Channel Sounding
Evaluation Application
User Guide

metirionic

WIRELESS DISTANCE MEASUREMENT

1. Introduction

Welcome to the Channel Sounding Evaluation Application user guide. This application allows you to monitor real-time distance measurements that are measured with Bluetooth® Channel Sounding and processed with MARS. A "initiator" development kit continuously measures distances to a "reflector" development kit and sends the results to the evaluation software.

In this guide, we'll walk you through setting up the hardware, configuring the application, and interpreting the various plots and data views.

2. System Requirements

1. Hardware Requirements
   - A development kit programmed with the Metirionic initiator firmware.
   - A USB cable for connecting the development kit to your computer.

2. Software Requirements
   - A computer running MS Windows.
   - The Channel Sounding evaluation application
   - Appropriate serial device drivers (if needed).

3. Permissions and Drivers
   - Ensure you have permission to access the chosen serial port (COM port on Windows) used by your development kit.
   - Install additional drivers if your OS doesn't natively recognize the development kit.

3. Installation & Setup

Follow these steps to prepare your environment for using the Channel Sounding evaluation demo:

1. Install and Launch the Channel Sounding evaluation application

2. Run the installer (if provided) or launch the executable directly, depending on how the software is packaged.

3. Ensure your development kits are flashed. One kit with initiator firmware and the other with reflector firmware.

4. Connect the Hardware. Use a USB cable to connect the initiator kit to your computer and ensure that that the reflector kit is powered.

5. Confirm that your computer recognizes the device and assigns it a COM port.

6. Launch the Demo and Configure the COM Port

7. Start the Metirionic Channel Sounding evaluation application.

8. Look for the Serial port dropdown at the top menu bar.

9. Select the COM port that corresponds to your nRF54L15-DK.

10. If no ports appear, click Refresh to rescan.

11. Once the correct port is selected, click Connect to establish communication.

12. Verify Connection

- When successfully connected, the application will begin displaying real-time distance measurements on its main plot(s).

4. Overview of the User Interface

Figure 1 Full application window

Once you've launched the Channel Sounding evaluation application and connected to the initiator kit, the application window is divided into several key areas:
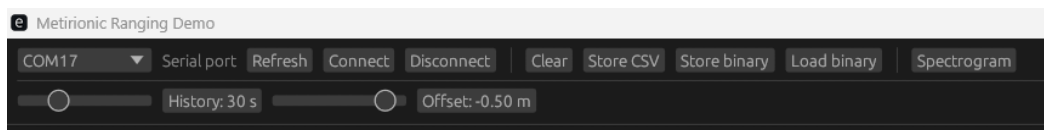
4.1 Top Menu Bar

Figure 2 Top menu bar

- Serial Port Dropdown: Choose the COM port your initiator kit is connected to (e.g., COM17).

- Refresh Button: Rescans available COM ports.

- Connect/Disconnect Button: Initiates or terminates the connection to the selected COM port.

- Clear Button: Clears the current data from the plots.

- Store CSV/Binary Buttons: Saves the measurement data in CSV or binary format for later analysis.

- Load Binary Button: Loads previously saved binary files into the application for review.

- View Toggle (Impulse Response / Spectrogram): Switches the right-hand panel between the impulse response plot and the spectrogram view.

- History & Offset Controls: Adjust the time window (e.g., 30 s or 60 s) and apply an offset to the measured distance.

4.2 Main Display – Left Panel (Distance vs. Time)

Figure 3 Left panel - distance over time

- Vertical Axis (Distance in meters): Ranges from 0 m upward (the displayed max can vary based on your measurement range).

- Horizontal Axis (Time in seconds): Shows the recent measurement interval (e.g., 60 s).

- Data Traces:

  - MARS Raw Distance (Gray): Real-time sampling of the measured distance, which can fluctuate slightly.

  - MARS Median Distance (Green): A filtered or averaged distance to reduce noise, typically stable around the actual distance.

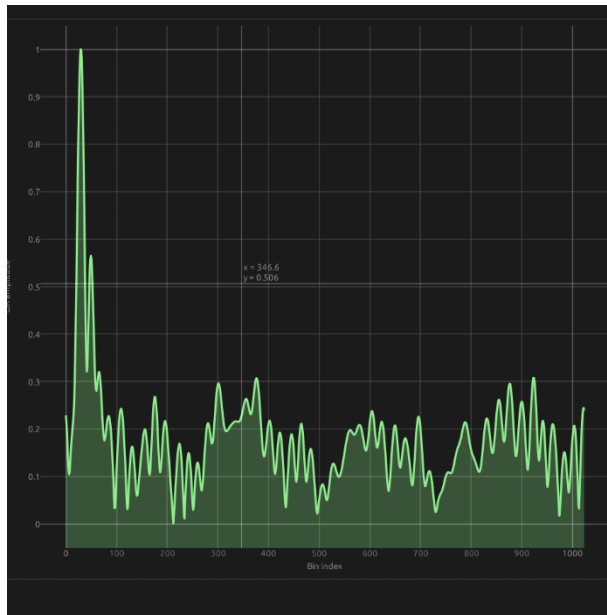## 4.3 Secondary Display – Right Panel (Impulse Response or Spectrogram)

Figure 4 Right panel - impulse response view

- Impulse Response View:

- Plots the amplitude (vertical axis) against a "bin index" (horizontal axis).

- A large spike often appears at a certain bin index, indicating the main signal path.

