Planning '97
CT Talks to Vendors

Phillips
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Telecommunications Engineers

'LOOKS GREAT, LESS FILLING'

Which of these bottles is MPEG-2 compressed?

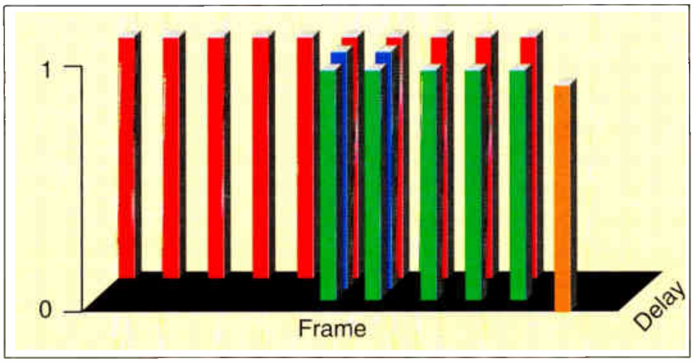
Find out on page 32

• Signal Security

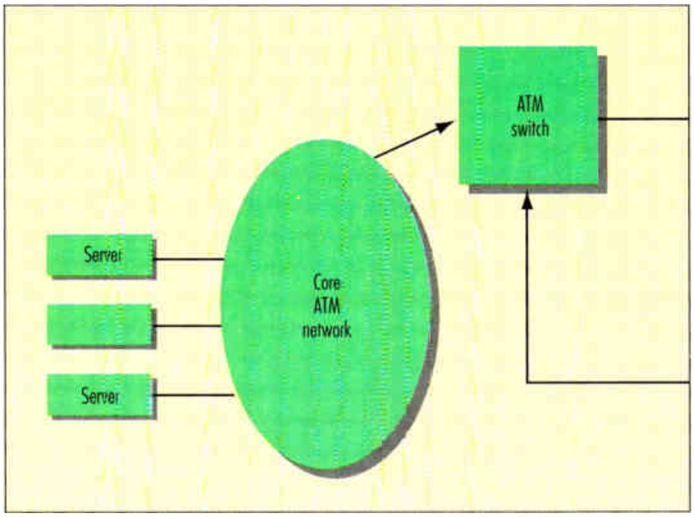
November 1996

DEPARTMENTS

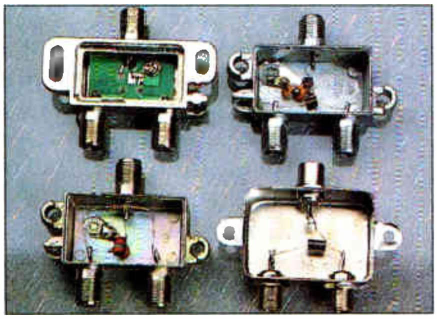
Planning '97 • 24



OFDMA vs. TDMA • 46



ATM, MPEG, QAM • 34



Back to Basics • 58

FEATURES

Cover
For a full explanation on this month's cover, see the sidebar on page 34. Bottle label design by Janet Cook.

 Communications Technology™ (ISSN 0884-2272) is published monthly, except twice in July, by Phillips Business Information Inc., 1201 Seven Locks Road, Suite 300, Rockville, MD 20854, USA. Editorial and sales offices located at 1900 Grant St., Suite 720, Denver, CO 80203 USA, (303) 839-1565. November 1996, Volume 13, Number 9. Periodicals postage paid at Rockville, MD, and additional mailing offices. POSTMASTER: Send address changes to *Communications Technology*, Phillips Business Information Inc., 1201 Seven Locks Road, Suite 300, Rockville, MD 20854.

EDITOR'S LETTER

Not worth two cents?

As I travel across the nation, calling on advertisers and attending seminars and cable shows, I meet with cable operators, large and small. Most of the large MSOs recognized the need for immediate training in data transmission systems. They made sure their engineers and technicians belonged to the Society of Cable Tele-communications Engineers and participated in the training available from CableLabs. But some of the smaller MSOs and independent cable systems formed a misconception of CableLabs from the start.

Some have said CableLabs is a facility that answers only to the "big" MSOs. Some have said membership in CableLabs costs too much. Some have said the "little" guys have no voice on CableLabs decisions and studies. Some even seem to think the MSOs that made huge investments to develop test sites for data studies, will share the results of their investments with all of the industry on a regular basis. (I never heard of any such agreement.)

CableLabs has a board of directors made up of 22 members. These members are from cable companies as large as TCI and as small as Cable TV Inc. From a total of 22, the top 10 MSOs are given seats on the board. Why shouldn't they have seats? They were financially responsible for the success of CableLabs today. But two seats are always set aside for "small" operators.

About 62 companies belong to CableLabs today. "But it costs too much to belong!" Ben Hooks of Buford Television, Doug Fuller of The News Press and Gazette Co., and Bill Bauer of WinDBreak Cable can convince you of the value of belonging to CableLabs. It costs two cents per subscriber per month to belong. That means CableLabs is the best deal in cable TV!

If you are an engineer or technician in any cable company or system that doesn't belong to CableLabs, I'd be cross-training for other employment. Why's that? Well, I don't know of another facility where you are going to receive the training and guidance on enhanced services. How will you keep abreast in digital video, high-speed data modems, and studies on ATM, MPEG-2, VSB, ADSL, HDTV, ITV, VOD, NVOD, PSTN, SONET, protocols, and the like?

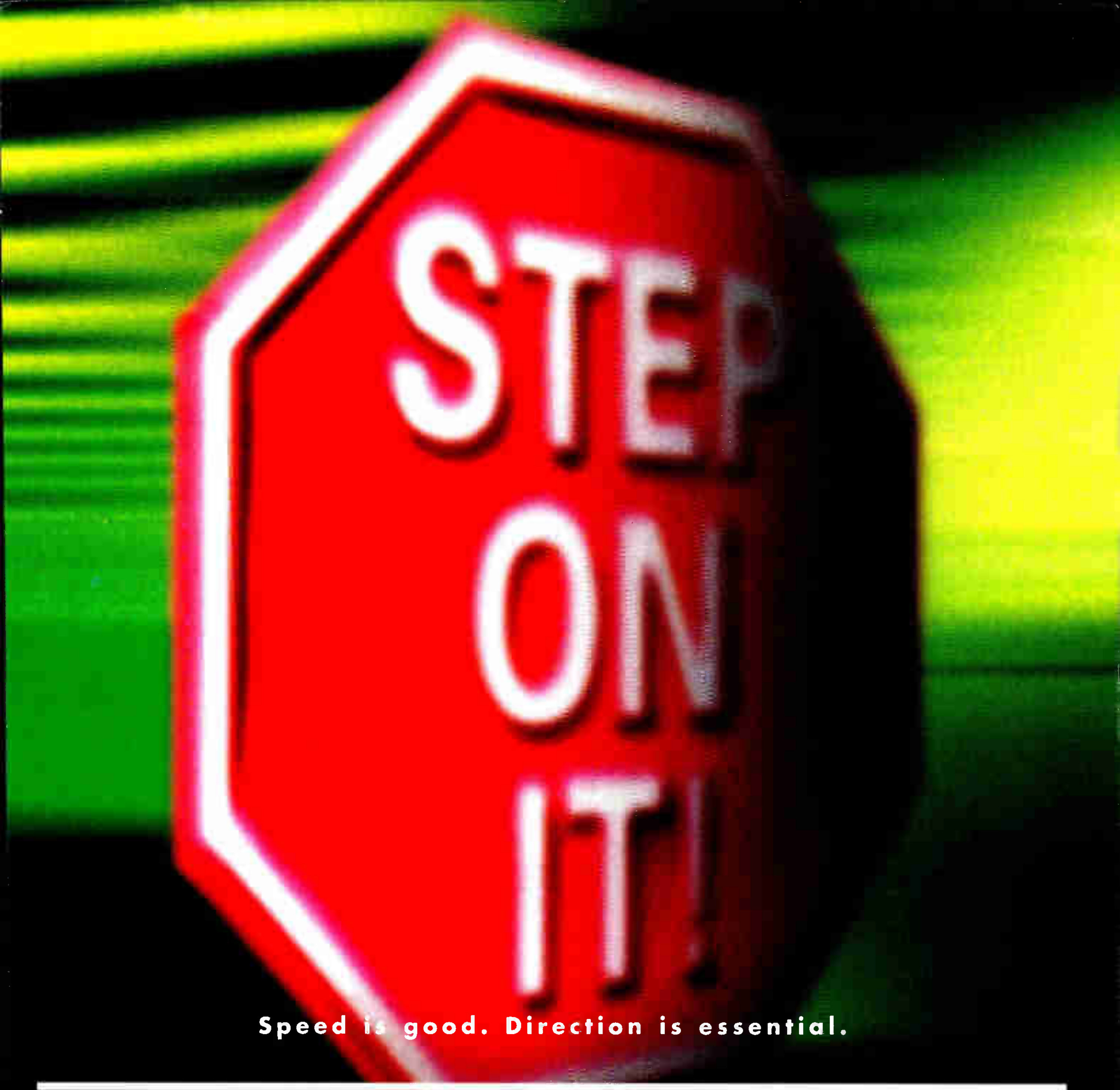
If your owner or top executive made the decision not to sign up as a member, you need to have a talk with him. Does he think that, just because you are up to date on analog transmission of entertainment TV, you are up to date on digital/data technology that changes daily, spawning a new set of studies and need for standards throughout communications?

It costs two cents per subscriber to ensure your technical future and the future of the systems where you work. If you don't keep up with this exploding technology, both you and the system will be left behind.

Data transmission is here. You will not be allowed to be simply a cable TV operator, no matter where you are. Your city or town will demand that you operate a full-service communications system. If you can't, I worry that city or town will demand that someone else provides that service, regardless of the number of years you have left on your franchise.

Is the future of your technical career and your cable system worth two cents?

Rex Porter
Editor


STEP
ON
IT!
Speed is good. Direction is essential.

COMMUNICATIONS
TECHNOLOGY

A CT Publications Product

Editor, Rex Porter
Executive Editor, Alex Zavistovich
Senior Editor, Laura K. Hamilton
Editorial Director, Alex Swan
Consulting Editor, Toni Barnett
Senior Technical Editor, Ronald J. Hranac
Technical Consultant, Michael Smith, Adelphia Cable

Publisher, John O'Brien
Associate Publisher, Nancy Umberger
Group Editorial Director, David Jensen
East Coast Regional Sales Manager, Tim Hermes, (301) 340-7788, ext. 2004
Account Executives
Mike Elmer, (303) 839-1565, ext. 34
David Gillespie, (303) 839-1565, ext. 35
Joel Goron, (301) 340-7788, ext. 2106
Rebekah Markheim, (303) 839-1565, ext. 33
Director of Marketing & Circulation Services, Maxine Minar
Marketing Manager, Alan J. Rubin
Administrative Assistant, Cathy Walker

Director of Operations, Blair Richards
Production Director, Bill Wynne
Graphic Designer, Kathy Weber
Advertising Production Administrator, Judy Lawrence
Circulation Manager, Sylvia Sierra
Subscription/Client Services
(800) 777-5006

CT Publications Corp.
A division of Phillips Business Information Inc.
CT Sales and Editorial Offices
1900 Grant St., Suite 720, Denver, CO 80203
(303) 839-1565 Fax (303) 839-1564
e-mail: CTmagazine@aol.com

Advisory Board

Richard Green, CableLabs (chairman)
Jim Chiddix, Time Warner
Richard Covell, TSX Corp.
H. Allen Ecker, Scientific-Atlanta
Jim Farmer, Antec
Ron Hranac, Coaxial International
Bob Luff, TV/COM International
Dan Pike, Prime Cable
Bill Riker, Society of Cable Telecommunications Engineers
Mike Smith, Adelphia Cable
Tony Werner, TCI
Wendell Woody, Sprint/North Supply

SCTE Board of Directors

At-Large Directors
Ron Hranac, Coaxial Interantional
Wendell Bailey, NCTA
Wendell Woody, Sprint

Regional Directors
Patrick O'Hare, Viacom Cable (Region 1),
Steve Johnson (Region 2)
Norrie Bush, TCI of Southern Washington (Region 3)
M.J. Jackson, Gilbert Engineering (Region 4)
Larry Stiffelman, CommScope (Region 5)
Robert Schaeffer, Star Cablevision Group (Region 6),
James Kuhns, Comcast Cablevision (Region 7)
Steve Christopher, Augat (Region 8)
Hugh McCarley, Cox Cable Communications (Region 9)
Maggie Fitzerald, DAVI Communications (Region 10)
Dennis Quinter, TWC Berks Cable (Region 11)
John Vartanian, Viewer's Choice (Region 12)

SCTE National Headquarters
(610) 363-6888 Fax (610) 363-5898

Corporate Offices

Phillips Business Information Inc.
1201 Seven Locks Road, Suite 300, Potomac, MD 20854
(301) 340-1520 Fax (301) 340-0542

Paul R. Levine, Senior Publisher
(303) 839-1565

David Shaw, Senior Vice President/Group Publisher
Thomas C. Thompson, President
Phillips Business Information Inc.

Thomas L. Phillips, President

Phillips SCTE BPA INTERNATIONAL

Where's the satellite and broadband technology that bridges the gap between yesterday and tomorrow? Right here at Standard.

From our first frequency-agile receivers and modulators to the breakthrough innovations of the still-emerging Stratum series of advanced network modulation equipment, Standard has been in the forefront of headend technology, offering value, ease of use, space saving design and exceptional signal quality.

Need examples? How about our Agile Omni Broadcast series, very possibly the most acclaimed commercial satellite TV receivers of all time? Or our TVM series of modulators that revolutionized how MSOs regarded frequency-agile performance? Or our space-saving, cost-saving CSG-60 BTSC stereo generator? Or the CATV industry's top-selling IRD, the one-rack-high Agile IRD-II?

Standard will help you cope with the challenges of bandwidth expansion with our new TVM550 frequency agile modulator and a changing industry with advanced technologies like our remarkable Stratum Series of signal distribution products. Stratum can put 78 channels in a six-foot rack space, and give you all the status monitoring, redundancy and remote control you could ask for.

Year after year, Standard has continued a tradition of quality and innovation. And we aren't stopping now. To learn the latest about the right technology for right now, use that old tried and true technology at the bottom of this ad.

Give us a call.

The Right Technology for Right Now.

Standard Communications

SATELLITE & BROADBAND
PRODUCTS DIVISION

P.O. Box 92151 • Los Angeles, CA 90009-2151
310/532-5300 ext. 280 • Toll Free 800/745-2445
Fax: 800/722-2329 (Toll Free) • 310/532-0397 (CA & Int'l Only)

Canadian Address: 41 Industrial Pkwy S., Units 5 & 6
Aurora, Ontario Canada L4G-3Y5
905/841-7557 Main • Fax: 905/841-3693
Sales: 800/638-4741

All the technology you need.

See us at the
Western Cable Show
Booth #2332

Reader Service Number 13

MediaOne debuts its mega-system

Editor Rex Porter recently toured the new MediaOne facilities in Atlanta.

Purchasing the former Wometco and GCTV systems in December 1994, MediaOne (a US West Co.) combined them into one mega-system. Replacing eight headends with two superheadends allowed MediaOne to serve 54 different franchise areas with a single system, reducing eight general managers' offices into one. With 12,000 miles (6,000 miles are fiber), Media One's "full service network" will pass 250,000 homes by the end of this year. The system map covers 65 miles east to west, and 75 miles north to south.

Using a "self-healing" ring architecture, 50 fiber nodes will be fed from each hub. Present plans call for an average of 500 homes per node. The signals at the nodes will be converted from optical to electrical and then transported to the homes over coax feeders. The headend buildings are huge and equipment is located in separate headend rooms for video, telephony and data processing. The same data networking capabilities will be used to feed maintenance and system status reports from every hub and node to a centralized monitoring station at the network operations center (NOC). In short, MediaOne's system is an Internet for its customers and its own operations and engineering staff. With a synchronous optical network (SONET) architecture, MediaOne will offer 95 channels, planning to grow to more than 200 soon.

Modernizing the original 450 MHz tree-and-branch system into a 750 MHz bidirectional hybrid fiber/coax (HFC) network, MediaOne will serve Atlanta with a complete communications network.

Co-sponsoring the media tour was Scientific-Atlanta, which provided a virtual end-to-end system for both superheadends. I also saw lots of equipment from SeaChange, ADC, APC, AT&T, Leitch, IBM, Gilbert, LRC, Belden, Synchronous and Times Fiber.

NOTES

• The deadline for submitting a one-page technical paper abstract for the **National Cable Television Association's** Cable '97 convention is Nov. 6. To qualify as a technical session speaker at the March 16-19 convention, send abstracts to: Katherine Rutkowski, NCTA, 1724 Massachusetts Ave., NW, Washington, DC 20036-1969; fax: (202) 775-3698; e-mail: KRUTKOWSKI@PRODIGY.com.

• **Harmonic Lightwaves** relocated to 549 Baltic Way, Sunnyvale, CA 94089; (408) 542-2500. A champagne reception celebrating the new 110,000-square-foot facility was held early last month.

• **Bay Networks** entered into a agreement to acquire **LANcity**. The deal was for $59 million in exchange for all outstanding shares.

SCTE web site up and running

The Society of Cable Telecommunications Engineers recently launched its official World Wide Web site to make current information on the Society and its activities more accessible to members of the telecommunications industry.

The address of SCTE's new web site is http://www.scte.org.

Presently, the bulk of the content defines SCTE's mission statement, "Training, Certification, Standards" and some of the many ways it is fulfilled by the Society.

The site also features the complete text of the recently released SCTE *Training Material Resource Guide* listing all publications and videotapes available through the Society, and a regularly updated calendar that shows the dates and locations of upcoming Society events such as national conferences and regional training seminars.

The web site was designed by SCTE Vice President of Technical Programs Marvin Nelson, who also has provided its initial content. SCTE senior member David Devereaux-Weber, network technician with the division of Information Technology at the University of Wisconsin-Madison, installed the protocol for the web site and actually put this new site on line. Together, they have worked very hard to develop the site and bring it to fruition.

Now that the web site is up and running, Nelson is working to expand not only its content, but also its user capabilities for greater ease in obtaining even more information. "We want to work on providing all of our chapters with their own Internet sites within our web site," Nelson explained. "That way, each chapter could post its most current activities."

"Many people cooperated in this effort," Devereaux-Weber pointed out, noting that use of the server hardware was donated by Sun Microsystems and Motorola Multimedia. The National Center for Supercomputer Applications provided the software.

The SCTE web site provides another medium through which to better serve the members and bring them the most updated information on SCTE events and activities. "The calendar, for example, is a really valuable feature," Devereaux-Weber stated, "because it is so convenient." Member can check on meeting dates at any time, no matter where they are.

Expo '97: Call for papers

SCTE is currently soliciting proposals for technical papers and/or workshops to be presented at Cable-Tec Expo '97 to be held June 4-7, 1997, at the Orange County Convention Center in Orlando, FL. Technical papers that are accepted will be presented at the Society's 21st Annual Engineering Conference.

Expo workshops should provide attendees with in-depth instruction on technical procedures that are used in everyday practice. Submission, which should include a brief abstract of the proposed paper or workshop, should be sent no later than Dec. 1, 1996, to Bill Riker/Roberta Dainton, SCTE, 140 Philips Road, Exton, PA 19341-1318.

For further information, please contact SCTE national headquarters at (610) 363-6888; fax (610) 363-5898.

ET '97: Are you registered?

This year's 1997 Conference on Emerging Technologies will be held Jan. 8-10 at the Opryland Hotel in Nashville, TN.

While the event is maintaining its usual broad cable telecommunications engineering scope, the overall theme for this year's conference is "data." (For more details on the confab, see "President's Message" on page 94.)

Registration packages will be mailed to all national SCTE members this month. Others who would like to attend should call national headquarters at (610) 363-6888 or fax to (610)-363-7133.

HFC '96: Intersociety success

"HFC '96," a technical workshop that took place Sept. 25-27 at the Loews Ventana Canyon Resort in Tucson, AZ, was co-sponsored by the SCTE and the Institute of Electrical and Electronics Engineers Communications Society, the division of the organization that is devoted to telecommunications, broadcasting and related disciplines.

HFC '96 focused on high integrity hybrid fiber/coax networks and was developed to provide an opportunity for industry experts to discuss the economics of HFC network design and how HFC can become the two-way network of the 21st century.

SCTE President Bill Riker discusses the workshop in detail in this month's "President's Message" on page 94.

Expo '96 videos available

Although the cable telecommunications technical community is looking forward to June's Cable-Tec Expo '97 in Orlando, FL, there's still an opportunity to gain from the technical training offered by Expo '96, which was held in Nashville, TN, this last June.

Expo '96 videotapes are available individually or in specially priced packages.

Also available is the 714-page proceedings manual.

For pricing and further ordering details, contact SCTE at (610) 363-6888.

900 MHz spread spectrum wireless communications

Every now and then a new technology comes along and really attracts my attention. Certainly there's the obvious headline-making stuff—digital compression, direct broadcast satellite (DBS) and cable modems are examples—but more often than not it's something that's very innovative but seemingly sitting quietly in the background. One such gadget is a 900 MHz spread spectrum modem (the manufacturer calls it a transceiver) available from Triad Communications of Littleton, CO.

Ron Hranac is senior vice president, engineering, for Denver-based consulting firm Coaxial International. He also is senior technical editor for "Communications Technology."

This device falls under Federal Communications Commission Part 15 rules, thus requiring no license to use. As I understand, it also falls under Canada's no-license rules. The basic modem can be used with a provided whip antenna, or for greater range, an external Yagi or similar antenna can be connected. More on this later.

Specs

First, a bit about the modem's specifications. Uncompressed data throughput is from 1,200 bps to 115.2 kbps, using an asynchronous, full duplex RS-232 interface. The operating frequency range is 902-928 MHz, and the modulation scheme is GFSK spread spectrum frequency hopping. Fifteen user-selectable hop patterns are available, and error detection includes 32-bit CRC with packet retransmit. Each modem has a unique address that is preset at the factory. Early units had a power output of approximately 1/3 watt (+25 dBm), but the current product is one watt (+30 dBm). Operation requires 10.5 to 18.0 volts DC. AC powered units are available and will operate from 85 to 264 volts AC, 50 or 60 Hz.

Initial marketing efforts targeted the broadcast industry. The most obvious application was for remote TV transmitter monitoring without the need for expensive dedicated phone lines or reverse STL RF transmission equipment. Another initial use was as a wireless data link between two computers, between a computer and a network host, and even remote computer access using one of the popular programs for this purpose such as pcANYWHERE. This latter application is where I first saw the product demonstrated. All of these are still popular uses for the modems.

Other uses

As more people see this modem, more clever ways to use it seem to come out of the blue. One of my first ideas was for point-to-point amateur radio spread spectrum communications. After all, the 902-928 MHz

THE KEY INGREDIENTS OF THE LECTRO POWERNODE.

Pre-installed Options
Power inserters, utility disconnect, AC distribution, Rf combining network can be pre-installed in our factory to save you time and money in field installation.

Cabinet
Low profile. Aircraft grade welded aluminum. Heavy-duty, lockable, and removable doors. Technician-friendly harnesses/connectors. Internal connections for utility, coax, and natural gas.

Battery
Three roll-out drawers for easy access. Parallel battery charging system. Multiple DC breaker points for added safety. Up to 12 batteries enclosed in a forced ventilated compartment.

Generator
Unlimited run-time for ultimate reliability. Can run on natural gas or propane. Easy-access maintenance of plugs, oil, and filter. Low vibration and low noise. AC or DC versions available.

Zero Transfer Time (ZTT) UPS
The industry's first true uninterruptible power system. Field-proven technology. Status-monitoring ready. Optional N+1 redundant module for added reliability.

Robust and scalable, the Lectro Powernode's modular design can accommodate up to four ZTT modules allowing you to increase your power capacity as you provide more advanced broadband services to your node locations. Easy access and the flexible nature of the design mean service is easier and can be performed while the system is on-line. And it's backed by the comprehensive support of Exide Electronics, a worldwide leader in power management solutions. All this provides greater value in flexible, growth-oriented power protection.

LecTro
A PRODUCT OF EXIDE ELECTRONICS CORPORATION

EXIDE ELECTRONICS
Strategic Power Management™

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 4513 RALEIGH, NC
POSTAGE WILL BE PAID BY ADDRESSEE

CUSTOMER SERVICE CENTER
EXIDE ELECTRONICS
8380 CAPITAL BLVD
RALEIGH NC 27690-1603

For more information on how the Lectro Powernode family can improve your network reliability with proven technology, call 1-800-551-3790, fax 1-919-713-5350, or mail the attached business reply card.

Visit us on the Internet at http://www.exide.com or send E-mail to info@exide.com

)and also is used by ham operators. I haven't tried this yet, because I .eed to verify if the spread spectrum requency hopping used in these nodems complies with FCC rules .bout amateur radio spread spectrum ransmissions. Still, you can see how omething like this can get the vheels turning.)

In the broadcast industry, one Kentucky TV station uses a pair of these nodems to access weather radar from ı remote truck. The studio's 900 MHz nodem is connected to a conventional elephone modem via a null modem .able. A second modem installed in he truck lets technicians access the tudio's dial-up modem, and download veather radar information directly to he truck. Another broadcast industry se is to relay GPS location informa.on from helicopters back to the stu.io. Yet another use is for remote teering of a satellite antenna at an .plink site.

In auto racing, this product is eing used in a bio-medical applica.on to allow the driver's heart rate nd other conditions to be monitored during a race. Race car telemetry also is being transmitted back to the pit crew. Neat, huh?

The nice thing about spread spectrum communications is its relatively high immunity to interference from other signals. The reverse also is true: Spread spectrum signals look like noise to other communications devices. I'm aware of only one situation where this particular modem had problems with other signals. At one mountaintop site, extremely strong signals on other frequencies simply overloaded the modem's front end. An external 902-928 MHz bandpass filter solved the problem. In-band interference has not been a problem so far.

Cable uses

You might ask why I'm so enthusiastic about a wireless product such as this. After all, ours is a wired industry. Bear with me: I've been thinking about how this modem might be able to be used by cable operators. (I'm told that one system is already using these modems to monitor battery conditions at remote sites.)

An obvious CATV application that parallels broadcast industry use is to monitor remote headend sites. For that matter, local headend sites also could be monitored. Rather than tie up a dedicated phone line, microwave subcarrier or even valuable spectrum on the cable network, why not use wireless spread spectrum modems? After all, the modems are two-way, so not only could the headend be monitored, but one could send acknowledgment or remote control commands back to the headend. Some headend equipment manufacturers have RS-232 interfaces available for remote control, monitoring and adjustment of modulators, satellite receivers and optoelectronics, so this may be a useful area to explore, too. High resolution color still pictures can be sent through these modems, so it might be possible to send images from a headend's remote security cameras back to the office. With appropriate compression technology, it might even be possible to send some sort of full-motion video. Voice communications between the headend and office is possible if audio codecs are connected to the modems.

More ideas: Status monitoring equipment at nodes or end-of-line locations could be linked to the office via these modems. If a fiber or coaxial cable gets cut, or there is a system outage, how do you know where or what the problem is? If you use the cable system's reverse path to get status monitoring signals back to the headend, they won't get too far if the cable is cut. An option is to pay for phone lines to each critical status monitoring equipment site, but that could get real expensive over time. It might be easier to figure a way to put one of these modems in a line extender housing, perhaps including a small battery pack to allow the modem to send its 900 MHz distress signal even if the power is out.

