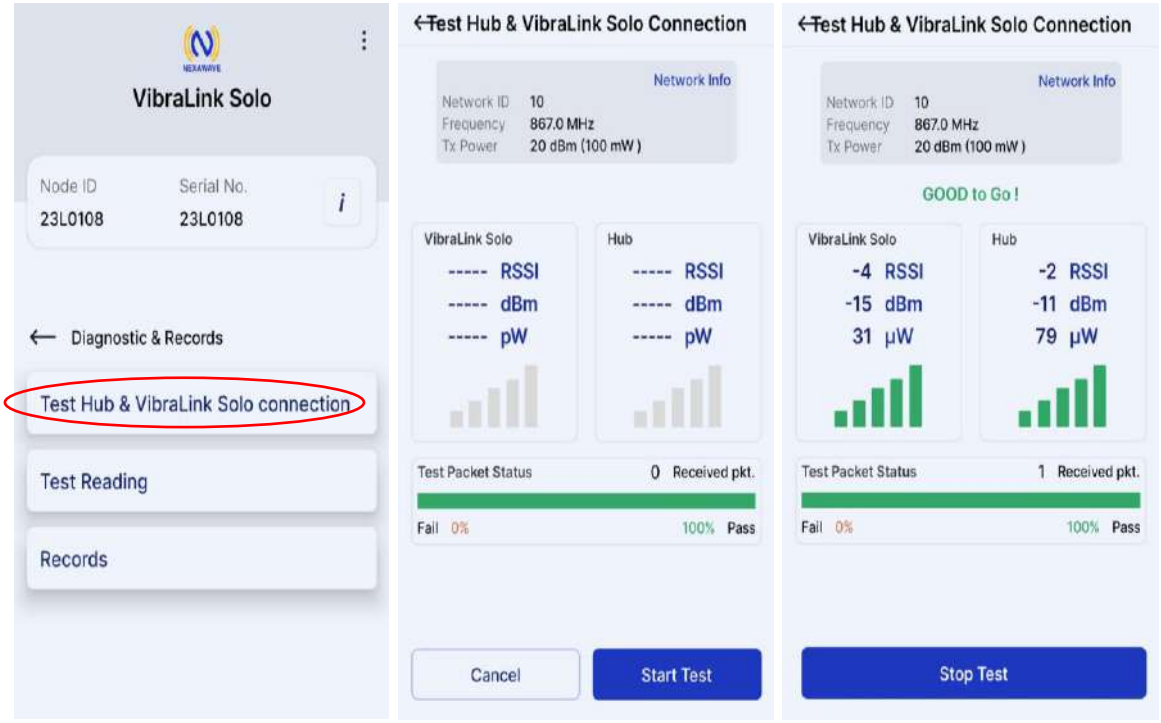



**Figure 5-29**

- To begin the **Test Reading** process on the VibraLink Solo, start by navigating to the **Diagnostic & Records** section from the main screen of the app. Once there, tap on **Test Reading** to open the test parameters. The **Test Reading** screen will display information such as **Frequency (Hz)**, **Temperature (°C)**, **Noise (Max 1 Hz)**, and other relevant readings. These values will update with the current data being monitored by the device.
- If you wish to take a new reading, simply tap on the **"Take Reading"** button. This will capture the latest values for frequency, temperature, and any noise associated with the device. If you need to stop the test at any time, you can press the **"Stop Reading"** button.
- For users looking for additional configurations, the **"Advance Settings"** button allows for more customization. Once you have completed the reading and confirmed the data, you can save it by tapping **"Save"**.

