

# CT'S OPTICAL T&M TECH GUIDE

September 2008

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## Success Fuels Sector

Remember the fiber scarcity? The usual sources dried up because so many new service providers had bought and deployed fiber with dangerously high hopes.

Most of those optical start ups are gone, but that fiber remains. That relative abundance combined with the strength of today's opto-electronics are two of the drivers behind the optical test and measurement sector.

### BACKBONES AND RINGS

Consider the maturity in the metro and long-haul space. Optical backbones, no longer the exclusive domain of the industry's largest MSOs, have themselves grown.

Both Cox and Comcast have taken greater ownership of their own national fiber networks. Tests of a 100 Gbps Ethernet link between Philadelphia and McLean VA demonstrated how much throughput these networks are capable of providing—and how far from the lab we've traveled.

With the maturing of technology, so too its deployment has widened, resulting in a curious narrowing of the gap between the larger and smaller MSOs. The optical rings that have helped regionalize

Time Warner Cable's Carolina systems is comparable in effect to the figure-eight ring that loops Suddenlink's West Texas properties, for instance.

Moreover, close a few missing links and Texas and Carolina could become virtual neighbors, sharing optical capacity.



### More colors, more testing

The technologies behind such developments—such as reconfigurable optical add/drop multiplexers (ROADMs) and photonic integrated circuitry—have made it all the more possible for operators of all sizes to exploit the available fiber.

With greater speeds and longer distances and so many strands of dark fiber comes

coincident needs for operators to measure, power, monitor and characterize.

As noted by Tim Brophy and Ray Thomas in their Cable-Tec Expo paper (see sidebar), optical time domain reflectometers (OTDRs) may be limited as troubleshooting tools, but they are very good at characterizing links not yet connected.

### MWL OPTIONS

One place where fiber remains on the scarce side—more so for some operators than others—is in the access plant. That constraint, however, has fueled the application of increasingly efficient wavelength division multiplexing (WDM) to this space.

The variety of what are now also commonly called multi-wavelength (MWL) optical access technologies has created several corresponding challenges.

One challenge involves simply keeping track of the wavelengths themselves.

The development of an optical channel checker (OCC) family of testers from JDSU—OCC-55 for coarse (C) WDM and OCC-56 for dense (D)WDM—is one response to that need.

Desire to forge a consensus  
*continued on page 3*

## Toolkit

From the paper presented at SCTE Cable-Tec Expo 2008 by Tim Brophy, Ph.D., director of network architectures, Cisco Systems, and Ray Thomas, principal engineer, Time Warner Cable on "Troubleshooting Today's Optically Rich and Expanded Bandwidth Networks":

### OPTICAL CONNECTOR VIDEO MICROSCOPES

*One area of optical measurements that should be emphasized is the cleanliness of optical connectors. This was already important in a single wavelength world. It becomes even more critical with the deployment of multiple wavelengths in the access network. Each and every connector should be inspected for contamination or other impairments of the end face before connecting.*

*Note that we did not say 'clean before connecting.' If inspection shows that the connector is already clean, swiping it from force of habit is not necessary and could even be detrimental.*

*Significant progress has been made on development of optical connector video microscopes...*

### OPTICAL TIME DOMAIN REFLECTOMETER (OTDR)

*Optical time domain reflectometry in a link is essentially a power measurement of light reflected*  
*continued on page 8*



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sus on how to test and on which exact wavelengths to deploy lead ARRIS and Cisco to submit a project authorization request to the SCTE Engineering Committee on related standards.

Whether the SCTE embarks on this effort or lets several options work themselves out in the market, perhaps with implicit guidance from existing ITU-T standards on the C-Band, remains to be seen.

What is clear is that as the optical realm from the head-end to the node grows in complexity, as it gains more wavelengths susceptible to drifting from their assigned slots on the grid, so too additional efforts are required to track and monitor them.

#### PON/RFOG

A final driver for additional attention to optical T&M equipment is the attention that operators and vendors have given to passive optical networking (PON) options.

By way of the RF over Glass (RFOG) effort within the SCTE Interface Practices Subcommittee, that is an effort that the industry has blessed. Vendors and operators have

likewise and respectively moved forward in building and in limited cases deploying fiber to the premises solutions.

Verizon's own activity in that realm has ripened the for optical field test equipment. But and tomorrow's will need more than a microscope to inspect fiber before splicing, as critical as that may be.

(See sidebar, p 1.)

