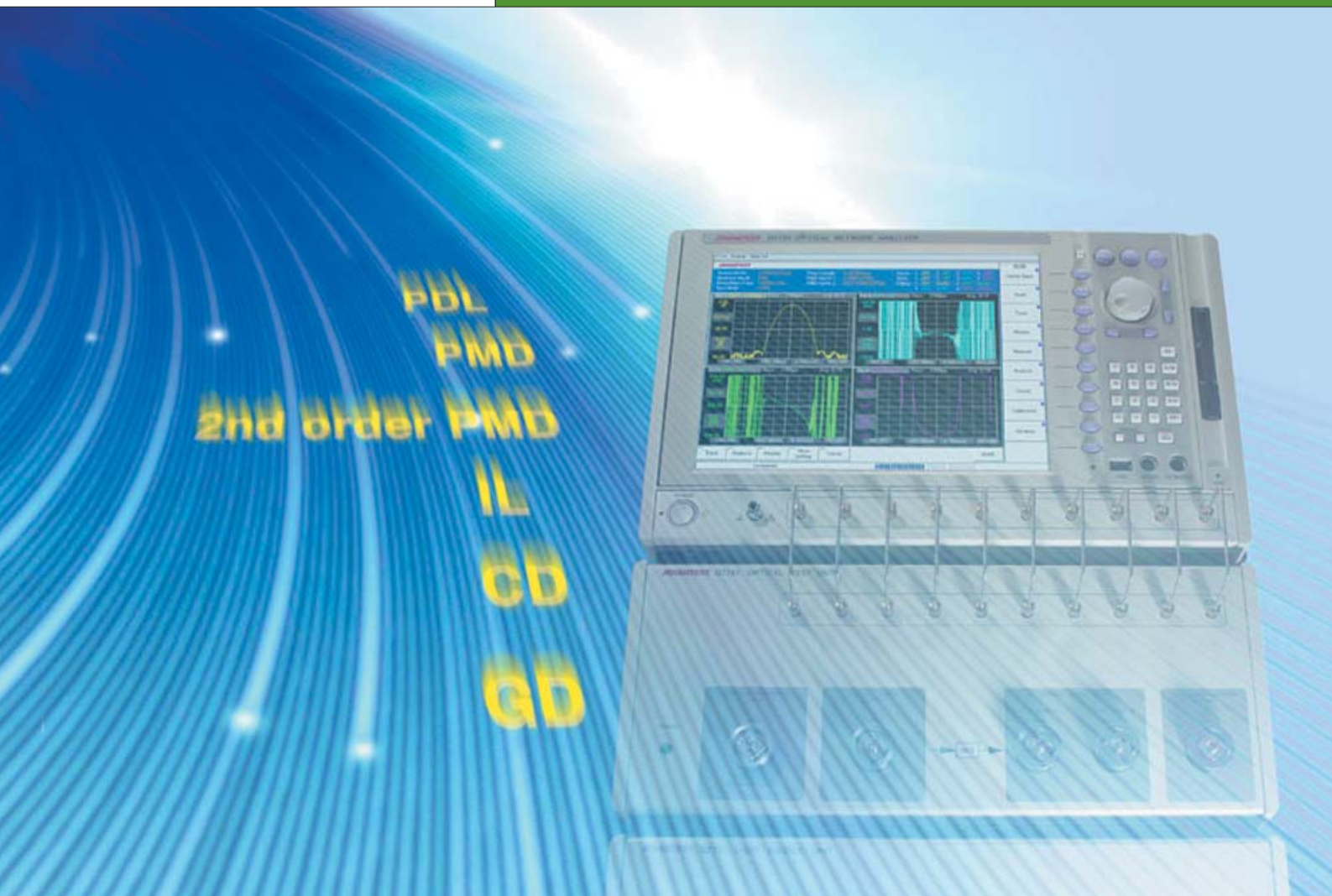
ADVANTEST

Q7761
Optical Network Analyzer

Versatile instrument that measures optical transfer characteristics for R&D and production environments

- Executes CD, GD, PMD, 2nd-order PMD, amplitude, and PDL measurements in one sweep
- Performs super fast measurements:
  ≈0.1 s (for a 1 nm span with 1 pm resolution)
  ≈1 s (for a 100 nm span with 10 pm resolution)
- Measures with excellent accuracy
  GD measurement accuracy: ±0.06 ps
- Operates over a wide dynamic range: 60 dB
- Makes synchronous 2-channel measurements
- Outputs the Optical Transfer Function data

Q7761



Performs super fast measurements

Ideal for R&D and Production environments of optical components and fibers

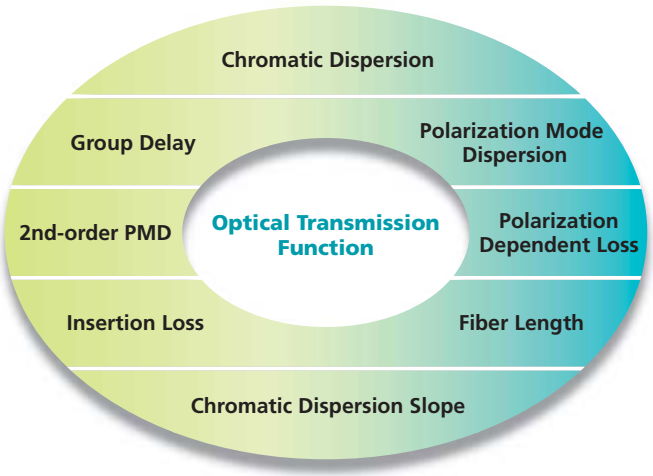
The Q7761 quickly and accurately measures chromatic dispersion (CD), group delay (GD), polarization mode dispersion (PMD), 2nd-order polarization mode dispersion (2nd-order PMD), amplitude (IL), and polarization dependency loss (PDL) characteristics

Dispersion can significantly impede the transmission performance of an optical communication system. For this reason, researchers and engineers need to characterize the dispersion characteristics of components, fibers, and subsystems.

