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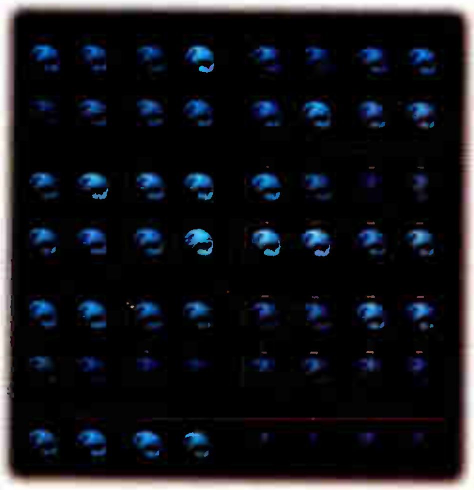
contents

FEATURES



Video and Internet • 42

Women in Technology Award • 82

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contents

Jobs on the Internet • 64

"IP telephony has the potential to offer several value-added services that are not practical with conventional telephone technologies."

Tony Werner
Senior Vice President of Engineering and Technical Operations
TCI

FEATURES continued

DEPARTMENTS

NEWS & OPINION

REFERENCE

COLUMNS

By Rex Porter

Pie in the Sky Or Manna From Heaven?

For half a century, cable operators have had the local broadcasters nipping at their heels.

The broadcasters didn't want cable systems built anywhere, at first. Then, it was okay for cable systems to carry their signals, via microwave, into distant towns and cities.

But God help you if you wanted to bring a cable system to their local coverage area. When we began to plan building in the major markets, local broadcasters attended every local franchise hearing with the message that cable television would run them out of business. At the same time, they were in Washington DC screaming for relief from "any" competition.

Now, direct broadcast satellite (DBS) comes with a plan to transmit 1,700 local broadcast nets and a handful of high definition TV (HDTV) channels to DBS viewers in these same local broadcaster's cities.

That's understandable but what isn't understandable is that the local broadcasters will fund the initial $800 million cost of the project. Capitol Broadcasting Company, headed by James Goodman, will oversee the construction of the uplink sites and deployment of 24-inch dishes.

But the local broadcasters will pay the costs for DBS operators to provide local channels?

I don't remember local broadcasters ever paying any cost for cable operators to offer their programming and local news on the cable system. The edict to the cable operator was to either provide local stations or shut down. With the introduction of digital TV, data and telephony by the cable system, Their plan to have Congress allow the launch of a Ka-band satellite into space, while asking local broadcasters to foot the bill for the added services, is a waste of taxpayer dollars and frequency allocation.

> "DBS will soon be unneeded and unwanted by the public."

As cable systems provide more data services for their customers, will DBS reach out to companies like Microsoft, Motorola, Intel, and other giants to solve their problems with carriage of data? Will AT&T be asked to support their efforts with telephony?

Why would the broadcasters and the DBS people get to be such good buddies, all of a sudden? What's in it for the broadcasters that they would be willing to bear the initial costs of $800 million when you would expect them to be in front of Congress demanding that DBS either carry their local broadcasts or go black?

The broadcasters would win and be ahead $800 million. And have we misjudged the personalities of the "Rupert Murdoch types" all along? This is beginning to be a political soap-opera!

Rex Porter
Editor

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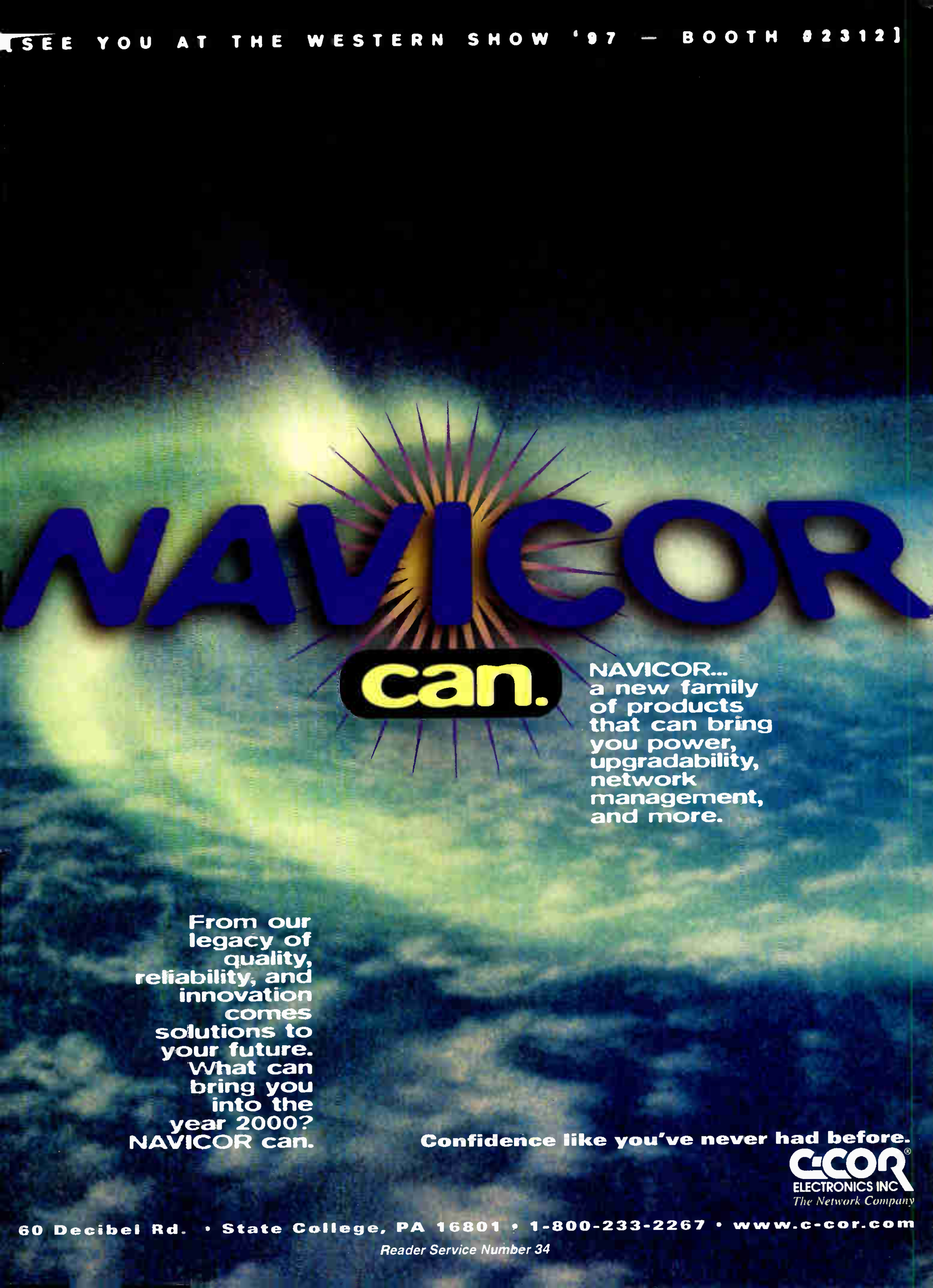
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My Search for the 704

Several years ago I decided I wanted a Jerrold-704 signal level meter. For no specific reason I could give anyone, I wanted a 704. Once I started my search, I quickly learned that locating a 704 was a lot like David Janssen's search for the infamous one-armed man in the '60s TV series, *The Fugitive*. It seemed everyone had seen one but no one could remember where.

Several years passed and no 704. How long would Rex Porter continue to talk to me? How long would Ted Hartson continue to allow me to come into the hallowed meeting hall of the "Loyal Order of The 704"? True, Ron Hranac was still returning my phone calls, but a man can only tolerate so much for so long. I was beginning to worry. I needed a 704. *Really, really bad!*

In June of 1997, I was accepted into the "Loyal Order of The 704." I was "in" but did they realize that I wasn't quite "there" yet? I would have to seriously step up my efforts to locate a 704. I had no desire to join the ranks of George Slats Spelvin as "unaccepted." Maybe I could take a leave of absence from work. Surely they'd understand. I had to have a 704. *Awfully bad!*

I told myself that if was only a box. I told myself maybe I would have better luck looking in Europe. I posted a message on the Internet. I put out feelers to friends. I had to have a 704. *Really, awfully bad!*

September, 1997, found me heading to Hillsdale, MI, on business and still no 704. I had begun to question my technical abilities. After conducting my business in Hillsdale, Roger, the ops manager, wanted to take me upstairs to the attic and show me his secure area for converter storage. OK, why not? We walked into the converter cage and looked around. Nothing unusual here. I walked over to a corner of the room where some old monitors and stuff were piled. Modulators, FM gear, wedgies (lots of wedgies). Then I saw the box. A dirty, dusty box. It wasn't possible. Could it be, after all my looking? I reached down and brushed across the ID plate on the top of the box. Still not quite convinced, I reached down and brushed my thumb across the ID plate on the top of the box: 54-220 MC. Jerrold. Serial Number 7787. Model 704B. *Yesssssss!*

Now, how do I get it out of here? It was too big to stuff under my shirt and I quickly concluded that Roger would probably take offense to my tackling him and forcibly taking the meter. Oh well, here goes nothing. I asked. He said "yes." He said "YES." I had my 704. I left. *Really fast!*

I got it home and began to clean it up. I used the Dremel tool to remove the small rust spots on the hinges and the snaps. I disassembled it and blew the dust and dirt out of the inside. I couldn't believe it. Under that dirt was a mint condition 704. *My 704!*

Now, would it work? It looked OK. I took it out to the garage, backed the cars out and then placed it in the middle of the floor. Where's the fire extinguisher? I plugged it in. I turned it on. No smoke. No smell of burning electronics. After half an hour, all systems were still "OK." I wondered if it would read signal. I took it in the house and connected the cable to it. Amazing! Not only had I found my 704; I had found one that was in mint condition and worked, too. *Unbelievable!* Wait 'til Porter and Hartson see this. I called Hranac and told him he could continue to return my phone calls.

Now it sits on a table in my office. Why? For no other reason than "because." Sure, the people I work with may feel I'm a few bricks shy of a load and my family may believe my boat doesn't float all the way up to the pier. It doesn't matter and I don't care. I have my 704 and getting here has been a lot of fun. The other day I decided I want a 704 with a low serial number. Bad. *Really, really, really bad!*

Jim Kuhns, Regional Engineering Manager, Comcast—Warren, MI


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O'Brien Joins National Cable Television Center and Museum

Beverly Jean O'Brien was recently selected to be vice president of institutional development for the National Cable Television Center and Museum. O'Brien will report directly to Marlowe Froke, Cable Center president. She was most recently director of development and executive director of leaders at the University of Missouri.

MidAmerica Celebrates 40th Year

(TCI's Leo Hindery, left, fields questions from CATA President Steve Effros, right)

The MidAmerica Cable Telecommunications Association celebrated its 40th anniversary at its annual meeting and show held in October. Community Television Antenna Association President, Steve Effros, moderated the open forum with his guest, TCI president Leo Hindery. Hindery pointed out the need for better dialogue between cable operators and their customers and of the lowering of operating costs through such open architectures as the Multimedia Cable Network System (MCNS) specifications and the ability of smaller, rural systems to branch into digital via the use of headend in the sky (HITS).

In other MidAmerica Cable news, Bob Weary was honored by the association recently at its meeting Overland, KS, meeting. Weary is a founder of three cable TV companies: Communications Services Inc., Cable World, and W.K. Communications Inc. He also serves as a two-term director of the National Cable Television Association, as a member of the Presidential Selection Committee and a member of the committee that negotiated cable TV's original copyright law.

At this same event, charter members of the new MidAmerica Pioneers were introduced. "The Pathfinders" are: Hank Bradley; Dave Clark; Pete Collins; Vic Davis; Ed Drake; Doug Fuller; Tom Gleason, Jr.; Jerry Lmape; Ron Marnell, Rob Marshall; Mike Pandzik; Rex Porter; Les Read, Larry Spangler; Dick Thiessen; Bob Weary and Wendell Woody. CT

Observations From the Floor

[The following commentary was contributed by "Communications Technology" Editor Rex Porter while attending the 1997 Eastern Cable Show in Atlanta.]

Milton Underwood works for the Discovery Channel. But I always think of him as a system technician and manager. At the Eastern Cable Show, Milt was given a prestigious "Dunn" award for his years supporting the Eastern Show and the southern cable operators. As I watched Milt accept the award, my mind wandered back to the early '60s. Milt was in charge of the cable systems in the tri-cities of Florence, Sheffield and Tuscumbia, AL. Owned today by Comcast, they were then properties of Teleprompter.

Milt's systems were "early-vintage" low-band systems; ours was state-of-the-art transistorized 12-channel and all-aluminum trunk and feeder. I was tired of working in the system and found an excuse to head up to the microwave tower on Capshaw Mountain to "tweak" the transmitters.

Both our system and Florence shared a common business-band radio frequency, our system being distant enough that we would not interfere with each other. However, up on Capshaw Mountain, I could hear Tri-Cities' transmissions as well as ours. Late in the afternoon, I heard the Florence radio transmitter come to life. The conversation went something like this:

"Base to Unit 1." (I recognized the caller to be the office manager from Florence and not ours.)

"Unit 1 to Base, go ahead."

"Unit One, Mrs. Brown called in and requests a service call."

"Roger."

(About an hour later) "Base to Unit 1."

"Unit 1 to Base, go ahead".

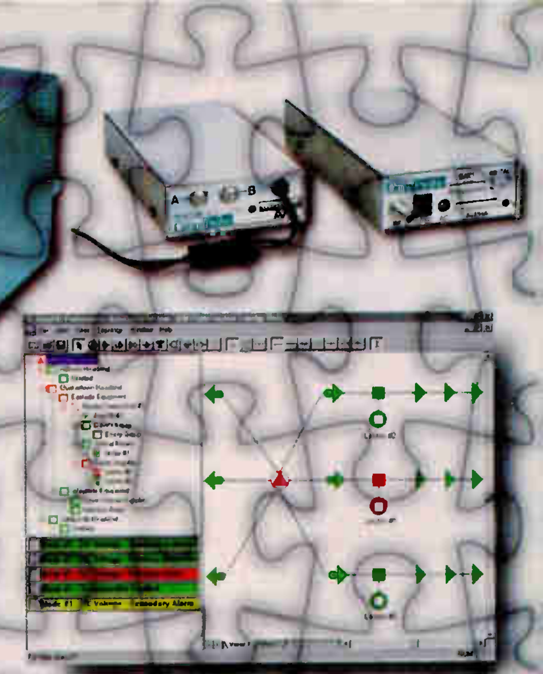
"Unit 1, What was the problem at Mrs. Brown's location?"

"Unit 1 to Base—She didn't have a problem with her service. She said Mrs. Smith, who lives across the street told her she got a service call. Mrs. Smith has only been on the cable for five years or so and Mrs. Brown has been on the cable for over 10 years. Mrs. Brown just felt that, if Mrs. Smith deserved a service call after being on the cable for five years, then someone who has been on the cable for over ten years certainly deserved one."

"Roger. Thanks, Unit 1!"

I listened to this exchange aghast. Sure, these were low-band systems with half our channels. But they had old cables in them. And old tube-type amplifiers. And they have two customers with a total of 15 years on their system without a problem with their pictures? Our system technicians bragged about our state-of-the-art amplifiers, cable and test equipment. Yet, each of our customers seemed to call us every month to complain!

I closed the door to the microwave headend. I got back into my technician van. And I sped back to Decatur to do some more preventive system maintenance.



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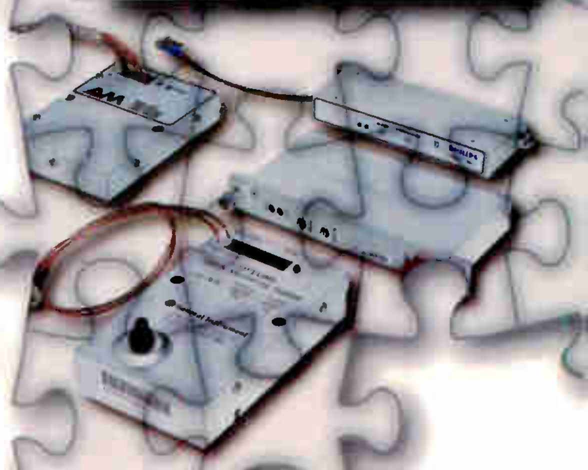

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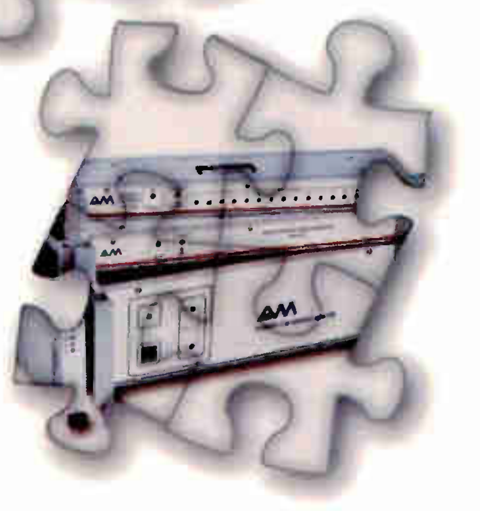

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Technical Sessions Scheduled For the Western Show

The SCTE will coordinate six technical sessions at The Western Show in Anaheim, CA, this month. These sessions will address some of the most important challenges facing today's broadband industry professionals. The SCTE sessions will highlight current information from industry leaders on topics including cable modems, telephony and two-way systems, as well as an update on governmental regulations in telecommunications.

SCTE President Bill Riker will lead a discussion on new technical regulatory developments being considered by the Federal Communications Commission. Representatives from the Federal Communications Commission and the National Cable Television Association will be on hand to review compatibility issues relating to broadband telecommunications.

SCTE At-Large Director Ron Hranac will moderate a session titled "Two-Way Plant: Traveling Down the Road to Success, in Reverse." Hranac, vice president of engineering for Coaxial International, plans to open the discussion on designing and maintaining a two-way cable system.

Jay Junkus, president of KnowledgeLink and an SCTE member, will mediate a discussion titled "Cable Telephony Today: Are the Phones Ringing?" Junkus will provide information to help cable operators prepare for the growing collaboration between the telephone and broadband industries.

A roundtable discussion of network management, led by TCI Director of Advanced Network Management Van Macatee, will feature the newest information on implementing a proactively managed network.

A hot item on everyone's mind these days, cable modems, will be the focus of a technical session led by Ron Wolfe. Wolfe, Regional Director for Cable Engineering, will moderate a panel discussion about the necessary skills and short- and long-term strategies for dealing with a complex new set of job skills.

SCTE's director of training development Alan Babcock will proctor written examinations for Installer and all categories of the Society's Broadband Communications Technician/Engineer (BCT/E) Certification Programs. Western Show attendees can also test their knowledge in SCTE's newest certification programs, Telephony and Service Technician.

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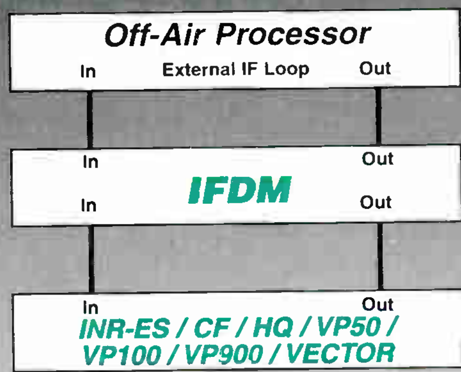

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month's "Broadband Insights '97" in Tampa, FL.

The two-day event, held Nov. 4 and 5 at the Tampa Convention Center, was a non-technical seminar designed to provide participants with an intensive overview of the advancement of cable technology. From the early days of broadband to the future of this dynamic industry, attendees learned more about topics including analog and digital signals, SONET, cable modems, using the Internet and HDTV, among others.

SCTE President Bill Riker kicked off the event on both days with a discussion of the Society's efforts in providing training opportunities and technical certification, and developing industry standards. "SCTE and NextLevel have been co-sponsoring seminars (originally called 'Cable Insights') around the country for several years in order to better educate non-technical industry personnel about the technologies that drive our business," said Riker.

SCTE Fellow Member Wendell Bailey presented "The History of Cable" and "Cable Infrastructure." NextLevel (San Diego) Vice President of Business Development Bob Rast and Vice President of Customer Accounts for NextLevel's Broadband Networks Group Charles Dougherty, both national SCTE members, presented sessions on advanced technologies..

SCTE Director of Standards Speaks at ANSI IISP Meeting

SCTE's director of standards Ted Woo, Ph.D., was a key speaker during last month's meeting of the American National Standards Institute Information Infrastructure Standards Panel (IISP).

The IISP meeting, held Nov. 5-6 in Alexandria, VA, was a forum enabling representatives from various telecommunications industries to identify common issues and interests encountered while sending signals to the Residential Gateway.

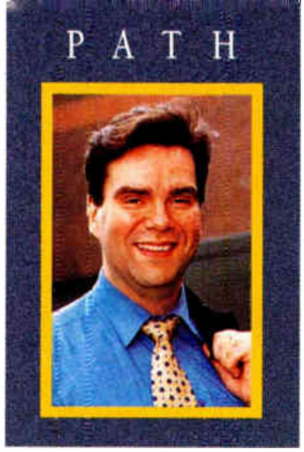
In an overview of the broadband industry, Woo discussed the SCTE Interface Practices Subcommittee's document on recommended practices for on-premise cable installation and performance.

"The residential environment for information and entertainment services could undergo a major transformation in the near future with the emergence of several popular new digital devices," Woo commented. "Set-top boxes, cable modems, digital video disk players, personal computers and television monitors will increase the presence of digital technology while carrying a promise of new or improved household services."

From the perspective of the cable industry, this new digital environment could provide new opportunities for services to be delivered to the aforementioned devices over cable television networks, according to Woo.

SCTE's "On-Premises Wiring for Digital Signal Devices" standards document investigates the possibilities of the new digital environment in the home based upon recent research among cable operators and manufacturers regarding their digital product applications and strategic visions for the future. CT

By Alex Zavistovich



A Ripening Apple and A Stale BLT

I admit it: I have no practical use for PCs. I'm a Macintosh guy. Typically, that would be a secret you'd never tell anyone, like having three nipples. In magazines, it's OK, because publishing's a Mac world. That lesson needs to be learned by more vendors of cable modems.

Although most vendors, when prodded, will grudgingly concede they have a Macintosh model "in the works," most seem to treat Mac cable modems like a red-headed stepchild. That's a shame when you consider the revenue-generating capabilities available to cable operators who eventually intend to use their HFC networks for enterprise-wide LAN and WAN applications.

Businesses that rely on creative desktop applications, like publishers, advertising agencies, and so forth, use Macintosh hardware. They are also most likely to need high-speed transfer and download capability for large files (like magazine pages, print advertisements, music, etc.). Are you getting the big picture here?

Well, the Macintosh contingent seems to be making some headway. In early November I was invited to a demonstration of a new cable modem product line from 3Com, the company that owns U.S. Robotics. USR is one of the biggest producers of analog modem products, cranking them out at the rate of 40,000 or so every day. These folks are coming out with a Mac cable modem by spring. But more about that later.

Through USR, 3Com will be making a massive push into the cable modem market, selling to operators initially, with retail sales of the products expected by early next year. The U.S. Robotics Cable Modem VSP and VSP Plus will be available at retail outlets before spring, at a price point of $199. Charter, Century, and Suburban are among the operators who will be announcing their broadband data services using these Multimedia Cable Network Systems (MCNS)-compliant devices. Macintosh models (outboard only) are slated for introduction at a price in the mid $300s.

The company has some lofty goals: By the end of 1998, 3Com intends to be first in market share in the industry. Longer term, their plans center around their "3 by 3" goal of cranking out one million cable modems per month by the year 2003. If you think that's unrealistic, consider that their analog business is already producing 40,000 telco modems every day, or 1.2 million modems per month. That ain't hay.

> "Two years later, we're still waiting for their highly-touted interoperability specs."

The MCNS specification is helping move cable modems along, no doubt. Even late entrants in the game have seen the wisdom of making MCNS-compliant modems. The week before Thanksgiving, Terayon announced a new modem that offers MCNS operability as part of its "standards-enhanced" package that they say delivers 30 Mbps both downstream and upstream.

What else is hot? Interoperability. Bay Networks (which owns LANcity) and 3Com have entered into an agreement to work toward further compliance with the MCNS specification. Let's hope they have better luck than the Broadband Link Team (BLT) from the Western Show in '95, which included the likes of Lucent Technologies. Two years later, we're still waiting for their highly-touted interoperability specs.

Of course, that group unwittingly undermined cable's own efforts at standardization. CableLabs made sure that BLT was toast, hold the mayo. Richard Green told *CT* at the time in no uncertain terms: Cable operators would drive cable's standardization efforts. This time, the arrangement among the vendors is better received, basically because it supports the MCNS standard. Not surprisingly, CableLabs is quoted extensively in the joint Bay/3Com press release.

Anyway, all of this brings us back to the Macintosh cable modem "in the works" from USR. This is supposed to be an external box with an Ethernet connection. The Mac version will have a maximum data throughput capability of 10 Mbps. The folks at 3Com explained that the cost difference between its PC and Macintosh versions (at 150 bucks, that's not chump change) is due to differences in construction of the two modems. PC boxes can use the memory and processing power of the computer's CPU, making it easy to keep costs controlled. Mac units will be sold only as outboard peripherals. Power supplies, processing and memory need to be built into the devices themselves, driving up costs. (Who do I have to call about this: Apple? U.S. Robotics? Other vendors? Cable operators?)

Am I the only person who thinks that the cable modem market is bigger than just PCs? Hello? CT

Alex Zavistovich is executive editor of "Communications Technology." He can be reached in Potomac, MD, at (301) 340-7788, ext. 2134.

By Ron Hranac

A Unique Approach to Reverse Path Testing

Back in October I had an opportunity to spend an afternoon visiting The Holtzman Company's Tom Williams. Tom has done quite a bit of work characterizing two-way systems, and recently completed development of some very interesting methods to test reverse path performance.

His methods are based on what he calls burst-mode data capture, and allow one to easily evaluate such things as overall subscriber drop shielding from outside the home, and testing the network itself for upstream frequency response, phase response, and group delay.

The required equipment for most of these measurements includes a reference signal transmitter unit, digital signal acquisition unit, a PC, and signal processing software. The Holtzman Company manufactures the reference signal transmitter and the signal processing software. You supply the PC—a 100 MHz or faster Pentium is recommended—and digital signal acquisition unit. This latter item can be a low cost 60 MHz digital oscilloscope such as a Tektronix model TDS 210 with the TDS2CM communications extension module. If you want to do in-field drop shielding tests, you'll also need Holtzman's "Cable Clothespin."

Let's start with network testing. I was particularly impressed with the ability of Tom's method of measuring reverse path group delay, and to a lesser extent phase response (frequency response measurements are probably more conveniently done with existing reverse sweep equipment). When I think of group delay and phase response measurements, vector network analyzers come to mind. Network analyzers are essentially very sophisticated and expensive bench sweep systems normally used in lab environments. Unfortunately, there really isn't an easy way to use a network analyzer to measure an operating cable TV system's reverse path. You'd need to connect one test lead to the headend upstream receiver, and the other test lead somewhere out in the field. Not real practical.

Burst-mode data capture solves this dilemma. Here's a brief overview of how it works. The reference signal transmitter first generates a 5 microsecond duration sine wave at 25 MHz, which is used to trigger the digital oscilloscope. This trigger signal is followed by an 18 microsecond duration burst reference signal, which is what is actually used for network characterization. The digital oscilloscope, which was triggered by the initial 25 MHz sine wave, receives the burst. The received burst is then processed on the PC using Holtzman's signal processing software in order for the user to observe the frequency response, phase and group delay information.

> "There really isn't an easy way to use a network analyzer to measure an operating cable TV system's reverse path."

In a typical application, you would start in the headend by connecting the reference signal transmitter directly to the digital oscilloscope with a two-way splitter. One leg of the splitter is connected to a 25 MHz bandpass filter and the digital oscilloscope's trigger input. The second leg of the splitter is connected to the digital oscilloscope's primary input. Next, you push the reference signal transmitter's test button, and store a reference signal in the digital oscilloscope/PC setup. Now you can go out into the network somewhere, say an end-of-line location, and connect the reference signal transmitter to an unused tap port. Push the transmitter test button, and the trigger and burst reference signal will be sent back through the network to the headend. After a few seconds of manipulation by the PC (actually some very complex digital signal processing including Fast Fourier Transform), the test results will be available.

The importance of good frequency response is fairly well understood, but why should you care about group delay? Before I go on, this might be a good time to provide a simplified explanation of just what group delay is. Consider any signal transmission "network," whether it's a simple bandpass filter, a headend processor, or the entire 50-750 MHz forward or 5-40 MHz reverse spectrum. Ideally, if you're transmitting multiple frequencies through a device or network, you want all of those signals to arrive at the output or receive end at the same time—assuming, of course, they were all transmitted at the same time. If they don't arrive at the output or receive end simultaneously, the time difference between when one arrives and the other arrives is called group delay, and is often measured in nanoseconds. A nanosecond, by the way, is a billionth of a second.

One type of group delay cable operators are most familiar with is chrominance to

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luminance delay inequality. When this occurs, a TV channel's chrominance information and luminance information arrive at the TV set at slightly different times. If it's severe enough, the visible result is the so-called funny paper effect, where the color doesn't exactly line up with the outline of the image.

With data transmission, excessive group delay can cause an increase in the bit error rate. Group delay is usually worst at band edges, especially near the diplex filter rolloff region. General frequency response problems (ripples, suckouts, etc.) will cause unwanted and sometimes excessive group delay. The solution is to sweep both the forward and reverse plant, and to keep frequency response as flat as possible. Forget multi-carrier alignment techniques—they simply don't provide adequate response resolution.

> "With data transmission, excessive group delay can cause an increase in the bit error rate."

So how much group delay is too much? Most cable modem manufacturers will warrant the bit error rate (BER) performance of their equipment, at least as it relates to group delay, if the overall reverse path group delay from subscriber to headend does not exceed about 70 to 200 nanoseconds. Above the specified group delay threshold, the BER can in some cases degrade fairly quickly. Check with your particular data equipment manufacturer for more information.

I mentioned earlier that burst-mode data capture also can be used to perform in-field drop shielding integrity tests. To do this, you need to disconnect the drop at the tap, and connect that end of the drop to a moderate length jumper that is connected to the digital oscilloscope. Alternatively, a directional coupler can be inserted in the drop near the tap for this test. The reference signal transmitter will provide the trigger and burst as before, but for this measurement the burst is coupled onto the drop's outer shield with a device Tom calls the Cable Clothespin. For the auto mechanics among you, the Cable Clothespin resembles the clip-on inductive pickup used with a timing light.

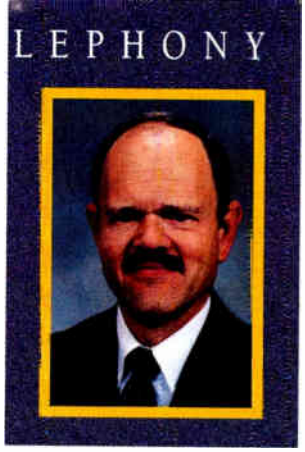
If there is a shielding discontinuity from, say, a loose connector at the side of the house, the burst will travel along the outer surface of the cable's shield as a common mode current, and it will enter the cable through the discontinuity and come back to the digital oscilloscope via the drop's center conductor. A notebook PC can be used for on-the-spot signal processing of the signal received by the digital oscilloscope. The displayed result is the approximate shielding integrity over the reverse path frequency spectrum, as well as an approximate distance to the problem.

Tom has confirmed the validity of this particular measurement in a battery of drop tests performed in a number of systems. The results confirm many of the things I've been preaching in this column. Ingress gets in via loose connectors, corroded connectors and drop components, poorly shielded TV sets, cheap coax installed by the subscriber, etc. No surprises here. One interesting observation is that reverse path ingress via the drop is very frequency dependent. This means that testing at a single frequency is not an effective indicator of shielding integrity over the entire reverse bandwidth.

Tom is preparing a white paper on some of his recent drop shielding testing. He has authored others on the use of burst-mode data capture for frequency, phase and group delay measurements. Burst-mode data capture can be used for other measurements such as spectrum monitoring for impulse noise, too. While visiting with Tom, I had a chance to verify the effectiveness of common mode chokes and other neat reverse path tricks. For more information, contact Tom Williams at The Holtzman Company, 6423 Fairways Drive, Longmont, CO 80503, (303) 444-6140, fax: (303) 444-7698. Tom can be reached via e-mail at thwill@concentric.net. CT

Ron Hranac is senior vice president, engineering for Denver-based consulting firm Coaxial International. He also is senior technical editor for "Communications Technology." He can be reached via e-mail at rhranac@aol.com.

By Justin J. Junkus



Another Route to Telephony

Along the same lines as last month's column, this month we are going to look at an alternate way that a cable company can become the phone company for its subscribers. Last month, we looked at the alternate technology of Internet telephony and its limitations. This month, we will be looking at an alternate strategy for implementing what has become almost conventional technology—hybrid fiber/coax (HFC).

As most of you know, HFC is one of two technologies that brings fiber closer to the subscriber. (The other is switched digital video, or SDV.) The typical HFC configuration for telephony begins at the telecommunications switch with an electrical or optical connection from the switch to a host digital terminal, or HDT. The HDT can be co-located with the switch, or remotely located at a hub. The HDT is where the switch's inherent signaling is converted to RF. Once converted to RF, the telephony electrical signals can be combined with other RF signals. These signals are then be converted to optical, and sent out towards the subscribers on fiber media.

The key word here is towards, and not to. Before the signal reaches the subscriber, it passes through a fiber node, that may serve up to 500 homes. The fiber node is located close to the subscriber, and its output media toward the subscriber is coax. Hence the name hybrid fiber/coax—fiber from the HDT to the fiber node, coax from the fiber node to the subscriber.

The typical HFC implementation strategy is to upgrade plant for 750 MHz, two-way service, and then offer telephony (or high-speed data) service to subscribers as the distribution plant to their locations is service-ready. For many operators, this is a major commitment of time and money. For small operators in particular, the commitment often requires several years of planning before actual service offering.

Now, let's begin to talk about an alternative strategy for implementing telephony over HFC. It tends to apply more to smaller, rural operators. In many cases, these business people now provide both cable TV and telephony, albeit sometimes over different systems. A lot of times, this is done through separate companies with common ownership. In a situation like this, implementing telephony on an HFC system means migrating subscribers from twisted-pair, narrowband telephone service to broadband telephony on the cable side of the business.

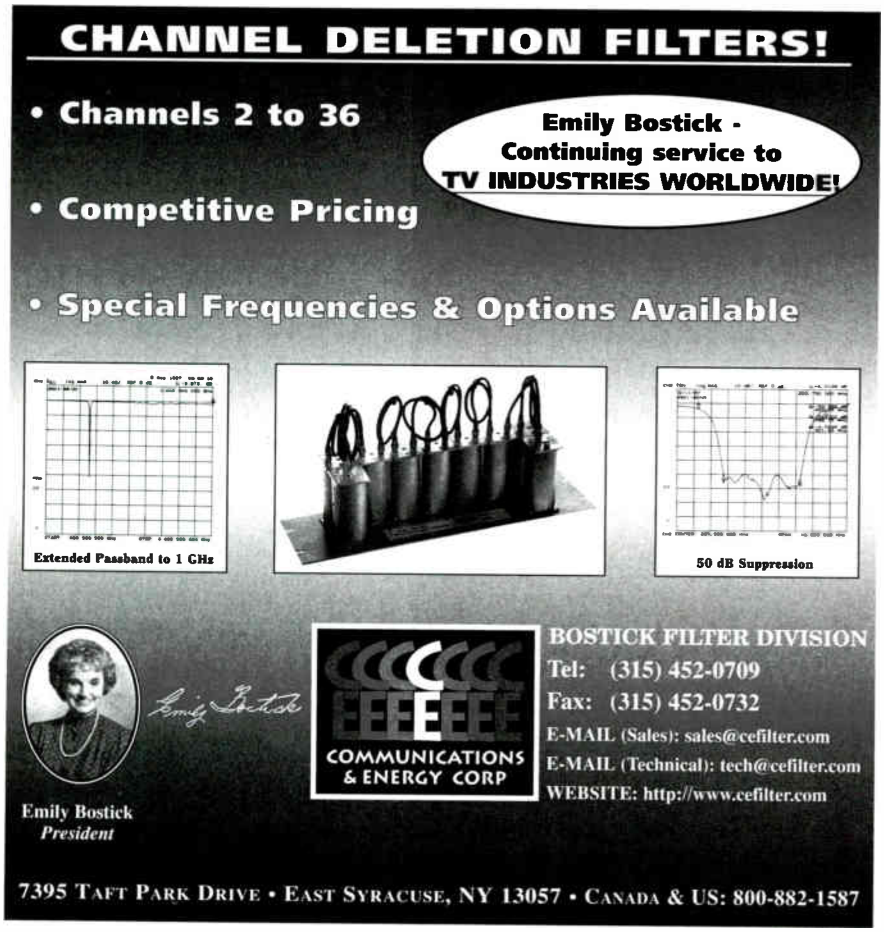
> "Something as simple as loose shielding on a do-it-yourself F-connector can degrade voice quality on the telephony side of the HFC system."

