NeoSpectra™ SWS62221
Quick guide for evaluation

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Thanks for evaluating NeoSpectra for you spectral sensing application. This quick guide shall help you in building the evaluation setup and making yourself familiar with the evaluation software (SepctroMOST). More details about the usage and requirements of the product can be found in the product manual. Please ask Si-Ware about it whenever needed.

1. Introduction

NeoSpectra™ spectral sensors deliver the same functionality as standard bench top FT-IR spectrometer instruments: quantification and identification of materials by measuring their spectral response. The evaluation kits are delivered for the assessment of the performance of the SWS62221. They contain the following components:

- The NeoSpectra module
- SpectroMOST: The evaluation software
- Setups for transmission and/or diffuse reflection measurement.

2. The evaluation software – SpectroMOST™

2.1. Installation

SpectroMOST6.1_Setup.exe is the installation wizard for the following components:

- ***SpectroMOST*** software
- ***JRE Version 7*** (if not already installed on PC)
- NeoSpectra hardware drivers

The installation procedure of SpectroMOST is as follows:

1. Run the installation wizard ***SpectroMOST6.1_Setup.exe***
2. Select the language to use during installation from the language menu. The selected language will operate during installation only. SpectroMOST uses English language only during operation.
3. When the welcome screen appears, make sure that all other applications are closed then click ***Next***.
4. When SpectroMOST terms and conditions are read, click ***Next*** to proceed.
5. Browse to the SpectroMOST's installation directory then click ***Next***. The path (C:\ SpectroMOST6.1) will be used as the default path.
6. Select the Start Menu folder in which SpectroMOST's shortcuts shall be created then click ***Next***. The folder (SpectroMOST) will be used as default folder.
7. Check preferences to ***Create a desktop icon*** then click ***Next***.
8. When the wizard is ready to install, click ***Install*** to proceed.
9. SpectroMOST installation wizard will detect if JRE Version 7 is already installed on the computer:
    - If it exists, installation wizard will proceed to step10
    - If it does not already exist, a JRE installer will be launched automatically.
10. SpectroMOST installation wizard will start preparation of the installation process of the NeoSpectra hardware drivers and a pop-up screen will guide for the steps required to finish the installation procedure. This may require user permission for Windows Security. If a warning message appears, select the option **"Install this driver software anyway"** on Windows Vista & Windows 7 or select **"Yes"** on Windows XP to proceed.
11. SpectroMOST installation wizard is complete.

2.2. The GUI

The GUI of SpectroMOST is depicted in Figure 1. The functions operated by each component are summarized below:

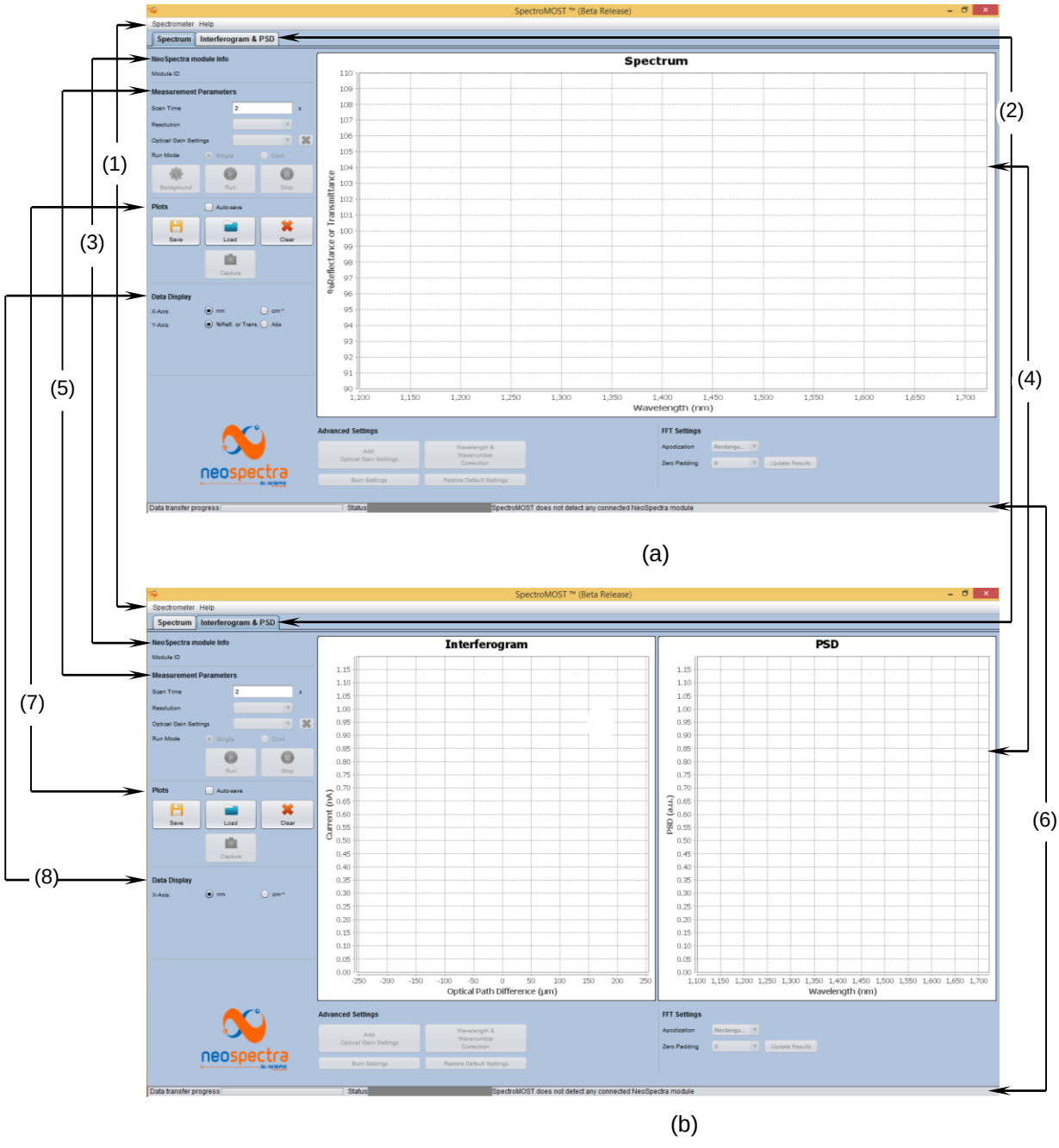

Figure 1: SpectroMOST GUI (a) Spectrum tab (b) Interferogram & PSD tab

(1) **Main toolbar:**
- SpectroMOST menu: enables to exit the software.
- Help: enables opening the About dialog of SpectroMOST.

(2) **Tabs selection:**
- Toggles between the following tabs:
  - "Spectrum" tab
  - "Interferogram & PSD" tab

(3) **NeoSpectra module Info:**
- Module ID: Displays the ID of the connected spectral sensing unit.

(4) **Display area:**
- User can zoom in and out the graphs, save, copy, or print images of measured data.

(5) **Measurements parameters area:**
- User can set the measurement parameters (scan time, resolution, optical gain settings, and run mode) and perform measurements

(6) **Lower bar:**
- The status bar displays the spectrometer module connectivity status.
- The progress bar displays the data transfer progress between the software and the spectrometer device.

(7) **Graph manipulation area:**
- User can save, load, and clear measured data.

(8) **Data display control area:**
- User can select the units of the X-axis and the Y-axis

3. Performing measurements

The spectrum ***S*** of a sample is given by the ratio of the spectrum of the beam transmitted or reflected from the sample ***I*** to the spectrum of the beam at the front face of the sample I_o over the spectral range of interest

$$S_{(\lambda_1 \to \lambda_2)} = \frac{I_{(\lambda_1 \to \lambda_2)}}{I_{o(\lambda_1 \to \lambda_2)}}$$

Hence, in practice, in order to measure samples' spectra ***S***, the background spectrum should be measured I_o (background measurement), as well as the light transmitted or reflected from the sample ***I*** (sample measurement). SpectroMOST software enables the acquisition of the background measurement and stores it to be used as a reference spectrum in further sample measurements.

It is recommended to operate the "background spectrum measurement" as frequent as possible, and ideally before each sample measurement. This ensures the most accurate results from the device.

3.1. Transmission measurements:

Practically, the background measurement I_o is obtained by measuring the spectrum of the beam at the input of the module without placing any material in the light path (e.g. an empty cuvette), under the same conditions at which the measurement of the sample will be conducted.

The sample measurement ***I*** is obtained by applying the measurement after placing the material inside the sample holder.

3.1.1. The setup

The standard setup for transmission measurements should be built as shown Figure 2.