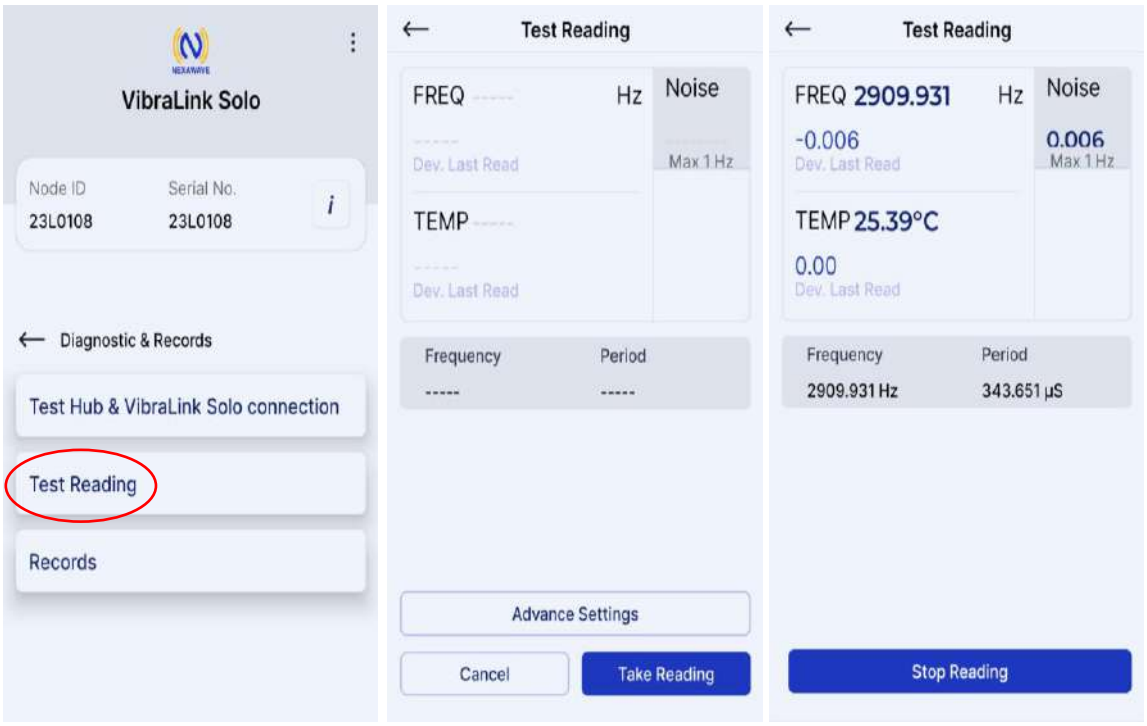



**Figure 5-30**

- For the **Records section** after clicking the "Records" button, you will see the "Download" tab in the application. Under this tab, you'll be able to view the number of records available for download and upload. The number of records since the last download and the number since the last upload will be displayed as indicated in the image.
- You can use the **Refresh** button to update the displayed data.
- To download the available records, click the **Download Records** button located at the bottom of the screen. This will initiate the download process for the stored records.

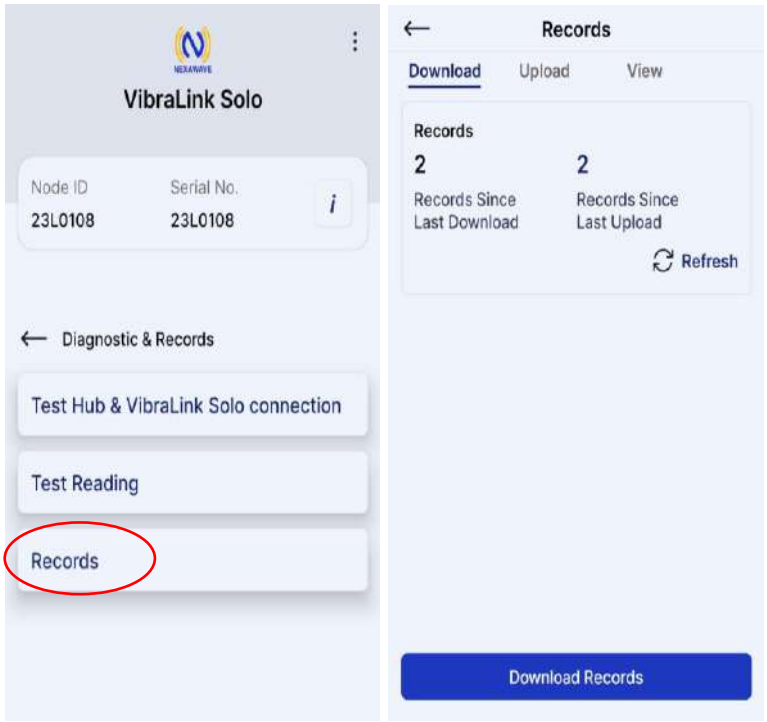



**Figure 5-31**

- To upload records, go to the **Records** section on the VibraLink Solo app and tap the **Upload** tab. Enter the **Server IP Address**, **Port**, **Username**, and **Password** in the **Server Settings** section. Then, select the files you want to upload from the **Select Files** section. Tap **Proceed** to start the upload, and wait for the confirmation message. You can choose to save the settings or cancel the process at any time.

