Dear reviewer,

We sincerely thank you for your valuable time and insightful comments during the careful review of our manuscript. All suggestions have been highly constructive in strengthening this work, and we have fully addressed each point in the responses below.

Comments 1:

Section 5 mentions buffer adjustment triggered when "STA/LTA deviates from the threshold range." To enable replication of the driver's optimization logic, explicitly define the STA/LTA thresholds (e.g., specific ratio bounds or values) and the sampling window sizes used for dynamic buffer adjustment.

Response 1:

We appreciate this suggestion for improving methodological transparency. The following details have been added to Section 5 in the revised manuscript:

The dynamic buffer management operates in two phases:

1. Initial buffer allocation:

   The baseline transmission rate is calculated as:

$$R_{\text{base}} = f_s \times \left(\frac{N_{\text{ch}} \times B_{\text{ADC}}}{8} + 1 \right)$$

   where f_s = sampling rate (305 Hz–2.5 MHz), N_{ch} = 5 channels, B_{ADC} = 24-bit resolution. To ensure that the upper-computer has a refresh rate of 20 frames, the DMA buffer size is set as the baseline transmission rate divided by 20. When the sampling rate is 2.5 MHz, the buffer size is 2 MB, when the sampling rate is 305 Hz, the buffer size is 256B.

2. Runtime dynamic adjustment:

   The dynamic buffer adjustment is triggered when the STA/LTA ratio exceeds the threshold range of [0.7, 1.3]. STA is calculated over a 1-second sliding window and LTA is calculated over a 10-second window. When the ratio is below 0.7, the buffer size is reduced by one level; when the ratio is greater than 1.3, it is increased by one level, until the STA/LTA stabilizes.

Comments 2:

Add a screenshot of the waveform display interface in the instrument testing section (Section 7).

Response 2:

Thank you so much for your comment. A screenshot of the real-time waveform display interface during field tests has been added after Figure 15 in Section 7. The image is shown below:

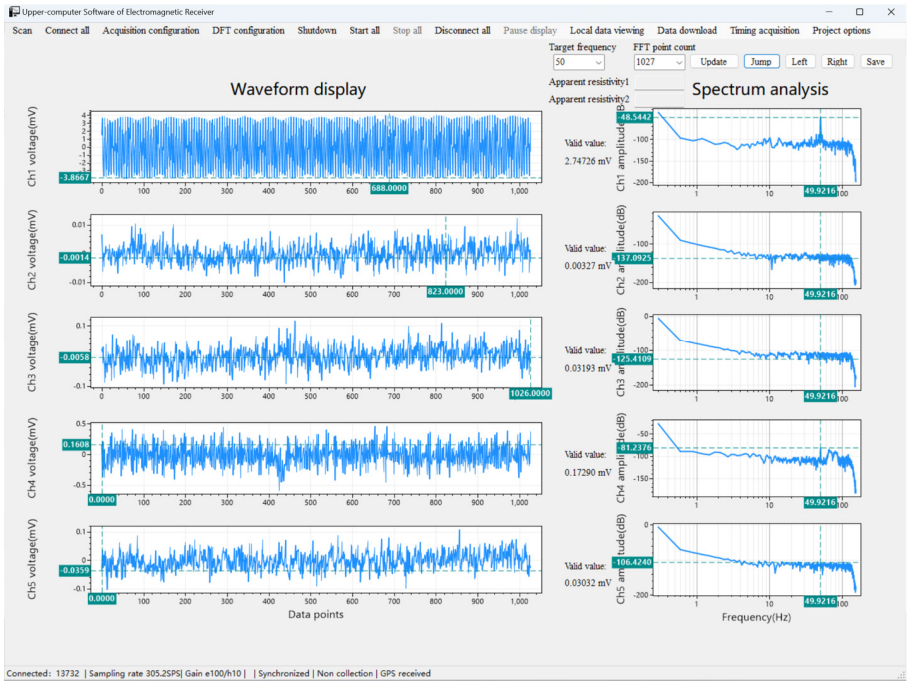

Figure 16. Self-developed upper-computer waveform display interface during field validation in Fengtai.

Comments 3:

Section 6 introduces the design of an SFTP-based file transfer function in the upper-computer software. To substantiate the implementation and user interaction, provide a screenshot of the software's SFTP transfer interface in action or a test result screenshot confirming successful transfer.

Response 3:

Your suggestion is highly valued. We have included a new Figure 11 in Section 6 demonstrating the SFTP functionality. The SFTP interface consists of an upper-computer section, a CSUMT-R section, and a progress bar. Both the upper-computer and CSUMT-R can select paths, and the upload and download between them are bidirectional. It allows not only the retrieval of collected data but also the system maintenance and upgrading of CSUMT-R. If the upper-computer is connected to multiple CSUMT-R devices, the desired one can be selected through a drop-down box, and the progress bar will display the upload or download progress in real time.