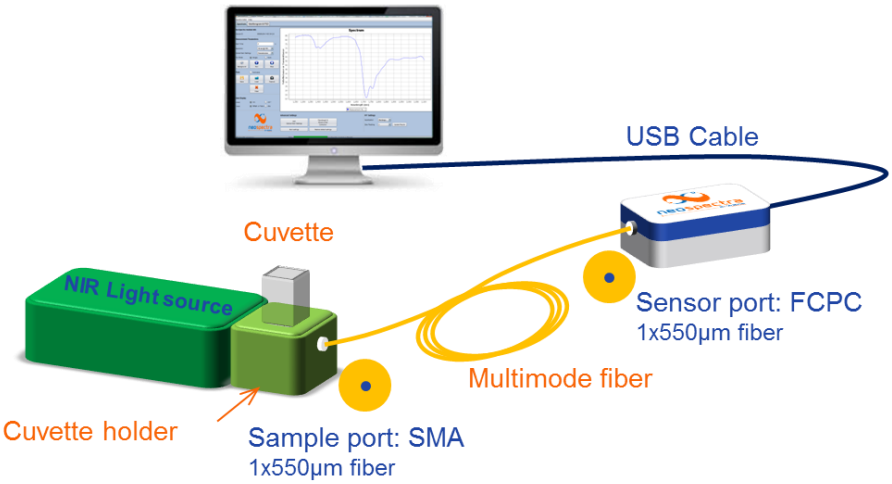

Figure 2: Diagram of evaluation setup for transmission measurement using the standard evaluation kit

The recommended components are summarized in Table 1

Table 1: Components of evaluation setup for transmission measurements

#	Component	Recommended Type	Specifications
1	Light source	Halogen or Tungsten-Halogen	Coupled light power, within wavelength range, to the module should be from 2,500 µW to 3,500 µW
2	Optical connection	Multimode optical fiber	Fiber 2: FCPC – SMA, Core diameter Ø> 400 µm and NA = 0.22
3	Sample holder	Quartz cuvettes	Pathlengths 1 mm , 2mm, 5 mm, or 10 mm. Depending on the sample absorptivity within the spectral range.
4	Electrical connection	USB cable	USB2.0 to micro-USB
5	Host	PC	SpectroMOST installed

3.1.2. Measurement steps

The following is an example to demonstrate the steps that should be followed to measure spectra using SpectroMOST:

1. **Initialize:**
    - Open SpectroMOST.
    - Connect the spectrometer module to the PC by the USB cable and wait for the module to initialize i.e. status bar's color becomes green.
    - SpectroMOST automatically detects the module's Spectrometer ID in use and sets the appropriate interfacing parameters.

2. **Set measurement parameters:** (see Figure 3)
   - Scan time: Set the scan time that best fits your requirement.
   - Resolution: Select the one that best fits your requirements.
   - Optical gain setting: Select Transmission
   - Run mode: Single

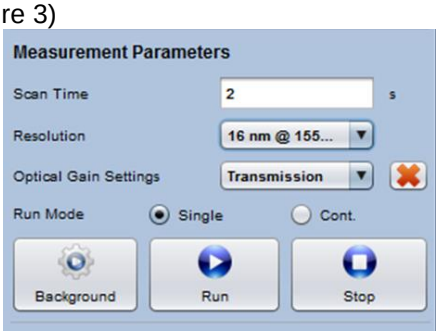

Figure 3: Measurement parameters for transmission measurement

3. **Make the measurement:**
   - To take a background measurement, make sure that there is no material placed in the light path and then click "**Background**" button, and then wait until the message "**Measurement completed successfully**" appears in the message bar.
   - To measure spectrum, place the sample material under test in the light path and click "**Run**" button:
4. **Post-measurement actions:**
   - Save plotted data (All visible plots will be saved)
   - Load previously saved plots
   - Plots are saved in file with an extension .spectrum. They can be easily viewed in a text reader converted to other readable formats.

3.2. Reflectance measurements:

Practically, the background measurement I_o is obtained by measuring the spectrum of the beam at the input of the module while placing a reference material with nearly flat spectral response across the spectral range of interest with 95% reflectance instead of the sample, under the same conditions at which the measurement of the sample will be conducted.

The sample's spectral response I is obtained by applying the measurement after placing the material at the collection fiber's interface.