Fiber optics is a technology that lifts all boats. Today's signal level meter (SLM) may become a more sophisticated optical signal analyzer (OSA). But tomorrow's field technician may also need access to what are increasingly becoming test platforms, with modules that might enable everything from

a physical layer characterization of dark fiber to Layer 2 and 3 protocol analysis.

Some of these tools can handle Ethernet, but this guide focuses on the realm of physical light. It's another modest attempt to assist those in the industry with sorting out the many options facing them.

— Jonathan Tombes



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## Communications TECHNOLOGY

#### editorial

editor **Jonathan Tombes**  
(301) 354-1795, jtombes@accessintel.com  
managing editor **Ron Hendrickson**  
(720) 938-2835, rhendrickson@accessintel.com

#### design/production

graphic designer **Tzaddi Andoque**  
(301) 354-1679  
senior production manager **John Blaylock-Cooke**  
(301) 354-1681

#### Access Intelligence

4 Choke Cherry Road, 2nd Floor,  
Rockville, Maryland 20850

**AFL/Noyes (www.afltele.com)**

Product Name	Product Type	Key Features
M700 Compact Single-mode OTDR	OTDR	Single-mode OTDR includes integrated visual fault locator, optical power meter capable of displaying up to three wavelengths simultaneously, and a transfective touch screen. Supports Real Time, Full-Auto, and Expert (manual) modes, event analysis, dual-wavelength testing, and job setup. Additional features: 38/36 dB dynamic range @ 1,310 / 1,550 nm, results saved as GR-196 .SOR files, tool-free, switchable adapters (SC/FC/LC)
OFL250 Handheld, Single-mode OTDR	OTDR	Single-mode OTDR with integrated OPM, laser source, and VFL. Handheld, weighs 1.7 lb. Designed for metro areas and FTTx networks. Provides automatic and manual setup, event analysis, multiple-wavelength testing, 12-hour battery life, internal data storage, and USB connectivity. OTDR and OPM test ports are equipped with tool-free adapters. Results are saved as .SOR files.
OFL200 Handheld, Single-Mode OTDR	OTDR	Designed for outside plant crews. Detects reflective and non-reflective breaks. Provides an integrated 650 nm VFL. Has automatic, semi-automatic, and manual setup modes. Fast change switchable adapter. Can internally store up to 48 traces. Saved traces can be transferred to a PC. Test results are stored in .SOR format. Rechargeable NiMH battery pack, AC adapter, or optional AA alkaline.
HiLite & VFI2	Visual fault identifier	Visible red laser sources can locate faults inside an OTDR's dead zone. Other applications include end-to-end continuity checks, identifying connectors in patch panels and fibers during splicing operations. The universal connector interface provides fast operation with many connector styles without changing an adapter.
MT Tracer (12-Fiber VFI & Display)	Visual fault identifier	The Tracer is a multi-fiber visual fault identifier (red laser source) supporting 8 or 12 fiber MTP connections. Fibers can be tested individually or all at once. The Display is a passive optical device designed to receive the light from the Tracer and provide an eye-safe method of viewing the red light.
OFI-FTTx Active ONT Detector	Fiber identifier	Hand-held optical fiber identifier designed to identify the presence or absence of an active optical network terminal (ONT) on FTTx F2 fibers at the hub. Fiber does not have to be removed from service. Will report either that the ONT is 'Active' or 'Not Detected.' Compatible with 2 mm jumper cable. Powered by two AA alkaline batteries, provides a low battery indication.
OPM 4 and 5	Optical power meter	Handheld OPM designed for measuring optical power and insertion loss on multimode or single-mode links. Features Wave ID, multiple test tone detection and stores (OPM5) references for each calibrated wavelength and up to 500 records per wavelength of power or insertion loss measurements. Records can be transferred to a PC. Shows measured power [dBm or μW] or insertion loss [dB], calibrated wavelengths [nm], tone signal [Hz], wavelength ID, and estimated remaining battery life. N.I.S.T. traceable.
OPM1 Optical Power Meter	Optical power meter	Portable OPM. When used with an LED or laser light source, can also measure attenuation of multimode or single-mode cables. Has only two controls – ON/OFF and wavelength. The optical input port accepts Noyes thread-on style connector adapter caps, which are required and must be ordered separately. N.I.S.T. traceable and runs on a standard 9V alkaline battery.
