Optical Network Analyzer Q7750 and Optical Chirpform Test Set Q7606

Unique measuring instruments for wavelength division multiplex

Photo: Photodisk

The enormous amount of data distributed today around the globe is mostly transmitted via fiber-optic cables, submarine cables featuring largely in this [1]. An efficient way of increasing the data rate in fiber-optic cable networks is to transmit several optical wavelengths using the wavelength division multiplex method. ADVANTEST, a cooperating partner of Rohde & Schwarz for many years, has launched two completely new and unique instruments on the world market for measurements on active and passive components in this application.

Before: one fiber, one wavelength

The developers of the first fiberglass transmission links knew that their bandwidth resources were immensely greater than those of copper cables. But many years of intensive research were required before this potential could be adequately utilized.

Until about three years ago, information in fiber-optic cables was transmitted to relatively wideband receivers almost exclusively with a single wavelength. More than ten years ago already, engineers achieved data rates of 2.5 Gbit/s with this method in the laboratory, shortly after 10 Gbit/s and more. Since these transmission rates are now far too low for

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FIG 1
Users familiar with RF network analysis will immediately feel at ease with Optical Network Analyzer Q7750: only the enter key labelled "THz" may seem unusual at first

handling international information exchange, eg on the Internet, new ways were sought of making full use of the bandwidth capacity of glass fibers.

Now: one fiber, many wavelengths

Since a data rate increase at the transmitter end can presently only be achieved with considerable technical outlay, the use of several multiplexed optical wavelengths is an efficient alternative. It is possible, for instance, to transmit 20 Gbit/s using eight of the presently favourably priced 2.5 Gbit channels on a single fiber with the aid of WDM (wavelength division multiplex). With greater channel density of up to 128 x 10 Gbit/s, laboratories are about to achieve transmission rates in the terabit range (DWDM = dense wavelength division multiplex).

In the high-frequency range the step into multiplexing was taken decades ago. With optical transmissions this was not possible for a long time since, until a few years ago, really stable transmitters were not available. In the beginning, the developers made do with two widely spaced wavelengths, but this proved to be unsuitable for long-haul transmissions. All modern WDM and DWDM systems operate in the region of 1550 nm with a channel spacing of often only 100 GHz (0.8 nm) and soon even 50 GHz (0.4 nm).

Compared to the standards used in radiocommunication, this spacing strikes one as being very wide. The situation is completely different in the case of optical transmissions. Here extremely stable lasers and highly selective wavelength demultiplexers are required, which also makes high demands on measuring instruments.

ADVANTEST took up the challenge and extended its range of measuring instruments accordingly, presenting two new instruments that are absolutely unique on the world market.

Unrivalled instruments for measurements on active and passive components

Optical Network Analyzer Q7750 (FIG 1) is designed for characterizing passive elements, eg optical wavelength splitters, which split up the WDM signal into single channels before it can be detected by a receiver.

Anyone familiar with RF network analysis will quickly feel at ease with this instrument. Only the enter key labelled "THz" (1 THz = 1000 GHz) indicates that Q7750 measures in the region of infrared light. It simultaneously measures reflection and transmission characteristics, the display being switchable between amplitude, optical group delay and chromatic dispersion. Revolutionary are not only the type and scope of result recording but also the short measurement time of only several seconds depending on instrument settings.

Optical Chirp Test Set Q7606 (FIG 2) is used for characterizing active com-

FIG 2 Optical Chirp Test Set Q7606 measures wavelength stability during level transition with unrivalled time-domain and spectral resolution

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ponents, ie laser generators and modulators. It measures wavelength stability during level transitions with unrivalled resolution in the time domain and spectrum. Q7606 works by the principle of an optical heterodyning receiver and its 20 MHz frequency resolution in the spectral range is higher by several powers of tens than that of an optical spectrum analyzer. This instrument opens up completely new potential in the fairly young field of optical phase modulation, unrivalled by any other product on the market. FIG 3 shows amplitude (blue) and optical frequency modulation (chirp) characteristics for comparison.

By offering these new measuring instruments, Rohde & Schwarz will contribute its share to reducing the time for measuring important parameters of WDM components in development, production and quality assurance. Users will be able to advance the development of even more powerful transmission components for the information society of the future.

Peter Wollmann

Condensed data of Q7750

Wavelength	1530 nm to 1600 nm
Channels	S11 and S21 (optical)
Measurement functions	amplitude, group delay, chromatic dispersion
Wavelength error	±0.025 nm
Sweep range	0.1 nm to 70 nm
Dynamic range	transmission: 35 dB (typ. 40 dB) reflection: 33 dB (typ. 38 dB)
Group delay	0.1 ps to 25 ns
Chromatic dispersion	0.01 ps/nm to 1 µs/nm

Condensed data of Q7606

Wavelength	1510 nm to 1590 nm (Q7606B) 1530 nm to 1580 nm (Q7606A)
Power range	–20 dBm to +10 dBm (Q7606B) –10 dBm to +10 dBm (Q7606A)
Free spectral range	150 GHz ±15 GHz
Demodulation bandwidth	100 Hz to 50 GHz
Resolution of resolution bandwidth	20 MHz pp
Insertion loss	10 dB (Q7606B only)

Reader service card 164/03

REFERENCES

[1] Peter Wollmann: Global players under the sea: market leader for fault location in submarine cables. News from Rohde & Schwarz (1999) No. 163, pp 42–43

FIG 3
Amplitude (blue) and optical frequency modulation (red)