

RadioMeteorSniffer (RMS) ©2026

v1.10

User Manual



Welcome to RadioMeteorSniffer (RMS)!

Welcome to RadioMeteorSniffer (RMS). RMS is a standalone Windows software developed to detect the entry of meteors into the Earth's atmosphere by analyzing the audio signals from a radio receiver (SSB or CW modes).

The software continuously performs a dual spectral analysis of the audio signal, generating spectrogram images which it then analyzes to detect meteor traces. It locally archives the detections (image and sound) and provides an hourly automated FTP synchronization interface to publish monthly statistics on the RMOB network (www.rmob.org).

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1. Introduction

1.1. Radio monitoring of meteor activity

When a meteoroid enters the upper atmosphere, friction creates a trail of ionized plasma that is briefly reflective to radio waves in the VHF bands. By tuning a receiver to the frequency of a distant transmitter (radar or beacon), RMS is capable of detecting the signal reflected by this trail within the radio's audio. Detection is performed in the frequency domain, across two types of spectrograms:

- with High Time Resolution (HTR): favoring the detection of short echoes characteristic of low-mass meteors.
- with High Spectral Resolution (HSR): better highlighting long echoes, originating from more massive meteors.

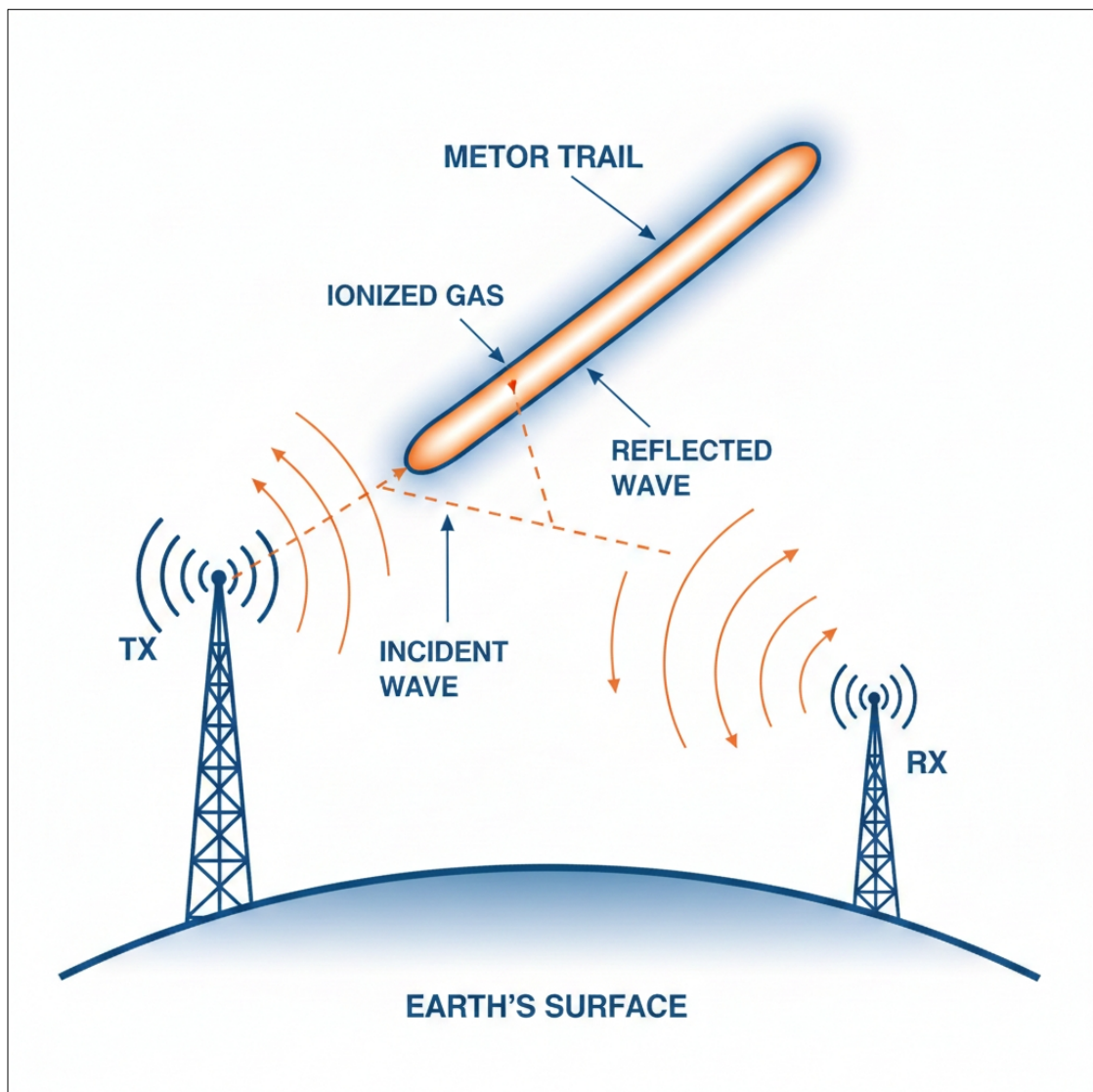


Figure 1: Reflection of a radio wave on the ionized trail of a meteor

2. Installation and Startup

2.1. System prerequisites

Spectral analysis via Fast Fourier Transform (FFT) requires a high-performance computer. The RMS algorithm operates at a sampling frequency of 4000 Hz and calculates two simultaneous FFT streams. RMS uses multithreading to avoid stuttering in the event of high computer load.

2.2. Installation

The installation is both simple and straightforward:

- Create a dedicated directory for the software (e.g., C:\RMS).
- Simply unzip the downloaded file and copy the 2 files (RMS.exe and RMS.ini) into this directory.
- Launch the application.

2.3. Startup and auto-calibration

After launching the application, you will need to specify the RF frequency band ('VHF Low' or 'VHF High', p. 7) and the audio input and output settings (p. 8-9). To share your detections on RMOB, you must also provide your station details (p. 13) and enable automatic detection transfers (p. 9).

Note that RMS automatically creates the directory structure required to store the collected data.

Upon launch, the system incorporates a mandatory security delay for calibration:

- **2 minutes and 30 seconds** before detection is authorized in the high time resolution spectrograms.
