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Find the *Advantest Q7606A* at our website: ***Click HERE***

Specifications

Functions

Measurement characteristics:	**Controls the discrimination point between optical frequency and intensity in the built-in optical-fiber-type Mach-Zehnder interferometer, converts the components of optical chirp (optical frequency modulation) of input light into the components of optical intensity, and outputs. Separates the components of optical chirp (optical frequency modulation) and the components of optical intensity modulation.**
Polarization compensation:	**Automatic polarization compensation by the optical-fiber-type polarization controller**
Built-in optical amplifier with automatic gain adjustment (Q7606A):	**The Q7606A has a built-in optical amplifier with the automatic gain adjustment function. The optical power is output from 0 dBm or higher, regardless of the input optical power. No need to prepare an external optical amplifier fit for external O/E converter to adjust optical output power and optical amplifier gain.**

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

Performance Specifications[1)]

	Q7606A	Q7606B
Wavelength measurement range	**1530 to 1580 nm**	**1510 to 1590 nm**
Input optical power range	**-10 to +10 dBm**	**-20 to +10 dBm**
Free spectral range	**150 GHz ±15 GHz**	
Demodulation band width[2)]	**100 Hz to 50 GHz**	
Deviation of demodulation frequency	**65 GHzp-p or less**	
Resolution of demodulation frequency	**20 MHzp-p or less[3)]**	
Insertion loss	**–**	**10 dB or less**
Optical output power	**0 dBm or higher[4)]**	**Input optical power (dBm) -10 dB or higher[5)]**
Output stage optical amplifier:	**Built-in optical amplifier with automatic gain adjustment**	**–[6)]**
Input light polarization compensation	**Built-in automatic polarization compensator**	

Notes:
1) At 23 ±5°C
2) 130 MHz as standard, 1 dB down.
3) Depends on the measurement level resolution of an external sampling oscilloscope and input optical power.
4) Output optical power in average. Optical power will be automatically adjusted by the automatic gain adjustment function.
5) Depends on the input optical power.
6) Generally, when Q7606B is used for chirp measurement, an external optical amplifier capable of gain adjustment is required to obtain optical power conforming with the range of input optical power of an external O/E converter.

Input/Output Specifications

Optical input/output:	**FC/PC connector**
GPIB:	**In accordance with the IEEE488-1978**

General Specifications

Operating environment:	**Ambient temperature: 0 to +40°C** **Relative humidity: 85% max. (no condensation)**
Storage environment:	**Ambient temperature: -20 to +60°C** **Relative humidity: 90% max. (no condensation)**
Power requirement:	**100 to 120 V AC, 220 to 240 V AC, 50/60 Hz, 85 VA or less** **Automatic switching between the 100 and 200 V systems**
Dimensions:	**Approx. 132 (H) x 424 (W) x 500 (D) mm**
Mass:	**15 kg or less (Approx. 33 lb or less)**



ADVANTEST

ADVANTEST CORPORATION
Shinjuku-NS building, 4-1
Nishi-Shinjuku 2-chome
Shinjuku-ku, Tokyo 163-0880,
Japan
Tel: +81-3-3342-7500
Fax: +81-3-5322-7270
http://www.advantest.co.jp

Advantest (Singapore) Pte. Ltd.
438A Alexandra Road,
#8-03/06 Alexandra Technopark
Singapore 119967
Tel: +65-274-3100
Fax: +65-274-4055

Tektronix Inc. (North America)
P. O. Box 500 Howard Vollum
Industrial Park Beaverton,
Oregon 97077-0001 U. S. A.
Tel: +1-800-426-2200
Fax: +1-503-627-4090

Rohde & Schwarz Engineering and Sales GmbH (Europe)
Mühldorfstraße 15
D-81671 München, Germany
P.O.B. 80 14 29
D-81614 München, Germany
Tel: +49-89-4129-13711
Fax: +49-89-4129-13723