To perform this characterization, ADVANTEST uses a proprietary Polarization Phase Shift method *) in its Q7761. This method quickly and accurately measures dispersion, amplitude, and polarization characteristics. The Q7761 also calculates and outputs the optical transmission function data.

*): Patented

Measurement items



Performs super fast measurements:

≈0.1 s (1 nm span with 1 pm resolution for CD and GD measurements)

≈1.0 s (100 nm span with 10 pm resolution for CD and GD measurements)

≈1.5 s (1 nm span with 1 pm resolution for CD, GD, and PMD, and 2nd-order PMD measurements)

Measures with excellent accuracy

- Absolute wavelength accuracy: ±1.5 pm (with Q8331)
- CD measurement accuracy:
  ±0.3% ±0.1 ps/nm or less (100 pm λ-resolution)
  ±3% ±1 ps/nm or less (10 pm λ-resolution)
- GD measurement accuracy: ±0.06 ps
- PMD measurement accuracy:
  ±3% ±0.06 ps (10 pm λ-resolution)
- PDL measurement accuracy: ±0.1 dB

Operates over a wide dynamic range: 60 dB

Possesses a wide wavelength range: 1525 to 1625 nm

Makes synchronous 2-channel measurements

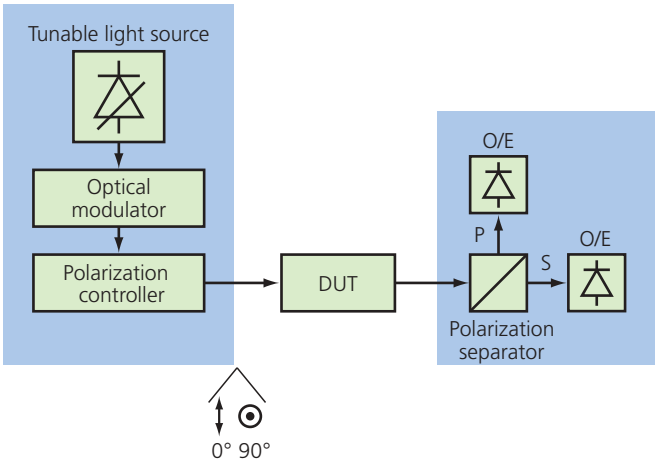
Outputs Optical Transmission Function data

Supports LAN/USB connections

*Developed in cooperation with KDDI CORPORATION

Executes CD, GD, PMD, 2nd-order PMD, PDL, and amplitude measurements simultaneously in one sweep

With its variable wavelength laser source and polarization controller, the Q7761 measures all of the optical transmission characteristics, including polarization dependency, with a single sweep.



Performs super fast measurements

Measurement time:

≈0.1 s (1 nm span with 1 pm resolution for CD and GD measurements)

≈1.0 s (100 nm span with 10 pm resolution for CD and GD measurements)

≈1.5 s (1 nm span with 1 pm resolution for CD, GD, and PMD, and 2nd-order PMD measurements)

The Q7761 can operate in one of two modes. The Ultra Fast Mode measures only CD, GD, IL. On the other hand, CD, GD, IL, PMD, 2nd-order PMD, and PDL are measured in the Super Fast Mode.

In both modes, the Q7761 allows you to adjust the DUT while monitoring measurement results on a real-time basis. This feature is very useful for measurements that are easily affected by the ambient environment of the DUT, such as PMD measurements.

For fiber measurements, there is a drift compensation function that allows you to accurately measure the zero-dispersion wavelength and dispersion slope. (This drift compensation function compensates for any fiber expansion/contraction caused by temperature changes.)

Measures with excellent accuracy

CD measurement accuracy:

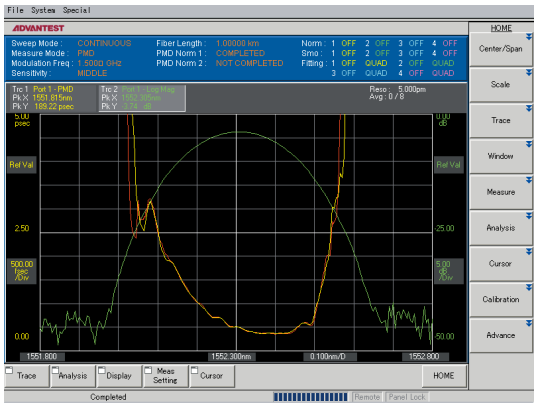
±0.3% ±0.1 ps/nm or less (100 pm resolution)

±3% ±1 ps/nm or less (10 pm resolution)

GD measurement accuracy: ±0.06 ps

PMD measurement accuracy: ±3% ±0.06 ps (10 pm resolution)

The Q7761 leverages a very accurate tunable laser, which in turn, dramatically improves CD and PMD measurements. This makes the Q7761 ideal for 40 Gbps R&D applications.



Repeatability of PMD measurement (overwrite)

Operates over a broad range of measurement applications

The Q7761 is an all-in-one analyzer that measures the optical transmission characteristics of not only passive optical devices, but also optical fiber, optical amplifiers, and optical communications systems.

Passive optical devices

FBGs, AWGs, interleavers, splitters, optical filters, variable dispersion compensators, variable PMD compensators, gain equalizers, etc.

Optical fiber

SMF, DCF, DSF, NZDF, EDF, PCF, RDF, PMF, etc.

Optical amplifiers

EDFAs, optical amplifier relays systems, etc.

Optical communications systems

Optical transmission channels in which optical fiber, optical amplifiers, and dispersion compensators are connected at multiple levels.