- **10 minutes** before detection is authorized in the high frequency resolution spectrogram. This delay allows the algorithm to accumulate enough audio samples to establish a baseline for local background noise and self-calibrate its colorimetric display levels. Please note that the same delays are reset if the analyzed audio frequency range is modified during execution.

3. The Software and its Interface

3.1. Interface overview

The main screen (Figure 2) gathers all the real-time analysis instruments:

- **Dashboard [A]:** Displays the daily number of unique detections (TOTAL), the exact timestamp of the last event (LAST), the UTC time of peak activity (PEAK), and the RMOB connection status.
- **Spectrograms [B] and [C]:** Two continuously scrolling windows using a thermodynamic palette (black, purple, red, yellow, white) over a 20 dB dynamic range. The left panel uses a high time resolution analysis technique, the right one, a high spectral resolution analysis.

- **Hourly Meteor Rate [D]:** Bar chart accumulating the number of events per UTC hour. (Clicking a bar displays the value in the status bar).
- **Detection Frequencies [E]:** Scatter plot recording the pitch (Hz) of each echo, along with the calculation of the mean and standard deviation.
- **Colorgram [F]:** Monthly matrix (31 days / 24 hours) displaying the hourly intensity according to the RMOB color standard.
- **Daily Total Detections [G]:** Daily total number of unique detections
- **Avg Hourly Rate [H]:** Average hourly rate of meteor echoes since the beginning of the month
- **Log Viewer [H]:** Interactive table listing the characteristics of the day's detections, with the following description of its columns:
 - **Time:** UTC time of the detection.
 - **Type:** Algorithmic index (**1:** High time resolution spectrogram / VHF Low, **2:** High spectral resolution spectrogram / VHF Low, **3:** High time resolution spectrogram / VHF High, **4:** High spectral resolution spectrogram / VHF High).
 - **Span:** Apparent frequency span [Hz] of the detection.
 - **Mean*:** Background noise (brightness) of the image [0..255]. The value also depends on the spectrogram type.
 - **Max:** Maximum observed brightness [0..255].
 - **SNR*:** Signal-to-Noise Ratio (Max/Mean) calculated in the picture of the spectrogramme.
 - **Dur:** Starting with version 1.10, echo duration is calculated in the time domain.
- *: the calculated value depends on the spectrogram in which the detection was made.
- An echo may be detected in the left spectrogram, the right one, or sometimes both. In any case, each echo is only counted once.

