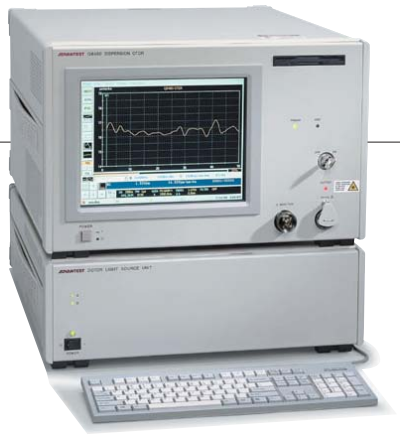
ADVANTEST

Q8480
Dispersion OTDR

For measuring chromatic dispersion maps of optical fibers

- Capable of measuring chromatic dispersion over length with a near-end measurement
- Dispersion distribution measurement accuracy: ±4.5% or less*
- Total dispersion measurement accuracy: ±4.5% or less*
- Maximum measurable fiber length: 40 km (@SMF)
- Spacial resolution: Minimum 150 m
- Dead zone: Minimum 100 m
- Measurable wavelength range: 1530.5 to 1559.5 nm
- Setting wavelength resolution: 0.1nm

*Typ., with external wavelength meter



Q8480

Q8480 Dispersion OTDR measures the chromatic dispersion map along the axis of the optical fiber. The Q8480 also operate over a wide wavelength range in a fast and accurate manner.

Dispersion management of optical fiber is becoming indispensable for carriers and system vendors because they are not only compensating for accumulative chromatic dispersion but also controlling non-linear effects.

To meet this demand for a Chromatic Dispersion OTDR, ADVANTEST developed the Q8480 Dispersion OTDR that measures chromatic dispersion maps for fibers of varying lengths.

The Q8480 measures chromatic dispersion over distance at various wavelengths. In fact, the user selects the desired wavelength before the chromatic dispersion map is generated. For example, the user can determine the chromatic dispersion map of a fiber at 1550 nm. This fiber can be either installed fiber from the field or from new fiber rolls.

The Q8480 has the following features:

- **Generates a Chromatic Dispersion map and Accumulated chromatic dispersion map for an optical fiber with a near-end measuring solution**
- **High accuracy of Dispersion distribution measurement: ±4.5% or less***
- **Excellent accuracy of Total dispersion measurement: ±4.5% or less***
- **High Spacial resolution: Minimum 150 m**
- **Short Dead zone: Minimum 100 m**
- **Wide Dispersion measurement range: Maximum ±300 ps/nm/km**
- **Wide Measurable wavelength range: 1530.5 to 1559.5 nm (wavelength interval of 0.5 nm)**
- **Setting wavelength resolution: 0.1 nm**
- **High speed measurement: Approx. 2 min. (measuring SMF 40 km)**
- **Wide variety of display functions: Multi-trace display allows up to 4 traces of measurement data and trace comparisons**

*Typ., with external wavelength meter

Features:

Capable of measuring chromatic dispersion map by near-end measurement only

The Q8480 leverages a Four-wave mixing (FWM) phenomenon, a non-linear effect in a fiber by sending two incident optical pulses at different wavelengths down the fiber. The chromatic dispersion map is then measured by observing the Stokes back-scattered radiation generated by the signals generated from the four-wave mixing. In this manner, Advantest effectively measures the chromatic dispersion map of fiber like a conventional OTDR (near-end measuring solution).

High accuracy of Dispersion distribution measurement: ±4.5% or less (Typ., with external wavelength meter)

The Q8480 measures chromatic dispersion map characteristics of optical fiber with high accuracy and high repeatability. Figure 1 shows the measurement results of the chromatic dispersion map of dispersion shifted fiber (20 km) from both ends (in the A and B directions). For comparison, Figure 2 superposes the result obtained by inverting the measurement in the B direction on that in the A direction. This shows the measurement results from both ends are matched with high repeatability.

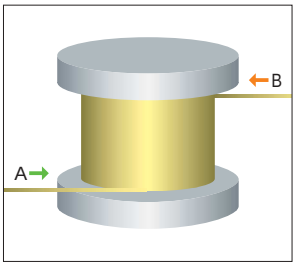


Figure 1: Dispersion Measurement Accuracy (Both Directions)

Figure 2: Dispersion Measurement Accuracy (Inversely Compared)

Excellent accuracy of Total dispersion measurement: ±4.5% or less (Typ., with external wavelength meter, at the same types of fiber)

Because of its high degree of measurement accuracy, the Q8480 supports manufacturing environments to determine the optimal dispersion values for dispersion-compensated fibers. Figure 3 shows the results of measuring a 7-km dispersion-compensated fiber. This shows the measurement results is matched with the total dispersion measurement results of the Q7760 Optical Network analyzer, which also employs a phase-shift method.