Make synchronous 2-Channel Measurements

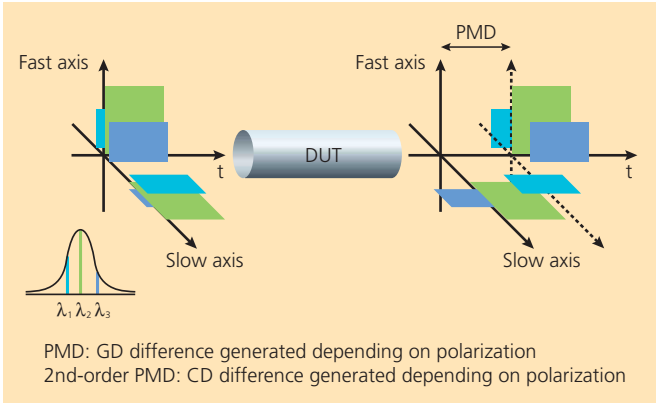
The Q7761 characterizes two-port devices such as interleavers. Synchronizing the measurement between two ports not only improves the measurement throughput for multi-port-devices, it also allows excluding elements from the measurement that vary among ports and frequently lead to problems during repeated measurements, such as the polarization status of incident rays and the device status.

PDL: Polarization dependent Loss
AWG: Arrayed Waveguide Grating
FBG: Fiber Bragg Grating
DCF: Dispersion Compensating Fiber
DSF: Dispersion-shifted Fiber
SMF: Single Mode Fiber
PCF: Photonic Crystal Fiber
NZDF: Nonzero Dispersion Fiber
EDF: Erbium Doped Fiber
RDF: Reverse Dispersion Fiber
PMF: Polarization Maintaining Fiber

Measures 2nd-order PMD characteristics

2nd-order PMD measurement error (typical):
±6% ±2 ps^2 (10 pm resolution)

Since transmission speeds are becoming increasingly faster and the transmission distances longer, the influence of high-order dispersion can no longer be ignored. As a result, there is a need for 2nd-order PMD measurements.

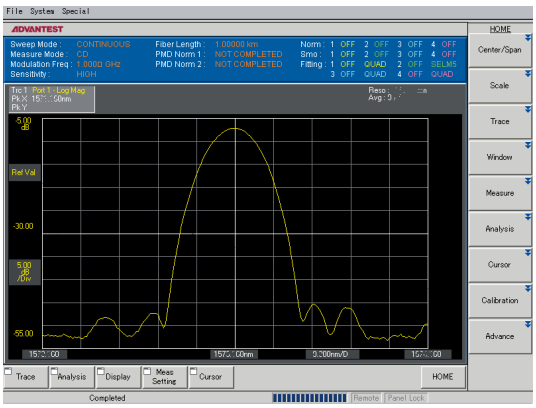


PMD and 2nd-order PMD

Operates over a wide Dynamic Range

Dynamic range: 60 dB (IL) and 45 dB (CD, GD)

The Q7761 makes the most of ADVANTEST's proprietary technologies to attain a 60 dB dynamic range for Insertion Loss measurements (or 45 dB for GD measurements). This functionality allows you to measure ripples in the rejection band for bandpass or notch filters. The Q7761 can also measure a DUT with large losses or long optical fibers while providing a good S/N ratio.



Dynamic range (IL measurement)

Possesses a wide wavelength range

Wavelength range: 1525 to 1625 nm

The Q7761 enables you to perform measurements in the C-band and L-band. The maximum wavelength span is 100 nm. This allows you to cover the entire wavelength range with one sweep.

Measures with excellent accuracy

Absolute wavelength accuracy:
±1.5 pm (with Q8331), ±5 pm (standard specification)
Relative wavelength accuracy: ±0.3 pm

The Q7761's absolute wavelength accuracy across a wavelength sweep is: ±5 pm. With the Q8331, this absolute wavelength accuracy improves to ±1.5 pm (±1 ppm). The Q7761's relative wavelength accuracy is ±0.3 pm.

Measures Group Delay over a wide range

Narrow resolution: 0.001 ps
Maximum measurement range: 100 µs

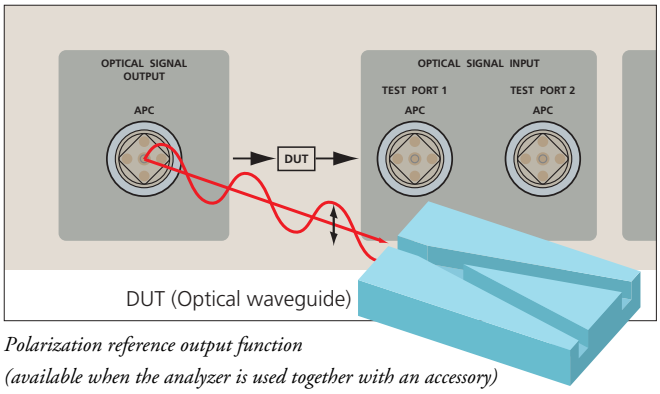
The analyzer has a group delay time resolution of 0.001 ps and a maximum measurement range of 100 µs. This allows the Q7761 to operate over a wide array of measurement applications.

Outputs the Optical Transfer Function data

The analyzer outputs amplitude and phase data.

Controls Polarization States

The Q7761 has a highly accurate polarization controller. This polarization controller allows you to manually change the polarization state of the output light. With an optional polarization reference accessory, you can create at the end of the optical connector (of the optical output port) a specified linear polarized light signal.



