All channel testing OmniBER OTN 10 Gb/s communications performance analyzer

Product note

Agilent Technologies

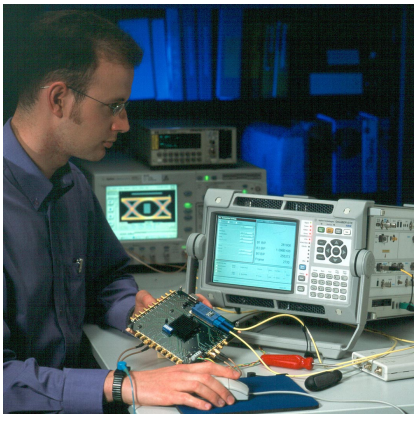
Introduction

The world of optical communications is quickly evolving as previously divergent data and telecommunications collide at 10 Gb/s. The collision of signal types, including SONET/SDH, ATM, IP and gigabit Ethernet, has forced network equipment manufacturers (NEMs) to create a new breed of network element (NE) — the multi-service aggregation platform.

Increasing deployed in the access network, these new NEs combine signal grooming with switching and multiplexing capability to enable more efficient use of bandwidth in the core network. However, while they ensure that heterogeneous traffic is safely transported over the network, these NEs have created new and challenging test requirements for NEMs in qualification and verification (Q&V) and manufacturing applications.

To fully check routing of transmission paths in multi-service aggregation platforms (or even SONET/SDH platforms), traditional testing using conventional test equipment would require sequential testing of each channel within the signal. To avoid this time consuming and inefficient test methodology, an obvious solution would be to simultaneously monitor all the channels in a single test — without compromising measurement accuracy.

Agilent's new OmniBER OTN offers the very latest in all-channel testing technology, providing simultaneous monitoring of up to 192 STS-1/AU3 channels in a 10 Gb/s signal. This product note examines how simultaneous monitoring technology can be applied to reduce design and manufacturing test time, and increase the depth of testing.



OmniBER OTN
10 Gb/s communications
performance analyzer

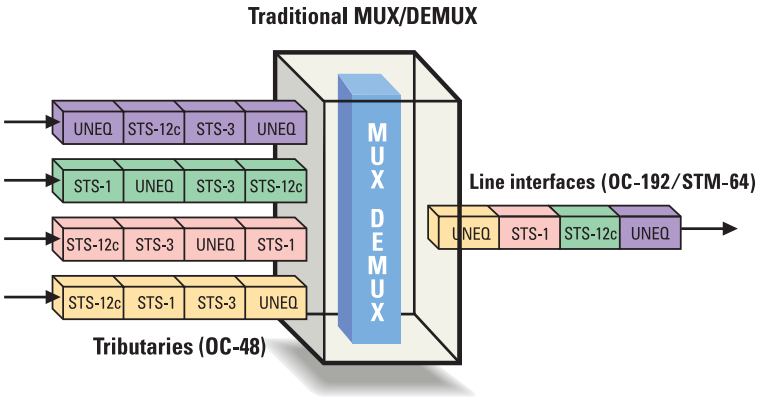
Simultaneous all-channel testing

To cope with the growth in traffic volume and diversity of traffic types in today's transmission networks, NEs are evolving. The latest NEs aggregate voice, data and video services and efficiently concentrate them for optimal use of bandwidth. These NEs also bring the functionality of multiple multiplexers, optical networking and switching together into a single platform, and typically support a variety of interfaces and bandwidths to STS-1/AU3 grooming granularity.

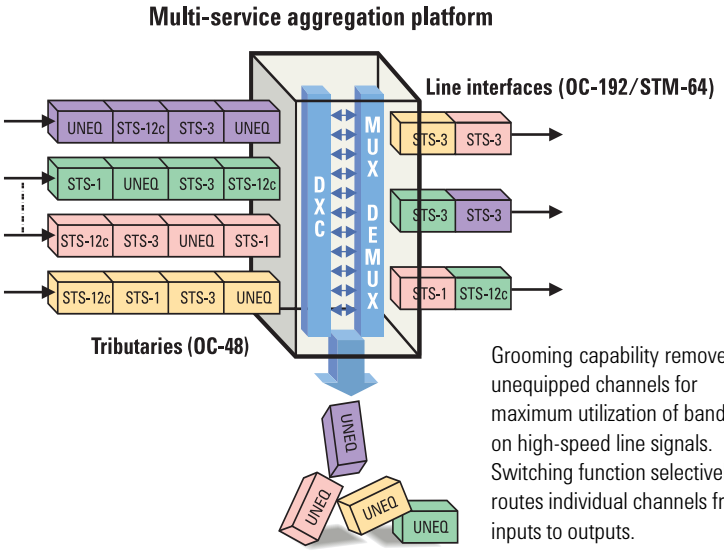
Agilent's latest member of the OmniBER family, the OmniBER OTN, allows the user to continuously monitor up to 192 channels (all STS-1's/AU-3's) simultaneously. It automatically identifies the line rate and channel structure of a received SONET/SDH signal, then monitors all channels for errors, alarms and pointer movements. In addition, it identifies the traffic-carrying status of each channel, including the type of service signal being transported. This level of precision is necessary if new generation aggregation platforms, add-drop multiplexers and digital cross-connects are to be both rigorously and efficiently testing for compliant operation.