Total dispersion measured using the Q7760:
–681.532 ps/nm (@1550 nm)
Total dispersion measured using the Q8480:
–683.202 ps/nm (@1550 nm)

Figure 3: Measurement example of Dispersion-compensated fiber (Accumulative chromatic dispersion Display Function)

High spacial resolution (when measuring dispersion): Minimum 150 m [12 x 10^3/(|D| x $\Delta\lambda^2$) m]

The Q8480 has a high spacial resolution to measure partial changes in dispersion of optical fiber that were impossible to measure by conventional total dispersion measurement instruments. Figure 4 shows the result obtained when a +1.2 ps/nm/km dispersion shift fiber of 5 km is connected to a +1.6 ps/nm/km dispersion shift fiber of 15 km. A spacial resolution of 600 m is used as the measurement condition.

Figure 4: Measurement example of Connected Fibers with Different Dispersion Values

Wide measurable wavelength range and simultaneous 4-trace display function

The Q8480 measures the chromatic dispersion map for a wide range of wavelengths. The Q8480 has a wide range of wavelength settings: 1530.5 to 1559.5 nm (when set to $\Delta\lambda$ = 0.5 nm). In addition, the Q8480 has a 4-trace simultaneous display function that enables comparison of the chromatic dispersion map along the wavelength axis. Figure 5 shows the measurement results of a 20-km dispersion shift fiber along the wavelength axis. Figure 6 is an example of simultaneously displaying both loss characteristics and chromatic dispersion map characteristics.

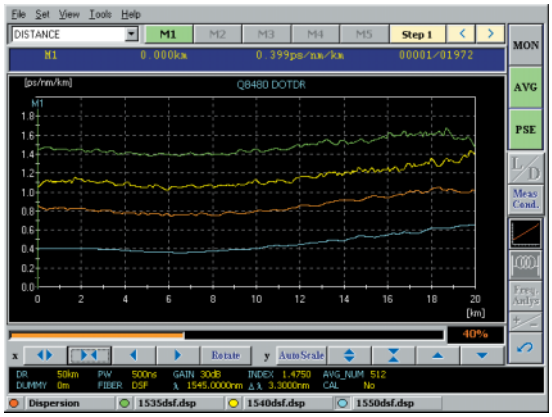


Figure 5: Four-trace Simultaneous Display of Measurements along the Wavelength Axis

Figure 6: Comparison of Loss Characteristics and Wavelength Dispersion Characteristics

Measurement example:

Measurement example of the different types of connected fiber

Figures 7 and 8 are measurement examples of a 20-km single mode fiber (SMF) joined with a 3.5-km dispersion compensation fiber (DCF). Figure 7 shows the measurement result of the chromatic dispersion map, and Figure 8 shows the measurement result of accumulative chromatic dispersion. With the Q8480, it is possible to measure the chromatic dispersion map even with different fibers that have been connected. In addition, it is possible to check the total dispersion by displaying accumulative chromatic dispersion.

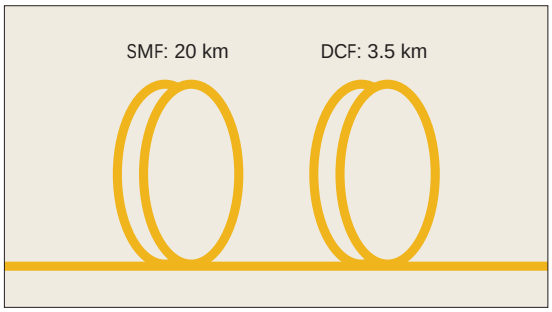


Figure 7: Measurement example of chromatic Dispersion map: SMF + DCF

Figure 8: Display of Accumulative chromatic Dispersion: SMF + DCF

Specifications

Dispersion Distribution Measurement Mode

Measurable wavelength range:	1530 nm + Δλ to 1560 nm – Δλ (Δλ: Wavelength interval, 0.5 nm ≤Δλ ≤4.0 nm)
Setting wavelength resolution:	0.1nm
Setting wavelength accuracy*1:	±0.030 nm (without wavelength meter) ±2 ppm ±1 count (with Q8326 wavelength meter)
Wavelength interval range:	0.5 to 4.0 nm
Dispersion measurement range:	+0.5 to +300 ps/nm/km –300 to –0.5 ps/nm/km
Dispersion distribution measurement accuracy*2:	±4.5% (Typical value) Excluding the index setting error
Total dispersion measurement accuracy*2:	±4.5% (Typical value)
Dispersion value reading resolution:	0.01 ps/nm/km
Spacial resolution*3:	150 to 1500 m
Dead zone*4:	100 to 1000 m
Maximum measurable fiber length*5:	≥40 km (Typical value)
Measurable fiber length*6:	≥1 km
Distance accuracy:	±17 m ±(measurement value) x 5 x 10^{-5} m Excluding the index setting error
Pulse width:	100 ns, 500 ns, 1 µs