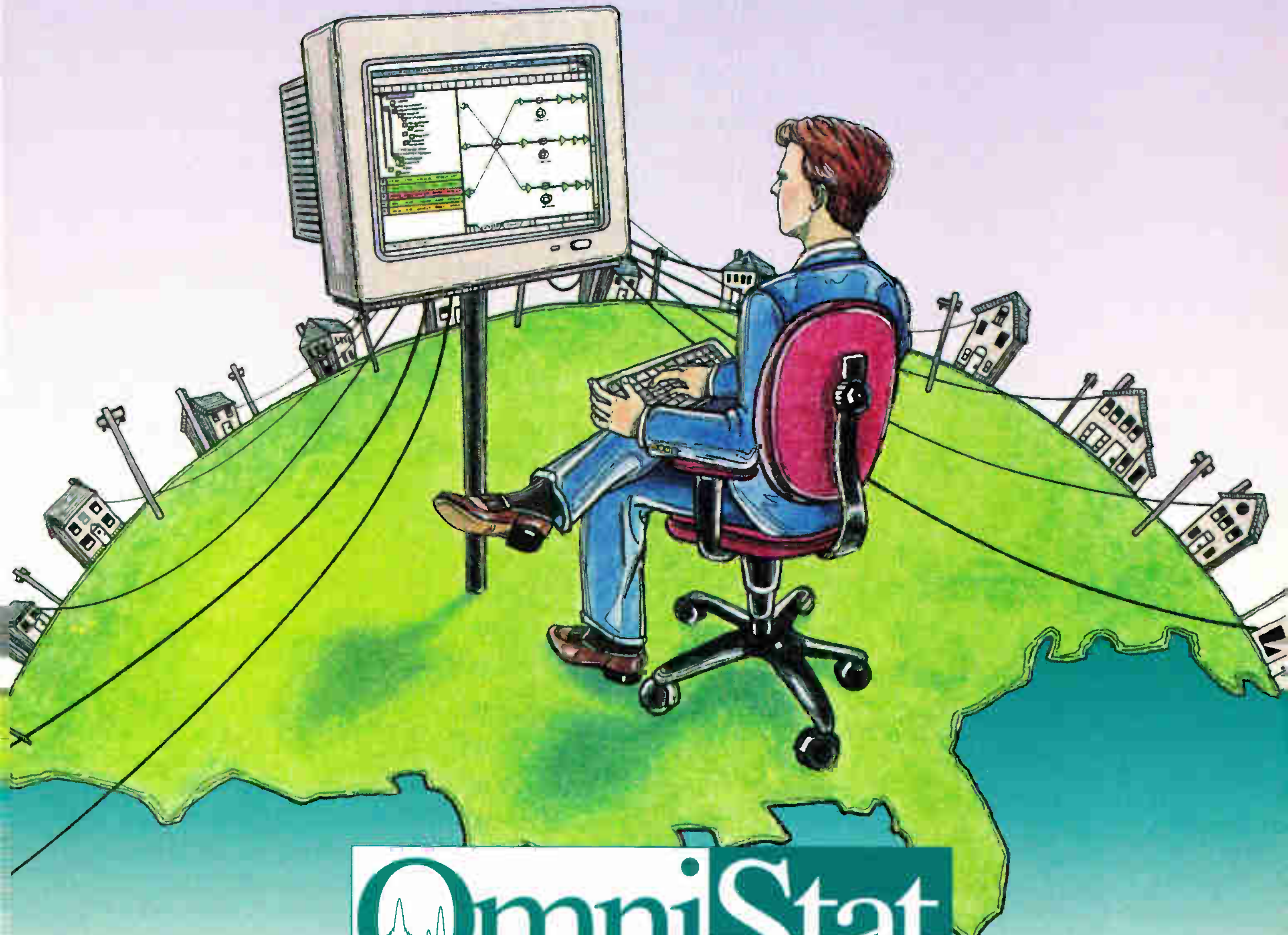
When CableLabs published C[illegible] age Reduction a few years ago, [illegible] of the discussion items was the possible use of end-of-line data accumulators in one-way systems. Standby power supplies could be equipped with status monitoring, and the status monitoring data sent downstream to the data accumulators. Instead of using phone lines to link the accumulators with the headend or system office, why not use these spread spectrum modems?

Even relatively distant sites (20 miles or more) could be monitored, because external antennas can be used to improve the modem communications range. If that's not good enough, the modems can be configured as store-and-forward repeaters, so the range can be extended even more. Part 15 rules applicable to this technology limits a modem's overall effective radiated power to +6 dBW (approximately 4 watts), so you might have to play with various combinations of feedline loss and antenna gain to maintain this. A TV station in California monitors a remote transmitter 23 miles distant with a pair of six element Yagis. At 900 MHz, antennas are quite small.

Borrowing the previously mentioned TV station's GPS/helicopter idea, certain system vehicles might be able to be equipped with GPS receivers and the location data sent back to the office for tracking purposes. This would be especially useful in inner city areas, or where it's important to be able to quickly locate the closest technician to a system problem. Response time could be improved dramatically.

Uses for this technology are really limited by one's imagination. I've highlighted a few of the more obvious uses. Although this product is not being actively marketed to the CATV industry at this time, I think it has a lot of potential. The modems are a little pricey ($1,800 to $2,300 each, depending on model), but compared to the long-term cost of dedicated phone lines, payback could be reasonable. For more information, contact Triad Communications, 997 E. Davies Ave., Suite 110, Littleton, CO 80122. The telephone number is (303) 730-3143. **CT**

CONTROL YOUR WORLD



OmniStat

Next Generation in Status Monitoring

The new OmniSTAT network monitoring system from AM puts you in control. Designed to monitor your entire system, including most all major equipment, OmniSTAT is flexible, simple and cost effective. Its modular, scalable architecture allows you to get started at a price which fits your budget today, yet anticipates the performance and interoperability you'll need for tomorrow's requirements.

The OmniStat System includes the easy to use OmniVU software, a Windows based, open architecture system that's powerful and will integrate easily with your operational support systems. Our OmniProbe monitors feature downloadable software and frequency agility. And our new OmniMCU is a PC based control system with practically unlimited capacity.

Because OmniSTAT is the system of choice by the major equipment OEM's, you can be assured that the system works right today and tomorrow.

From AM Communications...the monitoring standard for over a decade.

AM COMMUNICATIONS
GUARDRAILS FOR THE INFORMATION SUPERHIGHWAY
P.O. Box 9004, Quakertown, PA 18951-9004
215-536-1354 • **1-800-248-9004**
http://www.amcomm.com

Reader Service Number 145

By Justin J. Junkus

On the importance of customer service

Someone paid me the compliment just before I wrote this column that I was starting to sound like "one of us" (cable operators). Now, that made me feel pretty good, but I think the reason I am starting to come across like "one of us" is that I have taken some time to study both cable technology and history. Now, I want to help you sound like "one of us" in the new telephony business by giving you a short history lesson in this month's column. I hope it will help explain why a focus on customer service is so important as cable enters the telephony market.

Telephony's infancy

First, let's look at the beginnings of telephony. Alexander Graham Bell was not an engineer or a technician, yet he invented the instrument that started the industry. Bell was a teacher of the deaf, looking at better ways to understand hearing and how to help people communicate. His father also was a teacher of the deaf, and invented a method of sign language known as visible speech. Bell picked up on the work that his father started, and in his early 20s was well known as both a teacher and private tutor of deaf pupils. So you see, telephony's father and founder of the Bell System is the very image of a service provider, even before the telephone is invented.

Justin Junkus has over 25 years experience in the telecommunications industry. Previously the AT&T cable TV market manager for the 5ESS switch, he is currently president of KnowledgeLink Inc., a telecommunications training and consulting firm. If you want to contact him, he may be reached at his e-mail address, JJunkus@aol.com.

Two of Bell's pupils became important to his life and the telephony industry. His future wife, Mabel (Yes, that's the original Ma Bell), was the daughter of a respected patent attorney of the time (Gardiner Hubbard). Another pupil's father (George Sanders) was a prominent investor. Bell, Hubbard and Sanders formed the Bell Company to develop the "harmonic telegraph." (That's another story, but this was a form of frequency division multiplexing.) It was Hubbard who did the original patent search and filed Bell's application while the telephone was more a concept than a working reality, and did so one half day before the nearest competitor, Elisha Gray. This fortuitous circumstance began the intimate relationship between the telephone and lawyers that lasts to this day. I will later write about how this relationship led to the service orientation of the industry. But back to the legal genesis.

When Bell's instrument could actually be demonstrated ("Mr. Watson, come here. I need you"), the market grew rapidly. Gray and his backer, Western Union, wanted a part of the market that Bell might monopolize under his patent. After all, Western Union was the leader in current communications technology, albeit the telegraph. To make a long story short, the law-yers on both sides compromised, and the Bell Company became the purveyor of telephone service, with Western Union getting 20% of the revenues over the 17-year life of the Bell patent. The year was late 1879, and here we have the first "consent decree," only three years after the invention of the telephone.

Meantime, the original partners, including Bell, decided to leave the business. Management became professional, with the Bell company becoming the baby AT&T led by William Forbes and Theodore Vail. Vail did more to shape the industry into a national resource than any other officer since. A good part of his actions were driven by market forces.

Vail actually served as president of AT&T twice. The first time, his contribution was to expand the Bell Company by aggressively seeking backers in small towns to open new telephone offices, using the Bell patent license as collateral for the required capital. Once the town committed to beginning the telephone business with Bell's technology, Vail employed his legal resources to hold onto the newly found markets. The Bell position was that patents on improvements made after the first telephone effectively extended the monopoly granted by the original patent. More importantly, however, in his efforts to expand the market for the telephone, Vail was always open to any town that wanted to offer telephone service, not necessarily only those in the wealthy Eastern establishment towns. This openness ensured that telephone service propagated across the country, and hence enabled a highly regionalized product to grow into a national communications network. However, there was one catch—only Bell companies could connect to the Bell network. Hence, AT&T ensured the extra value of the Bell companies in being able to access more of the phones in the emerging telephone industry.

Vail's second tenure as president came 20 years after his first. He had

continued following the telephone industry while pursuing other interests, and was invited back as president when new financial backers realized that universal telephone service, whether from large Eastern cities or small Western towns, added to the financial value of a long distance national network. Their view, however, was still that this ubiquitous network would be pure Bell, with no interconnection to independent companies permitted.

Vail worked with the financiers to gain control of independent companies across the country, and then consolidated the newly acquired companies into a set of regional Bell operating companies (RBOCs), which were subsidiaries of AT&T. At the same time, AT&T as the parent of the Bell companies was attempting to remove competition from its old nemesis, Western Union, through purchases of Western Union stock. By 1911, control was accomplished to the extent that Western Union financial results were included in the AT&T annual report.

Service comes first

Enter the concept of service as an attribute of the telephone business. By 1913, AT&T had grown so large that the federal government was actively pursuing anti-trust actions against the company, in the name of the public interest. In that year, AT&T and the U.S. government voluntarily entered into the Kingsbury Agreement as a compromise to continued legal actions. In return for the government's end to anti-trust activity, AT&T agreed to allow independent companies to interconnect to the AT&T facilities so they could offer nationwide telephone services. This interconnection was AT&T's concession to the government to serve the public interest by providing a national telephone network open to anyone who provided telephone service. In 1921, the government further assisted AT&T in building that nationwide network by passing the Graham Act, which allowed both the Bell companies and the independents to become monopolies in their own geographic territory. This ensured that the new nationwide network would be nonoverlapping and cover the entire country. Universal service in the name of the public interest had arrived.

But was the public pleased? Not totally, since in 1935, the newly created Federal Communications Commission began a four-year investigation of AT&T's cost and pricing structure, with the concern that its captive manufacturing arm was overcharging for equipment sold to the subsidiary telephone companies, thereby allowing the telephone companies to show a low rate of return on the equipment they bought.

The investigation concluded that the pricing and costing structure was fair, but the die was cast for similar investigations until divestiture in 1982, including the Antitrust Case of 1949-1956 and the second anti-trust suit in 1974. Each time, the Bell response was that the entire organizational structure only served to further the Bell system aim of providing the public with the best possible service at the lowest possible price. Extensive legal investigations and detailed document retention associated with the legal actions made it mandatory that the Bell companies maintain and document how the structure improved the service capabilities of the companies from Vail's early AT&T to the present.

So what should all this mean to the cable industry? Our competition in the telephony business doesn't just view service as a marketing gimmick, or even a marketing tool. They are shaped and conditioned by almost 100 years of legal battles where the strongest weapon for survival was to show how service justified the organization. The Bell companies include customer service in their management philosophy as well as in their marketing mix as second nature. While cable can talk about how it will exceed the service objectives of the local telephone company, 100 years of conditioning will not let the telephone companies be easily beat at their own game.

If we in cable really believe better service is the weapon that will win us new markets, it is best to remember that our competition has a history of playing the same game and winning. We need to make service just as much of our business and personal lives as they do. Winning the consumer's business will be a tough game, and the victory will be ours only by our commitment with actions matching the words.

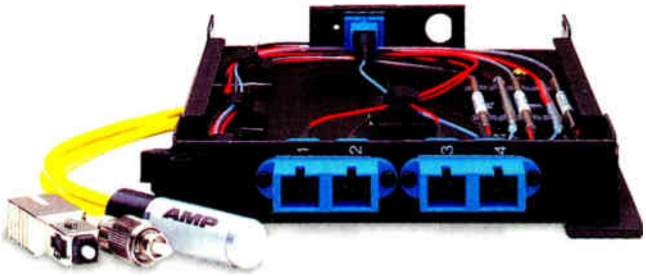
Next month, it's back to technical topics in this column, with a look at PBX and key systems. **CT**

Wherever there's cable, there's AMP to manage it, terminate it, and keep it on the job.

Wherever there's fiber or copper cable, there's AMP to add reliability and efficiency. We've got the broadband components today's projects demand, including innovative new products for evolving standards and advancing technologies. Wherever there's cable, there's AMP.

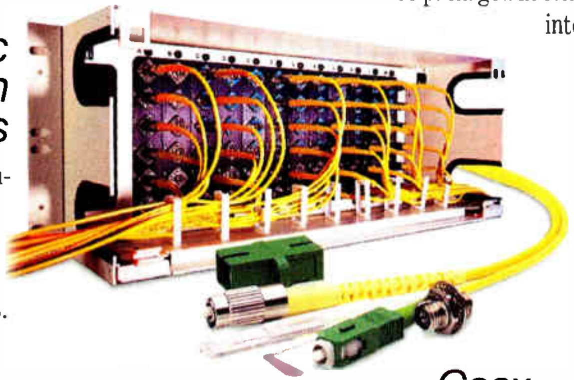
F-connectors

Rugged F-connectors provide superior performance and reliability to 1 GHz. Their standards-compliant, craft-friendly design terminates quickly with industry standard tooling. Available sealed and unsealed for outdoor or indoor use, AMP F-connectors are designed to meet Bellcore and SCTE specs.



Fiber Optic Control Devices

AMP fiber attenuators, wavelength division multiplexers, and couplers offer low reflectance, reliability, and a wide variety of packaging styles for your specific system's needs. These devices can be packaged in convenient modules that just snap into your fiber frames.



Fiber Optic Interconnection Devices

From complete fiber frames to high-performance cable assemblies, connectors, and splices, AMP is a leader in products to connect, organize, and protect fiber cables.

Coax Coupling Closures

Designed for direct burial, gel-filled CERTI-SEAL closures protect F-connector splices. Their one-piece design snaps together for easy assembly, and to eliminate lost parts. Innovative centering tabs and a molded-in strain relief reduce the possibility of temperature-induced movement.

Electrical Environment Monitor

Locate and identify abnormal electrical environment patterns based on real-time monitoring by AMP. Using our patented ACCU-SCAN 804 Electrical Environment Monitor, this valuable service can help you prevent the damage, and downtime, that can cost you subscribers and revenue.

Connecting at a HIGHER level.™

AMP, ACCU-SCAN, ACCU-SCAN 804 and CERTI-SEAL are trademarks.

For more information, call 1-800-220-5489 (fax 717-986-7321). AMP Incorporated, Harrisburg, PA 17105-3608. In Canada, call 905-470-4425. On the Internet, http://www.amp.com

AMP

Reader Service Number 41

PLANNING '97

By Laura Hamilton and Alex Zavistovich

Last month, "Communications Technology" began this two-part special report with a focus on how some of the major MSOs are planning purchases so they may continue building and upgrading their networks. In this part, we talk to the vendor side and find out how they are positioning themselves to supply those MSO needs.

As far as cable industry vendors are concerned, data delivery continues to create the biggest buzz in the marketplace. Nearly all the vendors contacted by *Communications Technology* cited Internet access and related data service as the area in which they saw the greatest interest, for the immediate future and beyond.

So intense is the battle for market share in data hardware and network infrastructure that new companies are continually entering the fray. Scientific-Atlanta, for example, is poised to deliver its latest cable modem entry in early 1997, which will use hybrid fiber/coax (HFC) downstream with a telco return. Another S-A introduction will utilize a cable plant's RF return capabilities.

Still, not all vendors see data as the be-all and end-all for cable. Roger Magoon, vice president of marketing and business development for West End Systems, cautioned, "There is no a priori reason why data transmission will remain the hot topic. The real issue is service diversification utilizing the existing cable plant.

"Within any one area, such as data transmission, I expect there will be demands for more services on top of the basic transmission," Magoon said. Telephone companies, he explained, do not stop at twisted copper pair transmission for their customers; they also provide access and protocol conversion to networks such as frame relay and ATM. With that in mind, West End Systems is eyeing the cable industry for products it is now selling into other markets—products including frame relay, X.25 and ISDN access.

Magoon anticipates "increasing depth in data transmission services, with a movement to other services such as telephony in the future." Still, he concedes that the data phenomenon will likely remain at the top of the industry's short list of hot technologies "for at least the next year."

That last sentiment was echoed by Bill Brobst, director of public relations for Scientific-Atlanta, who added the prediction that digital home communications terminals will begin to be deployed in volume "toward the latter half of 1997." Digital video will re-emerge as a major topic as deployments begin, he added.

S-A's above-described cable modem is designed to be a low-cost solution for one-way operations. The growing demand for data access also has led S-A to develop TV-based Internet access in its Explorer family of digital set-top terminal products.

Gary Granger, director of marketing operations for Motorola's Multimedia Group commented that "large-scale commercial deployment of cable-based telephony and high-speed data equipment" means "in the next 12 months, everyone from the system engineer to the

---

Laura Hamilton is senior editor of "Communications Technology" and can be reached at (303) 839-1565, ext. 43. Alex Zavistovich is executive editor and can be reached at (301) 340-7788, ext. 2134. Also contributing to research for this article was Editor Rex Porter, (303) 839-1565, ext. 31.

vendors will be moving up a steep learning curve" in deploying these services.

Once data products and services are proven in the field and customer penetration increases, what's next? For John Davalos, technical marketing manager for Hewlett-Packard's interactive broadband program, it's "defining a common gateway to the home." "Customer service and support expectations are very high for data services," Davalos continued. "Service productivity will need to increase if costs are expected to be controlled or even reduced." That means cable operators will need to pay greater attention to preventive maintenance and network monitoring systems and the tools required, which in turn means a greater emphasis on training. "The better the cable engineer is trained, the more effective he or she will be in quickly troubleshooting problems remotely and providing quality service."

Data drives the market

The skyrocketing interest in data transmission is clearly affecting vendors' plans for product introductions in the coming year. Take General Instrument, for example. According to Geoffrey Roman, vice president/general manager of GI's telecommunications business division, the company expects "significant" revenue contributions is 1997 from the SURFboard product line introduced in 1996 to support PC connectivity to the cable network. "We plan additional product capabilities in 1997 to support a broad range of applications. Further, GI is integrating the capability to support data applications such as Internet access into its advanced analog and digital set-top terminal platforms."

Tony Ley, president and CEO of Harmonic Lightwaves, noted that if data and telephony become successful for cable operators, his firm could only conclude that the industry "will go on building the infrastructure, rebuilding their systems next year to make them capable for two-way and to handle the bandwidth that you need for television and data together up to 750 MHz."

West End's Magoon noted that cable companies are responding to market demand for home data services as well as business applications including leased line or LAN bridging. West End, which has been providing the WestBound 9600 with data and voice capabilities since 1995, will introduce Ethernet access capabilities on its 9604 universal subscriber drop this fall.

On a "scale of asymmetry," Magoon said, LAN-type traffic is the most asymmetric, followed by general data communications; telephony requires symmetric service. West End's prediction is that cable companies will start with LAN/data transmission products and then become more interested in telephony-type services. The company therefore provides products to allow cable companies to conveniently migrate to voice service after getting its feet wet with data.

"The skyrocketing interest in data transmission is clearly affecting vendors' plans for product introductions in the coming year."

Hewlett-Packard's first product, the QuickBurst Network, will "begin shipping in limited volume first quarter 1997," said H-P's Davalos. The product consists of a signal conversion system (headend router and modem) and the QuickBurst cable modem. The company's broadband Internet data services (BIDS) offers a "full end-to-end system solution, including system integration and project management," he added; the system is based on H-P's existing client/server system solutions.

Motorola's Granger said his company is continuing "major investments in engineering, distribution, marketing and development for its CableComm technology." With the 1996 commercial launches of the CyberSURFR cable modem technology by several major MSOs (including Time Warner, TCI and Comcast) Granger said Motorola is "focused on shipping modems to meet market demand and continuing to develop next-generation product capability, as subscribers realize the benefit of high-speed access."

Other companies are not only investing in the future of data delivery themselves, they're also looking for partners to help fully realize the potential of the service. One such is ADC Telecommunications. Clyde Jenkins, the director of product management and development, for the company's Broadband Communications Division, pointed out that "ADC's HFC platform is designed to offer integrated video, telephony and data services." Because of the market demand for high-speed Internet access, Jenkins said, "ADC has increased its investment in its data development program for the coming year, and has partnered with other companies, which will better position ADC to provide complete end-to-end solutions for its customers."

"Motorola and the cable industry are working together to help launch a new industry," Granger concurred. "At Motorola this is viewed as more of a strategic partnership than a traditional vendor/supplier relationship. This means working very closely together to help develop products with the required feature sets to meet consumers' demands. This is a win-win situation when we cooperate to bring our shared vision to reality."

Evolution or revolution?

As the cable industry turns increasingly to digital, data and telephony services, the face of the industry will undoubtedly change. In some cases the changes will be evolutionary. GI's Roman explains: "Many of the technologies to support these advancements are related to those now being deployed. For example, the transmission technology for GI's SURFboard is adapted from that used in the DigiCable product." Other technology, however, such as the media access control protocol for network applications, are being developed especially for these applications.

"The biggest impact engineers will see," Roman added, "is the development of platforms that are used across applications with accompanying integrated network management systems. This contrasts with the array of independent components that comprise much of the industry today."

Magoon predicts cable equipment will focus more on software and network management systems. "Traditionally," he explained, "HFC transmission equipment has been predominantly hardware, with some low-level software code. At the opposite end are large central office or ATM-type switches for which 70-80% of the effort involved in their development is software-based.

"Communication systems such as the WestBound 9600 are a long way from a system that is over 90% hardware," he said. "The reliability of telephone-type systems can be achieved by cable companies with the right products, employee skills and operational support systems." For West End—and ADC, for that matter—improved transmission performance has become a central focus. Both companies are promoting orthogonal frequency division multiplexing (OFDM) as the transmission scheme of the future. "We have expended considerable effort in the development of OFDM," Magoon commented, "so that services requiring an efficient and robust use of the return path can achieve the high reliability and availability requirements of a sophisticated communications system."

ADC's Jenkins agrees. "OFDM and its enhanced bandwidth-carrying capacity is a modulation technology that provides many benefits over the existing QPSK technology for delivering telephony and high speed data services." Other changes, he said will be evolutionary, not revolutionary. "Expect to see power consumption reductions, enhanced performance monitoring, and additional services," Jenkins predicted.

Those kinds of changes still go

The industry view on modulation

Vendors increasingly feel more robust modulation schemes will be needed for the services of the future. Some are leaning toward quadrature amplitude modulation (QAM), some toward quadrature phase shift keying (QPSK) and still others feel orthogonal frequency division multiplexing (OFDM) is the best choice. As a counterpoint, here are some operators' observations on the subject.

Not surprisingly, MSOs seem to prefer modulation schemes with a proven track record. Operators providing data delivery are focused on QAM for downstream transmission. On the return path, opinions are more mixed, but favorite technology seems to be QPSK. The return path transmission choice is based on robustness, which most of the engineers polled found to be a necessity because of the 5-40 MHz return spectrum used for data.

Jones Intercable's Chris Bowick would not venture a preference, although he predicted, "I think what you're going to see is a forward-path QAM methodology standardized in the future, along with return path QPSK." According to Bowick, Jones is less concerned with the modulation format as they are the interoperability. "I think vendors need to focus on interoperability, not just on the bits level, but on the RF level as well," he said.

At Cox Communications, Alex Best said QAM is the preferred choice for the downstream portion, "since it offers high efficiency in terms of bits/Hz." In the upstream portion, QPSK, orthogonal frequency division multiplexing (OFDM) or code division multiple access (CDMA) are preferred, Best said, since the schemes offer robustness.

Michael Harris said Century Communications Corp. is "still deliberating our preference. Obviously signal quality, reliability and efficient utilization of bandwidth are all essential criteria to be considered." Initially, said Harris, robust but less efficient schemes "will give us ample capacity and the ability and time to improve the characteristic of our return paths." Harris predicted the company will migrate toward more sophisticated modulation techniques as the business progresses.

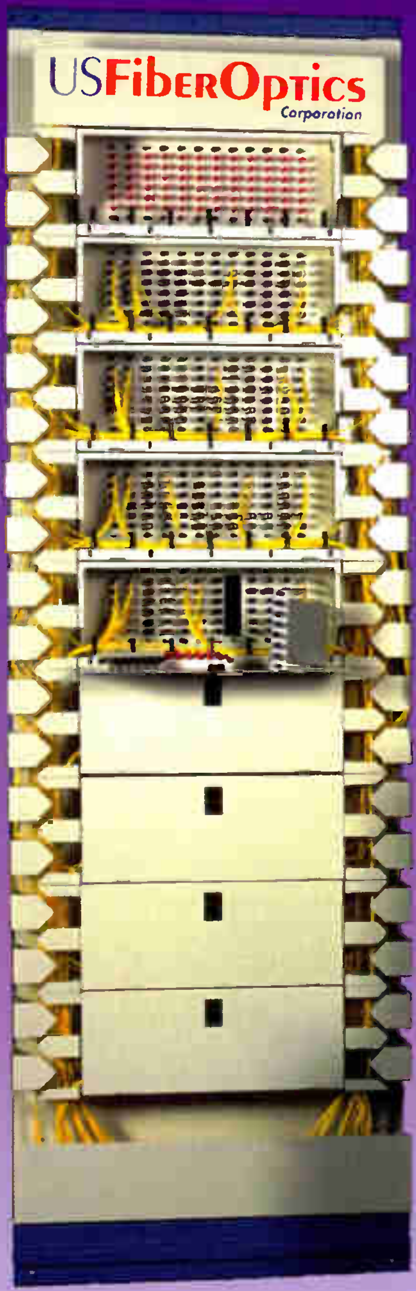
Jim Chiddix of Time Warner echoed the sentiments of most engineers polled: "We like to get as many bits per Hz as possible and still get reliable service." According to Chiddix, all of Time Warner's services use QPSK upstream. As for the signal from the headend, "Motorola modems use 64 QAM downstream," Chiddix said, "and we're using 64 QAM downstream in the Orlando Full Service Network interactive service, too." Chiddix said he remains open to hearing more about OFDM on the return. "We're certainly interested in what we hear from people like ADC and West End about OFDM upstream, and the possibility of higher bits per Hz, but we don't have that system in our lab, and we've never seen it work."

Regardless of the means of transmitting data from and back to the headend, most engineers agreed that some degree of filtering may need to be done to ensure a cleaner signal. A data stream interrupted by ingress means lost data, which ardent "webheads" will not tolerate.

Bowick noted that passive filtering may be a short term necessity. "If you find a suspected ingress path you can filter that path—whether it be a home or branch or whatever—on a selective basis." Longer term, Bowick sees cable modem vendors finding a way to "get smarter, to have modems capable of monitoring the return path, and ensuring that they're using viable spectrum, or are

(Continued on page 28)

GET CONNECTED...
1-800-US FIBER



Pretermination Shelves

Description	Connector Type	Availability
72 Port Pretermination Shelf with custom length fiber pigtail	SC/UPC SC/APC FC/UPC FC/APC etc.	Stock

Splice Shelves

Description	Capacity	Availability
144 Splice Capacity Splice Shelf	144 Fusion	Stock

Optical Transition Vaults

Description	Capacity	Availability
576 Splice Capacity Splice Shelf	144 Fusion	Stock

Splitter Modules

Description	Connector Type	Availability
10/90 Splitter Module	ANY	Stock
15/85 Splitter Module	ANY	Stock
20/80 Splitter Module	ANY	Stock
25/75 Splitter Module	ANY	Stock
30/70 Splitter Module	ANY	Stock
35/65 Splitter Module	ANY	Stock
40/60 Splitter Module	ANY	Stock
45/55 Splitter Module	ANY	Stock
50/50 Splitter Module	ANY	Stock
33/33/33 Splitter Module	ANY	Stock
35/35/30 Splitter Module	ANY	Stock
20/20/60 Splitter Module	ANY	Stock
15/15/70 Splitter Module	ANY	Stock
25/25/25/25 Splitter Module	ANY	Stock

Jumpers and Pigtails

Description	Connector Type	Availability
Custom Cable Assemblies	ANY	Stock

One-stop shopping for Telephony,
Broadband, LAN and WAN applications
We can provide the solution.
Call 1-800-US FIBER for the distributor in your area.