OLS7- FTTH & OLS7 Triple Wavelength Laser Sources	Laser sources	Handheld laser sources designed for performing insertion loss measurements on single-mode fiber optic links when used with an OPM. Can be paired with an optical fiber identifier. The laser output is stabilized. Both feature a triple wavelength laser output from a single port. Each wavelength may be transmitted individually at CW or with user selectable modulated tone. Each wavelength may be transmitted with Wave ID.
OLS4 Integrated LED and Laser Light Source with Wave ID	LED/laser light source	Integrated two-port LED and laser light source designed for insertion loss measurements on multimode or single-mode fiber with an OPM. Can be paired with an optical fiber identifier. LED and laser outputs are stabilized. Features 850/1,300 nm LED output from a multimode output port and 1,310/1,550 nm laser output from a single-mode output port. Each wavelength may be transmitted individually at CW or with user selectable modulated tone (SM output). Each wavelength may be transmitted with Wave ID.
OLS2 - Dual laser Light Source with Wave ID	Laser light source	Handheld laser source designed for performing insertion loss measurements on single-mode links with an OPM. Can be paired with an optical fiber identifier. Laser output is stabilized. Features 1,310 nm and 1,550 nm laser output from a single output port and offers several modes of operation. Each wavelength may be transmitted individually at CW or with user selectable modulated Tone. Each wavelength may be transmitted with Wave ID.
Turbotest 500B	Multi-test instrument	Designed for single fiber bi-directional loss and return loss testing. Performs optical power, optical return loss, and optical loss measurements. Five models are available, including the three wavelength (1,310/1,550/1,625) T506B and (1,310/1,550/1,490) T506B-FTTH. Can store up to 1,000 records (40 files) in any combination of its four operating modes (500 records in TRIPLE wavelength mode). Stored test results can be transferred to a PC.
OLTS 5 - Broadband Loss	Optical loss test set	Offers end-to-end single-mode testing at 1,310/1,550 nm (OLTS 5-3) or 1,550/1,625 nm (OLTS 5-5). May be operated in automatic or manual test modes. In "two-unit" automatic test mode, a pair of test sets can measure end-to-end, bi-directional insertion loss of a pair of single-mode fibers at 1,310/1,550nm or 1,550/1,625 nm. In "single-unit" automatic test mode, can measure bi-directional, dual-wavelength insertion loss of patch cords or fiber optic cables on the reel
ORL 3B Optical Return Loss Test Set	Optical return loss test set	Handheld field instrument performs optical return loss measurements and operates as an OPM. Can store up to 1,000 records (40 files) in any combination of its two operating modes. Saved test results can be transferred to a PC. Operates from an internal rechargeable Li-Ion battery pack or external AC power adapter.
OFS 300 Optical Microscope	Fiber scope	Can inspect for scratches, dirt, or other problems. Offers 60 hours of continuous battery life. A 2.5 mm universal adapter cap, holster, and user's guide are included. The OFS 300-200C offers 200X magnification; the OFS 300-400C has 400X magnification. The OFS 300-200C uses the same adapter caps as Noyes OPMs and loss test sets. The OFS 300-400C utilizes precentered snap-in adapter caps.
VS 300 View Safe Video Microscope	Video fiber scope	Designed to remove concerns for eye safety while inspecting optical fiber connectors. Eliminates the optical path to the eye by utilizing a miniature camera and micro-display. Modeled after the OFS300 line with NTSC video output and half the weight of the OFS300. Uses all OFS 300-200C adapter caps and has an automatic shutoff.
VFS 2 Video Fiber Scope 2nd Generation	Video fiber scope	Small video fiber scope. "Optical knuckle" allows the user orient the probe head in any direction to view connectors in difficult locations. Probe head length of less than 3.25." Resolves 0.75 micron scratches. Designed for one-hand ambidextrous operation. Precision adaptor tips put the fiber in the viewing area right away. May be paired with the VFS 2 high-resolution 3.5" display unit.

**Anritsu (www.us.anritsu.com)**

Product Name	Product Type	Key Features
CMA5 Series	Optical power meter	Handheld units for attenuation and power throughput measurements on point-to-point fiber links. LCD display, 9V battery and an optional power adapter. Designed for testing single-mode and multimode fibers; multiple wavelength calibration at 850/1,300 nm, 1,310/1,550/1,625 nm, and 1,490 nm. High input power capacity enables optical amplifier characterization and multimedia/CATV measurements.

