12   Validation

12.1   Window Layout
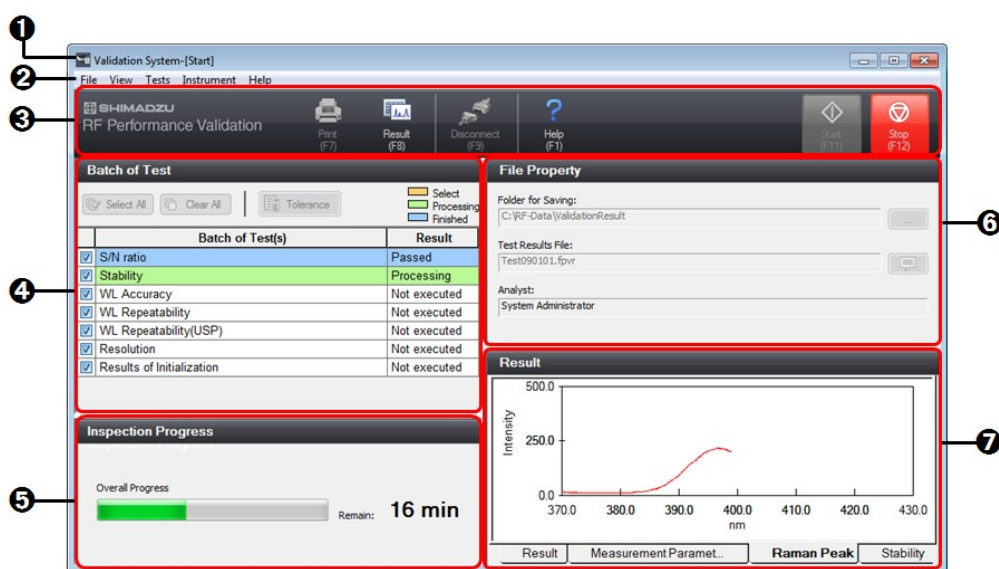
Validation Software Window Layout

No.	Name	Function
❶	Title bar	Displays the software name as well as the communication state ([Connect], [Disconnect], or [Start]).
❷	Menu bar	Displays the version of the validation software. Selecting a menu along the bar displays multiple command menus.
❸	Main toolbar	Displays tool buttons for executing main functions, such as printing, instrument connection, and disconnection.
❹	Test item area	Displays the test items and corresponding test results. Whether or not to perform each test can also be set.
❺	Test progress area	Displays the total progress of tests and the remaining time. The time (total test time) required to perform all tests is displayed according the tests that are selected to be performed. 🖊 NOTE This is provided as a guide to the total test time/remaining time. Individual test times may vary by a few minutes depending on the test item.
❻	File information area	Enter the test result file information that is automatically saved after measurement. If a test result file is open, the information of that file is displayed.
❼	Test result area	Displays the data of the current test or the test result for the item selected in the test item area. The information displayed differs for each test item.

		For details on the displayed information, refer to the help file for each test item.

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12.1.1   Test Item Area
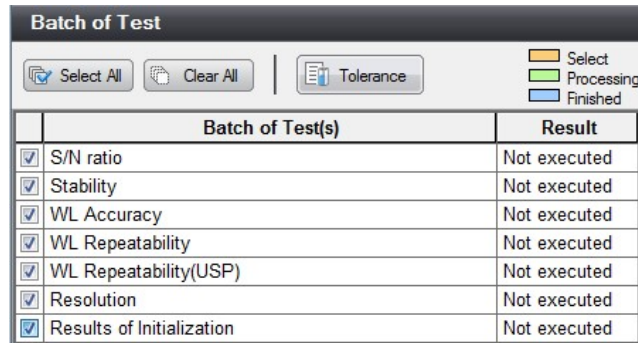
Test Item Area

Name	Function
[Select All]	Select all of the test item checkboxes.
[Clear All]	Deselect all of the test item checkboxes.
[Tolerance]	Display the window for setting the tolerance for each test item. ▶▶ **Reference** "12.3 Setting Tolerances"
Test item table	

	Checkboxes	Only tests with a selected checkbox are performed.
	[Batch of Test(s)]	Displays the available test items in a list. During testing or displaying of results, test progress and results are differentiated by row color and text color. Row color • Orange: Indicates the item selected for checking the test result. The result of the selected test item is displayed in the test result area. • Green: Indicates the item currently being tested (in processing). • Light blue: Indicates an item for which testing finished, was aborted, or was skipped (processing complete). Text color • Red: Indicates that the test resulted in a fail.
	[Result]	Displays the overall judgment result of each test item. • [Passed]: Indicates that the test result of all items in the test was a pass. • [Failed]: Indicates that at least one item in the test resulted in a fail or testing was aborted (includes items not executed). 💡 **Hint** In "WL Accuracy", if the test wavelength of 253.7 nm is a pass and the test for test wavelength of 546.1 nm is aborted and results in a fail, the overall judgment is a fail. • [Not executed]: Indicates that the test has not been executed.