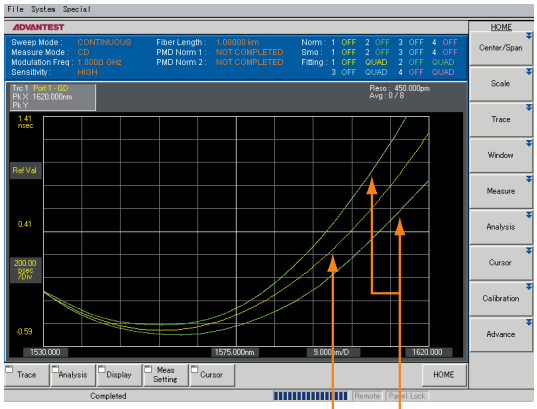
Polarization reference output function
(available when the analyzer is used together with an accessory)

Provides versatile fitting functions

The fitting function (quadratic polynomial, 3-term Sellmeier expression, and 5-term Sellmeier expression) allows you to accurately measure CD characteristics, CDS characteristics, and the zero-dispersion wavelength of optical fiber.

Compensates for GD Drift in optical fibers

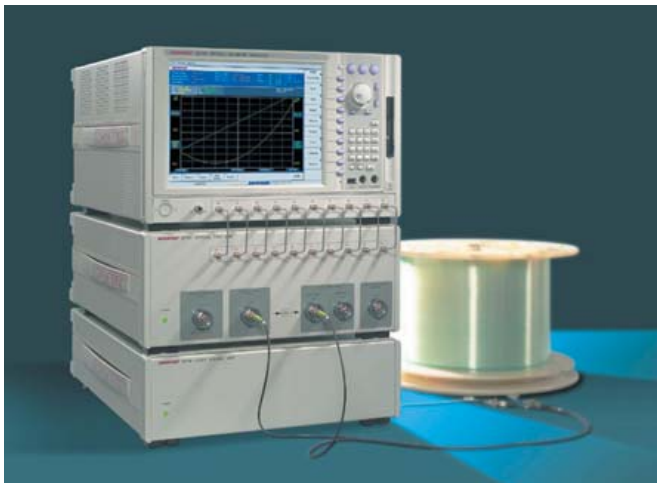
The longer the optical fiber, the greater the change in its group delay time according to ambient temperatures. For this reason, a drift in the group delay time is a source of measurement error. The Q7761 has a function for compensating in real-time group delay time drift. This functionality increases measurement accuracy.



Optical fiber GD drift measurement

Determines Optical Fiber Length

The analyzer can measure the length of an optical fiber. It fiber length range is between 0.2 m to 10,000 km. In addition, the analyzer can accurately measure its dispersion value per unit length. This measurement can be done before knowing the exact length of the fiber.



Optical fiber measurement

Enables Group Delay Ripple (GDR) analysis

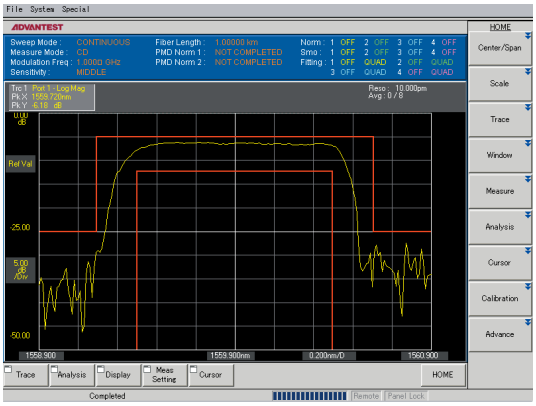
The Q7761 can easily evaluate group delay ripple.

GD characteristics of dispersion compensation FBG

GD ripple extraction display

Comes with Limit Line and Zoom-in Functions

If a limit line is set, pass/fail judgments are possible. This function is useful in production/manufacturing lines. In addition, you can zoom in on any range of wavelengths in the measured wavelength span. This allows you to look at details after a measurement sweep has been performed.



Limit line function

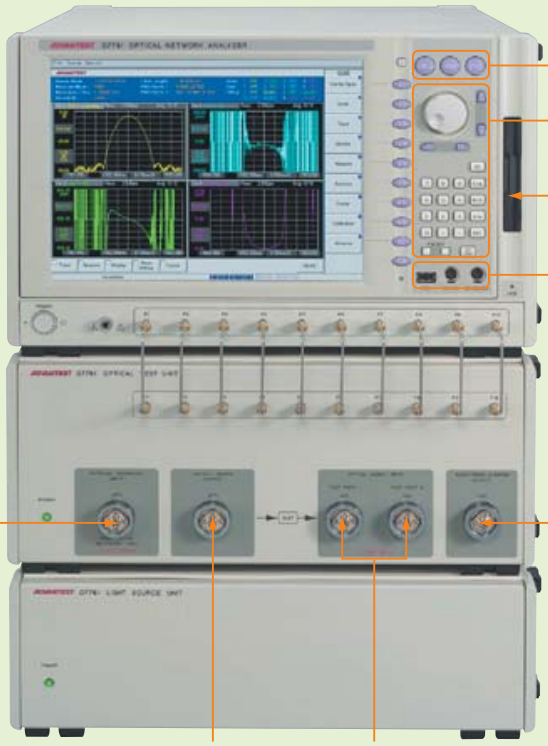
Large Screen and Function for Displaying Waveforms in Different Modes

The analyzer has a large 12.1-inch color LCD display and a touch panel. The Q7761 also has the ability to display up to four measurement windows, including CD, GD, PMD, and IL windows.

Variety of Interfaces

The Q7761 comes equipped with a variety of interfaces. A mouse and a keyboard can be connected via the front panel. The rear panel has GPIB, RS-232, LAN, printer, and VGA monitor output ports.

FRONT PANEL



Measurement control keys
SINGLE, STOP, and START

Data knob and numerical keypad
Used to enter numeric values and units.

Floppy disk drive

I/O connector block
- USB connector
- Mouse connector
- Keyboard connector

External optical input port for drift compensation function

Optical monitor output port
Connecting to External wavelength meter

Optical output port
Connecting to DUT

Optical input port
Optical input port for Q7761.
Make synchronous
2-channel measurements.