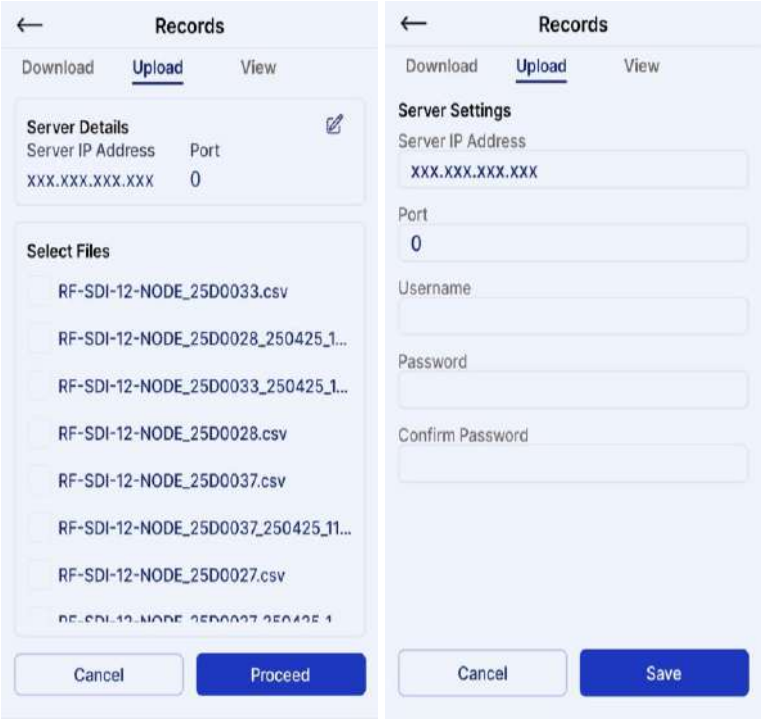



**Figure 5-32**

- The "View" section of the VibraLink Solo interface allows users to access and visualize the recorded data from the device. It provides a detailed overview of the data within a specific date and time range, allowing users to track parameters like frequency (Hz) and battery voltage (BATTV). The data is presented in a table format, where each entry shows the exact time and corresponding values for the selected parameter. Additionally, users can view the data graphically, with the option to display it over the selected time range, providing a clear visual representation of the readings. This feature enables easy analysis of trends and fluctuations in the monitored data. Users can also refresh the data view to ensure they are seeing the most up-to-date information.

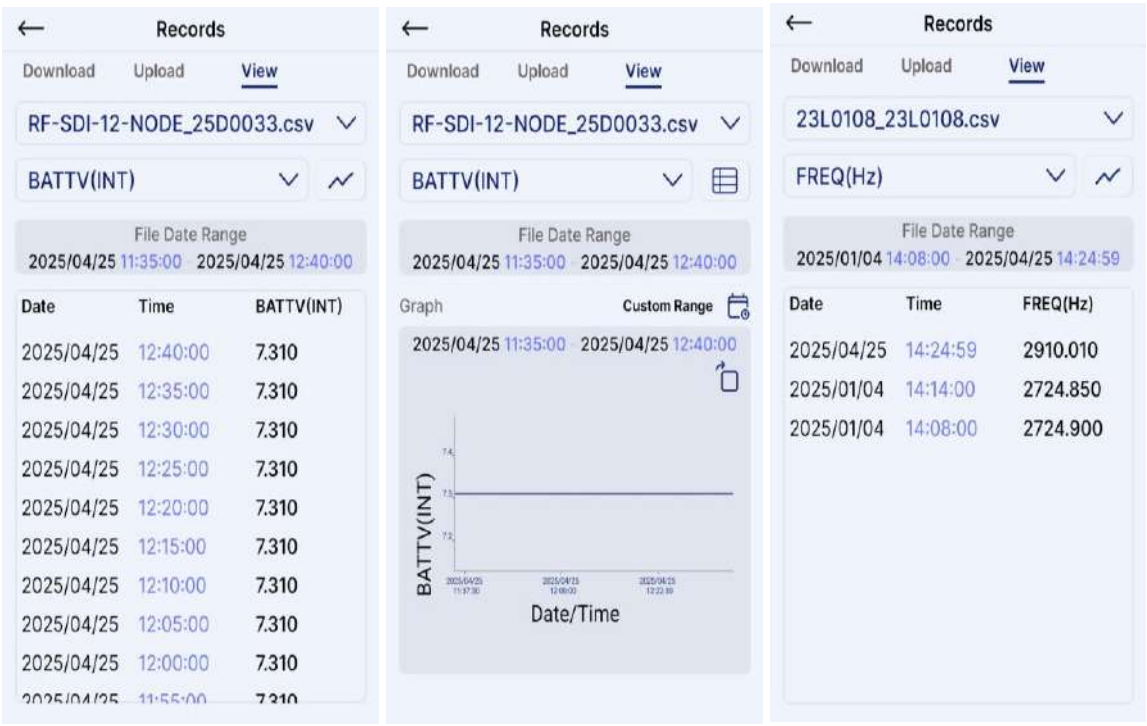



**Figure 5-33**

### *5.4.4 Configure Connected Devices*

- The "Configure Connected Devices" section of the VibraLink Solo app allows users to manage and configure devices connected to the system. The map view in this section provides a visual representation of the device's location, helping users quickly identify where each device is located. In the next screen, users can select a specific device, such as 23L0108, 24E0072, or 23K0065, from a list of available devices. This feature facilitates easy management of multiple devices, ensuring smooth operation and connectivity. The option to "View on map" provides an intuitive interface for tracking and configuring the devices as needed, ensuring they are properly set up for data collection and monitoring.

