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September 1996

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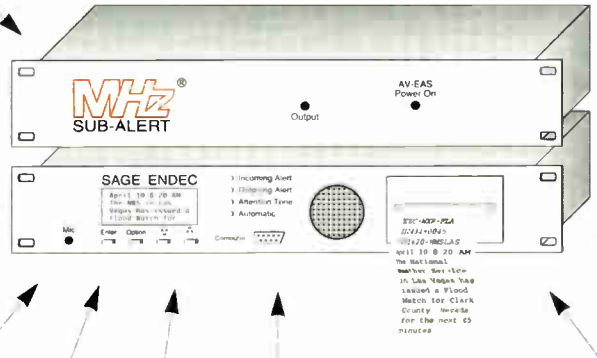

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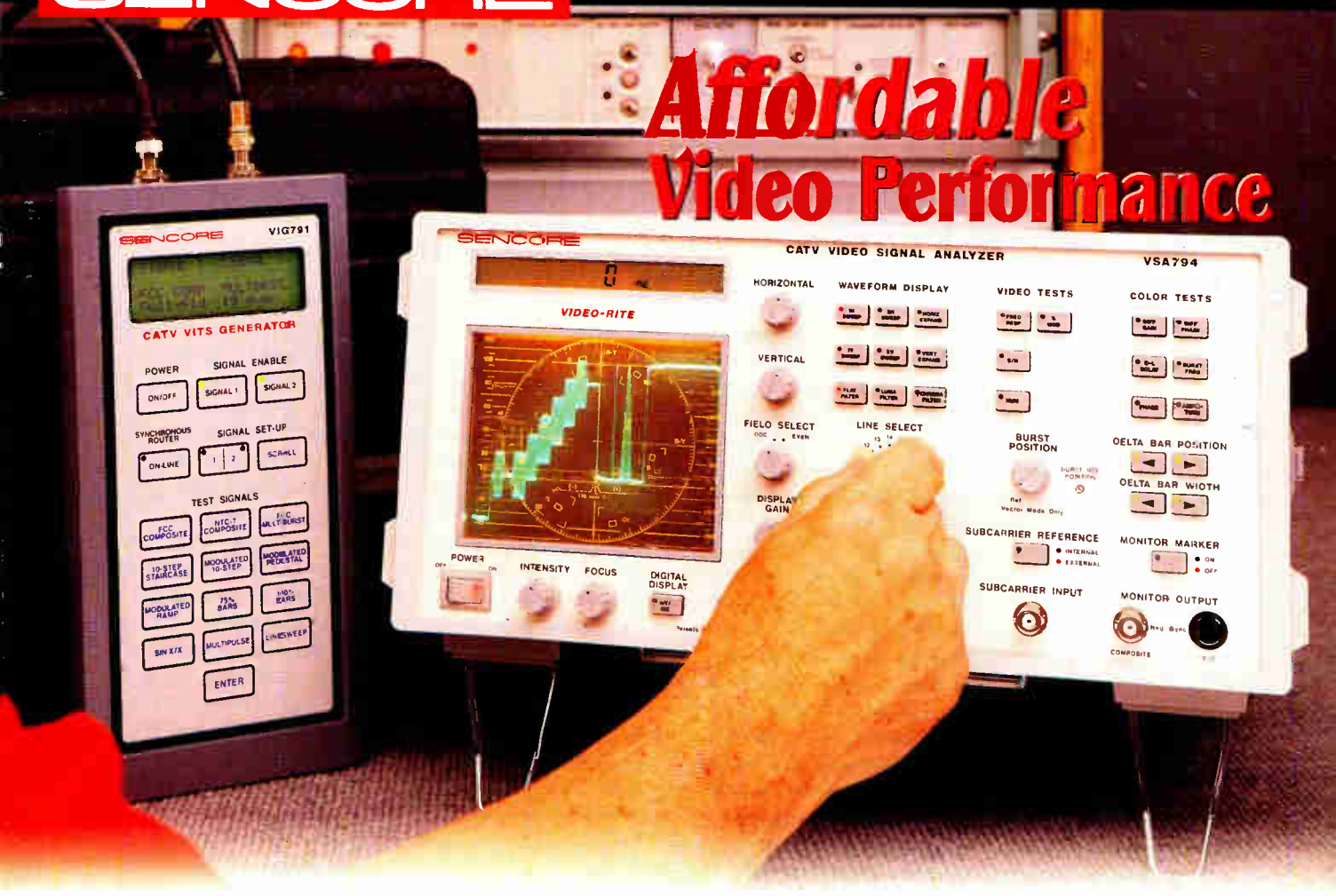

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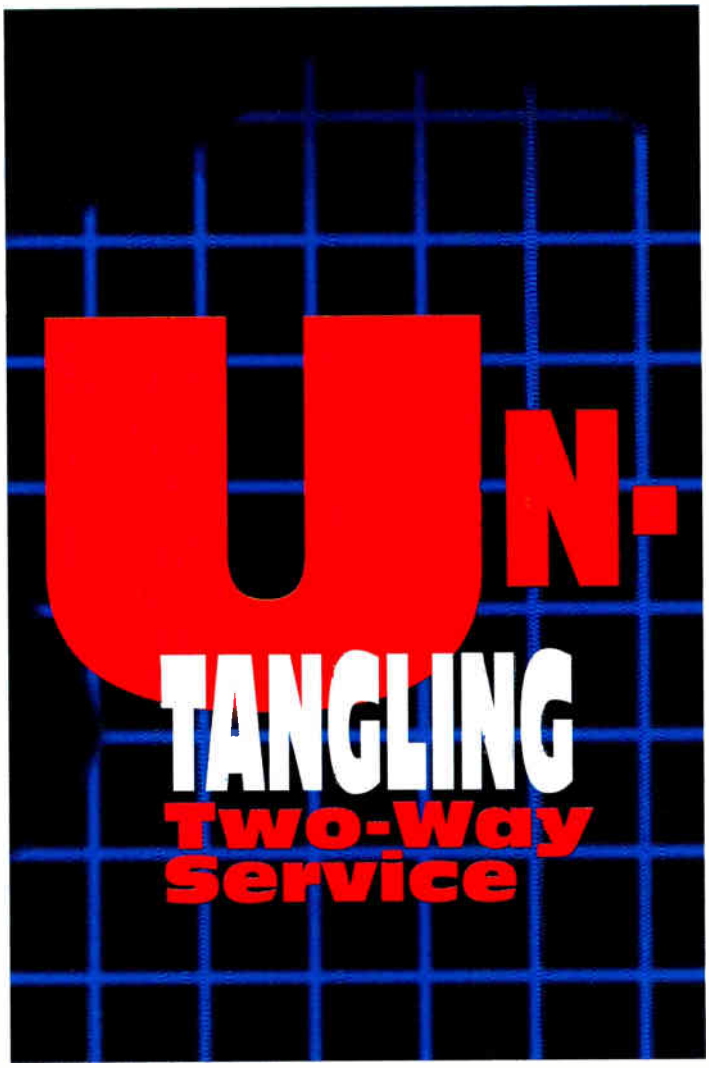

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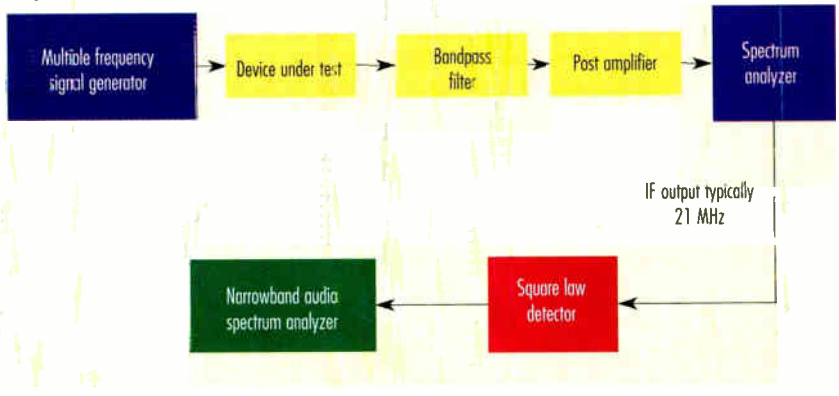
Figure 1: Intermodulation measurements method



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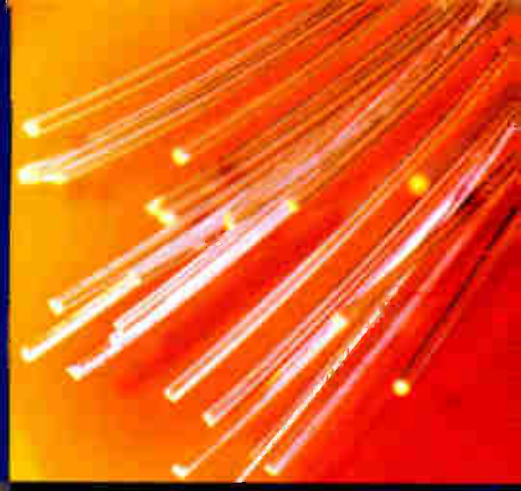

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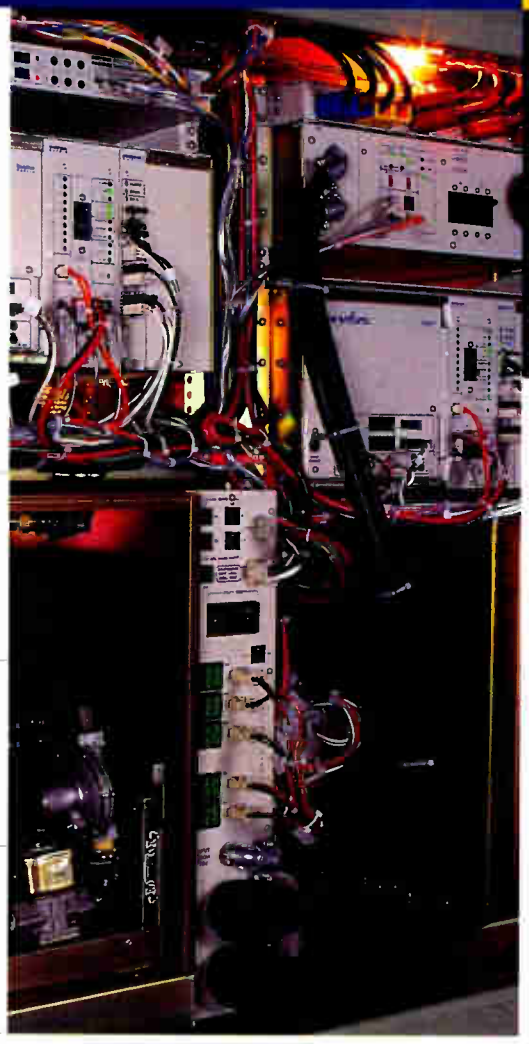

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Reader Service Number 5

Who owns the airwaves?

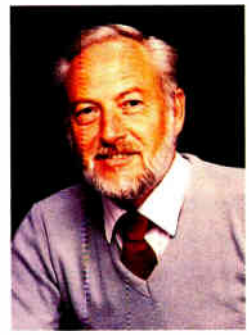
Counting my time in the Air Force, I have been in the electronic communications business for 40 years. For all these years, I have been told and believed that the public owned the airwaves.

But in the early years, to avoid chaos, Congress appointed the Federal Communications Commission to protect the public interest by assigning frequencies to the parties best fit to serve it. These parties were awarded short-term licenses that had to be renewed regularly.

"I don't remember ever hearing that the FCC was to be a money-making agency."

Granted, there was a nominal license fee, but the FCC did not have the authority to withhold a license from any party that could prove its abilities, financial stability and that a frequency or band of frequencies was available for the broadcast purpose. I have never heard of the FCC auctioning a broadcast license. And, until recently, I have never heard of the FCC auctioning off any frequencies that would be used, not for the public interest, but to line the pockets of private companies. With telecommunications representing one-seventh of the nation's economy, something really un-American, of huge proportions, is being perpetrated on us—by the very branch of government formed to protect our interests.