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ADVANTEST

Q7606A/7606B
Optical Chirpform Test Set

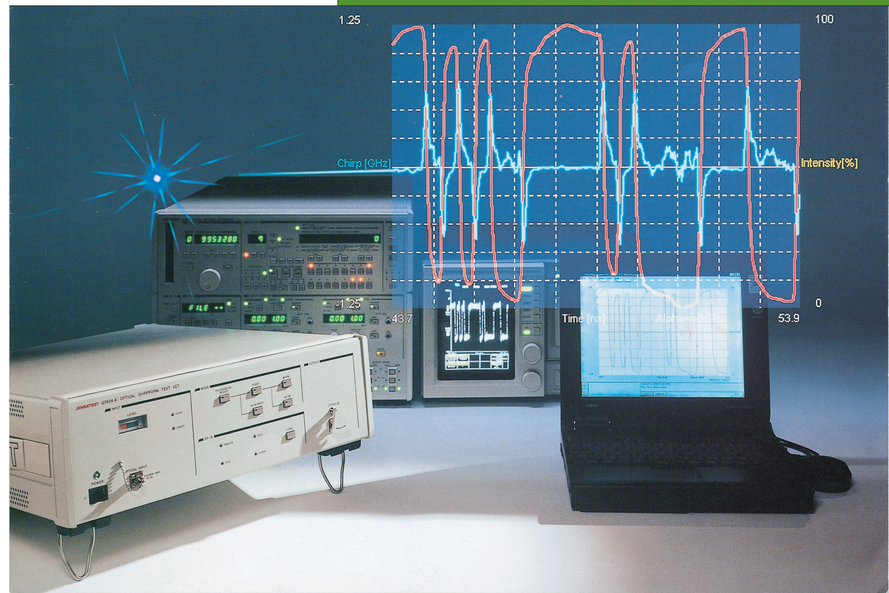
For Easy and Quick Measurement of Dynamic Chirp in Optical Modulators and Laser Diordes

Functionally Improved for Production Line Use!

- Quick Time-Domain Chirp Measurement: 30 sec. or less
- High Resolution: Approx. 20 MHz or less
- Excellent Repeatability: ±5 %
- Wide-Measurement Frequency Bandwidth: 50 GHz or more
- Automatic Polarization Adjuster
- Built-In Optical Amplifier (Q7606A)



Q7606A/7606B



Measures Dynamic Chirp in Optical Modulators and Laser Diordes Easy and Under 30 Sec.

The landscape for information carrying networks is rapidly changing due to enabling technologies that increase transmission rates for optical communication systems, especially for optical long-distance and wavelength division multiplexing (WDM) transmission systems. This means optical engineers who design/integrate high-speed optical components and transmission systems also require new instruments to meet their test needs. One such test need is the ability to measure dynamic chirp*. ADVANTEST developed the Q7606A/7606B Optical Chirp Test Set. With ADVANTEST's D3186 Pulse-Pattern Generator, a digital sampling oscilloscope, and a personal computer, the Q7606A/7606B evaluates chirp characteristics in the time-domain (dynamic chirp) generated from optical modulators and laser diodes.

Functionally improved for production line use!

NEW FUNCTION 1: Automatic Polarization Adjuster

The Q7606A/7606B has an automatic polarization adjuster that facilitates high-speed and high-accuracy measurements by automatically adjusting polarization.

NEW FUNCTION 2: Built-In Optical Amplifier (Q7606A)

The Q7606A comes with a built-in optical amplifier that amplifies the output signal for high-bandwidth, unamplified O/E converters. This feature automatically controls the amplifier gain, which improves both measurement accuracy and S/N ratio measurements.

Features

- **Quick Time-Domain Chirp Measurements: 30 seconds or less (*1)**
  Until now, no simple and easy method existed to measure dynamic chirp. With the Q7606, ADVANTEST makes dynamic chirp measurements a simple and easy process by automatically separating the frequency-modulation (FM) and intensity-modulation (IM) components. Conventional methods using spectral diffraction took 20 minutes or more for chirp measurement. However, using Q7606A/7606B allows the user to measure dynamic chirp in 30 seconds or less.
- **High-Resolution (*2)**
  The Q7606A/7606B measures chirp in approximately 20 MHz or less.
- **Excellent Repeatability (*3)**
  The Q7606A/7606B's measurement repeatability is + 5%.
- **Wide-Measurement Frequency Bandwidth**
  The measurement frequency is approximately 50 GHz or more. This allows the Q7606A/7606B to measure transmission signals greater than 10 Gbps.
- **Simple Operation**
  The user can measure chirp on any personal computer. The measurement data can also download to a spreadsheet, transmission waveform simulator, etc.

