



Operating Spectrometer-Microscope

Regula 5006

with Regula Forensic Studio

Version 5.6

User Guide

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2 GENERAL INFORMATION

Spectrometer-Microscope Regula 5006 is used to verify the authenticity features of passports, driver's licenses, identity cards, technical and transport documents, visa stamps, banknotes, securities, and other documents with special anti-counterfeiting protection. It is also used to conduct forensic examinations and document analyses to detect alterations, erasures, photo substitutions, and other document manipulations, as well as for examining stamp impressions and analyzing spectral characteristics.

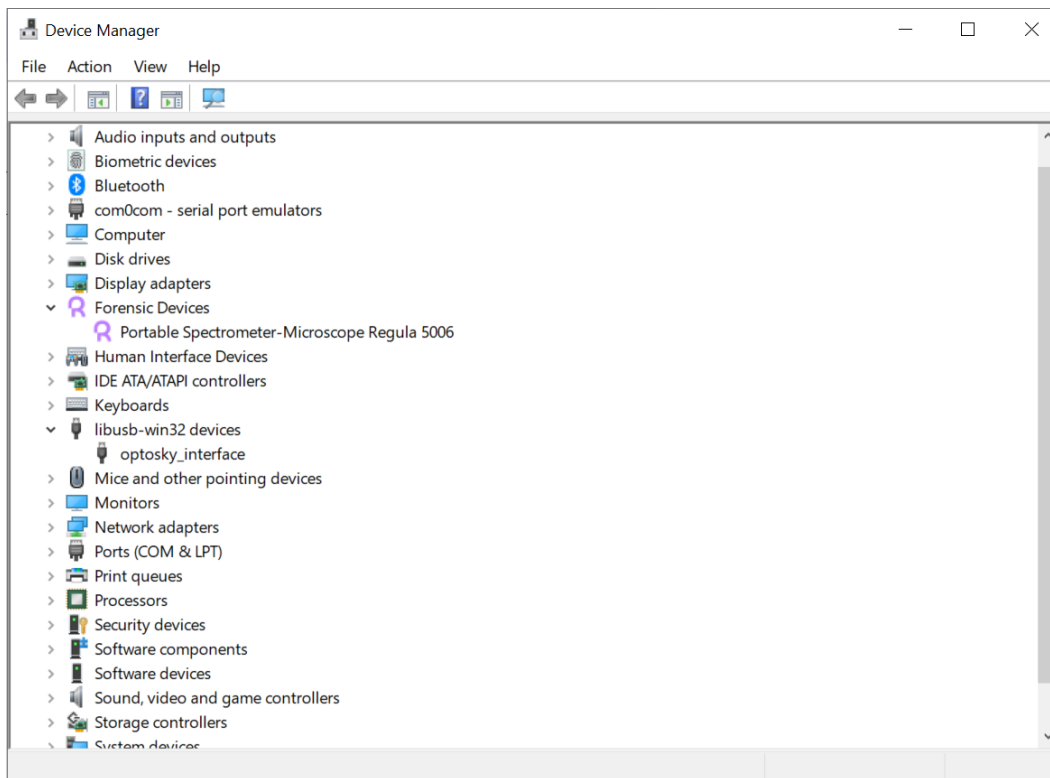
Device operation is exclusively controlled via the Regula Forensic Studio (RFS) software. The device does not operate autonomously. For detailed information on operating the software, refer to the **Regula Forensic Studio User Guide**.

3 INITIALIZATION

To install Regula Forensic Studio, run the installation program and follow the instructions.

To start using the device, connect it to a USB 3.0 port on your computer.

Once the initialization is successful, in the Device Manager, you will see the individual components of the device:

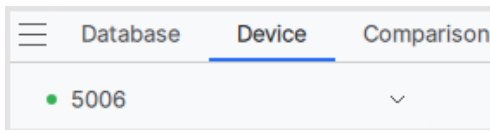


- **Portable Spectrometer-Microscope Regula 5006** under **Forensic Devices**
- **optosky_interface** under **libusb-win32 devices**

4 GETTING STARTED

To start using the device:

1. Connect the device to a USB 3.0 port on your computer.
2. Launch **Regula Forensic Studio**.
3. Open the **Device** tab and select the device from the drop-down list. The connected device state will look like this:



To disconnect the device, click the **5006** icon.

Note: If Regula 5006 is not listed among the available devices or if connection errors occur, check the correctness of the device connection and the installation of software components.