USFiberOptics Corporation

10015 Old Columbia Road
Columbia, Maryland 21046
Local: 410-290-3693 Fax: 410-290-3695

Reader Service Number 121

back to a fundamental need for improved network reliability. Alan Amato, manager of applications engineering for Times Fiber Communications, concluded that industry changes are essentially related to the system reliability. "That is," he elaborated, "how can a cable operator provide for continuous power to its system?"

For Amato, the cable industry is "looking to provide continuous reliability like we have in telephone systems right now—to provide service 99.99% of the time. One of the ways that Times Fiber has been responding to that is the use of different types of powering schemes for our customers. We've made some non-traditional cables to assist in powering cable systems in a more reliable way."

A similar sentiment was held by Harmonic's Ley, who, like other polled, stressed the value of network management in cable. "Today, (cable operators) let the customers call in when the network goes down. That's all right when you're paying $1 a day for television. It's not all right when you're working at home with your 10 Mbps modem and your telephone on the same circuit and the system goes down for a couple of hours. You're not going to be very happy."

Whether industry changes come incrementally or all at once, MSOs and vendors alike agree that come they will. They must, for cable to realize the revenue potential of data transmission. And when the data craze has finally transformed cable technology, it will have opened a doorway for interactivity, telephony and any other two-way service the industry's technical minds can devise.

The digital push

Even though it may sometimes seem that the issue of high-speed data over broadband nets overwhelms any other topic of interest in cable engineering conversations, there are of course other issues the industry will continue to tackle over the next year.

Digital is one of those issues. With direct broadcast satellite (DBS) and the wireless industries already touting the wonders of digital video and consumers responding

From the purchasing ranks:
Interview with an MSO purchasing VP

Recently, *Communications Technology* met with Shelbie Berry, vice president, materials and purchasing, at The Jones Co. (formerly Jones Intercable). She discussed how that company, as one of the major U.S. MSOs, handles purchasing in the cable telecommunications arena.

"Due to our restructuring and processes for the material selection, the old traditional role of purchasing products in the cable industry is extinct at Jones," she said.

So what is the new focus in purchasing? Berry listed it as entailing the following main points: 1) "Total cost" evaluation of products and processes; 2) planning and forecasting nationally; 3) standardization of materials, which means decreasing vendor base and increasing internal flexibility; 4) increasing contract / blanket orders; 5) team selection of product and vendor (includes technical engineering, new business development, purchasing, marketing, marketing, etc.); 6) attending shows and viewing product demonstrations as a group; 7) purchasing centralization; 8) establishing Jones Distribution Centers; 9) developing quality request for proposals (RFPs) and contracts that fully define requests and agreements and decrease misunderstandings, legal time, etc.; 10) strong vendor teamwork and improved relationships; 11) streamlined integrated on-line information processes. (Jones is implementing on-line software where anyone at corporate or at the system level can look at inventory, open purchase orders, product history/usage, order status, vendor performance, etc.)

Berry said that Jones purchasing approach is moving away from the following: 1) clerical/order placing functions; 2) non-value-added functions; 3) distributors and higher prices; 4) vendor deals at system level; 5) spreading business to too many vendors that results in higher costs; and 6) high inventory levels at each system location.

Berry added that Jones is trying to work with vendors as a "business partner" whereby each supports each other and thereby both companies grow. She also said Jones wants to

(Continued on page 30)

The industry view on modulation

(Continued from page 26)

able to move to viable spectrum in the event of ingress." Currently available modem technologies are also moving toward that kind of frequency agility, Bowick said.

Filtering at the home will become prevalent as we begin offering two-way services, said Best. "It offers a simple quick-fix to the ingress issues that predominately occur in the home's internal wiring." Filtering at the headend offers no solution to this problem, Best noted. Harris agreed that a very high percentage of leakage/ ingress comes from within the customer premise, and that passive filtering is therefore necessary. "(It) is the closest thing to a "silver bullet" we have at this time," he said. Active filtering in hardware and software will only help to improve the overall performance, Harris noted. "Our major focus is to eliminate the interference at its point of entry."

Filters or no, there is still no substitute for a well-managed system. As Chiddix pointed out, "The most demanding of all services is voice: you can't do a resend if you lose voice information." According to Chiddix, a large number of telephony customers use Time Warner's HFC network in Rochester, NY—a system which uses no high-pass filters.

"That's a well-managed, well-run cable system," Chiddix said. "While there isn't zero ingress, it's an issue they've paid attention to for quite some time." Filters are a tool for fighting ingress, he acknow-ledged, but he noted that "it can be wasteful, operationally complex and limiting to shotgun a high-pass filter at every subscriber drop. I think our experience in Rochester proves that a well-run system doesn't need to have that kind of filtering installed." —*AZ*

No Matter Whose Name Is On The Outside...Chances Are TV/COM Is On The Inside.

We've been pioneering innovations in the communications industry for more than 25 years. The proof of which is the key technology patents TV/COM holds for control and security system technology for both digital and analog systems. Today, as the leader in open systems architecture delivery solutions for cable, satellite and terrestrial network systems, TV/COM-originated technology has been widely adopted by the industry. So no matter whose products you buy, it's quite likely you're buying our technology. If your purchase decision is important to you, and you're looking for a flexible, secure delivery solution that gives a high return on your investment, then call 1-800-745-3811, Ext. 3029. Or fax us at 619-451-1505.

TV/COM

A Subsidiary of Hyundai Electronics

Reader Service Number 43

with dollars for digital, it's a given that cable MSOs will roll out more and more digital offerings in 1997.

Cable vendors say they are well at the ready to supply those needs. And, as digital communications terminals are expected to be deployed in volume toward the latter half of '97, some vendors predict that will add fuel to the interest in digital.

"We believe digital video will re-emerge as a major topic as (terminal) deployments begin," said S-A's Bill Brobst, "It's a major offensive tool in fighting DBS and other competition."

H-P's John Davalos also predicted that compressed digital video and the deployment of digital set-tops would be topics on the tip of the industry's tongue and said, "Once these products and services are proven in the field and customer penetration increases, defining a common gateway to the home and home networking will be the next step in bringing convenience, lower costs and greater ease of use to subscribers."

He added that "vendors will be challenged to keep the user interface of very complex, digital tools simple and easy to use."

Cable's suppliers say they're beefing up the digital technology they've introduced recently, but you also can expect to see a flurry of new products as well.

"GI's digital products, introduced in volume in 1996, will undergo further development in 1997," said the company's Geoffrey Roman. He cited GI's SURFboard product as one unit that will continue to evolve to include configurations that comply with the forthcoming MCNS standard. Roman also said to watch for GI's digital set-tops to get real-time return options as well as the ability to support two-way data services. (The company's advanced analog set-tops will get similar capabilities as well.)

Harmonic Lightwaves' Ley said the company is in the throes of heavy R&D work on new digital products and the industry should expect to see some of the fruits of this research unveiled sometime in 1997.

While S-A will continue to supply both analog and digital in the next year (both in the same system

From the purchasing ranks

(Continued from page 28)

visit vendors, especially the manufacturing locations, in addition to having the vendor meeting them at Jones' facility. Of course, the company expects to meet with vendors at the major shows as well.

"We want to get away from feeling that a salesman calls on us to meet his quota," she said, "Getting the order is only the first step. Having Jones receive the product on time and then experiencing a successful installation with positive results, customer service training and technical support are the required additional steps," she adds.

CT also asked Berry to detail Jones' preferences for working directly with a cable telecommunications vendor's sales staff. What follows are her comments.

CT: How much time would you expect to spend with a salesperson during his or her presentation on products?

Berry: In our industry, most products have to fit a "technical need" first, then if/when the technical need is identified, we as a company select the best vendor(s) based on technical, quality service, vendor performance to include sufficient communications and on-time delivery, availability, vendor financials, capacity, product support, training, flexibility, freight, follow-up, cooperation, internal process/ support, reputation, payment terms, and a commitment to future/improved R&D, which ensures continuous improvement, upgrades, and/or modification.

Once this process is applied, we would spend "whatever" time is required to review a vendors product... several sessions at 3-4 hours each on products that include processes, software/hardware performance, and higher level of technical analysis. If it's to review commodity type items that are mass produced, specs are established, etc., it would be much less time. We do not need a 4-5 hour presentation on "more of the same."

CT: If a salesperson attempts to set an appointment with your staff, but the company or products are not in the approved "buyers guide," what do you say to him or her?

Berry: We try not to waste our internal resources time as well as the vendor's. But we have to be careful and not turn away a source that can offer a product that is needed. There is no "set" and "predetermined" policy on this issue. We do not need another light bulb supplier! Depending on the product, the "need" for another vendor, and the priority for requesting our technical group, time to approve another part, we would probably request a catalog/profile sheet and/or general information about the vendor and product. Once received, we would determine with appropriate internal sources if it should be pursued. If the vendor or product has potential, we would keep in touch and pursue it when appropriate. If it is another distributor trying to sell more of the same, we would discourage any further dialog.

CT: How would a new company best approach Jones purchasing in able to introduce itself and new products?

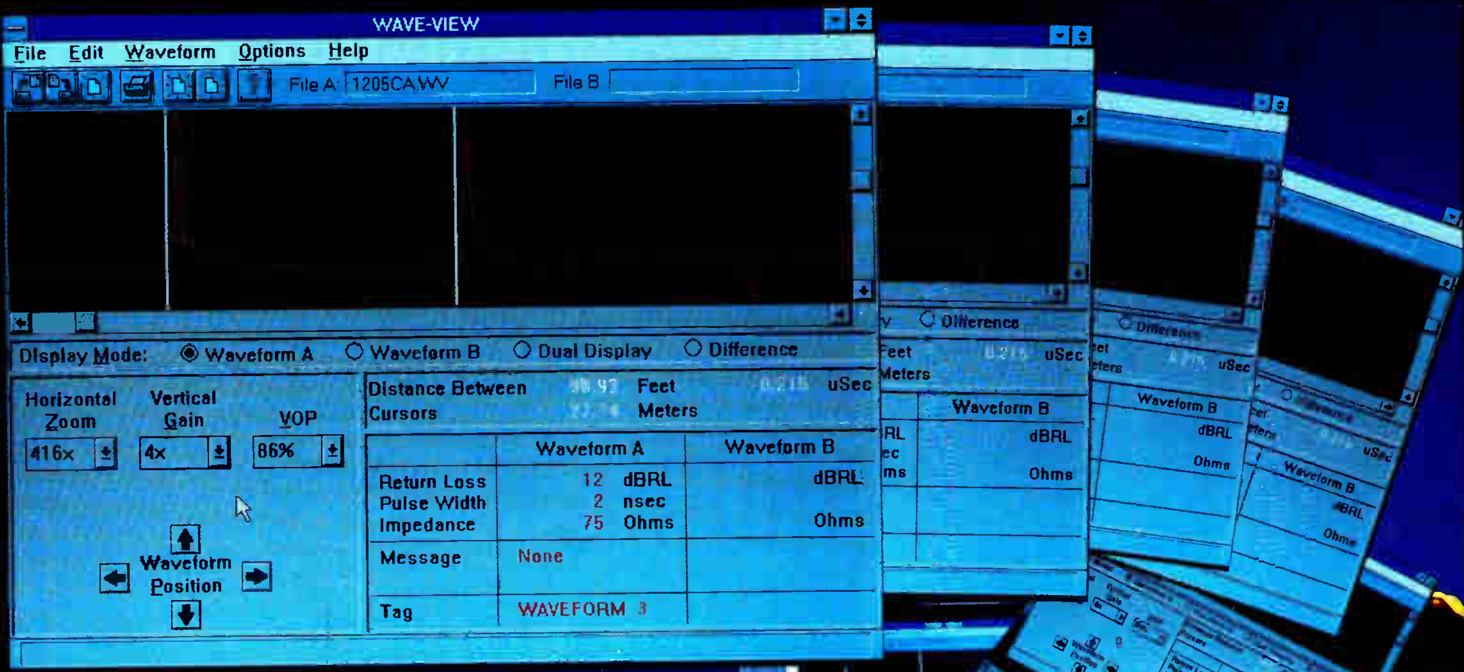
Berry: Call the purchasing manager and request an appointment. Our department has been restructured and has the staff qualified to prescreen any basic commodity, products or service and/or determine if it should be forwarded to other internal associate or department. If it is high-tech, we only prescreen with technical support from our engineering department.

CT: How often do you expect salespeople to contact your people in the field to make sure there are no problems with the product and its delivery?

Berry: Unfortunately, we have a variety of preferences on this issue from the field. Some of our field associates only want to see the vendors if/when they have a need. They may not ever want the salesperson to contact them. However, some system associates want periodic visits. We encourage our system associates to always relay problem issues immediately, not wait for a salesperson to call.—*LH, RP*

Ultimate TDR and Software package.

Model 1205C TDR and WAVE-VIEW Software, a powerful combination resulting in the most versatile, user friendly TDR available today! Standard with the Model 1205C, the WAVE-VIEW software is one of the unique and exclusive features of Riser-Bond Instruments' TDRs.



✪ Use your computer and WAVE-VIEW for Windows® as an extension of your Riser-Bond TDR. Waveform information can be archived, documented, manipulated, compared, or analyzed on your PC while your TDR goes back into the field, working for you! Teach technicians how to use a TDR without leaving the classroom or taking a real TDR out of service!

✪ Unlike any other TDR's software program, WAVE-VIEW not only allows you to recall stored waveforms on your PC, but it also displays the TDR's function keys. You can actually increase the vertical gain, zoom in and out, manipulate the waveform, adjust the cursors, and change VOP, right on your computer!

✪ Utilize your manpower more efficiently. Less experienced technicians can document the cable plant with the TDR while more experienced personnel download, analyze, and compare the waveform information on a computer. The TDR goes back to the field. *TRY THAT WITH ANY OTHER TDR!!!*

Visit our website at http://www.riserbond.com or E-mail us at email@riserbond.com

This is just one of the super features you get with a Model 1205C.

800-688-TDRs 402-466-0933 Fax: 402-466-0967

Call for a demonstration today!

Riser Bond
INSTRUMENTS

Reader Service Number 103

thanks to HFC), the company's Brobst commented, "Digital will begin to be deployed in 1997 for a certain segment of subscribers that want the choice, selection and customization that only digital compression can provide."

S-A, which has already put in excess of $50 million into digital development efforts and early trials, will continue to invest in the technology in '97, said Brobst.

Conclusion

It obviously would be a gross oversimplification to imply that high-speed data delivery over broadband networks and the wonders of digital technology are the only topics racing through the collective cable engineering community's mind. But as the industry's technical side approaches the challenges of the upcoming year, both network engineers and cable vendors tend to agree that the industry spotlight will continue to shine directly on data, with digital issues getting a fair amount of play as well. **CT**

Beep, beep: It's the info superhighway

In a raucous carnival atmosphere complete with pyrotechnics, explosions and cartoon characters come to life, Time Warner Cable of Northeast Ohio introduced the first commercial launch of the Road Runner on-line access service in the Akron-Canton area.

The September 10 event reinforced industry observers' contention that data delivery is the hottest technology in the market today, representing a large (but admittedly as-yet-unmeasureable) new revenue stream for cable operators.

Following only a scant two weeks later, Continental Cablevision Inc. announced that its own high-speed Internet access service, dubbed "Highway1," was available commercially to homes in the Boston-area communities of Needham, Wellesley and Newton, as well as Jacksonville, FL.

The Akron-Canton area was selected for the Road Runner launch, according to Time Warner CEO Joseph Collins, because Time Warner has invested some $120 million since 1992 to upgrade the 3,000 mile plant to HFC, "to allow high-speed data, increased capacity and future telecommunications applications."

The Internet delivery platform selected for the Akron launch is Hewlett-Packard's BIDS server complex, connecting multiple servers or software modules through an ATM or FDDI switch. The server complex includes the Broadband Internet Server as well as the company's Subscriber Management Server, Content Management Server, Operations Management Server, and Security and Firewall Server.

At the subscriber end, Motorola's CyberSURFR cable modem product connects via standard 10 Base T Ethernet interface to any PC or Macintosh system running TCP/IP protocols. The downstream ata rate is 27 Mbps; upstream, he rate is 768 kbps.

Time Warner selected Microsoft's nternet Explorer 3.0 as the web rowser software. Explorer also is ompatible with plug-ins designed to Netscape Navigator's proprietary in- erface. Road Runner includes hot inks to local Web sites including The Jniversity of Akron, Kent State Uni- ersity, the Cleveland Indians and he Ohio Governor's Office of Devel- pment (Ohiobiz.com). Access to ime Warner's Pathfinder and on- ine publications of the Time, Inc. mpire are included in the premium- ier package.

The Roadrunner launch also is art of the cable industry's ambi- ious "high-speed education connec- ion" initiative introduced this past ummer by the National Cable Tele- ision Association. Time Warner Cable has committed to supply free Road Runner service and one free able modem to each kindergarten hrough 12th grade public and pri- ate school in the upgraded Akron-Canton service area.

Next roll-outs for the service are slated for the New York towns of Binghampton, Elmira, Corning, and San Diego. (The latter will use Toshiba modem products.)

"These Internet access launches are proving industry observers right about the appeal of the technology."

Asked about the potential market for Internet access service, Steven Fry, president of Time Warner Cable in Northeast Ohio, said, "The fact is, we already have more than 400 customers on line, and more than 1,000 have placed their names on a waiting list before we've even geared up our sales effort."

Preliminary marketing efforts for Continental's Highway1 have yielded 200 residential subscribers; the company says its has taken orders from some 2,000 potential subscribers. Continental's greater Boston service will use the LCP two-way cable modem from LANcity. General Instrument's SURFboard is earmarked for the Florida market, to enable the company to offer Highway1 in areas where the cable plant has not yet been upgraded for bidirectional service.

These Internet access launches are proving industry observers right about the appeal of the technology. Whether it will catch on, and with whom, is another matter. Neither Canton Mayor Richard Watkins nor Akron Mayor Don Plusquellic—both of whom were on hand at the Road Runner launch—are computer literate. —*AZ*

By Masood Parvaresh

ATM, MPEG-2 and QAM

Three core technologies, asynchronous transfer mode (ATM), the Moving Pictures Experts Group ISO standard for compressed video (MPEG-2) and quadrature amplitude modulation (QAM), may in the near future enable fully interactive services through the set-top box. MPEG-2 will in at least part of the network be transported via high-bandwidth ATM technology. QAM is a front-runner to become the main form of modulation for transmitting signals to the set-top, while either QAM or quadrature phase shift keying (QPSK) is likely to be used for the return path from the home to the service provider.

The combination of ATM switching and MPEG-2 transport makes sense technically and economically. With virtually unlimited bandwidth available on demand, ATM provides interfaces to transmission speeds from 1 Mbps up to 1 Gbps, and can carry video, audio or data over long distances. Its low latency makes it suitable for time-sensitive transmissions such as video and audio.

Masood Parvaresh is a system engineer with TV/COM International Inc., in San Diego.

MPEG-2 has emerged as the standard for compressed video and audio for domestic satellite and cable. It takes into consideration how TV frames interlace, and reproduces full-screen, broadcast-quality video and sound. Direct broadcast satellite (DBS) services now broadcast in MPEG-2 compressed video and audio. With increased production, the cost of set-top boxes that can decode MPEG-2 transmissions will come down.

To enable interactive services to the set-top box using these core technologies, several technical issues must be examined. How does ATM support the transport of MPEG video? How should MPEG be mapped into ATM cells? These issues and others are discussed herein with the aid of a simple interactive video scenario shown in the accompanying figure on page 36.

This illustration presents two scenarios for digital video transmission. The first scenario is a one-way broadcast from a DBS; it is not interactive, and is presented here for comparison purposes. A modulated MPEG-2 transport stream (TS) is received from the DBS, demodulated at the headend to recover the MPEG-2 packets, then decrypted and demultiplexed into separate program streams. From these program streams, a new MPEG-2 TS is encrypted in a different encryption scheme according to the cable operator's requirements. The MPEG-2 TS is then modulated, using QAM, into 6 MHz channel on the hybrid fiber/coax (HFC) network from the headend to the home.

The second scenario is an interactive, two-way transmission originating from the service provider's video servers to the headend via a core ATM network. The video servers' role is to provide the storage and playback of video data, and to respond to subscriber requests such as pause, fast forward, etc. The servers encapsulate a nonencrypted MPEG-2 program stream into an ATM virtual channel that is routed to the headend by the ATM switch.

The ATM virtual channel is reassembled at the headend to recover the MPEG-2 program stream. A new MPEG-2 TS is created from selected program streams, encrypted, retimed at the headend by adjusting the program clock reference (PCR) to compensate for timing errors that the ATM network may have introduced, and then QAM modulated into a 6 MHz channel over HFC. →

Looks great, less filling: A look at this month's cover

It sounded like a great idea at the time: To illustrate the quality of digital video compression on the cover of this issue of Communications Technology, how about comparing a frame of uncompressed video to the same frame of video processed with MPEG-2 compression? After all, MPEG-2 is supposed to free up memory in a digital video server by compressing source material, with no visible degradation of image quality. We'll let our readers judge for themselves! Great idea!

Great idea, that is, until we tried to make it work. It turns out that almost any video production house can grab a frame of uncompressed video for a still file. A variety of companies can compress video with MPEG-2. So far, so good.

When it came to grabbing a frame of MPEG-2 compressed video and presenting it as a digital file for graphic design, however, that was another matter. It seemed like only two or three people on the planet knew that secret, and they all either had other plans or weren't feeling very well.

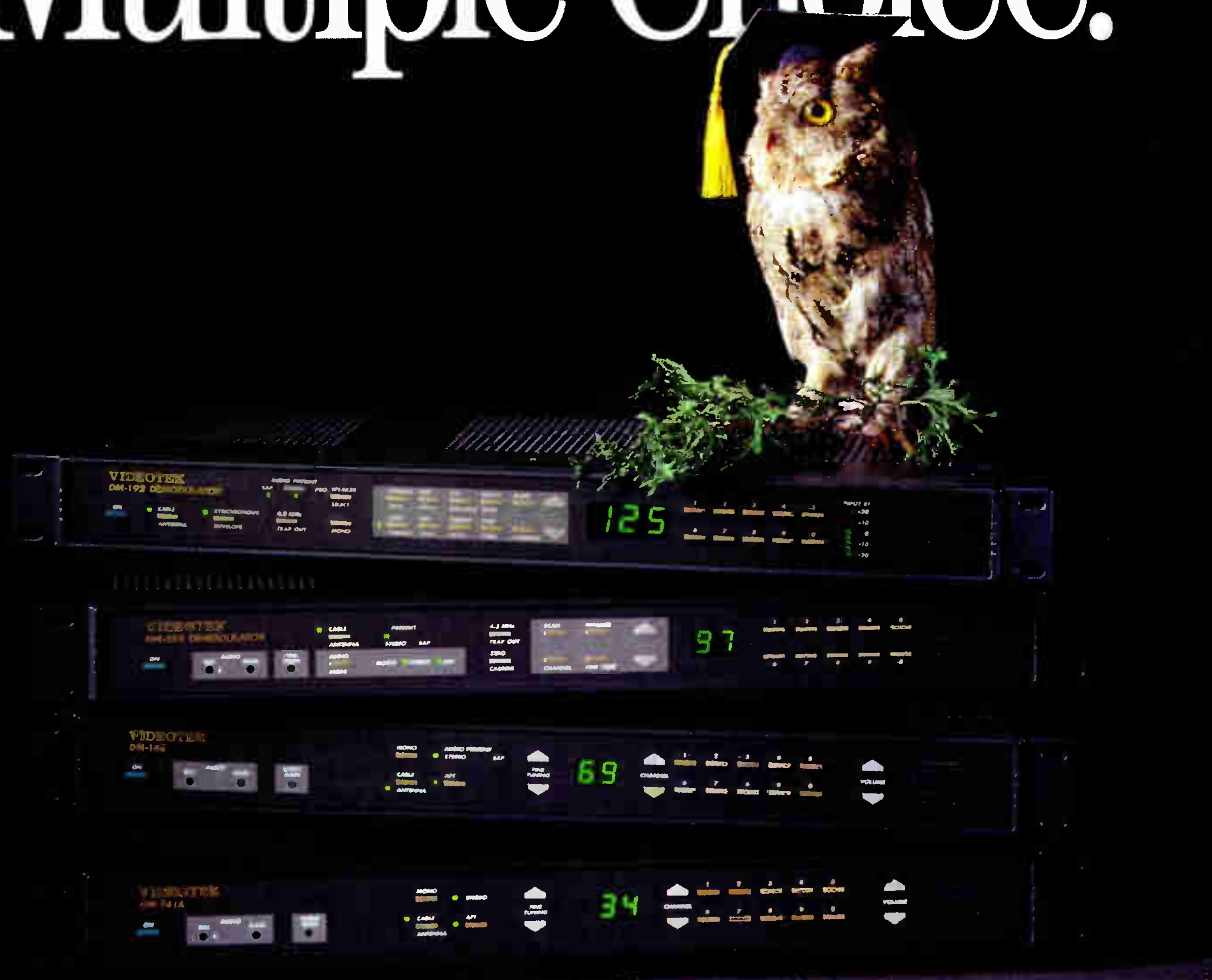
Otherwise, we were all set. Hap Heubusch of Screen Sense Productions in McLean, VA, had shot a Betacam SP video of the bottle, and Rick Powell of Vela Research in Clearwater, FL, had used Vela MPEG-2 compression to process the video at 10 Mbps, then posted the file on the company's homepage (www.vela.com) in their outgoing FTP directory. Unfortunately, Vela had no frame-grabbing software, so once we transferred the file we were on our own. Completely.

Enter Savage Bell, at IBM's Digital Video Services Division in Atlanta (interactive@vnet.ibm.com). Bell and Jon Vogt, a software compressionist, used a Targa 2000 board on a Macintosh Power PC connected to a Betacam SP video deck to capture a composite analog signal for an uncompressed still image.

IBM had some concerns, however,

(Continued on page 36)

Multiple Choice.



Agile Demodulators

Be wise... and choose from our family of agile demods.

- *WHO offers the greatest selection of agile demodulators in the industry?*
  VIDEOTEK
- *WHO is the largest agile demod supplier in North America?*
  VIDEOTEK
- *WHO offers a full range of versatile features?*
  VIDEOTEK
- *WHO combines premium quality & intelligent design with smart prices?*
  VIDEOTEK
- *WHO offers a FREE 30-day trial?*
  VIDEOTEK

With two new choices in agile demodulators, you have more reasons than ever to choose Videotek. At half the price of our competition, this foursome of demods with full front panel control, brings in up to 192 channels and has features that include Pro channel, zero carrier pulse, synchronous and envelope detection, simultaneous stereo and SAP capabilities, plus two baseband outputs.

Two of the models, the DM-192 and DM-154 have been ***specifically designed*** for FCC compliance testing. For other applications, the DM-145 and DM-141A round out our product family.

Innovation in agile demodulators has been our specialty for two decades, making Videotek the wise choice.

Premium Quality, Intelligent Design, Smart Prices... That's Videotek.

Call today to take advantage of our FREE 30-day trial or to receive a copy of the white paper report "Agile Demodulators in the Cable TV Industry." Contact Joy Bozeman at 1-800-800-5719 or e-mail your request to 104472.577@compuserve.com.

