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Evaluation of SONET/SDH Networks

More than a decade has passed since the SONET (Synchronous Optical Network) and SDH (Synchronous Digital Hierarchy) systems were standardized by the ANSI and the CCITT (present ITU-T). During that time, SONET/SDH technologies have been adopted in worldwide trunk networks and high-speed transmission networks have spread globally.

Thanks to increased demand due to the popularization of the Internet and other Services, line bit rates have increased. At present, the bit rates of most SONET/SDH nodes have increased to 2,5 Gbit/s or 10 Gbit/s, and R&D has begun on 40 Gbit/s products. In many submarine transmission systems constructed after 1999, 10 Gbit/s bit rates and WDM transmission technology have been adopted, and in many land transmission systems, too, 10 Gbit/s bit rates are also adopted.

Anritsu has launched an exclusive 10 Gbit/s measurement system using the ME3630A SDH/SONET Analyzer to meet the requirements for testing OC-192/STM-64 (10 Gbit/s) systems. Meanwhile, the company has commercialized small, lightweight analyzers, the MP1552B SDH/PDH/ATM and the MP1555B SONET/ATM Analyzers, both of which are capable of measuring up to 2,5 Gbit/s. Recently, Anritsu developed the MP1570A SONET/SDH/PDH/ATM Analyzer, capable of measuring up to 10 Gbit/s and successor to the MP1552B and the MP1555B, in order to make it possible to totally evaluate SONET/SDH networks.

Outline

The MP1570A has six slots for inserting suitable plug-in units, depending on the application, to enable SONET/SDH testing in a bit rate range from 1,5 Mbit/s to 10 Gbit/s with only a single unit. By combining suitable plug-in units, ATM, jitter and wander tests are also possible. Moreover, the compact main frame offers superior portability, and a built-in printer and a 3,5-inch floppy disk drive are standard equipment, making it ideal for the construction and maintenance of SONET/SDH networks. In addition, it has various other functions for SONET/SDH

system development and manufacturing.

Meanwhile, for transmission of IP (Internet Protocol) used on the Internet, IP over SONET/SDH or IP over ATM are mainly used. In both cases, SONET/SDH concatenation mapping technology is employed. The MP1570A is designed to handle concatenation mapping up to OC-192c/VC4-64c, and it can also carry out various measurements including Through No frame, CID, Tandem connection and APS measurements.

Features

Concatenation Mapping

IP packets multiplexed by core routers are, in many cases, mapped on the SONET/SDH system through PPP (Point-to-point protocol) or the ATM (Asynchronous transfer mode) system. The termi-

nal equipment of a SONET/SDH system is designed to directly accommodate high-speed core routers, and for the interface, large-capacity concatenation mapping using a number of linked SPEs (synchronous payload envelopes)/VC (Virtual container) is used. Currently, the speed of the core routers has been increased up to OC-48c/VC4-16c (2,5 G), and it will surely be increased further to OC-192c/VC4-64, (10 G) in the near future (fig. 2).

The MP1570A can measure such concatenation mapping, and has made OC-192c/VC4-64c testing possible for the first time. It can also test multiplexing, such as OC4 c/STM-16c x 4, enabling SONET/SDH interface testing of core routers and MUX/DEMUX testing of the terminal multiplex conversion equipment of SONET/SDH systems accommodating core routers.

With the OC-192c/VC4-64c system, PRBS patterns are inserted into almost all sections of the OC-92/STM-64 (10 G) signal. So by using the MP1570A for testing a WDM system, all errors can be evaluated at once.