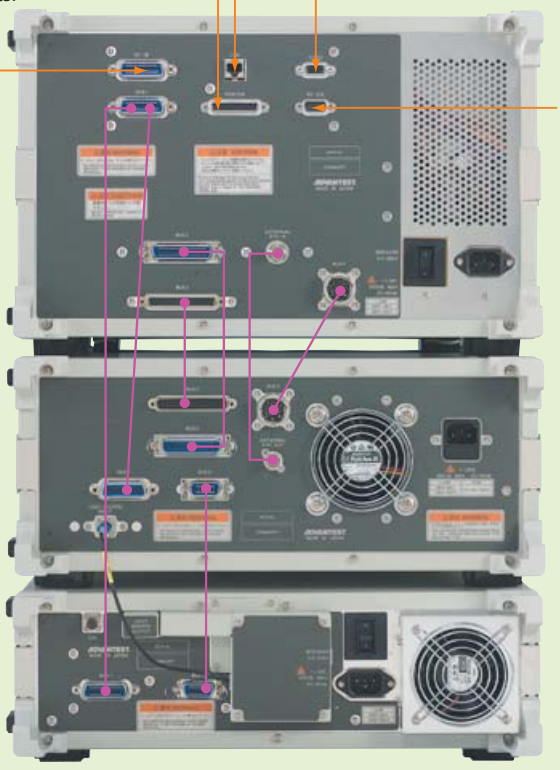
PRINTER
(conforming to
IEEE1284-1994)

LAN (10Base-T, TCP/IP)

VIDEO (VGA specifications)

GPIB
(conforming to
IEEE488.2)

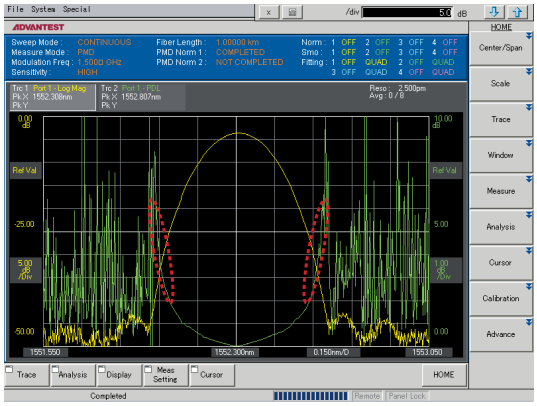
RS-232



REAR PANEL

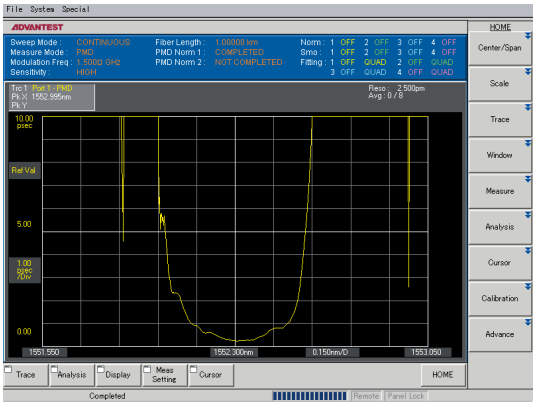
AWG Measurement Examples

Examples of measurements of AWG transmission characteristics are shown below. Making the most of its wide dynamic range of measurement, the analyzer can measure the IL characteristics in a range from the pass band to the rejection band with greater accuracy. Since PDL characteristics can be measured at the same time, the PDL characteristics in the IL slope (the section surrounded by red lines in the figure below) can be checked in greater detail.



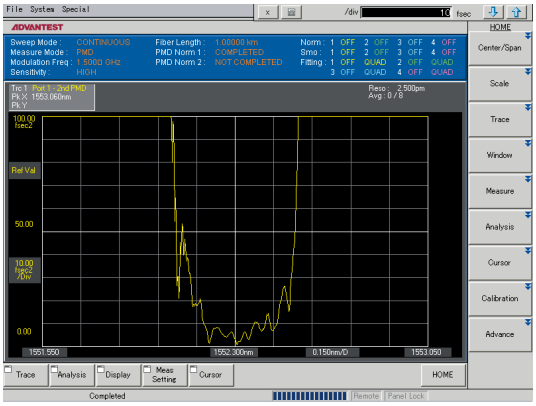
IL/PDL characteristics of AWG

GD characteristics and different types of dispersion can be measured in a wide dynamic range. The Q7761 also allows you to evaluate PMD and 2nd-order PMD. In addition, you can evaluate in greater detail how the dispersion characteristics change as the light signal's polarization state is changed.