The OmniBER OTN offers simultaneous monitoring at all SONET/SDH rates from 52 Mb/s up to 10 Gb/s. This capability is provided by the instrument's SignalWizard facility, providing depth and speed of test during qualification, verification and manufacturing test of NEs. Once enabled, SignalWizard automatically:

- Discovers the line rate and channel structure of any valid OC-n/STM-n signal. This includes OC-n/STM-n signals that contain any mix of standard and concatenated channels
- Simultaneously monitors the line signal and all STS/AU channels (up to 192) for errors, alarms and pointer activity
- Shows which channels are unequipped, and the type of service signal being carried by equipped channels
- Provides listing and search tools to identify path routing errors within the network element, and searches on any sub-string contained within the target path trace message



All input channels are multiplexed onto a single high-speed line signal (including unequipped).



Grooming capability removes unequipped channels for maximum utilization of bandwidth on high-speed line signals. Switching function selectively routes individual channels from inputs to outputs.

Figure 1. Network element evolution

Qualifications and verification applications

Qualifications and verification activities often generate the heaviest test demands, both at the initial design-release stage and with every change or upgrade in hardware or software. A strict test regime is required to ensure NE-design meets published specifications and relevant international standards for any configuration and setup. To meet this criteria, test regimes attempt to mimic a variety of network configurations the NE is likely to encounter in a working environment. This includes network interoperability test and hardware/software verification:

Network interoperability test

Network interoperability is a critical test for checking that different vendor's equipment can successfully function together. Usually performed after a change in hardware or software to the NE, these typically comprehensive tests look for unexpected faults caused by signal parameters and routing commands. The tests simulate live traffic and monitor the NE's response to errors and alarms.

Tributaries are loaded with a mix of signal types and the OC-192/STM-64 signal is monitored for alarms and errors, particularly intermittent faults that are difficult to detect in a real network. With traditional test equipment, each channel must be individually monitored. The OmniBER OTN's SignalWizard facility, however, lets you monitor all the channels simultaneously. This not only saves significant time, but also provides a more comprehensive test since all channels are visible thereby ensuring intermittent faults are unlikely to go undetected.

The OmniBER OTN can monitor the traffic in two modes: either from a tap, or in thru-mode. Figure 2 shows a typical network interoperability test set-up.

Hardware/software verification

When changes are made to an NE's hardware or software, it is crucial to ensure the modification does not affect the NE's operating performance. Whether the OmniBER OTN is used in thru-mode, or terminated on the line side or at a tributary, the ability to monitor all channels simultaneously has two benefits. First, test time is significantly reduced, and second, fault location (particularly intermittent faults) is greatly enhanced. Figure 3 shows a simplified hardware/software test set-up.