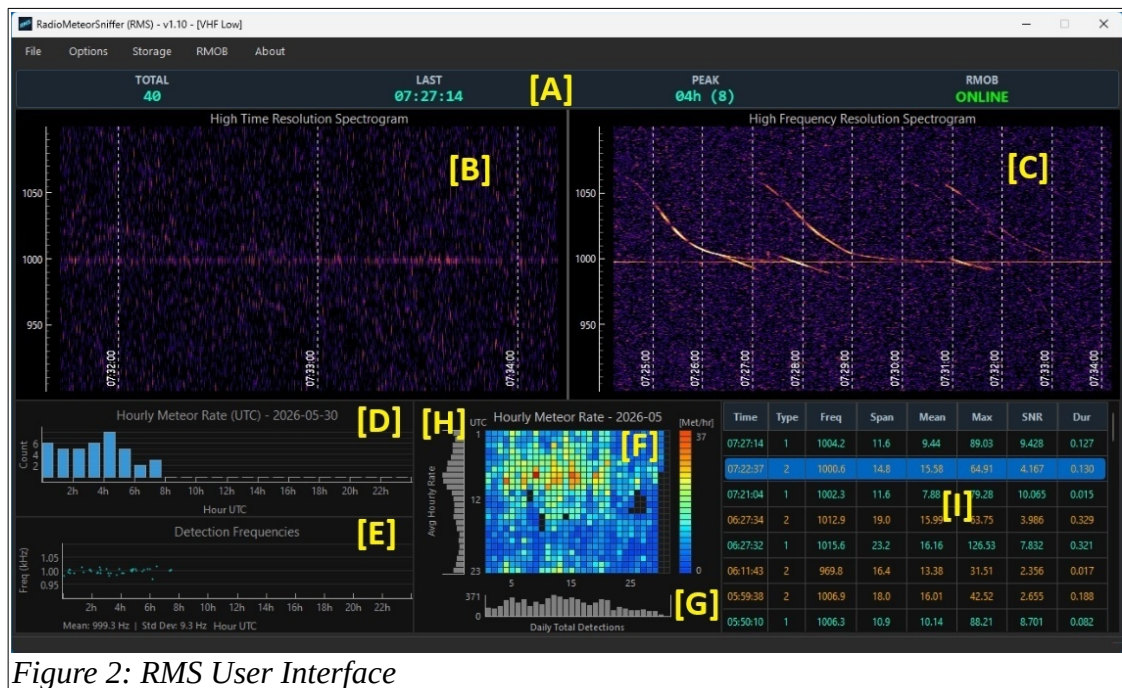


Figure 2: RMS User Interface

3.2. Menus

The top menu bar allows full control over the application:

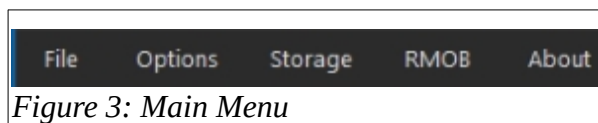


Figure 3: Main Menu

- **File Menu**

- **Exit:** Cleanly exits the application, saves the configuration, records the hourly statistics, and closes the log files.

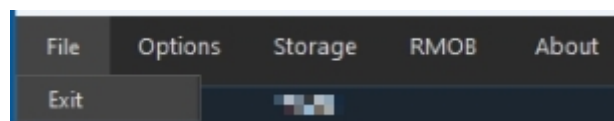


Figure 4: File -> Exit

- **Options Menu**

- **RF Frequency Band:** Toggles internal parameters between VHF Low (50 MHz) and VHF High (143 MHz). The detection criteria adapt dynamically.