12.1.2   File Information Area

Enter test result file information in this area. When starting testing, all items except for comments must be entered and set.
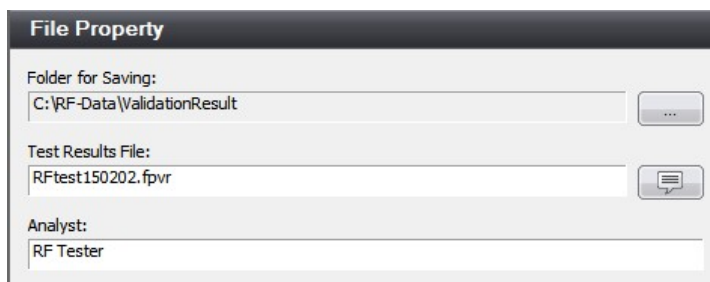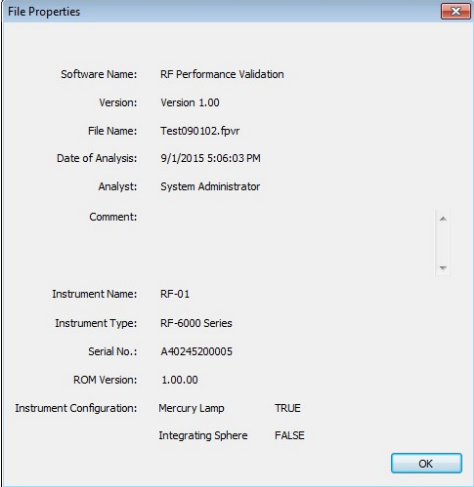
File Information Area

Name	Function
[Folder for Saving]	Specify the folder to save the test result file. The default setting is "C:\RF-Data\ValidationResult". Click [...] to display the folder selection window. [Browse For Folder] Window **Hint** Do not use text displayed as environment-dependant characters (Unicode) for filenames and destination folder names (in the case of using an input method editor). This may cause file operations, such as file saving, to fail.
[Test Results File]	Enter the name for the test result file. If a filename of the same name exists in the folder for saving, the date and time when testing is started is appended to the end of the filename (underlined part in the following example). Example: When testing was started at 10:30:56:21 AM on 9/9/2014 resultdata2014090910305621.pvr Click [💬] to display the window for entering comments. [Comment] Window **Hint** Do not use text displayed as environment-dependant characters (Unicode) in comments. Such text may not display correctly.

[Analyst]	Enter the name of the analyst in charge of testing. A maximum of 20 one-byte characters can be entered.

12.2   Menu Bar

### 12.2.1   [File] Menu

Command	Description	Tool Button
[New]	Use this command when creating a new testing condition. The available test items and recommended acceptance criteria are set when connecting to the instrument.	-
[Open Test Result]	Display the [Open Test Result] window. Use this window to select the destination folder and open the desired test result file.	-
[Print Preview]	Display a preview of printer output.	-
[Print]	Print the currently loaded results (or results for which testing is finished). The printer to use can be selected and other settings can be changed in the [Print] window. The paper size and orientation is A4 portrait.	
[Properties]	Display the [File Properties] window. This window displays information on the currently loaded test results (file). [File Properties] Window	-
[Exit]	Exit the validation application and close the window.	-

12.2.2   [View] Menu

Command	Description	Tool Button

[Results]	Select (highlight orange) a test item in the test item table and click [Results] to display the results of the selected test item in the test result area.	Result (F8)
[View Test]	Change to the window that displays the status of the test currently in progress.	View Test (F8)
[Graph Properties]	Use this command to change the line color, line width, and background color on the test result graph. ▶▶ Reference "Graph Property"	-

■**Graph Property**
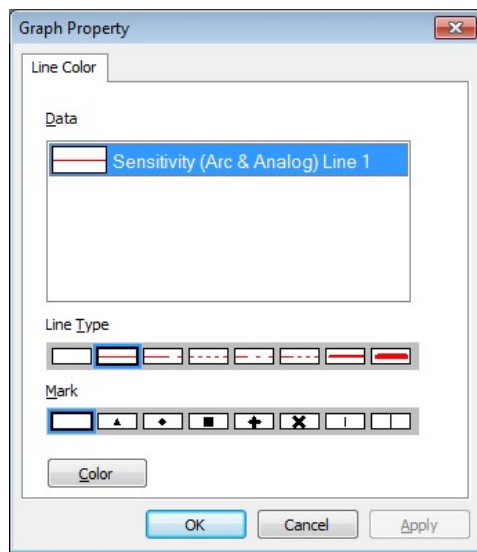
[Graph Property] Window