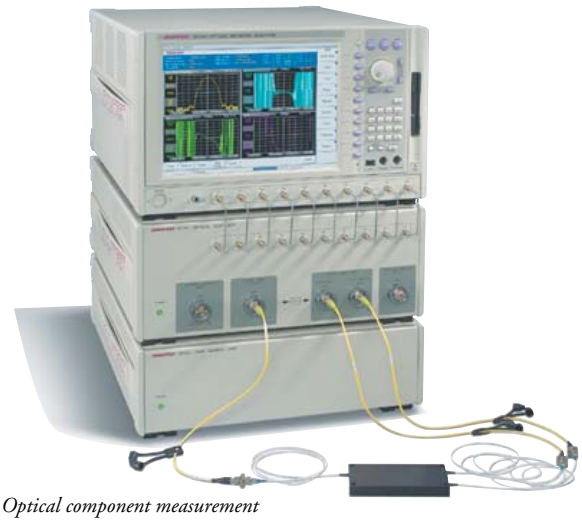


PMD characteristics of AWG

GD/CD characteristics of AWG



2nd-order PMD characteristics of AWG

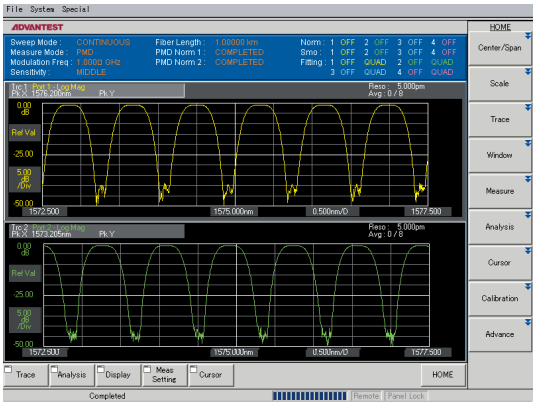


Optical component measurement

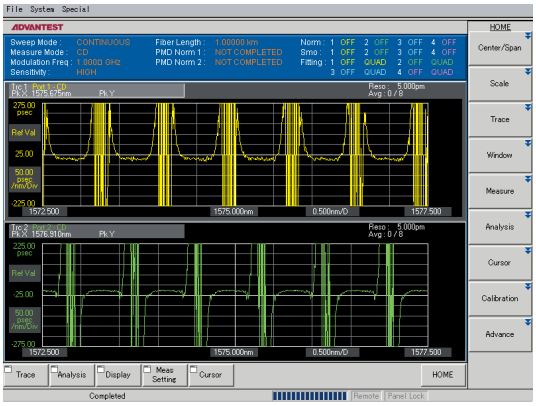
IL/GD/CD/PMD characteristics of AWG (4-screen display)

Interleaver Measurement Examples

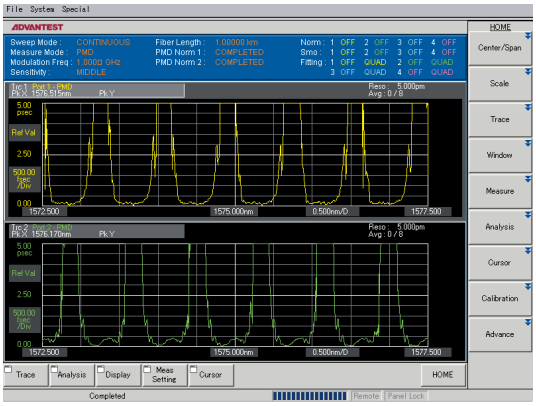
Examples of measurements of 50 GHz/100 GHz interleavers are shown below. The Q7761 measures characteristics of two output ports at the same time, allowing you to evaluate the port-to-port characteristics of the interleavers according to different types of parameters.



IL characteristics of interleavers (2-port measurement)



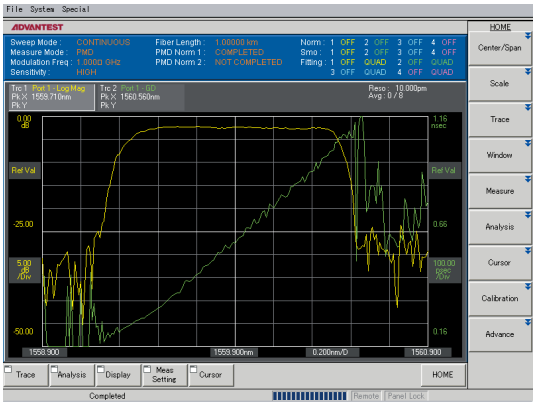
CD characteristics of interleavers (2-port measurement



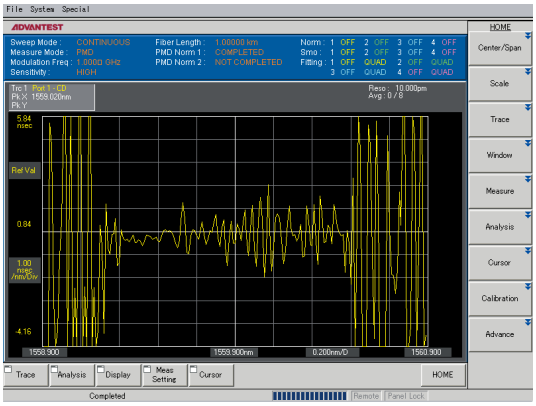
PMD characteristics of interleavers (2-port measurement

Dispersion Compensation FBG Measurement Examples

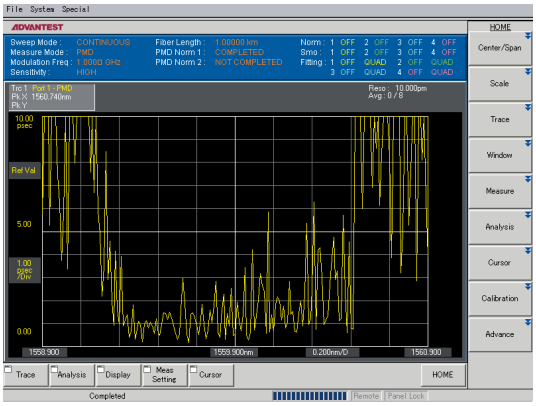
A measurement example of a dispersion compensating FBG is shown below. The analyzer measures GD at a high resolution, allowing you to clearly see and evaluate fine GD ripples in the dispersion compensation wavelength band. Also, because it uses the Polarization Phase Shift method, it can measure PMD at a high wavelength resolution.