There can be many ways to accomplish such a migration. The most often used strategy, however, is to first move telephony traffic to the cable system in rural or outlying areas. It is in these locations that upgrading cable TV plant also saves costs in maintenance and dispatch. Another reason for targeting rural subscribers is the high cost of extending copper twisted-pair to these areas.

This is exactly the way it happened at the Oneonta Telephone Company (Otelco) in Blount County, AL. Otelco, which has 7,100 telephone subscribers, 2,500 cable TV subscribers, and 200 data customers, operates both a traditional twisted-pair telephone network and an HFC video distribution network. Otelco's twisted-pair telephony network was near capacity. It had been forced to deny its customers any more than one line, and had to severely limit growth in newer, expanding residential areas.

To overcome this problem and conserve copper cable, Otelco installed a Philips Crystal Line HFC system on the cable TV side of its business to offer telephony in remote service areas, where it was already providing cable service. It is using redeployed copper facilities to serve telephony customers closer to their telephony central office. This strategy assists the company in several ways. In its more remote serving areas. it is able to provide all services over one, rather than two, plants, saving truck dispatch and maintenance costs. In these areas, it is also able to offer a range of new broadband services, such as data connectivity, thereby generating revenue from other applications. As an extra benefit, but in many cases just as important, copper redeployment saves it the costs of new twisted-pair for those subscribers still on the conventional telephony system.

The Otelco system illustrates how migration of telephony to a broadband service provides other migration opportunities. The subscriber interface unit in this system has a data interface that accepts a 128 kbps input from a customer's PC, without requiring a modem. Since rural customers



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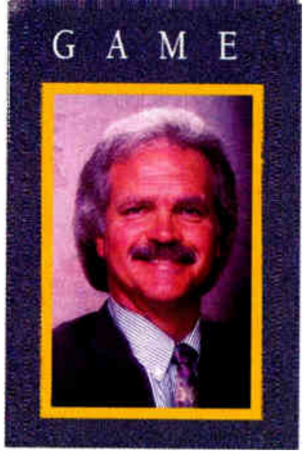
are often candidates for home offices, this capability could be extremely valuable to them. Although it is not a high-speed cable modem offering, it introduces subscribers to data speeds above those available from a telephony modem. Increased data speed tends to be addictive, because data users typically expand their applications rapidly. This need for "more" can open the door to cable modem service when it makes sense for the system operator to offer it.

Note that the key word in this strategy for implementing telephony over cable is migration. Rather than attempting to move everything to HFC immediately, the operator is able to implement a strategy that begins cash flow for services during system upgrade.

Of course, even with a migration strategy, all the usual caveats that go with an HFC system still apply. The reverse path is the weak link in an HFC system. Ingress must be minimized, and in many cases, that means re-educating the subscriber. Study results released by CableLabs about a year ago indicate that 70% of ingress problems occur between the network interface device and subscriber equipment—in other words, on the customer premises. Subscribers need to understand that incorrect wiring on either the video or telephony side of their system will affect the quality of telephone transmission. Something as simple as loose shielding on a do-it-yourself F-connector can degrade voice quality on the telephony side of the HFC system.

All of this points to the importance of planning. For migration to work, an operator needs to plan where and when it should start. The system technical personnel need to plan their technical training so they can be prepared to support the new technology. Finally, the system customer service personnel need to plan their responses to subscriber questions and requests for service, with an understanding of when and where new services will be available. CT

Justin J. Junkus is President of KnowledgeLink Inc., a training and consulting firm specializing in the cable telecommunications industry. To discuss this topic further, or to find out more about KnowledgeLink Inc., you may e-mail him at jjunkus@aol.com.



By Terry Wright

The Long and Winding Road To Standards-Based Technology

Surely, whoever coined the phrase "may you live in interesting times" was visualizing today, with its intriguing combination of the Internet, cable modems, high-speed data services, and the related underlying plurality of standards and agendas. The race appears to be on to eliminate that little hourglass your computer displays as it awaits the arrival of Internet content you have requested.

In fact, the "eliminate the hourglass" opportunity is so compelling that the North American cable industry has produced its own specification-turned standard. (After all, high performance Internet/data services represent substantial incremental revenues, and we can't forget that the telephone industry has its own ideas to eliminate the little hourglass with advanced digital subscriber line technologies.)

Tired of waiting for traditional standards-making bodies like the IEEE 802.14 WG to produce a viable cable modem solution standard, and sensitive to the competitive threat mentioned above, a group of North American cable operators (and related entities) formed the Multimedia Cable Network System (MCNS). The goal of this group was to quickly develop a cable modem solution purchasing specification. While developed in a proprietary environment, this goal was accomplished earlier this year, yielding the MCNS Data Over Cable Service Interface Specification, or DOCSIS.

Most of us are aware that numerous cable modem suppliers are racing to produce cable modem solutions compliant with MCNS DOCSIS. But how many of us understand the nature and relevance of DOCSIS, how it came to represent the United States recommendation to the International Telecommunications Union, its status, potential future, and where it fits within the global standards arena? Why is the standards topic important at all, or is it?

> "Common components such as line encoding chips and connectors, included across numerous vendor offerings tend to drive costs down."

Building the capability to deliver advanced data services over cable networks is analogous to building a house in which you intend to reside—both are serious, complex undertakings. All the solution piece parts must be up to code, and material and services from different suppliers must fit together smoothly. Further, the relative cost of deploying high-quality advanced data services capability is similar in scale to the cost of a modern new home to a typical new homeowner's budget. In building a home, code for such things as electrical wiring and service, plumbing, materials rating, and safety requirements are typically set by government bodies. Architects take these standards into consideration as they design the house and develop blueprints for implementing that design. Building a sophisticated data services delivery capability is much the same. Operators should rely on underlying technical standards whenever available. Where none are available, such as was the case with cable modems until recently, operators are faced with a serious dilemma.

Choosing a proprietary cable modem solution introduces potential supplier dependence issues, and due to the lack of common componentry in proprietary solutions, limited production volumes will likely keep costs high as compared to standards-based products. However, proprietary solutions can be the most advanced and reliable, offering the greatest service diversity, reliability, and revenue potential. But these are typically short-lived advantages. A self-feeding phenomenon tends to evolve after a standard has been defined. This typically accelerates market acceptance of standards-compliant products due to the economics of basic standardized functionality such as basic Internet access. This in turn drives higher penetration of those products, which gets the attention of a wider development community, who then add the features, functions, and other enhancements previously only found in proprietary solutions. The result is usually interoperable products across a wide market base, versus isolated pockets of varying capabilities in specific markets. ➤

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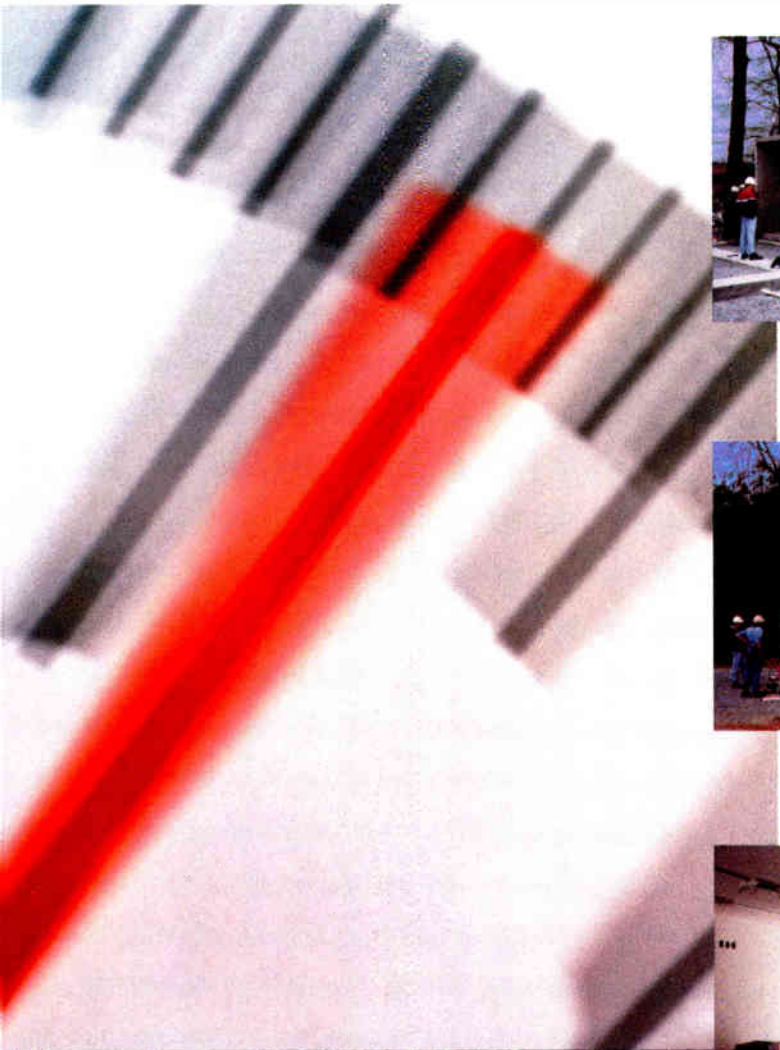

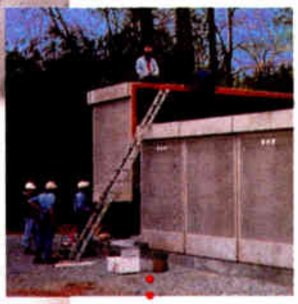

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The economic argument for standards is easily visible through the Ethernet example; network interface cards (NICs) can be attached to Ethernet local area networks (LANs) worldwide, and their declining costs over time reflect this universal applicability. But because standards are important, especially in complex technical environments, it is equally important to understand the various characteristics of a proposed standard that can affect its stability, support base, and related longevity. Space does not permit an in-depth examination of these attributes and characteristics for any specific technical standard. However, in the area of cable modem standards, some level of insight into the potential of various standards might be gained through an examination of the evolution of two competing standards of relevance to the cable industry. The following "winding road" event chronology is indicative of the "interesting times" we live in, especially since the continuing evolution of these efforts will very likely have a great deal of impact on the equipment you might deploy to enable data services delivery.

As background to the event chronology below, you should know that most developed countries maintain government-sanctioned entities for the purpose of developing country positions, and related technical standards recommendations, to be considered and hopefully adopted formal international standards bodies. These groups adhere to an "open due process" policy where anyone may join and contribute. In the United States this function is governed by the State Department through the American National Standards Institute, which is a parent group for a variety of Working Groups such as the Institute of Electrical and Electronic Engineers, Committee T1 (consisting of the subgroups: T1A1, T1M1, T1P1, etc.), and the Society of Cable Telecommunications Engineers. The IEEE body is the group that created the Ethernet/802.3 and Token Ring 802.5 standards, among others.

A key and often frustrating aspect of the IEEE 802.14 WG agenda is its liaison efforts with other key standards groups and consortiums. For example, the 802.14 WG regularly liaisons with the asynchronous transfer mode (ATM) Forum's Residential Broadband Group, as well as the Digital Audio-Visual Council (DAVIC), not to mention other IEEE groups.

The SCTE, receiving ANSI accreditation in late 1995, adopted the MCNS DOCSIS specification as its standard, and recently pushed it through the U.S. State Department Study Group D to be submitted to the ITU as the United States position on the topic of cable modems.

The MCNS is a closed group. Its members must execute non-disclosure and intellectual property agreements as a condition of membership. It is generally considered an industry consortium similar in concept to the ATM Forum, although far narrower in scope and membership. Many members of IEEE 802.14 WG are also members of MCNS.

- In early 1994, the IEEE 802.14 Working Group (WG) solicited the involvement of the top fifty MSOs (and CableLabs) to participate in the development of cable modem solution standard. (Response was very limited, due primarily with the cable industry's lack of awareness of data services issues. No MSOs joined IEEE 802.14)
- From its inception to late 1996, the IEEE 802.14 WG gains participants from around the world, reaching a voting membership peak of 136 individuals in March, 1997. In addition to technical consideration of various physical (PHY) and media access control (MAC) approaches, as well as aspects of compatibility with various installed legacy technologies, 802.14 WG spent considerable time (across many meetings) attempting to resolve conflicting approaches for forward error correction (FEC) and interleaving issues advocated by dominant set-top box suppliers. Technically, the debate was between ITU-T J.83 Recommendation Annex A (supported as well by the European-dominated DAVIC consortium and one significant U.S.-based set-top converter manufacturer) and ITU-T Recommendation J.83 Annex B (supported by most North American cable operators and another U.S.-based set-top converter manufacturer).
- Representatives of the North American cable industry, and CableLabs, issue a letter (September 1996) to the IEEE 802.14 WG, requesting that the WG focus its efforts on developing an "ATM-based" cable modem solution standard.
- MCNS DOCSIS "purchasing specification" development effort announced by MCNS, much to the surprise of IEEE 802.14. MCNS will focus on developing a cable modem specification to provide "packet data services" (i.e., "not" ATM-based) in support of residential Internet services market.
- IEEE 802.14 continues to address the industry's stated need for an ATM-based standard.
- Spring '97 MCNS DOCSIS specification is frozen, and submitted to SCTE.

"High-performance residential Internet access demand is already here."

- MCNS DOCSIS balloted by SCTE's DSS and approved as an SCTE standard.
- MCNS DOCSIS submitted to the State Department's Study Group D and approved as a US position to the ITU.
- MCNS DOCSIS submitted to ITU-T Study Group 9.
- MCNS DOCSIS passed to rapporteurs for the recommendation on cable modem technology.
- MCNS DOCSIS to be included in a new draft recommendation by Study Group 9 in Madrid in November for consideration by administrations.
- Upon a positive determination, MCNS DOCSIS to be approved as a new ITU recommendation in March 1998 in Geneva.
- IEEE 802.14 WG is currently reviewing comments on its first ballot draft.

There is a potentially serious issue confronting the MCNS-DOCSIS-SCTE standards-setting effort in the area of document ownership. Due to the traditional "open due process" policy maintained by traditional formal standards-making bodies such as the IEEE, document ownership has never been an issue: the work product of these bodies is the property of the body producing it. In the case of MCNS-DOCSIS-SCTE effort, the document approved by the SCTE as its standard, and subsequently submitted to the State Department as the U.S. position on the topic, is still owned by the MCNS consortium, a private closed entity. It is unknown how the ITU will view this issue. Further, many standards typically undergo revision from time to time in order to improve performance, reduce costs, and/or otherwise enhance the offering to better fit the market's needs.

For example, Ethernet's 10BaseT PMD option was the result of such a revision, and allowed the market to enjoy the costs savings and convenience of Ethernet performance over standard twisted-pair telephone wire. In the case of DOCSIS, the SCTE has no rights to revise and/or alter the standard it has adopted. This could prove to be a formidable obstacle to the longevity and overall success of the DOCSIS specification.

At a recent meeting of the IEEE 802.14 WG, considerable discussion was devoted to the effort to date, the scope and focus of the effort, and to the Working Group's future agenda. There have been discussions in both the SCTE and IEEE bodies regarding a convergence of DOCSIS and IEEE 802.14 standards, with the general consensus being that IEEE 802.14 represents the "next generation" cable modem standard, while the DOCSIS addresses the immediate high-speed residential Internet access connectivity needs. While the interests of both groups seem to be in addressing the needs of the market, the ownership issue described above could be a serious stumbling block.

In conclusion, while vendors scramble to deliver MCNS-DOCSIS compliant cable modems, the IEEE 802.14 WG continues its focus on responding to the requests of the cable industry as conveyed in the September, 1996 letter. The ability to deliver committed information rates and related classes of service represents a key element of the cable industry's ability to respond to the growing demand for commercial and work-at-home service solutions.

However, high-performance residential Internet access demand is already here. Hopefully, the true benefactor of both of these efforts will be the marketplace, the cable operators delivering advanced services, and the suppliers of advanced technologies based on the standards under consideration and development. As I said before, we do live in interesting times. CT

Terry Wright is chief technology officer at Atlanta-based Convergence Systems Inc. He can be reached at (770) 416-9993.

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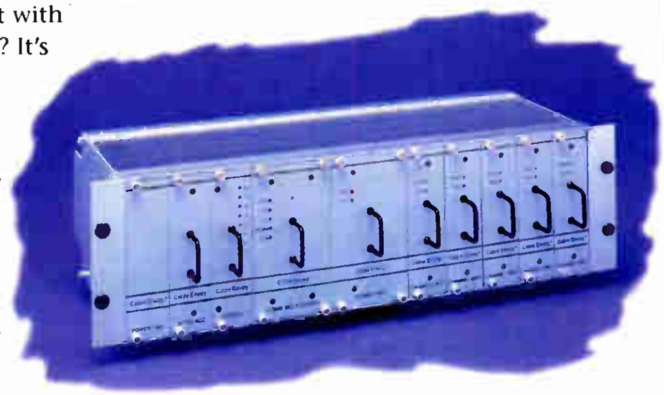

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Reader Service Number 128

By Alan Babcock

Training vs. Certification

How would you describe the difference between training and certification? Can you have one without the other? Do you have to get trained to be certified? What does certification mean to you, your company and your franchise authority? I want to share my answers to these questions.

What is the difference between training and certification? One definition of training according to Webster is "to make prepared (as by exercise) for a test of skill." This implies that one must become trained before taking a test of skill. When you think about it, why would you take a test if you weren't trained or educated to the point of having a reasonable chance to pass that test? All through our lives, we have to take tests, and whether we realize it or not, we get trained before we take the test. An example is getting a new driver's license after moving out of state (or country). I've been driving for years, but I still get the book from the department of transportation before taking the driver's license exams.

Certification can mean many things. I have known a great number of people who get hung up on the possible legal ramifications of "certification." Certification can indeed have legal connotations, but we don't want to lose sight of the intent of certification. We need to look to the rules around a specific program to understand what certification means relative to that program. For example, the rules for the Broadband Communications Technician/Engineer (BCT/E) Certification Program state that certification is "the formal recognition by a cognizant peer group of the demonstrated accomplishment of proficiency with and the comprehension of the uniquely defined body of knowledge at a point in time." In English, this means that an individual has mastery of the content of an exam that has been written by a recognized group of experts from the industry.

Can you have training without certification or certification without training? Yes. Many people attend college or trade school, study correspondence courses, read textbooks and magazines or otherwise get the education or training they need to be successful. They do all of this and perform well on the job without ever participating in a certification program to get recognition of their knowledge or skills. I have a very good friend who completed medical school and then elected not to take the state medical exams to get certified to practice medicine. He now works at a newsstand selling magazines and newspapers. I also have known people who can pass exams without ever studying the material that is included. Fortunately, most medical exams are too tough for that. Many of you know people, however, who passed their Federal Communications Commission license exam without knowing the first thing about the final RF output of a radio transmitter.

Certification is not training, but most of us need to obtain training or education to successfully pass a certification exam. Approximately 70% of Society of Cable Telecommunications Engineers certification exams are failed on the first attempt. I think this is because candidates don't think they need to get educated on the things in the exams first, or they think they already know most of the technical content.

What does certification mean to you, your employer or anyone else? The honest and sad answer is that it might not mean anything. This is changing rapidly. Many individuals state they have not received anything tangible after achieving certification. I even know of one person who got fired after becoming the first Broadband Certified Engineer (BCE) in his company. Upon reflection, however, all of these individuals say they believe strongly in the program and have a great deal of personal pride in being "certified." Most of the people I have spoken with achieve what others only dream of. They see certification as a way to prove to themselves that they are capable of passing the exams.

The number of individuals enrolling in the BCT/E program has remained steady or has decreased over the past few years. Does this mean that the people who haven't enrolled are not self-motivated to participate? That they expect something else as an external reward? Today, many MSOs are offering significant financial rewards to employees who successfully pass individual exams or attain full certification. Many companies advertise "SCTE Certified Candidates Preferred" in job postings. Some franchise authorities require technical reports on system performance be submitted by BCEs.

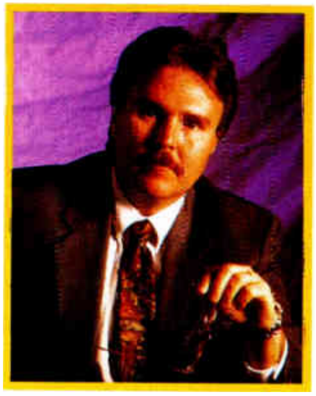
A significant key to continued success for SCTE certification programs revolves around the requirements for recertification. Candidates must prove they are staying current in the technology of the industry to maintain certification. The current schedule for recertification is three years. Certainly we see the importance of keeping up with technology in the broadband telecommunications industry. SCTE understands the difficulty of getting training for the subjects covered by the certification exams. Watch for enhanced training programs over the next few months that will improve your chances for success in the various SCTE certification programs. CT

Alan Babcock is director of training development for the Society of Cable Telecommunications Engineers. He can be reached by e-mail: ababcock@scte.org.

Pelé

By Rex Porter

Talking with TCI's Tony Werner



Tony Werner

Tony Werner is senior vice president of engineering and technical operations for Tele-Communications Inc. This marks Werner's 20th year in the cable industry. He has published multiple technical papers and is an active member of the Society of Cable Telecommunications Engineers, the National Cable Television Association and CableLabs.

Communications Technology: *TCI is a complex and broad telecommunications provider that has, with its market leader status, encountered as many challenges as opportunities. As a leading technical executive at the company, how do you balance and support this fast-paced environment?*
Werner: My current job is a huge responsibility, which I take very seriously, and while it is fast paced and high pressure at times, I don't think that it is different than what most of my industry colleagu's face. Everyone in our business thrives on the challenges and the fast paced technology curve that we are a part of. I believe that this enthusiasm is a key differentiation between our industry and others.

CT: *Could you discuss the "OpenCable" project and the new generation of set-tops and how they will benefit TCI?*
Werner: The OpenCable project is an industry project that will benefit several industries and ultimately the consumer. In doing so, OpenCable will also benefit TCI. Standards in this area mean a lot and OpenCable holds out several promises, including lower cost terminal devices, increased functionality, interoperability, bridging of the Internet and the living room, rapid development of new applications and a retail strategy, to name a few. This initiative can have a significant, positive impact on the future of this business.

CT: *How's the rollout of digital services coming along throughout the TCI properties?*
Werner: The digital roll out is going extremely well. Thanks to David Beddow and his group at Headend in the Sky (HITS) we have a solid product on the satellite that is employing sophisticated, statistical multiplexing techniques to maximize our capacity. Secondly, thanks to all of the fiber that we have deployed over the last several years, we have been able to greatly reduce the number of downlinks required to launch the service. We are well along the way with the required downlinks and headend upgrades and at this point, we do not see any speed bumps, let alone roadblocks, to launching this product.

CT: *Much like the "chicken and the egg," many companies seem to think they have to choose either data transmission or digital TV in 1998. What's your view on these services?*
Werner: I do not see this as an either/or decision. In fact in several ways they are complementary. Return plant, for example, greatly enhances both services. It offers a critical dimension to high speed data services and greatly reduces installation times for digital TV services. Digital TV offers its own standalone revenue stream, greatly increases subscriber satisfaction and provides a strong competitive response to direct satellite.

Digital TV can be offered on conventional systems as well as on hybrid fiber/coax (HFC) systems. High speed data on the other hand requires a certain degree of fiber, two-way plant and some staff training. While it requires more in the way of network capability, it also provides a standalone revenue stream. Both are powerful technologies that enable new services and revenue streams. They should not be poised as an either/or.

CT: *How has the outlook toward telephony changed? Does it seem that our industry has backed away from providing telephone services over the past few months?*
Werner: I am not sure that the industry has backed away from telephony. Several operators simply believe that IP (Internet protocol) telephony provides a better business model than conventional POTS. IP telephony can leverage off of our evolving data networks and has the potential to offer several value-added services that are not practical with conventional telephone technologies. We do know that telephony sells. Time Warner is proving this in Rochester and we are proving it in Hartford. The technology works and customers like an alternative.

CT: *TCI is one of the few MSOs whose chairman is an engineer. And Leo Hindery is considered a superior cable man by every cable pioneer I have spoken with. What's it like to work with these two who really understand what you need and why you need it?*
Werner: I am fortunate to be able to work with both of these individuals. Your latter point cuts both ways though. Both Leo and John know what we need and why we need it, but on the other side they also know what we don't need and why we don't need it. Seriously though, you do have to be rock solid on the issues when

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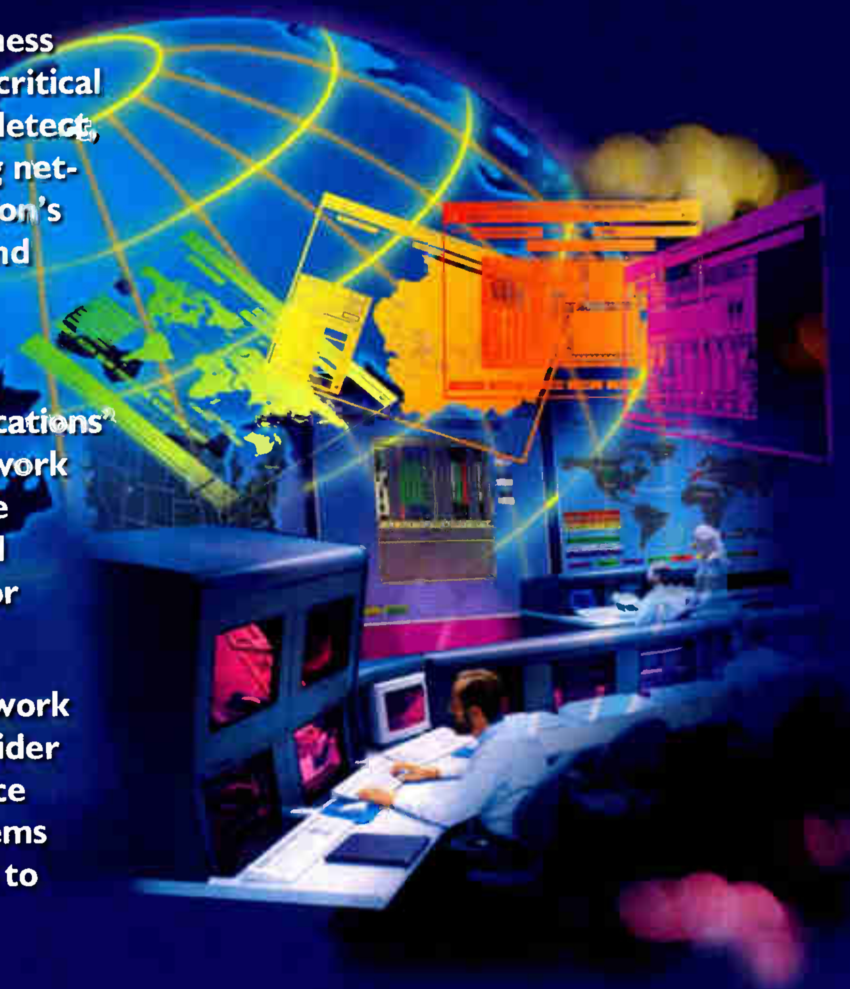

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Reader Service Number 29

The Best of Both Worlds

Tips on TV-Centric Video and Internet Services

By Bill Wall

As the cable TV industry responds to growing competition from direct broadcast satellite (DBS) and other multichannel service providers, there is an opportunity to differentiate the industry from the competition.

This can be done by offering services that take advantage of the two-way hybrid fiber/coax (HFC) plants that are being rapidly installed. Satellite-based DBS systems make use of digital as a *bandwidth enhancement* only: the ability to offer a large number of channels cost-effectively. Cable could do the same and offer digital as a "me too" service with no strong advantage over DBS, or they can offer digital video as part of an enhanced network and TV-centric service.

The Internet is becoming a source for not only information, but entertainment as well. A number of TV-based Internet access products are becoming available in the market, all with relatively slow-speed telephone connections to the Internet. The delivery of video over the Internet has been a topic of active discussion within the computer industry.

However, the Internet infrastructure will require drastic upgrades to be able to support entertainment-quality video—an upgrade that cannot occur quickly. At the same time, digitally encoded program sources are becoming more available to cable operators via satellite and even local servers.

Imagine an integrated service that seamlessly combines high-speed access to the Internet with broadcast entertainment-quality video and eventually true video-on-demand (VOD). Cable operators have the opportunity to offer this service now. Using advanced digital home terminals with real-time, two-way communications over HFC, such a service could combine the concepts of a network computer and a digital set-top. The home terminal could download and execute network-resident applications, surf the Web, as well as provide high-quality digital video.

HFC and two-way plant

The advantage cable operators with HFC plants have over other delivery mechanisms is the ability to not only broadcast information throughout the entire system, but to selectively narrowcast downstream information and receive upstream information at a subset of only one or more HFC optical nodes, achieving bandwidth reuse in both directions. Individual addressing capabilities within each digital home terminal allows high-speed communications in both directions with individual home terminals. The two-way capabilities of the plant can be exploited with efficient upstream protocols that can deliver messages upstream in a few milliseconds.

Such a system must be capable of adapting to a number of HFC architectures, such as centralized headends where all fiber nodes are brought to the headend, or distributed systems where broadcast originates at a centralized super-headend and is distributed through regional headends that also often terminate the reverse path. Interoffice connects may use AM supertrunks, synchronous optical network (SONET) digital interconnects or proprietary digital interconnects.

Photo by Bob Sullivan

A digital network

Using high-speed communications in both directions with individually addressed home terminals—and the potential need to route information to a specific terminal—the HFC network is beginning to resemble a standard local area network (LAN) in functionality. Why not use existing LAN and Internet protocols? By using Institute of Electrical and Electronic Engineers hardware media access control (MAC) addresses to identify each home terminal, and dynamically assigned Internet protocol (IP) addresses for the routing of messages to the home terminal, existing standard routers and communications protocol stacks can be used. Personnel trained in LAN technology can configure and manage the networks, and the networks can easily be connected to external wide area networks (WANs), including the Internet.

These Internet protocols may be encapsulated in Moving Picture Experts Group transport packets using protocols standardized in MPEG Part 6 (Digital Storage Media Command and Control), and then modulated over the network, along with broadcast or narrowcast video and audio programming, using the Society of Cable Telecommunications Engineers digital video system (DVS) quadrature amplitude modulation (QAM) standard. Full compliance with SCTE DVS standards allows the home terminal to receive all available sources of digital programming, and in fact interoperate in the same cable system with simpler broadcast-only set-tops.

Interactivity is provided using an upstream channel and an associated out-of-band (OOB) channel. Two-way IP connectivity with the set-top box is provided using this channel in conjunction with the MPEG broadcast channels. The OOB channel provides a path for reliable communications with the set-top, even when the set-top is tuned to analog channels. A major function of the OOB channel is to provide timing and MAC messages for efficient control of the upstream bandwidth resources. The Digital Audio Video Council (DAVIC) specified physical and MAC layer protocols for the upstream and OOB channel in 1995, and cost-effective components implementing this system are now becoming available.

An alternative to the DAVIC system that offers a higher bandwidth OOB channel is the SCTE data-over-cable specification—also known as the Multimedia Cable Network System (MCNS) spec. Adopted by SCTE in July 1997, it is expected that components implementing this specification will become readily available in 1999. The DAVIC system uses only 1 MHz of spectrum in both the forward and reverse directions, while the MCNS system requires a full 6 MHz channel in the forward direction. Both systems could coexist in the same HFC plant with each type of set-top tuning to its appropriate OOB channel.

The system also uses MPEG Part 6 (DSMCC) user-to-network and user-to-user protocols that provides the ability to set up and control true VOD sessions, if VOD servers are installed in the network. In the past, VOD server and switching complexes have been prohibitively expensive, but new approaches to VOD servers promise to provide much less expensive servers in the near future. DSMCC protocols also provide for the setup of client/server data sessions over the QAM channels and for the use of broadcast data carousels in the network. These data carousels repeatedly broadcast both system configuration data as well as application data to all home terminals.

Set-top or network computer?

A fundamental difference between a simple broadcast set-top and the advanced digital home terminal is that the broadcast set-top assumes that every service carried within an MPEG multiplex is either a video service or an audio service, while the advanced terminal associates an *application program* with every service. For simple applications such as video and audio play, the application is resident in the terminal. But for more advanced applications, such as Web browsing, VOD or games, the application is resident on the network, broadcast via a data carousel.

When such a service is requested by the user, the home terminal operating system downloads the application program and launches it automatically, using the network itself as the data storage medium. Using this paradigm, the advanced digital home terminal closely resembles the model of the network computer.

In fact, the terminal provides significant processing power and a multimedia-centric operating system that allows a wide variety of applications to be provided. Applications can be written using the native application programming interface (API) of the operating system, or in higher level APIs such as hypertext markup language (HTML) for graphics presentation or Java for resident application code. The use of Java and HTML as the principal authoring environments allows the system to be processor and operating-system-neutral. This opens the system to multiple competing set-top suppliers and independent application developers for the home terminal platform.

> "The HFC network is beginning to resemble a standard local area network (LAN) in functionality."

Phased deployment

The deployment and operation of an advanced digital network is more complex than that of a simple broadcast-only digital system. The network can be deployed incrementally, however, starting first with the components, both hardware and software, that support broadcast video and audio services only. Advanced broadcast services can be added incrementally through the addition of a data carousel and software. Web access and other interactive data services are added via the real-time upstream receivers and WAN interconnections.

Finally, VOD services are added by installing VOD servers. In this upgrade deployment scenario, equipment does not become obsolete and the installed base of home terminals are ready for all services from the beginning.

Key to this phased deployment is the architecture chosen for the HFC network, and proper planning for the inclusion of necessary WAN interconnection to support this architecture for future services.

Management of the network

Even though advanced digital networks are more complex than either analog or simple broadcast systems, a major goal of such a network would be to reduce the operational cost of the network and physical plant. The extensive use of standard data networking technologies and protocols allow the adoption of modern network management tools within the system.

All devices within the network can be monitored and provisioned through the use of simple network management protocol (SNMP). This capability extends all the way to the advanced digital home terminal itself. SNMP allows individual home terminals to be monitored on a regular polled basis and report end-of-line conditions such as signal level, signal-to-noise ratio (S/N), bit error rate (BER) and even channel passband shape. The condition and operational status of the home terminal can be monitored as well.

With this powerful management tool, all active devices in the network are monitored for alarm conditions, trouble reports can be diagnosed remotely, and standby equipment is provisioned and put on line remotely. Perhaps most importantly, continuous monitoring of the plant condition allows operators to see system degradation early enough to perform pre-emptive maintenance before a service fails.

Centralized monitoring and control allow a reduction in manual plant measurement and are less labor-intensive, reducing costs. At the same time, the coverage and quality of fault detection and plant performance measurements will improve significantly, potentially leading to more reliable service. CT

Bill Wall, Ph.D., is chief scientist, subscriber systems, at Scientific-Atlanta. He may be reached via e-mail at bill.wall@sciatl.com.

BOTTOM LINE

Integrate Video and The Internet on the TV Set

Advanced digital systems can provide services that cannot be matched by direct broadcast satellite or other multichannel competition. The ability to offer software-based services, both broadcast and two-way interactive, allow for a continuous enhancement of the product offerings.

Incremental deployment: New services can be added as incoming revenues justify the service without replacing hardware within the system, allowing an incremental deployment strategy. Even though the system is more complex than existing services, the inclusion of powerful network management capability offers the promise of reduced operating costs compared to existing systems.

Balancing Act:

How Much Digital Test Equipment Is Enough?

By Don Halsey

When the world was simple and all cable TV signals were analog, the cable industry had a general practice of outfitting field service trucks and field service engineers with the most commonly used, inexpensive test hardware (typically a $2,000 analog signal level meter).

When the troubleshooting got tough, more expensive and sophisticated instruments (say, a $12,000 spectrum analyzer) would be borrowed from a pool. In this way, most problems could be diagnosed and repaired the first time they were addressed. This was inexpensive, it kept customer satisfaction high, and it minimized total field service costs.

The world is no longer simple. In fact, with digital TV signals, it has become rather complex. Your engineers will have to learn new signal formats, new diagnostics and new test equipment. The signals themselves will have new and different sensitivity to various impairments. Will the universal/pool approach work for digital? Can you optimize digital TV service costs for your network?