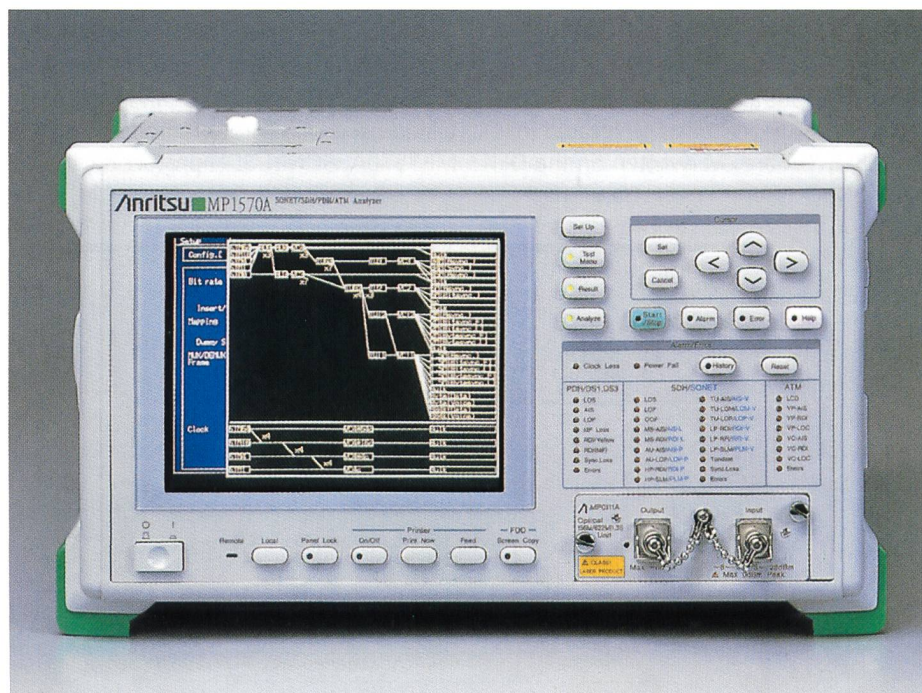


Fig. 1 External view of the MP1570A SONET/SDH/PDH/ATM Analyzer.

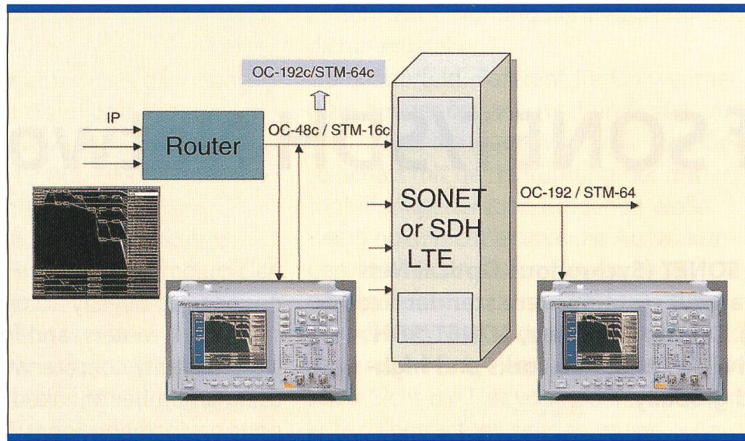


Fig. 2 Concatenation mapping.

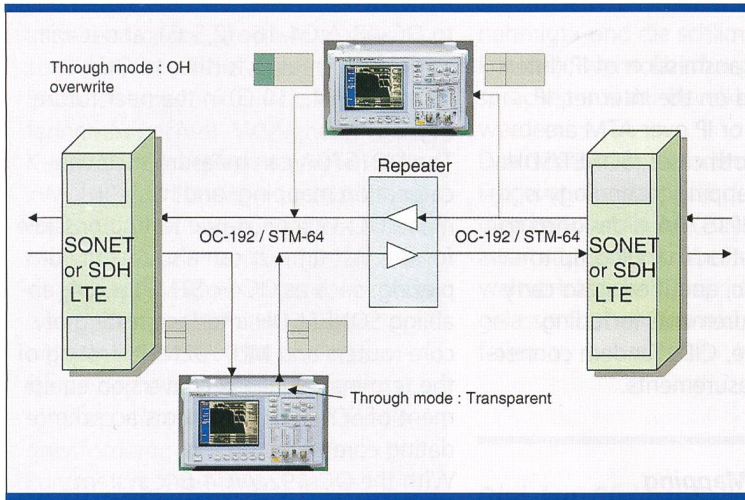


Fig. 3 Through mode.