**Anritsu (www.us.anritsu.com) continued**

CMA50	Optical power meter	Designed for attenuation and throughput measurement of FTTx networks, long haul telephony links, multimode LAN, and CATV. Features large mass storage capacity and pass/fail indicators and autowavelength switching mode. Automatic wavelength recognition when used in conjunction with CMA50 light sources. High input power capacity enables characterization of RF TV optical signal. Stores up to 100,000 data sets (4 MB of user data). Visual fault location source option.
MA9331A and MU931431A Optical Sensors	Optical power meter	Designed to measure high-power optical signals with absolute-value correction at +30dBm. Polarization dependant loss (PDL) of less than 0.01dB (MA9331A) and direct traceability to the UK National Physical Laboratory. The MA9331A is connected using the MU931001A Sensor Adapter and cable whereas the MU931431A sensor is a plug-in type unit with a direct optical input. The MA9331A can be used either with the MT9810A Optical Test Set or with the MT9812B Multi Channel Box when Option 01 is installed.
MU909020A Optical Channel Analyzer Module		Designed for installation, maintenance and troubleshooting of CWDM access networks. Field modular device designed to measure and monitor power and wavelength over the 18 CWDM channels. Pass/fail thresholds are stored for all parameters and configurations defined in ITU-T G.695. Enables long-term characterizations with several drift functions. No moving parts. Can save screen shots and be managed with one hand. Typically provides 4 hours of testing on battery.
MT9812B Multi Channel Box		Nine channel mainframe for evaluation of optical devices and systems including WDM. Can incorporate up to nine units of DFB-LD light sources and high-accuracy optical sensors. Setting and checking of setting conditions can be carried out on the front panel. GPIB and RS-232C are provided as standards.
MT9820A All-Band Optical Component Tester		Designed for optical loss measurements over a wide wavelength range. Adapts to any tunable laser source. Intended for labs test benches. Can sweep continuously over up to four lasers.
ORL Test Set Model Number: 6025/S50	Optical loss test set	Handheld instrument designed for attenuation, power throughput and optical return loss (ORL) measurements on point-to-point fiber links. Calibrated at 850, 1,300, 1,310, 1,550, and 1,625 nm; intended for testing in all single-mode and multimode fiber applications. Auto wavelength switching mode synchronizes the light source with a GN-6025 series Power Meter or Loss Test Kits Model 6025 and automatically switches between two wavelengths. Stores two loss readings and increments to the next fiber with one button push.
CMA5 Light Source	Light source	Designed for point-to-point attenuation measurement. Intended for testing single-mode and multimode fibers; offered in 850 and 1,300 nm and 1,310/1,550/1,625 nm wavelength. Up to two wavelengths on a single port. Interchangeable adapters.
CMA50 Light Source	Light source	Designed for point-to-point attenuation measurements or modulated tones for fiber identification. Offered in a variety of wavelength combinations and connector options. Features auto-wavelength switching mode that automatically alternates wavelengths and synchronizes them with the CMA50 Power Meter Series. Up to four sources per unit, out of a single port. Visual fault location source option.
Osics DWDM Testing Platform		Osics ASE modules feature broadband sources based on the Amplified Spontaneous Emission (ASE) of an Erbium-doped fiber. An internal proprietary spectral shaping provides two versions, ASE-SP and ASE-IN. Various modules are available: DFB, ECL, EDFA, and ASE.
Tunics Plus Tunable External Cavity Laser		Based on a self-aligned cavity; uses an active control and integrates an internal wavelength referencing system. Covers 1,260 nm to 1,640 nm and up to +10 dBm output power. Wavelength range of more than 150 nm is available.
Tunics Purity Tunable External Cavity Laser Diode with Full Power ASE Noise-Free Emission		Utilizes a proprietary intra-cavity filtering scheme to eliminate background ASE noise and emits a pure single-mode laser line. Covers the S-, C- and L-band from 1,430 nm to 1,625 nm and features up to +3 dBm output power, with an accuracy of 0.05 pm.
Tunics Reference High-Performance Tunable External Cavity Laser	WDM Testers	Features ±5 pm absolute wavelength accuracy, tuning range of 150 nm from 1,390 to 1650 nm, output power of >+10 dBm, sweeping and step-by-step modes, is mode-hop-free with continuous output power whether stepping or sweeping.
CMA5000 Multi-Layer Network Test and Measurement Platform		Test Gigabit Ethernet, DWDM, SONET, OTDR, ORL, Fibre Channel, PMD, and CD all with the same multi-layer test platform. Features many available wavelengths, up to 50 dB of dynamic range, and dead zones as small as 1.0 m. Designed to document physical layer, data link layer, network layer, and transport layer.
MT9083A/A1 ACCESS Master	OTDR	Designed to make measurement simple and error-free with one-button fault location, pass/fail classification, automated file saving and naming and a macro bend detection feature. Features multiple wavelengths and options. Offers an automated fiber construction application and multiple wavelengths including specialty applications such as 1,383 nm for certifying legacy fibers for CWDM upgrades.
MW9077A and MW9077A1 ODTR Modules	OTDR	Mountable-type ODTR module; RS-232C and 10 Mbps Ethernet connections available. Commands can be input externally to set up the measurement conditions, transfer the waveform data to the control unit, and read/write to files. OEM applications include loss measurement, splice and return loss measurement, and total return loss measurement.
CMA50 Loss Test Set	Optical loss test set	Designed for both attenuation and power throughput measurements. Offered with common calibrated wavelengths and connector options. Has auto bi-directional testing option, pass/fail threshold analysis, large capacity for test results storage, and RJ-45 interface Network Testing option.
MS9710B Optical Spectrum Analyzer	Optical spectrum analyzer	Diffraction grating OSA features improved wavelength accuracy, resolution bandwidth, and signal-to-noise averaging, covering a wavelength range from 600 to 1,750 nm.
MS9710C Optical Spectrum Analyzer	Optical spectrum analyzer	Improved version of the HYPERLINK "http://www.us.anritsu.com/products/ARO/North/Eng/showProd.aspx?&ID=411"MS9710B with improved wavelength accuracy, resolution bandwidth, and signal-to-noise averaging. Covers a wavelength range from 600 to 1,750 nm. Has been enhanced with optional better performance in the L-Band region between 1,570 nm and 1,620 nm.