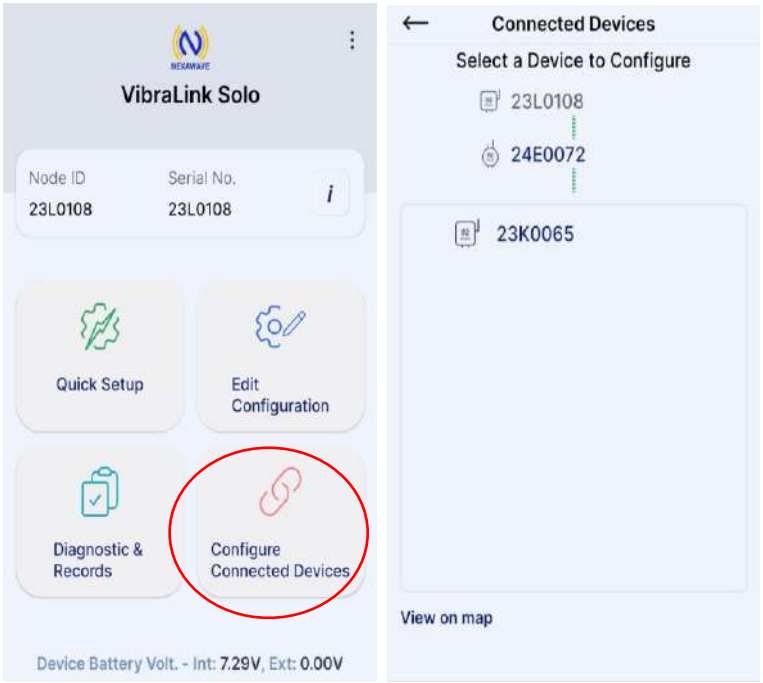



**Figure 5-34**

- After selecting the "HUB" device from the connected devices list, users can view its information and access "System Setup" to configure logging parameters, device date and time synchronization, and optionally erase the gateway memory, which permanently deletes stored records and settings. Changes are applied by tapping "Save," and users can return to the device list via "Back to Connected Devices," providing comprehensive control over the Hub's operation.