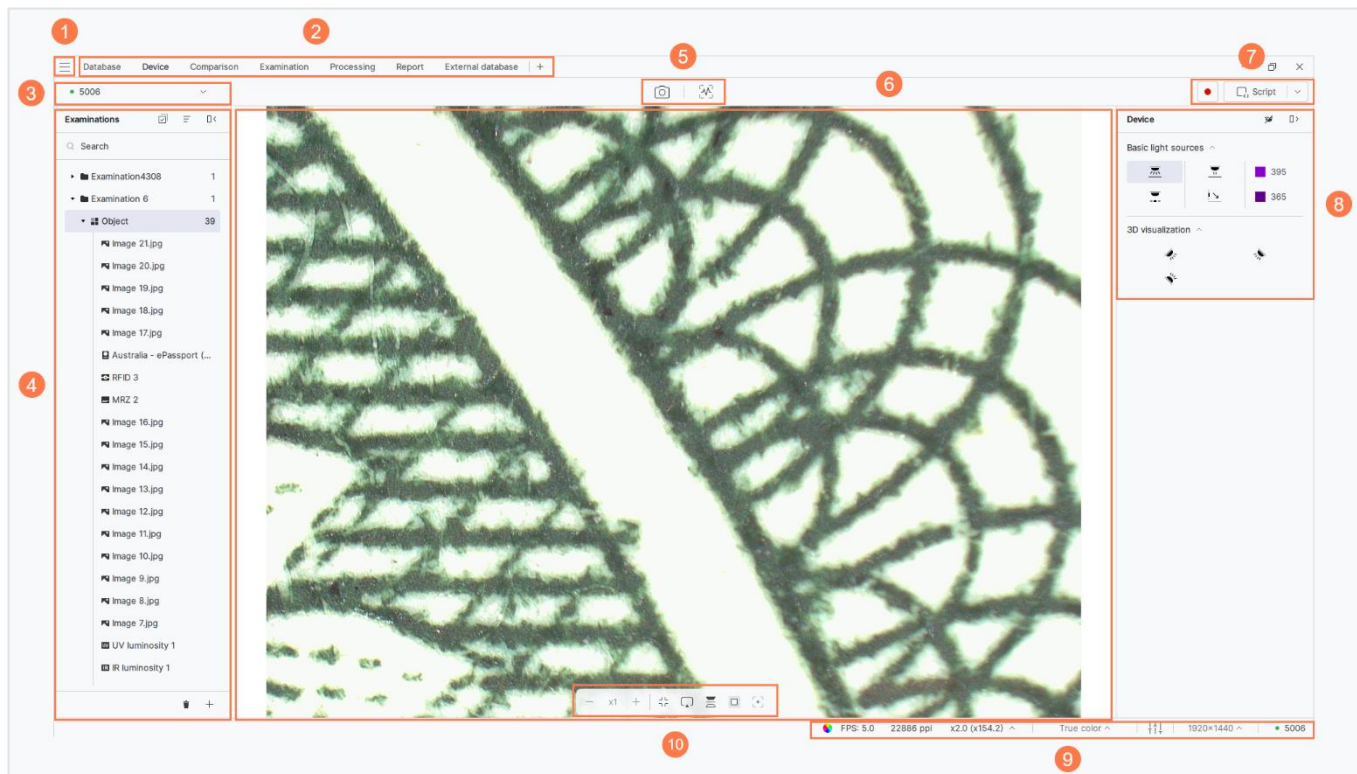
Upon successful connection, the main program window will display the camera's field of view (image view window) and the control panel on the right.

5 DEVICE TAB STRUCTURE AND TOOLS

The **Device Tab Structure and Tools** section describes the **Device** tab, panels, and controls available in the application workspace. This section explains how the application interface is organized and where to find the tools for working with the device.

Note. The screenshots in this guide are provided as examples and may differ slightly from the interface of your software version.

The **Device** tab for the Regula 5006 device looks as follows:



1 Control and settings menu Provides access to the program's basic functions and settings.

2 Main sections Provide access to the main sections of the program:

- **Database** – working with the database, managing the list of documents and objects.
- **Device** – work with the **Regula** device using the tools available on this tab.
- **Comparison** – comparison of data (images, video, and other data).

- **Examination** – examination of data with saving the results.
- **Processing** – modification of data using a set of processing tools.
- **Report** – viewing and editing of reports based on comparison, examination, and processing results using the built-in text editor. The report can be printed or saved in DOCX or PDF format.
- **External Database** – working with the information reference system (IRS), which contains images of banknotes, passports, identity cards, visas, driver's licenses, etc.