Fortunately, the answers are yes and yes. This article will explain how. The concepts have been incorporated in an Excel spreadsheet model that allows "what if" analysis. (*Editor's Note: For a copy of the model, contact the author at the address provided in the biographical note elsewhere in this article.*)

Planning equipment needs

One of the big problems with digital is that nobody really has much good data with which to project how frequently service call requests will occur, and how much equipment will be needed. In a survey of the distribution plant of a major metropolitan area, we have developed useful data for planning equipment requirements. What one would *like* to see in this data is that the percent of marginal sites is about the same for analog (NTSC) and digital. Unfortunately, this is not true. Worse still, the data indicates that even working analog sites can have problems with digital. (See Table 1.)

This suggests that an MSO could have post-installation service calls at as many as 25% of its digital subscribers. At another location, a few thousand

Table 1

Signal quality	Percent of locations
Percent locations with 40 dB C/N or less (NTSC)	approx. 3%
Percent with 0 dB digital signal margin	approx. 25%
Percent with -2 dB digital signal margin	approx. 10%

Survey population: about 100 measured test points, both tap and subscriber terminal

BOTTOM LINE

Balancing Costs

Looking for a way to balance the costs of technician labor, the costs of the digital test equipment and the costs of unhappy customers?

There now is some data which models estimated service call rates, and there are some distinct deployment strategies that can be compared.

Keep these points in mind:

1) Provisioning costs are dominated by installation labor, not test equipment.
2) Test equipment capital costs can be reduced.
3) The service call rate is key.
4) For various test equipment, keep track of how many of the problems could be detected and repaired by using it.

digital set-top boxes have been deployed onto a recently upgraded and generally NTSC compliant distribution plant, and service calls there have run less than 1%. One can elect to have a small, or even a 0 dB system margin—that's a decision for the chief engineer. But it would be prudent to pad this with at least 3-10 dB to allow for temperature variations, phase noise and frequency offsets in plant electronics, and degradations caused by ingress and other impairments. Then you can estimate a range for your post-install service call rate (say, 10%) as the first step.

Let's look at dollars, not decibels. Digital service costs can be predicted and equipment needs planned so as to minimize their costs. Digital test equipment frequently costs more than the corresponding analog equipment. Currently, 64 QAM signal analyzers can run from $15,000 to more than $50,000. Protocol specialized or general purpose bit error rate (BER) test sets can run from $5,000 to $60,000. The extra cost for digital equipment also manifests itself in headend equipment, trunk amplifiers, etc.

The more test equipment you buy, the faster you troubleshoot and repair your problems. Ideally, every problem is resolved on the first service call. This also keeps your customer satisfaction at the highest level. But the expenditure on proposed new digital test equipment may make this approach unaffordable. On balance, trying to get by with too few instruments may minimize the instrument pool expense, but your overall service expense may be higher due to the number of repeat service calls and the number of unhappy customers. How do you find what makes sense for your business?

Provisioning scenarios

You can find what is best by exploring some provisioning scenarios. For example, you could use the proposed equipment on install (first wave strategy), use it only on post-install service calls (a second-wave strategy) or use it only if your first service call was unsuccessful (a third-wave strategy). You could look at fourth waves, or even tenth waves, but ultimately the customers would be unhappy enough to cancel their service. Table 2 on page 50 presents the cost components of this trade-off, for three scenarios.

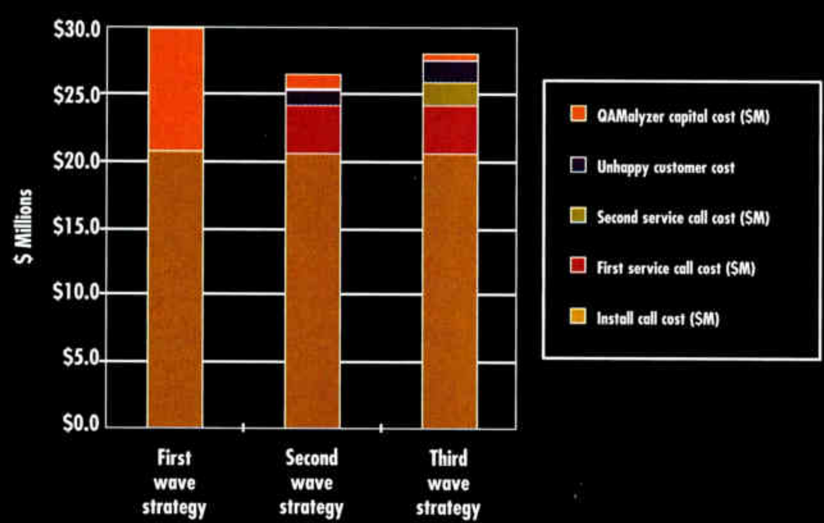
We've modeled these specific scenarios using a test equipment cost of $13,000. Other assumptions we've used are as follows:

- Deployment of digital set-top boxes to 500,000 subscribers over a 12 week period,
- $40 per hour loaded labor rate,
- 1.03 hours per installation call without special test equipment
- 1.04 hours per installation call *with* special test equipment
- 10% service call rate,
- 1.0 hours per first service call without special test equipment
- 1.1 hours per first service call *with* special test equipment
- 1.15 hours per second service call *with* special test equipment (second service call *always* has the equipment)
- 72 hours per week equipment availability (due to availability of service personnel)
- Equipment utilization at 70% to 90% of hours available, and
- $20 per service call customer satisfaction cost.

Table 2

	First Wave Strategy	Second Wave Strategy	Third Wave Strategy
Labor cost to install	High	High	High
Labor cost to do service to do servicecall after install call after install	Zero	Low	Low
Labor cost to do service call after call afterunsuccessful first service call	Zero	Zero	Low
Test equip acquisiition cost	High	Medium	Low
Cost due to unhappy customers	Zero	Low	Medium

Figure 1: Cost comparison: Various strategies for provisioning 500,000 digital cable subscribers



Reader Service Number 215

We used longer service call times *with* the special test equipment to reflect that the equipment does detect problems that would be invisible otherwise, and that time is taken to then fix such problems. A key simplifying assumption is that the test equipment permits the problem to be solved completely, hence no subsequent service calls. There will always be some small percentage of intermittent problems that remain undiagnosable/unrepairable under any scenario.

All these factors have been incorporated into the model that calculates how many units of test equipment are needed for each scenario, and the total provisioning cost for each scenario. The model calculates QAM analyzers needed for first wave, second wave and third wave strategies. Our results suggest that the "second wave" strategy makes sense for equipment such as QAM analyzers, and that total cost is more sensitive to labor cost than to equipment price (See Figure 1).

A few points are important to note here:

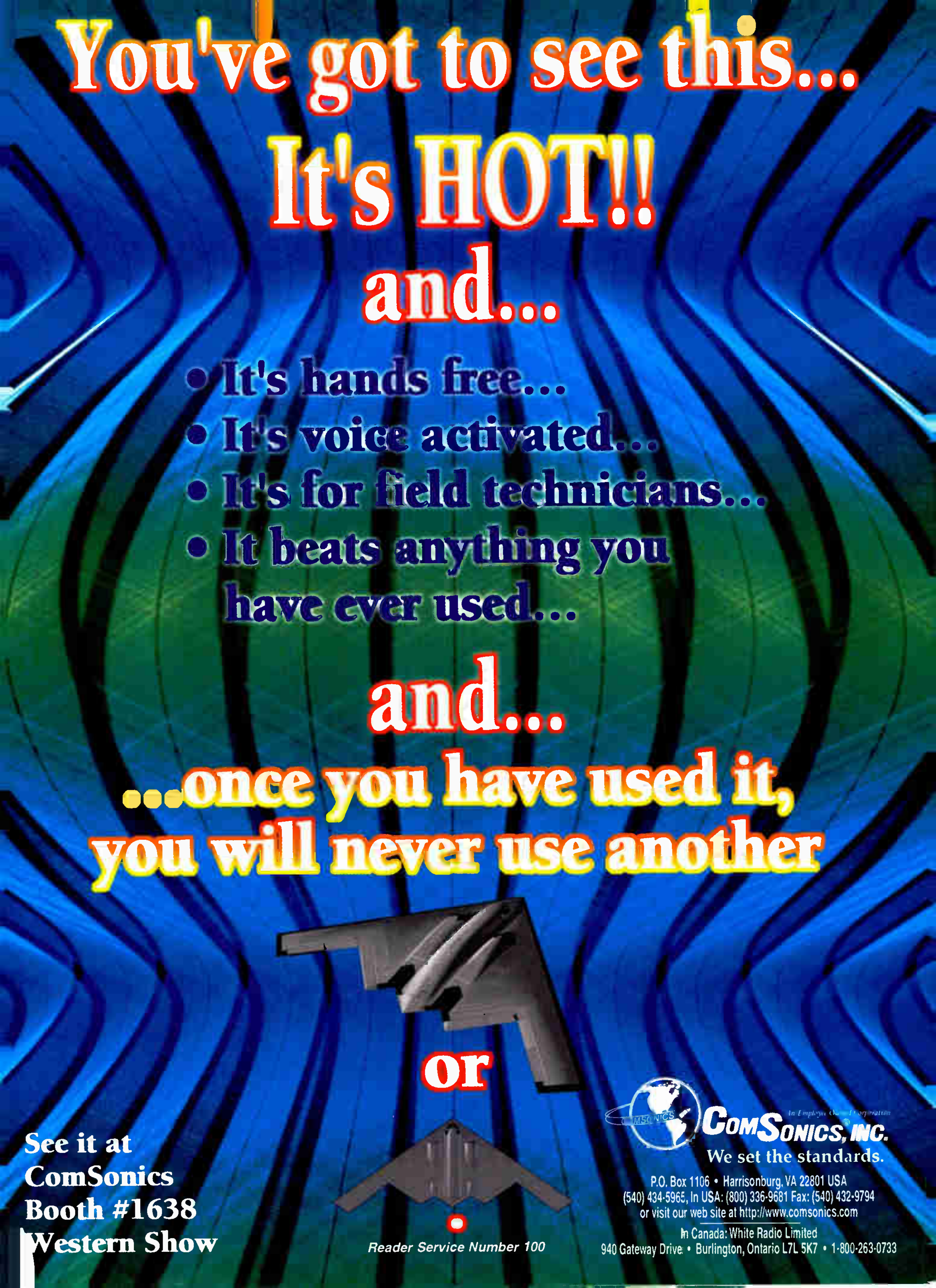
1) Provisioning costs are dominated by installation labor, not test equipment.
2) Test equipment capital costs can be reduced, but at some point the costs of unhappy customers and the costs of repeatedly going out to the same site drive up one's overall service cost.

"Provisioning costs are dominated by installation labor, not test equipment."

3) The entire model is very sensitive to the service call rate. The service call rate can be low if your plant is pretty new and you design and hold to conservative system margins. You can elect to run on thin system margins (keeping down one's upgrade costs) but the savings will be offset, at least in part, by increased service costs.
4) For another unit of test equipment, one would have to not only use a different price, but to make a careful assessment of how many of the problems could be detected and repaired by using it.

You can now use this model, adapting its assumptions, to assess your own needs for digital TV test equipment, and plan to have the optimal amount of digital test equipment for the job ready when you need it. CT

Don Halsey is a program manager at Applied Signal Technology in Sunnyvale, CA. If you would like a copy of the Excel spreadsheetdescribed in this article, contact him at (408) 522-3412 or Don_Halsey@appsig.com.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Simplify Troubleshooting With Numeric TDRs

By John Rasmus

A "numeric" time domain reflectometer (TDR) cable fault locator is an inexpensive alternative to traditional waveform TDRs. The greatly simplified operation makes it easy to use and the low cost enables an operator to put more troubleshooting "feet on the street"!

Maintaining a cable system and meeting particular regulations and specifications is not only an ongoing challenge; in some cases, it's a federal requirement. But, no matter how closely you fine-tune your cable system to meet specifications, it will not operate if your cable is cut or damaged.

Although a TDR is the fastest way to pinpoint cable faults, the cost and complexity of the instruments historically has made it prohibitive to supply every technician or service vehicle. Most of today's TDRs are more user friendly and cost effective. In addition, a second type of TDR has emerged that has one-button operation, a numeric display, a much lower cost and very simple operation results. A one-in-every-truck concept is now more realistic.

What's the difference?

A numeric TDR and the traditional waveform-type TDR both operate on the radar principle. However, the difference between the two is in how the test results are displayed. A waveform TDR displays the transmitted pulse and any reflections on a screen similar to an oscilloscope display. This provides detailed information about the cable under test that can be studied and analyzed by the operator. On the other hand, a numeric TDR displays only the distance to fault via a numeric reading in feet or meters.

Traditional waveform TDRs start at about $2,500 and up. The numeric TDR provides a less costly alternative

> "The TDR can be used to identify unmarked or mismarked cables by identifying where a cable goes."

with prices starting under $700. A numeric TDR can be supplied to every technician, with a traditional waveform TDR being shared among several technicians or engineers.

The numeric TDR is designed for locating major faults such as complete opens, dead shorts or other point problems where a major impedance change has occurred. A numeric TDR is fast, easy, compact, lightweight and can be used successfully with very little instruction or experience. However, the operator should keep in mind that a numeric TDR is not a replacement for more sophisticated and sensitive waveform instruments.

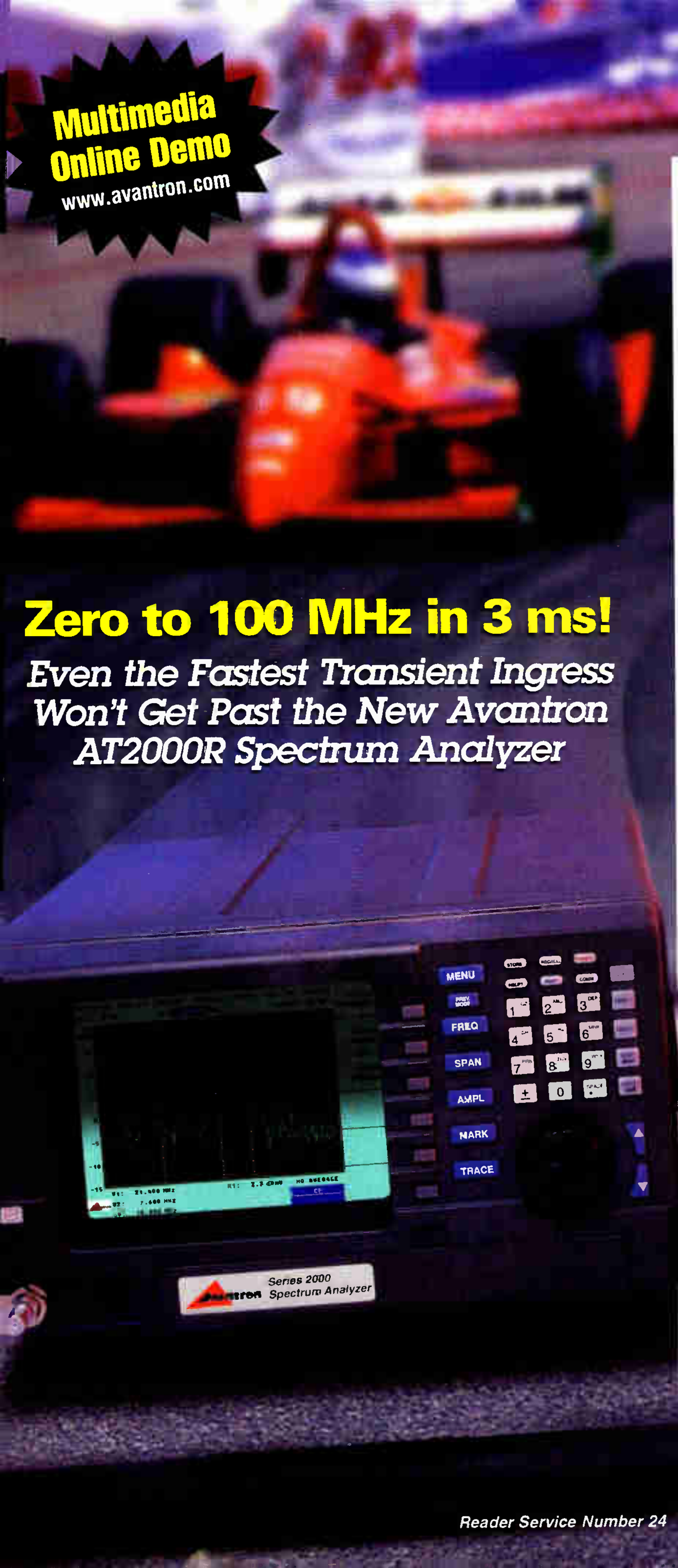
Good news and bad news

There is good news and bad news regarding a numeric-type TDR. The good news is that it takes away all of the waveform interpretation. However, the bad news is the same—it takes away all of the waveform interpretation.

A numeric TDR is low-cost and simple to operate, but may not yield the same results. A waveform instrument may be needed if you are looking for very small faults or testing long distances.

While waveform TDRs have their place in locating smaller cable faults and testing long lengths of cable, simplified numeric TDRs have their place, too.

For catastrophic problems, the numeric TDR is a valuable resource and a quick first test to determine whether the cable is cut or damaged severely. If so, the instrument will provide an instantaneous distance-to-fault reading. Although helpful in testing trunk and distribution cables, the hand-held numeric TDR also is an invaluable tool for troubleshooting cable drops. A drop cable could be put out of service with the whack of a shovel while planting a new rose bush, a cut from a post hole digger for a new fence post, or even a



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staple through the cable during an installation. Still, whatever the cause, a TDR can solve the problem of locating a fault quickly and easily. A TDR is even more helpful when the cable is buried or the fault is not obvious.

Digital tape measure

Although fault finding is the major function of a TDR, it also can be used to measure lengths of cable, whether the cable is installed or on the reel. A numeric TDR is perfect for this application. The results are quick, accurate and waveform interpretation is unnecessary. The distance is simply displayed as a footage reading.

This enables the operator to check incoming reels of cable for damage or cable shortages. The instrument can also be used for calculating cable usage. By obtaining a length reading of a reel of cable, both before and after, the amount used (the difference in the readings) is easily calculated.

Another use for a TDR is measuring partial reels of cable. You can quickly discover how much cable is left on a partial reel, so these partial reels can be used up before opening a new one. Cable inventory control and management is suddenly made easier and more cost-effective. A TDR will test all types and sizes of coaxial cable (or any two conductor cables), which makes it a very versatile tool for both cable measurement and troubleshooting.

Who's who in cable

A TDR also can be used as a cable identification tool. Although there are a variety of cable identifiers available that use either a tone or a resistor value technique, these types of identifiers will not pass a signal through a passive device. If there is a tap or splitter in the line, the signal is stopped cold!

A TDR uses an RF signal which will pass readily through taps and splitters. Therefore, the TDR can be used to measure and identify cables by length.

Furthermore, the TDR can be used to identify unmarked or mismarked cables by identifying *where* a cable goes. This is especially helpful in an apartment building, hospital, trailer park or business office. For this application, an assistant and two-way communications are needed.

Send the person with the TDR to a room, apartment or cable outlet. Connect the TDR to the cable and view the LCD. Have a second person (located at the headend or a location where all the cables come together) pick a cable, then open and short the end of that cable.

If the indicators flash between open and short, then the cable has been identified. If not, the second person keeps shorting each cable until the indicators on the TDR flash open and short. The cable is then identified and can be correctly marked.

> "A TDR can...help make the chore of system maintenance and certification quick and easy."

Before and after

Knowing your cable plant is helpful when it comes to troubleshooting. If you know the approximate cable length and path, it is easier to determine if a TDR distance reading is a fault, a system component or just the end of the cable. Use your TDR to help create and/or verify plant maps. A cable locator and measuring wheel also are helpful.

In the case of the waveform TDR, knowing what a cable's signature or trace looks like before there are problems will help the operator to determine where a fault is after the problem occurs.

As with any new instrument, the more you use it, the more benefits you will derive from it. Once you have learned the functions and differences of a TDR, the instrument can, and will, reduce troubleshooting time and help turn downtime into dollars.

Whether you choose a numeric TDR, a traditional waveform TDR, or a combination of both types of instruments, a TDR can save you time and money and help make the chore of system maintenance and certification a quick and easy one. CT

John Rasmus is marketing manager for Riser-Bond Instruments. He can be reached at (402) 466-0933 or jrasmus@riser-bond.com.

BOTTOM LINE

TDRs: We've Got Your Number

What's the difference between a numeric and traditional waveform-type TDR? Both operate on the radar principle. A waveform TDR displays the transmitted pulse and any reflections on a screen similar to an oscilloscope display.

A numeric TDR displays only the distance to fault via a numeric reading in feet or meters.

A numeric-type TDR takes away all of the waveform interpretation. It is low-cost and simple to operate, but may not yield the same results as a waveform TDR.

You may need a waveform instrument if you are looking for very small faults or testing long distances.

What are some uses for numeric TDRs, besides fault-finding?

- *Measuring cable lengths.* Whether installed or on the reel, a numeric TDR yields quick, accurate results, and waveform interpretation is unnecessary. The distance is simply displayed as a footage reading.
- *Identifying cable.* A TDR uses an RF signal which will pass readily through taps and splitters. Therefore, the TDR can be used to measure and identify cables by length. Cable identifiers that use either a tone or a resistor value technique will not pass a signal through a passive device.

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

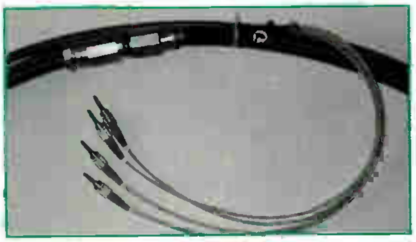
Why are you still using leased phone service for communication to remote headends? Radiant Communications has fiber optic systems compatible with all major OEM equipment...GI Omnistar, GI Set Top (TNA), GI Digital Headend, SA System Manager, SA Pegasus, Superior Cheetah, AM Communications. All systems are now available using only one fiber and will generally pay for themselves in a few months.

Reader Service Number 85

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 48



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 2 to 12 fibers with customer specified node connector. Also available are fiber optic assemblies, couplers, fiber management systems plus the industry's first and best low backreflection attenuators, both fixed and variable.

Reader Service Number 95

Broadband Telephony

Take Proactive Steps to Avoid Disaster

By Trygve Lode

Broadband cable TV and copper telephony share an important and fortunate quality: Their powering needs and operating performance are amenable to well-behaved static solutions. Unfortunately, the same cannot be said for broadband telephony. The combination of highly variable power demand from network interface units (NIUs), the positive feedback loop produced by resistive losses in the cable plant itself, and the small service area handled by a given node or power supply all add up to much more complex and hard-to-predict behavior than would be expected based on cable TV or conventional telephony considered individually.

This should be no small concern for anyone looking to provide broadband telephony service because this field—and, therefore, the pitfalls that need to be avoided—is so new that there are no comfortable and safe pathways we can follow without looking ahead very carefully before each step in design and construction.

During ordinary usage, the power demand of a single NIU might vary by a factor of three or more from one minute to the next. Worse, the more power needed by the NIU, the less efficient the cable plant becomes in delivering power, due to resistive losses in the cable itself. Those losses cause the voltage available at the NIU to drop and also reduce the voltage at any other NIU or active device that shares a portion of the cable plant between the supply and the first NIU. This further increases the current needed by the first NIU and all the other NIUs so affected, producing a still greater voltage drop, meaning yet more current is needed.

> "Random fluctuations in customer usage will push the system into various less drastic failure modes."

In the most serious of cases, such a situation will produce a "runaway" effect that will be stopped only by some portion of the plant being dragged outside of its operating range and shutting down. Such a situation would be quite unusual for most plant topologies and the typical safety margins used at design-time; even so, "never" is still much to be preferred over "rarely" when plant failures are concerned. So, performing various stress tests on the system's reliability under load is certainly worthwhile.

Random fluctuations

A much more realistic concern, though, is that random fluctuations in customer usage will push the system into various less drastic failure modes.

These include pulling NIUs or system actives below their minimum operating voltage (and in some upgrade scenarios, one must worry about exceeding the limits on operating voltage as well), exceeding the current-carrying capacity of a power supply or intermediate device, or simply exceeding the traffic-handling ability of the node itself.

With the exception of overall traffic level considerations, the probability that any of these failure modes will occur is very much a function of the topology of the power distribution system and the distribution of customers and customer types across that system.

System proofing

One approach to estimating the robustness of a section of plant while still in the design phase is to perform "worst case" simulations to determine the threshold

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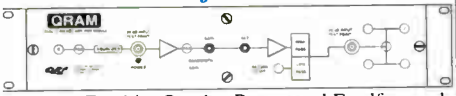

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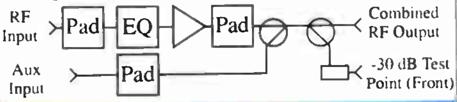

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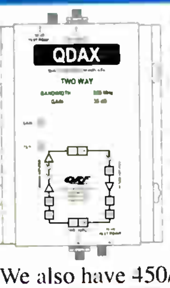

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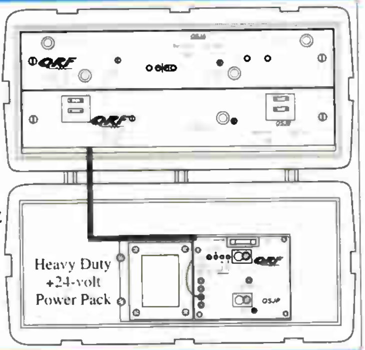

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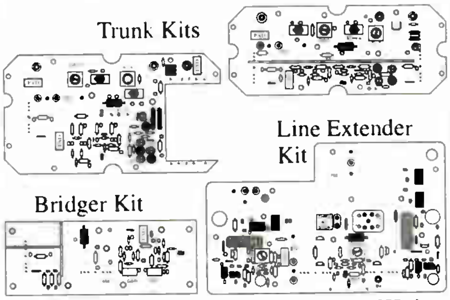

QRF converts 5-MC chassis to *550 MHz!*

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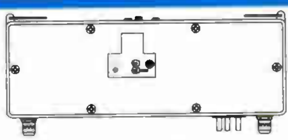

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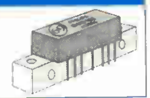

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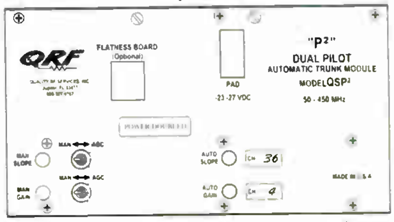

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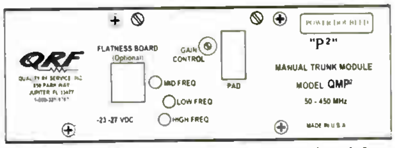
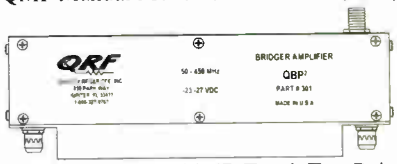


- QMP Manual Module, 32 dB Gain (Max)



- QBP Bridger has -30 dB Trunk Test Point
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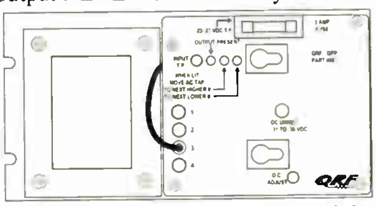

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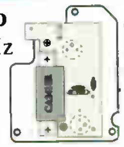

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beyond which the amount and distribution of loading can result in a failure condition.

This establishes the limits of "failure-proof" operation and allows one to examine, ahead of time, the effects that possible future expansion of services and equipment could produce on the service area's reliability. It also yields an idea of what additional improvements would need to be done to the plant to support those levels of expansion.

The main shortcoming of this type of stress test is that it only identifies the circumstances under which failures could start to occur, without determining the actual probability of failure, or how different design decisions could affect the likelihood of any of the possible failure modes.

Often, a design that would never experience an overloading-induced failure would be prohibitively expensive to build. A real-world plant is subject to hardware failure, physical damage, and other sources of down-time, so that, once overloading failures are reduced to a sufficiently low level, further improvement will yield minimal benefits in terms of real-world overall reliability.

Statistical simulation

A more thorough, and more generally useful, approach is to attack the matter of system reliability through statistical simulation. Taking the projections for customer demographics, equipment and service penetrations and usage patterns, it is possible to create thousands of simulated scenarios for how customer types within any service area might be distributed and what services would be allocated to them. For each such scenario, samples are taken of how the system would be expected to perform over time, and a statistical summary of the frequency of problems is then produced.

> "During ordinary usage, the power demand of a single NIU might vary by a factor of three or more from one minute to the next."

The finer detail inherent in this kind of estimation provides a much better guide to how much any given service area would benefit from a more robust design and how vulnerable it is to changing customer-usage patterns. This can be performed with a variety of initial parameters, each taking into consideration the different usage patterns associated with everything from an all-residential community experiencing a power failure on Mother's Day, to a mixed retail and industrial region at mid-afternoon.

Design phase testing

For any company planning to offer lifeline service it would be difficult to

overstate the importance of doing these kinds of tests while still in the design phase. Predicting expected downtime percentages and system reliability is critical when customer satisfaction and Federal Communications Commission approval is on the line. This kind of knowledge is also highly valuable if you, like most of us, don't have an unlimited supply of money to spend: safety margins.

Tolerances and excess capacity aren't free, and money spent on improving reliability in regions unlikely to cause critical failures instead of increasing the robustness of potentially unreliable areas, is money poorly spent. Further, once this information has been created, and as long as it is kept current, it is always available to examine the possible effects of future changes in customer base and usage patterns, equipment, and services on the system's robustness.

This is really what it's all about: Knowing where we can safely tread before each step instead of finding out afterwards. CT

Trygve Lode is president of Lode Data Corp. He can be reached at (303) 759-0100.

BOTTOM LINE

System Psychology

Offering broadband telephony on your system can produce behavorial abnormalities due to a combination of the following:

- **Variable power demand** from network interface units (NIUs),
- **Positive feedback loop** produced by resistive losses in the cable plant, and
- **The small service area** handled by a given node or power supply All of these add up to more problems than would normally be expected based on cable TV or conventional telephony considered individually.

Get control of your system by acting early: Estimate the robustness of a section of a plant while still in the design phase by performing **"worst case" simulations** that will help you determine the threshold beyond which the amount and distribution of loading can result in a failure.

Another approach to use what is known as **statistical simulation.** Based on projections of customer demographics, equipment and service penetrations and usage patterns, you can create simulated scenarios for how customer types might be distributed and how services would be allocated to them. From this, you can figure out which service areas would benefit most with a more robust design and how vulnarable a system would be to changing customer-usage patterns.

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The new MAXLink HLT 7709 improves upon Harmonic's current 1550 nm transmission system by increasing the dual complementary outputs to 9 dBm, without requiring optical amplifiers. This means new solutions to both old and new system topologies. Who says you can't have it all?

The high combined output power of the new MAXLink enables efficient 1550 nm distribution. The high signal output allows for remote location of the optical amplifier, producing high signal quality in the new fiber-to-the-node transport architectures. In supertrunking applications the new transmitter increases efficiency and improves CNR due to elimination of the optical amplifier. And no matter how you look at it, this all means better economy – in either long-distance or fiber-dense environments.

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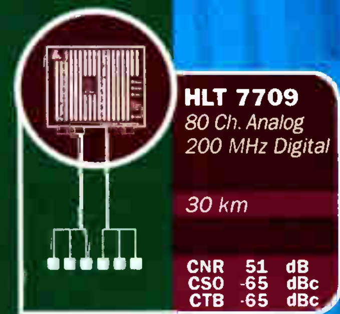
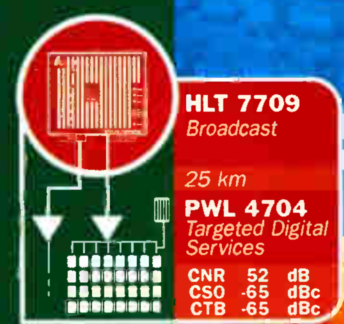


Efficient Distribution



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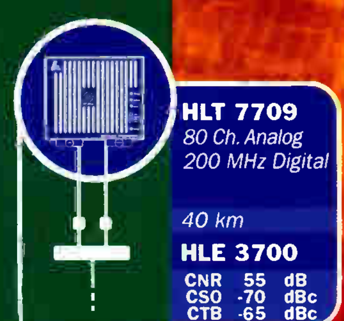

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Reader Service Number 78

Net a New Job

Virtual Job Hunting on the Internet

By Kenny Faust

After suffering a job loss due to a RIF (reduction in work force) at a major MSO, I needed to get back into the job market and match my 12 years of cable experience as a manager and engineer with a new position in the telecommunications field.

Of course, the first thing to do was to contact all of the people that I had been networking with over the past several years and let them know I was on the market. It also was time to return the phone calls of a couple of search firms that had been kind enough to call even before my dilemma became public knowledge. These people were really on top of things. I sent them a copy of a current resume with permission to send them to their clients.

I then took advantage of my former employer's generous offer to use an outplacement service to hone my job search skills. The outplacement counselor was supposed to have eight other managers in her class but I was the only one to show up. This was advantageous to me since I received 16 hours of one-on-one training with an experienced job consultant and 50 customized resumes at the end of the session.

In the process of researching a list of companies at the local library, I came across a book on electronic job searches. This was the catalyst needed to turbocharge my mission to rejoin the ranks of the employed. I signed up for an e-mail address on the library's freenet service and prepared to cybersearch for a new job in telecommunications.

My freshman daughter, Robin, was home from school for winter break and had brought with her the neatest thing from the University of Missouri, a brand-new Powerbook 1400cs laptop computer. The college of education requires all students to have these computers as a part of the curriculum. I immediately commandeered the machine to enhance my search. It turned out that Robin had a complete set of software and an account at the university for Internet access.

I asked her what she had been doing with the laptop so far and she said, "Playing solitaire and CDs, mostly." There was little reason to feel bad about "borrowing" the computer, and besides, the information acquired in the process might be beneficial to other out-of-work cable folks.

Jumping on the WWW

After firing up Netscape Navigator 2.0, it was time to surf the Net, or at least the World Wide Web portion of it. The first stop was http://www.works.state.mo.us, the Missouri Job Service. The State of Missouri is the host of this site where a candidate creates a resume in the "talent bank" and posts

> **BOTTOM LINE**
>
> **Work the Web for New Work**
>
> Even in a good economy and a booming industry, RIF (reduction in work force) is always a possible reality. If you find yourself looking to get back into the job market, the Internet is a great way you can match your cable engineering experience with a new position in the telecommunications field.
>
> Innumerable job Websites exist on the World Wide Web, including cable-specific pages. With a little organization and a list of some of these sites, you're on your way to clicking onto a new job.

RDU ©

The Return Display Unit

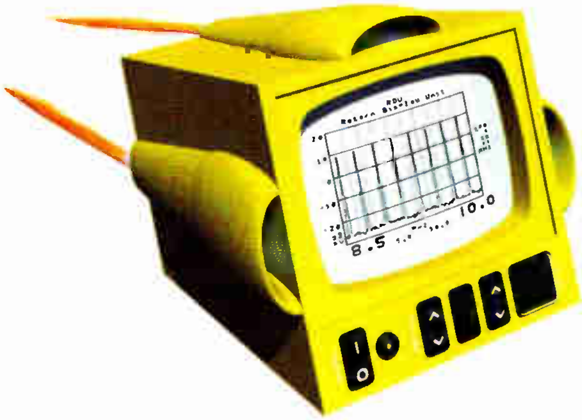
Real Time RF HE Levels

Ingress Noise Alarm

High Carrier Monitoring

Video and Data Outputs

Return System Operations made Simple...
A Key to 2-Way Success



RDU: patent pending.
RDU © 1997, Cable Resources Inc.

The RDU is a new piece of test equipment. It allows technicians to monitor the return system from any point in the cable system without the traditional and cumbersome HE spectrum analyzer / camera setup.

The RDU allows system installers and technicians to view on any TV screen, the RF Levels, Ingress and Noise present back at the HE from a subscriber's home, system amplifier, feeder tap or fiber node.

The RDU processes the X / Y output data generated by an internal spectrum analyzer and converts it to NTSC video for input to a standard CATV modulator. A data output allows the analyzer screen to be viewed on a computer, same as video. Software is Windows 95 networkable so office possibilites are endless.

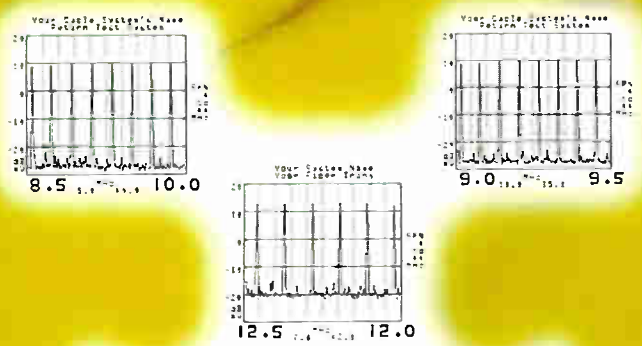
The RDU displays noise, ingress and RF carriers, the same as a spectrum analyzer with a video and computer screen refresh rate of just 350 milliseconds!