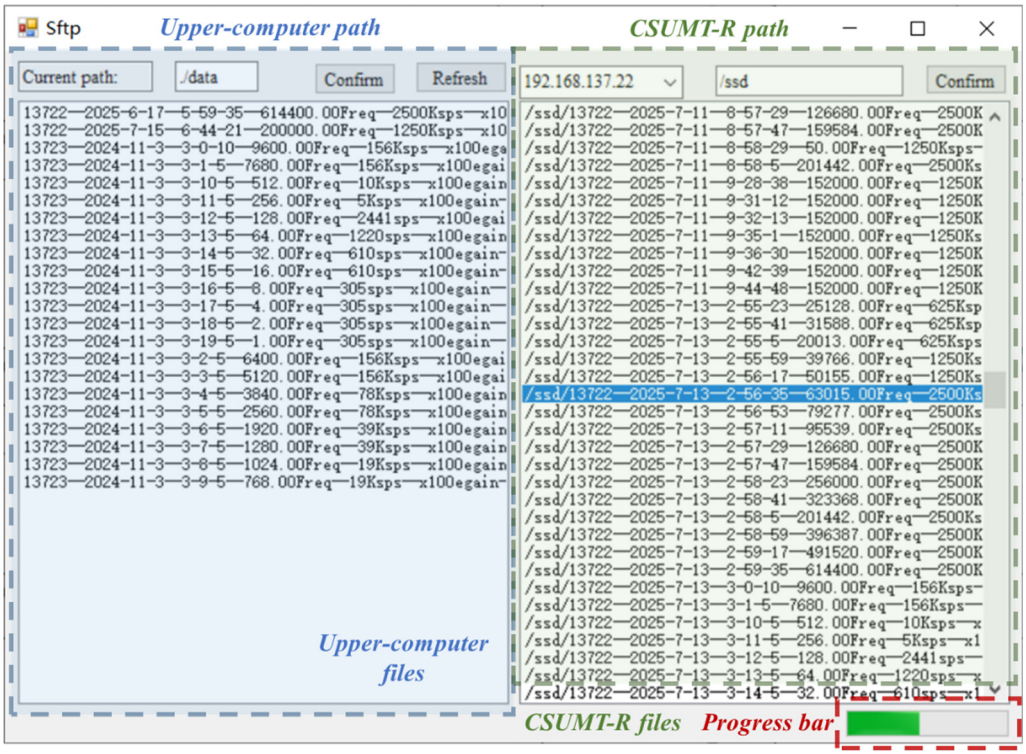

Figure 11. Self-developed upper-computer SFTP transmission screenshot.

Comments 4:

Figure. 7 attempts to illustrate both command transmission and data transmission flows. Currently, these distinct processes are visually intertwined, making the diagram difficult to interpret. Please clearly differentiate the command flow from the data flow within this figure.

Response 4:

We appreciate you raising this point. Figure 7 has been redesigned to decouple the two workflows: command flow (blue arrows) and data flow (red arrows). The command flow traverses TCP/UDP for network control to the ARM core, then AXI4-Lite bus to configure registers; concurrently, the data flow pipes raw ADC samples via AXI4-Stream to DMA, then through PCIe to SSD storage or via TCP for real-time display. The modified image is shown below:

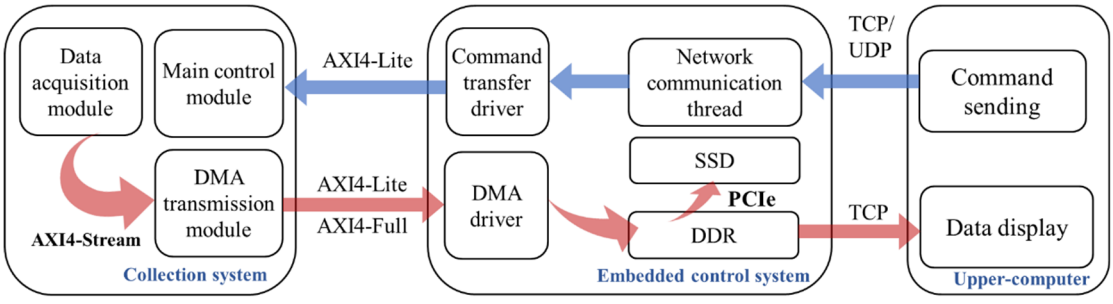

Figure 7. Data transmission flowchart.

Comments 5:

Revise the phrase "cloud- and IoT-based" to "cloud and IoT-based" (Section 8) to maintain grammatical precision in describing the software architecture.

Response 5:

Thank you for your careful review of the manuscript. We have modified the sentence.