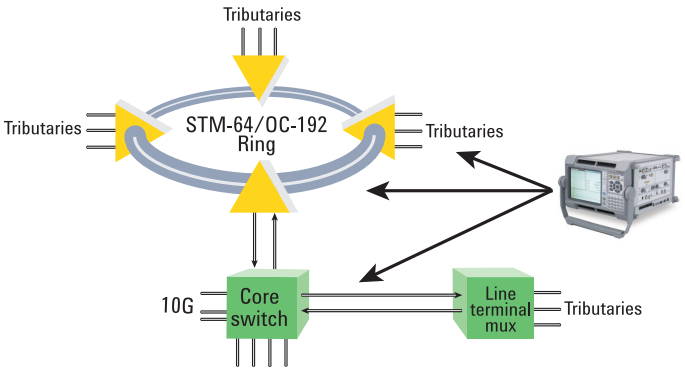


Figure 3. Simplified hardware/software verification test set-up

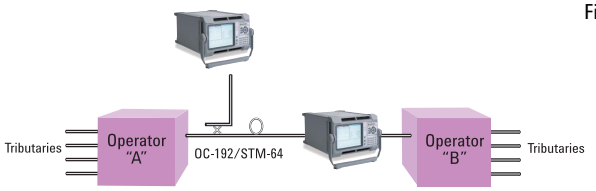


Figure 2. Interoperability test

Manufacturing applications

Line card test

Any manufacturing test regime is a compromise between two very different demands: short test time, and sufficiently comprehensive test routines. The OmniBER OTN ensures this compromise has minimal impact on product quality and delivery to customers. For example, many 10 Gb/s line cards have signal granularity as low as STS-1/AU-3. This can create test overload if each channel is tested individually. The OmniBER OTN's SignalWizard can detect the signal structure and monitor the performance of all 192 STS-1/AU3 channels in a 10 Gb/s signal simultaneously. Figure 4 shows a typical line card test set-up.

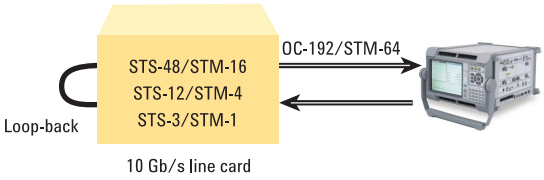


Figure 4. Line card test set-up

Just two key presses on the OmniBER OTN are required to access the test set's all-channel monitoring function. Once the OC-n signal of interest is connected to the appropriate receiver port on the test set, you simply press the 'Smart Test' button on the front panel of the instrument.

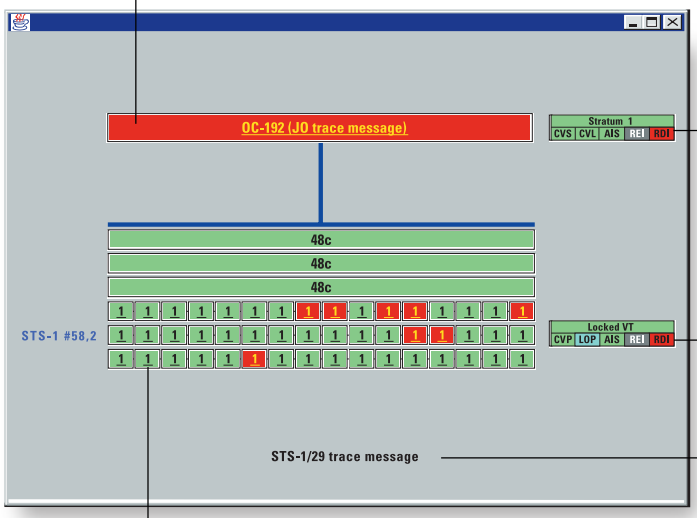
SignalWizard is now initiated and scans all the input ports to determine those receiving signals. (If more than one signal is detected, these will be displayed together with their associated line rates.)

The instrument displays the signal overview page allowing you to monitor the signal of interest, including error and alarm status, in its entirety.

In figure 3, it is evident that some of the STS channel mappings contain a sub-VT signal structure. By highlighting the signal of interest and pressing the 'Select' button, in-depth analysis can take place, as shown in figure 5.

Line signal viewer

Displays the detected SONET/SDH signal. If a J0 trace message is detected this is also displayed (both 16 and 64 byte message formats are supported).



Section/line viewer

Displays results information associated with the section and line levels of the signal, including

- synchronization status message (decoded S1 byte)
- CV-S (B1)/B1, CV-L (B2)/B2 and REI-L/MS-REI error status
- AIS-L/MS-AIS and RDI-L/MS-RDI alarm status

(LOS, LOF, OOF alarms are displayed on the instrument's front-panel LEDs.)

Selected STS/AU channel viewer

Displays result information associated with the selected STS/AU channel, including

- type of payload (traffic) being carried in the channel (decoded C2 byte)
- CV-P/B3 and REI-P/HP-REI error status
- AIS-P/AU-AIS, LOP-P/AU-LOP and RDI-P/HP-RDI alarm status
- indicator for detected pointer adjustments

STS/AU channel viewer

Each STS/AU channel detected in the signal is provided with a dedicated box that summaries the channels status. An STS/AU channel carrying a VT/VC mapping is highlighted by its size designator being underlined. Broadband mappings are not underlined.