IL/GD characteristics of dispersion compensation FBG



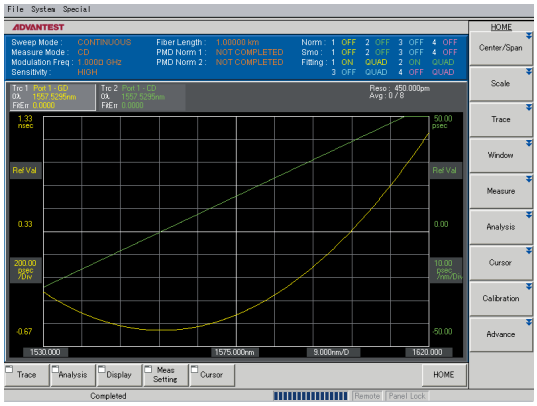
CD characteristics of dispersion compensation FBG



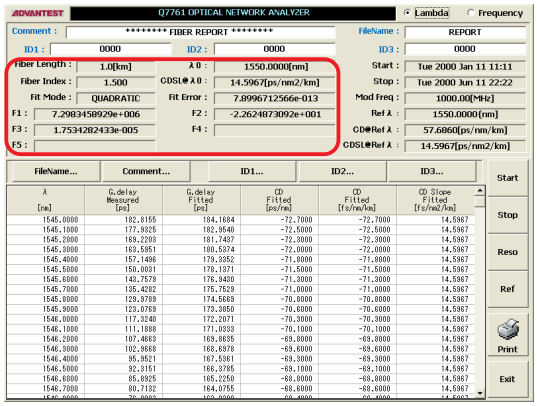
PMD characteristics of dispersion compensation FBG

Dispersion Shift Fiber Measurement Examples

The fitting function for optical fiber facilitates analysis of the zero-dispersion wavelength and CDS characteristics. Measurement results, which can be displayed as reports or output to external devices, can easily be attached to e-mail or saved.



GD/CD characteristics of dispersion shift fiber

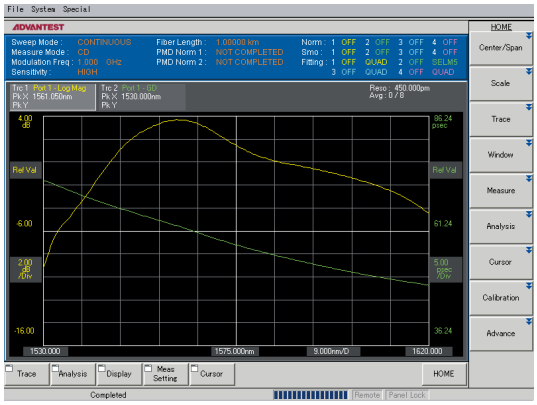


Measurement results displayed in a report

A fitting error value is displayed according to the zero-dispersion wavelength.

Optical Amplifier Measurement

The Q7761 utilizes the Polarization Phase Shift method, so it can measure optical amplifiers and optical communications systems.



IL/GD characteristics of optical amplifier

Specifications [1]

Measurement Functions

Insertion Loss
Group Delay
Chromatic Dispersion
Chromatic Dispersion Slope
Polarization Mode Dispersion
2nd-order Polarization Mode Dispersion
Polarization Dependent Loss
Fiber Length

Measurement Channels

2 optical input ports. Support of synchronous measurement of 2 ports, and each port measures all characteristics.

Wavelength Characteristics

Measurement range:	1525 to 1625 nm
Relative wavelength accuracy [2]:	±0.3 pm
Absolute wavelength accuracy:	±5 pm (without use of an external wavemeter) ±1.5 pm (with use of the Q8331, an external wavemeter)
Wavelength setting resolution:	1 pm
Wavelength sweep range:	Settable from 100 pm to 100 nm
Max. wavelength sweep speed:	100 nm/s
Wavelength sweep time (measurement time):	Approx. 0.1 s (1 nm span with 1 pm resolution for CD, GD and IL measurements, in Fast mode) Approx. 1 s (100 nm span with 10 pm resolution for CD, GD and IL measurements, in Fast mode) Approx. 1.5 s (1 nm span with 1 pm resolution for CD, GD, PMD and IL measurements, in Fast mode)

Amplitude Characteristics

Dynamic range [3] [4]:	60 dB or more (Wide Dynamic Range Mode) 45 dB or more (Dispersion Mode)
Linearity [4] [5]:	Wide Dynamic Range Mode: ±0.10 dB (relative level 0 to –40 dB) ±0.45 dB (relative level –40 to –50 dB) Dispersion Mode: ±0.10 dB (relative level 0 to –25 dB) ±0.25 dB (relative level –25 to –30 dB)
Polarization dependency:	±0.10 dB
Repeatability at connector insertion [6]:	±0.1 dB
Optical output port power [7]:	–18 dBm or more
Optical wavelength meter monitor output power [7]:	–25 dBm or more

Group Delay Characteristics

Max. measurement time:	100 µs
Group delay resolution:	1 fs
Relative group delay accuracy:	Relative level (dB) / Accuracy (s) / for fm = 2.5 GHz 0 to –10 dB / ±0.015%/fm / ±0.06 ps –10 to –15 dB / ±0.048%/fm / ±0.192 ps –15 to –20 dB / ±0.15%/fm / ±0.6 ps –20 to –25 dB / ±0.48%/fm / ±1.92 ps –25 to –30 dB / ±1.5%/fm / ±6 ps
Modulation frequency setting range:	10 MHz to 2.5 GHz

Chromatic Dispersion

Measurement accuracy [8]:	±0.3% ±0.1 ps/nm or less (at wavelength resolution of 100 pm) ±3 %±1 ps/nm or less (at wavelength resolution of 10 pm)
Measurement resolution:	1 fs/nm

Polarization Mode Dispersion

Max. measurement range:	100 ps
Measurement resolution:	1 fs
Measurement accuracy:	±3% ±0.06 ps (at wavelength resolution of 10 pm)

2nd-order Polarization Mode Dispersion

Max. measurement range:	1000 ps^2
Measurement resolution:	0.01 ps^2

Polarization Dependent Loss

Max. measurement range:	3 dB
Measurement resolution:	0.001 dB
Measurement accuracy:	±0.1 dB