Note. All tabs and unctions except the **Device** tab are described in the **Regula Forensic Studio User Guide**.

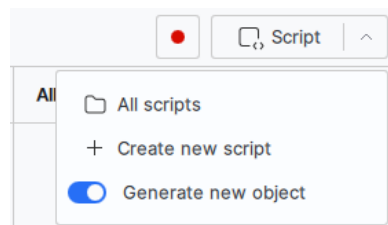
3	Device connect	Here you can select a device to connect to from the drop-down list.
4	RFS database	Contains a list of graphic and composite data related to the current examination object and provides quick access to them.
5	Toolbar	This panel contains: •  Standard •  Spectral examination For more tool details listed above, see below.
6	Main workspace	The central part of the Device tab displays the camera view from the device.
7	Video and script	 Video – this tool allows you to record: • Screen – everything that happens on the screen will be recorded as a video. • Camera video – everything captured by the device camera will be recorded as a video. To start video recording, follow these steps: 1. Click the  icon. A dialog pop-up window opens where you can enter a name and choose a storage location for the video file.

2. Enter the video file name.
3. Select the folder where the video file will be saved.
4. Close the dialog pop-up window. An  indicator appears, showing that video recording has started.

To stop video recording, click the  icon again.

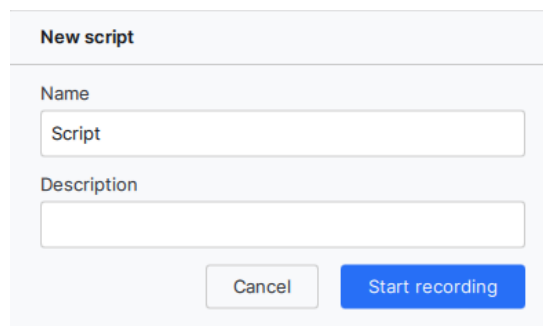
Script – this feature allows you to create, record, and manage scripts on the **Device** tab. By following these steps, you can capture a sequence of actions, save them as reusable scripts, and organize them for future use. The process includes creating a new script, recording actions, and managing saved scripts.

1. On the toolbar of the **Device** tab, find the **Script** button in the top right corner and click the drop-down icon. Select **+ Create new script**:



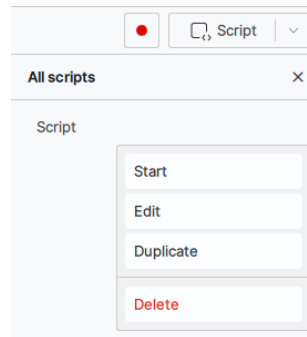
To save the outcomes of actions within the scenario as a separate object on the **Database** tab, select the **Generate new object** radio button.

2. Fill in the **Name** and **Description** fields and click the **Start recording** button:

A screenshot of the 'New script' dialog box. It has two input fields: 'Name' (containing the text 'Script') and 'Description' (empty). At the bottom, there are two buttons: 'Cancel' and 'Start recording' (which is highlighted in blue).

3. During script recording, the program window will be outlined in red. Perform the necessary actions in sequence; they will be saved in the list on the right. When finished, click the **Stop** button.

4. The script will be added to the **All scripts** list. To run, edit, duplicate, or delete the script, right-click on it:



- 8 Right-side device control panel** This panel contains the following device control sections:

- Basic light sources
- 3D visualization

For a detailed description of the sections listed above, see below.

- 9 Bottom device control panel** This panel contains the following device control sections:

- Mechanical zoom adjustment
- Color profile
- Adjustment
- Camera display mode

For a detailed description of the sections listed above, see below.

- 10 Device camera image controls** The main workspace also contains controls for the device camera image:

- **Zoom** – allows you to zoom in or out on the area under examination in the image.
- **Fit to screen** – adjusts the image display size to fit the Main Workspace.
- **Actual size** – restores the image to its original size.
- **Horizontal and vertical mirroring** – flips the image along the horizontal and vertical axis.
- **Mask on/off** – allows you to select and take a screenshot of a selected viewing area.
- **Frame center** – indicates the center of the current viewing area.

6 MANAGEMENT

Device management tools are located on the **Device** tab and are described in this manual. The other tabs and RFS functionality are described in detail in the **Regula Forensic Studio User Guide**.