VIDEOTEK™
A Zero Defects Company

ISO 9001

243 Shoemaker Road, Pottstown, PA 19464 1 800-800-5719 (610) 327-2292 Fax: (610) 327-9295

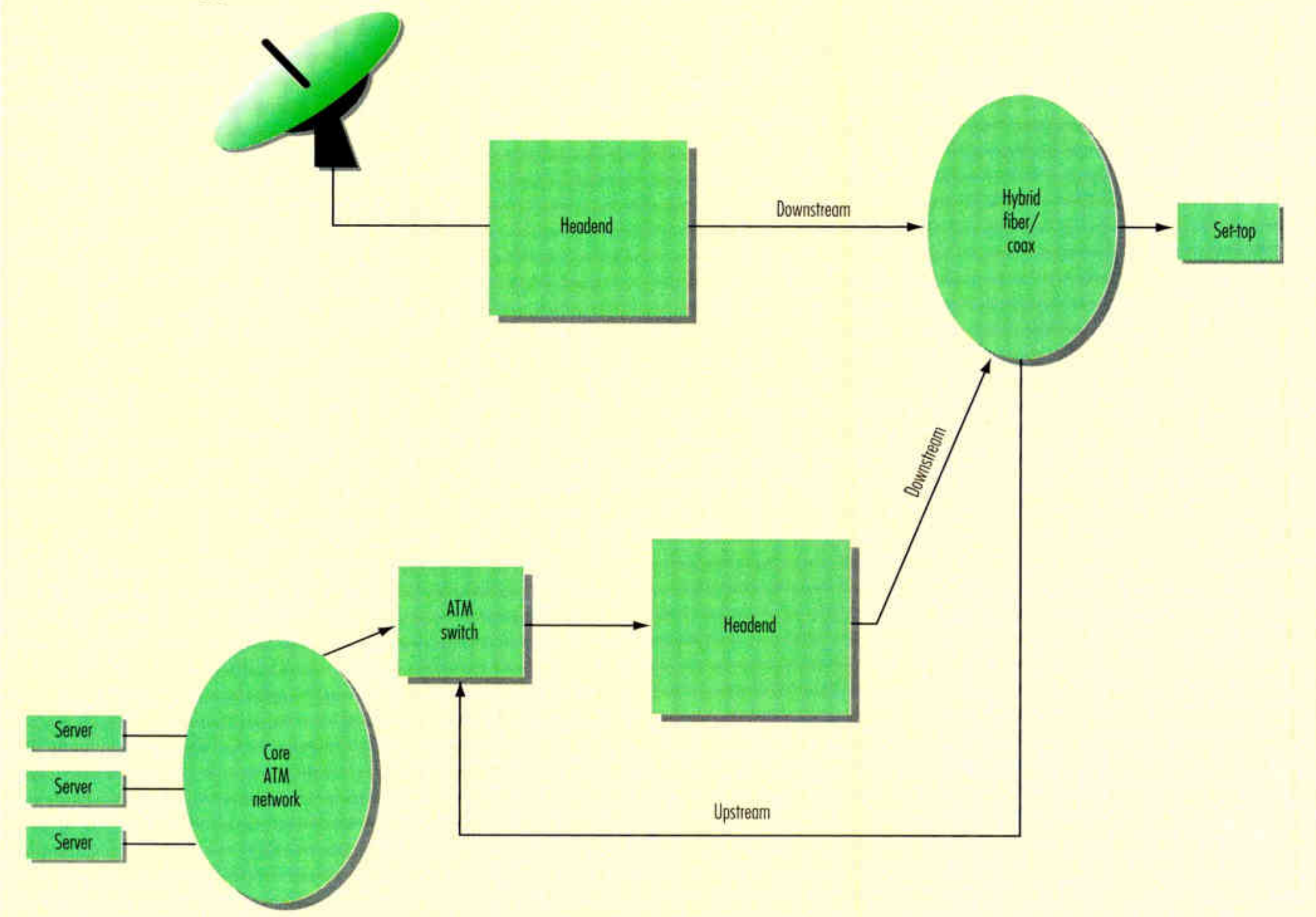
Reader Service Number 110

High-speed physical synchronous optical network (SONET) interfaces, OC-3 (155 Mbps) and OC-12 (622 Mbps), are available for ATM. These interfaces aggregate a number of digital streams into a single physical channel. ATM allows dynamic allocation of bandwidth where needed and deallocates it when not used.

Because ATM is a wide area network (WAN) protocol, the servers may be located at a distance from the headend. ATM can switch an on-demand application from the servers, also allowing new servers to be added for additional customers and services. At the headend, the SONET rates of 155 or 622 Mbps are converted to 27 Mbps for the downstream channel.

The servers also assign program identifier (PID) values for program maps, video and audio elementary streams. These PID values are remapped so they are unique within the new transport stream. A program map table is constructed and used to

ATM technology in interactive networks



Looks great, less filling

(Continued from page 34)

about the color matching on the videotape and the compressed file retrieved from the Vela Research home page. They made the decision to compress the source videotape again at their headquarters. IBM's Lenny Shkirenko encoded an MPEG-2 video stream at 9 megabits per second on a C-Cube compression engine, and decoding it on a Vela Research MPEG-2 decoder card.

Vogt then used the same computer setup, connected to the Vela MPEG-2 decoder card outputting a composite digital signal, to capture the MPEG-2 still image. The resulting still images were converted to EPS (Encapsulated PostScript) format and saved to a Hewlett-Packard 650 MB CD-ROM for use in the final graphic design you see on the cover.

Bell noted that better images could have been captured from the component outputs on the Betacam SP deck and the Vela card, but IBM's Vela card is only capable of composite outputs. In fairness to the MPEG-2 stream, Bell and Vogt opted to use the composite output on the Betacam SP deck.

Remember both the compressed and uncompressed images had to be saved as EPS files to be manipulated by *Communications Technology's* graphic designers. EPS files are themselves compressed, so what you're seeing on the cover is not the same as comparing video quality from, for example, two video monitors. Also, video image resolution is 72 dots per inch (dpi), while typical print image quality is 300 dpi; both images, therefore, are understandably grainy. Color was moderately adjusted at the print design stage.

Our thanks to Screen Sense Productions, Vela Research and IBM Digital Video Services for their help in realizing this cover concept.

Oh, one last thing: If you guessed that the bottle on the left was compressed using the MPEG-2 algorithm, you guessed correctly. Drinks are on us. —*Alex Zavistovich*

drive the PID remapping function. A program association section (PID0) is generated to provide a directory of services on the TS by listing each service by MPEG program number and PID of each program map section. The program association section also defines the network PID.

The headend adds a conditional access section (PID1) for each encrypted transport stream. PID1 carries the message that identifies the streams carrying entitlement management messages (EMMs). EMMs, assigned at the headend, must be uniquely addressed to each set-top and define access rights for each customer.

When the MPEG-2 payload is encrypted to the cable system requirements before transmission from the headend, encryption key information is inserted to entitlement control messages (ECMs). Forward error correction (FEC) also is applied to the MPEG-2 TS to protect against data errors that may occur during transmission over the HFC network.

Using this scenario, broadcast and video-on-demand (VOD) are transmitted in one format only—MPEG-2—from the headend to the set-top. This simplifies design of set-tops to receive AAL5 services via MPEG-2, whether originating from a satellite or from servers. Another advantage is that the MPEG-2 TS uses less overhead than ATM. With this scenario, channel bandwidth is used more efficiently.

For full service interactivity, MPEG-2 TS packets must be mapped into ATM cells at the headend. ATM supplies the switching necessary for full interactivity, while MPEG-2 transports the compressed video and audio into the home at a lower cost. A cost-effective solution, then, is to use the ATM switch at the headend, and MPEG-2 transport for delivery from the headend to the home.

If ATM packets also were used from server to headend to home, reassembling each program stream into MPEG-2 TS packets would be complex and very expensive. The segmentation and reassembly (SAR) function that extracts and then remaps the MPEG-2 TS from ATM packets would be needed not only at the headend but also in each set-top box. Because the SAR chip set is expensive, the cost of set-top boxes would need to be increased. Also, using ATM requires more bandwidth since its overhead is 10%, compared to MPEG-2's 2%. Mapping ATM into MPEG-2 TS at the headend limits the expense.

When a viewer requests a film through an interactive VOD service, the viewer expects guaranteed bandwidth and error-free, low-delay transmissions. The main potential for errors and delay is cell loss or cell-delay variation (jitter).

MPEG-2 packets, comprised of 188 data bytes, and ATM packets, at 53 bytes per cell, do not map neatly into one another. If a cell boundary is exceeded while mapping MPEG-2 TS packets into ATM packets, it is incomplete; incomplete cells represent lost data, and the results can be signal degradation, jitter or picture breakup. When the transport of ATM cells is delayed in a switch or elsewhere in the network, the resulting jitter can degrade or freeze the signal.

Mapping MPEG packets into ATM packets can be done in several ways. →

In 1988, the International Telecommunications Union designed the ATM cell format with a 48 byte payload and a 5 byte header. The ATM Forum defined the ATM adaptation layer (AAL), the complex top layer protocol that packages a variety of higher level traffic, into 48-byte ATM cells.

Five different AALs are available: AAL1, AAL2, AAL3, AAL4 and AAL5. In Europe, AAL1 is used for synchronous residual time stamp (SRTS) values and, in packet format, a sequence number (SN) and sequence number protection (SNP) for error protection. One byte supports these two functions, leaving 47 bytes of payload instead of 48. When AAL1 is used, one MPEG-2 TS packet (188 bytes of data), can be mapped into 4 ATM cells of 47 bytes each. AAL1's efficiency is 88.68%.

The drawbacks of AAL1 are that it does not provide CRC (cyclic redundancy check) or forward error correction (FEC). Also, the number of bits assigned for SRTS may be inadequate to read on-demand applications. In addition, AAL1 was primarily standardized for constant bit rate (CBR) services such as T1, T3, etc., not for video. AAL2 is for variable bit rate (VBR), while AAL3/4 are more software-oriented and expensive.

AAL5, sometimes called simple efficient adaptation layer (SEAL), was originally defined for data traffic. As soon as an MPEG-2 TS packet is received, the PCR value is checked. If there is a PCR value, then 44 bytes of padding are added (44 + 188 = 232 bytes). When 8 bytes for CRC are added, giving 240 bytes, one MPEG-2 TS packet maps neatly into 5 ATM payload cells (at 48 bytes per payload cell). This avoids jitter or delay.

If the MPEG-2 TS packet does not carry a PCR value, it is bundled with the next MPEG-2 TS packet, adding 8 bytes for CRC, which maps neatly into 8 ATM payload cells (2 x 188 = 376 + 8 = 384, divided by 48 = 8). This is a good, cost-effective way to map MPEG-2 TS packets into ATM payload cells, while avoiding jitter and delay. AAL5 has an 89% efficiency.

QAM is a bandwidth efficiency technology to deliver MPEG-2 signals to the set-top where the signals are then demodulated, decoded and synchronized for video and audio display.

The generation of QAM signals is straightforward. The information bit stream is demultiplexed into in-phase (I) and quadrature rails. Each rail encodes its bit stream into 2n levels, and limits the signals with baseband filters to limit the resulting signals to 6 MHz bands. The filtered baseband signals are then multiplied by two quadrature tones, the sine and cosine, which are typically at TV intermediate frequency (IF), which is about 43.75 MHz. The resultant is then summed together to produce a 6 MHz-wide signal centered at TV IF.

Transport of upstream signals for the return channel can use either QPSK or QAM modulation. Because of sensitivity to noise from home appliances or garage door openers, for example, a very robust modulation is needed, and QPSK is preferred for the return channel. The spectrum allocated for the return channel for QPSK is between 5 and 42 MHz. The set-top should be capable of accommodating both QAM and QPSK modulation.

Combining MPEG-2, ATM and QAM enables cost-effective transport of interactive services to the home. **CT**

By Mitchell Olfman

New signal security challenges

Signal security in the new cable TV environment now is more complicated and important. A signal security choice is driven by the service agenda, which in turn is shaped by the regulatory regime.

At various times, cable TV companies have used more or less complex tiering and packaging plans, depending on the regulatory environment. First traps, then addressable set-tops, have been the vehicles for signal control. Industry interest in outside-the-home addressability periodically erupts in a flurry of product development. Addressable taps and interdiction are examples of two broadband addressable systems in this tradition.

But fundamental changes are brewing.

Encryption in digital domain

The adoption of a digital platform alters the method of signal encryption. At the same time, dramatic consumer and business usage of the Internet, especially the World Wide Web, is leading cable TV and telcos into the Internet access business, driving demand for conditional access suitable for data transmission, whether the TV set or the PC is the display terminal.

Digital capability affects the business context in several ways. For the first time, cable TV companies deliver less usable bandwidth than the competition. In many, though not all cases, DBS and switched digital video networks will be able to provide more effective bandwidth than cable TV networks.

Also, the underlying cost of digital is dramatically revising the business case upon which addressable control has been built. Where in the past the cost of a trap approach was $10 to $20 per subscriber, and analog set-tops perhaps $135 per subscriber, digital set-tops are a $350 to $450 per subscriber proposition, for only the first TV set. That suggests that the financial return from digital set-top-enabled services should be 2.5 to 3 times greater than what one expects from an analog service, or else margins will be significantly lower.

New technology, including "smart card" conditional access (CA), widely used by DBS providers, also is changing the conditional access environment. Smart cards, which are at the heart of renewable security schemes, set the stage for a move to retail distribution of decoders, a profound change for the cable TV industry, reflecting the current distribution channel for most DBS companies.

Longer term, new CA technology will migrate further away from the network operators, and toward the providers of transaction capability. Where today the cable op or DBS provider controls access, in the future financial or transaction entities such as MasterCard and Visa, or Wal-Mart and Nordstrom, may control access to certain services. In the meantime, the growing popularity of the World Wide Web and the Internet may be extended to the TV set itself, creating a new class of appliances that are designed to enable Internet and web access right from the TV screen.

Retail model for security

All of these developments point to a fundamental change: Where an industrial model had prevailed, a new retail model ultimately will dominate.

In the industrial model, decisions are made on behalf of consumers, and implemented by the network, sandwiched between the content and the consumer. In the retail model, consumers make the decisions, and more of the control moves toward the extremities of the network (programmer uplink and customer terminal). Where the network was the locus of control, in the future the consumer will be the locus of control, especially as more services migrate to a standards-based, open model. The Internet is an indicator of the direction in which the industry is moving, though not a model in and of itself.

Competition plays a major role in security because all contestants now must worry about what new services a competitor may introduce, and how

Mitchell Olfman is president and CEO of Electroline Equipment Inc., in Montreal, Quebec, Canada.

easily that offer can be matched and extended. One early change is that signal security now is extended to include the security of voice and data communications from the home, possibly using separate CA mechanisms.

New services also are a part of every carrier's agenda. In part, that is a response to anticipated losses of market share in all core markets subject to competition. Leading U.S. cable TV companies are bracing for losses of up to 30% of their existing customer base, and executives at the regional Bell operating companies (RBOCs) privately say they expect the same in their core telephone markets. The dominant long distance carriers likewise will lose share as RBOCs enter the long-haul markets as well.

At the same time, rate regulations currently in effect for major U.S. cable TV companies will end in three years, freeing them to roll out new video services at competitive prices. One potential new development is a proposal from the U.S. Federal Communications Commission to allow building of "open video networks."

These new video networks would be provided by entities not subject to cable TV local franchising rules, and would reserve two-thirds of their bandwidth for programming entities unaffiliated with the owner of the network. Up to one-third of the capacity could be programmed directly by the network owner. In a sense, this proposal creates a sort of common carrier regime for video. It remains unclear what shape the proposal might ultimately take, but both cable TV and telephone companies will have the most to gain—and lose—if it does become law. Both types of enterprises may find the lack of local franchise regulation appealing.

Technical issues

At the technical level, there are two issues. First is how to control bandwidth that may be used by third parties. Second is how to control analog bandwidth. The use of a digital terminal of some type typically is seen as the appropriate means to provide conditional access for third parties, since every digital terminal provides for full channel-by-channel control of bandwidth.

In the analog environment, full channel-by-channel control might be required if any of the analog channels are to be wholesaled to third parties. Addressable interdiction is one method of providing such full channel control, including premium and pay-per-view (PPV), while at the same time avoiding the use of in-the-home decoders.

Interdiction also enables preview services, where service can be remotely and temporarily activated, allowing noncustomers to sample services. At the same time, interdiction-equipped systems can provide some basic lifeline level of service to noncustomers, again gaining a marketing and communications channel to all wired homes, not just current customers.

Addressable taps

Alternatively, where a third party is allocated a contiguous block of frequency, one can attain tier control by using remotely switched (addressable) taps and bandpass filters. In this scenario, it is possible to remotely activate and disable the entire block of frequencies provided by several different providers. This approach also enables preview services, providing programming contracts allow such previews.

Remotely switched taps also would enable a network provider to provide a convenient lifeline service for all wired homes. One approach might entail a low-cost over-the-air antenna service, in conjunction with public access and educational channels. Another possibility is a free access/education service, which generates no immediate revenue, but does create a marketing platform for upselling services.

Two-way active networks providing telephone or high-speed data services also could benefit in the area of ingress control when remotely switched taps are used. Some suppliers can incorporate remotely activated switches into the tap housing. Ingress is reduced because drops that are not using the return path can be switched into the closed position, preventing all return path noise from entering the network. Optionally, groups of drops (or each drop, depending on how the network is configured) can be remotely polled, to isolate ingress sources.

Some systems will sequentially poll in-the-field transponders. By momentarily switching attenuators into the "on" position at each transponder, it is possible to isolate an ingress source by monitoring signal quality on a spectrum analyzer located at a headend. **CT**

By Claude Baggett

The politics and dollars of security and access control

There's no shortage of opinions as to just how the cable industry should approach security and access control for our deployment of digital TV and data services. Despite the diversity of these opinions and the fervor of their proponents, it all really comes down to three choices.

Business as usual

With this approach, you go buy a digital set-top or decoder interface (set-back) unit with a proprietary security system built into the silicon in the box. This would probably lead to the cheapest upfront cost for the digital decoder, and gives the operator maximum control of the interface. However, if the security goes belly-up, or you want to add some different security features to accommodate new value-added services, you get to buy a whole new box. This probably sounds pretty good to the people who make their living selling boxes, but operationally and financially, it's a disaster for the cable operator and an irritation to the customer. This approach also ignores the instructions Congress included for us in the Telecom Act regarding the commercial availability of converters, without the security function.

Removable module

With the removable module option, everything dealing with security (and perhaps some optional value-added features) goes in a removable module. This includes the cryptographic engines for signal and control security, the key management system, and the secure signature functionality for purchasing and control. In general, modularity always costs more than a dedicated system, but it also means that if any of the problems mentioned before

Claude Baggett is director, industry relations, at Cable Television Laboratories.

occur in your system, you can fix it by replacing a relatively inexpensive module, rather than the whole digital box. This also lets the consumer retailers sell the decoder units and lets cable maintain control of the secure functionality; thus this approach is friendly to Congress and the Federal Communications Commission, but it means you give up some control of the interface. By establishing an open architecture interface between host devices and the modules, there will be multiple sourcing on the modules, with the resulting price advantages.

I didn't mention the current systems where the crypto-engine is in the host box, and the module does only key handling. These systems have been broken and are not of great interest.

Hybrid of two approaches

With the exception of the Telcom Act's directions regarding the commercial availability of converter boxes, the following option may combine the best features of both of the previous approaches. You buy a "business as usual" box that has one of the open architecture module sockets installed on it. So long as things are working well, you don't have to buy any modules. But when the time comes that upgrades are needed, the insertion of a security/features module of your choice essentially disconnects the internal security circuitry and replaces that internal functionality with that contained in the module.

While this approach may not be politically compatible with the Telecom Act, it probably does give the operators the most options and control at the interface.

Current activities

The Digital Video Broadcasting project in Europe has recommended a modular approach to security with a depleted-pin version of the PCMCIA card as the pluggable. DVB is proposing to use a common security approach for all types of delivery systems in Europe.

The National Renewable Security Standard Subcommittee of the Electronics Industry Association/National Cable Television Association Joint Engineering Committee is working on a U.S. module interface standard that would satisfy cable needs. This standard will define only the physical, electrical and logical interface between the module and the host device, and leaves the contents of the module up to the marketplace. Cable has rightly never felt comfortable with the concept of a single type of security system for all delivery media, and prefers to have competing approaches and feature sets to select from.

Several other accredited standards organizations are attempting to document their own personal concepts of how this required functionality should be accomplished for TV and data transmission. In the end, it will be the MSOs with checkbooks in hand that establish the favored industry approach.

CableLab's job is to make sure the industry knows the pluses and minuses of all significant options, and to assist the MSOs in developing acceptable technical and transitional strategies for this very important area. **CT**

By J. B. Anderson, C. Farlow and H. Roberts

OFDMA vs. TDMA: Broadband access wars

Two distinct access platform technologies have emerged as leaders within the context of the broadband access marketplace: orthogonal frequency division multiplex access (OFDMA) and time division multiplex access (TDMA). Both OFDMA and TDMA represent valid choices as system design options. As might be anticipated, however, each approach has a number of relative advantages and disadvantages.

At lower capacity levels, the simplicity of TDMA affords some advantage over OFDMA. However, as ever higher capacity is envisioned for broadband access systems, the inherent scalability of the more complex OFDMA approach emerges as the dominant factor by which superior system performance is achieved.

TDMA may be characterized as a "time domain" approach to multiple access in which an individual user is assigned a specific time "slot" during which a single carrier is modulated. This is in contrast to the "frequency domain" approach of OFDMA, in which a user is assigned a distinct RF carrier frequency for data exchange. Depending on the modulation scheme used, both TDMA and OFDMA can be rendered highly bandwidth efficient. The *de facto* modulation standard for TDMA broadband access is QPSK; for OFDMA it is 32-QAM.

It might be argued that, because 32-QAM encodes data at a 5 bits/symbol rate while QPSK encodes only 2 bits/symbol, the OFDMA/32-QAM system will facilitate a far higher information throughput and is therefore superior. That conclusion, however, is not so easily reached. Relative performance can only be discerned by considering the total system design, including factors relating to the multiple access technology being employed, such as noise immunity, achievable carrier-to-noise ratio (C/N), channel equalization, system synchronization, and system scalability.

J.B. Anderson, Ph.D., is principal engineer, C. Farlow is senior project engineer and H. Roberts is senior principal engineer of ADC Telecommunications Inc., in Minneapolis.

For example, in the previous comparison based upon modulation efficiency, the information throughput advantage can only be realized if a substantially higher C/N for 32-QAM can be maintained to satisfy the bit error rate (BER) requirement. In practical terms, use of more efficient modulation schemes will force a different set of system hardware design trade points. Also, in the particular case of the hybrid fiber/coax (HFC) distribution platform, more stringent requirements may be placed upon the cable plant ingress noise environment.

Noise funneling

TDMA exhibits some advantage over OFDMA in reverse channel (upstream) noise funneling. The TDMA modem transmitter (TX) may simply be "gated off" during intervals corresponding to inactive channels, whereas OFDMA modems will transmit full bandwidth spurious RF and quantization noise whenever any single channel is active within its span.

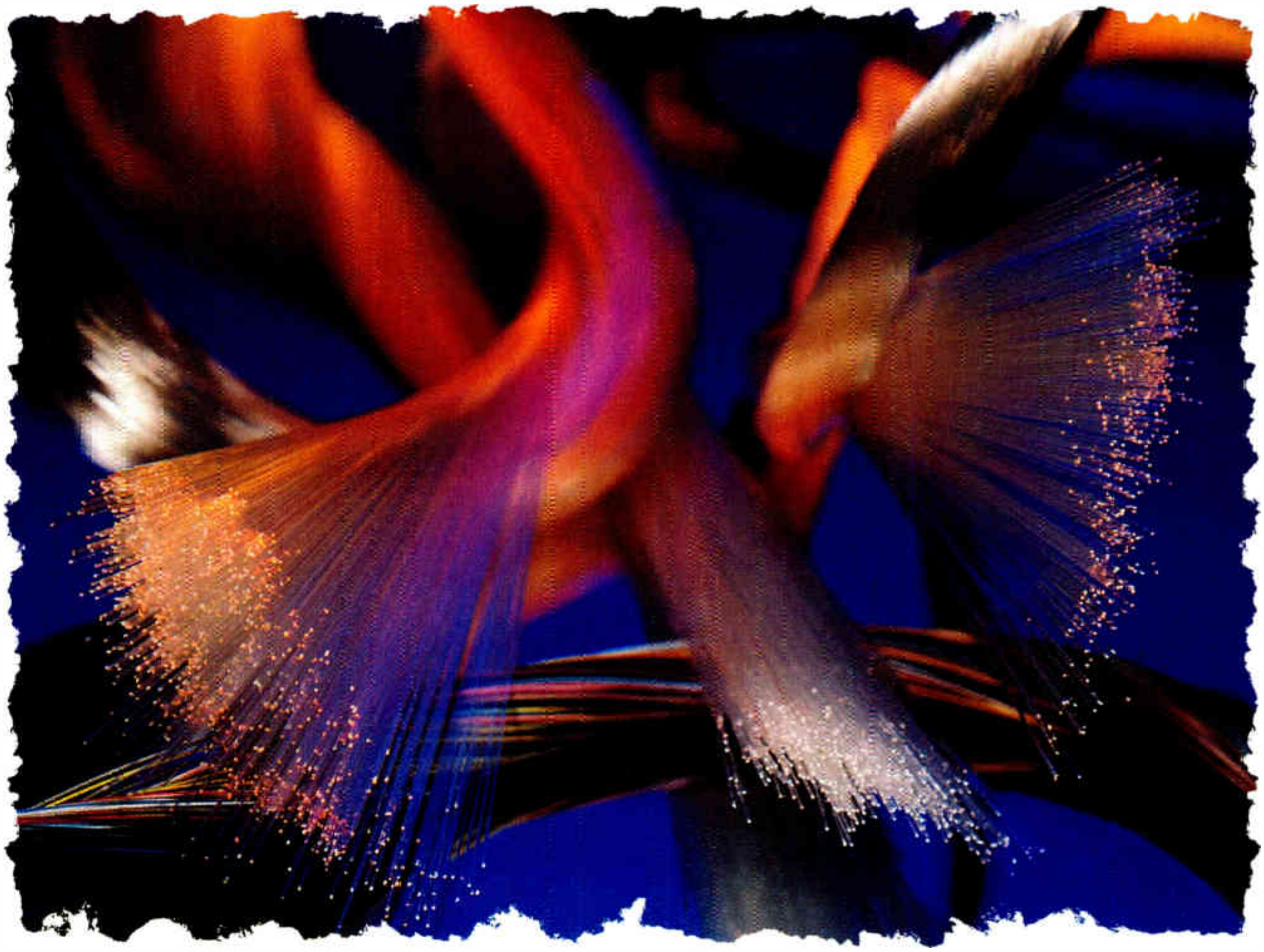
This is a deficiency for some OFDMA system designs where many modems may share the same subband. The upshot is that there must be more stringent hardware specifications to reduce spurious generation, and greater bit resolution may be required in connection with signal processing functions (such as fast fourier transform/inverse fast fourier transform—FFT/IFFT). A less desirable alternative is to use more aggressive forward error correction (FEC).

On the other hand, OFDMA possesses the advantage of true system scalability. The individual channels that make up the OFDM waveform are effectively created via a "parallel processing" operation. A serial data stream containing symbol information for each channel is clocked into the FFT engine, which simultaneously generates all channel carriers, modulated by the appropriate symbol vector. Consequently, in OFDMA, an increase in system capacity requires only an increase in the number of frequency bins associated with the FFT/IFFT employed for generation of the OFDM waveform. This is performed in hardware with no required change in symbol rate.

For TDMA, any increase in TDMA system capacity must be accompanied by a commensurate increase in the number of symbols transmitted and received per unit time. Thus, each symbol occupies a smaller time interval, rendering problems associated with detection, synchronization, equalization, and noise susceptibility increasingly more difficult.

At high capacity, TDMA can be affected by a "bandwidth coherence" difficulty. Both OFDMA and TDMA systems require increased bandwith as capacity is increased. However, at some critical level, one spectral boundary of the TDMA waveform begins to decorrelate with respect to the other, leading to an increase in inter-symbol interference (ISI) and BER. This is best understood as a frequency domain distortion that may occur due to accumulated reflections from impedance mismatches distributed throughout an HFC system, or perhaps due to multipath interference or fading in a wireless system.

The OFDMA system can effectively accommodate such phenomena via channel-by-channel dynamic equalization over the entire modem bandwidth. This is especially advantageous on the multipoint-point upstream link, where each individual carrier may exhibit a distinct bulk delay. (See Figures 1 and 2.) Time domain equalization as employed in TDMA systems is



Alcatel fiber optics. When you see the light, you'll see the difference.

At Alcatel, we're doing something few in the world can do. In Claremont, North Carolina, we're manufacturing our own fiber and incorporating it into cable in a facility so advanced, every step of the process occurs under one roof. The system gives us complete control over quality from beginning to end. It also produces many significant product enhancements, such as AFC3, our industry-leading fiber coating process. Ultimately, it means we can deliver our world class cable with superior reliability. And to a fiber hungry world, that's an advance worth talking about. For more information and a full color brochure, call **1-800-ALCATEL.**

ALCATEL

particularly difficult in this context, due to the fact that no frequency domain information is directly available. Thus, bandwidth coherence can be a fundamental limitation for high-capacity TDMA systems.

Error and noise

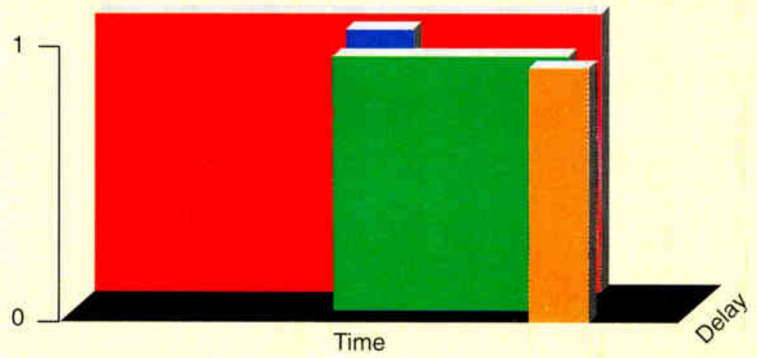
The reduction in symbol time interval that accompanies "scale-up" of the TDMA system leads to increased susceptibility to impulsive noise. This is because the symbol duration begins to approach that of more probable impulse events, giving rise to an increased probability of detection error (PError). If carried to the point where multiple bit error events become likely, the FEC problem can be more difficult than in an OFDMA system at equal system capacity.