Item	Description
[Data]	Indicates the data displayed on the current graph tab. Click (highlight) the data targeted for changing the line type etc.
[Line Type]	Select the type of graph line. Click (highlight) the desired line type and then click [Apply] to update the graph.
[Mark]	Select the mark to use for data points on the test result graph. Click (highlight) the desired mark and then click [Apply] to update the graph.
[Color]	Select the color of the graph line. Click on the desired color in the [Color] window and then click [OK] to update the graph.
[OK]	Confirm the settings made and close the [Graph Property] window.
[Cancel]	Cancel any settings made and close the [Graph Property] window.
[Apply]	Confirm the changed settings.

12.2.3   [Tests] Menu

| Command	Description	Tool Button
	Start testing for the items whose checkboxes are selected in the test item table.	

[Start]	When there are items that are recommended to be tested after the instrument state (temperature, lamp) has stabilized, the [Waiting for instrument to stabilize] window is displayed. ▶▶ **Reference** "[Waiting for instrument to stabilize] window"	◇ Start (F11)
[Stop]	Clicking [OK] in the displayed confirmation dialog box stops the test currently in progress as well as all remaining tests. Clicking [Cancel] closes the dialog box and resumes testing.	⊘ Stop (F12)
[Tolerance]	Display the window for setting the tolerance for all test items. ▶▶ **Reference** "12.3 Setting Tolerances"	-
[Reset All Tolerance]	Reset all input values for the set tolerances to the default (recommended) values.	-

■**[Waiting for instrument to stabilize] window**

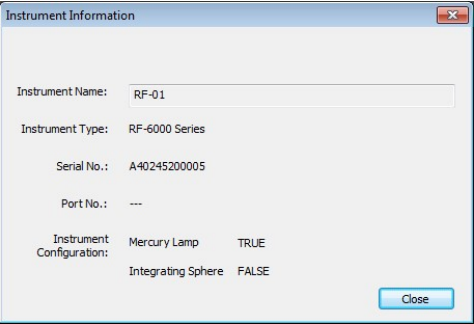Some items are recommended to be tested with the instrument state (temperature, lamp) stabilized.

- S/N ratio (Arc & Analog)

- Stability (Arc & Analog)

If the recommended stabilization time (30 minutes) has not been reached when testing is started for the above test items, the application enters the standby state and testing is resumed automatically when the stabilization time is reached.

[Waiting for instrument to stabilize] Window
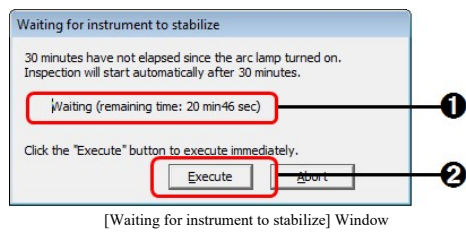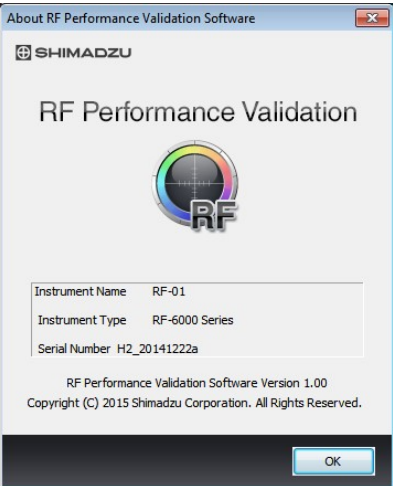
No.	Item	Description
❶	Waiting time	Indicates the time remaining until the stabilization time is reached. Testing is resumed when the stabilization time is reached.
❷	[Execute]	Click to cancel the standby state and resume testing.

12.2.4 [Instrument] Menu

Command	Description	Tool Button
[Information]	Display information regarding the instrument. RF-6000 Series Instrument Information 💡 **Hint** Because [Port No.] refers to a serial port, a hyphen (-) is indicated for RF-6000 units that communicate via USB.	-

[Connect]	Start communication with (connect to) the instrument.	
[Disconnect]	End communication with (disconnect from) the instrument.	