6.1 Right-side device control panel

On the **Right-side device control panel**, you'll find the following tools:

- **Basic light sources**

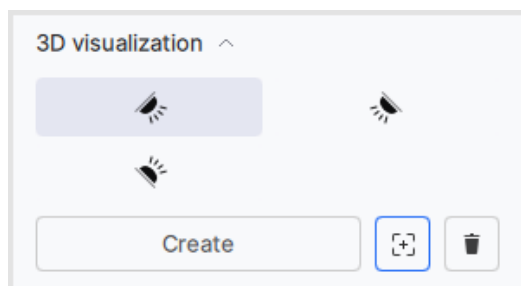


-  White
-  Spectrometer light
-  Coaxial white front
-  White side
-  Coaxial white
-  Violet 395 nm
-  Ultraviolet 365 nm

Note: The **Coaxial white**  light source becomes available for use once the semi-transparent mirror is installed in the microscope base.

- **3D visualization**

The procedure of 3D relief reconstruction involves capturing a sequence of images using one of the specialized 3D light sources. Subsequently, a 3D surface model of the examined object is generated.



-  White rear left
-  White rear right
-  White front left

To create a file with 3D visualization, follow these steps:

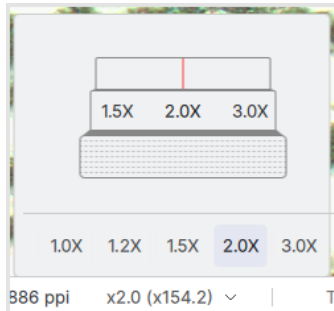
1. Select one of the light sources.
2. Click Create.

The results of the capture and formation of the 3D surface model are automatically saved as a database element with the **.Relief** extension and denoted by the icon . To view and modify the saved relief reconstruction data, navigate to the **Database** tab.

6.2 Bottom device control panel

The **Bottom device control panel** contains the following tools:

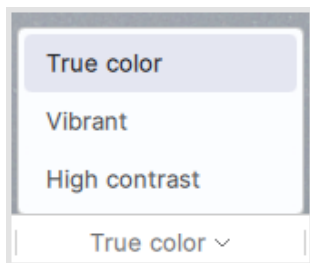
- **Zoom**



For **PPI** (pixels per inch) and on-screen **Zoom** to be displayed correctly, the same **Zoom** value must be selected on both the device and in the application.

In the application, select the **Zoom** parameter value that matches the value set on the device.

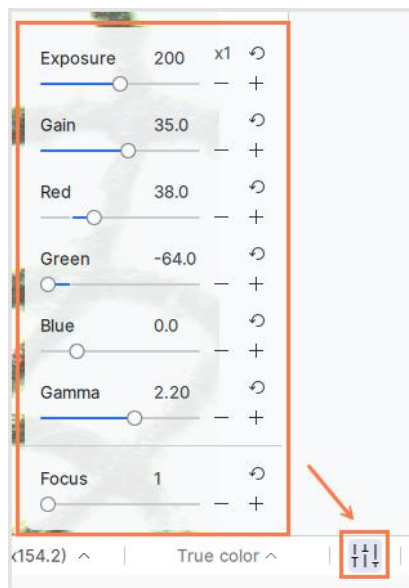
- **Color profile**



Select the device color rendering mode:

- **True color** — displays the data with natural color reproduction.
- **Vibrant** — makes the data more saturated and vivid.
- **High contrast** — enhances the differences between light and dark areas of the data.

- **Adjustment**



Adjustment of the red, green, and blue color, and gamma balance is performed within the range of -64.0 to 255.0, based on the object positioned in front of the camera lens.

Also, in the **Adjustment** group there are:

- **Focus**

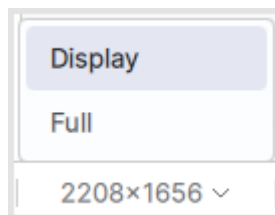
Note: The **Focus** parameter is not available for the microscope Regula 5006.

- **Exposure**

The numerical Exposure value is set within the range of 0.0 to 400.0 milliseconds.

- **Camera display mode**

You can select the camera operating mode on the toolbar at the bottom of the screen:



- **Display** mode shows a smaller-sized image.
- **Full** mode expands the camera frame for a wider view.