A related topic is susceptibility to interferers. The TDMA system possesses an inherent robustness against narrowband (NB) interferers, due to the wideband nature of the modulated waveform. This robustness actually improves as the symbol time is shortened. OFDMA can tolerate such interference via dynamic allocation of interference-free bandwidth. (That is, carrier tone "swapping" of DS0 channels.) TDMA systems, to the extent that they employ FDM "stacking" of individual TDM sub-bands, can employ swapping in similar fashion. However, in this case, the "granularity" of the swap may involve significant waste of spectrum.

Interferers of greater bandwidth, (partialband, or PB, interferers) can be a problem for both TDMA and OFDMA systems, although perhaps less so for OFDMA. DS0 tone swapping can be applied effectively against PB interferers, at the expense of significant OFDMA system capacity. In this case, TDMA sub-band swapping will not prove effective. Consequently, BER will simply degrade as corrupted bandwidth is increased, until at some critical point the link becomes unusable.

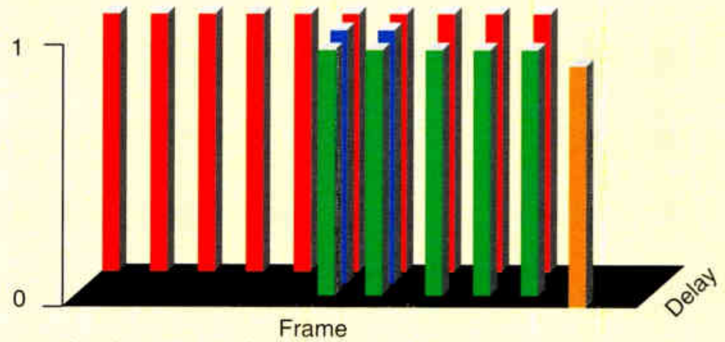
Another technique to minimize the impact of interferers is to use an efficient modulation scheme (such as 32-QAM) within the context of OFDMA. This may allow for an ADSL-like dynamic allocation of bandwidth at the level of bits per symbol, with a quality-dependent adaptive degradation of modulation constellation efficiency to maintain DS0 BER. While this technique is

Figure 1: OFDMA channel occupancy



An OFDMA channel is typified by contiguous occupancy along the time axis, at a bulk delay that corresponds to the subscriber's electrical path length. Constant bulk delay "per channel" simplifies upstream dynamic equalization over the entire band.

Figure 2: TDMA channel occupancy



Upstream TDMA channel occupancy is typified by time domain sampling of subscriber traffic at all active electrical pathelengths. This occurs within a single data frame. Thus, dynamic channel equalization is rendered more difficult. (Note: Sample density not to scale.)

available to OFDMA and TDMA, a QPSK-based TDMA system will not gain an appreciable advantage, due to the low efficiency associated with the TDMA modulation constellation.

Error correction coding

Forward error correction (FEC), alternatively known as error correction coding (ECC), will very likely be required for both OFDMA and TDMA system designs. The scalability of OFDMA, makes it relatively easy to maintain a high C/N on the downstream link, even at high system capacity. Consequently, downstream ECC will probably not be required. On the other hand, for reasons discussed previously, upstream ECC will very likely be necessary.

By contrast, TDMA typically requires both downstream and upstream ECC, due to the inverse dependence of symbol interval on information throughput. An efficient downstream ECC may be implemented based on a TDMA data frame that has been formatted to incorporate FEC bits. The reverse link however, will not have this capability. Consequently, upstream ECC, as is true for OFDMA, will have to be implemented upon a channel-by-channel basis.

Relative advantages and disadvantages to be associated with 32-QAM OFDMA and QPSK-based TDMA are summarized in the accompanying table on page 50. When weighed one against the other, OFDMA exhibits significant technical advantages over TDMA. However, TDMA still has much to offer.

TDMA enjoys a distinct advantage over OFDMA at low capacity because of the simplicity of its transport-layer access. TDMA also derives economy of scale from widespread availability of QPSK/TDMA modem "chipsets" in, for

example, the wireless marketplace.

The upshot is that low-performance, low-capacity subscriber modems can be manufactured at somewhat lower cost using TDMA technology. However, where high system capacity is being considered, the technical challenges that arise may effectively nullify any such advantages for the TDMA approach.

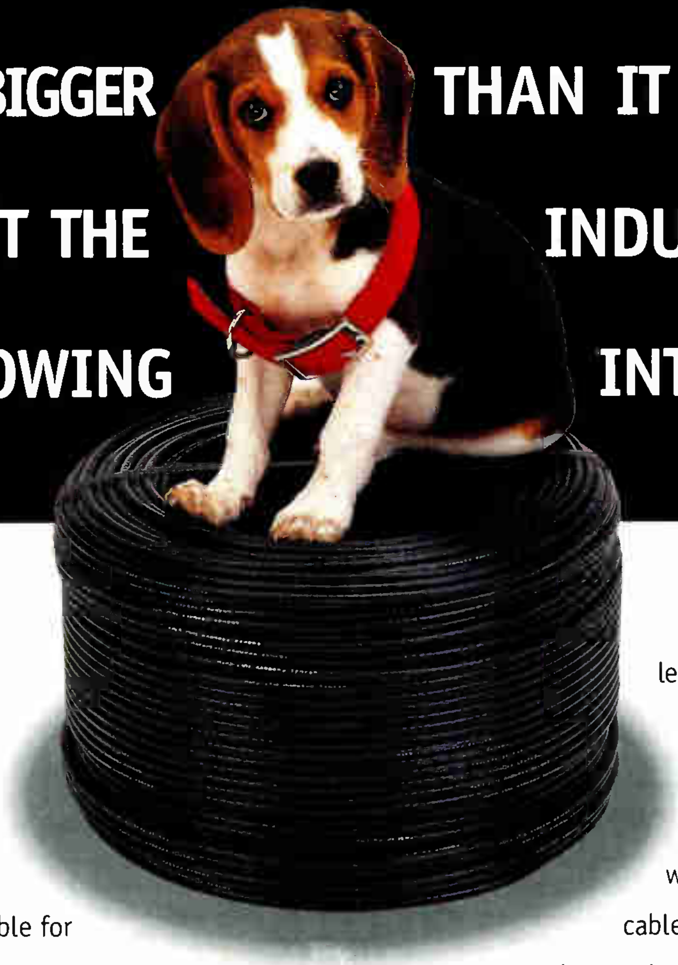
Furthermore, OFDMA application-specific integrated circuit (ASIC) designs, suitable for use in large-scale system design, are already completed. Deployment of these ASICs may sharply reduce modem cost. Thus, OFDMA modems may not only afford a generally higher performance level than their TDMA counterparts, but also will prove very cost-competitive.

There is room within the broadband access marketplace for both OFDMA and TDMA technologies. Either scheme may be used as a technical basis for development of high quality broadband access platforms. Where large-scale and large system capacity are concerned, the OFDMA approach appears to exhibit a number of important advantages. However, this does not necessarily imply that TDMA could not be successfully leveraged within this context. In fact, as demand for broadband access capacity continues to expand, an advantageous "hybridization" of these technologies may eventually prove worthwhile.

For example, an array of mutually orthogonal carriers could be generated via the OFDMA technique, each of which could be accessed via TDMA, employing some appropriate modulation scheme (likely more efficient than QPSK; 8-PSK, 16/32-QAM and related others). Use of conventional FDM may be insufficient in this context; to achieve reasonable spectral efficiency, true OFDM will be required. The "granularity" of the TDMA access mechanism could be implemented at whatever combination of distinct channels that makes sense from a systems perspective, such as sub-band swapping. In this manner, the advantages of both OFDMA and TDMA could be combined into a single technical approach. **CT**

	OFDMA	TDMA
Modulation efficiency	Generally amenable to efficient vector modulation: Direct relationship between modulation efficiency (bits/Hz-s) and required system C/N.	Generally amenable to efficient vector modulation: Direct relationship between modulation efficiency (bits Hz-s) and required system C/N.
Scalability	True scalability: Increase system capacity with additional FFT/IFFT frequency bins. No change to symbol rate.	Symbol rate (interval) directly (inversely) proportional to capacity scaling.
Noise funneling	E ach modem transmits full bandwidth quantization + spurious noise. Noise funneling "scale up" at high capacity.	Gate modem transmitters off during unused channel time slots. Upstream RMS noise may be significantly less.
Bandwidth coherence	Dynamic, "carrier-by-carrier," DS0, frequency domain equalization effectively eliminates bandwidth coherence problem.	Time domain equalization inefficient in this context; no channel coherence information directly available for equalization. Fundamental limitation on upstream link at high capacity.
Susceptibility to impulse noise	Both narrowband and partialband interferers are compensated for via dynamic allocation of interference free bandwidth (carrier "tone" swapping). 32-QAM affords ADSL-like adaptive modulation efficiency. PB interferers may give rise to significant loss of system capacity.	Inherent robustness against narrowband interferers. Significant BER degradation may result where partialband interferers are present. QPSK not amenable to significant adaptive modulation efficiency capability.
Susceptibility to NB/PB interferers	Both narrowband and partialband interferers are compensated for via dynamic allocation of interference-free bandwidth (carrier "tone" swapping). 32-QAM affords ADSL-like adaptive modulation efficiency. PB interferers may give rise to significant loss of system capacity.	Inherent robustness against narrowband interferers. Significant BER degradation may result where partialband interferers are present. QPSK not amenable to significant adaptive modulation efficiency capability.
Forward error correction	"Channel-by-channel" error correction coding required on upstream only.	Error correction coding required on both downstream and upstream channels. Downstream FEC based upon TDMA frame structure. Upstream FEC must be performed "channel-by-channel."

Our new Scottsboro Drop Cable Plant is bigger than it needs to be. But the industry is growing into it.



Some things are destined to grow. One of them is the need for a dependable and affordable supply of quality coaxial drop cable for the indoor wiring market. Continuing its commitment to the industry, CommScope has created what may be the world's best cable-manufacturing facility.

Our new Drop Cable Plant in Scottsboro, Alabama, features state-of-the-art equipment and processes. And, by limiting our product focus, we are able to produce a large volume for quick delivery.

You have enough problems with regulations and competition. We don't think you should have to worry about drop cable, too. At Scottsboro, we're running at peak efficiency to give you a powerful domestic source you can count on for superior product and value.

Our Scottsboro Drop Cable Plant is more than a testament to CommScope's continued growth. It's also an investment in your future, our future and the future of the industry.

So, go right ahead and grow. CommScope will keep up with you.

CommScope GI General Instrument

P.O. Box 1729 • Hickory, NC • 800 982 1708 • Fax 704 328 2400 • http://www.commscope.com

By John Grothendick

Future-proofing your last mile

Even with the ever-advancing technology in all areas of the broadband cable network, the subscriber drop or last mile remains the weakest link. In the past, many systems spent time and money on quality headend and distribution equipment, but concentrated more on installation quantity than quality. Drop-related problems still generate better than seven out of 10 service calls. Unless more attention is paid to the quality of products, installation practices and installers themselves, carriage of future digitally delivered services may be next to impossible.

Overview

Most advanced cable architectures have driven optically delivered signal deep into the plant. HFC (hybrid fiber/coax) networks incorporate star-bus and fiber-to-the-feeder (FTF) designs that use no more than two to three amplifiers to feed subscribers. Optical node sizes range from 5,000 to 500 homes or less. The fewer homes served by a node, the greater the available spectrum to the system users and the lower the level of system maintenance required. Operators positioning their systems in this way are preparing their networks for targeted, interactive, digitally delivered services. The subscriber drop will become the most powerful communications link to the subscriber.

John Grothendick is manager of product development for Antec Corp.

The new modulation techniques have been developed to squeeze more digital information into the traditional 6 MHz analog channel space. Schemes such as QPSK (quadrature phase shift keying), QAM (quadrature amplitude modulation), and VSB (vestigial sideband) will be used for both the forward and reverse path transmission.

This will present new system performance challenges to the system operator, requiring that the system stays as transparent as possible to all signal transmission. Analog signals degrade on a graduated scale before a failure threshold is realized. Digitally delivered signals, incorporated in modulation formats of different "bit-to-hertz" ratios perform at an optimal level until their failure level is reached. The more sophisticated the modulation scheme, the lower the failure threshold. Once this bit error rate (BER) threshold is passed, the information is unrecoverable. In the video world, an impaired analog signal will grow "snowy" or "ghosty" with increased degradation, whereas a digitally delivered picture will create a tiling effect or interfering artifacts that ruin the picture.

Future-proofing the drop system means making it transparently pass a 1 GHz spectrum of analog and digitally compressed signals and two-way interactive services. The services needed by the subscriber are expected to require 1 GHz of bandwidth by the year 2006. The proper choice of drop cable, connectors, passive devices, drop amplifiers and related hardware is critical to the long-term viability of a drop. Proper installation and maintenance of each component can mean the difference between a high-quality drop and one that will require maintenance once digital services are added.

Performance parameters

For drop cable, use no smaller than RG-6 for systems of 550 MHz or better. If the drop is over 150 feet, consider using a larger cable, such as RG-7 or better. Drop cable should be sweep tested to 1 GHz. Drop cable impedance should be 75 ohms ±2 ohms or better. Avoid bending the coax less than 10 times its diameter.

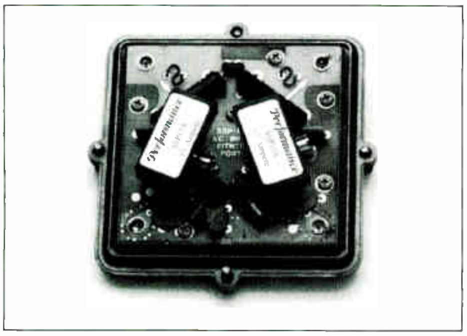
Try to avoid denting the cable at all. Changing the physical distance of the center conductor to the outer conductor changes its impedance and therefore its return loss, causing signal degradation. Structural return loss for drop cable should be 23 dB or better. Proper shielding in the form of braid and foil also is important. Some cables now have very thick, single-seamed outer conductors that helps lower signal loss and loop resistance. Make sure that the manufacturer will guarantee that this type of drop cable will not fatigue with flexing and develop stress cracks over time.

Braid percentage and foil layers required to successfully shield the signal transmission will vary according to the areas serviced. In rural areas, a 60% to 90% braided, foil wrapped drop coax may do. In more urban areas, a tri- or quad-shield product will be needed. Using this multi-foiled, braided drop cable is recommended for all areas. Remember: Drop cable shielding and return loss parameters degrade by as much

REPLACEMENT FERRO fits most manufacturers cabinets

The Performance Model FR2000 60V/16A Ferroresonant power supply is designed to replace or retrofit discontinued and obsolete power supplies. It fits most existing cabinet configurations and connects using existing wiring. Price is $299, call 800/279-6330.

Reader Service Number 115



SURGE-GARD protects against nuisance fuse blowing and resets in 60 seconds

Self-resetting circuit breaker fits fuse clips in Jerrold SSP power inserters. The Performance Surge-Gard replaces fuses in locations where they frequently blow for no apparent reason causing unnecessary truck rolls. Merely remove the undependable fuse and snap-in the Surge-Gard. Specify Model SG15A for 15 ampere protection. Cost only $15 (100 & up). Call toll free 800/279-6330.

Reader Service Number 116

VOLTEX CATV-27 Standby battery costs only $64.95

Best high temperature battery available! Normally outlasts valve regulated gelled electrolyte batteries two to one in CATV applications and provides as much as 15% longer run time. By far the best battery value on the market today. Call Performance today for details 800/279-6330.

Reader Service Number 117

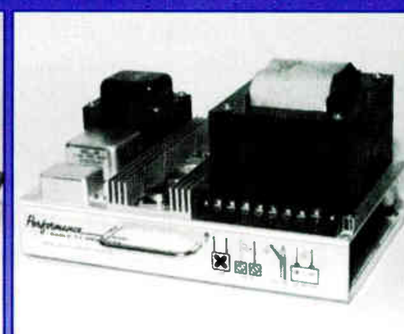
BATTERY TESTER checks 12 volt standby batteries automatically

The Performance Model BT 1200 universal battery tester checks gelled electrolyte and lead acid batteries in 10 seconds. Since batteries deteriorate gradually, regular testing with this unique device enables you to log changes in voltage levels as they occur. Having this history lets you know when to do preventive maintenance before a critical battery fails. Price is $250. Order today, call toll free 800/279-6330

Reader Service Number 118

Replacement Power Supplies

Replace this...



with this

The *Retro-Power* inverter is the replacement of choice for discontinued, obsolete and non-functional 60 Volt standby power supplies and is designed to fit directly into any manufacturers cabinet. Interconnection is easily done using existing wiring and for added savings, the unit may be used with any existing 60 Volt ferroresonant power supply. Adapters are available when replacing plug-in power supplies, allowing for quick and simple installation. Specify Model SB1000 priced at $499.00. Call today, toll free 800-279-6330

PERFORMANCE POWER TECHNOLOGIES

P.O. Box 947, Roswell, GA 30077 770-475-3192

AN EDWIN-ROSS COMMUNICATIONS COMPANY

Reader Service Number 124

as 10% to 15% when the drop cable is hung and is flexed. Use messengered for aerial drops and flooded for underground. Consider this: Many telcos protect their underground drops with armoring or conduit. With critical services being carried on the drop cable, perhaps broadband system operators should do the same.

Connectors should offer at least 70 dB of shielding within the 5 MHz to 1 GHz frequency band. A circumferencial seal at the port-to-connector interface is necessary in outdoor applications. A 360° compression style connector that is easy to install is desirable because these fittings offer more consistent performance when properly installed. Use torque specifications outlined by the manufacturer or tighten the connection an extra quarter turn to ensure a tight fit.

Check the F-ports on all user devices before installing the system connection. These ports may be very weakly attached to the device and will be damaged when a connector is tightened on them. However, make sure the connection is tight before leaving. Also check that all connections are properly sealed at the cable/connector interface.

Drop splitters and passives should effectively pass 5-1,000 MHz and give 100 dB of shielding or better. Each passive should provide a minimum 15 dB of input/output return loss. Purchase passives that have a rugged housing and backplate. For consistent high performance, use passives with printed circuit boards instead of free wired components. Make sure the circuit board is mounted on standoffs or equivalent means, attached well to the housing. Poor circuit grounding as well as substandard components will decrease the return loss of a splitting device.

Drop passives can suffer extreme abuse while in the warehouse or on the installer's vehicle. Tossing them in a box or leaving them on a truck bed can easily damage the components. The drop passives should be treated with as much care as the other system electronics. Remember that component performance problems often don't manifest themselves at lower frequencies and may not appear until the higher frequency bands are used.

As for subscriber amplifiers, choose a two-way amp that passes 5 to 40 MHz or better on the return. The amp should pass up to 750 MHz in the forward direction with no more than 1 dB peak/valley response. No more than 0.5 dB and 1 dB of total system composite second order (CSO) and composite triple beat (CTB) contribution respectively should be added by any drop amp device.

Pay attention to these performances because many written performance specs are not accurate. Surge protection within the amplifier will grow in importance as more and more of these devices are used in the field.

Adequate surge protection will become a huge issue as more services, including lifeline telephony, are added to the system. It may no longer be enough to show that the drop was properly bonded to alleviate operators from surge damage liability. →

Large investments in end user devices as well as the potential for personal injury dictates that additional protective elements be added to the drop network. Bonding will still remain the primary method of surge protection. Check the local codes as well as the National Electric Code to make sure you are bonding correctly. If possible, attach a short #12 or larger bond wire to the grounding devices installed by the local power company. Avoid severe bends in the bonding wire that would present extra impedances to the surge going to ground.

Operators worry that even the best installation can be ruined by customers adding their own outlets. Even with the latest FCC regulations, operators are still responsible for the disposition of their signal all the way to the subscriber device. Controlling home wiring may be impossible, but there are measures that can be taken to improve its quality. Public service announcements, bill stuffers and operator approved contractors can educate customers as to the importance of using system recommended products and procedures.

Value a good installer

Obviously, a system can use the best equipment and adopt the highest performance practices, and still suffer from drop-related problems by not recognizing the value of a well-trained, highly qualified installation technician. For far too long, the installer position has been treated as an entry-level function in the technical operations area. Installers that have become proficient in their trade are encouraged to move on to other technical positions such as service and line maintenance tech. Quite often, there are large differences in pay between these positions, with the installer at the lowest end of the scale. The result can be a constant churn of installation personnel, with the skilled installers moving to the positions of higher pay, leaving an inexperienced and quite often mediocre installation force.

The jobs of service and line maintenance technician are extremely important because they require further knowledge of broadband communications net-

"The subscriber drop or last mile remains the weakest link."

works and responsibility over larger areas of plant. The skills and responsibilities needed for installation have parallel importance. The position of installer not only demands a proficiency in wiring a structure with coax, but also requires in-depth customer relations skills, knowledge of building construction and local building codes, as well as TV set, VCR, audio system and computer game setup. Knowledge of system design, repair and network function also should be required.

Future installer skills will be needed for telephony, PC function, modem function and environmental monitoring systems as these sophisticated services come on line. The installer (and customer service representative) represents the system and its personality to the customer. The degree of professionalism by which the work is done and the customer is treated instills a lasting impression in the subscriber's mind.

Broadband network operators need to treat their installers with the same degree of respect as that given to the service and line maintenance technicians. Skilled professionals in installation should be given tangible motivations for job satisfaction. That is, they should be offered encouraging career advancement within the department as well as within the rest of the organization.

There is ever-increasing competition for qualified technical help among the old and new players in the broadband communications world. Technicians in all system positions are being enticed away from their existing companies, leaving operators dangerously understaffed. Those companies that recognize the value of having skilled, motivated installers using high-quality installation products and practices will help ensure their survival and prosperity. **CT**

Is ingress making your return path a road to nowhere?

Ingress is the major roadblock to getting your return path up and running. Fortunately, there's the new HP CaLan Sweep/Ingress Analyzer. It's the only test gear that allows you to quickly and accurately troubleshoot your system, regardless of the presence of ingress.

When ingress corrupts reverse-path communication, the headend unit (HP CaLan 3010H) senses the problem instantly, and transfers the display of the ingress problem to the field unit (HP CaLan 3010R). That means your technicians can begin troubleshooting immediately.

Now you can troubleshoot your system at all times. No matter how much ingress is present.

And of course, the HP CaLan Sweep/Ingress Analyzer offers DigiSweep, the industry's fastest, non-interfering, digital-services compatible forward and reverse sweep. In fact, reverse sweep measurements can be performed in real-time — even with multiple users.

So don't let ingress slow you down. To find out how HP CaLan's Sweep/Ingress Analyzer can help you identify, troubleshoot, and eliminate your ingress problems, call **1-800-452-4844, Ext. 1749**. Or visit us at: http://www.hp.com/go/catv

HEWLETT PACKARD

By Brian Bauer

Troubleshooting the drop: A new approach for a new era

The future of the telecommunications industry is not in traditional, one-way analog services, but in broadband, bidirectional services requiring consistent quality and availability of both signal and service. Cable operators are approaching this new age from different perspectives and with a wide range of past experiences, but ultimately they all have the same goal—to add broadband and digital signals (and the revenues they generate) to existing network capabilities. To keep up with the demand for increased service reliability and availability, cable operators must take a new approach to network troubleshooting. As this occurs, three primary factors have emerged:

Brian Bauer is senior product manager, integrated drop management system, for ADC Telecommunications' Broadband Connectivity Group.

- *Increased urgency of subscriber failure.* Because of the increasing amount of bidirectional traffic, noise funneling and potential failure have become common occurrences. (Noise funneling is the phenomenon caused when all legs of the coaxial plant effectively create a funnel into which all forms of ingress are fed, consequently appearing at the combined input to the reverse path transmitter at the optical distribution node.) As a result, when one part of the network fails, entire serving areas may potentially suffer unless some basic precautions have been taken.
- *Faster time to locate.* Methods for fast identification can be extremely economical, minimizing the time traditionally required to roll trucks to any/all potential problem areas. Using remote or methodical testing, problems can be narrowed down to the feeder leg—if not to the drop—decreasing

Figure 1: Directional couplers and high return loss components

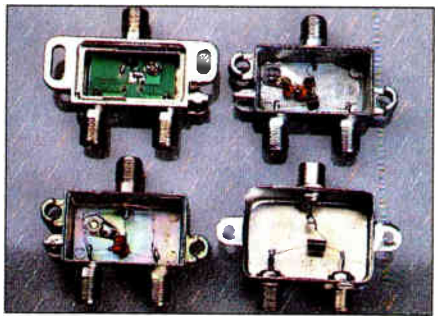


Figure 2: Retail "VCR" jumpers

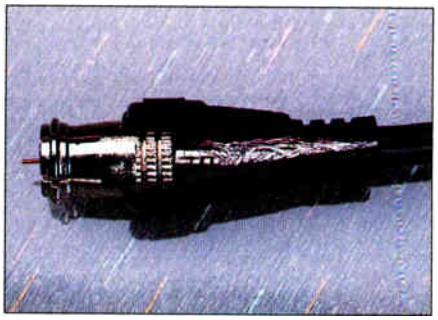
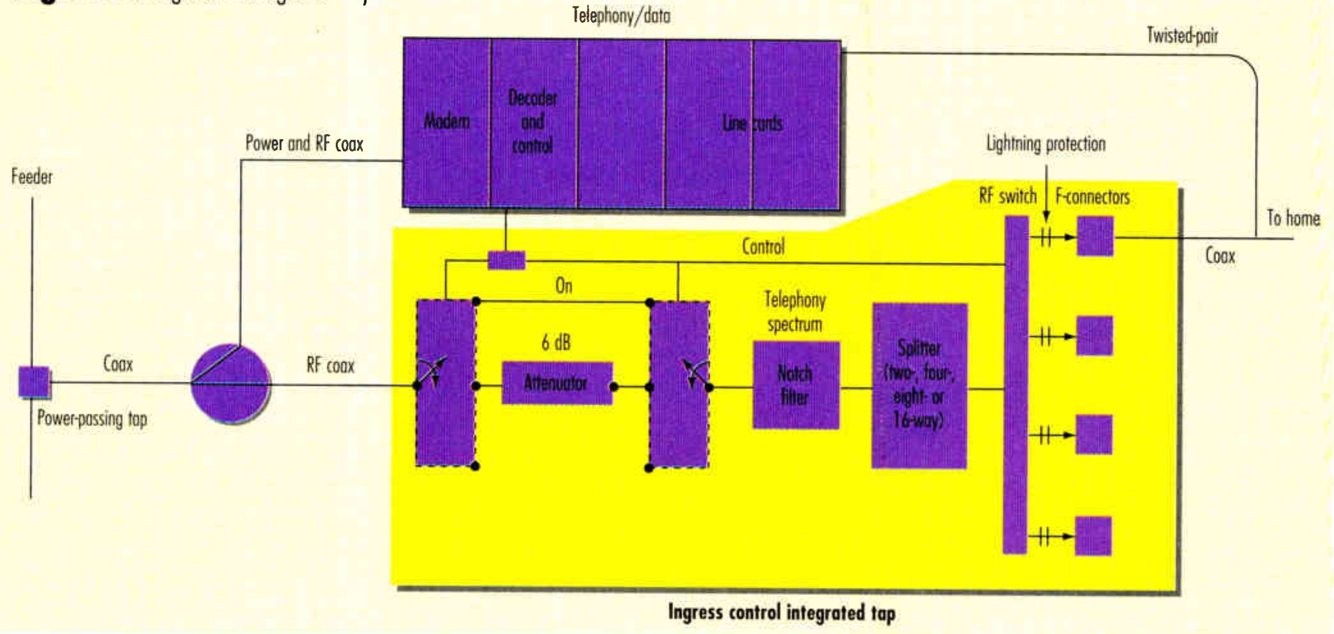


Figure 3: Ingress management system



Cost-Saving Fiber Optic CATV Control Systems Now Available On One Fiber

Radiant Communications has announced an alternative to expensive leased phone lines to control equipment at remote locations. Now Radiant manufactures a line of fiber optic data links that enable dark fibers to replace leased lines. Included are new RS232 and Manchester systems compatible with GI equipment, plus fiber optic systems compatible with SA and other equipment suppliers. These products are currently in use with most major MSO's. Radiant fiber optic control systems will frequently pay for themselves in only a few months. Fiber optic data multiplexers and singlemode to multimode converters are also available.