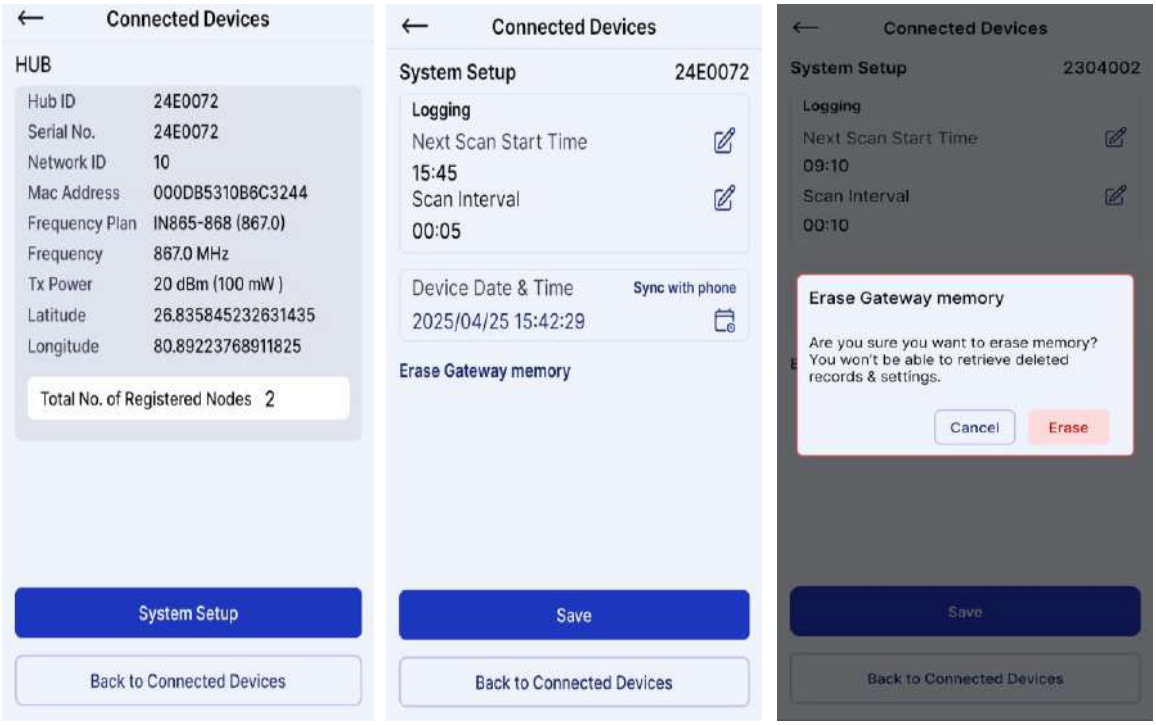



**Figure 5-35**

**Re-configuration other nodes in the same network via Node:**

- In the **Connected Devices** section of the VibraLink app, users can configure and manage other nodes connected within the same network. To configure a different node, simply choose the desired node from the list of connected devices. Once selected, you will see a dropdown menu where you can choose the **Chat Duration** for the session. This option allows you to select a duration ranging from 1 to 5 minutes, depending on your preference. After selecting the duration, click on the **Get Appointment** tab to establish a live connection with the chosen node. This will initiate a real-time session, and the **Appointment Status** will show as **Booked** with a countdown timer indicating the remaining time before the session starts.

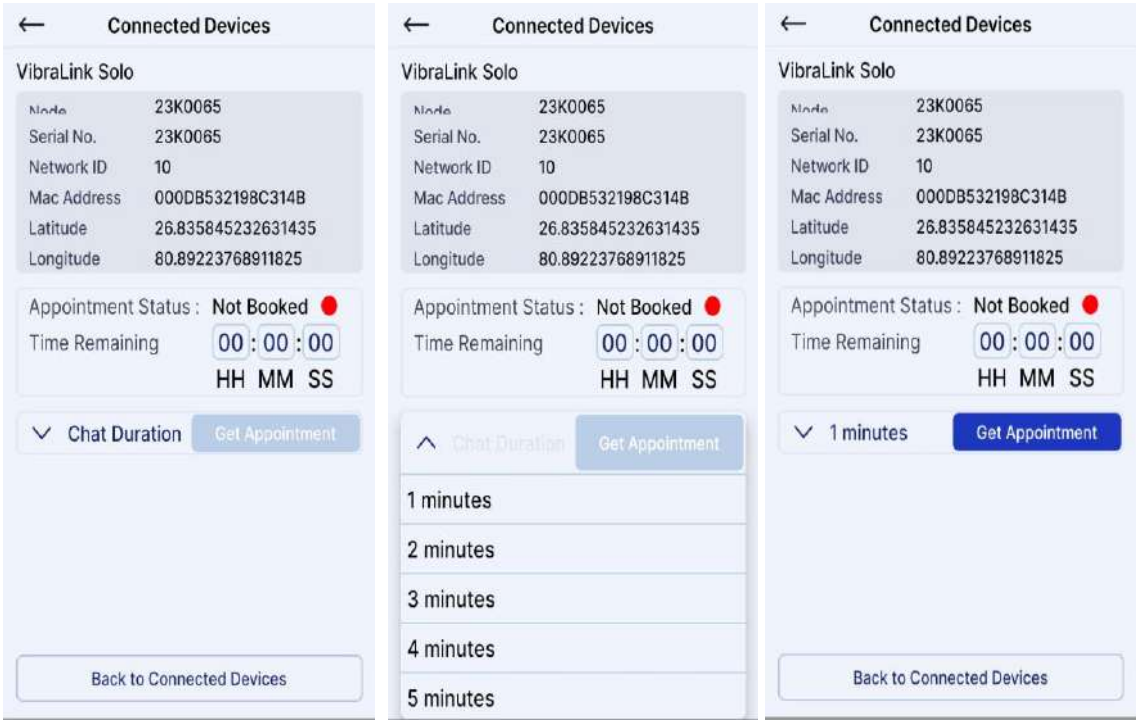



**Figure 5-36**

- A notification will appear stating **"Getting appointment from Node..."** while the connection is being established. Upon successful connection, the **Appointment Status** will change to **Connected**, and a countdown for **Time Remaining** will begin. During the session, the user can perform various actions such as viewing the **Node Battery Voltage**, checking **Node Records**, adjusting the **Node Date/Time**, or modifying the **Node Scan Interval**. If necessary, the user can cancel the appointment at any time by clicking the **Cancel Appointment** button.