*1 *Chirp measuring time depends on oscilloscope's trigger setting and other factors.*

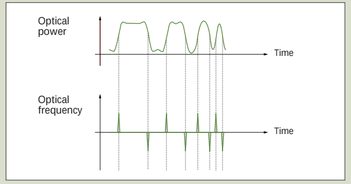
*2 *The measurement resolution depends on the sampling oscilloscope's setting and intensity of the incidental light.*

*3 *The measurement repeatability depends on intensity fluctuation of the sampling oscilloscope and the incident light.*

**Windows 95 is a registered trademark of Microsoft Corporation in the U.S.*

*What is Chirp?

Chirp is dynamic and subtle changes in wavelength that are generated during digital modulation of an optical carrier signal emitted from laser diode for communications in an optical communications system.
For example, an optical modulator generates pulses of light as signals by changing the optical intensity inside the modulator during digital modulation. Chirp, or fluctuation in optical frequency, is caused by slight changes in refractive index in the optical modulator (see figure at right). Chirp will generate group delay according to the wavelength dispersion characteristics in the optical transmission line, distort the waveform of the light signal, and cause deterioration in transmission quality. Also, as WDM uses transmission channels with very narrow spacings in between each, subtle changes in wavelength causes the channels to crosstalk and become interference to the transmission.



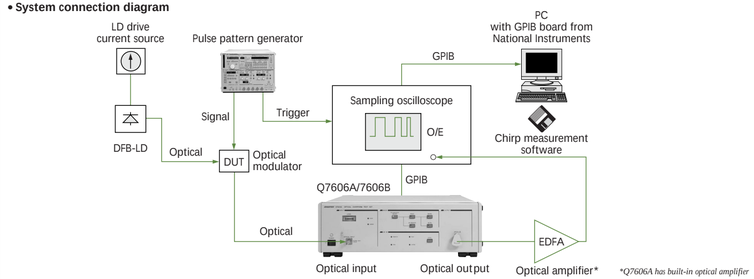
Digital modulation and chirp

Thus, measurement, evaluation, and control of the dispersion characteristics of optical transmission lines and the chirp characteristics of light signals are considered parameters that limit the transmission distance and bit rate of optical transmission systems.

Dynamic Chirp Measurement System

System Configuration

- **System connection diagram**



**Q7606A has built-in optical amplifier*

- **Products used in system**

Product Type	Model	Note
Optical Chirpform Test Set	Q7606A/7606B (ADVANTEST)	
Chirp Measurement Software	PQ76000401-FK (ADVANTEST)	For Windows 95, Windows 98, Windows NT4.0 or higher
Pulse Pattern Generator	D3186 (ADVANTEST) Clock option 10 (150 MHz to 12 GHz) or Clock option 11 (2 to 12 GHz) is necessary	
Personal Computer		OS: Windows 95, Windows 98, Windows NT4.0 or higher
GPIB Board		National Instruments
Sampling Oscilloscope	Tektronix:11801, CSA803	
Sampling Oscilloscope Plug-in (O/E converter)	Tektronix(Bit rate/Sampling head/O/E converter): 2.5Gbps/SD-22/SD-44,5Gbps/SD-26/SD-44, 10Gbps/SD-32/SD-48	
Optical Amplifier		Gain should be fixed.