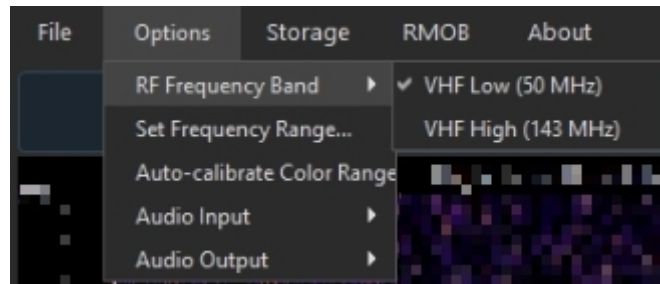


Figure 5: Options -> RF Frequency Bands

- **Set Frequency Range...:** Manually sets the analyzed frequency range (Fmin and Fmax in Hz). Attention: modifying the analysis range triggers a restart of the spectrograms and therefore an initial calibration procedure for them. It will thus be necessary to wait 2 minutes and 30 seconds before detection in the left spectrogram becomes operational, and 10 minutes for the right spectrogram.

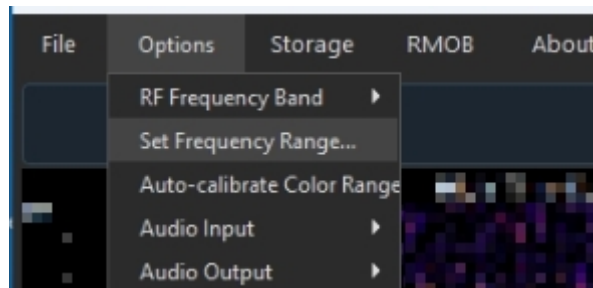


Figure 6A: Options -> Set (Audio) Frequency Range

The user can specify the audio spectrum range in which echo detection will be performed. For my station, I use the 600 to 800 Hz range.

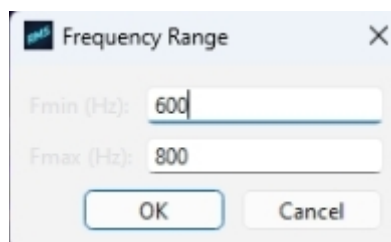


Figure 6B: Options -> Set (Audio) Frequency Range

- **Auto-calibrate Color Range:** Since version 1.10, the average image brightness is auto-adjusted by RMS; however, the user can still readjust it at any time via the menu. .

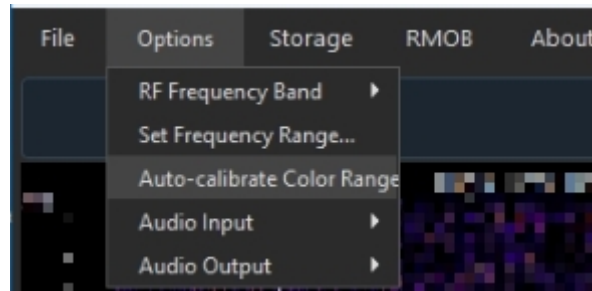


Figure 7: Options -> Auto-calibrate Color Range

- **Audio Input:** Selects the incoming audio signal source (sound card, virtual audio cable, ...).