7 SPECTROMETER MODES

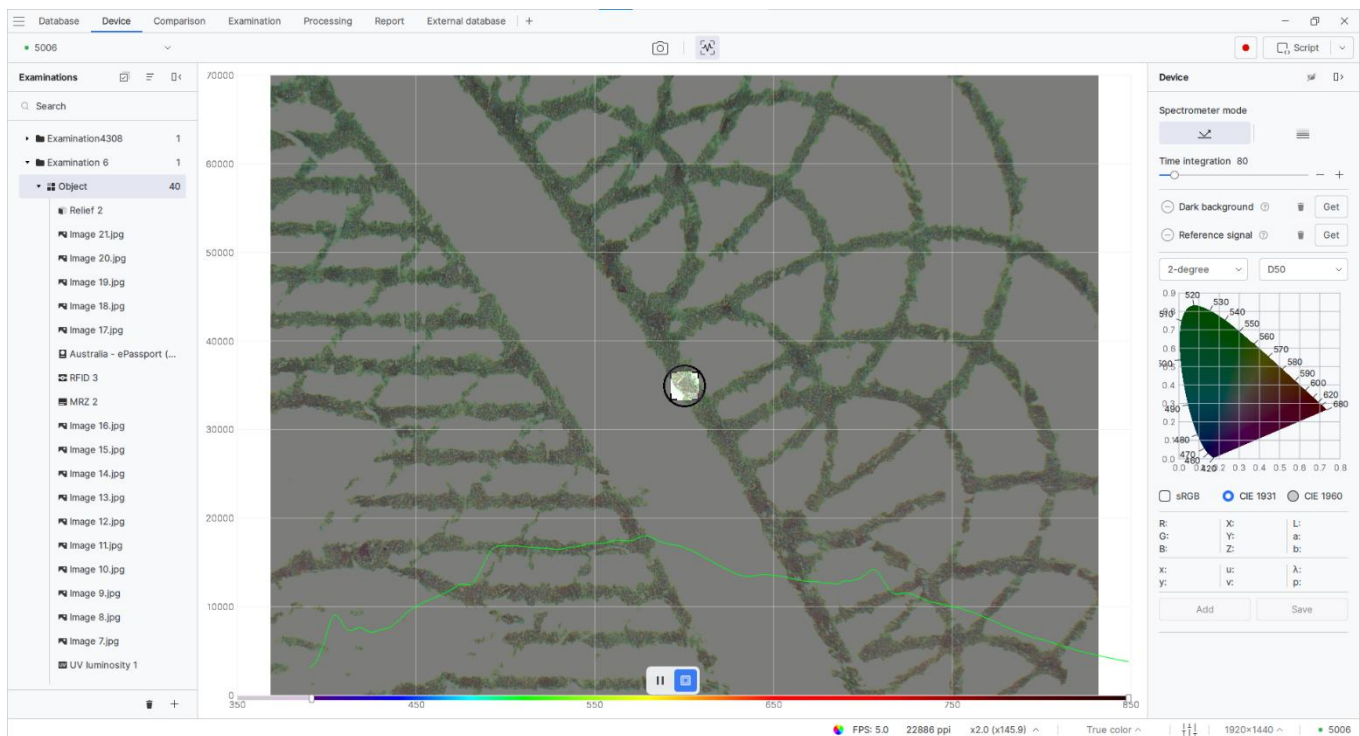
Spectrometer-Microscope Regula 5006 is equipped with a high-resolution spectrometer. Examination of the spectral characteristics of objects can be conducted in **Reflection** and **Luminescence** modes.

Before starting to study the spectral characteristics of an object, make sure that the additional translucent mirror is removed from the microscope.

The results of the examination are based on measurements of the relative signal power in the wavelength range of **350–850 nm**.

To conduct the examination, click the **Spectrum Examination**  button on the top horizontal panel.

This will initialize the spectrometer and turn on the basic light source. The **Reflection**  mode will be activated on the control panel and a preliminary spectral characteristic of the selected area of the object will be displayed (in the center of the screenshot) without accounting for **dark background** and **reference signal** measurements, which are necessary for the automatic calculation of the "true" spectral characteristics of the object:



During the measurement of the reflected signal spectrum, the basic light source is a broadband illuminator with an emission spectrum of 350–850 nm. For luminescence examination, the light source is Ultraviolet 365 nm.

The spectrometer records the signal using the device's optical system. The working area of the spectrometer is positioned at the center of the optical system during device setup, corresponding to the center of the video image. It dynamically changes depending on the current magnification, ranging from 150x150 μm (1x) to 50x50 μm (3x).

The horizontal axis of the spectral characteristic corresponds to the wavelength in the spectrum. The vertical axis represents the values corresponding to the absolute measurements of the spectrometer (ranging from 0 to 60000) or the values in percentage relative to the reference signal (ranging from 0% to 150%).