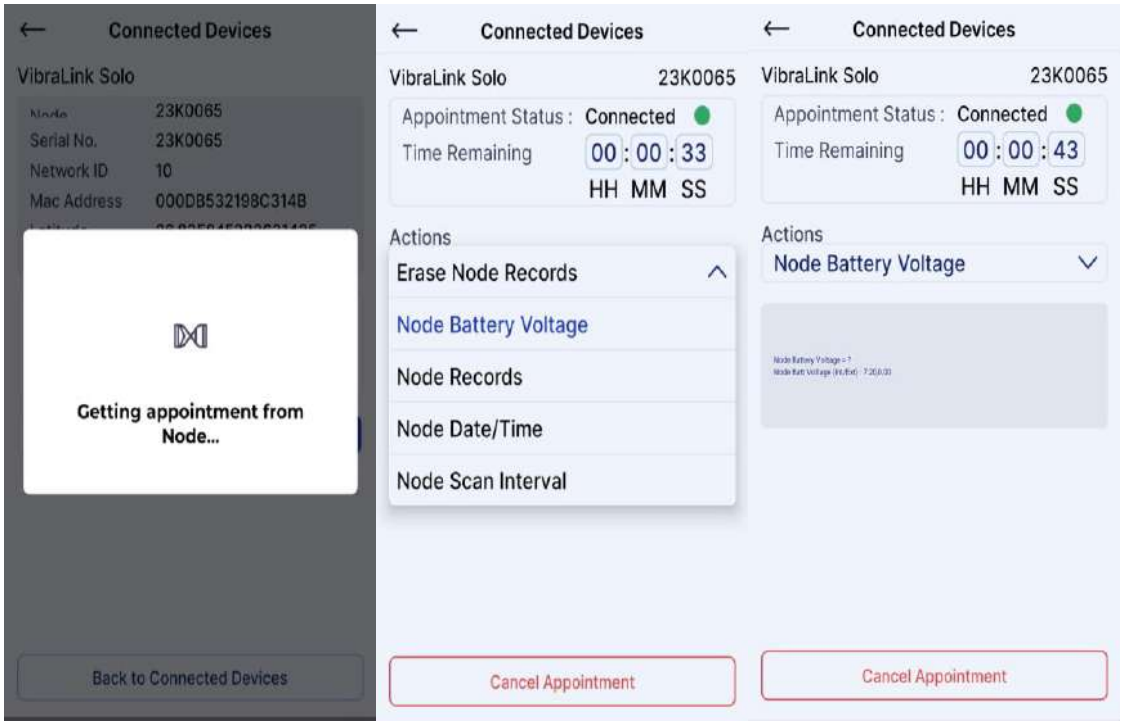



**Figure 5-37**

# 6 INSTALLATION PROCEDURE FOR NODE

Sites being different from each other must be properly surveyed to determine the best place for mounting the nodes and Gateway. Generally, the Gateway should be in line of sight of all the nodes. To achieve better coverage/transmission of data, it is recommended to mount the vibrating wire node as high as practicably possible at site. The nodes come with mounting accessories suitable for wall mounting or mast/pole mounting, depending on the type of order placed.

## 6.1 Wall mounting

- The Nodes can be directly fixed to a flat surface using four screws. The node enclosure has mounting holes for fixing it on any place surface.

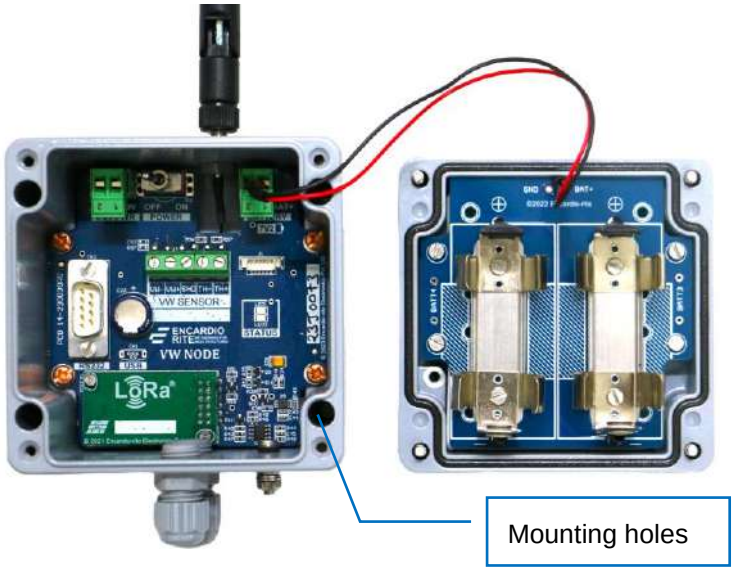



**Figure 6-1**

- Mark the locations of four mounting holes.
- Ensure that the position of the holes is aligned correctly, using a spirit level.
- Drill holes depending on the mounting fasteners being used for fixing the Node (supplied with the Node).
- Fix the Node on the surface using fasteners.