Through Function

The through mode can be selected in any of four modes: Transparent, Overhead (OH) overwrite, Payload overwrite, and Add/drop modes. In the Transparent Through mode, the received Through signal is output as it is, while in the OH overwrite mode, patterns generated in the MP1570A are overwritten on the OH

bytes of the Through signal. This makes it possible to test Alarm insertion in the Through signal. And thanks to the provision of four modes, testing applications in the Through mode, have been greatly increased (fig. 3). For example, when a high-speed ATM switch or an IP router is tested using the Through mode of the MP1570A, SONET/SDH protocols can be

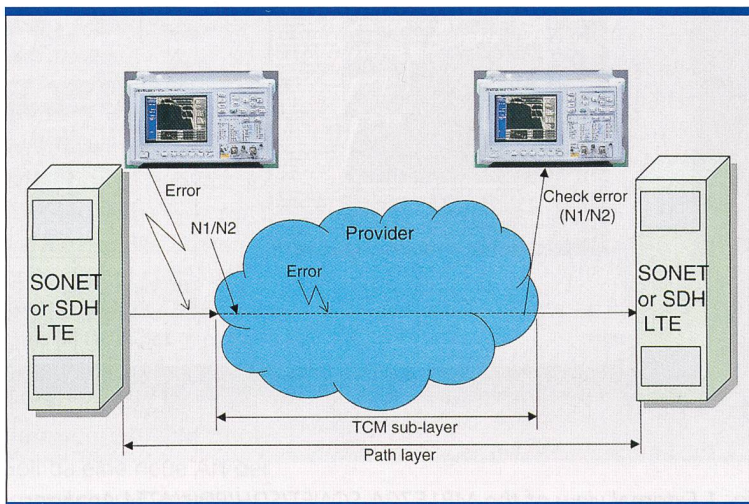


Fig. 4 Tandem connection.

tested easily without using an expensive, exclusive measuring instrument.

Tandem Connection

Thanks to the relaxation of regulations in the communications market, there are many cases where SONET/SDH paths are transmitted through other carrier systems. The ITU-T and other organizations regulate Tandem connection monitoring employing the N1/N2 byte of the POH (Path Overhead) in such cases, in order to monitor error generation in the carrier systems the paths pass through. The MP1570A not only has an IEC (Incoming error count) function, but also functions to generate and detect Trace IDs or Alarms in Tandem connection on a real-time basis (fig. 4).

APS test

The SONET/SDH system has an excellent automatic switching function, and both Bellcore and ITU-T regulate this switching time to less than 50 ms. The MP1570A can measure the switching time under various error/alarm conditions (fig. 5). It also supports switching function tests using K1/K2 byte sequence generation and sequence capture functions.

OC-192/STM-64 Jitter Measurement

Anritsu was the first to commercialize a 10 GHz jitter analyzer, the MP1777A, which can evaluate OC-192/STM-64 (10 G) jitter as recommended by ITU-T 0.172, that was introduced in Anritsu News Vol. 19, No. 93 published in June 1999.

Demand for jitter measuring instruments has increased since the US's Bellcore GR1377 regulation established the OC-192 jitter standard, and ITU-T will recommend its STM-64 jitter measurement standard in G.825 in the near future.

The MP1570A can be combined with the MP1777A Jitter Measurement System (fig. 6). In addition, Anritsu has also developed an exclusive O/E converter, the MP9677A, which is necessary for measuring jitter correctly in the 80 MHz jitter modulation band.

Conclusion

The MP1570A has various other functions in addition to those already described, such as POH setting on a dummy channel, insertion of PRBS into a Payload, simultaneous measurement of the VT1.528 and VC1221 channels, and

frequency and optical power measurement. From the very first use, its overall handiness cannot help but impress. Recently, new IP over WDM technology to support large-capacity data transmission has been proposed, in which SONET/SDH frames are canceled to directly transmit IPs through an optical fiber. Before this technology can be realized, however, many problems still need to be overcome. Consequently, SONET/SDH networks based on OC-192/STM-64 will certainly be developed even further, and the MP1570A SONET/SDH/PDH/ATM Analyzer, which totally supports testing of such networks, will contribute greatly to their development.

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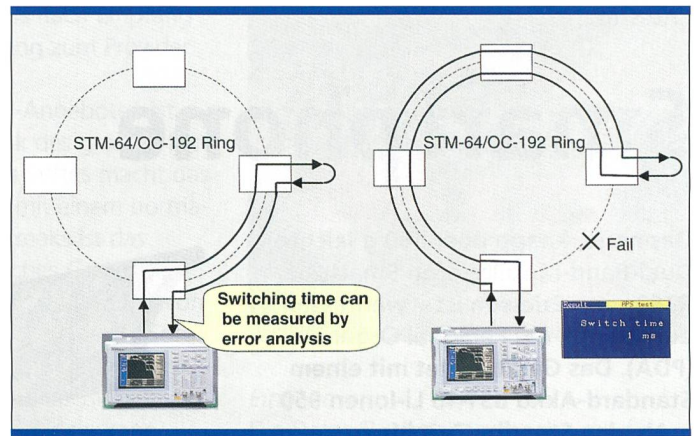


Fig. 5
 APS measurement.