The RDU displays HE return levels on two user selectable test carrier frequencies in the 4-44 mhz. bandwidth. Test carriers and ingress / noise levels can be easily documented from every installation and service call. Simple and easy to implement.

RDU software monitors ingress / noise by recording RF energy, where you designate, in 200 khz. segments. The RDU averages the data and displays a ingress / noise number, real time. Response over time charts can be outputed for analysis and documentation.

The RDU is an efficient new tool to activate and maintain broadband networks creating benchmarks for return cable system operations.

The RDU allows you to start your system with a return video channel and migrate to a data stream as your people master the art of return operations. Keep it simple to succeed.



Above are samples of a TV screen that system installers or technicians would "see" in the field.

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HP ESA-L1500A Portable Spectrum Analyzer: Low cost, high dynamic range, spectrum analyzer for return path and ingress maintenance.

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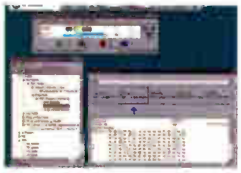

HP E6277A MPEGscope DVBplus: Real-time measurements and monitoring of MPEG streams.

HP 8591C Cable TV Analyzer: The industry's only one-box tester for all non-interfering RF and video measurements

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Be Prepared for the Interactive Technology of the Future.

To stay competitive, you have to be prepared for new digital technologies—including interactive services. And you have to know that the products you buy

it for employers in any or all of the 50 states.

To access a prospective employee's resume, an employer must register with the job service and pass a verification process that maintains the applicant's privacy.

Jobba the Hunt

The next site had the ominous title of The Monster Board, http://www.monster.com. This Web page has a link titled, no kidding, Jobba the Hunt. To utilize Jobba the Hunt's search engine, a candidate enters a login name and password that then becomes unique to that individual. To obtain a list of companies and job postings, one has only to select work locations and the type of job desired; Jobba will display a number of matches to the inquiry.

One initial search turned up over 1,000 matches until the parameters were narrowed a bit. The companies at this Web site range from Fortune 500 to small start-ups. Definitely, go there.

Cable-specific site

Another site of interest was sponsored by the Pennsylvania Cable Television Association, http://www.pcta.com. These forward-thinking people have a free service that places resumes of laid-off cable employees on the Internet and then advertises the fact by linking to other cable industry Web pages. They even mail out job notices to people who have their resume posted. Thanks, PCTA.

(Editor's note: Look for other cable-specific career opportunities starting in January at "Communications Technology's" Website. Check out http://ctinfosite.com.)

Interview prep

If a job seeker is unsure of how to prepare for an interview, or has questions during a search, the place to go is *Career Magazine* at http://www.careermag.com. Read advice from Joyce Lain Kennedy, a pioneer of electronic job searches, or a host of other career counseling professionals. There also is a place to submit resumes, naturally.

Hone in

Finally, if a particular company is the target of a job search, one can usually find its Web page by putting the name in the proper format such as http://www.comcast.com, for Comcast; http://www.bell-atl.com, for Bell Atlantic; or http://www.ibm.com, for IBM.

A search engine such as Lycos, http://www.lycos.com, or Yahoo!, http://www.yahoo.com, also will come in handy to find prospective employers.

Don't forget resource home pages such as the Society of Cable Telecommunications Engineers, http://www.scte.org; Cable On-Line, http://cable-online.com; and The Parrot Cable Site at http://www.parrotmedia.com/cable/cindex.

By placing resumes on several of the Web sites listed here, I received five job interviews in the first few days of unemployment. Every site was free to the user and the only request from the hosts of the Web pages was to let them know when their services were no longer needed or the information in the resume changed. This is a small price to pay for a virtual bulletin board listing your qualifications.

The key to successfully navigating the Web, or other aspects of the Internet, is to use the links to other Websites wisely. Create a resume that can be submitted on-line and then go for it. The surf is up and the computer-generated water is fine. Net yourself a new job using the Internet today. CT

Reference

Gary Scott Malkin, Xylogics, Bay Networks, editor of "Internet User's Glossary."

Kenny Faust is general manager, TCI of the Quad Cities. He can be reached at (309) 797-2580, ext. 3050, or via e-mail at faust.kenny.j@tci.com.

Glossary of Internet Terms

- **Authentication:** The process of verifying a computer user's identity.
- **Bandwidth:** The amount of data that can be transmitted through a network.
- **Bulletin board system (BBS):** A computer and software combination that provides programs, games and activities of interest to targeted users.
- **Cyberspace:** Fantasy novelist William Gibson created this word to describe the inner workings of the computer world.
- **Dialup:** A means of establishing a temporary connection to the Internet using phone lines.
- **Domain name system (DNS):** A method of looking up domain names such as: .com, .edu, .gov, .net, .us, .mil.
- **Electronic mail (e-mail):** The process of exchanging messages between computers in a communications network.
- **FAQ:** Frequently asked questions. Go to this part of any newsgroup before posting messages or risked getting flamed.
- **Flame:** A strongly worded put-down of someone that has offended others during a newsgroup discussion or in an e-mail. This usually happens to those who post inappropriate material.
- **Freenet:** Bulletin boards funded by individuals or groups in order to make computer telecommunications services freely available to a community.
- **Home page:** The first document in a Website.
- **Hyperlink:** A link within a hypertext document that allows connection to another document by clicking on an object or word.
- **Hypertext markup language (HTML):** Computer language used to create hyperlink documents.
- **Internet:** A network of computers originally created for use by the U.S. government to maintain a system of communications in the event of a nuclear attack.
- **Netiquette:** proper etiquette on the Internet.
- **Postmaster:** The person in charge of a Website's e-mail problems and other duties involved in communicating with users.
- **Server:** a computer that provides resources to a network.
- **Snail mail:** a nickname for the U.S. postal service.
- **Uniform resource locator (URL):** a string representation for a location on the World Wide Web. Example: http://www.tci.com.
- **World Wide Web (WWW):** A system created in Switzerland utilizing hypertext language to present information on the Internet.

By Alec Saunders

Data Enhanced TV Programming

In April of this year, the Federal Communications Commission gave its final approval to digital broadcasting in the United States. As a result, the TV industry is about to remake itself as we switch from analog to digital.

Digital broadcasting will mean changes everywhere, from the studios, networks and broadcasters, to the cable services, manufacturers of TV sets and receivers, and advertisers. The impact of digital broadcast extends beyond TV as well, as digital broadcast will become the new common ground between broadcasting, cable services, satellite, TV and computers.

The benefits of digital transmissions to consumers are exciting. In addition to the obvious higher quality TV images, other ways that digital transmissions can be used include:

- *More interactive TV.* When related data and video are transmitted together, these can be re-assembled by software in the receiver into more interactive TV programming. Viewers can request more information about a show (for instance, requesting additional statistics on a baseball player). When a back channel, such as a telephone modem or a cable modem, is part of the in-home setup, viewers can interact with other viewers or the program's producers via on-line chat or e-mail, or purchase goods and services. At its best, this interaction has the potential to create a sense of community and immediacy which today's TV technology simply cannot deliver.
- *High speed data delivery to the home.* Digital broadcast signals will be transmitted at a transmission rate of 19.3 Mbps, a rate far in excess of existing land-based technologies like

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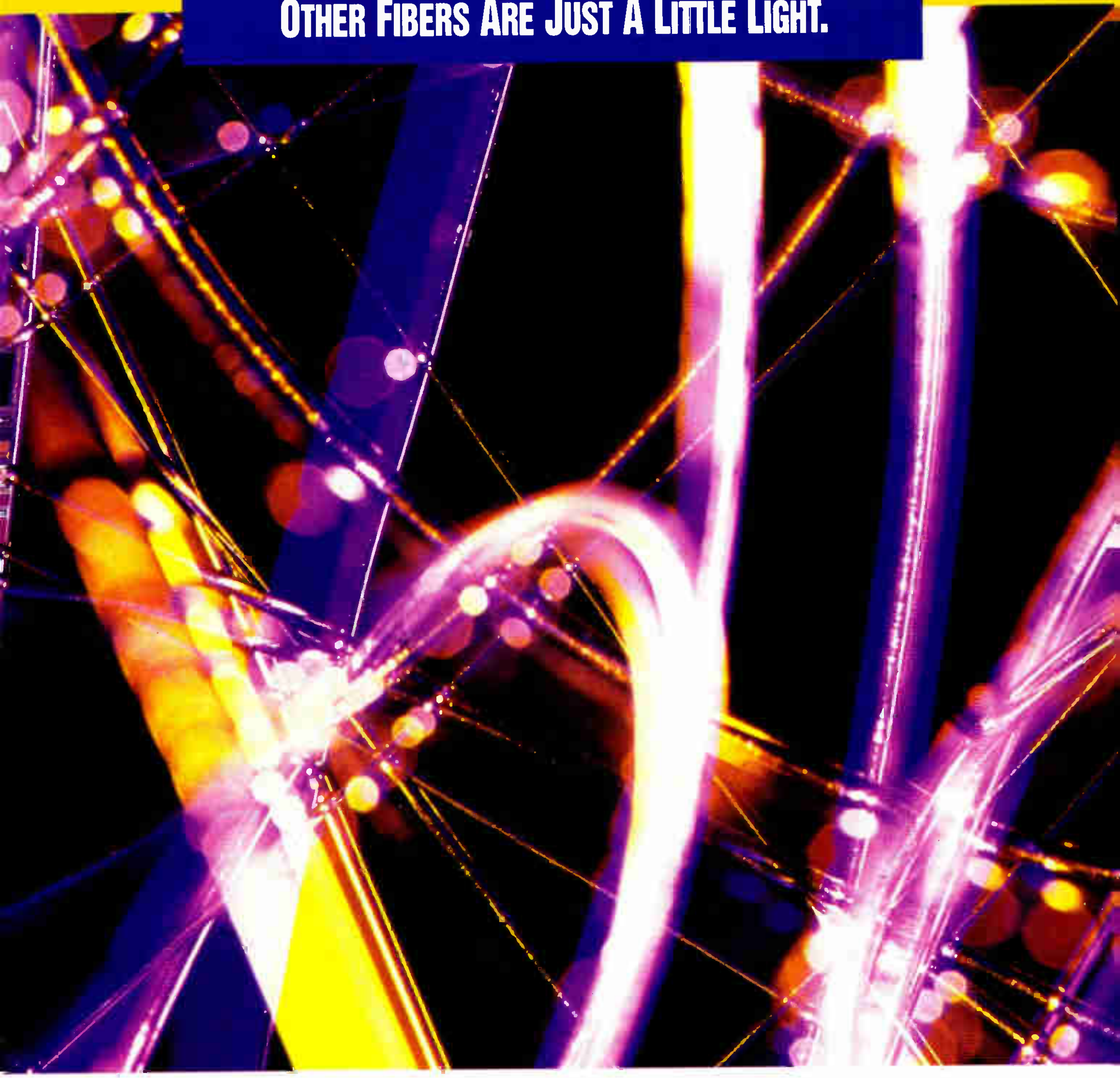

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ISDN and telco modem. Cable technologies have the potential to reach rates as high as 45 Mbps, allowing very high quality video images and gigabytes of data to be transmitted simultaneously. Coupled with the Internet, digital TV has the potential to revolutionize in-home Internet access, allowing applications like retailing (software, film and audio), Webcasting (the broadcast of Internet Web sites), multimedia magazines and more.

BOTTOM LINE

Data Draws a Blank

Every cable operator already has the infrastructure to begin broadcasting data to the home. What is it? The vertical blanking interval (VBI) of NTSC TV. Although not as fast as digital, relatively large amounts of data can be sent in the VBI.

Data rates approaching ISDN have been achieved in some VBI-based tests. Some companies claim to be able to send as much as 150 megabytes of data each day.

To receive this data, viewers will need a PC with a TV tuner card and broadcast-enabled client software. For two-way, customers also need a back-channel telephone line, ISDN, cable modem or asymmetric digital subscriber line (ADSL).

Enhanced TV:

Data enhanced TV programming is another cable opportunity. In enhanced TV, video is transmitted with accompanying related data, typically Internet Web pages, synchronized with the video.

In the future, in addition to sending TV signals and data, the cable operator's business could expand to include:

- *Transaction services*, to allow customers to immediately complete a sale via TV if they see a product of interest;
- *Composition services*, to assist advertisers in creating their data enhanced advertisements; and
- *Website hosting services*, to allow advertisers to provide information about products all of the time.

Data over VBI

The infrastructure to begin broadcasting data to the home is already in place today. While high-speed data delivery will have to wait until new switched digital equipment is installed at cable plants nationwide, every cable operator has access to the NTSC vertical blanking interval (VBI). Although not as fast as digital, relatively large amounts of data can be sent in the VBI. Using the Internet protocol (IP) with a suitable forward error correction algorithm, and all ten lines of available VBI, data rates similar to integrated services digital network (ISDN) have been achieved in some tests. Using just two lines of VBI, some companies have reported the ability to send as much as 150 megabytes of data each day.

To receive the data that is being transmitted, viewers will need to own a personal computer equipped with a TV tuner card and broadcast-enabled client software. For two-way interaction, customers also will require a connection to a back- channel telephone line, ISDN, cable modem or asymmetric digital subscriber line (ADSL).

There's an obvious business opportunity in subscription-based, premium data services to the home. Cable operators could simply devote a channel to data, and charge for it in the same way as pay-per-view movies or premium TV.

From a technology perspective, setting up a service like this could be as simple as adding a personal computer and VBI injector to the cable headend, and re-broadcasting Web-based content. The content could be IP multicast packets originating from a multi-caster on the Internet, or entire Web sites, which are picked up for rebroadcast.

Enhanced TV

Data enhanced TV programming represents another opportunity. In the model of data enhanced TV currently under development by several companies, video is transmitted with accompanying related data, which is most commonly Internet Web pages, synchronized with the video.

For example SciSquad, is a show aimed at older children and young teens about kids solving problems with science. In the screen shot on page 70, the National Television System Committee video signal is in the upper right quadrant of the screen.

The viewer could choose to watch this video as if it were standard TV by simply selecting the video and enlarging it to full screen. Around the edges of the video in this example are several data objects: The still images of the sharks are synchronized with the video signal, and can change as the show progresses. Below each shark there is a silver "canister" surrounded by a glowing green shadow.

When the viewer selects the canister, the accompanying caption text is exposed below the image, giving more information about what is being shown. The "pipe creature" in the lower left hand corner is a menu of other interactivity options. During normal viewing it is hidden, except for the two eyeballs. When the eyeballs are selected, the body of the creature glides up from the bottom of the screen exposing other options.

The "Chat" option allows the viewer to bring up a chat window, and communicate via a telephone line with other viewers who also are watching the show. The "E-mail" option allows the viewer to send mail to the cast and producers of the show.

The "The Lab" option takes the viewer to an additional set of data enhancements where they can explore the information presented in the show in more depth. It contains additional topical articles and games. The "Show" option restores the synchronized video window and lets the viewer simply watch the show.

These data enhancements are a simple precursor to what will be possible. In the future, it's easy to see a world where, in addition to sending TV signals and data, the cable operator's business could expand to include offering:


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- *Transaction services*, to allow customers to immediately complete a sale via TV if they see a product of interest;
- *Composition services*, to assist advertisers in creating their data enhanced advertisements; and
- *Web-site hosting services*, to allow advertisers to provide information about products all of the time.

The investment needed to get started transmitting data today is fairly minimal—a VBI inserter and a standard PC with appropriate software. Together, both can be purchased for under $10,000. What to transmit? Many networks already create Web sites, and therefore have the expertise to create Web-based content in hypertext markup language (HTML). Many also are news services themselves, transmitting the local news, weather and sports several times daily. A logical place to start would be to transmit this information as data so that viewers could access it at any time using an appropriate receiver.

If the operators' Website includes "push" content designed for Microsoft Internet Explorer 4.0, or Netscape Netcaster, this also could be easily broadcast, giving consumers a true push experience.

> "The addition of data broadcasting to the cable operator's package of services opens up a whole new world of opportunities."

Beyond these simple steps, operators also could contemplate selling additional ad space with programming, or charging advertisers a premium to broadcast an electronic brochure to accompany an advertisement—imagine the value to an advertiser in giving the customer the ability to immediately purchase or receive more information about an advertised product.

It is clear, that the addition of data broadcasting to the cable operator's package of services opens up a whole new world of opportunities.

For a minimal investment, a cable operator can get started with this new medium today, and be confident that this investment will be applicable to the future world of digital TV. Digital broadcasting, the transmission of digital media from one to many over diverse digital networks, is the new common ground of broadcasting, cable networks, satellite, TV, and computers. CT

Alec Saunders is product manager for the desktop and business systems division of Microsoft Corporation. He can be reached at 206-936-7087.

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Heart of Glass

Simple Steps to Better Optical Network Design

By Dean Yamasaki and David Kozischek

Optical technology has proliferated throughout the cable TV industry. The fiber network topology of each multiple system operator differs from one another; however, the basic principles that govern network design and material selection can universally be applied to all topologies.

The primary focus of this discussion is to relate transmission path (link) attenuation to active transmission equipment.

After cable routes and node placements have been established, an evaluation of the basic system transmission objectives is conducted. The system designer must first assess the attenuation characteristics for each fiber span in the overall route and select the appropriate electronics package based each span's requirements. Selection of the electronics package can be driven by a number of variables, including vendor, number of transmitters desired, standardization of equipment and cost. The ultimate goal in the design process is twofold: first, to ensure the optimum optical power level per equipment design specifications is delivered to the input of the receiver; and second, the electronics/delivery system chosen to meet the established operating requirements is keeping within the MSO's established preferences for its network.

Design objectives usually can be met by more than one system configuration. A trade-off analysis, varying one or more system parameter(s), might be necessary to consider all options and determine the best one. This type of analysis can be performed using some fundamental concepts and calculations to verify that the designated active and passive components work together to support proper system operation.

Calculating passive link attenuation

The initial step required for this type of system analysis is to establish the total attenuation of each link in the system. This may be done by summing system attenuation in a step-by-step manner. (See accompanying table on page 80.) The following is a detailed discussion of the process:

1) *Calculate the fiber loss:* Multiply the length of the proposed transmission path (total link length in km with adjustment for sag/slack) by the normalized cable attenuation (dB/km) for the fiber at the operating wavelength of interest.
2) *Calculate the connector loss:* Add the individual attenuation values (dB) for every connector pair along the route being considered, from transmitter to receiver, excluding transmitter and receiver connectors.
3) *Calculate the splice loss:* Add together the individual local attenuation values (dB) for every splice along the fiber route being considered, from transmitter to receiver.
4) *Calculate other component losses (e.g. couplers, splitters):* Add the attenuation values of any other components that will contribute to optical signal losses in the fiber route, from transmitter to receiver. This value will account for all other (if any) attenuation contributed by sources in the link not accounted for in Steps 1

> **BOTTOM LINE**
>
> **Network Design and Selection**
>
> Basic principles that govern network design and material selection include vendor consideration, number of transmitters desired, standardization of equipment and cost.
>
> The ultimate goal in the design process involves two steps:
>
> **1) Ensure the optimum optical power** level per equipment design specifications is delivered to the input of the receiver; and
>
> **2) The electronics/delivery system** chosen to meet the established operating requirements is kept within the MSO's established preferences for its network.
>
> Basic transmission objectives can be met by a variety of options and the merits of each can be evaluated using a calculated passive link attenuation and trade-off analysis.
>
> The final selection decision will be up to you and may be based on cost, vendor reputation and other user preferences.

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through 3. (Note: Trade-off analysis may require optical splitters to be integrated separately at a later time in the analysis.)

5) *Combine the values obtained in Steps 1, 2, 3 and 4:* This value is the estimated passive system attenuation for the link being considered. Note: This step is designed to calculate the total attenuation loss contributed by the transmission path under consideration. Maximum values or nominal values may be used to establish attenuation performance for Steps 1 through 4. Utilization of maximum values typically provide the "worst case" analysis and reflect a safe, conservative approach. Nominal values are representative of a statistically-based "typical" performance and may allow justification of longer links (with less headroom for contingency planning). Designers should select an option, or employ a combination of the two options, based on the objectives of the system operator.

Selecting transmission equipment

The active electronics can be selected once the link attenuation is established. The selection process normally will be driven by the receiver's operat-

> "Before starting to establish the transmitter requirements for the headend, define functional working parameters of interest such as the optical wavelength and optical power level required at the node."

ing parameters. Cable TV system designers' typical transmission selection criteria is based upon achieving a target power level at the input of the receiver. This target or "optimum" level is typically 0 dBm, but may vary depending on the manufacturer of the end electronics. A power level in excess of the target power level can potentially overdrive the electronics. A power level under the target power level can result in insufficient carrier-to-noise ratio (C/N). Neither is desirable since both degrade the ability of the receiver to produce error free radio frequency (RF) output from the optical input. ➤

Determining link attenuation

Fiber loss	Cable distance:	_____km	
	Performance:	x_____dB/km	=_____dB total fiber loss
Connector loss	Attenuation per pair:	_____dB	
	Number of pairs:	x_____	=_____dB total connector loss
Splice loss	Loss per splice:	_____dB	
	Number of splices:	x_____	=_____dB total splice loss
Other components	as applicable		=_____dB total components

The optimum receiver power level is usually above the minimum receiver sensitivity. However; analog amplitude modulated-vestigial sideband (AM-VSB) signals require a higher C/N than their digital counterparts. Analog transmission is much more sensitive to signal distortion than digital transmission and necessitates additional considerations. The higher C/N is necessary to ensure that the receiver can correctly convert the analog optical input to RF output. The higher input signal level into the receiver also is necessary to address effects such as composite second order (CSO) and composite triple beat (CTB). Proper input power at the receiver helps to compensate for these effects.

In some cases the electronics manufacturer will have already calculated an optical budget (dB) for the electronics. If not, the simplest way to calculate an optical budget or "system gain" is to subtract the receiver target input level (typically 0 dBm) from the transmitter average power output(dBm). The system designer then uses this optical budget value to correspond with the appropriate passive link attenuation.

A single transmitter can power one or multiple links. Also, a system can standardize on a single transmitter power and meet link requirements using asymmetrical couplers for power division down each leg. Another option is to power the entire system with one powerful laser in series with an erbium doped fiber amplifier (EDFA) and multiple couplers. We will now consider a simplified network to illustrate this analysis concept. This will demonstrate an example of trade-off analysis by considering two different transmitter options.

To conduct a system analysis, the attenuation losses (fiber, connections and components) are combined as discussed in the earlier section on passive link attenuation and the optical link losses at 1,310 nm and 1,550 nm are calculated.

Before starting to establish the transmitter requirements for the headend, we need to define functional working parameters of interest such as the optical wavelength and optical power level required at the node. These parameters are defined by the manufacturer of the end electronics. The manufacturer also will specify C/N, CTB and CSO levels; these values can vary based on the optical power received at the node. Taking all these parameters into consideration, we will set up a design criteria and consider some examples. A dedicated laser for each link is always an option; however, we will evaluate alternate design options to illustrate trade-off analysis. The design criteria are: operational wavelength of 1310 nm or 1550 nm; optical power required at the node is 0 dBm ± 1 dB; and C/N of 55 dB

> "The basic principles associated with cumulative link loss calculations can be universally applied to all topologies."

Option 1: Standardize equipment on a single power level laser(s) at 1310 nm with optical splitters to feed each optical node. Using the calculated attenuation of each link and the design criteria will result in the use of five lasers and 1x4 and 1x3 splitters to meet the requirements of all links. [Quantity, 5; Optical power, 10 dBm]

Option 2: Using the calculated attenuation of each link and the design criteria, the use of a single transmitter and a 1x16 splitter can meet the requirements of all links. [Quantity, 1; Optical power, 17 dBm]

Conclusion

We have demonstrated that basic transmission objectives can be met by a variety of options and the merits of each can be evaluated using a calculated passive link attenuation and trade-off analysis. The final selection decision will be up to the individual operator and may be based on cost, vendor reputation and other user preferences. The examples used in this article only describe some of the options available to system designers and have been used to demonstrate the value of this methodology. Even though the fiber network topology differs from MSO to MSO, the basic principles associated with cumulative link loss calculations can be universally applied to all topologies. The link loss analysis provides system designers with a valuable tool to assist with system integration of end electronics. CT

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Women in Technology Award

By Pam Nobles

Creating significance. Commitment to growth. Teaching others. Leading by example. Sharing knowledge and experience with the industry and the community. These are the qualities one might associate with a leader. These also are qualities you would associate with the 1997 Woman In Technology Award recipient, Yvette Gordon.

The annual Women in Technology Award recognizes and honors leading women in technology positions within the cable and telecommunications industry and creates visibility for all women in technical careers with the industry. Each year it identifies and acknowledges the achievements of an individual woman within the industry's technical community who has demonstrated significant personal and professional growth and has contributed significantly to the industry.

It is co-sponsored by the Society of Cable Telecommunications Engineers, Women in Cable & Telecommunications, and *Communications Technology* magazine.

The cable industry is not the first to recognize these qualities. Gordon was honored in 1995 with the Engineer of the Year award from the Institute of Electrical and Electronic Engineers signal processing chapter. This honor allowed her to be recognized with the likes of engineers with over 50 patents and many Ph.D.s.

In her career, Gordon has had diverse experience, from designing algorithms for the Longbow radar system of the Apache helicopter, to building the world's first digital interactive TV system.

She began her career as a software engineer at Lockheed Martin, as a UNIX and C programmer and system administrator. After receiving both a bachelors and masters in mathematics, she began work in signal processing, working on pattern recognition and compression algorithms for one and two dimensional radar signals. She also worked on image processing with medical and fingerprint images.

After 10 years at Lockheed Martin, Gordon moved on to Time Warner Cable and the design of the full service network (FSN). The FSN was to be the world's first digital interactive TV network, offering transactional service and full VCR functionality of video over cable. The task of integrating such a network had never been done before and proved to be quite a challenge in its design as well as its operation and management. The FSN became the launching and testing ground for several of Time Warner Cable's digital technologies that lead to RoadRunner (TWC's high-speed data delivery service) and Pegasus (advanced digital set-top box).

For the past two years Gordon has been involved with TWC's advanced engineering team on authoring the Pegasus request for proposals (RFPs)—the next generation of the digital and interactive technologies. The process began with a Phase 1.0 RFP, requesting a digital broadcast headend system and a digital set-top box that also would support full interactivity in the future. Time Warner announced at the 1996 Western Show that it would purchase around a million of the Pegasus set-top boxes.

In 1997, Gordon worked on the next phase of RFPs, requesting a hypertext markup language (HTML) engine for the Pegasus set-top and a full video-on-demand (VOD) system. HTML allows Web-based applications to run easily on a set-top and would allow Time Warner to support RoadRunner TV. The specifications included complete hardware and software requirements and Gordon's specialization in the RFP authoring focused primarily on component integration, operations, the set-top client application, and headend software requirements.

This October she moved on to become the director of interactive technologies for SeaChange International. SeaChange is a fast-growing company focused on providing digital video systems to the TV industry. It is well-known for holding over 80% of the U.S. digital ad insertion market. In addition to ad insertion equipment, SeaChange develops complete video server-based systems to support near-video-on-demand (NVOD) and VOD.

This summer, Time Warner Cable installed its hotel VOD system in New York, using the system from SeaChange and its partner IPC Interactive. It is run from their Manhattan headend and is capable of supporting the more than 140 hotels in the franchise area.

Gordon will be assisting SeaChange in architecting its system software for the VOD headend products. After Time Warner's announcement that the FSN was closing and the completion of the Pegasus specifications, Gordon wanted to continue to use her engineering skills to architect video systems. The move to SeaChange allows her to do that while continuing to maintain a close focus on the business, standards, and operational needs of the MSOs.

Keeping in touch

A product is only as good as the effort one puts into understanding the customer requirements. Gordon plans to maintain contact with the industry to ensure the software and hardware continue to evolve with the industry needs. This includes extensive involvement with the operators, both on an engineering design level as well as operational needs evaluation.

Jim Chiddix, chief technical officer for Time Warner, compares Gordon to a star, saying, "She's bright, capable, and has made many contributions to the full service network. Her winning this award is great."

Gordon has two patents pending. The first, "Apparatus for and Method of Classifying Patterns," describes mathematical methods for classifying what is found in a signal, for example, finding a tank or truck in a radar signal. The second patent is called "Intelligent Media Asset Management System," which describes the automated management of digital content.

Challenges on the horizon

When asked what challenges she sees, Gordon responds "The cable industry is going through a major change with the digital era. We are still talking about hybrid fiber/coax (HFC) upgrades and then throwing high definition TV (HDTV), NVOD and VOD on top of that.

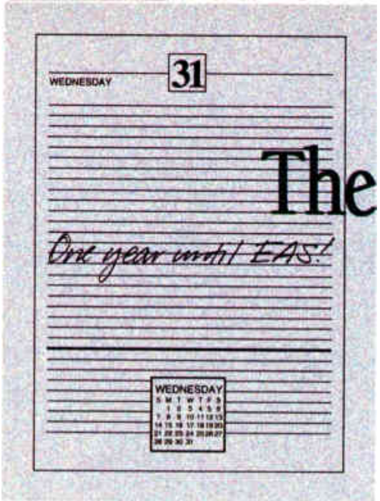
"I believe that everyone really has a good grasp on the need to stay ahead of the competition, but at the same time the new technology, its costs and the operational impacts are quite overwhelming.

"The biggest challenge I see is to help overcome the hesitancy to move forward with digital. This can be done two ways — help in sharing knowledge through presentations and classes, as well as making sure a product is designed well enough to minimize cost and operational impacts to divisions. I plan to do both."

What legacy would Gordon like future generations to remember about her? She would like to be remembered by the community as being caring, by her children as being a great mom and by the industry as having made a significant contribution to emerging technologies. She adds "Wow, that's asking a lot, isn't it? Well, we all have to have goals." CT

Pam Nobles is manager of technical development for Jones Intercable.

Yvette Gordon
Time Warner
We are proud to applaud your efforts, achievements, and contributions to the cable industry. You are an inspiration to those who know you and your work.
Congratulations!
Scientific Atlanta
Reader Service Number 230



The EAS Countdown Begins—Again

FCC Gives Operators to End of Next Year

By Alex Zavistovich

The FCC this fall put to rest months of speculation as to when the Commission might issue its final Report and Order on implementation of the Emergency Alert System (EAS). Its verdict: Large systems have until the end of the next calendar year to install EAS equipment in their headends.

In its late September Second Report and Order, the FCC said it was requiring "all wired cable systems that serve 10,000 or more subscribers to install EAS equipment and provide EAS audio and video messages on all channels by December 31, 1998." The FCC's requirement to carry cable systems to provide both audio and video messages on all channels came in response to concerns from persons with hearing disabilities.

The Commission chose not to exempt smaller systems from the EAS requirements: "such an exemption would be inconsistent with our statutory mandate," the FCC said. Instead, it required all wired cable systems with 5,000 or more (but fewer than 10,000), subscribers to install EAS equipment and provide EAS audio and video messages on all channels by October 1, 2002.

For wired cable systems serving fewer than 5,000 subscribers, the FCC is requiring either the national level EAS message be provided on all programmed channels, or to install EAS equipment with a video interrupt and audio alert on all programmed channels and EAS audio and video messages on at least one programmed channel by October 1, 2002.

"We will provide a phase-in period to provide additional time for cable television operators to comply with these and other EAS requirements," the FCC added.

Wireless cable systems are not exempt from the ruling, either, with the FCC requiring that industry segment to participate in the EAS on the same basis as wired cable systems. At present, satellite master antenna television and open video systems are exempt; the FCC gave no indication of when, if ever, that part of the ruling may change. Existing local franchise agreements for special warning systems will not be preempted by the EAS, the FCC added, as long as they do not conflict with EAS requirements under our rules.

For some, reaction to the decision was basically relief that the waiting is over. Steve Johnson, a senior project engineer for Time Warner Cable in Denver, has been an EBS subcommittee member for the SCTE since 1992. He and the rest of the subcommittee worked with FCC vendors to find cost-effective solutions for complying with the EAS program.

"There are not that many changes in this Report and Order," Johnson said. "Operators were worrying about lead time, but we have a year, so we feel pretty comfortable about that." He said one concern voiced by system operators was the possibility of disruption of programming by an EAS message that was not applicable to certain viewers that received it. Those concerns could be minimized depending on the length of the EAS override, and by customizing the types of emergencies to which an operator might alerts its viewers.

Duck and cover

A direct descendant of the CONELRAD warning system, EBS is a product of America's "duck-and-cover" days, designed to enable the President to speak to the public in event of national emergency. By the beginning of this decade, however, broadcasters were complaining that the two-tone test signal was a "tune-out factor" among listeners and viewers. More importantly, the repetitive tests were creating a "cry wolf" mentality among the public, which was just as apt to ignore a real emergency alert as a test.

In the early fight for a succeeding technology, two systems were competing for dominance: The National Weather Service's Weather Radar Specific Area Message Encoder (WRSAME), and the Radio Broadcast Data System (RBDS) from Sage Alerting Systems. In a 1994 ruling, the FCC named WRSAME as the encode/decode technology that forms the basis for EAS.

The FCC had taken on the revamping of the Emergency Broadcast System during the Al Sikes administration of the Commission. Chairman Sikes had applauded the effort to create EAS, emphasizing its importance to cable as a means of establishing parity with broadcasters—cable had never before had the chance to participate in a national alert network.

Cable operators were far from overwhelmed by this new opportunity. Early adopters have been few and far between. A common objection is that operators can't justify the expense for a product that doesn't really do much when there is no emergency. According to Gerald LeBow, president of Sage Alerting, operators were never very enthusiastic about the system. "These were not smiling faces that said,

'What a neat service, we finally have parity with the broadcasters.'"

The cost factor

Is the system too expensive to implement? If you can trust the FCC's economic model, you might not think so. According to the FCC ruling, "Detailed economic cost estimates to implement EAS for cable television systems ranged from a low of $4,500 to $6,500 per headend submitted by HollyAnne Corporation to a high of $40,000 to $50,000 per headend claimed by NCTA. The general range, however, of estimated costs to provide audio and video EAS messages on all channels submitted by small cable operators is between $15,000 and $20,000 per headend."

At that price, the FCC estimated a 10,000 subscriber system would pay the equivalent of approximately three cents per subscriber per month over a seven-year period. To provide audio and video EAS messaging on one channel, along with an audio alert message and a video interrupt would range from $6,000 to $10,000 per headend, according to the FCC. The cost per subscriber for a 4,000 sub system would be about three cents per month over seven years; the cost per sub for a 1,000 subscriber system would be 12 cents per month.

Time Warner's Johnson said he was not exactly sure of how the FCC arrived at these figures. "Some headends only serve, say, 50 subscribers. Even at a $6,500 investment per headend, that's a lot of money for some operators to spend."

Now that the implementation has been mandated, however, most vendors have begun focusing more on the marketing battle that lies ahead. Steve Grossman of Mega Hertz said he was concerned that some cable operator will purchase their EAS systems sight unseen. "Operators must take the time to compare operational features, specifications and the companies that are backing the products. There are vast differences," he noted.

"Most of all," added Grossman, "I wish all cable operators would use EAS to their advantage! Use it as a soap box, letting the communities know the value of this new service that is free to all subscribers. The good will that could be achieved is invaluable to the operator and to our industry.

"I worry that small cable operators have not considered their alternatives. I understand the financial concern of smaller cable operators; however, I believe that many communities or local businesses would become paying EAS advertising sponsors if they knew they could. The cost of purchasing and installing EAS systems in smaller cable systems could be shared." CT

Alex Zavistovich is executive editor of "Communications Technology" magazine.