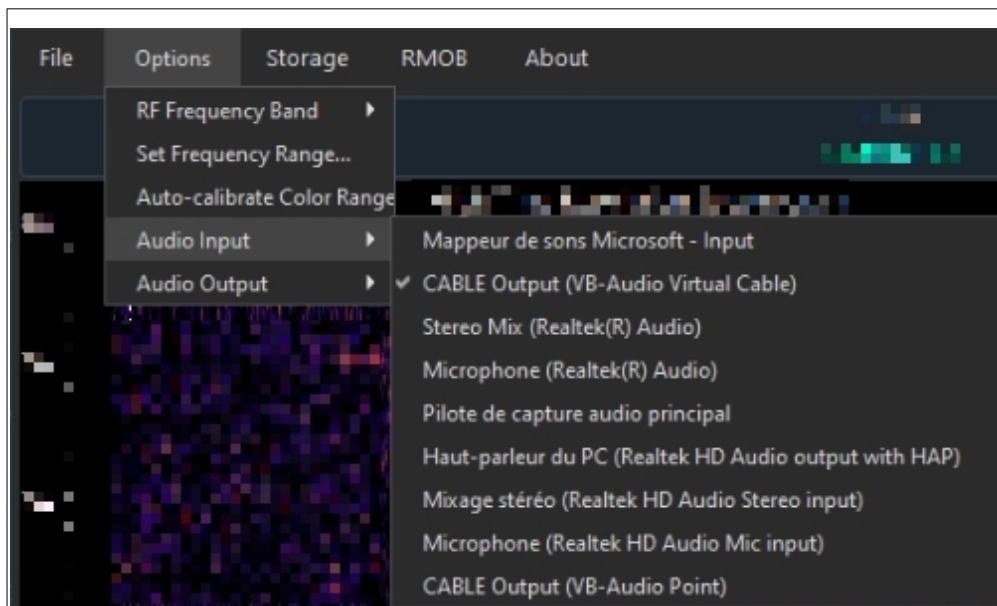


Figure 8: Options ->Audio Input

- **Audio Output:** Selects the playback device for listening to detections.

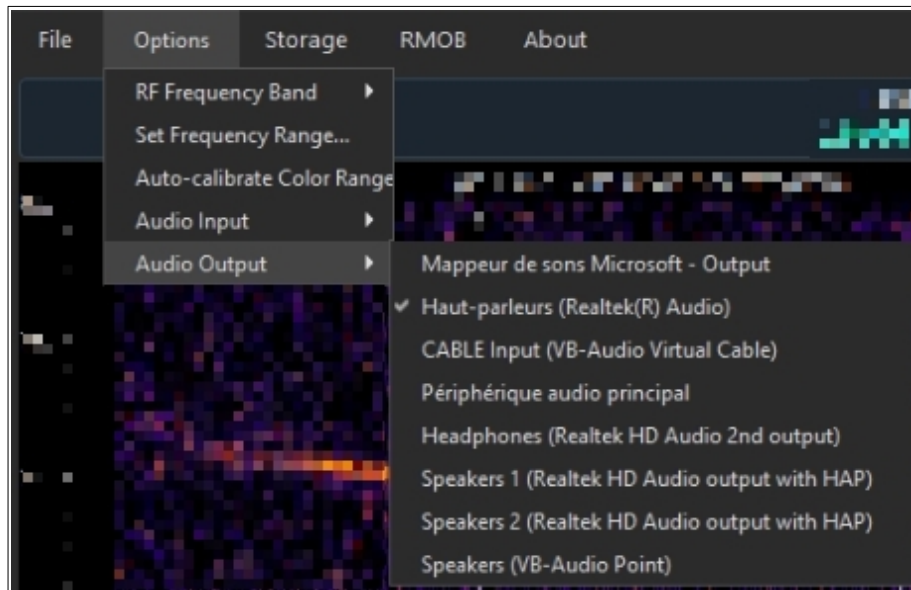


Figure 9: Options -> Audio Output

- **Storage Menu**

- **Auto-Purge Spectrograms:** Sets the retention period for spectrogram images to limit hard drive usage (OFF, > 31 Days, > 7 Days, > 1 Day). The logs and the 'Hourly Meteor Rate' and 'Detection Frequencies' charts from the end of the day are preserved.

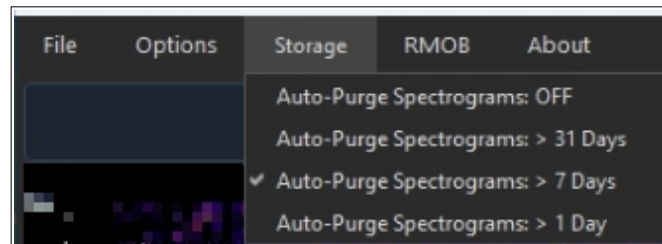


Figure 10: Storage Menu

- **RMOB Menu**

- **Edit User Form:** Opens the station metadata encoding form

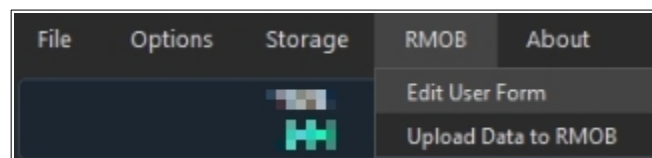


Figure 11: RMOB -> Edit User Form

- **Upload Data to RMOB:** Enables/Disables FTP synchronization.
(for more information, see 5. ‘Sharing on RMOB’)