Reader Service Number 251

Low-Cost Fiber Optic 5 Channel Broadband System

A low-cost fiber optic 5 channel broadband system for applications that require more than one channel is available from Radiant Communications. The Series VL2500 transmits channels 2 through 6 via singlemode fiber for distances up to 40 Km. A multimode fiber version for college campus requirements is also available. A true plug and play system, no adjustments are required. Radiant supplies other low-cost AM fiber optic broadband systems for 24 and 80 channels as well as a 16 channel FM system.

Reader Service Number 252

Fiber Optic CATV Drop Cables

Radiant offers a full line of fiber optic cable plant products. The company guarantees drop cables with back reflections of –60dB for ultra polish terminations and –70dB for angle polish terminations. Available from two to twelve fibers with customer specified node connector. Also available are fiber optic assemblies, couplers, fiber management systems and the industry's first and best low backreflection attenuators— both fixed and variable.

Reader Service Number 253

DON'T TIE UP PROFITS WITH DARK FIBER

Fiber Optic Electronic Systems from Radiant Let You Generate Revenue and Cut Costs. These systems are cost effective and can transmit up to 50Km.

- Fiber Optic Single-Channel Baseband Video Systems for Distance Learning Applications with schools, direct broadcast pick-ups and remote antenna sites. Systems also available in bi-directional versions...two ways over one fiber
- Fiber Optic Control Systems compatible with GI, SA and other equipment to replace your expensive leased phone lines
- Fiber Optic Ethernet Systems with high throughput (up to 100MBS) and no distance limitations (up to 100 Km)
- Fiber Optic Five Channel/Low Cost Broadband Systems for distance learning

See the light. For more information or free applications engineering assistance, contact:

AGENTS WANTED OUTSIDE U.S. Contact Us.

Radiant Communications Corporation

1-800-WOW-FIBR

in NJ 908-757-7444 • FAX 908-757-8666
Internet Address:www.RadiantCom.Com
P.O. Box 867 • South Plainfield, NJ 07080 U.S.A.

Reader Service Number 93

wear and tear on technicians.

• *Shorter time to repair.* Often referred to in network availability calculations as mean time to repair (MTTR), this time can be reduced by improving the ease with which components can be changed.

Future services will consist primarily of telephony, digital video and two-way data, all of which use two-way signals and digital modulation. Three things are essential to the success of such a network and should be considered when planning drop troubleshooting:

1) Maintain carrier-to-noise (C/N) by ensuring low loss and low noise;

2) Minimize reflection by providing low return loss and high isolation loss; and

3) Extend service life of components.

When properly installed and tightened, most of today's existing drops can meet the requirements necessary to support these advanced services. With proper maintenance, most current drops will perform adequately for a few years using unsealed plant, and even longer if they utilized sealed connectors. "Proper maintenance" includes a variety of basic preventive measures, including the following:

• Tightening the system at least to the modem terminal and installing ingress filters;

• Using directional couplers and high return loss components to maintain reflection isolation (Figure 1 on page 58);

• Protecting cable by assuring it is completely surrounded by conduit and buried far enough underground (power-passing telephony drop guidelines can be found in emerging UL standards);

• Inspecting cable for holes in jacket; and

• Examining cable route, including drip loops, staple attachments and P-hooks for kinks and holes.

Two-way digital drop

It is vital for cable operators to be able to monitor and control noise loss levels if they are to succeed in providing the two-way, digital services of the future. While C/N performance degradation may be gradual, visual degradation for such services tends to be catastrophic. Major ingress problems in one drop may destroy signals for everyone else in the node as a result of noise funneling. For this reason, it is essential to maintain the network and catch potential problems early, before they affect the end user.

To keep revenue-generating services up and running at all times, it is crucial to subject the network to at least a minimal level of test and maintenance. There are three things that can make all the difference between a smoothly functioning network and one that suffers constant system failures: bit error ratio (BER); radio frequency (RF) level; and ingress (noise). It is essential to test each of these in order to meet and maintain Federal Communications Commission and other signal quality standards. By maintaining the minimum

standard levels, many potential network problems can be avoided; testing beyond the minimum levels will often further reduce potential failures.

BER

The extremely abrupt failure and associated difficulty in troubleshooting of digitally modulated signals makes it especially vital to test the bit error ratio (BER) and assess regular updates from a large sampling of homes. Digital signals often use many different modulation schemes on the same network. Although not impossible, these signals can be very difficult to monitor using hand-held devices, and it is strongly recommended to use an automated, digital system whenever feasible in order to preserve the quality of revenue-generating services. Many digital terminals provide a BER feedback feature to allow for remote monitoring.

RF level

Maintaining RF levels is essential to proper operation of the reverse path. Digital signals can become clipped or compressed when amplifiers are not properly aligned, and the BER threshold can be violated when carrier levels drop too low. Careful testing and controlling of RF levels can prevent these problems. Equalization across frequencies should be monitored and maintained. Return levels through any tap should be equal to those of other taps on the feeder bus.

Ingress

Another crucial element to reverse path operation is the maintenance of proper C/N and carrier-to-ingress (C/I) ratios. Noise is a perpetual thorn in the side of signal quality, especially in the home cabling of the return path. There are virtually hundreds of things—both intended and accidental—that can cause ingress in the drop. Among these are the misuse of retail components, homemade splitterless splitters, loose connectors, staples, lawnmowers, teething dogs and a myriad of other hazards.

Take a look at Figure 2 on page 58. Retail "VCR" jumpers are recommended for use in VCR-to-TV set connections, but often become ubiquitous. The light-to-nonexistent compression of the cable braid to the connector spells problems for shielding, and can lead to significant ingress.

Current test methods

Both RF level and ingress are typically measured using portable, hand-held manual devices. Ingress levels have traditionally been monitored using cumulative leakage index (CLI) devices, while RF measurement has most commonly relied on manual, hand-held spectrum analyzers or smaller, single frequency testers.

Next-generation test methods

Manual test devices have improved tremendously over the years, becoming much smaller and easier to transport while improving their accuracy in locating problems. Some recently introduced systems incorporate a comprehensive reverse sweep test capability into the same equipment that performs the forward sweep, allowing both forward (outbound) and reverse (inbound) path alignment to be done simultaneously

B+K PRECISION RF PRODUCTS GROUP

Finally, A Spectrum Analyzer Series With The Features And Prices You Really Need!

When choosing a new spectrum analyzer, it's easy to end up buying features you'll never use. That's why B+K Precision is proud to offer the 2600 Series Spectrum Analyzers. We give you the features and performance you really need at less than a third of the price of comparable units.

Compare these specifications and prices:

Model Number	Bandwidth (MHz)	Resolution Bandwidth (kHz)	Dynamic Range*	Maximum Input	Drift (kHz/Hour)	AM/FM Demod	Tracking Generator	Retail Price
2615	500	12.5 & 250	113* dB	+20 dBm	<150	------	------	$1,795
2620	500	12.5 & 250	113* dB	+20 dBm	<150	------	YES	$2,195
2625	1,050	20 & 400	113* dB	+20 dBm	<150	YES	------	$2,595
2630	1,050	20 & 400	113* dB	+20 dBm	<150	YES	YES	$3,395

*with attenuation (-100 dBm to +13 dBm)

Compare the 2600 Series to the competition and you'll see why they are the best value in Spectrum Analyzers available.

B+K PRECISION
RF PRODUCTS GROUP

Domestic and International Sales:
6470 W. Cortland St., Chicago, IL 60635
Tel: 312-889-1448 • Fax: 312-794-9740
Canadian Sales: DCS Electronics, Ltd.
Tel: 905-683-4500 • Fax: 905-683-8074

Reader Service Number 106

Our NEW Spectrum Analyzer Series is ideal for RF testing and troubleshooting.

With the 2600 Series, you don't have to pay for the "bells & whistles" you don't need

B+K Precision has been providing high quality electronic test and measurement equipment for over 40 years.

For the name of your nearest B+K Distributor, call 1-800-462-9832.

by one person using a single, portable, hand-held instrument. A unit like this will contain both a transmitter and a receiver with frequency agile telemetry, and a built-in contention mechanism will permit multiple users to perform alignment. Return path measurement is optimized using this kind of instrument: the bandwidth is relatively narrow (5 to 30 MHz) and the reverse path consists of only inserted signals, so sweep update can occur very quickly.

In spite of all the advances made in manual testing devices, the future of network testing is gradually shifting toward the use of status monitors, which can isolate problems much faster than the traditional, manual methods. By isolating noise to a particular drop, both time to locate and time to repair will be greatly improved, the cost of rolling trucks will be significantly reduced, and signal availability/reliability will be increased.

Despite all design efforts, there will be the occasion when return path noise from an uncontrolled source may cause service problems. A gate level controller function can be designed into each return path leg to address this problem. When a return path problem is identified in a serving area, each individual return path leg from the optical node can be attenuated in succession, by using remote commands from the headend, until the offending leg is specifically identified. Depending on the severity of the problem, either a technician can be dispatched to the exact location and/or the offending leg immediately turned off to minimize the outage, as chosen by the network provider.

This functionality also can be integrated at the drop level. Ideally, noise can be monitored, located and rejected on a home-by-home basis, eliminating the offending drop without disrupting more than one home. Cost-efficiency is attained by sharing integrated service unit (ISU) electronics such as the power supply, modem and other hardware.

Permanent drop

The switching feature of this next-generation module (either tap or side-of-home) not only benefits the ingress management (Figure 3 on page 58) and rejection portion of the drop, but also provides a means for a truly permanent drop system. Because of the inherent instability of F-connections (few threaded devices can assure consistent tightening every time a connection is made), there is an incremental probability of a faulty installation that will introduce an ingress point. The odds of maintaining a hardened plant are greatly increased by minimizing the number of times connections are made or repeated.

By monitoring the drop at the tap or ISU, the number of connect/ disconnect sessions in the field will be greatly reduced, both for test purposes and for truck rolls. Furthermore, by reducing the time needed to locate ingress, maintenance costs will be decreased and costly network down time will be avoided. Faults can be located in just minutes, as opposed to the several hours often needed by traditional manual methods.

As the two roads meet

Ultimately, all monitoring will be done remotely and components will be built for long life (20 years or more). Within the next decade, cable companies will become highly automated providers of multiple, integrated services. Status monitoring equipment, RF switches for adding/ dropping subscribers, and BER test equipment will all be integrated into the modem electronics, providing an extremely high degree of service reliability and availability. However, during the initial roll-out of two-way digital services over the next several years, most systems will operate quite adequately using traditional, manual equipment.

By following the proper maintenance and basic preventive measures outlined earlier, most existing drop systems will be able to support advanced services until the arrival of complete automation and remote testing. The transition period between manual and automated procedures can be considerably simplified when service providers minimize their locate and repair time, use ingress identification techniques, and make use of BER monitors within their modem terminals. As the transition nears completion, network operators can make the final leap a seamless one by first automating the two-way drop and implementing strong modem troubleshooting links. **CT**

General Instrument delivers the action to subscribers and new sources of revenue to you

Interactive programming and services. GI leads the way to make your vision a reality with the CFT 2200 enhanced analog consumer terminal.

Near-video-on-demand accessed through an interactive program guide. Multilingual capability. Virtual channels for sports, finance, news, weather and community information. Interactive data services. VCR control. And a host of other entertainment and revenue-generating services. All engineered to perform seamlessly with existing analog cable systems.

The intelligent CFT 2200 provides subscriber satisfaction and greater revenues for you. In an innovative way that allows analog and digital to coexist within the same system.

The CFT 2200 redefines intuitive operator simplicity too. On-screen prompts and help screens make subscribers the captains of their own entertainment and information centers. Now that's simplicity. That's the 21st century.

So, if you're thinking of advanced analog services for your system, depend on the company that's leading the way. General Instrument. We'll work with you as you plan for the future.

GI General Instrument

(215) 674-4800 (worldwide) • (800) 523-6678 (toll-free in U.S.) • (215) 956-6497 (fax worldwide)

Reader Service Number 15

By Dan Harris

Reflections on AM video transmission

• I've heard that reflections can degrade the transmission of information over optical fiber. Can you explain how reflections affect video transmission and what I can do to minimize them?

In practical lightwave systems, reflections can create noise in two ways. The first arises from light that is reflected back into the laser transmitter, effectively altering the laser cavity. Fortunately, noise generated in this way can be eliminated essentially by placing an optical isolator directly at the laser output, keeping the reflected light from re-entering the laser. A second source of noise more difficult to overcome, results from multiple reflections in the fiber link. These reflections can occur anywhere in the fiber span, so they cannot be eliminated by placing an isolator in any one location along the link.

"The effects of MPI noise are generally less severe for systems operating in the 1,550 nm wavelength region than for systems operating at 1,310 nm."

Generation of noise from multiple fiber reflections results in the following manner. First, forward-traveling light is reflected back up the fiber. Then, a portion of this reflected wave is reflected a second time back down the fiber, creating a forward-traveling wave that interferes with the original, producing multipath interference (MPI). The resulting MPI power depends on the optical phase relationship between the two interfering waves. Because this phase relationship is random to some degree, MPI produces fluctuations that look like noise and negatively impact the carrier-to-noise ratio (C/N) of analog video signals. MPI can be generated from two basic

Dan Harris, Ph.D., is market development engineering manager of broadband technology for Corning Inc. For more details on this month's column, contact the Corning Optical Fiber Information Center at (800) 525-2524, send an e-mail to fiber@corning.com, or post your question on Corning's Web site at http://www.usa.net/corning-fiber.

MicroStealth and Combination Meters

Wavetek meters are designed around your business to provide the right solutions for the wide range of your cable testing needs.

Multi-Featured . . . Four different models provide the features needed for the job — and your budget.

- Simultaneous multi-channel display
- One-button *Go/No-Go*
- Multiple channel plans
- Leakage detection
- Store and print measurement results
- Reverse ingress scan
- Download to Stealthware
- Performs 24 hour tests

Versatility . . . With our **MS1300**, cable engineers get a snapshot of the system while performing a wide range of diagnostic measurements, including 24 hour testing and reverse path ingress. It delivers powerful performance with hand-held convenience.

With the high sensitivity of the **CLI-1450**, cable technicians can find even the smallest leaks, plus have all the features of the **MS1300**.

And, installers can press a single button of the **MS1000** and check all channels quickly and accurately according to system-defined limits. You'll ensure compliance and reduce subscriber callbacks.

Confidence . . . Each portable Combination and MicroStealth meter offers powerful performance and is designed to meet your specific testing needs — at an affordable price.

In the U.S. Call 1-800-622-5515
http://www.wavetek.com

Worldwide Sales Offices

United Kingdom (44) 1603-404-824
France (33) 1-4746-6800
Germany (49) 89-996-410
Eastern Europe (43) 1-214-5110
United States (1) 317-788-9351
Southeast Asia (65) 356-2522
Asia Pacific (852) 2788-6221
China (86) 10-6500-2255
Japan (81) 427-57-3444

WAVETEK

Wavetek...partners in productivity for over 35 years

Reader Service Number 55

types of reflections. The first are discrete reflections, which typically occur at fiber splices and connectors. Continuous reflections resulting from Rayleigh backscatter—the fundamental loss mechanism in the fiber—also cause MPI. Since the light must be reflected twice to create noise, this phenomenon is commonly called "double" Rayleigh backscattering.

The noise created by MPI is a consequence of light from the laser source interacting with itself. Therefore, the average noise power is proportional to the laser output power. Noise that exhibits this dependence on source power is commonly called relative intensity noise (RIN). An important difference between RIN and noise generated in the receiver amplifier or photodiode is the fact that the impact of the latter noise sources can be reduced by simply increasing the laser power. Since RIN increases at the same rate as laser power, the C/N in a RIN-limited application is independent of laser power and cannot be improved in this way. Therefore, noise from MPI imposes a fundamental limit on C/N for analog video transmission.

"The noise created by MPI is a consequence of light from the laser source interacting with itself."

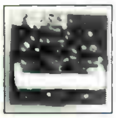
• Under what conditions will MPI reduce C/N to unacceptably low levels?

Noise generated by MPI is dependent primarily on the magnitude of the reflections in the transmission path, some of which are from the fiber and others from the connection points and other elements in the optical path. This is illustrated in Figure 1 on page 70, where the calculated C/N for MPI from two discrete reflections of equal magnitude is plotted vs. their reflectance. Here, the source is a 1,310 nm directly modulated DFB laser with a linewidth of 2 GHz. (We would get identical results at the 1,550 nm wavelength.) From the plot, we see that C/N in dB decreases at a rate equal to twice the reflection strength in

QRF

REPLACEMENT EQUALIZERS
QUALITY RF SERVICES, JERROLD, SCIENTIFIC ATLANTA, MAGNAVOX, TEXSCAN 'T SERIES', PATHMAKER AND RCA

QSA



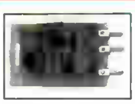
Replacement Equalizer For Scientific Atlanta
QSA-330 MHz
QSA-450 MHz
QSA-550 MHz
QSA 750 MHz Now Available
$12.00*

Passband = 330, 450, 550, and 750 MHz
Flatness = ± .15 dB
Return Loss = ≥ -17 dB
Insertion Loss = ≤ 1 dB
Values 0, 3-30 in 1.5 dB increments

SXP-T-TOPS

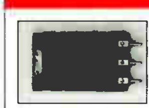
For Scientific Atlanta Equipment
SXP T-Top Blue 600 MHz–**$1.75**
0-20 dB in 1 dB increments
SXPTY-Top Yellow 860 MHz–**$2.14**
0-13 dB in 1 dB increments
SXPTY-Top Yellow 860 MHz–**$2.64**
14-20 dB in 1 dB increments

QSYL



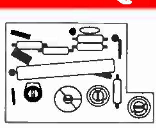
PATHMAKER
$10.00
Available in the following bandwidths:
300, 330, 400 and 450 MHz
Nominal Values:
4, 7, 10, 13, 16, 19, 22, 25 dB

QSYL-P

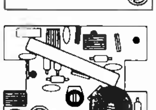


PATHMAKER PADS
$4.50
0 to 6 dB
9, 12 and 15 dB

QXFE/QXE



NEW! NEW! NEW!
QXFE-554 FIXED EQ
Use QXFE-554 for XFE
3, 6, 9, 12, 15, 18, 21 dB
Fixed EQ's • **$18.00**



Use QXE-454 for XE
TL, L, M, H & ST EQ's
Variable EQ's for **$19.50**
Including the handle.

Call for special orders of other frequencies. The QXE board can also substitute for JE-series. Minimum order quantities may apply to non-stocked models.

QMAG

QMAG – 62E Series
Replacement EQ's for Philips
(330, 400, 450 and 550 MHz)
$10.00

330 MHz – 2, 5, 8, 11, 14, 17, 20, 23 dB
400 MHz – 2, 5, 8, 11, 14, 17, 20, 23, 26 dB
450 MHz – 2, 5, 8, 11, 14, 17, 20, 23, 26 dB
550 MHz – 2, 5, 8, 11, 14, 17, 20, 23, 26, 29 dB

QMAG – 5EE Series
(Fixed Values)
(330, 400 and 450 MHz)
$10.00

330 MHz – 5, 8, 11, 14, 17, 20 dB
400 MHz – 5, 8, 11, 14, 17, 20 dB
450 MHz – 5, 8, 11, 14, 17, 20 dB
Return Loss = 16 dB All Values
Insertion Loss = ≈1.0 dB All Values

QMAGV

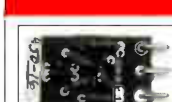
Replacement Equalizer For Magnavox 5CE Series Adjustable
(330 and 450 MHz)
$14.00*

330 MHz – 0, 5, 8, 11, 14, 17, 20, 23 dB
450 MHz – 5, 8, 11, 14, 17, 20, 23 dB
Return Loss = 16 dB All Values
Insertion Loss = ≈1.2 dB All Values

QMAG-P

4-A Pad **4.50**
6-A Pad **1.75**
7-A & 9-A Pad **2.90**
4-A – 0, 3, 6, 9, 12 dB
6-A, 7-A, 9-A – 0-20 dB in 1 dB increments

QTEX



TEXSCAN 'T SERIES'
$10.00
Available in the following bandwidths:
330, 400, 450, 475
330-400 MHz – 4, 8, 12, 15, 18 dB
450 MHz – 4, 6, 8, 10, 12, 14, 16, 18, 20 dB
475 MHz – 4, 6, 8, 10, 12, 15 dB

QTEX-P

TEXSCAN 'T SERIES'
PADS – $5.50
0 to 6 dB
9, 12 and 15 dB

QLX

Equalizer for Jerrold JLX
(Replaces Jerrold EQ & SEA)
$6.75

(330, 350, 400, 450, 500 and 550 MHz)
330-450 MHz – 0-30 dB 500 MHz – 2-22 dB
550 MHz – 0-24 dB
600 MHz **$7.50** 750 MHz **$11.00**
(0-24 dB, in 2dB increments)

QEP-ADP

Fixed Value Equalizer System
Allows QLX to Replace SEP's
QEP-ADP - **$7.00** Plus QLX - **$6.75**
TOTAL - **$13.75**

QEP

Trunk Equalizers (Replaces SEP by Jerrold)
(ST 20 and SJ Chassis Compatible - Available in one-way or two way...4's and 5's)

TL - 5 thru 11 dB
L - 10 thru 16 dB
H - 16 thru 22 dB
ST - 18 thru 25 dB
(300 through 450 MHz Bandwidths)
$15.00 all values

QEE

Line Extender Equalizers
(Replaces SEE by Jerrold)
270 MHz, 300 MHz, 330 MHz, 350MHz, 400 MHz
$5.00
450 MHz - **$6.00** 550 MHz - **$7.00**
600 MHz - **$8.00**
Values: 6 dB, 12 dB, 18 dB, 24 dB

JXP PADS
$2.90
(0 to 24 dB in 1 dB steps)
Also available
JXP A's 750 MHz

SXP PADS
$1.75
(0 to 20 dB in 1 dB steps)

RCA EQ'S & PADS AVAILABLE ***DISCOUNTS AVAILABLE FOR QUANTITY**

Quality RF Services is not a Sales agent for Jerrold, Scientific Atlanta, Magnavox, Texscan, or RCA

QUALITY RF SERVICES, INC.
850 PARK WAY
JUPITER, FL 33477

Reader Service Number 89

(800) 327-9767
(561) 747-4998
FAX (561) 744-4618

Figure 1: C/N from noise due to two discrete reflections of equal strength

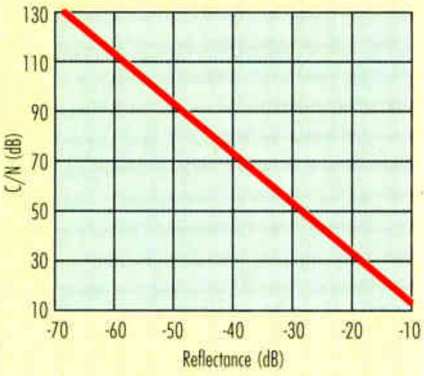


Figure 2: C/N from noise due to double Rayleigh backscatter

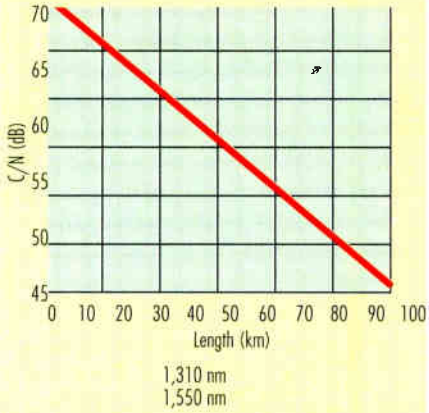
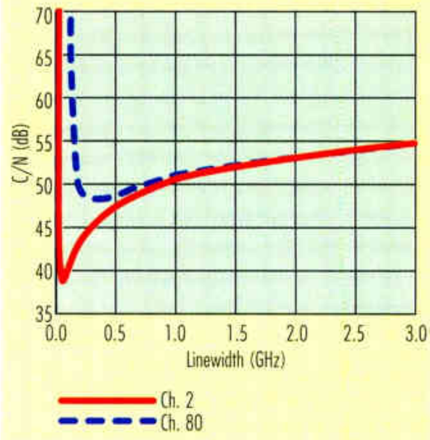


Figure 3: Dependence of C/N on DFB laser linewidth (chirp)



dB, and that reflections of about -30 dB are required to reduce C/N to levels near the cable TV limit of 50 dB. In most cases, if discrete reflections are kept below -40 dB—which is the specification for most commercially available splices and connectors—C/N degradation should not be a concern.

As for MPI noise generated from double Rayleigh backscatter in the fiber, the amount of backscatter increases with fiber length, so the amount of noise generated also increases with fiber length. Figure 2 shows a plot of C/N resulting from MPI noise due to double Rayleigh backscatter vs.standard single-mode fiber length for both the 1,310 nm and 1,550 nm DFB laser sources with 2 GHz linewidths. Here, we see C/N drops rapidly the first few kilometers at both wavelengths, leveling off to maintain 50-55 dB in the range of 30 km to 100 km. In this realm where the fiber length exceeds 30 km or so, MPI noise due to double Rayleigh backscatter in conjunction with receiver noise can begin to degrade C/N to levels below our target of about 50 dB. Note that MPI noise is less severe at 1,550 nm, for reasons outlined in the next section.

• When I specify lasers, fibers and splices and connectors, what attributes should I consider to minimize the effect of MPI on my system?

The primary laser characteristic that affects MPI noise is laser linewidth. This dependence is shown in Figure 3 for Chs. 2 and 80 of a system using a 1,310 nm distributed feedback (DFB) source and 50 km of standard single-mode fiber. As the figure shows, at the <100 MHz linewidths typical of externally modulated DFB laser systems, the C/N is different for the two channels. In particular, C/N caused by MPI noise is well above the 50 dB limit at channel 80 for linewidths below 100 MHz. To maintain the same C/N at Ch. 2, an ultralow linewidth of less than a few MHz is necessary. That said, care must be taken when selecting externally modulated sources to make sure the linewidth is narrow enough to avoid MPI noise problems.

As linewidth increases above 1 GHz, which is typical for directly modulated DFB laser sources, the MPI-induced C/N for both channels begins to increase and approach a common value. At this point, the advantage of having larger laser linewidths from a C/N standpoint is evidenced by the 5 dB C/N increase between 1 and 3 GHz.

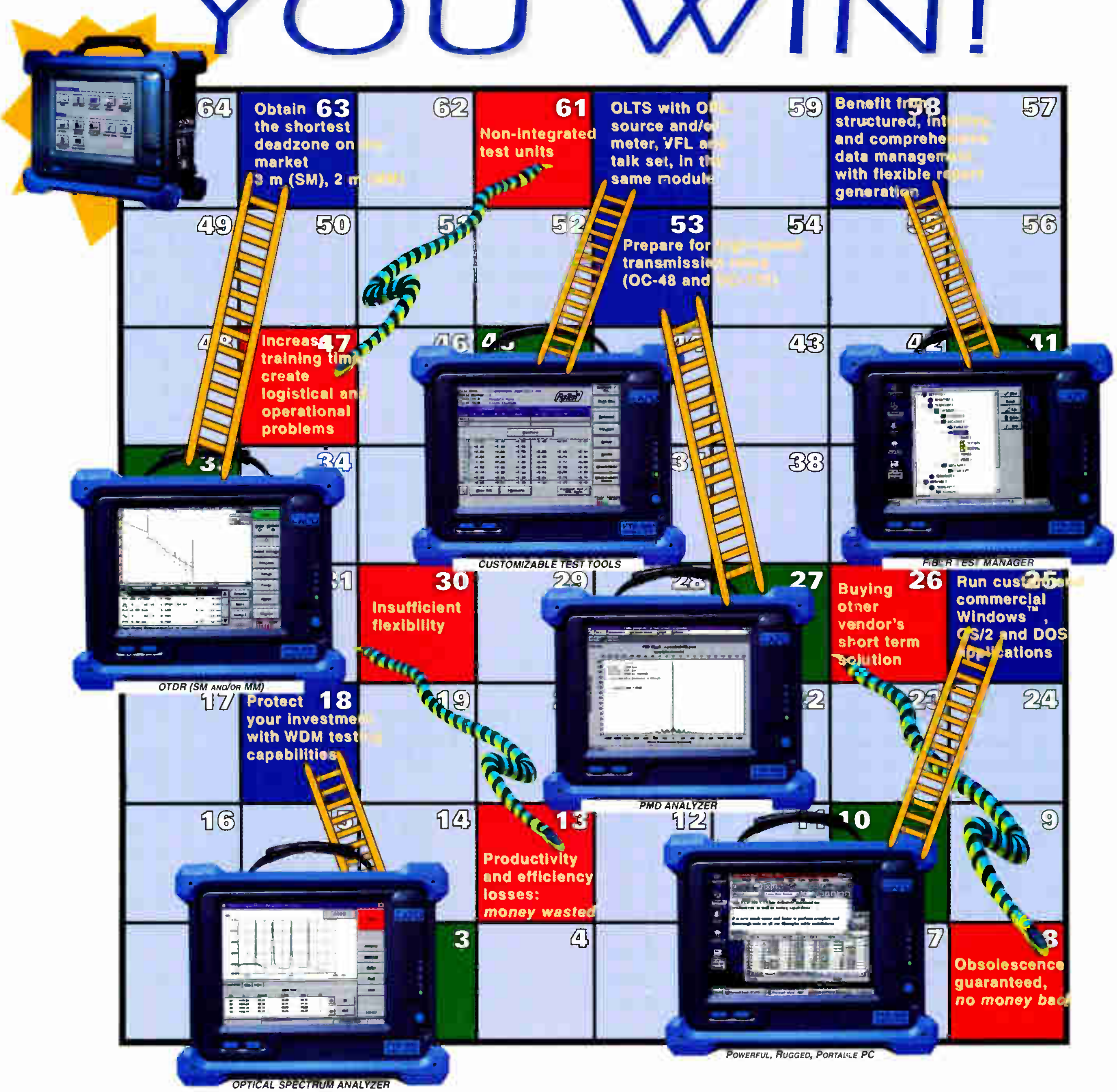
When considering fiber attributes, minimizing Rayleigh backscatter is the primary concern. Since Rayleigh backscatter is the primary loss mechanism in fibers, it follows that lower fiber loss means less backscatter. Additionally, the amount of backscattered light that is "captured," or remains in the fiber core is an important consideration. Generally, the amount of captured backscattered light is inversely dependent on the mode field diameter of a single-mode fiber. Therefore, a larger mode field will reduce MPI noise. Since most single-mode fibers have lower loss and larger mode fields at 1,550 nm than at 1,310 nm, we find that transmission at the 1,550 nm wavelength is generally less susceptible to MPI noise problems, as illustrated in Figure 2.