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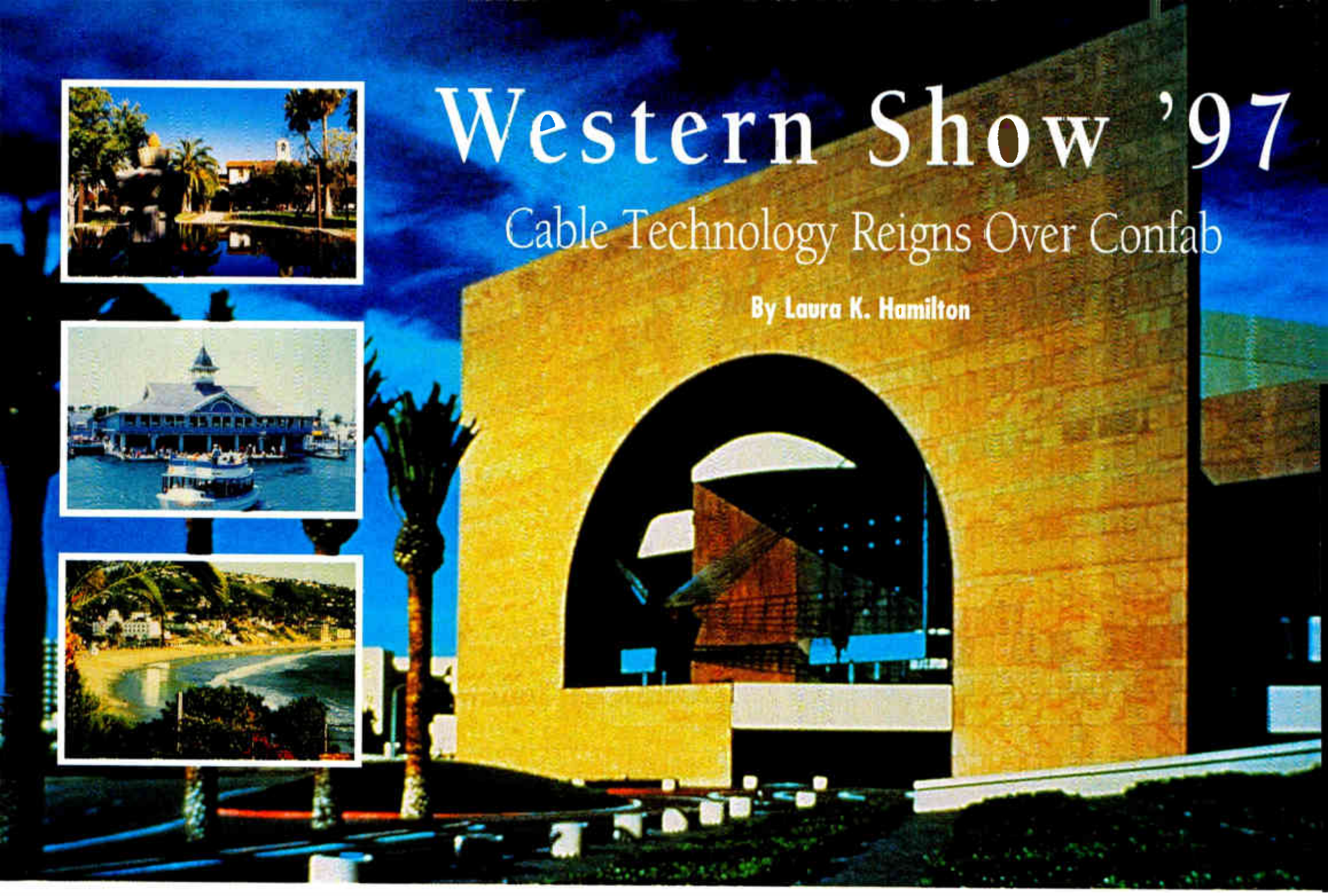
See us at Western Cable. Booth 2646. December 10th thru 12th.



Western Show '97

Cable Technology Reigns Over Confab

By Laura K. Hamilton

Photos: Courtesy of the Anaheim/Orange County Visitor & Convention Bureau

Two-way plant. Cable modems. Federal Communications Commission issues. Network management. Certification. Cable telephony. The 6,000-square-foot CableNET cable technology demo.

Put them all together and you've got a good idea of the technical smorgasbord laid out before cable's technical community at this month's Western Show (Dec. 9-12 in Anaheim, CA). If you're reading this beforehand, or you've found a few moments at the show, here's a bit of advice: Make a plan. There's too much for even the hardiest technical type to see and tweak for a wing-it kind of attitude to work. While the exhibit hall beckons with new products, there's some great technical sessions as well. Then of course there's the CableNET Technology Showcase featuring over 45 vendors demonstrating the latest telecommunications technology.

If you're reading this afterwards and kicking yourself for missing it, you should check out "Bottom Line" in this article. It offers details on obtaining the California Cable Television Association's Western Show CD-ROM with all the highlights.

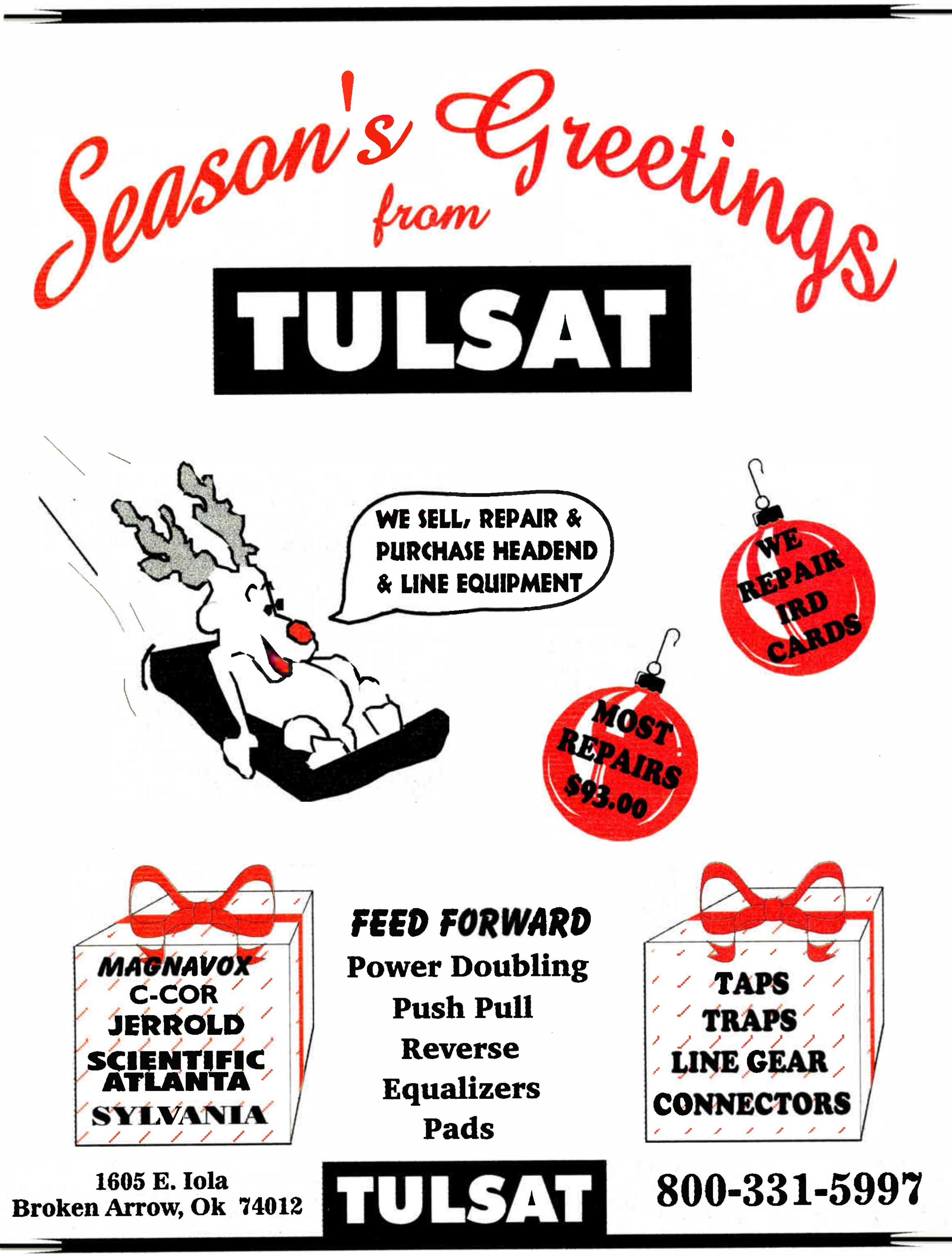
Technical sessions

- FCC/Washington Update: FCC and National Cable Television Association reps provide an update of technical regulatory issues currently being considered by the ommission and discuss compatibility issues relating to broadband telecommunications. Society of Cable Telecommunications Engineers President Bill Riker moderates.
- Two-Way Plant: Traveling Down the Road to Success, in Reverse: Ron Hranac, senior vice president of Coaxial International (and senior technical editor of this magazine), moderates this session on one of his favorite topics.

Whether you are implementing Internet access, telephony or looking ahead to interactive TV, the key component is a well-designed and maintained two-way cable system. Industry experts provide clues about some of the technical pitfalls that can be experienced along the road to building and operating a reverse cable system.

- Cable Telephony Today: Are the Phones Ringing? Jay Junkus of KnowledgeLink (also telephony columnist for this magazine) moderates.

Many cable operators have been



Reader Service Number 255

doing telephony trials and talking about getting into the residential phone business. Today, many of those same operators are ready for the next step—customer service. Operators and manufacturers discuss what has been learned in the trials. Get a view of the future in cable telephony.

- Network Management: It's Not Just Another Name for Status Monitoring: It's 11 p.m. Do you know where your next outage will be? You know you're thinking about it. TCI's Van Macatee moderates.

  Historically, cable systems have relied on their customers to tell them of problems in the cable plant. Today we need to know about problems and respond to potential problems before our customers suspect anything. Several cable operators are considering the implementation of network management systems. Many cable competitors have already installed equipment and are reaping the benefits.
- Cable Modems: Are They "Plug-and-Play"? Good question. What technical skill sets are needed to install and service the hardware and software required? @Home's Ron Wolfe moderates. ➤

BOTTOM LINE

The Western Show '97

There's no doubt about it—technology is stealing the show. The Western Show, that is. This month's big confab (Dec. 9-12), one of the majors in our industry, packs quite the technology punch, to put it mildly. If you're going, you better plan your time carefully because there's a lot to take in technology-wise in just a few days.

If you're reading this after the show and you missed it, you might want to check out the California Cable Television Association's CD-ROM. It offers the following:

- Verbatim session transcripts and case studies,
- Audio and video highlights,
- Exhibitor and product listings
- Speaker slides, biographies and contact information,
- Easy-to-use interface, instant keyword search, Web links,
- Transcripts formatted for screen and print, and
- Supports both Windows and Macintosh computers.

The CableNET showcase also is highlighted.

Call (800) 301-2341 or outside the United States, call (818) 879-1131; Fax (818) 879-0533; or go to the CCTA's Web site (http://www.cct-assn. org/index .html).

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CABLE INNOVATIONS PRODUCTS SHOWCASE

PLS-125™, PLS-225™, PLS-220™ Power Line Surge Suppressors

The PLS-125, PLS-225 and PLS-220 reduce outages and customer complaints by eliminating breaker outages, blown fuses in power supplies, and damage to power supplies due to voltage transients, surges, spikes, and lightning. The PLS-125, PLS-220, and PLS-225 also protect expensive headend equipment from overvoltage related damage.

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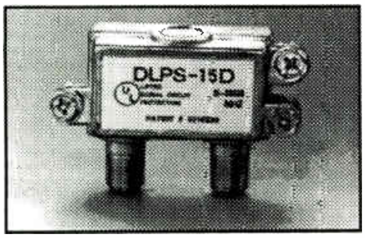

DLPS-15D™ Drop Line Power Suppressor

Developed and patented by Cable Innovations, the 1 Ghz., UL approved DLPS-15D protects drop line electronics from damaging faults due to surges, transients, spikes, and lightning. The DLPS-15D, using dual direction Sidactor technology, protects both directions (from the house and into the house). With a trigger sensing time of one nanosecond, the DLPS-15D will virtually eliminate damage to drop line electronics caused by overvoltages.

If you are currently using Zener diodes, gas discharge tubes, MOV's or just a ground block, you are taking unnecessary risks with your equipment and with your subscriber's electronics. The DLPS-15D offers a longer life, greater current handling capacity and faster response than any other type of protection.

Reader Service Number 302

DLPS-15DF™ High Pass Filter/Drop Line Power Suppressor

The DLPS-15DF is an essential ingredient in achieving the reliability and subscriber satisfaction necessary in those systems that need to eliminate return path noise and protect both their equipment and the subscriber's electronics.

The DLPS-15DF offers the same suppression as the DLPS-15D, taking any overvoltage directly off the center conductor and zapping it to ground instantaneously before any damage can occur to cable line electronics or the subscriber's electronics.

The DLPS-15DF offers a wider and deeper filter, longer life, greater current handling capacity and faster response than any other type of protector/filter.

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GB-401™ Direct Pickup Filter

Eliminates ghosting and diagonal lines due to direct pick problems The GB-401 (Ghost Buster) is a patented filter used to solve direct pickup problems caused by cable ready TV's and VCR's (ghosting & diagonal lines). A high percentage of "cable ready" televisions and VCR's are manufactured with a shielding deficiency problem. Most brandnames and models are susceptible to this problem, regardless of how new or expensive the set is. These poorly shielded units may experience degraded picture quality because strong local TV signals get into the tuner and mix the cable signals inside the set. When a television receives two channels at once, the picture will have interference in the the background. The GB-401 eliminates this problem.

Reader Service Number 304

The 99.99% Reliability Factor

[Cable Innovation's CLPS-4065 Surge Suppressor]

Cable Innovations surge suppression products are an essential ingredient in achieving the 99.99% reliability necessary in CATV systems today. The CLPS-4065 and CLPS-4065PI (power inserter), patented surge suppression technology, protects trunk line and feeder line electronics from overvoltages, and virtually eliminates overvoltage related outages. The CLPS-4065 and CLPS-4065PI are simply the very best surge suppressors available. If you're concerned about the reliability of your system, call us today.

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See the Cable Innovations Showcase Products on this page!

Can cable installers learn to install network interface cards (NICs)? Can they install the software and train customers on its use? Short and long term strategies for dealing with a complex new set of job skills are discussed.

- Certification Examinations: Written exams for SCTE Installer and all categories of Broadband Communications Technician/Engineer (BCT/E) Certification are offered.

CableNET

This display has leading vendors in the telecommunications industry joining forces to show which applications and services they expect to offer over cable networks in the coming year. The concept is exclusive to the Western Show, and indicates the convention's emphasis on technology.

Participants include 3Com, Bay Networks, Broadcom, CableData, Com21, Community Networks, Ericsson, Excite, Harmonic Lightwaves, Hayes, Hybrid Networks, Integrity Communications, Intel, International Billing Services, Libit Signal Processing, Motorola, NextLevel, Panasonic, Phasecom, Scientific-Atlanta, SkyConnect and Oracle, Toshiba, Tut Systems, and many more.

"There's no doubt about it—technology is stealing the show."

Attention international attendees

Do you do business internationally or are you planning on attending from another country? The International Lounge is the place for international delegates and their U.S. counterparts to meet and exchange strategies for successfully bringing their customers the latest technology has to offer. Co-sponsored by Phillips Publishing's *International Cable*, the Lounge provides business services, meeting facilities, translators and guided tours of the exhibit hall, including CableNET '97.

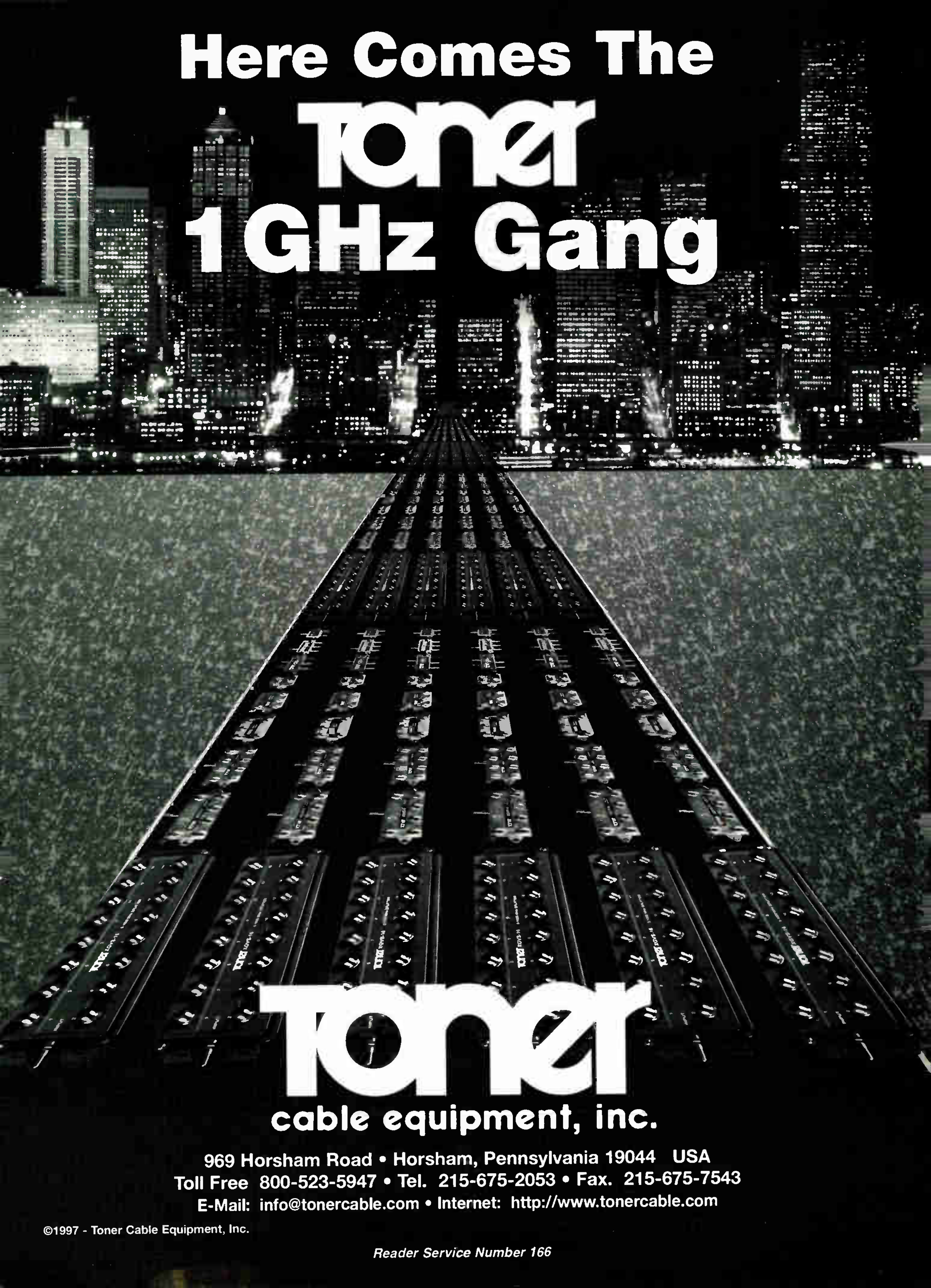
CT/IC Daily

One of the best ways to plan your mission onto the enormous show floor is with the *CT/IC Daily*, put out by *Communications Technology* and its sister publications, *International Cable* and *CableFAX*. The daily lets you know what vendors are rolling out the hot new products as well as those displaying the tried-and-true.

Tech sessions and the CableNET display also are covered.

If you missed the confab or misplaced your copies of the dailies, a limited supply are available after the show. E-mail cwalker@phillips.com or scarp@phillips.com. CT

Laura Hamilton is senior editor at "Communications Technology" in Denver. She may be reached via e-mail at lhamilton@phillips.com.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Cable Network Return Path Systems

By Tim Templeton

The two-way capability of coaxial systems has been in use at one time or another by systems all around the world. Early use was usually limited to status monitoring and control, pay-per-view applications, and local origination.

With the advent of new services and competition within the telecommunications industry, the return capability of these systems has received much attention.

System architectures

Noise "funneling" in the standard tree and branch architectures keeps return path utilization down. In forward spectrum performance analysis, noise is added with each amplifier the downstream signal travels through. The return noise characteristic is the total contribution of all of the amplifiers plus ingress, impulse noise and other impairments combining into a single return path. This is the definition of noise funneling. Usually, only the most robust digital modulation schemes are able to be successfully implemented under these conditions.

Newer system architectures, especially hybrid fiber coax (HFC) have reduced the overall magnitude and impact of noise funneling. By separating a large distribution area into many neighborhood service areas, each fed by a single fiber node, the total number of amplifiers feeding return path signals to a single return path termination is reduced. At the node, the collected signals are combined and presented to a fiber-optics transmitter for transport to the system's signal processing center(s). Multiport fiber nodes also may employ block upconversion, multiple return fiber transmitters (Figure 1), or other methods to further separate return paths. One recently emerging technology is the use of dense wave division multiplexing (DWDM) to combine the outputs of several return path fiber transmitters, each with a different output wavelength or "color," into one fiber. Benefits of these approaches include additional return bandwidth re-use and further segregation to reduce return path noise funneling and limit the number of total subscribers sharing the same path.

Most two-way systems are either subsplit (forward bandwidth=50 MHz to 300-1,000 MHz, return bandwidth=5 MHz to 30-42 MHz; international splits may occur at slightly different frequencies) midsplit (forward bandwidth from about 150 MHz to high frequency limit, return bandwidth=5 MHz to about 112 MHz; or high-split (forward badwidth from 222 MHz to high frequency limit, return bandwidth=5 MHz to about 180 MHz). Most CATV systems operate with the subsplit plan and also may have separate midsplit networks deployed for institutional (I-NET) purposes, such as hospital training and government/educational institution connectivity. Some banks have utilized the local cable facilities for two-way data services.

Midsplit architectures are commonly used as local area networks (LAN) or wide area networks (WAN) carrying video and/or data. Although midsplit networks have not enjoyed the popularity of subsplit architectures, recent service delivery realities have renewed interest in midsplit, high-split, and combined sub-plus-high-split alternatives. These options offer immediate relief for congestion in the face of return path services proliferation. Other methods may rely on modulation methods that offer a higher efficiency for existing bandwidth.

Typical return usage

Point-to-point local origination channels (city hall and community channels) typical-

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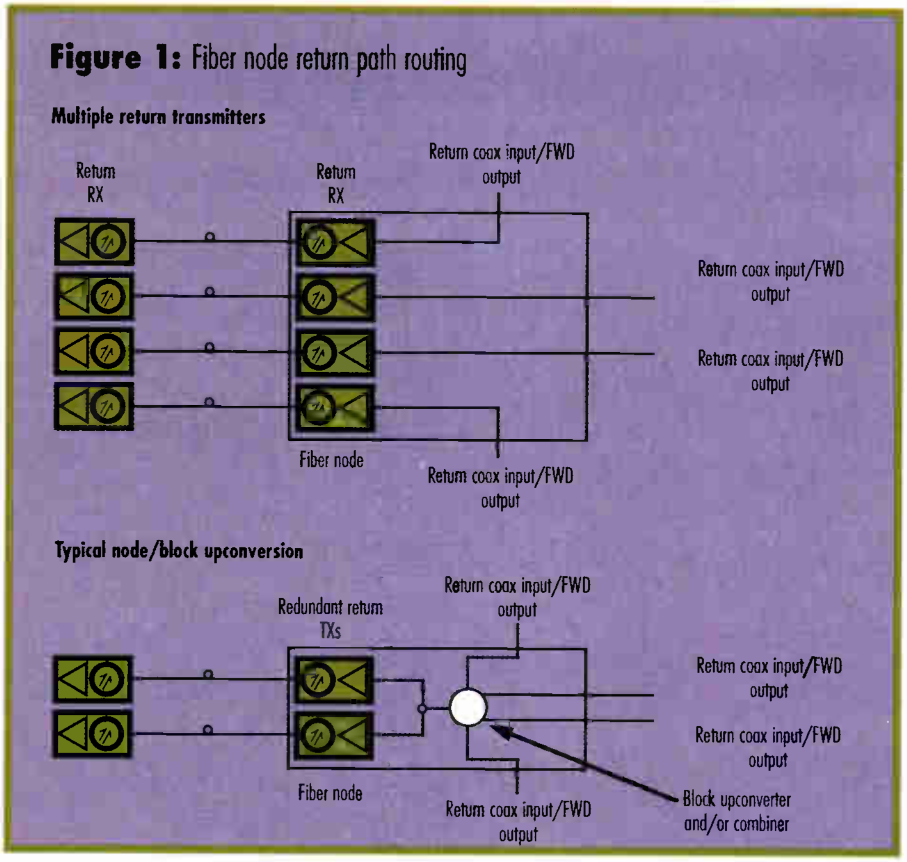
BOTTOM LINE

Cable Return Path Systems: Something Old, Something New...

If you don't already have your return path planned, you will be at it soon. The best way to plan for the future is to know the technology and history.

- *Know your history.* How were return paths previously used?
- *Know your application.* What services and transmission methods are out there? What happens if I change them at a later time? Will they work together?
- *Know your components.* What building blocks should I use to construct a cost-effective return system? How do they work?
- *Know your system.* How do I install and operate the system so that I might achieve harmony and inner peace? (OK, I guess I would settle for a system that works!) What kind of impairment road blocks lie across my return paths and how should I deal with them?

Figure 1: Fiber node return path routing



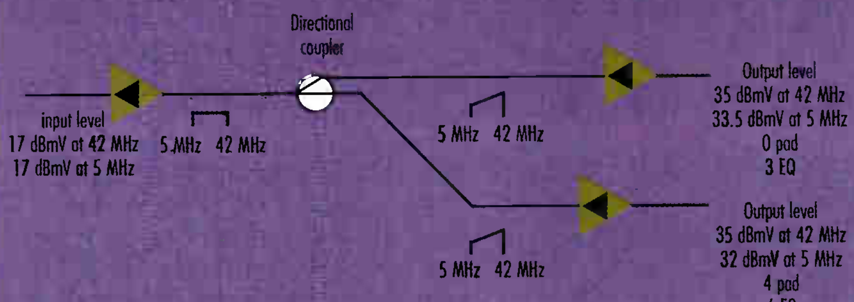
ly have been transported in the return path as NTSC 6 MHz signals using channels T-7 (7 MHz video carrier) to T-13 (43 MHz video carrier). They are inserted in the return path at a point in the distribution plant and transmitted upstream to a headend or hub, then processed and/or up-converted to a forward path channel for distribution to a subscriber service area (point-to-multipoint). Alternate modulation methods, such as digital or FM, may be employed to take advantage of reduced degradation and present the highest quality signal to the headend where, during forward path distribution, the channel will endure further degradation.

New generation return path usage

In the past few years, many new digital services have been implemented. These services have terminal devices that carry out their functions in a digital domain and transmit the digital information through the network by modulating it on an analog carrier. The analog carriers with their digital payload have to survive the common degradations suffered in the network. Types of services include, but are not limited to:

- Impulse pay-per-view (IPPV)
- Near Video on demand (NVOD)
- Telephone
- Personal communications services (PCS)
- Data and information services (banking, Internet access)
- Status monitoring and control (SM&C)
- Distance learning video and audio
- Electronic news gathering (ENG) feeds
- Utility monitoring (such as remote meter reading and control)

Figure 2: Return system levels and slope



Note: output levels are *after* return EQ and *before* return output pad.

TDMA, FDMA and CDMA modulation

Time Division Multiple Access (TDMA) allows multiple users to share a single frequency by allocating "time slices" to each user. If the time slicing is synchronized among the devices sharing the network, each device is transmitting data at a specified time slot when no other device is transmitting. The overall transmission rate is dependent on the number of devices sharing the frequency.

CSMA/CD (carrier sense multiple access/collision detection) does not synchronize the devices. Instead, this method establishes a means of detecting when a transmission may have taken place at the exact same instant that another device was transmitting.

If the processing equipment in the headend does not send an acknowledgment to the transmitting device that it received the data in a certain, reasonable length of time, the transmitter assumes that a collision has occurred with another device's transmission and that the transmitted information did not reach the headend. It then waits for a random length of time (as does the other transmitter) and retransmits the data.

By the process of carrier sensing, the transmitter "listens" to network transmissions to detect a "lull" after which it may transmit, without interference, with other transmitters in the network that share the same frequency. The advantage is efficient use of bandwidth. The disadvantage is during high network usage, throughput rate is reduced (by slower throughput)

Data that is not as time sensitive (computer files, etc.) is not seriously hindered. Data that is time sensitive (telephone conversations, etc.) can be delayed, which is not acceptable. The only way to avoid this is to aggressively plan and model network usage (traffic engineering) and allocate network equipment to meet the demands. Over-engineering the network usage can result in purchasing equipment that is not necessary. On the other hand, under-engineering usage can create inconveniences to the subscriber.

Frequency division multiple access (FDMA), essentially, is the dedication of a frequency to an individual user. This is a very aggressive and successful approach for telephony that is constant rather than "bursty" in nature. For the bursty services (modems, SM&C, etc.), it is not necessary. For a large number of users of a particular FDMA service that are fed from a single fiber node, the dedicated frequencies include a frequency for overhead and control of the entire service (call supervision, etc.). The advantage is once a network access is established, the dedicated connection is not affected by network usage. The disadvantage is inefficient use of bandwidth, especially for bursty services that do not require full time network usage during a session.

Code division multiple access (CDMA), otherwise known as "spread spectrum" uses codes that are shared between the customer and headend controller to spread a single data transfer over a range of frequencies. A paging carrier in one frequency slot of the band is used to impart the codes to terminal sets. The advantage is that it is especially immune to noise impairments and maintains a high level of security.

Network performance considerations

Because of the past use of the return path, most amplifier equipment manufacturers specified the performance of return amplifiers and distribution fiber equipment with respect to analog loading. If a network was designed to effectively carry NTSC channels with a minimum quality, the return path would deliver a minimum of 50 dB C/N or better and mid-60 dBc or better in distortions. With a very small number of channels in the return path (compared to the forward path) these return path performances were fairly easy to achieve. Even some of the most intricate digital modulation schemes, such as the QAM family, have C/N and distortion minimum requirements that are less strict.

There are two methods of C/N performance prediction for the return path. The first method uses the following formula:

C/N = C/N of a single return amp - 10log[sqrt(AxB)]

where:

A = the total number of amplifiers in cascade

B = the total number of amplifiers feeding back to one combination point.

For example, assuming C/N performance of one return amplifier is 65 dB, the maximum cascade of amplifiers is six, and the total number of amplifiers in the coaxial service area is 60: ➤

$$C/N = 65 - 10\log[\sqrt{6 \times 60}]$$
$$= 65 - 10\log[\sqrt{360}]$$
$$= 65 - 10\log(18.97)$$
$$= 65 - 10\,(1.278)$$
$$= 65 - 12.78$$
$$C/N = 52.22 \text{ dB}$$

Note: This formula is a mathematical model that is based upon empirical results.

The second method uses the following formula:

C/N = C/R of a single amplifier - 10log N
where
N=the total number of return amplifiers feeding back to one combination point

Using the example above:

$$C/N = 65 - 10\log(60)$$
$$= 65 - 10\,(1.778)$$
$$= 65 - 17.78$$
$$= 47.22 \text{ dB}$$

The results of these methods must then be combined with the C/N performance of the return fiber link. For example, assuming return fiber link C/N performance is 55 dB:

Method 1:

$$C/N = -10\log[10^{(-55/10)} + 10^{(-52.22/10)}]$$
$$= -10\log[(3.2 \times 10^{-6}) + (6 \times 10^{-6})]$$
$$= -10\log[9.2 \times 10^{-6}]$$
$$= -10\,(-5.036)$$
$$C/N = 50.36 \text{ dB}$$

Method 2:

$$C/N = -10\log[10^{(-55/10)} + 10^{(-47.22/10)}]$$
$$= -10\log[(3.2 \times 10^{-6}) + (19 \times 10^{-6})]$$
$$= -10\log[22.2 \times 10^{-6}]$$
$$= -10(-4.654)$$
$$C/N = 46.54 \text{ dB}$$

With the typical return path usage making a decidedly firm move towards fully digital, manufacturers are specifying the performance of components with digital loading. These parameters include group delay at various frequencies, dynamic range and network bit error rate (BER) performance for a particular modulation scheme and component configuration.

The telecommunications industry is trying to define the minimum requirements and to standardize how components are tested and specified. Once this is complete, a customer can directly compare components from different vendors.

To illustrate the complexity of this issue, let's consider the case of characterizing the performance of one service in the return path. First, the type of service and modulation scheme must be defined. The frequency where it will be positioned in the return path is very important to determine its susceptibility to common ingress impairments. Minimum BER requirements must be defined so that a minimum quality for this service will be ensured. The maximum number of return amplifiers present in a fiber service area (FSA) must be defined to predict the C/N performance. ➤

Next, the same exercise must be conducted for every service that will be positioned in the return path. At this point, the system engineer is ready to begin calculating the system performance of different network component configurations and system operating levels, substituting different components and adjusting operating signal levels (and calculating a new system performance for each adjustment of operating levels).

Components

Most HFC RF amplifier stations can be equipped with hybrid or discrete return amplifiers. Discrete amplifiers have the advantage of less power consumption than hybrids. On the other hand, hybrid return amplifiers usually exhibit better distortion performance when compared with a discrete amplifier of the same gain. Recent tests have indicated that hybrid amplifiers have a better dynamic range than discrete amplifiers. This is important due to the fact that bursty return path services present a range of different power levels at any given instant.

Dynamic range is usually characterized as the range of signal levels that a component delivers an acceptable performance (BER, C/N, distortions, etc.). The high and low limits of a dynamic range are usually marked by a drastic change or "knee" in the performance. For example, a return path fiber-optic transmitter will typically respond to an increase of 1 dB in RF drive level presented at the input by delivering a 2 dB decrease in cross-modulation and third order distortions, a 1 dB decrease in second order distortions, and a 1 dB increase in C/N.

As the drive level is increased, there is a point at which the C/N begins to sharply decrease. It is at this point that the high end of the dynamic range of the transmitter has been reached and it has begun to exhibit clipping. (Note: Other dynamic range tests may substitute BER performance for C/N to characterize dynamic range). At the low end of the dynamic range, the test signal fails to turn the transmitter on or becomes "lost" in the thermal noise floor.

There is a difference of opinion on whether return path transmitter performance can be more accurately predicted by laser drive current or drive power (the total power level presented at the input of a transmitter). To relate this in an operational scenario, consider the roll-out of a new service in the return path, which increases its power. The question that must be answered is: Does the added power in the return path drive the optical transmitter to or beyond the upper limits of its dynamic range? If it does, the input level of the new service and, perhaps, the existing services must be reduced.

Another characteristic that is the source of concern is the power added by the presence of impulse noise and signal ingress. These perturbations may be sporadic in nature and can drive a return path transmitter into clipping. Once this occurs, it affects return path services that are not necessarily at the same frequency as the ingress. To remedy this, the best prescription is an aggressive maintenance program that identifies signal leakage and ingress problem areas.

System setup

Since the outputs of several return path amplifiers may combine and arrive at the input of the next upstream return amplifier with different slopes, it is necessary to equalize each return amp at its output. (See Figure 2 on page 101) It also is necessary to control the output signal level of each return amplifier independently due to the fact that they must be combined at the same level to avoid a higher level signal from obliterating a lower level signal at the combining point. This signal combining point may occur at a point in the network other than at an amplifier (such as a directional coupler or splitter). A normal system practice is to maintain the same input level and slope for each return amp input and vary the output level and slope of return amplifier outputs. This is usually accomplished through the use of plug-in equalizers and attenuator "pads."

As new technologies become available and return path operations trends evolve, we can be sure that there will be more technical challenges ahead. Along with these challenges comes the satisfaction of forging the networks of tomorrow. Successful deployments have shown that the return path can work. In light of this, the future of telecommunications in HFC networks is very bright, indeed. CT

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Digital Upgrades

The Springboard to New Test Gear

By Robert Wells

Selling subscriber-pleasing digital services will require cable operators to consider putting digital test equipment into the hands of field technicians. That's the realization that's been dawning—perhaps a bit belatedly—in the cable industry, according to recent interviews with engineers at CableLabs.

With digital looming, a scramble has begun—to assess test-equipment needs, to communicate those needs to vendors, and to start budgeting to acquire the needed tools, those sources report. CableLabs has been spreading the word among member companies "that there's a new generation of test equipment on the horizon that they may want to consider in their budgets," said Bob Cruickshank, CableLabs' director of data applications. Lab officials also have been talking with vendors about what MSOs will need and when.

"Vendors are tuning in to cable operator needs and will be ready with the needed gear," said Brian James, director of CableLabs' TAC Test Centre, located at a Rogers Cablesystems site in Toronto. At the Society of Cable Telecommunications Engineers Cable-Tec Expo last June, James recalls, "I saw devices that are designed to at least measure digital signal levels on systems. As digital signals and set-tops are deployed, people will start pressing manufacturers for what they need."

The digital difference

"Digital is a challenge. It's different from what we're used to," said James. "There will be teething problems getting the services up and running. If they're not working, we have to be able to search out on the network and find out why."

"Digital," he added, "either works perfectly or it doesn't work at all. With analog TV, you can look at the picture and get an idea if it's getting noisy or there are beats in it, and you know what's causing the problem."

"The last thing a good cable tech would give up in the analog domain is his TV set," said David Eng, CableLabs' director of laboratory testing. "It's a marvelous test diagnostic. I can look at it at each amp and see if there's a slight degradation." Distortions, composite triple beat, low carrier-to-noise—they're all there to be seen by the trained eye, he said.

Compare that, he added, to the "on-off" digital realm. "For digital testing, we need a device that's easy to understand yet is able to know what margin I'm at—how close I am to the cliff. Knowing once I've fallen off the cliff is not necessarily a good thing. Knowing that I have another five feet before I fall is a much better place to be in."