- Hovering over a point in the left plot highlights the corresponding impulse response in red.
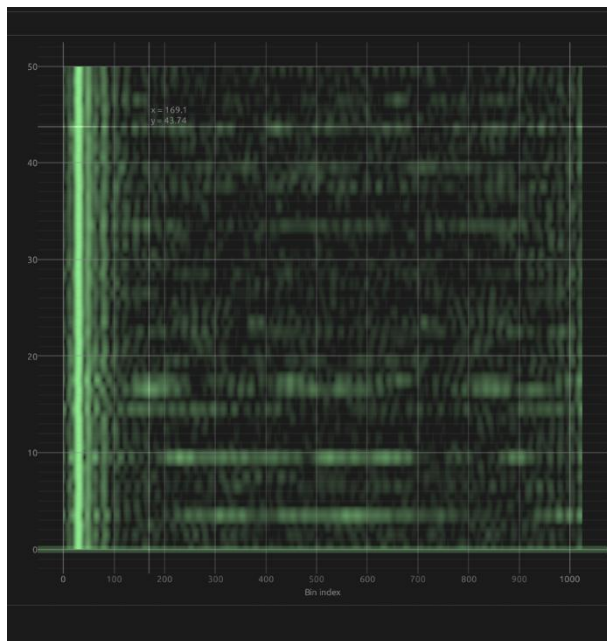

Figure 5 Right panel - spectrogram view

- Spectrogram View:

- Displays a color-scaled map of amplitude vs. bin index over a sequence of measurements.

- The measurement index is typically on one axis, the bin index on the other, and color intensity represents the amplitude.
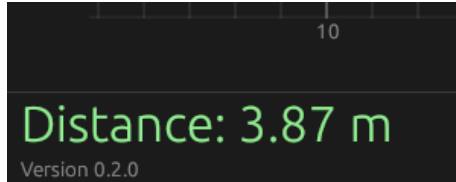
4.4 Status Bar

Figure 6 Distance read out and version information

- Distance Readout: Shows the most recent distance measurement (e.g., 3.87 m).

- Application Version: Displays the current app version (e.g., 0.2.0).

5. Operating the Application

Once you have set up the hardware and established a connection via the correct COM port, you can start monitoring real-time distance measurements:

5.1 Start/Stop Measurements

- After clicking Connect, measurements begin automatically.

- The MARS raw distance (gray trace) and MARS median distance (green trace) should begin updating on the left panel.

5.2 Live Distance Readout

- Observe the Distance value in the status bar at the bottom of the window.

- You can also watch the real-time distance values on the left plot's y-axis.

5.3 Adjusting the Display

- Use the History dropdown or slider to change how many seconds of past data are displayed (e.g., 30 s or 60 s).

- The Offset field can be used to add or subtract a fixed value from all distance readings (e.g., if you know there is a static offset of 0.5 m from the antenna front end).

5.4 Clearing Data

- Click Clear to remove the existing traces and reset the plotting window if you want to start fresh.

5.5 Saving Data

- Store CSV: Saves the current session's distance data as a CSV file (easily opened in spreadsheet apps).

- Store Binary: Saves the data in a binary format, typically more compact.

- Load Binary: Opens a previously saved binary file for offline analysis or playback in the evaluation application.

5.6 Switching Views

- Use the Impulse Response / Spectrogram toggle in the top menu bar to change the right-hand visualization.

- While in Impulse Response mode, hover over the distance plot on the left to see the corresponding impulse response in red.

- In Spectrogram view, you'll see a color map that shows amplitude over time (or measurement index) vs. bin index.

6. Troubleshooting

If you encounter any issues while using the Channel Sounding evaluation application, consider the following tips:

1. No COM Port Detected
   - Ensure your kits are powered and the initiator kit plugged in properly via USB.
   - Click Refresh in the top menu bar to rescan for available ports.
   - Check the Windows Device Manager to verify the device appears and note which COM port is assigned.
   - Update or reinstall USB drivers if necessary.

2. Connection Fails or Drops
   - Confirm the correct COM port is selected.
   - Check whether your USB cable is suitable for data communication
   - Check that the development kit is running the correct initiator firmware.
   - Try disconnecting/reconnecting the USB cable or power-cycling the development kit.
   - Close any other applications that may be blocking or using the same COM port.

3. No Distance Data Displayed
   - Verify that you have clicked Connect (the button should now offer "Disconnect" if connected).
   - Look for any error messages in the demo's status bar or console (if available).
   - Ensure the initiator firmware is functioning correctly. If in doubt, reflash the firmware.

4. Erratic or Noisy Measurements
   - The MARS raw distance may fluctuate somewhat, but the MARS median distance should be more stable.
   - Consider whether the signal path is obstructed, or if the antenna orientation is poor.
   - Change the Offset if you suspect a different static offset.
   - Check for interference sources in the environment (e.g., other wireless equipment).

5. Application Freezes or Crashes
   - Restart the Metirionic Channel Sounding evaluation application.

- Ensure your computer meets the minimum system requirements and that you have a stable USB connection.

- Update to the latest version of the Channel Sounding evaluation application if available.

6. Support
   - If issues persist, consult the Metirionic documentation or contact Metirionic support for further assistance.

7. Conclusion

The Channel Sounding evaluation application is a powerful tool for visualizing real-time distance measurements derived from Bluetooth Channel Sounding. By following this guide, you can:

1. Prepare and Connect the initiator kit via a USB COM port.
2. View Live Measurements in the Distance vs. Time plot (left) and either an Impulse Response or Spectrogram (right).
3. Save and Analyze your data using CSV or binary export and re-import.
4. Optimize your setup through the offset feature and by adjusting the time window of displayed data.

With these capabilities, you can quickly verify distance readings and delve into signal analysis to gain insights about your environment or debug wireless applications. If you need more advanced features or run into any difficulties, consult Metirionic's documentation or reach out to support.