The size designator displayed within each box is the channel size identifier, where 1 indicates STS-1 (3c indicates STS-3c, 12c indicates STS-12c, 48c indicates STS-48c and 192c indicates STS-192c). For SDH 3 indicates AU-3 (4 indicates AU-4, 4c indicates AU-4-4c, 16c indicates AU-4-16c and 64c indicates AU-4-64c). While any non-standard concatenated channel will be detected and displayed, no errors or alarms are reported. Unequipped channels are grayed out.

Pointer activity within the channel structure is indicated by the STS/AU background flashing blue.

J1 trace mesage

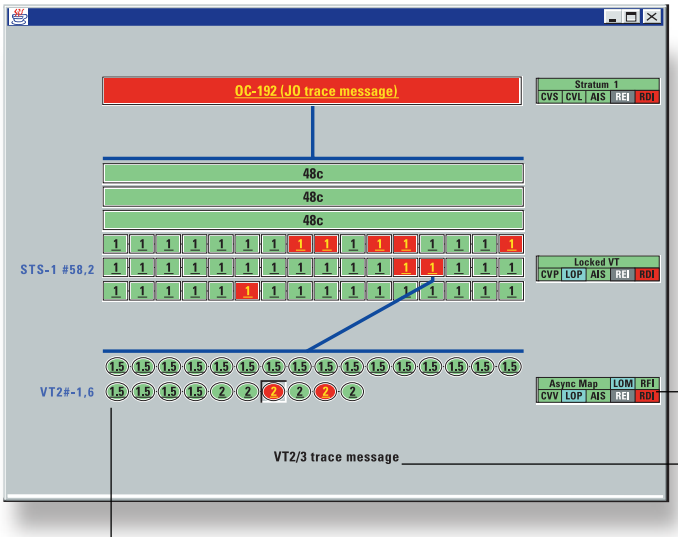
Displays the decode path trace message associated with the selected channel. Both 16 and 64 byte message formats are supported.

Color-coded results key

green	No errors/alarms detected since test started
red	Errors/alarms currently detected
yellow	Currently no alarms detected and error-free, however, errors/alarms detected earlier in measurement
grey	Unequipped channel
blue	Pointer adjustment detected
black	Illegal pointer value
red/black	AIS alarm

Figure 5. SignalWizard STS/AU-level monitoring

Figure 4. SignalWizard STS and VT monitoring



Selected VT/TU channel viewer

Displays result information associated with the selected VT/TU channel, including

- type of service mapping being carried in the channel (decoded V5 byte)
- BIP-2 and REI-V/LP-REI error status
- AIS-V/TU-AIS, LOP-V/TU-LOP, RFI-V/LP-RFI, RDI-V/LP-RDI and TU-LOM alarm status
- indicator for detected pointer adjustments

VT/TU channel viewer

Each VT/TU channel detected is provided with a dedicated display area identifying traffic status. For SONET the VT channel's size designator identifies the tributary rate, where 1.5 indicates VT1.5 and 2 indicates VT2. For SDH the TU size designator identifies the tributary rate, where 11 indicates TU-11 and 12 indicates TU-12. Channels underlined indicate the channel is carrying a mapped service. Unequipped channels are grayed out.

Pointer activity within the channel structure is indicated by the VT background flashing blue.

J2 trace message

Displays for the selected VT channel. Both 16 and 64 byte message formats are supported.

Path routing and traffic overview

When verifying new software upgrades for NEs, the ability to generate and monitor path trace messages is essential. That's because path trace messages confirm correct routing performance of the NE, enabling you to identify and locate any routing errors within the network. Path trace messages are also useful for checking routing performance of NEs during protection switching to confirm that the correct signals have been protected following fault conditions.

The OmniBER OTN provides path trace and traffic overview facilities for both the STS/AU and VT/VC signal structures. Furthermore, all the J1 path trace messages can be displayed at the same time, as can J2 path trace messages associated with each VT/VC channel for a selected STS/AU.

This makes it easy to continually monitor and therefore identify path routing errors.

It is also possible to perform a search on any sub-string contained within a target path trace message.

This includes all J1 path trace messages in the STS/AU channels, all J2 path trace messages in the VT/VC channels within a selected STS/AU, and all VT/VC channels in all STS/AU channels.