To change the amplitude of the received signal values, use the **Time integration** option:



To measure the image spectrum, it is necessary to obtain **dark background** (with the light source turned off) and **reference signal** measurements. The reference signal is the baseline signal, the spectrum of the basic light source applied to the current examination mode.

For the **Reflection** mode, the reference is the reflection spectrum from any area of a reference white object.

For the **Luminescence** mode, the reference is the reflection spectrum from an area of the examined object that is free of luminescent fragments.

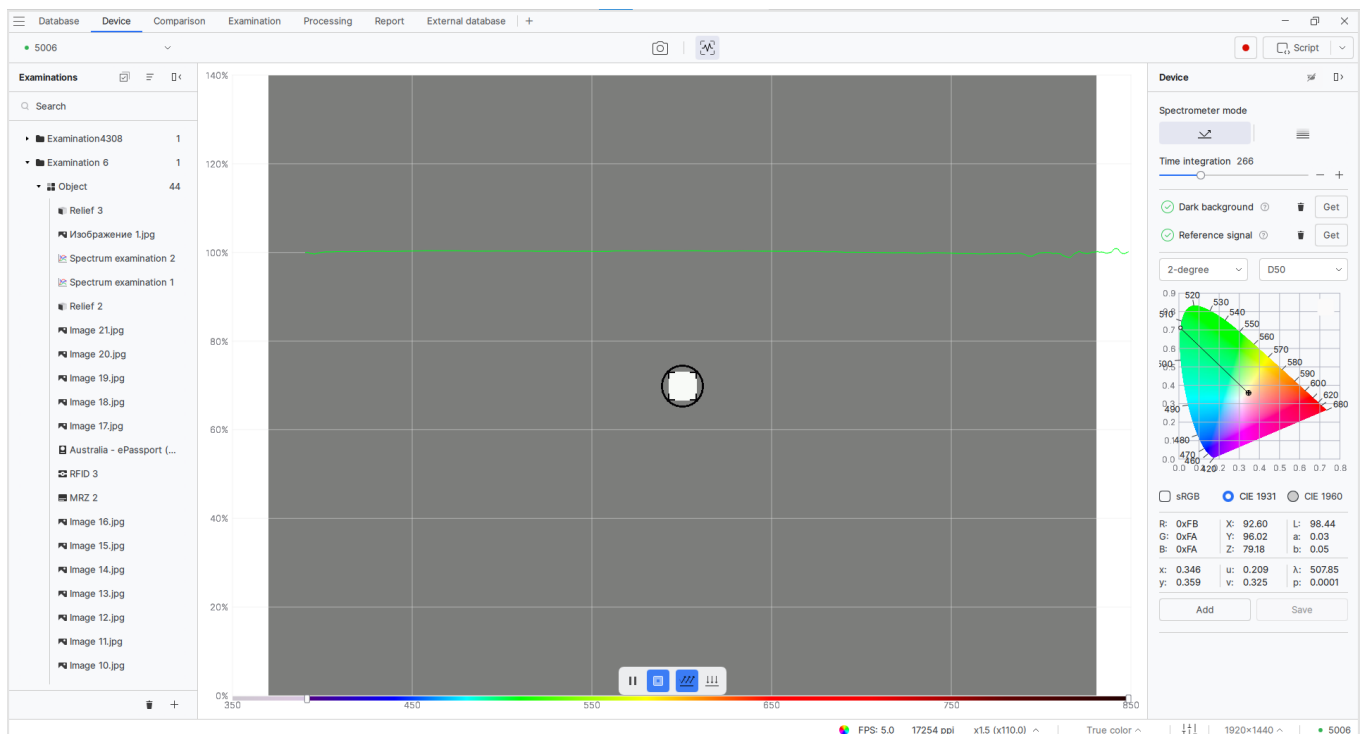
7.1 Preparation for Operation

To ensure that the measurements performed by the spectrometer are as accurate as possible, you must prepare the spectrometer using the **Spectrometer Calibration Tool NIST** before starting work.

The preparation is carried out **before the first use of the device**, as well as each time after the spectrometer is connected to the computer. The procedure ensures correct formation of the reference signal used in the calculation of spectral characteristics.