According to various reports, the FCC has made $18 billion for the U.S. Treasury by auctioning air. Since when did the federal government or the FCC own the air? "What's the danger," you ask, "since the money is going into the Federal Treasury, into our own government?"



Remember that, in the beginning, the IRS allowed us to deduct *all* interest payments from our annual income taxes. Then, in the '80s, two senators announced the Gramm-Rudman bill which reduced these deductions by 20% each year until we could no longer deduct any interest payments except our home mortgage. That money was to be used to reduce the federal deficit. So how many billions have they collected by disallowing interest deductions? And how was that money spent? What is the size of today's federal deficit?

I don't remember ever hearing that the FCC was to be a money-making agency. I understood it was to regulate the use of the airwaves in the public interest. How can you ever put the interest of the public first when you auction to the highest bidder? Does this mean that only large, wealthy companies are capable of serving the public interest? Does it mean that a new company with the brightest of engineers and the best of ideas, but the least of dollars, cannot properly serve our needs and interests? How will we ever know? The only winners will be the megacompanies with deep pockets.

Next will the FCC renew radio and TV broadcast licenses based on an auction system? Why not? That money also will surely go into the Federal Treasury!

Rex Porter
Editor

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How the world plugs in.

Clarification
Last month, in the table of contents, we misprinted the company affiliation of Eric Wentz, who authored the article on powering. He is marketing communications manager of Alpha Technologies.

Museum's new home to be in "Cable Capital"

Visitors to Denver, the "Mile High City" and the "Cable Capital," will soon have the chance to glimpse cable telecommunications' future and remember its humble past as the new National Cable Television Center and Museum heads west to Denver.

Previously located at Penn State University in State College, PA, the new building will be erected near the University of Denver and will include five areas: The Center Library, The Center Institute, The Center Museum, The Center Works, and The Center Demonstration Academy.

Although still in the planning stages, visitors can probably look forward to seeing videos on the history of cable, a Hall of Fame, and areas highlighting major industry technical milestones. (Are you someone that remembers ladder line/G-line, transistors, or the launch of HBO?)

Marlowe Froke, acting president, and Dave Willis, curator, look over some of the boxes containing equipment soon to be displayed at the new home of the National Cable Television Center and Museum.

Although not much to look at now, out of this site will rise the new National Cable Television Center and Museum near the Unversity of Denver.

Presently, Marlowe Froke is acting president and 41-year cable industry veteran Dave Willis is slated to be curator. Willis will be using those years of cable knowledge to sort out the vast array of equipment collected for display in the museum. —*Laura Hamilton*

Selling data: CTAM talks technology

Internet service may enable cable companies to increase market share, as long as content can match the technology available to deliver it. That was the undercurrent propelling discussions at the Cable and Telecommunications Marketing Association (CTAM) convention held this summer in Boston, MA.

In his keynote address, Sumner Redstone, Viacom CEO and chairman of the board, discussed four myths the cable industry must dispel as it approaches the end of the century: that technology drives the industry, that media conglomerates are too slow to stay on the cutting edge, that the TV market is saturated, and that there is a war between the broadcast networks and cable.

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Reader Service Number 62

By Bill Riker

1996: The year in pictures

By now, all of our members should have received the SCTE *1996 Membership Directory and Yearbook*. You will notice that in an effort to give the directory a new look, there were many design and layout changes made for this edition. The Society's official colors, teal and white, are prominently displayed on the cover of the directory and throughout its contents.

What's inside

The yearbook features one of our crowning events from 1996, the relocation of SCTE national headquarters from its Exton Commons location to a new building at 140 Philips Road in Exton, PA. Tremendous effort was put into this project, which successfully relocated the office with minimal disruption to the Society's operations. The yearbook offers numerous color photos of the new building in various stages of construction and finally in its impressive completed form.

Our visit to the old National Cable Television Center and Museum site in State College, PA, to receive artifacts for display in SCTE's on-site museum also is documented. Some of the actual vintage pieces of cable equipment that the Center generously loaned to the Society are shown at their current residence in SCTE's cable museum.

Member praise

The directory also features the activities of the members and officers of SCTE's local chapters and meeting groups across the country. This section proudly displays the many seminars, meetings and vendor shows that these groups organized during the past year. Member participation is the engine that drives the Society, and this section recognizes the hard working members who volunteer their time to advance the Society through its local chapters and meeting groups.

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

Awards

The efforts and achievements of our members also are recognized in the pages featuring SCTE award recipients. The annual awards luncheon is held every year at Cable-Tec Expo, and the directory shows photos of recent award winners in addition to those members who were honored as leaders in the industry, having made significant contributions to the advancement of telecommunications.

New features

Some new features appear in this year's directory, including the "History of the Annual Engineering Conference" and "The SCTE Staff Remembers." The first section covers SCTE's Annual Engineering Conference, which celebrated its 20th anniversary with the conference held at Cable-Tec Expo '96 in Nashville, TN. This feature traces the roots of the conference from its beginnings in 1976 when it was known as the Annual Conference on CATV Reliability. Since then, the conference has evolved from a small-scale forum for technical discussion, to a major industry event that is presented to thousands of Expo attendees every year.

The second of these new features, "The SCTE Staff Remembers," shares the staff's experiences while working at the Society. Staff members recall how they became involved with SCTE, humorous stories, Expo legends, special memories, staff interaction, great accomplishments, the recent move into the new office and plans for the future. We wanted to share some our fond memories of the Society with the members, because working for SCTE has been such a rewarding and enjoyable experience for all of us over the years.

Many of the regular directory features appear in this year's edition, including my "President's Report" and "From the Chairman," by John Vartanian. These sections, provide an overview of the Society's many activities and achievements over the course of 1996.

Cable guys

A special feature in the yearbook section is a reproduction of a very well-received marketing piece that SCTE released at Expo '96 entitled "The Truth About Cable Guys." It is the continuing story of a character named Louie Carter who first appeared in a comic book-style marketing piece from 1995 titled "I Was an Untrained Cable Technician."

In the 1995 story, Louie learns that through SCTE he can receive the training he needs to become a skilled and successful cable installer. The new story revisits Louie, who has since been promoted to chief technician. As a humorous response to the negative image of cable installers portrayed in the movie *The Cable Guy*, Louie promotes the benefits of SCTE's training, certification and standards and shows how SCTE's services can help cable systems maintain successful on-time service guarantee programs.

Tradition

The traditional highlights of every year, Cable-Tec Expo and the Annual Conference on Emerging Technologies, are covered in color photos that commemorate these momentous industry training events. The attendees, workshops, technical demonstrations and presentations of each have all been captured on film, and are well represented in these comprehensive overviews.

Every active SCTE member received a copy of the *1996 Membership Directory and Yearbook* as a benefit of membership. For further information, contact SCTE national headquarters by calling (610) 363-6888, faxing to (610) 363-5898 or visiting our Web site at http://www.scte.org. **CT**

and software—or distribution vs. content—Redstone said he stood "unapologetically on the content side."

"The fact is that it's what's on it, not what it's on that counts," Redstone asserted, urging attendees not to let technology become a dictator. "Master it, exploit it, build on it and value it. But remember that technology is always a means."

Accepting CTAM's Grand Tam Award, National Cable Television Association President Decker Anstrom emphasized that the recently adopted Telecommunications Act of 1996 will offer more choices to consumers, which will make customer service more important than ever. Understanding customer preferences and demands, then responding to them quickly, will be the key to telecommunications competitiveness, Anstrom said. He also discussed the U.S. cable education initiative, a voluntary measure in which multiple system operators (MSOs) would outfit every secondary school in their communities with high-speed cable Internet connection.

Despite some skepticism about technology and its role in developing new revenue streams for cable, sessions devoted to the topic were well-attended and gave attendees new angles to consider in developing demand for technology.

In a session on marketing the Internet, Dave Woodrow of Cox Communications said cable stands to gain market share because of the access speeds afforded by cable modem technology. Content developers will take advantage of that speed to create broadband services, he said. Cable's other competitive advantage, according to Woodrow, is that with cable modems, customers are essentially wired to the World Wide Web all the time. He cautioned, however, that because technical standards for cable modems have not been developed yet, operators must take care when selecting vendors.

AT&T's Vinnie Grosso pointed out that churn at America OnLine is an astounding 40% per quarter. He suggested that cable operators can deal with that rate of churn by "bonding with customers" and bundling other services such as personal communications services (PCS) or telephony with data delivery into attractive packages.

In a session on building consumer demand for high-tech products, the message from all the panelists was similar: Find a way to set aside the sophistication of technology and focus on how the product can improve a customer's quality of life. Former Sony US President Mickey Schulhof stressed that marketers must develop a "big idea" that emphasizes the lifestyle benefits of technology.

Jim Phillips, vice president of Motorola's Multimedia Group, noted that "early adopters are not your market" when it comes to technology. In the paging industry, he recalled, early marketing strategy was aimed at service technicians; the industry really began to grow when the focus shifted from these early adopters to business people and eventually to the home. The cable modem market, he predicted, will develop even more rapidly than paging because the technology is already available in many different countries, including France, Belgium and Singapore.

In the closing session, CTAM attendees were addressed via satellite by Microsoft founder Bill Gates, who said the deployment of the digital set-top box will allow the cable industry to ward off competition from direct broadcast satellite and wireless cable. "As soon as you get the digital set-top, you match satellites," he said. Gates also noted that cable's hybrid fiber/coax infrastructure offers a substantial advantage over dial-up lines for Internet access and data delivery.

"The real limitation of the Internet isn't the backbone—we'll take care of that—it's the final mile, and that's why cable is in such a good position," he said. Gates predicted that within the next two years, "millions of cable modems (will be) bringing in 20-30 dollars a month" in revenue, but he stressed that operation must be transparent to the customer. "You must make connections simple and seamless so users are not frustrated offline."—*Alex Zavistovich*

FCC opens local phone market

The Federal Communications Commission approved rules opening the $100 billion local phone market, giving cable operators and long-distance providers the go-ahead to tap current local exchange carriers (LECs) for a fee. Regional Bell operating com-

Light up your fiber with the best broadcast quality video possible.

With more broadcasters and CATV operators realizing the benefits and switching to fiber optic networks, the demand for "signal purity" and higher signal quality transmission has increased.

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DX ANTENNA

Reader Service Number 86

panies (RBOCs) in the long-distance market will be penalized if they don't cooperate.

Cable lobbied hard for the national guidelines, which will leave pricing decisions up to the states when arbitrating negotiations between LECs and new market entrants. FCC Chairman Reed Hundt said consumers should see the local phone battle heat up around Christmas.

Memorial funds

The pipe bomb that exploded at Olympic Centennial Park on Saturday, July 27, claimed the life of TCI/TKR of Georgia's Albany system receptionist Alice Hawthorne. One of her two daughters also was hospitalized by the blast. Contributions can be sent to the Hawthorne Memorial Fund, c/o Jim Walker, TCI/TKR of Georgia, P.O. Box 1707, Albany, GA 31703-7501.

A scholarship fund has been established in the names of John and David Rigsby, sons of Time Warner Cable Florida President John Rigsby. The two teenagers died in a car accident the week of July 21. Donations can be sent to the John & David Rigsby Memorial Fund, c/o Sun Trust, 200 South Orange Ave., Treasury Management Dept., Mail Code 0-2041, Orlando, FL 32801.

Notes

• **Scientific-Atlanta** reports that its Scarlet network, developed with **Panasonic** and **BellSouth**, provided 20 times more coverage of the 1996 Olympic Games than the commercial broadcast TV crews. The network delivered 3,000 hours of live action to journalists from venues all over Georgia. In other news, the company named **Brian Bosco, Ph.D.**, previously of **Tektronix**, vice president of research and development for its Broadband Transmission Systems Division.

• **Zenith** CEO **Albin Moschner** resigned. In the interim, the post will be filled by **Peter Willmott**, former president and COO of **Federal Express Corp.**, and a Zenith board member for six years.

• **C-COR Electronics** named **Scott Chandler** president and CEO. **Richard Perry**, who formerly held this position, will continue as chairman of the board. Chandler comes to the company from **US West Communications Cable & Multimedia**, where he held the post of vice president/general manager.

• Former **Sybase** Vice President/CFO **Ken Goldman** was appointed senior vice president/CFO of **@Home**.

• **William Fenoglio** resigned as president and CEO of **Augat Inc.** To fill the vacancy, the company named **John Lemasters**, a company director since 1988, chairman and CEO; and retired Chairman **Marcel Joseph** president and COO. Also, the company appointed **L. Ronald Hoover** vice president of technology of the company's Communication Products Division.

• **TCI Communications Inc.**, an operating unit of **Tele-Communications Inc. (TCI)**, named **Tom Beaudreau** to the newly created position of vice president, **TCI Digital TV Inc.**, and Doug Seserman vice president of long-term product development, TCI Digital TV Inc.

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Reader Service Number 51

Digital subcommittee seeks proposals

The Society announced the formation of its first venture into the realm of digital video technology—the SCTE Digital Video Subcommittee. This group, which held its first meeting June 9 at Cable-Tec Expo '96 in Nashville, TN, recently issued a call for participants, as well as a call for proposals for digital video standards and practices it will develop for submittal to the American National Standards Institute.

The Digital Video Subcommittee is responsible for identifying and developing necessary standards for the delivery of digital TV services via cable. It encourages the participation of representatives of cable system operators, equipment developers and other interested industry personnel.

"Due to the imminent deployment of digital services," states Subcommittee Chairman Paul Hearty, "we will be pursuing an aggressive agenda, with the goal of completing much of our work by the end of 1996." To achieve this goal, the subcommittee has established the following working groups to work in specific areas of digital technology:

- Video and Audio Services—Chairman: Craig Cuttner, (212) 512-5249
- Data and Transport Applications—Chairman: Tom Elliot, (303) 267-5222
- Network Architecture and Management—Chairman: Nick Hamilton-Piercy, (416) 391-7225
- Transmission and Distribution—Chairman: Richard Prodan, (303) 661-3739
- Encryption and Access Control—Chairman: Claude Baggett, (303) 661-3807

The subcommittee also is seeking proposals for the five disciplines indicated by these working groups. "We welcome contributions and proposals concerning digital video standards and practices in these areas," states Hearty, who added that submissions can be sent to him at: Paul Hearty, General Instrument Corp., 6262 Lusk Blvd., San Diego, CA 92121.

For further information on the Digital Video Subcommittee, contact Hearty at (619) 623-2935, or fax to (619) 535-2485; or contact SCTE Director of Standards Ted Woo at (610) 363-6888.

The truth about "cable guys"

The Society recently released its summer issue of *Interface*, the Society's quarterly newsletter for senior management. This issue features a story entitled "The Truth About Cable Guys." This comic-book-style tale, containing full-color photographs, is a follow-up to the illustrated story that appeared in the summer '95 *Interface*, "I Was an Untrained Cable Technician."

Produced entirely in-house by the SCTE staff, "The Truth About Cable Guys" was written by Manager of Editorial and Promotion Howard Whitman and photographed by Public Relations Administrative Assistant Raia King. The photos for were shot at Harron Communications' Malvern, PA, offices, and Harron's Technical Operations Manager James Mellon graciously allowed SCTE to photograph scenes throughout the building, including his own office. Two professional actors, Leonard Kelly and Heather Little, portrayed the story's characters, Louis Carter and Monica

Smith, acting out the story line in the authentic setting.

The cover, a tribute to the Beatles' classic *Sergeant Pepper's* album, was shot outside Harron's building by the facility's satellite dish. Using photo composition software, the SCTE Board of Directors, the national headquarters staff, several Society chapters and a bucket truck were added to the background creating an imaginary scene that suited the project's tone.

"The Truth About Cable Guys" was created to address some of the problems cable systems across the U.S. have faced over the last several years concerning the industry's public image, and to provide some solutions to these incorrect perceptions.

In addition to SCTE training programs and services, the industry's public relations initiative, "The Future is on Cable," and its on-time service guarantee, also is promoted in the piece. SCTE is a participant in the initiative and encourages cable systems to embrace this program.

Preview copies of this edition were distributed to attendees of Cable-Tec Expo '96 in Nashville, TN, in June. It was well-received by industry executives, managers and technical personnel, who appreciated the story's positive and realistic message and entertaining format.

Anyone wishing to obtain copies of "The Truth About Cable Guys" can contact Raia King at national headquarters by calling (610) 363-6888 or via fax at (610) 363-5898.

Society premieres digital newsletter

SCTE recently released the first issue of its all-new digital newsletter, *Digi-Points*. Copies of this publication were given to all registered attendees at Cable-Tec Expo '96. In addition, copies were sent to cable telecommunications system managers throughout the United States.

"We created *Digi-Points* to answer an ever-increasing need in cable telecommunications—the need to become proficient in digital technology," stated SCTE President Bill Riker. "This vital new technology is impacting every aspect of cable, from the headend to the subscriber.

"While analog has served our industry well and will continue to coexist with digital, it is digital technology that enables us to deliver many of the new products and services needed to remain leaders in broadband telecommunications."

The newsletter also would be very useful for candidates enrolled in the Society's Broadband Communications Technician/Engineer (BCT/E) Certification Program, because the program's Category V, "Data Networking and Architecture," specifically tests one's knowledge of digital communications.

Digi-Points will be available on a subscription basis at the rate of $60 per year, working out to just $5 a month for one of the best career investments a cable telecommunications technician or engineer could make. In addition to their monthly issues, subscribers will receive a full-size binder in which to collect them.

To subscribe or receive a sample copy of *Digi-Points*, please contact SCTE at (610) 363-6888.

By Ron Hranac

Toward the perfect drop

During the past few years cable operators have been upgrading or rebuilding systems for increased channel capacity, improved reliability, better quality, and the ability to deliver future entertainment and nonentertainment services. After DBS became a reality, and especially after passage of the new telecommunications legislation earlier this year, the upgrade and rebuild pace picked up considerably. The introduction of AM fiber technology in the late '80s has played a big role in defining new architectures, as well as providing sometimes significant new construction and operational cost savings. The bottom line is better networks.

Despite this, I've noticed what could be a disturbing trend. In many instances cable operators are more than willing to invest millions in a state-of-the-art hybrid fiber/coax (HFC) plant, only to leave the old subscriber drops in place. Some companies go as far as replacing the outdoor F-connectors during the rebuild, while leaving old nonmessengered drops hanging in the air. But that new HFC network sure shines, doesn't it?

Uh, what's wrong with this picture?

Subscriber drops are responsible for the majority of our trouble calls—as much as 75%—in one-way systems. In two-way systems, subscriber drops account for 95% of the junk that gets into the reverse. Drop problems are nothing new. So why are old drops being ignored when it's time to upgrade or rebuild?

Surely cost can't be a major factor. Consider the following example of a hypothetical 25,000-subscriber system undergoing a 750 MHz HFC rebuild. Assume 40,000 homes passed by 500 miles of plant, for a density of about 80 homes per mile.

"If we're spending millions to get a 'perfect' network, then why not spend another 10% or so to also get 'perfect' drops?"

At $21,000 per mile to do the rebuild, the network upgrade cost will be $10.5 million. That's $420 per subscriber, or a little more than $260 per home passed. Drop replacement cost will probably be around $35 each, or $875,000 if all 25,000 drops are changed out. This is about 8% of what is being spent to rebuild the network! Upping the drop replacement cost to $50 each would still be only 12% of the system rebuild cost. How can we justify not doing this?

If we're spending millions to get a "perfect" network, then why not spend another 10% or so to also get "perfect" drops?

And just what is a perfect drop anyway?

Well, I'm glad you asked. Regular readers of this column will no doubt recognize most of these recommendations:

• *Drop shielding:* In one-way systems, the minimum coax shielding configuration should be bonded foil, four-end braid. Two-way systems should use no less than bonded foil, tri-shield cable.

• *Aerial drops:* Messengered cable only. No exceptions, regardless of drop length. Forget nonmessengered cable and support grips. They're signal leakage and ingress waiting to happen. All cable used outdoors should include corrosion inhibitor compounds such as Belden's CoreGuard, Comm/Scope's APD or Times Fiber's lifeTime.

• *Underground drops:* Flooded cable.

• *Connector installation:* Use the right connector for the cable in question. Prep the cable correctly. If you're using conventional one-piece hex crimp connectors, do not cut off the braid. Instead, fold it back over the jacket. Don't use worn out crimp tools. Premium connectors generally require special tools for cable prep and connector installation. Use them. Tighten all connectors on their respective mating ports to at least 20 inch-pounds. (The exception to this is on TV sets, VCRs and other consumer devices. The mating port could break off if you try to tighten the F-connector beyond finger tight.)

• *Weatherproofing:* All outdoor connectors—even those in pedestals, lock boxes and other enclosures—must have proper weatherproofing. If you're not using premium environmentally sealed connectors, then boots and silicone grease are mandatory. Oh, yes. Don't put boots without grease on the connectors. If you do, you've just made a miniterrarium out of that greaseless boot. Once the water gets in, it's almost impossible for it to get back out.

• *Grounding and bonding:* While you're replacing the old drops, make sure the grounding and bonding comply with the latest National Electrical Code or other pertinent requirements. This is simply a safety issue. Contrary to some old engineers' tales, grounding

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

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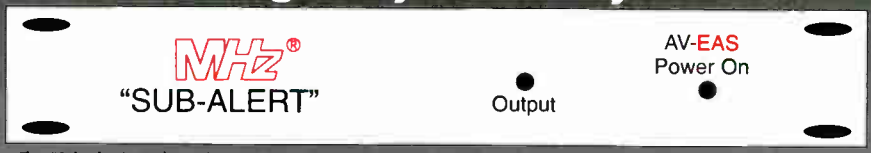

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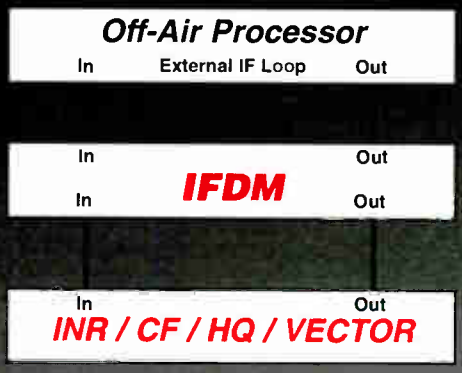

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and bonding don't improve signal leakage performance. (A comment is in order here: Old drops often may be grandfathered under the rules in effect at the time of the original installation. Once you upgrade, replace or otherwise change the drop, then you're usually obligated also to make sure the grounding and bonding comply with the latest codes and laws. If in doubt, check with appropriate authorities.)

• *Drop passives:* Use high-quality, well-shielded passives with a bandwidth suitable for your intended system bandwidth. To be safe, 5 to 1,000 MHz is a good idea. Make sure return loss and isolation performance (not just the published specs) are as high as possible.

• *Cable attachment:* If you have to use clips, clamps, brackets, etc., to support the cable on the side of the home, do not space them evenly. (Please, no staples!) Instead, space them randomly. Even those support devices that do not visibly "dent" the cable can put enough pressure on the cable to ever-so-slightly press on the shield somewhat. This will cause a very small point impedance change. Evenly spaced support clips can result in repetitive impedance discontinuities that will result in degraded structural return loss and potentially harmful (to data, at least) microreflections.

• *Interior wiring:* With few exceptions, you probably will be required to use UL-listed drop cable per the National Electrical Code. Again, it's a safety issue.

• *Ingress and impulse noise:* In two-way systems, you may find it necessary to install high-pass filters on all drops where two-way services are not being used. If cost has been an issue in the past, there are now available from the trap manufacturers "mini" high-pass filters that sell for about $2.50 each. High-pass filters should be installed at the tap, or as close to the tap as possible. I highly recommend that you make a coiled cable common mode choke (see this column in the July and August 1996 issues of *Communications Technology*) at the input to every in-home device: TVs, VCRs, converters, cable modems, etc. This trick requires an extra 10 feet of cable at each device, but can provide a substantial reduction of common mode ingress in the reverse path spectrum.

• *General installation procedures:* Guidelines in publications such as SCTE's Installer Certification Manual are highly recommended. For that matter, there is no reason why all installers shouldn't be properly trained and certified in SCTE's program or a comparable in-house program. There simply is no substitute for a well-trained, knowledgeable staff.

• *Quality control:* The final ingredient necessary for the perfect drop is an effective quality control program. This will provide positive feedback to those doing good work, and will help identify problem employees or areas requiring better training and support. Make accountability part of the QC process, too.

All of these recommendations are common sense, nontechnical ones. If you're going to replace drops as part of your upgrade or rebuild, you might as well do it right, and make them at least as good as your new, state-of-the-art HFC network. **CT**

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Reader Service Number 146

By Justin J. Junkus

Intelligence isn't just for people

Stuff is just getting smarter. Look around your house if you don't believe this. A long time ago, you had to stoke the old pot belly stove before you went to bed just to keep warm through the night. Now, not only does the house keep itself at the right temperature, even the oven knows when to turn dinner on. The same trend is happening in the telecommunications network. The term for this phenomenon is the intelligent network, or IN for short.

"The STP/SCP combination allows service providers to program their own software changes ... without changing switch hardware or software."

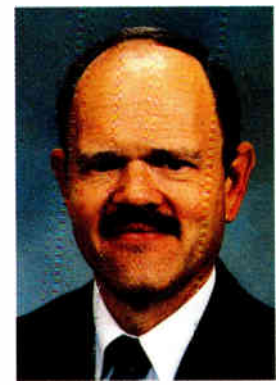
The network gets its intelligence from adjunct processors designed to more efficiently and securely set up call paths. Early telephone switches depended upon tones in the voice frequency range to signal back that a path was available and that billing could take place because the call had been established. This in-band signaling was simple, but it left a lot of room for creative thievery of telephone service through the use of black box tone generators.

CCS

To prevent this type of toll fraud, and at the same time save network resources trying to set up a call path when the last trunk circuit was busy, telecommunications engineers in the late 1960s designed an out-of-band signaling system known as common channel signaling, or CCS. This technology uses a network that is separate from the voice network to send messages to switch locations before the call path is established, to see if the connection is available from end to end. It does this by having the originating switch send a message to an adjunct processor (aka, computer) in the CCS network during the initial call setup process. This processor then sends its own messages into the CCS network to check facility availability. While it was never marketed as such, CCS was the earliest packet network, passing data at 2,400 bits per second between the processors, known as signal transfer points (STPs). Data bases known as network control points (NCPs) were associated with the STPs, to define how the calls should be routed under various network conditions, to verify credit cards, and to correlate 800 numbers with regular network phone numbers.

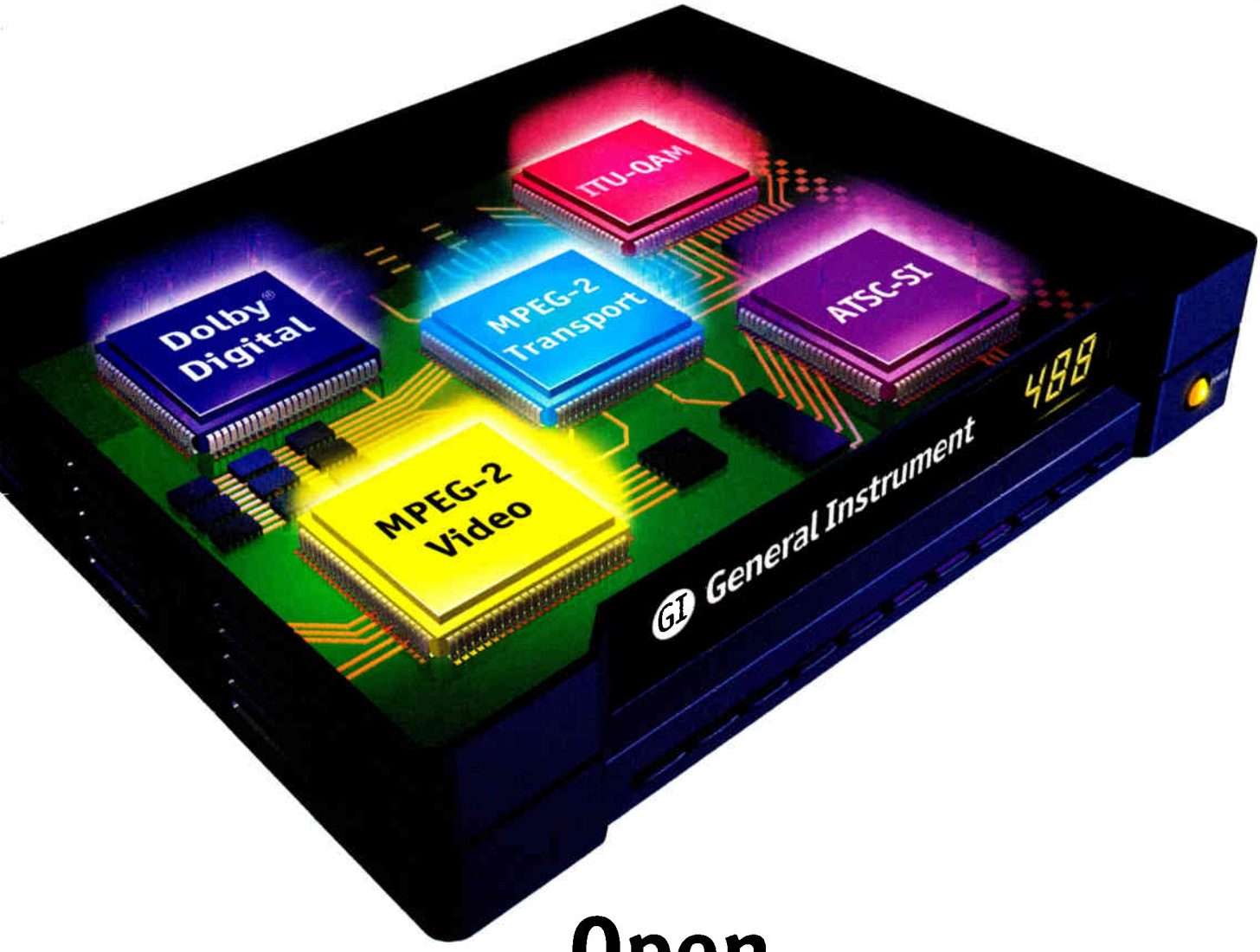
New applications

Technology has a way of expanding into new applications. Once a computer network was in place, it didn't take long for the engineers to find other uses for the data base capability. Data rates between SCPs increased to the 56 kilobits per second range, and the NCPs evolved into service control points (SCPs) that could be called into service not only during the initial phases of call setup, but also during other call processing events known as call triggers. These triggers provide access to the intelligent network features and data bases, making possible network-based services such as:



- Centrex service (the replacement for a customer premise-based switch, or PBX) on a citywide basis, instead of just within the serving central office. This service can be very useful to large companies with several locations spread across one or more cities. With citywide Centrex, it becomes possible to have one standard set of telephone features that operate the same at each location. Employees need not be retrained on telephone features each time they move between buildings because the network correlates features with company locations. Perhaps even more important, abbreviated dialing (four or five digits instead of seven) between locations is possible, just as though the phones involved were in the same building.
- Personal communications service (PCS), which allows the telephone network to ring your phone at the location where you are most likely to be, based on mobility patterns you provide. With this service, the network tells the telecommunications switch which phone number corresponds to your most likely location, and directs the switch to ring that phone first. If you do not answer within a given number of rings, the network reroutes the call to your next most likely location, or to your voice mail service.
- 900 service where the caller pays for access to information services. While some of these services

Justin Junkus has over 25 years experience in the telecommunications industry. Previously the AT&T cable TV market manager for the 5ESS switch, he is currently president of KnowledgeLink Inc., a telecommunications training and consulting firm. He can be contacted for comments or questions via e-mail at JJunkus@aol.com.



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may have been an abuse of the intended capability, many others provide worthwhile social benefits. Some examples are charitable fund raising, access to computer information services, and help lines for technical support.

• 500 service that extends PCS by providing a truly portable, personal phone number that belongs to a person and not to a location. Not only do these numbers provide for a "reach me anywhere" capability, they also allow call screening by comparing the calling number information provided to the STP with a data base of numbers and requested call treatment programmed by the consumer.

• Number portability to provide consumer-friendly choice of local access provider. Although the whole issue of number portability is still being addressed in the standards bodies, one proposal would have the intelligent network perform the data base lookups to correlate your existing phone number with a new service provider's switch hardware. This service is especially valuable to new entrants in the telecommunications business, since it eliminates a major possible objection from customers who do not want a new phone number every time they change service providers.

Meeting market needs

Perhaps even more important, the STP/SCP combination allows service providers to program their own software changes to introduce new features into their networks without changing switch hardware or software. This service creation capability is important because switch vendors typically charge service providers to add features or functions. In addition, switch changes must be scheduled into vendor development priorities, possibly delaying implementation beyond the needs of the service provider. Network-based service creation places the development and introduction of features in the hands of the service provider and makes it easier to meet market needs.

What this means to the cable telecommunications industry is that market opportunities can be met as they appear. Potential new product offerings based on network features can be easily trialed and targeted to specific markets, with response to customer demand in the customer's time frame, not some vendor's. Even if the cable company doesn't own an STP, through alliances with other companies, it can have these capabilities.

What this means to the cable telecommunications professional is that he or she needs training in areas beyond traditional RF knowledge. The intelligent network is a data network, the same as a local area network, and requires data-trained network managers and programmers to keep it smart. Data communications is an integral part of cable telecommunications and our technical people need to acquire data skills to keep our network competitive with those of other telecommunications service providers. **CT**

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By Paige Albiniak

Internet telephony: Once a hobby, now an industry

"Internet telephony," a phrase that had almost no meaning two years ago, is now an industry. Startups and telecommunications behemoths alike are scrambling to figure out how they will turn a profit as this technology threatens to change radically the voice communications marketplace.

The technology allows people to run voice communications from their personal computers over the public network, access to which is almost free. AT&T Corp. of Basking Ridge, NJ, which can afford to subsidize prices, is giving its long distance customers five hours per week of free Internet access for one year, or $19.95 for unlimited access.

Paige Albiniak is editor of two Phillips Business Information newsletters: "Voice Technology & Services News" and "Electronic Messaging News." She can be contacted at (301) 340-7788.

The result has been both fear and anticipation. Startup software companies are rushing to market with new products, partnerships and public offerings. Traditional communications companies spent the past year and a half figuring out how to stay ahead of a rapidly changing telecommunications market in the wake of the Telecommunications Act of 1996 and the Wild West of the Internet.

"It's a very hot marketplace," says Jeff Pulver, moderator of the Voice on the Net user group on the Internet.

Involving policy

One effort to stem the rapid change is asking the Federal Communications Commission to regulate telephone traffic over the Internet. A small group of telecommunications providers, the America's Carriers Telecommunications Association, in March 1996 filed a petition with the FCC. They asked the agency to:

- Order Internet software providers to immediately stop their unauthorized provisioning of telecommunications software;
- Confirm the Commission's authority over interstate and international services over the Internet; and
- Institute rules to govern the use of the Internet for providing telecommunications services.

Although the predominant Internet telephony user group, the grassroots Voice on the Net coalition, is fighting the petition, FCC Commissioner Reed Hundt admits the area is somewhat out of the FCC's reach.

"I think the Internet inevitably will be used for commercial purposes," Hundt says. "That can't be stopped, and I don't think there is anything terribly wrong with that. The real challenge for the Internet is how to develop an electronic pricing model that makes sense. I would rather see the Internet develop those models than the FCC." →

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A Commitment to Quality:

THE PHILIPS BROADBAND PHILOSOPHY

For all of us at Philips Broadband Networks, Inc., (PBNI) quality and reliability permeate everything we do. It means more than just making sure a particular piece of equipment works right out of the box, however. At Philips, quality means both reliable products as well as systems that meet the needs of our customers, now and for the future.

To deliver quality to the customer, you have to learn what the customer wants. That's a basic tenet of our corporate philosophy. From our perspective, it's nothing more than common sense. After all, what good does it do to design a system which won't meet a customer's expectations for future applications? In the wake of the Telecommunications Act of 1996, those future applications will include video, voice and data delivery—broadband services that require sophisticated network management and systems integration solutions.

"We attribute our success to listening to our customers' requirements and providing the best possible solutions based on what we've learned."

That's what we do best at PBNI. We aim to provide integrated systems-based solutions to complex telecommunications problems and provide the network management tools our customers need to make those systems work at peak efficiency. We attribute our success to listening to our customers' requirements and providing the best possible solutions based on what we've learned.

As you might imagine, our approach to customer service takes considerable time and dedication. How do we benefit from it? The results speak for themselves. Philips Broadband Networks' success in technical development, customer service and support is evidenced by rather remarkable growth. In the last year alone, Philips Broadband Networks has added more than 250 new associates and increased production by 82 percent from the same period in the previous year. Philips has enjoyed this impressive growth because our customers' trust in the quality and reliability behind the Philips name.

Quality and reliability. They are the cornerstones of our business. No matter what products we build, or which services we provide, they are what we stand for.

Dieter B. Brauer
President and Chief Executive Officer
Philips Broadband Networks, Inc.

A Small-Town Company with Global Reach

MAKING TECHNOLOGY TRANSPARENT

Your customers are probably not thinking about Philips Broadband Networks, Inc., while they're watching cable television.

That's the way we like it: high technology, invisible to the people who use it.

Based just outside of Syracuse, NY, in the town of Manlius, Philips Broadband Networks got its start in 1963 as Craftsman Electronics, building directional taps, splitters, transformers and connectors. In 1975 the company (then called Magnavox CATV Systems) became a subsidiary of North American Philips Corporation, one of the 100 largest industrial companies in the United States. We were the first to produce such industry staples as the 330 MHz and 440 MHz amplifiers, as well as the first high-efficiency power supply.

Now, Philips Broadband Networks associates design, engineer, manufacture and supply state-of-the-art electronics to transport today's broadband signals reliably and seamlessly.

PBNI's broadband RF and fiber-optic transport equipment and systems are at work in over 60 countries, providing unsurpassed quality. Our technology is at the forefront of such wide-ranging telecommunications services as telephony, videoconferencing, distance learning and interactive data services.

For over three decades, our company has nurtured a tradition of uncompromising quality that has given us a worldwide reputation for reliability. Our geographical reach has spread from the United States to Europe, South America, the Middle East and the Pacific Rim. Sales are conducted domestically through sales representatives and internationally through national sales organizations and third-party value-added resellers in over 35 countries.

This global reputation should come as no surprise. Both PBNI and its parent company are subsidiaries of Philips Electronics, N.V., one of the world's largest electronics firms, with annual sales of $34 billion. As part of the Philips family, we have access to our parent company's $1 billion annual research and development fund. This has enabled PBNI to develop groundbreaking products such as the rack-mounted Diamond Transport™ system, the most space-efficient system currently available for transmission and reception of analog fiber signals.

PBNI products are designed and manufactured in Manilus, N.Y., and sold globally, from the United States to Europe, South America, the Middle East and the Pacific Rim.

As part of the Philips family, we have access to our parent company's $1 billion annual research and development fund.

When customers purchase our equipment or take advantage of our network solutions, they are gaining more than the benefit of our experience alone. They are also taking advantage of the combined expertise of an international group of companies.

Now and for the future, Philips is dedicated to continually designing and delivering the highest-quality products—and providing systems for broadband communications that are so dependable they seem almost invisible. ■

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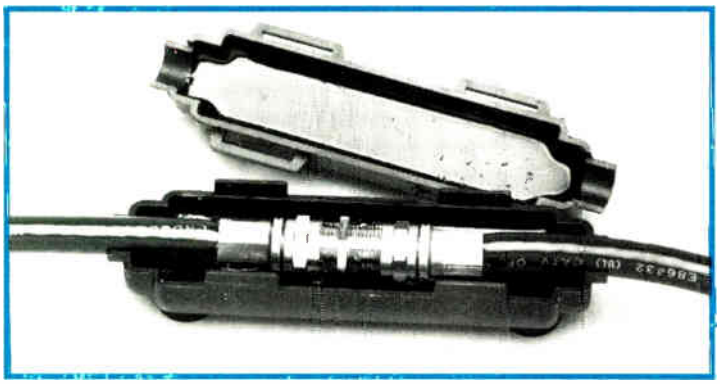
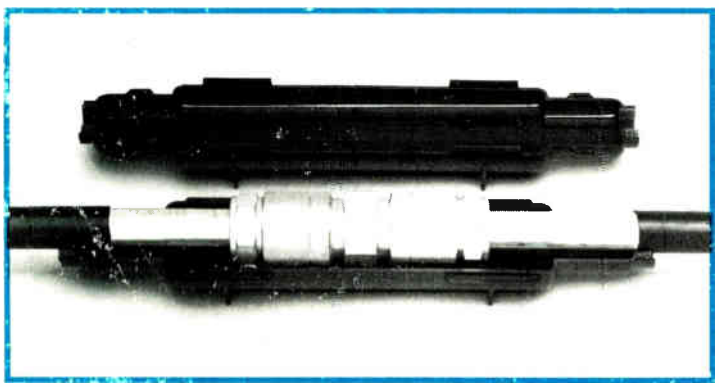


Part No. 3610-GS For RG6/59 Drop Cable Twisted Pair

Part No. 3611-GS For RG11/7 Drop Cable Twisted Pair



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Water Immersion	Room temperature, for 30 days, 2 foot waterhead
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Salt Fog	per ASTM B-368, 30 days
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Reader Service Number 16

Practical System Solutions for Today

Telecommunications reform has removed barriers to the marketing of voice, video and data services. Telephone companies are offering video; cable companies are offering telephony; and both industry segments are offering high-speed access to on-line data services.

The challenge for broadband providers in this new era of telecommunications is not only to prepare their networks for today's technology but also to create platforms with the migration path to accommodate future developments in voice, video and data transfer.

What's the solution? Philips Broadband Networks.

With over three decades of experience in telecommunications hardware and network management services, Philips provides our customers with two essential elements for their broadband networking success: superior quality and unparalleled reliability, all at competitive prices.

Here are some of the many ways Philips Broadband Networks can create a solution to your company's networking challenges.

For over three decades, Philips Broadband Networks, Inc., has nurtured a tradition of uncompromising quality.

Network Management

Don't let broadband network problems disrupt service to your subscribers. You can save repair time and money by monitoring your network status with Philips Broadband Networks management systems. Diagnostic techniques available in Philips' network management systems identify problems and facilitate corrective action even from a remote location.

The Diamond Diagnostics™ element management system monitors and controls network headend transmitters and receivers, optical nodes, RF amplifiers, line extenders, power supplies, end-of-line monitors and other network elements. The Diamond Diagnostics system monitors your broadband network's performance, comparing it with previously specified operating parameters.

The Diamond Diagnostics Line Monitor measures signals carried by the amplifier and every component in the network. And, to monitor signals in the optical nodes, the Diamond Diagnostics Foto module watches node parameters, and the Diamond Diagnostics Return Signal Switch (RSS) optionally alternates or disconnects return paths to isolate system return problems.

System Design

Philips Broadband Networks has extensive experience designing broadband systems around the world. Our network specialists use a computer-aided approach to plan your design and to suggest the best equipment to use in your network.

If you need help incorporating fiber optics into new builds, rebuilds and upgrades, our design team can arrive at a cost-effective solution. Team members fully understand the modularity of our products, so they develop systems that can

The new Diamond Transport™ system offers optical transmit and receive capabilities at 862 MHZ.

's Networking Challenges

be upgraded efficiently without depleting your bottom line. The designers perform complete system engineering calculations to determine the best possible technologies, cable sizes and cascade lengths to use in your network.

Applications Engineering

Philips Broadband Network's technical support hotline gives you access to our applications engineering staff 24 hours a day. For years, our service and technical support has been a reliable source of security to those who've purchased PBNI equipment—long after the sale. Our in-house applications engineering staff has daily contact with PBNI product specialists and engineers, so when a customer calls with a product question or service request, we're equipped to respond immediately, whether it entails a personal visit to a customer location or a simple review of product information.

Philips Broadband's technical support hotline gives you access to our applications engineering staff 24 hours a day.

Training

Success in the changing telecommunications industry means knowing broadband basics as well as advanced concepts. Philips Broadband Networks instructors have provided superior, comprehensive training for over 15 years. Most Philips instructors have at least 10 years of experience as system experts.

Theoretical training and hands-on experience are combined in programs including broadband RF technology, fiber optics, local area networks (LANs) and element management systems. You'll even learn advanced techniques to improve the effectiveness of your system.

We offer training onsite in your facility, at our Manlius, NY headquarters, and in our Mobile Training Center at selected locations across the U.S. The Mobile Training Center is a complete laboratory in a custom 45-foot trailer, housing a headend/central office, amplifier cascade, a computer-controlled test center and a fiber optics display.

Customer Support and Materials

PBNI sales representatives monitor accounts to ensure you receive accurate and timely deliveries.

Our advanced repair and refurbishment facility offers reliable maintenance for your Philips products. Units sent in for repair are thoroughly analyzed for problems. If the problems are not visible on the bench, the units are examined in cascade. Factory-trained technicians are regularly updated on proper servicing techniques. We're so confident of the quality of our workmanship and materials, we back all our repairs with a one-year warranty. And, of course, much of our equipment carries the most extensive warranties at purchase in the industry, including our 5/50 warranty, which provides a comprehensive five-year warranty and a $50.00 material credit if the equipment fails in the first year.

PBNI ships broadband RF and fiber-optic transport equipment to over 60 countries from its new state-of-the-art facility in nearby Syracuse, N.Y.

With a broad range of services like these, you can rest assured that Philips Broadband Networks has the skill and the resources to meet whatever networking challenge your company may come up against. We've had years of experience doing just that for companies around the world. We can do the same for you. ■

Products and Service: The Total Pac

Whether your needs are RF, fiber, data or telephony, PBNI develops networks that grow to meet the demands placed on your system.

RF

Nothing is more important in maintaining a high quality network than the integration of reliable RF components. PBNI offers state-of-the-art HFC products, including network amplifiers, mainstations, line extenders, return amplifiers, multi-taps and line passives to meet your system needs. Choose from a range of compatible network components to ensure seamless system operation. And don't worry about reliability: PBNI RF products have the best mean time between failure (MTBF) rate in the industry, yielding the lowest cost of ownership available today.

Fiber

If your plans for tomorrow are to develop a multimedia interactive network, your strategy for today depends on fiber optic technology. Philips' Diamond series Fiber Optics products will prepare you to meet your goals for the future. PBNI's transmitters and receivers allow two-way delivery of video, voice and data. What's more, you can integrate the technology at your own pace: fiber to the feeder today, a nearly all-passive network tomorrow. Philips can help you make the transition without making your current equipment or network architecture obsolete.

PBNI RF products have the best mean time between failure (MTBF) rate in the industry, yielding the lowest cost of ownership available today.

Data and Telephony

For data and telephony service, you need look no further than Philips. With the Broadband Communications Gateway (BCG) system, you gain a platform for multimedia services over coaxial cable or hybrid fiber/coax. BCG system components provide public switch telephone network interfaces with the HFC system at the headend and network termination at the subscriber premises via the PBNI Subscriber Interface Unit.

The BCG offers easy access to telephony, on-line services, video conferencing and work-at-home. The system also provides controlled access to several broadband services along the HFC, including long-distance learning, broadcast video and shop-at-home capabilities. It's your on-ramp to the Information Superhighway.

The Inside Story

Satisfied PBNI customers themselves endorse Philips' commitment to high quality products and service after the sale.

Jeff Miskie
VP Engineering, Cable Division
Century Communications
New Canaan, CT

"Listening to customers' needs is a major strength of Philips Broadband. For example, when I expressed my company's need for technical assistance in the area of reverse activation, PBNI began a proactive educational effort and began developing user-friendly products that addressed my specific needs."

"Philips designs products based on feedback from customers like Century. They use their technological experience as the basis for new product development, but what adds value from our standpoint is that we, too, contribute to the products PBNI brings to the marketplace."

"Philips Broadband has always been responsive to change...and in this industry that means a lot because technology and product platforms are constantly changing."

Michael Wegg
Chief Technical Supervisor
San Bruno Municipal Cable
San Bruno, CA

"PBNI's equipment is extremely reliable. When we first installed our new system back in 1985, we had some technical questions. Without hesitation, PBNI sent an engineer out here from New York and walked us through the process. Since then, we've had very few questions about our PBNI network, but when we do,

kage

we always get prompt assistance from people who know exactly what they're talking about."

"Philips Broadband's people continue to provide support long after the sale. It's been 11 years since we've rebuilt our network, and in that time, Phillips continued to pay attention to our needs. Through the years, they stayed committed to us. When we rebuild again, Philips Broadband will certainly be called on to help us."

TOM STANIEC
Director of Network Engineering
Excalibur Group (a division of Time, Inc.)
East Syracuse, NY

"I've worked with Philips Broadband and the former Magnavox CATV Systems for over 24 years. I've had experience working with a wide range of PBNI equipment—from passives to optics—and through it all, PBNI has been very supportive of our day-to-day efforts."

"What distinguishes PBNI is its willingness to listen to the needs of its customers. For instance, years ago we had several pressing needs for our laser systems. At that time, (PBNI) made a commitment to understanding the issues involved and made a promise to provide us with a solid product that met our expectations. They followed through on it and eventually developed a product that we've relied on for years."

KELVIN SMITH
Director of Engineering
Post-Newsweek, Inc.
Phoenix, AZ

"Our PBNI sales rep always returns calls promptly...and he always knows what he's talking about. He's more than a sales rep, and that's what people in my position need—someone who educates me and helps me out when an urgent issue arises. Our Philips Broadband rep never has to sift through seas of manuals to locate the information we need. He always knows it right then and there. That is very reassuring to me."

"Over the years, Philips Broadband has made it very simple and trouble-free to upgrade our network...there's not a lot of tweaking involved in the process because their equipment is compatible with most everything out there. There are very few adjustments necessary when you use PBNI and Magnavox equipment."

JUAN MOLINARI
President
BCD Electronica
(PBNI Value-Added Reseller)
Rosario, Argentina

"PBNI's products are user-friendly and compatible with a wide range of equipment. That's important in South America, where cable TV is still in its early stages."

"Years ago, one of our biggest customers in Brazil, Net Sul of Porto Alegre, Rio Grande Du Sul, implemented the first return path in South America. Following installation, Net Sul experienced technical difficulty with its return path, a problem unrelated to Philips Broadband or its equipment. Without hesitation, PBNI sent a team of engineers to Brazil who worked with our engineers for two weeks and provided a solution to the problem while implementing procedures to address potential long-term challenges. That kind of hands-on technical support is something Philips Broadband customers can expect."

The Diamond Diagnotics™ management system lets network operators locate and correct problems from a remote location, minimizing service disruptions and reducing repair costs.

Philips Broadband's new Broadband Communications Gateway (BCG) system will enable hybrid fiber/coaxial networks to deliver voice, data and video services.

Is your company looking for an equipment vendor that treats you like a business partner? If so, you should join the growing ranks of companies that trust Philips Broadband Networks to provide the total package of reliable products and dedicated customer service. PBNI is the one-stop choice when designing quality broadband systems. Let's make things better. Together. ■

PHILIPS BROADBAND NETWORKS REPRESENTATIVES

For more information on Philips Broadband Networks products, please call the representative nearest you. For more information on our representatives in the U.S. and around the world, call our U.S. headquarters at 315-682-9105 or 800-448-5171 (800-522-7464 in NYS).

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PHILIPS

Reader Service Number 65

The FCC still is gathering comment and has not made a decision on the petition. The final deadline for comments was June 8. However, no additional action has yet been taken. The long distance companies AT&T, MCI Communications Corp. and Sprint Corp. are not members of ACTA and did not participate in the filing.

Birth of an industry

Internet telephony burst on the scene in February 1995 when a small, Israel-based company called VocalTec Inc. introduced an Internet product called Internet Phone. Virtually overnight, the product launched an industry.

A rival company, Dallas-based Camelot Corp., almost immediately sprang out of nowhere and announced it soon would release a product similar to VocalTec's. No product emerged from Camelot until September 1995, but the rivalry already had begun.

Since Internet Phone appeared, several companies have come forth with similar products.

The Internet Telephone Co. in Miami, FL, released WebPhone in November 1995, which received rave reviews from Internet telephony user groups.

Quarterdeck Corp. launched WebTalk around the same time, and also integrated it with its own Web browser, Quarterdeck Mosaic. Quarterdeck's stock jumped to highs in the mid-30s with the release but since has returned to its regular place in the mid-teens.

Attention moving to bigger layers

As this new market has evolved quickly, attention for the smaller vendors has been overshadowed by the bigger companies' grabs for market share and how they are incorporating Internet telephony into their products.

The name of the game for vendors in this early stage is to establish their products as an industry standard. If a vendor can do that, as Mountain View, CA-based Netscape Communications Corp. has done with its Navigator browser, success nearly is guaranteed.

Competing in such a market proves difficult for small companies. Typically, only large vendors can afford to establish a product as a standard requires: Companies often have to give such products away nearly free of charge, forgoing profits.

Netscape is embedding Internet telephony and audioconferencing into its World Wide Web browsers. Netscape purchased InSoft Inc. in Mechanicsburg, PA, to add its CoolTalk audio/video software to Netscape's next generation browser, Navigator 3.0. Netscape does not give its browser away, but neither does it strictly enforce payment for individual browser users. Early testers of CoolTalk report the product is difficult to set up and use, but Netscape still is in the beta testing phase.

Major vendors also are creating Internet audio and video standards frameworks to advance their own products.

Netscape introduced LiveMedia last February. Redmond, WA-based Microsoft Corp. also has introduced its own multimedia Internet developer's framework, which it calls Active X. The two frameworks are not the same—Netscape's is a bundle of specific protocols while Microsoft's is more of a developer's environment. But the idea is similar: Win out as the standard and control the market.

The two companies are not unfamiliar with this business model. Microsoft's Windows operating system runs more than 80% of corporate computers, while more than 80% of those who cruise the Web use Netscape's Navigator browser. Both companies boast standards in their own right. The question is, who will win the battle for the Internet? **CT**

"Voice Technology & Services News" provides expert analysis on the voice market, in the interactive voice response, speech recognition, text-to-speech, voice mail, voice processing, fax, PBX, Centrex and key switching, call center and videoconferencing sectors.

"Electronic Messaging News" offers business intelligence on client-server messaging technologies, LAN-based file-sharing messaging, host-based messaging, X.400, X.500, security, VANs, protocols and APIs.

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By John Galligan

Combating ingress with addressable taps

Formidable competition is gathering in the pursuit to deliver CATV, data services and even telephony to households via a two-way network. It would be logical then that multiple system operators (MSOs) and regional Bell Operating Companies (RBOCs) would construct highly reliable transport networks and systems that save on labor costs and enable quick identification and resolution of return path troubles. Deploying an addressable tap system with reverse path switching may go a long way toward meeting those goals.

An addressable tap system reduces operations costs (dispatches) by remotely enabling/disabling subscriber drops, enhances the isolation and elimination of ingress interference in the upstream network, and delivers somewhat higher basic CATV subscribership by deterring signal theft. Optional benefits may arise from creative revenue-producing services such as weekend-only cable, cable-on-demand and pay-per-view to nonsubscribers. Another benefit is preventing unscrupulous parties from introducing damaging signals into the return network. Lastly, as outlined later, addressable taps are especially applicable in the multiple dwelling unit (MDU) environment.

Addressable taps provide the operator an ability to:

1) Build a tight RF system, including the drop, from the outset to ensure its continued viability;

2) Quickly isolate subscriber-induced interference which may be detrimental to the entire system;

3) Remotely disconnect drops that are inducing ingress noise;

4) Remotely deactivate disconnects and nonpay subscribers; and

5) Remotely activate reconnects.

Theft of service

Theft of CATV services takes a number of forms. Nonsubscribing users have been known to pirate basic cable service by connecting their drops to a vacant tap port or to their neighbor's tap port. Other ways to defraud the cable provider include removing traps installed by the cable company on the drop and using pirate converters to receive pay TV and pay-per-view.

"Addressable taps can reduce the connection and reconnection of subscriber drop F-connectors at the faceplate."

Addressable taps defeat most not-so-ingenious attempts to steal basic cable service by electronically cutting off the service at the tap. In a noncompetitive situation, addressable taps allow the subscriber only two choices: go without cable service or subscribe legally. In a competitive situation, however, nonsubscribers who have a propensity to steal basic cable service may have four choices: attempt to steal from the other cable company, subscribe legally to the competitor, subscribe legally to your cable company or go without cable service.

Cost-benefit analysis using increased subscribership as a benefit must consider the percentage of nonsubscribers with a propensity to steal basic CATV and the percentage of those likely to convert to subscribing legally. It is worthy to note, however, that the degree of theft of any cable service is proportional to the diligence of the cable operator. If the cable operator uses frequent audits and bring-up files for past offenders, theft of service will be minimized greatly.

The MDU environment

In the MDU environment, addressable taps offer increased utility over residential single-family service due to the following:

- Potential basic cable theft is higher in MDUs;
- Access to the premises and to central tap locations can be much more difficult;
- Basic cable subscribership possesses a very high churn rate typically between 40-60%;
- The price per port of the 16- to 64-port MDU addressable tap is nearly half that of strand-mounted four- to eight-port addressable taps; and
- Some negative byproducts of competition are lessened, such as churn due to switching CATV providers, damage to the drop at the subscriber premises, etc., since contracts are often consummated with the building owner for some duration. This helps maximize the goal of building and maintaining a tight RF system.

The installation technician's service order will dictate which tap to use for a new or reconnected subscriber and which port on the tap. When the technician installs the drop and connects it to the tap port that has an active, he or she will pass the order. This will result in a flow-through to the operations center to update the data base of the addressable tap system.

Addressable taps can reduce the connection and reconnection of subscriber drop F-connectors at the faceplate. The standard method of service activation/disconnect in a nonaddressable tap system has been to disconnect one or both ends of the drop cable. →

John Galligan is manager of network planning, consumer media, at BellSouth Corp.

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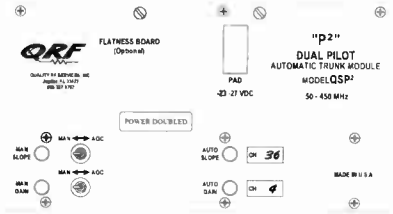

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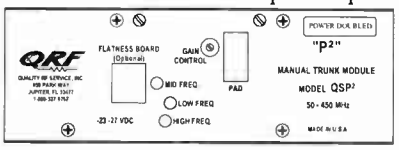

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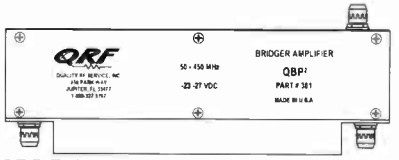

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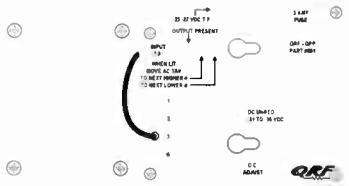

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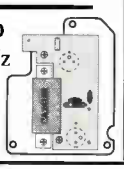

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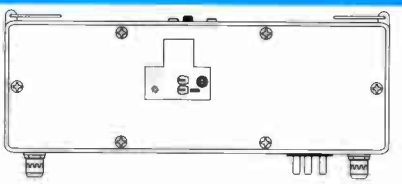

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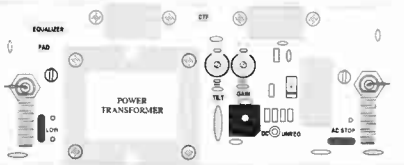

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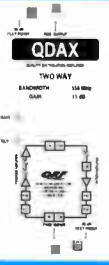

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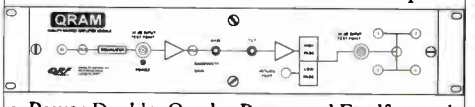

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System ingress, intermittent problems and poor performance occur when the drop connections are not tight. Manually disconnecting the F-connectors over time will potentially result in damaged connectors and deterioration. The use of traps, however, in an addressable system would lessen F-connector protection benefits because the F-connector will have to be disconnected each time a trap is added, changed or removed. The more that specialized traps are used, the more the wear and tear on the F-connector.

Ingress

Ingress interference and isolation is being recognized as a formidable problem, especially as data communication services are added to the cable systems. The interest and concern also is due to the fact that most cable system operators are just beginning to experience the difficulties in establishing two-way systems capable of transporting enhanced services. As telephony, PC data services and other enhanced services are added to a two-way system, few operators have a solid estimate of the troubles to be expected, the average time to clear and the learning that takes place over the years in combating ingress interference. It is clear the viability and success of data communication services will depend in large part upon an ability to quickly isolate and curtail ingress problems. Addressable taps, used in conjunction with reverse path switching in the fiber node, amplifiers or distribution network may provide such a capability.

Irrespective of a decision to deploy addressable taps, it may prove advisable to deploy reverse patch switching in the fiber node, amplifiers or return coaxial plant. Reverse path switches allow the remote insertion of a 6 dB pad and an on/off capability in the return path to assist in ingress interference isolation. In a node covering some 400-600 living units in which ingress interference is playing havoc with data communication services, the operations center currently may have only limited alternatives to locate the offending source.

The primary method has been to dispatch technicians into the plant to test and disconnect until the offending source of interference is located. This can be very time-consuming and disruptive. The use of reverse path switching, in conjunction with automated headend noise surveillance equipment, would facilitate the ingress isolation to an individual fiber node leg, between two amplifiers, before and after splitters or directional couplers, and finally to a string of taps. The use of addressable taps in conjunction with the reverse path switching not only will permit the rapid isolation of the ingress noise to the subscriber's drop, but also permit the immediate disconnection of the offending drop from the system. This capability may not eliminate a dispatch (which still may be required to the subscriber premises), but it provides a very quick method of isolating and terminating subscriber-induced ingress interference.

The tap-port efficiency or usage rate of taps in cable systems can have a significant effect on the capital efficiency of addressable taps.

Underutilization results when two, four- or eight-port taps are used curbside, but the lot layout permits the use of a single port out of a two-port unit, three ports out of a four-port unit, or five to seven ports out of an eight-port unit. The addressable electronics installed, but unused for the vacant ports, take away from the efficiencies gained from employing the system.

Conclusion

Addressable taps and reverse path switching can add a great amount of functionality to a well-built cable TV system. This significant functionality does not come without cost, however.

Taken across a large network, addressable taps, in-line reverse path switches and transponders to control amplifier and node switches represent a notable capital investment.

Although proven to be very reliable so far, this functionality does add active elements to the plant. Additionally, addressable taps consume power even while inactive. Despite all this, operations savings can be realized, basic signal theft may be reduced and a significant capability will be in place in case ingress interference gets the best of us as we deploy enhanced two-way services. **CT**

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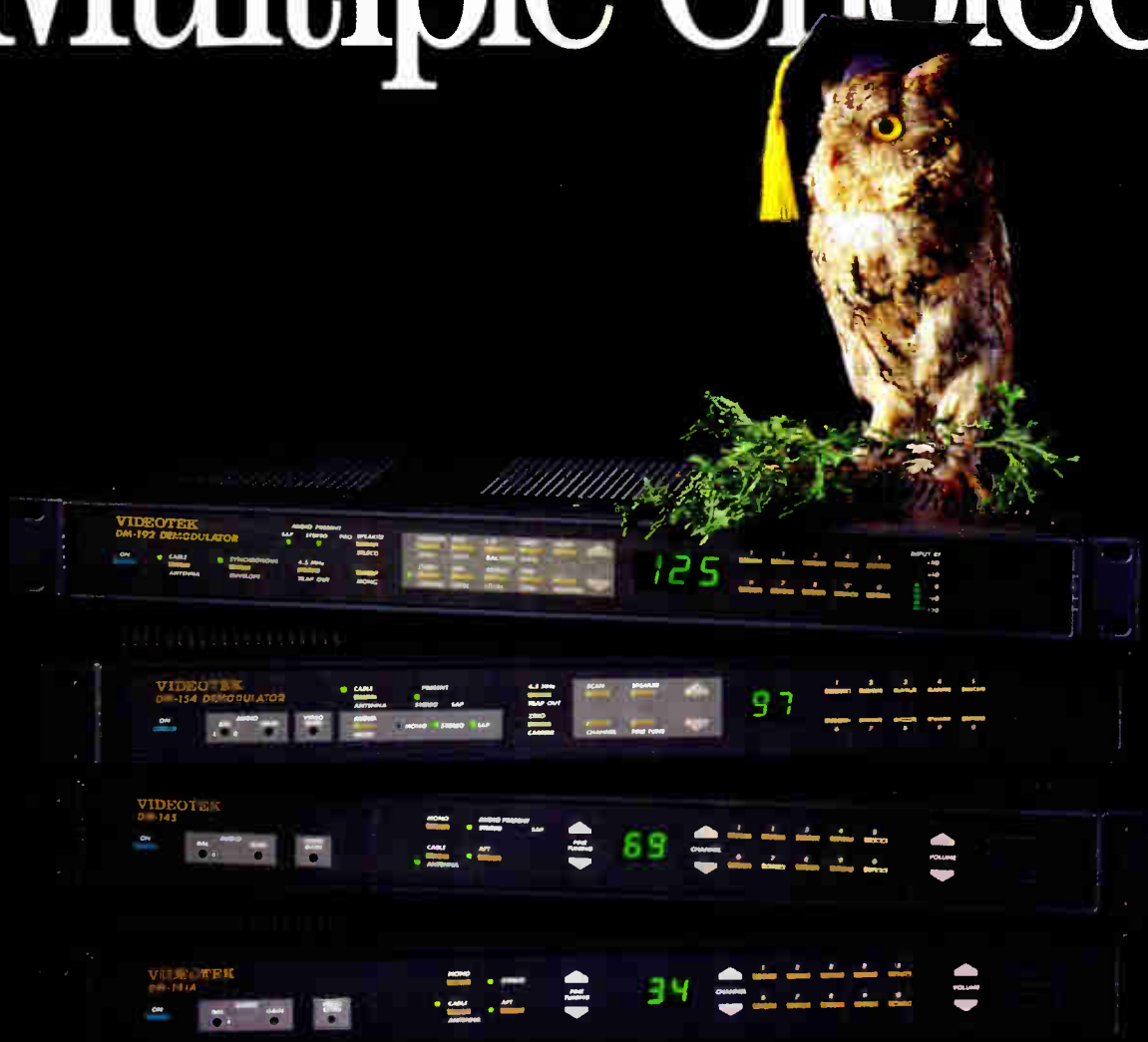

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Reader Service Number 110

By Raja Natarajan and Douglas M. Robertson

Tackling telephony and data challenges

The Telecom Act of 1996 has, among other things, paved the way for alternate access providers to enter the local telephony market. Telephony products for CATV networks have progressed beyond trial stages and are now commercially available. Rapid deployment of these products is expected over the next few years. Currently, less than 10% of U.S. CATV systems are two-way capable; however, the CATV companies are rapidly upgrading their networks with more fiber and two-way capability. This article discusses technical and business-related factors to be considered by a CATV company before selecting a product for deployment over a two-way plant.

Multiple revenue streams

Hybrid fiber/coax (HFC) networks provide the opportunity to offer residential and small business customers services previously available only to big businesses. One of the important factors to consider is whether the technology chosen allows the service provider to capture the greatest number of revenue streams. Does the product allow the service provider to add new services? Efficient bandwidth management becomes the key to supporting multiple revenue generating services in a subsplit cable system.

In addition to traditional CATV revenues of approximately $30 per subscriber, estimates of new revenues from telephony and high-speed data services are listed in the accompanying table.

Monthly revenue from telephony and data services

Service	Monthly revenue per subscriber
Basic local telephone service (residential)	$15-$20
Residential local service including value-added services	$30-$40
Internet access	$15-$25
ISDN	$30-$75

A leading CATV operator in a trial market of more than 15,000 homes found that the take-rate on high-speed data services was about 3% without any marketing effort. By the end of the year, the operator hopes to have a nearly 5% subscription rate.

Videophone equipment, if priced less than $500, appears to have a large potential market, according to a recent survey. Data also suggest that a price of greater than $1,000 will result in losing most of the videophone customers.

Start-up cost

CATV companies in the domestic market will be competing with a local exchange carrier (LEC), which has nearly 100% share of the access to the residential telephony market. Constrained financially from rapid expansion in the 1980s, most cable companies are planning joint ventures for financial and technical resources to go head-to-head with others in the emerging interactive and multimedia markets.

Start-up cost is defined as the cost of the infrastructure, in addition to the two-way upgrade, for a CATV company to announce the availability of telephony service. Analysts estimate the two-way upgrade costs—fiber-to-the-node, and upgrade to 750 MHz capability—to be in the range of $150 to $225 per home passed. These fiber-optic upgrades to current infrastructure will improve reliability, enhance system capability and allow for cost-efficient delivery of current and future services.

Technology for telephony and other services should allow the provider to enter the business with a low start-up cost and add equipment to the network with no disruption as the demand for the service grows. The low start-up costs allow the business to operate profitably in low take-rate situations. The technology should allow the service provider to start with a large serving area and a small number of time-slots (a time-slot is a 64 kbps, DS-0 channel) that can be shared among the subscribers.

There are two ways to address increase in take-rate for the services: first, by increasing the number of time-slots that are shared by the subscribers and second, by decreasing the size of the serving areas.