**NOTE:** Installation may have to be improvised or tailor-made depending upon site conditions, like using cable ties

## 6.2 Mast mounting

Mounting the Node on a tall mast is a good solution to achieve better height. Ample precautions must, however, be taken for the protection of the equipment.

The type of mast to be used for such an application depends on the site location.

- A mast can be a small pole mounted to the roof of any structure or portable cabin available at the site (with required permissions).
- In an open field or hilly region application, a mast can be a pole installed in the ground with a strong foundation. If required, it can be supported with guy wires.

The height of Node mounting needs to be carefully planned to be in line with Gateway's sight, but not too high to attract lighting.

Once the mast is ready, the Node can be fixed on it using suitable brackets, clamps, and fixing plate. If required, a suitable protection box can be provided. A typical installation photograph is shown below for reference. A protection box may be provided, depending on site requirements.

**NOTE**: Mast, mounting accessories, protection cover, and necessary civil works are in the Client's scope.

# 7 TROUBLESHOOTING

## 7.1 Unable to connect Node over Bluetooth

- Android phone's Bluetooth may not be enabled.
- Bluetooth modem may be out of Bluetooth range from Android phones.
- Bluetooth modem may not be paired with android phone.
- Check Bluetooth modem baud rate settings. It must be configured for 115200 and hardware flow control should be OFF.
- Turn OFF the Node and then turn ON again.
- Remove the power from Node, wait for 30 seconds and then connect the power again. Now try to connect.

## 7.2 Unable to connect Node with FTDI-OTG Cable

- RS232 interface connector may be loose.
- Check the interface cable's connector for damage.
- RS232 interface cable may be broken.
- Node battery may be discharged.
- Remove the batteries, wait for 30 seconds and then mount the batteries. Now try to connect.

## 7.3 Unable to communicate with Gateway

- Check the antenna for loose connection.
- Antenna to RF modem connecting cable may be damage.
- Antenna itself may be damaged try with another antenna
- Node battery may be discharged.

# 8 SAFETY AND WARNINGS

## 8.1 Operation Safety

- Before taking any action, please read the user's manual carefully,.
- Ensure that all the procedures and installations are correctly carried out.
- The case and mountings should be grounded, where practicable.
- This product has been designed to meet a certain water-proof level. However, it becomes vulnerable to water ingress when the lid screws are not tightened properly, or if the cable gland has not been sealed properly.
- This product must not be disassembled under any circumstances. If done, it will void the warranty and may leave the product in a dangerous state.

## 8.2 Battery caution & warning

- To install the battery into a holder, please follow the "+" (positive) and "-" (negative) signs carefully. Wrong orientation of a battery could potential cause unit damage.
- If battery is incorrectly replaced, there may be danger of explosion.
- Use only with the type recommended by the manufacturer. Observe any warnings specified by the battery manufacturer.
- The battery has a relatively high capacity, so please take special care during storage and usage.
- When disposing of the batteries please contact your local authorities or dealer and ask for the correct method of disposal.
- When disconnecting the battery, please take special care not to apply excessive force, otherwise the battery holder and the nearby circuitry can get damaged.

If the above safety precaution and warnings are not followed, the manufacturer cannot be held responsible for any damage and injury caused to the users.

# 9 WARNING RADIATION EXPOSURE

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

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.

Note: 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.

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

Antenna Specification: 4.44dBi

## 10 ENVIRONMENTAL RESPONSIBILITY DECLARATION

Encardio Rite Group ("**Encardio**") is committed to ensuring full compliance with environmental responsibilities under all applicable Indian environmental statutes, collectively referred to herein as the **"Law(s)"**. This declaration is applicable to all products manufactured and marketed by Encardio.