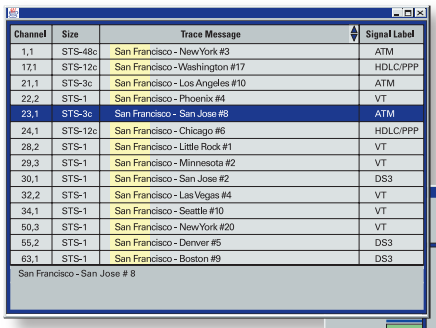


Figure 5. Path trace overview

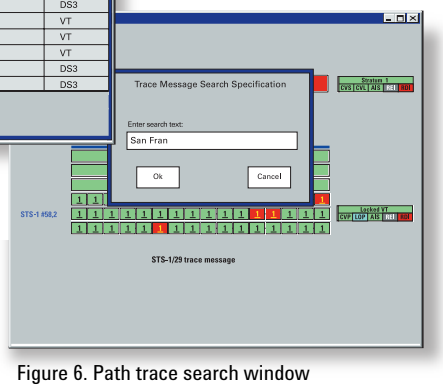


Figure 6. Path trace search window

Conclusion

Generating a test signal with the ability to simultaneously monitor all of the channels within the signal quickly determines the integrity of the NE-under-test without setting up complex testing procedures. The signal can also be applied to either the tributary or the line side of an NE (see figues 7 and 8). The attractive proposition of stimulating the NE from the line side is the reduction in the amount of test ports that require testing to completely check operational conformance. In short, SignalWizard offers fast, effortless and comprehensive testing.

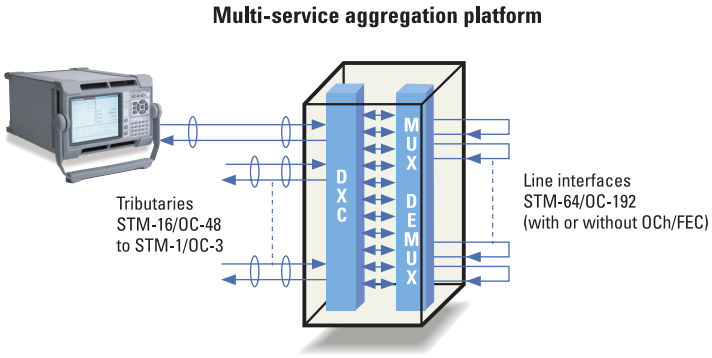


Figure 7. Tributary-side testing a next-generation platform

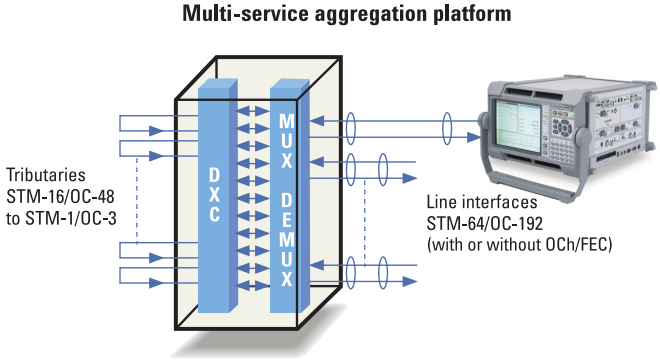


Figure 8. Line-side testing a next-generation platform

Product literature

You'll find further details of the OmniBER OTN's capability in the product specification publications no. 5988-3653EN and configuration guide publication no. 5988-3654EN or at www.agilent.com/comms/otn

Related products

The Agilent Technologies OnmiBER 718 communications performance analyzer is the proven SONET/SDH one-box test solution. It provides full T-carrier/PDH and SONET/SDH up to 2.5 Gb/s, including concatenated payloads, ATM, Jitter and POS. For further information, refer to publication no. 5968-8740E

OmniBER 718

The OnmiBER 725 combines best in class SDH and SONET jitter capability at all rates up to 2.5 Gb/s, with differential electrical interfaces. Offering unframed PRBS signals it's the ideal choice for testing optical components and modules. For further information, refer to publication no. 5988-0327EN.

OmniBER 725

Focused on field applications, the J2127A transmission test sets cover all rates from 64 kb/s up to 10 Gb/s. Supporting SONET/SDH and T-carrier/PDH configurations, the test set offers simultaneous monitoring technology for faster turn-up and troubleshooting. For further information, refer to publication no. 5988-2569EN.

Transmission test set

Agilent Technologies manufactures the OmniBER OTN under a quality system approved to the international standard ISO 9001 plus TickIT (BSI Registration Certificate No FM 10987).

CE

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