12.2.5   [Help] Menu

Command	Description	Tool Button
[Help]	Display the help window for this software.	
[About]	Display the window for checking the version number of the software and information on the connected instrument. Software Version Information	-

12.3   Setting Tolerances

Click [Tolerance] in the test item area to display the window for setting the tolerances for all test items.
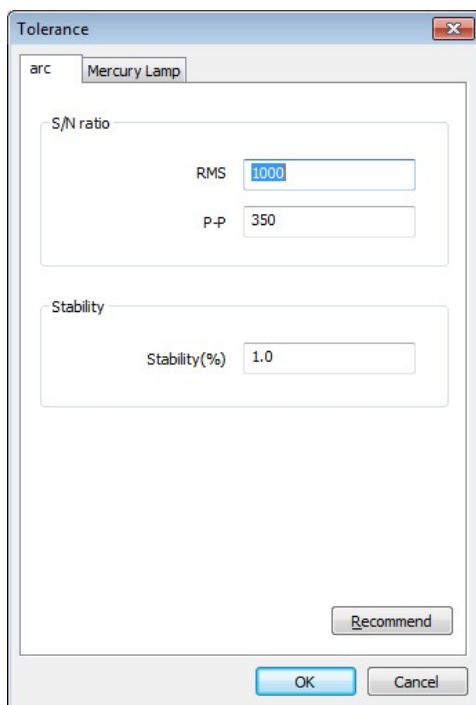
[Tolerance] Window

Item	Description
Tabs	Use the tabs to switch between the test items. The test items and tolerances differ depending on the system configuration (light source type). ▶▶ **Reference** "12.4 Test Items"
Tolerances	Displays the test items and the currently set tolerance values. Tolerance values can be changed by directly entering values into the relevant fields.
[Recommend]	Return the tolerances to the recommended values (default values) for the test items displayed on the relevant tab. **NOTE** When a Shimadzu representative performs a periodic inspection, the recommended values serve as the minimum test items and standards required for checking in order to judge whether or not there is a problem with the instrument.
[OK]	Set the tolerances and close the [Tolerance] window.
[Cancel]	Cancel any changes to the tolerance settings and close the [Tolerance] window.

12.4   Test Items

■**RF-5300PC**

Test Item	Overview
[Sensitivity (Arc & Analog)]	Determine the sensitivity (S/N ratio) from the height of the water Raman peak (S value) and noise level (N value) and perform pass/fail judgment on this value.

■**RF-6000 series**

Test Item	Overview

[Results of Initialization]	Output the results of initialization and self-diagnosis of the spectrofluorophotometer.

The test items differ depending on the type of light source installed in the instrument and the type of signal processing.

When connecting to the instrument, the test item area displays a list of the available tests that can be performed with the current system configuration.

Light source: Xenon arc lamp

You must wait at least 30 minutes after lighting the lamp to allow the lamp to stabilize.

▶▶ **Reference**   "[Waiting for instrument to stabilize] window"

Test Item	Overview
[S/N ratio (Arc & Analog)]	Determine the sensitivity (S/N ratio) from the peak height of the Raman scattering spectrum of water (S value) and noise level (N value) at the peak wavelength and perform pass/fail judgment on this value.
[Stability (Arc & Analog)]	Measure the Raman scattering peak of water and then the change in fluorescence intensity over time at the Raman scattering peak, and perform pass/fail judgment on the drift amount over a 5 minute interval.

Light source: Mercury lamp

The optional mercury lamp unit is required.

Testing is performed with respect to the monochromator on both the excitation side and emission side.

Test Item	Overview
[WL Accuracy]	Measure the emission line spectra of mercury emitted by the mercury lamp (at 253.7 nm, 365.0 nm, 435.8 nm, and 546.1 nm) and perform pass/fail judgment on the amount of error with respect to the emission line wavelengths.
[WL Repeatability]	Repeat measurement of the same emission line spectrum (546.1 nm) emitted by the mercury lamp three times, determine the average value of the read wavelength values, and perform pass/fail judgment on the deviation between each measured value and the average value.
[WL Repeatability(USP)]	This test uses the method specified in the United States Pharmacopeia (USP). Repeat measurement of the emission line spectrum of mercury emitted by the mercury lamp unit (at 546.1 nm) six times. Detect the peak wavelength from each emission line spectrum and perform pass/fail judgment on their standard deviation.
[Resolution]	With the monochromator set to the minimum spectral bandwidth, measure the emission line spectrum (435.8 nm) emitted by the mercury lamp and perform pass/fail judgment on the spectral bandwidth.

- 12.4.1 Results of Initialization
- 12.4.2 S/N ratio
- 12.4.3 Stability
- 12.4.4 Wavelength Accuracy (WL Accuracy)
- 12.4.5 Wavelength Repeatability (WL Repeatability)
- 12.4.6 Wavelength Repeatability(USP) (WL Repeatability(USP))
- 12.4.7 Resolution

12.4.1   Results of Initialization

The results of initialization and self-diagnosis that start automatically when power to the instrument is turned ON are recorded on the instrument. These results are retrieved when the software connects to the instrument.

■**Results display**

The result of all items performed in initialization and self-diagnosis are displayed.

Because the initialization and self-diagnosis items differ depending on the model, refer to the instrument instruction manual for details on these items.

12.4.2   S/N ratio

■Setting tolerances

The "P-P" and "RMS"methods for determining the noise level (N value) used in sensitivity calculation each require tolerance values to be set.

Noise level measurement is performed for 10 minutes.

💡 **Hint**   • P-P: The maximum fluctuation width of fluorescence intensity within the specified time period is defined as "P-P" (peak to peak).

• RMS: Indicates the RMS value determined from all data captured within the specified time period.

If the sensitivity is greater than the entered tolerance value, the result is a pass.

RF-5300 series

Light Source	Noise Level	Recommended Value (S/N)	Settable Range
Xenon arc	P-P	150	Integer value from 1 to 150

RF-6000 series

Light Source	Noise Level	Recommended Value (S/N)	Settable Range
Xenon arc	P-P	350	Integer value from 1 to 350
	RMS	1000	Integer value from 1 to 1000

■Display of test results

[Result] tab

Test Results ([Result] Tab)

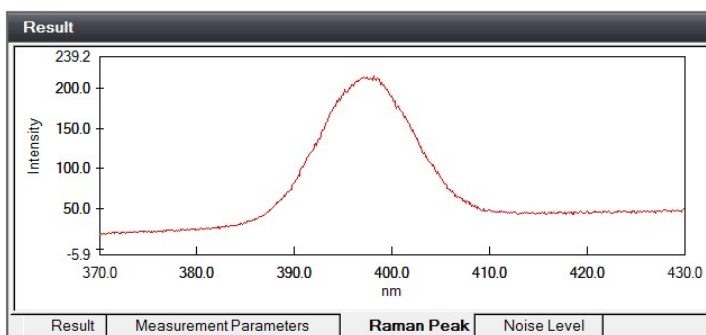| Name	Function
[WL (nm)]	Indicates the peak wavelength obtained from the result of measuring the Raman peak of water.
[Tolerance]	Indicates the tolerance values set for "P-P" and "RMS".
[S/N ratio]	Indicates the value (S/N ratio) calculated from the peak height of the Raman scattering spectrum of water (S value) and noise level (N value) determined from time-course data captured during the the specified time period at the peak wavelength.
[Result]	Indicates the judgment result. If the sensitivity of both "P-P" and "RMS" is greater than the corresponding tolerance value, the result is a pass.

[Measurement Parameters] tab

This tab displays the measurement parameter information of the test.

Test Results ([Measurement Parameters] Tab)
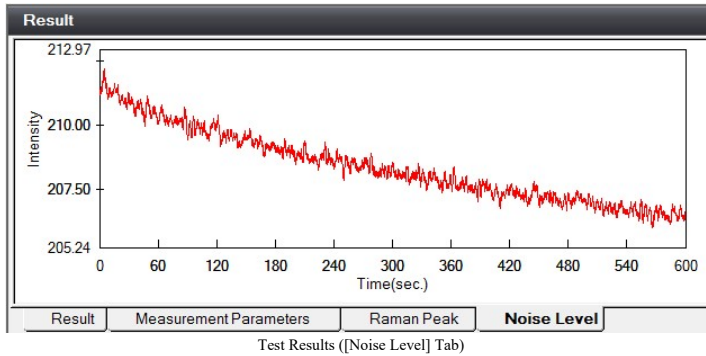
[Raman Peak] tab

This tab displays a graph of the Raman scattering spectrum of water obtained during the test.

Test Results ([Raman Peak] Tab)

[Noise Level] tab

This tab displays a graph of the time-course data obtained during the test.

Test Results ([Noise Level] Tab)

12.4.3 Stability

■Setting tolerances

Tolerances can be set separately according to differences in light source and signal processing.

If the drift amount is the entered tolerance value or less, the result is a pass.