## Anritsu ([www.us.anritsu.com](http://www.us.anritsu.com)) continued

MS9715A WDM Tester		Designed for use in system manufacture, construction, and maintenance. Combines measurement of necessary items over long periods with simplicity of use, lightness and compactness, and resists vibration and shock. LabVIEW driver is fitted as standard as is a Windows compatible floppy disk drive. NOTE: MS9715A is a build-to-order product.
MS9780A Optical Spectrum Analyzer	Optical spectrum analyzer	Diffraction-grating spectrum analyzer for analyzing optical spectra in the 600 to 1,750 nm wavelength band. Its input section has been redesigned to support fibers with core diameters of 50/62.5 μm. The input section can be used to measure the spectra of LDs and LEDs. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as the NF/Gain of optical fiber amplifier systems.
Xtract Tunable Optical Channel Drop Unit		Features a square flat-top tunable filter for clean DWDM optical channel extraction. Covers all the transmission bands and is designed for next generation DWDM transport systems.

## EXFO ([www.EXFO.com/catv](http://www.EXFO.com/catv))

Product Name	Product Type	Key Features
FOT-930 MaxTester Loss Tester	Loss tester	Intended for construction and maintenance. All-in-one portable test solution: backreflection, fiber-length, high-power, bidirectional loss and video fiber inspection probe test functions. FasTesT: three-wavelength measurement of optical loss, ORL and fiber length in 10 seconds. More than 8 hours of battery autonomy
AXS-100 Series Handheld OTDR	OTDR	Intended for troubleshooting 850, 1,300, 1,310 and 1,550 nm wavelengths, with respective dynamic ranges of 24, 25, 32 and 30 dB. Event dead zone of 0.8 m. One-touch testing, summary screen, macrobend finding. USB stick compatibility and USB cable data download. Value-added options, including power meter, visual fault locator (VFL), fiber inspection probe, printer and IP testing. More than 8 hours of battery autonomy
FTB-5700 Dispersion Analyzer	Dispersion analyzer	Features include: single-ended PMD and CD measurements, complete dispersion analysis with a single module, a single connector and a one-step test setup, all automated software, testing range up to 140 km, 40 Gbps-ready
FTB-5500B PMD Analyzer	PMD analyzer	Features include: five-second testing time, no auto-correlation peak, tests through EDFAs, 40/100 Gbit/s-ready, combines with the FLS-5800A light source (for CD/PMD testing)
FTB-5800 Chromatic Dispersion Analyzer	Chromatic dispersion analyzer	Features include: uses phase-shift method to measure chromatic dispersion in networks and fiber links in DWDM, long-haul and ultra-long-haul systems, tests through EDFAs, 40/100 Gbps ready, combines with the FLS-5800A light source (for CD/PMD testing)
FTB-5200 Series Optical Spectrum Analyzer (OSA)	Optical spectrum analyzer	Features include: intended for testing 12.5 GHz ultra-DWDM networks, network elements and components (FTB-5240B), intended for 50 GHz spacing and network element testing applications (FTB-5240), in-band OSNR ROADM testing (FTB-5240 and 5240B), OSA for O-Band testing, CWDM and 100 GHz DWDM networks (FTB-5230)