Finally, as I mentioned earlier, splices and connectors should maintain reflectance less than -40 dB. Since splice and connector reflectance can vary a great deal as a function of temperature, one should make sure that the maximum reflectance specification is maintained over the anticipated temperature extremes for the particular operating environment.

To recap, reflections in fiber can create noise due to a phenomenon known as multipath interference. This arises from both discrete reflections at splice points and connectors, as well as from Rayleigh backscatter in the bulk fiber. Typically, MPI noise is not a problem in cable TV transmission systems where discrete reflections are less than -40 dB and fiber span length is below 30 km. In systems with fiber spans exceeding 30 km, excessive MPI noise can be avoided using either very narrow (<1 MHz) or broad (>1 GHz) linewidths. Also, the effects of MPI noise are generally less severe for systems operating in the 1,550 nm wavelength region than for systems operating at 1,310 nm. **CT**

Climb the Ladder. Move to Modularity.

YOU WIN!



LET'S TALK MODULARITY.

Housing up to three field interchangeable modules, the FTB-300 Universal Test System is the only portable multi-modular system on the market. It simply is the winning solution for your fiber-optic testing requirements.

Available test tools include:

- High-Resolution SM OTDR
- Long-Haul SM OTDR
- High-Resolution MM OTDR
- Optical Spectrum Analyzer
- PMD Analyzer
- Power Meter and Light Source
- Optical Return Loss Test Set
- Automated Bi-Directional Loss Test Set
- Visual Fault Locator
- Digital Talk Set
- 1X12 Optical Switch
- More modules to come as your needs evolve

Call now to arrange a demo.

FTB-300 Universal Test System: one instrument, all the tools.

Reader Service Number 21

USA & CANADA: 1-800-663-EXFO

CORPORATE HEADQUARTERS, 465 Godin Avenue, Vanier, Que., Canada, G1M 3G7, Tel.: 418-683-0211, Fax: 418-683-2170
EXFO AMERICA, 903 North Bowser, Suite 360, Richardson, TX 75081, USA, Tel.: 1-800-663-EXFO, Fax: 972-907-2297
EXFO EUROPE, Centre d'Affaires-Les Metz, 100, rue Albert Calmette, 78353 Jouy-en-Josas, France, Tel.: 33 1 34.63.00.20, Fax: 33 1 34.65.90.93
E-mail: info@exfo.com **Web site: http://www.exfo.com**

EXFO QUALITY CERTIFIED

EXFO
Electro-Optical Engineering

HFC upstream kit

Stanford Telecom introduced the STEL-9251/CE upstream modulation/demodulation kit for evaluation and testing of its modulator and demodulator products designed for hybrid fiber/coax (HFC) systems. The kit provides a complete matched-feature set of products for pre-trial testing and verification of performance in HFC upstream transmission applications. The product contains the following: a burst modulator, modulator evaluation assembly, headend demodulator, cabling, PC-based software and instructions.

The STEL-1108 burst modulator is a complete BPSK/QPSK modulator in a single chip ASIC, specifically designed for the transmission of data from the subscriber modem to the headend equipment. The STEL-1208 assembly is specifically designed for evaluation of the STEL-1108 modulator ASIC, and provides both burst and continuous modulated output, enabling more timely lab simulations. The STEL-9244 burst demodulator is a board-level assembly for demodulation of upstream burst QPSK signals at the cable headend site.

Reader service #312

Headend controller

LanCity has developed a 750 MHz headend controller that is said to offer a 60% reduction in physical rack space and as much as 50% decrease in per-cable-modem headend integration costs. Dubbed the Headend Controller, the product provides minimal rear wiring connection in addition to remote access anywhere on the network.

It is contained within a 3.5-inch side-by-side rack and offers a 60% space-saving reduction in headends over previous multiple devices taking 9 inches of space.

Reader service #311

Fiber monitoring

The Smart LGX fiber test and surveillance system from Lucent Technologies integrates surveillance and monitoring capabilities with existing network administrative capabilities to provide a comprehensive cable management system.

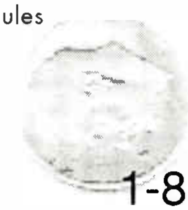
The system includes remote fiber testing capabilities coupled with proactive, continuous performance monitoring. Test results that detail fiber fault location and associated geographical landmarks are integrated with a data base of circuits, customers and other network configuration data. Results are constantly compared against baseline performance requirements and alarms are generated in response to service-threatening or service-interrupting conditions.

Reader service #310

Drill screw drives into wood or screws into metal or AC shingles. Holds where nails pull out.

Super hard nail drives into wood, concrete, mortar or brick.

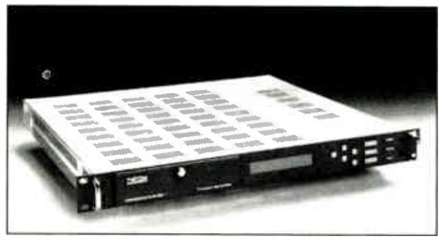
Reader Service Number 208



Reader Service Number 53

Multiplexer

New from TV/COM is the DVB/ MPEG-2 compliant transport multiplexer (TMUX) that multiplexes up to four multichannel transport streams into a single transport stream. This capability allows full 54 MHz bandwidth transponder utilization.



The unit is said to be especially useful for digital satellite uplinks and cable headends and for digital broadcast networks requiring video servers, redundancy and/or full transponder utilization. While each of the company's universal services processors digitally multiplex video, audio and data into one transport stream, the TMUX remultiplexes up to four USP DVB/ MPEG-2 compliant transport streams into a single transport stream.
Reader service #309

Higher output

Wavetek announced that all its Stealth forward and reverse sweep transmitters will now have standard +50 dBmV output capability. The output range will change from +10 through +40 dBmV to +20 through +50 dBmV. For sweep technicians, this is said to ensure more accurate testing in areas with large test point and internal losses prior to the actual reverse amplifier input. It also will permit a larger number of nodes to be combined on the input of the reverse sweep unit.
Reader service #308

Test set option

Recently unveiled by Tektronix was a new option for its CTS750 SDH portable test set. The new jitter and wander generation/analysis option allows operators deploying new services to assess the impact of timing, pointers and jitter/wander on the voice, data and video services carried to end users.

The option card provides SDH/ PDH jitter and wander testing from 2.048 Mbit/s to 622 Mbit/s. It addresses concerns about network timing and synchronization often found in synchronous networks.
Reader service #307

F-connector

Trompeter Electronics introduced a new one-piece, field-terminable F-connector, the PL130C. The one-piece body and integrated center contact pin is said to provide high-performance two-way transmission for all indoor headend applications.

The return loss is <-36 dB at 1 GHz and <-23 dB at 2 GHz, compared to the typical <-18 dB at 1 GHz.
Reader service #306

SCTE MEMBERSHIP APPLICATION

NAME: ______________________ PHONE: ______________________
MSO: ______________________ FAX: ______________________
COMPANY: ______________________ TITLE: ______________________
ADDRESS: ____
CITY: ______________________ STATE: __________ ZIP: __________
ON-LINE ADDRESS: __________ HAM RADIO CALL SIGN: __________

Affiliation: ☐ Cable ☐ Telephone ☐ Other: __________

Job Description: ☐ Manager/Administrator ☐ Installer ☐ Engineer ☐ Operations ☐ Sales ☐ Technician ☐ Financial ☐ Construction ☐ Other: __________

Membership Type: ☐ Individual @ $40 ☐ International @ $60* ☐ Sustaining Member Co. @ $250
**Applicants from outside the U.S. include an additional $20 for mailing expenses.*

Make checks payable to SCTE, or include MasterCard or Visa information below. Please make payments in U.S. funds, drawn on a U.S. bank. SCTE is a 501 (c) (6) non-profit professional membership organization. Your dues may be tax deductible. Consult your local IRS office or tax advisor. Additional member material will be mailed within 30 days. Dues are billed annually.

An Individual SCTE member will receive all standard benefits of membership. A Sustaining member is listed under the company name and has one contact person who is afforded all benefits of an individual membership. Sustaining member companies are given discounts while exhibiting at the SCTE Cable-Tec Expo.

Type of Card: ☐ MasterCard ☐ Visa Card#: __________
Exp. Date: __________ Signature: __________
Sponsoring Chapter or Meeting Group: __________
Sponsoring Member: __________

Send Completed Application to: SCTE, 140 Philips Road, Exton, PA 19341-1318 or Fax to: (610) 363-5898

Complimentary Subscription Application

☐ YES! I want to receive/continue to receive a **FREE** subscription to *Communications Technology*, SCTE's Official Trade Journal. ☐ NO

Signature ______________________ Date ________
(Signature and date required by U.S. Postal Service.)

B. Please check the category that best describes your firm's primary business (check only one):

Cable TV Systems Operations combined
- 03.☐ Independent Cable TV Systems
- 04.☐ MSO (two or more Cable TV Systems)
- 05.☐ Cable TV Contractors
- 06.☐ Cable TV Program Networks
- 07.☐ SMATV, DBS Operator
- 08.☐ MMDS, STV or LPTV Operations
- 9A.☐ Microwave
- 9B.☐ Telecommunications Carrier
- 9C.☐ Electric Utility
- 9D.☐ Satellite Manufacturer
- 9E.☐ Satellite Distributor/Dealer
- 9F.☐ Fiber-Optic Manufacturer
- 10.☐ Commercial TV Broadcasters
- 11.☐ Cable TV Component Manufacturers
- 12.☐ Cable TV Investors
- 13.☐ Financial Institutions, Brokers & Consultants
- 14.☐ Law Firm or Govt. Agencies
- 15.☐ Program Producers, Distributors and Syndicators
- 16.☐ Advertising Agencies
- 17.☐ Educational TV Stations, Schools and Libraries
- 18.☐ Other (please specify) __________

C. Please check the category that best describes your job title: (check only one)
- 19.☐ Corporate Management
- 20.☐ Management
- 21.☐ Programming

Technical/Engineering
- 22.☐ Vice President
- 23.☐ Director
- 24.☐ Manager
- 25.☐ Engineer
- 26.☐ Technician
- 27.☐ Installer
- 28.☐ Sales
- 29.☐ Marketing
- 30.☐ Other (please specify) __________

D. Which one of the following best describes your involvement in the decision to purchase a product/service? (check only one)
- 31.☐ Recommend
- 32.☐ Specify
- 33.☐ Evaluate
- 34.☐ Approve
- 35.☐ Not involved

The following is a listing of some of the videotapes currently available by mail order through the Society of Cable Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers must add 20% when ordering.

☛ *Category VII Review Course: Engineering Management and Professionalism*—Category VII Curriculum Committee Chairman Wendell Bailey presents an in-depth discussion of this BCT/E certification category. (1 hr.) Order #T-1048, $35. **(Reference for BCT/E Category VII)**

☛ *Channel Deletion and Reprocessing Networks*—This video, produced by Microwave Filter Co. for the SCTE Product-Specific Tele-Seminar Program, explains the construction of RF filters and their applications in cable system headend processing. (30 min.) Order #T-1051, $30.

☛ *Standby Power Supply Maintenance*—Alpha Technologies produced this in-depth program on this important topic, which features company representative Bob Bridge, for the SCTE Product-Specific Tele-Seminar Program. (1 hr.) Order #T-1052, $35.

Note: The videotapes are in color and available in the NTSC 1/2-inch VHS format only. They are available in stock and will be delivered approximately three weeks after receipt of order with full payment.

Shipping: Videotapes are shipped UPS. No P.O. boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: a $15 surcharge will be collected on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required, or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 140 Philips Rd., Exton, PA 19341-1318 or fax with credit card information to (610) 363-5898.

November

5: Scientific-Atlanta technical course, "Analog Headend Technology," Atlanta. Contact Kim Davis-Mitchell, (800) 722-2009, press 3.

6: Scientific-Atlanta technical course, "Analog Headend Design," Atlanta. Contact Kim Davis-Mitchell, (800) 722-2009, press 3.

7: SCTE Great Plains Chapter seminar, test equipment use with TDRs, cable locators and fiber-optic test equipment, Courtyard Cafe, Bellevue, NE. Contact Randy Parker, (402) 292-4049.

7: SCTE Lake Michigan Chicago Chapter seminar, installer safety, Days Inn, Grand Rapids, MI. Contact Steve Kuk, (800) 544-5368.

7-8: Scientific-Atlanta technical course, "Operating Analog Headend Systems," Atlanta. Contact Kim Davis- Mitchell, (800) 722-2009, press 3.

11: SCTE Old Dominion Chapter annual membership meeting and seminars, cable, telephone and the return path, and BCT/E Category IV tutorial—distribution systems, BCT/E and Installer exams. Contact Margaret Fitzgerald, (800) 231-0237.

12: SCTE Cascade Range Chapter seminars, BCT/E Category III—Transportation Systems tutorial, BCT/E Category VII—professionalism and management tutorial, and EAS systems, Holiday Inn, Wilsonville, OR. Contact Cindy Welsh, (503) 667-9390, ext. 226.

12: SCTE Desert Chapter seminar, SONET/ATM, El Rancho, Beaumont, CA. Contact Bruce Wedeking, (909) 677-2147.

12: SCTE Mid-South Chapter, BCT/E and Installer exams, Time Warner Cable office, Memphis, TN. Contact Kathy Andrews, (901) 365-1770, ext. 4110.

12: SCTE Pocono Mountain Chapter seminar, fiber management and applications, Holiday Inn, Hazelton, PA. Contact Robert Trently, (717) 493-2605.

12-14: SCTE Wheat State Chapter, BCT/E exams, Wichita, KS. Contact Joe Cvetnich, (316) 262-4270.

13: SCTE Badger State Chapter seminar, broadband outside plant, Holiday Inn, Fond du Lac, WI. Contact Brian Revak, (715) 493-2605.

13: SCTE Golden Gate Chapter seminar. Contact Mark Harrigan, (510) 927-7060.

13: SCTE New England Chapter, Installer exams, Worcester, MA. Contact Tom Garcia, (508) 562-1675.

13: SCTE Southern California Chapter seminar, Time Warner Cable office, Chatsworth, CA. Contact Tom Colegrove, (805) 252-5280.

13: SCTE West Virginia Mountaineer Chapter, Ramada Inn, South Charleston, WV. Contact Steve Johnson, (614) 894-3886.

14: SCTE Satellite Tele-Seminar Program, "Telephony 101 (Part I)" from Expo '95 in Las Vegas, NV, to be shown on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Contact SCTE national headquarters, (610) 363-6888.

14: SCTE West Virginia Mountaineer Chapter seminar, Holiday Inn, Bridgeport, WV. Contact Steve Johnson, (614) 894-3886.

15: SCTE Chaparral Chapter seminar, TVI, Albuquerque, NM. Contact Rick Padilla, (505) 761-6290.

16: SCTE Cascade Range Chapter, BCT/E exams, McMinnville, OR. Contact Cindy Welsh, (503) 667-9390, ext. 226.

18-19: SCTE Regional Training Seminar, "Introduction to Telephony" Greensboro, NC. Contact SCTE national headquarters, (610) 363-6888.

19: SCTE Sierra Chapter seminar, telephone services on coax networks, Sacramento Cable Office, Sacramento, CA. Contact Andy White, (707) 448-7478.

20-22: SCTE Regional Training Seminar, "Introduction to Fiber Optics" Greensboro, NC. Contact SCTE national headquarters, (610) 363-6888.

20: SCTE Oklahoma Chapter, BCT/E exams, Norman, OK. Contact Oak Bandy, (405) 364-5763, ext. 249.

20: SCTE Piedmont Chapter seminar, headend operation and maintenance, and annual membership meeting, BCT/E exams, Hickory, NC. Contact Mark Eagle, (919) 220-3889.

20: SCTE San Diego Chapter meeting. Contact Kathleen Horst, (310) 438-0295.

21: SCTE Greater Chicago Chapter seminar, BCT/E Category II—Video and Audio Systems tutorial, Holiday Inn, Willowbrook, IL. Contact Joe Thomas, (815) 356-6105.

21: SCTE Penn-Ohio Chapter 5th annual SCTE & SBE Broadcaster Forum, Sheraton Inn North, Pittsburgh. Contact Marianne McClain, (412) 531-5710.

Planning ahead

Jan. 9-11, 1997: SCTE Conference on Emerging Technologies, Nashville, TN. Contact (610) 363-6888.

Feb. 19-21: Texas Cable Show, San Antonio Convention Center, San Antonio, TX. Contact (512) 474-2082.

March 16-19, 1997: NCTA Cable '97, New Orleans. Contact (202) 775-3606—exhibitor information; (202) 775-3669—other information.

June 4-7, 1997: SCTE Cable Tec-Expo '97, Orlando, FL. Contact (610) 363-6888.

CABLE TRIVIA

By Rex Porter

Our historical guru (aka Editor Rex Porter) has provided us with these trivia questions on the cable industry. Answers to the last set of questions appear first. (The last "Cable Trivia" ran on page 106 of the October issue.) Look for answers to this month's questions in a future issue (along with a new set of 10 questions). The person supplying the most correct answers will be awarded a special Trivia T-shirt. You may only win once per calendar year.

To be in the running for a prize, your answers need to be postmarked, faxed or e-mailed to us by the 20th of the month of the issue date that the specific trivia test appears in. The first person who sends in the most correct answers will be the award winner. Good luck!

Your answers need to be sent to: The Trivia Judge, *Communications Technology*, 1900 Grant St., Suite 720, Denver, CO 80203; fax: (303) 839-1564; e-mail: CTmagazine@aol.com.

Trivia #10 answers

1) Vic Tarbutton
2) Jim Stillwell
3) J.C. Sparkman
4) SSS
5) Robert Luff
6) Spencer Kaitz
7) Maynard Polkinghorn
8) Dan Pike
9) James Palmer
10) Donn Nelson

1) This company had a division named "SAFE" (Spectrum Analysis and Frequency Engineering), providing engineering of paths, routes and frequencies for terrestrial or satellite. It is:

A) General Instrument
B) Scientific-Atlanta
C) Boeing
D) Rockwell International

2) His hobby is photography. But one of his needlepoint projects hangs on his office wall reading "God Bless Our P&L." He is:

A) Burt Harris
B) Rick Michaels
C) Kyle Moore
D) Bob Miron

3) In October 1978 when Phil Donahue asked QUBE viewers in Columbus, OH, to respond to the question, "Do you like me?", how many responded "Yes"?

A) 27%
B) 11%
C) 89%
D) 100%

4) The first "Technology for Technicians" seminar was held Sept. 12-14, 1988, at the Harvey Hotel in:

A) Dallas
B) Chicago
C) Nashville, TN
D) Philadelphia

5) K-14 was a type of early:

A) Cable
B) Single-channel amplifier
C) UHF frequency allocation
D) Electronic tube

6) With a BSEE and MSEE from the Georgia Institute of Technology, he is known as an outstanding speaker on video. Author of many technical papers, he won the National Cable Television Association's 1977 Outstanding Engineering Achievement Award and is a member of the Society of Cable Telecommunications Engineers' Hall of Fame. He is:

A) Dave Large
B) Alex Best
C) Richard Green
D) Bob Luff

7) With a BA from Rice University and an MBA from Harvard Graduate School of Business Administration, he wrote "Expanding to 17 Channels" in 1970 and "A Method for Appraising Cable Television Systems" in 1971. He is:

A) Bill Hinton
B) James Hirschfield, Jr.
C) James Heyworth
D) Charles Henry

8) He built some of the very first CATV tube-type amplifiers, in New Boston, PA, after graduating with an EE from Penn State University. He developed pressure taps, broadband line amps, VHF/UHF converters and even developed an electric vehicle motor control. He is:

A) Bob Tarlton
B) Paul Habenicht
C) Luther Holt
D) James Coste

9) He has a bachelor's degree in science. He was a vice president of Continental Telephone Transmission, worked for Cypress Comm, and was responsible for the first interactive TV system in Reston, VA. He is:

A) Frank Drendel
B) John Egan
C) Jim Emmick
D) Irv Faye

10) He holds a BSEE from Drexel University. He was project manager for Channel Master, chief engineer for Peca Inc., and senior engineer for Jerrold Electronics. He is a member of the SCTE and coauthor of "Microprocessor Control for CATV Test Instruments." He holds patent for simultaneous sweep testing method. He is:

A) Bob Hayward
B) Sid Fluck
C) Mike Jeffers
D) Ken Simmons

And the winner is ...

For last month's Trivia #10, Bob Toner of Toner Cable Equipment sent in the most correct answers. Congratulations and a t-shirt go to Bob!

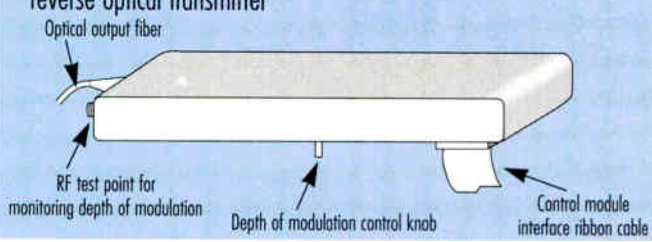
By the National Cable Television Institute

Reverse optical transmitters: Part 2

This is the second part of a series on reverse optical transmitters. Its purpose is to provide useful information complemented by training suggestions to reinforce the material in a classroom setting. The top portion is excerpted from a lesson in NCTI's Fiber Optic Technician Course. The hands-on training suggestions are modeled after NCTI's new facilitator training courses for administering hands-on labs. Part 1 covered theory of operation. © NCTI.

Controls: Jerrold, Philips, Scientific-Atlanta, Texscan and most other reverse optical transmitters are aligned at the manufacturing plant. Field alignment or adjustment is usually not recommended by manufacturers, such as Jerrold and Texscan. Other reverse optical transmitters can be adjusted or aligned in the field. For example, the depth of modulation of the C-COR return optical transmitter can be field-adjusted, if necessary, using the depth of modulation control knob shown in Figure 1.

Figure 1: The depth of modulation control knob on the C-COR reverse optical transmitter



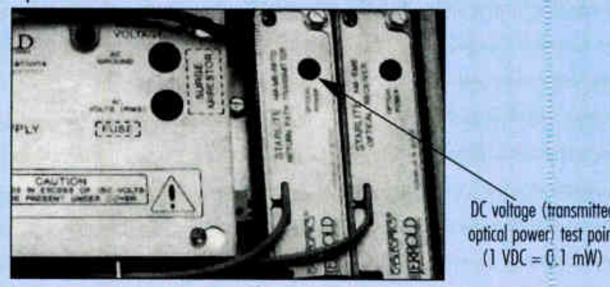
Courtesy of C-COR Electronics Inc.

Test points

Reverse optical transmitters have a DC voltage test point corresponding to the reverse optical transmitter output power level. The test point location is shown in Figure 2 for the Jerrold AM-RPTD return path transmitter.

A reverse optical transmitter's DC voltage test point output is calibrated to an optical power level in dBm. For example, the Jerrold AM-RPTD's test point is calibrated so that a 0.1 mW change in transmitter output optical power equals a 1 VDC change at the test point.

Figure 2: DC voltage test point on Jerrold AM-RPTD reverse optical transmitter



Courtesy of Jerrold/General Instrument

Figure 3A contains the formula for calculating the optical power level at the output of a return path transmitter with a 1 VDC/0.1 mV ratio using that transmitter's DC test point voltage. To calculate the optical output power in dBm using a DC test point voltage of 4 VDC, follow the calculations in Figure 3B: 1) multiply the measured DC voltage times 0.1 to obtain a quotient; 2) calculate the log of that quotient to obtain a resultant; and 3) multiply that resultant by 10.

The formulas for calculating optical power levels using DC test point voltages vary among brands. Always follow the manufacturer's recommended formula for calculating optical power levels.

Figure 3: Converting DC test point voltage to optical power level for Jerrold AM-RPTD

A

Optical power level in dBm = 10 log (Test point voltage x 0.1)

B

Optical power level in dBm = 10 log (4.0 VDC x 0.1)
= 10 log (0.4)
= 10 (-0.398)
= -3.98 dBm

Courtesy of Jerrold/General Instrument

Next month, reverse optical transmitter specs will be covered. Also included will be a quiz on this series.

Hands-on performance training

***Proficiency objectives:** Identify reverse optical transmitter controls and DC voltage (transmitted optical power) test point, and calculate optical power in dBm.*

Make sure students understand that all optical transmitters generate invisible laser light at dangerous optical power levels and that they should never look into any type of laser or the end of an exposed optical fiber attached to one.

Use one of your system's reverse optical transmitters to show students controls and test points, as applicable.

Have students locate the DC voltage test point, and determine the VDC/mW ratio to use in calculating the optical power level on your reverse optical transmitter.

Verify that each student can identify any controls and the DC voltage test point, and knows how to calculate the optical power level of your return path transmitter(s). **CT**


A WHOLE NEW BREED
OF FIBER OPTIC CLOSURE.™
3
1
2
4
5
COYOTE™
CLOSURE
1 Fiber management system includes splice trays for mass or single fusion and mechanical splicing.
2 Three-section end plate has six cable entry ports, captive nuts and bolts, strength member tie off and isolated grounds.
3 Durable glass-filled high-density thermoplastic shells. Two diameters, 6.0", 8.5". Built-in shell stabilizers and air valve.
4 Field-proven, permanent neoprene gasket sealing system. No re-entry kits needed. No flame required to break the seal or to install.
5 LOCK-TAPE™ Sealing System ensures a tightly, permanently sealed end plate assembly and maximum shear strength to resist pull out.
THE ONE AFFORDABLE CLOSURE THAT GOES WHEREVER YOUR FIBER OPTIC CABLE TAKES YOU. AERIAL, UNDERGROUND, BURIED, VAULT, BUILDING ENTRANCE, OR SPLICE BOX.
COYOTE™
CLOSURE
PREFORMED LINE PRODUCTS
P.O. Box 91129 Cleveland, OH 44101 U.S.A. 216/461-5200 Fax 216/442-8816
©1995 Preformed Line Products. All rights reserved.
Reader Service Number 25

Don't be puzzled by digital transmission.

NEW! QAMalyze it!