1. **Scope:** This declaration binds and guides every stakeholder involved in the product's lifecycle including individuals, institutions, organizations, or entities hereinafter referred to collectively as the **"User(s)"**.
2. **Waste Segregation and Handling:** All Users are required to manage the product and any waste generated from its use in accordance with the law, including proper segregation of waste at the source into biodegradable, recyclable, and hazardous categories; authorized disposal of all end-of-life products, electronic components, batteries, and packaging materials only through government-authorized collection, recycling, or refurbishing systems; and ensuring that products bearing the crossed-out wheeled bin symbol are not mixed with general household or municipal waste streams.
3. **E-Waste Disposal and Battery Waste Management:** All electronic and electrical equipment and components manufactured or sold by Encardio must be disposed of only through authorized recycling or refurbishing facilities as per applicable law, ensuring no harm to human health or the environment; users shall ensure that all used items are returned to designated collection points and shall also maintain proper documentation and adhere to return, reporting, or record-keeping obligations; products nearing end-of-life must not be discarded along with general household waste, as improper disposal of e-waste may lead to toxic chemical release and pollution.
4. **Plastic Waste Management:** Users must not discard plastic components or packaging into unsorted municipal waste; instead, they should separate and hand over such plastic waste to authorized waste processors and ensure that no banned plastic items, as notified under law, are used or circulated.
5. **Industrial and Hazardous Waste:** If the User operates any facility where industrial, hazardous, or biomedical waste may arise due to the installation, maintenance, or testing of the product, all necessary consents and permits must be obtained and renewed from competent authorities; adequate protective measures must be taken to ensure no harm is caused to the environment or human health; and such waste must be stored, treated, and disposed of in accordance with the law.
6. **Pollution Control:** Users operating manufacturing, repair, or testing premises must not emit air or water pollutants beyond prescribed limits, must operate only after securing applicable consents under the law, and must maintain environmental records and submit reports as required
7. **Record Keeping and Reporting:** All Users associated with Encardio must maintain comprehensive records of production, sales, collection, and disposal in accordance with applicable Law(s) and submit timely reports to regulatory authorities.
8. **Contact and Support:** Encardio urges all Users to act responsibly and support sustainable environmental practices by adhering to this declaration and the Law. For safe disposal and further compliance assistance, Users are encouraged to contact their local municipal waste authorities, or authorized recyclers. Non-compliance with the above obligations may constitute a violation of Indian environmental laws and attract penalties under the relevant Law(s). Users can contact Encardio at:

Contact Number: +91 522 2661039-42

Website**:** https://www.encardio.com/

## 11 RECOMMENDATION OF BATTERIES FOR DATALOGGERS

We recommend to use any of the following batteries in all Encardio-rite products (Dataloggers, Wireless Nodes and Gateway). These batteries can be sourced locally.

| SN | Manufacturer | Mfr Part No. | Battery type | Datasheet | Photo | Example Links to buy |
|---|---|---|---|---|---|---|
| 1 | ACT | ER34615M | LI-SOCL2 (Power Type) | https://actsales04.en.ec21.com/ACT_ER34615M_3.6volts_Lithium_Battery--8201912_8271376.html |  | actsales |
| 2 | SAFT | LSH 20 | LI-SOCL2 (Power Type) | https://www.saft.com/products-solutions/products/ls-lsh-lsp?text=&tech=84&market=&brand=764&sort=newest&submit=Search |  | Digikey<br>Atbatt.com<br>Potensa<br>Batteryexperts.com |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | SAFT | LSH 20 HTS | LI-SOCL2 (Power Type) | https://www.saft.com/products-solutions/products/ls-lsh-lsp?text=&tech=84&market=&brand=764&sort=newest&submit=Search |  | Tteckai.com<br>indiamart<br>patareid<br>Aliexpress.com<br>globalbat |
| 4 | Ultra Life | ER34615M | LI-SOCL2 (Power Type) | https://www.ultralifeindia.com/wp-content/uploads/2020/01/TDS_ER34615M.pdf |  | mouser |
| 5 | FANSO | ER34615M | LI-SOCL2 (Power Type) | https://www.texim-europe.com/product/battery-and-power-supplies/batteries/primary-batteries/lithium-li-socl2/detail/er34615m-fso |  | texim-europe<br>tme.com<br>ecocell.com<br>batterydirect.com |
| 6 | RAMWAY | ER34615M | LI-SOCL2 (Power Type) | http://en.ramwaybat.com/product_46/ |  | Alibaba.com<br>Lazada<br>zgqjnyw.mobi |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | Bex Batteries | ER34615M | LI-SOCL2 (Power Type) | batteryExperts |  | batteryExperts |
| 8 | PKCELL | ER34615M | **LI-SOCL2 (Power Type)** | Pkcellpower.com |   | Pkcellpower.com<br>electronicworld<br>Amazon<br>Alibaba |
| 9 | HCB | ER34615M | LI-SOCL2 (Power Type) | https://www.enhcb.com/products/li-socl2-lithium-thionyl-chloride-cylindrical-battery/ |   | Enhcb.com |
| 10 | FORTE | ER34615M | LI-SOCL2 (Power Type) | Fortebattery |   | Fortebattery<br>zinchu<br>ozon |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | EVE | ER34615M | LI-SOCL2 (Power Type) | https://microchip.ua/battery/er34615m.pdf |  | Jm.pl<br><br>repairnspares |
| 12 | TekCell | ER34615M | LI-SOCL2 (Power Type) | https://www.tme.eu/Document/69a4b065e0660fedf2cdae1c1c0fb8d4/BAT-ER34615M.pdf |  | tme |