Fiber Length Measurement

Measurement range:	0.2 m to 10,000 km
Measurement resolution:	0.01 m
Range of inputs for refraction index:	1.0000 to 3.0000
Measurement repeatability:	20 mm

Fiber Chromatic Dispersion Measurement

Repeatability of dispersion coefficient measurement:	0.025 ps/nm, 0.003 ps/nm/km
Repeatability of zero dispersion wavelength measurement[9]:	0.010 nm
Repeatability of dispersion slope measurement at zero dispersion wavelength:	0.025 ps/nm^2, 0.002 ps/nm^2/km
Accuracy of zero CD wavelength:	±0.035 nm
Waveform fitting functions:	Linear fit, Quadratic fit, Three-term sellmeier fit, Five-term sellmeier fit

Drift Compensation Measuring Function

Real-time drift compensation function

Polarization Control Function

Polarization extinction ratio:	30 dB or more
Angle setting resolution:	0.1 degree
Incident port optical connector end linear polarization output function:	With an optional polarization reference accessory

Data Processing Functions

Memory function:	Save measurement data to back-up memory and to a floppy disk
Display:	Optical frequency display, Overlay
Computing/analysis:	Averaging, Normalization, Smoothing, Expansion show function, Limit line, Partial waveform fitting functions, Report output function
Optical transfer function data output function	
Statistics computing function:	Statistics processing of PMD, etc.

Optical Input/Output Port and Standard Optical Connector

Optical output port:	1 port: FC/Angled PC
Optical input ports:	2 ports: FC/Angled PC
Optical monitor output for optical wavelength meter:	1 port: FC/Super PC
External reference optical input:	1 port: FC/Angled PC

Users can easily replace the standard optical connector with an optional accessory.

1) Warm-up time: 2 hours under constant temperature
2) If the distance between neighboring measurement points is 100 pm or less.
3) Difference between amplitude and the noise level (average values) obtained in through-hole measurement. The setting of SENS = HIGH – SENS is used.
4) The Wide Dynamic Range Mode is used to measure amplitude. The Dispersion Mode is used to simultaneously measure CD, GD, PMD, 2nd-order PMG, PDL, and amplitude characteristics.
5) As the relative level, the amplitude level obtained in through-hole measurement is used as a reference. The measured object is assumed to not have a change in group delay time over time. SENS = HIGH – SENS.
6) If the accessory optical fibers with FC connectors are disconnected ten times
7) Under average power
8) If the wavelength is differentiated at an aperture between neighboring measurement points (wavelength resolution)
9) Using an 11 km DSF, if measurements are repeated ten times at a modulation frequency of 2.5 GHz, span ranging from 1525 to 1625 nm, resolution of 1 nm, and setting of SENS = HIGH – SENS, and results are fitted with a quadratic polynomial

Input/Output Interfaces

GPIB:	Conforming to IEEE-488.2, rear panel
Floppy disk drive:	Complies with MS-DOS FAT format. Two modes (DD: 720 KB, HD: 1.2 MB/1.4 MB)
Printer port:	Conforming to IEEE-1284-1994, rear panel
Keyboard:	PS/2 101/106 keyboard, front panel
Display:	12.1-inch SVGA-TFT color LCD
Mouse:	PS/2 mouse, front panel

General Specifications

Operating environment:	Ambient temperature: 15 to 35°C Relative humidity: 85% or less (No condensation)
Storage environment:	Ambient temperature range: –20 to +60°C Relative humidity: 90% or less (No condensation)
Power	
Analysis unit:	100 to 120 VAC, 220 to 240 VAC, 50/60 Hz, 500 VA or less
Optical test unit:	100 to 120 VAC, 220 to 240 VAC, 50/60 Hz, 200 VA or less
Light source unit:	100 to 120 VAC, 220 to 240 VAC, 50/60 Hz, 300 VA or less
Dimensions	
Analysis unit:	Approx. 424 (W) x 266 (H) x 530 (D) mm
Optical test unit:	Approx. 424 (W) x 177 (H) x 530 (D) mm
Light source unit:	Approx. 424 (W) x 132 (H) x 530 (D) mm
Mass	
Analysis unit:	33 kg or less
Optical test unit:	19 kg or less
Light source unit:	22 kg or less

Accessories (sold separately)

FC/APC-FC/APC master optical fiber:	A180001
SC/APC-SC/APC master optical fiber:	A180002
FC/APC-FC/SPC master optical fiber:	A180003
SC connector output adapter:	A180004
FC/FC adapter (for APC):	A180005
SC/SC adapter (for APC):	A180006
FC/FC adapter:	A180007
FC/SC adapter:	A180008
Polarization reference module:	A180009
FC/APC-SC/SPC plug:	A08329

Rack Mount kit (sold separately)*

Analysis unit	
EIA, with Front handles:	A02714
JIS, with Front handles:	A02715
EIA, without Front handles:	A02724
JIS, without Front handles:	A02725
Optical test unit	
EIA, with Front handles:	A02710
JIS, with Front handles:	A02711
EIA, without Front handles:	A02720
JIS, without Front handles:	A02721
Light source unit	
EIA, with Front handles:	A02708
JIS, with Front handles:	A02709
EIA, without Front handles:	A02718
JIS, without Front handles:	A02719

**: To install the analyzer on the Advantest TR16801 rack (A02615), a slide rail set, is required. To install the analyzer on a rack manufactured by another company, either the A02642, an L-angle set, or a tray that supports the analyzer must be used. One slide rail set or L-angle set is required for each of the units (ANALYSIS, OPTICAL TEST, and LIGHT SOURCE)*

Laser Product Safety:
This product is a Class I system based on the IEC60825-1 Am.2, 2001. The product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001.

Please be sure to read the product manual thoroughly before using the products.
Specifications may change without notification.

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