Preparation procedure:

1. Remove the protective glass from the spectrometer lens.
2. Enable the **spectrometer** mode by clicking the **Spectrum Examination**  button.
3. Adjust the image focus.
4. Place the **Spectrometer Calibration Tool NIST** test object under the spectrometer lens.
5. Acquire the data:
 - a. Click **Get** in the **Dark background** field.
 - b. Click **Get** in the **Reference signal** field.
6. Make sure that the green line on the graph reaches the 100% level:

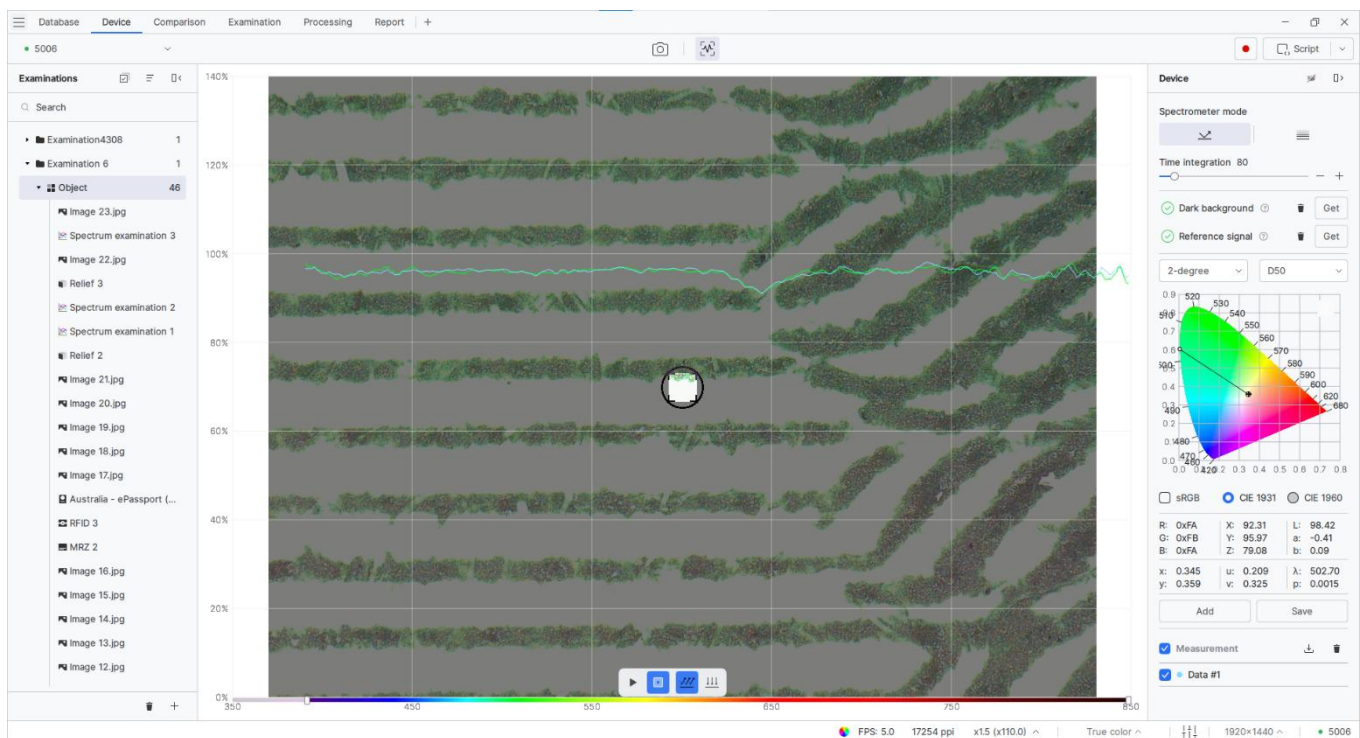


7. After successful calibration, remove the test object and proceed to the examination.

7.2 Reflection

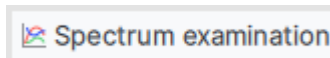
1. Click the Reflection  button. The spectrometer will switch to examination mode, and a spectrum graph will appear. The  button at the bottom of the image view window will change to .
2. To obtain dark background data, click the **Get** button in the **Dark background** row.
3. To obtain the reference signal, click the **Get** button in the **Reference signal** row.
For accurate measurement of color characteristics, the reference signal and the signal from the object under examination must be measured with the same integration time. Therefore, if the integration time is changed, the reference signal data is reset and needs to be obtained again.
It is recommended to choose an integration time so that the signal amplitude is maximized without overloading the spectrometer (not exceeding 60000 or 150% on the Y-axis).
4. To save the measurement results in the **Measurements** list, sequentially click the **Stop**  button and then click the **Add** button.