LOSS Measurement Mode

Measurement center wavelength:	1550 nm ±30 nm				
Pulse width:	100 ns	500 ns	1 µs	4 µs	10 µs
Dynamic range*7:	12.1 dB	15.4 dB	16.2 dB	19.6 dB	21 dB
Dead zone*8:	27 m	75 m	135 m	520 m	1300 m
Spacial resolution*9:	27 m	75 m	135 m	520 m	1300 m
Vertical axis reading resolution:	0.01 dB				
Distance accuracy:	±3 m ±(measurement value) x 5 x 10^{-5} m Excluding the index setting error				

Common Specifications

Average setting number:	2^N (4≤N≤16)
Index setting range:	1.4000 to 1.7000 (0.0001 step)
Distance range:	15, 50, 100, 150 km
Display span:	0.5, 1, 2, 5, 10, 20, 50, 100, 150 km

Optical Interface Specifications

Connector used for measurements:	FC-APC (Angled PC)
Connector used for the monitor:	FC-SPC
Laser class:	FDA Laser Class IIIb according to 21 CFR 1040.10 IEC Laser Class I according to IEC 60825-1
Optical output control:	Interlocked using the key on the front panel Remote interlock connector (BNC)

Interface Specifications

OS:	Windows 98® second edition
CPU:	MMX PENTIUM233MHz
Memory:	64 MB
Floppy disk:	3.5 inch (2 mode: 720 kB/1.44 MB)
Hard disk:	2.5 inch (up to 8 GB)
Serial:	RS-232C D-sub 9 pin
Parallel:	D-sub 25 pin
External RGB output:	Analog RGB mini D-sub 15 pin
Mouse:	PS/2 mini DIN 6 pin
Keyboard:	PS/2 mini DIN 6 pin
PC card:	JEIDA4.2/PCMCIA2.1 (Type I/II x 2, III x 1)
USB:	USB1.1 series A 1 port
LCD:	10.4 inch VGA 256 colors with touch panel

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

General Specifications

Power supply voltage	
OTDR unit:	AC100 to 120 V, AC220 to 240 V (automatic change) 50/60 Hz, 300 VA or less
Light source unit:	AC100/120/220/240 V (manual change), 50/60 Hz, 220 VA or less
Operating temperature and humidity range:	+15 to +30°C (relative humidity 85% or less)
Storing temperature range:	–10 to +45°C (relative humidity 90% or less)
External dimensions	
OTDR unit:	Approximately: 424 (W) x 265 (H) x 500 (D) mm
Light source unit:	Approximately: 424 (W) x 132 (H) x 500 (D) mm
Mass	
OTDR unit:	25 kg or less
Light source unit:	27 kg or less

Standard accessories

Power cable:	2
keyboard:	1
GPIB cable:	1
Optical code:	1
Laser Class 1 product label:	1
Fuse (Light source unit)	
1A:	2
2A:	2
Touch panel driver:	1
Ferrite core:	4
Cover guard 6U:	1
Recovery disk set:	1
Instruction Manual:	1

Options

OPT8480+50:	OS (Japanese)
OPT8480+51:	OS (English)
OPT8480+32:	120 V
OPT8480+42:	220 V
OPT8480+44:	240 V

**1: Under constant temperature.*

**2: The test sequence may be repeated when measuring SMF 20 times continuously, under the following conditions:*
Measuring wavelength: 1550.0 nm, Temperature: 23±3°C
**SMF: 1.3 µm band zero dispersion optical fiber (ITU-T G.652)*

**3: $12 \times 10^3/(|D| \times \Delta\lambda^2)$ m*
D (ps/nm/km): Dispersion value, Δλ (nm): Wavelength interval

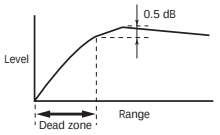
**4: Near-end and dead-end in a dispersion calculation interval. $8 \times 10^3/(|D| \times \Delta\lambda^2)$ m*
D (ps/nm/km): Dispersion value, Δλ (nm): Wavelength interval

**5: When measuring SMF under the following conditions:*
Measuring wavelength: 1550.0 nm, Δλ=0.7 nm

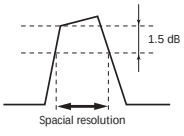
**6: When measuring SMF under the following conditions:*
Measuring wavelength: 1550.0 nm, Δλ=1.8 nm

**7: Average: 2^9 times, SNR=1*

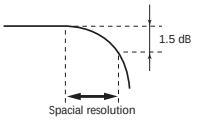
**8: Distance between the near-end and a level of 0.5 dB lower than the back radiation light peak level.*



**9: Reflectivity: Pulse width at a level of 1.5 dB below the pulse peak.*



Non-reflectivity: Distance between the steady-state level of back radiation light and a level 1.5 dB lower.



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