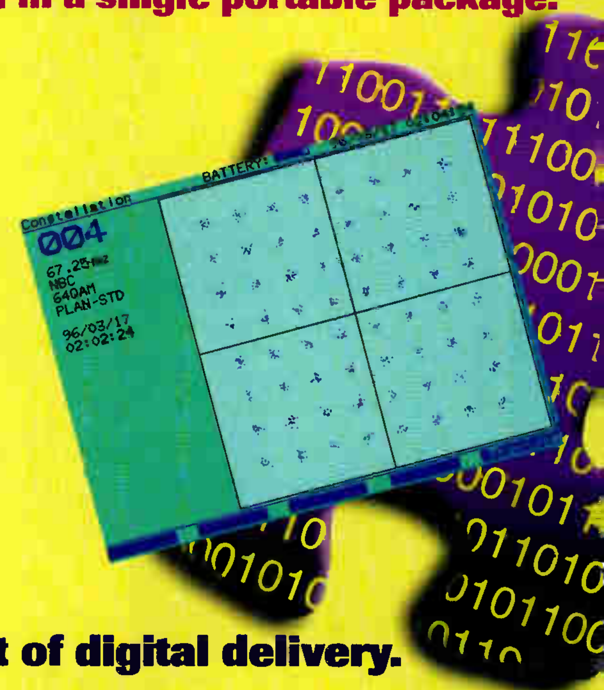
QAMalyzer™ Digital Signal Meter
The first portable 64 QAM digital transmission analyzer.

- ✔ Qualify your system before digital introduction
- ✔ Smooth the installation process
- ✔ Maintain your digital network after roll-out

The QAMalyzer™:

- ✔ Identifies interference for 64 QAM and other digital signals
- ✔ Indicates bit error-rate
- ✔ Provides spectrum displays
- ✔ Measures signal level

. . all in a single portable package.



Avoid repeated service calls. The QAMalyzer™ provides a System Margin measurement to tell how close (in dB) your system is to freeze frame video failure. Conventional test equipment cannot provide these measures.

See the problem. A patent pending Online-Ingress-Check™ reveals ingress hidden under the online digital channel.

Graphics and numeric displays. All results can be stored and transferred to a PC or printer.

QAMalyzer™ - taking the mystery out of digital delivery.

Applied Signal Technology, Inc.

See us at the Western Cable Show Booth #4767

Reader Service Number 35

400 W. California Ave.
Sunnyvale, CA 94086
(800) 374-3560
Email: customer@appsig.com
http://www.appsig.com

Broadband Training

A comprehensive, broadband technology seminar

Seattle, Washington	February 19-21, 1997
Concord, California (Vendor's Day)	March 5-7, 1997
Orange City, California	March 12-14, 1997
Phoenix, Arizona	March 19-21, 1997
Dallas, Texas	April 2-4, 1997
Denver, Colorado	April 9-11, 1997
Indianapolis, Indiana	April 16-18, 1997
Toronto, Ontario, Canada	April 30-May 2, 1997
Ottawa, Ontario, Canada	May 7-9, 1997
Montreal, Quebec, Canada	May 14-16, 1997

Includes hands-on training in Philip's mobile classroom, simulating a complete hybrid fiber coax (HFC) system.

For Information/registration, call:
1.800.448.5171
In NY State: 1.800.522.7464
Philips Broadband Networks, Inc.
100 Fairgrounds Dr., Manlius, NY 13104

Let's make things better.

PHILIPS

TRAINING

Learn to splice, test, connect and troubleshoot a fiber optic network.

970-663-6445

Fiberlight International
2100 W. Drake #269
Ft. Collins, Colorado
80526

See The Training Column on Page 116

NMI Management & Training Services
30 Kingwood Rd.
Oakland, CA 94619

SAVE $$$ ON UNNECESSARY PLANT RELOCATION COSTS!

RIGHT OF WAY TRAINING

The most comprehensive and cost effective right of way training available.

You will learn:

- Why easements are necessary
- How to write and interpret easements
- To read and understand legal descriptions of real property
- Basic real property law
- To **negotiate** with property owners and governmental agencies
- How to read and comprehend tax assessor's maps and ownership information
- How to comprehend franchise rights and obligations
- The best way to handle **trespass complaints** (when your company is the trespasser)
- The pitfalls of verbal permission to occupy private property

The 1984 Cable Act provides a great deal of protection; however, **your company needs more than the act provides.** Our class is four and one half days in length and **is only $975 per student.** Call for a complete brochure and schedule. **Classes taught nationwide. References and client list available.**

BUY | SELL | REPAIR | MFG | UPGRADE | Scientific Atlanta

dB-tronics

Upgrading or adding channels?
Contact us for all your equipment needs.

SA II Amps · *Fiber Optics* · *Videociphers*
Addressable Converters · *S-A, C-COR EQ's* · *Magnavox Upgrades*

864-574-0155 • Fax 864-574-0383 • e-mail sales@dbtronics.com
http://www.dbtronics.com

PYRAMID

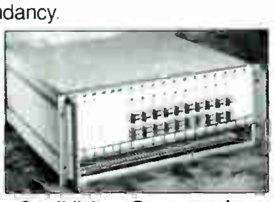
Is Quality Construction

Pyramid Industries offers **Quality** Smoothwall, Ribbed or Corrugated Innerduct at **competitive prices** and **immediate** delivery, contact your local distributor or call us at: **814-455-7587**.

PYRAMID INDUSTRIES INC.
1422 Irwin Dr. Erie, PA 16505 • 814/ 455-7587 Fax 814/ 454-8756

Singlemode Optical Switches
Switchable Optical Splitters

- Corning Multiclad™ coupler technology used exclusively.
- Lowest loss Optical Switches in the world.
- Switchable Optical Splitters save 50% of the optical power required for route redundancy.



OptiVideo Corporation
5311 Western Avenue,
Boulder, Colorado 80301
TEL: 303-444-2160 FAX: 303-444-2242

Emergency Alert Systems By

IdEA/ONICS

TO MEET THE FCC MANDATE or
For local franchise requirements
Complete Audio and Video or
Audio only systems available.
Compatible with all headends.
Affordable

IdEA/ONICS

The Pioneers in Emergency Alert Systems
(701) 786-3904
Fax: (701) 786-4294

IF YOUR LIGHT IS OUT, YOU COULD BE FINED!

Avoid Costly FCC Fines with CFT's

TowerSentry™

For more information on how to put TowerSentry™ to work for you, call...
1-800-448-8099

Tower Light and Transmitter Monitoring Specialists

WE BUY SCRAP CATV CABLE

MIDWEST CABLE SERVICES

800-852-6276

10 YRS OF NATIONWIDE SERVICE

PO Box 96 Argos, IN 46501

CDS CAD DRAFTING SERVICES, INC.

Charles Wright
(815) 698-2564
Rt. 116 & I-57, Central Plaza
Ashkum, IL 60911

- Base Mapping
- Strand Mapping
- Digitizing Services
- As-Built Mapping
- System Design
- System Walkout

Specializing in high volume precision drafting.

"Quality service for all your cable drafting and design needs."

Call for literature.

CABLE CONSTRUCTORS, INC.

COMPLETE TURNKEY CONSTRUCTION 1-800-338-9299

- Coaxial and Fiber
- Mapping and Design
- Member SCTE
- Splicing and Activation
- Fusion Splicing
- Aerial, Underground & Fiber Construction
- Material Supply
- Emergency Fiber Restoration
- System Sweep
- Proof of Performance
- Turnkey Headend
- Complete Turnkey Project Management

quality service performed on a timely basis

RETURN PATH ACTIVATION

TSB

- HEADEND SERVICES
  - COMPLETE HEADEND RELOCATION SERVICE
  - RERACK AND REWIRE
  - OPTIMIZE
- FCC PROOF OF PERFORMANCE
  - RF PROOFS
  - VIDEO TRIANUAL PROOFS
- RETURN ACTIVATION
- ON SITE TRAINING
- DESIGN AND DRAFTING
  - AS BUILT MAPPING
  - SYSTEM DESIGN
  - MAP MANAGEMENT AND SYSTEM UPDATES

P.O. Box 305
Ipswich, S.D. 57451
(605) 426-6140

800-292-0126

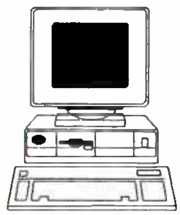
BRIDGEPOINT

COMMUNICATIONS INC.

Aerial	Underground
New Build	Rebuild
Fiber Placement	Upgrade Splicing
Installations	Splicing

(800) 766-2188

DALLAS • HOUSTON • PHOENIX • BOSTON • HONOLULU



ANNOUNCING PCMS

A PC character generator for under **$500!**

VERY EASY TO USE

Does not require Windows

Optional VCR controller.

Full color graphics / remote entry / multiple users

Dickel Communications
5208 E. Hanbury
Long Beach, CA 90808

call today
FAX 310-496-4716
Tel. **310-496-0674**

---

130 SPECIALIZED TRUCKS IN STOCK

1100

(10) Telsta-Versilift 1 Ton Buckets In Stock
(10) Digger Derricks Etc.
(50) 28 To 75 Ft Bucket Trucks In Stock

Call For Price List: (215) 721-4444 Fax: (215) 721-4350

Opdyke Inc.
Truck & Equipment Sales
3123 Bethlehem Pike
Hatfield, PA 19440 USA

We Buy Surplus Trucks

TKR REPAIR CENTER *Quality Repair at Competitive Pricing*

REPAIRS & SALES

- *In Warranty Repair*
- *Jerrold Addressable Repair Specialist*
- *DP5, DP7 & DPV7 / Panasonic 1402, 1403*
- *Remote Repair (URC 450, 550)*

Free delivery & pickup in certain areas

For more information contact:

TKR Repair Center
Tel: (908) 583-2026 • Fax: (908) 290-1677
25 Industrial Drive • Cliffwood Beach, NJ 07735

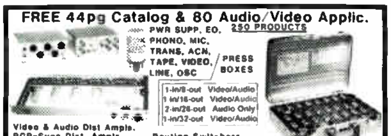
TCI AFFIL.

The January 1997 issue of Communications Technology

closes November 25.

Call Rebekah Markheim before then to stay on 1996 rates.

1-800-325-0156 x33



UNITED STATES POSTAL SERVICE

Statement of Ownership, Management, and Circulation
(Required by 39 U S C. 3685)

1 Publication Title	2 Publication No	3 Filing Date
Communications Technology	0 8 8 4 - 2 2 7 2	10/01/96
4 Issue Frequency	**5 No. of Issues Published Annually**	**6 Annual Subscription Price**
Monthly	12	NONE

7 Complete Mailing Address of Known Office of Publication *(Street, City County, State, and ZIP+4) (Not Printer)*

1201 Seven Locks Road, Suite 100, Potomac, MD 20854

8 Complete Mailing Address of Headquarters or General Business Office of Publisher *(Not Printer)*

7811 Montrose Road, Potomac, MD 20854

9 Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor *(Do Not Leave Blank)*

Publisher *(Name and Complete Mailing Address)*

John O'Brien - 1201 Seven Locks Road, Suite 300, Potomac, MD 20854

Editor *(Name and Complete Mailing Address)*

Rex Porter - 1900 Grant Street, Suite 720, Denver, CO 80203

Managing Editor *(Name and Complete Mailing Address)*

Laura K. Hamilton - 1900 Grant Street, Suite 720, Denver, CO 80203

10 Owner *(If owned by a corporation, its name and address must be stated and also immediately thereafter the names and addresses of stockholders owning or holding 1 percent or more of the total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) (Do Not Leave Blank.)*

Full Name	Complete Mailing Address
Thomas L. Phillips	Phillips Publishing International, Inc.
Robert S. King	7811 Montrose Road
	Potomac, MD 20854

11 Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. If none, check here ☒ None

Full Name	Complete Mailing Address
NONE	

12 For completion by nonprofit organizations authorized to mail at special rates. The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes *(Check one)*
☐ Has Not Changed During Preceding 12 Months
☐ Has Changed During Preceding 12 Months
(If changed, publisher must submit explanation of change with this statement)

PS Form 3526, October 1994 *(See Instructions on Reverse)*

13 Publication Name	14 Issue Date for Circulation Data Below	
Communications Technology	September 1995 - September 1996	
15 Extent and Nature of Circulation	**Average No. Copies Each Issue During Preceding 12 Months**	**Actual No. Copies of Single Issue Published Nearest to Filing Date**
a. Total No. Copies *(Net Press Run)*	28,565	27,550
b. Paid and/or Requested Circulation (1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales *(Not Mailed)*		
(2) Paid or Requested Mail Subscriptions *(Include Advertisers' Proof Copies/Exchange Copies)*	25,023	24,952
c. Total Paid and/or Requested Circulation *(Sum of 15b(1) and 15b(2))*	25,023	24,952
d. Free Distribution by Mail *(Samples, Complimentary, and Other Free)*	1,332	1,318
e. Free Distribution Outside the Mail *(Carriers or Other Means)*	1,163	200
f. Total Free Distribution *(Sum of 15d and 15e)*	2,495	1,518
g. Total Distribution *(Sum of 15c and 15f)*	27,518	26,470
h. Copies Not Distributed (1) Office Use, Leftovers, Spoiled	1,047	1,080
(2) Return from News Agents		
i. Total *(Sum of 15g, 15h(1), and 15h(2))*	28,565	27,550
Percent Paid and/or Requested Circulation *(15c / 15g x 100)*	91%	95%

16 This Statement of Ownership will be printed in the Nov. 1996 issue of this publication. ☐ Check box if not required to publish

17 Signature and Title of Editor, Publisher, Business Manager, or Owner: [signature] VP, Group Publisher — Date: 9-23-96

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions *(including fines and imprisonment)* and/or civil sanctions *(including multiple damages and civil penalties)*.

Instructions to Publishers

1. Complete and file one copy of this form with your postmaster on or before October 1, annually. Keep a copy of the completed form for your records.
2. Include in items 10 and 11, in cases where the stockholder or security holder is a trustee, the name of the person or corporation for whom the trustee is acting. Also include the names and addresses of individuals who are stockholders who own or hold 1 percent or more of the total amount of bonds, mortgages, or other securities of the publishing corporation. In item 11, if none, check box. Use blank sheets if more space is required.
3. Be sure to furnish all information called for in item 15, regarding circulation. Free circulation must be shown in items 15d, e, and f.
4. If the publication had second-class authorization as a general or requester publication, this Statement of Ownership, Management, and Circulation must be published; it must be printed in any issue in October or the first printed issue after October if the publication is not published during October.
5. In item 16, indicate date of the issue in which this Statement of Ownership will be printed.
6. Item 17 must be signed.

Failure to file or publish a statement of ownership may lead to suspension of second-class authorization.

PS Form 3526, October 1994 *(Reverse)*

Place help wanted ads Now for your new hires in 1997.
Call Rebekah Markheim, Classified Manager
1-800-325-0156 x33 or
fax 1-303-839-1564

PLATTE RIVER CABLE

Sweep Tech with construction knowledge to work in southeast Wyoming. Requires valid drivers license. Salary depends on experience. FAX: 1-800-224-3517 or call 1-800-759-8448. EOE.

Cable Search Associates

Professional Search and Placement

Engineering • Management • Technicians • Sales • Marketing • Construction

Call or Write

WICK KIRBY

Office (630) 369-2620 FAX (630) 369-0126
P.O. Box 2347 • Naperville, IL 60567
Fees Paid

Southern Louisiana Interconnect For Sale

Over 10 years. Profitable every year. Large stable base. Send inquiries to P.O. Box 20234, New Orleans, LA 70141-0234.

PERSONNEL SERVICES

ALL LEVELS OF POSITIONS FILLED NATIONWIDE
• Technicians • Engineers • Managers • Sales
Send resume with salary requirement to address below.
Employer Inquiries Invited.

Communication Resources
The Communication Personnel Specialists
Since 1989
P.O. Box 141397 • Cincinnati, OH 45250
606-491-5410 / FAX 606-491-4340

TESINC

6523 N. Black Canyon Highway
Suite 200
Phoenix, Arizona 85015
(602) 242-8110 FAX (602) 242-8227
t•e•s•i•n•c
A Dycom Company

EXPERIENCED CATV POSITIONS AVAILABLE NATIONWIDE

Fiber/Coax Splicers
CATV Make Ready Engineers
Strand Mappers *Project Managers*
CATV Designers *As-Builters*
Installers *CAD Drafters*

An Equal Opportunity Employer

Send Resumes and Call: 1-800-800-7886

Irwin Utilities of Texas, Inc.

Employees & Sub-Contractors
Aerial, Underground, Splicing, and Activation
Several Locations in U.S.
FAX Resume: 214-388-7994

Multilink™

INTERNATIONAL SALES MANAGER AND REGIONAL SALES MANAGER WANTED for growing premise and CATV telecommunications company. CATV and premise wiring experience required. Send resumes to: P. O. Box 955, Elyria, OH 44035, ATTN: Steve.

CATV Tech needed in LA area. 3 years experience as a line or headend tech required. BCT/E or NCTI certification and fiber experience a plus. Must have strong preventative maintenance and troubleshooting skills. Call 302-292-0246., ext. 105 and fax resume to 302-292-8312. Positions available in other areas.

Steve Odell, Technical Operations Manager
Campus TeleVideo
94-A Albe Dr.
Newark, DE 19702
Phone: 302-292-0246, ext. 105
Fax: 302-292-8312

Wanted!

Experienced long term help for Southeast rebuilds/upgrades

Aerial Crews
Underground Crews
Splicers
Installers
Field Engineers

CABLE MAN, INC.
Call (601) 374-5832
Fax: (601) 374-2198

Cable TV Technician

to perform new installs, disconnects & system svc in the Los Angeles area. Phone experience a plus. Full benefits. Vehicle & tools supplied. Fax resume to: (818) 313-9091 or send to 21160 Califa St., Woodland Hills, CA 91367
(Attn: Terence Mulholland)

Peter Froehlich & Co. executive search

SCTE Sustaining Member

P.O. Box 339 Weatherford, TX 76086
(800) 742-4947 FAX (817) 594-1337

All levels of Technical Positions - Corporate to Hourly. Operators and Manufacturers
Call or Write. Fees Paid.

- **TECHNICAL OPERATIONS MANAGERS**
- **SYSTEM ENGINEERS**
- **HEAD-END TECHNICIANS**
- **CONSTRUCTION MANAGERS & SUPERVISORS**

We currently have multiple openings with Top Five MSO's and foreign clients. Please send your resume and salary history to: **Warren, Morris & Madison, Ltd., Attn: Jim Milton, Technical Dept., 132 Chapel St., Portsmouth,NH 03801 or call Jim at 603-431-7929.** An Equal Opportunity Employer

Warren, Morris & Madison, Ltd.

Construction & Line Technicians

Continental Cablevision, a premier telecommunications company is seeking experienced TECHNICIANS for construction and maintenance. Excellent customer service and communications skills are essential. Must have a valid IL drivers license with a good driving record, ability to lift 80lbs., work at heights, in enclosed spaces and outside in all types of weather conditions. Also, must be able to work overtime and on-call. Positions are available throughout the suburban Chicagoland area. Please submit resume to: 688 Industrial Dr., Elmhurst, IL 60126, Attn: HR or fax to: 630-716-2466 or call 630-716-2710. EOE M/F/D/V

AD INDEX

By Bill Riker

SCTE national conferences: Top forums for technical discussion

While it's difficult to even envision planning for beyond the holidays right now, the SCTE national headquarters staff is busy making the final preparations for the 1997 Conference on Emerging Technologies. This year's conference will be held Jan. 8-10 at the Opryland Hotel in Nashville, TN. While the event maintains its broad scope, the overall theme is "data."

Jan. 8 will feature a series of preconference tutorials: "What is ATM?"; "What is Ethernet?"; and "What is TCP/IP?" That evening, SCTE will hold a Welcome Reception sponsored by General Instrument and Jerrold.

The first official day of the conference, Thursday, Jan. 9, will begin with opening remarks to attendees from yours truly. The first three-hour session, "Data over cable—The technology and where it is going" will begin at 9 a.m. The luncheon will feature a keynote speaker discussing "The history of the Internet." The afternoon session, "Data over cable—Applications for new services," and the evening will end with the Polaris Award Reception, sponsored by Corning, *CED* and SCTE.

Friday morning will feature "New science applied to current issues," and "Empirical data and field experiences." A speaker will address attendees at the luncheon on "The history of new business technology equipment." The conference will conclude with "Over the horizon."

Registration

Each year, response to SCTE's Conference on Emerging Technologies has been overwhelmingly positive, with attendees commenting that they find the sessions and panel discussions very valuable and that the technologies discussed bring them up to date on the evolving technologies in the industry. This year, we feel that the focus is on data, and it is our hope that the conference is as effective a learning experience as previous events have been.

Registration packages will be mailed to all national SCTE members this month. Others who would like to attend should call national headquarters at (610) 363-6888.

HFC '96

Another recent forum for high-level technical discussion was the tremendously successful "HFC '96" technical workshop that took place Sept. 25-27 at the Loews Ventana Canyon Resort in Tucson, AZ. The conference was cosponsored by the SCTE and the Institute of Electrical and Electronics Engineers Communications Society, the division of the organization that is devoted to telecommunications, broadcasting and related disciplines.

HFC '96 focused on high integrity hybrid fiber/coax networks and was developed to provide an opportunity for industry experts to discuss the economics of HFC network design and how HFC can become the two-way network of the 21st Century. Common approaches to high integrity HFC network design were discussed, and conference sessions dealt with spectral integrity and protection, survivable network configurations, powering, encryption and security and telecommunications services network integrity specifications.

A tremendous amount of material that is crucial to our industry's development was covered during this program, including:

- Standards and technical requirements for telecommunications
- Transmission spectral integrity
- Transmission availability and security
- Specific HFC broadband services requirements
- Traffic predictions, network sizings, modulation techniques

This was the first time the Society has collaborated with the IEEE Communications Society in this capacity. Attendance at the conference was exceptional, as 75 attendees were expected and 135 actually attended.

The Intersociety Technical Committee on Cable-Based Broadband Access, consisting of many leaders in the telecommunications industry, proposed this technical workshop on the topic of high integrity HFC networks. Committee Chairman Jack Terry, assistant vice president in broadband access at Northern Telecom in Atlanta, headed up the endeavor on behalf of both organizations to present an essential workshop that would address key issues concerning HFC that the industry must plan for in the near future.

Response from those who attended was extremely favorable with several attendees noting that speaker provided "clear explanations" were "articulate" providing "well-presented" topics at the "right level of detail" during sessions that were "very objective and interesting."

You can benefit from the information presented at HFC '96 right now, as audio transcripts of the sessions and copies of the proceedings manual are available through the Society. Plans are already underway for Cable-Tec Expo '97 to be held June 4-7 in Orlando, FL. The program subcommittee has already held its first meeting, toured the Orlando Convention Center, and issued a call for papers with abstracts due Dec. 1.

In addition, the 1997 Exhibitors' Prospectus will be mailed to prospective companies this month. CT

Bill Riker is president of the Society of Cable Telecommunications Engineers.

Who's Watching...

When you're not?

Innovative Status and Performance Monitoring Solutions from Cheetah.

Continuous Monitoring.
The Cheetah System never sleeps. When you are away from your network, rest assured knowing you will be notified of equipment problems or out-of-spec conditions. Should a power supply fail, a modulator deviate from specifications or if system Carrier-to-Noise impacts picture quality, the Cheetah System makes sure you know. And you'll be aware of it before your subscribers call.

Improve Performance.
The Cheetah System helps you manage your network. Monitor headend and distribution devices throughout your multi-vendor plant. Measure ingress and noise on your return path. Fully automate all your performance measurements including non-interfering distortion monitoring, measurements, levels and frequencies. Plus with Cheetah, your network reliability increases, giving you the flexibility, quality and control you require to implement new data and video services.

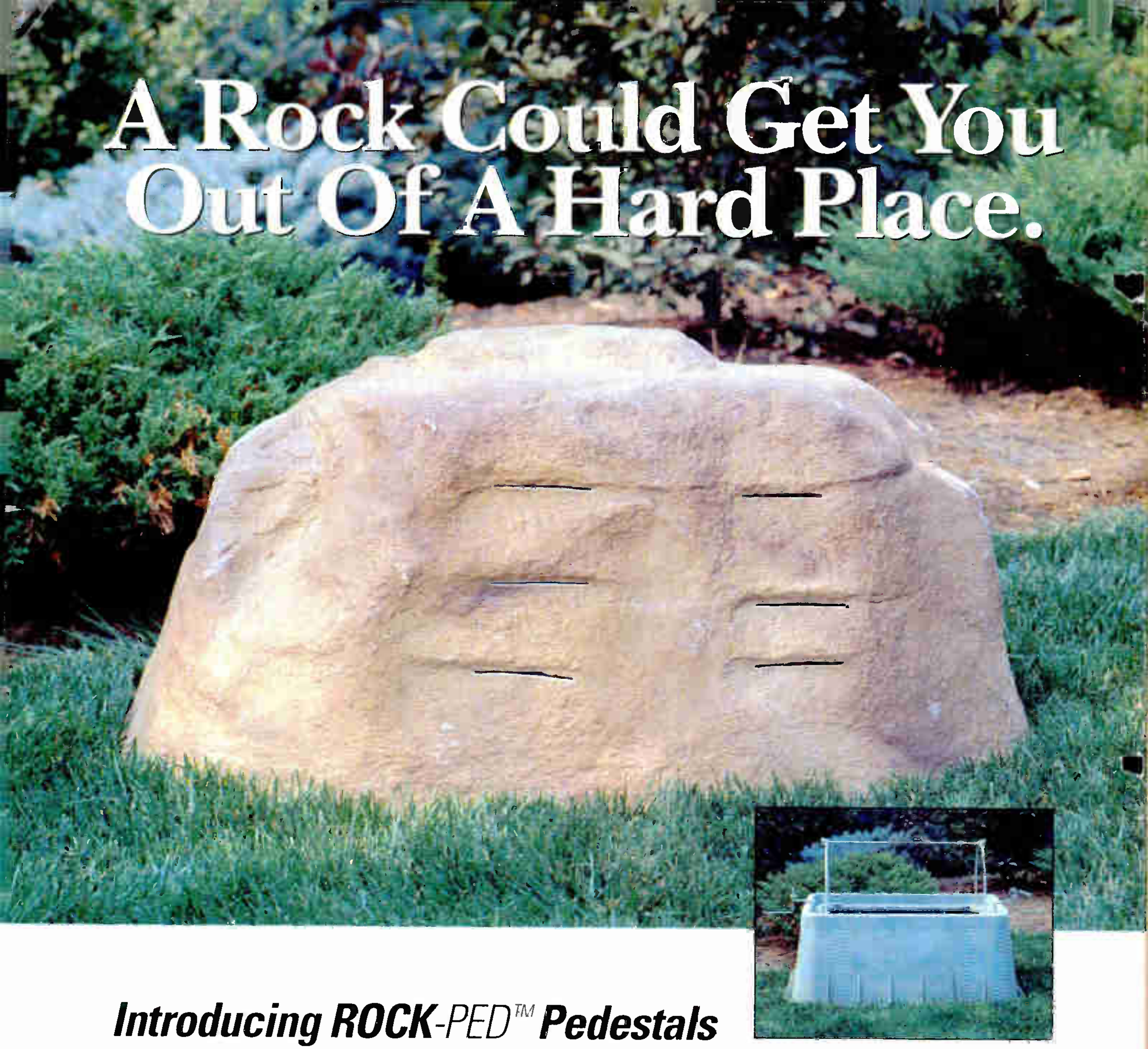
The International Benchmark.
The Cheetah System is a standard around the world. From the Pacific Rim and South Pacific to Europe, Latin America and North America, Cheetah monitors the world's broadband networks. For status and performance monitoring, the Cheetah system will work for you now and in the future. For further information and product literature, call (941) 756-6000 today.

Cheetah™

SUPERIOR ELECTRONICS GROUP, INC.

6432 Parkland Drive • Sarasota, Florida, USA 34243 • (941) 756-6000 • FAX: (941) 758-3800

Reader Service Number 95



Introducing ROCK-PED™ Pedestals

ROCK-PED™ is the perfect solution to customer and municipal requests for an aesthetic alternative for above grade line equipment.

Here Are Some Rock Solid Reasons Why:

- **Real Aggregate Surface**
- **2 Colors** - light granite or sandstone
- **3 Sizes** - complete assemblies for amplifier, L.E. and tap/interconnect
- **Retrofit Kits** - for existing installations
- **Larger Handhole & Top Opening** - for more work area & storage
- **4 Times Stronger** - than polyethylene/ABS
- **UV Stabilized**
- **Ventilated**
- **Maintains Temperature Stability**
- **Various Locking Styles**

For more information and our brochure, call your Multilink Representative today!

Multilink™

Engineered to Make the Difference

580 Ternes Avenue P.O. Box 955,
Elyria, OH 44035

Phone (216)366-6966 - area code subject to change June 1, 1997 to (440).
FAX (216)366-6802

Internet:
http://www.multilinkinc.com/multilinkinc
E-mail: MuLink@ix.netcom.com
24 Hour Voice Messaging
Worldwide Distribution

Rock-Ped™ Brand Pedestal Covers are manufactured utilizing the exclusive Envirostone™ finish, which is a registered trademark of Future Stone, Inc.

Reader Service Number 16