The screenshot below shows the spectral characteristic as a percentage relative to the reference signal value after clicking **Add**:



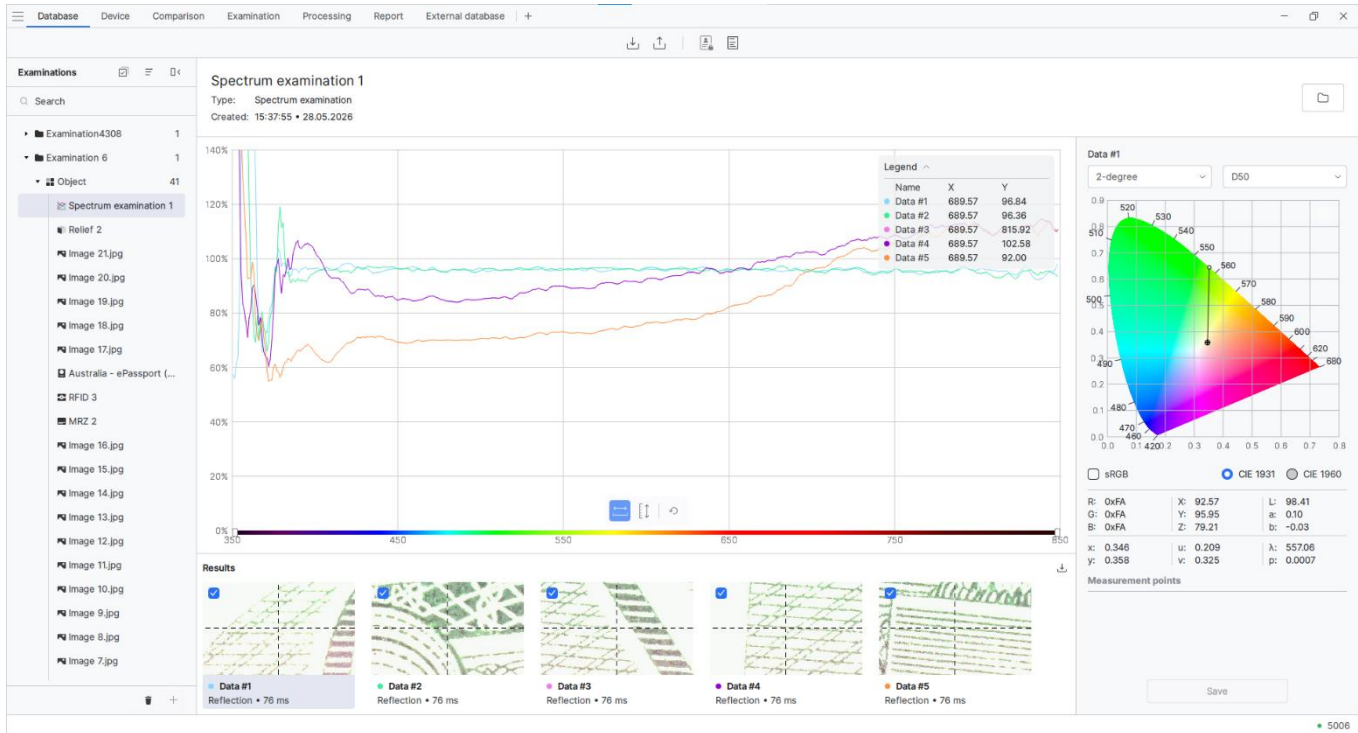
To save a measurement as a database item, click the **Save** button.

The file will be available on the **Database** tab as an item



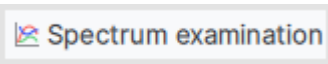
The Regula 5006 microscope allows you to save the absorption spectrum of a selected area of the object in Reflection mode to the database. To do this, click the **Absorption**  button at the bottom of the image view window, then click **Add** and **Save**.

Example of a spectral analysis result for reflected and absorbed signals (shown in red) in **Reflection** mode, saved in the database:



7.3 Luminescence

1. Click the **Luminescence**  button:
2. Place an area of the object under examination that is free from luminescent fragments in the microscope's field of view and click the **Get** button in the **Background** row.
3. Place an area of the object under examination that contains a luminescent fragment in the microscope's field of view and sequentially click the **Get** button in the **Color calculation** row, **Add**, and **Save** buttons.

To view the saved  results of the spectrum examination in the **Luminescence** mode, go to the **Database** tab.

Example of a spectral analysis result for reflected and absorbed signals (shown in red) in **Luminescence** mode, saved in the database:

