



Thank you for purchasing the AQ6360 Optical Spectrum Analyzer. This instrument enables high speed measurement of the optical properties of LD and LED light sources, optical amps, and other devices.

This user's manual describes the instrument's functions, operating procedures, and handling precautions, and provides other important information for use of the instrument. For correct operation, please read this manual thoroughly before use. After reading this manual, keep it in a convenient location for quick reference in the event a question arises during operation.

## List of Manuals

The following manuals, including this one, are provided as manuals for the AQ6360. Please read all manuals.

Manual Title	Manual No.	Description
AQ6360 Optical Spectrum Analyzer User's Manual	IM AQ6360-01EN	This manual. The manual is located on the CD included in your package (pdf format). Explains all functions and operating procedures of the AQ6360 except remote control and program functions.
AQ6360 Optical Spectrum Analyzer Getting Started Guide	IM AQ6360-02EN	This guide explains the handling precautions, installation procedure, basic operations, and specifications of this instrument.
AQ6360 Optical Spectrum Analyzer Remote Control User's Manual	IM AQ6360-17EN	The manual is located on the CD included in your package (pdf format). Explains functions for controlling the instrument with communication commands and program functions.
Model AQ6360-01 AQ6360 Optical Spectrum Analyzer Limited model User's Manual	IM AQ6360-51EN	Explains the specifications of the limited model of the AQ6360.
Optical Spectrum Analyzer	IM AQ6360-92Z1	Document for China.

The "EN" and "Z1" in the manual numbers are the language codes.

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Document Description	Description
PIM 113-01Z2	List of worldwide contacts

## Notes

- The contents of this manual are subject to change without prior notice as a result of improvements in the instrument's performance and functions. Display contents illustrated in this manual may differ slightly from what actually appears on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without the permission of YOKOGAWA is strictly prohibited.

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## Revisions

- 1st Edition: April 2018
- 2nd Edition: April 2019
- 3rd Edition: January 2021
- 4th Edition: April 2021

# Conventions Used in This Manual

## Safety Markings

The following markings are used in this manual.



Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

### WARNING

Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

### CAUTION

Calls attention to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

## French

### AVERTISSEMENT

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures graves (voire mortelles), et sur les précautions de sécurité pouvant prévenir de tels accidents.

### ATTENTION

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures légères ou d'endommager l'instrument ou les données de l'utilisateur, et sur les précautions de sécurité susceptibles de prévenir de tels accidents.

### Note

Calls attention to information that is important for proper operation of the instrument.

## Notations Used on Pages Describing Operating Procedures

On pages that describe the operating procedures in Chapter 2 through 7, the following notations are used to distinguish the procedures from their explanations.

<b>Procedure</b>	This subsection contains the operating procedure used to carry out the function described in the current chapter. All procedures are written with inexperienced users in mind; experienced users may not need to carry out all the steps.
<b>Explanation</b>	This subsection describes the setup parameters and the limitations on the procedures.

## Characters and Terminology Used in Procedural Explanations

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Bold alphanumeric characters in procedural explanations indicate characters appearing near panel controls and characters of the control menu items shown on the screen.

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## Unit

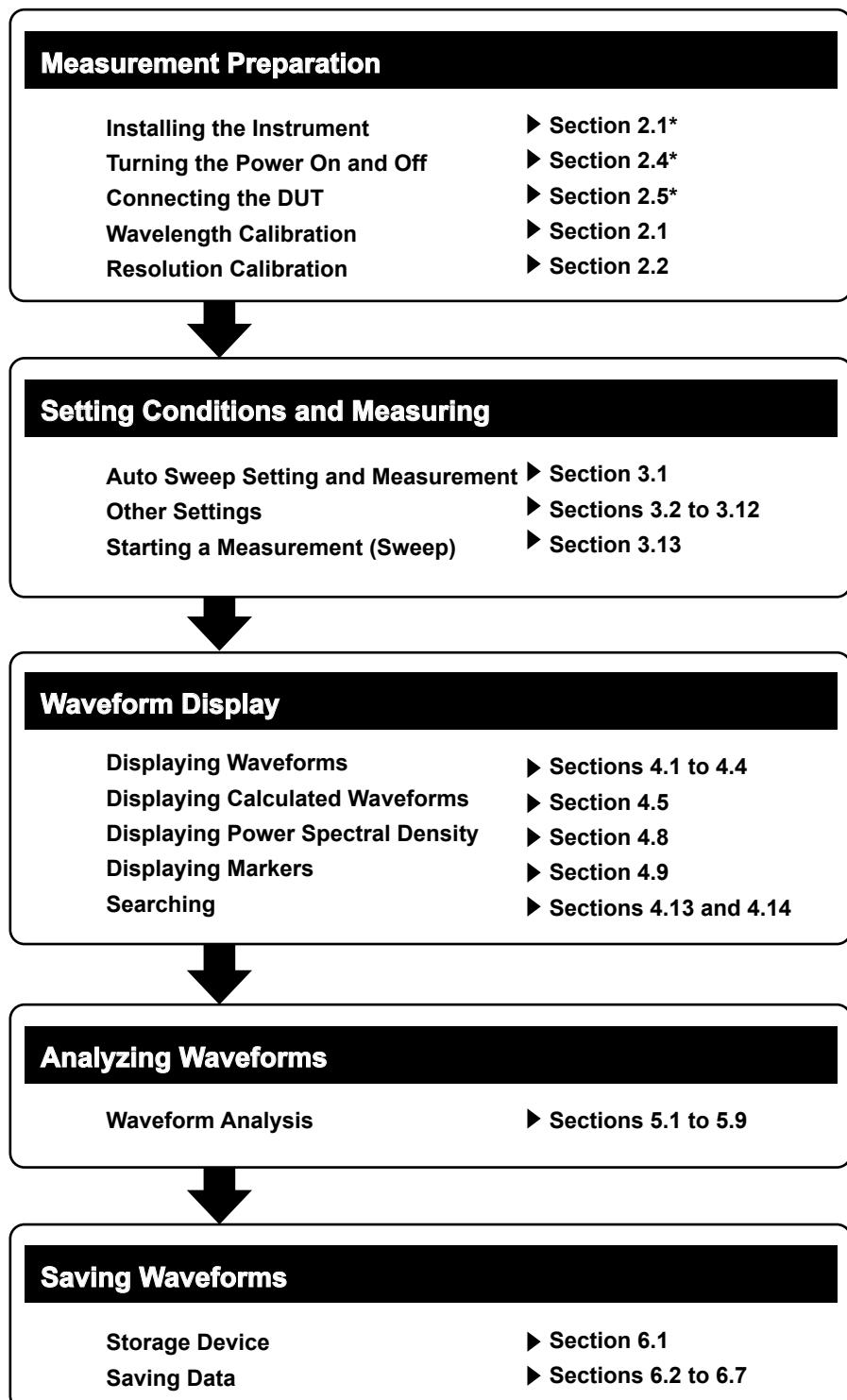
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k: Denotes "1000."	Example: 100kS/s
K: Denotes "1024."	Example: 459KB (file data size)

---

# Workflow

The figure below is provided to familiarize the first-time user with the basic workflow for operating the product. For the details of each item, see the relevant section in IM AQ6360-01EN or IM AQ6360-02EN.



\* IM AQ6360-02EN

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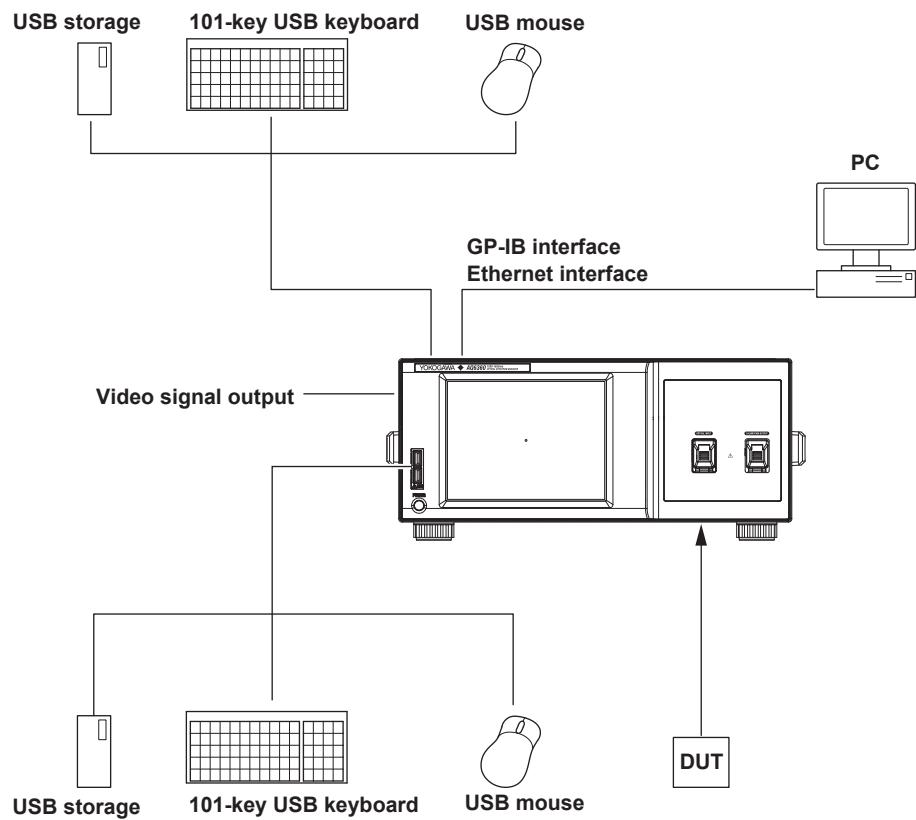
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## 1.1 System Configuration



## 1.2 Feature Summary

### Measurement (Details in chapter 3)

#### Sweep Settings

Optical power at different wavelengths can be measured while changing the wavelength automatically.

The available sweep modes are (1) single sweep, which makes a single measurement, (2) repeat sweep, which repeats measurements using the same measurement conditions, and auto measurement, which makes measurements by automatically setting the measurement conditions to the optimal conditions. If the optimal measurement conditions are unknown, auto measurement is convenient.

In addition, sweeping between markers, which makes measurements within the specified sweep wavelength range, and 0 nm sweeping, which measures the variation in the level over time with a fixed wavelength measurement point are available.

The 0 nm sweeping function is useful for aligning the optical axis when a light source is input into an optical fiber.

#### Measurement Condition Settings

Measurements can be performed by setting various conditions.

In addition to center wavelength, span, wavelength resolution, and measurement sensitivity, a smoothing function that reduces measurement waveform noise and a function for switching between air wavelength and vacuum wavelength are available.

By using the one-action key functions, you can set measurement conditions using the data of the active trace waveform (currently displayed waveform).

To use them, a waveform must be displayed in the active trace.

#### One-Action Keys

One-action key name	Description
Peak Level → Ref Level	The reference level is set to the peak level of the active trace measurement waveform.
Marker → Ref Level	The reference level is set to the moving marker level.
Peak WL → Center	The center wavelength or center frequency is set to the peak wavelength or peak frequency of the active trace measurement waveform.
Mean WL → Center	The center wavelength or center frequency is set to the RMS 20 dB center wavelength or center frequency of the active trace measurement waveform.
View Scale → Measure	The measurement scale (CENTER, START, STOP, SPAN) of the next sweep to the zoom scale currently displayed.
Marker → Center	The center wavelength or center frequency is set to the moving marker wavelength or frequency.
Δλ → Span	The sweep span is set to RMS 20 dB span × 6 of the active trace measurement waveform.
Marker L1-L2 → Span	The sweep span is set to the span between line markers 1 and 2.
Peak → Zoom Ctr	The center wavelength of the zoom display is set to the peak wavelength of the active trace measurement waveform.
Marker → Zoom Ctr	The center wavelength of the zoom display is set to the moving marker wavelength.
Marker L1-L2 → Zoom Span	The sweep span of the zoom display is set to the span between line markers 1 and 2.

## Display (Details in chapter 4)

### Display Mode

Measured waveforms and calculated waveforms are shown in the waveform display area of the screen.

A function that splits the waveform display area into two screens and a function that displays analysis results in data tables are also available.

### Vertical Scale

The vertical axis of the waveform display area has a level scale and a sub level scale, and each scale can be set to a log scale or linear scale to display optical power levels. In addition, a power spectral density display function, which shows power per nm (dB/nm) and a noise mask function, which masks levels at or less than the specified value are available.

### Horizontal Scale

The horizontal scale of the waveform display area can be set to wavelength (nm) or frequency (THz).

You can specify a wavelength to zoom in on a waveform or pinch out or pinch in on the touch panel to adjust the zoom display.

While the zoom display is shown, an overview window (entire waveform) is shown at the bottom of the waveform display area where you can view the zoom range.

## Trace (Details in chapters 3 and 4)

### Display Function

This instrument has seven independent traces in which measured waveforms and calculated waveforms are drawn.

For each trace, you can turn the waveform display on and off as well as set the trace to write mode or calculation mode.

Write mode is further divided into (1) MAX/MIN HOLD mode, which detects and writes the maximum and minimum values of each sweep, (2) roll average (sweep average) mode, which takes a cumulative average for each sweep and writes the result, and (3) FIX mode in which no writing takes place.

In calculation mode, calculated results such as calculation between traces, normalization of waveforms, and approximation (curve fitting) of waveforms can be displayed in another trace.

### Marker and Search (Details in chapter 4)

#### Marker

The marker function is used to place the moving marker (▼) on a displayed waveform and show the wavelength and level at the marker position.

The function can be used to easily search for peak wavelengths and peak levels. Further, by setting up to 1024 fixed markers, you can measure the wavelength difference or level difference between adjacent fixed markers and between the moving marker and a fixed marker.

In addition to the normal marker, there are two vertical and horizontal line markers (wavelength line marker and level line marker) and advanced markers.

Wavelength line markers show wavelengths and wavelength difference while level line markers show levels and level difference. Line markers can be used to specify a sweep range or analysis range.

Advanced markers can be used to display the power value per normalization bandwidth (power spectral density) and integrated power of a specified range.

#### Search

The peak/bottom search function can be used to detect waveform peak levels and bottom levels.

The function has two search modes: single, in which a single peak or a single bottom of the measured waveform's level are detected, and multi, in which multiple peaks and bottoms are detected in a single search.

Markers are displayed at the peak and bottom points.

There is also an auto search function that automatically performs peak/bottom searches during each sweep. This is useful when you want to observe the changes to the peak and bottom levels during repeat sweeping.

## Data Analysis (Details in chapter 5)

### Analysis Function

The following analysis functions are available.

#### Spectral Width Measurement

The spectral width and center wavelength can be displayed using the following four calculation methods.

- THRESH
- ENVELOPE (envelope curve)
- RMS
- PEAK RMS

#### Notch Width Measurement

Passband/notch width can be analyzed by measuring filters with V-shaped or U-shaped wavelength characteristics.

### Device Analysis

Light source parameter analysis can be performed by measuring the DFB-LD, FP-LD, and LED light sources.

- SMSR measurement of DFB-LD  
Side mode suppression ratio (SMSR) can be analyzed by measuring a DFB-LD.
- Total power measurement of FP-LD and LED  
Optical power can be analyzed by integrating the measured waveform levels.

### PMD Measurement

A wideband light source such as an ASE or high-output LED light source can be combined with a polarizer, polarization controller, and analyzer to analyze the polarization mode dispersion (PMD) of the DUT such as an optical fiber.

### WDM Analysis

WDM transmission signals can be analyzed. The OSNR of a DWDM transmission system with 50 GHz spacing can also be analyzed. The wavelength, level, wavelength spacing, and OSNR of up to 1024 channels of WDM signals are measured collectively, and the analysis results are shown in a data table.

### Optical Amplifier Measurement

The signal light to an optical amplifier and the output light from the amplifier can be measured to analyze the gain and noise figure (NF) of the amplifier.

### Optical Filter Characteristics Measurement

The input light to an optical filter and the output light from the filter can be measured to analyze the characteristics of the filter.

Analysis is possible not only for single-mode optical filters but also multi-mode WDM filters.

### Auto Measurement (Details in IM AQ6360-17EN)

#### Programming

You can select program commands freely and register up to 64 programs (200 steps/program).

The program function can be used to control external devices connected to the Ethernet interface of this instrument.

### Others

#### Wavelength Calibration (Details in chapter 2)

The built-in reference light source (/LFC, /LSC option) or an external light source can be used to perform wavelength calibration of the instrument.

#### Resolution Calibration (Details in chapter 2)

In general, the resolution bandwidth accuracy affects measurement results. In resolution calibration, an equivalent noise bandwidth can be measured and used as the resolution bandwidth.

#### USB Mouse Operation (Details in IM AQ6360-02EN)

You can connect a USB mouse to perform the same operations that you can perform by tapping the instrument's touch panel. Connect a USB mouse to a USB port on the instrument's front panel.

#### User Keys (Details in chapter 7)

Frequently used keys can be registered in the function menu (user keys).

By registering user keys, you can execute specific operations with less steps.

Up to 24 keys can be registered. By default, none of the keys are registered.

#### Data Initialization (Details in chapter 7)

Settings can be reset to their factory defaults.

#### Help (Details in chapter 7)

Explanations of various settings, function menus, and keys can be shown on the instrument's screen.

#### Key Lock (Details in chapter 7)

Operation of keys other than the registered user keys can be locked to prevent operation mistakes by the user.

#### Remote (Details in IM AQ6360-17EN)

This instrument can be remotely controlled over a network from a PC or other controllers.

## 2.1 Wavelength Calibration



### WARNING

The instrument has a built-in reference light source for wavelength calibration (/LFC, /LSC option), and infrared light is always being output from the optical output connector. Never look into the optical output connector. Infrared light entering the eyes can cause severe injury and loss of vision.

French



### AVERTISSEMENT

Cet instrument dispose d'une source de lumière de référence (/LFC, /LSC option) intégrée pour les ajustements d'alignement. La lumière infrarouge est toujours émise depuis le connecteur de sortie optique. Ne regardez jamais directement dans le connecteur de sortie optique. La lumière infrarouge risquerait de gravement vous blesser ou de provoquer une perte de vision.

### Procedure

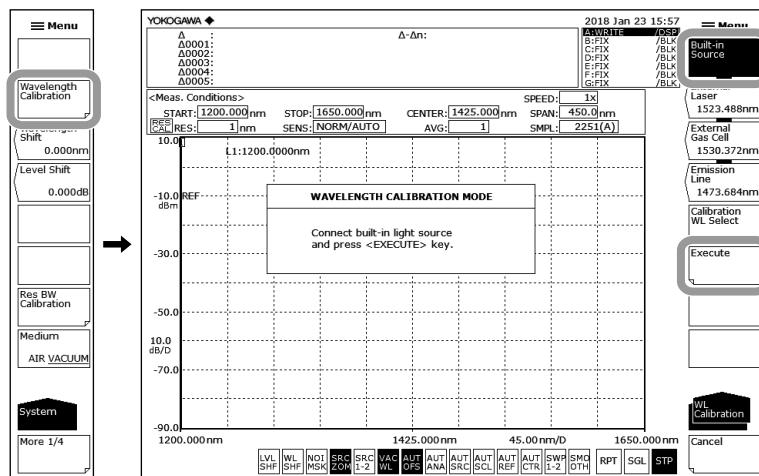
#### Calibrating the Wavelength with the Built-in Reference Light Source (/LFC, /LSC Option)

1. Turn on the instrument.

Turn on the **MAIN POWER** switch and then press the **POWER** switch.

For instructions on how to turn on and off the power, see section 2.4 in IM AQ6360-02EN.

2. Connect the instrument's optical input connector and optical output connector using a 9.5/125  $\mu\text{m}$  SM (single mode) optical fiber.
3. Tap **☰ Menu**. The Main Menu window appears.
4. Tap **SYSTEM**. The function menu appears.
5. Tap **Wavelength Calibration**.



6. Tap **Built-in Source**.

## 2.1 Wavelength Calibration

7. Tap **Execute**. The message “Calibration now! Please wait” appears, and wavelength calibration begins. It will take approximately 1 minute for the wavelength calibration to complete. When it finishes successfully, the message “Wavelength Calibration is completed successfully” appears.
8. Tapping **Cancel** while the wavelength calibration is being executed cancels the calibration.

### Note

- Be sure to execute wavelength calibration after warm-up when you turn on the instrument.
- If the instrument’s wavelength error is greater than or equal to  $\pm 5$  nm, wavelength calibration using the built-in reference light source is not possible.

(Because readjustment is required, contact your nearest YOKOGAWA dealer.)

## Calibrating the Wavelength Using an External Light Source

In addition to the built-in reference light source, the instrument can be calibrated using a light source that you provide. However, the following light sources cannot be used for wavelength calibration.

### Laser Type

- When the specified wavelength is different from that of the calibration light source
- If the instrument’s wavelength error is greater than or equal to  $\pm 5$  nm, readjustment is necessary. Contact your nearest YOKOGAWA dealer.
- If the calibration light source level is less than or equal to -40 dBm

### Emission Line Light Source Type

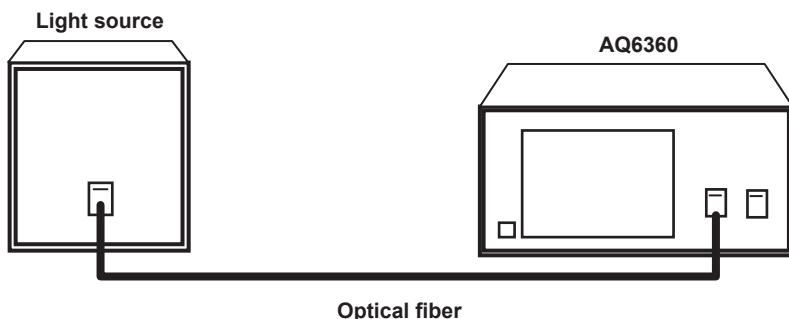
- When the specified wavelength is different from that of the calibration light source
- If multiple emission lines are included in the calibration wavelength  $\pm 0.5$  nm range
- If the instrument’s wavelength error is greater than or equal to  $\pm 0.5$  nm, readjustment is necessary. Contact your nearest YOKOGAWA dealer.
- If the calibration light source level is less than approximately -65 dBm (varies depending on the wavelength)

### Gas Cell Absorption Line Type

- When using a reference light source with multiple absorption lines if the instrument’s wavelength deviation is greater than the wavelength spacing of the absorption lines (because the adjacent absorption line will be assumed to be the reference wavelength)

## Connecting the External Light Source

1. Turn on the instrument.  
Turn on the **MAIN POWER** switch and then press the **POWER** switch.  
For instructions on how to turn on and off the power, see section 2.4 in IM AQ6360-02EN.
2. Connect the external light source’s optical output connector to the instrument’s optical input connector using a single mode optical fiber.



## 2.1 Wavelength Calibration

### Note

- Use a 9.5/125  $\mu\text{m}$  single mode optical fiber.
- If you have to use an optical fiber with a large core diameter, such as when using an external emission line light source, use an optical fiber with a core diameter of 100  $\mu\text{m}$  or less. Otherwise, wavelength calibration will not be performed correctly.

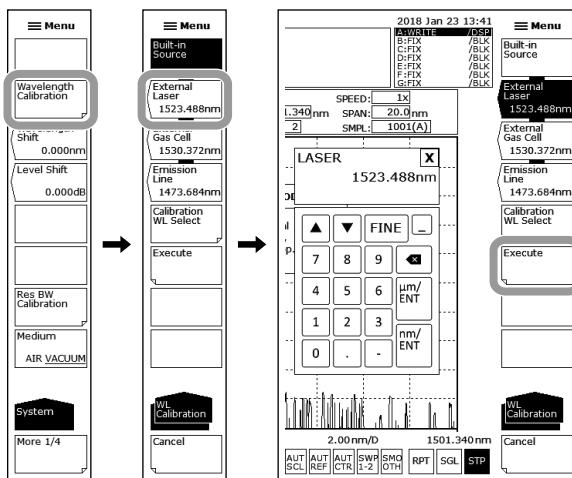
### Setting the Type of External Light Source and the Calibration Wavelength Value

3. Tap **☰ Menu**. The Main Menu window appears.
4. Tap **SYSTEM**. The function menu appears.
5. Tap **Wavelength Calibration**.

Set the type of external light source (laser, emission line spectrum, gas cell absorption line) and the calibration wavelength value. There are three methods to set the wavelength value.

#### Laser Type

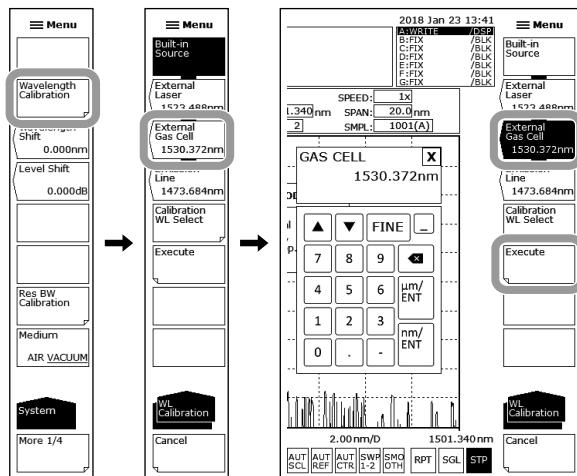
6. Tap **External Laser**. A parameter input window appears.
7. Set the wavelength value of the laser in the parameter input window. The selectable wavelength range is 1200 nm to 1650 nm.
8. Tap **nm/ENT**. The wavelength value is set.
9. Tap **Execute**. The message “Calibration now! Please wait” appears, and wavelength calibration begins. When the wavelength calibration finishes successfully, the message “Wavelength Calibration is completed successfully” appears.
10. Tapping **Cancel** while the wavelength calibration is being executed cancels the calibration.



## 2.1 Wavelength Calibration

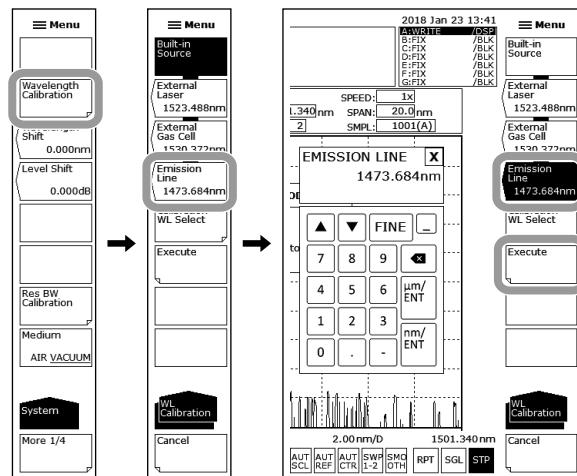
### Gas Cell Absorption Line Type

6. Tap **External Gas Cell**. A parameter input window appears.
7. Set the wavelength value of the gas cell absorption line in the parameter input window. The selectable wavelength range is 1200 nm to 1650 nm.
8. Tap **nm/ENT**. The wavelength value is set.
9. Tap **Execute**. The message “Calibration now! Please wait” appears, and wavelength calibration begins. When the wavelength calibration finishes successfully, the message “Wavelength Calibration is completed successfully” appears.
10. Tapping **Cancel** while the wavelength calibration is being executed cancels the calibration.



### Emission Line Light Source Type

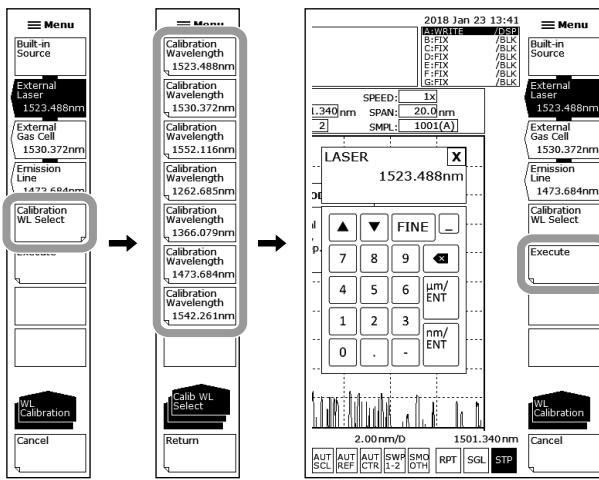
6. Tap **Emission Line**. A parameter input window appears.
7. Set the wavelength value of the emission line light source in the parameter input window. The selectable wavelength range is 1200 nm to 1650 nm.
8. Tap **nm/ENT**. The wavelength value is set.
9. Tap **Execute**. The message “Calibration now! Please wait” appears, and wavelength calibration begins. When the wavelength calibration finishes successfully, the message “Wavelength Calibration is completed successfully” appears.
10. Tapping **Cancel** while the wavelength calibration is being executed cancels the calibration.



## 2.1 Wavelength Calibration

### When Using the Instrument's Internal Calibration Wavelength Value

7. Tap **Calibration WL Select**. The function menu changes to display the wavelength value.
8. Tap the appropriate wavelength value.
9. Tap **Execute**. The message “Calibration now! Please wait” appears, and wavelength calibration begins. When the wavelength calibration finishes successfully, the message “Wavelength Calibration is completed successfully” appears.
10. Tapping **Cancel** while the wavelength calibration is being executed cancels the calibration.



#### Note

There is no need to calibrate at multiple wavelengths. If calibration is performed at multiple wavelengths, only the last calibration result is applied.

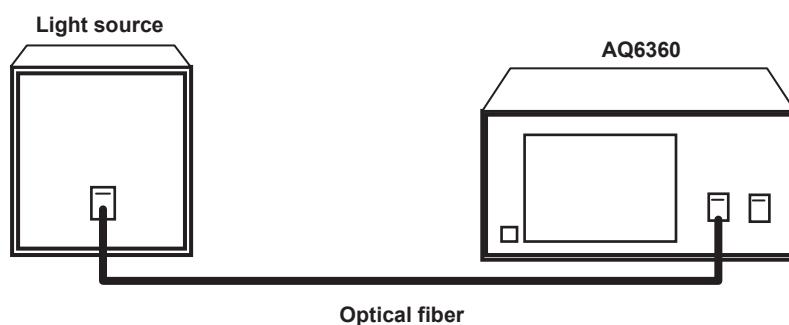
## 2.2 Resolution calibration

### Procedure

The resolution of the instrument can be calibrated using a light source that you provide.

#### Connecting the External Light Source

1. Turn on the instrument.  
Turn on the **MAIN POWER** switch and then press the **POWER** switch.  
For instructions on how to turn on and off the power, see section 2.4 in IM AQ6360-02EN.
2. Connect the external light source's optical output connector to this instrument's optical input connector using a 9.5/125  $\mu\text{m}$  SM (single mode) optical fiber.



#### Note

For the light source, use a stabilized single-mode laser light.

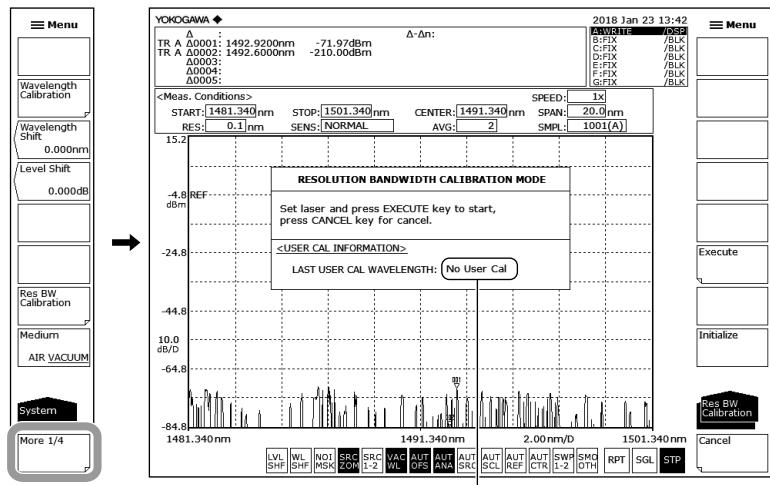
Set the optical output power to  $-20$  dBm or higher.

Use a light source with a level stability of  $0.1$  dB $\mu$ p or less and an output line width of  $5$  MHz or less.

## 2.2 Resolution Calibration

3. Tap **☰ Menu**. The Main Menu window appears.
4. Tap **SYSTEM**. The function menu appears.
5. Tap **Res BW Calibration**. A resolution calibration function menu and a message explaining how to perform resolution calibration appear.

The message also contains the wavelength value of the previous resolution calibration.



### Wavelength value of the previous resolution calibration

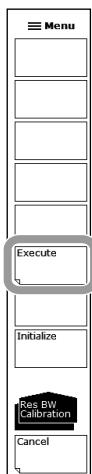
If calibration has not been performed or has been cleared, "No User Cal" will appear.

### Executing Resolution Calibration

6. Tap **Execute**. The message “Res BW calibration Step @/4 Please wait” (where @ is a number between 1 and 4) appears, and resolution calibration begins.

When the resolution calibration finishes successfully, the message “Resolution bandwidth calibration is completed successfully” appears.

7. Tapping **Cancel** while resolution calibration is being executed cancels the calibration.

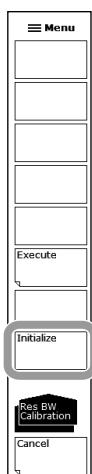


**RES CAL** appears in the measurement condition area when a resolution calibration has been performed.



### Clearing the Resolution Calibration Value

8. Tap **Initialize**. The calibration value will be cleared.

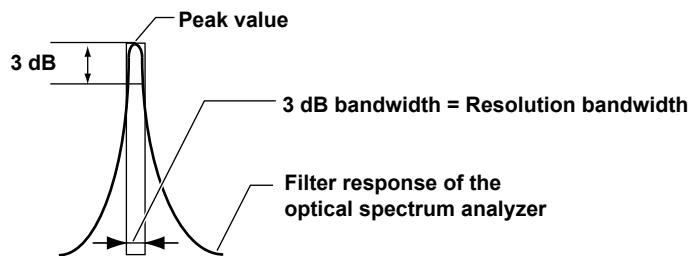
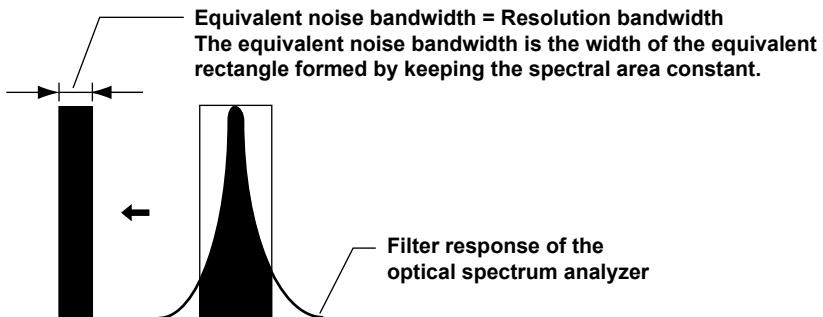


**Explanation**

Typically the filter response of an optical spectrum analyzer is not rectangular, and thus the resolution bandwidth differs slightly from the equivalent noise bandwidth. The resolution calibration function measures the equivalent noise bandwidth at each resolution setting and internally sets the resolution bandwidth to the result.

The resolution bandwidth accuracy affects the results of noise measurements and the results of optical power measurements of wideband light sources. In detail, the resolution bandwidth is used when the following analysis and computation functions are executed.

- WDM analysis
- EDFA-NF (optical amp gain, NF measurement)
- Power analysis
- OSNR and total power of DFB-LD analysis
- Total power of FP-LD analysis
- Total power of LED analysis
- Power spectral density marker, integrated power marker

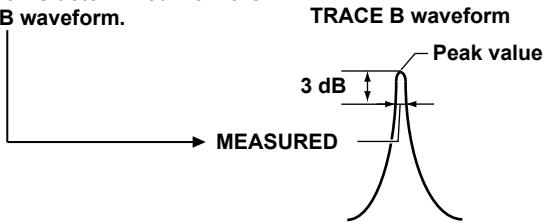
**Before resolution calibration****After resolution calibration**

## 2.2 Resolution Calibration

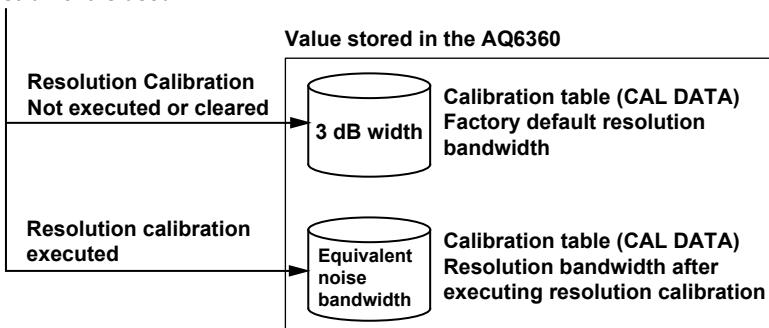
### Measurement resolution used in the analysis algorithm (e.g. EDFA-NF)

For details on the RES BW parameters, see “NF Calculation Parameters” in the explanation of section 5.8.

If the RES BW parameter is set to “MEASURED,” the resolution bandwidth is determined from the TRACE B waveform.



If the RES BW parameter is set to “CAL DATA,” the resolution bandwidth stored in the instrument is used.



The analysis algorithm other than EDFA-NF uses the value stored in the AQ6360.

### Clearing the Resolution Calibration Value

The calibration table of equivalent noise bandwidth is cleared. After clearing, the factory default resolution bandwidth is used in the analysis algorithm calculations. Use this function when you need to align with existing analysis data.

## 2.3 Measurement Precautions

### Types of Optical Fibers That Can Be Used with This Instrument

This instrument can use single mode optical fibers with a core diameter of 5 to 9.5  $\mu\text{m}$  and multi-mode (GI) optical fibers with a core diameter of 50  $\mu\text{m}$  or 62.5  $\mu\text{m}$ . The optical input section of this instrument has a free-space structure, so even larger core-diameter optical fibers can be connected directly. Particularly when taking in spatial light, optical fibers with a large core diameter are advantageous, but use cables appropriate for the application while referring to the following note.

#### Note

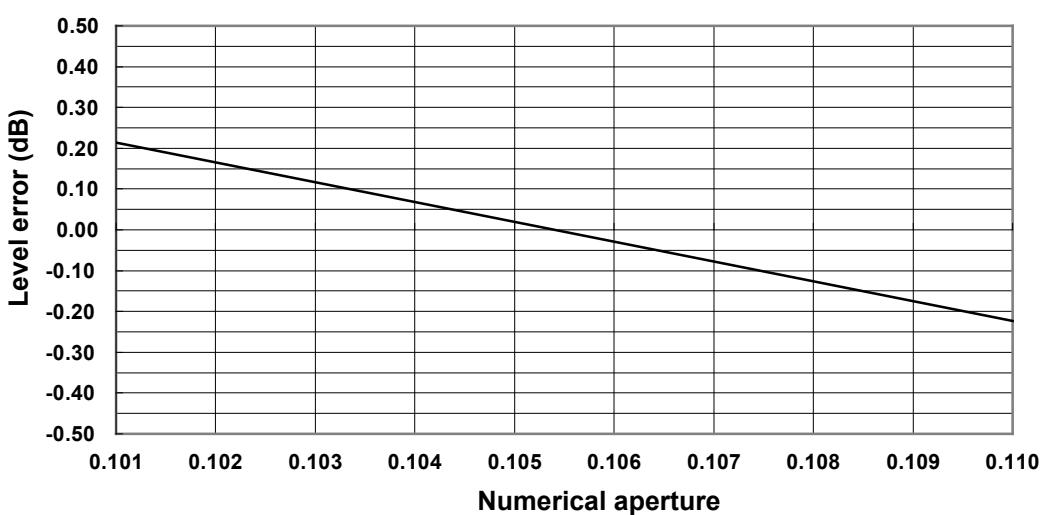
When a large-core optical fiber with a core diameter of 100  $\mu\text{m}$  or wider is connected, the amount of light that can be collected in is not necessarily proportional to the core diameter area. In particular, using a 400  $\mu\text{m}$  or larger core optical fiber hardly increases the amount of light that can be collected. In addition, even though the maximum resolution of this instrument is 0.1 nm, when using 100  $\mu\text{m}$  or larger core optical fibers, we recommend setting the wavelength resolution to 0.5 nm or greater.

Note that this instrument is designed exclusively for optical fiber input. It is not possible to apply a gas laser beam directly into the optical input connector, input LED light by bringing the LED in close contact with the optical input connector section, or input light by any other method without using an optical fiber. Note that optical spectrum measured using such methods is totally unreliable. To measure spatial light, you need to collect the spatial light into the optical fiber and then apply it to this instrument.

### Numerical Aperture (NA) of Input Optical Fibers and Level Measurements

The level measurement errors of this instrument varies depending on the numerical aperture (NA) of the optical fiber connected to the input connector section. The absolute level of this instrument is calibrated with a 9.5/125  $\mu\text{m}$  single mode optical fiber (SSMA type in JIS C6835, PC polishing, mode field diameter: 9.5  $\mu\text{m}$ , NA: 0.104 to 0.107). If the NA value is not within this range even for single mode optical fibers, the level accuracy is not guaranteed.

Numerical aperture of input optical fibers and level errors (representative characteristics)



## 2.3 Measurement Precautions

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### Absolute Level Accuracy

The absolute level of this instrument is calibrated with a 9.5/125  $\mu\text{m}$  single mode optical fiber (SSMA type in JIS C6835, PC polishing, mode field diameter: 9.5  $\mu\text{m}$ , NA: 0.104 to 0.107). The level accuracy when other optical fibers are used is not guaranteed.

For multi-mode (GI) fibers, a relatively accurate spectrum is indicated for low-coherence light, such as white light, natural light, and LEDs.

For high-coherence light, such as a laser beam, interference occurs within the optical fiber, and the intensity distribution of light reflected from the end of the fiber varies depending on the fiber form. As such, moving the fiber may change the spectrum (measurement level).

### Ripples in the 1350 to 1450 nm Area

Water (OH-) ions present in the monochromator absorb light in the 1350 to 1450 nm area, resulting in ripples in the measurement waveform. The amount of ripples can be reduced by setting a coarser resolution or using the instrument in a low-humidity environment.

### Second Order Diffraction Light

The monochromator of this instrument uses a diffraction grating. When light with a wavelength shorter than the lower limit (1200 nm) of the measurement wavelength range is received, optical spectrum ghost referred to as second order diffraction light, appears.

For example, if 700 nm light is input, a ghost optical spectrum will appear at the 1400 nm position. Avoid applying light with a wavelength shorter than the lower limit of the measurement wavelength range.

### Luminance at the Installation Location

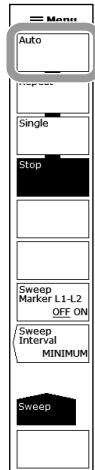
The light shielding performance of this instrument is designed on the assumption that the instrument will be used in a typical office or factory room (300 to 1000 lx). As such, depending on the lighting conditions of the installation location, the instrument may collect extraneous light, and this may affect the measurement results when weak light is measured. In such situations, darkening the surroundings of this instrument will reduce the inaccuracies.

## 3.1 Auto Measurement

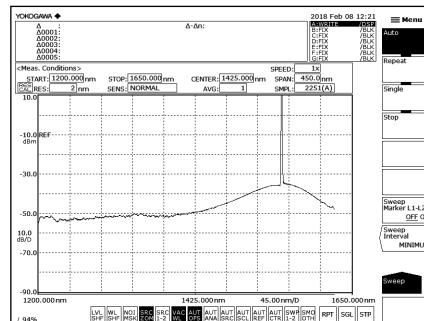
### Procedure

With auto measurement, measurements are made by automatically setting the optimal measurement conditions for the light source to be measured.

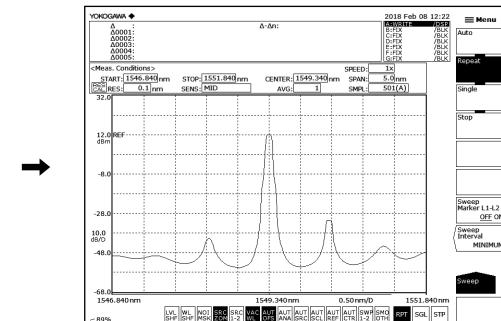
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SWEEP**. A function menu appears for sweeping.
3. Tap **Auto**. The key is highlighted, and auto measurement is executed.



Example of displayed waveform



Screen immediately after auto sweep starts



Screen after auto sweep is completed

### Explanation

The wavelength range of input light that auto measurement can perform on is 1200 to 1650 nm. The following four items are automatically set to make measurements.

- Center wavelength (CENTER)
- Sweep span (SPAN)
- Reference level (REF LEVEL)
- Resolution (RESOLUTION)

Other measurement conditions (sensitivity, average times, sampling points, and interval settings) are set to the default values. The spectrum waveform is displayed with the horizontal scale and vertical scale adjusted appropriately.

An auto sweep is performed once to set the optimal measurement conditions, and then measurements are made using repeat sweep.

During auto configuration, only the REPEAT, SINGLE, STOP, and UNDO/LOCAL (when in remote mode) keys are enabled.

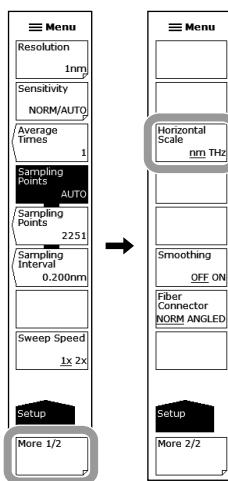
## 3.2 Setting the Horizontal and Vertical Scales

### Procedure

#### Setting the Horizontal Scale

##### Setting the Horizontal Scale Unit to Wavelength or Frequency

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SETUP**. A function menu appears for setting measurement conditions.
3. Tap **More 1/2**.
4. Tap **Horizontal Scale nm/THz**. Each time you tap, the horizontal scale unit is changed between THz and nm.



##### Note

The displayed marker values and analysis results also change between wavelength and frequency in sync with the horizontal scale setting.

#### Setting the Measured Wavelength to Wavelength in Air or Wavelength in Vacuum

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**. A function menu appears for setting measurement conditions.
3. Tap **Medium AIR VACUUM**. A confirmation message appears.
4. Tap **YES**. To cancel the setting tap **NO**.

##### Note

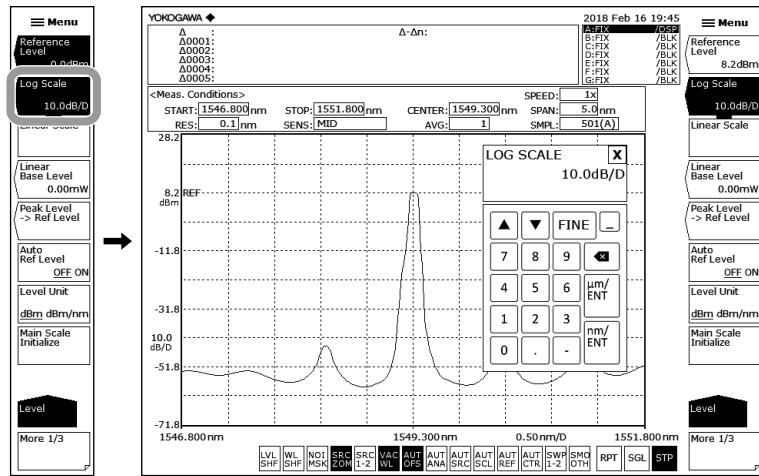
- This function takes effect when a measurement is executed after the setting is changed. It is not applied to the waveform that has already been measured.
- The shortcut key **AIR WL** (displayed during AIR mode) and the shortcut key **VAC WL** (displayed during VAC mode) only display the setting status. You cannot change the setting from this display area.

### 3.2 Setting the Horizontal and Vertical Scales

#### Setting the Vertical Scale

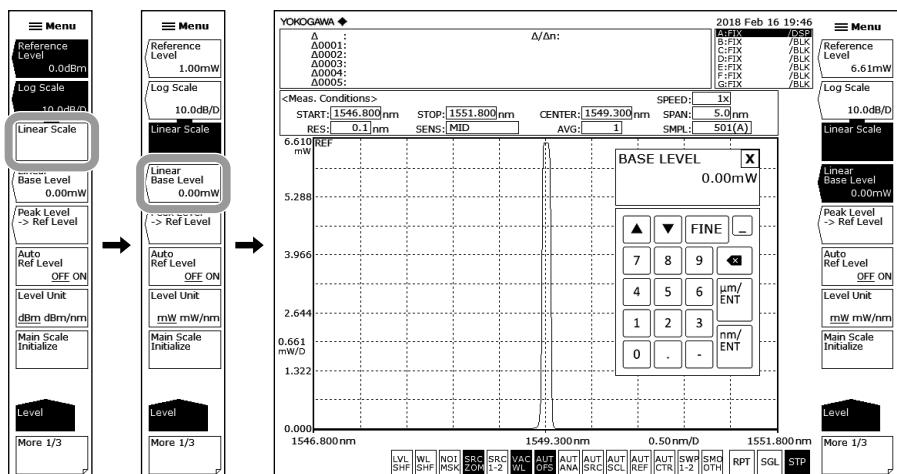
##### Changing to a Log Scale Display

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**. A function menu appears for setting the vertical scale.
3. Tap **Log Scale**. The vertical scale is displayed with the currently set log scale value. At the same time, a parameter input window appears.
4. Enter the log scale value in the parameter input window.
5. Tap **μm/ENT** or **nm/ENT**.



##### Changing to a Linear Scale Display

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**. A function menu appears for setting the vertical scale.
3. Tap **Linear Scale**. The vertical scale is displayed with the currently set linear scale value.
4. Tap **Linear Base Level**. A parameter input window appears.
5. Set the value at the bottom of the level scale in the parameter input window.
6. Tap **μm/ENT** or **nm/ENT**.



## 3.2 Setting the Horizontal and Vertical Scales

### Setting the Vertical Scale Unit

1. Tap **☰ Menu**. The Main Menu window appears.

2. Tap **LEVEL**.

3. Tap **Level Unit**.

If the vertical scale is set to log scale, each time you tap, the unit changes between dBm and dBm/nm (dBm/THz).

If the vertical scale is set to linear scale, the unit changes between nW,  $\mu$ W, mW, or pW and nW/nm (nW/THz),  $\mu$ W/nm ( $\mu$ W/THz), mW/nm (mW/THz), or pW/nm (pW/THz).

### Setting the Number of Divisions of the Vertical Scale (for Log Scale)

1. Tap **☰ Menu**. The Main Menu window appears.

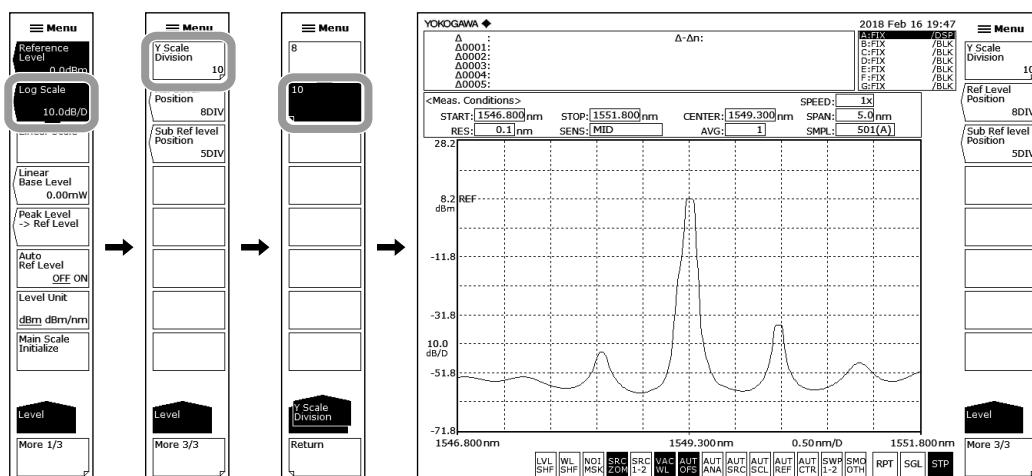
2. Tap **LEVEL**.

3. Tap **Log Scale**.

4. Tap **More** to display the More 3/3 function menu.

5. Tap **Y Scale Division**. A function menu appears for selecting the number of divisions.

6. Tap **8** or **10**. A level axis is displayed with the specified number of divisions.



### Note

- This is valid only when the main scale is set to log scale.
- For linear scale, the number of divisions is fixed at 10.

## 3.2 Setting the Horizontal and Vertical Scales

### Setting the Reference Level Position on the Screen (for Log Scale)

5. Continuing from step 4, tap **Ref Level Position**. A parameter input window appears.
6. Set the reference level position (REF position) on the screen in the parameter input window.  
Enter the number of divisions counted from the screen bottom. The input range is 0 to 10.  
The input step when entering with the arrow keys is 1 step for FINE and 1-2-5 step for COARSE.
7. If you entered with the numeric keypad, tap **μm/ENT** or **nm/ENT**.

#### **Note**

- This is valid only when the main scale is set to log scale.
- If the REF position value is greater than the number of divisions, it is reduced to the same value as the number of divisions.
- For linear scale, the REF position is fixed at the top (fixed at 10 DIV).

### Explanation

#### Wavelength Display Mode

- Measured waveforms are displayed with the horizontal scale set to wavelength.
- The measurement scale and display scale are set in terms of the wavelength.
- The horizontal scale unit of marker values and analysis results is wavelength.

#### Frequency Display Mode

- Measured waveforms are displayed with the horizontal scale set to frequency.
- The measurement scale and display scale are set in terms of the frequency.
- The horizontal scale unit of marker values and analysis results is frequency.

#### Displayed Units for Horizontal Scale and Marker Values

The unit displayed for marker values (wavelength or frequency) can be set separately from the waveform display's horizontal scale unit set with Horizontal Scale nm THz under SETUP. (Default: nm)

(For example, it is possible to set the horizontal scale to frequency display mode and marker values to wavelength display mode.)

#### **Note**

- The Marker Unit nm THz setting changes in sync with the Horizontal Scale setting, but changing the Marker Unit nm THz setting will not change the Horizontal Scale setting under SETUP.

#### Log Scale \*\*.\*dB/D

This key switches the vertical scale to LOG display. After you tap this key, set the level scale.

The setting range is 0.1 to 10.0 dB/DIV. You can set it in steps of 0.1 dB. When COARSE is selected, you can set it in steps of 1-2-5 (e.g., 1 dB/DIV → 2dB/DIV → 5dB/DIV).

When you change this setting, the displayed waveform is redrawn according to the new scale.

If you specify a scale greater than 5 dB/DIV in fixed range mode (measurement sensitivity NORM/HOLD), a warning will be displayed because the top and bottom of the waveform will not be measured correctly.

## 3.2 Setting the Horizontal and Vertical Scales

---

### Measurement Sensitivity and Effective Vertical Scale Range

If the measurement sensitivity is set to NORM/HOLD, the internal amplifier is set to fixed gain. The gain is set automatically from the five available settings depending on the reference level (REF) setting. The effective range of measurement data is limited to the following range relative to the reference (REF) level.

$$\text{REF}-20 \text{ dBm} < (\text{effective range}) < \text{REF}+10 \text{ dBm}$$

If the level scale is set to 10 dB/DIV, the display will fall outside the effective range, and thus 10 dB from the top edge of the screen and 20 dB from the bottom edge of the screen will be inaccurate.

If the measurement sensitivity is set to NORM/HOLD, we recommend that you use the level scale at 5 dB/DIV or less.

If the measurement sensitivity is NORM/AUTO, MID, or HIGH 1 or 2 (standard model (-10) only), auto gain is used allowing a wide level range to be measured in one sweep. Select the appropriate sensitivity according to the reception level necessary for measurement.

### Linear Scale

The main scale is set to linear scale.

The level per DIV varies in sync with the reference level (REF level) setting.

For setting the REF level, see section 3.4, "Setting the Reference Level."

### Linear Base Level\*\*.\*mW

When the vertical scale is set to linear scale, set the value at the low end of the level scale. This is invalid for log scale.

The setting range is 0.0 to REF level  $\times$  0.9. You can set it in steps of 0.1. When COARSE is selected, you can set it in steps of 1. The unit can only be set to the same unit set by REF level.

When you change this setting, the displayed waveform is redrawn according to the new scale.

The scale display at the upper left of the waveform is set to 1/10 of [reference (REF) level – low-end (BASE) level (\*W/D)].

For setting the REF level, see section 3.4, "Setting the Reference Level."

### Level Unit dBm dBm/nm

When the level axis is log scale, you can switch the display to dBm or dBm/nm.

dBm: Power per resolution (absolute power)

dBm/nm: Power per 1 nm (power spectral density)

For details on how to use dBm and dBm/nm, see "Power Spectral Density Display" on the next page.

If you set a calculated waveform to power spectral density, the level unit is automatically set to dBm. If power spectral density is assigned as the calculated waveform to Trace F and the unit is set to dBm/nm, Trace F enters FIX mode, and the waveform is no longer updated.

### Level Unit mW mW/nm

When the level axis is linear scale, you can switch the display between nW,  $\mu$ W, mW, or pW (absolute power), and nW/nm,  $\mu$ W/nm, mW/nm or pW/nm (power spectral density).

### Power Spectral Density Display

Power per 1 nm is called the power spectral density.

The level axis of the optical spectrum analyzer indicates the absolute power per wavelength resolution. For example, if the resolution is set to 0.100 nm, the power per 0.100 nm will be displayed.

Since the optical spectrum of such devices as a gas laser or a laser diode is narrower than the wavelength resolution of the instrument, the entire power is accommodated within the band of a resolution. Therefore, the measured power (peak level) is equal to the total power of the light source. This instrument has been calibrated to display accurate power under such conditions.

On the other hand, natural light or lights such as fluorescent lamps or LEDs, have, in many cases, optical spectrums wider than the wavelength resolution set for the instrument. Therefore, if the instrument measures these lights, measured power will vary, depending on the resolution setting.

In order to deal with this issue, the instrument has a Level Unit setting to allow the level axis displays to switch from the absolute power (dBm, mW,  $\mu$ W, nW, pW) per resolution to power spectral density (dBm/nm, mW/nm,  $\mu$ W/nm, nW/nm, pW/nm).

In the case of power spectral density displays, a measured value is converted to power per 1 nm. Therefore, whatever resolution is used for measurement, a constant measured value will always be obtained.

The trace computation function can be used to display the power spectral density in the specified bandwidth within the range of 0.1 nm to 10 nm (see section 4.8).

#### **Note**

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Specifications such as level accuracy, measurement level range, and level linearity of the instrument are provided for the absolute power display.

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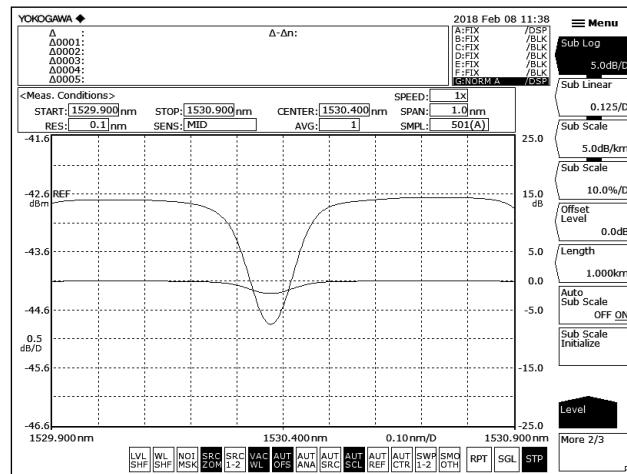
## 3.3 Sub Scale

### Procedure

The level scale is displayed based on relative values when a differential waveform (based on LOG values) or normalized waveform is displayed. A level scale based on relative values is called a sub scale.

#### Displaying a Sub Scale

Follow the procedure in section 4.5, “Displaying Calculated Waveforms,” or section 4.6, “Normalized Display” to display differential waveforms or normalized waveforms.



#### Automatically Scaling the Sub Scale

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**. A function menu appears for setting the vertical scale.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Auto Sub Scale OFF ON** to select ON.

#### Setting the Sub Scale REF Position

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**.
3. Tap **More** to display the More 3/3 function menu.
4. Tap **Sub Ref level Position**. A parameter input window appears.
5. Set the REF position in the parameter input window.

#### Note

A sub scale is displayed when differential waveforms (based on LOG values) or normalized waveforms are displayed. When these waveforms are superimposed on waveforms based on absolute values, the absolute value scale is shown on the left and the relative value scale on the right at the same time. If the left scale (main scale) is changed to LOG (8 DIV) or linear (10 DIV), the sub scale is displayed to correspond to the DIV count on the main scale.

## Setting the Sub Scale to Log Display

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**. A function menu appears for setting the vertical scale.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Sub Log**. The sub scale is displayed with the currently set log scale value. At the same time, a parameter input window appears.
5. Enter the log scale value in the parameter input window.
6. Tap **μm/ENT** or **nm/ENT**.

## Setting the Sub Scale Unit to dB/km

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**.
3. Tap **More** to display the More 2/3 function menu.
4. Continuing from step 6, tap **Sub Scale \*\*.\*dB/km**. The sub scale unit changes to dB/km. At the same time, a parameter input window appears.
5. Enter the log scale value in the parameter input window.
6. Tap **μm/ENT** or **nm/ENT**.

When displaying the loss characteristics of the optical fiber per unit of length (km)

7. Continuing from step 6, tap **Length**.
8. Enter the optical fiber length in the parameter input window.
9. Tap **μm/ENT** or **nm/ENT**.

## Setting the Sub Scale Offset Value

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Offset Level**. A parameter input window appears.
5. Enter the offset value (sub scale REF value) in the parameter input window.
6. Tap **μm/ENT** or **nm/ENT**.

#### Setting the Sub Scale to Linear Display

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**. A function menu appears for setting the vertical scale.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Sub Linear**. The sub scale is displayed with the currently set linear scale value. At the same time, a parameter input window appears.
5. Enter the linear scale value in the parameter input window.
6. Tap **µm/ENT** or **nm/ENT**.

#### Setting the Sub Scale Unit to %/D

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Sub Scale \*\*\*.\*%/D**. The sub scale unit changes to %. At the same time, a parameter input window appears.
5. Enter the percentage in the parameter input window.
6. Tap **µm/ENT** or **nm/ENT**.

#### Setting the Sub Scale Low-End Value

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Scale Minimum**. A parameter input window appears.
5. Enter the sub scale low-end value in the parameter input window.
6. Tap **µm/ENT** or **nm/ENT**.

### Explanation

#### Sub Scale \*\*.\*dB/km

##### (Sets the sub scale to dB/km.)

The setting range is 0.1 to 10.0 dB/km. You can set it in steps of 0.1. When COARSE is selected, you can set it in steps of 1-2-5 (e.g., 1 dB/DIV → 2dB/DIV → 5dB/DIV).

When you change this setting, the displayed waveform is redrawn according to the new scale.

#### Sub Scale \*\*\*.\*%/D

##### (Sets the sub scale to %.)

The setting range is 0.5 to 125%/D. You can set it in steps of 0.1. When COARSE is selected, you can set it in steps of 1-2-5.

When you change this setting, the displayed waveform is redrawn according to the new scale.

### 3.3 Sub Scale

#### Offset Level

(Sets the offset value. This is valid when the sub scale is dB/D or dB/km.)

The setting range is as follows:)

dB/D:	0 to $\pm 99.9$ dB. You can set it in steps of 0.1. When COARSE is selected, you can set it in steps of 1.
dB/km:	0 to $\pm 99.9$ dB/km. You can set it in steps of 0.1.

#### Scale Minimum

(Sets the low-end value of the scale.) This is valid when the sub scale is LIN or %.

The setting range is as follows:)

LIN:	0 to sub scale value ( $***.*/D$ ) $\times 10$
%:	0 to sub scale value ( $***.*%/D$ ) $\times 10$

#### Length $**.***$ km

(Sets the optical fiber length. This is valid when the sub scale is dB/km.)

The setting range is 0.001 to 99.999 km. You can set it in steps of 0.001. When COARSE is selected, you can set it in steps of 1-2-5.

#### Auto Sub Scale OFF/ON

(Turns on or off the function that displays the sub scale through auto scaling after calculations.)

When this key is set to on and trace C is displayed, SUB LOG or SUB LIN and OFFSET LEVEL change automatically. When these are changed, the displayed waveform is redrawn according to the new scale.

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

#### Sub Ref level Position $**$ DIV

(Sets the sub scale REF position.)

You can set the REF position at the specified division counted from the bottom of the screen.

The setting range is 0 to 10. You can set it in steps of 1. When COARSE is selected, you can set it in steps of 1-2-5.

#### Sub Scale Initialize

This function returns the vertical scale (sub scale) to its original condition after the waveform is moved or zoomed through dragging or pinching out or pinching in. The original scale value, offset value, or low-end value specified on the function menu is stored. This is not synchronized to the main scale display.

You can also tap **Y-Init** on the operation tool window to return to the original condition.

For details, see chapter 3, "Common Operations" in IM AQ6360-02EN.

## 3.4 Setting the Reference Level

### Procedure

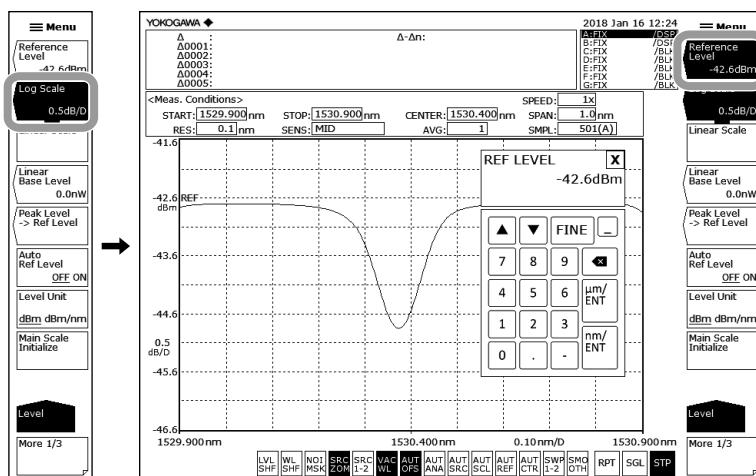
There are two methods to set the reference level.

- Using the Reference Level parameter
- Using the one-action keys

The procedure for each method is explained below.

#### Using the Reference Level Parameter (log scale)

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**. A function menu appears for setting the vertical scale.
3. If the vertical scale is not set to log scale, tap **Log Scale**. If the log scale is displayed, proceed to step 4.
4. Tap **Reference Level**. A parameter input window appears.
5. Enter the reference level in the parameter input window.
6. Tap **μm/ENT** or **nm/ENT**.

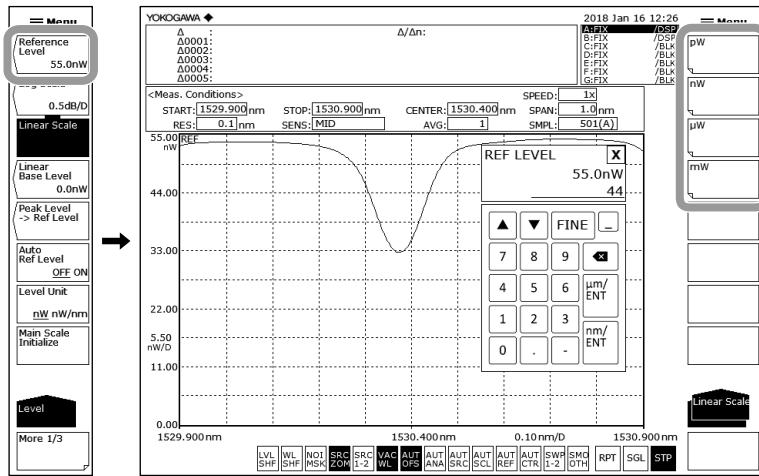


#### Note

The vertical scale setting is applied to the waveform display in real-time.

## Using the Reference Level Parameter (linear scale)

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**. A function menu appears for setting the vertical scale.
3. If the vertical scale is not set to linear scale, tap **Linear Scale**. If the linear scale is displayed, proceed to step 4.
4. Tap **Reference Level**. A parameter input window appears.
5. Enter the reference level in the parameter input window. When you enter a value, a function menu appears for selecting the unit.
6. Tap the unit you want to use. The reference level is set.



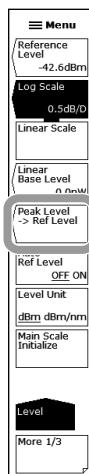
### Note

If you enter the value using the arrow keys of the parameter input window, the reference level is set with the current unit.

## Using the One-Action Keys

### Setting the Reference Level to the Peak Level of the Waveform

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **LEVEL**.
3. Tap **Peak Level → Ref Level**. The specified reference level is displayed, and the displayed waveform is redrawn according to the new reference level.



### 3.4 Setting the Reference Level

#### Setting the Reference Level to the Peak Level Automatically Based on the Measured Waveform for Each Sweep

- Continuing from step 2, tap **Auto Ref Level OFF/ON** to select ON.

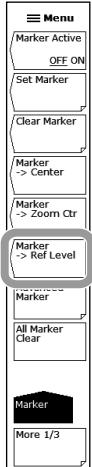
##### Note

- The reference level is set to the peak level of the active trace measurement waveform.
- This does not work when the active trace is set to a type other than WRITE (MAX HOLD, MIN HOLD, CALCULATE, ROLL AVG).
- You can also set the parameter by tapping the **AUT REF** shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

#### Setting the Reference Level to the Moving Marker Level

- Tap **☰ Menu**. The Main Menu window appears.
- Tap **MARKER**.
- With the moving marker displayed, tap **Marker → Ref Level**. The specified reference level is displayed, and the displayed waveform is redrawn according to the new reference level.

For details on displaying the moving marker, see section 4.9, "Marker Display."



### Explanation

#### Log Scale (Reference Level)

The setting range for the log scale reference level is -90.0 to 30.0 dBm. You can set it in steps of 0.1. When COARSE is selected, you can set it in steps of 1.

#### Linear Scale (Reference Level)

The reference level setting range for the linear scale is 1.00 pW to 1000 mW. For 1.00 to 9.99 (pW, nW,  $\mu$ W, mW), you can set the value in steps of 0.01. For 10.0 to 99.9 (pW, nW,  $\mu$ W, mW), you can set the value in steps of 0.1. For 100 to 999 (pW, nW,  $\mu$ W, mW), you can set the value in steps of 1. When COARSE is selected, you can set it in steps of 1-2-5 (e.g., 1pW → 2pW → 5pW → 10pW → 20pW). If you change from 999 to 1.00 or 1.00 to 999, the unit will be changed (e.g., pW → nW or nW → pW).

## One-Action Keys

This is the general term for the keys that use data from the active trace waveform (the currently displayed waveform) to set measurement conditions.

To use them, a waveform must be displayed in the active trace.

### Peak Level → Ref Level

The reference level is set to the peak level of the active trace waveform.

The specified reference level (peak level value) and waveform are displayed in the reference level setting screen. The reference level setting can be changed after being set initially.

The setting can be changed within the range of -90.0 to +30.0 dBm for log scale or 1.00 pW to 1000 mW for linear scale.

If the peak level value exceeds the allowed range, it is set to the nearest value within the range and a warning is displayed.

### Marker → Ref Level

The reference level is set to the level of the moving marker placed on the measured waveform.

The specified reference level and waveform are displayed in the reference level setting screen.

The reference level setting can be changed after being set initially.

The setting can be changed within the range of -90.0 to +30.0 dBm for log scale or 1.00 pW to 1000 mW for linear scale.

If the moving marker value exceeds the allowed range (the moving marker is at a point where the level is -210 dBm), it is set to the nearest value within the range and a warning is displayed.

In the following states, the MARKER → REF LEVEL key is disabled.

- When the moving marker is off (Marker Active is OFF)
- When both split screens are on hold (Upper Hold and Lower Hold are ON)

## Main Scale Initialize

This function returns the vertical scale (main scale) to its original condition after the waveform is moved or zoomed through dragging or pinching out or pinching in. The original scale value or low-end value specified on the function menu is stored. This is not synchronized to the sub scale display.

You can also tap **Y-Init** on the operation tool window to return to the original condition.

For details, see chapter 3, “Common Operations” in IM AQ6360-02EN.

## 3.5 Setting the Center Wavelength (Center Frequency)

### Procedure

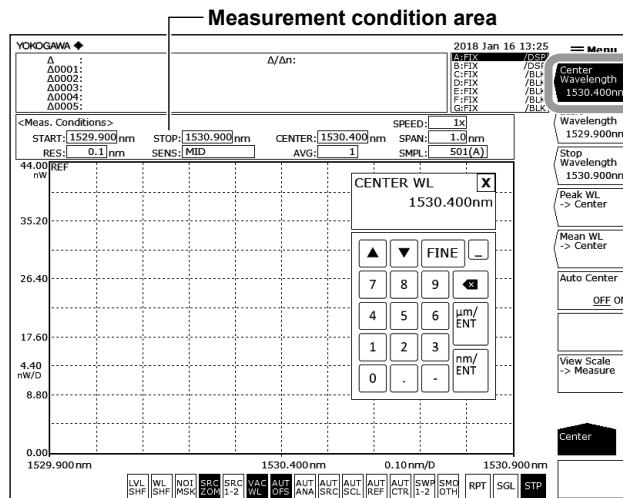
There are three methods to set the center wavelength (center frequency).

- Using the Center Wavelength or Center Frequency parameter
- Using the Start Wavelength and Stop Wavelength parameters of Start Frequency and Stop Frequency parameters
- Using the one-action keys

The procedure for each method is explained below.

#### Using the Center Wavelength or Center Frequency Parameter

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **CENTER**. A function menu appears for setting the center wavelength or center frequency.
3. For wavelength measurement, tap **Center Wavelength**. For frequency measurement, tap **Center Frequency**. A parameter input window appears.
4. Enter the center wavelength or center frequency in the parameter input window.
5. Tap **nm/ENT**.



#### Note

- There is no need to tap nm/ENT when using arrow keys to enter the value.
- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.
- When a setting is changed, **NEW** appears in the measurement conditions area.
- If you enter a value outside the setting range, the nearest permitted value is assigned.

For instructions on switching the wavelength and frequency displays, see section 3.2.

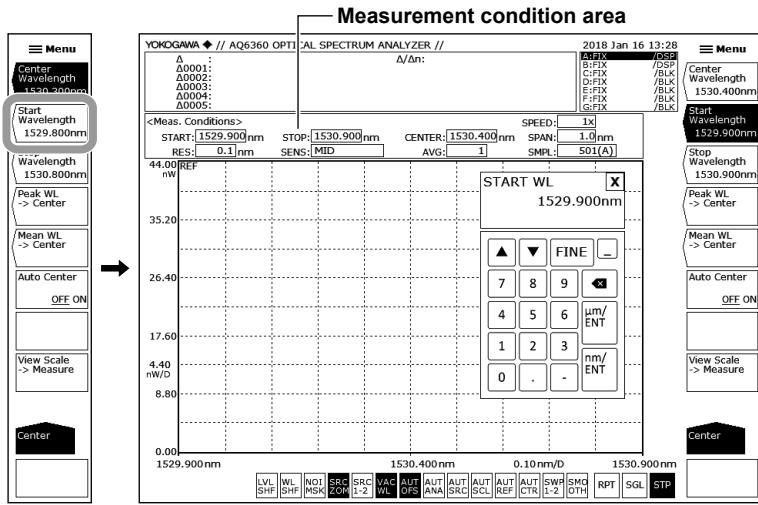
### 3.5 Setting the Center Wavelength (Center Frequency)

## Using the Start Wavelength and Stop Wavelength Parameters of Start Frequency and Stop Frequency Parameters

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **CENTER**. A function menu appears for setting the center wavelength or center frequency.

### Setting the Start Wavelength or Start Frequency

3. For wavelength measurement, tap **Start Wavelength**. For frequency measurement, tap **Start Frequency**. A parameter input window appears.
4. Enter the start wavelength or start frequency in the parameter input window.
5. Tap **nm/ENT**.



### Setting the Stop Wavelength or Stop Frequency

6. For wavelength measurement, tap **Stop Wavelength**. For frequency measurement, tap **Stop Frequency**. A parameter input window appears.
7. Enter the stop wavelength or stop frequency in the parameter input window.
8. Tap **nm/ENT**.

#### Note

- There is no need to tap **nm/ENT** when using arrow keys to enter the value.
- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.
- When a setting is changed, **NEW** appears in the measurement conditions area.
- If you enter a value outside the setting range, the nearest permitted value is assigned.

For instructions on switching the wavelength and frequency displays, see section 3.2.

### 3.5 Setting the Center Wavelength (Center Frequency)

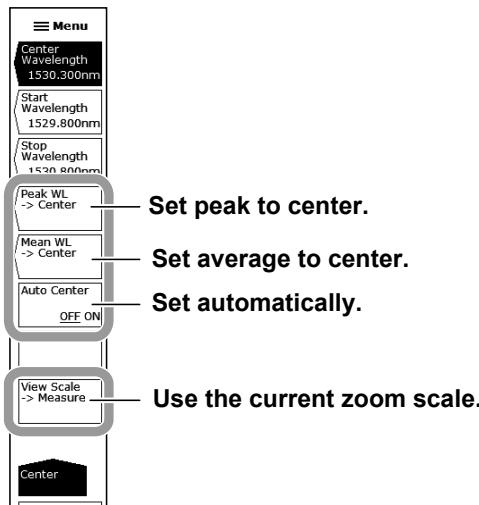
#### Using the One-Action Keys

Tap one of the one-action keys in the function menu. These one-action keys appear after you tap **CENTER**.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **CENTER**.
3. To use a peak wavelength or peak frequency to set the center wavelength, tap **Peak WL → Center**. To use the RMS 20 dB center wavelength or center frequency, tap **Mean WL → Center**. To use the currently displayed zoom scale, tap **View Scale → Measure**. The specified center wavelength or center frequency is displayed, and the displayed waveform is redrawn according to the new center wavelength.

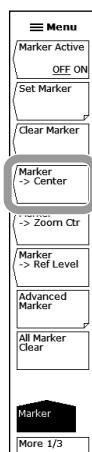
#### Automatically Setting the Center Wavelength or Center Frequency to the Peak Wavelength or Peak Frequency of the Active Trace Measurement Waveform for Each Sweep

3. Continuing from step 2, tap **Auto Center OFF/ON** to select ON.



#### Setting the Center Wavelength or Center Frequency to the Moving Marker Wavelength or Frequency

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**.
3. With the moving marker displayed, tap **Marker → Center**. The specified center wavelength or center frequency is displayed, and the displayed waveform is redrawn according to the new center wavelength or center frequency.  
For details on displaying the moving marker, see section 4.9, "Marker Display."



**Explanation****Center Wavelength**

The setting range is 1200.000 to 1650.000 nm.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1 nm. When FINE is selected, the value changes in steps of 0.1 nm.

**Start Wavelength**

The setting range is 975.000 to 1650.000 nm.

**Stop Wavelength**

The setting range is 1200.000 to 1875.000 nm.

**Note**

- When you set the start wavelength or stop wavelength, the sweep span will change because the other wavelength is fixed. The center wavelength will also change.
- Changing the center wavelength does not change the sweep span.

**Auto Center OFF / ON**

This key sets whether the Peak WL → Center function will be applied for each sweep.

When this key is set to ON, the peak is automatically searched in the active trace waveform and assigned to the center wavelength for each sweep.

The active trace must be set to WRITE.

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

**One-Action Keys**

This is the general term for the keys that use data from the active trace waveform (the currently displayed waveform) to set measurement conditions.

To use them, a waveform must be displayed in the active trace.

**Peak WL → Center**

The center wavelength is set to the wavelength at the peak value of the active trace waveform.

When executed, the specified center wavelength is displayed in the center wavelength setting screen. The center wavelength can be changed after the setting is made initially.

**Mean WL → Center**

The center wavelength is set to the average (RMS 20 dB center wavelength) of the spectrum in the range from the peak of the active trace waveform down to the threshold (20 dB). The center wavelength can be changed after the setting is made initially.

**View Scale → Measure**

The measurement scale (CENTER, START, STOP, SPAN) is set to the currently set zoom scale (ZOOM CENTER, ZOOM SPAN, ZOOM START, ZOOM STOP).

When you tap this key, the measurement scale of the next sweep is set to the current waveform display scale.

### 3.5 Setting the Center Wavelength (Center Frequency)

---

#### Center Frequency

The setting range is 181.5000 to 250.0000 THz.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 0.1 THz. When FINE is selected, the value changes in steps of 0.01 THz.

#### Start Frequency

The setting range is 147.2500 to 250.0000 THz.

#### Stop Frequency

The setting range is 181.5000 to 284.2500 THz.

#### Note

---

- When you set the start frequency or stop frequency, the sweep span will change because the other frequency is fixed. The center frequency will also change.
- Changing the center frequency does not change the sweep span.

---

#### Auto Center OFF / ON

This key sets whether the Peak WL → Center function will be applied for each sweep.

When this key is set to ON, the peak is automatically searched in the active trace waveform and assigned to the center frequency for each sweep.

The active trace must be set to WRITE.

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

#### One-Action Keys

Like the wavelength, you can use one-action keys to set the center frequency.

##### Peak WL → Center

The center frequency is set to the frequency at the peak value of the active trace waveform.

When executed, the specified center frequency is displayed in the center frequency setting screen. The center frequency can be changed after the setting is made initially.

##### Mean WL → Center

The center frequency is set to the average (RMS 20 dB center frequency) of the spectrum in the range from the peak of the active trace waveform down to the threshold (20 dB). The center frequency can be changed after the setting is made initially.

##### View Scale → Measure

The measurement scale (CENTER, START, STOP, SPAN) is set to the currently set zoom scale (ZOOM CENTER, ZOOM SPAN, ZOOM START, ZOOM STOP).

When you tap this key, the measurement scale of the next sweep is set to the current waveform display scale.

## 3.6 Setting the Sweep Span

### Procedure

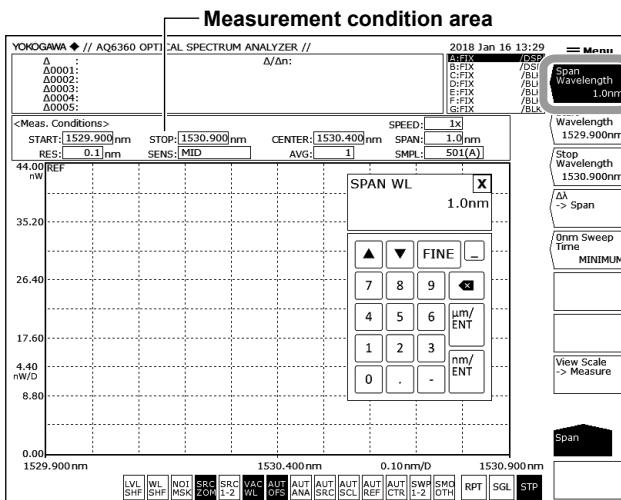
There are two methods to set the sweep span (span).

- Using the Span Wavelength or Span Frequency parameter
- Using the Start Wavelength and Stop Wavelength parameters of Start Frequency and Stop Frequency parameters
- Using the one-action keys

The procedure for each method is explained below.

### Using the Span Wavelength or Span Frequency Parameter

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SPAN**. A function menu appears for setting the sweep span.
3. For wavelength measurement, tap **Span Wavelength**. For frequency measurement, tap **Span Frequency**. A parameter input window appears.
4. Enter the sweep span in the parameter input window.
5. Tap **nm/ENT**.



### Note

- There is no need to tap nm/ENT when using arrow keys to enter the value.
- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.
- When a setting is changed, **NEW** appears in the measurement conditions area.
- If you enter a value outside the setting range, the nearest permitted value is assigned.

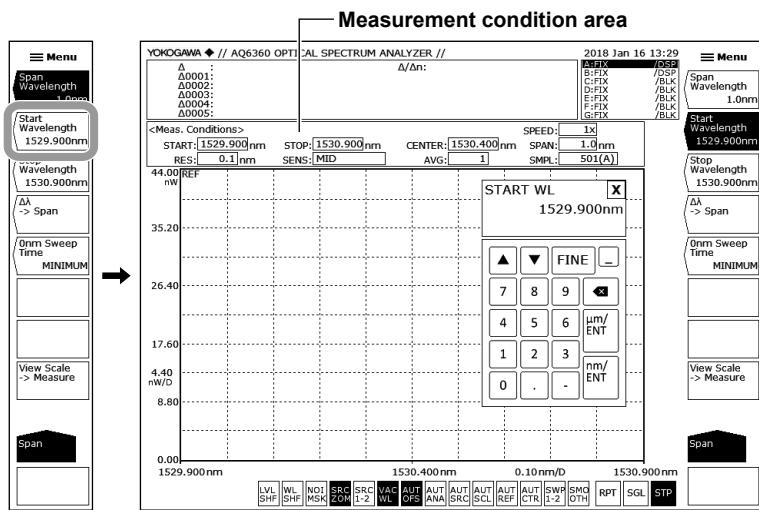
For instructions on switching the wavelength and frequency displays, see section 3.2.

## Using the Start Wavelength and Stop Wavelength Parameters of Start Frequency and Stop Frequency Parameters

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SPAN**. A function menu appears for setting the sweep span.

### Setting the Start Wavelength or Start Frequency

3. For wavelength measurement, tap **Start Wavelength**. For frequency measurement, tap **Start Frequency**. A parameter input window appears.
4. Enter the start wavelength or start frequency in the parameter input window.
5. Tap **nm/ENT**.



### Setting the Stop Wavelength or Stop Frequency

6. For wavelength measurement, tap **Stop Wavelength**. For frequency measurement, tap **Stop Frequency**. A parameter input window appears.
7. Enter the stop wavelength or stop frequency in the parameter input window.
8. Tap **nm/ENT**.

#### Note

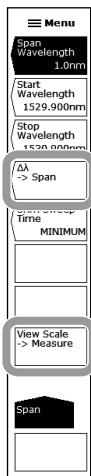
- There is no need to tap **nm/ENT** when using arrow keys to enter the value.
- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.
- When a setting is changed, **[NEW]** appears in the measurement conditions area.
- If you enter a value outside the setting range, the nearest permitted value is assigned.

For instructions on switching the wavelength and frequency displays, see section 3.2.

## Using the One-Action Keys

### Setting the Sweep Span Based on the Measured Waveform

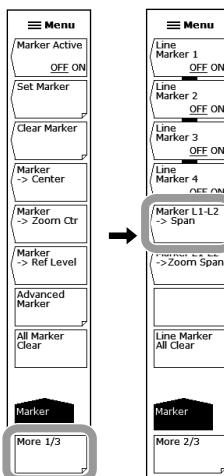
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SPAN**.
3. To set the sweep span to RMS 20 dB width × 6, tap  $\Delta\lambda \rightarrow$  **Span**. To set it to the currently displayed zoom scale, tap **View Scale → Measure**.



### Setting the Sweep Span to the Span between Line Markers 1 and 2

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the marker.
3. Tap **More** to display the More 2/3 function menu.
4. With line markers 1 and 2 displayed, tap **Marker L1-L2 → Span**. The sweep span is set to the span between line markers 1 and 2.

For instructions on displaying line markers, see section 4.9.



#### Note

- If only line marker L1 is displayed, the measurement stop wavelength is set to the wavelength at the right edge of the screen. If only line marker L2 is displayed, the measurement start wavelength is set to the wavelength at the left edge of the screen.
- Marker L1-L2 → Span cannot be used under the following conditions.
  - When both L1 and L2 are off.
  - When both split screens are on hold.
  - When the span of the active trace is 0 nm.

#### Explanation

##### **Wavelength Sweep Span**

The setting range is 0, and 0.1 to 450.0 nm.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1-2-5. When FINE is selected, the value changes in steps of 1 nm.

##### **Start Wavelength**

The setting range is 975.000 to 1650.000 nm.

When COARSE is selected, the value changes in steps of 1 nm. When FINE is selected, the value changes in steps of 0.1 nm.

##### **Stop Wavelength**

The setting range is 1200.000 to 1875.000 nm.

When COARSE is selected, the value changes in steps of 1 nm. When FINE is selected, the value changes in steps of 0.1 nm.

#### **Note**

- When you change the sweep span, the start wavelength and stop wavelength will change. The center wavelength or center frequency will not change.
- When you change the center wavelength, the start wavelength and stop wavelength will change. The sweep span will not change.
- When you set the start wavelength or stop wavelength, the sweep span will change because the other wavelength is fixed. The center wavelength will also change.

---

#### **One-Action Keys**

This is the general term for the keys that use data from the active trace waveform (the currently displayed waveform) to set measurement conditions.

To use them, a waveform must be displayed in the active trace.

##### **$\Delta\lambda$ → Span**

The sweep span is set to six times the spectral width based on the RMS method (20 dB threshold) of the active trace waveform.

##### **View Scale → Measure**

See the explanation in section 3.5, "Setting the Center Wavelength (Center Frequency)."

##### **Marker L1-L2 → Span**

The sweep span is set to the span between line markers 1 and 2.

#### **Frequency Sweep Span**

The setting range is 0 and 0.01 to 68.50 THz.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1-2-5. When FINE is selected, the value changes in steps of 0.1 THz.

##### **Start Frequency**

The setting range is 147.2500 to 250.000 THz.

When COARSE is selected, the value changes in steps of 0.1 THz. When FINE is selected, the value changes in steps of 0.01 THz.

##### **Stop Frequency**

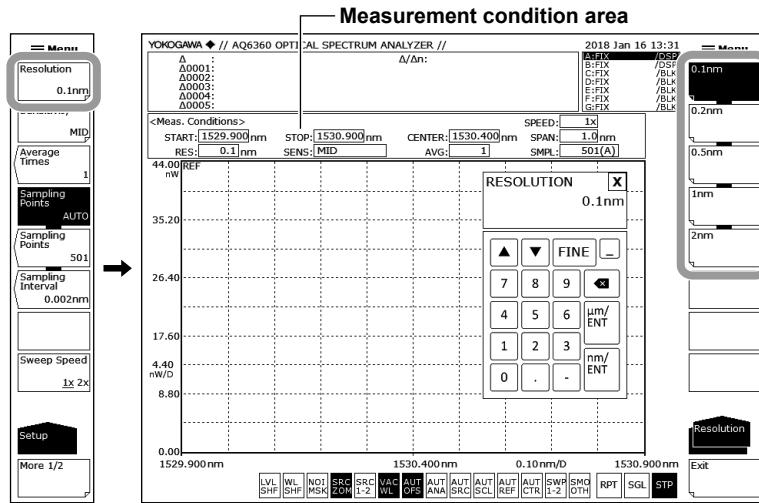
The setting range is 181.5000 to 284.2500 THz.

When COARSE is selected, the value changes in steps of 0.1 THz. When FINE is selected, the value changes in steps of 0.01 THz.

## 3.7 Setting the Wavelength (Frequency) Resolution

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SETUP**. A function menu appears for setting measurement conditions.
3. Tap **Resolution**. The function menu shows the available resolutions.
4. Tap the resolution you want to use. The screen returns to the previous level, the Resolution key shows the assigned value.



### Note

- If you enter a value in the parameter input window that appears when you tap Resolution, the nearest permitted resolution is assigned.
- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.
- If the span, sampling points, or resolution setting is inappropriate, **UNCAL** is displayed.

### What to Do When “UNCAL” Is Displayed

Perform any of the following:

- Decrease the span.
- Increase the sampling points.
- Lower the resolution (increase the value).
- Set Sampling Points under SETUP to AUTO.

When the span, sampling points, and resolution settings become appropriate, the **UNCAL** disappears.

**Explanation**

**Conditions That Cause “UNCAL” to Be Displayed**



is displayed when you start a single sweep or repeat sweep if the following relationship between the span, resolution, and sampling points is true.

$$\frac{\text{Span}}{\text{Setting resolution}} \times 5 > \text{specified sampling points} - 1$$

**Ripples in the 1350 to 1450 nm Area**

Water (OH-) ions present in the monochromator absorb light in the 1350 to 1450 nm area, resulting in ripples in the measurement waveform. The amount of ripples can be reduced by setting a coarser resolution or using the instrument in a low-humidity environment.

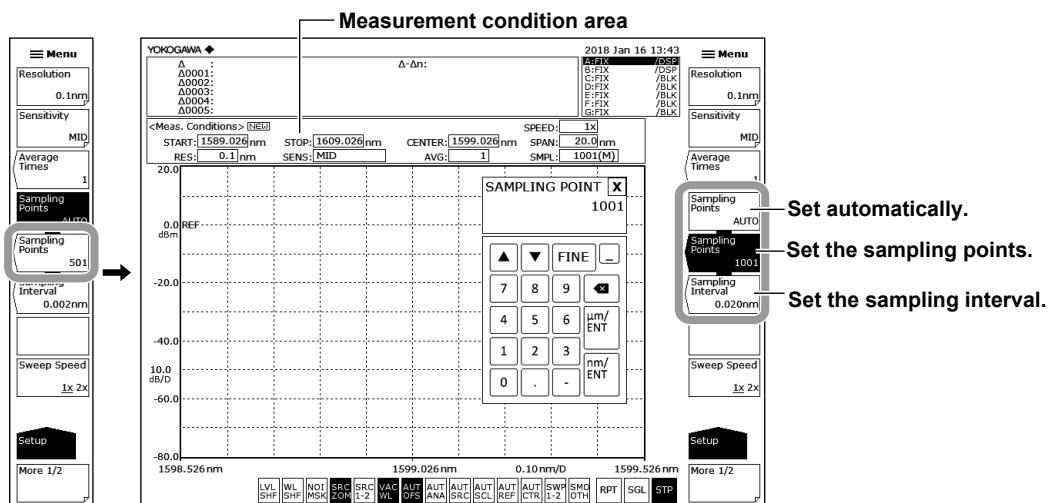
## 3.8 Setting the Sampling Points and Interval

### Procedure

There are three methods to set the sampling points.

- Setting the sampling points directly
- Setting the sampling interval
- Automatically setting the optimum sampling points or interval according to the sweep span (span) and resolution setting

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SETUP**. A function menu appears for setting measurement conditions.
3. To set the sampling points, tap **Sampling Points**. To set the sampling interval, tap **Sampling Interval**. A parameter input window appears.
4. To automatically set the sampling points and interval according to the span and wavelength (frequency) resolution settings, tap **Sampling Points AUTO**.
5. Tap **μm/ENT** or **nm/ENT**. The sampling points or interval will be set.



### Note

- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.
- If the span, sampling points, or resolution setting is inappropriate, **UN CAL** is displayed.
- For instructions on what to do when **UN CAL** is displayed, see section 3.7, "Setting the Wavelength (Frequency) Resolution."

#### Explanation

##### **Sampling Points (the number of points measured in a single sweep)**

Sampling points are the number of points measured within the range of the specified span.

The setting range is 101 to 50001.

##### **Relationship between Sampling Points, Interval, and Span**

The relationship between sampling points, interval, and span is as follows:

$$\text{Sampling points} = \frac{\text{Span}}{\text{Interval}} + 1$$

Given the same span, the sampling points are automatically determined when the interval is known, and vice versa.

For the span setting range, see the explanation in section 3.6, "Setting the Sweep Span."

#### **Note**

- Increasing the sampling points or decreasing the sampling interval reduces the sweeping speed.
- Settings that would cause the number of samples in the sweep range to be extremely small cannot be specified.
- Changing the sampling points also changes the sampling interval accordingly.

##### **Relationship between the Interval and Wavelength (Frequency) Resolution**

If settings are entered such that the sampling interval determined by the span and sampling points settings is extremely long relative to the wavelength (frequency) resolution, data dropout may occur. In such a situation, **UNCAL** is displayed as described below. Enter settings that are appropriate for the resolution.

##### **Conditions That Cause "UNCAL" to Be Displayed**

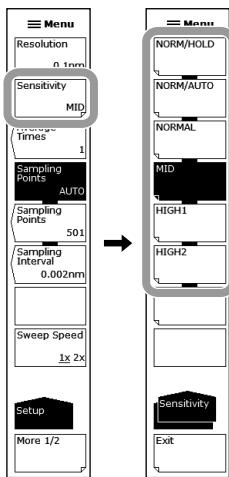
**UNCAL** is displayed when you start a single sweep or repeat sweep if the following relationship between the span, resolution, and sampling points is true.

$$\frac{\text{Span}}{\text{Setting resolution}} \times 5 > \text{specified sampling points} - 1$$

## 3.9 Setting the Sensitivity

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SETUP**. A function menu appears for setting measurement conditions.
3. Tap **Sensitivity**. The function menu shows the available six sensitivity options.
4. Tap the option you want to use. The screen returns to the previous level, the **Sensitivity** key shows the assigned value.



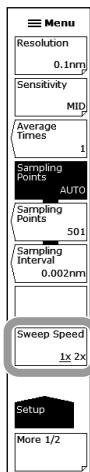
### Note

- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.
- HIGH 1 and HIGH 2 are available only on the standard model (-10).

## 3.10 Setting the Sweep Speed

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SETUP**. A function menu appears for setting measurement conditions.
3. Tap **Sweep Speed**. The value switches between 1x and 2x each time you tap.



### Explanation

#### Sweep Speed

Sets the sweep speed.

1x This is the instrument's standard sweep speed.

2x Select this value to set the sweep speed to approximately twice the speed of the 1x value.

Measurements using this value have the following characteristics.

- If you select this value when "UNCAL" is displayed, for waveforms that have sharp spectrum shape changes, such as those produced by the DFB-LD, the level and wavelength measurement accuracies may be lower than those when you select 1x. First check the measurement spectrum, and then select this value if appropriate.
- The noise level is approximately 2 dB higher than that when you select 1x.

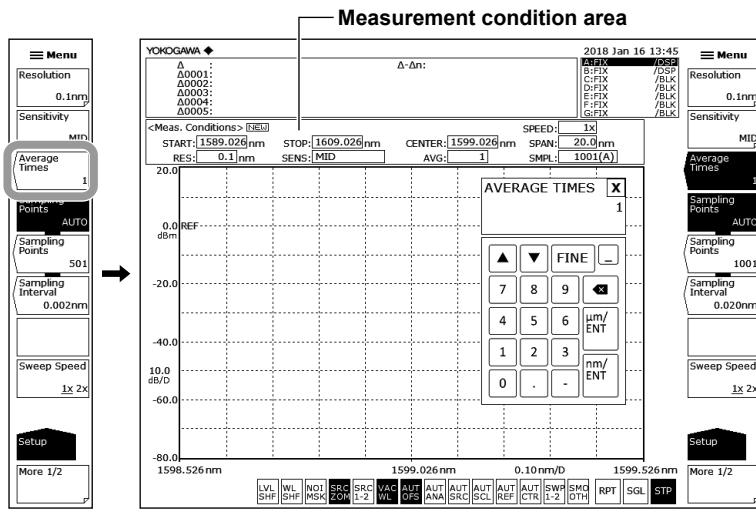
#### Note

The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.

## 3.11 Setting the Average Times

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SETUP**. A function menu appears for setting measurement conditions.
3. Tap **Average Times**. A parameter input window appears.
4. Enter the average times in the parameter input window.
5. Tap **μm/ENT** or **nm/ENT**. The Average Times shows the assigned value.



### Note

Increasing the averaging times reduces the sweeping speed but the S/N improves.

### Explanation

#### Averaging

Averaging is a function that makes multiple measurements at each measurement point and shows the average values.

You can use this function when it is difficult to make accurate measurements due to unstable waveforms such as when the light source level is fluctuating or when measuring a modulated signal of several kHz or less. You can also use this function when even higher measurement sensitivity is required.

#### Average Times

This key is used to set the average times for each point.

The setting range is 1 to 999.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1-2-5. When FINE is selected, the value changes in steps of 1.

### Note

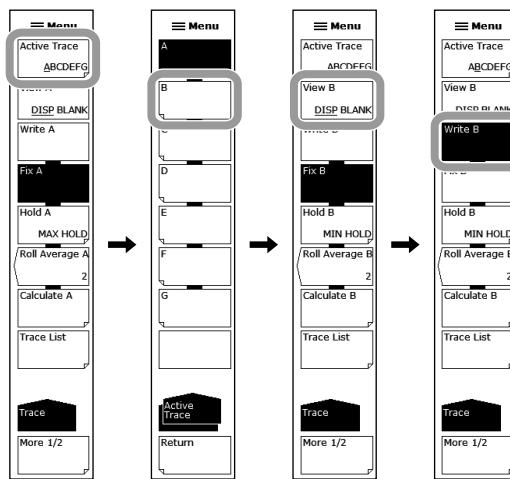
- When the sweep speed is set to 2x, averaging is not performed. The number of averaging times can be set when the sweep speed is set to 1x.
- The assigned value is applied to the measurement conditions area. You can also tap the value in the measurement condition area directly to set it.

## 3.12 Selecting Traces

### Procedure

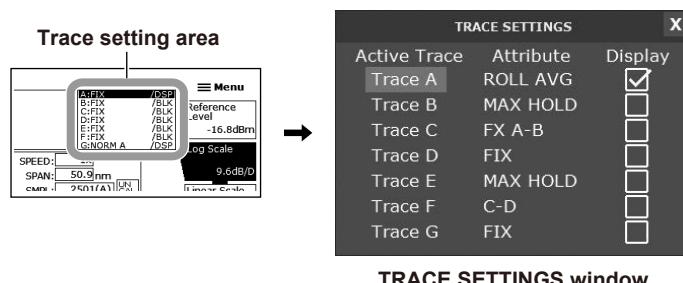
The following procedure selects a trace for writing and displaying waveform data.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for traces.
3. Tap **Active Trace**. Traces A through G are displayed in a function menu.
4. Tap the trace you want to use. The active trace is set to that trace (in the following explanation, trace B is used as an example).
5. Tap **View B** to select DISP.
6. Tap **Write B**. Trace B is set to write mode.



### Note

- Waveforms of traces for which View A to View G are set to BLANK cannot be displayed on screen.
- You can also use the TRACE SETTINGS window to select the active trace, show or hide waveforms, and select write mode or calculation mode. To show the TRACE SETTINGS window, tap the trace setting area in the upper right of the screen. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



## Explanation

### Active Trace

Active trace refers to a target trace to which settings and changes can be applied.

A trace shows a waveform and measurement conditions. The instrument has a total of seven independent traces (A through G). You can show or hide each trace or display several traces simultaneously on the waveform screen.

The function menu for setting traces is explained below.

#### Active Trace...ABCDEFG

Selects the active trace from traces A to G.

### Displaying Traces

You can select whether to display the active trace on the screen.

#### View @...DISP / BLANK

“View @ DISP”: The waveform is displayed on the screen. The trace display changes to “DSP”.

“View @ BLANK”: The waveform is not displayed on the screen. The trace display changes to “BLK”.

Each time you tap the key, the highlight toggles between “View @ DISP” and “View @ BLANK”.

Note that if BLANK is set, markers applied to the trace set in DISP will be cleared.

The ampersand (@) indicates the currently selected trace. It is set to one of the letters from A to G.

### Write mode

#### Write @

Sets the active trace to write mode.

When a trace is set to write mode, waveform data is written to it and updated during measurement. The trace display next to the data area also changes to “WRITE”.

The ampersand (@) indicates the currently selected trace. It is set to one of the letters from A to G.

### Fix mode

#### Fix @

Sets the active trace to fix mode.

When a trace is set to this mode, its waveform data do not change even when measurement is performed. As such, the waveform on the screen is not redrawn. The trace display changes to “FIX”.

If you tap **Fix** on the function menu during sweeping, the waveform display is fixed at that point.

The ampersand (@) indicates the currently selected trace. It is set to one of the letters from A to G.

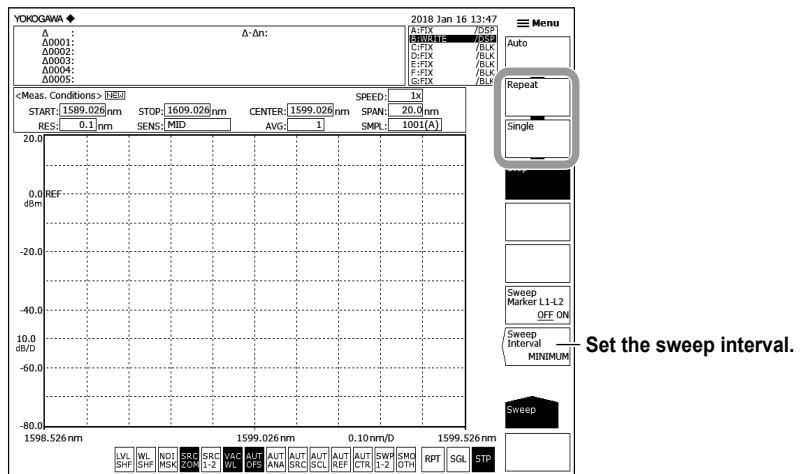
### TRACE SETTINGS Window

You can use the TRACE SETTINGS window to show or hide other traces and change the mode without changing the active trace.

## 3.13 Starting a Measurement (Sweep)

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SWEEP**. A function menu appears for sweeping.
3. Tap **Single** or **Repeat**. Sweeping will begin.
4. To set the sweep interval, tap **Sweep Interval**. A parameter input window appears.
5. Enter a value in the parameter input window, and then tap **μm/ENT** or **nm/ENT**.
6. To stop the sweep, tap **Stop**.



### Note

- You can also start or stop sweeping by tapping the **RPT** **SGL** **STP** shortcut key at the bottom of the screen.
- During a sweep, a sweep bar indicating the current sweep status is displayed below the horizontal axis.
- During a sweep, a sweep icon indicating the sweep status is displayed in the lower left of the screen. (The sweep progress from the start wavelength to the sweep wavelength is indicated as a percentage.)

### Explanation

#### Sweep Interval

This key is used to set the time from the start of one sweep to the start of the next sweep. If the time required for sweeping is greater than the specified time, the next sweeping is started immediately after the current sweeping ends.

Tapping this key shows the currently set time in the parameter input window. The setting range is MINIMUM or 1 to 99999 s. If you enter a zero with the numeric keypad, the value is set to MINIMUM.

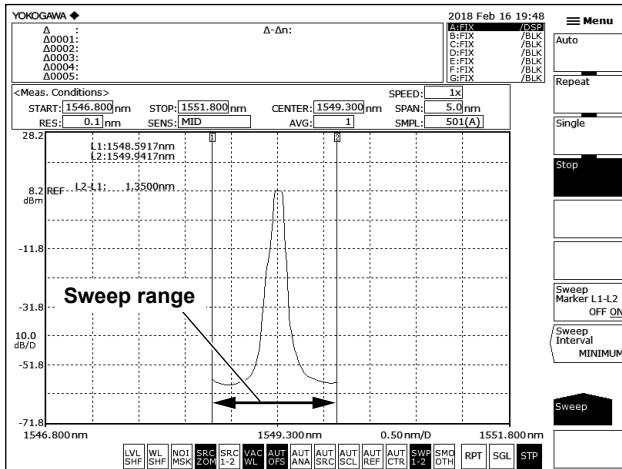
## 3.14 Specifying a Sweep Range

### Procedure

#### Sweeping between Line Markers

You can sweep between wavelength line marker 1 and wavelength line marker 2.

1. Display wavelength line marker 1 and wavelength line marker 2 at the boundaries of the range you want to sweep.  
For the procedure, see section 4.9, "Marker Display."
2. Tap **☰ Menu**. The Main Menu window appears.
3. Tap **SWEEP**. A function menu appears for sweeping.
4. Tap **Sweep Marker L1-L2 OFF/ON** to select ON.
5. Tap **Repeat** or **Single**. Sweeping between line markers will begin.
6. To cancel, tap **Sweep Marker L1-L2 OFF/ON** to select OFF. Sweeping will be performed over the entire screen.



#### Note

- If both L1 and L2 are set, sweeping is performed between line markers 1 and 2.
- If only L1 is set, sweeping is performed from line marker 1 to the right edge of the screen.
- If only L2 is set, sweeping is performed from the left edge of the screen to line marker 2.
- If neither L1 or L2 is set, sweeping is performed from the specified start wavelength to the stop wavelength.
- The Sweep Marker L1-L2 OFF/ON setting is shared with Sweep Marker L1-L2 OFF/ON of MARKER(More 3/3) on the Main Menu window.
- You can also set the parameter by tapping the **SWP** **1-2** shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

## 3.15 Pulse Light Measurement

When pulse light is input to this instrument, it is measured as a spectrum averaged over time. The average level of measured pulse light is displayed as the spectrum level. For example, if the pulse light is a perfect rectangular wave, the measured level will be (peak level of the pulse light [mW]) × (duty cycle of the pulse light).

Thus, if the duty cycle of the pulse light is small, the measured level will be small.

The measurable repetition frequency of pulse light varies depending on the measurement sensitivity. Refer to the table below. Lower repetition frequency can be measured by increasing the average times. If average times is set to n, the measurable repetition frequency is approximately 1/n for the frequencies in the table below.

### Sensitivity setting and measurable repetition frequency (when average times is 1)

Sensitivity setting	Repetition frequency
NORM/HOLD	1 MHz or higher
NORM/AUTO	1 MHz or higher
NORMAL	200 kHz or higher
MID	50 kHz or higher
HIGH1*	10 kHz or higher
HIGH2*	2 kHz or higher

\* HIGH 1 and HIGH 2 are available only on the standard model (-10).

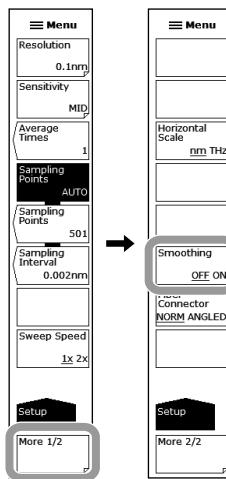
These values are not guaranteed. When measuring, use these as values as guidelines.

## 3.16 Smoothing

### Procedure

#### Setting Waveform Smoothing

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SETUP**.
3. Tap **More 1/2**.
4. Tap **Smoothing OFF ON** to select ON.



#### Note

You can also set the parameter by tapping the **SMOOTH** shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

## Explanation

### Smoothing Function

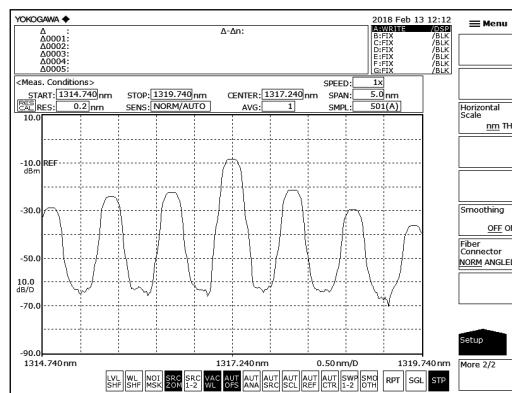
The smoothing function attenuates the noise in the measured waveform.

Using the smoothing function allows areas on the waveform with a large amount of noise to be “smoothed out” when measured. Note that when noise is superimposed on abrupt changes in the spectrum, the peaks and valleys of the spectrum are integrated thereby reducing the measurement resolution.

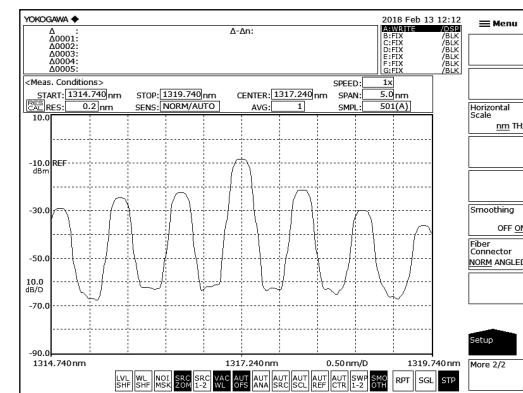
Therefore, do not leave the smoothing function turned on at all times, and use it while checking the effects on the measured spectrum.

Also, if a relatively small number of samples is set relative to the measurement span (for example, when UNCAL is displayed), smoothing may not be performed properly.

#### Waveform with smoothing turned off



#### Waveform with smoothing turned on



## 4.1 Zooming a Waveform

### Procedure

The following methods are available to zoom a waveform.

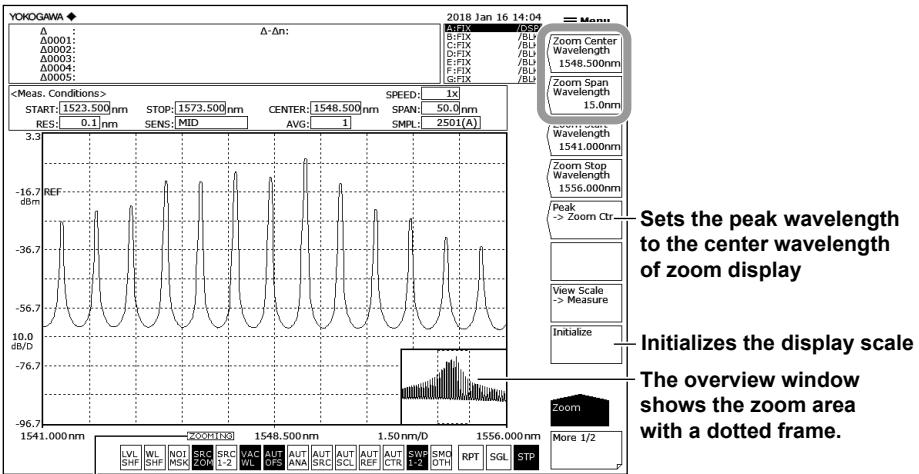
- By specifying a center wavelength and display sweep span
- By specifying start and stop wavelengths
- By specifying the range with the mouse
- Pinching out or pinching in the waveform display area

The procedure for each method is explained below.

#### By Specifying a Center Wavelength and Display Sweep Span

1. Tap **≡ Menu**. The Main Menu window appears.
2. Tap **ZOOM**. A function menu appears for setting the waveform zoom.
3. Tap **Zoom Center Wavelength**. A parameter input window appears.
4. Enter the zoom center wavelength in the parameter input window.
5. Tap **nm/ENT**.
6. Tap **Zoom Span Wavelength**. A parameter input window appears.
7. Enter the display sweep span (the range to zoom) in the parameter input window.
8. Tap **nm/ENT**.

Example of displayed waveform



After changing the display scale (zooming), **ZOOMING** is displayed

#### Note

- There is no need to tap nm/ENT when using arrow keys to enter the value.
- If you enter a value outside the setting range, the nearest permitted value is assigned.

#### Setting the Zoom Center Wavelength to the Peak Wavelength of the Displayed Waveform

3. Tap **Peak → Zoom Ctr**. The zoom center wavelength is set to the peak wavelength. Proceed to step 6 above.

## 4.1 Zooming a Waveform

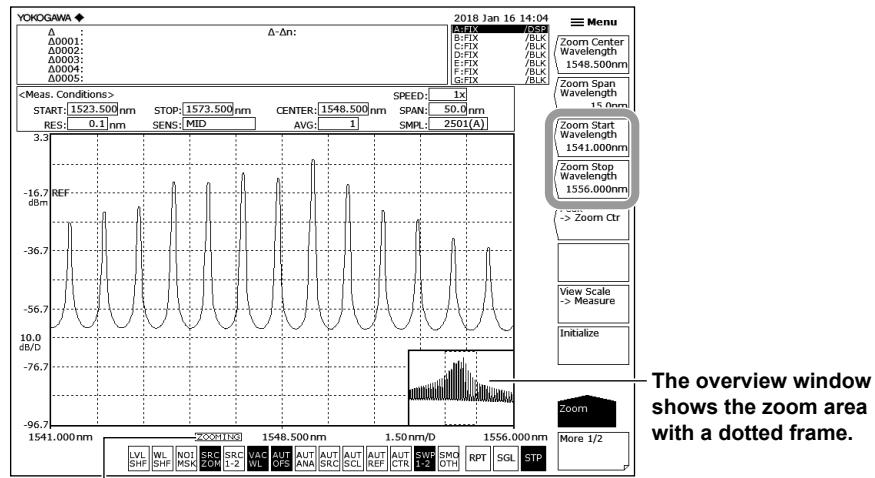
### Restoring the Zoomed Waveform to Its Original Size

9. Tap Initialize.

### By Specifying Start and Stop Wavelengths

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ZOOM**. A function menu appears for setting the waveform zoom.
3. Tap **Zoom Start Wavelength**. A parameter input window appears.
4. Enter the zoom start wavelength in the parameter input window.
5. Tap **nm/ENT**.
6. Tap **Zoom Stop Wavelength**. A parameter input window appears.
7. Enter the zoom stop wavelength in the parameter input window.
8. Tap **nm/ENT**.

#### Example of displayed waveform



After changing the display scale (zooming), **ZOOMING** is displayed

#### Note

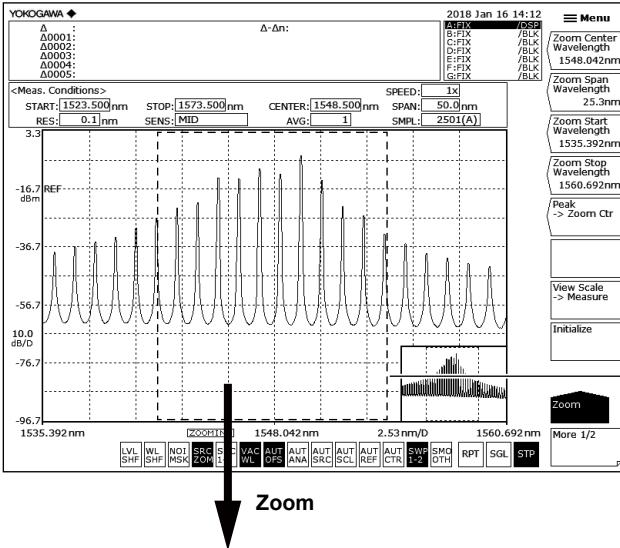
- There is no need to tap **nm/ENT** when using arrow keys to enter the value.
- If you enter a value outside the setting range, the nearest permitted value is assigned.

## 4.1 Zooming a Waveform

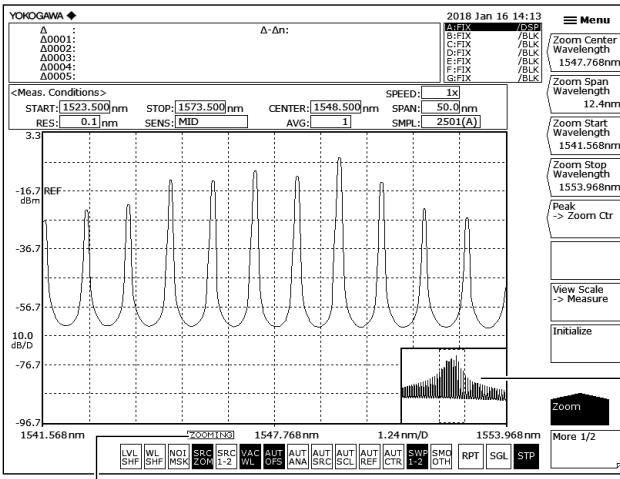
### By Specifying the Range with the Mouse

1. In the waveform display area, drag the area you want to zoom. The area is displayed with a dotted frame (zoom area).
2. When you release the left mouse button, the dotted frame is zoomed.

At the same time, the overview window shows the zoom area with a dotted frame.



Drag the mouse in the waveform display area to set the zoom area.



The overview window shows the zoom area with a dotted frame.

After changing the display scale (zooming), **ZOOMING** is displayed.

#### Note

- If you change the display scale to a value different from the measurement scale, **ZOOMING** appears on screen. Also, an overview window that shows the measurement scale is displayed in the corner of the measurement screen.
- The display scale is independent of the measurement scale.
- Changing the zoom function settings does not change the measurement conditions. When you tap View Scale → Measure, the measurement scale of the next sweep is set to the current waveform display scale.

### Pinching Out or Pinching In the Waveform Display Area

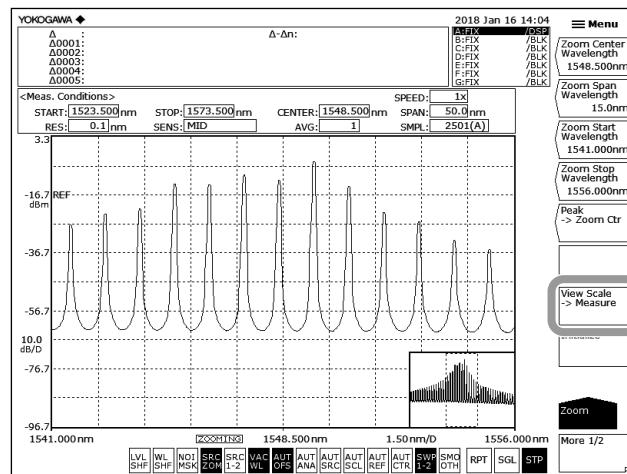
The instrument's screen is a touch panel. You can zoom the waveform as you like by pinching out or pinching in the waveform display area. For details, see section 3.1 in IM AQ6360-02EN.

## 4.1 Zooming a Waveform

### Setting the Measurement Scale by Using the Current Waveform Display Scale

With the waveform zoomed, tap **View Scale** → **Measure**.

The measurement scale of the next sweep (CENTER, START, STOP, SPAN) is set to the current waveform display scale (ZOOM CENTER, ZOOM SPAN, ZOOM START, ZOOM STOP).



### Configuring the Overview Window

When the waveform display is enlarged or reduced using the zoom function, an overview window is displayed at the very bottom of the waveform display area (only displayed when a zoom is in use).

### Showing/Hiding the Window and Setting the Display Position

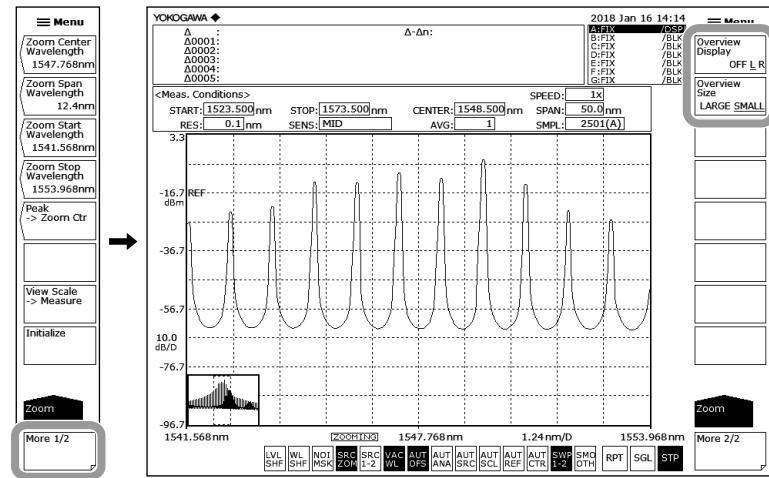
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ZOOM**.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Overview Display OFF/L/R**. Each time you tap, the window changes between hidden, displayed on the left, and displayed on the right.

### Setting the Window Size

2. Tap **ZOOM**.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Overview Size LARGE/SMALL**. The window switches between large and small.

## 4.1 Zooming a Waveform

Example of a screen with Overview Display OFF/L/R set to L and Overview Size LARGE/SMALL set to SMALL



### Changing Settings Using the Mouse

A mouse can be used in the overview window to change the display scale settings.

#### Changing the Center Wavelength (Center Frequency)

1. Move the mouse pointer into the overview window.
2. Drag within the zoom area in the dotted frame.  
While doing so, the mouse pointer changes to a hand tool.

#### Changing the Zoom Start/Stop Wavelength

1. Move the mouse pointer into the overview window.
2. Drag a vertical dotted line of the zoom area.  
While doing so, the mouse pointer changes to an arrow.

#### Specifying a New Zoom Area

1. Move the mouse pointer into the overview window.
2. Drag outside of the zoom area. A new zoom area is created.  
While doing so, the mouse pointer changes to a plus (+) sign.

#### Note

For information on power measurement inside the zoom area, see section 5.12.

## 4.1 Zooming a Waveform

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### Explanation

#### Zoom Center Wavelength

The setting range is 1200.000 to 1650.000 nm.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1 nm. When FINE is selected, the value changes in steps of 0.1 nm.

#### Wavelength Display Sweep Span

The setting range is 0, and 0.1 to 450.0 nm.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1-2-5. When FINE is selected, the value changes in steps of 1 nm.

#### Zoom Start Wavelength

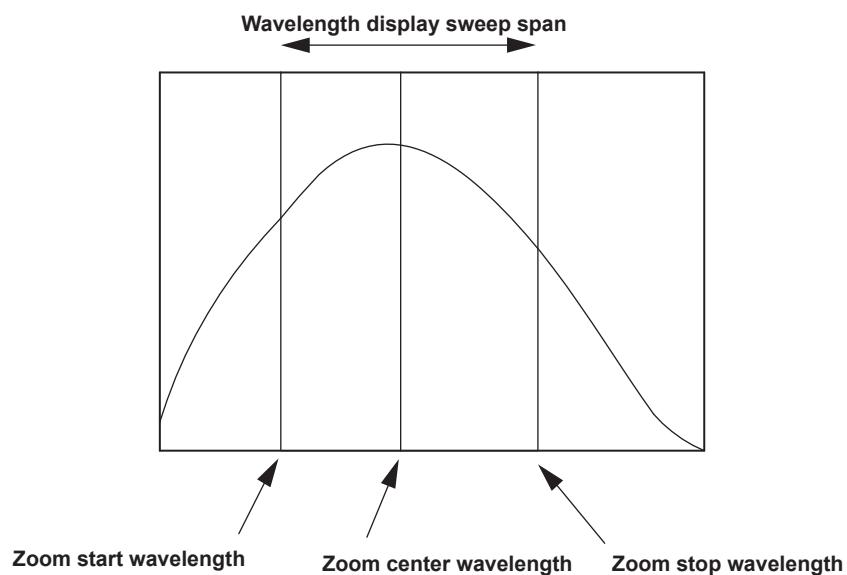
The setting range is 975.000 to 1649.950 nm.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1 nm. When FINE is selected, the value changes in steps of 0.1 nm.

#### Zoom Stop Wavelength

The setting range is 1200.050 to 1875.000 nm.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1 nm. When FINE is selected, the value changes in steps of 0.1 nm.



#### Note

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- When you change the zoom center wavelength, the zoom start wavelength and zoom stop wavelength will change. The wavelength display sweep span will not change.
- When you change the wavelength display sweep span, the zoom start wavelength and zoom stop wavelength will change. The zoom center wavelength will not change.
- When you set the zoom start wavelength or zoom stop wavelength, the wavelength display sweep span will change because the other wavelength is fixed. The center zoom wavelength will also change.

---

### Zoom Center Frequency

The setting range is 181.5000 to 250.0000 THz.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 0.1 THz. When FINE is selected, the value changes in steps of 0.01 THz.

### Frequency Display Sweep Span

The setting range is 0 and 0.01 to 68.50 THz.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 1-2-5. When FINE is selected, the value changes in steps of 0.1 THz.

### Zoom Start Frequency

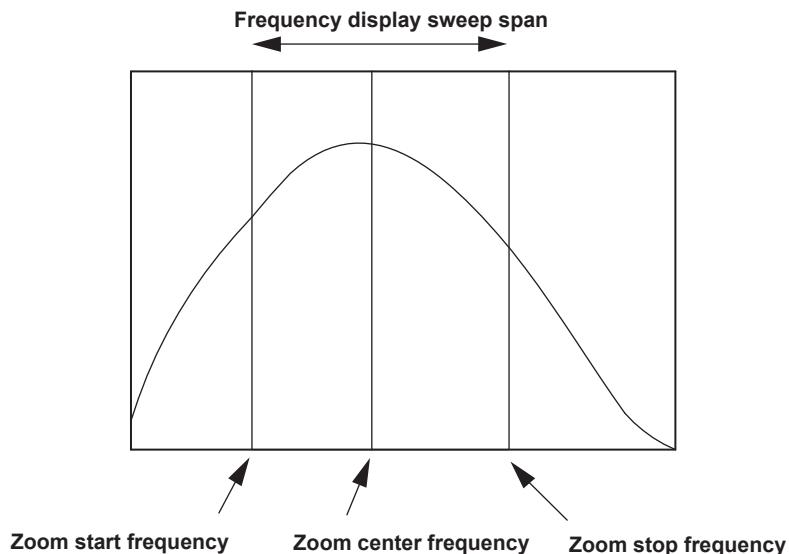
The setting range is 147.2500 to 249.9950 THz.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 0.1 THz. When FINE is selected, the value changes in steps of 0.01 THz.

### Zoom Stop Frequency

The setting range is 181.5050 to 284.2500 THz.

When entering with the arrow keys when COARSE is selected, the value changes in steps of 0.1 THz. When FINE is selected, the value changes in steps of 0.01 THz.



### Note

- When you change the zoom center frequency, the zoom start frequency and zoom stop frequency will change. The frequency display sweep span will not change.
- When you change the frequency display sweep span, the zoom start frequency and zoom stop frequency will change. The zoom center frequency will not change.
- When you set the zoom start frequency or zoom stop frequency, the frequency display sweep span will change because the other frequency is fixed. The center zoom frequency will also change.

## 4.2 Updating or Fixing Waveforms

### Procedure

#### Selecting a Trace to Update or Fix

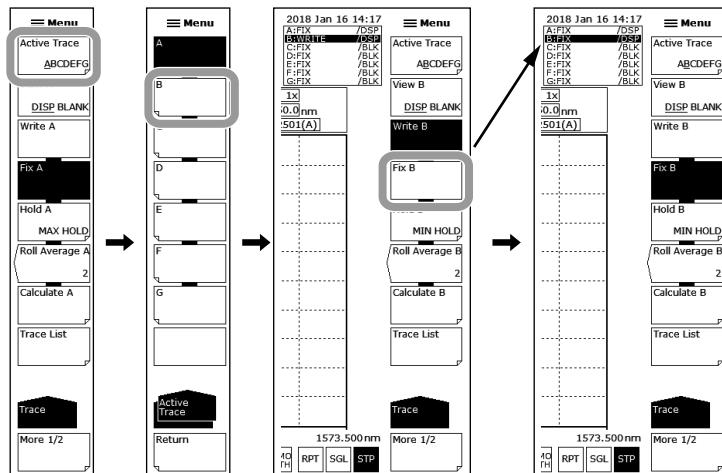
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Active Trace**. Traces A through G are displayed in a function menu.
4. Tap the trace you want to update or fix. The active trace is set to the selected trace, and the operation below will be applied to it.
5. Tap **View** of the selected trace to select DISP. Each time you tap, the value switches between DISP and BLANK. (In the following explanation, trace B is used as an example.)

#### Updating a Waveform

6. Tap **Write**. The trace setting area display changes to WRITE.
7. Perform a measurement. The waveform data will be updated.

#### Fixing a Waveform

6. Tap **Fix**. The trace setting area display changes to FIX.
7. The waveform data is fixed. When a measurement is performed, the waveform data will not be updated.



#### Note

- Only a single trace can be the active trace. If you need to change several traces, change them one at a time.
- If all traces are set to FIX, a warning appears, and measurements cannot be performed.
- You can also use the TRACE SETTINGS window to select the active trace, show or hide waveforms, and select write mode or calculation mode. To show the TRACE SETTINGS window, tap the trace setting area in the upper right of the screen. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.

## Explanation

### Active Trace

Active trace refers to a target trace to which settings and changes can be applied.

A trace shows a waveform and measurement conditions. The instrument has a total of seven independent traces (A through G). You can show or hide each trace or display several traces simultaneously on the waveform screen.

The function menu for setting traces is explained below.

#### Active Trace...ABCDEFG

Selects the active trace from traces A to G.

You can also switch the active trace by tapping the trace setting area of the screen.

### Displaying Traces

You can select whether to display the active trace on the screen.

#### View @...DISP / BLANK

“View @ DISP”: The waveform is displayed on the screen. The trace display changes to “DSP”.

“View @ BLANK”: The waveform is not displayed on the screen. The trace display changes to “BLK”.

Each time you tap the key, the highlight toggles between “View @ DISP” and “View @ BLANK”. Note that if BLANK is set, markers applied to the trace set in DISP will be cleared.

The ampersand (@) indicates the currently selected trace. It is set to one of the letters from A to G.

### Write mode

#### Write @

Sets the active trace to write mode.

When a trace is set to write mode, waveform data is written to it and updated during measurement. The trace display next to the data area also changes to “WRITE”.

The ampersand (@) indicates the currently selected trace. It is set to one of the letters from A to G.

### Fix mode

#### Fix @

Sets the active trace to fix mode.

When a trace is set to this mode, its waveform data do not change even when measurement is performed. As such, the waveform on the screen is not redrawn. The trace display changes to “FIX”.

If you tap **Fix** on the function menu during sweeping, the waveform display is fixed at that point.

The ampersand (@) indicates the currently selected trace. It is set to one of the letters from A to G.

## 4.3 MAX/MIN HOLD Display

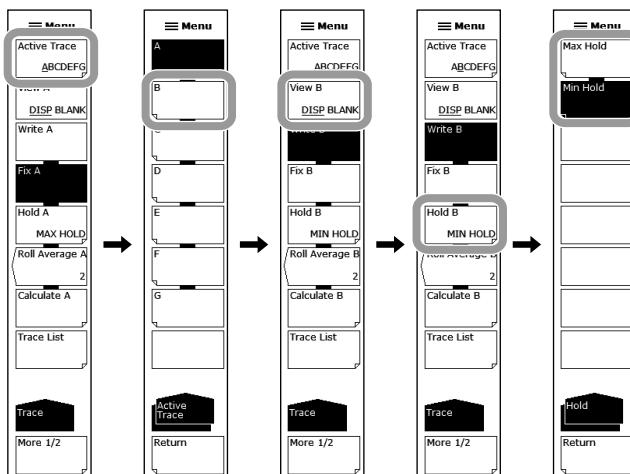
### Procedure

#### Selecting a Trace to Hold

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Active Trace**. Traces A through G are displayed in a function menu.
4. Tap the trace you want to hold the maximum or minimum value of. The active trace is set to the selected trace, and the operation below will be applied to it.
5. Tap **View** of the selected trace to select DISP. Each time you tap, the value switches between DISP and BLANK. (In the following explanation, trace B is used as an example.)

#### Holding the Maximum/Minimum Value

6. Tap **Hold**. A function menu appears for selecting MAX/MIN.
7. To hold the maximum value, tap **Max Hold**.  
To hold the minimum value, tap **Min Hold**.  
The maximum or minimum value will be held.
8. Tap **Repeat**. Sweeping will begin.  
If Max Hold is selected, the waveform data is updated when the measured value is greater than the previous value.  
If Min Hold is selected, the waveform data is updated when the measured value is less than the previous value.



#### Note

- Max Hold/Min Hold is valid only when the sweep mode is Repeat. It does not work if you repeat single sweeps.
- You can also use the TRACE SETTINGS window to select the active trace, show or hide waveforms, and select write mode or calculation mode. To show the TRACE SETTINGS window, tap the trace setting area in the upper right of the screen. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.

**Explanation****MAX/MIN HOLD Mode (maximum/minimum value detection mode)**

The maximum or minimum value of the waveform data is written in each sweep.

For traces set to MAX/MIN HOLD mode, for every sweep, the data at each measurement point is compared with the previous measured value, and the larger (MAX HOLD) or smaller (MIN HOLD) level data is written.

If you want to measure the maximum or minimum value of a waveform that changes each time a sweep is performed, set the trace you want to measure to MAX/MIN HOLD mode and perform repeat sweeps.

The trace display next to the data area shows "MAX HOLD" or "MIN HOLD".

Note that the Noise Mask value does not affect maximum/minimum value detection. The value is applied when the waveform is displayed.

## 4.4 Sweep Average

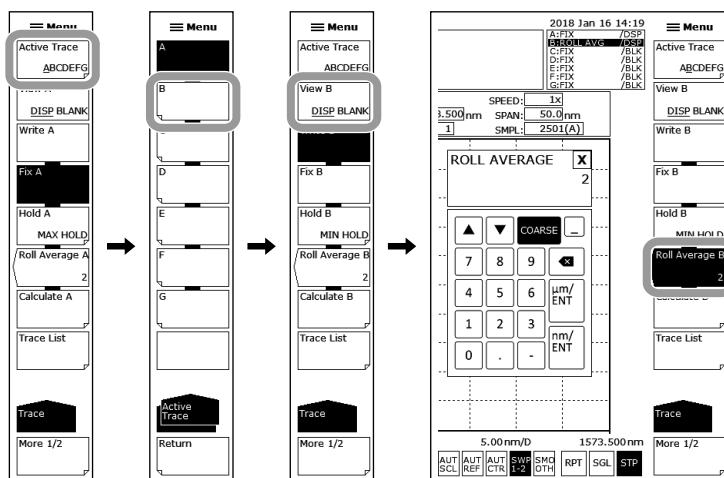
### Procedure

#### Selecting a Trace to Average

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Active Trace**. Traces A through G are displayed in a function menu.
4. Tap the trace you want to average. The active trace is set to the selected trace, and the operation below will be applied to it.
5. Tap **View** of the selected trace to select DISP. Each time you tap, the value switches between DISP and BLANK. (In the following explanation, trace B is used as an example.)

#### Setting the Average Times

6. Tap **Roll Average**. A parameter input window appears.
7. Enter the average times in the parameter input window.
8. Perform a measurement. The sweep average value is updated each time a measurement is performed.



#### Note

- The setting range for average times is 2 to 100.
- You can also use the TRACE SETTINGS window to select the active trace, show or hide waveforms, and select write mode or calculation mode. To show the TRACE SETTINGS window, tap the trace setting area in the upper right of the screen. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.

**Explanation****ROLL AVG Mode (sweep average value display)**

The rolling average value of the waveform data for each sweep.

When a trace is set to ROLL AVG mode, each time a measurement is performed, the rolling average of the current measurement and past measurements is calculated, and the measurement data is updated.

Set the average times between 2 and 100.

The trace display next to the data area changes to "ROLL AVG".

Averaging is performed according to the following equation.

$$W_j(i) = W_{j-1}(i) \cdot (n - 1) / n + W(i) \cdot 1 / n \quad (i=1, 2, \dots, N)$$

$W_j(i)$ : Newly displayed waveform

$W_{j-1}(i)$ : Previously displayed waveform

$W(i)$ : Newly obtained waveform

$N$ : Sampling points

$n$ : Number of averaging operations

**Note**

Sweep averaging is not affected by the noise mask value. Noise mask is executed when the sweep average results are displayed.

## 4.5 Displaying Calculated Waveforms

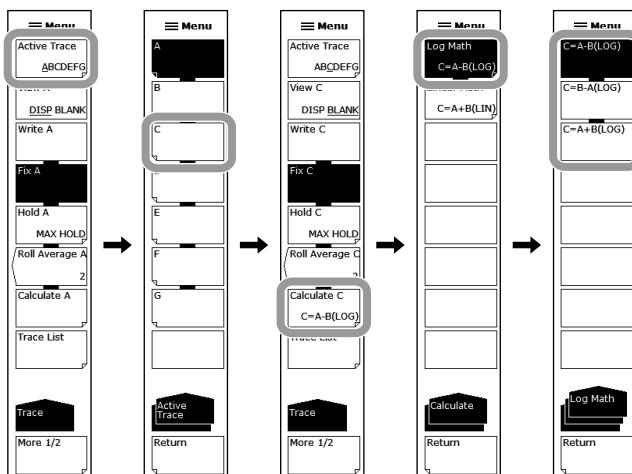
### Procedure

#### Selecting Traces for Calculation

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Active Trace**. Traces A through G are displayed in a function menu.
4. Tap trace C, F, or G, which can be used for trace-to-trace calculation.  
The calculated results are displayed in the selected trace.  
Calculations that can be performed differ depending on the trace selected.
5. Tap **View** of the selected trace to select DISP. Each time you tap, the value switches between DISP and BLANK.

#### Selecting a Calculation

6. Tap **Calculate**. The LOG and linear selection menus are displayed.
7. To perform log calculations, tap **Log Math**. To perform linear calculations, tap **Linear Math**. A function menu appears showing the calculation details.
8. Tap the calculation you want to perform. The calculation will be executed.



#### Note

- Trace-to-trace calculations can only be performed on C, F, or G. If the active trace is set to something other than trace C, F, or G, the Calculate key is disabled.
- If the calculation trace is remeasured or if the measurement center wavelength or measurement span is changed, the calculation is performed again and redisplayed.
- If the measurement condition (resolution) of the calculation trace is in conflict, a warning is displayed.

**Explanation****Calculation Mode (calculation result display)**

In calculation mode, the results of calculations performed between data from different traces are written.

When a trace is set to calculation mode, subtraction between data from different traces, normalized display, power display per specified bandwidth, or curve-fit display is performed according to the specified calculation mode.

Note that only traces C, F, and G can be set to calculation mode.

Also, the available calculations vary from trace to trace.

**Executable Trace-to-Trace Calculations****Trace C**

LOG calculations: A-B, B-A, A+B

Linear calculations: A+B, B-A, A-B, 1-k(A/B), 1-k(B/A)

**Trace F**

LOG calculations: C-D, D-C, C+D, D-E, E-D, D+E

Linear calculations: C+D, C-D, D-C, D+E, D-E, E-D

Power/NBW (A, B, C, D, E )

**Trace G**

LOG calculations: C-F, F-C, C+F, E-F, F-E, E+F

Linear calculations: C+F, C-F, F-C, E+F, E-F, F-E

Normalize (A, B, C)

Curve Fit (A, B, C)

Peak Curve Fit (A, B, C)

Marker Fit

Calculation results are written to their corresponding traces.

**Details of Calculation**

The following are explanations given for traces C, F, and G.

**Trace C: Calculate C****Log Math**

This key is used to perform LOG calculations on trace-to-trace data and write the results to trace C.

Calculations can be applied to trace A and trace B.

If both traces selected for calculation are set to "BLANK", then the sub scale is displayed on the left side of the screen. Otherwise it is displayed on the right side. The calculation results are displayed using the sub scale.

C=A-B(LOG) Subtracts trace B from trace A in LOG form.

C=B-A(LOG) Subtracts trace A from trace B in LOG form.

C=A+B(LOG) Adds trace A and trace B in LOG form.

## 4.5 Displaying Calculated Waveforms

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### Linear Math

This key is used to perform linear calculations on trace-to-trace data and write the results to trace C.

Calculations can be applied to trace A and trace B.

The calculation results are displayed using the main scale.

C=A+B(LIN) Adds trace A and trace B in linear form.

C=A-B(LIN) Subtracts trace B from trace A in linear form.

C=B-A(LIN) Subtracts trace A from trace B in linear form.

C=1-k(A/B) Given Trace A and Trace B, calculates 1-k(A/B).

Calculates  $1-k \times (\text{trace A}/\text{Trace B})$  (linear value), and writes the results to trace C.

The coefficient k may be changed in the range of 1.0000 to 20000.0000 (in steps of 0.0001) from the parameter input window. The coefficient k setting applies to both the <C=1-k(A/B)> key and <C=1-k(B/A)> key.

The trace display next to the data area also changes to "1-k(A/B)".

C=1-k(B/A) Given Trace A and Trace B, calculates 1-k(B/A).

Calculates  $1-k \times (\text{trace B}/\text{Trace A})$  (linear value), and writes the results to trace C.

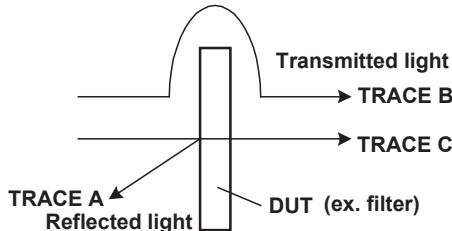
The trace display next to the data area also changes to "1-k(B/A)".

## Specific Examples

As shown below, this  $<1\text{-kA/B}\rightarrow\text{C k=*****.*}>$  key or  $<1\text{-kB/A}\rightarrow\text{C k=*****.*}>$  key may be used to estimate the transmission efficiency from the reflection light spectrum, or estimate the reflectivity from the transmission light spectrum for DUT.

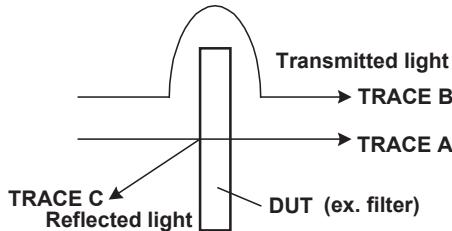
(1) Estimating the transmission efficiency (trace C) from the reflected light spectrum (trace A)

Transmitted light spectrum (TRACE C) =  $1-k$  (TRACE A/TRACE B)



(2) Estimating the reflectivity (trace C) from the transmitted light spectrum (trace A)

Reflected light spectrum (TRACE C) =  $1-k$  (TRACE A/TRACE B)



The value of  $k$  is an absorption coefficient which is used in determining the DUT reflectivity and transmission efficiency. Different algorithms are used depending on whether transmission efficiency or reflectivity is estimated, so the  $k$  value also varies accordingly.

The following equation can be used to determine "kr" and "kt". In the equation,  $P_{in}$  is the level prior to DUT input;  $P_{out}$  is the level after DUT input;  $P_{ref}$  is the DUT reflection level; "kr" is the absorption coefficient used to determine the reflectivity; and "kt" is the absorption coefficient used to determine the transmission efficiency. (Each level is a linear value.)

Estimating the reflected light spectrum from the transmitted light spectrum

$$kr = (P_{in} - P_{ref})/P_{out}$$

Estimating the transmitted light spectrum from the reflected light spectrum

$$kt = (P_{in} - P_{out})/P_{ref}$$

### Trace F: Calculate F

#### Log Math

This key is used to perform LOG calculations on trace-to-trace data and write the results to trace F.

Calculations can be applied to trace C, trace D, and trace E.

If both traces selected for calculation are set to "BLANK", then the sub scale is displayed on the left side of the screen. Otherwise it is displayed on the right side. The calculation results are displayed using the sub scale.

$F=C-D(\text{LOG})$  Subtracts trace D from trace C in LOG form.

$F=D-C(\text{LOG})$  Subtracts trace C from trace D in LOG form.

$F=C+D(\text{LOG})$  Adds trace C and trace D in LOG form.

$F=D-E(\text{LOG})$  Subtracts trace E from trace D in LOG form.

$F=E-D(\text{LOG})$  Subtracts trace D from trace E in LOG form.

$F=D+E(\text{LOG})$  Adds trace D and trace E in LOG form.

#### Linear Math

This key is used to perform linear calculations on trace-to-trace data and write the results to trace F.

Calculations can be applied to trace C, trace D, and trace E.

The calculation results are displayed using the main scale.

$F=C+D(\text{LIN})$  Adds trace C and trace D in linear form.

$F=C-D(\text{LIN})$  Subtracts trace D from trace C in linear form.

$F=D-C(\text{LIN})$  Subtracts trace C from trace D in linear form.

$F=D+E(\text{LIN})$  Adds trace D and trace E in linear form.

$F=D-E(\text{LIN})$  Subtracts trace E from trace D in linear form.

$F=E-D(\text{LIN})$  Subtracts trace D from trace E in linear form.

#### Power/NBW

See section 4.8.

## Trace G: Calculate G

### Log Math

This key is used to perform LOG calculations on trace-to-trace data and write the results to trace G.

Calculations can be applied to trace C, trace E, and trace F.

If both traces selected for calculation are set to "BLANK", then the sub scale is displayed on the left side of the screen. Otherwise it is displayed on the right side. The calculation results are displayed using the sub scale.

G=C-F(LOG) Subtracts trace F from trace C in LOG form.

G=F-C(LOG) Subtracts trace C from trace F in LOG form.

G=C+F(LOG) Adds trace C and trace F in LOG form.

G=E-F(LOG) Subtracts trace F from trace E in LOG form.

G=F-E(LOG) Subtracts trace E from trace F in LOG form.

G=E+F(LOG) Adds trace E and trace F in LOG form.

### Linear Math

This key is used to perform linear calculations on trace-to-trace data and write the results to trace G.

Calculations can be applied to trace C, trace E, and trace F.

The calculation results are displayed using the main scale.

G=C+F(LIN) Adds trace C and trace F in linear form.

G=C-F(LIN) Subtracts trace F from trace C in linear form.

G=F-C(LIN) Subtracts trace C from trace F in linear form.

G=E+F(LIN) Adds trace E and trace F in linear form.

G=E-F(LIN) Subtracts trace F from trace E in linear form.

G=F-E(LIN) Subtracts trace E from trace F in linear form.

### Normalize

This is one of the trace calculation modes. The trace data is normalized and displayed.

The normalization results can be written to trace G and displayed. One trace can be normalized, either trace A, B, or C.

The peak of a normalized waveform is 1 if the sub scale is linear or 0 dB if it is LOG.

Data is displayed when sweeping is finished to the end.

If both traces selected for calculation are set to "BLANK", then the sub scale is displayed on the left side of the screen. Otherwise it is displayed on the right side. The calculation results are displayed using the sub scale.

The trace display next to the data area changes to "NORM @".

G=NORM A Normalizes trace A and writes the normalized data to trace G.

G=NORM B Normalizes trace B and writes the normalized data to trace G.

G=NORM C Normalizes trace C and writes the normalized data to trace G.

### Curve Fit

See section 4.7.

### Peak Curve Fit

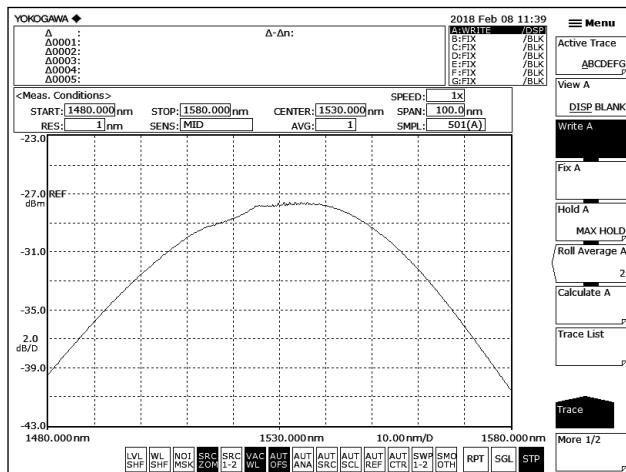
See section 4.7.

## 4.6 Normalized Display

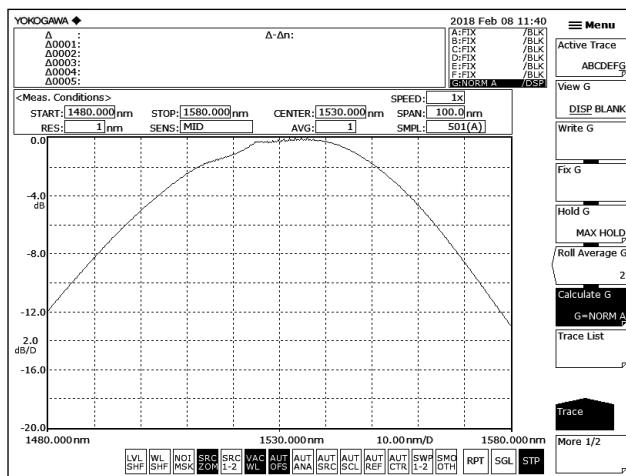
### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Active Trace** to select trace G. A function menu appears for trace G.
4. Tap **View G DISP/BLANK** to select DISP. Each time you tap, the value switches between DISP and BLANK.
5. Tap **Calculate G**.
6. Tap **Normalize**.
7. To normalize trace A, tap **G=NORM A**. To normalize trace B, tap **G=NORM B**. To normalize trace C, tap **G=NORM C**.

Example of waveform before normalization



Example of waveform after normalization



### Note

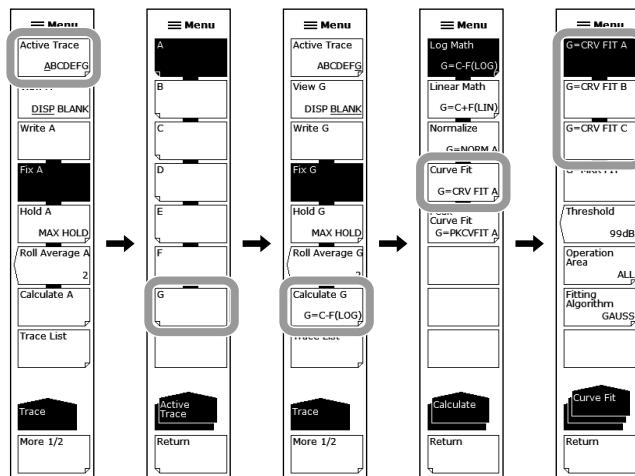
- Normalization is not possible if the waveform level is too low.
- For a description of Normalize, see section 4.5.

## 4.7 Curve Fitting

## Procedure

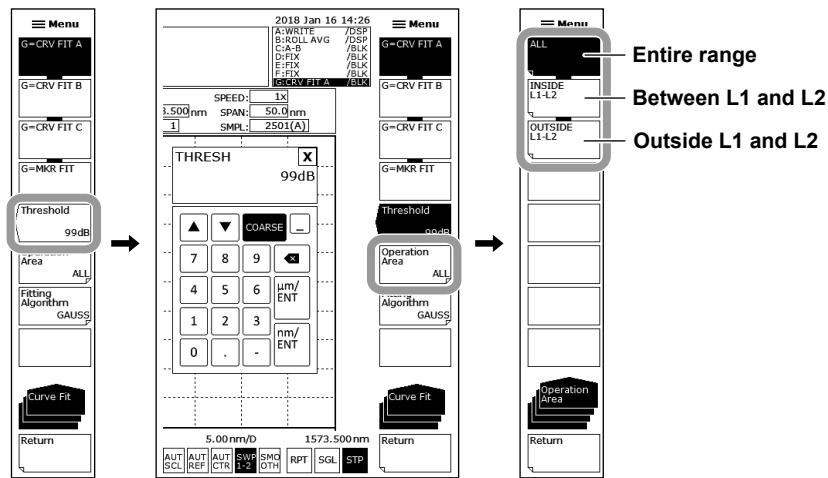
## Setting the Target Trace

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Active Trace** to select trace G. A function menu appears for trace G.
4. Tap **View G DISP/BLANK** to select DISP. Each time you tap, the value switches between DISP and BLANK.
5. Tap **Calculate G**.
6. Tap **Curve Fit**. A menu for selecting the trace to curve fit is displayed.
7. To curve fit trace A, tap **G=CRV FIT A**. To curve fit trace B, tap **G=CRV FIT B**. To curve fit trace C, tap **G=CRV FIT C**.



### Setting the Calculation Target Range

8. Tap **Threshold**. A parameter input window appears.
9. Enter the threshold in the parameter input window.
10. Tap **μm/ENT** or **nm/ENT**.
11. Tap **Operation Area**. A menu for setting the calculation target range is displayed.
12. Tap the range to be calculated.

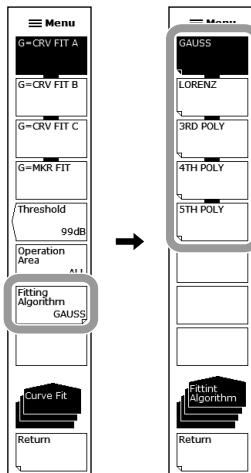


#### Note

For a description of the calculation target range, see the explanation.

### Selecting the Curve Fitting Algorithm

13. Tap **Fitting Algorithm**. An algorithm setting menu is displayed.
14. Tap the algorithm you want to use.



#### Note

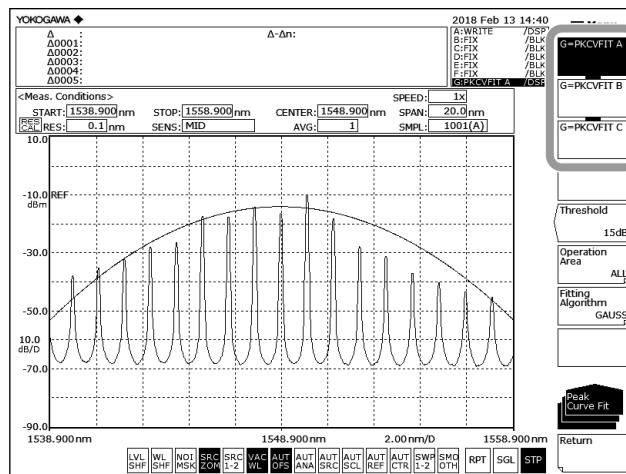
For a description of the curve fitting algorithm, see the explanation.

## Peak Curve Fitting

6. Continuing from step 5, tap **Peak Curve Fit**.
7. To peak curve fit trace A, tap **G=PKCVFIT A**. To peak curve fit trace B, tap **G=PKCVFIT B**. To peak curve fit trace C, tap **G=PKCVFIT C**.

Step 8 and thereafter are the same as for curve fitting.

Example of a screen running a peak curve fitting when the curve fitting algorithm is set to GAUSS



**Explanation****Curve Fit Target Range**

Curve fitting is performed on the specified trace waveform, and the results are written in trace G.

Calculations are performed on data from the threshold to the peak.

Set the threshold in the range of 0 to 99 dB (steps of 1).

The display in the trace setting area next to the data area changes to CRV FIT @ and MKR FIT.

**Curve Fit Target Trace**

Function menu display

G=CRV FIT A Curve-fits trace A.

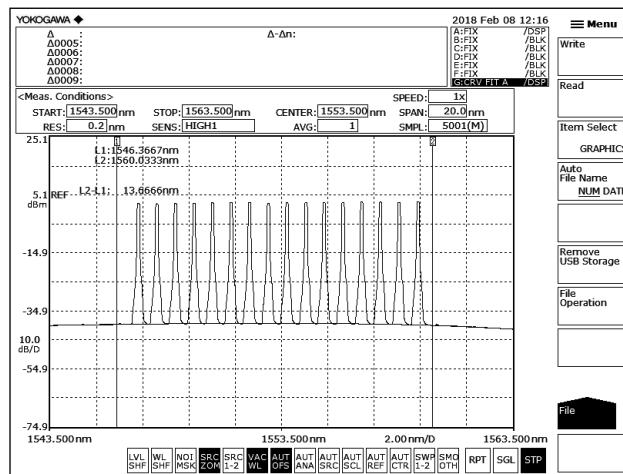
G=CRV FIT B Curve-fits trace B.

G=CRV FIT C Curve-fits trace C.

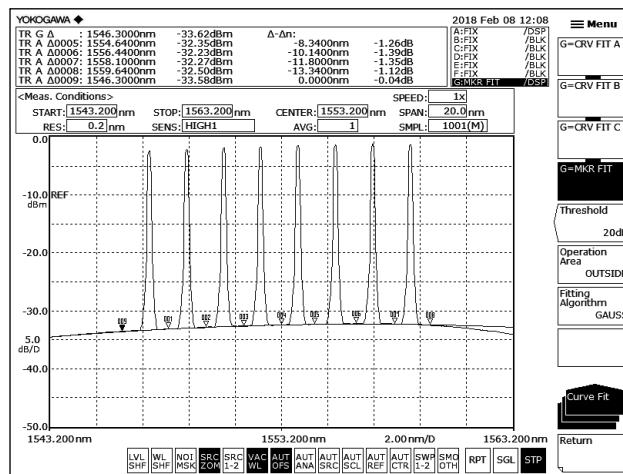
G=MKR FIT Curve-fits the placed markers using the current measurement scale.

Curve fitting is performed even when markers are placed on different traces.

Example of a curve-fitted waveform (data range: OUTSIDE L1-L2)



Example of a marker-fitted waveform (data range: ALL)



## Peak Curve Fit Target Range

Peak curve fitting is performed on the specified trace waveform, and the results are written in trace G.

Calculations are performed on mode peaks that are greater than or equal to the threshold.

Set the threshold in the range of 0 to 99 dB (steps of 1).

The display in the trace setting area next to the data area changes to PKCVFIT @.

## Peak Curve Fit Target Trace

Function menu display

G= PKCVFIT A Peak-curve-fits trace A.

G= PKCVFIT B Peak-curve-fits trace B.

G= PKCVFIT C Peak-curve-fits trace C.

### Range of Target Data for Calculation

Vertical axis

Data from the threshold to the peak. Set the threshold in the range of 0 to 99 dB (steps of 1).

Horizontal axis

Function menu display

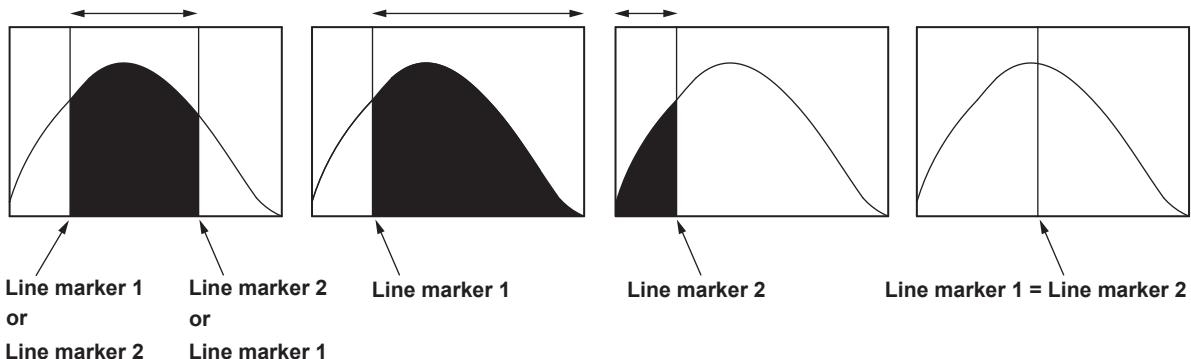
ALL Includes all trace data in the calculation.

INSIDE L1-L2 Includes the data between the line markers in the calculation.

OUTSIDE L1-L2 Includes the data outside the line markers in the calculation.

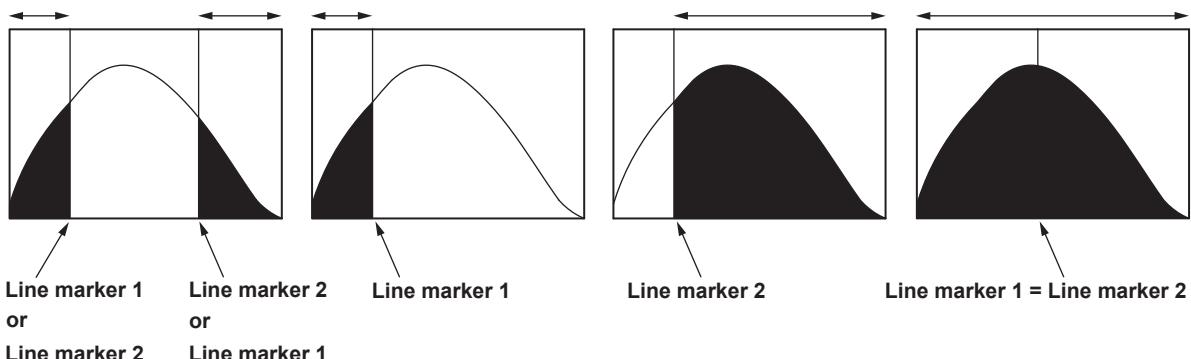
#### When INSIDE L1- L2 is selected

 : Calculation target range



#### When OUTSIDE L1- L2 is selected

 : Calculation target range



### Curve Fitting Algorithm

Function menu display	Description
GAUSS	Normal distribution curve
LORENZ	Lorenz curve
3RDPOLY	3rd order polynomial
4THPOLY	4th order polynomial
5THPOLY	5th order polynomial

#### Note

If G=MKR FIT is selected, fitting cannot be performed if only a small number of markers are placed. A warning appears when the number of markers is as follows. WARNING 111 : <G=MKR FIT>failed

GAUSS , LORENZ: Fewer than three markers

3RD POLY: Fewer than four markers

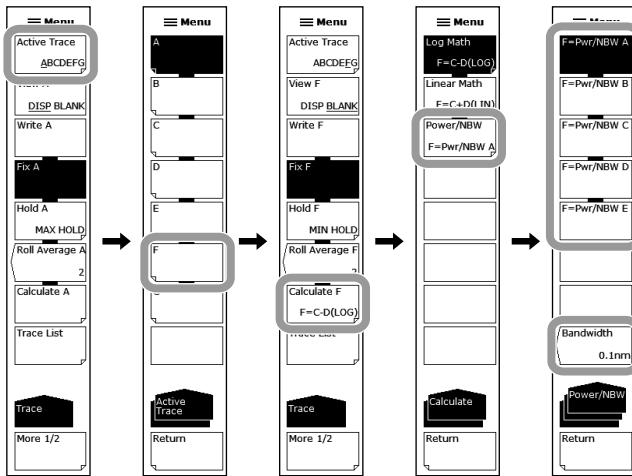
4TH POLY: Fewer than five markers

5TH POLY: Fewer than six markers

## 4.8 Power Spectral Density Trace

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Active Trace** to select trace F. A function menu appears for trace F.
4. Tap **View F DISP/BLANK** to select DISP. Each time you tap, the value switches between DISP and BLANK.
5. Tap **Calculate F**.
6. Tap **Power/NBW**.
7. To display the power spectral density of trace A, Tap **F=Pwr/NBW A**.  
To display the power spectral density of trace B, tap **F=Pwr/NBW B**.  
To display the power spectral density of trace C, tap **F=Pwr/NBW C**.  
To display the power spectral density of trace D, tap **F=Pwr/NBW D**.  
To display the power spectral density of trace E, tap **F=Pwr/NBW E**.
8. Tap **Bandwidth**. A parameter input window appears.
9. Enter the bandwidth in the parameter input window.
10. Tap **μm/ENT** or **nm/ENT**.



### Explanation

#### Power Spectral Density Trace

The power spectral density in the specified bandwidth is calculated, and the results are written in Trace F. The target trace is a single trace selected from Traces A to E.

The trace display next to the data area changes to "PWR/NBW @".

In setting the unit (LEVEL UNIT) of the vertical axis in section 3.2, "Setting the Horizontal and Vertical Scales," the power per nanometer can be displayed, but here the power per the specified band in the range of 0.1 nm to 10 nm in 0.1 nm resolution can be displayed. With the analysis function using the ANALYSIS key, only PMD can be analyzed.

#### Level Axis Unit (Section 3.2)

Level axis units, namely dBm/nm and mW/nm, are units for displaying power per nanometer. If trace F is set to Power/NBW, the unit is automatically changed to dBm or mW.

If trace F is set to Power/NBW and you change the level axis to dBm/nm or mW/nm, trace F enters FIX mode, and the waveform is no longer updated.

## 4.9 Marker Display

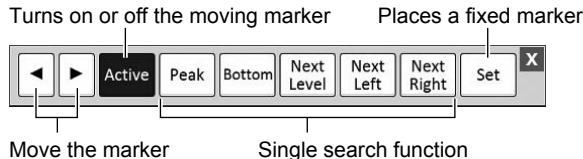
### Procedure

#### Displaying the Moving Marker

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the marker.
3. Tap **Marker Active OFF/ON** to select ON.

### Note

- If the active trace is not set to DISP, you cannot use the moving marker. Set View @ DISP/BLANK under TRACE to DISP.
- When Marker Active OFF/ON is set to ON, tapping the waveform display area and selecting Marker from the pop-up list displays a operation tool window for the moving marker. The operation tool window allows you to quickly set frequently used functions.



- The moving marker is also displayed when you tap **PEAK SEARCH** in the Main Menu window.

#### Moving the Moving Marker

4. Enter the wavelength using the numeric keypad, and then tap **nm/ENT**.
5. Or, refer to the following information, and move the moving marker.

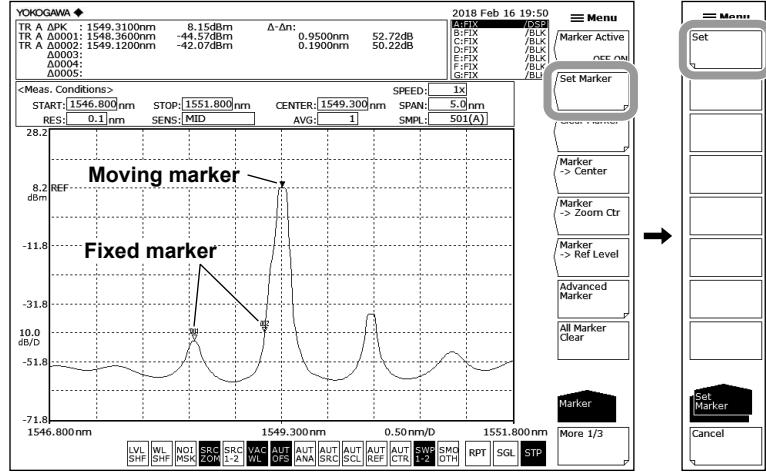
Direction	Procedure
Move to the right	Drag to the right the dotted line that appears when you tap the moving marker. Tap the right arrow key in the operation tool window.
Move to the left	Drag to the left the dotted line that appears when you tap the moving marker. Tap the left arrow key in the operation tool window.

## 4.9 Marker Display

### Placing Fixed Markers

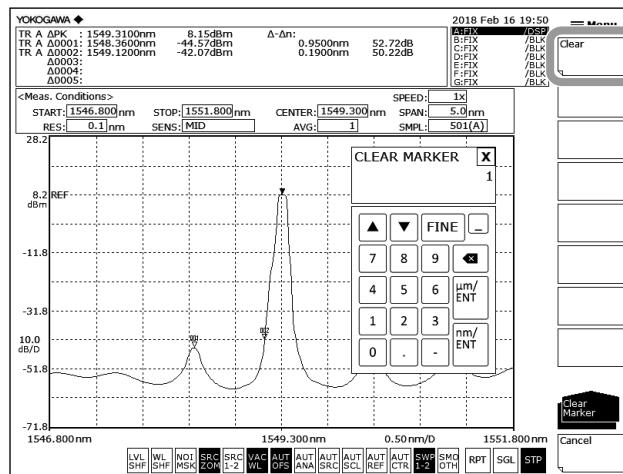
- With the moving marker displayed, tap Set Marker. A function menu with Set and a parameter input window appear.
- Enter a marker number in the parameter input window, and tap Set. A fixed marker is placed at the current moving marker position.

If you do not enter a marker number, the number is assigned automatically in order from 001.



### Clearing a Fixed Marker

- Tap Clear Marker.
- Enter the fixed marker number you want to clear in the parameter input window.
- Tap Clear.



### Clearing All Markers

- Tap All Marker Clear. All markers (moving marker and fixed markers) displayed on the screen will be cleared.

The Marker Active settings is also set to OFF.

## Using the Moving Marker to set the Center Wavelength to Be Measured, the Zoom Center Wavelength, and the Reference Level

### Setting the Center Wavelength to Be Measured to the Moving Marker Wavelength

With the moving marker displayed, tap **Marker → Center**. The value of the center wavelength to be measured is displayed in a parameter input window.

For a description of the center wavelength, see section 3.5, “Setting the Center Wavelength (Center Frequency).”

You can adjust the center wavelength further in the parameter input window.

#### Note

Marker → Center cannot be used under the following conditions.

- When the moving marker is off
- When both spit screens are on hold.
- When the span of the measured data is 0 nm.

### Setting the Zoom Center Wavelength to the Moving Marker Wavelength

With the moving marker displayed, tap **Marker → Zoom Ctr**. The value of the zoom center wavelength is displayed in a parameter input window. For a description of the zoom center wavelength, see section 4.1, “Zooming a Waveform.”

You can adjust the zoom center wavelength further in the parameter input window.

#### Note

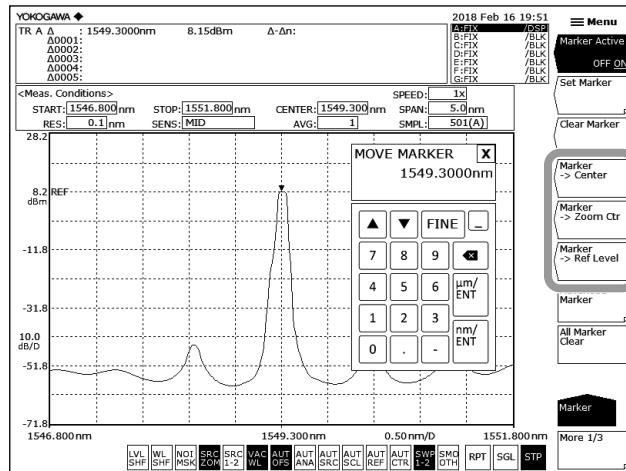
Marker → Zoom Ctr cannot be used under the following conditions.

- When the moving marker is off
- When both spit screens are on hold.
- When the span of the measured data is 0 nm.

### Setting the Reference Level to the Moving Marker Level

With the moving marker displayed, tap **Marker → Ref Level**. The value of the reference level is displayed in a parameter input window. For a description of the reference level, see section 3.4, “Setting the Reference Level.” The displayed waveform is redrawn according to the new reference level.

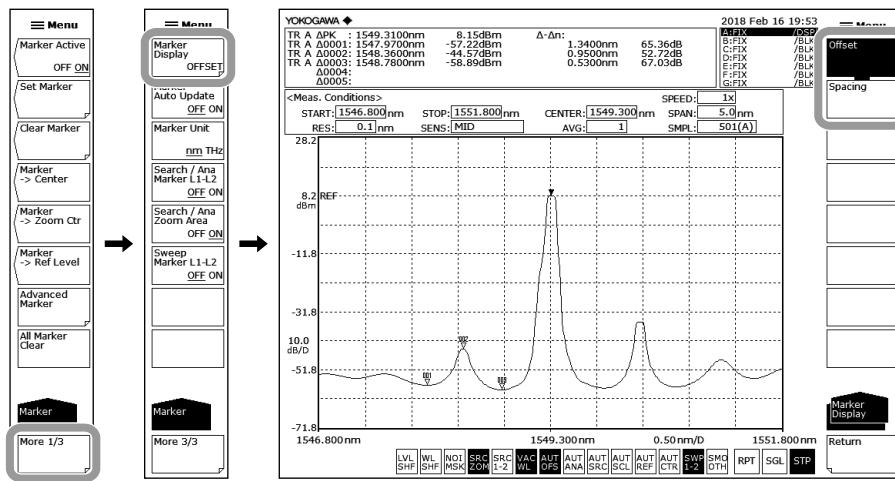
You can adjust the reference level further in the parameter input window.



## Setting the Marker Difference Value Display

You can set the marker difference display displayed in the data area to **OFFSET** or **SPACING**.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**.
3. Tap **More** to display the More 3/3 function menu.
4. Tap **Marker Display**. A menu for selecting the difference value display appears.
5. Tap **Offset** or **Spacing**.



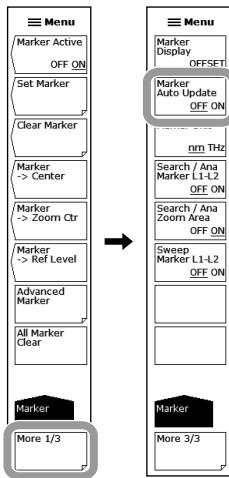
### *Note*

When Offset is selected, the difference between the moving marker (▼) and each fixed marker is displayed. When Spacing is selected, the difference between the moving marker and the smallest numbered fixed marker is displayed along with the differences between fixed markers.

## Automatically Updating the Level Values of the Fixed Markers

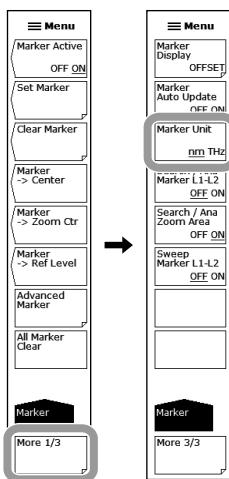
The level values of fixed markers are updated each time the displayed waveform is updated.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**.
3. Tap **More** to display the More 3/3 function menu.
4. Tap **Marker Auto Update OFF ON** to select ON.



## Setting the Unit of Marker Values

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**.
3. Tap **More** to display the More 3/3 function menu.
4. Tap **Marker Unit nm THz**. Each time you tap, the value switches between nm and THz.

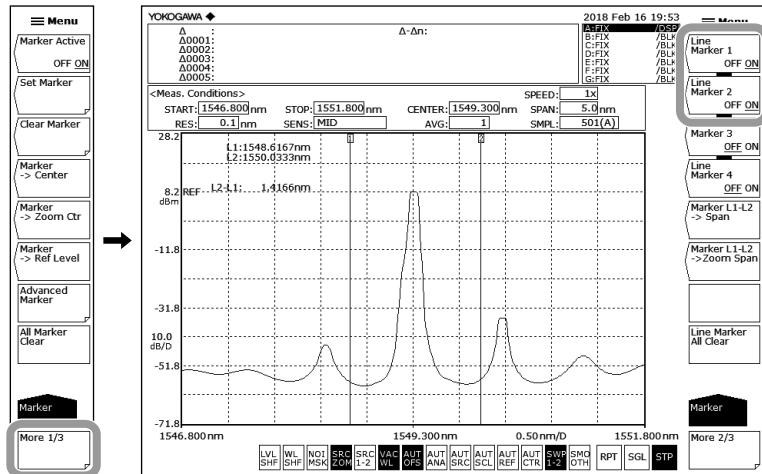


### Note

The unit displayed for marker values (wavelength or frequency) can be set separately from the waveform display's horizontal scale unit set with **Horizontal Scale nm THz**.

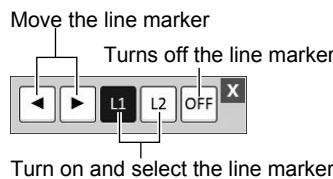
## Displaying Wavelength Line Markers

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the marker.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Line Marker 1 OFF/ON** or **Line Marker 2 OFF/ON** to select ON. Line marker values are displayed in the upper left of the waveform area.



### Note

- Wavelength line markers cannot be displayed if the active trace measurement span is 0.000 nm.
- When both wavelength line markers 1 and 2 are displayed, the wavelength difference (L2–L1) is shown below the marker values.
- Tapping the waveform display area and selecting X Line Marker from the pop-up list displays a operation tool window for the wavelength line markers. The operation tool window allows you to quickly set frequently used functions.



## Moving the Line Markers

5. Refer to the following information, and move the line markers.

Direction	Procedure
Move to the right	Drag the line marker to the right. Tap the right arrow key in the operation tool window.
Move to the left	Drag the line marker to the left. Tap the left arrow key in the operation tool window.

## Clearing the Line Markers

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the marker.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Line Marker 1 OFF/ON** or **Line Marker 2 OFF/ON** to select OFF.

## Setting Measurement Sweep Span & Display Sweep Span with Line Markers

### Setting the Measurement Sweep Span to the Span between Line Markers 1 and 2 <<See section 3.6 for details>>

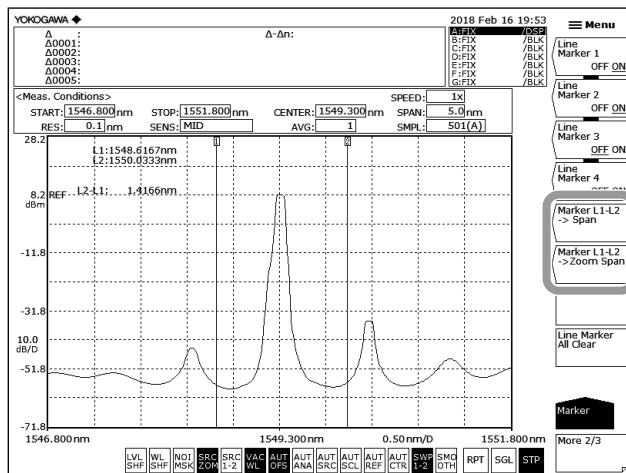
With line markers 1 and 2 displayed, tap **Marker L1-L2 → Span**. The value of the sweep span is displayed in a parameter input window. The measurement sweep span, measurement start wavelength, and measurement stop wavelength will be changed. You can adjust the measurement sweep span further in the parameter input window. The setting range is 0.1 to 450.0 nm (in steps of 0.1 nm).

### Setting the Zoom Span of the Display Scale to the Span between Line Markers 1 and 2

With line markers 1 and 2 displayed, tap **Marker L1-L2 → Zoom Span**. The value of the display sweep span is displayed in a parameter input window. The displayed waveform is redrawn according to the new Zoom Span.

#### Note

- If only line marker L1 is displayed, the zoom stop wavelength is set to the wavelength at the right edge of the screen. If only line marker L2 is displayed, the zoom start wavelength is set to the wavelength at the left edge of the screen.
- Marker L1-L2 → Span and Marker L1-L2 → Zoom Span cannot be used under the following conditions.
  - When both L1 and L2 are off.
  - When both split screens are on hold.
  - When the span of the active trace is 0 nm.

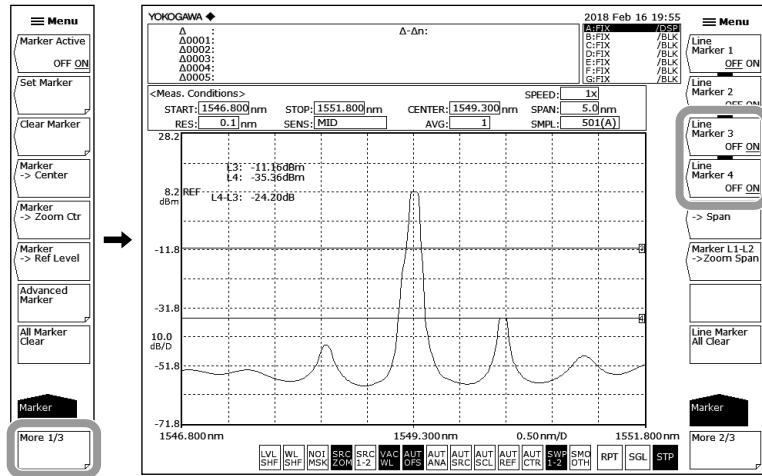


#### Note

For instructions on how to analyze between line markers, see section 5.12, "Specifying an Analysis Range."

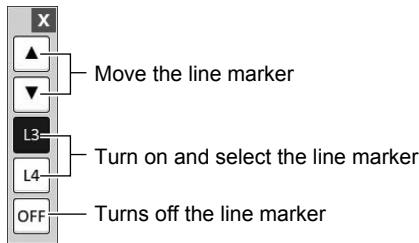
### Displaying Level Line Markers

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the marker.
3. Tap **More** to display the More 2/3 function menu.
4. Tap **Line Marker 3 OFF/ON** or **Line Marker 4 OFF/ON** to select ON. Line marker values are displayed in the upper left of the waveform area.



#### Note

- When both level line markers 3 and 4 are displayed, the level difference (L4-L3) is shown below the marker values.
- Tapping the waveform display area and selecting Y Line Marker from the pop-up list displays a operation tool window for the level line markers. The operation tool window allows you to quickly set frequently used functions.



### Moving the Level Line Markers

5. Refer to the following information, and move the level line markers.

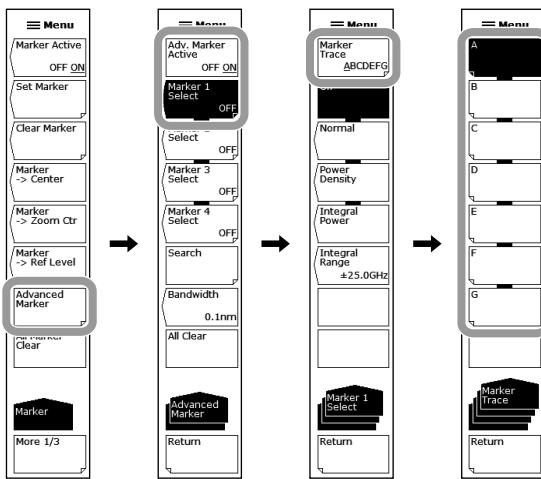
Direction	Procedure
Move up	Drag the line marker up. Tap the up arrow key in the operation tool window.
Move down	Drag the line marker down. Tap the down arrow key in the operation tool window.

### Clearing All Markers

Tap **Line Marker All Clear**. All line markers (wavelength line markers and level line markers) displayed on the screen will be cleared.

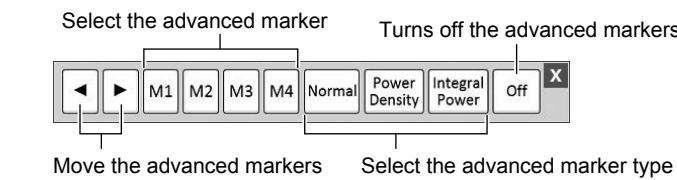
## Displaying Advanced Markers

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the markers.
3. Tap **Advanced Marker**.  
A function menu appears for setting the advanced marker markers.
4. Tap **Adv. Marker Active OFF/ON** to select ON.
5. Tap any of the keys from **Marker 1 Select** to **Marker 4 Select**.  
A function menu appears for setting the advanced marker type and the trace to place the marker on.
6. Tap **Marker Trace**. Traces A through G are displayed in a function menu.
7. Tap the trace to place the marker on. The marker can now be displayed on the selected trace waveform.



### *Note*

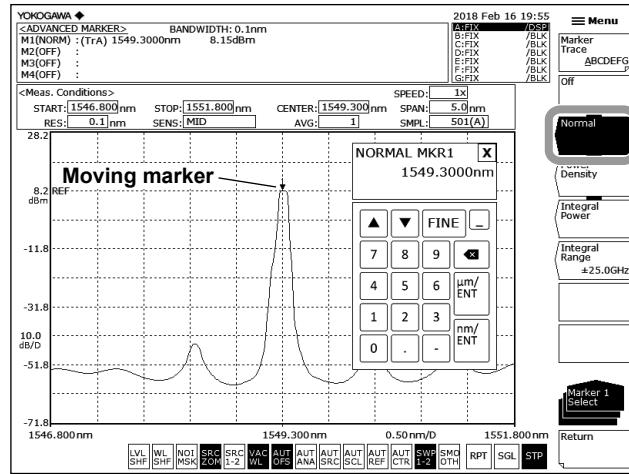
- If the active trace is not set to DISP, you cannot use the advanced markers. Set View@DISP/BLANK under TRACE to DISP.
- If Adv. Marker Active OFF/ON is set to ON, the moving marker (Marker Active OFF/ON) described on page 4-29 will automatically turn off. Likewise, if you turn on the moving marker (Marker Active OFF/ON) described on page 4-29, Adv Marker Active OFF/ON is set to OFF.
- When Adv. Marker Active OFF/ON is set to ON, tapping the waveform display area and selecting Marker from the pop-up list displays a operation tool window for the advanced markers. The operation tool window allows you to quickly set frequently used functions.



## 4.9 Marker Display

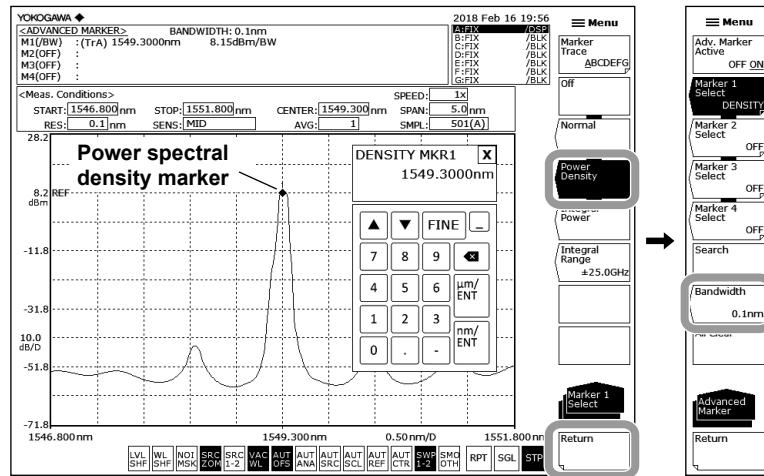
### Displaying the Moving Marker

8. Tap **Normal**. The moving marker appears on the waveform.



### Displaying the Power Spectral Density Marker

8. Tap **Power Density**. A power spectral density marker appears on the waveform.
9. Tap **Return**. The menu returns to the previous level.
10. Tap **Bandwidth**. A parameter input window appears.
11. Enter the normalization bandwidth in the parameter input window.
12. Tap **μm/ENT** or **nm/ENT**.

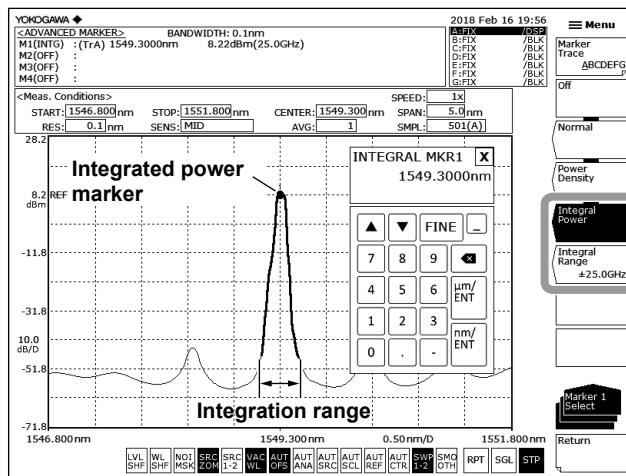


### Note

The power spectral density marker cannot be assigned to a differential waveform (based on LOG values) or normalized waveform.

## Displaying the Integrated Power Marker

8. Tap **Integral Power**. An integrated power marker appears on the waveform.
9. Tap **Integral Range**. A parameter input window appears.
10. Enter the integration frequency range in the parameter input window.
11. Tap **μm/ENT** or **nm/ENT**.



### Note

The integrated power marker cannot be assigned to a differential waveform (based on LOG values) or normalized waveform.

## Moving an Advanced Marker

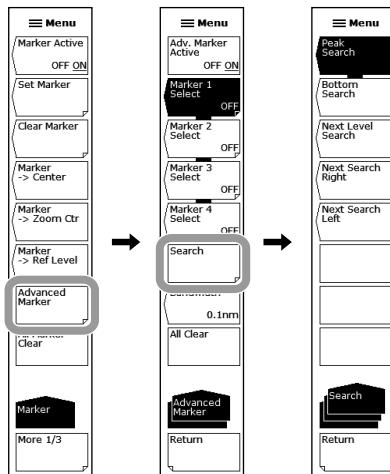
Enter a wavelength in the parameter input window, and tap **nm/ENT**. The parameter input window appears at the same time when an advanced marker is displayed in step 8.

Or, move the advanced marker by referring to the information below.

Direction	Procedure
Move to the right	Drag to the right the dotted line that appears when you tap the advanced marker. Tap the right arrow key in the operation tool window.
Move to the left	Drag to the left the dotted line that appears when you tap the advanced marker. Tap the left arrow key in the operation tool window.

### Performing a Single Search Using an Advanced Marker

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the markers.
3. Tap **Advanced Marker**.  
A function menu appears for setting the advanced marker markers.
4. Tap **Search**. A function menu appears for searching.



#### Note

If the advanced marker is turned off, the Search key will be unavailable.

### Finding the Peak Wavelength/Level

5. Tap **Peak Search**. An advanced marker is set to the peak (maximum value) of the waveform, and the marker values are displayed in the data area.

### Finding the Bottom Wavelength/Level

5. Tap **Bottom Search**. An advanced marker is set to the bottom (minimum value) of the waveform, and the marker value is displayed in the data area.

### Finding the Next Peak/Bottom Level

6. When the advanced marker is displayed at the peak or bottom of the waveform, tap **Next Level Search**. On the marker trace waveform, the moving marker at the peak or bottom is set to the next peak (local maximum value) or bottom (local minimum value).

### Finding the Level Peak/Bottom to the Right of the Advanced Marker

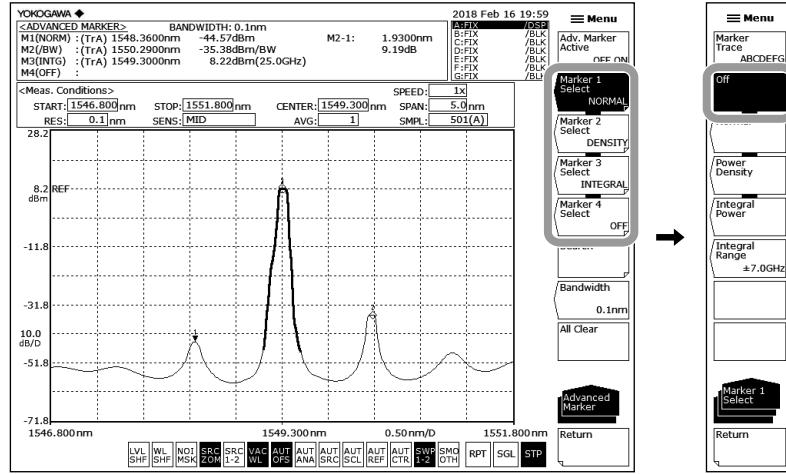
6. When the advanced marker is displayed at the peak or bottom of the waveform, tap **Next Search Right**. The advanced marker is set to the next peak (local maximum value) or bottom (local minimum value) on the right.

### Finding the Level Peak/Bottom to the Left of the Advanced Marker

6. When the advanced marker is displayed at the peak or bottom of the waveform, tap **Next Search Left**. The advanced marker is set to the next peak (local maximum value) or bottom (local minimum value) on the left.

## Turning Off the Advanced Marker Display

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the markers.
3. Tap **Advanced Marker**.  
A function menu appears for setting the advanced marker markers.
4. Tap any of the keys from **Marker 1 Select** to **Marker 4 Select** that you want to turn off.
5. Tap **off**.



### Note

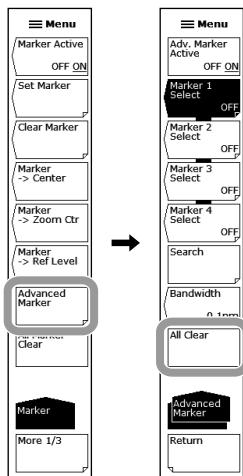
The advanced marker display automatically turns off if you perform any of the following operations.

- Execute auto measurement (section 3.1)
- Clear all traces (section 4.12)
- Change the vertical axis settings (section 3.2) and execute a measurement (section 3.13)
- Change the number of samples (section 3.8) and execute a measurement (section 3.13)

### Clearing All Advanced Markers

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **MARKER**. A function menu appears for setting the markers.
3. Tap **Advanced Marker**.  
A function menu appears for setting the advanced marker markers.
4. Tap **All Clear**. All displayed advanced markers (moving markers, power spectral density markers, and integrated power markers) are cleared.

Tapping **Adv. Marker Active OFF/ON** and selecting OFF also clears all advanced markers.



## Explanation

### Markers

#### Moving Marker

You can move the moving marker to any wavelength by entering the wavelength in the parameter input window. You can also drag the moving marker.

The moving marker moves along the waveform and shows the marker values (wavelength and level) in the data area. If you fix the moving marker at a given position, a fixed marker is displayed.

The moving marker works on the active trace.

#### Fixed Markers

A marker fixed to a specific number using the moving marker is called a fixed marker.

You can place up to 1024 fixed markers. Fixed markers can be placed across different traces.

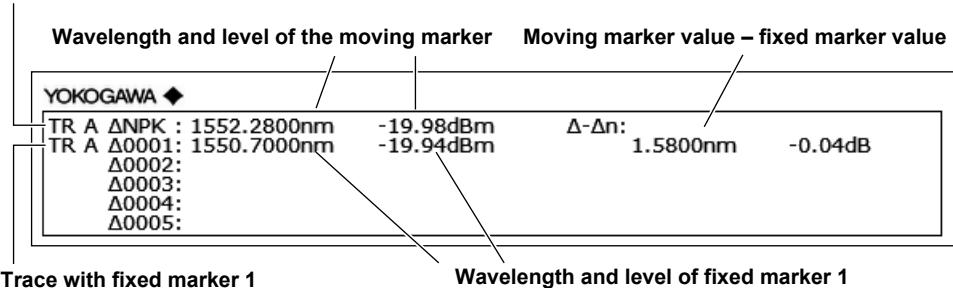
Fixed markers are assigned marker numbers in order from 001. You can also enter a specific number in the parameter input window. The maximum number that can be assigned is 1024.

#### Marker Data in the Data Area

The data area shows the marker values (wavelength value and level value) of the displayed moving marker and fixed markers.

When there are five or more fixed markers, all the fixed markers cannot be displayed in the data area. To view the values of markers that are not displayed, drag the data area to scroll it. Scrolling is possible when the moving marker is on and active.

#### Trace with moving marker (Active trace)

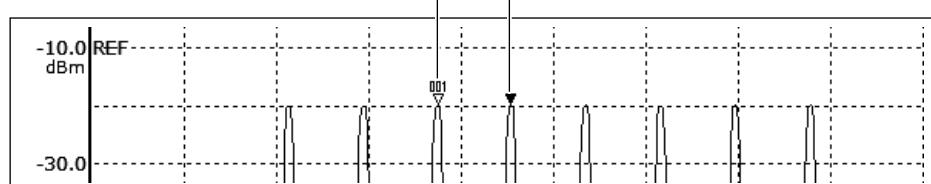


#### Trace with fixed marker 1

#### Wavelength and level of fixed marker 1

A number is displayed with a fixed marker.

#### Moving marker



### Marker Display

This key is used to set whether to display the difference relative to the moving marker (Offset) or the difference relative to the next marker (Spacing) in the marker display. (Default: Offset)

If the active trace span is 0 nm, the wavelength difference relative to the moving marker is 0.000 nm.

If a fixed marker is placed at the -210 dBm wavelength value, “?????????” is displayed as the level difference from that fixed marker.

When a fixed marker is positioned and the moving marker is set to a wavelength value of -210 dBm, the level difference is set to -210.00 dB, regardless of the fixed marker's level.

#### Offset

Sets the difference value display as the difference between each marker and the moving marker (Offset).

**YOKOGAWA ♦**

TR A ΔNPK : 1555.5200nm	-19.96dBm	Δ-Δn:	
TR A Δ0001: 1550.7000nm	-19.94dBm	4.8200nm	-0.02dB
TR A Δ0002: 1552.2800nm	-19.98dBm	3.2400nm	0.02dB
TR A Δ0003: 1553.9000nm	-19.92dBm	1.6200nm	-0.04dB
Δ0004:			
Δ0005:			

#### Spacing

Sets the difference value display as the difference between each marker and the next marker.

**YOKOGAWA ♦**

TR A ΔNPK : 1555.5200nm	-19.96dBm	SPACING:	
TR A Δ0001: 1550.7000nm	-19.94dBm	-4.8200nm	0.02dB
TR A Δ0002: 1552.2800nm	-19.98dBm	1.5800nm	-0.04dB
TR A Δ0003: 1553.9000nm	-19.92dBm	1.6200nm	0.06dB
Δ0004:			
Δ0005:			

## Line Markers

There are four line markers: two wavelength line markers and two level line markers. Wavelength line markers show wavelengths and wavelength difference while level line markers show levels and level difference.

In addition, line markers can be used to specify a sweep range or analysis range.

### Wavelength Line Markers

When line markers are displayed, the marker values are shown in the upper left of the waveform area.

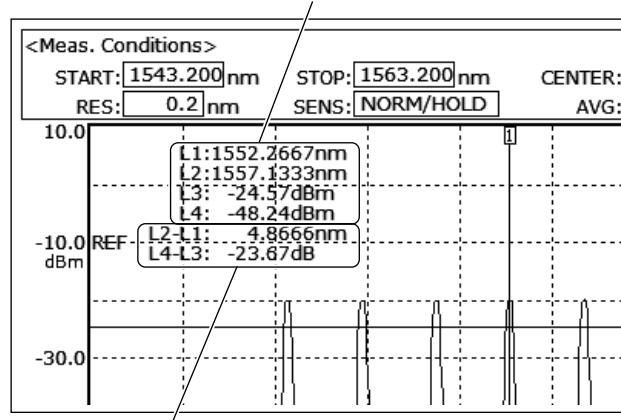
When both wavelength line markers 1 and 2 are displayed, the wavelength difference (L2–L1) is shown below the marker values.

### Level Line Markers

When line markers are displayed, the marker values are shown in the upper left of the waveform area.

When both level line markers 3 and 4 are displayed, the level difference (L4–L3) is shown below the marker values.

**Marker values are displayed.**



**Wavelength difference (L2 – L1) and level difference (L4 – L3) are displayed.**

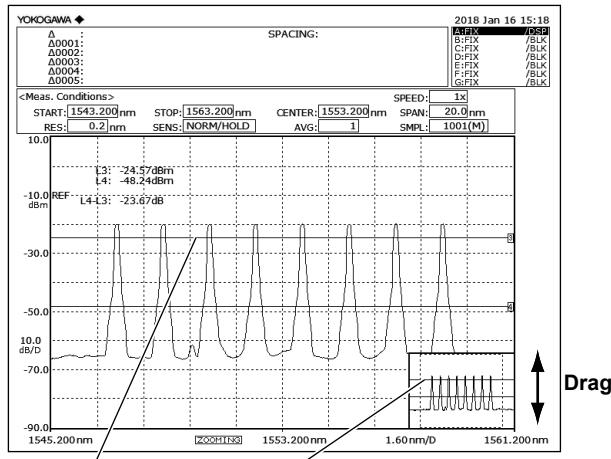
### Note

You can move a line marker by dragging it. When you move a line marker, the line marker in the overview window also moves accordingly.

## 4.9 Marker Display

### Line Markers in the Overview Window

The instrument displays an overview window when the display scale is increased or decreased. When line markers are displayed, they are also displayed on the overview window.



Line markers are synchronized.

## Advanced Markers

There are four advanced markers.

There are three types of advanced markers: moving marker, power spectral density marker, and integrated power marker. Advanced markers can be placed on any of the waveforms from trace A to G.

### Moving Markers

You can move a moving marker to any wavelength by entering the wavelength in the parameter input window. You can also drag a moving marker.

Moving markers move along the waveform and show marker values (wavelength and level) in the data area.

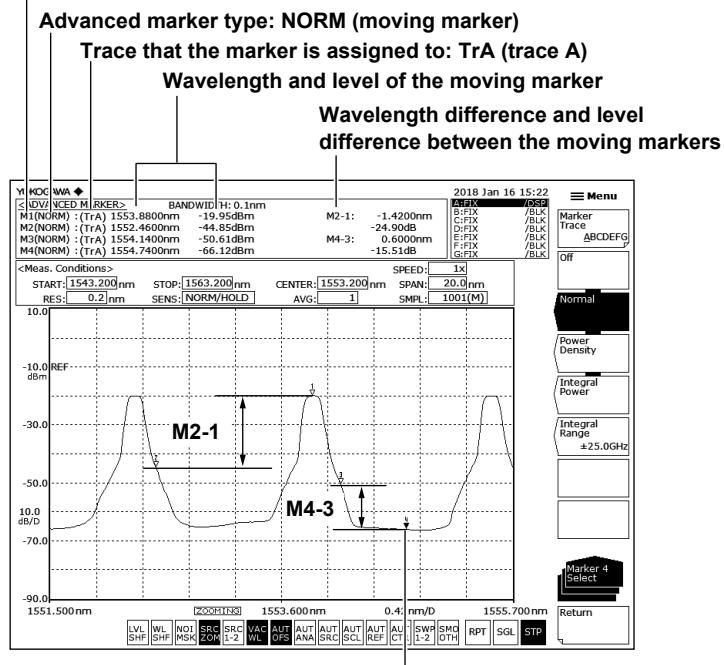
If two markers are displayed, the wavelength difference and level difference between the markers are displayed.

When marker 1 (M1) and marker 2 (M2) are displayed: marker 2 – marker 1 (M2–1)

When marker 3 (M3) and marker 4 (M4) are displayed: marker 4 – marker 3 (M4–3)

The moving markers of the advanced marker function are the same as the moving marker of the marker function. However, the fixed marker function is not available.

#### Marker number



#### Moving marker

A number is displayed with the moving marker.  
When active, the marker is solidly filled.

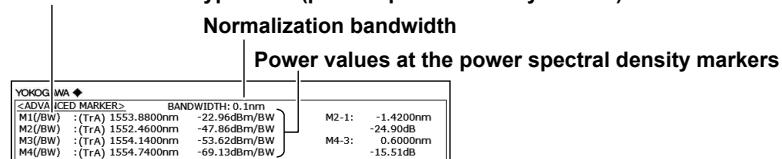
## Power Spectral Density Markers

Power spectral density markers show power values per normalization bandwidth by assuming the marker position on the waveform to be the center. The power values are displayed in the data area. They are used to determine converted power values per given bandwidth such as when measuring the signal noise level.

The selectable normalization bandwidth range is 0.1 to 10.0 nm. When entering with the arrow keys when COARSE is selected, the value changes in steps of 1 nm. When FINE is selected, the value changes in steps of 0.1 nm.

The way to move the markers and the data display between markers are the same as with the above-mentioned moving markers.

Advanced marker type: /BW (power spectral density marker)



## Integrated Power Markers

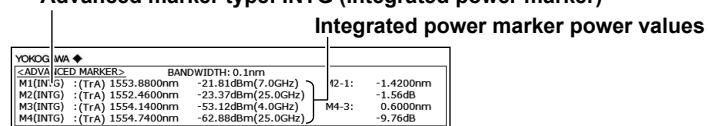
Integrated power markers show integrated power values over specified frequency ranges by assuming the marker position on the waveform to be the center. The power values are displayed in the data area. These markers are used to determine the integrated power of a widely spread spectrum such as to determine the signal level from a modulated optical signal spectrum. The selectable range of frequencies to integrate over is 1.0 to 999.9 GHz. When entering with the arrow keys when COARSE is selected, the value changes in steps of 10 GHz. When FINE is selected, the value changes in steps of 1 GHz.

To determine the signal level of a modulated optical signal, set the integration frequency range so that the point approximately  $-30$  dB below the spectrum peak is included.

The waveform in the integration range appears highlighted (in blue).

The way to move the markers and the data display between markers are the same as with the above-mentioned moving markers.

Advanced marker type: INTG (integrated power marker)



### *Note*

When advanced markers are in use, the marker levels at the end of measurements are automatically updated.

## 4.10 Displaying a Split Screen

### Procedure

The screen can be split vertically into two windows (split mode).

The trace waveform can be assigned to either window.

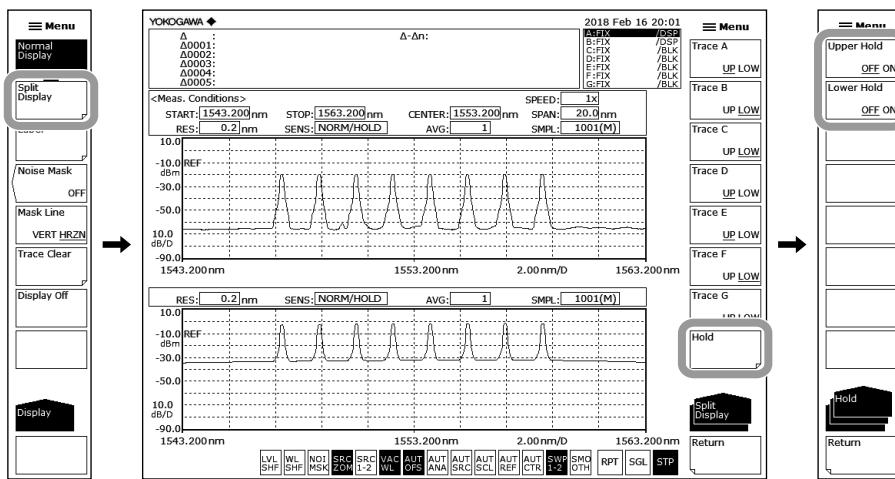
#### Splitting the Screen

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **DISPLAY**. A function menu appears for setting the screen.
3. Tap **Split Display**. The screen is split vertically into two windows, and a function menu appears for assigning traces.

#### Selecting the Window (Top or Bottom) to Display the Traces In

4. Tap the trace you want to change the screen assignment of. Select a trace from **Trace A** to **Trace G**. Each time you tap, the trace assignment changes between the top and bottom windows.

By default, traces A, B, D, and E are assigned to the top window and traces C, F, and G are assigned to the bottom window.



#### Fixing a Trace

4. Tap **Hold**.

#### Fixing/Releasing a Trace in the Upper Window

5. Tap **Upper Hold OFF / ON**. The traces assigned to the top window as well as the scale are fixed.

To release them, tap **Upper Hold OFF / ON** again. The display scale and waveforms are updated to the most recent states.

#### Fixing/Releasing a Trace in the Lower Window

5. Tap **Lower Hold OFF / ON**. The traces assigned to the bottom window as well as the scale are fixed.

To release them, tap **Lower Hold OFF / ON** again. The display scale and waveforms are updated to the most recent states.

### Returning to the Normal Display

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **DISPLAY**. A function menu appears for setting the screen.
3. Tap **Normal Display**. The screen returns to the normal display (one window).

## Explanation

### Hold

The hold function is used to display waveforms measured with different wavelength ranges in the top and bottom windows of the screen.

For example, you can measure trace A in the top window and hold it, change the measurement conditions, and measure trace B in the bottom window.

The hold function has the following features. They are the same for the top and bottom windows.

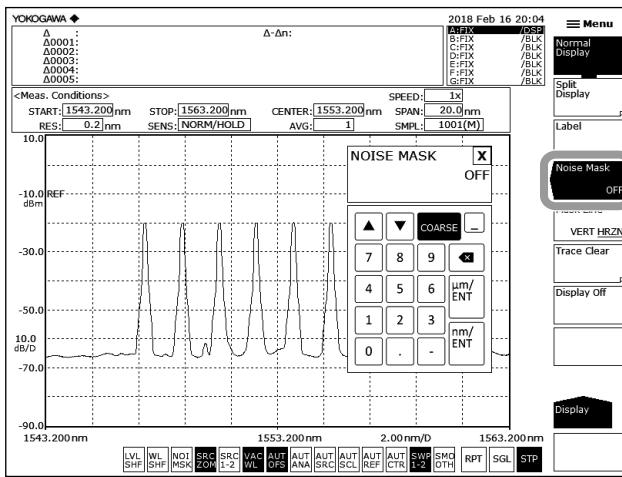
- The display scale is fixed.
- The traces are fixed.
- Setting the window showing the active trace (Write @) to hold automatically fixes the active trace. (Fix @)
- When the screen is changed from Hold to Normal Display, the display scale is set to the last specified display scale.
- Changing a held trace (fix state) to any other state automatically releases the hold. When this happens, a warning message will be displayed.

## 4.11 Noise Mask

### Procedure

This key is used to display a waveform so that parts of the waveform at or below the specified value are masked. In addition, when a noise mask value is set, the waveform is overwritten in real time.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **DISPLAY**. A function menu appears for setting the screen.
3. Tap **Noise Mask**. A parameter input window appears.
4. Enter the noise mask value in the parameter input window.
5. Tap **μm/ENT** or **nm/ENT**.
6. Tap **Mask Line VERT/HRZN** to select VERT or HRZN.



### Note

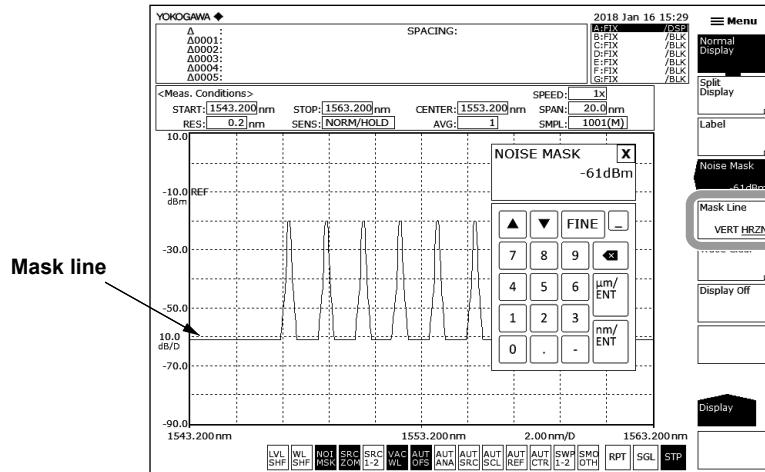
- The noise mask setting range is OFF (-999) and -100 to 0. When entering with the arrow keys when COARSE is selected, the value changes in steps of 10. When FINE is selected, the value changes in steps of 1.
- You can also set the parameter by tapping the **NOI MSK** shortcut key at the bottom of the screen. When the noise mask is not off, the shortcut key is highlighted.

**Explanation**

**Noise Mask Type**

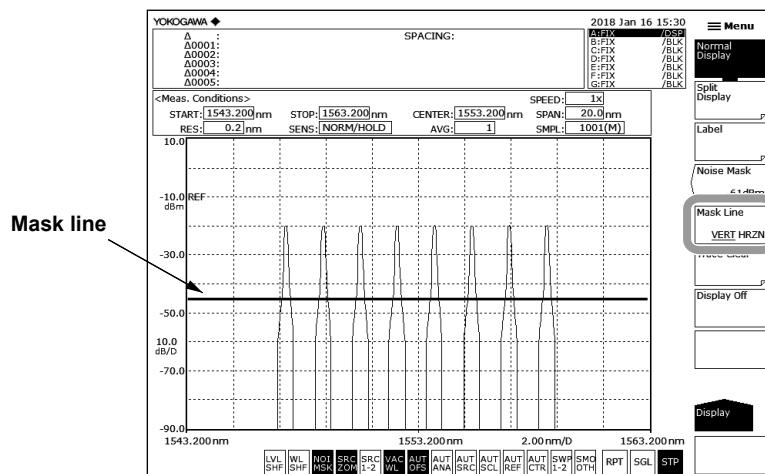
**HRZN**

Displays the waveform with level values at or below the mask value as the mask value.



**VERT**

Displays the waveform with level values at or below the mask value as the display lower limit value (-210 dBm).



**Note**

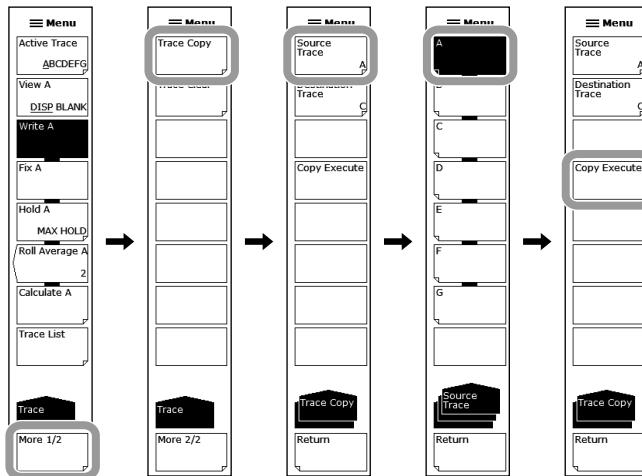
The noise mask function is disabled when the vertical scale is linear.

## 4.12 Copying and Clearing Traces

### Procedure

#### Copying Traces

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Trace Copy**.
5. Tap **Source Trace** to select the copy source trace (A to G). When you make the selection, the menu returns to the previous level.
6. Tap **Destination Trace** to select the copy destination trace (A to G). When you make the selection, the menu returns to the previous level.
7. Tap **Copy Execute**. The copy will be executed.

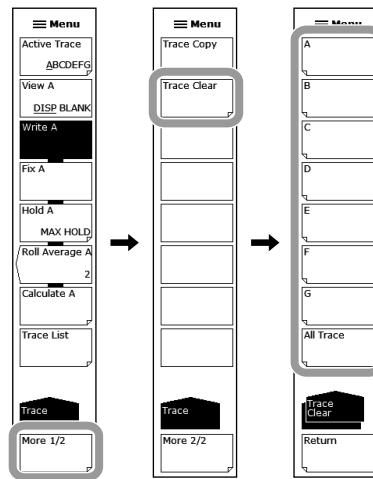


#### Note

- After the copy is executed, the copy destination trace status changes to FIX and DISP.
- If the copy source and destination trace are the same, Copy Execute will be disabled.

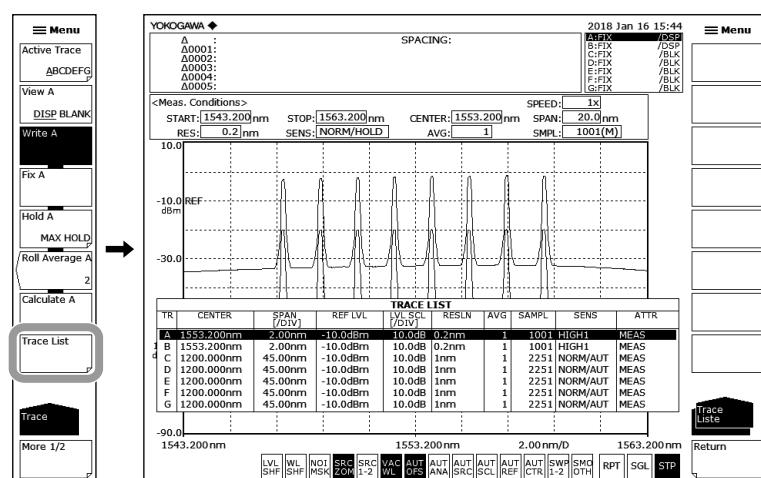
### Clearing Traces

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Trace Clear**.  
You can also tap Trace Clear in the function menu that appears when you tap DISPLAY on the Main Menu window.
5. Tap the trace (A to G) you want to clear the data of.
6. To clear the data of all traces, tap **All Trace**.



### Trace List

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **TRACE**. A function menu appears for setting traces.
3. Tap **Trace List**.



## 4.13 Single Search

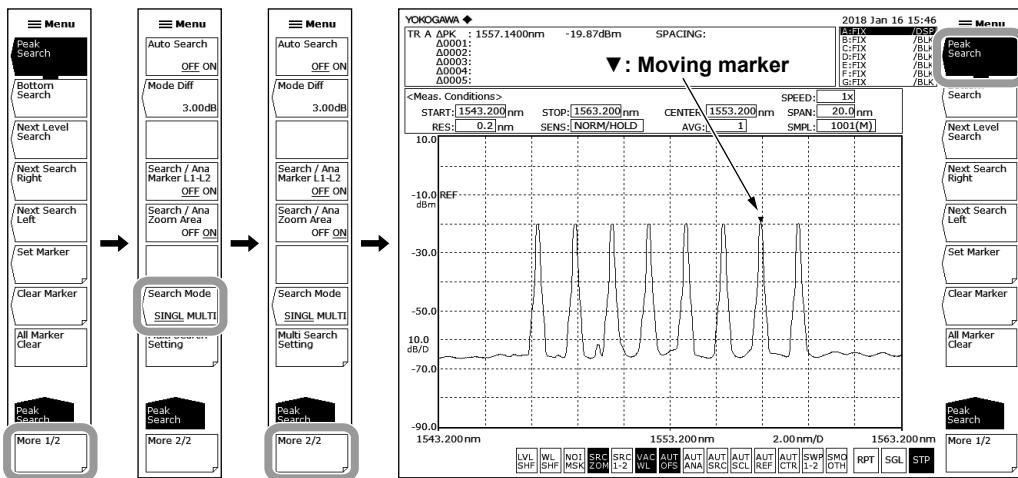
### Procedure

#### Selecting the Single Search

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **PEAK SEARCH**. A function menu appears for detecting peak values.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Search Mode** to select **SINGL**.  
In the default settings, **SINGL** (single search) is selected.
5. Tap **More** to display the More 1/2 function menu.

#### Finding the Peak Wavelength/Level

6. Tap **Peak Search**. A moving marker is set to the peak (maximum value) of the waveform, and the marker values are displayed in the data area.



#### Finding the Bottom Wavelength/Level

6. Continuing from step 5, tap **Bottom Search**. A moving marker is set to the bottom (minimum value) of the waveform, and the marker value is displayed in the data area.

#### Note

If the active trace is not set to DISP, you cannot use the moving marker. Set View @ DISP BLANK under TRACE to DISP.

#### Finding the Next Peak/Bottom Level

6. When the moving marker is displayed at the peak or bottom of the waveform, tap **Next Level Search**. On the marker trace waveform, the moving marker at the peak or bottom is set to the next peak (local maximum value) or bottom (local minimum value).

#### Finding the Level Peak/Bottom to the Right of the Moving Marker

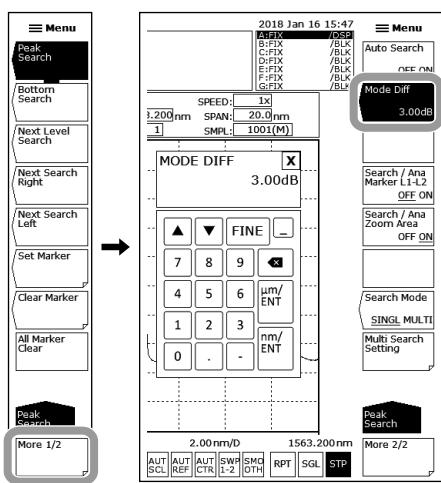
6. When the moving marker is displayed at the peak or bottom of the waveform, tap **Next Search Right**. The moving marker is set to the next peak (local maximum value) or bottom (local minimum value) on the right.

### Finding the Level Peak/Bottom to the Left of the Moving Marker

- When the moving marker is displayed at the peak or bottom of the waveform, tap **Next Search Left**. The moving marker is set to the next peak (local maximum value) or bottom (local minimum value) on the left.

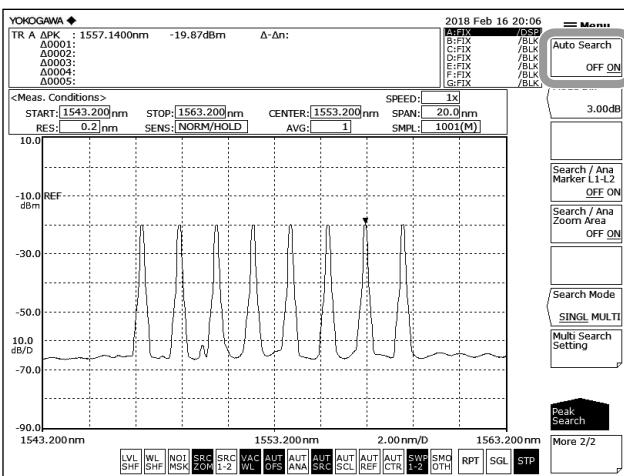
### Setting the Minimum Peak/Bottom Difference of the Mode Judgment Reference

- Tap **≡ Menu**. The Main Menu window appears.
- Tap **PEAK SEARCH**. A function menu appears for detecting peak values.
- Tap **More** to display the More 2/2 function menu.
- Tap **Mode Diff**. A parameter input window appears.
- Enter the minimum peak/bottom difference of the mode judgment reference in the parameter input window.
- Tap **nm/ENT**.



### Auto Search

- Tap **≡ Menu**. The Main Menu window appears.
- Tap **PEAK SEARCH**. A function menu appears for detecting peak values.
- Tap **More** to display the More 2/2 function menu.
- Tap **Auto Search** to select ON.



## Explanation

The instrument detects the peak (the maximum level value) or bottom (the minimum level value) of the measured waveform.

### Peak Search

A peak search (a search for the maximum level value) is performed on the active trace waveform. The moving marker is displayed at the peak point, and the marker value is displayed in the data area. If the peak level is off the screen, its marker is displayed at the top or bottom edge of the screen. Even in this situation, the correct marker value is displayed.

For details on using the moving marker after executing a measurement, see section 4.9, "Marker Display."

### Bottom Search

A bottom search (a search for the minimum level value) is performed on the active trace waveform. The moving marker is displayed at the bottom point, and the marker value is displayed in the data area. If the bottom is off the screen, its marker is displayed at the top or bottom edge of the screen. Even in this situation, the correct marker value is displayed.

For details on using the moving marker after executing a measurement, see section 4.9, "Marker Display."

### Next Level Search

On the active trace waveform, the moving marker at the peak or bottom is set to the next peak (local maximum value) or bottom (local minimum value).

If such peak or bottom is not found, a warning appears.

WARNING 103 : No data in active trace

### Next Search Right

On the active trace waveform, the moving marker at the peak or bottom is set to the peak (local maximum value) or bottom (local minimum value) on its right.

If such peak or bottom is not found, a warning appears.

WARNING 103 : No data in active trace

### Next Search Left

On the active trace waveform, the moving marker at the peak or bottom is set to the peak (local maximum value) or bottom (local minimum value) on its left.

If such peak or bottom is not found, a warning appears.

WARNING 103 : No data in active trace

### Set Marker Set

Sets a fixed marker with the assigned number at the moving marker position.

The number can be assigned in the range of 001 to 1024. The default number is one greater than the highest fixed marker number among the currently set markers or 001 if no markers have been set.

If Marker Active is set to OFF, Set Marker is disabled.

### Clear Marker Clear

Clears the specified fixed marker number. The marker value in the data area is also cleared.

The default fixed marker number to be cleared is the last assigned fixed marker number.

### All Marker Clear

Clears all currently displayed moving markers and fixed markers.

### Mode Diff

Sets the minimum peak/bottom difference (dB) serving as a basis for mode determination during mode detection.

The setting range is 0.01 to 50.00 dB (FINE: steps of 0.01, coarse: steps of 1). You set the value in a parameter input window. (Default value: 3.00 dB)

### Search / Ana Marker L1-L2

When set to ON and wavelength line markers L1 and L2 are set, peak searching, bottom searching (PEAK SEARCH in the Main Menu window), and analysis function (ANALYSIS in the Main Menu window) calculations are only applied between line markers 1 and 2.

The setting applies to MARKER, PEAK SEARCH, and Search / Ana Marker L1-L2 of ANALYSIS.

If wavelength line markers L1 and L2 are not set, the key is disabled even when Search / Ana Marker L1-L2 is set to ON. (Default value: OFF)

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

#### Note

- If both L1 and L2 are set, the functions are executed between line markers 1 and 2.
- If only L1 is set, the function is executed from line marker 1 to the right edge of the screen.
- If only L2 is set, the function is executed from the left edge of the screen to line marker 2.

---

### Search / Ana Zoom Area

When set to ON, peak searching, bottom searching (PEAK SEARCH in the Main Menu window), and analysis function (ANALYSIS in the Main Menu window) are only applied to data in the ZOOM SPAN range.

The setting applies to MARKER, PEAK SEARCH, and Search / Ana Zoom Area of ANALYSIS.

When this key and the SEARCH/ANA L1-L2 key are set to ON, calculations are applied to data that are both within the ZOOM SPAN range and between line markers 1 and 2. (Default value: ON)

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

### Auto Search

The peak or bottom value is detected automatically every time a sweep is performed.

### Auto Search

Turns on or off peak/bottom searching that is performed every sweep.

When set to ON, a peak/bottom search is performed automatically and a moving marker is set automatically after sweeping ends. (Default value: OFF)

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

## 4.14 Multi Search

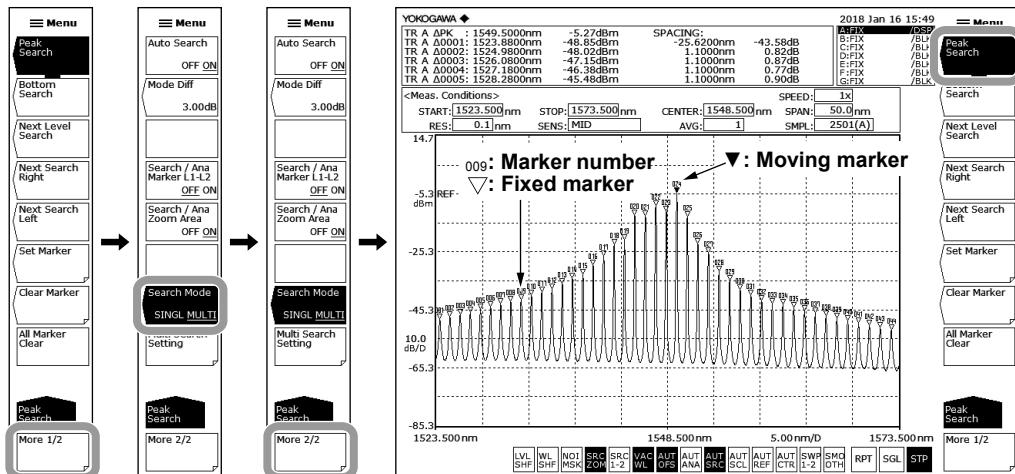
### Procedure

#### Selecting the Multi Search

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **PEAK SEARCH**. A function menu appears for detecting peak values.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Search Mode** to select **MULTI**.  
In the default settings, **SINGL** (single search) is selected.  
When you select **MULTI**, a peak search or a bottom search is executed. Which search is executed depends on which key, Peak Search or Bottom Search, has been selected on the More 1/2 function menu.
5. Tap **More** to display the More 1/2 function menu.

#### Finding Multiple Peak Wavelengths/Levels

6. Tap **Peak Search**. Fixed markers are set on the multiple peaks of the waveform, and the marker values are displayed in the data area. The moving marker is set on the highest peak.



#### Finding Multiple Bottom Wavelengths/Levels

6. Continuing from step 5, tap **Bottom Search**. Fixed markers are set on the multiple bottoms of the waveform, and the marker values are displayed in the data area. The moving marker is set on the lowest bottom.

#### Note

- If the active trace is not set to **DISP**, you cannot use the moving marker. Set **View @ DISP BLANK** under **TRACE** to **DISP**.
- The moving marker is also displayed when you tap **PEAK SEARCH** in the Main Menu window.

### Finding the Next Peak/Bottom Level

The procedure is the same as the procedure shown for the single search in the previous section.

### Finding the Level Peak/Bottom to the Right of the Moving Marker

The procedure is the same as the procedure shown for the single search in the previous section.

### Finding the Level Peak/Bottom to the Left of the Moving Marker

The procedure is the same as the procedure shown for the single search in the previous section.

## Setting the Mode (Peak/Bottom) Detection Threshold and the Detection List Sort Order

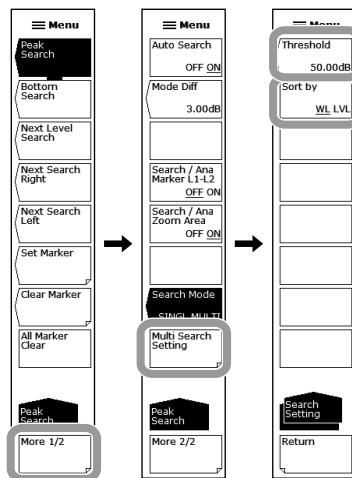
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **PEAK SEARCH**. A function menu appears for detecting peak values.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Multi Search Setting**. A function menu appears for setting the mode (peak/bottom) detection threshold and the marker number assignment order.

### Setting the Mode (Peak/Bottom) Detection Threshold

5. Tap **Threshold**. A parameter input window appears.
6. Enter the mode detection threshold in the parameter input window.
7. Tap **nm/ENT**.

### Setting the Detection List Sort Order

5. Tap **Sort by**. Each time you tap, the value switches between WL and LVL.



## Explanation

The instrument detects multiple peaks (maximum level values) or bottoms (minimum level values) of the measured waveform at the same time.

### Threshold

Set the threshold (detection range level) that is used when the multi search detects modes (peaks/bottoms).

For peak searches, the peak detection range is defined as being the levels from the measured waveform's maximum peak to the threshold value.

For bottom searches, the bottom detection range is defined as being the levels from the measured waveform's minimum bottom to the threshold value.

### Sort by

The detected marker values are displayed as a list in the data area. This setting sets the sort order of the detection list.

WL: Wavelengths are displayed in order starting from the shortest wavelength.

LVL: For the peak search, levels are displayed in order starting from the highest level.

For the bottom search, levels are displayed in order starting from the lowest level.

### Peak Search

A peak search (a search for the maximum level values) is performed on the active trace waveform. Fixed markers are displayed on the peak points. The moving marker is displayed on the maximum peak (the maximum level value). The marker values are displayed in the data area. If the peak level is off the screen, its marker is displayed at the top or bottom edge of the screen. Even in this situation, the correct marker value is displayed.

For details on using the moving marker after executing a measurement, see section 4.9, "Marker Display."

If there are five or more data values, you can drag the data area to scroll.

### Bottom Search

A bottom search (a search for the minimum level values) is performed on the active trace waveform. Fixed markers are displayed on the bottom points. The moving marker is displayed on the minimum bottom (the minimum level value). The marker values are displayed in the data area. If the bottom is off the screen, its marker is displayed at the top or bottom edge of the screen. Even in this situation, the correct marker value is displayed.

For details on using the moving marker after executing a measurement, see section 4.9, "Marker Display."

If there are five or more data values, you can drag the data area to scroll.

### Other Keys

The following keys are also displayed on the PEAK SEARCH function menu. These keys have the same functions as the functions explained in the previous section on the single search. For details, see the explanation in the previous section.

**Next Level Search**  
**Next Search Right**  
**Next Search Left**  
**Set Marker**  
**Set**  
**Clear Marker**  
**Clear**  
**All Marker Clear**  
**Mode Diff**  
**Search / Ana Marker L1-L2**  
**Search / Ana Zoom Area**  
**Auto Search**

### ***Note***

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The Mode Diff (mode judgment reference)—the peak/bottom difference—setting is shared between the multi search and single search.

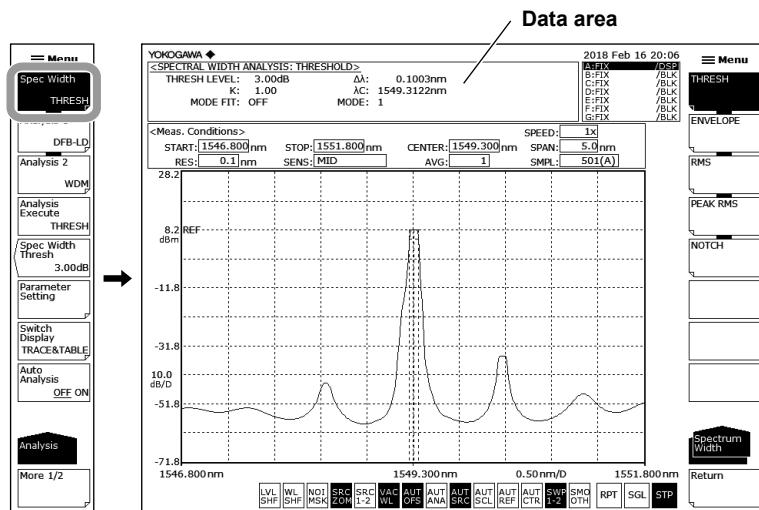
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## 5.1 Spectral Width Measurement

### Procedure

Spectral width can be measured from the measured waveform.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Spec Width**. A menu appears for selecting the analysis algorithm.
4. Tap **THRESH, ENVELOPE, RMS, or PEAK RMS**. Analysis is performed, and the results are displayed in the data area.



When changing the analysis parameters

5. Continuing from step 4, tap **Parameter Setting**. An analysis parameter setting screen appears.

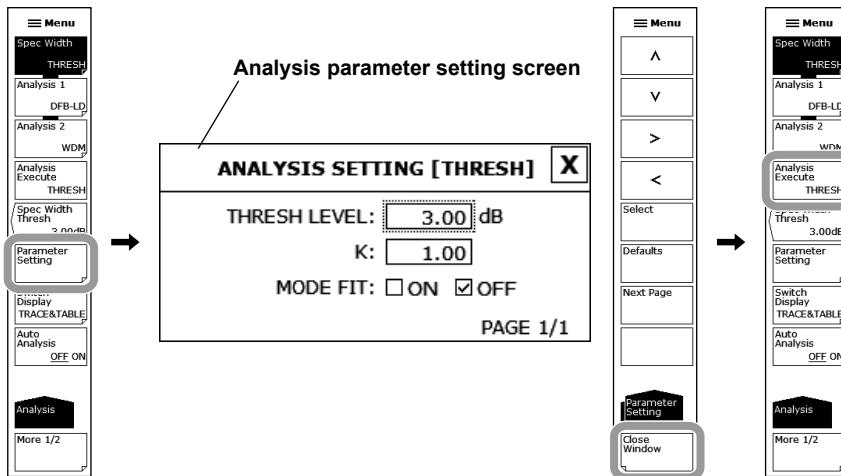
6. Tap within the frame of values, and set them.

If a parameter input window appears, enter the value in the window.

For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.

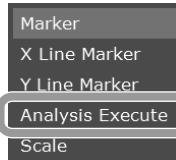
7. Tap **X** to close the analysis parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
8. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.

## 5.1 Spectral Width Measurement



### Note

You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



If you want to change just the threshold level, you can use Spec Width Thresh.

### Changing the Threshold Value for Each Algorithm

5. Continuing from step 4, tap **Spec Width Thresh**. A parameter input window appears.
6. Enter the value in the parameter input window.
7. Tap **μm/ENT** or **nm/ENT**.

### Automatic Analysis on Each Sweep

5. Continuing from step 4, tap **Auto Analysis OFF ON** to select ON. At the end of each sweep, the Spec Width, Analysis 1, or Analysis 2 function (whichever is selected) is executed automatically.

### Note

- If Auto Search under PEAK SEARCH is set to ON and Auto Analysis is set to ON, Auto Search will automatically be set to OFF.
- You can also set the parameter by tapping the **AUT ANA** shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

## Saving the Analysis Results

3. Continuing from step 2, Tap **More** to display the More 2/2 function menu.
4. Tap **Result Save**. A file list appears.
5. For the remaining procedure, see section 6.5, "Saving and Loading Analysis Results Data."

## Explanation

### Algorithms

#### Algorithms for Spectral Width Analysis

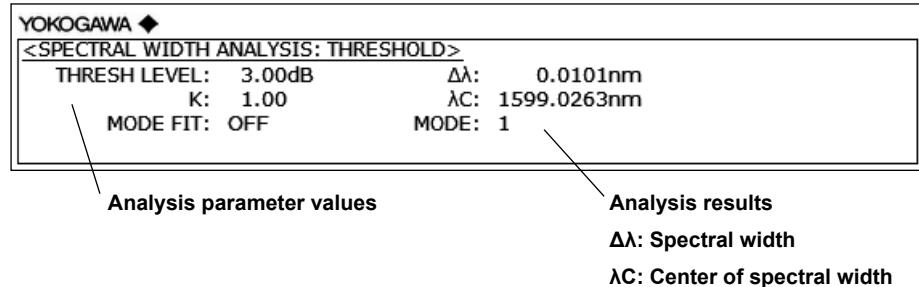
Algorithm	Description
THRESH	Determines spectral width from the width between points where the waveform crosses the threshold value.
ENVELOPE	Determines spectral width from waveform envelope.
RMS	Determines spectral width from waveform standard deviation.
PEAK RMS	Determines spectral width from waveform mode peak standard deviation.

#### Note

- For details on the spectral width analysis algorithms and parameters, see appendix 2, "Data Calculation Algorithms for Spectral Widths."
- For information on NOTCH, see section 5.2, "Notch Width Measurement."

## Result Display

Analysis results are displayed in the data area.



#### Spec Width Thresh

You can set threshold values for each spectral width analysis algorithm. After the value is set, analysis is executed and the display is updated.

The setting range is 0.01 to 50.00 dB. You can set it in steps of 0.01. When entering with the arrow keys when COARSE is selected, the value changes in steps of 1.00.

Each analysis algorithm has its own threshold value.

When Spec Width is set to OFF, this key is disabled.

The value set with this key is shared with the value set on the analysis parameter setting screen that appears when Parameter Setting is tapped.

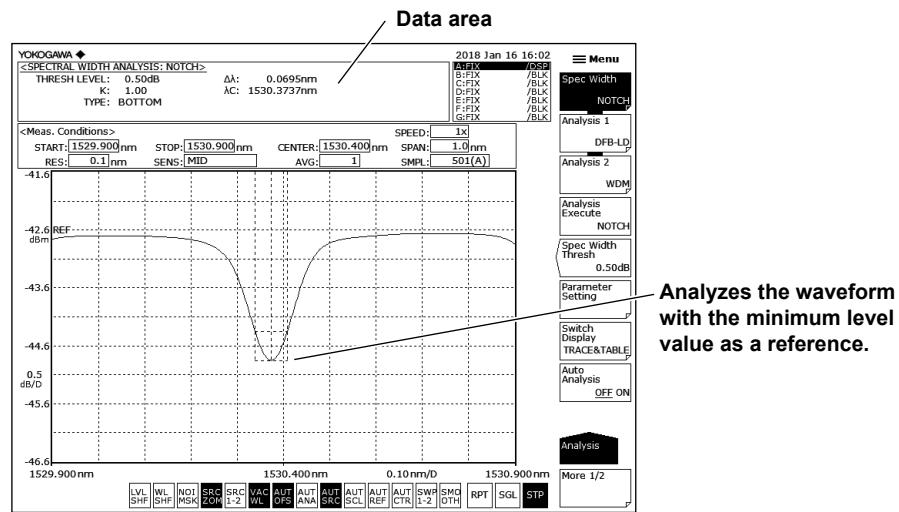
## 5.2 Notch Width Measurement

### Procedure

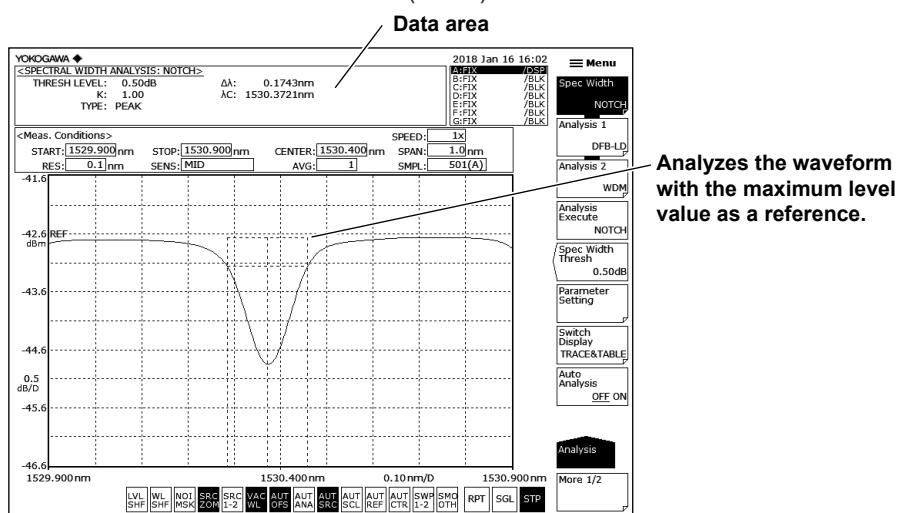
Notch width measurement measures the notch width (passband/notch width) from the measured waveform of a filter with U-shaped or V-shaped wavelength characteristics.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Spec Width**. A menu appears for selecting the analysis algorithm.
4. Tap **NOTCH**. Analysis is performed, and the results are displayed in the data area.

Notch width measurement waveform (BOTTOM)

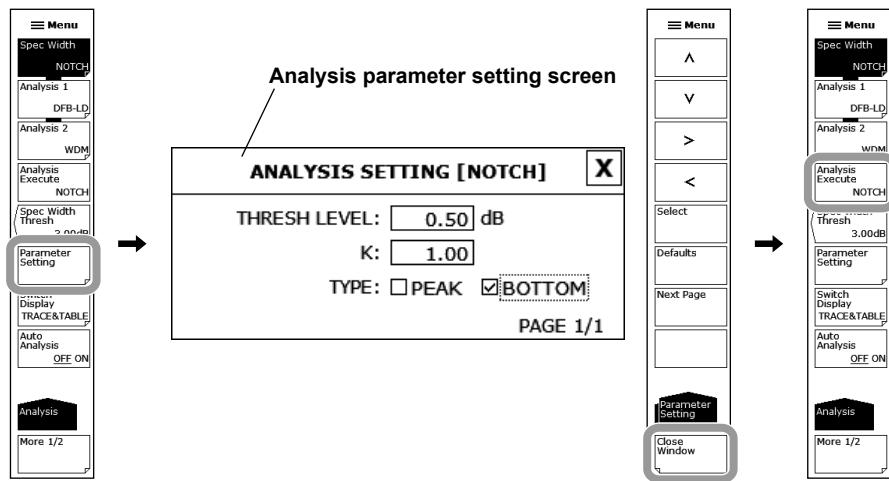


Notch width measurement waveform (PEAK)



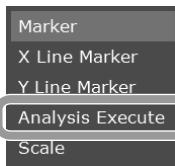
When changing the analysis parameters

5. Continuing from step 4, tap **Parameter Setting**. A notch analysis parameter setting screen appears.
6. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
7. Tap **X** to close the notch analysis parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
8. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.



### Note

- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



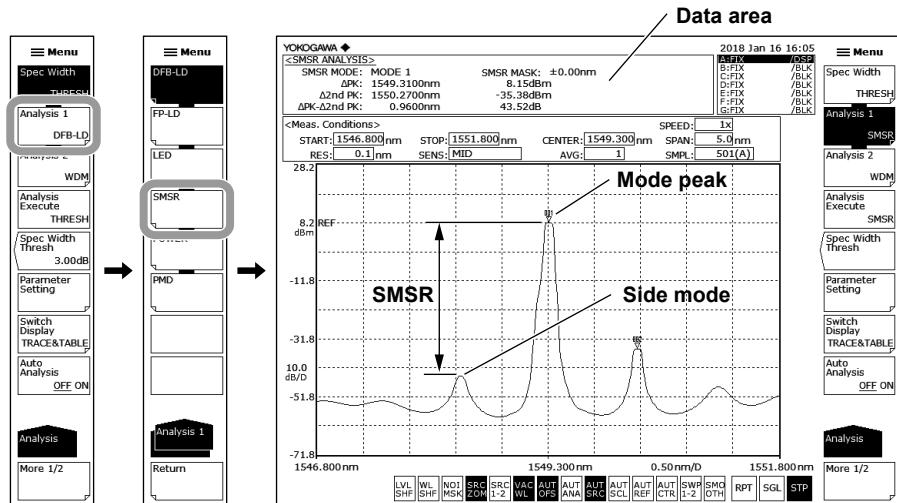
- For details on the notch width analysis algorithms and parameters, see appendix 2, "Data Calculation Algorithms for Spectral Widths."

## 5.3 SMSR Measurement

### Procedure

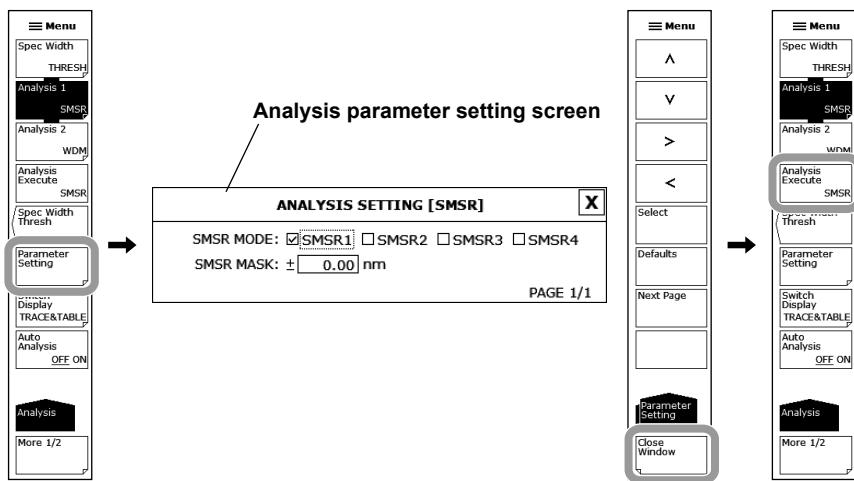
SMSR can be measured from the measured waveform of a DFB-LD.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 1**. A menu appears for selecting the analysis function.
4. Tap **SMSR**. Analysis is performed, and the results are displayed in the data area.



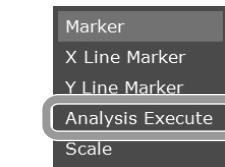
When changing the analysis parameters

5. Continuing from step 3, tap **Parameter Setting**. An SMSR measurement parameter setting screen appears.
6. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
7. Tap **X** to close the SMSR measurement setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
8. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.



### Note

You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list.  
To display the pop-up list, tap or right-click the waveform display area showing the waveform.  
For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



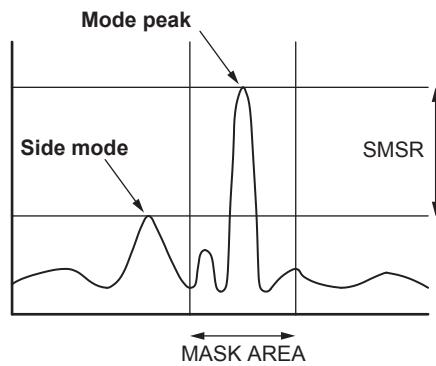
### 5.3 SMSR Measurement

#### Explanation

##### SMSR

SMSR stands for side-mode suppression ratio.

SMSR represents the difference between the mode peak and the side-mode level. It is one of the parameters used to evaluate the performance of DFB-LDs and the like.

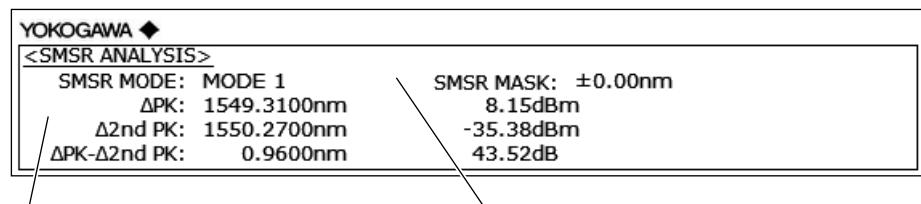


#### Note

For details on SMSR analysis algorithms, see appendix 3, "Details of Each Analysis Function."

### Result Display

Analysis results are displayed in the data area.



#### Analysis results

▽PK: Mode peak wavelength, level value

▽2nd PK: Side mode wavelength, level value

#### Analysis parameter values

MODE 1: Set the 2nd peak excluding the MASK AREA as the side mode.

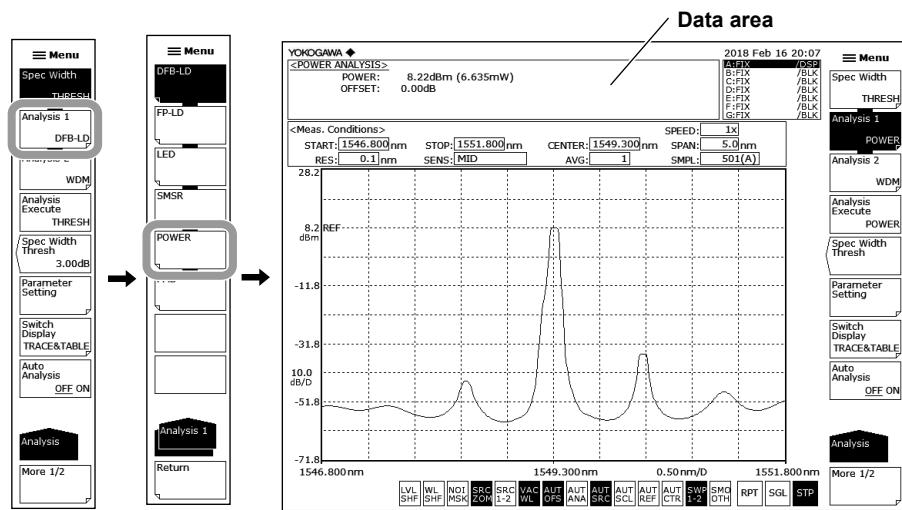
SSMR MASK: Mask setting range

## 5.4 Power Measurement

### Procedure

Optical power can be measured by integrating the measured waveform levels.

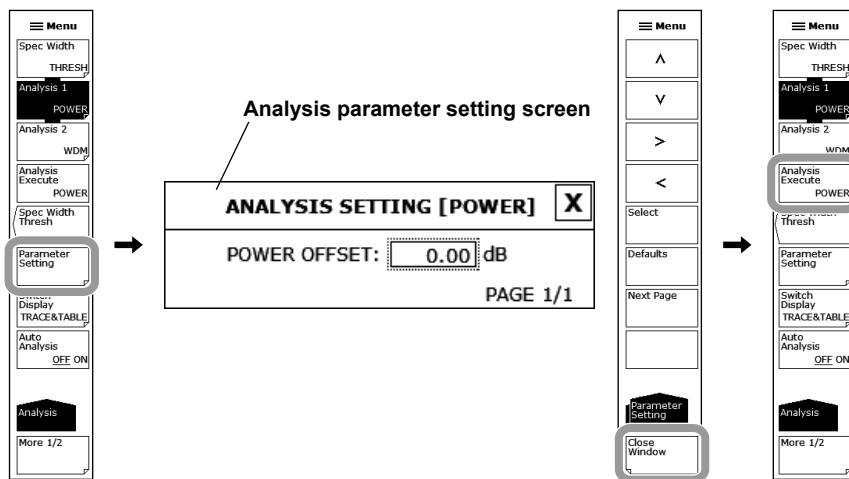
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 1**. A menu appears for selecting the analysis function.
4. Tap **POWER**. Analysis is performed, and the results are displayed in the data area.



## 5.4 Power Measurement

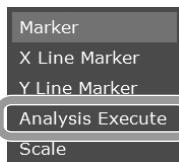
When changing the analysis parameters

5. Continuing from step 4, tap **Parameter Setting**. A power offset setting screen appears.
6. Tap the frame of the value, and enter the value in the parameter input window.
7. Tap **X** to close the power offset setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
8. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.



### Note

- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



- For details on power analysis algorithms, see appendix 3, "Details of Each Analysis Function."

## 5.5 DFB-LD, FP-LD, and LED Measurement

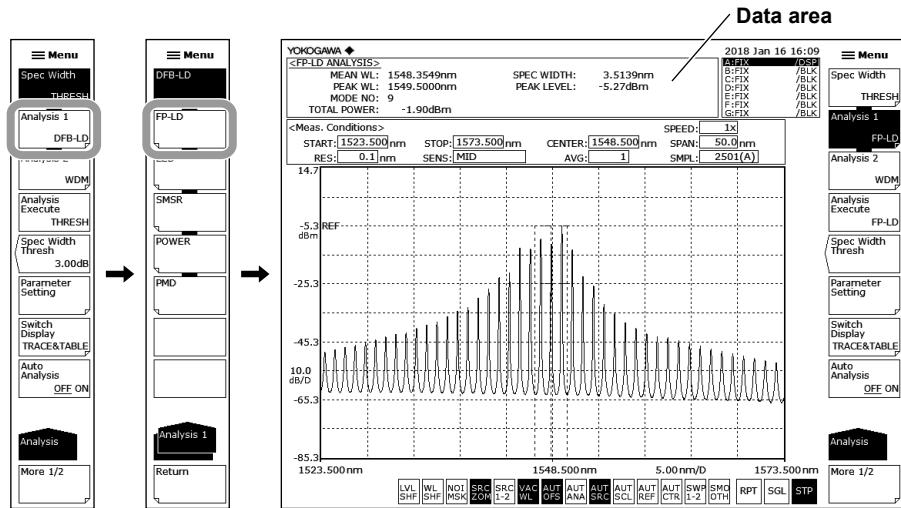
### Procedure

Light source parameters can be analyzed from the measured waveform of each light source (DFB-LD, FP-LD, LED).

For instructions on how to acquire measured waveforms, see “Loading a Waveform for PMD Measurement” on page 5-14.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 1**. A menu appears for selecting the analysis function.
4. Tap **DFB-LD**, **FP-LD**, or **LED** according to the type of light source to be analyzed. Analysis is performed, and the results are displayed in the data area.

Example of a measured waveform of an FP-LD



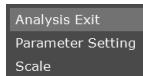
To end the DFB-LD analysis

5. Tap the waveform display area to display a pop-up list, and tap **Analysis Exit**. This procedure is not necessary for FP-LD or LED.

The analysis also ends when you select another function on the Main Menu window or tap a value in the measurement condition area or the like.

### Note

On the DFB-LD analysis result display, when you tap the waveform display area, you can select the following functions from the pop-up list.



- Analysis Exit: Finish the analysis.
- Parameter Setting: Display a parameter setting screen.
- Scale: Display a operation tool window for waveform zooming.

## 5.5 DFB-LD, FP-LD, and LED Measurement

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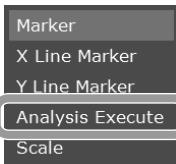
When changing the analysis parameters

6. Continuing from step 4, tap **Parameter Setting**. A measurement parameter setting screen appears for the selected type of light source.
7. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
8. Tap **X** to close the measurement parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
9. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.

### **Note**

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- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



- For details on the analysis algorithms for the DFB-LD, FP-LD, and LED light sources and related parameters, see appendix 3, "Details of Each Analysis Function."

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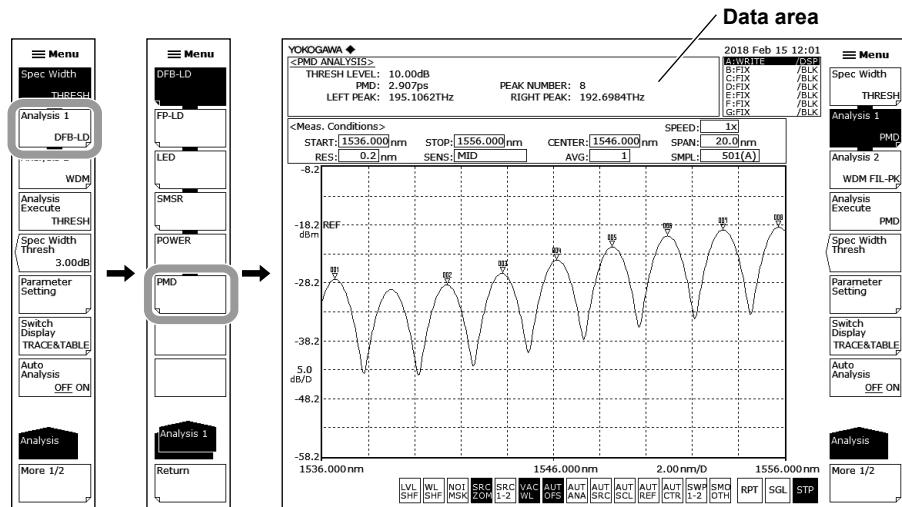
## 5.6 PMD Measurement

### Procedure

The polarization mode dispersion (PMD) can be determined from a measured waveform by using the instrument in combination with a wideband light source and polarizer, a polarization controller, and an analyzer.

For instructions on how to acquire measured waveforms, see “Loading a Waveform for PMD Measurement” on page 5-14.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 1**. A menu appears for selecting the analysis function.
4. Tap **PMD**. Analysis is performed, and the results are displayed in the data area.

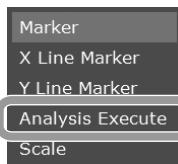


When changing the analysis parameters

5. Continuing from step 4, tap **Parameter Setting**. A threshold level setting screen appears.
6. Tap the frame of the value, and enter the value in the parameter input window.
7. Tap **X** to close the threshold level setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
8. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.

**Note**

- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.

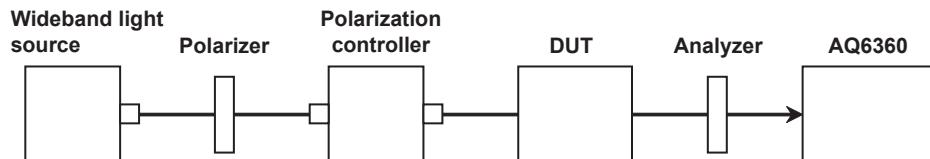


- When PMD measurement is performed, waveform data at or below the threshold level from the peak is not used in analysis. The threshold level is set on the threshold level setting screen.
- The mode judgment threshold level used during PMD analysis execution is set with Mode Diff under PEAK SEARCH. On the waveform, a level difference exceeding the value set with Mode Diff is recognized as a mode.
- For a description of how to set the mode judgment threshold level, see section 4.13, "Single Search."
- For details on the PMD analysis algorithm and parameters, see appendix 3, "Details of Each Analysis Function."

**Loading a Waveform for PMD Measurement**

PMD measurement is performed after loading of the waveform used for PMD measurement.

The configuration for PMD measurement and the waveform acquisition procedure are explained below.



1. Set the measurement conditions so that the entire wavelength range of the wideband light source can be measured. Set the resolution to about 0.2 nm.
2. Tap **☰ Menu**. The Main Menu window appears.
3. Tap **SWEEP**. A function menu appears for sweeping.
4. Tap **Repeat**. Repeat sweeping will begin.
5. While watching the waveform during repeat sweeping, adjust the polarization controller so as to maximize the waveform's peak/bottom difference (the level difference between the maximum and minimum values).
6. Tap **Single** to perform a single sweep. Acquisition of measurement waveforms is complete.

## 5.7 WDM Transmission Signal Analysis

### Procedure

The center wavelength, level, and SNR of each channel can be measured from the measured waveform of a WDM transmission signal.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 2**. A menu appears for selecting the analysis function.
4. Tap **WDM**. Analysis is performed, and the results are displayed on the screen.

Tapping **Switch Display** switches the analysis results display screen.

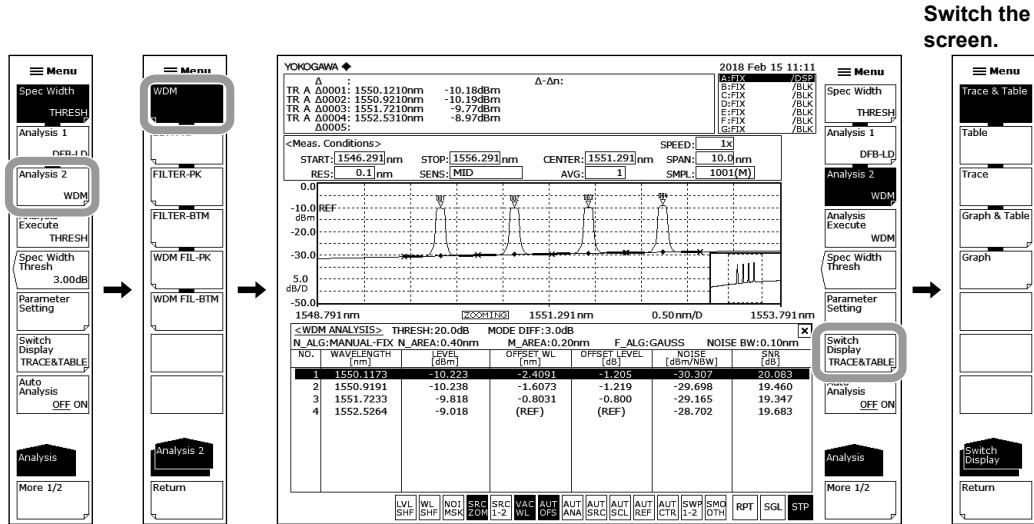
**Trace & Table:** A waveform and table are displayed.

**Trace:** Only the waveform is displayed.

**Table:** Only the table is displayed.

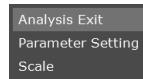
5. To end the analysis, tap **X** in the upper right of the table, or tap the waveform display area to display a pop-up list, and tap **Analysis Exit**.

The analysis also ends when you select another function on the Main Menu window or tap a value in the measurement condition area or the like.



### Note

- If you select Trace & Table or Trace using Switch Display, when you tap the waveform display area, you can select the following functions from the pop-up list.



- Analysis Exit: Finish the analysis.
- Parameter Setting: Display a parameter setting screen.
- Scale: Display a operation tool window for waveform zooming.
- If you select Trace & Table using Switch Display and you tap the analysis results list while the waveform is zoomed, the waveform of the tapped channel appears in the center of the waveform screen.

## 5.7 WDM Transmission Signal Analysis

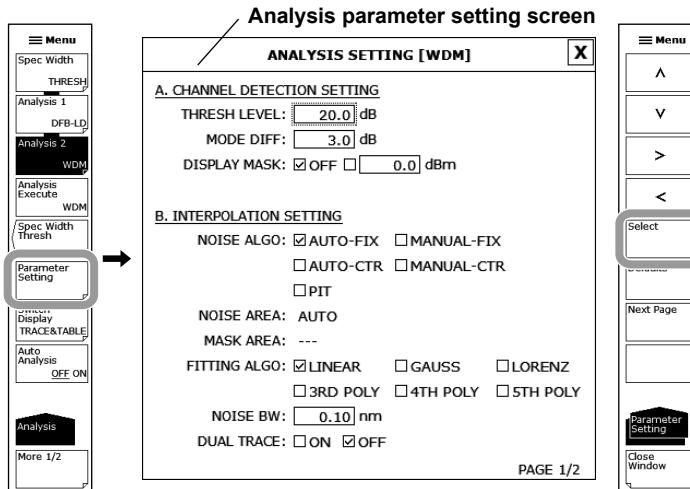
When changing the analysis parameters

- Continuing from step 4, tap **Parameter Setting**. A WDM analysis parameter setting screen appears. If a setting screen has multiple pages, tapping **Next Page** shows the next screen.

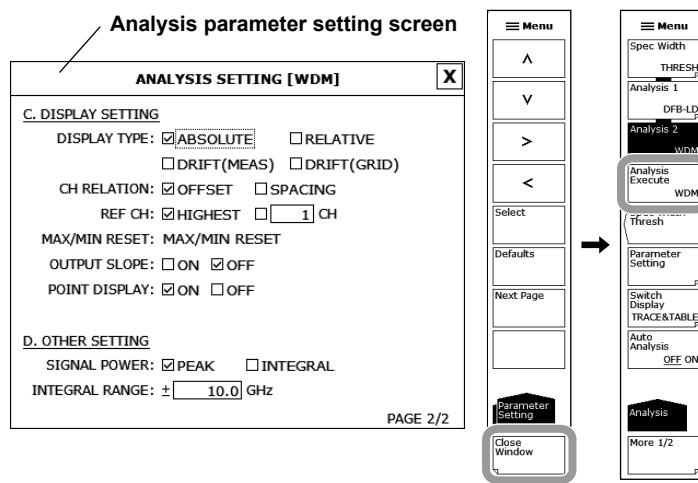
- Tap within the frame of values, and set them.

If a parameter input window appears, enter the value in the window.

For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.

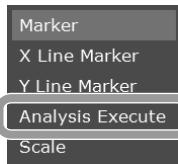


- Tap **X** to close the WDM parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
- Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed on the screen.



**Note**

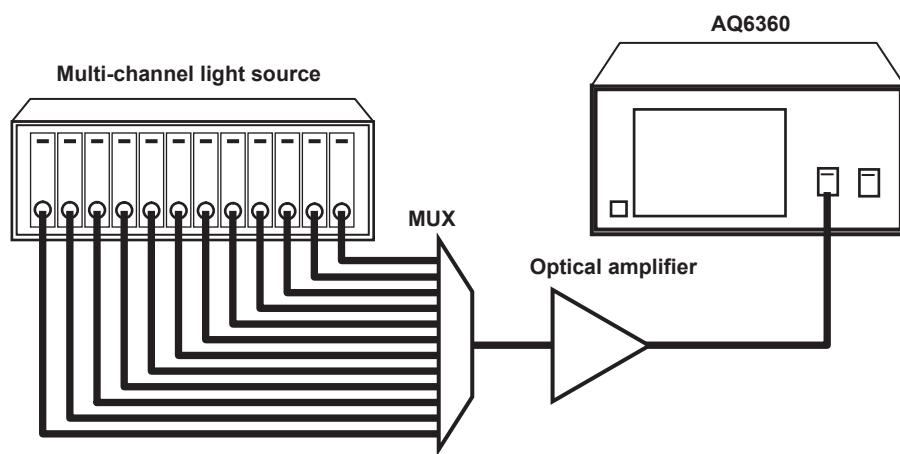
- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



- For details on the WDM analysis algorithm and parameters, see appendix 4, "WDM Analysis Function."

**Explanation**

The following configuration is used to measure WDM transmission signals.



WDM signal light is measured, and the waveform is drawn in the active trace.

**Setting Analysis Parameters**

WDM analysis parameters are broadly divided into the following three categories.

Change the parameter settings according to the analysis being performed.

- Channel detection parameters (CHANNEL DETECTION SETTING)
- Noise level measurement parameters (INTERPOLATION SETTING)
- Analysis result display parameters (DISPLAY SETTING)

These are explained below.

For details on parameters, see appendix 4, "WDM Analysis Function."

### Channel Detection Parameters

These parameters are used to set the threshold level and the like for WDM channel detection.

#### THRESH LEVEL

This parameter sets the threshold level for channel detection.

This setting determines how far down in decibels from the peak level to detect a mode peak as a channel.

#### MODE DIFF

This parameter sets the minimum value for the peak/bottom difference during channel peak detection.

If the waveform peak/bottom difference equals or exceeds this value, it is detected as a mode peak.

#### DISPLAY MASK

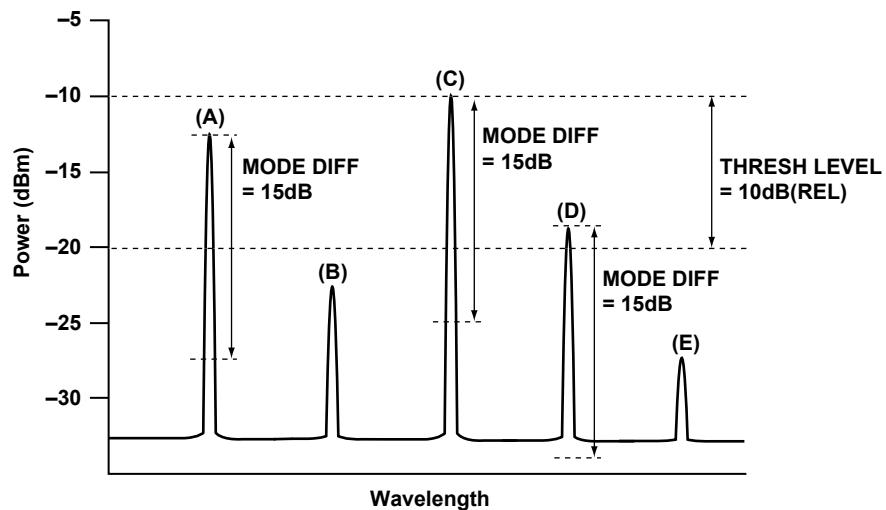
This parameter sets the mask level value for channel masking.

Channels at a level equal to or below this setting are masked.

#### Examples of Channel Detection Parameter Settings

THRESH LEVEL = 10.0 dB

MODE DIFF = 15.0 dB



- In the above example, only (A) and (C) are detected as channels.
- Because the peak powers of (A) and (C) are within the THRESH LEVEL range and the peak/bottom difference is greater than the MODE DIFF value, they are detected as channels.
- (B) and (E) are not detected because their peak powers are outside the THRESH LEVEL range.
- The peak power of (D) is within the THRESH LEVEL range but because the peak/bottom difference is less than the MODE DIFF value, it is not detected as a channel.
- If you want to mask a channel, set DISPLAY MASK. For example, setting DISPLAY MASK to -20.0 dBm masks (B) and (E) because their levels are less than this value.

## Noise Level Measurement Parameters

These parameters are used to set the interpolation method and bandwidth for noise level measurement.

### NOISE ALGO

Select one of the five algorithms shown below for measuring the noise level.

If AUTO-FIX or AUTO-CTR is set, the measurement parameters at another noise level are set automatically. To set the values manually, select MANUAL-FIX or MANUAL-CTR.

- AUTO-FIX Automatic settings (FIX type)
- MANUAL-FIX Manual settings (FIX type)
- AUTO-CTR Automatic settings (CENTER type)
- MANUAL-CTR Manual settings (CENTER type)
- PIT Automatic settings (PIT type)

#### **Note**

- If AUTO-FIX, AUTO-CTR, or PIT is selected, the NOISE AREA and MASK AREA parameters are set automatically according to the measured waveform. FITTING ALGO is set to LINEAR.
- For details on the WDM analysis algorithm and parameters, see appendix 4, "WDM Analysis Function."

### NOISE AREA

This parameter is used to set the range of waveform data to be used in determining the noise level through interpolation.

This parameter is only set when NOISE ALGO is set to MANUAL-FIX.

### MASK AREA

This parameter is used to set the range of signal light to be masked when determining the noise level through interpolation.

This parameter is only set when FITTING ALGO is not set to LINEAR.

### FITTING ALGO

This parameter is used to select the interpolation algorithm for determining the noise level.

This parameter is only set when NOISE ALGO is set to MANUAL-FIX or MANUAL-CTR.

#### Interpolation Algorithms

Fitting Algorithm	Description
LINER	Linear interpolation
GAUSS	Normal distribution curve
LORENZ	Lorenz curve
3RD POLY	3rd order polynomial
4TH POLY	4th order polynomial
5TH POLY	5th order polynomial

#### **Note**

- If NOISE ALGO is AUTO-FIX or AUTO-CTR, then FITTING ALGO is automatically set to LINEAR and does not need to be set manually.

### NOISE BW

This parameter is used to set the noise bandwidth.

### DUAL TRACE

This parameter is used to turn the dual trace function on or off.

When the dual trace function is used, the signal level and noise level during SNR measurement can each be determined from different traces.

### Analysis Results Display Parameters

These parameters are used to set the format for displaying the analysis results on the screen.

#### DISPLAY TYPE

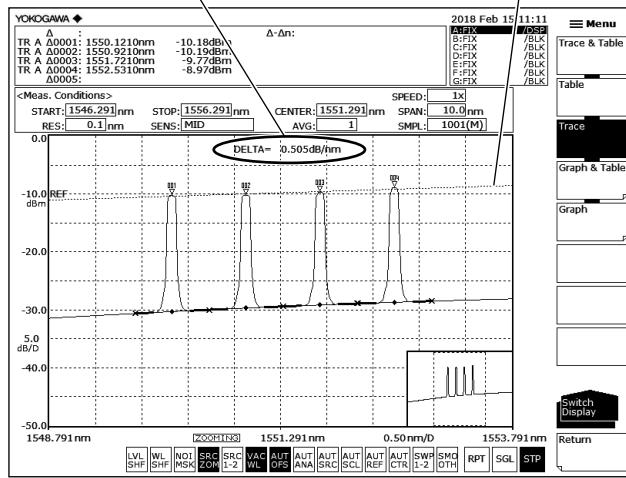
This parameter is used to select the analysis results display format.

DISPLAY TYPE	Description and Procedure
ABSOLUTE (absolute value display)	<p>1. Set CH RELATION to OFFSET or SPACING.</p> <p>OFFSET: Displays a value relative to the reference channel.</p> <p>SPACING: Displays the wavelength difference and level difference from the adjacent channel.</p> <p>2. If you select OFFSET, select the reference channel with REF CH.</p> <ul style="list-style-type: none"> <li>When using the channel with the highest level as the reference Select HIGHEST.</li> <li>When using a specific channel as the reference Set the reference channel number in “***CH”.</li> </ul>
RELATIVE (values relative to the grid)	<p>There are no settings for this display type.</p> <p>(If you want to change the grid table, see appendix 1, “Grid Table for WDM Wavelength.”)</p>
DRIFT(MEAS) (drift display relative to a past measured wavelength)	<p>The procedure varies depending on the reference.</p> <ul style="list-style-type: none"> <li>To use the waveform data of the current active trace waveform as the reference Tap MAX/MIN RESET.</li> <li>To use the first measured waveform after changing the measurement conditions as the reference Because the first measured waveform data is used as the reference, there are no settings that need to be specified with parameters.</li> </ul>
DRIFT(GRID) (drift display relative to grid wavelength)	<p>The procedure varies depending on the reference.</p> <ul style="list-style-type: none"> <li>To use the waveform data of the current active trace waveform as the reference Tap MAX/MIN RESET.</li> <li>To use the first measured waveform after changing the measurement conditions as the reference Because the first measured waveform data is used as the reference, there are no settings that need to be specified with parameters.</li> </ul> <p>(If you want to change the grid wavelength, see appendix 1, “Grid Table for WDM Wavelength.”)</p>

## OUTPUT SLOPE

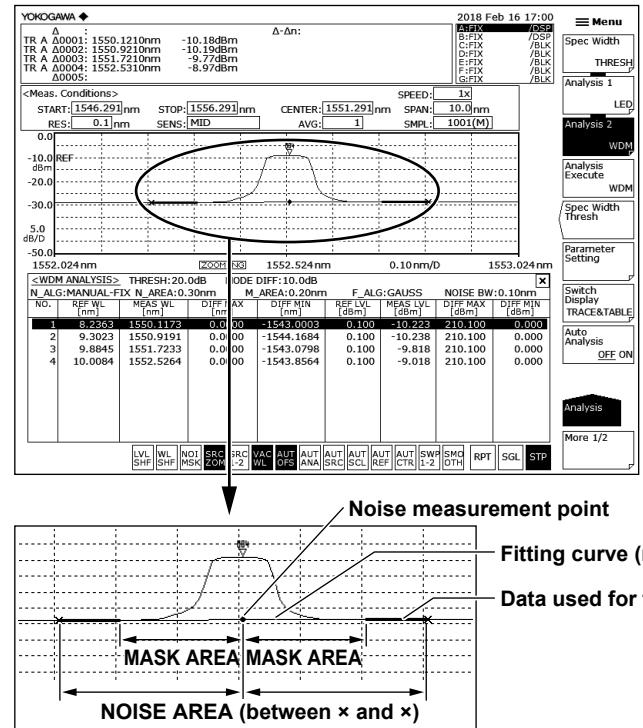
Displays the least square approximation line passing through the detected channel peak. The channel slope can be obtained as a numerical value.

### Analysis results of OUTPUT SLOPE      OUTPUT SLOPE



## POINT DISPLAY

This parameter is used to display the range of data used in interpolation for determining the noise level.



## Other Parameters

### SIGNAL POWER

This parameter sets the signal optical power calculation method.

### INTEGRAL RANGE

This parameter sets the integral range for determining signal optical power.

## 5.8 Optical Amp Gain and NF Measurement

### Procedure

Measurement can be performed of the optical amp gain and noise figure (NF) from the measured waveform of the signal light going into the optical amp, and the measured waveform of the output light leaving the optical amp.

For instructions on how to acquire measured waveforms, see “Acquiring the Waveform to Be Analyzed” on page 5-25.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 2**. A menu appears for selecting the analysis function.
4. Tap **EDFA-NF**. Analysis is performed, and the results are displayed on the screen.

Tapping **Switch Display** switches the analysis results display screen.

**TRACE & TABLE**: A waveform and table are displayed.

**TRACE**: Only the waveform is displayed.

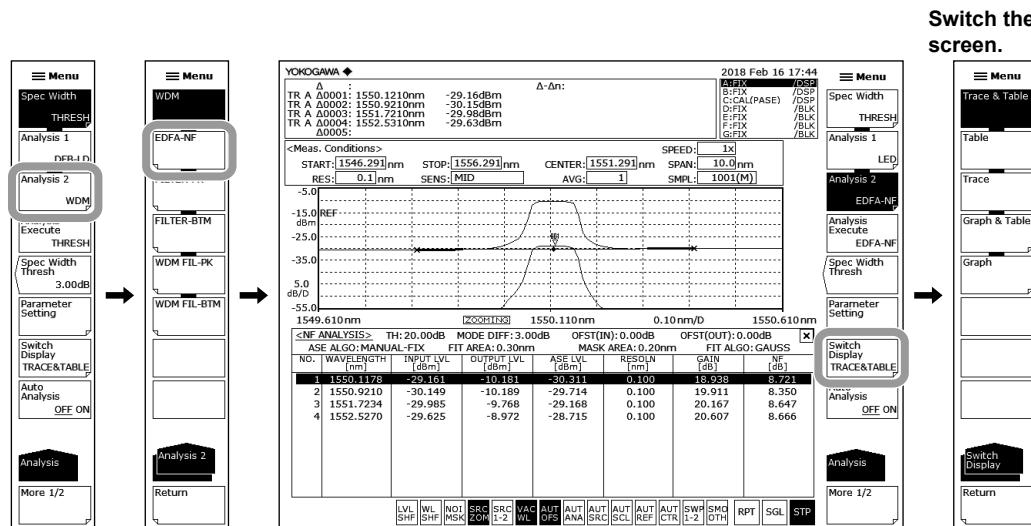
**TABLE**: Only the table is displayed.

**GRAPH & TABLE**: A graph and table are displayed.

**GRAPH**: Only the graph is displayed.

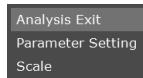
5. To end the analysis, tap **[X]** in the upper right of the table or graph, or tap the waveform display area to display a pop-up list, and tap **Analysis Exit**.

The analysis also ends when you select another function on the Main Menu window or tap a value in the measurement condition area or the like.



**Note**

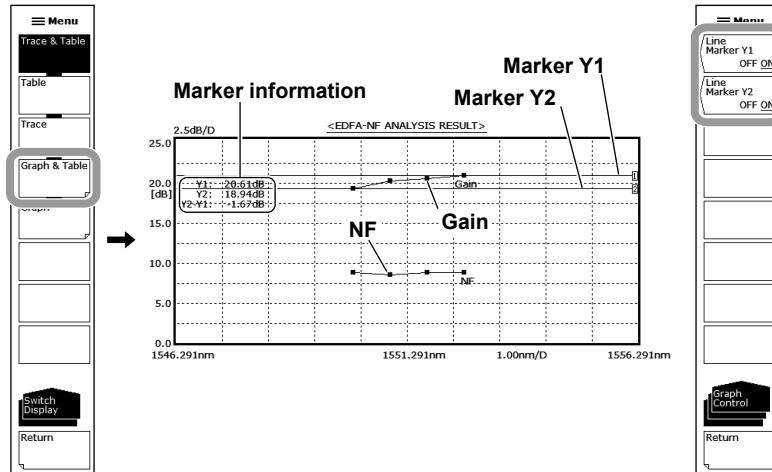
- If you select Trace & Table or Trace using Switch Display, when you tap the waveform display area, you can select the following functions from the pop-up list.



- Analysis Exit: Finish the analysis.
- Parameter Setting: Display a parameter setting screen.
- Scale: Display a operation tool window for waveform zooming.
- If you select Trace & Table using Switch Display and you tap the analysis results list while the waveform is zoomed, the waveform of the tapped channel appears in the center of the waveform screen.

**Displaying the Gain (Gain) and Noise Factor (NF) Graphs**

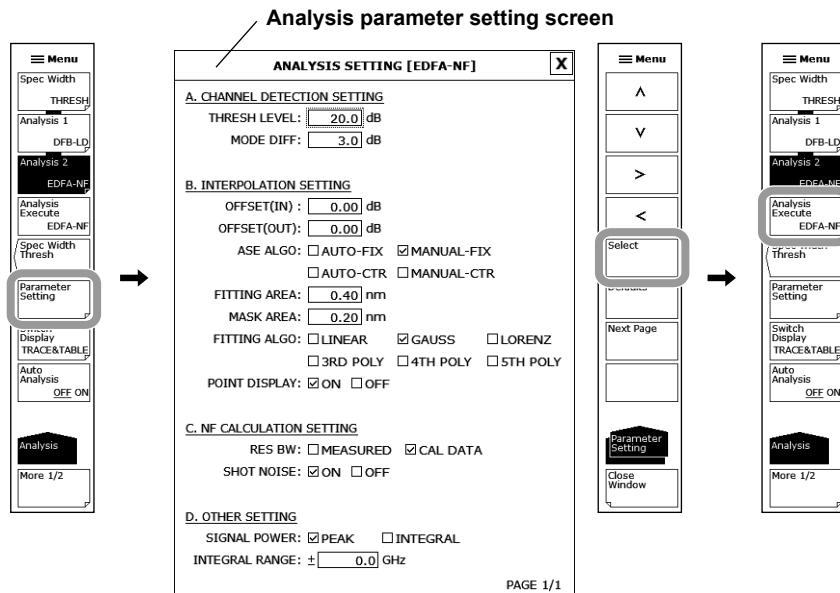
6. For Switch Display, tap **Graph & Table** or **Graph**. A function menu appears for setting the graph display and markers.
7. Tap **Line Marker Y1**. Marker Y1 appears on the graph, and a parameter input window appears.
8. Enter the value in the parameter input window.
9. Tap **μm/ENT** or **nm/ENT**.
10. Tap **Line Marker Y2**. Marker Y2 appears on the graph, and a parameter input window appears.
11. Enter the value in the parameter input window.
12. Tap **μm/ENT** or **nm/ENT**.

**Note**

If both markers Y1 and Y2 are turned on, the difference between the markers are displayed in the marker information.

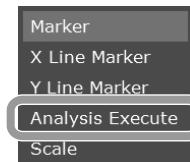
### When changing the analysis parameters

6. Continuing from step 4, tap **Parameter Setting**. A EDFA-NF analysis parameter setting screen appears.
7. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
8. Tap **X** to close the EDFA-NF analysis parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
9. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed on the screen.



### Note

- You can also perform the currently set analyze by tapping **Analysis Execute** on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



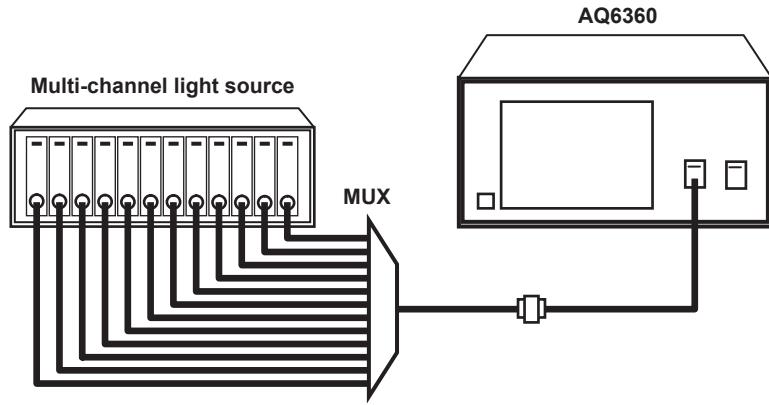
- For details on the optical amp analysis algorithm and parameters, see appendix 5, "Optical Amp Analysis Function."

## Acquiring the Waveform to Be Analyzed

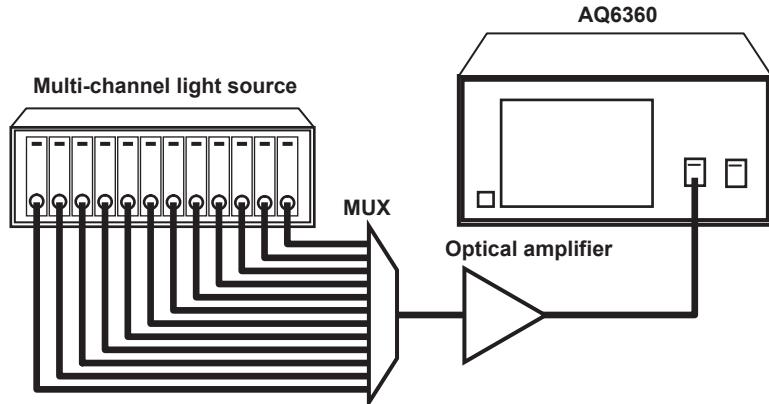
Analysis of optical amp gain and NF is performed after measuring the signal light going into the optical amp and the output light leaving the optical amp.

The following configuration and general procedure is used to measure optical amp gain and NF.

Signal light measurement configuration



Output light measurement configuration



## Writing to Trace A the Waveform of the Signal Light Input to the Optical Amp

1. Input the signal light sent to the optical amp into the instrument.
2. Tap **≡ Menu**. The Main Menu window appears.
3. Tap **TRACE**. A function menu appears for traces.
4. Tap **Active Trace** to select A.
5. Tap **View A** to select DISP.
6. Tap **Write A**. Trace A is set to write mode.
7. Measure the signal light waveform according to measurement conditions for the signal light waveform.  
(For details on the measuring procedure, see chapter 3, "Measurement.")
8. Tap **Fix A** under TRACE. Trace A is set to fix mode.

### Note

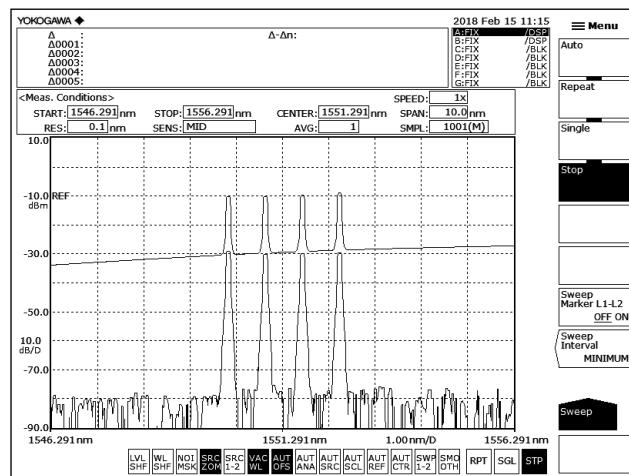
If all traces from trace A to trace G have been set to fix mode (FIX) as a result of step 8, a warning is displayed. However, this does not pose a problem because trace B is set to write mode in the next step.

## 5.8 Optical Amp Gain and NF Measurement

### Writing to Trace B the Waveform of the Output Light from the Optical Amp

9. Input the light output from the optical amp into the instrument.
10. Display the Main Menu window, and tap **TRACE**.
11. Tap **Active Trace** on the function menu to select B.
12. Tap **View B** to select DISP.
13. Tap **Write B**. Trace B is set to write mode.
14. Measure the waveform of the output light with the same measurement conditions used for measuring the signal light waveform.

Examples of signal and output light waveforms



**Explanation****Setting EDFA-NF Analysis Parameters**

EDFA-NF analysis parameters are broadly divided into the following two categories.

Change the parameter settings according to the analysis being performed.

- Channel detection parameters (CHANNEL DETECTION SETTING)
- ASE level measurement parameters (INTERPOLATION SETTING)

These are explained below.

For details on parameters, see appendix 5, "Optical Amp Analysis Function."

**Channel Detection Parameters**

These parameters are used to set the threshold level and the like for WDM channel detection.

**THRESH LEVEL**

This parameter sets the threshold level for channel detection.

This setting determines how far down in decibels from the peak level to detect a mode peak as a channel.

**MODE DIFF**

This parameter sets the minimum value for the peak/bottom difference during channel peak detection.

If the waveform peak/bottom difference equals or exceeds this value, it is detected as a mode peak.

***Note***

For details on setting parameters for channel detection, see "Channel Detection Parameters" in section 5.7, "WDM Transmission Signal Analysis."

### ASE Level Measurement Parameters

These parameters are used to set the waveform level, offset, and interpolation method for ASE level measurement.

#### OFFSET(IN)

A level offset can be set on a signal light waveform (trace A).

Specify "0.00" if a level offset is not needed.

#### OFFSET(OUT)

A level offset can be set on an output light waveform (trace B).

Specify "0.00" if a level offset is not needed.

#### ASE ALGO

Select one of the five algorithms shown below for measuring the ASE level. If AUTO-FIX or AUTO-CTR is set, the measurement parameters at another ASE level are set automatically. To set the values manually, select MANUAL-FIX or MANUAL-CTR.

- AUTO-FIX Automatic settings (FIX type)
- MANUAL-FIX Manual settings (FIX type)
- AUTO-CTR Automatic settings (CENTER type)
- MANUAL-CTR Manual settings (CENTER type)

#### Note

- If AUTO-FIX or AUTO-CTR is selected, the FITTING AREA and MASK AREA parameters are set automatically according to the measured waveform. FITTING ALGO is set to LINEAR.
- For details on parameters, see appendix 5, "Optical Amp Analysis Function."

---

#### FITTING AREA

This parameter is used to set the range of waveform data to be used in determining the ASE level through interpolation.

This parameter is only set when ASE ALGO is set to MANUAL-FIX.

#### MASK AREA

This parameter is used to set the range of signal light to be masked when determining the ASE level through interpolation.

This parameter is only set when FITTING ALGO is not set to LINEAR.

#### FITTING ALGO

This parameter is used to select the interpolation algorithm for determining the ASE level.

This parameter is only set when ASE ALGO is set to MANUAL-FIX or MANUAL-CTR.

Interpolation Algorithms

Fitting Algorithm	Description
LINER	Linear interpolation
GAUSS	Normal distribution curve
LORENZ	Lorenz curve
3RD POLY	3rd order polynomial
4TH POLY	4th order polynomial
5TH POLY	5th order polynomial

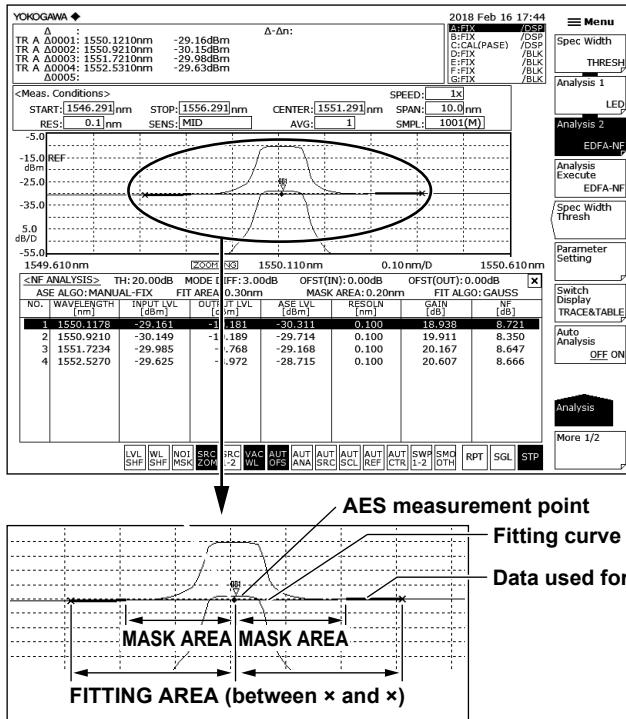
#### Note

- If ASE ALGO is AUTO-FIX or AUTO-CTR, then FITTING ALGO is automatically set to LINEAR and does not need to be set manually.

---

## POINT DISPLAY

This parameter is used to display the range of data used in interpolation for determining the ASE level.



## NF Calculation Parameters

### RES BW

This parameter sets the method for calculating the measurement resolution RBi of each channel used in computing the NF value.

The default is MEASURED.

If the measuring resolution varies greatly from channel to channel, or in other such cases, select CAL DATA.

- MEASURED: The value of the THRESH 3dB width for each channel is determined from the TRACE B waveform and assigned to RBi.
- CAL DATA: The actual resolution value stored in the instrument is assigned to RBi.

### SHOT NOISE

This parameter sets whether the Shot Noise component is included in computation of the NF value.

The default is ON.

- ON: Shot Noise component is included in computation of the NF value.
- OFF: Shot Noise component is not included in computation of the NF value.

## Other Parameters

### SIGNAL POWER

This parameter sets the signal optical power calculation method.

### INTEGRAL RANGE

This parameter sets the integral range for determining signal optical power.

## 5.9 Optical Filter Characteristics Measurement

### Procedure

Optical filter characteristics can be measured from the measured waveform of the light input to the optical filter from the light source, as well as from the measured waveform light output from the optical filter.

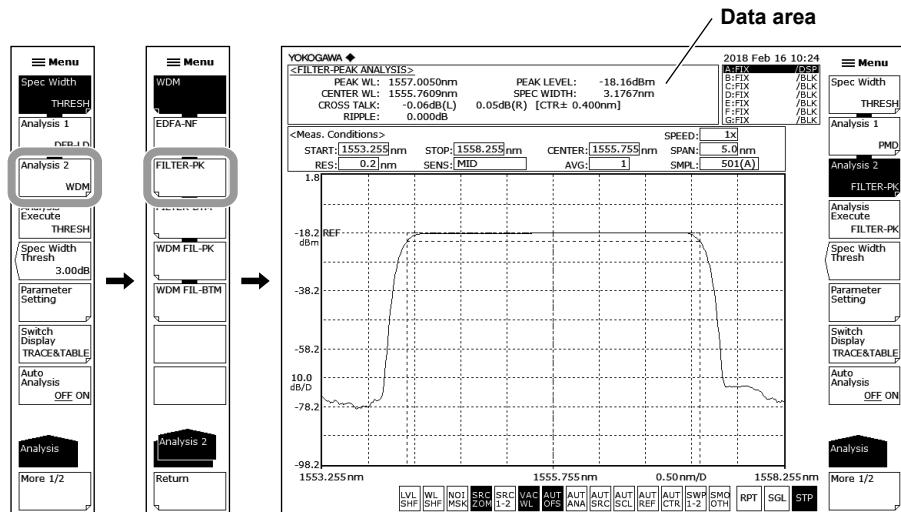
For instructions on how to acquire measured waveforms, see "Acquiring the Waveform to Be Analyzed" on page 5-36.

### Filter Measurement (Single Channel)

You can analyze a waveform whose number of modes is 1.

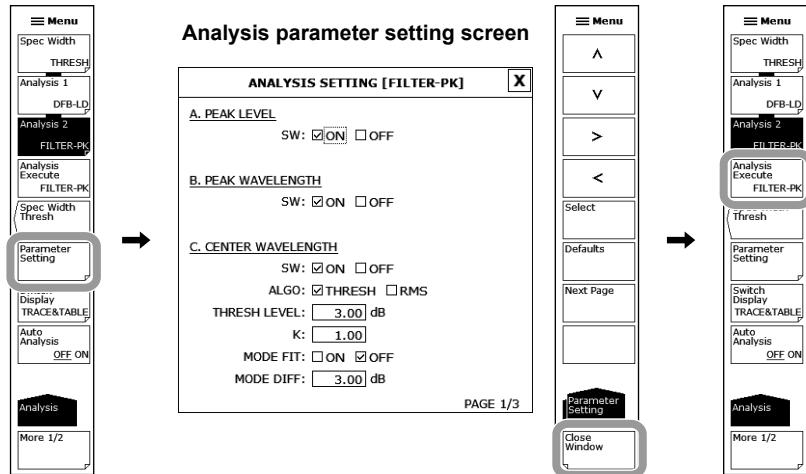
#### Filter Peak Analysis

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 2**. A menu appears for selecting the analysis function.
4. Tap **FILTER-PK**. Analysis is performed, and the results are displayed in the data area.

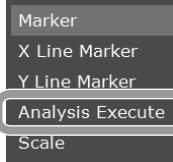


When changing the analysis parameters

5. Continuing from step 4, tap **Parameter Setting**. A FILTER-PK analysis parameter setting screen appears. If a setting screen has multiple pages, tapping **Next Page** shows the next screen.
6. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
7. Tap **X** to close the FILTER-PK parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
8. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.

**Note**

- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



- For details on the optical filter analysis algorithm and parameters, see appendix 6, "Optical Filter Analysis Function."

### Filter Bottom Analysis

This is used if the optical filter is of a notch type rather than a pass band type.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 2**. A menu appears for selecting the analysis function.
4. Tap **FILTER-BTM**. Analysis is performed, and the results are displayed in the data area.

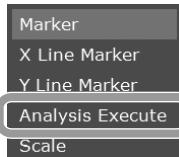
When changing the analysis parameters

5. Continuing from step 4, tap **Parameter Setting**. A FILTER-BTM analysis parameter setting screen appears. If a setting screen has multiple pages, tapping **Next Page** shows the next screen.
6. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
7. Tap **X** to close the FILTER-BTM parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
8. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed in the data area.

#### Note

---

- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



- For details on the optical filter analysis algorithm and parameters, see appendix 6, "Optical Filter Analysis Function."

---

## Filter Measurement for WDM (Multi Channel)

You can analyze multi-mode waveforms.

### WDM Filter Peak Analysis

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 2**. A menu appears for selecting the analysis function.
4. Tap **WDM FIL-PK**. Analysis is performed, and the results are displayed on the screen. Tapping **Switch Display** switches the analysis results display screen.

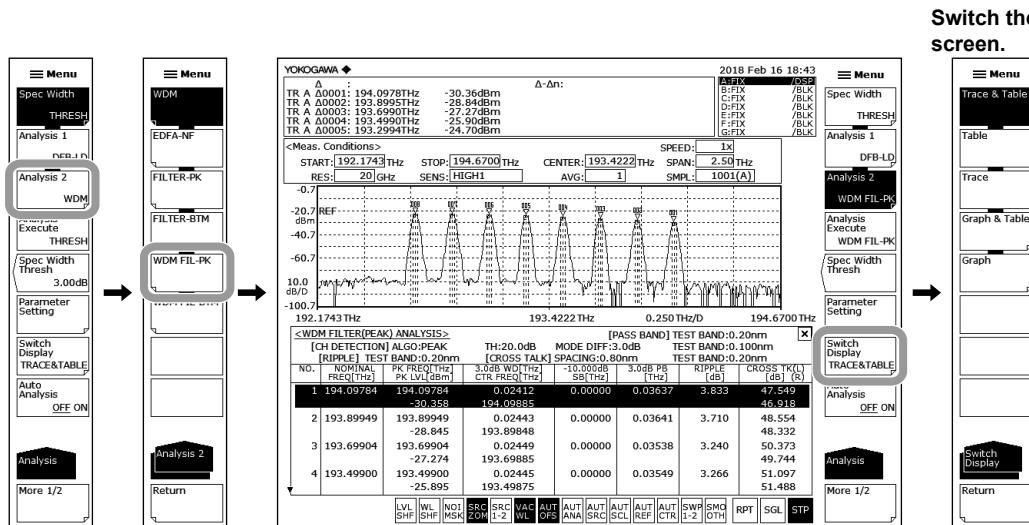
**TRACE & TABLE:** A waveform and table are displayed.

**TRACE:** Only the waveform is displayed.

**TABLE:** Only the table is displayed.

5. To end the analysis, tap **X** in the upper right of the table, or tap the waveform display area to display a pop-up list, and tap **Analysis Exit**.

The analysis also ends when you select another function on the Main Menu window or tap a value in the measurement condition area or the like.



### Note

- If you select Trace & Table or Trace using Switch Display, when you tap the waveform display area, you can select the following functions from the pop-up list.

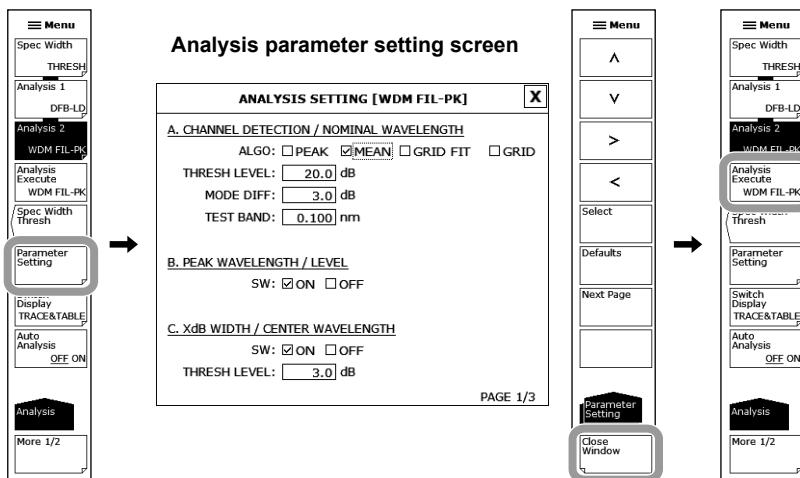


- Analysis Exit: Finish the analysis.
- Parameter Setting: Display a parameter setting screen.
- Scale: Display a operation tool window for waveform zooming.
- If you select Trace & Table using Switch Display and you tap the analysis results list while the waveform is zoomed, the waveform of the tapped channel appears in the center of the waveform screen.

## 5.9 Optical Filter Characteristics Measurement

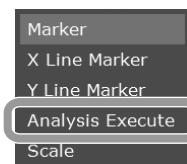
When changing the analysis parameters

6. Continuing from step 4, tap **Parameter Setting**. A WDM FIL-PK analysis parameter setting screen appears. If a setting screen has multiple pages, tapping **Next Page** shows the next screen.
7. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
8. Tap **X** to close the WDM FIL-PK parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
9. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed on the screen.



### Note

- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



- For details on the optical filter analysis algorithm and parameters, see appendix 6, "Optical Filter Analysis Function."

### WDM Filter Bottom Analysis

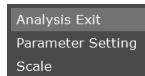
This is used if the optical filter is of a notch type rather than a pass band type.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **Analysis 2**. A menu appears for selecting the analysis function.
4. Tap **WDM FIL-BTM**. Analysis is performed, and the results are displayed on the screen. Tapping **Switch Display** switches the analysis results display screen.  
TRACE & TABLE: A waveform and table are displayed.  
TRACE: Only the waveform is displayed.  
TABLE: Only the table is displayed.
5. To end the analysis, tap **X** in the upper right of the table, or tap the waveform display area to display a pop-up list, and tap **Analysis Exit**.

The analysis also ends when you select another function on the Main Menu window or tap a value in the measurement condition area or the like.

#### Note

- If you select Trace & Table or Trace using Switch Display, when you tap the waveform display area, you can select the following functions from the pop-up list.



- Analysis Exit: Finish the analysis.
- Parameter Setting: Display a parameter setting screen.
- Scale: Display a operation tool window for waveform zooming.
- If you select Trace & Table using Switch Display and you tap the analysis results list while the waveform is zoomed, the waveform of the tapped channel appears in the center of the waveform screen.

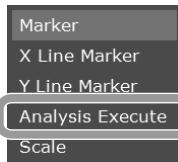
When changing the analysis parameters

6. Continuing from step 4, tap **Parameter Setting**. A WDM FIL-BTM analysis parameter setting screen appears. If a setting screen has multiple pages, tapping **Next Page** shows the next screen.
7. Tap within the frame of values, and set them.  
If a parameter input window appears, enter the value in the window.  
For check boxes, you can also use the arrow keys on the function menu to move the cursor and tap **Select**.
8. Tap **X** to close the WDM FIL-BTM parameter setting screen. You can also tap **Close Window** on the function menu. The function menu returns to the previous level.
9. Tap **Analysis Execute**. Analysis is performed according to the changed parameters, and the results are displayed on the screen.

## 5.9 Optical Filter Characteristics Measurement

### Note

- You can also perform the currently set analyze by tapping Analysis Execute on the pop-up list. To display the pop-up list, tap or right-click the waveform display area showing the waveform. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.



- For details on the optical filter analysis algorithm and parameters, see appendix 6, "Optical Filter Analysis Function."

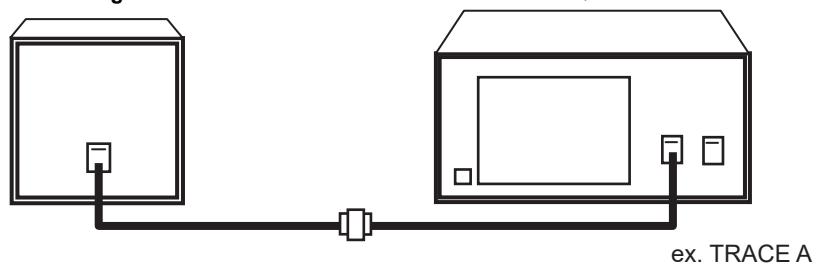
### Acquiring the Waveform to Be Analyzed

First measure the waveform of the wideband light source as a reference waveform, then subtract the optical filter's output waveform from the reference waveform to measure the characteristics of the optical filter.

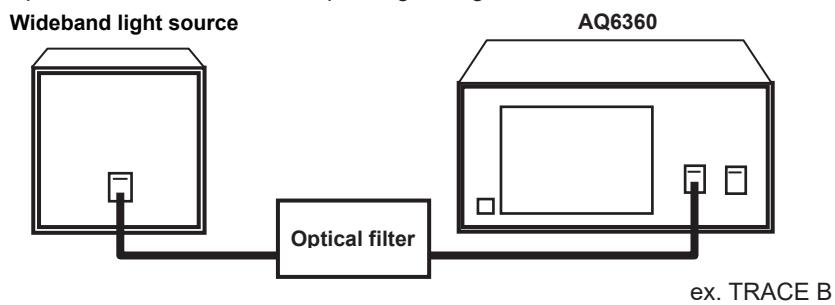
The following configuration and general procedure is used to measure optical filter characteristics.

A pass band type optical filter is used as an example.

Reference spectrum  
**Wideband light source**



Spectrum measurement after passing through the filter



## Writing to Trace A the Waveform of the Light Source Input to the Optical Filter

1. Input the emitted light from the light source that is input to the optical filter into the instrument.
2. Tap **☰ Menu**. The Main Menu window appears.
3. Tap **TRACE**. A function menu appears for traces.
4. Tap **Active Trace** to select A.
5. Tap **View A** to select DISP.
6. Tap **Write A**. Trace A is set to write mode.
7. Measure the light source waveform according to measurement conditions for the light source waveform.  
(For details on the measuring procedure, see chapter 3, "Measurement.")
8. Tap **Fix A** under TRACE. Trace A is set to fix mode.

### Note

If all traces from trace A to trace G have been set to fix mode (FIX) as a result of step 8, a warning is displayed. However, this does not pose a problem because trace B is set to write mode in the next step.

## Writing to Trace B the Waveform of the Output Light from the Optical Filter

9. Input the emitted light from the light source to the optical filter, then input the light that is output from the optical filter into the instrument.
10. Display the Main Menu window, and tap **TRACE**.
11. Tap **Active Trace** on the function menu to select B.
12. Tap **View B** to select DISP.
13. Tap **Write B**. Trace B is set to write mode.
14. Measure the waveform of the output light with the same measurement conditions used for measuring the light source waveform.

## Writing to Trace C the Difference between Traces

15. Display the Main Menu window, and tap **TRACE**.
16. Tap **Active Trace** on the function menu to select C.
17. Tap **View C** to select DISP.
18. Tap **Calculate C**.
19. Tap **Log Math**. A menu appears for selecting the equation.
20. Tap **C=A-B(LOG)**. The waveform which is obtained by subtracting the trace B waveform from the trace A waveform is displayed in trace C.

## Explanation

### Setting WDM Filter Analysis Parameters

WDM FIL-PK analysis parameters are broadly divided into the following three categories.

Change the parameter settings according to the analysis being performed.

- Channel detection parameters
- Parameter settings for each analysis item

These are explained below.

For details on parameters, see appendix 6, "Optical Filter Analysis Function."

### Channel Detection Parameters

These parameters are used to set the algorithm and threshold level for WDM channel detection.

#### ALGO

Select one of the four algorithms shown below for detecting the WDM channel and analyzing the reference wavelength of each channel.

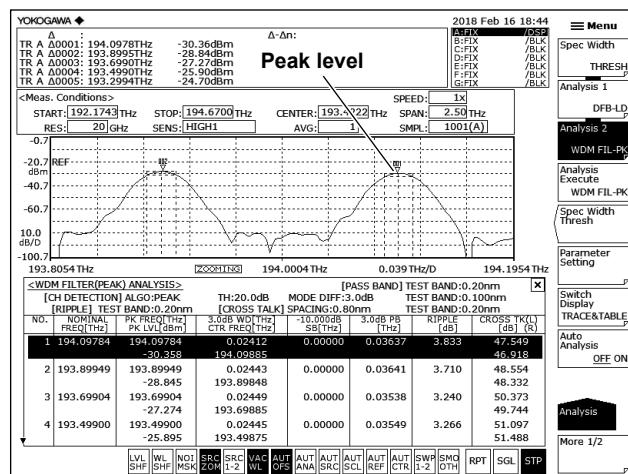
- PEAK
- MEAN
- GRID FIT
- GRID

The channel detection and reference wavelength analysis results for each channel vary depending on the algorithm selected.

#### • When PEAK is selected

Each mode peak is detected as a channel.

The peak wavelength of each channel is the reference wavelength.

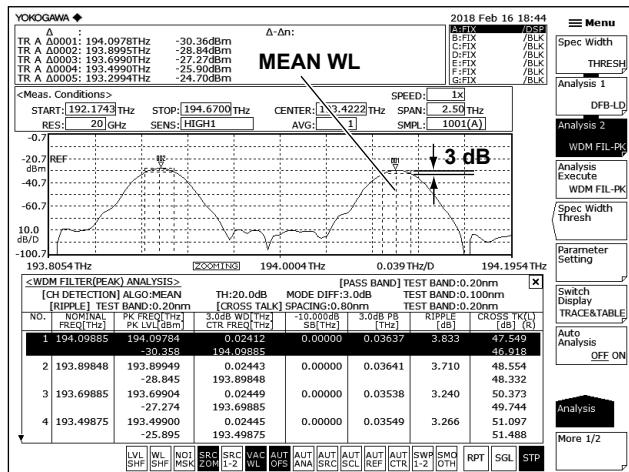


## 5.9 Optical Filter Characteristics Measurement

- When MEAN is selected

Each mode peak is detected as a channel.

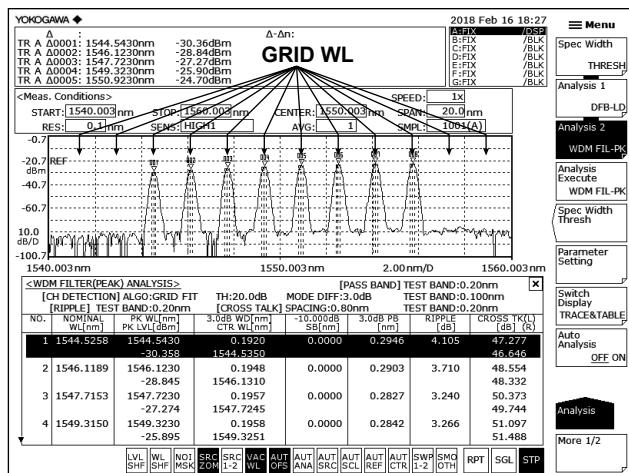
The 3 dB center wavelength of each channel is the reference wavelength.



- When GRID FIT is selected

The mode peak detected within grid wavelength  $\pm$  (test band/2) is set as the channel.

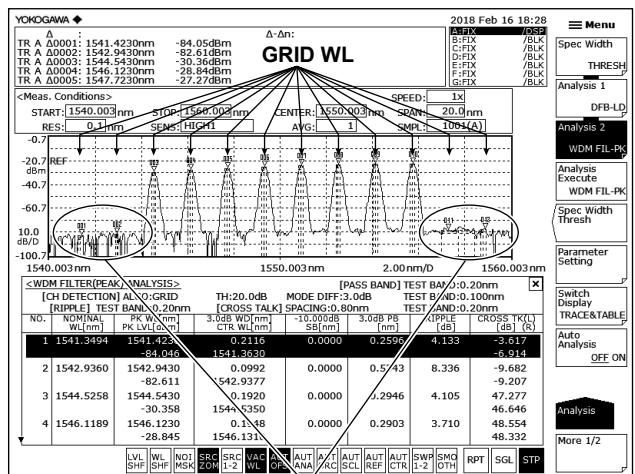
The grid wavelength nearest to each channel is the reference wavelength.



## 5.9 Optical Filter Characteristics Measurement

### • When GRID is selected

The wavelengths registered in the grid table wavelength are recognized as channels. Grid wavelength is set as the reference wavelength.



Grid wavelengths are detected as channels.

### THRESH LEVEL

This parameter sets the threshold level for channel detection.

### MODE DIFF

This parameter sets the minimum value for the peak/bottom difference during channel peak detection.

### Note

For details on setting parameters for channel detection, see “Channel Detection Parameters” in section 5.7, “WDM Transmission Signal Analysis.”

### TEST BAND

This parameter sets the bandwidth for reference wavelength analysis.

### Parameter Settings for Each Analysis Item

Set the parameters of each WDM optical filter analysis item.

An analysis parameter setting screen appears.

### Note

For details on the optical filter analysis algorithm and parameters, see appendix 6, “Optical Filter Analysis Function.”

## 5.10 Editing the Grid Table

### Procedure

#### Editing a Standard Grid Table

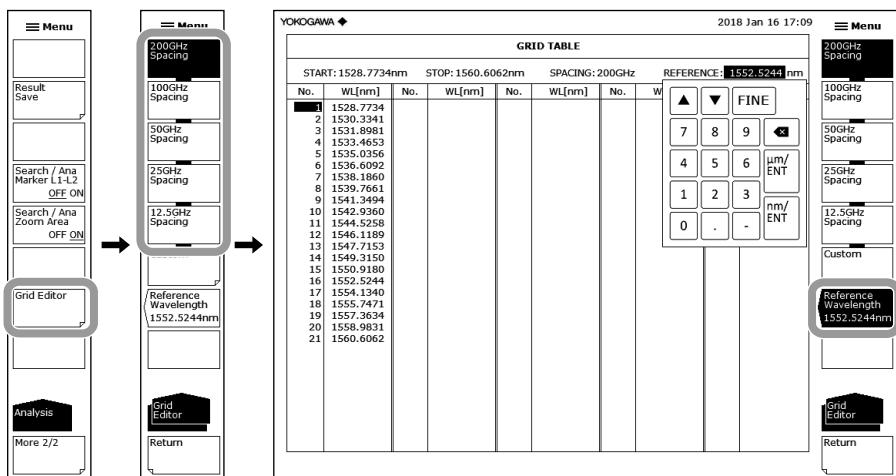
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Grid Editor**. A grid table edit screen appears.

#### Setting the Frequency Spacing

5. Tap any of the keys from **200GHz Spacing** to **12.5GHz Spacing**. Depending on the selected key, a frequency spacing table of 200 GHz, 100 GHz, 50 GHz, 25 GHz, or 12.5 GHz can be used.

#### Setting the Reference Wavelength

6. Tap **Reference Wavelength**. A parameter input window appears.
7. Enter the reference wavelength in the parameter input window, and tap **nm/ENT**.



## Editing a Custom Grid Table

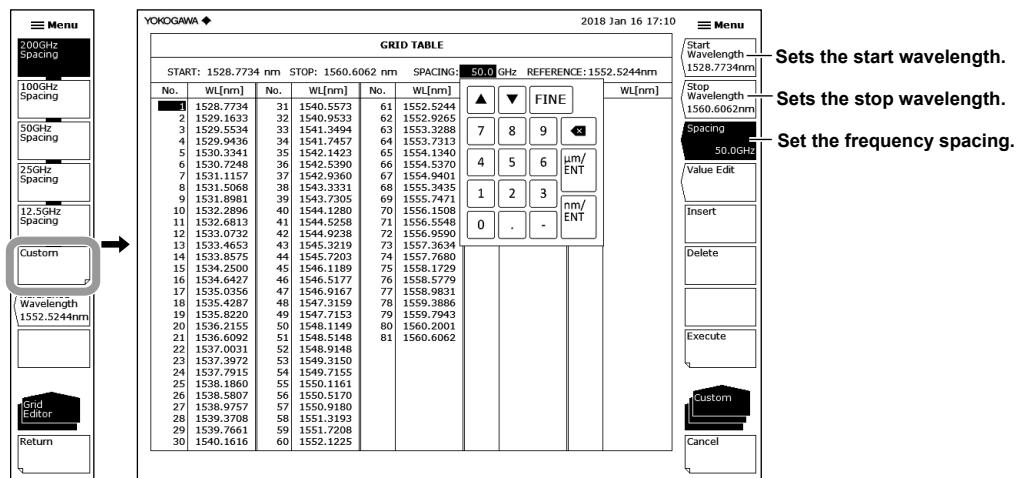
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
3. Tap **More** to display the More 2/2 function menu.
4. Tap **Grid Editor**. A grid table edit screen appears.
5. Tap **Custom**. A custom grid table edit screen appears.

### Setting the Start and Stop Wavelengths

6. Tap **Start Wavelength** or **Stop Wavelength**. A parameter input window appears.
7. Enter the start or stop wavelength in the parameter input window, and tap **nm/ENT**.

### Setting the Frequency Spacing

8. Tap **Spacing**. A parameter input window appears.
9. Enter the frequency spacing in the parameter input window, and tap **nm/ENT**.
10. Tap **Execute**. The settings entered up to this point are finalized, and the previous menu is displayed allowing setting of the reference wavelength.



### Setting the Reference Wavelength

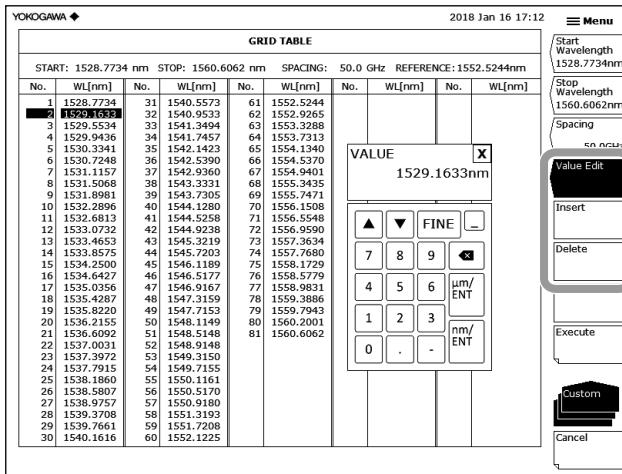
11. Tap **Reference Wavelength**. A parameter input window appears.
12. Enter the reference wavelength in the parameter input window, and tap **nm/ENT**.

#### Note

- If you edit a custom grid table and tap **Cancel** without tapping **Execute**, the edits that have been made will be canceled.
- Tapping **Execute** applies the custom grid table to the analysis function.

### Setting Channel Point Wavelength

- Continuing from step 5, tap the number of the channel point you want to change on the custom grid table edit screen. The cursor moves to the number that you tapped.
- Tap Value Edit.** A parameter input window appears.
- Enter the wavelength in the parameter input window, and tap **nm/ENT**.



### Inserting Channel Points

- Continuing from step 5, tap the number of the channel point you want to insert into on the custom grid table edit screen. The cursor moves to the number that you tapped.
- Tap Insert.** A channel point is inserted with the same wavelength as the selected channel point. Subsequent channel points are shifted down by one point.

### Deleting Channel Points

- Continuing from step 4, tap the number of the channel point you want to delete on the custom grid table edit screen. The cursor moves to the number that you tapped.
- Tap Delete.** The selected channel point is deleted. Subsequent channel points are shifted up by one point.

### Switching the Unit of the Wavelength Axis on the Grid Table to Frequency

- Tap Menu.** The Main Menu window appears.
- Tap MARKER.**
- Tap More** to display the More 3/3 function menu.
- Tap Marker Unit nm THz.** Each time you tap, the value switches between nm and THz.

#### Note

For a description of the operation screen of the marker function menu, see section 4.9, "Marker Display."

### Explanation

#### Grid Table

A grid table lists wavelengths (frequencies) that are referenced by part of the analysis function when it is executed. There is a standard grid table and a custom grid table.

##### Standard Grid Table

This grid table is created with pre-defined wavelength (frequency) ranges. It can be created by setting the reference wavelength (frequency) and frequency spacing.

##### 200 GHz Spacing to 12.5 GHz Spacing

Creates a grid table with 200 GHz to 12.5 GHz grid spacing.

##### Reference Wavelength

Sets the grid table reference wavelength. You can set the value between 1200.0000 and 1650.0000 nm.

##### Custom Grid Table

This is a grid table that users can edit as they like.

It is created automatically by setting the start/stop wavelength (frequency), reference wavelength (frequency), and frequency spacing.

Users can add or delete an arbitrary channel to/from the created grid table or edit wavelength (frequency) values for each channel there.

##### Start Wavelength

Sets the start wavelength.

##### Stop Wavelength

Sets the stop wavelength.

##### Spacing

Sets the frequency spacing.

##### Reference Wavelength

Sets the grid table reference wavelength. You can set the value between 1200.0000 and 1650.0000 nm.

##### Value Edit

You can edit channel points.

---

##### Note

---

For details on the grid table, see appendix 1, "Grid Table for WDM Wavelength."

---

## 5.11 Measurement of Level Fluctuations in Single-Wavelength Light (0 nm Sweeping)

### Procedure

This function measures changes over time in the level of a specific wavelength level. It is useful for purposes such as optical axis alignment when connecting an optical fiber to a light source. The following discussion pertains to an example in which the spatial light of an He-Ne gas laser (1523.488 nm) is input to an optical fiber.

#### Setting the Center Wavelength to 1523.488 nm

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **CENTER**. A function menu appears for setting the center wavelength.
3. Tap **Center Wavelength**. A parameter input window appears.
4. Enter the center wavelength 1523.488 nm in the parameter input window.
5. Tap **nm/ENT**.

#### Setting the Resolution to 2 nm

6. Display the Main Menu window, and tap **SETUP**. A function menu appears for setting measurement conditions.
7. Tap **Resolution**. A menu appears for selecting the resolution.
8. Tap **2nm**.

#### Note

On the AQ6360, the resolution bandwidth during 0 nm sweeping is approximately 0.1 nm (varies depends on the wavelength), regardless of the resolution setting. As such, the measured power will not be affected even if you change the resolution value.

#### Setting the Sweep Width to 0 nm

9. Display the Main Menu window, and tap **SPAN**. A function menu appears for setting the sweep span.
10. Tap **Span Wavelength**. A parameter input window appears.
11. Enter the sweep span 0 nm in the parameter input window.
12. Tap **nm/ENT**. The sweep span is set to 0 nm. The measurement start wavelength, measurement center wavelength, and measurement stop wavelength are all set to 1523.488 nm.

#### Note

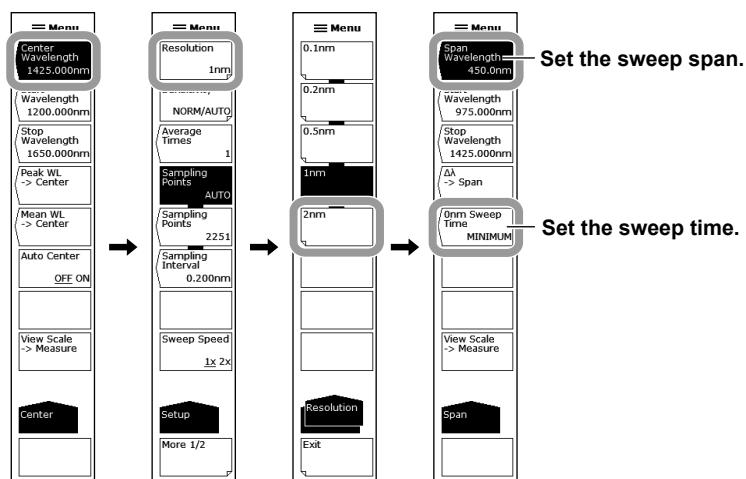
When you tap a value in the measurement condition area of the screen, the function menu automatically changes accordingly, and you can set the value directly. For details, see section 3.2, "Menu Operations" in IM AQ6360-02EN.

<Meas. Conditions> <b>NEW</b>		SPEED: <b>1x</b>	
START: <b>1523.488</b> nm	STOP: <b>1523.488</b> nm	CENTER: <b>1523.488</b> nm	SPAN: <b>0.0</b> nm
RES: <b>2</b> nm	SENS: <b>MID</b>	AVG: <b>1</b>	SMPL: <b>501(A)</b>

Measurement condition area

### Setting the Sweep Time

13. Tap **0nm Sweep Time**. A parameter input window appears.
14. Enter a sweep time in the parameter input window, and tap **nm/ENT**.
15. Display the Main Menu window, and tap **SWEEP**.
16. Tap **Repeat**. Sweeping will begin.

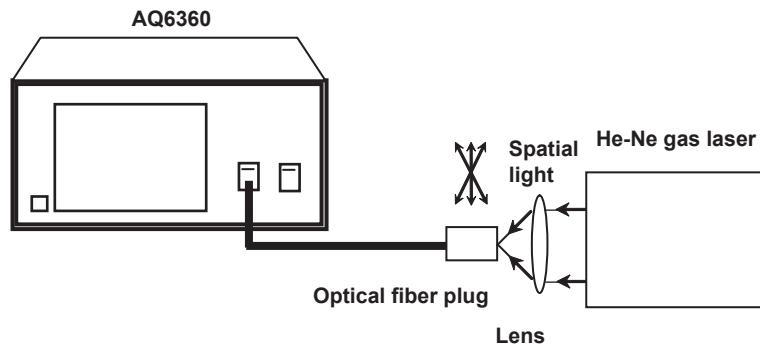


### Note

- When the sweep range is set to 0 nm, the horizontal scale changes to time.
- The sweeping time varies depending on the measurement sensitivity (Sensitivity under SETUP). If the 0nm Sweep Time value is less than the sweeping time for each sensitivity, the setting for the key is invalid and the MINIMUM setting is used.

**Explanation**

The following figure shows the configuration for applying the spatial light of an He-Ne gas laser (1523.488 nm) into an optical fiber.



The sweep width is set to 0 nm, the center wavelength is fixed, and the level of a single wavelength of light is measured.

The optical fiber plug is adjusted while observing the displayed waveform so as to set the light source input level to the peak.

**0nm Sweep Time**

When the sweep width is 0 nm, the horizontal scale is time.

Set the time required to measure from the left edge to the right edge of the screen.

You can set the value in the range of 1 to 50 s or to MINIMUM. You can set it in steps of 1 s. When entering with the arrow keys when COARSE is selected, the value changes in steps of 1-2-5.

If 0 is entered, MINIMUM is shown on the display.

The sweeping time varies depending on the measurement sensitivity (Sensitivity under SETUP). If the 0nm Sweep Time value is less than the sweeping time for each sensitivity, the setting for the key is invalid and the MINIMUM setting is used.

The sampling points are automatically set to 1001.

## 5.12 Specifying an Analysis Range

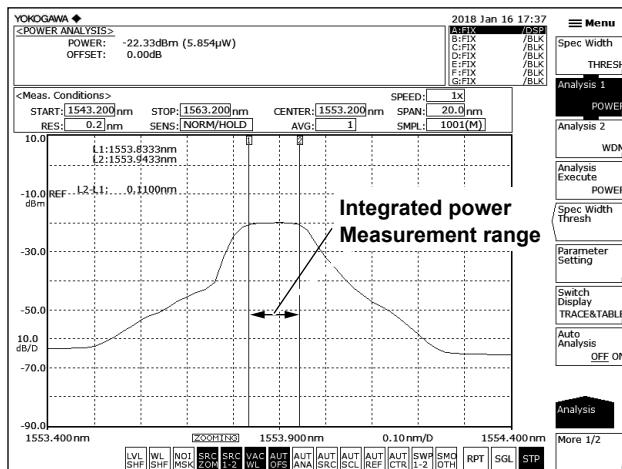
### Analysis between Line Markers

You can specify the range to be analyzed using line markers. The range between the two line markers is analyzed.

#### Power Measurement between Line Markers

The integrated power can be determined for the area between wavelength line marker 1 and wavelength line marker 2.

1. Set wavelength line marker 1 and wavelength line marker 2 at either end of the range where you want to measure the integrated power.
2. Tap **☰ Menu**. The Main Menu window appears.
3. Tap **MARKER**. A function menu appears for setting the marker.
4. Tap **More** to display the More 3/3 function menu.
5. Tap **Search / Ana Marker L1- L2** to select ON.
6. Display the Main Menu window, and tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
7. Tap **Analysis 1**. A menu appears for selecting the analysis function.
8. Tap **POWER**. Analysis is performed between the line markers, and the results are displayed in the data area.
9. To cancel, tap **Search / Ana Marker L1- L2** to select OFF. Analysis will be performed over the entire screen.



#### Note

- If both L1 and L2 are set, measurement is performed between line markers 1 and 2.
- If only L1 is set, the measurement is performed from line marker 1 to the right edge of the screen.
- If only L2 is set, measurement is performed from the left edge of the screen to line marker 2.
- If neither L1 or L2 is set, measurement is performed from the specified start wavelength to the stop wavelength.
- You can also set the parameter by tapping the **SRC 1-2** shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

## 5.12 Specifying an Analysis Range

### Analysis in the Zoom Area

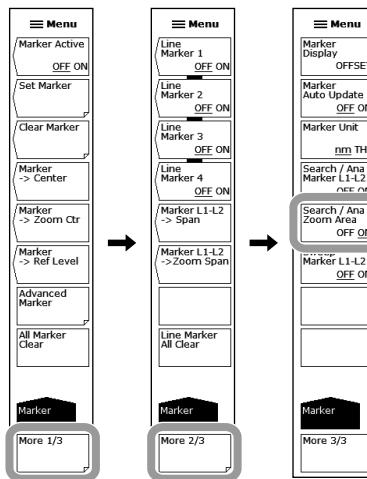
You can specify the zoomed area as the analysis range.

For example, the power in the zoom area can be measured. This function calculates the integrated power between display scales. It is a useful function for the ASE evaluation of optical amplifiers and the like.

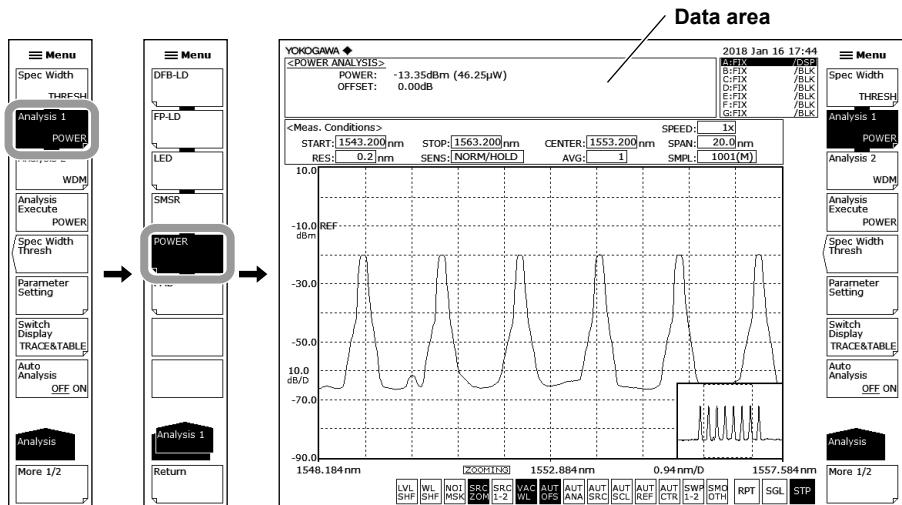
### Power Measurement in the Zoom Area

Optical power can be measured by integrating the measured waveform levels in the zoom area.

1. Zoom the measured waveform. Set the display scale to the range you want to measure. For the procedure to zoom the waveform, see section 4.1, "Zooming a Waveform."
2. Tap **☰ Menu**. The Main Menu window appears.
3. Tap **MARKER**. A function menu appears for markers.
4. Tap **More** to display the More 3/3 function menu.
5. Tap **Search / Ana Zoom Area** to select ON.



6. Display the Main Menu window, and tap **ANALYSIS**. A function menu appears for analyzing measured waveforms.
7. Tap **Analysis 1**. A menu appears for selecting the analysis function.
8. Tap **POWER**. Analysis is performed between the display scales, and the results are displayed in the data area.



## 5.12 Specifying an Analysis Range

### Note

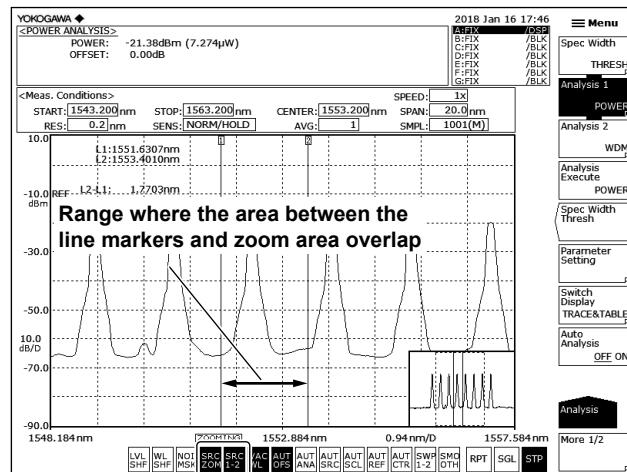
- You can also set the parameter by tapping the **SR<sub>C</sub>** **ZOM** shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.
- If Search / Ana Zoom Area is set to OFF, analysis is performed over the entire range of the measurement scale.
- For details on the power analysis function, see appendix 3, "Details of Each Analysis Function."

### Explanation

When the line marker search function and zoom area search functions are enabled at the same time, the intersection of the two ranges is the range for analysis.

The following figure shows the analysis range of a power measurement when both Search / Ana Marker L1- L2 and Search / Ana Zoom Area are set to ON.

Because both settings are ON, the **SR<sub>C</sub>** **1-2** and **SR<sub>C</sub>** **ZOM** shortcut keys at the bottom of the screen are highlighted.

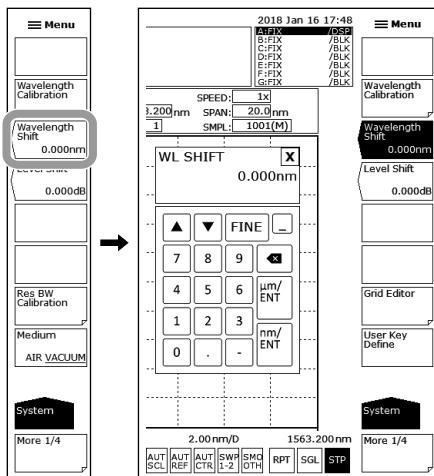


## 5.13 Correcting the Displayed Values

### Procedure

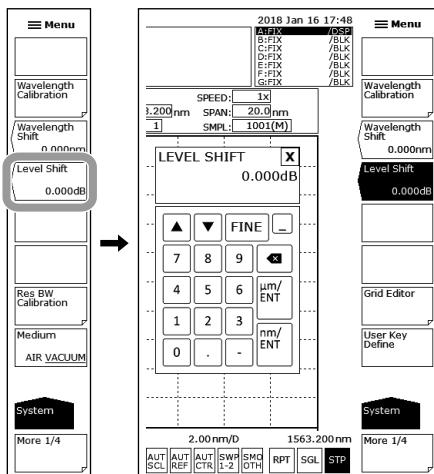
Set the amount of wavelength shift.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **Wavelength Shift**. A parameter input window appears.
4. Enter the amount of wavelength shift in the parameter input window.
5. Tap **μm/ENT** or **nm/ENT**.



Setting the Amount of Level Shift

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **Level Shift**. A parameter input window appears.
4. Enter the amount of level shift in the parameter input window.
5. Tap **μm/ENT** or **nm/ENT**.



### Note

After you enter the amount of wavelength or level shift, it is applied to the displayed values when the next measurement is performed.

## 5.13 Correcting the Displayed Values

### Determining the Amount of Level Shift

Even when the NA of the optical fiber in use is unknown, the amount of level shift is determined so that correct level measurements can be performed.

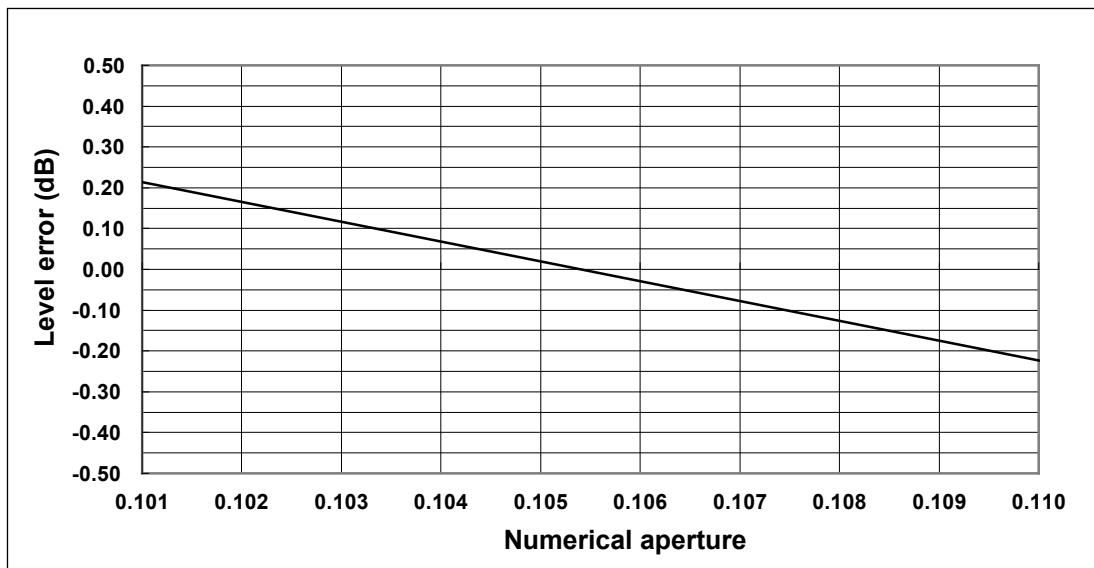
1. Set up a light source such as a DFB-LD with a spectrum width that is narrower than the instrument's resolution (with a wavelength of 1310 nm or 1550 nm).
2. Connect the light source and the instrument using an optical fiber cord and set the instrument's resolution to 2.000 nm.
3. Perform a measurement to determine the peak level.
4. Disconnect the optical fiber cord from the instrument and connect it to a light power meter to measure the light power.
5. Calculate the difference between the peak level value obtained from the instrument and the power value obtained from the light power meter, and set this amount as the instrument's level shift.

### Explanation

#### Numerical Aperture (NA) of Input Optical Fibers and Level Measurements

The level measurement errors of this instrument varies depending on the numerical aperture (NA) of the optical fiber connected to the input connector section. The absolute level of this instrument is calibrated with a 9.5/125  $\mu\text{m}$  single mode optical fiber (SSMA type in JIS C6835, PC polishing, mode field diameter: 9.5  $\mu\text{m}$ , NA: 0.104 to 0.107). If the NA value is not within this range even for single mode optical fibers, the level accuracy is not guaranteed.

Numerical aperture of input optical fibers and level errors (representative characteristics)



### Absolute Level Accuracy

The absolute level of this instrument is calibrated with a 9.5/125  $\mu\text{m}$  single mode optical fiber (SSMA type in JIS C6835, PC polishing, mode field diameter: 9.5  $\mu\text{m}$ , NA: 0.104 to 0.107). The level accuracy when other optical fibers are used is not guaranteed.

For multi-mode (GI) fibers, a relatively accurate spectrum is indicated for low-coherence light, such as white light, natural light, and LEDs.

For high-coherence light, such as a laser beam, interference occurs within the optical fiber, and the intensity distribution of light reflected from the end of the fiber varies depending on the fiber form. As such, moving the fiber may change the spectrum (measurement level).

### Wavelength Shift \*\*.\*nm

Sets the amount of wavelength shift.

When the wavelength shift is changed, the specified value is added to the display value on the wavelength axis. This key is used for purposes such as correcting differences in wavelength display values among different measurement instruments.

The setting range is –5.000 to 5.000 nm. You can set it in steps of 0.001 nm. When entering with the arrow keys when COARSE is selected, the value changes in steps of 0.1 nm.

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When you set the amount of wavelength shift, the shortcut key is highlighted.

### Level Shift \*\*\*.\*\*\*dB

Sets the amount of level shift.

When the level shift is changed, the specified value is added to the display value on the level axis.

This key is used for purposes such as correcting level errors due to differences in the NA values of 9.5/125  $\mu\text{m}$  SM optical fibers connected to the instrument, and correcting loss on externally connected isolators, filters and the like.

The setting range is –60.00 to 60.00 dB. You can set it in steps of 0.01 dB. When entering with the arrow keys when COARSE is selected, the value changes in steps of 0.1 dB.

You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When you set the amount of level shift, the shortcut key is highlighted.

## 6.1 USB Storage Device

### Compatible USB Storage Devices

The instrument supports USB memory devices and hard drives compliant with USB 1.0 or USB 2.0.

For more details, contact your nearest YOKOGAWA dealer.

### Removing a USB Storage Device

Be sure to follow the procedure below to remove a USB storage device.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data. Check whether the Remove USB Storage key is disabled (dimmed). If it is, the USB storage device can be removed.
3. If the Remove USB Storage key is enabled, Tap **Remove USB Storage**. The Remove USB Storage key is disabled (dimmed), and the USB storage device can be safely removed.



#### Note

- If there are multiple connected USB storage devices, the instrument detects only the one connected first.  
If you restart the instrument, the devices connected afterward will also be detected.
- For other notes, see the instruction manual supplied with the USB memory device.

## 6.2 Saving and Loading Waveform Data

### Procedure

You can save waveforms displayed on the instrument to a USB storage device or internal memory and load data from a USB storage device.



#### CAUTION

Do not remove the USB storage medium or turn the power OFF while the USB storage medium access indicator is blinking. This can damage the data on the medium or the device itself. Also, always place a USB storage medium in the removable state (following the procedure in section 6.1) before removing it.

### French



#### ATTENTION

Ne retirez pas le dispositif de stockage USB et ne coupez pas l'alimentation lorsque le voyant d'accès au dispositif de stockage USB clignote. Cela risquerait d'endommager le dispositif ou les données se trouvant sur ce dernier. De plus, toujours faire passer un support de stockage USB à l'état de retrait en toute sécurité (en suivant la procédure figurant à la section 6.1) avant de le retirer.

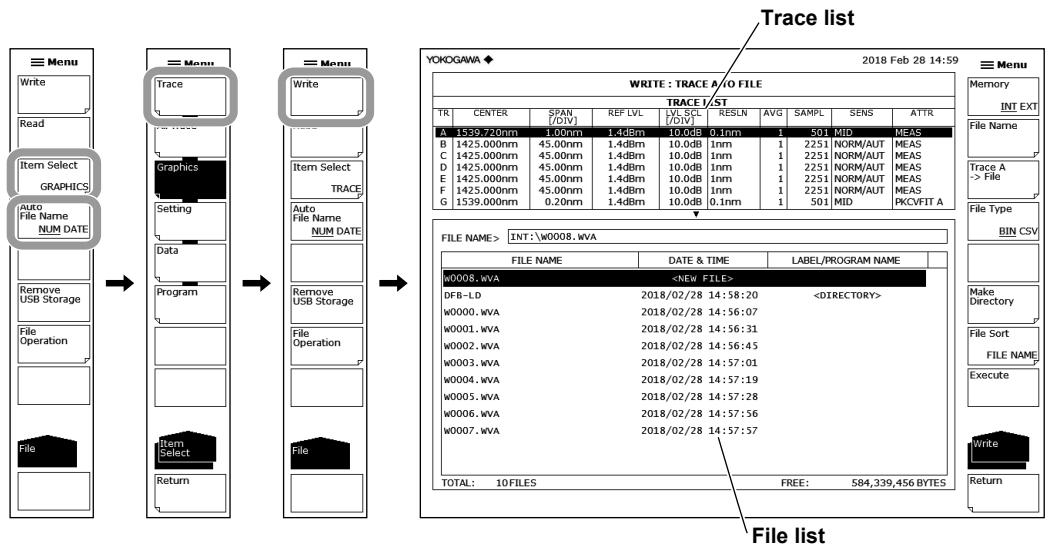
### Saving Trace Data

#### Selecting the Method of Automatically Setting the File Name

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Auto File Name** to select NUM (serial number) or DATE.

#### Setting the Type of File to Save to TRACE

4. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
5. Tap **Trace**. Trace is selected, and the menu returns to the previous level.
6. Tap **Write**. A trace list and a file list are displayed on the screen.



### Selecting the Save Destination and Data Format

7. Tap **Memory** to select INT (internal memory) or EXT (USB storage device).
8. Tap **File Type** to set the data format to BIN (binary format) or CSV (ASCII format).

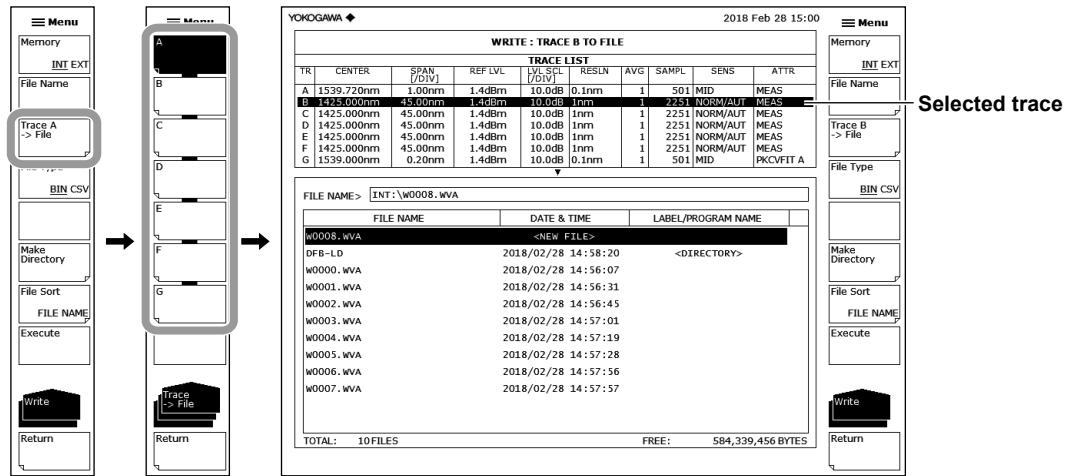


## 6.2 Saving and Loading Waveform Data

### Selecting a Trace to Save

9. Tap **Trace @→File** (where @ is the currently selected trace number). Traces A through G are displayed in a function menu.

10. Tap the trace you want to save.



### Note

Instead of tapping **Trace @→File**, you can also tap the appropriate line on the trace list to select the trace to save.

### Entering a File Name (When Saving to a Specific File Name)

If you do not set a file name, the file will automatically be assigned a name using a serial number or date.

For instructions on how to create directories and sort the file list, see the next page.

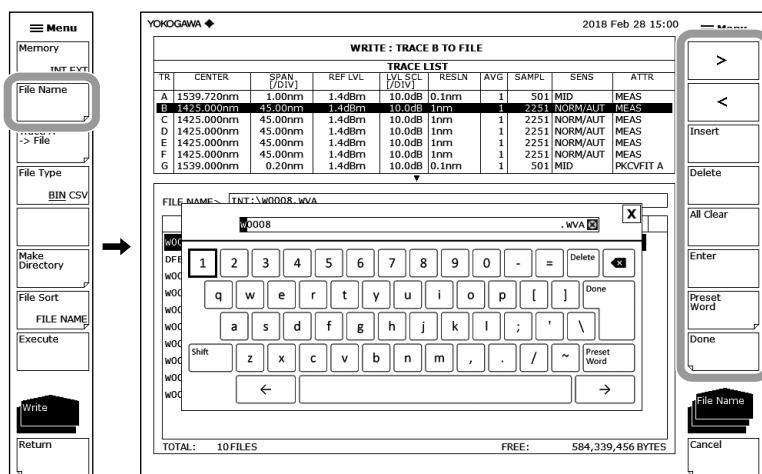
11. Tap the line displaying “NEW FILE” to move the cursor to it.

12. Tap **File Name**. A keyboard appears.

13. Use the keyboard to input the new file name.

For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.

14. Tap **Done**. The file name is confirmed, and the screen returns to the previous level.



## Saving the File

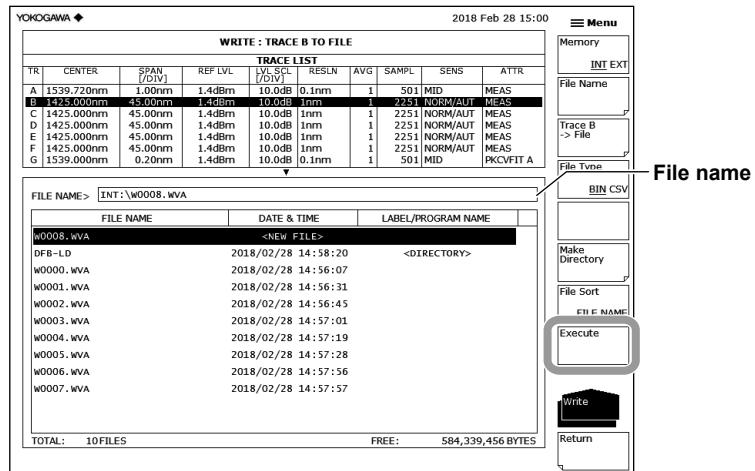
15. To overwrite an existing file, move the cursor to the name of the file you want to overwrite.

16. Tap **Execute**. The file is saved.

If you tap **Return**, the data will not be saved. The menu will return to the previous level.

17. When overwriting a file, a confirmation message appears. Tap **YES**.

To cancel saving, tap **NO**.



## Creating a Directory and Sorting Files

Perform the following procedure if needed.

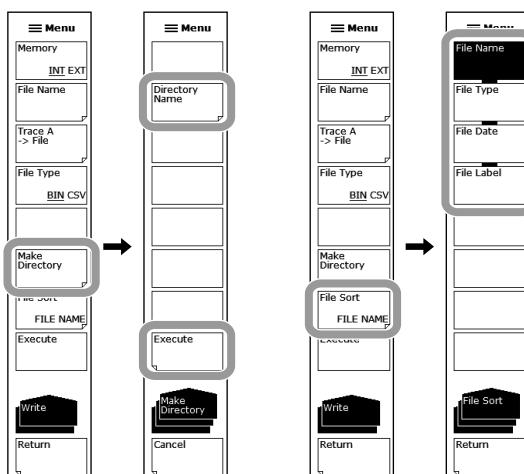
18. Tap **Make Directory**.

19. Tap **Directory Name**. A keyboard appears. Enter a directory name in the same manner as when entering a file name.

20. Tap **Execute**. A directory will be created. Tap **Cancel** if you do not want to create the directory.

21. Tap **File Sort**. A menu appears for selecting the item to sort by.

22. Tap the item you want to sort by. The files are sorted in ascending order by the selected item.

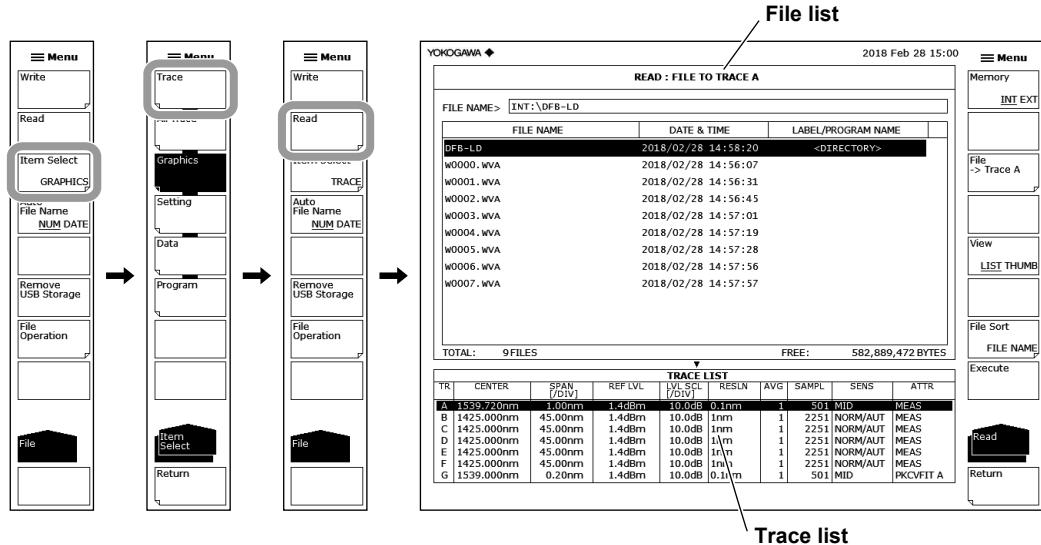


## 6.2 Saving and Loading Waveform Data

### Loading Trace Data

#### Setting the Type of File to Load to TRACE

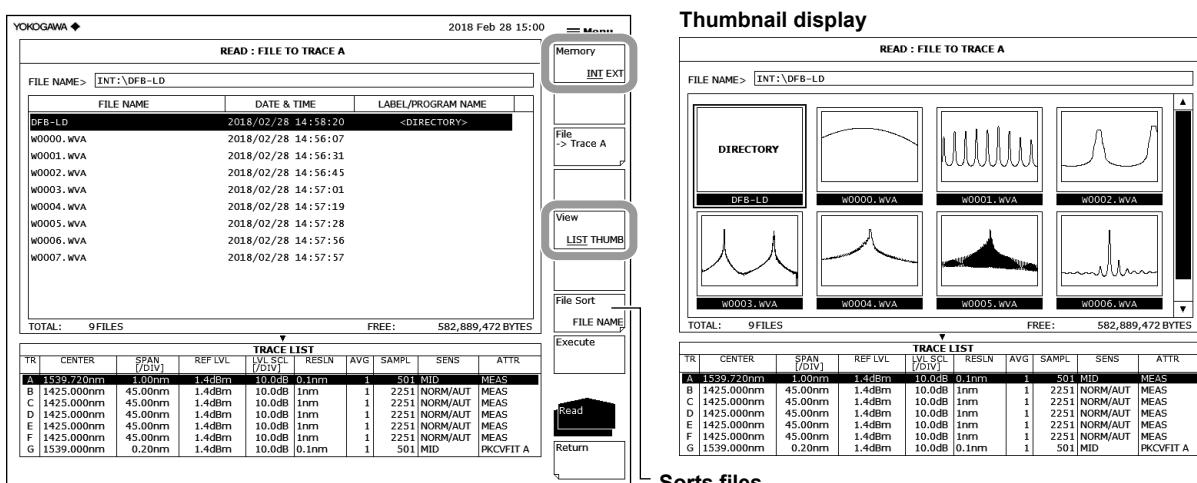
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Trace**. Trace is selected, and the menu returns to the previous level.
5. Tap **Read**. A file list and a trace list appear on the screen.



### Selecting the File to Load

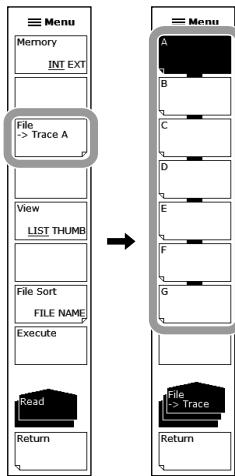
6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device). The file list of the selected device appears.
7. Tap a line in the file list to move the cursor to the file you want to load.

Tapping **View** changes the display between list and thumbnail. To sort the files, see page 6-5.



## Selecting the Trace to Assign the Loaded Data To

8. Tap **File**→**Trace @** (where @ is the currently selected trace number). Traces A through G are displayed in a function menu.
9. Tap the trace you want to assign.



### Note

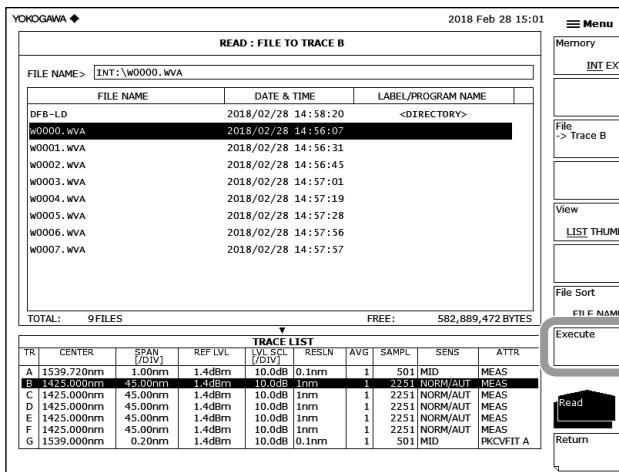
Instead of tapping **File**→**Trace @**, you can also tap the appropriate line on the trace list to select the trace to assign.

## Loading the File

10. Tap **Execute**. The file is loaded.

If you tap **Return**, the file will not be loaded. The menu will return to the previous level.

11. Tap **Return**. The file list and trace list disappear, and the waveform is displayed in the assigned trace.



### Explanation

You can save data from traces A to G to internal memory or a USB storage device or assign previously saved data to trace A to G and display it.

### Extensions

The file name extensions for saving data are shown below.

BIN (binary format): .WVA

CSV (ASCII format): .CSV

### File Name

You can save files by assigning their names automatically or with specific names.

If you do not specify a file name, the following file name will be assigned automatically according to the Auto File Name setting.

When Auto File Name is set to NUM

File name: WXXXX.CSV (or .WVA)

XXXX is a serial number from 0000 to 9999.

When Auto File Name is set to DATE

File name: Wyyyymmdd\_hhmmss.CSV (or .WVA)

yyyymmdd: Year (Gregorian) month day

hhmmss: Hour (24 hours) minute second

(Date/time when the file list was updated)

### Note

---

- The date/time used when file names are assigned based on the date through remote commands or program commands is the date/time when the file is created.
- When assigning a file name manually, use characters that are allowed by MS-DOS. The maximum number of characters that you can use for a file name is 56 (including the extension).

The characters that you can use are shown below.

!#\$%&'()-

0123456789@

ABCDEFGHIJKLMNPQRSTUVWXYZ^

abcdefghijklmnpqrstuvwxyz{}^-

---

### Data Format

Data can be saved in the following two formats.

#### BIN

Data is saved in binary format.

You cannot view the waveform data directly using an external application. The file size will be smaller than that of ASCII format.

#### CSV

Data is saved in comma-separated (CSV) ASCII format.

You can view the waveform data directly using an external application. The file size will be larger than that of binary format.

## File Size

The file size varies depending on the data that you are saving. Check that there is sufficient free space at the storage destination before saving the data.

## Sorting Files

You can sort the file list in ascending order by file name, file type, date, or label.

## CSV Data Format

CSV data is saved in the following format.

```

60CSV
// AQ6360 OPTICAL SPECTRUM ANALYZER //
35
"CTRWL",1549.300000
"SPAN",5.000000
"START WL",1546.800000
"STOP WL",1551.800000
"WLFREQ",0
"REFL",+8.2
"LSCL",10.0
"RESLN",0.100
"AVG",1
"SMPLAUTO",1
"SMPL",501
"SMPLINTVL",0.0100
"MID"
"MEAS"
"LSUNT",0
"NMSKH","OFF"
"RESCOR",1
"RESCOR_XUNIT",0
"SMOOTH",0
"LIBERTYPE",0
"MEASWL",1
"SWPSPD",0
"MODELNAME","AQ6360"
"NEBWICAL0",0
"NEBWICAL1",0
"NEBWICALWL",0
"RESPARM",0
"REQPARM",0
"CHGPT",0
"RESCALO_0",10000
"RESCALO_1",0
"RESCALO_2",0

"[TRACE DATA]"
1546.8000, -53.419
1546.8100, -53.370
:
:
:
1551.8000, -51.535

```

Header

Measurement condition parameters

Waveform data

### Header

60CSV	File header
// AQ6360 OPTICAL SPECTRUM ANALYZER //	Label (57 characters)
35	Number of lines to TRACE DATA

### Measurement condition parameters

"CTRWL",1549.300000	Center wavelength
"SPAN", 5.000000	Span
"START WL",1546.800000	Measurement start wavelength
"STOP WL",1551.800000	Measurement stop wavelength
"WLFREQ", 0	Horizontal scale mode (0: wavelength mode, 1: frequency mode)
"REFL",+8.2	Reference level
"LSCL",10.0	Main level scale
"RESLN",0.100	Measurement resolution
"AVG",1	Average times
"SMPLAUTO",1	Sample points setting mode (0: MANUAL, 1: AUTO, 2: SMPL INTVL)
"SMPL", 501	Number of measured sampling points
"SMPLINTVL",0.0100	Measurement sampling interval
"MID"	Measurement sensitivity
"MEAS"	Measurement type
"LSUNT",0	Vertical scale mode (0: dBm, 1: dBm/nm)
"NMSKH","OFF"	Noise mask setting (NMSKV: VERTICAL, NMSKH: HORIZONTAL)
"RESCOR",1	Resolution correction setting (always 1: ON)
"RESCOR_XUNIT",0	Unit of resolution correction (0: no designation, 1: wavelength, 2: frequency)
"SMOOTH",0	Smoothing setting (0: OFF, 1: ON)
"FIBERTYPE",0	Fiber connector setting (0: NORM, 1: ANGLED)
"MEASWL",1	Wavelength in air or vacuum (0: AIR, 1: VACUUM)
"SWPSPD",0	Sweep speed (0: 1x, 1: 2x)
"MODELNAME","AQ6360"	Model name
"NEBWCAL0",0	Resolution calibration coefficient
"NEBWCAL1",0	Resolution calibration coefficient
"NEBWCALWL",0	Resolution calibration wavelength
"RESPARM",0	RMS wavelength resolution coefficient
"FREQPARM",0	RMS frequency resolution coefficient
"CHGPT",0	Diffraction order parameter (fixed to 0)
"RESCAL0_0",10000	RMS resolution correction coefficient
"RESCAL0_1",0	RMS resolution correction coefficient
"RESCAL0_2",0	RMS resolution correction coefficient

The reference level and main level scale are saved to one of the following depending on the vertical scale.

Main level scale

Vertical Axis Scale	Save Format	Description
LOG	"REFL",***.*	Reference level
	"LSCL",***.*	Level scale
Linear	"REFL",***.*	Reference level
	"LSCL",***.*	Level scale
	"BASEL",****.**	Base level

Sub level scale

Vertical Axis Scale	Save Format	Description
LOG	"REFL",***.*	Reference level
	"SSCLLOG",***.*	Level scale
	"LOFST",***.*	Level offset
Linear	"REFL",***.*	Reference level
	"SSCLN",***.*	Level scale
	"SMIN",****.**	Base level
DB/km	"REFL",***.*	Reference level
	"SSKM",***.*	Level scale
	"OFSKM",****.**	Offset level
	"LENG",***.***	Optical fiber length
%	"REFL",***.*	Reference level
	"SSPS",***.*	Level scale
	"SMINP",***.*	Base level

Measurement Sensitivity

The data below is saved as measurement sensitivity depending on the measurement sensitivity type.

Format	Format (during gate sampling measurement)	Measurement Sensitivity Type
"NORM-HOLD"	"G-NORM-HOLD",****.*	NORM/HOLD
"NORM-AUTO"	"G-NORM-AUTO",****.*	NORM/AUTO
"NORMAL"	"G-NORMAL",****.*	NORMAL
"MID"	"G-MID",****.*	MID
"HIGH 1"	"G-HIGH 1",****.*	HIGH 1
"HIGH 2"	"G-HIGH 2",****.*	HIGH 2

HIGH 1 and HIGH 2 are available only on the standard model (-10).

Measurement Identifier

The data below is saved as a waveform identifier depending on the waveform type.

Format	Waveform Type	Format	Waveform Type	Format	Waveform Type
"MEAS"	WRITE	"E-D"	E-D(LOG)	"C+F"	C+F(LIN)
"MAXH"	MAX HOLD	"C+D"	C+D(LOG)	"C-FL"	C-F(LIN)
"MINH"	MIN HOLD	"D+E"	D+E(LOG)	"F-CL"	F-C(LIN)
"RAVG"	ROLL AVG	"C+DL"	C+D(LIN)	"E+FL"	E+F(LIN)
"A-B"	A-B(LOG)	"C-DL"	C-D(LIN)	"E-FL"	E-F(LIN)
"B-A"	B-A(LOG)	"D-CL"	D-C(LIN)	"F-EL"	F-E(LIN)
"A+B"	A+B(LOG)	"D+EL"	D+E(LIN)	"NORM A"	NORMALIZE A
"A-BL"	A-B(LIN)	"D-EL"	D-E(LIN)	"NORM B"	NORMALIZE B
"B-AL"	B-A(LIN)	"E-DL"	E-D(LIN)	"NORM C"	NORMALIZE C
"A+BL"	A+B(LIN)	"C-F"	C-F(LOG)	"CVFT A",**	CURVE FIT A
"1-K(A/B)",****.****	1-k(A/B)	"F-C"	F-C(LOG)	"CVFT B",**	CURVE FIT B
"1-K(B/A)",****.****	1-k(B/A)	"E-F"	E-F(LOG)	"CVFT C",**	CURVE FIT C
"C-D"	C-D(LOG)	"F-E"	F-E(LOG)	"CVFTPK A",**	PK CURVE FIT A
"D-C"	D-C(LOG)	"C+F"	C+F(LOG)	"CVFTPK B",**	PK CURVE FIT B
"D-E"	D-E(LOG)	"E+F"	E+F(LOG)	"CVFTPK C",**	PK CURVE FIT C

### Waveform Data

The measured waveform data is stored as sets of wavelength (in nm) and level. The number of sets equals the number of measurement samples.

Waveforms measured in frequency mode are stored using their frequencies (THz).

Level values are stored as log values if the vertical scale is LOG, and as linear values if the vertical scale is linear.

(For LOG scale)

[TRACE DATA]	Header indicating the start of the trace data
****.****, ±***.***(CR)(LF)	Wavelength value, level value (LOG) of the first point
****.****, ±***.***(CR)(LF)	Wavelength value, level value (LOG) of the second point
:	
****.****, ±***.***(CR)(LF)	Wavelength value, level value (LOG) of the last point

(For linear scale)

[TRACE DATA]	Header indicating the start of the trace data
****.**** * ***E±*** (CR)(LF)	Wavelength value, level value (linear) of the first point
****.**** * ***E±*** (CR)(LF)	Wavelength value, level value (linear) of the second point
:	
****.**** * ***E±*** (CR)(LF)	Wavelength value, level value (linear) of the last point

## 6.3 Saving and Loading Waveform Data (All Trace)

### Procedure

You can save waveform data (all measured trace data) displayed on the instrument to a USB storage device and load data from a USB storage device.



#### CAUTION

Do not remove the USB storage medium or turn the power OFF while the USB storage medium access indicator is blinking. This can damage the data on the medium or the device itself. Also, always place a USB storage medium in the removable state (following the procedure in section 6.1) before removing it.

### French



#### ATTENTION

Ne retirez pas le dispositif de stockage USB et ne coupez pas l'alimentation lorsque le voyant d'accès au dispositif de stockage USB clignote.

Cela risquerait d'endommager le dispositif ou les données se trouvant sur ce dernier. De plus, toujours faire passer un support de stockage USB à l'état de retrait en toute sécurité (en suivant la procédure figurant à la section 6.1) avant de le retirer.

### Saving All Trace Data

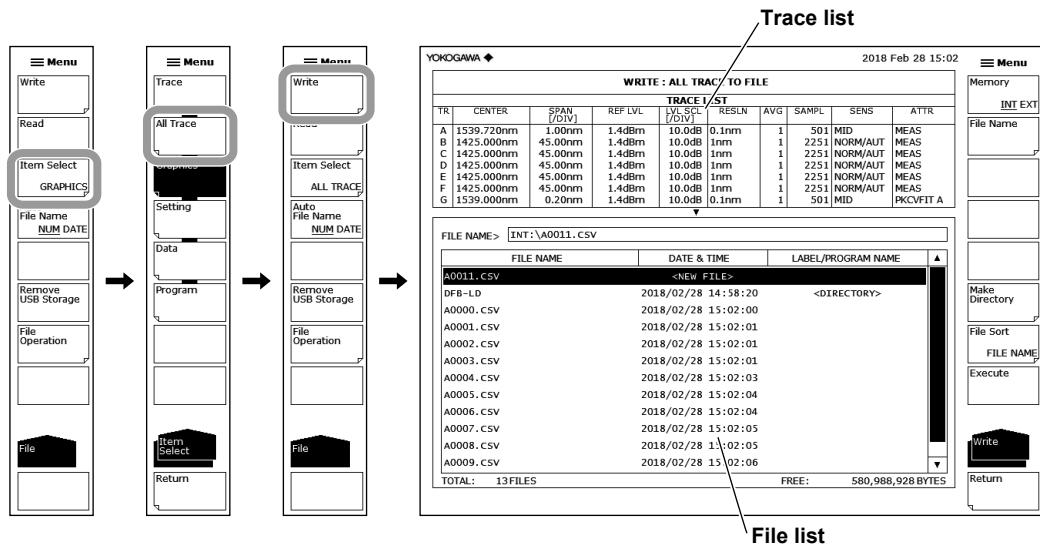
#### Selecting the Method of Automatically Setting the File Name

Select the method of automatically setting the file name by referring to page 6-2.

#### Setting the Type of File to Save to ALL TRACE

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **All Trace**. All Trace is selected, and the menu returns to the previous level.
5. Tap **Write**. A trace list and a file list are displayed on the screen.

### 6.3 Saving and Loading Waveform Data (All Trace)



#### Selecting the Save Destination

5. Tap **Memory** to select INT (internal memory) or EXT (USB storage device).



### Entering a File Name (When Saving to a Specific File Name)

If you do not set a file name, the file will automatically be assigned a name using a serial number or date.

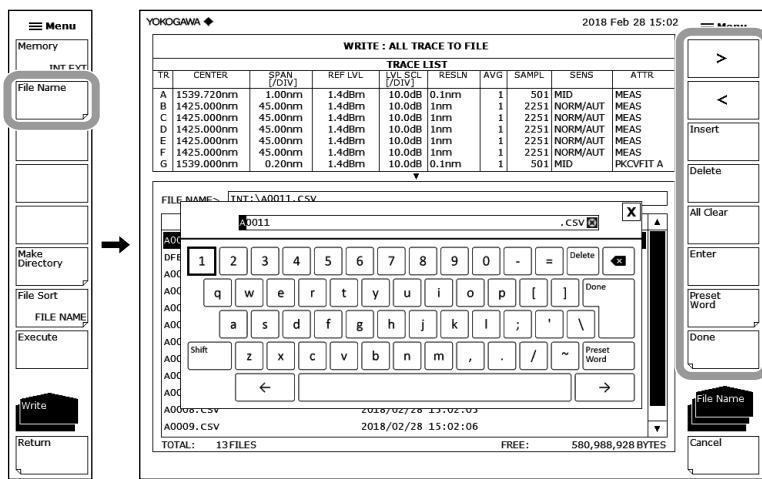
6. Tap the line displaying “NEW FILE” to move the cursor to it.

7. Tap **File Name**. A keyboard appears.

8. Use the keyboard to input the new file name.

For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.

9. Tap **Done**. The file name is confirmed, and the screen returns to the previous level.



### Saving the File

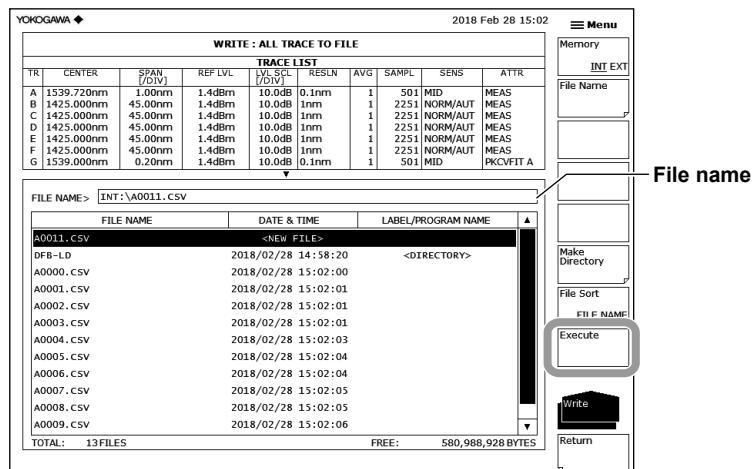
10. To overwrite an existing file, move the cursor to the name of the file you want to overwrite.

11. Tap **Execute**. The file is saved.

If you tap **Return**, the data will not be saved. The menu will return to the previous level.

12. When overwriting a file, a confirmation message appears. Tap **YES**.

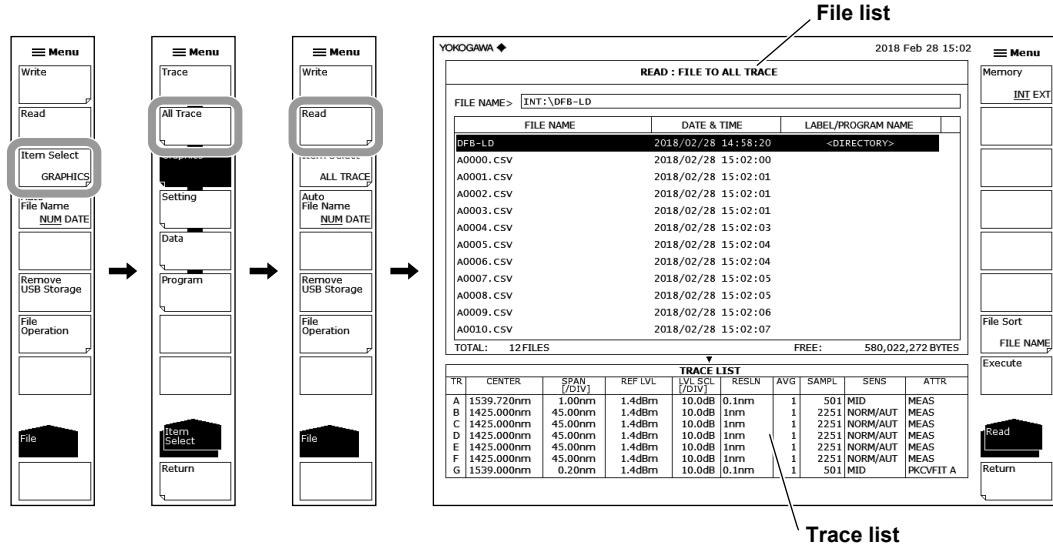
To cancel saving, tap **NO**.



### Loading All Trace Data

#### Setting the Type of File to Load to ALL TRACE

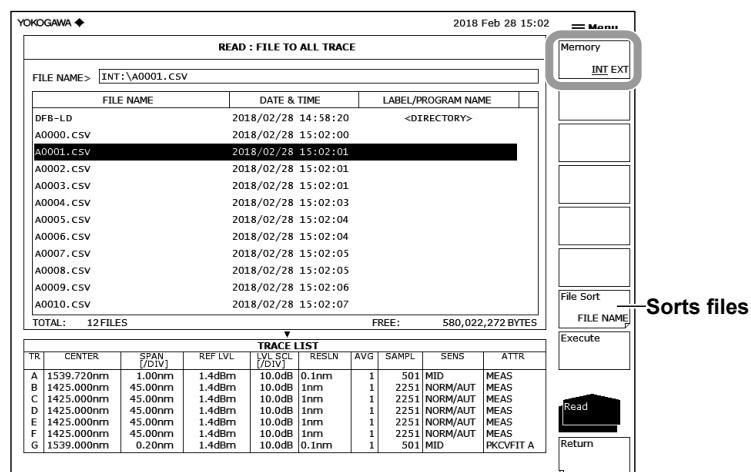
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **All Trace**. All Trace is selected, and the menu returns to the previous level.
5. Tap **Read**. A file list and a trace list appear on the screen.



#### Selecting the File to Load

5. Tap **Memory** to select INT (internal memory) or EXT (USB storage device). The file list of the selected device appears.
6. Tap a line in the file list to move the cursor to the file you want to load.

You can sort the files tapping **File Sort**. For the operating procedure, see page 6-5.

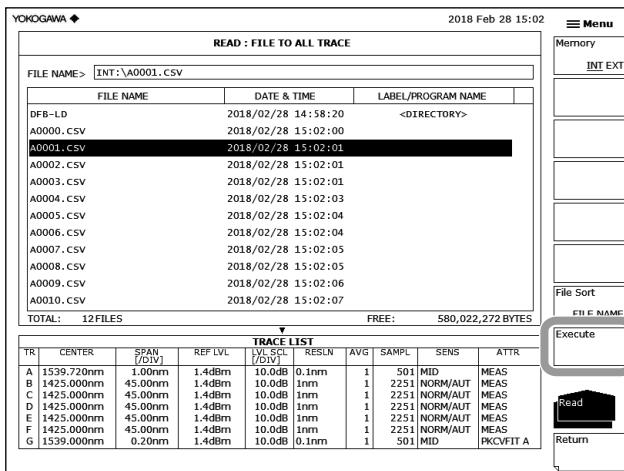


### Loading the File

7. Tap **Execute**. The file is loaded.

If you tap **Return**, the file will not be loaded. The menu will return to the previous level.

8. Tap **Return**. The file list and trace list disappear, and the waveforms loaded from the file is displayed.



### Explanation

You can save measured waveform data in a single file in the internal memory or a USB storage device and load previously saved data into traces A and G and display it.

#### Extension

Data is saved to a file with .CSV extension.

#### File Name

You can save files by assigning their names automatically or with specific names. If you do not specify a file name, the following file name will be assigned automatically according to the AUTO FILE NAME setting.

When AUTO FILE NAME is set to NUM

File name: AXXXX.CSV

XXXX is a serial number from 0000 to 9999.

When AUTO FILE NAME is set to DATE

File name: Ayyyyymmdd\_hhmmss.CSV

yyyyymmdd : Year (Gregorian) month day

hhmmss : Hour (24 hours) minute second

(Date/time when the file list was updated)

#### Note

---

- The date/time used when file names are assigned based on the date through remote commands or program commands is the date/time when the file is created.
- When assigning a file name manually, use characters that are allowed by MS-DOS. The maximum number of characters that you can use for a file name is 56 (including the extension).

The characters that you can use are shown below.

!#\$%&'()

0123456789@

ABCDEFGHIJKLMNPQRSTUVWXYZ^

abcdefghijklmnopqrstuvwxyz{}^-

---

#### File Size

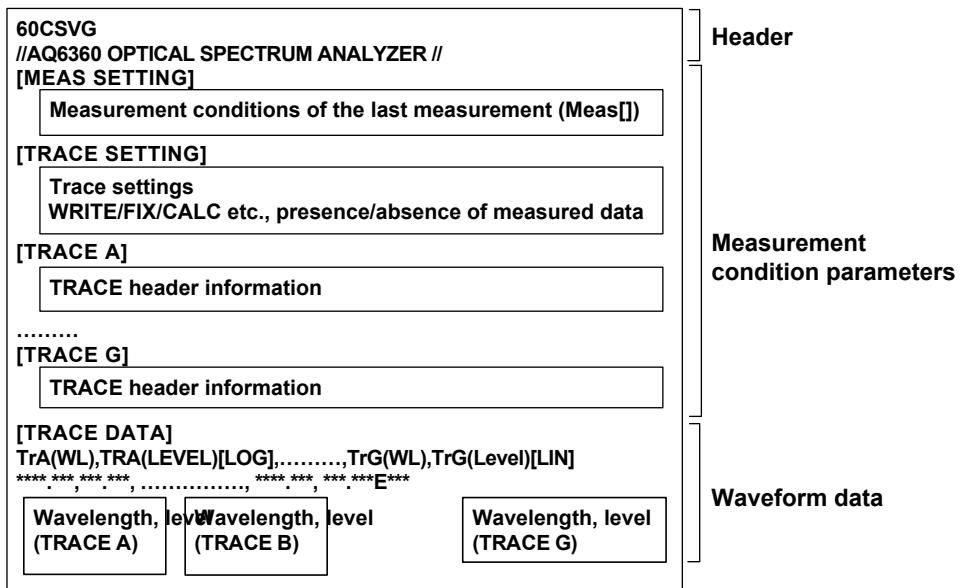
The file size varies depending on the data that you are saving. Check that there is sufficient free space at the storage destination before saving the data.

#### Sorting Files

You can sort the file list in ascending order by file name, date, or label.

**CSV Data Format**

CSV data is saved in the following format.

**Header**

60CSVG

File header

// AQ6360 OPTICAL SPECTRUM ANALYZER //

Label (57 characters)

**Measurement condition parameters**

Measurement conditions of each trace, measurement conditions when files were saved, and trace settings are saved.

[MEAS SETTING] section: Measurement settings when files were saved

[TRACE SETTING] section: Trace settings

(active trace information, each trace's settings, presence/absence of measured data)

[TRACE A] to [TRACE G]: Measurement conditions for each trace

The waveform condition format is the same as that of the waveform file.

See section 6.2, "Saving and Loading Waveform Data."

**Measured Data**

The measured waveform data of traces A through G are saved as wavelength and level values of the measured number of samples.

Unmeasured trace data is not saved.

Waveforms measured in Frequency mode are also saved as wavelength values.

## 6.4 Saving and Loading Setting Data

### Procedure

You can save the instrument's measurement conditions and function menu states to a file in binary format.



### CAUTION

Do not remove the USB storage medium or turn the power OFF while the USB storage medium access indicator is blinking. This can damage the data on the medium or the device itself. Also, always place a USB storage medium in the removable state (following the procedure in section 6.1) before removing it.

### French



### ATTENTION

Ne retirez pas le dispositif de stockage USB et ne coupez pas l'alimentation lorsque le voyant d'accès au dispositif de stockage USB clignote.

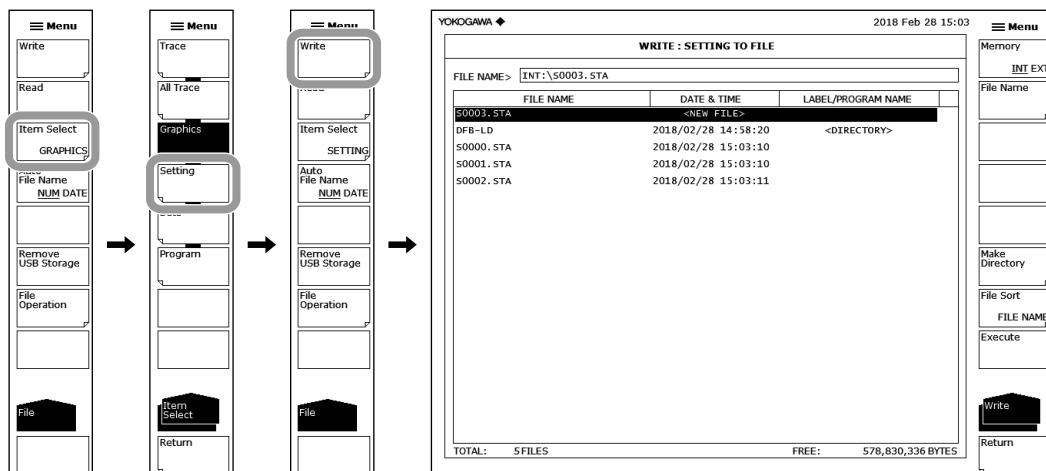
Cela risquerait d'endommager le dispositif ou les données se trouvant sur ce dernier. De plus, toujours faire passer un support de stockage USB à l'état de retrait en toute sécurité (en suivant la procédure figurant à la section 6.1) avant de le retirer.

### Selecting the Method of Automatically Setting the File Name

Select the method of automatically setting the file name by referring to page 6-2.

### Setting the Type of File to Save to SETTING

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Setting**. Setting is selected, and the menu returns to the previous level.
5. Tap **Write**. A file list appears.



## Selecting the Storage Device

6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device).



## Entering the Name of a File to Save

If you do not set a file name, the file will automatically be assigned a name using a serial number or date.

For instructions on how to create directories and sort the file list, see page 6-5.

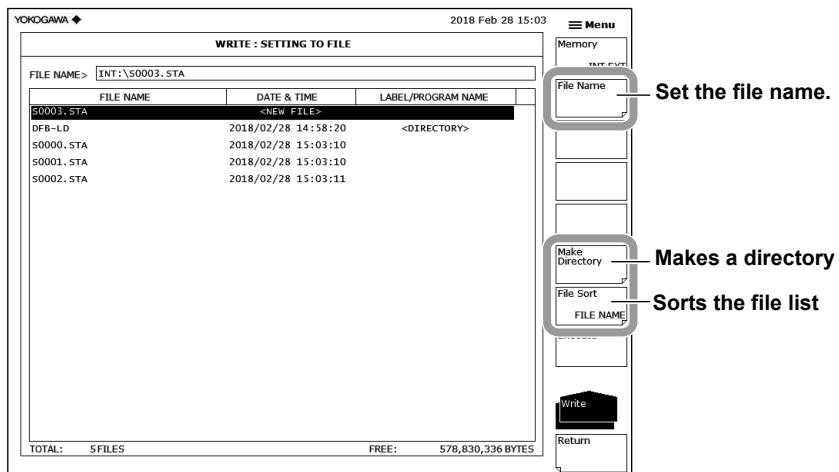
7. Tap the line displaying “NEW FILE” to move the cursor to it.

8. Tap **File Name**. A keyboard appears.

9. Use the keyboard to input the new file name.

For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.

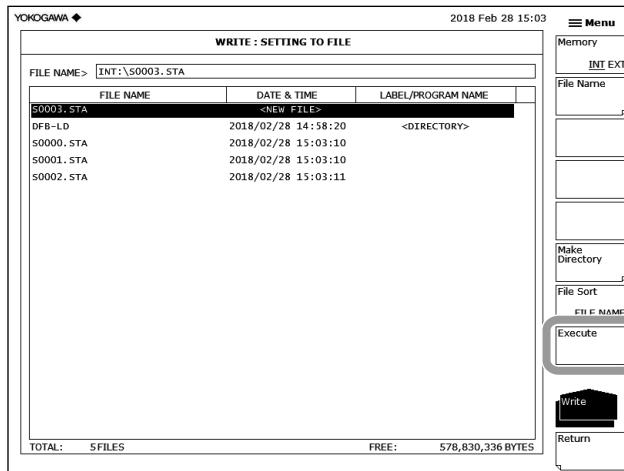
10. Tap **Done**. The file name is confirmed, and the screen returns to the previous level.



## 6.4 Saving and Loading Setting Data

### Saving the File

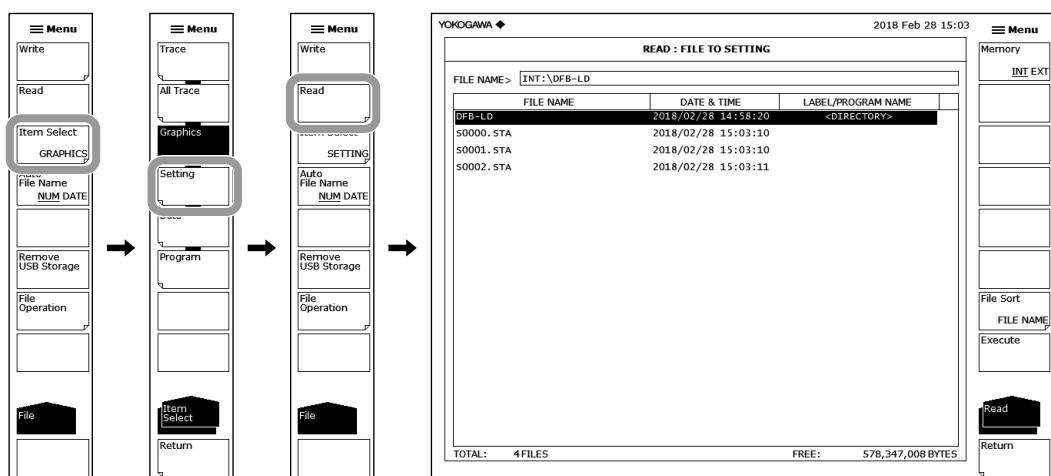
11. To overwrite an existing file, move the cursor to the name of the file you want to overwrite.
12. Tap **Execute**. The file is saved.  
If you tap **Return**, the data will not be saved. The menu will return to the previous level.
13. When overwriting a file, a confirmation message appears. Tap **YES**.  
To cancel saving, tap **NO**.



### Loading Setting Data

#### Setting the Type of File to Load to SETTING

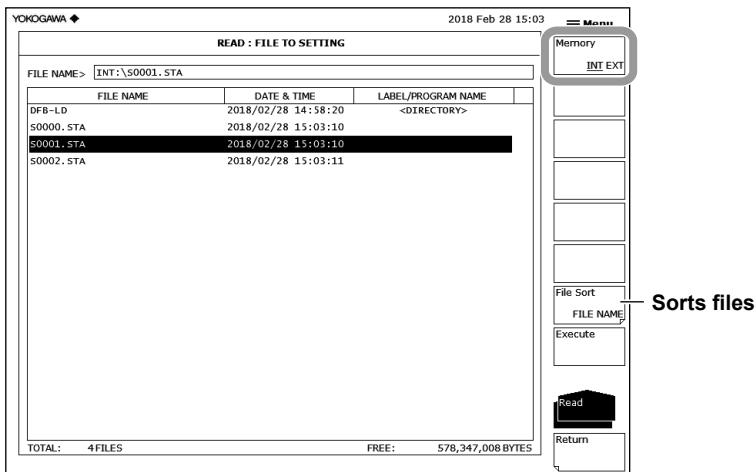
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Setting**. Setting is selected, and the menu returns to the previous level.
5. Tap **Read**. A file list appears.



## Selecting the File to Load

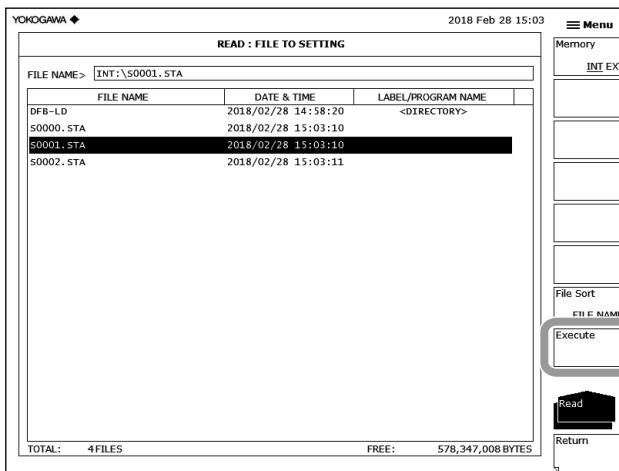
6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device). The file list of the selected device appears.
7. Tap a line in the file list to move the cursor to the file you want to load.

You can sort the files tapping **File Sort**. For the operating procedure, see page 6-5.



## Loading the File

8. Tap **Execute**. The file is loaded, and the instrument settings change. If you tap **Return**, the file will not be loaded. The menu will return to the previous level.
9. Tap **Return**. The file list disappears.



### Explanation

You can save setting data to the internal memory or USB storage device and also load setting data saved previously and change the instrument settings.

### Extension

Data is saved to a file with .STA extension.

### File Name

You can save files by assigning their names automatically or with specific names.

If you do not specify a file name, the following file name will be assigned automatically according to the AUTO FILE NAME setting.

When AUTO FILE NAME is set to NUM

File name: SXXXX.STA

XXXX is a serial number from 0000 to 9999.

When AUTO FILE NAME is set to DATE

File name: Syyyymmdd\_hhmmss.STA

yyyymmdd: Year (Gregorian) month day

hhmmss: Hour (24 hours) minute second

(Date/time when the file list was updated)

### Note

---

- The date/time used when file names are assigned based on the date through remote commands or program commands is the date/time when the file is created.
- When assigning a file name manually, use characters that are allowed by MS-DOS. The maximum number of characters that you can use for a file name is 56 (including the extension).

The characters that you can use are shown below.

!#\$%&'()-

0123456789@

ABCDEFGHIJKLMNPQRSTUVWXYZ^

abcdefghijklmnpqrstuvwxyz{}~

---

### File Size

The file size is about 74 KB.

### Sorting Files

You can sort the file list in ascending order by file name, file type, date, or label.

## 6.5 Saving and Loading Analysis Results Data

### Procedure

You can save analysis results, the time when the data was saved, and waveform data in ASCII format.



### CAUTION

Do not remove the USB storage medium or turn the power OFF while the USB storage medium access indicator is blinking. This can damage the data on the medium or the device itself. Also, always place a USB storage medium in the removable state (following the procedure in section 6.1) before removing it.

### French



### ATTENTION

Ne retirez pas le dispositif de stockage USB et ne coupez pas l'alimentation lorsque le voyant d'accès au dispositif de stockage USB clignote.

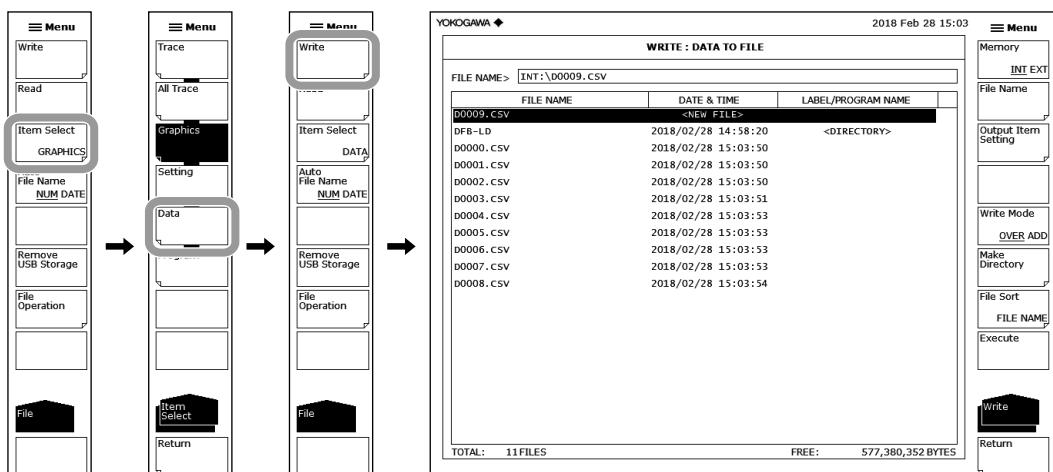
Cela risquerait d'endommager le dispositif ou les données se trouvant sur ce dernier. De plus, toujours faire passer un support de stockage USB à l'état de retrait en toute sécurité (en suivant la procédure figurant à la section 6.1) avant de le retirer.

### Selecting the Method of Automatically Setting the File Name

Select the method of automatically setting the file name by referring to page 6-2.

### Setting the Type of File to Save to DATA

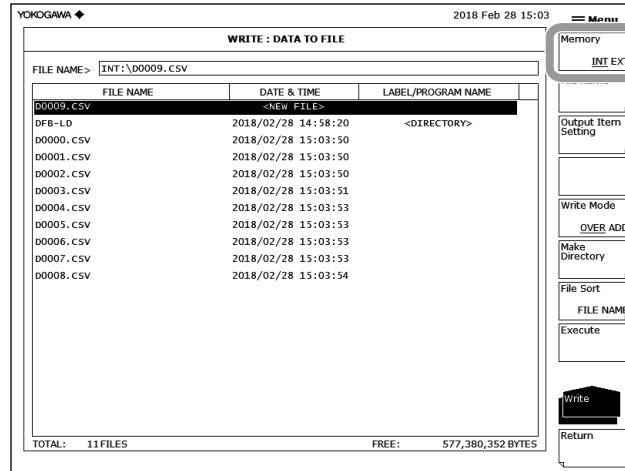
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Data**. Data is selected, and the menu returns to the previous level.
5. Tap **Write**. A file list appears.



## 6.5 Saving and Loading Analysis Results Data

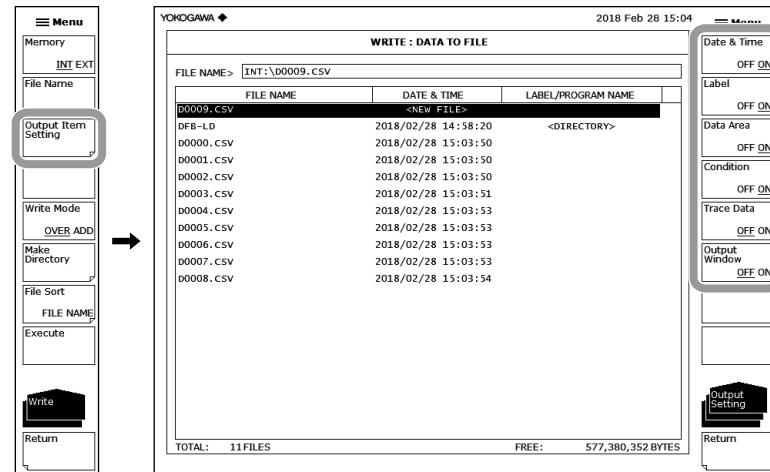
### Selecting the Storage Device and Data Format

6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device).



### Selecting Data Items to Save

7. Tap **Output Item Setting**. A menu appears for selecting the data items to save.
8. Tap the data items to select ON (save) or OFF (not save).
9. Tap **Return**. The menu returns to the previous level.



## Entering the Name of a File to Save

If you do not set a file name, the file will automatically be assigned a name using a serial number or date.

For instructions on how to create directories and sort the file list, see page 6-5.

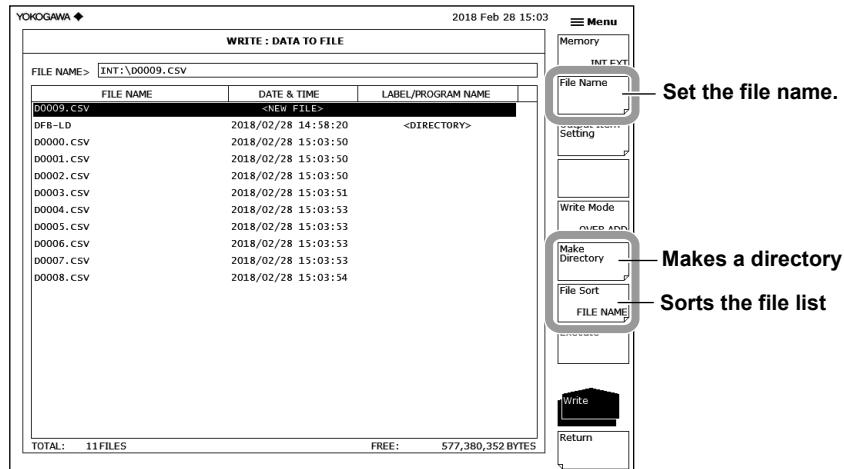
**10.** Tap the line displaying “NEW FILE” to move the cursor to it.

**11.** Tap **File Name**. A keyboard appears.

**12.** Use the keyboard to input the new file name.

For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.

**13.** Tap **Done**. The file name is confirmed, and the screen returns to the previous level.



## Setting the Save Method and Saving the File

**14.** Tap **Write Mode** to select OVER (overwrite) or ADD (add).

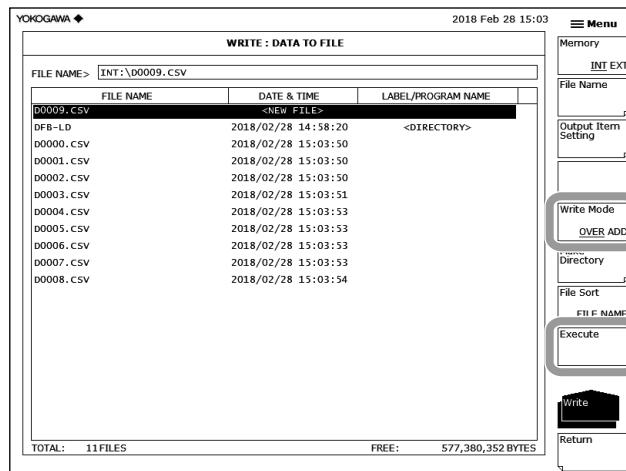
**15.** To overwrite an existing file, move the cursor to the name of the file you want to overwrite.

**16.** Tap **Execute**. The file is saved.

If you tap **Return**, the data will not be saved. The menu will return to the previous level.

**17.** When overwriting a file, a confirmation message appears. Tap **YES**.

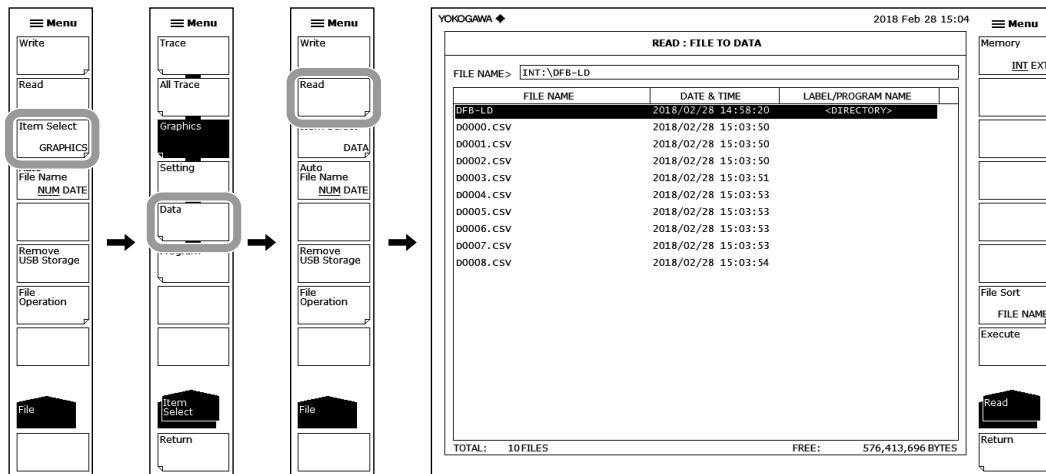
To cancel saving, tap **NO**.



### Loading Analysis Data

#### Setting the Type of File to Load to DATA

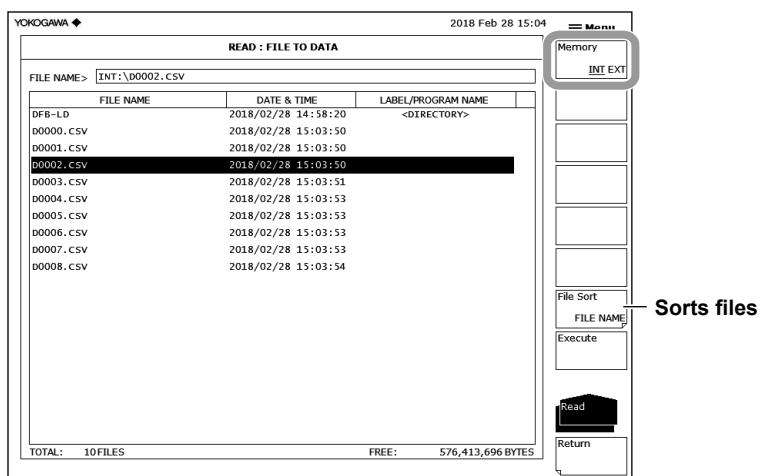
1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Data**. Data is selected, and the menu returns to the previous level.
5. Tap **Read**. A file list appears.



#### Selecting the File to Load

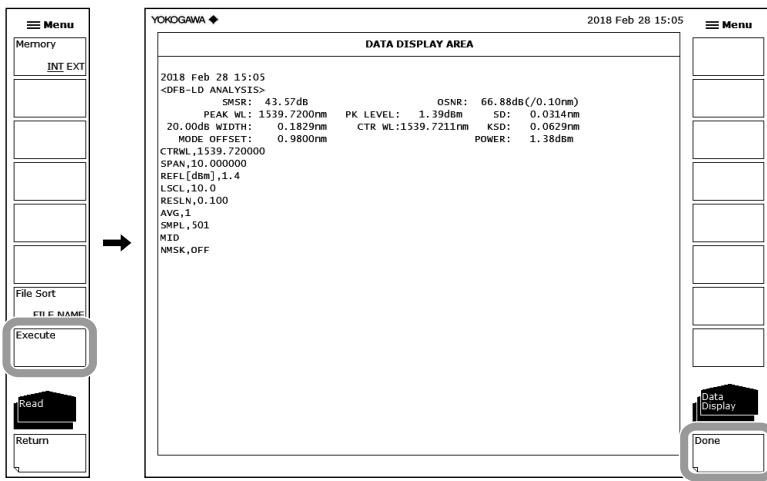
6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device). The file list of the selected device appears.
7. Tap a line in the file list to move the cursor to the file you want to load.

You can sort the files tapping **File Sort**. For the operating procedure, see page 6-5.



## Loading the File

7. Tap **Execute**. The file is loaded, and the data content is displayed.  
If you tap **Return**, the file will not be loaded. The menu will return to the previous level.
8. Tap **Done**. The data content display closes.
9. Tap **Return**. The file list disappears.



## Explanation

### Extension

The file name extensions for saving data are shown below.

CSV (ASCII format): .CSV

### File Name

You can save files by assigning their names automatically or with specific names.

If you do not specify a file name, the following file name will be assigned automatically according to the AUTO FILE NAME setting.

When AUTO FILE NAME is set to NUM

File name: DXXXX.CSV

XXXX is a serial number from 0000 to 9999.

When AUTO FILE NAME is set to DATE

File name: Dyyymmdd\_hhmmss.CSV

yyymmdd: Year (Gregorian) month day

hhmmss: Hour (24 hours) minute second

(Date/time when the file list was updated)

### Note

- The date/time used when file names are assigned based on the date through remote commands or program commands is the date/time when the file is created.
- When assigning a file name manually, use characters that are allowed by MS-DOS. The maximum number of characters that you can use for a file name is 56 (including the extension).

The characters that you can use are shown below.

!#\$%&'()-

0123456789@

ABCDEFGHIJKLMNPQRSTUVWXYZ^

abcdefghijklmnoprstuvwxyz{}^-

## 6.5 Saving and Loading Analysis Results Data

---

### Data to Save

The following data can be saved.

Saved Item	Default Value	Description
DATE&TIME	ON	Date and time
LABEL	ON	Label
DATA AREA	ON	Data area value
CONDITION	ON	Measurement conditions
TRACE DATA	OFF	Trace data
OUTPUT WINDOW	OFF	Output window data used by the program function

### File Size

The file size varies depending on the data that you are saving. Check that there is sufficient free space at the storage destination before saving the data.

### Sorting Files

You can sort the file list in ascending order by file name, file type, date, or label.

### Overwriting

If a file with the same name exists at the save destination, you can select whether to overwrite the file or add data to the file.

OVER: The file is overwritten.

ADD: Data is added to the existing data in the file.

### Data Format

#### CSV

Data is saved in comma-separated (CSV) ASCII format.

## Data Format

The CSV format is shown below.

```

60DAT2
TEST
2018 Apr 07 16:42
<NF ANALYSIS>
TH[dB],20.00
MODE DIFF[dB],3.00
OFST(IN)[dB],0.00
OFST(OUT)[dB],0.00
A_ALGO,AUTO-FIX
F_AREA,AUTO
M_AREA,---
F_ALGO,LINEAR
INTEGRAL RANGE[GHz],50.0
NO.,WAVELENGTH[nm],INPUT LVL[dBm],OUTPUT LVL[dBm],
ASE LVL[dBm],RESOLN[nm],GAIN[dB],NF[dB]
1,1544.4983,-29.320,-2.260,-22.281,0.102,27.017,8.533
2,1545.3041,-29.530,-2.420,-22.184,0.101,27.064,8.619
CTRWL,1551.670000
SPAN,20.000000
REFL[dBm],-10.0
LSCL,10.0
RESLN,0.100
AVG,1
SMPL,2001
HIGH 2
NMSK,OFF
1541.6700, -23.200

```

Diagram illustrating the CSV structure:

- Label**: Brackets group the first three lines: 60DAT2, TEST, and the date/time 2018 Apr 07 16:42.
- Date/time of save**: Brackets group the date/time line 2018 Apr 07 16:42.
- Analysis results header and data**: Brackets group the analysis section starting with <NF ANALYSIS> and ending with the last data line 1541.6700, -23.200.
- Measurement condition parameters**: Brackets group the parameters listed under CTRWL, SPAN, and the following lines: REFL[dBm], LSCL, RESLN, AVG, SMPL, HIGH 2, and NMSK, OFF.
- Waveform data for the sample points (wavelength and level values)**: Brackets group the data lines starting with NO., WAVELENGTH[nm], INPUT LVL[dBm], and OUTPUT LVL[dBm], followed by ASE LVL[dBm], RESOLN[nm], GAIN[dB], and NF[dB].

## 6.6 Saving and Loading Program Data

### Procedure

Programs created with the program function can be saved in binary format.



#### CAUTION

Do not remove the USB storage medium or turn the power OFF while the USB storage medium access indicator is blinking. This can damage the data on the medium or the device itself. Also, always place a USB storage medium in the removable state (following the procedure in section 6.1) before removing it.

### French



#### ATTENTION

Ne retirez pas le dispositif de stockage USB et ne coupez pas l'alimentation lorsque le voyant d'accès au dispositif de stockage USB clignote.

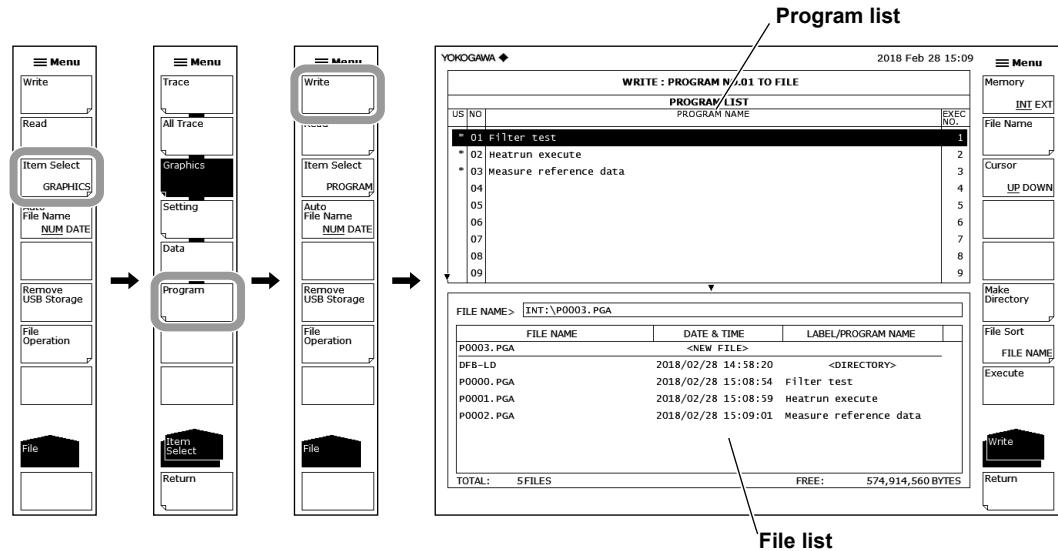
Cela risquerait d'endommager le dispositif ou les données se trouvant sur ce dernier. De plus, toujours faire passer un support de stockage USB à l'état de retrait en toute sécurité (en suivant la procédure figurant à la section 6.1) avant de le retirer.

### Selecting the Method of Automatically Setting the File Name

Select the method of automatically setting the file name by referring to page 6-2.

### Setting the Type of File to Save to PROGRAM

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Program**. Program is selected, and the menu returns to the previous level.
5. Tap **Write**. A program list and a file list are displayed on the screen.



### Selecting the Save Destination and Data Format

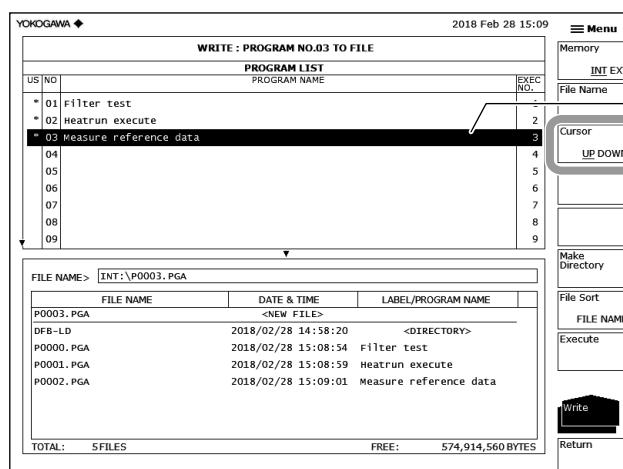
6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device).



### Selecting a Program Number to Save

7. Tap a line in the program list to move the cursor to the program you want to save.

You can move the cursor between the file list window (DOWN) and program list window (UP) by tapping **Cursor**.



**Selected program number**

### Setting the Name of a File to Save

If you do not set a file name, the file will automatically be assigned a name using a serial number or date.

For instructions on how to create directories and sort the file list, see page 6-5.

8. Tap **Cursor** to move the cursor to the file list window (DOWN). An underscore is displayed at the program number selected in step 7.

You can also move the cursor to the file list window by tapping the window.

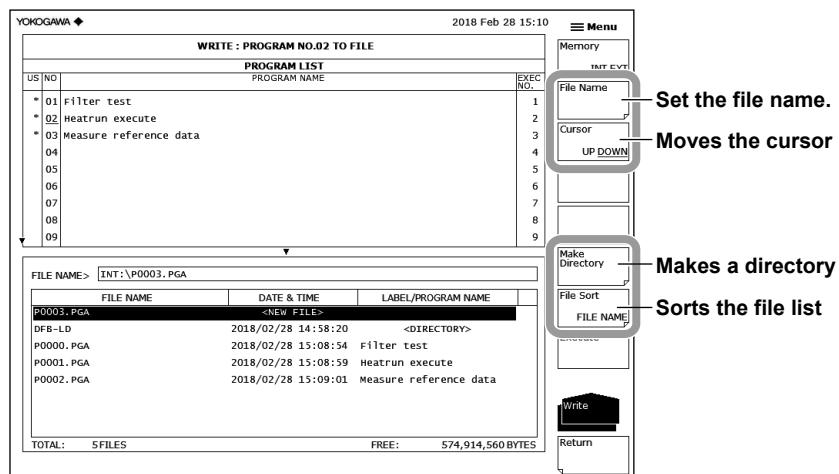
9. Tap the line displaying “NEW FILE” to move the cursor to it.

10. Tap **File Name**. A keyboard appears.

11. Use the keyboard to input the new file name.

For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.

12. Tap **Done**. The file name is confirmed, and the screen returns to the previous level.



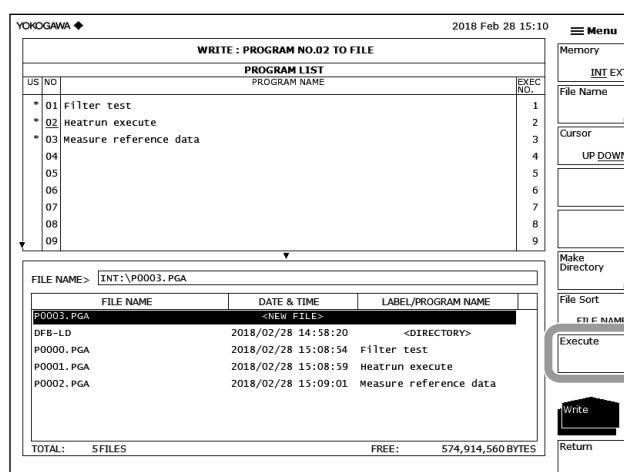
### Saving the File

13. To overwrite an existing file, move the cursor to the name of the file you want to overwrite.

14. Tap **Execute**. The file is saved.

If you tap **Return**, the data will not be saved. The menu will return to the previous level.

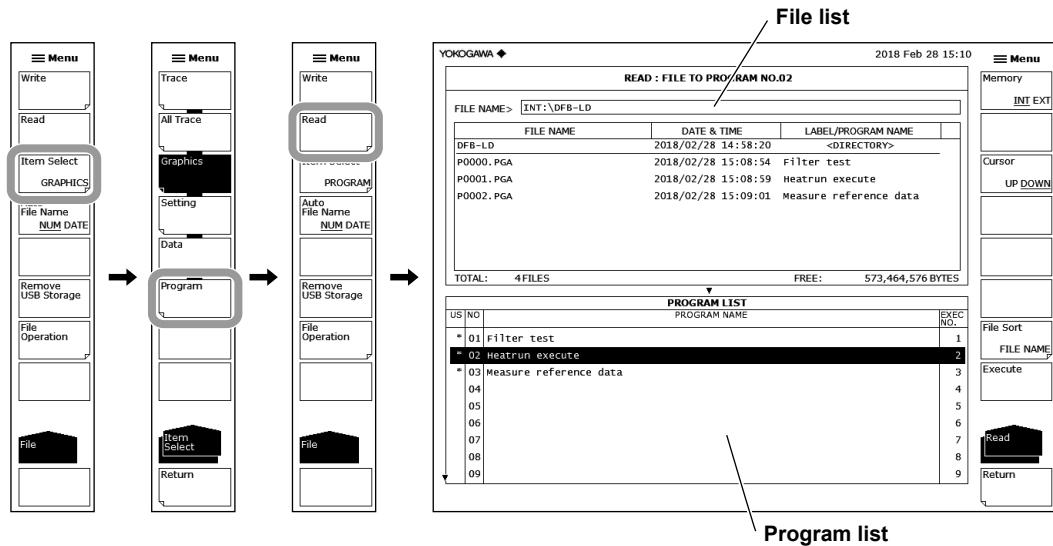
15. When overwriting a file, a confirmation message appears. Tap **YES**. To cancel saving, tap **NO**.



## Loading a Program File

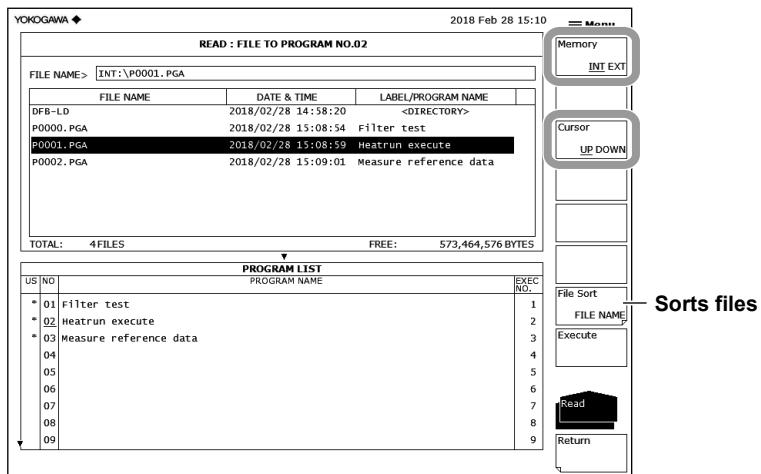
### Setting the Type of File to Load to PROGRAM

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Program**. Program is selected, and the menu returns to the previous level.
5. Tap **Read**. A file list and a program list appear.



### Selecting the File to Load

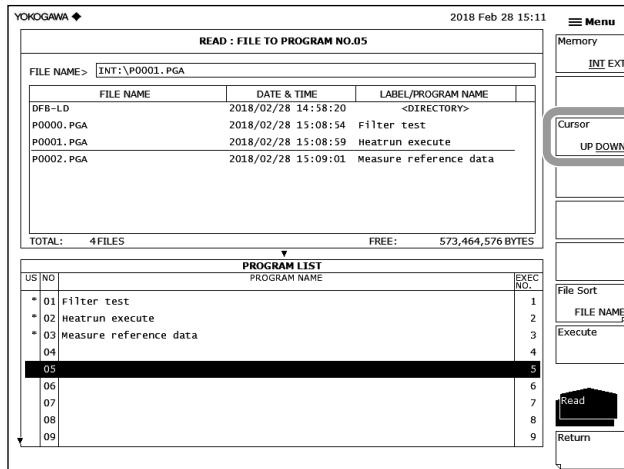
6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device). The file list of the selected device appears.
7. Tap **Cursor** to move the cursor to the file list window (UP). You can also move the cursor to the file list window by tapping the window.
8. Tap a line in the file list to move the cursor to the file you want to load. You can sort the files tapping **File Sort**. For the operating procedure, see page 6-5.



### Selecting the Program Number to Load To

9. Tap **Cursor** to move the cursor to the program list window (DOWN). You can also move the cursor to the program list window by tapping the window.

10. Tap a line in the program list to move the cursor to the load destination program number.

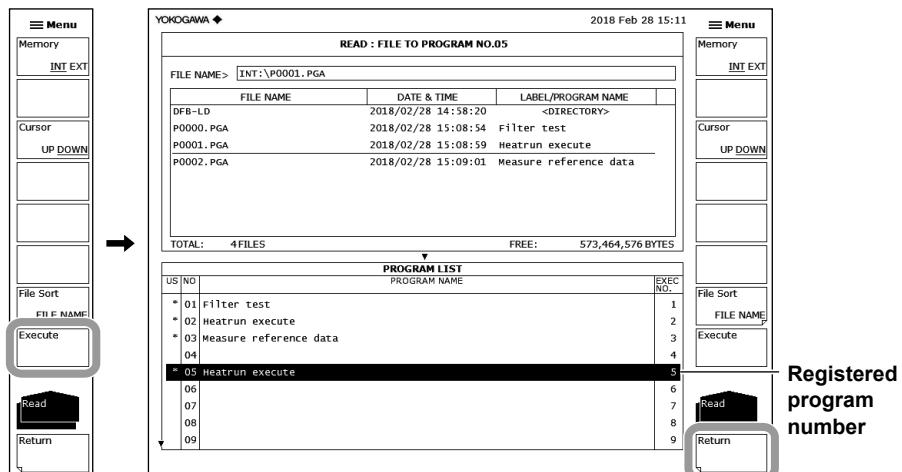


### Loading the File

11. Tap **Execute**. The file is loaded and registered in the specified program number.

If you tap **Return**, the file will not be loaded. The menu will return to the previous level.

12. Tap **Return**. The file list and program list disappear.



**Explanation****Extension**

The file name extensions for saving data are shown below.

BIN (binary format): .PGA

**File Name**

You can save files by assigning their names automatically or with specific names.

If you do not specify a file name, the following file name will be assigned automatically according to the AUTO FILE NAME setting.

When AUTO FILE NAME is set to NUM

File name: PXXXX.PGA

XXXX is a serial number from 0000 to 9999.

When AUTO FILE NAME is set to DATE

File name: Pyyyymmdd\_hhmmss.PGA

yyyymmdd: Year (Gregorian) month day

hhmmss: Hour (24 hours) minute second

(Date/time when the file list was updated)

**Note**

- The date/time used when file names are assigned based on the date through remote commands or program commands is the date/time when the file is created.
- When assigning a file name manually, use characters that are allowed by MS-DOS. The maximum number of characters that you can use for a file name is 56 (including the extension).

The characters that you can use are shown below.

!#\$%&()'-

0123456789@

ABCDEFGHIJKLMNPQRSTUVWXYZ^

abcdefghijklmnpqrstuvwxyz{}\_-

**File Size**

The file size is about 13 KB.

**Data Format**

Data is saved in binary format.

## 6.7 Saving Screen Capture Data

### Procedure

You can capture the screen and save it in a file.



### CAUTION

Do not remove the USB storage medium or turn the power OFF while the USB storage medium access indicator is blinking. This can damage the data on the medium or the device itself. Also, always place a USB storage medium in the removable state (following the procedure in section 6.1) before removing it.

### French



### ATTENTION

Ne retirez pas le dispositif de stockage USB et ne coupez pas l'alimentation lorsque le voyant d'accès au dispositif de stockage USB clignote.

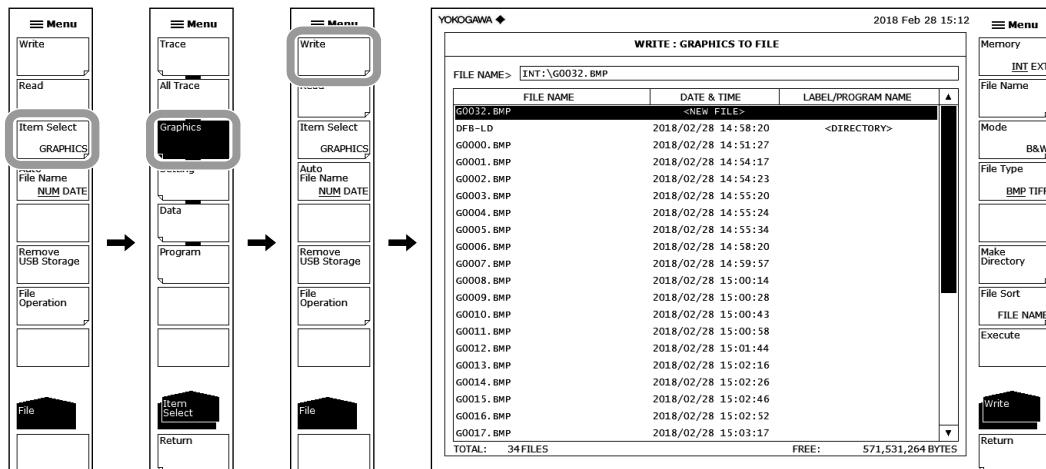
Cela risquerait d'endommager le dispositif ou les données se trouvant sur ce dernier. De plus, toujours faire passer un support de stockage USB à l'état de retrait en toute sécurité (en suivant la procédure figurant à la section 6.1) avant de le retirer.

### Selecting the Method of Automatically Setting the File Name

Select the method of automatically setting the file name by referring to page 6-2.

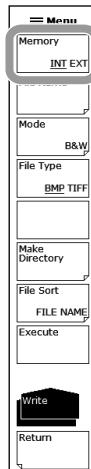
### Setting the Type of File to Save to GRAPHIC

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **Item Select**. A menu appears for selecting the type of file to save or load.
4. Tap **Graphics**. Graphics is selected, and the menu returns to the previous level.
5. Tap **Write**. A file list appears.



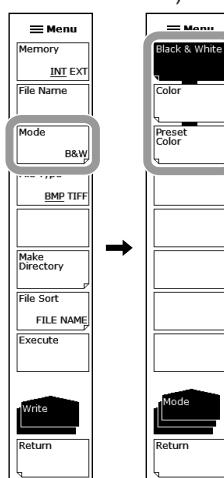
## Selecting the Save Destination and Data Format

6. Tap **Memory** to select INT (internal memory) or EXT (USB storage device).



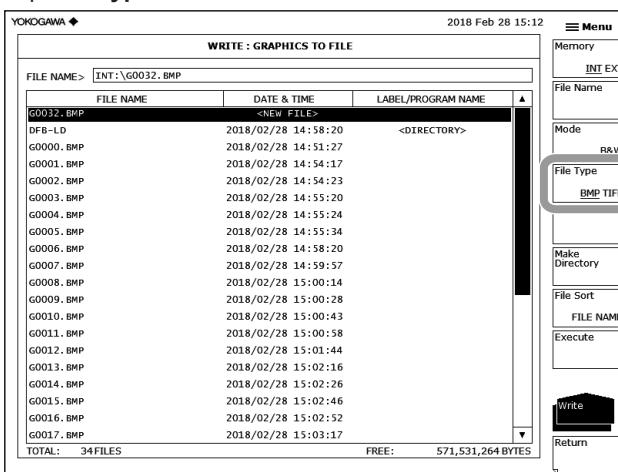
## Selecting the Color

7. Tap **Mode**. A menu appears for selecting the color.  
 8. Tap **Black & White** (black and white), **Color**, or **Preset Color** (only waveform markers in color).



## Selecting the File Type

9. Tap **File Type** to select BMP or TIFF.



### Setting the Name of a File to Save

If you do not set a file name, the file will automatically be assigned a name using a serial number or date.

For instructions on how to create directories and sort the file list, see page 6-5.

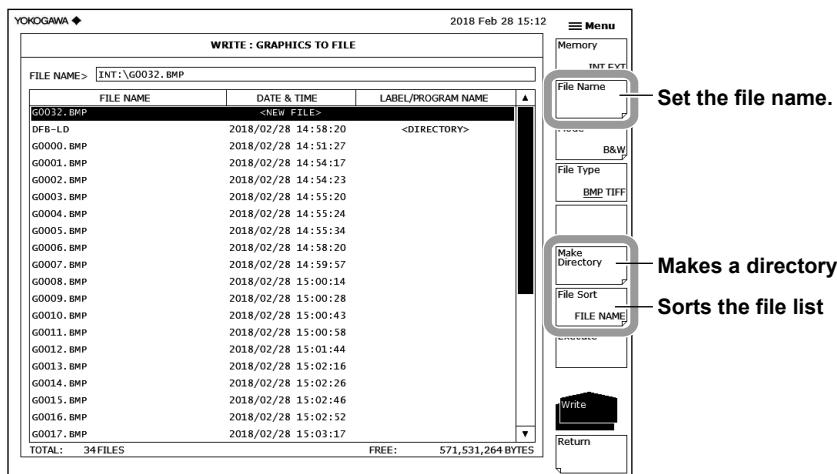
**10.** Tap the line displaying “NEW FILE” to move the cursor to it.

**11.** Tap **File Name**. A keyboard appears.

**12.** Use the keyboard to input the new file name.

For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.

**13.** Tap **Done**. The file name is confirmed, and the screen returns to the previous level.



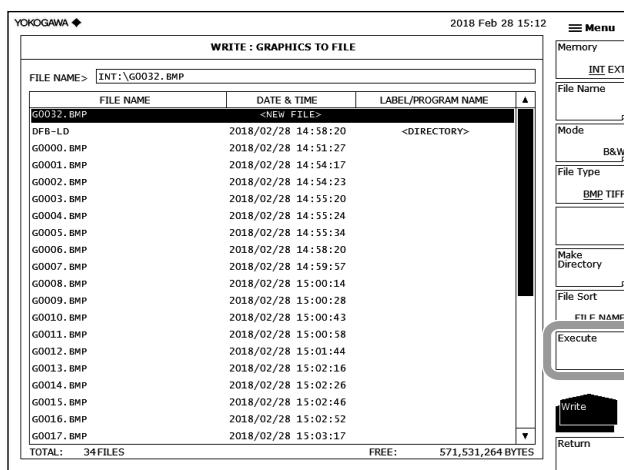
### Saving the File

**14.** To overwrite an existing file, move the cursor to the name of the file you want to overwrite.

**15.** Tap **Execute**. The file is saved.

If you tap **Return**, the data will not be saved. The menu will return to the previous level.

**16.** When overwriting a file, a confirmation message appears. Tap **YES**. To cancel saving, tap **NO**.



**Explanation****Extension**

The file name extensions for saving data are shown below.

BMP (bitmap format): .BMP

TIFF: .TIF

**File Name**

You can save files by assigning their names automatically or with specific names.

If you do not specify a file name, the following file name will be assigned automatically according to the AUTO FILE NAME setting.

When AUTO FILE NAME is set to NUM

File name: GXXXX.BMP (or TIF)

XXXX is a serial number from 0000 to 9999.

When AUTO FILE NAME is set to DATE

File name: Gyyyyymmdd\_hhmmss.BMP (or .TIF)

yyyyymmdd: Year (Gregorian) month day

hhmmss: Hour (24 hours) minute second

(Date/time when the file list was updated)

**Note**

- The date/time used when file names are assigned based on the date through remote commands or program commands is the date/time when the file is created.
- When assigning a file name manually, use characters that are allowed by MS-DOS. The maximum number of characters that you can use for a file name is 56 (including the extension).

The characters that you can use are shown below.

!#\$%&(')-

0123456789@

ABCDEFGHIJKLMNPQRSTUVWXYZ^

abcdefghijklmnopqrstuvwxyz\_

**Color**

Black & White: A black-and-white screen capture is produced.

Color: A color screen capture is produced.

Preset Color: Only the waveforms and markers are saved in color. All other items are saved in black and white.

**Data Format**

You can save the data in bitmap format (BMP) or TIFF format.

**File Size**

The file size varies depending the data format and color setting.

BMP (color): Varies depending on the display color.

BMP (black and white): Approx. 52 KB

TIFF (color): Approx. 412 KB

TIFF (black and white): Approx. 52 KB

## 6.8 File Operations

### Procedure

You can perform file operations such as renaming and copying files.



### CAUTION

Do not remove the USB storage medium or turn the power OFF while the USB storage medium access indicator is blinking. This can damage the data on the medium or the device itself. Also, always place a USB storage medium in the removable state (following the procedure in section 6.1) before removing it.

### French



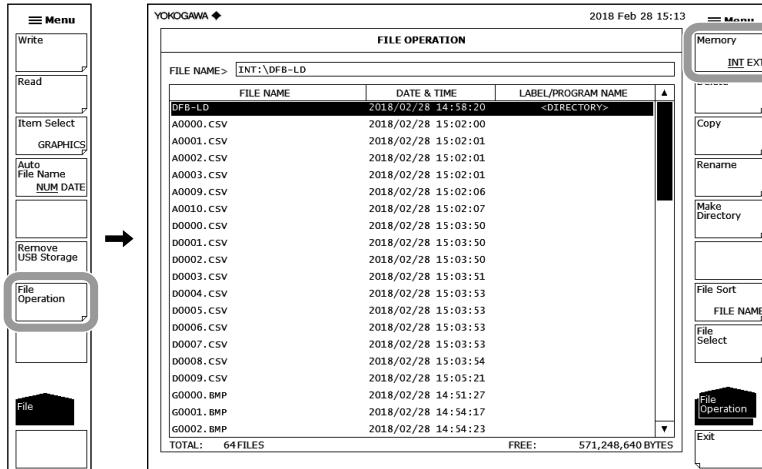
### ATTENTION

Ne retirez pas le dispositif de stockage USB et ne coupez pas l'alimentation lorsque le voyant d'accès au dispositif de stockage USB clignote.

Cela risquerait d'endommager le dispositif ou les données se trouvant sur ce dernier. De plus, toujours faire passer un support de stockage USB à l'état de retrait en toute sécurité (en suivant la procédure figurant à la section 6.1) avant de le retirer.

### Selecting the Storage Device of the File

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **FILE**. A function menu appears for saving and loading data.
3. Tap **File Operation**. A file operation menu appears.
4. Tap **Memory** to select INT (internal memory) or EXT (USB storage device). The file list of the selected device appears.

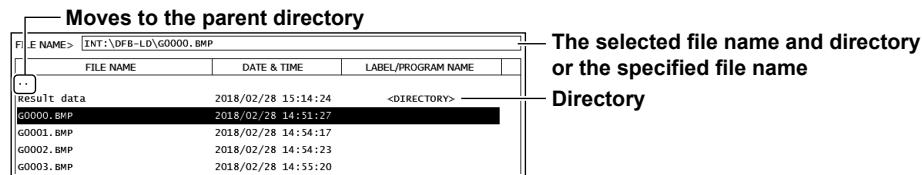


## Selecting a File or Directory

4. Tap a line in the file list to move the cursor to a file or directory.

To move into a directory, double-tap the directory.

Double-tap “..” to move up one directory.



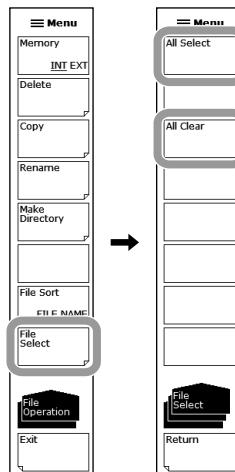
## Selecting All Files

5. Tap **File Select**. A file selection menu appears.

6. Tap **All Select**. All files are selected.

Tapping **All Clear** clears the file selection.

7. Tap **Return**. The menu returns to the previous level.

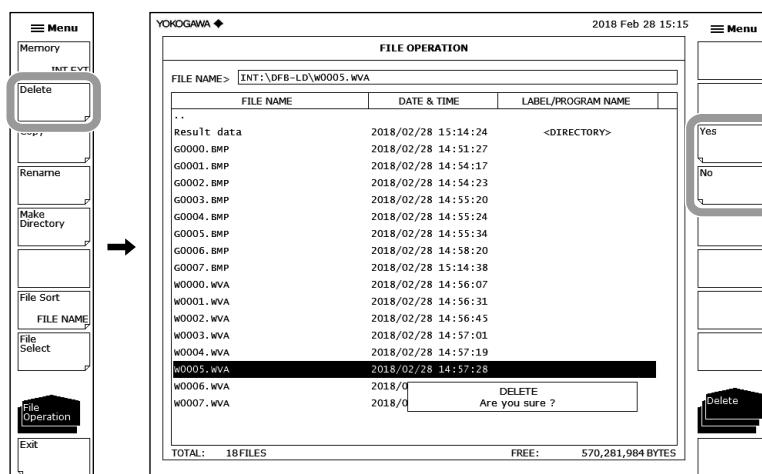


## Deleting Files and Directories

8. Select files or directories by following step 4 or steps 5 to 7.

9. Tap **Delete**. A menu appears for confirming the deletion.

10. Tap **YES**. The selected files and directories will be deleted. Tap **NO** if you do not want to delete them. The menu returns to the previous level.



### Copying Files and Directories

8. Select files or directories by following step 4 or steps 5 to 7.

9. Tap **Copy**.

10. Display the copy destination file list by following steps 3 and 4.

If the copy destination storage device is different from the copy source storage device, tap **Memory** to select the copy destination storage device.

To paste with the same name, proceed to step 11.

To paste with a different name, proceed to step 12.

11. To paste with the same name, tap **Execute**. The selected files or directories are pasted.

12. To paste with a different name, tap **File Name**. A keyboard appears.

13. Use the keyboard to input the new file name.

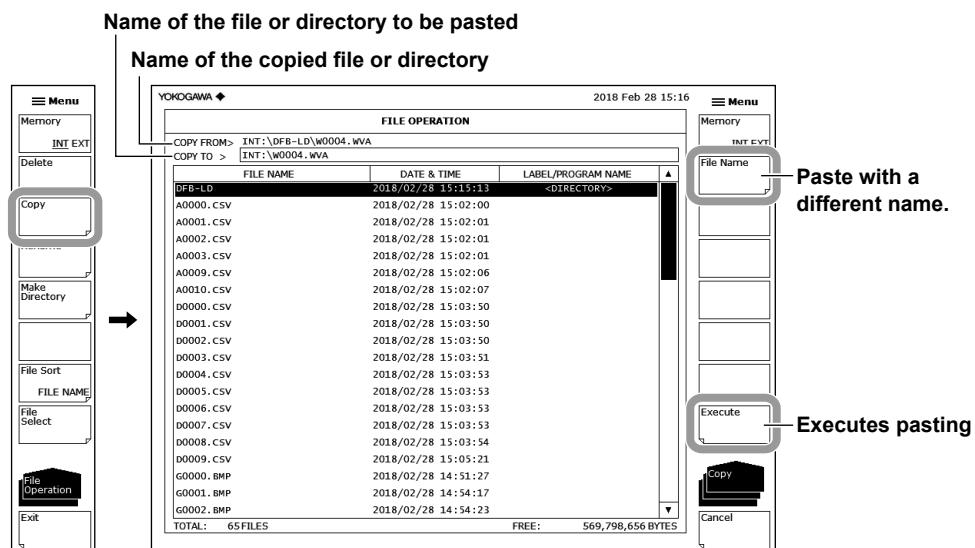
For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.

14. Tap **Done**. The file name is confirmed, and the keyboard disappears.

15. Tap **Execute**. The file or directory is pasted with the specified name. Tap **Cancel** if you do not want to change the file name or directory name.

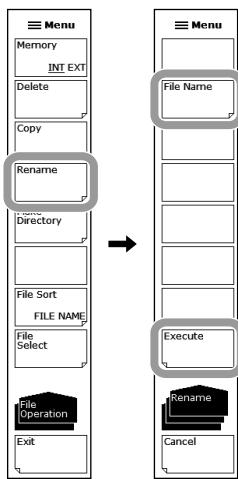
#### Note

- When pasting in the same directory as the copy source, change the name before pasting.
- While pasting is in progress, you cannot cancel the operation.



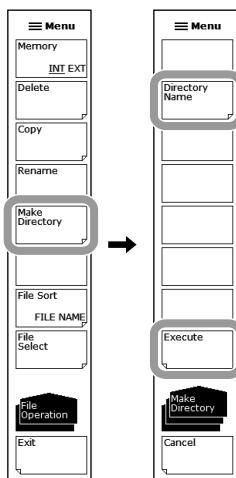
## Renaming a File or Directory

5. Select the file or directory you want to rename by following step 4.
6. Tap **Rename**.
7. Tap **File Name**. A keyboard appears.
8. Use the keyboard to input the new file name.  
For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.
9. Tap **Done**. The file name or directory name is confirmed, and the screen returns to the previous level.
10. Tap **Execute**. The file or directory is renamed. Tap **Cancel** if you do not want to change the file name or directory name.



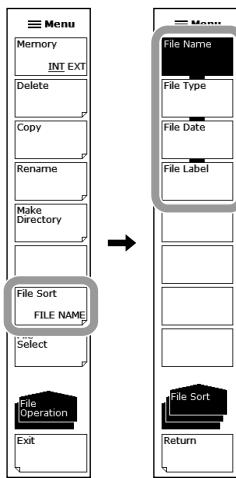
## Making a Directory

5. Display the file list of the directory you want to make a directory in by following steps 3 and 4.
6. Tap **Make Directory**.
7. Tap **Directory Name**. A keyboard appears.
8. Use the keyboard to input the new file name.  
For instructions on how to enter text, see section 3.3, “Entering Numerical Values and Strings,” in IM AQ6360-02EN.
9. Tap **Done**. The directory name is confirmed, and the screen returns to the previous level.
10. Tap **Execute**. A new directory is created. Tap **Cancel** if you do not want to create the directory.



## Sorting Files

5. Display the file list by following steps 3 and 4.
6. Tap **File Sort**. A menu appears for selecting the item to sort by.
7. Tap the item you want to sort by. The files are sorted in ascending order by the selected item.



**Explanation****File Names and Directory Names**

For file and directory names, use characters that are allowed by MS-DOS. The maximum number of characters that you can use for a file name is 56 (including the extension).

The characters that you can use are shown below.

!#\$%&'()-  
0123456789@  
ABCDEFGHIJKLMNOPQRSTUVWXYZ^  
abcdefghijklmnopqrstuvwxyz{}^-

**Sorting Files**

You can sort the file list in ascending order by file name, file type, date, or label.

## 7.1 Screen Display

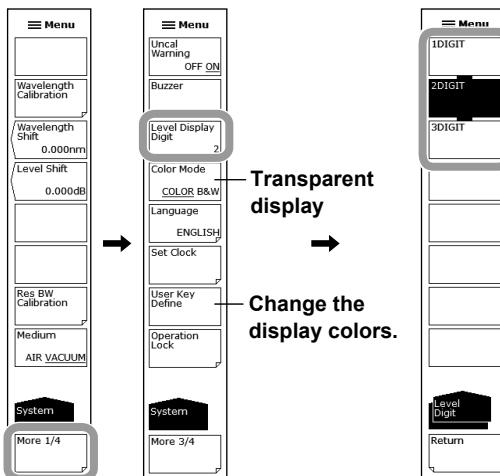
### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 3/4 function menu.

#### Setting the Number of Decimal Places to Display for Level Data

4. Tap **Level Display Digit**. A menu appears for setting the number of decimal places.
5. Tap the number of decimal places you want to use.

1DIGIT The number of decimal places displayed for level data is set to 1.  
2DIGIT The number of decimal places displayed for level data is set to 2.  
3DIGIT The number of decimal places displayed for level data is set to 3.



#### Enabling the Transparent Display

4. Tap **More** to display the More 4/4 function menu.
5. Tap **Window Transparent OFF ON**. Each time you tap, the value switches between ON and OFF. When set to ON, the parameter input window and overview display window are displayed transparently.

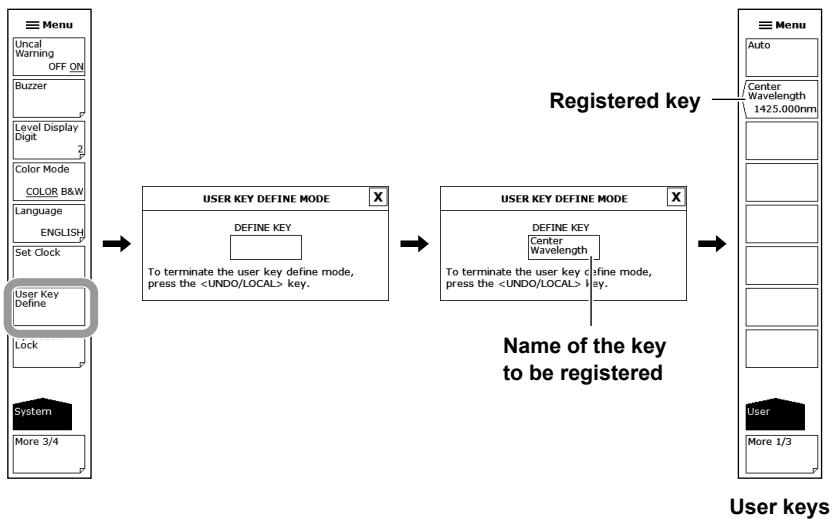
#### Changing the Display Colors

4. Continuing from step 3, tap **Color Mode**. Each time you tap, the value switches between COLOR and B&W (black and white).

## 7.2 Registering User Keys

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**. A function menu for the system appears.
3. Tap **More** to display the More 3/4 function menu.
4. Tap **User Key Define**. A registration screen (USER KEY DEFINE MODE) appears.
5. Display the Main Menu window, and tap the function containing the key you want to register.  
If necessary, tap **More** to change the function menu pages.
6. Tap the key you want to register. The name of the key appears in the key registration display area of the registration screen.
7. Display the Main Menu window, and tap **USER**. User keys appear.  
If necessary, tap **More** to change the user key pages.
8. Tap a user key.  
The key selected in step 5 will be registered. At the same time, the key registration display area is cleared. If you tap a key that is already registered, it will be overwritten.
9. To clear a registered key, tap the key with the key registration display area in a blank state.
10. To close the registration screen (USER KEY DEFINE MODE), tap **[X]** or **UNDO/LOCAL** in the Main Menu window.



### **Note**

- As a general rule, only the first level function menus can be registered. (Lower level function menus cannot be registered.) Keys that cannot be registered do not appear in the key registration display area.
- Registered user keys execute actions like other normal keys on the function menus.

### **Explanation**

Up to 24 function menu keys can be registered as user keys.

To display the user keys, display the Main Menu window, and tap **USER**.

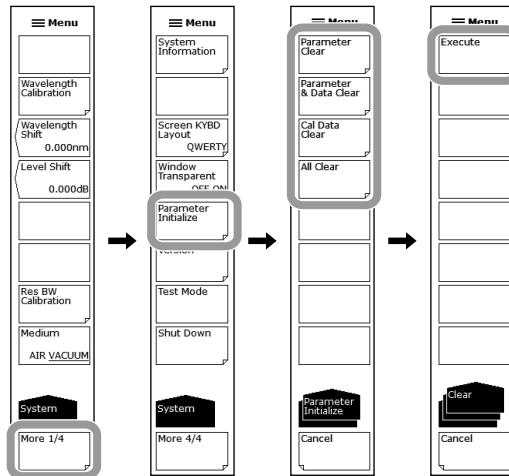
By registering frequently used keys as user keys, you can access them simply by tapping **USER**.

## 7.3 Data Initialization

### Procedure

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**. A function menu for the system appears.
3. Tap **More** to display the More 4/4 function menu.
4. Tap **Parameter Initialize**. An initialization item setting menu appears.
5. Select the initialization type according to the items you want to initialize.
6. Tap **Execute**. Initialization is executed.

To cancel, tap **Cancel**.



### Explanation

You can restore all settings to their factory defaults.

The following four types of initialization are available depending on the items to be initialized.

- **Parameter Clear**

The parameter setting value of each function is initialized.

The waveform data of traces A to G is also initialized.

Use this to initialize the instrument to the default condition.

- **Parameter & Data Clear**

Parameter values and program data are initialized.

- **Cal Data Clear**

Wavelength calibration value and resolution calibration value are initialized.

- **All Clear**

All parameter values, data, and wavelength calibration value are initialized.

The default values for each setting are shown below.

### SWEEP

Function	Default Value	Maximum Value	Minimum Value
Sweep Marker L1-L2 OFF/ON	OFF	-	-
Sweep Interval ****s	MINIMUM=0	99999	MINIMUM=0

### CENTER

Function	Default Value	Maximum Value	Minimum Value
Center Wavelength ****.***nm	1425.000	1650.000	1200.000
Center Frequency ***.****THz	215.7597	250.0000	181.5000
Start Wavelength ****.***nm	1200.000	1650.000	975.000
Start Frequency ***.****THz	181.6924	250.0000	147.2500
Stop Wavelength ****.***nm	1650.000	1875.000	1200.000
Stop Frequency ***.****THz	249.8270	284.2500	181.5000
Auto Center OFF/ON	OFF	-	-

### SPAN

Function	Default Value	Maximum Value	Minimum Value
Span Wavelength ****.nm	450.0	450.0	0 / 0.1
Span Frequency ***.**THz	68.13	68.50	0/0.01
Start Wavelength ****.***nm	1200.000	1650.000	975.000
Start Frequency ***.****THz	181.6924	250.0000	147.2500
Stop Wavelength ****.***nm	1650.000	1875.000	1200.000
Stop Frequency ***.****THz	249.8270	284.2500	181.5000
0nm Sweep Time**s	MINIMUM	50	MINIMUM

### LEVEL

Function	Default Value	Maximum Value	Minimum Value
Reference Level	Log	-10.0	30.0
	Linear	100 $\mu$ W	1000mW
Log Scale **.*dB/D	10.0 , ON	10.0	0.1
Linear Scale	OFF	-	-
Linear Base Level **.*mW	0.0	REF×0.9	0.0
Auto Ref Level OFF/ON	OFF	-	-
Level Unit dBm / dBm/nm / dBm/THz	dBm	-	-
Sub Log **.*dB/D	5.0 , ON	10.0	0.1
Sub Linear *.**/D	0.125 , OFF	1.250	0.005
Sub Scale **.*dB/km	5.0 , OFF	10.0	0.1
Sub Scale **.*%/D	10.0 , OFF	125.0	0.5
Offset Level **.*dB	0.0	99.9	-99.9
Scale Minimum *.*	0.00	1.25	0.00
Offset Level **.*dB/km	0.0	99.9	-99.9
Scale Minimum **.*%	0.0	100.0	0.0
Length **.*km	1.000	99.999	0.001
Auto Sub Scale OFF/ON	OFF	-	-
Y Scale Division **	10	10	8
Ref Level Position **DIV	8	10	0
Sub Ref level Position **DIV	5	10	0

### 7.3 Data Initialization

#### SETUP

Function	Default Value	Maximum Value	Minimum Value
Resolution *.*nm	1	2	0.1
Sensitivity	NORM/HOLD	OFF	-
	NORM/AUTO	ON	-
	NORMAL	OFF	-
	MID	OFF	-
	HIGH1	OFF	-
	HIGH2	OFF	-
Average Times ***	1	999	1
Sampling Points AUTO	ON	-	-
Sampling Points ****	<SAMPLING POINT AUTO> calculated value, OFF	50001	101
Sampling Interval *.****nm	<SAMPLING POINT AUTO> calculated value, OFF	SPAN/100	0.001
Sweep Speed 1x/2x	1x	-	-
Horizontal Scale nm/THz	nm	-	-
Smoothing OFF/ON	OFF	-	-
Fiber Connector NORM/ANGLED	NORM	-	-

#### ZOOM

Function	Default Value	Maximum Value	Minimum Value
Zoom Center Wavelength ****.***nm	Measurement center wavelength of the last measurement or loaded trace	1650.000	1200.000
Zoom Center Frequency ***.****THz	Measurement center frequency of the last measurement or loaded trace	250.0000	181.5000
Zoom Span Wavelength ****.*nm	Measurement span of the last measurement or loaded trace	450.0	0.1
Zoom Span Frequency ***.****THz	Measurement span of the last measurement or loaded trace	68.50	0.01
Zoom Start Wavelength ****.***nm	Measurement start wavelength of the last measurement or loaded trace	1649.950	975.000
Zoom Start Frequency ***.****THz	Measurement start frequency of the last measurement or loaded trace	249.9950	147.2500
Zoom Stop Wavelength ****.***nm	Measurement stop wavelength of the last measurement or loaded trace	1875.000	1200.050
Zoom Stop Frequency ***.****THz	Measurement stop frequency of the last measurement or loaded trace	284.2500	181.5050
Overview Display OFF/L/R	R	-	-
Overview Size LARGE/SMALL	LARGE	-	-

**DISPLAY**

Function		Default Value	Maximum Value	Minimum Value
Normal Display		ON	-	-
Split Display		OFF	-	-
Split Display	Trace A UP/LOW	UP	-	-
	Trace B UP/LOW	UP	-	-
	Trace C UP/LOW	LOW	-	-
	Trace D UP/LOW	UP	-	-
	Trace E UP/LOW	UP	-	-
	Trace F UP/LOW	LOW	-	-
	Trace G UP/LOW	LOW	-	-
	Hold	Upper Hold OFF/ON	OFF	-
		Lower Hold OFF/ON	OFF	-
Label		// AQ6360 OPTICAL SPCTRUM ANALYZER //		
Noise Mask ***dB		OFF	0	OFF(-999)
Mask Line VERT / HRZN		HRZN	-	-

**TRACE**

Function		Default Value	Maximum Value	Minimum Value
Active Trace A/B/C/D/E/F/G		A	-	-
View @ DISP/BLANK		Trace A=DISP, Trace B/C/D/E/F/G =BLANK	-	-
Fix @		Trace B/C/D/E/F/G	-	-
Hold @	Max Hold	No Trace, Trace A, C, E, G	-	-
	Min Hold	No Trace, Trace B, D, F	-	-
Roll Average *		No Trace, 2	100	2
Calculate C @@@@	Log Math @@@@	C=A-B(LOG), ON	-	-
	Linear Math @@@@	C=A+B(LIN), OFF	-	-
Calculate F @@@@	LOG MATH @@@@	F=C-D(LOG), ON	-	-
	Linear Math @@@@	F=C+D(LIN), OFF	-	-
	Power/NBW @@@@	F=Pwr/NBW A, OFF	-	-
	Log Math @@@@	G=C-F(LOG), ON	-	-
Calculate G	Linear Math @@@@	G=C+F(LIN), OFF	-	-
	Normalize @@@@	G=NORM A, OFF	-	-
	Curve Fit @@@@	G=CRVFIT A, OFF	-	-
		Threshold **dB	20	99
		Operation Area ALL / INSIDE L1-L2 / OUTSIDE L1-L2	ALL	-
		Fitting Algorithm	GAUSS	-
	Peak Curve Fit @@@@	G=PKCVFIT A, OFF	-	-
		Threshold **dB	2020	9999
		Operation Area ALL / INSIDE L1-L2 / OUTSIDE L1-L2	ALL	-
		Fitting Algorithm	GAUSS	-
Trace Copy	Source Trace @	A	-	-
	Destination Trace @	B	-	-

### 7.3 Data Initialization

#### MARKER

Function		Default Value	Maximum Value	Minimum Value
Marker Active OFF/ON		OFF	-	-
Set Marker	Set	1	1024	1
Line Marker 1 OFF/ON		OFF	WL=1650.000 FREQ=249.82705	WL=1200.000 FREQ=181.69240
Line Marker 2 OFF/ON		OFF	WL=1650.000 FREQ=249.82705	WL=1200.000 FREQ=181.69240
Line Marker 3 OFF/ON		OFF	LOG=30.0 LINEAR=1000mW	LOG=-90.0 LINEAR=1.00pW
Line Marker 4 OFF/ON		OFF	LOG=30.0 LINEAR=1000mW	LOG=-90.0 LINEAR=1.00pW
Marker Display OFFSET/SPACING		Offset	-	-
Marker Auto Update OFF/ON		OFF	-	-
Marker Unit nm/THz		nm	-	-
Search / Ana Marker L1-L2 OFF/ON		OFF	-	-
Search / Ana Zoom Area OFF/ON		ON	-	-
Sweep Marker L1-L2 OFF/ON		OFF	-	-
Advanced Marker	Adv. Marker Active ON/OFF	OFF	-	-
	Marker 1 Select	OFF	-	-
	Marker 2 Select	OFF	-	-
	Marker 3 Select	OFF	-	-
	Marker 4 Select	OFF	-	-
	Bandwidth	0.1nm		

#### PEAK SEARCH

Function		Default Value	Maximum Value	Minimum Value
Peak Search		ON	-	-
Bottom Search		OFF	-	-
Set Marker	Set	1	1024	1
Auto Search OFF/ON		OFF	-	-
Mode Diff **.**dB		3.00	50.00	0.01
Search / Ana Marker L1-L2 OFF/ON		OFF	-	-
Search / Ana Zoom Area OFF/ON		ON	-	-
Search Mode SINGL/MULTI		SINGL	-	-
Multi Search Setting	Threshold **.**dB	50.00	99.99	0.01
	Sort by WL/LVL	WL	-	-

#### ANALYSIS

Function		Default Value	Maximum Value	Minimum Value
Spec Width @@@@	THRESH	THRESH LEVEL *.*dB	3.00	50.00
		K	1.00	10.00
		MODE FIT OFF/ON	OFF	-
	ENVELOPE	THRESH LEVEL1 *.*dB	3.00	50.00
		THRESH LEVEL2 *.*dB	13.00	50.00
		K	1.00	10.00
	RMS	THRESH LEVEL *.*dB	20.00	50.00
		K	2.00	10.00
	PEAK RMS	THRESH LEVEL *.*dB	20.00	50.00
		K	2.00	10.00
	NOTCH	THRESH LEVEL *.*dB	3.00	50.00
		K	1.00	10.00
		TYPE PAEK/BOTTOM	BOTTOM	-

Analysis 1 @@@@ @@@@ @@@@ @

Function		Default Value	Maximum Value	Minimum Value
DFB-LD	ALGO ENVELOPE/THRESH/RMS/PK-RMS	THRESH	-	-
	THRESH **.**dB	20.00	50.00	0.01
	THRESH2 **.**dB	20.00	50.00	0.01
	K	1.00	10.00	1.00
	MODE FIT OFF/ON	OFF	-	-
	MODE DIFF *.*dB	3.00	50.00	0.01
	SMSR MODE SMSR1/SMSR2/SMSR3/SMSR4	SMSR1	-	-
	SMSR MASK **.**nm	0.00	99.99	0.00
	MODE DIFF **.**dB	3.00	50.00	0.01
	ALGO RMS/PK-RMS	RMS	-	-
OSNR	THRESH	20.00	50.00	0.01
	K	2.00	10.00	0.01
	MODE DIFF	3.00	50.00	0.01
	SPAN	0.40	10.00	0.01
	MODE DIFF	3.0	50.00	0.01
	NOISE ALGO	PIT	-	-
	NOISE AREA	AUTO	10.00	0.01
	MASK AREA	-	10.00	0.01
	FITTING ALGO	LINEAR	-	-
	NOISE BW	0.10	1.00	0.01
FP-LD	SIGNAL POWER	PEAK	-	-
	INTEGRAL RANGE	10.0	999.9	1.0
	ALGO ENVELOPE/THRESH/RMS/PK-RMS	PK-RMS	-	-
	THRESH **.**dB	20.00	50.00	0.01
	THRESH2 **.**dB	20.00	50.00	0.01
	K	2.00	10.00	1.00
	MODE FIT OFF/ON	OFF	-	-
	MODE DIFF *.*dB	3.00	50.00	0.01
	ALGO ENVELOPE/THRESH/RMS/PK-RMS	PK-RMS	-	-
	THRESH **.**dB	20.00	50.00	0.01
TOTAL POWER	THRESH2 **.**dB	20.00	50.00	0.01
	K	2.00	10.00	1.00
	MODE FIT OFF/ON	OFF	-	-
	MODE DIFF *.*dB	3.00	50.00	0.01
	OFFSET LEVEL *.*dB	0.00	10.00	-10.00
	ALGO ENVELOPE/THRESH/RMS/PK-RMS	PK-RMS	-	-
	THRESH **.**dB	20.00	50.00	0.01
	THRESH2 **.**dB	20.00	50.00	0.01
	K	2.00	10.00	1.00
	MODE FIT OFF/ON	OFF	-	-
	MODE DIFF *.*dB	3.00	50.00	0.01

### 7.3 Data Initialization

		Function	Default Value	Maximum Value	Minimum Value
Analysis 1 @@@@	LED	ALGO ENVELOPE/THRESH/RMS/PK-RMS	THRESH	-	-
		THRESH **.**dB	3.00	50.00	0.01
		THRESH2 **.**dB	20.00	50.00	0.01
		K	1.00	10.00	1.00
		MODE FIT OFF/ON	OFF	-	-
		MODE DIFF *.*dB	3.00	50.00	0.01
		ALGO ENVELOPE/THRESH/RMS/PK-RMS	RMS	-	-
		THRESH **.**dB	20.00	50.00	0.01
		THRESH2 **.**dB	20.00	50.00	0.01
		K	2.00	10.00	1.00
Analysis 2 @@@@	WDM	MODE FIT OFF/ON	OFF	-	-
		MODE DIFF *.*dB	3.00	50.00	0.01
		OFFSET LEVEL *.*dB	0.00	10.00	-10.00
		SMSR MODE SMSR1/SMSR2/SMSR3/SMSR4	SMSR1	-	-
		SMSR MASK *.*nm	0.00	99.99	0.00
		POWER	OFFSET LEVEL *.*dB	0.00	10.00
		PMD	THRESH LEVEL *.*dB	3.00	50.00
		THRESH LEVEL *.*dB	3.00	50.00	0.01
		MODE DIFF *.*dB	3.00	50.00	0.01
		DISPLAY MASK OFF/*.*dB	OFF	0.00	-100.00
Analysis 3 @@@@	INTERPOLATION SETTING	NOISE ALGO AUTO-FIX/MANUAL-FIX/ AUTO-CTR/MANUAL-CTR	AUTO-FIX	-	-
		NOISE AREA *.*nm	0.40	10.00	0.01
		MASK AREA *.*nm	0.20	10.00	0.01
		FITTING ALGO LINEAR/GAUSS/LORENZ/ 3RD POLY/4TH POLY/5TH POLY	LINEAR	-	-
		NOISE BW *.*nm	0.10	1.00	0.01
		DUAL TRACE OFF/ON	OFF	-	-
		DISPLAY TYPE ABSOLUTE/RELATIVE/ DRIFT(MEAS)/DRIFT(GRID)	ABSOLUTE	-	-
		CH RELATION OFFSET/SPACING	OFFSET	-	-
		REF CH HIGHEST/**CH	HIGHEST	1024	1
		OUTPUT SLOPE OFF/ON	OFF	-	-
Analysis 4 @@@@	DISPLAY SETTING	POINT DISPLAY OFF/ON	ON	-	-
		SIGNAL POWER PEAK/INTEGRAL	PEAK	-	-
		INTEGRAL RANGE	10.0	999.9	1.0
		OTHER SETTING			

Analysis 2 @@@@ @

Function		Default Value	Maximum Value	Minimum Value
EDFA-NF	THRESH LEVEL *.*dB	3.00	50.00	0.01
	MODE DIFF *.*dB	3.00	50.00	0.01
	OFFSET(IN) *.*dB	0.00	99.99	-99.99
	OFFSET(OUT) *.*dB	0.00	99.99	-99.99
	ASE ALGO LINEAR/GAUSS/LORENZ/ 3RD POLY/4TH POLY/5TH POLY	LINEAR	-	-
	FITTING AREA *.*nm	0.40	10.00	0.01
	MASK AREA *.*nm	0.20	10.00	0.01
	FITTING ALGO LINEAR/GAUSS/LORENZ/ 3RD POLY/4TH POLY/5TH POLY	LINEAR	-	-
	POINT DISPLAY OFF/ON	ON	-	-
	RES BW MEASURED/CAL DATA	CAL DATA	-	-
FILTER-PK	SHOT NOISE OFF/ON	ON	-	-
	SIGNAL POWER	PEAK	-	-
	INTEGRAL RANGE	10.0	999.9	1.0
	SW OFF/ON	ON	-	-
	SW OFF/ON	ON	-	-
	SW OFF/ON	ON	-	-
	ALGO THRESH/RMS	THRESH	-	-
	THRESH LEVEL *.*dB	3.00	50.00	0.01
	K	1.00	10.00	1.00
	MODE FIT OFF/ON	OFF	-	-
CROSS TALK	MODE DIFF *.*dB	3.00	50.00	0.01
	SW OFF/ON	ON	-	-
	ALGO THRESH/RMS	THRESH	-	-
	THRESH LEVEL *.*dB	3.00	50.00	0.01
	K	1.00	10.00	1.00
	MODE FIT OFF/ON	OFF	-	-
	MODE DIFF *.*dB	3.00	50.00	0.01
	SW OFF/ON	ON	-	-
	THRESH LEVEL *.*dB	3.00	50.00	0.01
	MODE DIFF *.*dB	0.500	50.000	0.001
	SW OFF/ON	ON	-	-
	ALGO THRESH/PK LEVEL/GRID	THRESH	-	-
	THRESH LEVEL *.*dB	3.00	50.00	0.01
	K	1.00	10.00	1.00
	MODE FIT OFF/ON	OFF	-	-
	MODE DIFF *.*dB	3.00	50.00	0.01
	CH SPACE ±.*nm	0.40	50.00	0.00
	SEARCH AREA ±.*nm	0.01	10.00	0.01

### 7.3 Data Initialization

Function		Default Value	Maximum Value	Minimum Value
Analysis 2 @@@@	FILTER-BTM	SW OFF/ON	ON	-
		SW OFF/ON	ON	-
		SW OFF/ON	ON	-
		ALGO PEAK/BOTTOM	BOTTOM	-
		THRESH LEVEL * **dB	3.00	50.00
		MODE DIFF * **dB	3.00	50.00
		SW OFF/ON	ON	-
		ALGO PEAK/BOTTOM	BOTTOM	-
		THRESH LEVEL * **dB	3.00	50.00
		MODE DIFF * **dB	3.00	50.00
	CROSS TALK	SW OFF/ON	ON	-
		ALGO PEAK/BOTTOM/BOTTOM LVL/GRID	BOTTOM	-
		THRESH LEVEL * **dB	20.00	50.00
		MODE DIFF * **dB	3.00	50.00
		CH SPACE ±* **nm	0.40	50.00
		SEARCH AREA ±* **nm	0.01	10.00
		ALGO PEAK/MEAN/GRID FIT/GRID	MEAN	-
		THRESH LEVEL * .*dB	3.0	50.0
WDM FIL-PK	CHANNEL DETECTION/NOMINAL WAVELENGTH	MODE DIFF * .*dB	3.0	50.0
		TEST BAND * .***nm	0.100	9.999
		SW OFF/ON	ON	-
		SW OFF/ON	ON	-
		SW OFF/ON	ON	-
		THRESH LEVEL * ***dB	-10.000	30.000
		TEST BAND * .**nm	0.20	99.99
		SW OFF/ON	ON	-
		TEST BAND * .**nm	0.20	99.99
	CROSS TALK	SW OFF/ON	ON	-
		SPACING * **nm	0.80	99.99
		TEST BAND * .**nm	0.20	99.99

Function		Default Value	Maximum Value	Minimum Value	
Analysis 2 @@@@ @	WDM FIL-BTM	ALGO BOTTOM/NOTCH(P)/NOTCH(B)/ GRID FIT/GIRD	NOTCH(B)	-	
		THRESH LEVEL *.*dB	20.0	50.0	
		MODE DIFF *.*dB	20.0	50.0	
		TEST BAND *.*nm	0.100	9.999	
		SW OFF/ON	ON	-	
		SW OFF/ON	ON	-	
		ALGORITHM NOTCH(P)/NOTCH(B)	NOTCH(B)	-	
		THRESH LEVEL *.*dB	3.0	50.0	
		SW OFF/ON	ON	-	
		THRESH LEVEL *.*nm	-10.000	30.000	
Switch Display	XBB ELIMINATION XBB STOP XBB BAND	SW OFF/ON	ON	-	
		THRESH LEVEL *.*dB	3.0	50.0	
		TEST BAND *.*nm	0.20	99.99	
	RIPPLE	SW OFF/ON	ON	-	
		TEST BAND *.*nm	0.20	99.99	
	CROSS TALK	SW OFF/ON	ON	-	
		SPACING *.*nm	0.80	99.99	
		TEST BAND *.*nm	0.20	99.99	
Spec Width Thresh *.*dB		3.00	50.00	0.01	
Trace & Table/Table/Trace/Graph & Table/Graph	Trace & Table	-	-		
Graph & Table/ Graph	Line Marker Y1 OFF/ON	OFF	-		
	Line Marker Y2 OFF/ON	OFF	-		
	Auto Analysis OFF/ON		OFF	-	-
	Search / Ana Marker L1-L2 OFF/ON		OFF	-	-
	Search / Ana Zoom Area OFF/ON		ON	-	-

### 7.3 Data Initialization

Function		Default Value	Maximum Value	Minimum Value
Grid Editor	200GHz Spacing	ON	-	-
	100GHz Spacing	OFF	-	-
	50GHz Spacing	OFF	-	-
	25GHz Spacing	OFF	-	-
	12.5GHz Spacing	OFF	-	-
	Start Wavelength ****.****nm	1528.7734	1650.0000	1200.0000
	Start Wavelength ****.****THz	192.1000	249.8270	181.6924
	Stop Wavelength ****.****nm	1560.6062	1650.0000	1200.0000
	Stop Wavelength ****.****THz	196.1000	249.8270	181.6924
	Spacing ***.*GHz	50.00	999.90	0.10
Reference Wavelength ****.****nm		1552.5244	1650.0000	1200.0000
Reference Wavelength ****.****THz		193.1000	249.8270	181.6924

### FILE

Function		Default Value	Maximum Value	Minimum Value
Write	Memory INT/EXT	INT	-	-
	Trace @ → File	A	-	-
	File Type BIN/CSV	BIN	-	-
	Graphics	Mode Black & White/Color/Preset Color	Color	-
		File Type BMP/TIFF	BMP	-
	Data	Date & Time OFF/ON	ON	-
		Label OFF/ON	ON	-
		Data Area OFF/ON	ON	-
		Condition OFF/ON	ON	-
		Trace Data OFF/ON	OFF	-
		Output Window OFF/ON	OFF	-
	Write Mode OVER/ADD		OVER	
Program	Cursor UP/DOWN		DOWN	-
File Sort @@@@		File Name	-	-
Read	Memory INT/EXT	INT	-	-
	Trace @ → File	A	-	-
	View LIST/THMB	LIST	-	-
	Program	Cursor UP/DOWN	DOWN	-
	File Sort @@@@@@@@		File Name	-
Item Select @@@@		Trace	-	-
Auto File Name NUM/DATE		NUM	-	-
File Operation	Memory INT/EXT		INT	-
	Copy	Memory INT/EXT	INT	-
	File Sort @@@@@@@@		File Name	-

**PROGRAM**

Function	Default Value	Maximum Value	Minimum Value
Execute 1 **	01 (program number)	-	-
Execute 2 **	02 (program number)	-	-
Execute 3 **	03 (program number)	-	-
Execute 4 **	04 (program number)	-	-
Execute 5 **	05 (program number)	-	-
Execute 6 **	06 (program number)	-	-
Execute 7 **	07 (program number)	-	-
Execute 8 **	08 (program number)	-	-
Execute 9 **	09 (program number)	-	-
Execute 10 **	10 (program number)	-	-
Execute 11 **	11 (program number)	-	-
Execute 12 **	12 (program number)	-	-
Execute 13 **	13 (program number)	-	-
Execute 14 **	14 (program number)	-	-
Execute 15 **	15 (program number)	-	-
Execute 16 **	16 (program number)	-	-
Execute 17 **	17 (program number)	-	-
Execute 18 **	18 (program number)	-	-
Execute 19 **	19 (program number)	-	-
Execute 20 **	20 (program number)	-	-
Execute 21 **	21 (program number)	-	-

### 7.3 Data Initialization

## SYSTEM

Function		Default Value	Maximum Value	Minimum Value
Wavelength Calibration	Built-in Source	OFF <sup>1</sup>	-	-
	External Laser ****.***nm	1523.488, ON <sup>1</sup>	1650.000	1200.000
	External Gas Cell ****.***nm	1530.372, OFF	1650.000	1200.000
	Emission Line ****.***nm	1473.684, OFF	1650.000	1200.000
Wavelength Shift **.***nm		0.000	5.000	-5.000
Level Shift ***.***dB		0.000	60.000	-60.000
Remote Interface @@@@		GP-IB	-	-
GP-IB Setting	My Address **	1	-	-
	Command Format @@@@	AQ6360	-	-
Network Setting	TCP/IP Setting		AUTO (DHCP)	-
	Remote Port No.		10001	65535
	Command Format @@@@		AQ6360	-
	Remote Monitor	Monitor Port OFF/ON	ON	-
		Port No.	20001 (FIX)	-
	Folder Sharing DISABLE/READ ONLY		DISABLE	
Firewall OFF/ON		ON		
Auto Offset Setting	Auto Offset OFF/ON		ON	-
	Interval *** min		10	999
Uncal Warning OFF/ON		ON	-	-
Buzzer	Click OFF/ON		ON	-
	Warning OFF/ON		ON	-
Level Display Digit *		2	3	1
Window Transparent OFF/ON		ON	-	-
Set Clock	YR-MO-DY		ON	-
	MO-DY-YR		OFF	-
	DY-MO-YR		OFF	-
Color Mode @@@@		COLOR	-	-
Screen KYBD Layout QWERTY/QWERTZ		QWERTY	-	-
Medium AIR/VACUUM		VAC	-	-

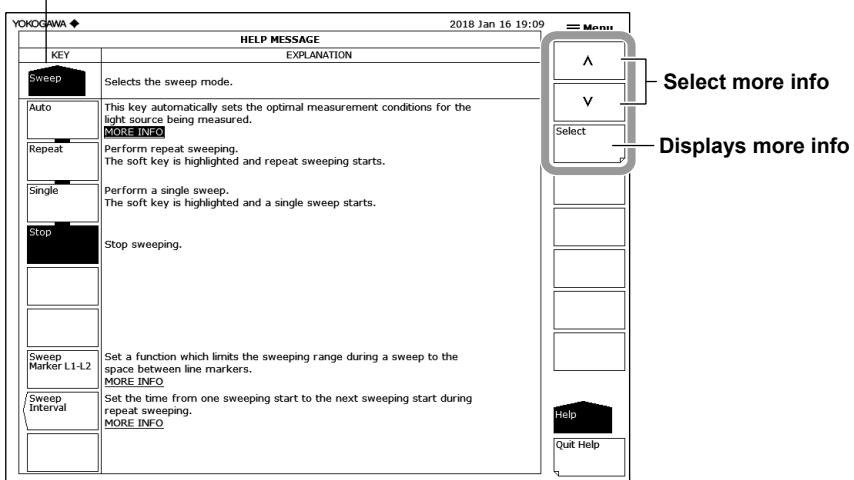
\*1 For the /LFC and /LSC options, the default value of Built-in Source is ON.

## 7.4 Help

### Procedure

1. Display the function menu that you want to display the help for.
2. Tap **☰ Menu**. The Main Menu window appears.
3. Tap **HELP**. An explanation appears for the displayed function menu.
4. If **MORE INFO** is displayed in the explanation, a further detailed explanation is available. Tap **MORE INFO**, or select **MORE INFO** with the arrow keys and then tap **Select**.
5. To finish, tap **Quit Help**.

Menu that appears when **HELP** is tapped



## 7.5 Registering and Recalling Character Strings

On the character input screen of this instrument, you can register character strings input to the keyboard shown on the screen and recall them for use.

### Procedure

#### Registering a Character String

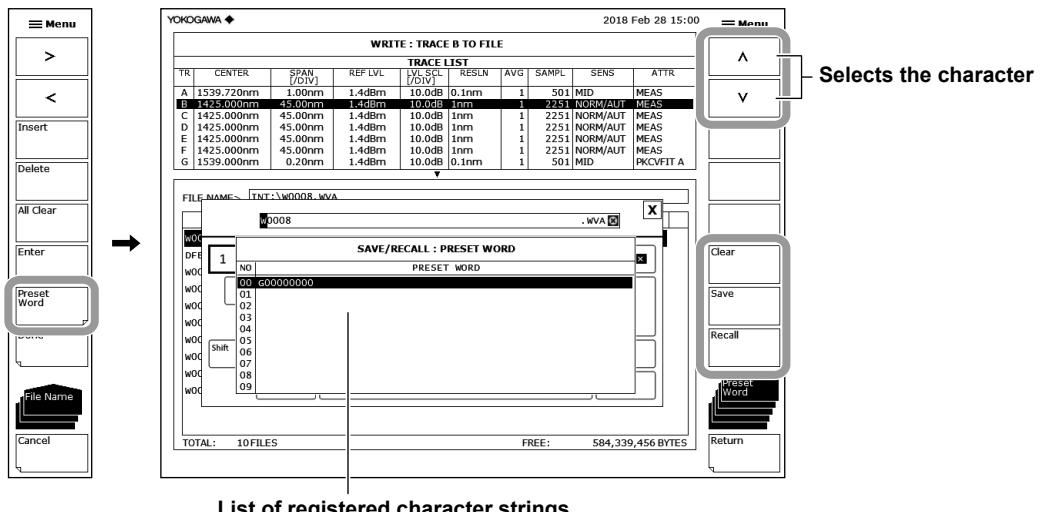
1. Display the character input screen, and enter the character string that you want to register with the keyboard.
2. Tap **Preset Word** on the function menu. A preset word list appears.
3. Tap a line in the preset word list to move the cursor to the number you want to register at. You can also move the cursor by tapping the arrow keys.
4. Tap **Save**. The character string is registered at the specified number.
5. To close the preset word list, tap **Return**.

#### Recalling a Character String

1. Using the keyboard, move the cursor to the position where you want to enter a character string.
2. Tap **Preset Word** on the function menu. A preset word list appears.
3. Tap a line in the preset word list to move the cursor to the character string you want to recall. You can also move the cursor by tapping the arrow keys.
4. Tap **Recall**. The character string will be recalled at the specified position.
5. To close the preset word list, tap **Return**.

#### Deleting a Character String

1. Display the character input screen, and tap **Preset Word** on the function menu. A preset word list appears.
2. Tap a line in the preset word list to move the cursor to the character string you want to delete. You can also move the cursor by tapping the arrow keys.
3. Tap **Clear**. The character string will be deleted.



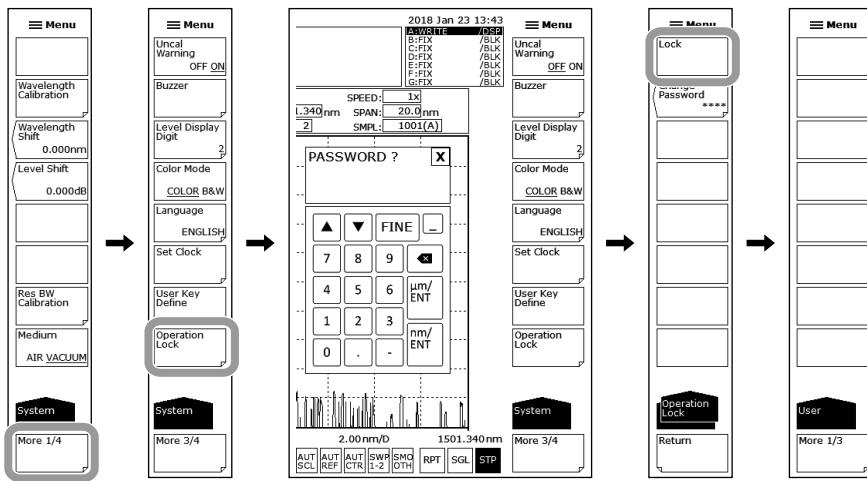
## 7.6 Locking the Keys

This function prevents all operations except for the function menu containing user keys. For details on how to register user keys, see section 7.2, "Registering User Keys."

### Procedure

#### Locking the Keys

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**. A function menu for the system appears.
3. Tap **More** to display the More 3/4 function menu.
4. Tap **Operation Lock**. A parameter input window appears.
5. Enter a password in the parameter input window. The default password is 1234.
6. Tap **Lock**. A message appears stating that the keys have been locked, and the function menu changes to a **USER** menu.



#### Note

- If no user keys are registered, nothing appears on the **USER** function menu. In the screen example, three keys, CENTER WL, ZOOM CENTER WL, and DISPLAY OFF, are registered.
- When the keys are locked, the following operations can be performed in addition to the registered user keys.
  - **USER**, **LOCAL** (release remote mode), **HELP**, and **COPY** in the Main Menu window
  - **POWER** switch
  - If you forget the password, initialize the data (All Clear). For the procedure, see section 7.3, "Data Initialization."
  - The power switch is enabled even while the keys are locked. If you turn off the instrument in the lock mode, it starts in lock mode when the power is turned back on.

### Changing the Password

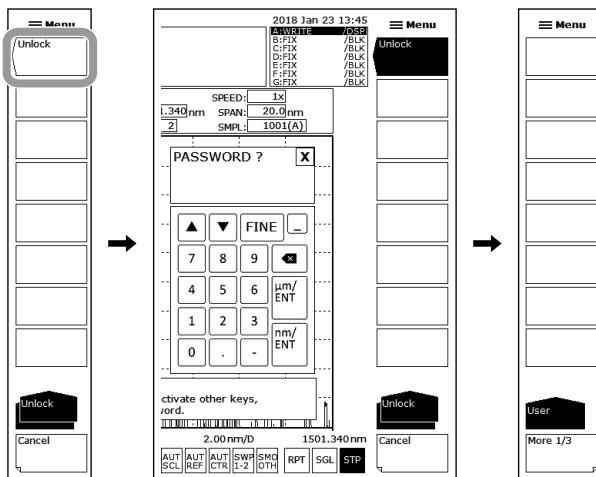
6. Tap **Change Password**. A parameter input window appears.
7. Enter a new 4-digit password in the parameter input window.
8. Enter the password entered in step 7 again in the parameter input window. A password change completion message appears.

### Note

- The characters that can be used for the password are numbers from 0 to 9.
- If you forget the password when the keys are locked, you will not be able to unlock. If you change the password from the default, manage your password carefully.

### Unlocking the Keys

1. Display the Main Menu window, and tap any of the locked keys (other than USER, LOCAL, COPY, or HELP keys or POWER switch).
2. Tap **Unlock**. A parameter input window appears.
3. Enter the password in the parameter input window. A message appears stating that the keys have been unlocked.



### Note

Even when the keys are locked, you can still use the instrument remote commands and program commands as usual. However, if the instrument is in remote mode as a result of receiving REN (Remote Enable) or a listen address with ATN set to True from the controller, the key lock cannot be released. In such a case, Tap LOCAL on the Main Menu window to switch the instrument to remote mode, and then release the key lock. For details on switching between local and remote modes, see section 1.2 in the Remote Control User's Manual (IM AQ6360-17EN).

## 7.7 Other Settings

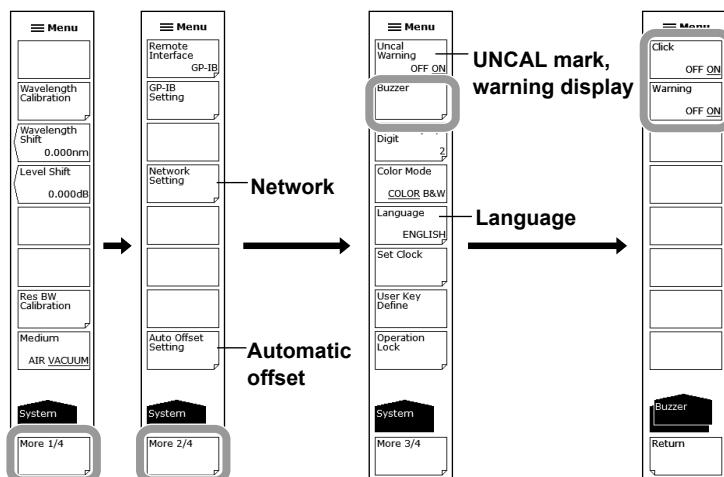
### Procedure

#### Setting the UNCAL mark and Warning Display

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 3/4 function menu.
4. Tap **Uncal Warning**. Each time you tap, the value switches between ON and OFF. When set to ON, the UNCAL mark and warning can be displayed.

#### Setting the Buzzer

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 3/4 function menu.
4. Tap **Buzzer**. A menu appears for turning on and off the click sound and warning sound.
5. Tap **Click** or **Warning**. Each time you tap, the value switches between ON and OFF. When set to ON, the buzzer sound is enabled.



#### Setting the Test Mode

The test mode is used to adjust the instrument at the factory and is not used in ordinary situations.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 4/4 function menu.
4. Tap **Test Mode**. A parameter input window appears.

### Setting the Automatic Offset

You can set whether to perform automatic offset on the amplifier circuit in the instrument.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 2/4 function menu.
4. Tap **Auto Offset Setting**. The automatic offset setup menu appears.
5. Tap **Auto Offset**. Each time you tap, the value switches between ON and OFF. When set to ON, automatic offset is enabled.
6. Tap **Interval** to set the automatic offset execution interval.  
(We recommend the default value of 10min.)

#### Note

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- If the AUTO OFFSET is set to OFF, the offset can vary over time, and the level axis performance can degrade. Normally, have this turned on.
- You can also set the parameter by tapping the  shortcut key at the bottom of the screen. When set to on, the shortcut key is highlighted.

---

### Sharing the Remote Monitor

This function can be used to monitor the instrument's screen and control the instrument from a remote PC that is connected over TCP/IP.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 2/4 function menu.
4. Tap **Network Setting**. An Ethernet setup menu appears.
5. Tap **Remote Monitor**. A remote monitor setup menu appears.
6. Tap **Monitor Port**. Each time you tap, the value switches between ON and OFF. When this is set to ON, the remote monitor is enabled.

### Sharing Directories

The user area directory of the instrument's internal memory can be shared on a PC.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 2/4 function menu.
4. Tap **Network Setting**. An Ethernet setup menu appears.
5. Tap **Folder Sharing**. A directory sharing setup menu appears.
6. Tap **Read Only**. Directory sharing is enabled.  
Tapping **Disable** disables directory sharing.

## Configuring a Firewall

You can close the TCP port when the communication interface (Ethernet), remote monitoring, and directory sharing are not in use.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 2/4 function menu.
4. Tap **Network Setting**. An Ethernet setup menu appears.
5. Tap **Firewall**. Each time you tap, the value switches between ON and OFF. When set to ON, the firewall is enabled.

## Setting the Language

You can set the language for the function menu and messages to English or Chinese.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 3/4 function menu.
4. Tap **Language**. A language setting menu appears.
5. Tap the language you want to use.

## Setting the Keyboard Display

You can set the language for the function menu and messages to English or Chinese.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 4/4 function menu.
4. Tap **Screen KYBD Layout**.
5. Tap **QWERTY**. A QWERTY keyboard display is selected.  
Tap **QWERTZ**. A QWERTZ keyboard display is selected.

## Turning the Display OFF

This function can be used to temporarily turn the display off.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **DISPLAY**.
3. Tap **Display Off**. The display turns OFF.

Tapping the screen or operating the mouse will turn the display on.

## Clearing Measured Data, Analysis Conditions, Parameters, Etc.

The PRESET key clears all internal settings of the instrument except for the remote interface (ETHERNET and GP-IB) settings.

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **RESET**. A message appears for confirmation.
3. Tap **YES**. The measured data and parameter settings are cleared. If you do not want to clear the settings, tap **No**. The function menu will return to the previous level.

### Explanation

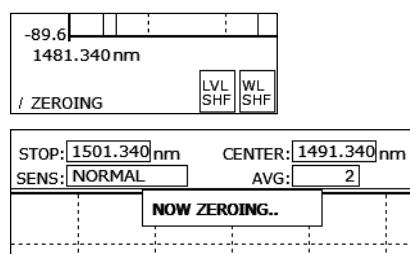
#### Automatic Offset

When Auto Offset is set to ON, the offset of the internal amplifier circuit is adjusted at the specified interval (default value: 10min). (Default value: ON)

When Auto Offset is set to OFF, automatic offset adjustment is not executed. When the setting is changed from OFF to ON, an offset adjustment is executed immediately.

If repeat sweep is in progress, offset adjustment is executed when sweeping reaches 100%. If a single sweep is in progress, offset adjustment is executed when the sweep is completed.

During offset adjustment, a message indicating that the offset is being adjusted is displayed in the lower-left corner and in the top center of the screen.



#### Note

If, during offset adjustment, you use key operations or remote commands to execute a sweep, the sweep will start after the offset adjustment is completed.

### Remote Monitoring

This function can be used to monitor the instrument's screen and control the instrument from a remote PC that is connected to the instrument through a TCP/IP port.

To use this function, you need remote monitoring software (not included). You cannot use the remote monitoring port to perform remote control with normal remote commands.

#### User Name and Password

A user name and password are required to access the instrument using this function.

Use the menu that is displayed when you tap Remote User Account in the Ethernet setup to specify these settings. See the remote control user's manual, IM AQ6360-17EN.

#### Monitor Port

Enables and disables the remote monitor TCP/IP port.

If you set this to OFF, the remote monitor is disabled.

#### Port No.

This is the remote monitor TCP/IP port number. It is fixed to 20001. You cannot use this port to perform remote control with normal remote commands.

#### Disconnect

During remote monitoring, tap this key to disconnect the instrument from the remote PC. This key can only be used when the instrument is connected to a PC.

## Sharing Directories

The user area directory of the instrument's internal memory can be shared on a PC. When the user area directory is shared, files in the directory can be copied to the PC over a network. You cannot save files to the instrument.

## Firewall

This feature closes the TCP port to cut off the communication when features that use the TCP port are set to off.

Feature Name	Operation
Key Name	
Sharing Directories	Disable: Communication is cut off (the TCP port is closed). Read Only: Communication is not cut off (the TCP port is open).
<Folder Sharing>	
Remote monitoring	OFF: Communication is cut off (the TCP port is closed). ON: Communication is not cut off (the TCP port is open).
<Monitor Port ON/OFF>	
Communication interface	GP-IB: Communication is cut off (the TCP port is closed). ETHERNET: Communication is not cut off (the TCP port is open).
<Remote Interface>	

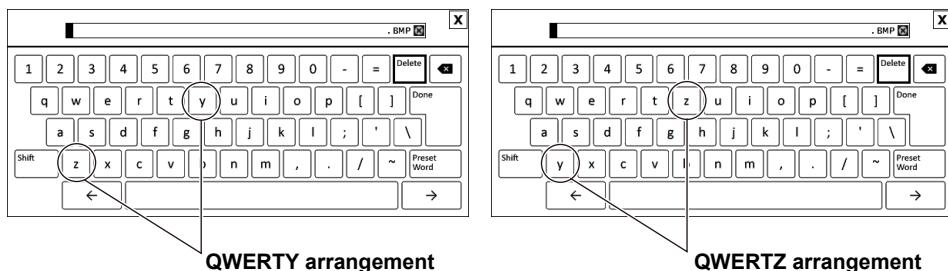
## Language

You can set the language for the following items to English or Chinese.

- Function menus
- Title of parameter input windows
- Warnings and messages
- Help

## Setting the Keyboard Display

You can select a QWERTY keyboard or QWERTZ keyboard. The positions of the Y and Z keys on the keyboard display are switched.



### Turning the Display OFF

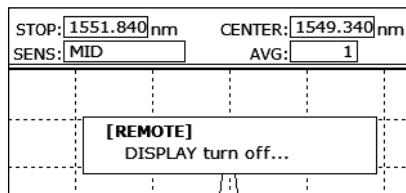
This function can be used to temporarily turn the display off. Use this function when you are using the instrument in a darkroom or similar environment in which the light from the screen has an effect on the work.

#### Display Off

Turns off the backlight, which will also turn the display off.

#### When Remote Commands Have Been Used to Turn the Display OFF

If remote commands have been used to turn the display off, even if you perform touch panel or mouse operations to turn the display on, the following message will be displayed and the display will be turned off after approximately 5 seconds.



To keep the display turned on, use a remote command, or Tap LOCAL on the Main Menu window to switch the instrument from remote to local mode.

### Clearing Measured Data, Analysis Conditions, Parameters, Etc.

This function clears all measurement parameters, display parameters, analysis parameters, and the waveform display. It is the same operation as when the instrument receives an \*RST remote command.

The following data is not cleared.

- Remote interface (ETHERNET and GP-IB) settings
- wavelength calibration data
- Various type of data saved to internal memory
- Registered programs created using the program function

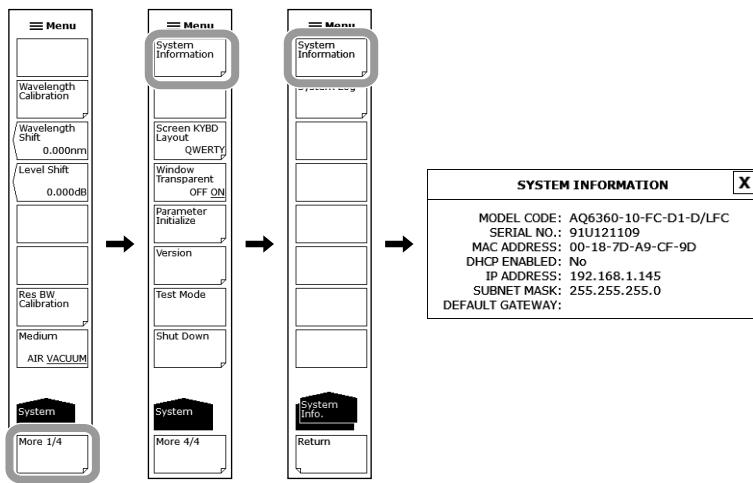
## 7.8 Displaying the System Information

### Procedure

#### Displaying the System Information

##### Displaying the System Information

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 4/4 function menu.
4. Tap **System Information**. A system information menu appears.
5. Tap **System Information**. The system information is displayed on the screen.
6. Tap **Return** to return to the previous menu.



#### Displayed Information

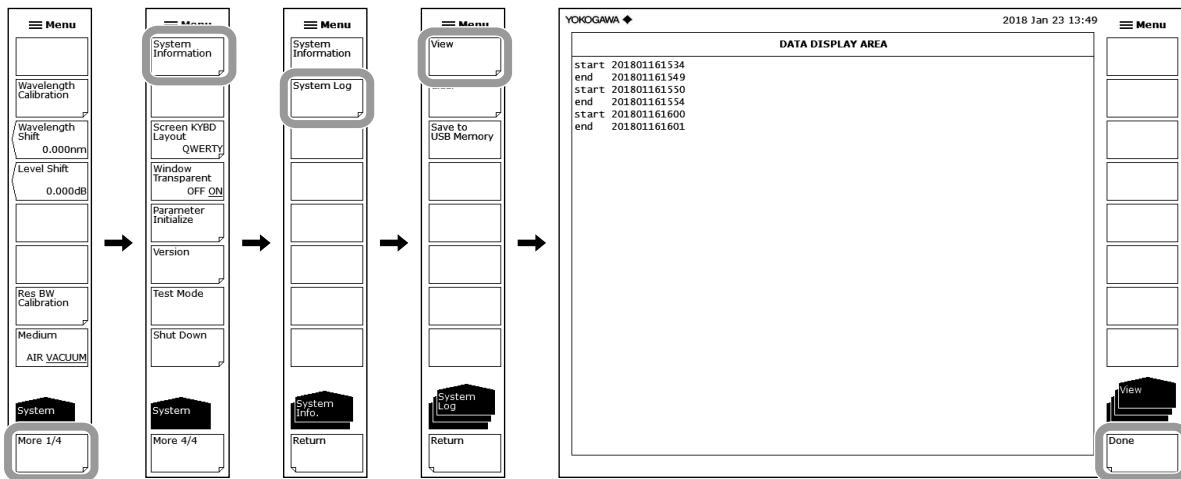
MODEL	Model
SPECIAL CODE	Special code (may not be displayed)
SERIAL NO.	Serial number
MAC ADDRESS	MAC address of the Ethernet port
DHCP ENABLED	
IP ADDRESS	TCP/IP settings
SUBNET MASK	
DEFAULT GATEWAY	

## 7.8 Displaying the System Information

### Displaying or Clearing the System Log and Copying to USB Memory

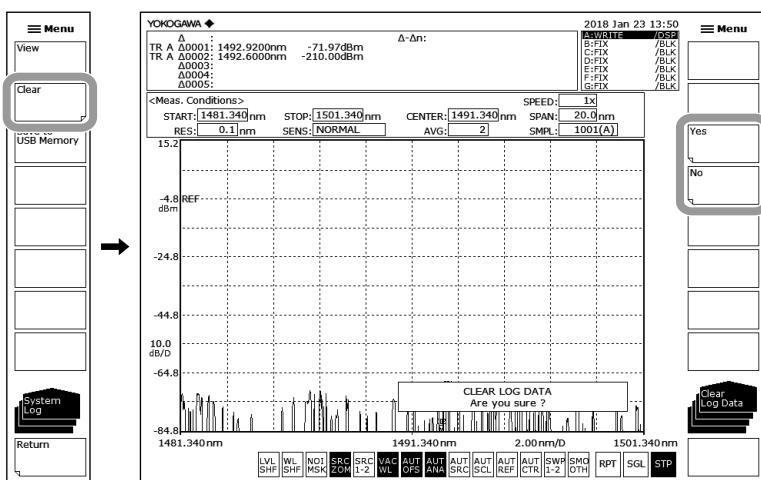
#### Displaying the System Log

1. Tap **☰ Menu**. The Main Menu window appears.
2. Tap **SYSTEM**.
3. Tap **More** to display the More 4/4 function menu.
4. Tap **System Information**. A system information menu appears.
5. Tap **System Log**. A system log menu appears.
6. Tap **View**. The system log is displayed on the screen.
7. Tap **Done** to return to the previous menu.



#### Clearing the System Log

8. Tap **Clear** and then **YES**. The system log will be cleared.



#### Copying the System Log to USB Memory

9. Connect a USB memory device, and then tap **Save to USB Memory**. The system log will be copied to the USB memory device.

File name: SystemLog.txt

# Appendix 1 Grid Table for WDM Wavelength

Some analysis functions refer to the grid table for analysis (see the following table).

The instrument has a table of nominal center frequencies specified by the ITU-T (International Telecommunication Union-Telecommunication sector) G692.

It also has two additional tables: the standard grid table created according to the predefined wavelength (frequency) range and the custom grid table that users can edit freely.

## List of Analysis Functions with Grid Tables

Function	Item	Parameter Name	Parameter
WDM	DISPLAY SETTING	DISPLAY TYPE	DRIFT(GRID)
FILTER PEAK	CROSS TALK	ALGO	GRID
FILTER BOTTOM	CROSS TALK	ALGO	GRID
WDM FILTER PEAK	CAHNEL DETECTION/ NOMINAL WAVELENGTH	ALGO	GRIF FIT GRID
WDM FILTER BOTTOM	CAHNEL DETECTION/ NOMINAL WAVELENGTH	ALGO	GRIF FIT GRID

## Note

The unit of the wavelength axis in the grid tables can be set to wavelength or frequency using the MARKER UNIT setting.

The standard and two custom grid tables have different parameter ranges. The following table shows the parameter ranges.

Type	Parameter Range
Standard grid table	
Start frequency	191.1000 THz (fixed)
Stop frequency	196.1000 THz (fixed)
Reference frequency	181.6924 to 249.8270 THz
Frequency spacing	Select 200 GHz, 100 GHz, 50 GHz, 25 GHz, or 11.5 GHz.
Custom grid table	
Start frequency	181.6924 to 249.8270 THz
Stop frequency	181.6924 to 249.8270 THz
Reference frequency	181.6924 to 249.8270 THz
Frequency spacing	0.1 to 999.9GHz

## Standard grid table

This grid table is created with pre-defined wavelength (frequency) ranges.

It can be created by setting the reference wavelength (frequency) and frequency spacing.

## Custom grid table

This is a grid table that users can edit as they like.

It is created automatically by setting the start/stop wavelength (frequency), reference wavelength (frequency), and frequency spacing.

Users can add or delete an arbitrary channel to/from the created grid table or edit wavelength (frequency) values for each channel there.

## Appendix 2

# Data Calculation Algorithms for Spectrum Widths

The instrument can calculate spectrum widths of waveforms being displayed. This section provides four types of spectrum width calculation methods as well as algorithms for the notch width calculation.

### THRESH Method

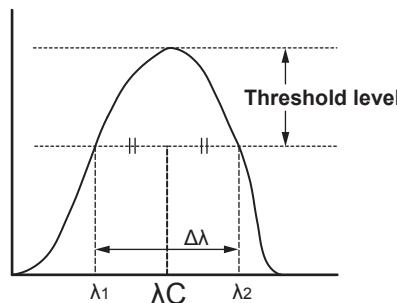
This method is used to obtain the spectrum widths of two points, which are lower than the peak level by a threshold value (THRESH [dB]) specified by a parameter, as well as their center wavelengths.

The following table shows the details of the parameters of the THRESH method.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	3.00	0.01 to 50.00	dB	Threshold value
THRESH K	K	1.00	1.00 to 10.00	-	Multiplying factor
MODE FIT	MODE FIT	OFF	ON / OFF	-	Sets whether the half of maximum point is aligned to the mode peak.

Algorithms differ depending on the number of mode peaks. Algorithms for these numbers are described below.

#### One mode peak



- A mode search is performed to obtain the mode peaks.
- Wavelengths, which cross the line below the mode peak by the threshold value (THRESH[dB]), are assigned to  $\lambda_1$  and  $\lambda_2$ .
- New  $\lambda_1$  and  $\lambda_2$  are obtained by multiplying factor K to the original  $\lambda_1$  and  $\lambda_2$  according to the following equations.

$$\lambda'c = (\lambda_2 + \lambda_1)/2$$

$$\lambda_1 = K \times (\lambda_1 - \lambda'c) + \lambda'c$$

$$\lambda_2 = K \times (\lambda_2 - \lambda'c) + \lambda'c$$

- The spectral width is determined from the following equation.

$$\Delta\lambda = \lambda_2 - \lambda_1$$

- Center wavelength  $\lambda'c$  is determined from the following equation.

$$\lambda'c = (\lambda_2 + \lambda_1)/2$$

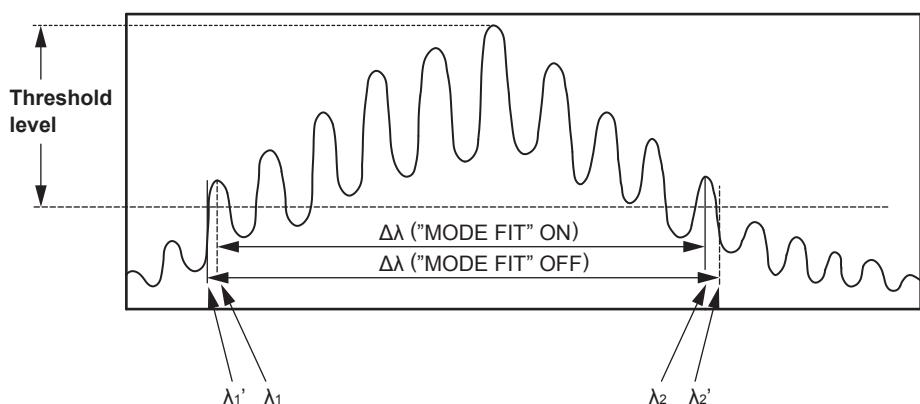
#### Note

If "MODE FIT" is set to ON for one mode peak, the spectral width  $\Delta\lambda$  and the center wavelength  $\lambda'c$  will become as follows.

$$\Delta\lambda = 0.0000\text{nm}$$

$$\lambda'c = \text{mode peak wavelength}$$

## Two or more mode peaks



- If "MODE FIT" is ON, the wavelengths of the mode peaks, which are outmost from the threshold value (THRESH[dB]) among the mode peaks, are assigned to  $\lambda_1$  and  $\lambda_2$ . If "MODE FIT" is OFF, the wavelengths, which are located outside  $\lambda_1$  and  $\lambda_2$ , and which cross the line below the mode peak with the largest mode peak level by the threshold value (THRESH[dB]), are assigned to  $\lambda'_1$  and  $\lambda'_2$ .
- If "MODE FIT" is ON, New  $\lambda_1$  and  $\lambda_2$  are obtained by multiplying factor K to the original  $\lambda_1$  and  $\lambda_2$  according to the following equations.

When "MODE FIT" is ON

$$\lambda'c = (\lambda_2 + \lambda_1)/2$$

$$\lambda_1 = K \times (\lambda_1 - \lambda'c) + \lambda'c$$

$$\lambda_2 = K \times (\lambda_2 - \lambda'c) + \lambda'c$$

When "MODE FIT" is OFF

$$\lambda'c = (\lambda'_2 + \lambda'_1)/2$$

$$\lambda'_1 = K \times (\lambda'_1 - \lambda'c) + \lambda'c$$

$$\lambda'_2 = K \times (\lambda'_2 - \lambda'c) + \lambda'c$$

- The spectral width is determined from the following equation.

$$\Delta\lambda = \lambda_2 - \lambda_1 \text{ (when "MODE FIT" is ON)}$$

$$\Delta\lambda = \lambda'_2 - \lambda'_1 \text{ (when "MODE FIT" OFF)}$$

- Center wavelength  $\lambda c$  is determined from the following equation.

$$\lambda c = (\lambda_2 + \lambda_1)/2 \text{ (when "MODE FIT" is ON)}$$

$$\lambda c = (\lambda'_2 + \lambda'_1)/2 \text{ (when "MODE FIT" is OFF)}$$

MODE displayed in the data area are to be the number of mode peaks between  $\lambda_1$  and  $\lambda_2$ .

## ENVELOPE (envelope curve) Method

This method is used in conjunction with a straight line (envelope) connecting mode peaks to obtain the spectrum widths of the two points, which are lower than the peaks by a configured threshold value (THRESH [dB]), as well as their center wavelengths.

The following table shows the details of the parameters of the ENVELOPE method.

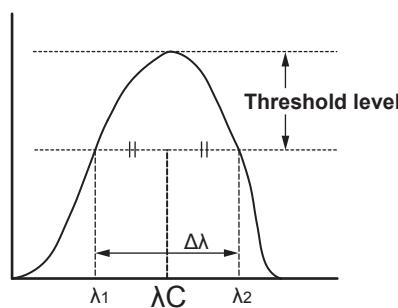
Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH 1	TH1	3.00	0.01 to 50.00	dB	Threshold value
THRESH 2	TH2	13.00	0.01 to 50.00	dB	Threshold value when the number of modes is calculated
K	K	1.00	1.00 to 10.00	-	Multiplying factor

Algorithms differ depending on the number of valid mode peaks.

Valid mode peaks mean the mode peaks, among the mode peaks obtained from a mode search, whose level (LOG) is equal to or greater than the line that is below the peak level by the lower limit (THRESH2).

Algorithms for these numbers of valid modes are described below.

### One valid mode peak



- A mode search is performed to obtain the mode peaks.
- Wavelengths, which cross the line below the mode peak by the threshold value (THRESH[dB]), are assigned to  $\lambda_1$  and  $\lambda_2$ .
- New  $\lambda_1$  and  $\lambda_2$  are obtained by multiplying factor K to the original  $\lambda_1$  and  $\lambda_2$  according to the following equations.  

$$\lambda'c = (\lambda_2 + \lambda_1)/2$$

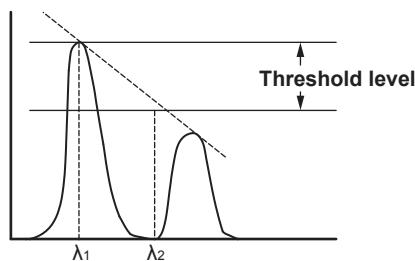
$$\lambda_1 = K \times (\lambda_1 - \lambda'c) + \lambda'c$$

$$\lambda_2 = K \times (\lambda_2 - \lambda'c) + \lambda'c$$
- The spectral width is determined from the following equation.  

$$\Delta\lambda = \lambda_2 - \lambda_1$$
- Center wavelength  $\lambda_c$  is determined from the following equation.  

$$\lambda_c = (\lambda_2 + \lambda_1)/2$$

## Two valid mode peaks



- The levels (LOG) of the two valid mode peaks are assigned to LG1 and LG2 in order from the left.
- $\lambda_1$  and  $\lambda_2$  are obtained using the following method.
  - When  $|LG2-LG1| \leq$  threshold value (THRESH1[dB])  
 $\lambda$  becomes  $\lambda_1$  and  $\lambda_2$  from the left in order.
  - When  $|LG2-LG1| >$  threshold value (THRESH1[dB])  
 Two valid mode peaks are connected with a straight line (envelope).  
 If  $LG1 > LG2$ , the wavelength for the left mode peak is assigned to  $\lambda_1$ . The wavelength of the point where the line below the peak level by the threshold value (THRESH[dB]) and the straight line (envelope) cross is assigned to  $\lambda_2$ .  
 If  $LG1 < LG2$ , the wavelength for the right mode peak is assigned to  $\lambda_2$ . The wavelength of the point where the line below the peak level by the threshold value (THRESH[dB]) and the straight line (envelope) cross is assigned to  $\lambda_1$ .
- New  $\lambda_1$  and  $\lambda_2$  are obtained by multiplying factor K to the original  $\lambda_1$  and  $\lambda_2$  according to the following equations.  

$$\lambda'c = (\lambda_2 + \lambda_1)/2$$

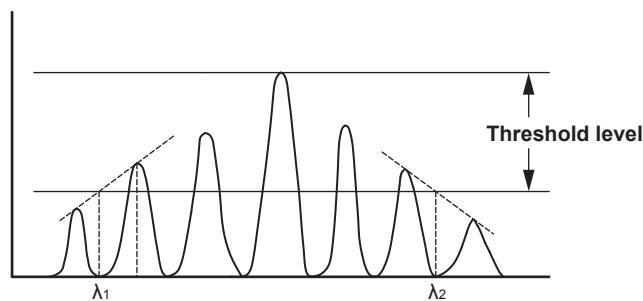
$$\lambda_1 = K \times (\lambda_1 - \lambda'c) + \lambda'c$$

$$\lambda_2 = K \times (\lambda_2 - \lambda'c) + \lambda'c$$
- The spectral width is determined from the following equation.  

$$\Delta\lambda = \lambda_2 - \lambda_1$$
- Center wavelength  $\lambda c$  is determined from the following equation.  

$$\lambda c = (\lambda_2 + \lambda_1)/2$$

Three or more valid mode peaks



- The levels (LOG) of three or more valid mode peaks are assigned to LG1, LG2, . . . , LGn in order from the left. The level of the mode peak at the highest level is assigned to LGp.
- $\lambda_1$  is obtained using the following method.
  - When  $|LGp-LG1| \leq$  threshold value (THRESH1[dB])  
The wavelength of the LG1 mode peak is assigned to  $\lambda_1$ .
  - When  $|LGp-LG1| >$  threshold value (THRESH1[dB])
    - The leftmost mode peak that is greater than  $|LGp-THRESH1|$  is determined.
    - The mode peak obtained in (i) and the highest mode peak on the left of (i) are connected with a straight line.
    - The point where the line of  $|LGp-THRESH1|$  and the straight line (envelope) cross is assigned to  $\lambda_1$ .
- $\lambda_2$  is obtained using the following method.
  - When  $|LGp-LGn| \leq$  threshold value (THRESH1[dB])  
The wavelength of the LG1 mode peak is assigned to  $\lambda_2$ .
  - When  $|LGp-LGn| >$  threshold value (THRESH1[dB])
    - The rightmost mode peak that is greater than  $|LGp-THRESH1|$  is determined.
    - The mode peak obtained in (i) and the highest mode peak on the right of (i) are connected with a straight line.
    - The point where the line of  $|LGp-THRESH1|$  and the straight line (envelope) cross is assigned to  $\lambda_2$ .
- New  $\lambda_1$  and  $\lambda_2$  are obtained by multiplying factor K to the original  $\lambda_1$  and  $\lambda_2$  according to the following equations.  

$$\lambda'c = (\lambda_2 + \lambda_1)/2$$

$$\lambda_1 = K \times (\lambda_1 - \lambda'c) + \lambda'c$$

$$\lambda_2 = K \times (\lambda_2 - \lambda'c) + \lambda'c$$
- The spectral width is determined from the following equation.  

$$\Delta\lambda = \lambda_2 - \lambda_1$$
- Center wavelength  $\lambda c$  is determined from the following equation.  

$$\lambda c = (\lambda_2 + \lambda_1)/2$$

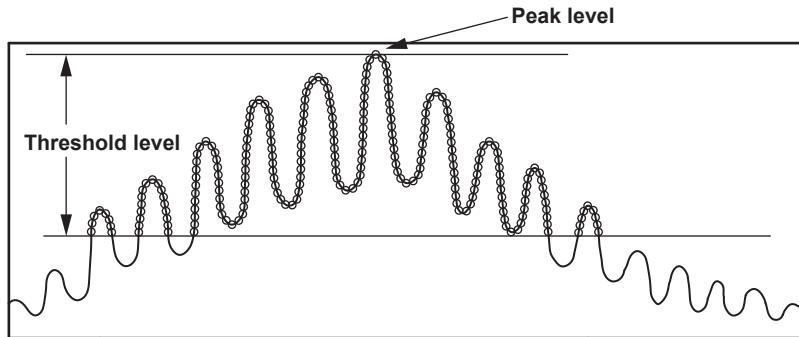
## RMS Method

The RMS method is used to obtain the spectrum width and its center wavelength.

The following table shows the details of the parameters of the RMS method.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	20.00	0.01 to 50.00	dB	Threshold value
K	K	1.00	1.00 to 10.00	-	Multiplying factor

The algorithm is described below.



- The data points exceeding the threshold value TH, within the displayed waveform, are removed, and the spectrum width is determined by the following calculation.
- When the wavelength at each point is  $\lambda_i$  and the level at each point is  $P_i$ , the mean wavelength  $\lambda_c$  can be found by the following expression.

$$\lambda_c = \frac{\sum P_i \times \lambda_i}{\sum P_i}$$

- Mean wavelength  $\lambda_c$  found above is used to find spectrum width  $\Delta\lambda_c$  with the following expression.

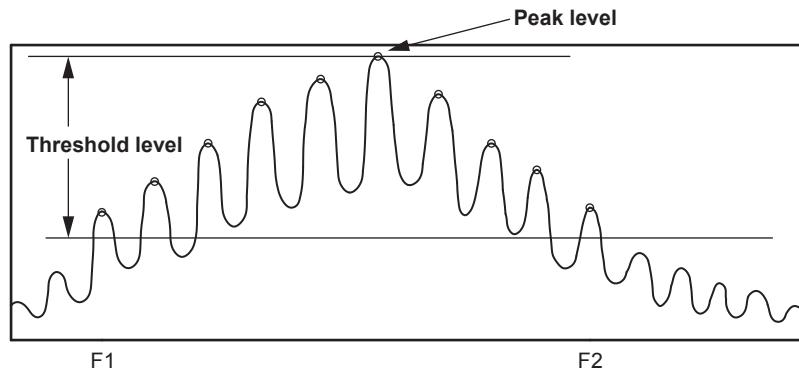
$$\Delta\lambda = K \times \sqrt{\frac{\sum P_i \times (\lambda_i - \lambda_c)^2}{\sum P_i}}$$

### PEAK RMS Method

The PEAK RMS method is used to obtain the spectrum width and its center wavelength. The following table shows the details of the parameters of the PEAK RMS method.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	20.00	0.01 to 50.00	dB	Threshold value
K	K	1.00	1.00 to 10.00	-	Multiplying factor

The algorithm is described below.



- The mode peaks exceeding the threshold value TH, within the displayed waveform, are removed, and the spectrum width is determined by the following calculation. MODE NUM in the data area shows the number of mode peaks exceeding the threshold value TH.
- When the wavelength at each point is  $\lambda_i$  and the level at each point is  $P_i$ , the mean wavelength  $\lambda_c$  can be found by the following expression.

$$\lambda_c = \frac{\sum P_i \times \lambda_i}{\sum P_i}$$

- Mean wavelength  $\lambda_c$  found above is used to find spectrum width  $\Delta\lambda$  with the following expression.

$$\Delta\lambda = K \times \sqrt{\frac{\sum P_i \times (\lambda_i - \lambda_c)^2}{\sum P_i}}$$

## NOTCH Width Measurement

The bottom level is determined, and the NOTCH width for the bottom level and its center wavelength are determined.

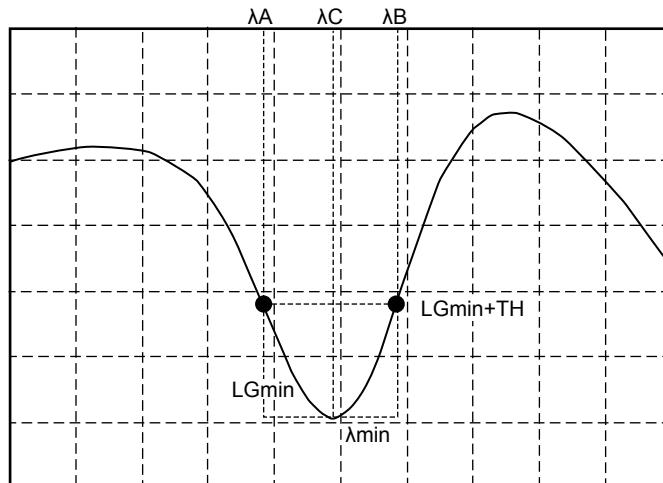
The following table shows the details of the NOTCH analysis parameters.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	3.00	0.01 to 50.00	dB	Threshold value
K	K	1.00	1.00 to 10.00	-	Multiplying factor
TYPE	TYPE	BOTTOM	BOTTOM / PEAK	-	Reference position for searching

The algorithm is described below. The algorithm differs depending on the analysis type (BOTTOM or PEAK).

The algorithms for each type of analysis are described below.

**When "TYPE" is BOTTOM**



- The minimum level "LGmin" is obtained. The wavelength of this point assigned to  $\lambda_{min}$ .
- The rightmost wavelength located on the left of  $\lambda_{min}$  and that crosses the level (LOG) of  $|LG_{min} + \text{threshold value (THRESH[dB])}|$  is assigned to  $\lambda_A$ .
- Set the leftmost wavelength located on the right of  $\lambda_{min}$  and that crosses the level (LOG) of  $|LG_{min} + \text{threshold value (THRESH[dB])}|$  is assigned to  $\lambda_B$ .
- New  $\lambda_A$  and  $\lambda_B$  are obtained by multiplying factor K.  

$$\lambda'_C = (\lambda_B + \lambda_A)/2$$

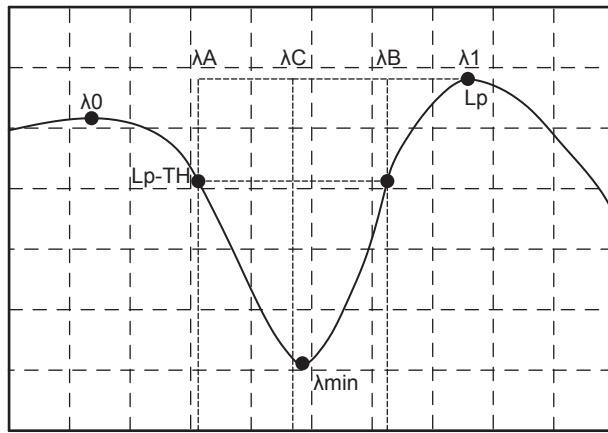
$$\lambda_A = K \times (\lambda_A - \lambda'_C) + \lambda'_C$$

$$\lambda_B = K \times (\lambda_B - \lambda'_C) + \lambda'_C$$
- The notch width is determined from the following equation.  

$$\Delta\lambda = \lambda_A - \lambda_B$$
- Center wavelength  $\lambda_C$  is determined from the following equation.  

$$\lambda_C = (\lambda_A + \lambda_B)/2$$

When “TYPE” is PEAK



- The minimum level “LGmin” is obtained. The wavelength of this point assigned to  $\lambda_{min}$ .
- LG0 at the peak level (LOG) on the left of LGmin is determined. The wavelength of this point assigned to  $\lambda_0$ .
- LG1 at the peak level (LOG) on the right of LGmin is determined. The wavelength of this point assigned to  $\lambda_1$ .
- The larger of the two levels, LG0 or LG1, is assigned to Lp.
- The leftmost wavelength between  $\lambda_0$  and  $\lambda_1$  crossing the level (LOG) of  $|Lp$ -threshold value (THRESH[dB]) is assigned to  $\lambda_A$ .
- The rightmost wavelength between  $\lambda_0$  and  $\lambda_1$  crossing the level (LOG) of  $|Lp$ -threshold value (THRESH[dB]) is assigned to  $\lambda_B$ .
- New  $\lambda_A$  and  $\lambda_B$  are obtained by multiplying factor K.  

$$\lambda'_C = (\lambda_B + \lambda_A)/2$$

$$\lambda_A = K \times (\lambda_A - \lambda'_C) + \lambda'_C$$

$$\lambda_B = K \times (\lambda_B - \lambda'_C) + \lambda'_C$$
- The notch width is determined from the following equation.  

$$\Delta\lambda = \lambda_A - \lambda_B$$
- Center wavelength  $\lambda_C$  is determined from the following equation.  

$$\lambda_C = (\lambda_A + \lambda_B)/2$$

# Appendix 3 Details of Each Analysis Function

This section describes the algorithms of analyses available under ANALYSIS 1. ANALYSIS 1 provides such functions as collective analysis of various light sources, power analysis, SMSR analysis, and PMD analysis.

## SMSR Analysis Function

The optical spectrum after the measurement of DFB-LD is used to analyze the SMSR (Side Mode Suppression Ratio) of DFB-LD.

The following table shows the details of the SMSR analysis parameters.

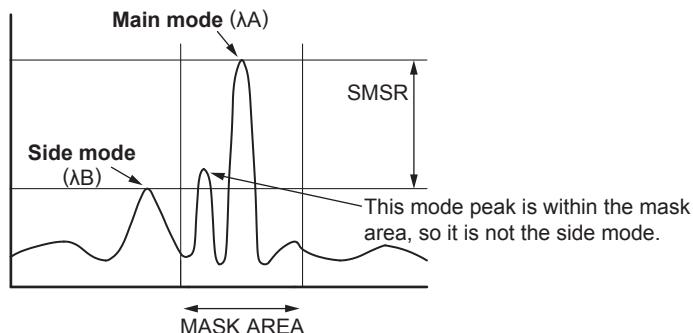
Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
SMSR MODE	MODE	SMSR1	SMSR1/SMSR2/ SMSR3/SMSR4	-	Execution mode during SMSR measurement
SMSR MASK	MASK	±0.00	0.00 to 99.99	nm	Setting of near-peak mask range during SMSR1 or SMSR3 measurement

The algorithm differs depending on the SMSR mode.

The analysis algorithms of each mode are described below.

### SMSR1

The main mode is defined as the highest mode peak. The side mode is defined as the highest mode peak outside of the mask area.



The analysis algorithm for the SMSR1 mode is as follows:

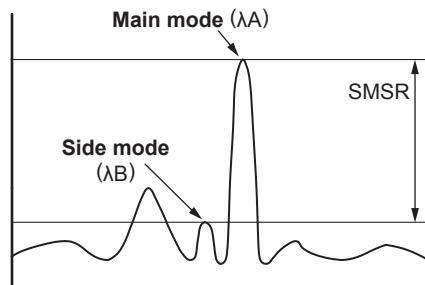
1. A mode search is performed to determine the mode peak.
1. The wavelength of the main mode is assigned to  $\lambda A$ .
3. The wavelength of the side mode is assigned to  $\lambda B$ .  
If relevant points do not exist, the wavelength of the highest level outside of the mask area is assigned to  $\lambda B$ .  
If there are multiple wavelengths that can be assigned to  $\lambda B$ , the leftmost wavelength is assigned to  $\lambda B$ .
4. The levels (linear values) of  $\lambda A$  and  $\lambda B$  are assigned to LA and LB, respectively.
5. SMSR and  $\Delta\lambda$  are determined from the following equations.

$$\text{SMSR} = \text{LA} / \text{LB}$$

$$\Delta\lambda = \lambda B - \lambda A$$

### SMSR2

The main mode is defined as the highest mode peak. The side mode is defined as the highest mode peak adjacent to the main mode.



The analysis algorithm for the SMSR2 mode is as follows:

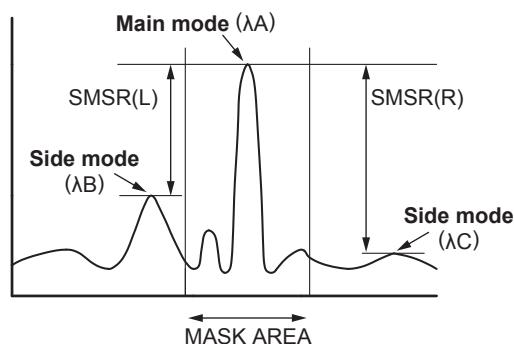
1. A mode search is performed to determine the mode peak.
1. The wavelength of the main mode is assigned to  $\lambda A$ .
3. The wavelength of the side mode is assigned to  $\lambda B$ . If there are no mode peaks other than the one whose wavelength has been set to  $\lambda A$ ,  $\lambda B$  is set to  $\lambda A$ .
4. The levels (linear values) of  $\lambda A$  and  $\lambda B$  are assigned to  $LA$  and  $LB$ , respectively.
5. SMSR and  $\Delta\lambda$  are determined from the following equations.

$$SMSR = LA / LB$$

$$\Delta\lambda = \lambda B - \lambda A$$

### SMSR3

The main mode is defined as the highest mode peak. The side modes are defined as the highest mode peaks outside of the mask area—one on the left side and one on the right side of the mask area.



The analysis algorithm for the SMSR3 mode is as follows:

1. A mode search is performed to determine the mode peak.
1. The main mode point is assigned to  $PA$ . The wavelength of this point is assigned to  $\lambda A$ .
3. The wavelength of the side mode that has a wavelength shorter than  $PA$  is assigned to  $\lambda B$ . The wavelength of the side mode that has a wavelength longer than  $PA$  is assigned to  $\lambda C$ . If relevant points do not exist, for the levels outside the mask area, the wavelength at the highest level whose wavelength is shorter than  $PA$  is assigned to  $\lambda B$  and the wavelength at the highest level whose wavelength is longer than  $PA$  is assigned to  $\lambda C$ .
4. The levels (linear values) of  $\lambda A$ ,  $\lambda B$ , and  $\lambda C$  are assigned to  $LA$ ,  $LB$ , and  $LC$ , respectively.
5. SMSR and  $\Delta\lambda$  are determined from the following equations.

$$SMSR(L) = LA / LB$$

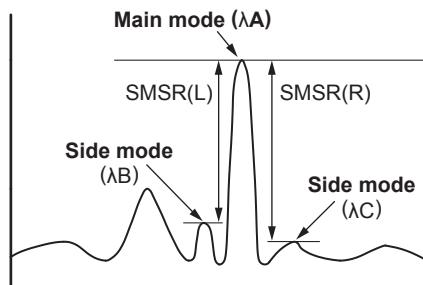
$$SMSR(R) = LA / LC$$

$$\Delta\lambda(L) = \lambda B - \lambda A$$

$$\Delta\lambda(R) = \lambda C - \lambda A$$

**SMSR4**

The main mode is defined as the highest mode peak. The side modes are defined as the mode peaks adjacent to the main mode.



The analysis algorithm for the SMSR4 mode is as follows:

1. A mode search is performed to determine the mode peak.
1. The main mode point is assigned to PA. The wavelength of this point is assigned to  $\lambda A$ .
3. The wavelength of the side mode that has a wavelength shorter than PA is assigned to  $\lambda B$ . The wavelength of the side mode that has a wavelength longer than PA is assigned to  $\lambda C$ .  
If there is no mode peak whose wavelength is shorter than PA,  $\lambda B$  is set to  $\lambda A$ . If there is no mode peak whose wavelength is longer than PA,  $\lambda C$  is set to  $\lambda A$ .
4. The levels (linear values) of  $\lambda A$ ,  $\lambda B$ , and  $\lambda C$  are assigned to LA, LB, and LC, respectively.
5. SMSR and  $\Delta\lambda$  are determined from the following equations.

$$\text{SMSR}(L) = LA / LB$$

$$\text{SMSR}(R) = LA / LC$$

$$\Delta\lambda(L) = \lambda B - \lambda A$$

$$\Delta\lambda(R) = \lambda C - \lambda A$$

App

Appendix

### Power Analysis Function

This function determines the total power by integrating the level values of the measured waveform.

Using the line marker search function and zoom area search function is convenient when performing power analysis.

The following table shows the details of power analysis parameters.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
POWER OFFSET	OFST	0.00	-10.00 to 10.00	dB	Compensation value in power measurement

The algorithm is described below.

- The resolution bandwidth is determined for all display points.  
(The values for  $\lambda_x = \lambda_{SHIFT} + \lambda_{OFST}$  are determined through interpolation using a table.)

In the vacuum wavelength mode (MEAS WL AIR/VACUUM key under SET UP), the following equation is used to obtain  $\lambda_x$ .

$$\lambda_0 = \lambda + \lambda_{SHIFT}$$

$$\lambda_x = \lambda_0 / N(\lambda_0) + \lambda_{OFST}$$

If the X-axis display mode is frequency, the equation below is used to convert the resolution bandwidth (frequency)  $R_i$  for all display points to wavelength values.

$$R_i = (\lambda_i \times \lambda_i \times R_{fi})/C$$

where  $\lambda_i$ : Wavelength (nm) at each point

$R_{fi}$  : Resolution bandwidth (THz)

$C$  : Speed of light in the vacuum ( $1.99792458 \times 10^8$ [m/s])

- The resolution bandwidth for the  $i$ th point is assigned to  $R_i$  and the level to  $L_i$ .
- The total power is determined from the following equation.

$$\text{POWER} = \frac{\text{SPAN}}{\text{SAMPLE} - 1} \times \sum \frac{L_i}{R_i} \times \text{POWEROFFSET}$$

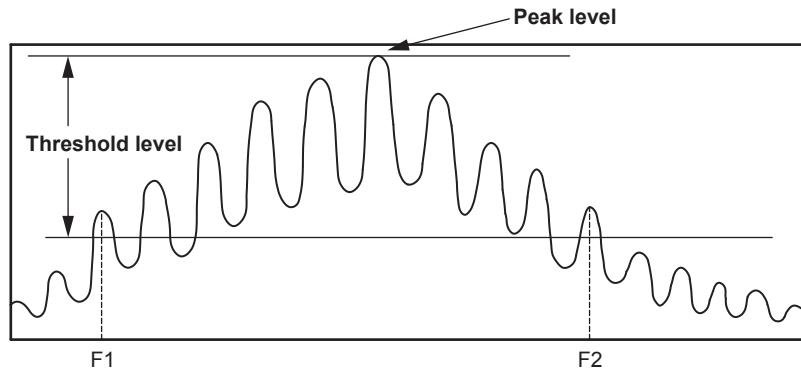
## PMD Analysis Function

PMD values are analyzed from measured waveforms.

The following table shows the details of PMD analysis parameters.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
THRESH	TH	10.00	0.01 to 50.00	dB	Threshold value

The algorithm is described below.



- A mode search is performed to obtain the mode peaks.
- Of these mode peaks, the ones whose level (LOG) is equal to or greater than the line that is below the peak level by the lower limit (THRESH) are considered valid mode peaks.
- The frequency of the leftmost valid mode peak is assigned to F1 (THz).
- The frequency of the rightmost valid mode peak is assigned to F2 (THz).
- The number of mode peaks between F1 and F2 is assigned to N.
- The PMD value is determined from the following equation.

$$\text{PMD} = (N-1) / (F2-F1)$$

### Appendix 3 Details of Each Analysis Function

#### DFB-LD Analysis Function

The following parameters for DFB-LD light sources are analyzed collectively.

- -XdB WIDTH (Center WL/SPWD)
- SMSR
- RMS
- POWER
- OSNR

The following table shows the details of DFB-LD analysis parameters.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
-XdB WIDTH (Center WL/ SPWD)	ALGO	THRESH	ENVELOPE/ THRESH/RMS/ PK-RMS	-	-
	THRESH	20.00	0.01 to 50.00	dB	-
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00	-	-
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	Invalid when ALGO is RMS.
SMSR	SMSR MODE	SMSR1	SMSR1/ SMSR2/ SMSR3/ SMSR4	-	-
	SMSR MASK	±0.00	0.00 to 99.99	nm	-
	MODE DIFF	3.00	0.01 to 50.00	dB	-
RMS	ALGO	RMS	RMS/PK-RMS	-	-
	THRESH	20.00	0.01 to 50.00	dB	-
	K	1.00	0.01 to 10.00	-	-
	MODE DIFF	3.00	0.01 to 50.00	dB	Invalid when ALGO is RMS.
POWER	SPAN	0.40	0.01 to 10.00	nm	-
OSNR	MODE DIFF	3.00	0.01 to 50.00	dB	-
	NOISE ALGO	PIT	AUTO-FIX/ MANUAL-FIX/ AUTO-CTR/ MANUAL-CTR/ PIT	-	-
	NOISE AREA	AUTO	AUTO/ 0.01 to 10.00	nm	-
	MASK AREA	-	-/ 0.01 to 10.00	nm	-
	FITTING ALGO	LINEAR	LINEAR/ GAUSS/ LORENZ/3RD POLY/4TH POLY/5TH POLY	-	-
	NOISE BW	0.10	0.01 to 1.00	nm	-
	SIGNAL POWER	PEAK	PEAK/ INTEGRAL	-	-
	INTEGRAL RANGE	10.0	1.0 to 999.9	GHz	-

For details on the DFB-LD analysis algorithms, see the data calculation algorithms for spectrum widths, the SMSR analysis algorithms, and the WDM analysis algorithms (OSNR analysis).

## FP-LD Analysis Function

The following parameters for FP-LD light sources are analyzed collectively.

- SPECTRUM WIDTH
- MEAN WAVELENGTH
- TOTAL POWER
- MODE NO.

The following table shows the details of FP-LD analysis parameters.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
SPECTRUM WIDTH	ALGO	PK-RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20	0.01 to 50.00	dB	
	THRESH2	20	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	2	1.00 to 10.00	-	
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3	0.01 to 50.00	dB	
MEAN WAVELENGTH	ALGO	PK-RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20	0.01 to 50.00	dB	
	THRESH2	20	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	2	1.00 to 10.00	-	
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3	0.01 to 50.00	dB	
TOTAL POWER	OFFSET LEVEL	0	-10.00 to 10.00	dB	
MODE NO.	ALGO	PK-RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20.00	0.01 to 50.00	dB	
	THRESH2	20.00	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1.00	1.00 to 10.00	-	
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3.00	0.01 to 50.00	dB	

For details on the FP-LD analysis algorithms, see the data calculation algorithms for spectrum widths and power analysis algorithms.

### Appendix 3 Details of Each Analysis Function

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#### LED Analysis Function

The following parameters for LED light sources are analyzed collectively.

- SPECTRUM WIDTH
- MEAN WAVELENGTH
- TOTAL POWER

The following table shows the details of LED analysis parameters.

Parameter	Abbreviation	Default Value	Setting Range	Unit	Description
SPECTRUM WIDTH	ALGO	THRESH	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	3	0.01 to 50.00	dB	
	THRESH2	20	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	1	1.00 to 10.00	-	
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3	0.01 to 50.00	dB	
MEAN WAVELENGTH	ALGO	RMS	ENVELOPE / THRESH / RMS / PK-RMS	-	
	THRESH	20	0.01 to 50.00	dB	
	THRESH2	20	0.01 to 50.00	dB	Valid only when ALGO is ENVELOPE.
	K	2	1.00 to 10.00	-	
	MODE FIT	OFF	ON / OFF	-	Valid only when ALGO is THRESH.
	MODE DIFF	3	0.01 to 50.00	dB	
TOTAL POWER	OFFSET LEVEL	0	-10.00 to 10.00	dB	

For details on the LED analysis algorithms, see the data calculation algorithms for spectrum widths and power analysis algorithms.

## Appendix 4 WDM Analysis Function

This function provides the analyses of noise level and SNR in each mode within the measurement range of WDM waveforms.

### Analysis Items

NO.:	Channel number i
WAVELENGTH:	Center wavelength $\lambda_i$ of the channel
LEVEL:	Level (peak level – noise level) $L_i$ of the channel
OFFSET WL:	Relative wavelength to the wavelength of the reference channel (REF)
OFFSET LVL:	Relative level to the level of the reference channel (REF)
SPACING:	Wavelength spacing to the adjacent channel
LVL DIFF:	Level difference from then adjacent channel
NOISE:	Noise level $L_{Ni}$ of the channel
SNR:	SNR value $S_{Ni}$ of the channel
GRID WL:	Nearest grid wavelength to the channel
MEAS WL:	Center wavelength $\lambda_i$ of the channel
REL WL:	Relative wavelength to the nearest grid wavelength of the channel

### Note

dBm/nm and dBm/THz figures are changed to dBm figures before execution.

### Parameters

#### Channel Detection Parameters

Parameter Name	Default	Setting Range	Unit	Description
THRESH	20.0	0.1 to 99.9	dB	Threshold value for channel detection.
MODE DIFF	3.0	0.0 to 50.0	dB	Minimum value for peak/bottom difference during channel detection.
DISPLAY MASK	OFF	OFF, -100.0 to 0.0	dBm	Levels equal to or below this level are not detected as WDM channels.

## Appendix 4 WDM Analysis Function

### SNR Analysis Parameters

Parameter Name	Default	Setting Range	Unit	Description
NOISE ALGO	AUTO-FIX	AUTO-FIX MANUAL-FIX AUTO-CTR MANUAL-CTR PIT	-	Selection of algorithms for noise level measurement.
NOISE AREA	0.40nm	0.01 to 10.00nm	nm	A range of waveform data for use in noise level analysis is specified as a range centering on channel wavelengths.
MASK AREA	0.20nm	0.01 to 10.00nm	nm	Specifies the signal optical spectrum range to be masked within the waveform data, while using the channel wavelength as its center. When N_ALGO is: <ul style="list-style-type: none"><li>• AUTO-FIX "AUTO"</li><li>• MANUAL-FIX **.**</li><li>• AUTO-CTR "Between Ch"</li><li>• MANUAL-CTR "Between Ch"</li><li>• PIT "-"</li></ul> When N_ALGO is: <ul style="list-style-type: none"><li>• AUTO-FIX "-"</li><li>• MANUAL-FIX When F_ALGO is LINEAR: "-" Other cases: Parameter value input</li><li>• AUTO-CTR: "-"</li><li>• MANUAL-CTR When F_ALGO is LINEAR: "-" Other causes: Parameter value input</li></ul> Limiter is applied during input to ensure NOISE AREA ≥ MASK AREA. <ul style="list-style-type: none"><li>• PIT "-"</li></ul>
FITTING ALGO	LINEAR	LINEAR GAUSS LORENZ 3RD POLY 4TH POLY 5TH POLY	-	Selection of a fitting algorithm for obtaining noise levels.
NOISE BW	0.10nm	0.01 to 1.00 nm	nm	Noise bandwidth setting.
DUAL TRACE	OFF	ON/OFF	-	OFF: The active trace is analyzed. ON: Wavelengths and levels are calculated from TRACE A. Noise levels are calculated from TRACE B.

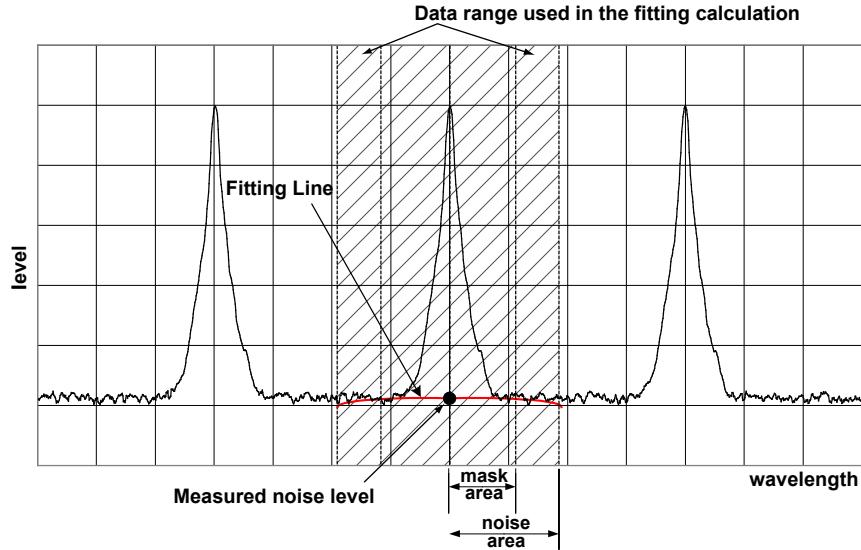
## Display Parameters

Parameter Name	Default	Setting Range	Unit	Description
DISPLAY TYPE	ABSOLUTE	ABSOLUTE RELATIVE DRIFT(MEAS) DRIFT(GRID)	-	Setting of the format to display wavelengths, levels, noises, and SNRs, which are the results of analyses. ABSOLUTE: Absolute values RELATIVE: Relative values to the grid DRIFT(MEAS): Drift relative to a past measured wavelength DRIFT(GRID): Drift relative to the grid wavelength
CH RELATION	OFFSET	OFFSET SPACING	-	Setting of the format to display wavelengths between channels and level relative values during DISPLAY: ABSOLUTE. This parameter is valid only when DISPLAY is set to ABSOLUTE. OFFSET: Offset values by using one arbitrary channel as the reference. SPACING: Offset values compared to an adjacent channel
REF CH	HIGHEST	HIGHEST ****	-	Setting of the reference channel when CH RELATION is set to OFFSET. This parameter is valid only when DISPLAY is set to ABSOLUTE and also when CH RELATION is set to OFFSET. HIGHEST: A channel with the highest level is used as the reference. ****: The ****th channel is used as the reference.
MAX/MIN RESET	-	-	-	Tapping resets MAX/MIN. Button valid only when DISPLAY is set to DRIFT.
OUTPUT SLOPE	OFF	ON/OFF	-	ON/OFF of the function to obtain the least square approximation line of the channel peak.
POINT DISPLAY	ON	ON/OFF	-	ON/OFF of the function to display the data range used for fitting into the waveform window.

## Other Settings

Parameter Name	Default	Setting Range	Unit	Description
SIGNAL POWER	PEAK	PEAK INTEGRAL	-	Setting of the signal optical power calculation method PEAK: Peak level value INTEGRAL: Level value obtained by integration
INTEGRAL RANGE	10.0	1.0 to 999.9	GHz	Setting of the integral range for determining the signal optical power Valid when the SIGNAL POWER setting is INTEGRAL. If the set value is $\Delta f$ , the integral is calculated in the range of channel center wavelength $\pm \Delta f$ .

## Analysis Algorithm



1. Channel detection is performed on the measured waveform data according to the following procedure.
  - All maximum points and minimum points are found to obtain mode peaks where peak/ bottom differences between maximum points and minimum points on both sides are equal to or greater than MODE DIFF.
  - Of the obtained mode peaks, only the ones whose level difference compared to the highest peak is equal to or greater than THRESH are chosen. However, mode peaks with a level difference equal to or less than DISPLAY MASK are excluded. The number of mode peaks chosen in this manner is the number of channels N.
1. The wavelength  $\lambda'i$  of each mode peak is determined.
3. The center wavelengths  $\lambda'i$  of each mode peak that are 2 points down A[dB] to the left and right from mode peak  $\lambda'i$  are determined (where A[dB] is 3 dB or the MODE DIFF setting, whichever is smaller).
4. The signal level  $LSi$  of each mode is determined according to the parameter SIGNAL POWER setting.
  - For "PEAK"  
 $LSi$  = Level  $Lpi$  of each mode peak
  - For "INTEGRAL"  
 $LSi$  = The integral of the power value in the range of the center wavelength  $\pm\Delta f$  [GHz] of each mode  
 $(\Delta f: \text{parameter INTEGRAL RANGE setting value})$
5. The noise area and mask area for performing the NOISE fitting are determined according to the setting of the parameter NOISE ALGO.  
 If the mask area is set outside the noise area when the channel wavelength  $\lambda i$  is the center, the mask area and the noise area will be the same value.
6. The measurement resolution  $RBi$  of each channel is determined from the values stored in the instrument.
7. Fitting waveforms are generated from the noise area and mask area determined in 5 according to the setting of the parameter FITTING ALGO, and the level at the center wavelength  $\lambda i$  is determined as the noise level  $LNi$ .
8. The signal level  $LSi$  and noise level  $LNi$  obtained in 4 and 7 are used to determine the level  $Li$  of each channel using the following equation.

$$Li = LSi(\text{linear}) - LNi(\text{linear})$$

9. The normalized noise level  $LNNi$  is determined from the following equation.  

$$LNNi = [LNi(LOG) - 10 \times \log(RBi[nm])] + 10 \times \log(NBW)$$

NBW = noise bandwidth (configurable parameter)
10. The mode peak level  $Li$  obtained in 8 and 9 and the normalized noise level  $LNNi$  are used to determine  $SNi$  from the following equation.  

$$SNi = 10 \times \log(Li) - LNNi$$
11. The analysis results found above are displayed according to the DISPLAY SETTING parameter.

## Automatic Parameter Setting Function

This instrument has a function that automatically configures the noise area and mask area settings.

To perform automatic setting, set the algorithm to AUTO-FIX, AUTO-CTR, or PIT.

### AUTO-FIX

#### Noise Algorithm

The left and right noise areas ( $NA_{Ri}$ ,  $NA_{Li}$ ) of each channel are determined according to the number of detected WDM channels as follows:

##### When the number of WDM channels “n” is 1

The measurement resolution of  $SNi$  calculation trace and the value of the noise measurement point NOISE AREA in accordance with the resolution are determined internally, and then the values are found from the following equations.

$$NA_{Ri} = \lambda_i + \text{NOISE AREA}$$

$$NA_{Li} = \lambda_i - \text{NOISE AREA}$$

##### When the number of WDM channels “n” is 2 or more

The channel spacing of each channel (spacing of  $\lambda_i$ ) is determined. With the minimum spacing assigned to SPACING and using  $\text{NOISE AREA} = \text{SPACING} / 2$ , the NOISE AREA is determined using the following equation.

$$NA_{Ri} = \lambda_i + \text{NOISE AREA} \quad (i=1,2,\dots,n)$$

$$NA_{Li} = \lambda_i - \text{NOISE AREA} \quad (i=1,2,\dots,n)$$

#### Fitting Algorithm

When AUTO-FIX is selected, LINEAR is used for the fitting algorithm. The details of the calculation are as follows:

- $ELi$  and  $ERi$  are determined as the level (LOG) of each position of the noise areas  $NA_{Li}$  and  $NA_{Ri}$ .
- The data of the straight line connecting the two points of  $ELi$  and  $ERi$  is used to fill the inside of the fitting range.
- The level of  $\lambda_i$  of the data generated in the fitting is assigned to the noise level  $LNi$ .

#### Note

Because LINEAR is used, it is not possible to set mask areas.

## AUTO-CTR

### Noise Algorithm

The left and right noise areas (NA\_Ri, NA\_Li) of each channel are determined according to the number of detected WDM channels as follows (while treating the center points between channels as NA\_Ri and NA\_Li).

#### When the number of WDM channels “n” is 1

The measurement resolution of SNI calculation trace and the value of the noise measurement point NOISE AREA in accordance with the resolution are determined internally, and then the values are found from the following equations.

$$NA\_Ri = \lambda_i + \text{NOISE AREA}$$

$$NA\_Li = \lambda_i - \text{NOISE AREA}$$

#### When the number of WDM channels “n” is 2 or more

$$\lambda N1 = (3\lambda_1 - \lambda_2)/2$$

i=2,3,...,n

$$\lambda Ni = (\lambda_i - \lambda_{i-1})/2$$

$$\lambda Nn+1 = (3\lambda_n - \lambda_{n-1})/2$$

When the above values are calculated, the following results will be obtained.

i=1,2,...,n

$$NA\_Li = \lambda Ni$$

$$NA\_Ri = \lambda Ni+1$$

### Fitting Algorithm

When AUTO-CTR is selected, LINEAR is used for the fitting algorithm. The details of the calculation are as follows:

- ELi and ERi are determined as the level (LOG) of each position of the noise areas NA\_Li and NA\_Ri.
- The data of the straight line connecting the two points of ELi and ERi is used to fill the inside of the fitting range.
- The level of  $\lambda_i$  of the data generated in the fitting is assigned to the noise level LNi.

### Note

---

Because LINEAR is used, it is not possible to set mask areas.

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## PIT

### Noise Algorithm

For each channel, the minimum level position in the area up to the next channel is determined from the measured waveform and used as NOISE AREA.

For the left-most and right-most channels, the internal NOISE AREA is used for the outer NOISE AREA.

#### When the number of WDM channels “n” is 1

The measurement resolution of SNI calculation trace and the value of the noise measurement point NOISE AREA in accordance with the resolution are determined internally, and then the values are found from the following equations.

$$NA\_Ri = \lambda_i + \text{NOISE AREA}$$

$$NA\_Li = \lambda_i - \text{NOISE AREA}$$

**When the number of WDM channels “n” is 2 or more**

i=1

$$NA\_Li = \lambda_i - (\lambda Ni - \lambda_i)$$

$$NA\_Ri = \lambda Ni$$

i=2,3,...,n-1

$$NA\_Li = \lambda N(i - 1)$$

$$NA\_Ri = \lambda Ni$$

i=n

$$NA\_Li = \lambda N(i - 1)$$

$$NA\_Ri = \lambda_i + (\lambda_i - \lambda N(i - 1))$$

**Fitting Algorithm**

When PIT is selected, LINEAR is used for the fitting algorithm. The details of the calculation are as follows:

- ELi and ERi are determined as the level (LOG) of each position of the noise areas NA\_Li and NA\_Ri.
- The data of the straight line connecting the two points of ELi and ERi is used to fill the inside of the fitting range.
- The level of  $\lambda_i$  of the data generated in the fitting is assigned to the noise level LNi.

**Note**

Because LINEAR is used, it is not possible to set mask areas.

**DUAL TRACE Parameter Setting**

This function enables more precise analyses by measuring waveforms with different measurement resolutions at trace A and trace B and also by performing measurements with resolutions different in noise level from the signal level of each channel.

When “DUAL TRACE” is ON, targets for the analysis of each trace are as follows:

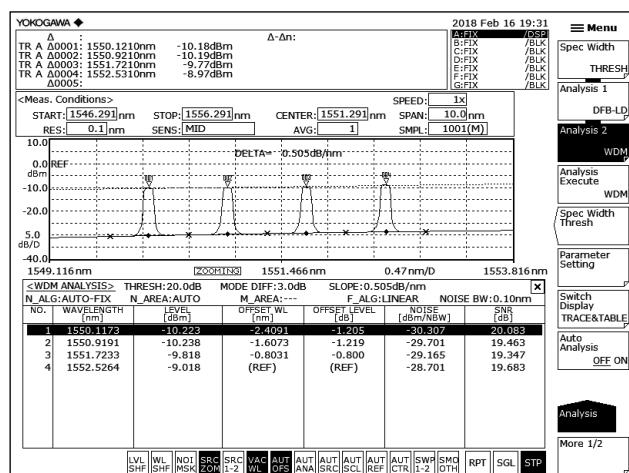
TRACE A: trace subject to channel detection

TRACE A: calculation traces  $\lambda_i$  and  $L_i$

TRACE B: noise level  $L_{Ni}$  calculation trace

**OUTPUT SLOPE Function**

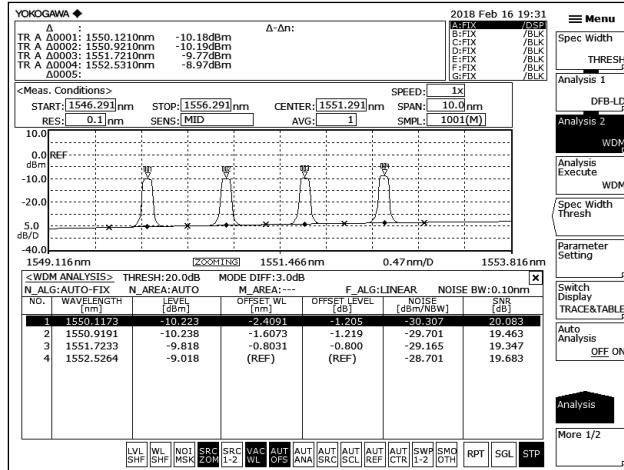
The parameter “OUTPUT SLOPE” provides a function to obtain the least square approximation curve of channel peaks. This function makes it possible to measure gain tilts. If “OUTPUT SLOPE” is set to ON, results will be displayed in the waveform display section and in the analysis table.



## Items to be Displayed When DISPLAY is Set

### ABSOLUTE

Results of analyses are displayed with absolute values.



### Explanations of displayed items

NO: Channel number

WAVELENGTH: Center wavelength  $\lambda_i$  of the channel

LEVEL: Level (peak level – noise level) of the channel

OFFSET WL: Relative wavelength to the wavelength of the reference channel (REF)

OFFSET LVL: Relative wavelength to the wavelength of the reference channel (REF)

SPCAING: Wavelength spacing to the adjacent channel

LVL DIFF: Level difference from then adjacent channel

NOISE: Noise level of the channel

SNR: SNR value of the channel

• OFFSET WL/LVL is displayed when the parameter CH RELATION is “OFFSET.”

SPACING and LVL DIFF are displayed when the parameter CH RELATION is “SPACING.”

• When ABSOLUTE and CH RELATION are OFFSET, it is possible either to set the reference channel to the mode peak with the highest level or to set a mode peak that will become the reference arbitrarily.

• When REF CH is HIGHEST

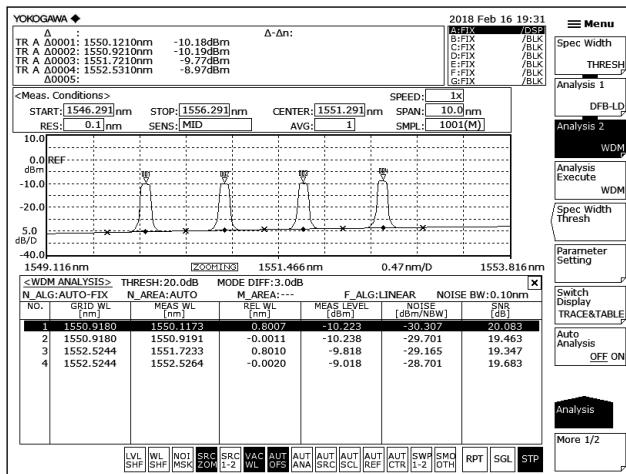
The WDM mode peak with the highest level shall be the reference. The wavelength difference and level difference (LOG) compared to it shall be OFFSET WL and OFFSET LVL of each WDM mode peak.

• When REF CH is \*\*\*

REF CHANNEL\*\*\* shall be the reference. The wavelength difference and level difference (LOG) against it shall be OFFSET WL and OFFSET LVL of each WDM mode peak. (If the \*\*\*th mode peak does not exist, the WDM mode peak on the longest wavelength shall be the reference.)

## RELATIVE

Of the analysis results, wavelength values are displayed as relative values to the values in the grid table.



### Explanations of displayed items

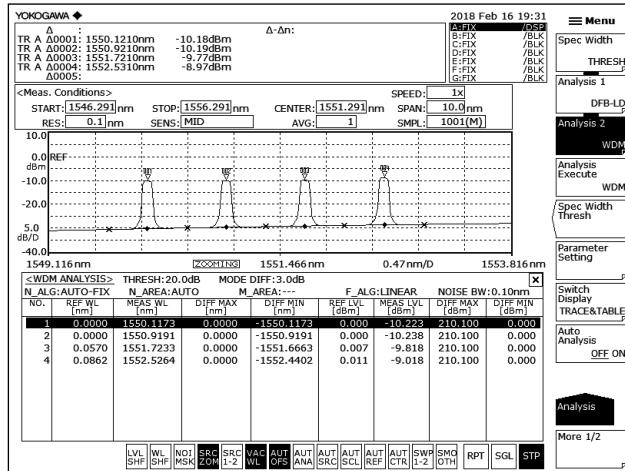
NO: Channel number  
 GRID WL: Grid wavelength of the channel  
 MEAS WL: Center wavelength  $\lambda_i$  of the channel  
 REL WL: Relative wavelength to the grid wavelengths of the channel  
 MEAS LVL: Level (peak level – noise level) of the channel  
 NOISE: Noise level of the channel  
 SNR: SNR value of the channel

App

Appendix

## DRIFT(MEAS)

Wavelengths measured previously are used as references to display wavelength/level changes (drifts).



### Explanations of displayed items

NO: Channel number

REF WL: Reference wavelength of the channel (previous wavelength measured)

MEAS WL: Center wavelength  $\lambda_i$  of the channel

DIFF MAX (wavelength): Maximum value of the relative wavelength to the reference wavelength of the channel

DIFF MIN (wavelength): Minimum value of the relative wavelength to the reference wavelength of the channel

REF LVL: Reference level of the channel (previous measurement level)

MEAS WL: Measurement level of the channel

DIFF MAX (level): Maximum value of the relative level to the reference level of the channel

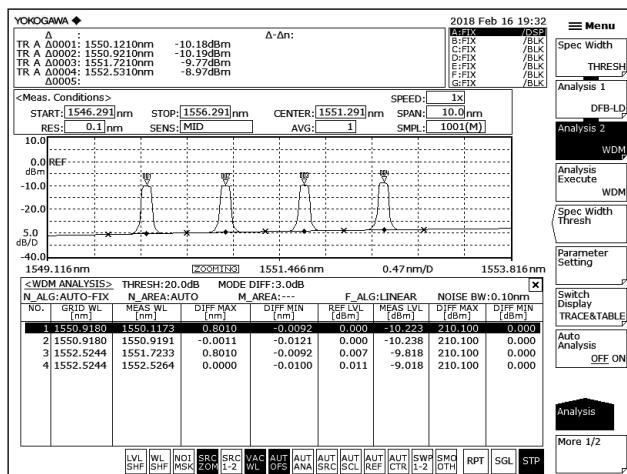
DIFF MIN (level): Minimum value of the relative level to the reference level of the channel

Reference wavelength/level can be changed under the following conditions.

- Active trace waveform data when MAX/MIN RESET is set by the parameter.
- The first waveform data measured when wavelength axes (SPAN WL/START WL/STOP WL) were changed according to the measurement conditions.

**DRIFT(GRID)**

Grid wavelengths are used as references to display wavelength/level changes (drifts). Note that reference levels are previous measurement levels.

**Explanations of displayed items**

NO: Channel number

GRID WL: Reference wavelength of the channel (grid wavelength)

MEAS WL: Center wavelength  $\lambda_i$  of the channel

DIFF MAX (wavelength): Maximum value of the relative wavelength to the reference wavelength of the channel

DIFF MIN (wavelength): Minimum value of the relative wavelength to the reference wavelength of the channel

REF LVL: Reference level of the channel (previous measurement level)

MEAS WL: Measurement level of the channel

DIFF MAX (level): Maximum value of the relative level to the reference level of the channel

DIFF MIN (level): Minimum value of the relative level to the reference level of the channel

- Absolute values and reference values to the grid table are displayed. The grid table can be freely configured.
- Reference wavelengths/levels can be changed under the following conditions:
  - When MAX/MIN RESET is set by the parameter, reset is performed by the active trace waveform data.
  - Reset is performed by the first waveform data that was measured when wavelength axes (SPAN WL/START WL/STOP WL) were changed by measurement conditions.

# Appendix 5 Optical Amp Analysis Function

This function analyzes gains and NF (noise figures) of optical fiber amplifiers.

## Analysis Items

$\lambda_i$	Center wavelength of each channel. Center frequency in frequency mode.
LIN <sub>i</sub>	Signal optical power of each channel (after OFFSET compensation)
LOUT <sub>i</sub>	Output optical power of each channel (after OFFSET compensation)
LASE <sub>i</sub>	ASE power of each channel (after OFFSET compensation)
R <sub>bi</sub>	Measurement resolution of each channel
G <sub>i</sub>	Gain of each channel
NF <sub>i</sub>	NF of each channel

## Parameters

### Channel Detection Parameters

Parameter Name	Default	Setting Range	Unit	Description
THRESH	20.0	0.1 to 99.9	dB	Threshold value for channel detection.
MODE DIFF	3.0	0.0 to 50.0	dB	Minimum value for peak/bottom difference during channel detection.
OFFSET(IN)	0.00	-99.99 to 99.99	dB	Level offset value of signal optical power.
OFFSET(OUT)	0.00	-99.99 to 99.99	dB	Level offset value of output optical power.
ASE ALGO	AUTO-FIX	AUTO-FIX MANUAL-FIX AUTO-CTR MANUAL-CTR	-	Selection of the algorithm for ASE level measurement.
FITTING AREA	0.40nm	0.01 to 10.00nm	nm	A range of waveform data for use in ASE level analysis is specified as a range centering on channel wavelengths. When A_ALGO is: AUTO-FIX: "AUTO" • MANUAL-FIX: ** • AUTO-CTR: "Between Ch" • MANUAL-CTR: "Between Ch"
MASK AREA	0.20nm	0.01 to 10.00nm	nm	Specifies the signal optical spectrum range to be masked within the waveform data, while using the channel wavelength as its center. When A_ALGO is: • AUTO-FIX: "-" • MANUAL-FIX When F_ALGO is LINEAR: "-" Other cases: Parameter value input • AUTO-CTR: "-" • MANUAL-CTR When F_ALGO is LINEAR: "-" Other cases: Parameter value input Limiter is applied during input to ensure FITTING AREA $\geq$ MASK AREA.
FITTING ALGO	LINEAR	LINEAR GAUSS LORENZ 3RD POLY 4TH POLY 5TH POLY	-	Selection of a fitting algorithm for obtaining ASE levels.
POINT DISPLAY	ON	ON / OFF	-	ON/OFF of the function to display the data range used for fitting into the waveform window.

RES BW	CAL DATA	MEASURED CAL DATA	-	<p>Sets the method for calculating the measurement resolution RBI of each channel.</p> <p>MEASURED: The value of the THRESH 3dB width is determined for each channel from the TRACE B waveform and set to RBI.</p> <p>CAL DATA: The resolution bandwidth stored in the instrument is set to RBI.</p>
SHOT NOISE	ON	ON / OFF	-	<p>Selects whether the Shot Noise component is included in computation of the NF value.</p> <p>ON: Included.</p> <p>OFF: Not included.</p>

### Other settings

Parameter Name	Default	Setting Range	Unit	Description
SIGNAL POWER	PEAK	PEAK INTEGRAL	-	<p>Setting of the signal optical power calculation method</p> <p>PEAK: Peak level value</p> <p>INTEGRAL: Level value obtained by integration</p>
INTEGRAL RANGE	10.0	1.0 to 999.9	GHz	<p>Setting of the integral range for determining the signal optical power</p> <p>Valid when the SIGNAL POWER setting is INTEGRAL.</p> <p>If the set value is <math>\Delta f</math>, the integral is calculated in the range of channel center wavelength <math>\pm \Delta f</math>.</p>

## Analysis Algorithm

1. WDM analysis is performed on the signal optical waveform data of TRACE A to perform channel detection. However, the DISPLAY MASK parameter is not used.
2. The center wavelength  $\lambda_i$  of each channel and signal optical level  $LIN'i$  of TRACE A optical signal are determined according to the SIGNAL POWER parameter setting. (The computation of the power value from this point uses linear values.)
  - For "PEAK"  
 $LIN'i$  = The level of each mode peak
  - For "INTEGRAL"  
 $LIN'i$  = The integral of the power value in the range of the center wavelength  $\pm\Delta f$  [GHz] of each mode  
( $\Delta f$ : the INTEGRAL RANGE parameter setting value)
3. The output optical level  $LOUT'i$  of each channel is determined from the output optical waveform data of TRACE B according to the SIGNAL POWER parameter setting.
  - For "PEAK"  
 $LOUT'i$  = The level of each mode peak
  - For "INTEGRAL"  
 $LOUT'i$  = The integral of the power value in the range of the center wavelength  $\pm\Delta f$  [GHz] of each mode  
( $\Delta f$ : the INTEGRAL RANGE parameter setting value)
4.  $LIN'i$  and  $LOUT'i$ , which are generated by compensating OFFSET (IN,OUT) for signal optical level and output optical level, respectively are determined.
5. The fitting area and mask area for performing the ASE fitting are determined according to the setting of the parameter ASE ALGO.
6. Measurement resolution  $RBi$  of each channel is determined.
  - MEASURED: The value of the THRESH 3dB width for each channel is determined from the TRACE B waveform and assigned to  $RBi$ .
  - CAL DATA: The resolution bandwidth stored in the instrument is assigned to  $RBi$ .
7. The signal optical SE elements contained in the output optical spectrum is removed in the following order, and the result is written into TRACE C.
  - Levels (linear) on both sides of the channel of the fitting area that was obtained in 5 are determined.
  - The obtained levels on both sides are used to obtain the ASE level  $L'ASEi$  via the linear interpolation.  
At this point, if the SIGNAL POWER parameter is "INTEGRAL",  $L'ASEi$  is converted to a level near the integration range  $\pm f$  [GHz].
    - $LASEi$ , which is generated by compensating OFFSET (OUT) for the provisional ASE level  $L'ASEi$  is determined.
    - Gain  $Gi$  (linear) is determined from the following equation.  
 $Gi = (LOUTi - LASEi)/LINi$
    - The TRACE A data (linear) is multiplied by the gain  $Gi$  and subtract the result from the TRACE B data (linear). Then, the result is written into TRACE C. (The signal light SE component contained in the output optical spectrum is eliminated.)
8. In the TRACE C data (linear) generated in 7, fitting is performed according to the settings of the parameter FITTING ALGO, and the estimated ASE spectrum is created in TRACE C.
  - The data used in the fitting is from the range of the center wavelength of each channel  $\pm$  FITTING AREA to the range of MASK AREA.
  - The level at  $\lambda_i$  in TRACE C is determined in terms of the ASE level  $LASE\_AMP'i$  with the signal light SE component removed.
  - $LASE\_AMP'i$  is determined by compensating OFFSET (OUT).

NF (linear) is calculated from the following equations.

NF value (during the air wavelength mode)

$$NFi = \frac{N(\lambda_i)^2}{h \times c^2} \times \frac{\lambda_i^3}{RBi} \times \frac{LASE\_AMPi}{Gi} + \frac{1}{Gi} \quad (\text{SHOT NOISE parameter: ON})$$

$$NFi = \frac{N(\lambda_i)^2}{h \times c^2} \times \frac{\lambda_i^3}{RBi} \times \frac{LASE\_AMPi}{Gi} \quad (\text{SHOT NOISE parameter: OFF})$$

NF value (during the vacuum wavelength mode)

$$NFi = \frac{1}{h \times c^2} \times \frac{\lambda_i^3}{RBi} \times \frac{LASE\_AMPi}{Gi} + \frac{1}{Gi} \quad (\text{SHOT NOISE parameter: ON})$$

$$NFi = \frac{1}{h \times c^2} \times \frac{\lambda_i^3}{RBi} \times \frac{LASE\_AMPi}{Gi} \quad (\text{SHOT NOISE parameter: OFF})$$

where  $N(\lambda_i)$ : Refraction index of the air

$C$ : Speed of light in the vacuum ( $1.99792458 \times 10^8$ [m/s])

$h$ : Planck's constant  $6.6260755 \times 10^{-34}$  [J•s]

- $NFi$ ,  $Gi$ , and  $LASE\_AMPi$  are converted into LOG.

## Automatic Parameter Setting Function

This instrument has a function that automatically configures the fitting area and mask area settings.

### AUTO-FIX

#### ASE Algorithm

The fitting algorithm is LINEAR.

Since the algorithm is LINEAR, the mask area setting will not be required.

The left and right fitting areas (NA\_Ri, NA\_Li) of each channel are determined according to the number of detected channels as follows:

#### When the number of channels “n” is 1

The measurement resolution of trace B and the value of the noise measurement point FITTING AREA in accordance with the resolution are determined internally, and then the values are found from the following equations.

$$NA_{Ri} = \lambda_i + FITTING\ AREA$$

$$NA_{Li} = \lambda_i - FITTING\ AREA$$

#### When the number of channels “n” is 2 or more

The channel spacing of each channel (spacing of  $\lambda_i$ ) is determined. With the minimum spacing assigned to SPACING and using  $FITTING\ AREA = SPACING / 2$ , the FITTING AREA is determined using the following equation.

$$FITTING\ AREA = SPACING / 2$$

$$NA_{Ri} = \lambda_i + FITTING\ AREA \quad (i=1,2,\dots,n)$$

$$NA_{Li} = \lambda_i - FITTING\ AREA \quad (i=1,2,\dots,n)$$

### AUTO-CTR

#### ASE Algorithm

The fitting algorithm is LINEAR.

Since the algorithm is LINEAR, the mask area setting will not be required.

The left and right fitting areas (NA\_Ri, NA\_Li) of each channel are determined according to the number of detected channels as follows (while treating the center points between channels as NA\_Ri and NA\_Li).

#### When the number of channels “n” is 1

The measurement resolution of trace B and the value of the noise measurement point FITTING AREA in accordance with the resolution are determined internally, and then the values are found from the following equations.

$$NA_{Ri} = \lambda_i + FITTING\ AREA$$

$$NA_{Li} = \lambda_i - FITTING\ AREA$$

#### When the number of channels “n” is 2 or more

$$\lambda N1 = (3\lambda_1 - \lambda_2) / 2$$

$$i=2,3,\dots,n$$

$$\lambda Ni = (\lambda_i + \lambda_{i-1}) / 2$$

$$\lambda Nn+1 = (3\lambda - \lambda_{n-1}) / 2$$

When the above values are calculated, the following results will be obtained.

$$i=1,2,\dots,n$$

$$NA_{Li} = \lambda Ni$$

$$NA_{Ri} = \lambda N_{i+1}$$

# Appendix 6 Optical Filter Analysis Function

## FILTER PEAK Analysis Function

This function analyzes collectively the measured waveforms of optical filters via multiple parameters.

It can be used for filter analysis only if the number of modes is one. Items and algorithms for analysis are the same as in the AQ6317 series.

### Analysis Items

PEAK LVL: Peak level

PEAK WL: Peak wavelength

CENTER WL: Center wavelength

SPECTRUM WIDTH: Wavelength width at threshold value TH

RIPPLE WIDTH: Ripple width

CROSS TALK: Crosstalk

App

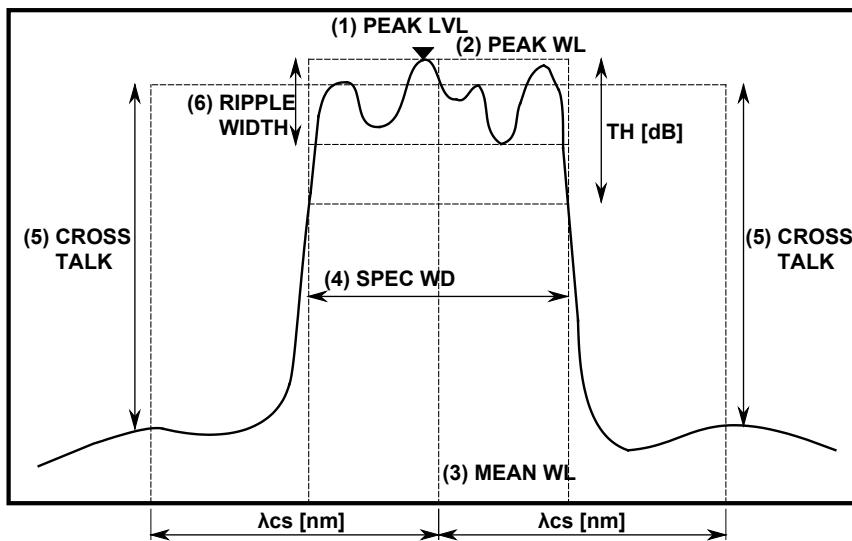
Appendix

## Appendix 6 Optical Filter Analysis Function

### Parameters

Item	Parameter Name	Default	Setting Range	Unit	Description
PEAK LEVEL	SW	ON	ON or OFF	-	Display ON/OFF switch.
PEAL WL	SW	ON	ON or OFF	-	Display ON/OFF switch.
CENTER WL	SW	ON	ON or OFF	-	Display ON/OFF switch.
	ALGO	THRESH	THRESH RMS	-	Selection of algorithm for spectrum width.
	THRESH LVL	THRESH : 3.00 RMS : 3.00	0.1 to 50.0	dB	Threshold value for channel detection.
	K	THRESH : 1.00 RMS : -	1.00 to 10.00	-	Multiplying factor Valid only when ALGO is THRESH.
	MODE FIT	THRESH : OFF RMS : -	ON or OFF	-	Whether "half of maximum point" is set to the mode peak. Valid only when ALGO is THRESH.
	MODE DIFF	THRESH : 3.00 RMS : -	0.0 to 50.0	dB	Minimum value of the peak/bottom difference during channel detection. Valid only when ALGO is THRESH.
SPECTRUM WIDTH	SW	ON	ON or OFF	-	Display ON/OFF switch.
	ALGO	THRESH	THRESH RMS	-	Selection of algorithm for spectrum width.
	THRESH LVL	THRESH : 3.00 RMS : 3.00	0.1 to 50.0	dB	Threshold value for channel detection.
	K	THRESH : 1.00 RMS : -	1.00 to 10.00	-	Multiplying factor Valid only when ALGO is THRESH.
	MODE FIT	THRESH : OFF RMS : -	ON or OFF	-	Whether "half of maximum point" is set to the mode peak. Valid only when ALGO is THRESH.
SPECTRUM WIDTH	MODE DIFF	THRESH : 3.00 RMS : -	0.0 to 50.0	dB	Minimum value of the peak/bottom difference during channel detection. Valid only when ALGO is THRESH.
RIPPLE WIDTH	SW	ON	ON or OFF	-	Display ON/OFF switch.
	THRESH LVL	3	0.1 to 50.0	dB	Threshold value for channel detection.
	MODE DIFF	0.5	0.000 to 50.000	dB	Minimum value for peak/bottom difference during channel detection.
CROSS TALK	SW	ON	ON or OFF	-	Display ON/OFF switch.
	ALGO	THRESH	THRESH PK LVL GRID	-	Selection of algorithm for spectrum width.
	THRESH LVL	THRESH : 3.00 PK LVL : - GRID : -	0.1 to 50.0	dB	Threshold value for channel detection. Valid only when ALGO is THRESH.
	K	THRESH : 1.00 PK LVL : - GRID : -	1.00 to 10.00	-	Multiplying factor Valid only when ALGO is THRESH.
	MODE FIT	THRESH : OFF PK LVL : - GRID : -	ON or OFF	-	Whether "half of maximum point" is set to the mode peak. Valid only when ALGO is THRESH.
	MODE DIFF	THRESH : 3.00 PK LVL : - GRID : -	0.0 to 50.0	-	Minimum value of the peak/bottom difference during channel detection. Valid only when ALGO is THRESH.
	CH SPACE	0.4	0.00 to 50.00	nm	Channel spacing setting.
	SEARCH AREA	0.01	0.01 to 10.00	nm	Analysis range setting. Valid only when ALGO is GRID.

## Analysis Details



(1) Peak level (PEAK LVL) value of the level at the waveform peak position  
 (2) Peak wavelength (PEAK WL) value of the wavelength at the waveform peak position  
 (3) Center wavelength (MEAN WL): value of the center wavelength at the threshold value TH  
 (4) Spectrum width (SPEC WD): spectrum width at the threshold value TH  
 (5) Cross talk (CRS TALK)

In the case of THRESH / PEAK LV algorithms

The value of the level on the reference wavelength (MEAN WL for THRESH and PEAK WL for PEAK LV) is determined. Also, the value of the level at the wavelength which is  $\pm\lambda_{\text{CH SPACE}}[\text{nm}]$  away from the reference wavelength is determined. Then, the difference in level value between the two is assumed to be the cross talk.

In the case of ITU-T algorithms

The ITU-T grid wavelength, which is nearest to the peak wavelength, is assigned to the reference wavelength. The difference between the bottom level within the range of the reference wavelength  $\pm\lambda_{\text{SEARCH AREA}}[\text{nm}]$  and the peak level within the range of the position  $\pm\lambda_{\text{CH SPACE}}[\text{nm}]$  away from the reference wavelength  $\pm\lambda_{\text{SEARCH AREA}}[\text{nm}]$  are assumed to be the cross talk.

(6) Ripple width (RIPPLE WD) A spectrum width search is performed. The value of the peak level – bottom level within the obtained spectrum width is assumed to be the ripple width.

#### Note

- Unless the parameter “MODE DIFF” is set to a value smaller than uneven portions of a waveform regarded as a ripple, RIPPLE = 0 will result.
- RIPPLE = 0 if the parameter setting is “THRESH” < “MODE DIFF”

## **FILTER BOTTOM Analysis Function**

This function analyzes collectively the measured waveforms of optical filters via multiple parameters.

It is used for filter analysis if the number of modes is one. Items and algorithms for analysis are the same as in the AQ6317 series.

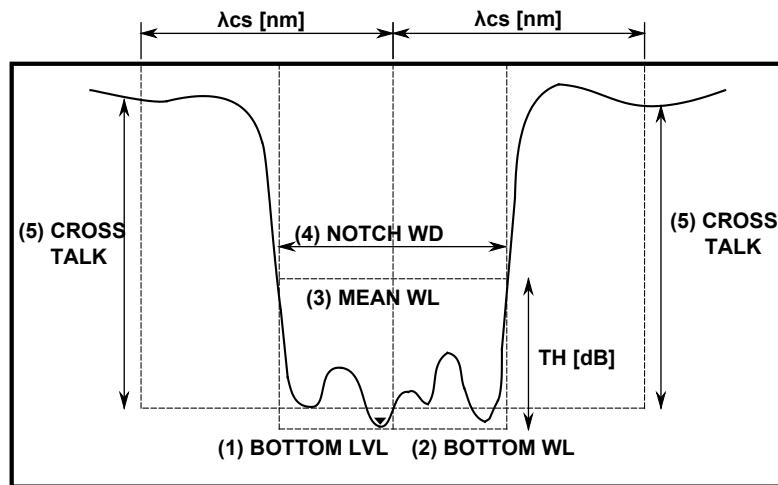
### **Analysis Items**

BOTTOM LVL:	Bottom level
BOTTOM WL:	Bottom wavelength
CENTER WL:	Center wavelength
NOTCH WIDTH:	Notch width
CROSS TALK:	Crosstalk

### **Parameters**

Item	Parameter Name	Default	Setting Range	Unit	Description
BOTTOM LEVEL	SW	ON	ON or OFF	-	Display ON/OFF switch.
BOTTOM WL	SW	ON	ON or OFF	-	Display ON/OFF switch.
CENTER WL	SW	ON	ON or OFF	-	Display ON/OFF switch.
	ALGO	BOTTOM	PEAK BOTTOM	-	Selection of algorithm for spectrum width.
	THRESH LVL	3	0.1 to 50.0	dB	Threshold value for channel detection.
	MODE DIFF	3	0.0 to 50.0	dB	Minimum value for peak/bottom difference during channel detection.
NOTCH	SW	ON	ON or OFF	-	Display ON/OFF switch.
WIDTH	ALGO	BOTTOM	PEAK BOTTOM	-	Selection of algorithm for spectrum width.
	THRESH LVL	3	0.1 to 50.0	dB	Threshold value for channel detection.
	MODE DIFF	3	0.0 to 50.0	dB	Minimum value for peak/bottom difference during channel detection.
					Valid only when ALGO is THRESH.
CROSS TALK	SW	ON	ON or OFF	-	Display ON/OFF switch.
	ALGO	BOTTOM	PEAK BOTTOM BOTTOM_LVL GRID	-	Selection of algorithm for spectrum width.
	THRESH LVL	3	0.1 to 50.0	dB	Threshold value for channel detection. Valid when ALGO is PEAK/BOTTOM.
	MODE DIFF	3	0.0 to 50.0	-	Multiplying factor Valid only when ALGO is THRESH.
	CH SPACE	0.4	0.0 to 50.00	nm	Channel spacing setting.
	SEARCH AREA	0.01	0.01 to 10.00	nm	Analysis range setting. Valid only when ALGO is GRID.

## Analysis Details



(1) Bottom level (BTM LVL) Value of level at the waveform bottom position  
 (2) Bottom wavelength (BTM WL) Value of wavelength at the waveform bottom position  
 (3) Center wavelength (MEAN WL) Value of center wavelength at the threshold value TH  
 (4) Notch width (NOTCH WD) Notch width at the threshold value TH  
 (5) Cross talk (CRS TALK)

In the case of PEAK / BOTTOM / BOTTOM LV algorithms

The level value at the reference wavelength (MEAN WL for PEAK/BOTTOM, BOTTOM WL for BOTTOM LV) is determined. Also, the level value at the wavelength which is  $\pm\lambda_{CH\ SPACE}$ [nm] away from the reference wavelength is determined. Then, the difference in level value between the two is assumed to be the cross talk.

In the case of ITU-T algorithms

The ITU-T grid wavelength, which is nearest the bottom wavelength, is assigned to the reference wavelength. The difference between the peak level within the range of the reference wavelength  $\pm\lambda_{SEARCH\ AREA}$ [nm] and the bottom level within the range of the position  $\pm\lambda_{CH\ SPACE}$ [nm] away from the reference wavelength  $\pm\lambda_{SEARCH\ AREA}$ [nm] is assumed to be the cross talk.

## WDM FILTER PEAK Analysis Function

This function analyzes collectively multiple items for each channel via the measured waveforms of multi-channel optical filters.

Unlike the FILTER PEAK analysis, filter analysis is possible on multi-mode waveforms.

### Analysis Items

Analysis Item	Description
Nominal Wavelength	Reference wavelength/frequency of each channel.
Peak Wavelength / Level	Peak wavelength/frequency and level of each channel.
xdB Width / Center Wavelength	xdB width of each channel and its center wavelength/frequency.
xdB stop-band	Wavelength width/frequency width across xdB of each channel.
xdB pass-band	Pass band xdB from the bottom within the test band of each channel.
Ripple	Max-min level (flatness) within the test band of each channel.
Cross Talk	Difference in level from the position xnm away from each channel.

### Parameters

Item	Parameter Name	Default	Setting Range	Unit
Channel Detection, Nominal Wavelength	ALGO	MEAN	PEAK / MEAN / GRID/ GRID FIT	-
	MODE DIFF	3	0.1 to 50.0	dB
	THRESH	20	0.1 to 99.9	dB
	TEST BAND	0.1	0.001 to 9.999	nm
Peak Wavelength/ Level	SW	ON	ON / OFF	-
XdB Width	SW	ON	ON / OFF	-
Center Wavelength	THRESH	3	0.1 to 50.0	dB
XdB stop-band	SW	ON	ON / OFF	-
	THRESH LVL	-10	-90.00 to 30.00	dB
XdB pass-band	SW	ON	ON / OFF	-
	THRESH	3.0	0.1 to 50.0	dB
	TEST BAND	0.20	0.01 to 99.99	nm
Ripple	SW	ON	ON / OFF	-
	TEST BAND	0.20	0.01 to 99.99	nm
Cross Talk	SW	ON	ON / OFF	-
	SPACING	0.80	0.01 to 99.99	nm
	TEST BAND	0.20	0.01 to 99.99	nm

**Analysis Algorithm****Channel Detection, Nominal Wavelength**

## Parameter

THRESH  
MODE DIFF  
ALGO  
TEST BAND

## Procedure

## PEAK

- Channel: Each mode peak detected via a mode search  
(except for the mode peaks at levels which are lower than the mode at the highest level by THRESH[dB] or less.)
- Reference wavelength: Wavelength of each mode peak.
- Peak wavelength/level: Wavelength and level of each mode peak.

## MEAN

- Channel: Each mode peak detected via a mode search  
(except for the mode peaks at levels which are lower than the mode at the highest level by THRESH[dB] or less.)
- Reference wavelength: 3 dB center wavelength at each mode peak.
- Peak wavelength/level: Wavelength and level of each mode peak.

## GRID FIT

- Channel: Modes within the range of grid wavelength  $\pm$  (TEST BAND/2) among the mode peaks detected via a mode search (except for the mode peaks at levels which are lower than the mode at the highest level by THRESH[dB] or less.)  
If the number of relevant modes in one grid is more than one, only the mode at the highest level will be regarded as the channel.
- Reference wavelength: Grid wavelength nearest to each channel.
- Peak wavelength/level: Wavelength and level of the mode peak of each channel.

## GRID

- Channel: A mode search is not be performed. All grid wavelengths within the range of analysis are used as channels.
- Reference wavelength: Grid wavelength of each channel
- Peak wavelength/level: Peak wavelength and peak level within the range of grid wavelength  $\pm$  (TEST BAND/2) of each channel.

### PEAK LVL/PEAK WL

Parameter

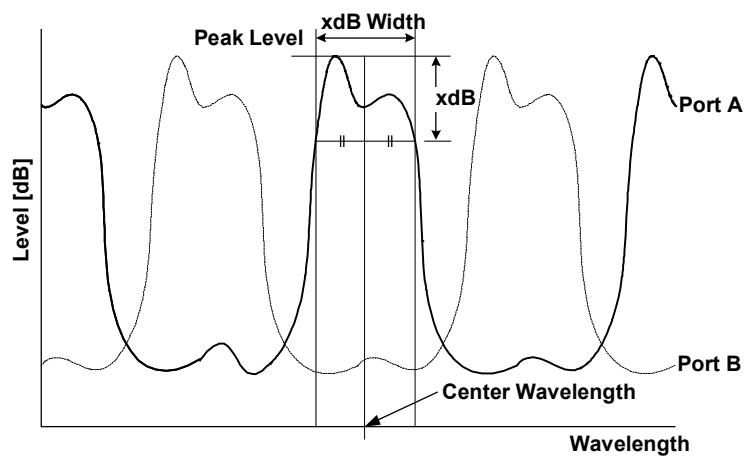
THRESH

MODE DIFF

Procedure

- WDM analysis is performed on the waveform data of an active trace, and channels are detected. However, the DISPLAY MASK parameter is not used.
- The mode peak wavelength (PEAK WL) of each channel of the active trace and its signal optical level (PEAK LVL) are determined.

### XdB Width



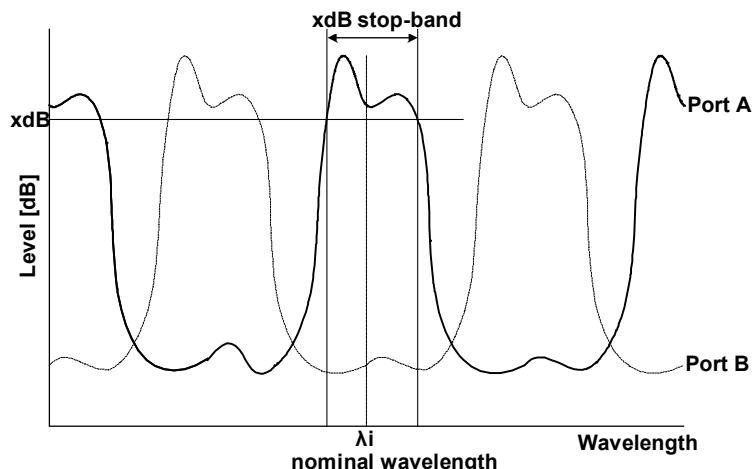
Parameter

THRESH

Procedure

The width (xdB\_Width), which is below the peak level LPi of each channel by the parameter THRESH\_LEVEL both on the left and on the right, and its center wavelength are determined.

The algorithm for analysis is the same as the algorithm THRESH of the spectrum width.

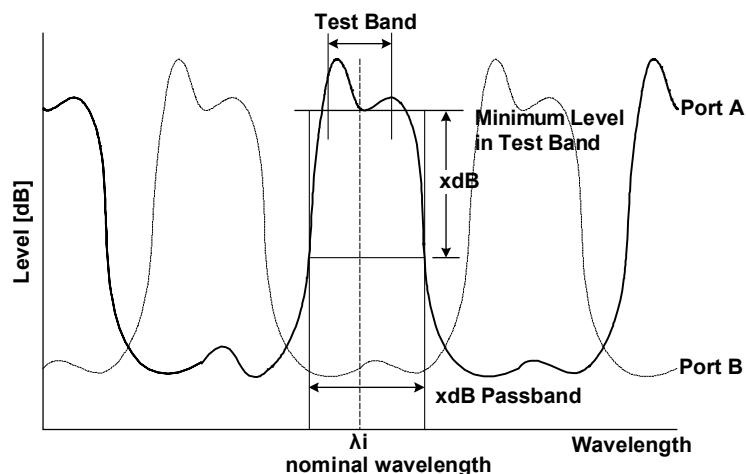
**XdB stop band**

## Parameter

THRESH

## Procedure

The width ( $xdB\_stop-band$ ) that centers on the reference wavelength  $\lambda_i$  of each channel and that is located below by the parameter THRESH\_LEVEL both on the left and on the right is determined.

**XdB pass-band**

## Parameter

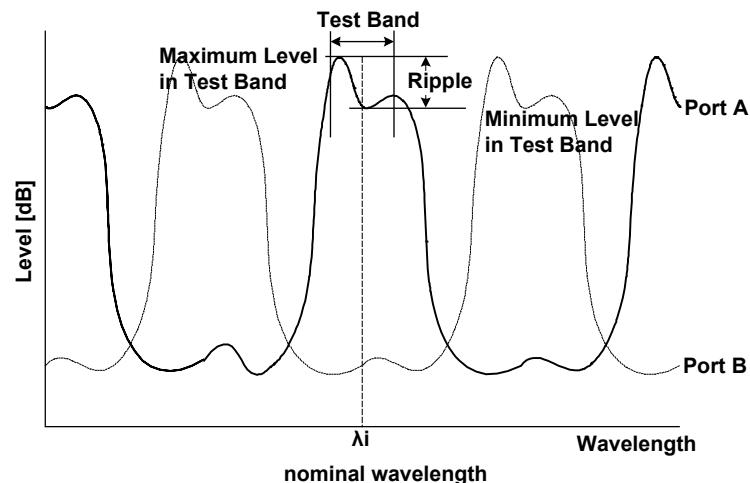
THRESH

TEST BAND

## Procedure

- A bottom search is performed within the range of parameter  $Test\_Band/2$  by centering on reference wavelength  $\lambda_i$  of each channel and obtain the bottom level ( $LBi$ ).
- The width ( $xdB\_pass-band$ ) that is below the bottom level  $LBi$  obtained in the above procedure by the parameter THRESH\_LEVEL is determined.

### Ripple



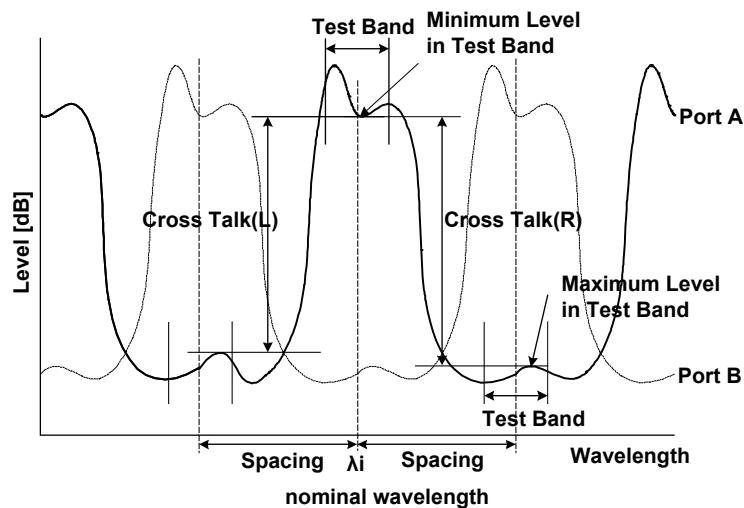
#### Parameter

##### TEST BAND

#### Procedure

- A peak search and bottom search are performed within the range of parameter Test\_Band/2 by centering on the reference wavelength  $\lambda_i$  of each channel, and the peak level ( $LP'i$ ) and the bottom level ( $LB'i$ ) are determined.
- The peak level ( $LP'i$ ) and bottom level ( $LB'i$ ) obtained in the above procedure are used to obtain the ripple from the following equation:

$$\text{Ripple} = LP'i - LB'i$$

**Cross Talk****Parameter**

SPACING

TEST BAND

**Procedure**

- A bottom search is performed within the range of parameter `Test_Band/2` by centering on reference wavelength ( $\lambda_i$ ) of each channel and obtain the bottom level ( $L_{Bi}$ ).
- A peak search is performed within the range of parameter `Test_Band/2` while centering on the point ( $\lambda_i - \lambda_{SP}$ ) that is obtained by subtracting the parameter `SPACING` from the reference wavelength  $\lambda_i$  of each channel. Then, the peak level ( $L_{PLi}$ ) is determined.
- A peak search is performed within the range of parameter `Test_Band/2` while centering on the point ( $\lambda_i + \lambda_{SP}$ ) that is obtained by adding the parameter `SPACING` to the reference wavelength  $\lambda_i$  of each channel. Then, the peak level ( $L_{PRi}$ ) is determined.
- The values obtained in the above procedure are used to obtain the left and right cross talks ( $X_{TLi}$ ,  $X_{TRi}$ ) of each channel from the following equations:  

$$X_{TLi} = L_{Bi} - L_{PLi}$$

$$X_{TRi} = L_{Bi} - L_{PRi}$$

## WDM FILTER BOTTOM Analysis Function

This function analyzes collectively multiple items for each channel via the measured waveforms of multi-channel optical filters.

Unlike the FILTER BOTTOM analysis, filter analysis is possible on multi-mode waveforms.

### Analysis Items

Analysis Item	Description
Nominal Wavelength	Reference wavelength/frequency of each channel.
Bottom Wavelength / Level	Peak wavelength/frequency and level of each channel.
xdB Notch Width frequency. / Center Wavelength	xdB notch width of each channel and its center wavelength/frequency.
xdB stop-band	Wavelength width/frequency width across xdB of each channel.
xdB Elimination band	Elimination band xdB from the bottom within the test band of each channel.
6Ripple	Max-min level (flatness) within the test band of each channel.
Cross Talk	Difference in level from the position xnm away from each channel.

### Parameters

Item	Parameter Name	Default	Setting Range	Unit
Channel Detection, Nominal Wavelength	ALGO	NOTCH(B)	PEAK / NOTCH(P) / NOTCH(B) / GRID / GRID FIT	-
	MODE DIFF	3.0	0.1 to 50.0	dB
	THRESH	20.0	0.1 to 99.9	dB
	TEST BAND	0.100	0.001 to 9.999	nm
Bottom Wavelength/Level	SW	ON	ON / OFF	-
XdB Width Center Wavelength	SW	ON	ON / OFF	-
	ALGORITHM	NOTCH(B)	NOTCH(P) / NOTCH(B)	-
	THRESH	3.0	0.1 to 50.0	dB
XdB stop-band	SW	ON	ON / OFF	-
	THRESH	-10.000	-90.000 to 30.000	dB
XdB Elimination band	SW	ON	ON / OFF	-
	THRESH	3.0	0.1 to 50.0	dB
	TEST BAND	0.20	0.01 to 99.99	nm
Ripple	SW	ON	ON / OFF	-
	TEST BAND	0.20	0.01 to 99.99	nm
Cross Talk	SW	ON	ON / OFF	-
	SPACING	0.80	0.01 to 99.99	nm
	TEST BAND	0.20	0.01 to 99.99	nm

## Analysis Algorithm

### NOMINAL WAVELENGTH

#### Parameter

ALGO  
MODE DIFF  
THRESH  
TEST BAND

#### Procedure

- BOTTOM
  - Channel: Each mode bottom detected by a mode search (except for the mode bottoms at levels which are above the mode at the lowest level by THRESH[dB] or more.)
  - Reference wavelength: Wavelength of each mode bottom.
  - Bottom wavelength/level: Wavelength/level of each mode bottom.
- NOTCH(B)
  - Channel: Each mode bottom detected by a mode search (except for the mode bottoms at levels which are above the mode at the lowest level by THRESH[dB] or more.)
  - Reference wavelength: 3 dB-center wavelength with each mode bottom as the reference (ALGO=BOTTOM).
  - Bottom wavelength/level: Wavelength and level of each mode peak.
- NOTCH(P)
  - Channel: Each mode peak detected via a mode search (except for the mode bottoms at levels which are above the mode at the lowest level by THRESH[dB] or more.)
  - Reference wavelength: 3 dB-center wavelength with each mode bottom as the reference (ALGO=PEAK).
  - Bottom wavelength/level: Wavelength/level of each mode bottom.
- GRID FIT
  - Channel: Modes within the range of grid wavelength  $\pm$  (TEST BAND/2) among the mode bottoms detected via a mode search (except for the mode bottoms at levels which are above the mode at the lowest level by THRESH[dB] or more.)  
If the number of relevant modes in one GRID is more than one, only the mode at the lowest level will be regarded as the channel.
  - Reference wavelength: Grid wavelength nearest to each channel.
  - Bottom wavelength/level: Wavelength and level of the mode bottom of each channel.
- GRID
  - Channel: A mode search is not be performed. All grid wavelengths within the range of analysis are used as channels.
  - Reference wavelength: Grid wavelength of each channel
  - Peak wavelength/level: Bottom wavelength and bottom level within the range of grid wavelength  $\pm$  (TEST BAND/2) of each channel.

### BOTTOM WL / BOTTOM LVL

Parameter

THRESH

MODE DIFF

Procedure

The wavelength  $\lambda_i$  of the mode bottom of each channel and its signal optical level  $L_i$  are determined.

### XdB\_NOTCH\_WIDTH/CENTER WAVELENGTH

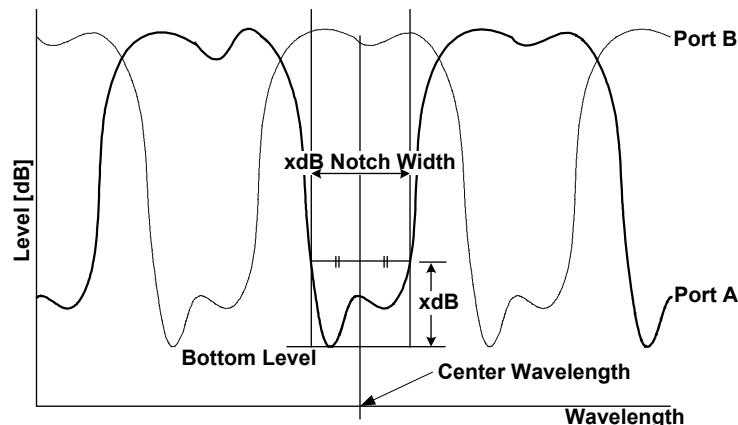
Parameter

ALGO

Procedure

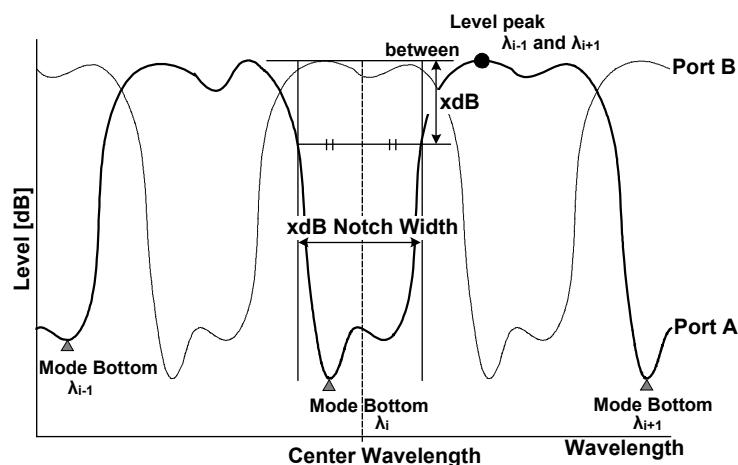
The xdB notch width (xdB\_Notch\_Width) of each channel and its center wavelength/frequency (Center\_Wavelength) are determined according to the settings of the parameter ALGO.

#### NOTCH(B)

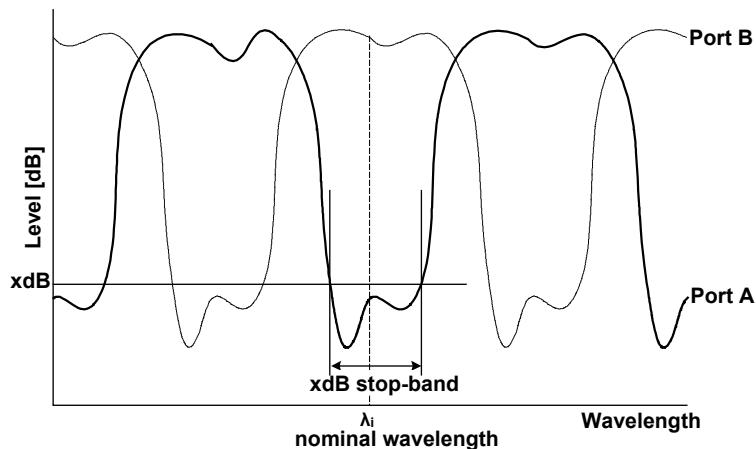


The width (xdB\_Notch\_Width) between the two points, which are above the bottom level of each channel by the parameter THRESH\_LEVEL, and its center wavelength (Center\_Wavelength) are determined.

#### NOTCH(P)



The width (xdB\_Notch\_Width) between the two points, which are below the higher point of either the left peak level or the right peak level of each channel by the parameter THRESH\_LEVEL, and its center wavelength/frequency (Center\_Wavelength) are determined.

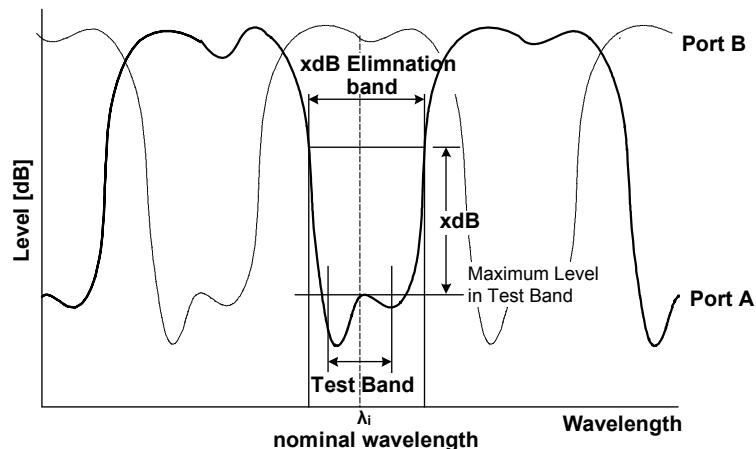
**XdB\_STOP-BAND**

Parameter

THRESH

Procedure

The width (xdB\_stop-Band) that centers on the nominal wavelength  $\lambda_i$  of each channel and that is located below by the parameter THRESH\_LEVEL both on the left and on the right is determined.

**XdB\_ELIMINATION BAND**

Parameter

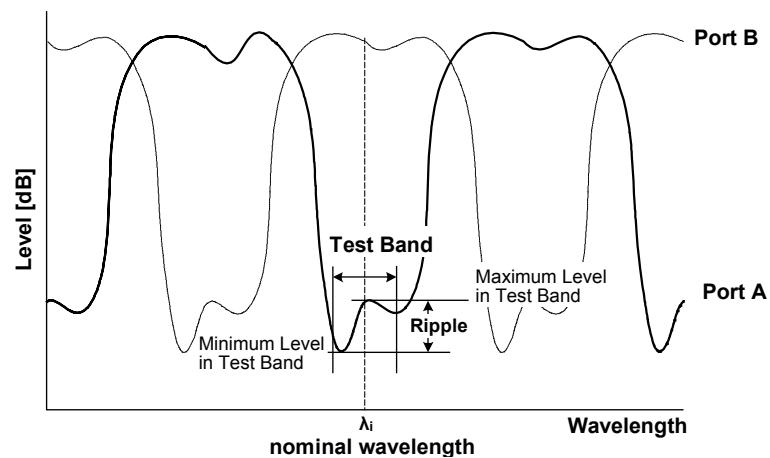
THRESH

TEST BAND

Procedure

- A peak search is performed within the range of the parameter Test\_Band/2 by centering on the nominal wavelength  $\lambda_i$  of a channel, and the peak level (LPI) is determined.
- The width (xdB\_Elimination\_Wavelength) that is above the peak level LPI obtained in the above procedure by the parameter THRESH\_LEVEL both on the left and on the right is determined.

**RIPPLE**



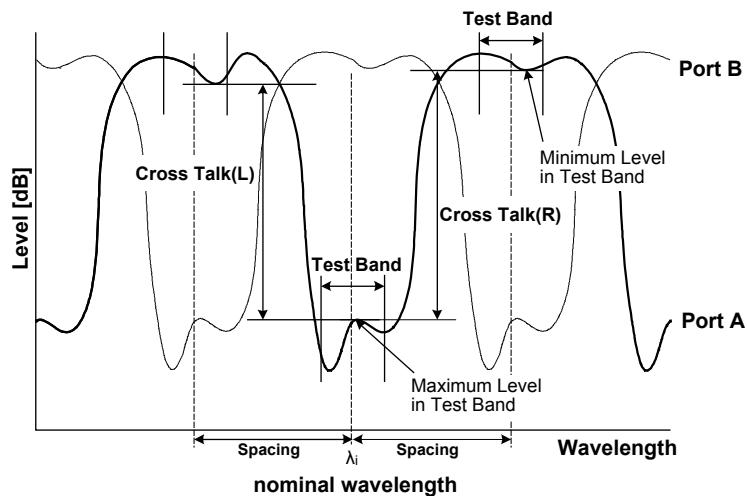
Parameter  
TEST BAND

Procedure

1. A peak search and bottom search are performed within the range of parameter Test\_Band/2 by centering on the reference wavelength  $\lambda_i$  of each channel, and the peak level ( $LP'i$ ) and the bottom level ( $LB'i$ ) are determined.
1. The peak level ( $LP'i$ ) and bottom level ( $LB'i$ ) obtained in the above procedure is used to obtain the ripple (Ripple) from the following equation:  

$$\text{Ripple} = LP'i - LB'i$$

## CROSS TALK



## Parameter

SPACING

TEST BAND

## Procedure

- A peak search is performed within the range of parameter Test\_Band/2 while centering on the reference wavelength  $\lambda_i$  of each channel, and the peak level ( $LP''i$ ) is determined.
- A bottom search is performed within the range of parameter Test\_Band/2 while centering on the point  $(\lambda_i - \lambda_{SP})$  that is obtained by subtracting the parameter SPACING ( $\lambda_{SP}$ ) from the reference wavelength  $\lambda_i$  of each channel. Then, the bottom level ( $LPLi$ ) is determined.
- A bottom search is performed within the range of parameter Test\_Band/2 while centering on the point  $(\lambda_i + \lambda_{SP})$  that is obtained by subtracting the parameter SPACING ( $\lambda_{SP}$ ) from the reference wavelength  $\lambda_i$  of each channel. Then, the bottom level ( $LPri$ ) is determined.
- The values obtained in the above procedure are used to obtain the left and right cross talks ( $XTLi$ ,  $XTRi$ ) of each channel from the following equations:  

$$XTLi = LP''i - LPLi$$

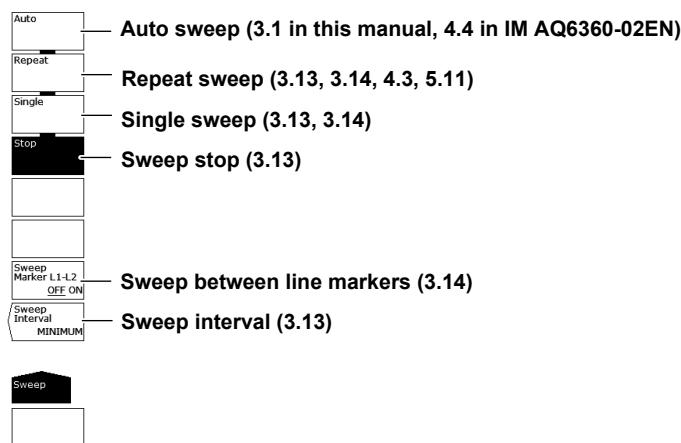
$$XTRi = LP''i - LPri$$

# Appendix 7 Function Menu Tree Diagram

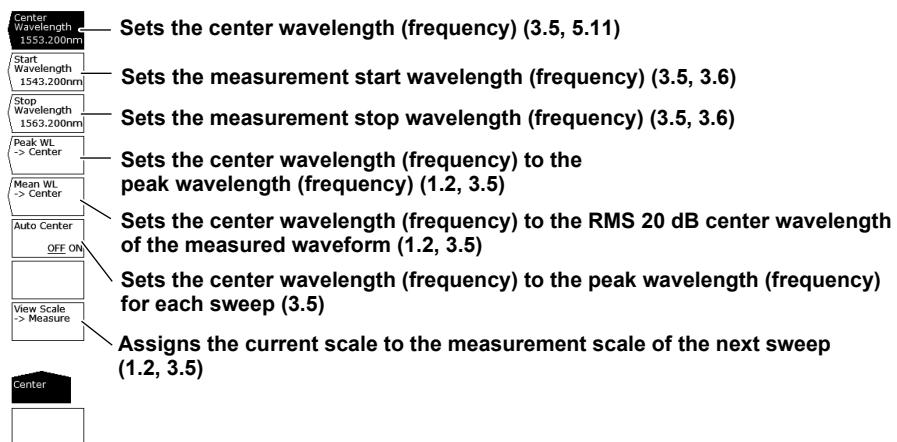
The menu structure of the instrument is illustrated below.

Some menus have been omitted.

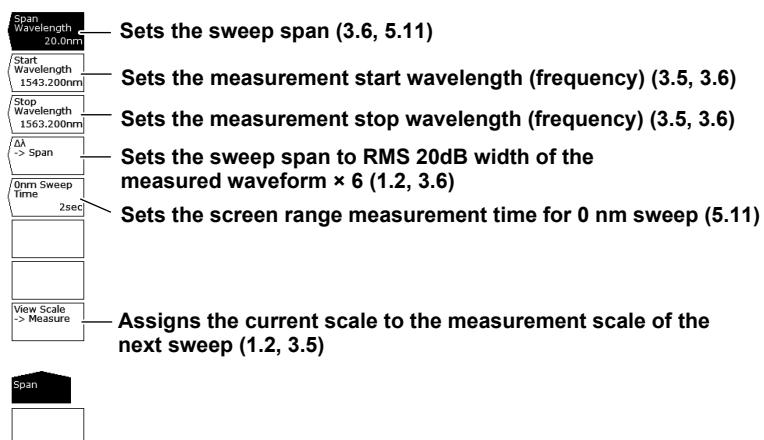
## SWEEP



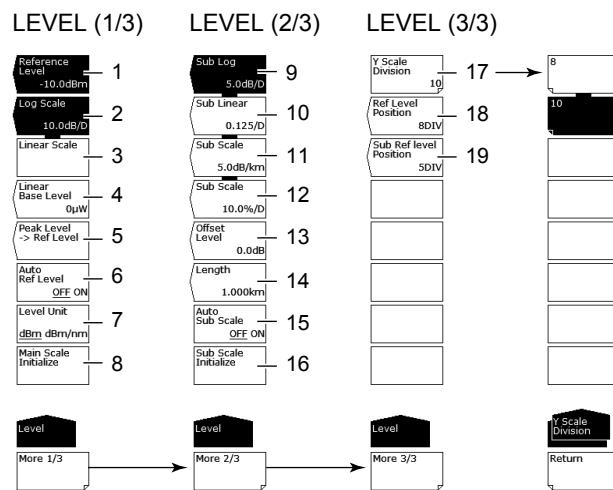
## CENTER



## SPAN

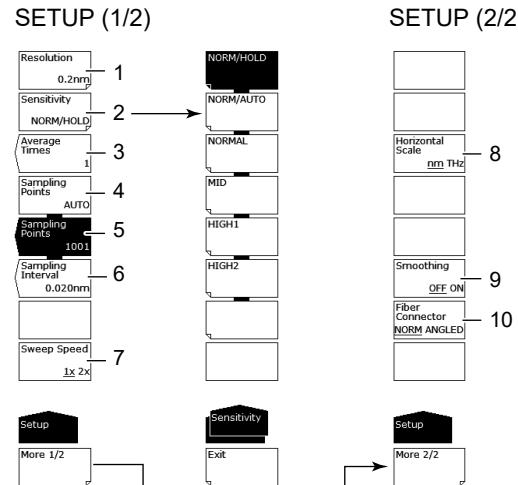


## LEVEL

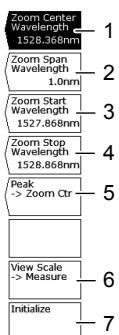
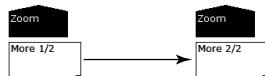


- 1 Reference level setting (3.1, 3.4)
- 2 LOG scale setting (3.2, 3.4)
- 3 Linear scale setting (3.2, 3.4)
- 4 Linear scale bottom settings (3.2)
- 5 Setting the peak level to the reference level (1.2, 3.4)
- 6 Automatic setting of reference level (3.4)
- 7 Vertical scale unit setting (3.2)
- 8 Initialization of the main vertical scale (3.2)
- 9 Setting the sub scale to LOG (3.3)
- 10 Setting the sub scale to LINEAR (3.3)
- 11 Setting the sub scale to dB/km (3.3)
- 12 Setting the sub scale to % (3.3)
- 13 Linear subscaler bottom setting or offset level setting for LOG (3.3)
- 14 Optical fiber length setting (3.3)
- 15 Automatic scaling of subscaler (3.3)
- 16 Initialization of the sub vertical scale (3.3)
- 17 Number of divisions in the level axis (3.2)
- 18 Reference level position on the screen (3.2)
- 19 Reference level position on the sub scale (3.3)

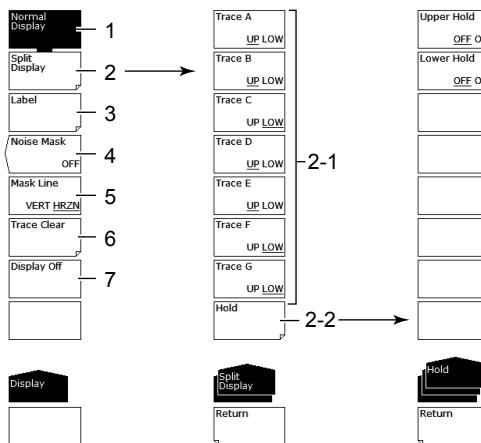
## SETUP



- 1 Measurement resolution setting (3.7, 5.11 in this manual, 4.4 in IM AQ6360-02EN)
- 2 Measurement sensitivity (3.9)
- 3 Average times setting (3.11)
- 4 Automatic sampling points setting (3.7, 3.8)
- 5 Manual sampling points setting (3.8)
- 6 Sampling interval setting (3.8)
- 7 Sweep speed setting (3.10)
- 8 Horizontal scale unit setting (3.2)
- 9 Smoothing (3.16)
- 10 Fiber connector setting (2.5 in IM AQ6360-02EN)

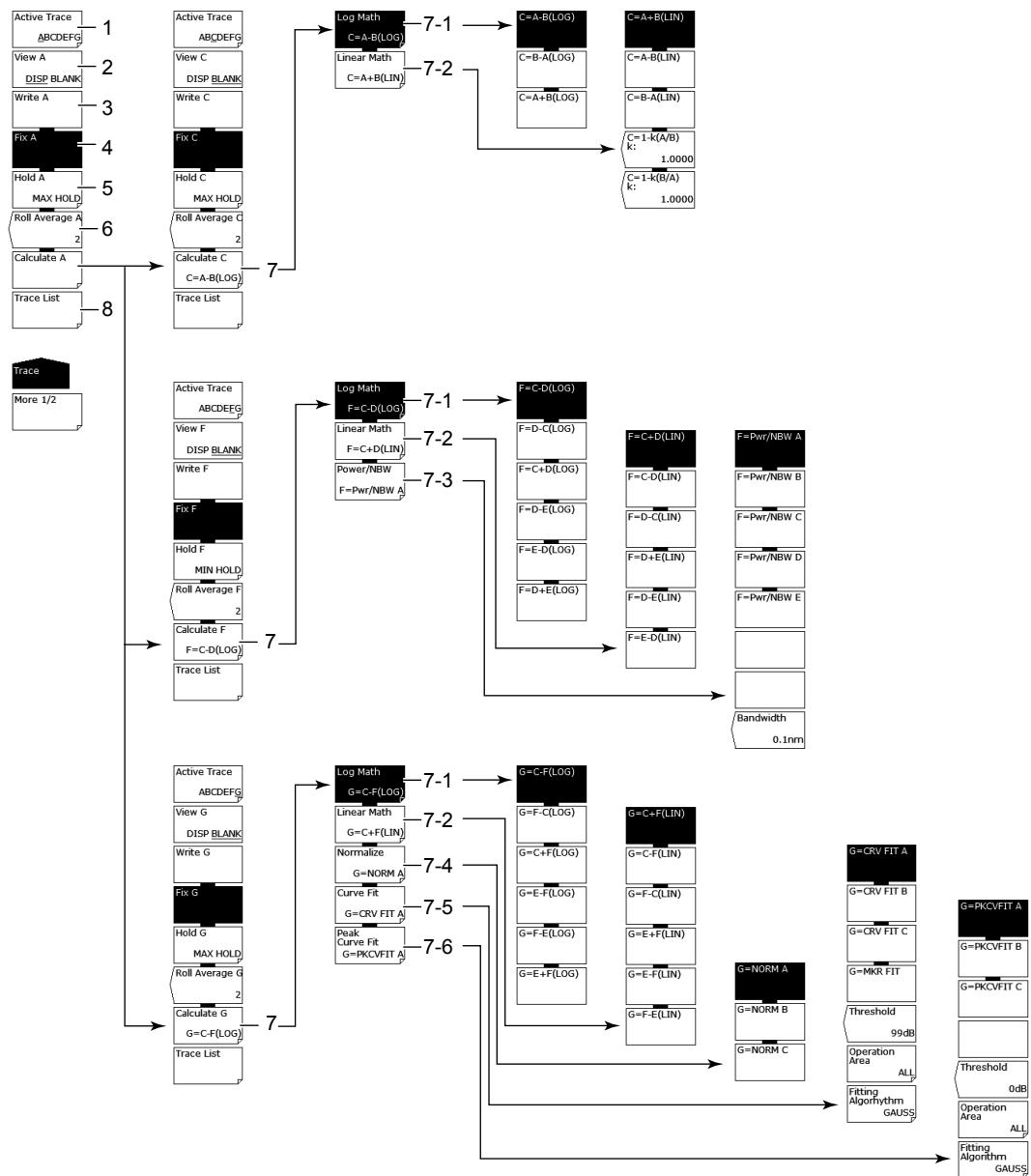
**ZOOM****ZOOM (1/2)****ZOOM (2/2)**

- 1 Setting the center wavelength (frequency) of the zoom display (4.1)
- 2 Setting the span of the zoom display (4.1)
- 3 Setting the start point of the zoom display (4.1)
- 4 Setting the stop point of the zoom display (4.1)
- 5 Setting the peak position to the center of the zoom display (1.2, 4.1)
- 6 Assigning the current scale to the measurement scale of the next sweep (1.2, 3.5)
- 7 Initializing the display scale (4.1)
- 8 Setting the display position of the overview (4.1)
- 9 Setting the size of the overview (4.1)

**DISPLAY****App****Appendix**

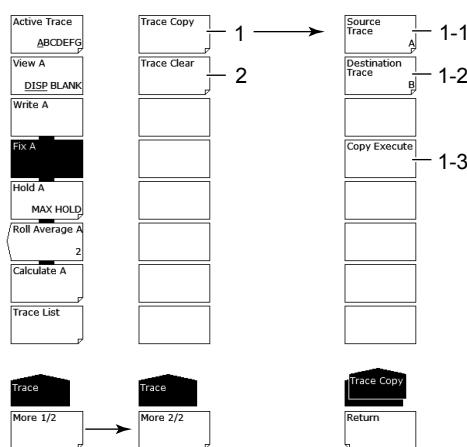
- 1 Normal display (4.10)
- 2 Split display (4.10)
  - 2-1 Display position setting (4.10)
  - 2-2 Display position fixing (4.10)
- 3 Label setting (3.3 in IM AQ6360-02EN)
- 4 Noise mask setting (4.11)
- 5 Mask method setting (4.11)
- 6 Trace clearing (4.12)
- 7 Turning the display off (7.7)

**TRACE(More 1/2)**



- 1 Active trace setting (3.12, 4.2 to 4.8, 5.8, 5.9)
- 2 Show/hide active trace setting (3.12, 4.2 to 4.8, 5.8, 5.9)
- 3 Setting active trace to write mode (3.12, 4.2, 5.8, 5.9)
- 4 Setting active trace to fix mode (4.2, 5.8, 5.9)
- 5 Setting active trace to MAX/MIN hold mode (4.3)
- 6 Setting active trace sweeping to average mode (4.4)
- 7 Trace-to-trace calculation settings (trace C, F, G only) (4.5 to 4.8, 5.9)
  - 7-1 Trace-to-trace calculation in LOG (4.5, 5.9)
  - 7-2 Trace-to-trace calculation in LIN (4.5)
  - 7-3 Power spectral density display (trace F only) (4.5, 4.8)
- 8 Trace condition list display (4.12)

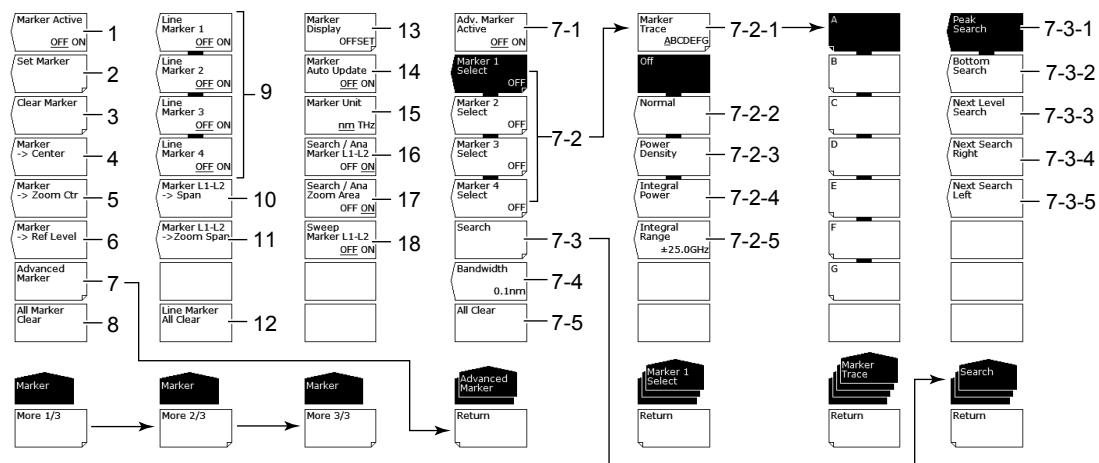
## TRACE(More 2/2)



- 1 Copy trace (4.12)
  - 1-1 Copy source trace setting (4.12)
  - 1-2 Copy target trace setting (4.12)
  - 1-3 Execute copy (4.12)
- 2 Trace clearing (4.12)

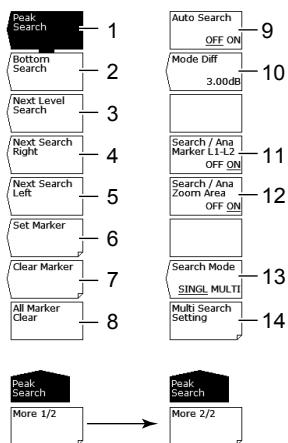
## **Appendix 7 Function Menu Tree Diagram**

## MARKER



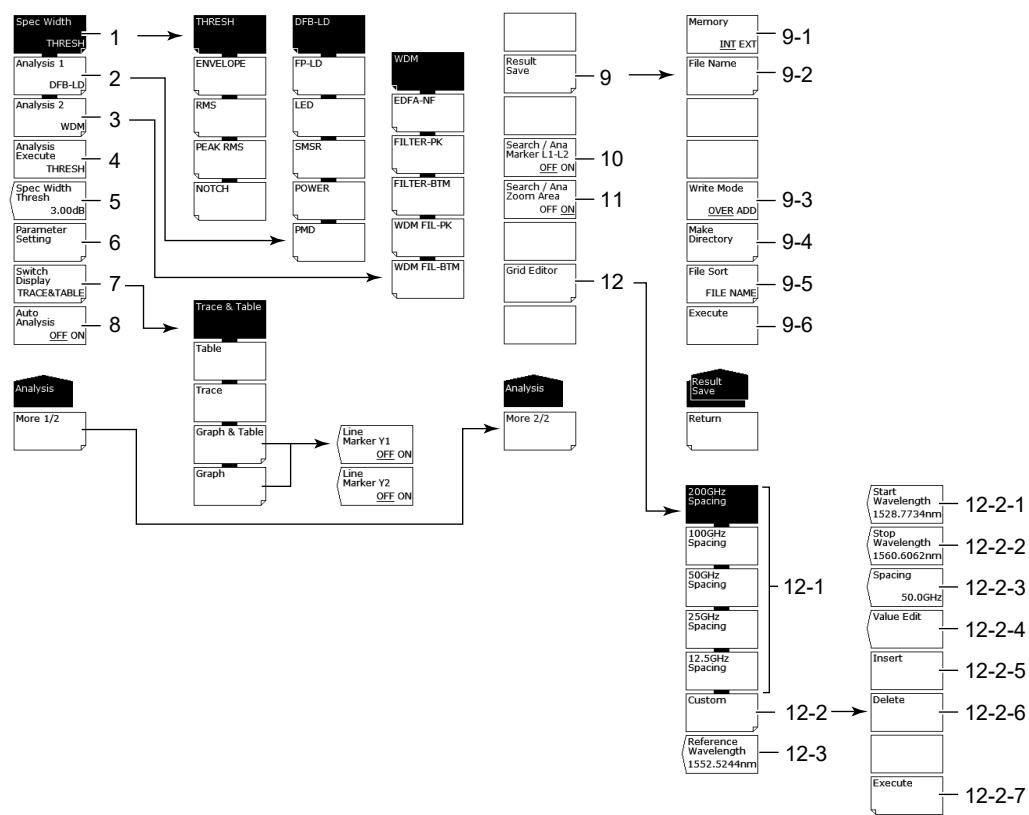
- 1 Moving marker display on/off (4.9)
- 2 Setting moving markers to fixed markers (4.9, 4.13)
- 3 Clearing fixed markers (4.9, 4.13)
- 4 Setting the moving marker wavelength (frequency) to measurement center (1.2, 3.5, 4.9)
- 5 Setting the moving marker wavelength (frequency) to display scale center (1.2, 4.9)
- 6 Setting the moving marker level to reference level (1.2, 3.4, 4.9)
- 7 Advanced marker display (4.9)
  - 7-1 Advanced marker display on/off (4.9)
  - 7-2 Sets advanced markers (4.9)
    - 7-2-1 Selects the trace to assign the marker to (4.9)
    - 7-2-2 Sets moving markers (4.9)
    - 7-2-3 Sets power spectral density markers (4.9)
    - 7-2-4 Sets integrated power markers (4.9)
    - 7-2-5 Sets integration wavelength range (4.9)
  - 7-3 Executes a search based on advanced markers (4.9)
    - 7-3-1 Executes a peak search (4.9)
    - 7-3-2 Executes a bottom search (4.9)
    - 7-3-3 Sets the advanced marker from the current position to the next peak or bottom value (4.9)
    - 7-3-4 Sets the advanced marker from the current position to the next local peak or bottom value on the right (4.9)
    - 7-3-5 Sets the advanced marker from the current position to the next local peak or bottom value on the left (4.9)
- 8 Clear all displayed moving and fixed markers (4.9, 4.13)
- 9 Line markers on/off (4.9)
- 10 Setting the measurement span to between line markers L1 and L2 (1.2, 3.6, 4.9)
- 11 Setting the zoom span to between line markers L1 and L2 (1.2, 4.9)
- 12 Clear all displayed line markers (4.9)
- 13 Marker display settings (4.9)
- 14 Setting whether to automatically update the fixed marker's level values when updating active trace (4.9)
- 15 Marker value units setting (4.9, 5.10)
- 16 Setting the peak search, bottom search, and analysis function ranges to between line markers L1 and L2  
(For both the PEAK SEARCH and ANALYSIS menus) (4.13, 5.12)
- 17 Setting the peak search, bottom search, and analysis function ranges to within the zoom range  
(For both the PEAK SEARCH and ANALYSIS menus) (4.13, 5.12)
- 18 Sweep between line markers (3.14)

## PEAK SEARCH



- 1 Executing peak search (4.13)
- 2 Executing bottom search (4.13)
- 3 Moving the moving marker from the current position to the next peak/bottom value (4.13)
- 4 Moving the moving marker from the current position to the next peak/bottom value to the right (4.13)
- 5 Moving the moving marker from the current position to the next peak/bottom value to the left (4.13)
- 6 Setting the moving marker to the fixed marker (4.9, 4.13)
- 7 Clearing fixed markers (4.9, 4.13)
- 8 Clearing all displayed moving and fixed markers (4.9, 4.13)
- 9 Turning on/off peak/bottom search each sweep (4.13)
- 10 Setting the minimum peak/bottom difference of the mode judgment reference (4.13, 5.6)
- 11 Setting the peak search, bottom search, and analysis function ranges to between line markers L1 and L2  
(For both the MARKER and ANALYSIS menus) (4.13, 5.12)
- 12 Setting the peak search, bottom search, and analysis function ranges to within the zoom range  
(For both the MARKER and ANALYSIS menus) (4.13, 5.12)
- 13 Switching between the single and multi peak/bottom searches (4.13, 4.14)
- 14 Setting the threshold and sort order of the multi search (4.14)

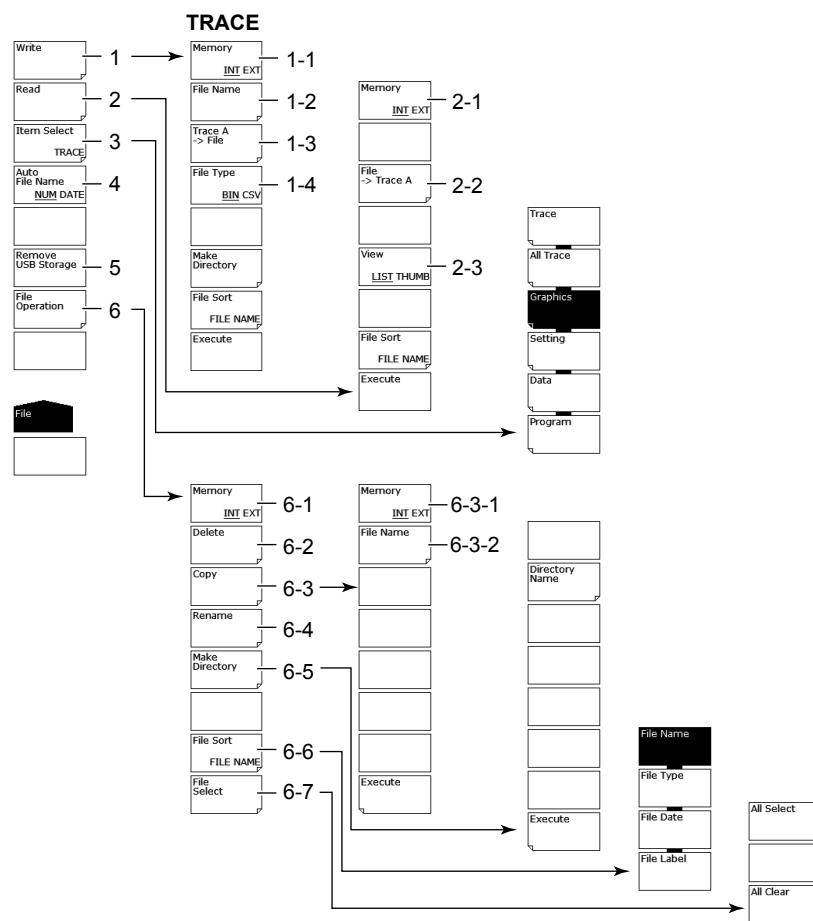
## ANALYSIS



- 1 Spectrum width analysis algorithm settings/execution (5.1, 5.2)
- 2 Analysis function settings (5.3 to 5.6)  
(DFB-LD, FP-LD, LED, SMSR, POWER, PMD)
- 3 Analysis function settings (5.7 to 5.9)  
(WDM, EDFA-NF, FILTER-PK, FILTER-BTM, WDM FIL-PK, WDM FIL-BTM)
- 4 Executing the specified analysis (chapter 5)
- 5 Spectrum width analysis threshold setting (5.1)
- 6 Analysis parameter settings (5.1 to 5.9)
- 7 Editing the ANALYSIS2 analysis results display screen (5.7 to 5.9)
- 8 Turning on/off automatic analysis each sweep (5.1)
- 9 Saving analysis results (5.1)
  - 9-1 Setting the save destination (6.5)
  - 9-2 Setting a file name (6.5)
  - 9-3 Setting overwrite or add (6.5)
  - 9-4 Creating a directory (6.5)
  - 9-5 Sort files (6.5)
  - 9-6 Executing saving (6.5)
- 10 Setting the peak search, bottom search, and analysis function ranges to between line markers L1 and L2  
(For both the MARKER and PEAK SEARCH menus) (4.13, 5.12)
- 11 Setting the peak search, bottom search, and analysis function ranges to within the zoom range  
(For both the MARKER and PEAK SEARCH menus) (4.13, 5.12)

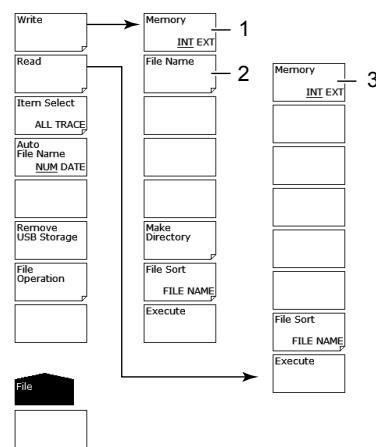
- 12 Editing the grid table (5.10)
  - 12-1 Creating a grid table with predetermined grid spacing (5.10)
  - 12-2 Creating a custom grid table (an arbitrary grid table) (5.10)
    - 4-2-1 Setting the start wavelength of the custom grid (5.10)
    - 4-2-2 Setting the stop wavelength of the custom grid (5.10)
    - 4-2-3 Setting the frequency spacing of the custom grid (5.10)
    - 4-2-4 Setting channel point wavelength of the custom grid (5.10)
    - 4-2-5 Inserting channel points of the custom grid (5.10)
    - 4-2-6 Deleting channel points of the custom grid (5.10)
    - 4-2-7 Finalizing input values of the custom grid (5.10)
  - 12-3 Setting the grid table reference wavelength (5.10)

## FILE



- 1 Saving data (chapter 6)
  - 1-1 Setting the save destination for trace data (6.2)
  - 1-2 Setting a file name (6.2)
  - 1-3 Setting the trace to save (6.2)
  - 1-4 Setting the data format (6.2)
- 2 Loading data (chapter 6)
  - 2-1 Setting the loading source for trace data (6.2)
  - 2-2 Setting the loading destination trace (6.2)
  - 2-3 Switching list/thumbail display (6.2)
- 3 Setting the target item (chapter 6)
- 4 Setting the method of assigning file names (6.2)
- 5 Removing the USB storage medium (6.1 in this manual, 2.3 in IM AQ6360-02EN)
- 6 File operation (6.8)
  - 6-1 Setting the target storage device (6.8)
  - 6-2 Deleting a file (6.8)
  - 6-3 Copying a file (6.8)
    - 6-3-1 Setting the paste destination (6.8)
    - 6-3-2 File name when saving to separate name (6.8)
  - 6-4 Renaming (6.8)
  - 6-5 Creating a directory (6.8)
  - 6-6 Sorting files (6.8)
  - 6-7 File selection (6.8)

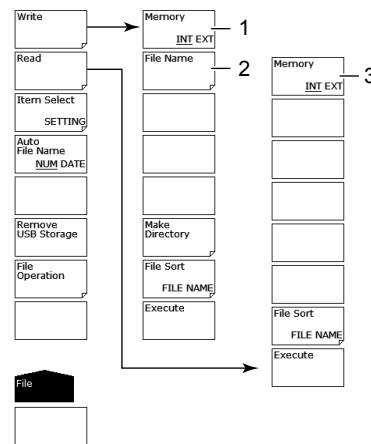
### ALL TRACE



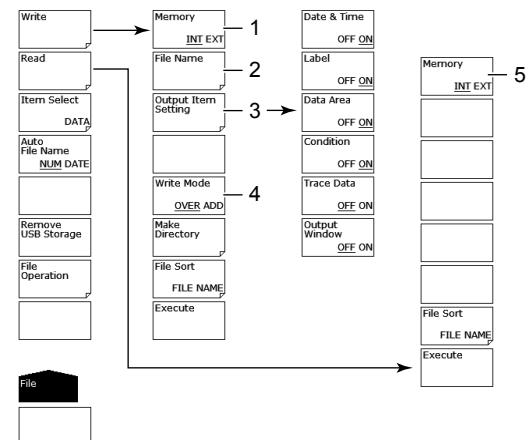
### ALL TRACE

- 1 Save destination setting for all trace data (6.3)
- 2 Setting a file name (6.3)
- 3 Load source setting for all trace data (6.3)

### SETTING



### DATA



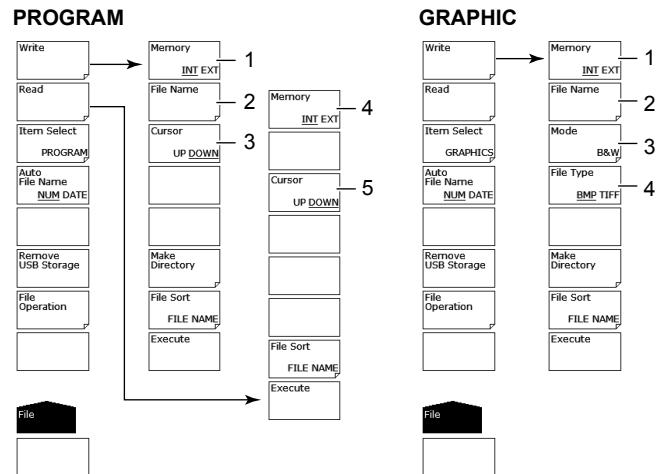
### SETTING

- 1 Setting the save destination for settings (6.4)
- 2 Setting a file name (6.4)
- 3 Setting the loading source for settings (6.4)

### DATA

- 1 Setting the save destination for analysis results data (6.5)
- 2 Setting a file name (6.5)
- 3 Setting the items to save (6.5)
- 4 Setting overwrite or add (6.5)
- 5 Setting the loading source for analysis results data (6.5)

## Appendix 7 Function Menu Tree Diagram



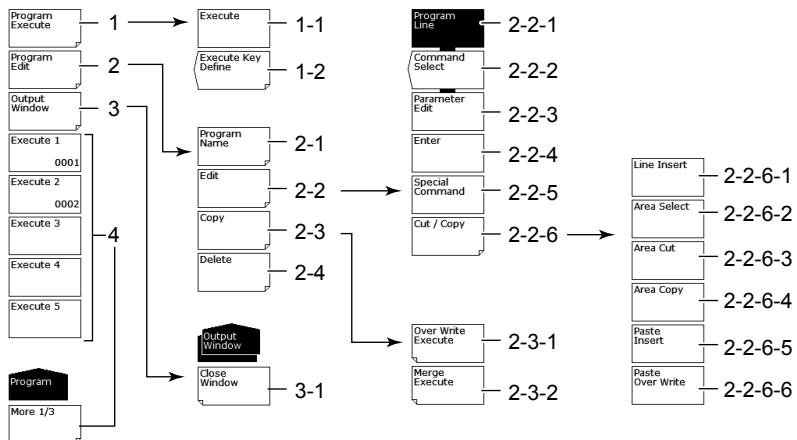
### PROGRAM

- 1 Setting the save destination for program data (6.6)
- 2 Setting a file name (6.6)
- 3 Switching the cursor target window (6.6)  
(setting the source/destination program number)
- 4 Setting the loading source for program data (6.6)
- 5 Switching the cursor target window (6.6)  
(setting the source/destination load file)

### GRAPHIC

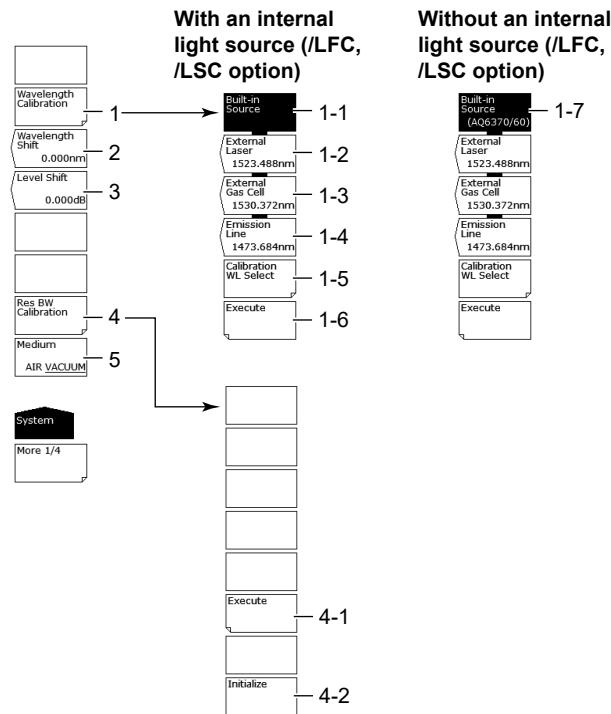
- 1 Setting the save destination for image data (6.7)
- 2 Setting a file name (6.7)
- 3 Color mode setting (6.7)
- 4 Data format setting (6.7)

**PROGRAM (see IM AQ6360-17EN)**



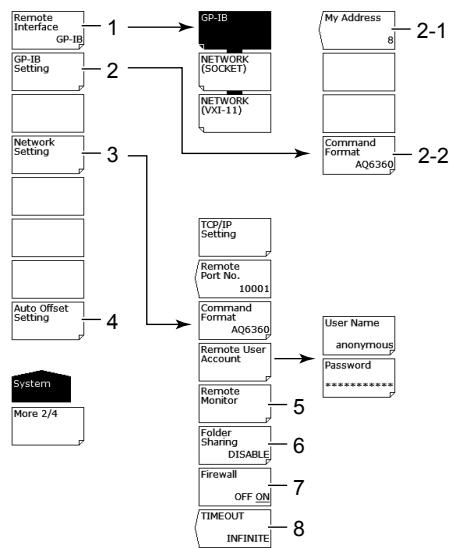
- 1 Program execution
  - 1-1 Program execution
  - 1-2 Registering programs to function menus
- 2 Editing programs
  - 2-1 Entering program names
  - 2-2 Editing lines
    - 2-2-1 Setting program lines
    - 2-2-2 Setting function commands
    - 2-2-3 Editing parameters
    - 2-2-4 Finalizing input values
    - 2-2-5 Special command settings
    - 2-2-6 Cutting/pasting lines
      - 2-2-6-1 Inserting lines
      - 2-2-6-2 Setting the target area
      - 2-2-6-3 Deleting an area
      - 2-2-6-4 Copying an area
      - 2-2-6-5 Pasting (inserting)
      - 2-2-6-6 Pasting (overwriting)
  - 2-3 Printing program lists
    - 2-3-1 Overwriting
    - 2-3-2 Copying and adding contents (merge)
  - 2-4 Deleting programs
- 3 OUTPUT WINDOW display
  - 3-1 Closing the OUTPUT WINDOW
- 4 Executing programs registered to function menus

**SYSTEM(More 1/4)**



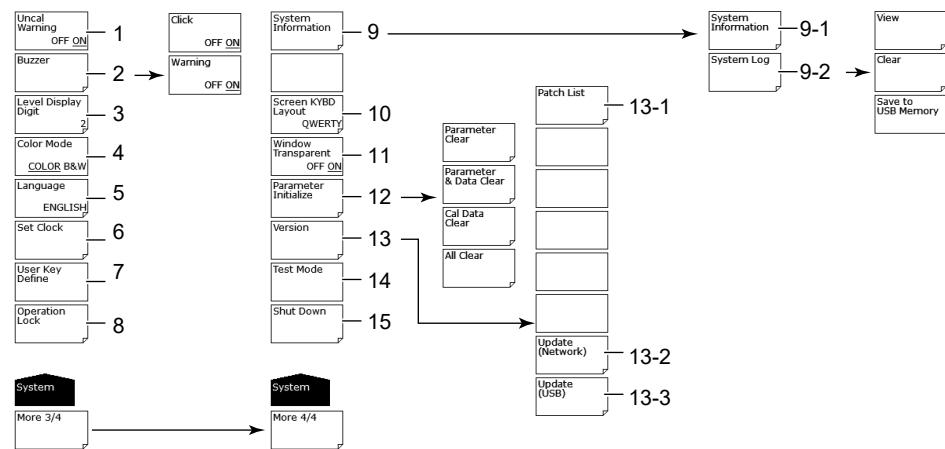
- 1 Wavelength calibration (2.6)
  - 1-1 Wavelength calibration using the internal light source (2.6)
  - 1-2 Wavelength calibration using a laser type external reference light source (2.6)
  - 1-3 Wavelength calibration using a gas cell type external reference light source (2.6)
  - 1-4 Wavelength calibration using an emission line type external reference light source (2.6)
  - 1-5 Wavelength calibration setting for wavelength calibration using an external reference light source (2.6)
  - 1-6 Executing wavelength calibration (2.6)
  - 1-7 Using the built-in reference light source of the AQ6370 series or the AQ6360 (2.6)
- 2 Setting the wavelength shift amount (value specified for the wavelength axis display value is added) (5.13)
- 3 Setting the level shift amount (value specified for the level axis display value is added) (5.13)
- 4 Performs rms resolution calibration (2.2)
  - 4-1 Executes calibration (2.2)
  - 4-2 Clears the calibration value (2.2)
- 5 Air wavelength/vacuum wavelength mode (3.2)

## SYSTEM (More 2/4)



- 1 Communication interface settings (see IM AQ6360-17EN)
- 2 GP-IB interface settings (see IM AQ6360-17EN)
  - 2-1 Setting the GP-IB port address
  - 2-2 Setting the command format
- 3 Ethernet interface settings (see IM AQ6360-17EN)
- 4 Auto offset ON/OFF (7.7)
- 5 Remote monitor (7.7)
- 6 Director sharing setting (7.7)
- 7 Firewall setting (7.7)
- 8 Setting the Remote Timeout (see IM AQ6360-17EN)

## SYSTEM(More 3/4, More 4/4)



- 1 UNCAL, warning display on/off (7.7)
- 2 Buzzer settings (7.7)
- 3 Setting the number of level data digits (7.1)
- 4 Setting the display color (7.1)
- 5 Language setting (7.7)
- 6 Date/time setting (3.5 in IM AQ6360-02EN)
- 7 Registering user keys (7.2)
- 8 Locking the operation key and changing the password for operation lock (7.6)
- 9 System information display (7.8)
  - 9-1 Displaying the serial number, Ethernet port MAC address, and other items (7.8)
  - 9-2 Displaying, clearing, and saving the system log to USB memory (7.8)
- 10 Keyboard display setting (7.7)
- 11 Semitransparent display on/off (7.1)
- 12 Initialize the settings (7.3)
- 13 Displaying the version and updating the software (4.1 in IM AQ6360-02EN)
  - 13-1 Displaying the patch list
  - 13-2 Updating the firmware (via network) (4.1 in IM AQ6360-02EN)
  - 13-3 Updating the firmware (USB memory) (4.1 in IM AQ6360-02EN)
- 14 Service menu (7.7)
- 15 System shutdown (2.4 in IM AQ6360-02EN)

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