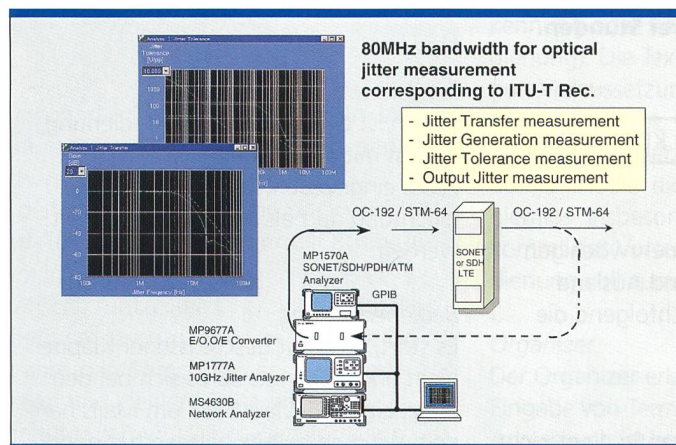


Fig. 6.
 OC-192/STM-64
 optical jitter
 measurement.

Mobiltelefon im Auto und seine Folgen

Das New England Journal of Medicine hat eine Studie veröffentlicht, nach der das Mobiltelefonieren im Auto die Unfallgefahr vervierfacht. In den USA haben daraufhin vielfältige Aktivitäten eingesetzt, die den Gebrauch von Hand-Set-Mobiltelefonen beim Fahren unterbinden sollen. Ausgenommen sollen davon die «Hands-free»-Einrichtungen mit Ohrhörer und Mikrofon sein. Das führt in Chicago und im ganzen Bundesstaat Illinois zu einem Kuriosum: Dort ist nämlich durch Verordnung die Benutzung von Kopfhörern beim Fahren strikt untersagt. Dieser Beschluss wurde früher gefasst, da jugendliche Autofahrer mit Kopfhörern bei hohen Lautstärken keine akustischen Warnsignale (Hupen, Feuerwehrsirenen) mehr wahrgenommen haben. Man grübelt derzeit, wie man die gegensätzlichen Forderungen unter ein Dach bringen kann.

Japan will wieder an die Spitze der Halbleitertechnologie

Mitte der 90er-Jahre gab es für kurze Zeit ein Kopf-an-Kopf-Rennen zwischen Japan und den USA um die Führung auf dem Halbleitergebiet. Durch die finanziellen Turbulenzen in Ostasien fielen die Japaner dann zurück und haben auch gegenüber den Europäern Federn lassen müssen. Sowohl die japanische Regierung als auch die grossen japanischen Halbleiterfirmen machen seit kurzem alle Anstrengungen, um auf strategisch wichtigen Gebieten in die frühere Wettbewerbsposition zurückzukehren. Die japanischen Chiphersteller (unter ihnen NEC, Toshiba und Hitachi) haben sich im so genannten Asugi-Projekt zusammenschlossen, das ab April 2001 technische Grundlagen für Chips mit feinsten Strukturen unter 100 nm erarbeiten will. 340 Mitarbeiter sollen in dem Projekt tätig werden. Zunächst sind rund 700 Mio. US-\$ für die Finanzierung vorgesehen.

4-MPixel-CCD macht Digitalphotos bis DIN A5 möglich

Sharp ist mit einem neuen CCD (Charge Coupled Device) auf den Markt gekommen, das mit einer Auflösung von vier Millionen Pixel neue Massstäbe setzt. Damit lassen sich Bilder in guter Qualität bis zum Format DIN A5 vergrössern. Das neue CCD hat eine Chipdiagonale von 9 mm. Gemeinsam mit dem CCD wird ein Chip ausgeliefert, der die Bildverarbeitung und die peripheren Anschlüsse zur Verfügung stellt. Beide Bausteine sollen zusammen zunächst für 278 US-\$ angeboten werden. Die Serienproduktion des Chipsets wird im April 2001 anlaufen.

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