Operating Principle

Uniquely Developed Built-in Polarization Controlled Optical-fiber-type Mach-Zehnder Interferometer for Optical Frequency Discrimination

The Q7606A/7606B has a built-in polarization controlled optical-fiber-type Mach-Zehnder interferometer for discriminating optical frequency (Fig. 1). Other features include an automatic polarization controller for the optimum state light input, and controlling output signals by monitoring the interferometer output with discrimination operating-point-control signal, so the interferometer maintains optimum discrimination characteristics.
Fig. 2 shows the frequency discrimination characteristics of the Mach-Zehnder interferometer. The light-frequency deviation of light input is measured as changes in output power. However, the interferometer outputs modulated light as a signal containing both frequency-modulation component (FM) and intensity-modulation component (IM). Under this condition, the FM cannot be accurately measured.
To separate the FM from the IM, the Q7606A/7606B identifies two pairs of data streams: the sum (IM+FM) and the difference (IM-FM) by switching measurement modes (Fig. 3), which switches the polarity of the optical frequency discrimination characteristics of the interferometer. These two types of data are then calculated.

$$\frac{(IM+FM) - (IM-FM)}{2} = FM$$

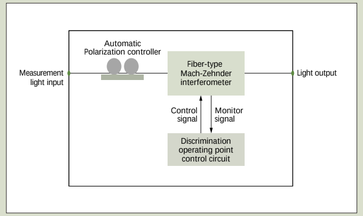


Fig. 1 Q7606A/7606B Interferometer Configuration of the Q7606A/7606B Optical Block

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Chirp Measurement Considerations

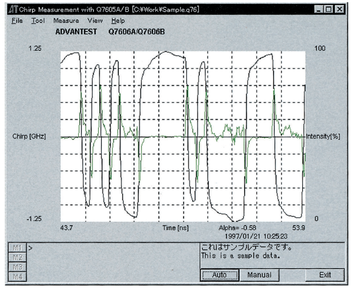
The chirp value is the difference of one pair of output signals from the Q7606A/7606B and the sampling oscilloscope. Hence, the time resolution of the chirp measurement depends on the time resolution of the sampling oscilloscope. The user should measure the sampling oscilloscope's signal at an appropriate S/N ratio. Also, suitable averaging for the sampling oscilloscope should be selected to obtain the optimized S/N ratio.

Sampling Oscilloscope Considerations

The output of the Q7606A/7606B is a light signal. Therefore, an O/E converter with sufficient bandwidth is required to display the output on a sampling oscilloscope. The sampling oscilloscope must also possess sufficient bandwidth to handle the measured frequencies. Zero-offset correction is necessary for the sampling oscilloscope before measuring chirp. If zero-offset is not corrected, the measured chirp will include an offset error. The sampling oscilloscope requires a waveform trigger signal. For the chirp measurement, the sampling oscilloscope's waveform must be in the time-domain.

Chirp Measurement Software Considerations (Sold separately)

The chirp measurement software requires 10 megabytes of free space on the personal computer's hard-drive.
The chirp measurement software can be used with the appropriate sampling oscilloscopes.



Example of Chirp Measurement

Personal Computer Requirements

The operating system must be Windows 95(J, Windows 98 (J, Windows NT 4.0(J or higher.
The personal computer requires a GPIB board from National Instruments. (The type of National Instrument's GPIB board depends on which bus the personal computer uses. For details, refer to the GPIB board catalog from National Instruments.)

Reference
Time-resolved chirp measurement of modulator-integrated DFB LD by using a fiber interferometer. OFC '95 Technical Digest
Y. Kotaki, H. Shoda

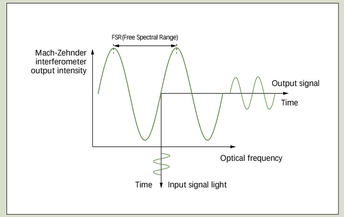


Fig. 2 Mach-Zehnder Interferometer I/O characteristics

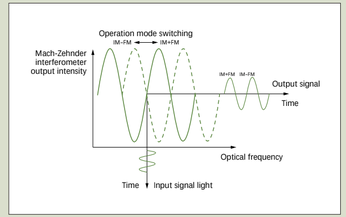


Fig. 3 Separation of IM and FM

Conventional methods using spectral diffraction for optical frequency discrimination required complicated adjustment in the optical system, since spatial light is used. As a result, stable measurement cannot be performed quickly, and took more than 20 minutes for measurement. The Q7606A/7606B uses optical fiber, which requires no adjustment of the optical axis. Therefore, chirp can be measured reliably and in less than 30 seconds.

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