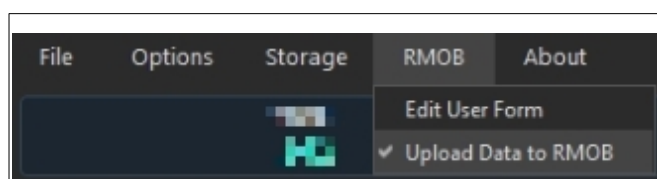


Figure 12: RMOB -> Upload Data to RMOB

- **About Menu**

- Displays the version, copyright, and disclaimer.

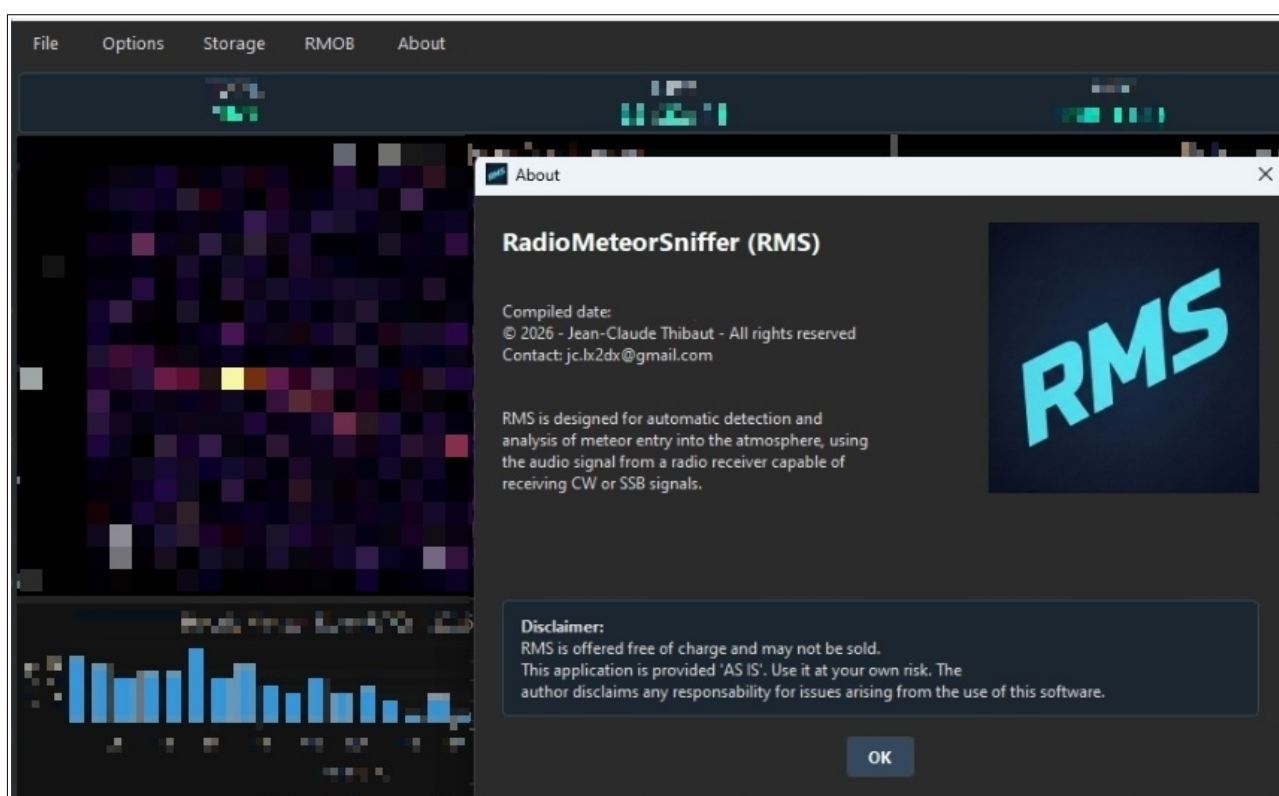


Figure 13 : About Menu

4. Files, Storage, and Visualization

4.1. Data structure and generated files

From its first launch, RMS automatically creates a local tree structure organized chronologically by Year/Month/Day. Nine distinct types of files are stored there in a fully automated manner:

- 1. Global configuration: RMS.ini (Permanent). Stores technical parameters and RMOB user data.
- 2. Visual spectrograms: YYYYMMDD_HHMMSS_[Type]*.jpg (Event-driven). Capture of the spectral analysis window of a detection (left or right).
- 3. Audio extracts: YYYYMMDD_HHMMSS_[Type]*.wav (Event-driven). Normalized audio segment (PCM 16-bit mono 4000 Hz) with temporal margins surrounding the echo.
- 4. Detection log: YYYYMMDD_detections.txt (Daily). Tabulated list of the day's detections.
- 5. Hourly Rate Chart: YYYYMMDD_HourlyRate.jpg (Daily). Daily export of the bar chart.
- 6. Frequencies Chart: YYYYMMDD_DetectionFreq.jpg (Daily). Daily export of the frequency scatter plot.
- 7. Hourly statistics (Cumulative): YYYY-MM_hourly_stats.txt (Monthly). Tabulated history of unique detections for each UTC hour.
- 8. RMOB textual export: [Name]_[MMYYYY]rmob.TXT (Monthly). Standardized RMOB format (31d/24h matrix and metadata).
- 9. RMOB graphic export: [Name]_[MMYYYY].jpg (Monthly). Standardized RMOB visual synthesis.

*_[type] = _HTR (High Time Resolution) or _HFR (High Frequency Resolution)

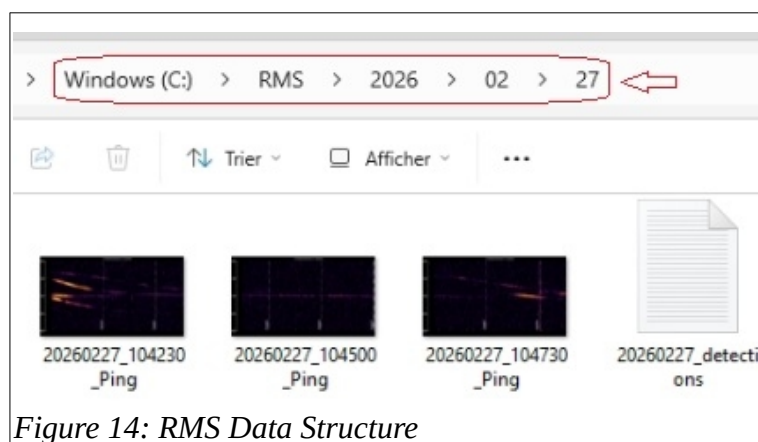


Figure 14: RMS Data Structure

4.2. Viewing and listening to detections

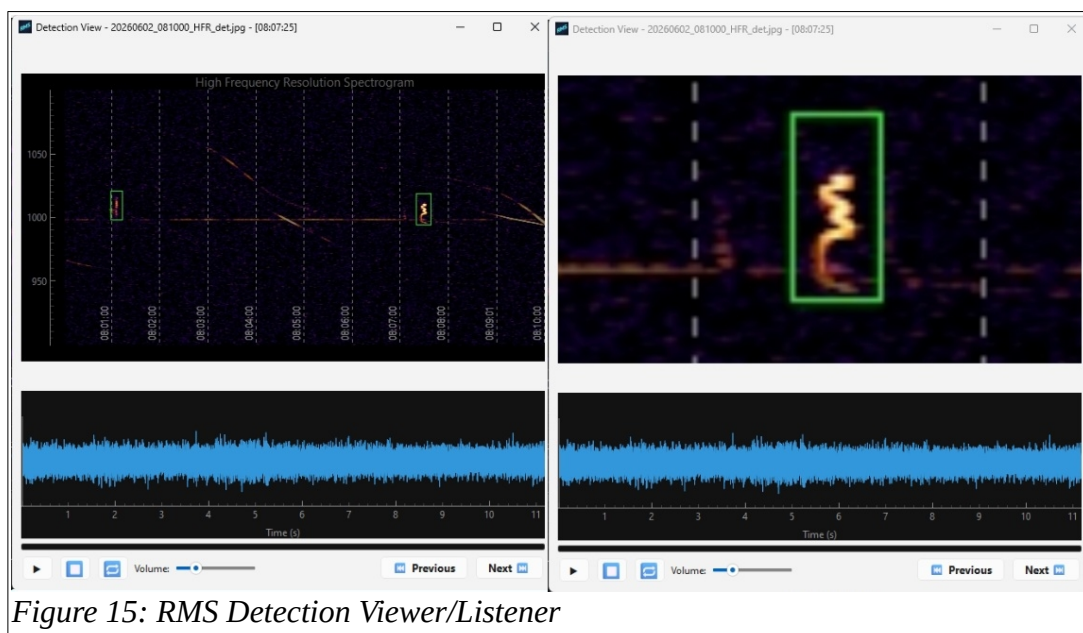
RMS integrates a dedicated multimedia viewer (ImageViewer) allowing for individual examination of each detected meteor. Access is via a double-click on an event line in the Log Viewer of the main window. This standalone window combines visual and acoustic analysis:

- **High-resolution display:** The upper part displays the JPEG spectrogram of the selected detection.
- **Time curve (Waveform):** Below the image, a dynamically generated graph represents the audio signal amplitude (.wav) over time (seconds). The scale auto-adjusts to the event's duration.
- **Integrated audio player:** Playback control buttons (▶, □, and 🔊) allow you to replay or loop the sound sequence via the configured output device.
- **Playback tracking:** A red playback line moves across the amplitude curve in perfect synchronization with the audio heard, coupled with a progress bar.
- **Volume control:** A horizontal slider allows you to adjust the sound gain of the playback.

Since version 1.10, you can zoom in and out of the spectrogram image using the mouse buttons and scroll wheel:

- **Scroll wheel:** zoom in/out
- **Hold down left-click:** pan across the zoomed image
- **Right-click:** restore the original view

You can also browse the day's detections more easily by using the 'Next' and 'Previous' buttons.



5. Sharing on RMOB

Native integration with the global RMOB (Radio Meteor Observation Bulletin) network allows for the automated publication of your data:

- Open Options -> RMOB -> Edit User Form.
- Rigorously fill in all fields (DMS and decimal coordinates, antenna elevation/azimuth, receiver model).
- Your email address is strictly encrypted.
- Validation indicators (✓ / ✗) ensure that no technical data is missing. Save.
- Check "Upload Data to RMOB" in the RMOB menu. The dashboard indicator will display "ONLINE" in green.
- The software will transparently transmit the required .TXT and .jpg files to the server on a monthly basis.

RMOB User Information

Before submitting your observations to RMOB, please ensure that you complete ALL fields in this form.

Name: Thibaut_RMS ✓

First Name: Jean-Claude ✓

Country: Luxembourg ✓

City: Clemency ✓

Antenna: Indoor Dipole ✓

Antenna Elevation (*): 0 ✓

Frequency (MHz): 49.970 ✓

Antenna Azimuth (*): 270 ✓

Preamp: 1.5 dB Noise Factor ✓

Receiver: SDR RTL2832U ✓

Observing Method: RMS (Beta version) ✓

Computer Type: Medion Akoya Notebook ✓

Your email *: jc.lx2dx@gmail.com ✓

Longitude (DMS): 5 ° 52 ' 21 " East ✓

Latitude (DMS): 49 ° 35 ' 43 " North ✓

Longitude (*) decimal: 5.872 ✓

Latitude (*) decimal: 49.595 ✓

[Find your location on Open Street Map Location by clicking here](#)

*Please enter a valid email address.
This will enable RMOB to contact you in the event of an issue when publishing your data on RMOB.
To ensure the confidentiality of your email address, it will not be published on www.rmob.org.
Furthermore, your email address will be encrypted before being transferred to or stored on the RMOB server.

Save and Exit

Figure 16: RMOB User Information

5. Final Words

With RadioMeteorSniffer, you will be able to observe, listen to, and count the meteors falling in your reception area 24/7. Let the application run in the background and enjoy the signals detected by your station.

Special thanks to Pierre and Philippe for their participation and feedback during the RMS Beta testing.

Jean-Claude Thibaut (LX2DX)

June 9, 2026