Four major sources of signal degradation loom in the digital domain:

- Impulse noise: In an analog world, impulse noise will generally turn a fraction of an inch on one line of the 525 line picture white. In a digital world, if impulse affects the received picture at all it could interrupt the digital framing, resulting in the loss of the picture for a second or more. If the interference is less severe, the error correction and/or concealment circuits in the receiver may

> **BOTTOM LINE**
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> **A New Generation**
>
> Here comes the next generation of test equipment for field technicians—courtesy of digital video and cable modems. Officials at CableLabs contend that the devices that cable technicians will need most will be (in this order): signal strength testers, failure-threshold indicators and spectrum analyzers. But only dole them out, they urge, to those who need them. Measuring performance of return-path signals and high-speed data signals may each require further specific tools.
>
> **All in all, it's a potential hefty price-tag—but there may be ways to "think outside the box" and keep costs down.** *One potential trick:* Ping digital set-tops and cable modems and grab the diagnostic data those devices are quietly hoarding.

Reader Service Number 120

be able to fully recover the signal or mask the error so there will be no visible picture impairment:

- Thermal noise: It originates from amplifiers set too low or from failed amps. The automatic gain control (AGC) in an amp further into the system may bring the level back up to where it should be, but it brings up a lot of noise with it.
- Interfering carriers or beats: These could be either an off-air signal getting into the system or some amplifiers running at excessively high levels and putting distortions caused by intermodulation of carriers into the channel.
- Frequency response: Response in the channel is not flat. An equalizer tries to flatten it out before delivering the signal.

What's needed

In recent discussions with vendors, CableLabs staffers have stressed that digital field test equipment should be easily portable, easy to use, and cost-effective, said Dr. Majid Chelehmal, director of engineering research and development.

CableLabs' input to vendors is derived from lengthy experience testing digital signals, said Chelehmal. In the case of downstream signaling, in a "digital characterization" project begun in 1993, CableLabs measured signals reaching 300

> "A device that could be useful for both lab and field work is an RF MCNS protocol analyzer."

homes on 20 different cable systems with the aid of a Hewlett-Packard link analyzer (an augmented spectrum analyzer). The resulting "channel model" was shared with modulator and data-modem vendors.

What devices does the industry need for downstream testing? The foremost need is for a signal-level tester, said James. Due to the dispersed nature of digital signals across a channel, it will need to take readings "at multiple points across a 6 MHz channel, then do some calculations to tell you what the total power in the channel is," he said.

- *The next-most-needed device* is "more elaborate and more costly," James said, is a threshold analyzer, "a device that can tune the digital channels to determine how hard the equalizers and the error correction are working in the channel receiver, then give you an idea of how far you are from the threshold at which point the channel receiver would quit."
- *A third needed device* is "something along the lines of a spectrum analyzer," able to further analyze the signal to see whether its problem stems from a single interfering carrier or from a generalized high noise level.

Return-path signals

The HFC return path "presents special problems, mainly because most of the impairments are transient," said

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Chelehmal. To measure them, CableLabs recently developed a device it called the CW tester, a hardware-software combo that listens over time on an upstream channel, recording microseconds-long impairments and building a record of their duration and characteristics (copies of the tester are now being used by some CableLabs member companies).

A companion CW tester data browser analyzes the performance of a return channel over time, estimating error rates and unavailable seconds over a prescribed threshold. The laboratory performance measurements of vendor transmission equipment can then be used to predict performance in the field for the channel analyzed with the CW tester.

Data signals

For testing cable modems, CableLabs wrote software to be used with the SmartBits test system, from Netcom Systems of Chatsworth, CA, a device that used plug-in cards to simulate two-way data dialogues with up to 80 modems, measuring such parameters as throughput, data loss, latency and jitter.

But SmartBits isn't intended for field use, Cruickshank said. Rather, he added, CableLabs is in discussion with a half-dozen vendors about devices for field-testing high-speed data signals. Possibly, a single device could have both an RF port and a 10BaseT port for analyzing signals both on RF plant and in the Ethernet link between cable modem and PC, he said. Another device that could be useful for both lab and field work is an "RF MCNS (Multimedia Cable Network System) protocol analyzer," which would "pick off packets from the RF plant" and gauge whether they are compliant with the MCNS DOCSIS (data-over-cable service interface specifications) data protocol, Cruickshank said.

Conclusion

James said that when digital test equipment becomes available, probably late this year, it will undergo rigorous testing at the TAC Test Centre, with performance data to be shared with CableLabs members. "Test equipment vendors need to think outside the box and figure out some inventive solutions that will give MSOs what they need more cheaply," Eng said.

Cable techs must think like the digital network managers they are fast becoming, said Chelehmal. Data assembled by status-monitoring devices on the network, massaged by the right software into status indicators, can be a substitute for expensive test instruments and truck rolls, he observed: "I'm not trying to take away any techs' jobs. But the more we can use intelligence in the network to identify problems, the easier a tech's job to prevent or to remedy problems can be." CT

This article was written for "Communications Technology" by Robert Wells on behalf of Cable Television Laboratories (CableLabs), the industry research consortium based in Louisville, CO. CableLabs can be reached at (303) 661-9100.

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Broadband to the Home

Comparing the Access Alternatives

By Mark Laubach

As the momentum builds for cable operators in the acquisition and deployment of cable modem-based services, it appears that the promise of delivering high-speed affordable data service soon will be realized.

For cable companies the timing is perfect. Dramatic growth in data traffic due to increased demand for remote computing and Internet access has created a huge bottleneck, revealing limitations in the local loop—the segment from the central office to the customer.

While extending the fiber from the transport network up to the subscriber premises would be the ultimate solution, today it is not economically feasible. In fact, many analysts believe that fiber-to-the-home will not happen for several years. Therefore, in order to maintain its customer base and to realize a portion of the perceived multi-billion dollar high-speed opportunity, the telephone companies are aggressively mobilizing. But, how do you compare these technologies? Which technology is better? Finally, which technology will win the race to the home?

Defining alternatives

Several emerging technologies address the market need for increased bandwidth and improved access speeds. Of these, three solutions are considered the most promising: ISDN, xDSL, and cable modem systems.

ISDN (integrated services digital network) is the most mature among access network technologies. ISDN integrates voice and data over the regular copper phone lines and enables symmetric data rates of up to 128 kbps. It was developed in the 1980s, when powerful digital signal processing became a reality. This circuit switched service is now widely available throughout most of Europe, and has seen increased deployment in North America and in the Asia-Pacific region.

XDSL is a collective shorthand for high-speed transmission systems over twisted pair copper phone lines (DSL stands for digital subscriber line and the prefix "x" represents the specific types of this technology). xDSL takes full advantage of the bandwidth potential of the copper by using sophisticated modulation and signal processing techniques. The xDSL family of technologies includes asymmetric DSL (ADSL), high-bit rate DSL (HDSL), and very-high-bit rate DSL (VDSL). ADSL, which was originally developed by Bellcore to deliver video-on-demand over the telco's installed phone lines, now enables data transmission at speeds of up to 8 Mbps downstream and 640 kbps upstream. HDSL is a symmetric protocol, and was developed to provide a less expensive way to implement T-1/E-1 circuits (1.544 Mbps/2 Mbps) on twisted-pair wires. VDSL, which can be symmetric or asymmetric, is capable of delivering the highest speed: 13 to 52 Mbps downstream and 1.5 to 23 Mbps upstream.

> **"The battle between network operators and networking technologies to solve the local loop access problem is heating up."**

Cable modem technology is the youngest among the alternative technologies. Cable modem systems utilize upgraded cable TV plant to provide two-way data communication to homes and businesses at transmission speeds of 10 to 30 Mbps downstream and 128 kbps to 10 Mbps upstream. An interim variation of this technology, dubbed as "cable modem with telephone return," uses the telephone network for the return path thus allowing cable operators to deploy service using their one-way plant.

Technology alternatives

ISDN service is the only alternative which is widely available today if one requires the higher speeds. The major hurdle for subscribers and network operators with ISDN today is not its lack of availability but rather the practical operational problems like, for example, provisioning the subscriber line. Setting up an ISDN connection is everything but "plug-and-play." In addition, the circuit switched service is quite pricey, considering the speed it delivers. Moreover, although the 128 kbps of basic rate ISDN offerings is fast enough to support desktop videoconferencing, it is still too slow for real-time video.

xDSL delivers higher speeds. The main problem with xDSL is that it is distance sensitive: the longer the loop, the lower the speed it delivers. Among the xDSL technologies, perhaps ADSL has the most potential; but even the commercially most viable, rate-adaptive version of ADSL is limited by the subscriber's distance from the central office, the quality of the twisted copper wires, or the presence of load coils. Today, DSL technologies are most suitable for private networks such as those at universities, hospitals, corporate complexes and other campus environments where distance between buildings is within the limitations of the technology, which is typically 12,000 feet. While less expensive

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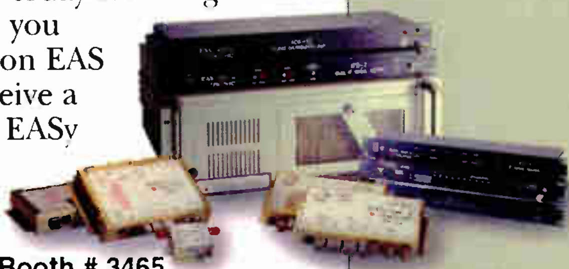

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than a T-1 connection, xDSL is still significantly more costly than ISDN or other telecommunications-based solutions.

The cable modem system is also capable of delivering high speed, and the technology is less distance sensitive. The most often mentioned shortcoming of cable modem systems is that the medium is shared among subscribers, which can result in security and performance problems. The shared medium can be turned to the advantage of the cable operator, if the installed system was designed to be capable of maintaining full control over the medium (ATM transport with Quality of Service), and to employ multiple layers of protection (encryption, passwords/firewalls). A connectionless environment does not waste bandwidth when no data is being transmitted by the user and the subscriber's computers can always be on-line, since no dial-in is required. A wide variety of multicast and broadcast services can also be offered over these networks.

Economic assessment

Upgrading the access network contains high risk because the upgrade requires high capital investment while the market is characterized by strong uncertainties. The per-subscriber cost of the upgrades strongly depends on factors like take rates and traffic requirements assumed.

It seems today that the xDSL and the cable modem technologies are both viable alternatives with prospects of line costs close to $500. In areas where higher demand for broadband services exists, or where the service distance is beyond the limitations of the xDSL technology, the cable modem technology is better suited. XDSL requires only minimal upfront investment as opposed to cable modems which require significant initial investment. This is why xDSL technology seems to have an advantage on geographic areas where the demand for broadband services are lower, or where the cable infrastructure is inferior. [1]

However, to consider the cost of upgrades only is a big mistake. Other factors, like cost of ownership and definition of service packages, are key in developing the successful business case for access network upgrade. Network operators can pay back the huge investment for the access network evolution, if they can define services which have a broad appeal to the distinct market segments, such as Internet users, telecommuters, and small businesses, and will be able to minimize the operating costs. This is another area where advanced cable modem systems might have some advantage. They can satisfy different market needs over the same network platform, and require fewer truck rolls, if the network management system has been developed properly.

Since mid-1996, MSOs with two-way ready systems have been involved in successful high-speed trials throughout the world. Many MSOs with one-way cable plants also are in trials and are using the telephone system as an interim return path.

Comparison of competitive high bandwidth solutions

Service		Medium	Average data rate		Coverage	Service availability
			Upstream	Downstream		
ISDN		twisted pair	128 kbps	128 kbps	Nearly ubiquitous	Commercial service is available in most areas
xDSL	ADSL	twisted pair	1.5-8 Mbps	384-640 kbps	9k ft to 18k ft from telephone central office	Market trials widespread; commercial availability in 2 to 3 years
	HDSL	twisted pair	1.5 Mbps	1.5 Mbps	12k ft to 15k ft from telephone central office	Commercially available on niche markets
	VDSL	twisted pair	13-52 Mbps	1.5-2.3 Mbps	1k ft to 4.5k ft from telephone central office	Widespread commercial availability unlikely
Cable modem		Coax (HFC)	10-30 Mbps	.128-10 Mbps	Nearly ubiquitous	Market trials widespread commercial availability in 2 to 3 years

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Cable modem deployment

Cable plant and cable broadcasting have historically been one-way (broadcasting information from the cable plant to the subscribers home). With the promise of high-speed Internet access (or on-line services), two-way functionality is mandatory. Some estimates are that 80% of plants are currently one-way only.

Cable operators are executing aggressive upgrade plans in order to increase bandwidth, make ready for two-way communications, reduce maintenance costs and provide better noise management. The table on this page depicts the plans of top cable operators.

Most of these companies are executing substantial upgrades including two-way activation and fiber trunks in order to get more bandwidth. The bandwidth increase will be useful for delivering more channels so that these operators can compete with direct broadcast offerings. Upgrades of this sort, which install fiber and activate two-way, can cost as much as $200 per home passed, depending on the state of the plant before the upgrade.

Conclusion

The proliferation of Internet traffic has accentuated the bandwidth limitations in today's network architectures. The number of Website users grows exponentially, and the complexity of Internet content is increasing with the popularity and availability of real-time video, CD-quality audio and high-resolution graphics that require large amounts of bandwidth.

The battle between network operators and networking technologies to solve the local loop access problem is heating up. The time to market window is beginning to close as competitive leads narrow. The technology which will win the race to the home is one which both meets the consumers' growing appetite for bandwidth-hungry applications and which also provides the network operator with the best revenue generation possibilities.

Selecting the right technology is necessary but not sufficient for success. Since the

Reader Service Number 165

demand for high bandwidth access is driven by activity in several different market segments, only the business case which effectively can address the distinct bandwidth, quality and pricing requirements of these market segments will be successful. CT

Reference

[1] Ims, L., Myhre, D., Olsen, B., *Economics of Residential Broadband Access Network Technologies and Strategies.* IEEE Network, January/February, 1997. pp. 51-57.

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BOTTOM LINE

The Technology Race

There are several technologies available that address the market need for increased bandwidth and improved access speeds. The most promising include: ISDN, xDSL, and cable modem systems. What's the difference?

- ISDN (integrated services digital network)—The most mature among access network technologies. ISDN integrates voice and data over regular copper phone lines and enables symmetric data rates of up to 128 kbps. It was developed in the 1980s, when powerful digital signal processing became a reality. **Problem:** ISDN has practical operational problems, for example, provisioning the subscriber line.
- XDSL—A collective shorthand for high-speed transmission systems over twisted pair copper phone lines (DSL stands for digital subscriber line and the prefix "x" represents the specific types of this technology). xDSL uses sophisticated modulation and signal processing techniques to deliver higher speeds. **Problem:** xDSL is distance sensitive: The longer the loop, the lower the speed it delivers.
- Cable modem technology—The youngest among the alternative technologies. Cable modem systems utilize upgraded cable TV plant to provide two-way data communication at transmission speeds of 10-30 Mbps downstream and 128 kbps to 10 Mbps upstream. The system also is capable of delivering the high-speed and the technology is less distance sensitive. **Problem:** The medium is shared among subscribers, which can result in security and performance problems.

Remember these factors in planning for your own high-speed venture:

- Upgrade cost
- Cost of ownership
- Definition of service packages

It's About Time

Reduce Upgrade Headaches With TDRs

By Ken Ditto

Upgrading a cable TV system is a common occurrence these days. With the development of better electronics, amplifier spacing often does not have to be changed to add additional bandwidth. This allows you to continue using the existing distribution line.

What if the upgrade also includes the addition of digital services? How will the feeder line handle the new digital services?

And what about the customer drops? Normally drops aren't replaced, yet they are the cause of the majority of customer complaints. This article describes how improvements in test technology can relieve some of the most common upgrade headaches.

Relieving headaches

Using time domain reflectometers (TDRs) for cable TV applications is a 25-year-old story with a new chapter. This valuable test tool is often viewed as complicated and expensive. The new-generation TDRs have changed all that. They deliver greater performance, yet are so easy to use that little or no training is required. These leading-edge TDRs can test more system bandwidth, find faults previously invisible to earlier TDRs, and can initiate automatic testing with the push of a single button.

New-generation TDRs can reduce many of the headaches associated with a system upgrade. Let's first consider how a TDR can be useful in the feeder portion of the upgrade. Suppose the current system is operating at 330 MHz and is being upgraded to 550 MHz, with digital services. You already know that the cable works at 330 MHz, but how will it handle the increased bandwidth and the digital signals? Digital signals are more susceptible to small mechanical defects in the cable.

Because the new generation TDRs test at a higher bandwidth, they can test more of the system capacity. This also allows them to pinpoint more accurately the faults that can cause microreflections, which can be damaging to digital transmissions. Previous generation TDRs have test bandwidths of less than 100 MHz, which means they are limited to finding faults that only affect frequencies below 100 MHz. The effective bandwidths of some of the leading edge TDRs are near 400 MHz, enabling them to find problems that may only exist at higher frequencies.

When performing an upgrade, if you are using an existing distribution line, it is a good practice to test every link with a TDR to locate any impedance mismatches. The TDR trace shows corroded connectors or kinks in the cable. This test also confirms that the cable is the expected length, a critical issue for setting up new amplifier spacing. And a TDR test of the

---

BOTTOM LINE

Testing the Limits of Time

Let's say you're upgrading your current system from 330 MHz to 550 MHz, with digital services. Digital signals are more susceptible to small mechanical defects in the cable. Even if your cable works at 330 MHz, how do you know it will handle the increased bandwidth and the digital signals?

Consider a TDR. New time domain reflectometers (TDRs) test at a higher bandwidth, so they can test more of the system capacity. With effective bandwidths approaching 400 MHz, new TDRs now can find problems that may only exist at higher frequencies.

What to watch for. If you're using existing distribution line, test every link with a TDR to locate any impedance mismatches. It can reveal corroded connectors or kinks in the cable. A TDR can also help spot problems before they turn into trouble calls.

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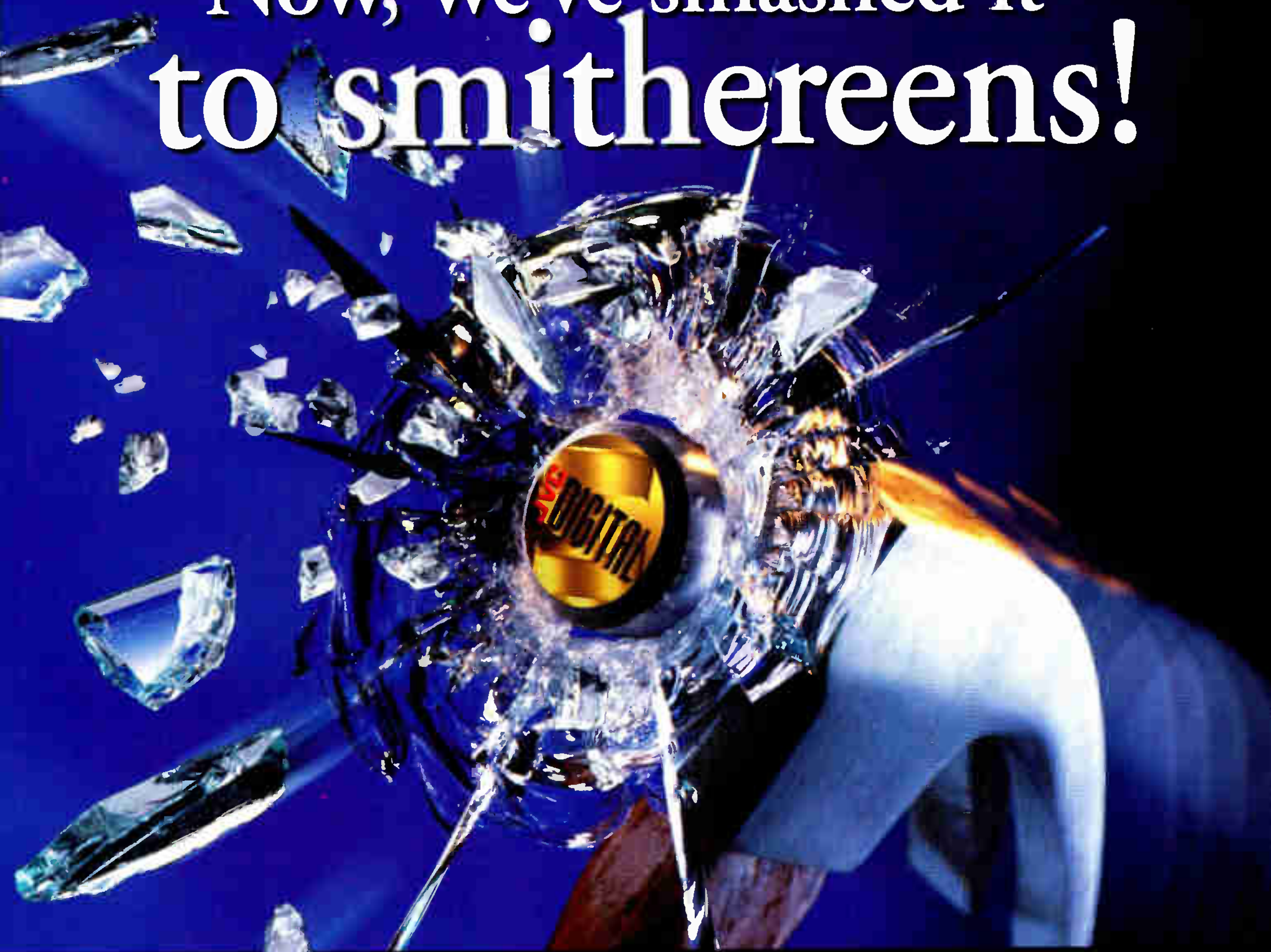

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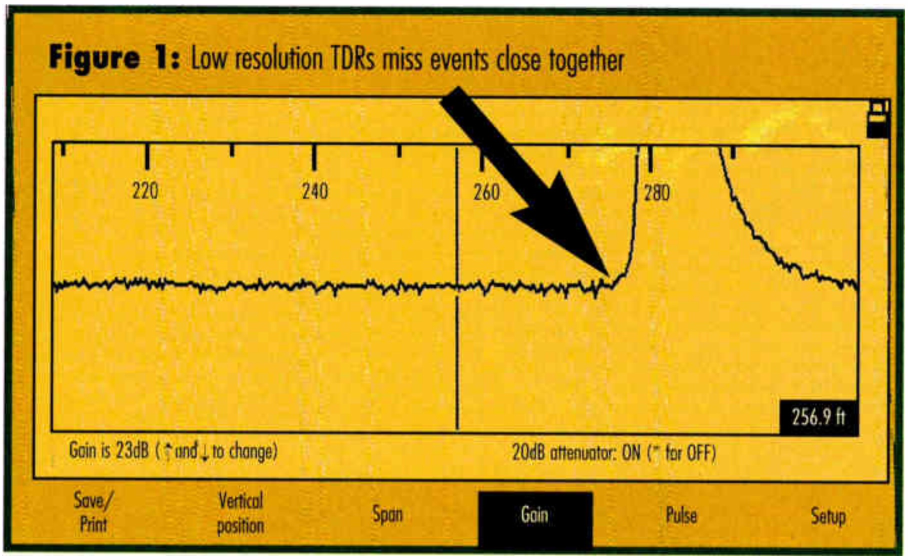


distribution lines boosts your confidence that the cable plant will handle the new services.

Trouble calls

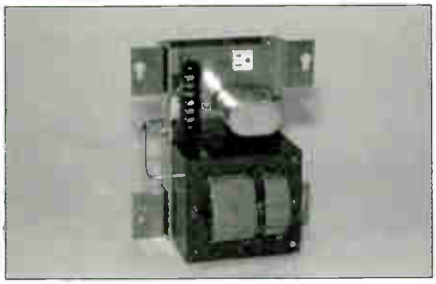
After you upgrade your CATV system, and the trunk and distribution portions are running just as they should, what happens when customers start calling in because their reception isn't as good as they think it should be? Never mind that it may be no worse than it was before the upgrade. After all, you've "upgraded," so now they expect more. One system operator said that following an upgrade, 30% of the drops had problems. The problem is you don't have any more people available to make trouble calls than you had before the upgrade, but the trouble call volume is suddenly much higher. This increased volume of trouble calls can be a real problem for any system.

Following the upgrade, customer drops are required to handle more signal. Since some of the drops were marginal before the upgrade, you know that after adding more information, these drops will not be able to carry the new services. Several components make up each drop: cable, connectors, ground blocks, splitters, and transformers. Any one of these components may be the source of a problem. Customers may not call in when problems are marginal, but with the addition of new services, they expect the overall performance to be better.

In the past, when responding to a trouble call, the practice was to replace the drop because of the difficulty in locating the offending component. Clearly this shotgun approach doesn't make good business sense. Companies don't have the extra manpower or budgets for this type of inefficiency. Replacing an F-connector is much less time-consuming than replacing the entire drop. Still, you must determine which connector is faulty. Let's investigate how today's TDR can help.

Because of performance and feature improvements, new-generation TDRs can locate problem components in the customer drop better than ever before. A critical improvement to this application is higher resolution. A low resolution TDR may miss events occurring close together (as in Figure 1). Some of today's leading edge TDRs have very short pulse widths, around 1 ns. This means that the user can locate faults that are very close to the TDR, or very close to each other (see Figure 2). This is particularly important in troubleshooting drops, because components like splitters and ground blocks can be very close together. For instance, if a TDR has a 5 ns pulse width, the best resolution that can be seen is more than one meter. A TDR with a 1 ns pulse width allows 0.3 meter resolution (that's one foot)!

Improvements in signal-to-noise ratio (S/N) now make it possible to find more faults. New designs and electronics have reduced the noise level so that the



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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.

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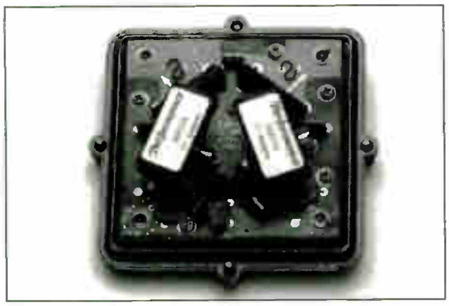

SURGE-GARD protects against nuisance fuse blowing and resets in 60 seconds

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VOLTEX CATV-27 Standby battery costs only $64.95

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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

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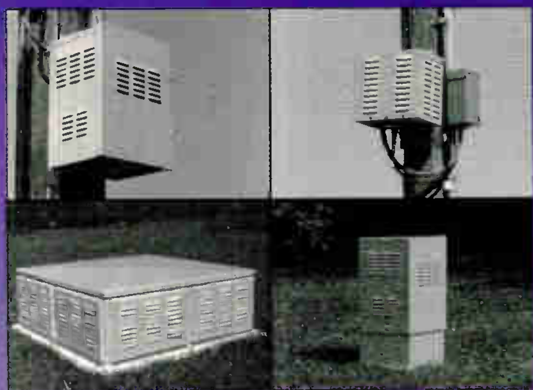

Reliability is what it's all about when selecting power supplies for your system, regardless of whether they're for an upgrade or a retrofit. Our industry-leading design and reliability assure that our products give years of trouble free service, but that isn't all, our confidence in the integrity of Performance power supplies is so positive,that we back them with a lifetime limited warranty. So call today to find out more about the many benefits of using Performance power supplies. You'll be glad you did . . . for years to come.

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Figure 2: High resolution TDR finds events close together

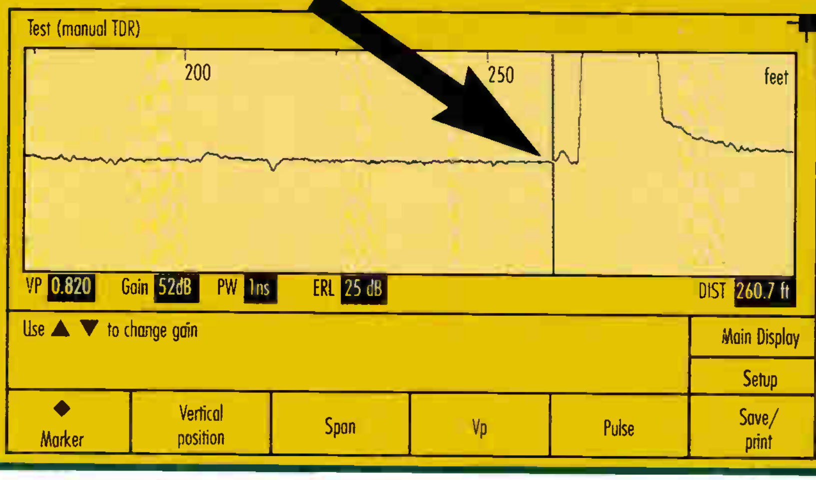
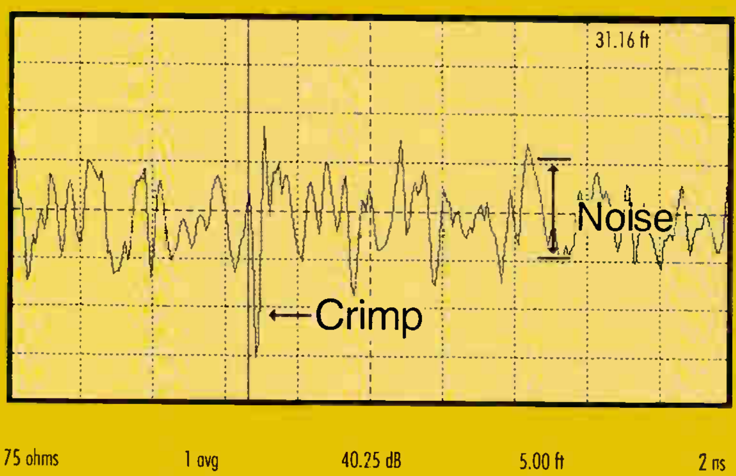


Figure 3: Finding a fault with low SNR



"bumps" on the trace represent real faults, not just noise. Events that were difficult or impossible to find using old generation TDRs with higher SNR (see Figure 3) are visible above the noise because the noise is much lower. This also means that you can clearly see faults further away than you could in the past (see Figure 4).

Improved resolution and better signal-to-noise ratios mean that with today's improved TDRs, the operator can easily detect two faults on a 100-foot cable when the faults are less than one foot apart. Before such advancements, the operator would have seen just one fault.

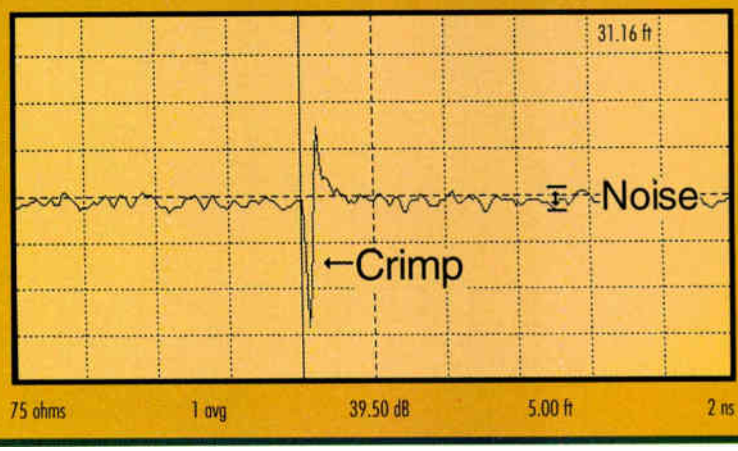
Among the biggest improvements in next-generation TDRs is automated testing and event marking. In the past, technicians had to be meticulous in properly setting up a TDR, and then carefully interpreting the meaning of the displayed waveform. This meant substantial training expense, extended time to get the measurement, and the possibility of error. By the time the technician adjusted all parameters such as pulse width, gain, number of averages, etc., and interpreted the results, the customer drop could have been replaced.

Troubleshooting efficiency

Today's automated TDRs remove much of the error, and much of the test time. For instance, the technician needs only to choose the type of cable to be tested and the TDR uses the correct Velocity of Propagation (Vp). Leading-edge TDRs also automatically adjust the acquisition parameters to achieve the best combination of resolution and S/N. The technician no longer interprets the waveform, because the TDR automatically marks the locations of the events on the cable. The overall affect of this automated testing is that set-up time is reduced or eliminated, the time to get results is improved, and the number of errors is reduced. Technicians today don't have to be skilled in interpreting waveforms, they just check the location of the event causing the fault. Troubleshooting efficiency is improved, and repairs are made quickly.

The best TDRs have a one-button test system. There are a number of other improvements in leading-edge TDRs that assist the user in obtaining fast, accurate information. Improvements in making return-loss measurements now make it as easy as placing the cursor on the event and reading the return-loss value. On-line help menus assist the user with questions, and large backlit displays make the data easy to understand. The user interfaces of new TDRs have been substantially improved to make the instruments easy to use.

Figure 4: Finding a fault with high SNR



Improved TDRs give you the capability to find faults that cause problems on digital services as well as those that have not been visible using TDRs of the past. More than this, they are so easy to use that anyone can use them. As a result, you can upgrade your system, then use a TDR to quickly and easily troubleshoot those marginal events, rather than replacing each one. CT

Ken Ditto is product marketing manager for cable network analysis for Tektronix Inc. He may be reached at (541) 923-4531.

Installing Digital Terminals

Guidelines And Considerations

By Lawrence R. Kewin

As broadband operators deploy hundreds of thousands of digital TV terminals throughout North America, installation training courses must be revised to address the now-emerging era of digital TV.

Proper planning and preparation will ensure successful digital installations and satisfied customers. This article serves as a tool for operators developing their own installation training programs for digital cable networks.

Many of the installation practices for digital and analog are similar. However, in digital installations, considerations such as location, inside wiring, tools, and signal quality and levels become more important. Also, since digital subscribers are willing to pay higher fees for additional, high-quality, interactive programming (and therefore represent an operator's best customers), additional time and attention to detail should be taken at these installations to ensure full customer satisfaction.

Location

When choosing a site for the digital set-top terminal, operators must consider powering, ventilation, aesthetics and convenience.

Powering: The terminal must be connected to an electrical outlet that will remain powered at all times. This connection protects the digital terminal's capability of monitoring a data or control frequency to receive data and ensures that no data stored in volatile memory will be lost.

Ventilation: Digital terminals should not be placed in areas with restricted ventilation or near contaminants likely to spill or fall inside the terminal. These contaminants include liquids such as water, coffee or soda; metal objects like paper clips or staples; and items with low melting points such as crayons or chocolate.

> "Additional tools and materials are recommended for digital terminal installations... parameters that are nonexistent in analog transmissions."

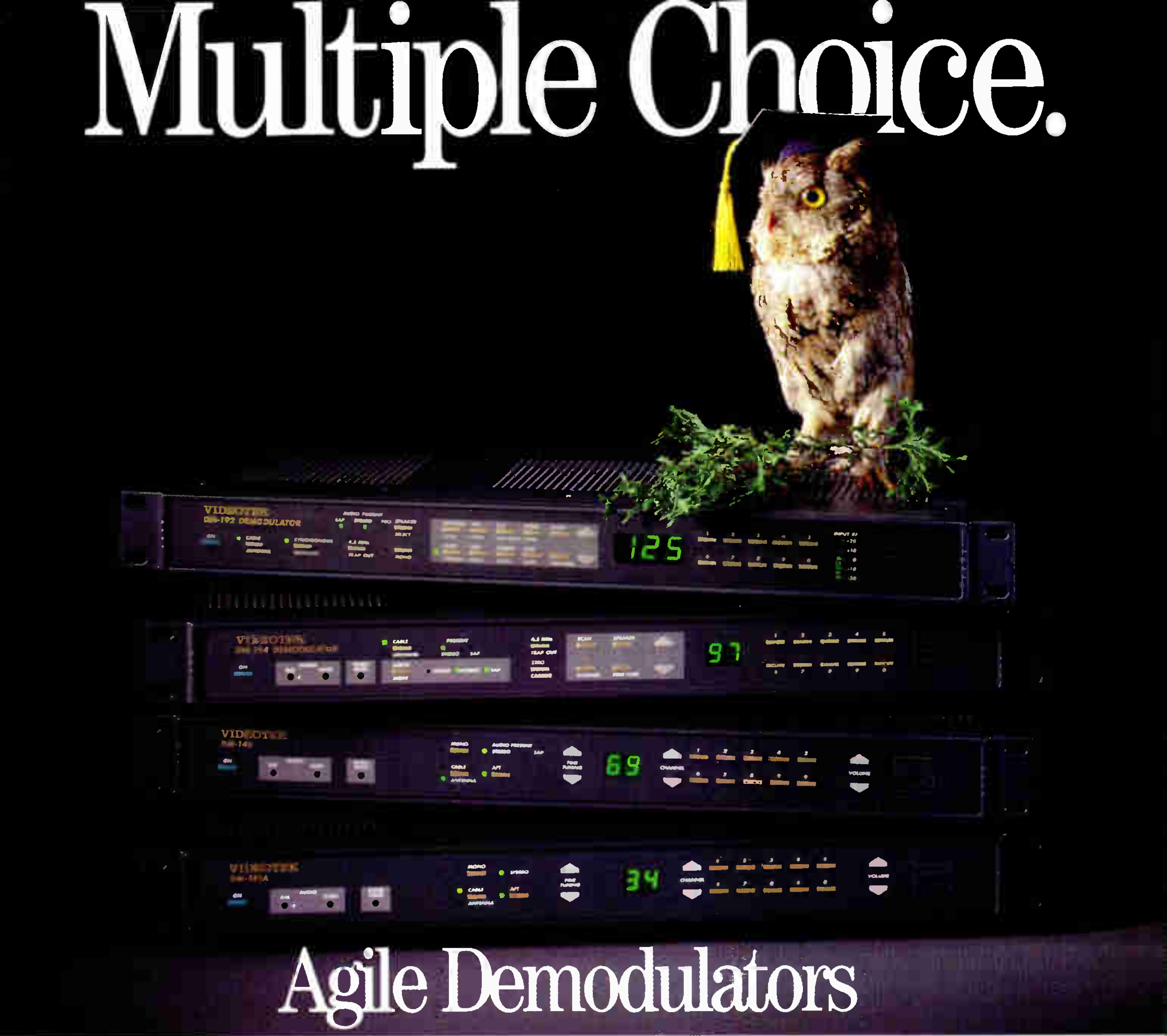
Aesthetics and convenience: Certain digital terminal models support interactivity through telephone modems, provide control of other equipment like VCRs, and provide digital audio feeds to stereo/audio equipment. Most entertainment centers keep wiring concealed while also protecting against contamination and providing good ventilation.