Light Source	Signal Processing	Recommended Value (Stability(%))	Settable Range
Xenon arc	Analog	1.0	1.0 to 10.0

■Display of test results

[Result] tab

Test Results ([Result] Tab)

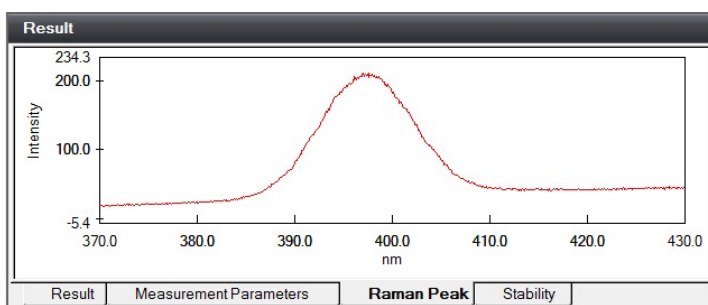| Name	Function
[WL (nm)]	Indicates the peak wavelength obtained from the result of measuring the Raman peak of water.
[Tolerance]	Indicates the tolerance value used in judgment.
[Stability(%)]	Indicates the Stability determined from time-course data obtained by measuring the fluorescence spectrum of water to acquire a peak wavelength and then performing time-course measurement for 5 minutes at this peak wavelength. The drift amount can be determined from the maximum, minimum, and average values of the time-course data using the following formula. Stability(%) = {(maximum - minimum) / average} × 100
[Result]	Indicates the judgment result. If the drift amount (photometric drift) is the tolerance value or less, the result is a pass.

[Measurement Parameters] tab

This tab displays the measurement parameter information of the test.

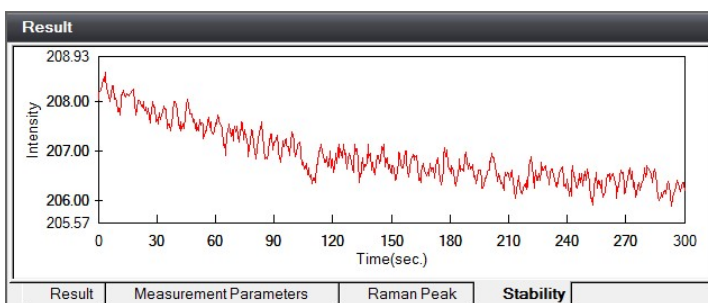Test Results ([Measurement Parameters] Tab)

[Raman Peak] tab

This tab displays a graph of the Raman scattering spectrum of water obtained during the test.

Test Results ([Raman Peak] Tab)

[Stability] tab

This tab displays a graph of the time-course data obtained during the test.

Test Results ([Stability] Tab)

12.4.4   Wavelength Accuracy (WL Accuracy)

■**Setting tolerances**

Tolerances can be set separately for the reference wavelength, excitation side monochromator, and emission side monochromator.

For an entered tolerance value of "1.0 (nm)", if the error between the emission line wavelength and peak wavelength is within the range of -1.0 to 1.0 nm, the result is a pass.

	Recommended Value (Error from Emission Line Wavelength)		Settable Range
Emission Line Wavelength			

(nm)	Excitation Side (nm)	Emission Side (nm)	
253.7	1.0	1.0	1.0 to 10.0
365.0	1.0	1.0	1.0 to 10.0
435.8	1.0	1.0	1.0 to 10.0
546.1	1.0	1.0	1.0 to 10.0

■**Display of test results**

[Result] tab

	Ex/Em	WL(nm)	Tolerance(n	Peak(nm)	Error(nm)	Result
1	Ex.	253.7	+/-1.0	253.3	-0.4	Passed
2	Ex.	365.0	+/-1.0	364.9	-0.1	Passed
3	Ex.	435.8	+/-1.0	435.6	-0.2	Passed
4	Ex.	546.1	+/-1.0	545.8	-0.3	Passed
5	Em.	253.7	+/-1.0	253.8	0.1	Passed
6	Em.	365.0	+/-1.0	365.0	0.0	Passed
7	Em.	435.8	+/-1.0	435.9	0.1	Passed
8	Em.	546.1	+/-1.0	546.1	0.0	Passed

Result | Measurement Parameters | Ex Spectrum | Em Spectrum

Test Results ([Result] Tab)

Name	Function
[Ex/Em]	Displays "Excitation" when the test target is the excitation side monochromator and "Emission" when the test target is the emission side monochromator.
[WL (nm)]	Indicates the emission line wavelength of the mercury lamp used in testing.
[Tolerance (nm)]	Indicates the tolerance range used in judgment. For "±1.0", the tolerance range is -1.0 to 1.0 nm.
[Peak (nm)]	Indicates the peak wavelength detected near the test wavelength in the captured spectrum. **Hint** If a peak is not detected, "no peak" is displayed.
[Error (nm)]	Indicates the difference between the test wavelength (reference) and detected wavelength.
[Result]	Indicates the judgment result. If the error is within the tolerance range, the result is a pass.