## Fiber Instrument Sales ([www.fiberinstrumentsales.com](http://www.fiberinstrumentsales.com)) continued

Product Name	Product Type	Key Features
FIS Deluxe Mini OTDR	OTDR	Suitable for indoor or outdoor operation; one button Auto Test feature will detect optimal pulse width, range and duration setting. Event and trace analysis. Selectable dual trace mode tests two wavelengths at the same time and overlays trace results. Suitable for testing metro and FTTH PON networks, even through high port count splitters. On-screen help menu. Includes Li-Ion batteries, AC charger, USB cable, one interchangeable adapter for each launch port and software. Other features include: 2.5 meter event deadzone, TFT color display, Telcordia compatible trace files, analysis software, storage for up to 500 traces, 8-hour battery life. Handheld; weighs 2.2 lbs; USB and RJ-45 Interfaces
FIS Hand Held Certification Mini-OTDR	OTDR	Full-function certifying OTDR when used with FIS certification software. View and store traces in the field, then download traces to a PC for further analysis and printing of the certifying documents. Tri-wavelength model can be used for testing FTTH. Use with 1X4 and 1X8 couplers. Attach the connector to a launch cable via a mating sleeve, press the Scan button, and slowly insert the fiber into the connector. The scan of the field fiber will rise up the screen as the optical connection improves. Two-point loss feature shows the throughput of the connector.
FIS Hand Held Power Meter	Power meter	Features 0.01 dB resolution; CATV units test from +23 dBm to -45 dBm. Provided with operating manual, 9V battery, and 2.5 mm universal adapter (others available). Other features include: Zero set reference storage ability at each wavelength; 2 mm germanium photodiode, high resolution unit available with 1,490 nm calibrated wavelength, auto shutoff; 70-hour battery life; optional AC power supply, Low battery indicator, protective rubber boot.  Single-mode units are equipped with lasers having a typical output power of -1.0dBm. Multimode units have LEDs with a minimum output of -17dBm. Operating manual and 9V battery included. Additional features include: single or dual Light sources; continuous wave (CW) or 2kHz modulation, choice of ST or FC adapters, auto shutoff and low battery indicator, available in 1,300 nm LED with 1,310 nm laser combination, optional AC power supply, 30-hour typical battery life, protective rubber boot
FIS Hand Held Light Source	Light source	Single-mode units are equipped with lasers having a typical output power of -1.0dBm. Multimode units have LEDs with a minimum output of -17dBm. Operating manual and 9V battery included. Additional features include: single or dual Light sources, continuous wave (CW) or 2kHz modulation, choice of ST or FC adapters, auto shutoff and low battery indicator, available in 1,300 nm LED with 1,310 nm laser combination, optional AC power supply, 30-hour typical battery life, protective rubber boot
FIS Pocket Fault Locator	Fault locator	7.1 inches in length and only 4.5 oz. Universal adapter accepts any 2.5mm ferrule, allowing 650 nm laser light to be injected into a fiber. Can identify breaks or sharp bends 6-7 km away on single-mode fiber, 4-5 km away on multimode fiber. Features include: extra-long battery life with two AA batteries, continuous and modulated modes, heavy-duty pouch
FIS Visual Fault Locator	Fault locator	A 1mW fiber coupled laser sends a 650 nm visible red light down the length of the fiber. The escaping light allows identification of breaks or severe macro bends. Internal optics are used for single-mode or multimode applications. Designed for fiber end identification and continuity testing. Operates with two AA batteries (provided).
FIS Fiber Continuity Tester	Continuity tester	Red LED light transmits light down fiber, providing ID at fiber's far end. Designed for continuity verification or simple fiber identification when fiber is one of many in an interconnect location. Operates with two AA batteries. Hard rubber packaging. Multimode only.
FIS Optical Verifier OV-3	Verifier	Available in a number of models; InGaAs photodetector; LED and laser light sources; RS-232 for downloading test data; included Li-Ion batteries and charger; optional CATV, VFL and Talk functions. Features include: High resolution power meter calibrated at 850/1,310/1,490/1,550nm, 2 mm InGaAs detector, backlit display, available as power meter only or as test set, single or dual wavelength, stores up to 255 tests, one-year warranty, carry case