Inside wiring

In addition to the usual RF wiring, a digital terminal installation may require telephone wiring for the telephone return modem and audio and video wiring for interconnection to video monitors and stereo processing equipment. If jumpers from jacks, splitters or other equipment are necessary, they should be kept as short as possible to reduce signal loss and to lower the chances of ingress.

Adapters, often used to tailor the improper cable to the correct connector, should be avoided whenever possible. Their use can cause an impedance mismatch, which will reduce the quality of the audio or video image. Adapters also introduce additional connection points, which can create more potential connection failures and reliability problems.

Completion of a digital terminal installation may require several kinds of wiring. Installers should select the proper type of cable for each signal to be carried. All cables should be of a high quality and kept properly shielded



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and as short as possible. Connectors should be properly mated to cables and tightly attached to all junctions and end products.

Tools

Additional tools and materials are recommended for digital terminal installations due to the increased types of wiring and the need to measure parameters that are nonexistent in analog transmissions. These tools and materials include:

- Telephone wire
- Telephone jack or splitter
- RJ-11 modular connector installation tool
- Inexpensive telephone line testing equipment that will verify proper wiring polarities and connectivity to the telephone network.
- Assorted-length audio and video cables with RCA (phono)-type connectors.

Signal levels and quality

Signal levels and quality present the biggest differences between analog and

BOTTOM LINE

Digital Installation

Preparing an installation training program for digital cable networks involves location, inside wiring, tools, and signal quality and level considerations.

1) **Location:** Consider powering, ventilation, aesthetics and convenience.
2) **Inside wiring:** Besides the usual RF wiring, telephone wiring for the telephone return modem and audio and video wiring for interconnection to video monitors and stereo processing equipment may be required.
3) **Additional tools and material:** Telephone wire; telephone jack or splitter; RJ-11 modular connector installation tool; inexpensive telephone line testing equipment; and assorted-length audio and video cables with RCA (phono)-type connectors.
4) **Signal levels and quality:** These present the biggest differences between analog and digital installations. When viewed on a spectrum analyzer, the digital signal's energy may appear to be spread uniformly over the entire signal bandwidth. Constellation diagrams, bit error rate tests, and signal-to-noise ratio anaxlysis are commonly used for digital cable headend and distribution network installations and digital signal evaluations.

Successful installations and satisfied customers are the results of proper planning and preparation.

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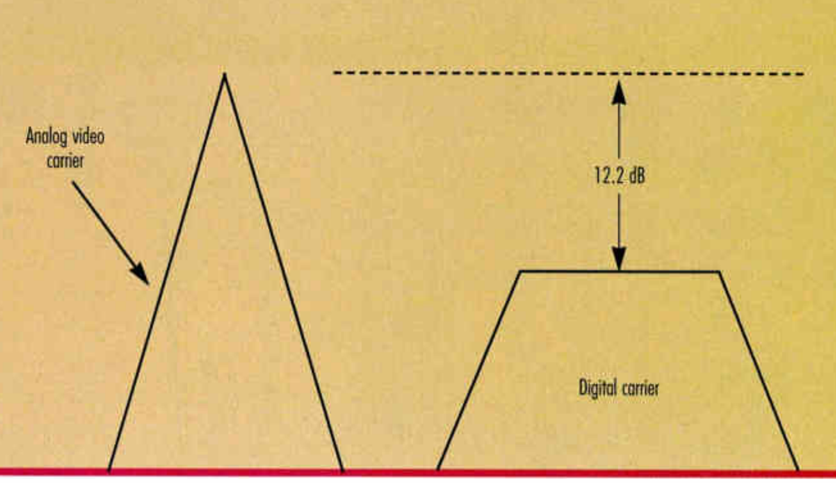
Figure 1: Digital signal at equal power of analog signal



digital installations. When viewed on a spectrum analyzer, the digital signal's energy may appear to be spread uniformly over the entire signal bandwidth, depending on the type of digitally modulated carrier. Conversely, an analog signal has most of its energy concentrated around the visual carrier. The resolution bandwidth of the meter or spectrum analyzer captures all of the analog signal's energy, so no correction is needed. But because the digital

> "Use of a signal level meter also requires a correction factor between digital and analog signals."

signal's bandwidth is often greater than the measuring device's resolution bandwidth, a correction factor must be applied to obtain the correct power level.

For example, the measurement of a 6 MHz 64 QAM (quadrature amplitude modulation) digital signal (signal bandwidth 5 MHz at 3 dB points), should be made with a spectrum analyzer set with a resolution bandwidth of 300 kHz and a video bandwidth of 30 kHz. In this configuration, the correction factor would be 12.2 dB1 (Correction factor = 10 log [signal bandwidth/spectrum analyzer resolution bandwidth]). To determine the digital signal's actual power level, the QAM signal is measured and then added to the 12.2 dB correction factor. (See Figure 1.) *[Editor's note: This method will produce an approximate value for a flat digital channel. Other digital modulation schemes such as those that have a haystack shaped trace may read 3 to 4 dB higher than the true channel power. For more information on potential errors that can affect digital carrier power measurements, refer to the article "Digital Measurement" by Hewlett-Packard's Kim K. Brown and Francis Edgington, September 1997 "Communications Technology," page 48.]*

Use of a signal level meter also requires a correction factor between digital and analog signals. This correction factor varies from manufacturer to manufacturer depending upon the device's resolution bandwidth. The correction bandwidth for a signal level meter can be determined by following these steps:

1) Measure a digital signal with the spectrum analyzer as detailed before and read the corrected level.
2) Measure the same signal with the signal level meter and record this reading.
3) Subtract the reading in Step 2 from the reading in Step 1. The result will be the correction factor that must be applied when measuring digital signals with that particular signal level meter. *[Editor's note: Unless the signal level meter has been designed specifically to measure digitally modulated carriers, measurements should be considered as approximate only.]* ➤

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Figure 2: Constellation diagram showing various impairments

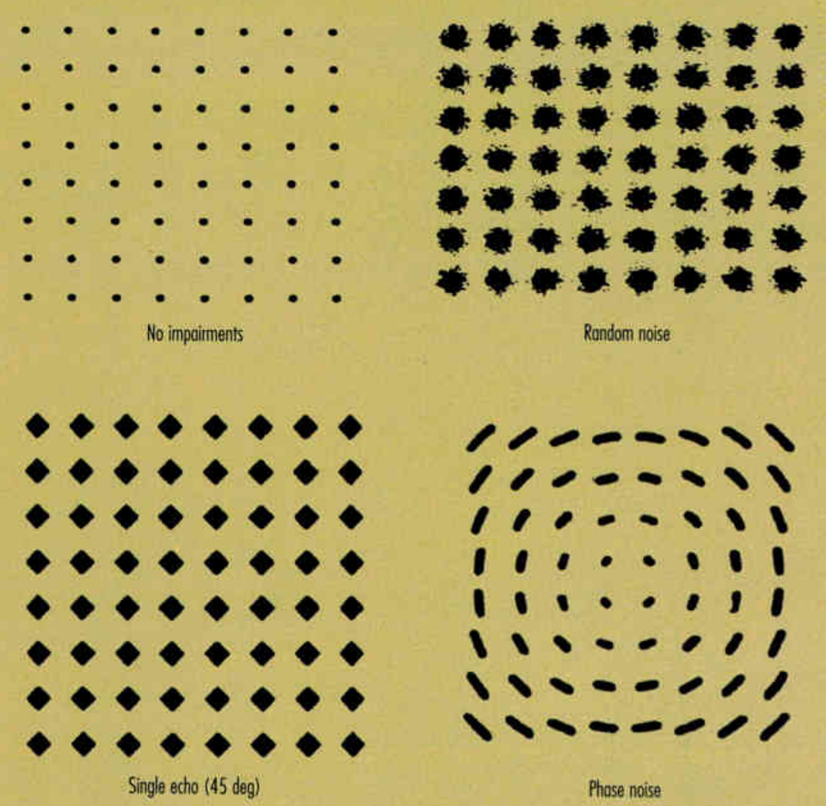
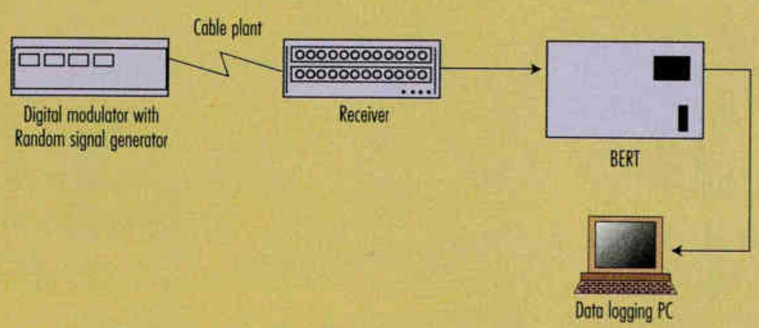


Figure 3: BERT Set-up



Digital signals' quick degradation makes accurate quality measurement techniques critical. Each digitally compressed carrier contains multiple services, so the loss of one digital carrier results in the loss of the many services modulated onto that carrier.

Several procedures and tests exist to evaluate digital signal levels and quality. Constellation diagrams, bit error rate tests, and signal-to-noise ratio analysis are commonly used for digital cable headend and distribution network installations and digital signal evaluations. Installers rely on built-in terminal diagnostics based on these tests.

Constellation diagrams

The constellation diagram (see Figure 2) is the most useful display for evaluating signal quality. Constellation diagrams reveal if there are any impairments present and show what types of impairments they are. These impairments can be classified as random noise, single echo or phase noise.

Random noise, usually a product of amplification, should not pose a problem for cable systems meeting FCC specifications. Unless a low-quality or defective amplifier in the customer's home is the noise source, it is uncorrectable during the installation.

Reflections or echoes are caused by poor terminations or splitters, poorly made connectors or mismatched cable impedance, usually from using incorrect cable and adapters. They are usually short and can be corrected through adaptive equalization in the receiver.

Phase noise is introduced in cable systems by modulators and tuners. Therefore, when feeding both the digital terminal and a VCR, it is best to split the signal rather than loop it through the VCR where additional frequency conversion could inject unwanted phase noise. As the dots that indicate specific value from the digitization process increase in size, they approach the decision boundary between one value and another. When the dots cross the decision boundary, an incorrect or "errored" bit is transmitted. This errored bit is observed as a multicolored block on the screen. If an overwhelming number of bits are errored, a total loss of video will occur.

Bit error rate test

Measuring the number of bits that were errored during the transmission requires the use of a bit error rate tester. In a bit error rate test, a random pattern of bits (data) and a reference signal (clock) are transmitted from the headend at a specific rate for a finite amount of time. At the receive location, a receiver receives the data and clock signal and outputs this information to a BERT. A printer or computer then records the errors. (See Figure 3.)

Signal-to-noise ratio

In analog systems, an installation is acceptableif the picture is free of system noise and other visible distortions. With digital systems, however, a measure of quality, such as the signal-to-noise ratio,

must be employed to determine signal quality. Every digital decoder manufacturer has its own threshold; typical thresholds are in the 20 dB range. The digital terminal measures the S/N and reports it in the diagnostics screens. The technician then can see how close to threshold the signals in the customer's home areand the amount of margin for signal degradation.

On-screen diagnostics

On-screen diagnostics can serve as an installer's most useful tool. The digital terminal's built-in diagnostics can provide a wealth of information to guide the installer through to completion. Information displayed may include:

1) The health of the terminal's circuitry, as determined by a power-up self-check.
2) Indication of in-band (program) and out-of-band (control) data carrier presence, strength as estimated through AGC voltage monitoring and quality as determined by S/N.
3) Short- and long-term error counts.
4) Type of signal (analog or digital), status of encryption (clear, fixed key or full), and the authorization state of the terminal (authorized, not authorized, initialized, acquiring authorization).
5) Status of renewable security (TV passcard), if employed.
6) Status of RF return data transmitter, including frequency and signal level or status of telephone return data modem (transmitting, receiving errors, etc.).
7) A list of applications and/or upgrades that have been installed and are enabled.

Conclusion

The information contained in this article can serve as an outline for broadband operators as they develop their own training programs for digital terminal installations. While digital installations do involve new considerations and procedures, proper planning and preparation will yield successful installations and satisfied customers. CT

Acknowledgments: The author wishes to thank Joe Waltrich, John Ernandez and all of the NextLevel digital engineers who contributed information on digital signal transmission, processing and measurement, as well as Carl Vassia and Dan Sutorius who provided the time, resources and encouragement to write this article. Special thanks also go to Neil Tingaard, Charlie Friday and Thomas Bailey of TCI for their input on installation guidelines.

References

[1] Waltrich, Joseph B., "Using a spectrum analyzer for digital signal measurements," NextLevel Systems' Broadband Networks Group (formerly General Instrument Corp.); White Paper.

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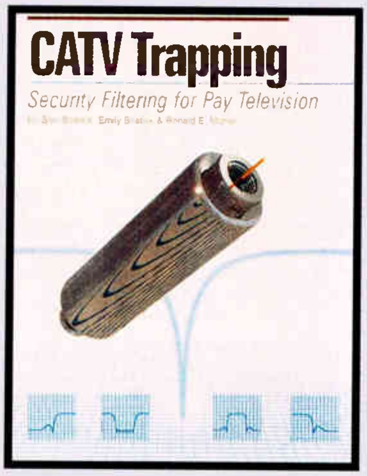


Cable TV Filtering Book

CATV Trapping: Security Filtering for Pay Television is the new book published by the Electric Press division of Communications & Energy Corp. based in East Syracuse, NY. Written by Glen Bostick, Emily Bostick and Ronald E. Mohar, the book explores the application of pay TV filtering technology.

The fully documented book begins with a history of cable TV and pay TV filtering and then compares filtering with a variety of other program security systems explaining the advantages and disadvantages of each. Subsequent chapters cover filter design and construction as well as the application of positive traps, negative traps and tier traps. A number of new filtering techniques are highlighted including the use of surface acoustical wave (SAW) filters for pay TV applications. Other chapters discuss system planning, cable piracy, tap audits, physical security, and the use of filters to solve a variety of other problems.

Reader service #312

Fuselite Termination System

Siecor Corp. has developed the Fuselite termination system, a combination of connector and optical fiber fusion splicing technology. The splicer allows direct fusion splicing of a factory-polished connector to fiber-optic cable. It provides a connectorization option at no additional cost, and converts from a connector splicer to a fiber-to-fiber splicer in seconds.

It can be used for system maintenance and restoration, broadband applications, aerial splicing and new construction. The connector is "near -zero-length" pigtail or a connector with a fiber stub installed in the ferrule and polished in the factory.

Reader service #311

Network Access

The newest member of the Janua family of network access and concentration products developed by West End Systems is the Arcadian-Plus access concentrator. The product combines a broad range of networking solutions and high port density (up to 21 ports) onto a single platform.

The Arcadian-Plus architecture features the application modules from the Janua Arcadian desktop system, which includes high-speed X.25 and frame relay interfaces as well as local area network (LAN), integrated services digital network (ISDN) and simple network management protocol (SNMP) management.

Reader service #309

Philips Introduces Return Signal Switch

Designed for use in optical stations or four-port optical node amplifiers, the highly flexible return signal switch (RSS) from Philips Broadband Networks manages and controls upstream traffic in the return path for enhanced signal clarity and improved system integrity.

The RSS module accepts analog and digital signals from up to four individual return paths and isolates noise ingress in upstream traffic. If noise is present in the return system, each individual return leg can be attenuated by 6 dB to determine if it is carrying the noise ingress. The offending return leg can be shut down until the noise ingress source is found, allowing the remaining legs to continue functioning.

The switch provides notice of impending system problems and speeds response time with its signal isolation feature. The RSS works with a FOTO transponder and an element management system for remote monitoring and control of the return path.

Reader service #310

Phasecom Introduces PC Card Version of SpeedDemon

Phasecom Inc., a developer of voice and data communications products for cable TV networks based in Cupertino, CA, has introduced its SpeedDemon. Phasecom's SpeedDemon-PCI is an internal cable modem that plugs into a PCI slot on the motherboard of any personal computer. SpeedDemon is an asymmetric and frequency agile cable modem employing quadrature amplitude modulation (QAM) for the downstream and quadrature phase shift keying (QPSK) for the upstream. The system employs TDMA (time division multiple access) and achieves speeds of up to 30 Mbps in the downstream direction and 2.56 Mbps (TDMA-based) in the upstream direction.

SpeedDemon-PCI is designed to work off the same headend hardware as Phasecom's external SpeedDemon cable modem. SpeedDemon-PCI is the first addition to Phasecom's SpeedDemon family of cable modems. Other additions including MCNS-based cable modems are slated for production.

Reader service #308

Above Ground Repeater Case

ADC Telecommunications Inc. has released the Soneplex Radiator above-ground repeater case. The product supports up to eight repeaters for high bit-rate digital subscriber line (HDSL) and also accommodates integrated services digital network (ISDN) or digital data system (DDS) repeaters. The thermally-enhanced case improves reliability of electronic components in outside plant applications where direct exposure to the sun (solar loading) is a concern. It is designed for deployment in above-ground applications such as telephony poles and pedestals.

The case has a ventilated dome and white-finned perimeter shield that prevents heat-related failures in the electronic components. Its thermodynamic design allows it to radiate the heat externally.

Reader service #307

Teflon-Free Plenum Cable

Trilogy Communications has introduced the AirCell Plenum, a plenum-rated 50 ohm coaxial cable designed to meet the safety and performance requirements of the in-building wireless communications and wireless data marketplace. The design does not include Teflon.

AirCell Plenum is suited for applications requiring distribution of RF in confined areas where fire-code requirements dictate a plenum-rated (UL-910) cable.

The cable features a corrugated outer conductor with a flame retardant PVC jacket to provide handling flexibility. Performance characteristics include a maximum attenuation of 2.45 dB per 100 ft. at 1 GHz and 3.5 dB per 100 ft at GHz for PCS (personal communication service) applications.

Reader service #304

Fiber-Optic Transceivers

AMP Inc. has announced the availability of its new VCSEL-based transceivers designed with a vertical cavity surface emitting laser (VCSEL) source. These optoelectronic devices allow increase of system and subsystem throughput in the backbone while maintaining a low manufacturing cost.

Reader service #305

Book 'Em, AEMC

If your field technicians are lacking tools to do their job properly, check out AEMC Instruments' "short-form" catalog. It describes AEMC's entire selection of portable test instruments for electrical system testing, maintenance and quality control. The product line includes megohmmeters, ground resistance and soil resistivity testers, clamp-on ground testers, current leakage testers, power and demand analyzers data loggers and temperature scanners and probes.

Reader service #306

Clip-On Coupling Device

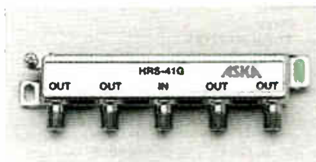
EXFO announces the release of a new fiber clip-on device that serves as an accessory to the VCS-20A fiber-optic talk set to establish full duplex communication anywhere on a network. The device also is for use with any of EXFO's FOT family of power meter/loss test sets to be used for 2 kHz tone detection.

Reader service #303

Cable Envoy Distribution

The HollyAnne Corp. will be distributing Altronix Systems Corp.'s Cable Envoy EAS (Emergency Alert System) addressable messaging system. Cable Envoy is a character generator that allows cable TV managers to inject video and audio override messages individually into any channel's program signal, for display of text, in crawl, full-page or multi-page formats. The Envoy is modular and allows the cable system to start with the basic system and add crawl capability on a channel by channel basis as customer demand and budget dictate.

Reader service #302



Spectrum Analyzer

DKD Instruments has developed the PA2500B spectrum analyzer, covering the frequency range from 100 kHz to 1300 kHz. In conjunction with a notebook computer and its optional internal battery, the analyzer can be operated cord free for up to one hour.

Absolute amplitude accuracy is better than ± 2.7 dB with resolution of 0.1 dB and measurement range from -130 dBm to +10 dBm. Three resolution bandwidths are supported: 300 kHz, 100 kHz and 3 kHz. An optional 500 Hz is available. The software allows simplified operation with many built in automatic features including: markers, spectrum memories, max hold, peak search and signal track.

Reader service #301

European Addition

The I-Flex Line Extender and the I-Flex Network Management Agent are the latest additions to C-COR's I-Flex 862 MHz family of RF transmission equipment. The extender can be used for European cabinet-mount cable TV market. It has one-input, one-output amplifier design and can carry 60 PAL channels as well as digitally compressed video.

The network management agent enables an operator to monitor, manage and inventory the I-Flex technology in C-COR's CNM network management system. Downloadable firmware will enable the agent to be compatible with the CableLabs standard for outside plant management. An optional reverse-path switch enables operators to isolate and eliminate subscriber ingress.

Reader service #299

Mini Push-Button Switch

A new mini push-button switch developed to meet the needs of designers and engineers facing minimal space and multiple switching requirement s has been introduced by ITW Switches.

The UltraLite Series 39-7 switch features crisp action; process compatibility; clear and bright LED status indication; maintained or momentary action; and resistance to high temperatures.

The product is ideal for low-level switching applications including audio instruments, computers and peripherals, hand-held instruments, telecommunications and compact communications equipment, battery operated monitors and diagnostic devices.

Reader service #300

Integrated Service Management

CrossKeys Systems Corp. has launched its Resolve Release 2.0 suite of integrated service management solutions, which is a carrier-scale, standards-based portfolio that allows service providers to work closely with their customers by having a complete end-to-end customer view of service usage and performance.

Resolve 2.0 is designed for ATM (asynchronous transfer mode), frame relay and TDM networks and integrates into any operational framework.

Reader service #296

Expandable Cabinets

A customized cabinet that accepts any copper, coax and fiber-optic combination is available from 3M. The cabinets can be combined with any of 3M's cross-connect/terminating systems for easy access, fast installation and maintenance, and quick jumpering capabilities.

The 4220 series units house from 300 to 5,400 pairs with space for splicing; additional frames can be installed to accommodate growth or changes in network traffic. Removable skirts and backs, split cable ports and drop-down interior frames ease cable installation. Other features include: heavy gauge construction; sealed, lockable doors; cabinet-to-base isolation system to resist moisture; available in four sizes.

Reader service #294

Termination Kit

Radiant Communications Corp., a manufacturer of fiber-optic interconnect products has announced a new termination kit with anaerobic adhesive. The Series TKx-AE fiber-optic termination kit includes all the fiber and cable preparation tools required to terminate multimode fiber. Also included is a continuity tester, polishing equipment, self-curing anaerobic adhesive and enough parts to terminate 100 ends of fiber.

The "connector-grip" enables the curing connectors to be held in place prior to polishing for a clean, "hands-free" bond. The anaerobic adhesive allows the installer to polish within two minutes of connectorization. All parts come in a heavy duty, lockable case.

Reader service #293

56K Analog, ISDN Access Modem

A combination ISDN (integrated services digital network) plus modem chipset capable of supporting both 56K analog modem and ISDN technologies was developed by Motorola. The ISDN+modem system provides a complete system solution, enabling analog modem speeds of up to 56 kbps downstream/33.6 kbps upstream and ISDN TA speeds of 128 kbps bidirectional. End users will be able to dial remote sites that are either digital or analog. The Motorola MCK14353 (U-Interface) and MCK14354 (S/T-Interface) are comprehensive Windows-based ISDN+modem chipsets and software. The system is based on the DSP56300 digital signal processor (DSP) core.

Reader service #295

DWDM Addition

Multichannel dense wavelength division multiplexers (DWDMs) have been added to the product line of Amphenol Fiber Optic Products. These DWDMs are based upon a combination of the company's fused biconic taper (FBT) and fiber Bragg grating filter technologies. The multiplexers feature a flexible design architecture that allows modular expansion from 4 up to 16 channels. Standard DWDM network configurations of 4,8, or 16 channels also are available.

Reader service #297

PWRBlazer Mini Node

The new PWRBlazer Mini Node produced by Harmonic Lightwaves is an optical node receiver for cable operators and telecommunications companies who are installing broadband overlays.The mini node features a single trunk level output and supports return path and network management through a return transmitter, a status transponder and an automatic gain control (AGC) card. Bandwidth extends to 870 Mhz.

Reader service #298

Communications Technology's
Product and Data Showcase

AM Communications

AM Communications
AM Communications is a leading supplier of monitoring systems for HFC transmission networks. AM's OmniStat product offers solution for virtually every brand and kind of network equipment.

PHONE: (212) 538-8700
FAX: (212) 538-8779
www.amcomm.com

Hukk Engineering

Hukk Engineering manufacturers digital test equipment for the CATV industry providing bit error rate measurements for QAM and QPR modulated digital signals. The new CR1200 provides users with pre-and post-FEC bit error rate information, signal-to-noise, and shows the constellation. It also does traditional analog testing like signal level, carrier-to-noise and hum.

PHONE: (888)236-8948
FAX: (770)446-6850
www.hukk.com

Amphenol

Amphenol Amphenol Corporation is one of the largest man ufacturers of interconnect products in the world. The company designs, manufacturers and markets CATV cable and connectors, electronic connectors, fiber optic connectors, RF coaxial cable, flat ribbon cable and interconnect systems. Amphenol connectors enable systems to send and receive secure signals with no reflections. . . especially in the critical 5 - 40 MHz range.

Amphenol
Broadband Connectors. When Clear Connections Count.

PHONE: (203) 743-9272
FAX: (203) 796-2032
www.amphenol.com

Klungness Electronic Suppl

KES distributes the "Little Oscar" hand held signal generators permitting **easy activation of the return path** using two independently controlled CW carriers. Oscar-II has fixed frequencies at 6 MHz and 39 MHz. Oscar-IV is frequency agile from 5 MHz to 50 MHz. A companion unit to the Oscar, Model RPC-III is installed at the headend and translates the return carriers to downstream carriers. Using "Little Oscar" and the technician's field strength meter, one technician can align and maintain the return path.

PHONE:(800) 338-9292
FAX: (906) 774-6117
www.ccikes.com

VENDOR CONNECTION

Vendor Connection is *Communications Technology's* resource for up-to-date information on the industry's leading technology suppliers. These vendors have advertised in this issue. Check their ads for products and services that will improve your cable system's reliability, efficiency and capacity.

ADC Telecommunications, Inc.

P.O. Box 1101
Minneapolis, MN 55440-1101
(800) 366-3891; (612) 938-8080
Fax: (612) 946-3292
Annette Biederman
adc.com

ADC Telecommunications is a leading, global supplier of transmission and networking systems used to deliver voice, data and video services and physical connectivity products for wireless, fiber-optic, twisted-pair and coaxial networks.

Reader Service #5,2

Alpha Technologies

3767 Alpha Way
Bellingham, WA 98226
(360) 647-2360; Fax: (360) 671-4936
Eric Wentz
alpha.com

Alpha Technologies is a world leading manufacturer of application specific powering solutions for voice, video and data communication systems. Alpha's products include: UPSs, line conditioners, surge suppressors, batteries, and accessories.

Reader Service #15

Altec Industries, Inc.

210 Inverness Center Parkway, Suite 130
Birmingham, AL 35242
(205) 991-7733; Fax: (205) 991-7747
Altec.com
Julie Walden

Altec Industries, Inc. Features the Altec AP38 Aerial Cable Placer designed to place fiber and coaxial cable along with the Altec AT235FSB Telescopic Aerial Device mounted on a fibersplicing body.

Reader Service #6

AM Communications, Inc.

100 Commerce Blvd.
Quakertown, PA 18951-2237
(800) 248-9004; (215) 538-8700
Fax: (215) 538-8779
amcomm.com
David L. DeLane
(215) 538-8703
sales@amcomm.com

AM Communications supplies monitoring systems for HFC transmission networks. AM's OmniStat product offers solutions for virtually every brand and kind of network equipment.

Reader Service #20, 220

Amherst International, Inc.

63 Sarasota Center Blvd.
Sarasota, FL 34240
(941) 925-9292; Fax: (941) 925-9291
AmherstFO@aol.com
Scot K. Ware
(941) 925-9292

Amherst is the distributor of Ericsson fusion splicer, clever, and preparation tools for use in Telephony, CATV and manufacturing applications.

Reader Service #8

Amphenol Corp., Communication and Network Products Division

One Kennedy Avenue
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(203) 743-9272; Fax: (203) 796-2032
amphenol.com

Manufacture and supply a complete line of 40 dB Broadband connectors that enable transmission of secure, two-way signals with no reflections, ingress or leakage.

Reader Service #25, 148

ANTEC Network Technologies

5720 Peachtree Parkway, N.W.
Norcross,GA 30092
(770) 441-0007; Fax: (770) 441-2460
Brad Halverson
Brad.Halverson@antec.com

ANTEC Network Technologies, the Atlanta-based manufacturing division of ANTEC Corp., designs, manufacturers, distributes and markets a wide range of active transmission, powering, passives, and interconnection products for fiber optic coaxial and twisted pair networking, worldwide.

Reader Service #14

ATCI

1128 E. Greenway
Mesa, AZ 85203
(602) 264-7275; Fax: (602) 898-7667
atci.net
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ATCI creates unique and resourceful global communications solutions from simulsat multiple satellite reception systems to satellite uplink solutions.

Reader Service # 50

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barco-usa.com
Earlene Bentley
EBBARCO@AOL.COM

BARCO hardware and software improve the quality and reliability of signal delivery. BARCO CATV equipment incorporates advanced capabilities to remotely monitor and control signal distribution system-wide, maximizing up-time and subscriber satisfaction.

Reader Service #60, 128

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(814) 238-2461; Fax: (816) 238-4065
c-cor.com
Sally Thiel

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Reader Service #34, 107

Cable Innovations, Inc.

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Nick Haralson
Haralson@rightmove.com

Cable Line, drop line, and power line surges suppressors. Including the CLPS-3009PI, DLPS-15D and PLS-125. And new from Cable Innovations the UHB-2001 Universal House Box.

Reader Service #75

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(860) 526-4337; (800) 394-4046
Fax: (860)526-2291
cableprep.com
deborah@cableprep.com or cableprep@aol.com

Cable Prep designs and manufactures a full line of hand tolls for the broadband industry. New Products include the Pocket TerminX handtool for compression-type fittings.

Reader Service #36

Cable Resources, Inc.

85 M Hoffman Lane
Islandia, NY 11722
(516) 234-1411; Fax: (516) 234-4436
Maura O'Riordan

Cable Resources offers a new line of test equipment to maintain return networks in the Cable TV environment. RDU shows the big picture; ingress, noise and carrier levels for real time analysis of 5-40 mhz return networks.

Reader Service #80

CANUSA-EMI

25 Bethridge Road
Toronto, Ontario M9W 1M7
Fax: (416) 743-7199
canusa-emi.com
marketing@canusa-emi.com
Jay Larock
(416) 744-5811

CANUSA-EMI is a global manufacturer and supplier of outside plant proection solutions. Products offered include heat shrink tubing, closures, enclosures, tapes and wiring accessories for copper, coax and fiber cables.

Reader Service #109

Channell Commercial Corporation

26040 Ynez Road
P.O. Box 9022
Temecula, CA 92589-9022
(909) 694-9160; (800) 423-1863
Fax: (909) 694-9170
channellcomm.com
Andrew M. Zogby, V.P. of Marketing

Channell Commercial Corp.designs and manufactures precision-molded, thermoplastic and metal fabricated enclosures supplied worldwide to telecommunications network operators.

Reader Service #44, 31, 111

CIS, Inc.

6855 Jimmy Carter Blvd., Suite 200
Norcorss, GA 30071
(770) 448-0977; Fax: (770) 242-8583
cisfocus.com
Gary Evans, Lynn Hamlin

CIS Develops and markets an integrated broadband and fiber management software product called FocusOne. FocusOne is an enterprise-wide software solution for network mapping, planning, design and management of the outside plant.

Reader Service #95

ComSonics, Inc.

1350 Port Republic Road, Harrisonburg, VA 22801
(540) 434-5965; Fax: (540) 432-9794
Roy Weitzell

(540) 434-5165 x 228
marketing@comsonics.com

ComSonics is a 100% employee owned (ESOP) company. We manufacturer and sell test equipment for the telecom industry. Signal, label meters, leakage detectors, global leakage system and video test sets.

Reader Service #100

Corning Inc.

35 West Market Street
Corning, New York 14831
(800) 525-2524 ; Fax: (607) 974-4473
corningfiber.com
James Bratton (607) 974-7243
brattonjl@corning.com

Corning Inc., is a manufacturer of single-node, multimode, specialty optical fiber and fiber-optic components.

Reader Service #90

DX Communications

Division of Itochu Cable Services, Inc.
1143 W. Newport Center Drive
Deerfield Beach, FL 33442
(888) 294-5856; (954) 427-5711
Fax: (954) 427-9688
DXCKM@aol.com
Ken Mosca

Manufacturer of quality headend equipment. Products include digital satellite receivers, IRDs, agile modulators, satellite receivers, combiners, FM modulators, combiners, LNBs and accessories.

Reader Service #9

Eagle Comtronics, Inc.

4562 Waterhouse Road]
Clay, NY 13036
(315) 622-3402; Fax: (315) 622-3800
eaglefilters.com
eagle@eaglefilters.com

Eagle Comtronics, Inc., is the world's largest manufacturer of positive, negative and multi-channel traps and scramblers for the CATV, MATV, SMATV, and MMDS industries.

Reader Service #62

Ericsson

1525 O'Brien Drive
Menlo Park, CA 94052
Fax: (415) 463-6821
ericcson.com/US/networks supercoax.html
Steffan Nilsson
(415) 463-6000

Ericsson is the world's leading telecommunications supplier with 90,000 employees in more than 130 countries. Its HFC network solutions, based on ATM, provide the backbone infrastructure for broadband multiservices access.

Reader Service #11

FrontLine Communications

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Salt Lake City, UT 84115
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frontline.com
Bill Robertson
w.robertson@frontline.com

Frontline Communications makes Emergency Alert and PC based Chararacter Generator products for the cable and multi-channel marketplace. Our products meet the needs of multi-channel system operators.

Reader Service #72

Fujitsu Network Communications

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Design, manufacture and market high-speed switching and transmission equipment.

Reader Service #21

Harmonic Lightwaves, Inc.

549 Baltic Way
Sunnyvale,CA 94089
(408) 542-2500; (800) 788-1330
Fax: (408) 542-2511

Harmonic Lightwaves supplies highly integrated fiber optic transmission, digital headend and element management systems for the delivery of interactive services over broadband networks.

Reader Service #78

Harris Corporation

1025 West NASA Blvd., C-99
Melbourne, FL USA 32919
(407) 724-3828; Fax: (407) 724-3947
harris.com
Gary Pacilio
gpacilio@harris.com

Harris is a leading provider of advanced network management systems for large, multimedia telecommunication networks. Harris Network Management is scalable software, with dynamic customizable graphics, that allows network operators to quickly make real-time evaluations and respond to changing network conditions.

Reader Service #29

Hewlett-Packard Company

Test and Measurement Organization
P.O. Box 50637
Palo Alto, CA 94303-9511
(800)-452-4844; Fax: (303) 754-4990
hp.com/go/catv
hpcatv@aol.com

Hewlett-Packard Company offers a comprehensive range of test equipment to keep your broadband system at peak performance from manufacturing through the headend and into plant maintenance.