[Measurement Parameters] tab

This tab displays the measurement parameter information of the test.

Excitation Monochromator

[Measurement]
Ex Wavelength　　　: 240nm - 560nm
EM Wavelength　　　: 0nm(zero-order light)
Scan Speed　　　　: 200nm/min
Data Interval　　　　: 0.1nm

[Instrument]
EX Bandwidth　　　: 3.0nm
EM Bandwidth　　　: 20nm
Sensitivity　　　　: Low

Emission Monochromator

[Measurement]
EX Wavelength　　　: 0nm(zero-order light)
EM Wavelength　　　: 240nm - 560nm
Scan Speed　　　　: 200nm/min
Data Interval　　　　: 0.1nm

[Instrument]
EX Bandwidth　　　: 20nm
EM Bandwidth　　　: 3.0nm
Sensitivity　　　　: Low

Result | **Measurement Parameters** | Ex Spectrum | Em Spectrum

Test Results ([Measurement Parameters] Tab)

[Ex Spectrum] Tab/[Em Spectrum] tab

These tabs display a graph of the excitation spectrum and emission spectrum obtained during the test.

Test Results ([Ex Spectrum] Tab/[Em Spectrum] Tab)
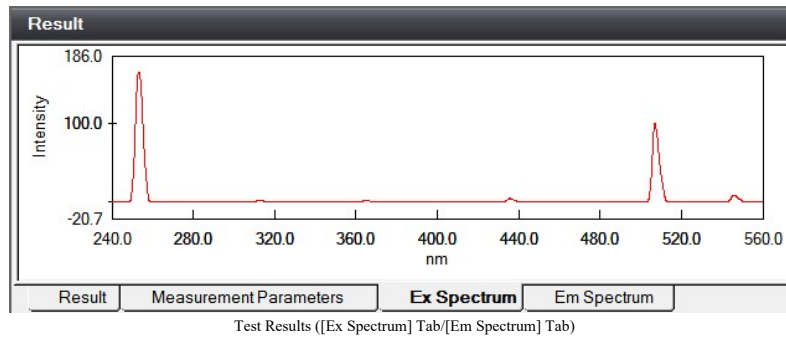
12.4.5 Wavelength Repeatability (WL Repeatability)

■**Setting tolerances**

Tolerances can be set separately for the excitation side monochromator and emission side monochromator.

For an entered tolerance value of "0.2 (nm)", if the deviation of the emission line peak wavelengths obtained from repeating measurement three times are all in the range of -0.2 to 0.2 nm, the result is a pass.

Emission Line Wavelength (nm)	Recommended Value (Deviation from Average Value)		Settable Range
	Excitation Side (nm)	Emission Side (nm)	
546.1	0.2	0.2	0.2 to 10.0

■**Display of test results**

[Result] tab

Test Results ([Result] Tab)

Name	Function
[Ex/Em]	Displays "Ex." when the test target is the excitation side monochromator and "Em." when the test target is the emission side monochromator.
[WL (nm)]	Indicates the emission line wavelength of the mercury lamp used in testing.
[Tolerance (nm)]	Indicates the tolerance range used in judgment. For "±0.2", the tolerance range is -0.2 to 0.2 nm.
[Peak (nm)]	Indicates the peak wavelengths detected from the spectra obtained by repeating scanning three times near the test wavelength and the average of these wavelengths. Hint The detected peak wavelengths are displayed in the [1st], [2nd], and [3rd] columns. If a peak is not detected, "no peak" is displayed.
[Deflection (nm)]	Indicates the maximum deviation after determining the average value of the detected wavelengths and their deviations.
[Result]	Indicates the judgment result. If the (maximum) deviation is within the tolerance range, the result is a pass.

[Measurement Parameters] tab

This tab displays the measurement parameter information of the test.
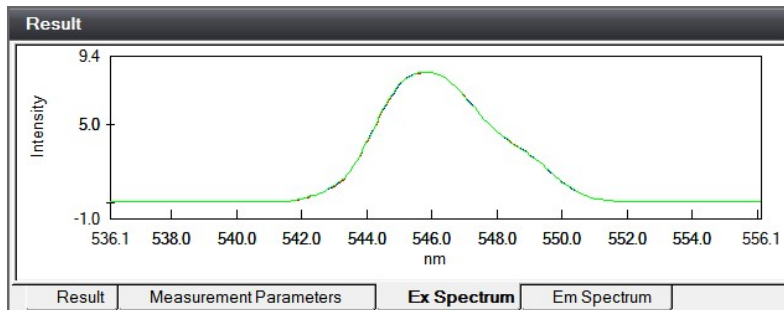
Test Results ([Measurement Parameters] Tab)

[Ex Spectrum] Tab/[Em Spectrum] tab

These tabs display a graph of the excitation spectrum and emission spectrum obtained during the test.