## Fiber Instrument Sales ([www.fiberinstrumentsales.com](http://www.fiberinstrumentsales.com)) continued

FIS Ruggedized Power Meter/ Loss Test Set	Power meter/ loss test set	Designed for harsh work conditions; available with single or dual wavelength light sources. Power meters are provided with a 2.5mm universal adapter. Light sources include an ST adapter for multimode and FC adapter for single-mode. Power supply/charger included. Features include: zero set reference storage ability at each wavelength, 2 mm germanium photodiode, high resolution unit available with 1,490 nm calibrated wavelength, standard with 2.5mm universal adapter, auto shutoff, 70-hour battery life, optional AC power supply, low battery indicator, protective rubber boot
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## JDSU ([www.jdsu.com](http://www.jdsu.com))

Product Name	Product Type	Key Features
MTS/TBerd-8000	Fiber characterization	The MTS/TBerd-8000 with dispersion, allows characterization of the fiber in a matter of minutes, reducing test time by 90 percent. It includes all required tests in one single platform and runs OTDR+IL/ORL+CD+PMD+AP at the same time. Supports 10Gig and 40Gig conventional and ROADM networks and automated scripting provides time savings.
Optical Channel Checker	Handheld optical channel analyzer	The JDSU Optical Channel Checker (OCC) performs wavelength and power measurements on DWDM and CWDM networks. This new class of handheld testers provides a low-cost alternative to optical spectrum analyzers (OSAs).The OCC automatically scans power levels for channels defined in the ITU-T grid and with advanced ease-of-use features, provides workforce efficiencies for today's technicians.
CWDM OTDR Module	CWDM OTDR test solution	In-service CWDM OTDR test solution to maintain and troubleshoot CWDM fiber networks. Allows OTDR characterization and measurement through CWDM muxed and demuxed networks.
Fiber Inspection and Cleaning Kits		Nearly 80 percent of optical network field test failures can be attributed to dirty connectors. JDSU provides a solution for inspecting and cleaning fiber with the Westover family of hand-held probes that show fiber end face images for visual inspection of contamination, cleaning tools, and precision inspection tips for different connectors and applications.
OSA 150	Optical spectrum analyzer	For the TBerd-8000, the OSA 150 is an inexpensive module designed for CWDM and 100 GHz DWDM networks. Fully functional OSA.
Optical Network Management System (ONMS)	Network management system	ONMS is designed to increase workforce productivity and facilitate the management of fiber-optic networks with fewer technicians through fiber remote testing and accurate fiber plant documentation. The system monitors, detects and maps the location of fiber cuts and degradations. Measurement schedules allow network operators to assess long-term fiber performance to form the basis of efficient asset management.
OSA 320	Optical spectrum analyzer	The OSA 320 is designed for measuring OSNR in ROADM networks. The OSA 320 is designed for detecting performance of 10Gig and 40Gig in ROADM networks and brings a patent pending in-band method to measure ROADM filtered networks.

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AFL Noyes M700 Compact Single-Mode OTDR with included Visual Fault Locator and Optical Power Meter

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## M2Optics (www.m2optics.com) continued