Reader Service #33

Hukk Engineering

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Norcross, GA 30092
(888) 236-8948; (770) 446-6086
Fax: (770) 446-6850

Hukk Engineering manufactures digital test equipment for the CATV industry. This equipment gives bit error rates and other tests for QAM and QPR digital services.

Reader Service #92, 210

iCS-ITOCHU Cable Services Inc.

1143 W. Newport Center Drive
Deerfield Beach, FL 33442
Toll Free:800-327-4966
(954) 427-5000; Fax: (954) 427-0934
Alex Firmino

iCs Inc. is a leading full-service stocking distributor for NextLevel, SA, PPC, Joslyn, Diamond, DX and many more. ICS operates ten sales offices and nine warehouses conveniently located in North and South America.

Reader Service #84

Integral Corporation

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Meiching Chou

Integral Corporation, an ISO 9002 certified conduits manufacturer, has invented a flexible pre-assembled cable-in-conduit system-Cablecon, serving CATV, telephony and electrical industries.

Reader Service #39

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(201)794-3900; Fax: (201) 794-3239
jvcpro.com

JVC Professional Co., based in Elmwood Park, New Jersey, distributes a complete line of broadcast and professional equipment including cameras, recorders, monitors, projects and editing products.

Reader Service #41

KES (Klungness Electric Supply)

P.O. Box 885
101 Merritt Avenue
Iron Mountain, MI 49801
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(800) 338-9292
Greg Michaud
(906) 774-6621, ext.276

Distributes a full line of broad band products/delivers construction equipment, executive level stocking distributor/complete system integrator specializing in interdiction, data, internet integration, CATV, load management distance learning/substation/distribution management.

Reader Service #47

Leaming Industries

15339 Barranca Parkway
Irvine, CA 92618
(714) 727-4144; Fax: (714) 727-3650
leaming.com
Laura Klepitch
lic@leaming.com

Manufacturer of BTSC Stereo/SAP encoders. BTSC /Stereo DSP decoders, audio AGC FM modulators/demodulators/upconvertors, CATV/SMATV audio-video modulators.

Reader Service #98, 40

Lindsay Electronics

50 Mary Street West
Lindsay, ON K9V
(705) 324-2196; Fax: (705) 324-5474
From USA: (800) 465-7046
lindsayelec.com
David Altman
sales@hq.lindsayelec.com

Focused on the last mile, our revolutionary new technology creates communication equipment to solve system problems before they become subscriber problems. This is achieved through applied ISO continuous improvement disciplines, innovation, and strict attention to details.

Reader Service #61

Lode Data Corporation

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Denver, CO 80224
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lodedata.com
Mike Springer
Mikes@lodedata.com
Mary Garcia
Maryg@lodedata.com

Lode Data Corp. produces software used for CATV design and drafting. Our software's speed, power, flexibility and accuracy combine to create the most effective production design and drafting programs available.

Reader Service # 57

Main Line Equipment, Inc.

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megahz.com
Steve Grossman
TUGSO8A@Prodigy.com

MEGA HERTZ represents or distributes; off air or satellite antennas; character stand-by generators; headend electronics; satellite electronics; stereo processors; test equipment; custom traps and filters.

Reader Service #73,77,79,81,83,87

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Passive electronic filters and filter networks for signal processing and interference suppression.

Reader Service #93

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multilinkinc.com/multilinc
Steve Kaplan
mulink@ix.netcom.com

Multilink is a leading manufacturer of cable television supplies. Multilink manufactures plastic enclosures, metal enclosures, and splice closures as well as fiber-optic, and telecommunications products.

Reader Service #110,115

NextLevel Broadband Networks Group

2200 Byberry Road
Hatboro, FPA 19040
(215) 830-5554
awetzel@nvl.com

The Broadband Networks Group of NextLevel Systems, Inc., designs and manufactures end-to-end broadband telecommunications systems, including digital and analog programming encryption /decryption systems and end-to-end addressable transmission systems.

Reader Service #102

Newton Instruments Company

111 East "A" Street
Butner, NC 27509
(919) 575-6426; (919) 575-4708
Carla Rein

Newton Instrument Co. is an ISO 9001 Certified supplier of cable management systems. Products include cabinets, cable and equipment racks, distribution frames and terminal blocks, outside plant enclosures and accessories.

Reader Serive #120

Norscan

301 -F3 10th Street NW
Conover, NC 28613
(704) 464-1148; (704) 464-7608
norscan.com
John Chamberlain
(704) 464-1148
norscan@twave.net

Norscan manufacturers a full line of fiber optic preventative maintenance and monitoring equipment.

Reader Service #104

Oldcastle Precast, Inc.

4478 Greer Circle
Stone Mountain, GA 30083
(770) 493-5420; Fax: (770) 493-5425
oldcastle-precast.com
Rick Sauer
(770) 493-5444
rick.sauer@oldcastleprecast.com

Oldcastle is a leading manufacturer of precast concrete products used in the construction of telco, CATV, PCS, and other communications networks. Buildings, CEVs, cabinets, fiber manholes and pads are just a few of the many products provided to serve network construction.

Reader Service #106

PDI-Electronics for Telecommunications

6353 West Rogers Circle #6
Boca Raton, FL 33487
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pdi-eft.com
Johathan Edelman
(561) 998-0600
PDI.Electronics@worldnet.att.net

PDI manufacturers and distributes every product that any type of cable system may need. From high tech headend products to passives and tools, PDI has it all.

Reader Service #108

Performance Power Technologies

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Batteries-Standby, Battery Chargers Test Equipment, Diagnostic Monitoring Systems, Power Conversion Products, Power Supply Products, Test Equipment. Power Supplies for Cable and Telecom featuring the "Magnum UPS" 90 volt 32 Amp HFC Centralized Node Powering System with "Smart/Gard" output protection.

Reader Service #140

Philips Broadband Networks

100 Fairgrounds Drive
Manlius, NY 13104
be.philips.com/pbn
Jim Brady
Jbrady@pbni.attmail.com

Philips Broadband Networks, a longtime supplier of broadband RF and fiber optic transport equipment and systems used in video entertainment, is a leading global provider of advanced systems used to access broadband telephony, the Internet and other high-speed interactive data services.

Reader Service #145

Pico Macom, Inc.

12500 Foothill Blvd.
Lakeview Terrace, CA 91342
(800) 421-6511; (818) 897-0028
Fax: (818) 834-7197
Dan Ward

Pico Macom offers a full line of quality headend components including satellite receivers, agile modulators and demodulators, signal processors, amplifiers, and completely assembled headends. Pico also manufacturers the complete line of Tru-Spec 1 GHz drop and installation passives, splitters, couplers, switches and connectors to CATV/MMDS/SMATV and DBS installation.

Reader Service #150

PK Technology, Inc.

9405 S. W. Gemini Drive
Beaverton, OR 97008-7160
(503) 644-1960; Fax: (503) 526-4700
pktechnology.com
Valrie Dyhouse
(503) 526-4717
info@pktechnology.com

Photon Kinetics and York Technology have been at the forefront of optical fiber measurement technology for over 15 years. These two companies are now known as PK Technology, Inc.

Reader Service #116

Power & Telephone Supply

2673 Yale Avenue
Memphis, TN 38112
(901) 320-3080; Fax: (901) 320-3082
ptsupply.com
Mary Bowen

Power & Telephone Supply for 34 years provided superior material distribution services to the CATV, communications and network industries. We are an independent wholesale distributor of CATV hardware, electronics, drop material, tools & test equipment.

Reader Service #160

Preformed Line Products

P.O. Box 91129
Cleveland. OH 44101
(440) 461-5200; Fax: (440) 442-8816
preformed.com
Michelle Weininger

Preformed Line Products is a leading supplier of high quality cable anchoring and control hardware and systems, overhead and under-ground splice cases, and fiber optic splicing and high speed cross-connect devices.

Reader Service #165, 124

Quality RF Services, Inc.

850 Parkway street
Jupiter, FL 33477
(800) 327-9767; (561) 747-4998
Fax:(561) 744-4618
Jerry K. Thorne

Quality RF Services manufactures RF amplifiers and equalizers for bandwidth upgrades of CATV systems, laser drivers and isolation amplifiers for the headend, high-quality amplifiers for the MDU, hotel/motel industry and the home. .

Reader Service #126

Radiant Communications

5001 Hadley Road
P.O. Box 867
South Plainfield, NJ 07080
(800) 969-3427; Fax:(908) 757-8666
Radcom.com
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Pamela Girardin
(941) 756-6000, ext. 1340
Pamela.girardin@cheetahnet.com

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Dennis Donnelly
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Reader Service #166, 168, 245

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Fax:(317) 895-3613
trilith.com
Bob Jackson
(317) 895-3600, ext. 152
bjackson@trilithic.com

Trilithic designs and manufacturers portable HFC test equipment; ingress monitoring systems; EAS compliance systems; RF and microwave components.

Reader Service #250, 174

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Fax:(610) 327-9295
David C. Hirsch
dchirsch@videotek.com

Videotek, Inc., is a leading manufacturer of test and measurement equipment, video demodulators, routing and production switchers, color correctors and processors, and related equipment for the professional video and television broadcast markets. Videotek is committed to Zero Defects and is ISO-9001 certified.

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Gary Culbertson

Wavetek Corp. designs, manufactures and markets worldwide a broad line of electronic test and measurement instruments for the cable television, telecommunications, wireless communications, radio, video, LAN, ATE and metrology markets.

Reader Service #184, 186

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SCTE INSTALLER PROGRAM INFORMATION REQUEST CARD

The SCTE Installer Certification Program was created to establish minimum skill requirements for CATV installers and installer/technicians. Participants in the program must successfully complete practical examinations in the areas of cable preparation and meter reading, as well as a written examination on general installation practice. The program is being administered by local SCTE chapters and meeting groups under the guidance of SCTE national headquarters. All candidates for certification in the program are recognized as SCTE members at the Installer level, and receive a copy of the *SCTE Installer Manual*.

☐ Please send me information and an application for the SCTE Installer Program

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BOOKSHELF

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.

- *Fiber for Management*—Continental Cablevision and Paragon Cable present real-life case histories that examine the "dollars and sense" of fiber usage in cable TV transmission systems and rebuilds. (3 hrs.) Order #T-1093, $75.
- *Fiber Project Management*—Representatives from AT&T Bell Labs, Cable Constructors and CommScope speak respectively on lightguide cable construction guidelines, fiber construction and fiber cable placement. (3 hrs.) Order #T-1094, $75.
- *Fiber for Engineers: Performance Issues*—Representatives from Jerrold Communications, Scientific-Atlanta, Engineering Technology Group, Cencom Cable Associates, Continental Cablevision and NewChannels Corp. discuss fiber from an engineer's viewpoint, focusing on such issues as upgrades, "star" architectures, fiber deployment, plant upgrade, rebuild, extension and design. (3 hrs.) Order #T-1095, $75.
- *New Developments in Fiber*—A series of exciting, groundbreaking new fiber products, concepts and plans are presented by Sumitomo Electric, AT&T Bell Labs, C-COR, Scientific-Atlanta, Synchronous Communications and ATC. (3 hrs.) Order #T-1096 , $75.
- *One-on-One with John Wong of the FCC: A Candid Interview*—This presentation deals with the CLI issue one year after the July 1990 deadline. Wong discusses the progress the FCC has made with 1990 filings, as well as what it expects for 1991. (1 hr.) Order #T-1097, $35.
- *OSHA Regulations: Safety in the Workplace*—Ralph Haimowitz and Roger Keith ask the questions: Are you ready for the compliance officer's visit? What does OSHA require of you as an employer? What records should you maintain on each employee? What do you do if you get a citation? (1 hr.) Order #T-1098, $35.
- *Satellite Proof-of-Performance Measurements*—Doyle Catlett, John Vartanian, Scott Grone and Kevin Hatch cover the installation of multiple-setting antenna feed systems, as well as proof-of-performance testing procedures.They also provide many maintenance tips that will improve system performance in years to come, and address replacement satellites, the required spacing changes and the impact these changes will have on headends. (70 min.) Order #T-1099, $45.
- *Painless Technical Speaking*—Doug Ceballos and Rikki Lee discuss ways to prepare to give a presentation, deal with factors such as stage fright, use visual aids effectively and make public speaking opportunities positive, rewarding and enjoyable experiences. (1 hr.) Order #T-1100, $35.
- *Practical Technical Calculations Made Easy*—This program covers basic definitions and calculations as only Richard Covell can. He begins with Ohm's Law and proceeds to discuss the use of logarithms, dBs, dBmVs, return loss and various distortions including second and third order. (45 min.) Order #T-1101, $30.
- *Tap to TV: Strengthening the Weakest Link*—Robert Glass and Pam Nobles address the installer's function and career, covering training, service call reduction programs, bonding and CLI and fire code regulations in the context of cable material choices. (45 min.) Order #T-1102, $30.
- *Fiber-Optic Trunk Restoration*—Charles Mogray Jr., Dave Johnson and Ron Causey explore typical fiber faults that occur, as well as temporary and permanent repairs. They clearly cover topics such as site evaluation, damage assessment, repair/restoration and what a typical restoration kit should consist of. (70 min.) Order #T-1103, $45.
- *CLI Ninjas II: The Sequel*—John Wong of the FCC and Les Read provide a view of how one MSO is dealing with the CLI issue. They also cover important topics such as the chances of being targeted for an FCC inspection, what inspectors look for and the new role of the Emergency Broad-cast System and how it affects cable operators. (1 hr.) Order #T-1104, $35.
- *A Look Back-The Birth of Broadband Communications*—Industry pioneers Edward Allen, Leonard Ecker, Keneth Simons, E. Stratford Smith and Archer Taylor provide unique and entertaining insight into how our industry started and developed. (70 min.) Order #T-1105, $45.
- *Exploring Fiber-Optic Architectures*—Ed Callahan, Earl Langenberg, Bob Luff, Jay Vaughan and David Willis discuss the different fiber architectures in use today, covering fiber's uses, performance and future applications. (1-1/2 hrs.) Order #T-1106, $45.
- *Interdiction and Other Signal Security Techniques*—Paul Harr, Roger Pence, Leonard Falter and Terry Mast define and evaluate signal security methods of preventing service theft, including positive and negative traps, scrambling, interdiction and video compression. (1 hr.) Order #T-1107, $35.
- *Anatomy of Professionalism*—Produced by SCTE in association with NCTA and funded by CableLabs, this outstanding program serves as an effective tutorial for BCT/E Category VII, "Engineering Management and Professionalism." Even for those who are not pursuing BCT/E certification, this professionally produced tape offers an in-depth evaluation of case studies relating directly to cable industry operations. (1 hr.) Order #T-1110, $18. CT

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.

CALENDAR

December

2: 1997 CDMA North American Regional Congress, Orlando, FL. Contact (619) 535-8252.
2: The Light Brigade training course for installers, maintenance personnel and engineer designers, "Introduction to Fiber Optics—the Basics," course. Contact (800) 451-7128.
2-4: Converging Technologies Expo & Conference, Los Angeles. Contact John Golicz, (203) 256-4700, ext. 121.
3: SCTE Badger State Chapter, technical seminar, "Hands-On Return Plant Activation and Maintenance," Fond du Lac, WI. Contact Brian Revak, (715) 493-2605.
3: SCTE Smokey Mountain Chapter, technical seminar, "Vendor Show," Johnson City, TN. Contact: Roy Tester, (615) 878-5502.
4-5: IBC Broadcast Event, "Broadband Strategies: The Battle for Customer Access," London. Contact Suzi Morris, +44 171 453 2700.
4: SCTE New England Chapter, technical seminar and testing session, Boxborough, MA. BCT/E and Installer certification exams to be administered. Contact Tom Garcia, (508) 562-1675.
9-10: SCTE Wheat State Chapter, testing session, BCT/E and Installer certification exams to be administered, Wichita, KS. Contact Vicki Marts, (316) 262-4270.
10: SCTE Bluegrass Chapter, technical session, BCT/E and Installer certification exams to be administered, Elizabethtown, KY. Contact Max Henry, (502) 435-4433.
10: SCTE North Country Chapter, technical seminar, "Signal Processing Centers," St. Paul, MN. Contact Bill Davis, (612) 445-8424.
10: SCTE Appalachian Mid-Atlantic Chapter, technical seminar and testing session, "Digital Headends and Terminals," BCT/E and Installer certification exams to be administered, York, PA. Contact Doug Hair, (717) 243-4918.
10: SCTE Mid-South Chapter, testing session, BCT/E and Installer certification exams to be administered, Memphis, TN. Contact Kathy Andrews, (901) 365-1770, ext. 4110.
10: SCTE West Virginia Mountaineer Chapter, technical session, "Fifth Annual Vendor Show," South Charleston, WV. Contact Steve Johnson, (614) 894-3270.
10-12: The Western Show, Anaheim, CA. Contact the California Cable Television Association, (510) 428-2225.
11: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program, "Data Over Cable (Part One)," Galaxy 1R, Transponder 14, 2:30-3:30 pm. Eastern Time. Contact: SCTE National Headquarters, Janene Martin, (610) 363-6888, ext. 220.
11: SCTE Music City Chapter, testing session, BCT/E and Installer certification exams to be administered, Nashville, TN. Contact Ken Long, (615) 244-7462, ext. 319.
11: SCTE Razorback Chapter, technical seminar, Little Rock, AR. Contact Jack Trower, (501) 327-8320.
13: InteropNetswitch '97 tour. One-day seminar on switched network design, Toronto, Canada. Contact (800) 506-9517.
18: SCTE Gateway Chapter, testing session, BCT/E and Installer certification exams to be administered, St. Louis, MO. Contact: Chris Kramer, (314) 579-4627.
19: SCTE Oklahoma Chapter, testing session, BCT/E certification exams to be administered, Edmond, OK. Contact: Doug Huston, (405) 348-4225.
26-28: Southern Cable Telecommunications Association's 1998 Eastern Show, Orlando, FL. Contact Patti Hall, (404) 255-1608.

January

5-9: Siecor Corp. fiber-optic training course, "Hands-On Fiber Optic Installation for Local Area Networks (Multimode and Singlemode)," Hickory, NC. Contact (800) 743-2671.
7-9: KMI Corp.-sponsored conference, "Fiberoptics Markets in the Asia-Pacific Region," Honolulu, Hawaii. Contact (401) 849-6771.
8: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program, "Data Over Cable (Part Two)," Galaxy 1R, Transponder 14, 2:30-3:30 pm. Eastern Time. Contact: SCTE National Headquarters, Janene Martin, (610) 363-6888, x220.
8-10: Caribbean Cable TV Association annual conference, Puerto Rico. Contact Margaret Dean, CCTA executive director, (809) 776-3320 or fax (809) 779-8133.
12-14: Technology Futures Inc. seminar, "Technology Forecasting for the Telecom Industry, Austin, TX. Contact Diane Sanso, (800) 835-3887.
13-16: Siecor Corp. fiber-optic training course, "Passive Fiber Optic System Design for Local Area Networks," Keller, TX. Contact (800) 743-2671.
26-29: Latin American CATV & Satellite '98, Miami. Contact (800) 882-8684; fax: (201) 256-0205; e-mail: info@iqpc.com; URL: http://www.tig2000.com.
26-30: Siecor Corp. fiber-optic training course, "Hands-On Fiber Optic Installation for Local Area Networks (Multimode and Singlemode)," Hickory, NC. Contact (800) 743-2671.
28-30: Society of Cable Telecommunications Engineers Conference on Emerging Technologies, San Antonio, TX. Contact: SCTE National Headquarters, (610) 363-6888.

Planning Ahead

February 9-11: Technology Futures Inc. seminar, "Technology Forecasting for the Telecom Industry," Austin, TX. Contact Diane Sanso, (800) 835-3887.
March 4-6: Global TMN Summit '98 and Vendor Showcase, sponsored by Vertel and HP OpenView Telecom, Orlando, FL. Contact www.vertel.com or www.hp.com/go/ovtelcom.
April 21-23: Digital Signal Processing Design Conference, Santa Clara, CA. Contact Liz Austin, (415) 538-3848.
April 27-29: Internet & Electronic Commerce & Exposition, sponsored by the Gartner Group Inc. and Advanstar Communications Inc. Contact (203) 256-4700.
May 12-14: Pacific Equipment & Technology Expo, Orlando, FL. Contact Robert Morock, (800) 525-7383.
June 7-9: Consumer Electronics Manufacturers Association's CES Habitech '98, Atlanta, GA. Contact Jonathan Thompson, (703) 907-7664.
September 13-16: ICSPAT & DSP World Expo '98, Toronto, Ontario, Canada. Contact Liz Austin, (415) 538-3848.

CABLE TRIVIA

By Rex Porter

Our historical guru (aka Editor Rex Porter) has provided these trivia questions on the cable industry. Answers to the last set of questions appear first. (The last "Cable Trivia" ran on page 104 of the November issue.) Look for answers to this month's questions in a future issue (along with a new set of 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 or faxed 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, 6565 E. Preston, Mesa, AZ 85215 or fax: (602) 807-8319.

Trivia #19 answers

1) The first microelectronic chip used in a cable TV amplifier was manufactured by: Hewlett-Packard
2) One of the first products made by Jerrold was: an FM-Wobulator
3) Cable TV job descriptions and educational requirements were published in 1973 by: U.S. Department of Commerce
4) C-COR Electronics was originally known as: Community Engineering
5) An FM-Wobulator was an instrument used to: sweep aligned IF systems

Trivia #20

1) A graduate of Iowa State University with a BSEE, he began his career in radar and radar countermeasures. He was Society of Cable Telecommunications Engineer Member of the Year and received the National Cable Television Association Outstanding Achievement Award in 1979. An SCTE Fellow, and a member of the Institute of Electrical and Electronic Engineers and Society of Motion Picture and Television Engineers. Awarded U.S. patents #2,457,222 for an electron sawtooth oscillator and #2,449,801 for an oscillograph apparatus, his name:
   A) Ken Gunter
   B) Frank Bias
   C) Bob Luff
   D) Andy Devereaux

2) Founder of her own company in 1980, she graduated magna cum laude from the University of Colorado with a B.S. in business. She was awarded the Women In Cable Award for Woman Entrepreneur in 1985, was elevated to senior member of the SCTE in 1981 and named Member of The Year in 1986. She is:
   A) Pam Nobles
   B) Diana Riley
   C) Sally Kinsman
   D) Maggie Fitzgerald

3) The author of a new book on satellites published by the NCTI, he is a regional of the SCTE. Broadband Communications Technician/Engineer (BCT/E) certified, he holds a senior broadcast engineer-TV endorsement and is a senior certified electronics technician. Always active in the SCTE, he is listed in Who's Who in Science & Engineering. He is:
   A) Jim Kuhns
   B) Steve Johnson
   C) Wendell Bailey
   D) Dennis Quinter

4) Although its name has been changed, this was the first SCTE chapter.
   A) The Hudson Valley Chapter
   B) The Southern California Chapter
   C) The Delaware Valley Chapter
   D) The Appalachian Mid-Atlantic Chapter

5) The first issue of *DigiPoints* was printed in the SCTE newsletter, *The Interval*, in:
   A) December 1996
   B) February 1997
   C) March 1997
   D) April 1997

6) Scientific-Atlanta introduced its Model 6400 series broadband data modem as the first in a series of business products in:
   A) 1987
   B) 1992
   C) 1982
   D) 1989

7) Jerrold's Ken Simmons designed the first 20-channel electromechanical prototype converter for the NCTA show in:
   A) 1972
   B) 1976
   C) 1967
   D) 1970

8) ANTEC (then known as Anixter) introduced Raychem's unique F-connector, "EZF" at the National Cable Show in Las Vegas in:
   A) 1985
   B) 1987
   C) 1982
   D) 1986

9) Riser-Bond's original name was:
   A) Wavetek
   B) Avantek
   C) CWY
   D) Avtek

10) The terms "fairing jettison," "delta cutoff," "energize flywheel" and "operational" are:
   A) jargon associated with weather-scan operation
   B) various stages of a satellite launch from liftoff to orbit
   C) digital modulation terms
   D) various energizing stages within a convention RF modulator

11) The Drop Shop marketed a security device to prevent ladders from falling left or right due to weight shifts or strong wind. They called these:
   A) Scures
   B) Gzontas
   C) Sledges
   D) Grabz

And the winner is...

The winner for Cable Trivia #18 is **Robert J. Greiner, Jr.**, senior vice president of Pico Macom, based in New York. Congratulations Robert! At press time, there was no winner for Cable Trivia #19 (which ran in the November issue). The winner will be announced in an upcoming issue. CT

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Education Criteria: Minimum of a High School diploma and formal technical education. Candidates with BS in engineering and partial or full SCTE BCE certification get preference. At least one position requires fluency in Spanish or Portuguese. Travel requirements range from moderate to extensive, depending on the position

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TRAINING

By the NCTI

Troubleshooting the Drop System: Part 4

This month's installment covers troubleshooting abnormal RF signal levels in drop cable. The material is adapted from NCTI's Installer Technician Course, complemented by performance training suggestions to reinforce the material in a hands-on classroom setting. © NCTI.

Next to F-connectors, the most common problems found on a service call pertain to drop cables. Certain visual observations of the condition of the drop cable can reveal causes of signal level and picture quality problems. There are times, however, when a visual inspection doesn't reveal the problem or can't be accomplished (e.g., with a buried drop). When this occurs, using a signal level meter to measure your system's lowest and highest channels at both ends of the drop cable (e.g., at the tap port and input to the ground block) and factoring in the cable's attenuation characteristics at each channel's frequency, can reveal if the cable is damaged.

Coaxial cable normally attenuates RF signals differently at each frequency. Some physical damages cause a change in the attenuation characteristics of the cable at certain frequencies and no change at other frequencies. To determine if a section of drop cable is attenuating RF signals properly at all frequencies, it is important to know the attenuation characteristics of the drop cable in use and how to calculate the normal signal loss at various frequencies and expected signal level at a particular point in the drop.

To calculate the normal attenuation of a certain length of coaxial drop cable, use the following formula:

	Drop cable length (in 100´ units)
x	Cable attenuation (dB/100´) @ particular frequency
=	Total cable attenuation @ particular frequency

For example, using the cable loss figure from the accompanying table for the nearest frequency to the desired channel and the previous formula, there is 1.18 dB attenuation in 87 feet of 6 Series (foam) drop cable for Ch. 2 (using 50 MHz) and 4.04 dB attenuation at Ch. 78 (using 550 MHz).

0.87´ x (1.36 dB/100´) = 1.18 dB (1.2 rounded off)

0.87´ x (4.64 dB/100´) = 4.04 dB (4.0 rounded off)

By measuring the output of the tap port for the RF input signal level to a certain length of drop cable and calculating the cable's total attenuation at particular frequencies, you can determine the expected RF output signal level at those frequencies, as shown in the following formula.

	Measured tap port output signal level @ particular frequency
–	Cable attenuation @ particular frequency
=	Ground block input signal level @ particular frequency

For example:

	10.5 dBmV @ Ch. 2 (55.25 MHz)
–	1.2 dB @ 50 MHz
=	9.3 dBmV @ Ch. 2

	13.6 dBmV @ Ch. 78 (547.25 MHz)
–	4.0 dB @ 550 MHz
=	9.6 dBmV @ Ch. 78

If the measured signal at the ground block input is more than 1.5 dBmV below the calculated levels, there may be physical damage in that section of the drop. When using this method inside a customer premises, the number of outlets, size, type and length of the drop cable, and type of routing method (home run or loop through) affect signal losses. The size and length of the cable, and the number of outlets determine how much signal is lost at a given frequency.

Next month's installment will begin a series on troubleshooting drop passives.

Hands-on performance training

Proficiency objective: *Check a drop cable for damage by performing measurements and calculations to determine if the cable is attenuating signals properly.*

Ensure that you have enough work stations with active taps feeding broadband cable signals to drop cable and ground blocks for your number of students to practice on. Purposely damage the drop cable on some of the work stations, but don't make it visible.

Provide each student with an attenuation table for the type of drop cable and frequencies/channels used in your work stations/system.

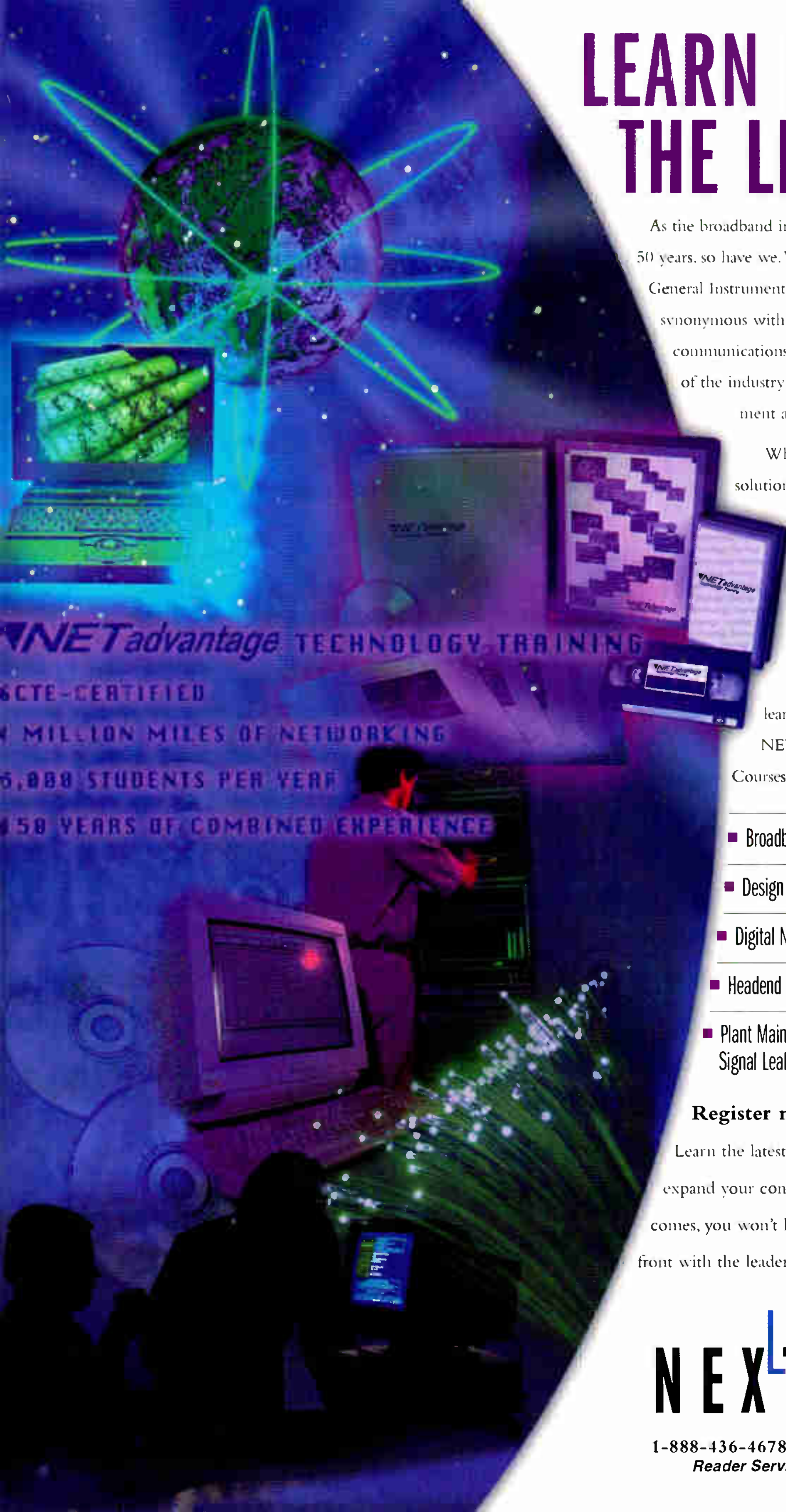
Demonstrate performing measurements and calculations to determine if the cable is attenuating signals properly.

Have students practice the procedures at several of the work stations (i.e., one with a damaged cable and one with good cable).

Verify that each student can correctly perform measurements and calculations to determine if a drop cable is attenuating signals properly. CT

Drop cable attenuation summary (dB per 100 feet)

Frequency (MHz)	59 Series (Maximum)	6 Series (Maximum)	11 Series (Maximum)
5	0.79	0.58	0.35
30	1.42	1.10	0.73
50	1.72	1.36	0.90
108	2.44	2.01	1.28
216	3.48	2.86	1.83
240	3.67	3.02	1.94
270	3.90	3.21	2.07
300	4.12	3.39	2.19
325	4.29	3.53	2.28
350	4.46	3.67	2.38
375	4.62	3.80	2.47
400	4.78	3.93	2.55
450	5.07	4.18	2.72
500	5.37	4.41	2.88
550	5.65	4.64	3.04
600	5.93	4.85	3.18
650	6.20	5.06	3.32
700	6.46	5.26	3.46
750	6.71	5.45	3.60
800	6.96	5.64	3.73
850	7.25	5.86	3.90
900	7.43	6.02	4.03
950	7.66	6.21	4.16
1,000	7.88	6.39	4.28



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By Bill Riker

What's Emerging in 1998?

As the end of 1997 quickly approaches, it seems that everyone is anticipating an exciting new year. To kick off what promises to be a momentous and provocative next 12 months, the Society is now gearing up for its 1998 Conference on Emerging Technologies to be held Jan. 28-30 in San Antonio, TX.

This yearrquotes theme, "Building the Digital Platform," will primarily focus on technological advancements in the digital video arena, as well as in data transmission. The newly expanded San Antonio Convention Center will be the setting for our latest annual event, which is already looking to be another record-breaking show for the Society.

A brand-new addition to this year's conference is the SCTE Interface Practices Subcommittee (IPS) Test Procedures Demonstrations to be held during the Conference. These hands-on demonstrations will illustrate the processes used in such test procedures as composite triple-beat distortion, composite second-order distortion, cross-modulation distortion, insertion gain and loss, frequency response, and bandwidth and noise figure, as well as test methods for group delay, isolation and return loss.

The IPS meeting itself (to be held in San Antonio on January 27 and 28) is cause for excitement in the broadband community these days. The Society's Engineering Committee has produced more than 90 standards documents over the last two years. Now, not only are more operators interested in attending the subcommittee meetings, but industry manufacturers are more enthusiastic than ever about the IPS, too. 1998 should be a very prolific year for SCTE as a standards-setting organization.

Another extra feature of this year's show is a series of special "Viewing Salons" set up to allow conference participants to experience first-hand the future of digital TV. These salons will include demonstrations of transmission and HDTV techniques. Since seating is available only on a first-come, first-served basis, please be sure to mark your calendar to include this unique opportunity as part of your Emerging Technologies experience.

The Annual Conference on Emerging Technologies, which attracted more than 1,300 broadband professionals this year, will continue to feature technical presentations of vital interest to corporate and system engineers, manufacturers and consultants alike. As in the past, pre-conference tutorials will be presented to provide attendees with supplemental information pertinent to the technologies discussed in the two-day workshops. This year's tutorials, to be held Jan. 28, include "Data Primer," "Digital TV Primer" and "Display Technologies." The 1998 agenda includes five top-notch sessions from some of our industry\rquote s engineering leaders. SCTE Charter and Fellow Member Ted Hartson will moderate the first technical session on Thursday. Ted, who is also a member of the Society's Hall of Fame, will lead an exciting discussion on digital TV technology. Part II of this discussion will continue on Friday under the direction of SCTE Senior Member Brian James.

Prime Cable Vice President of Engineering Dan Pike plans to head up a discussion on data transmission. As Chairman of the SCTE Engineering Committee and a Senior Member of the Society, Dan will be an interesting and informative addition to the forum as top experts discuss such topics such as reverse data multiplexing, glass architectures and low-cost cable upgrades for two-way broadband. Rex Bullinger, engineer for Hewlett-Packard, will moderate the second half of this presentation on Friday, with information on architectures.

Plus, because the idea of convergent services is becoming more of a reality every day, SCTE will offer a unique panel for information exchange. "Alternative Transmission Techniques" will continue the popular "Who Are These Guys?" type forum from our 1994 Emerging Technologies conference in Phoenix, AZ. This interactive session was created to encourage communication between competitive service providers. Representatives from the wireless, satellite and computer industries, among others, will be on hand to discuss their respective businesses.

A special reception is scheduled for Thursday evening to honor one of our industry peers. Named for the brightest star in the sky, the Polaris Award represents the next generation of fiber optics engineer. This year's award will be given to an individual who has been a committed leader in the pursuit of improved fiber optic technology. To discover who the 1998 honoree will be, be sure to join us in our celebration of his or her achievement.

While you are in San Antonio, don't forget to experience some of the attractions offered by "The Alamo City." As the ninth largest city in the United States, San Antonio is progressive, yet historic: an ideal setting for old friends and new colleagues alike to discover the future of broadband telecommunications.

I look forward to seeing all of you in January. In the meantime, best wishes for a successful new year.

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


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