3.2.1. The setup

The standard setup for diffuse reflection measurements should be built as shown in Figure 4.

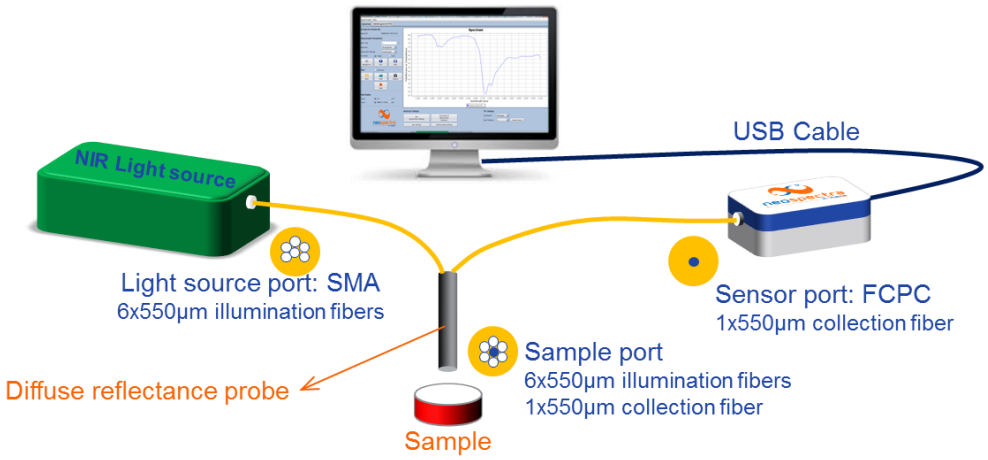

Figure 4: Diagram of evaluation setup for diffuse reflection measurement using the standard evaluation kit

The recommended components are summarized in Table 2.

Table 2: Components of evaluation setup for diffuse reflection measurements

#	Component	Recommended Type	Specifications
1	Light source	Halogen or Tungsten-Halogen	Coupled light power to the module should be >100 µW within its spectral range, The source should have a spot diameter of 1.5 mm to 2 mm at its SMA connector interface.
2	Optical interface	Reflection probe	• 6 illumination fibers. Core diameter Ø= 600 µm • Collection fiber. Core diameter Ø= 550/600 µm • FCPC connector (fiber to NeoSpectra)*
3	Sample reference	Spectralon/ PTFE	Reflectivity 95%
4	Electrical connection	USB cable	USB2.0 to micro-USB
5	Host	PC	SpectroMOST installed

* For reflection probes with SMA output port, it is required to have a hybrid fiber with core diameter Ø> 400 µm FCPC Connectorized at one end and SMA Connectorized at the other end. Besides an SMA/SMA feed-through adaptor is needed.

3.2.2. Measurement steps

The following is an example to demonstrate the steps that should be followed to measure spectra using SpectroMOST:

1. **Initialize:**
   - Open SpectroMOST.
   - Connect the spectrometer module to the PC by the USB cable and wait for the module to initialize i.e. status bar's color should turn from yellow to green.
   - SpectroMOST automatically detects the module's Spectrometer ID in use and sets the appropriate interfacing parameters.
2. **Optimize the optical power coupling:**
   - Go to the Interfegram tab in SpectroMOST software.
   - Adjust the parameters: (see Figure 5)
     - Scan time: 100 ms (Short scan time is selected for high repetition rates of measurements. No intent to have high SNR in the step)
     - Resolution: Select the one that best fits your requirements.
     - Optical gain settings: Select Reflection
     - Run Mode: Continuous.

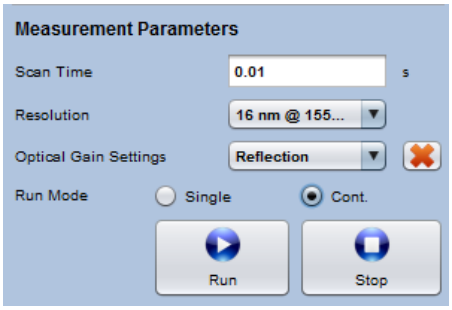

Figure 5: Measurement parameters for optimization of optical power coupling in reflectance measurements

   - Place the probe inside the holder.
   - Place spectralon at the front face of the probe
   - Click "**Run**"
   - Monitor the interferogram & PSD plots:
     - The plots will keep being refreshed. Keep monitoring the peak to peak value of the interferogram's center burst (see Figure 6) while slightly adjusting the distance between the probe and spectralon inside the holder.
     - Stop adjusting the distance at the point where the value of the peak to peak centerburst in the interferogram and/or the PSD value are maximum, and lock it with the screw. This is the optimum optical distance. It should be few millimeters.
     - Optional: Capture the plots and save them for future reference.
   - Click "**Stop**".

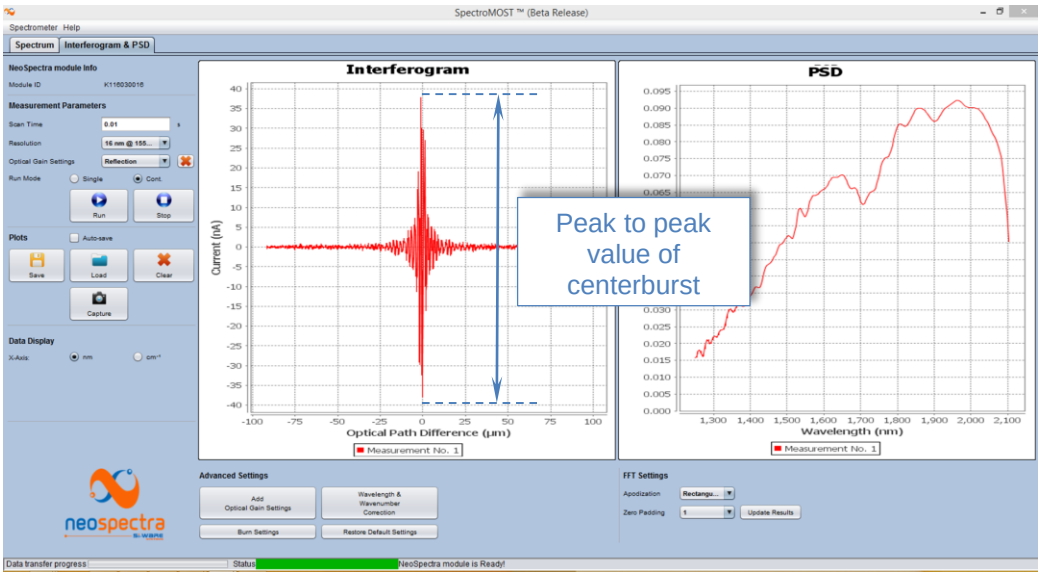

Figure 6: Monitoring interferogram's peak to peak on SpectroMOST to optimize the power coupling

3. **<u>Set measurement parameters:</u>** (see Figure 7)
   - Go to the Spectrum tab
   - <u>Scan time:</u> Set the scan time that best fits your requirement.
   - <u>Resolution:</u> Select the one that best fits your requirements.
   - <u>Optical gain setting:</u> Select Reflection
   - <u>Run mode:</u> Single

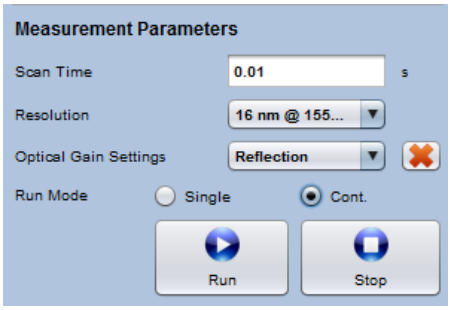

Figure 7: Measurement parameters for reflection measurement

4. **<u>Make the measurement:</u>**
   - To take a background, make sure that there is no material placed in the light path and then click background button, and then wait until the message "**Measurement completed successfully**" appears in the message bar.
   - To measure spectrum, place the sample material under test at the front face of the probe and click "**Run**" button:
     - If operating in single mode: Wait until the data is displayed.
     - If operating in continuous mode: SpectroMOST will operate consecutive measurements and will automatically update the plotted data. Click "**Capture**" to capture a certain measured spectra that is displayed on the screen or Click "**Stop**" to stop acquisition of new spectra.
5. **<u>Post-measurement actions:</u>**
   - Save plotted data (All visible plots will be saved)
   - Load previously saved plots
   - Plots are saved in file with an extension .spectrum. They can be easily viewed in a text reader converted to other readable formats.

Document Revision History

Revision Number	Revision Date	Contributor	Details of Change
V1	27-6-2016	Ahmed Korayem	Original version