Test Results ([Ex Spectrum] Tab/[Em Spectrum] Tab)

12.4.6   Wavelength Repeatability(USP) (WL Repeatability(USP))

■**Setting tolerances**

Tolerances can be set separately for the excitation side monochromator and emission side monochromator.

For an entered tolerance value of "1.0", if the standard deviation of the emission line peak wavelengths obtained from repeating measurement six times is 1.0 or less, the result is a pass.

Emission Line Wavelength (nm)	Recommended Value (Standard Deviation of Six Measurements)		Settable Range
	Excitation Side	Emission Side	
546.1	1.0	1.0	0.2 to 10.0

■**Display of test results**

[Result] tab

Test Results ([Result] Tab)

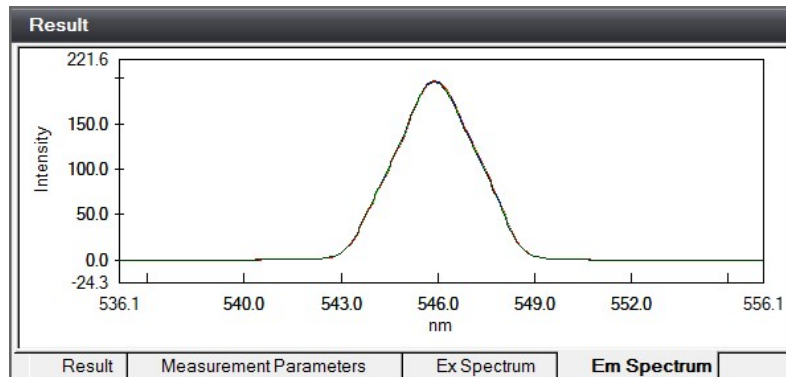| Name	Function
[Ex/Em]	Displays "Ex." when the test target is the excitation side monochromator and "Em." when the test target is the emission side monochromator.
[WL (nm)]	Indicates the emission line wavelength of the mercury lamp used in testing.
[Tolerance]	Indicates the tolerance range used in judgment. For "<=1.0", if the standard deviation is 1.0 or less, the result is a pass.
[Peak (nm)]	Indicates the peak wavelengths detected from the spectra obtained by repeating scanning six times near the test wavelength. 💡 Hint The detected peak wavelengths are displayed in the [1st] to [6th] columns. If a peak is not detected, "no peak" is displayed.
[SD]	Indicates the standard deviation determined by the peak wavelengths which are detected from measurement.
[Result]	Indicates the judgment result. If the standard deviation is within the tolerance range, the result is a pass.

[Measurement Parameters] tab

This tab displays the measurement parameter information of the test.

Test Results ([Measurement Parameters] Tab)

[Ex Spectrum] Tab/[Em Spectrum] tab

These tabs display a graph of the excitation spectrum and emission spectrum obtained during the test.

Test Results ([Ex Spectrum] Tab/[Em Spectrum] Tab)

12.4.7   Resolution

■**Setting tolerances**

For an entered tolerance value of "1.2 (nm)", if the resolution (spectral bandwidth) of the emission line spectrum obtained from measurement is 1.2 nm or less, the result is a pass.

Monochromator	Recommended Value (nm)	Settable Range
Emission	1.2	1.2 to 10.0

■Display of test results

[Result] tab

Test Results ([Result] Tab)

Name	Function
[Ex/Em]	Displays "Em." because the test target is the emission side monochromator.
[Tolerance (nm)]	Indicates the tolerance value used in judgment. For "<=1.2", if the resolution (spectral bandwidth) of the obtained emission line spectrum is 1.2 nm or less, the result is a pass.
[Resolution (nm)]	Indicates the resolution (spectral bandwidth) determined by measuring the emission line (436.0 nm) spectrum of the mercury lamp.
[Result]	Indicates the judgment result. If the resolution is the tolerance value or less, the result is a pass.

[Measurement Parameters] tab

This tab displays the measurement parameter information of the test.

Test Results ([Measurement Parameters] Tab)

[Em Spectrum] tab

This tab display a graph of the emission spectrum obtained during the test.

Test Results ([Em Spectrum] Tab)