Product Name	Product Type	Key Features
OPM-3034	Fiber optic power meter	The OPM-3034 Series Optical Power Instruments are full-featured hand-held products that cover the full range of optical fiber applications. For use in the field or in the lab, they are user-friendly with excellent performance, and are designed into a compact, rugged, and quality engineered package. The OPM-3034 are calibrated at the four frequently used wavelengths; 850 nm, 980 nm, 1310 nm, and 1550 nm making them ideal for both single and multimode fiber testing. Additional features include: 65 dB Dynamic Range (min), version B = -60 to +10 dBm, version C = -40 to +27 dBm, compact & lightweight, selectable backlight, protective case
FOS 860A Standard Node Receiver and OMI Instrument	Optical test system	The RF Optics, Inc. FOS 860A Standard Optical Receiver is a high quality, microprocessor controlled, optical test system. It was specifically designed to look like the typical wide band optical node widely used in today's CATV, CCTV, Multi-channel or other high quality optical telecommunications network. Unique to the FOS 860A is its ability to monitor and measure the Optical Modulation Index of an optical carrier in percent (%), per channel, or (%) total. Additional features include: usable as optical node, measures OMI, measures optical power, integrated optical attenuator, 15 MHz to 860 MHz flat, hi quality RF output, optional protective bag
FOS 1000A Standard Node Receiver and OMI Instrument	OMI instrument	The FOS 1000A, 1 GHz optical receiver, is designed to "look" like the typical wide band optical node widely used in CATV, CCTV, multichannel, or other high quality communication networks. An internal electrically controlled optical attenuator comes standard to adjust the input power to the instrument. Capable of measuring the OMI of an optical carrier in percent per channel or percent total, all controls on this micro-processor controlled instrument are front panel accessible and the results are displayed on an easy to read 2 line 48 character, back lit LCD.

## Optelian (www.optelian.com)

Product Name	Product Type	Key Features
LightPRO	Fiber test and turn-up kit	A set of fiber test and inspection tools for test and turn-up. Features include: verify optical connectivity, inspect for dirty or defective connectors, clean dirty connectors, measure span loss at both 1,310 and 1,550 nm, verify jumper/attenuator performance and quality, locate fiber and connector faults, connector inspector, 400x magnification, fiber-optic light source and meter, 1,310 and 1,550 nm modes of operation, Visual Fault Locator, bright 650 nm "red" light, optical cleaners, Ferrule Mate: Clean both 2.5 and 1.25 ferrules including SC, SC/APC, ST, FC, LC and MU, optical cleaners, MTP/MPO: Clean 12 fibers at once, test existing fiber routes for xWDM upgrade, acceptance testing of leased fiber, troubleshooting transport links

## Sunrise Telecom (www.sunrisetelecom.com)

Product Name	Product Type	Key Features
STT (Scalable Test Toolkit)	Network testing solution	Modular communication testing solution to address Layer 1 through Layer 7 requirements, from fiber optics to QoS; consists of a display unit, test modules, and a power supply module. STT Manager software controls test modules from the STT Control Module or a PC. Features include: fully independent or stackable test modules, LCD touch screen, Microsoft Windows XP Interface, fixed IP or DHCP terminal emulation, remote operation or standalone capabilities with PC, several power supply options, optional battery, portable, local or remote configuration, multiple tests can be run simultaneously
MTT Platform	Handheld test set	Gives field personnel an all-in-one platform for installing, verifying, and troubleshooting voice, data, and video services. Includes chassis configurations for diverse testing needs; upgradeable modular design. Modules are available for multiple testing needs and applications, including metro, DSL, transport, optics, and service. Features include: comprehensive network testing solution, modular, field-upgradeable design, tests multiple services and technologies, designed for field use, automated tests and reporting features, LED indicators for test status

### TOOLKIT *continued from page 1*

by a fiber back towards a source. The reflections are small and may occur from a discrete discontinuity or from distributed reflections in the glass itself. These distributed reflections in a long fiber create a background level, which can mask weaker signals. The primary sources of discrete reflections in the fiber are splices, connectors, or other discontinuities. Fiber attenuation appears as a slope in the power of the back-reflected signal, consistent with the increasing

length of glass the reflected light traverses.

The OTDR is most useful for looking at links before they are connected because, if used in live plants, the launched pulses of light can interfere with video or data traffic. This limits the OTDR's use as a troubleshooting tool. Further, in a multi-wavelength environment, the limited number of source wavelengths for the OTDR prevents end-to-end paths from being measured. OTDR traces stored before a link

was activated may be useful for comparison if troubleshooting the link at a future date.

#### **OCM: THE BRAVE NEW WORLD OF CONTINUOUS MONITORING**

Optical channel monitors (OCM) have been employed only rarely in cable telecommunications networks to date. In their simplest configuration, these units connect to a transmission fiber and will measure the power level of wavelengths traversing it.

More sophisticated units can measure the optical signal

to noise ratio (OSNR) of each of the wavelengths, correct the power measurement for a temperature and wavelength, and track changes in the power and/or wavelength over time.

Units are installed as a permanent part of a physical network deployment or as a portable troubleshooting tool, which would connect to a network via an optical tap (used as an optical test point) located as strategic locations throughout a network.