Selective deployment of services

The ability to provide data services without voice services gives the CATV company a competitive advantage. There might be geographic areas where the demand for high-speed data services for Internet access or work-at-home might be high, while demand for telephony might be very low. The technology should be such that the service provider can offer any com-

Raja Natarajan is principal staff engineer and Douglas M. Robertson is director of business development and marketing for Motorola Multimedia Group. They can be contacted at 3436 N. Kennicott Ave., Arlington Heights, IL 60004.

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bination of voice, video or data services. This would allow the CATV company to minimize the network infrastructure expenditure in areas where only a part of the portfolio of services is expected to be profitable.

It is likely that the penetration rates for new services will be high in some geographic areas, with low to medium take-rates in others. If the service provider must use different technologies to meet the varying take-rates, it becomes difficult to achieve economies of scale and results in increased operational and maintenance costs.

Ease of use for both the service provider and the subscriber are important for successful service. From a subscriber's point of view, the technology should provide seamless integration into existing in-house wiring, use existing interfaces (such as RJ-11) and readily available customer premises equipment (CPE). New services such as high-speed data delivery should be extremely simple to use.

The intelligence built into the customer premises equipment/network elements should be capable of self-configuration for service so that the subscriber should not have to understand the technology to benefit from the new service. From a service provider's perspective, the network elements should not have to be configured in the field.

The installation procedure should be extremely simple: "Connect the cables to the unit and let the network and the unit dialog with each other and auto-discover the features based on the provisioning done for the subscriber." This reduces the training required for both the subscribers and the field installation personnel and increases customer acceptance of the product.

Operational savings, billing

The technology selected for delivering telephony, data and other interactive services should, in addition to offering the potential for multiple new revenue streams, be capable of reducing the service provider's operational expenses. The addition of intelligent electronics in the network as well as at the customer premises allows for operational savings from various sources as shown in Figure 1 on page 40. A single system may not

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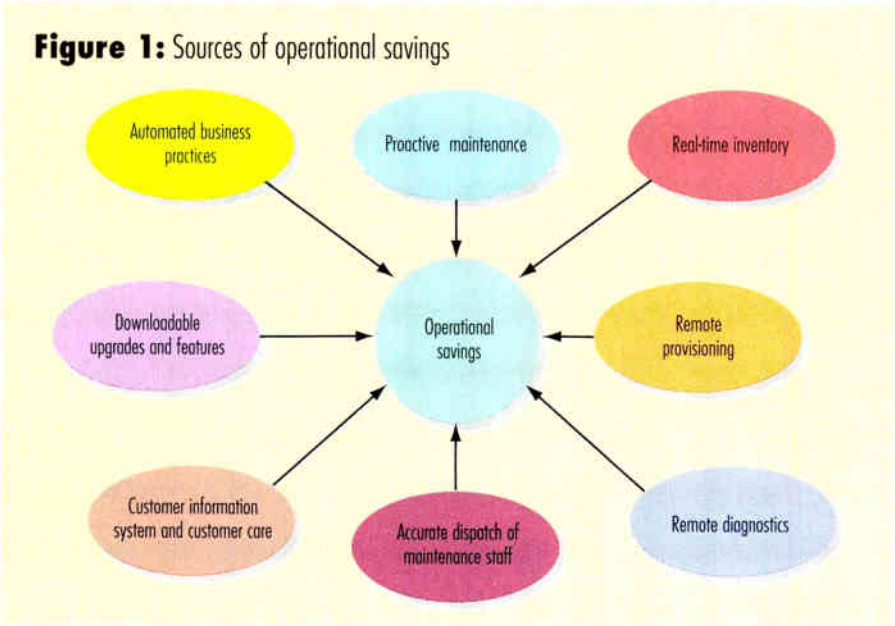
be able to integrate all of these functions efficiently, or there might be existing subsystems that the service provider would like reused. This requires an operational support system (OSS) or an element manager that supports standard interfaces (such as SNMP, Q3) to other OSSs.

To support telephony and data services, the billing method must change from a predominantly flat-rate method for CATV services to a usage-based system (minutes of use, kilobytes of data, etc.). The capacity to provide accurate billing statements is critical to maintain a positive "service" image with the subscribers. The capability of the system to provide detailed billing records is important in providing innovative services (for example, AT&T's Reach Out America, MCI's Friends & Family, etc.). Standard interfaces to the billing system allow the service provider to choose the billing system best suited to its specific business plan. The capabilities of the billing system will often limit the types of services and "service packages" that can be provided.

Figure 1: Sources of operational savings



Noise/spectrum management

The noise in the subsplit (5 to 40 MHz) region of the spectrum used for upstream communications varies from one system to another and more importantly, varies with the time of day. Common sources of noise include ham radio, short-wave radio broadcasts, light dimmers, and a variety of home appliances.

Dynamic allocation of carriers on a per-call basis is critical to making the system work in almost any cable HFC system, as is the capability of switching from one carrier to another

in the event of noise, in a manner transparent to the user. (That is, within a few milliseconds.) If the system maintains statistics about the entire upstream spectrum, it could select the best available frequencies for use each time and avoid potentially problematic frequencies.

Use of narrow carriers for telephony are critical for successful operation in a noisy environment. Assuming a system with a telephony carrier used for 24 time slots and occupying approximately 1.5 MHz in RF bandwidth, then:

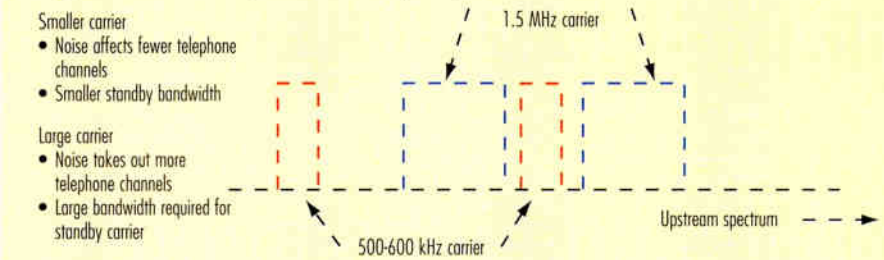
1) A noise-free 1.5 MHz wide spectrum is required for its operation;

2) If there is any noise encountered anywhere in the 1.5 MHz region, the entire set of time-slots are lost and have to be carried elsewhere; and

3) The standby spectrum also should be 1.5 MHz wide.

Alternately, if the telephony carrier is only 500 to 600 kHz wide, it is easier to find noise-free areas of spectrum (because of the narrower bandwidth requirement) and the spare bandwidth required to do a carrier switchover in case of noise is also smaller. (See Figure 2.)

Figure 2: Advantage of smaller telephony carrier



Spectrum management in systems over which multiple services are offered should be transparent to the service provider; that is, the system should automatically identify good portions of the spectrum in which to operate. This allows the service provider to add new services without having to perform technical analysis of the spectrum.

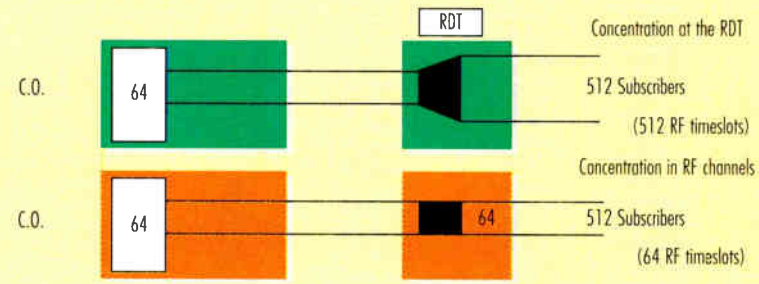
Powering

The capability to provide centralized powering—without having to insert power in multiple locations—for all the network elements (amplifiers, customer access units, etc.) allows the service provider to provide backup power easily during long periods of power outage using a smaller battery and a generator set. Powering from a single location allows the use of a battery small enough to provide backup until the generator starts up.

The power required to be delivered from the central node/powering location is largely dependent on the power consumption of the individual customer access units. Consider an example with 500 customers served from a 2,000 homes-passed node. If each of the customer access units

draws an average power of 500 milliwatts, the power needed from the node is only 250 watts plus transmission losses, which is within the power carrying capability of the coaxial network. On the other hand, if the average power consumption is 3 to 4 watts, the power required is 1,500 to 2,000 watts; this would require multiple power insertion points and adds initial as well as operating cost.

Figure 3: Concentration at the remote digital terminal (RDT) vs. RF concentration



Reliability

Telephony subscribers in the U.S. market have come to expect a very high level of reliability. CATV network-provided telephony should be capable of meeting the same reliability objectives as those of conventional telephone providers. Telcos' objectives are 99.99% availability, which translates to a downtime of no more than 53 minutes per year. It is possible with the proper maintenance of the network and selection of the network elements to meet or exceed the reliability objective set by the LECs. The CATV companies have to formulate maintenance and operations procedures and enforce strict maintenance practices to ensure the reliability of the network on a par with the LECs.

Concentration in the loop

The advent of TR-303 in the domestic market and V5.2 in the international market has allowed the concentration to be done in the distribution part of the network while maintaining the same grade of service (GOS) as in a conventional telephony network. Concentration in the distribution can be achieved using two different approaches as indicated in Figure 3.

In both cases, 64 time slots from the local digital switch are used to serve 512 subscribers, for an 8:1 concentration. In the first case, the concentration is done at the remote digital terminal (RDT). This results in 512 RF channels being used in the coaxial network to deliver telephony services to the subscribers. In the second case, the 64 time slots are transmitted over the coaxial cable. The subscribers use the 64 time slots available in the coaxial network only as needed. In this approach, only 64 RF time slots are transmitted from the RDT location.

The GOS is the same in both cases, but the second approach uses fewer electronics and less bandwidth on the distribution network. The flexibility gained by the ability to assign bandwidth on an as-needed basis allows the capability to offer services such as n x 64 kbps, integrated services digital network (ISDN), and video telephony. In addition, the bandwidth freed can be used to support high-speed packet-based services, such as Internet access and Ethernet to the home.

Forecasting and traffic engineering

Forecasting and traffic engineering were prerequisites for building a traditional telephone distribution network. HFC technology, because of the shared distribution medium, minimizes the need for accurate forecasting and traffic engineering. The service provider makes some broad assumptions to start offering the service. The actual traffic engineering can be done on an ongoing basis based on statistics from the network.

If the concentration is done in the RF channels, the service

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provider has two parameters that can be adjusted to achieve the desired traffic engineering parameters: the number of RF channels (i.e., RF DS-0 time slots), and the capability to split or combine the nodes. This allows the service provider to match the network to the demands of the market—for example, a residential telephone service might offer a load of 0.1 Erlangs, while a business user might offer a load of 0.3 to 0.6 Erlangs—and nearly eliminates the need for traffic engineering as it is done in a traditional telephony network. *(Editor's note: For an explanation of Erlangs as a unit of measure, see "Communications Technology," May 1996, page 98.)*

International deployments

The international market for cable telephony is growing rapidly.

Recently, Optus Vision of Australia announced that it had selected HFC technology to provide telephony to more than 200,000 subscribers. There are more than 140 million CATV subscribers worldwide, with about 60 million of them in the United States. In countries like China, more than 80% of the CATV subscribers do not have telephone service. The "green field" opportunity for voice telephony growth is about 107 million lines per year worldwide. (As a comparison, BellSouth has about 20 million lines.) This segment of the market has some unique requirements and challenges.

Some countries have a very low tariff structure for telephony services and these are regulated by the local government. The take-rates in some of these countries also could be low. Low start-up costs are a key in these areas. Standards specifications for interfaces to the local telephone network, switch, etc., are different (e.g., E-1, V5.1, MELCAS, and V5.2) from those in the domestic market; in addition, there are likely to be country specific modifications of the standards. It is important to ensure that the product has all the required interfaces since development of these interfaces require specialized skills and is often time-consuming.

Conclusion

The major challenges in providing telephony and other telecommunications services are:

1) To manage the RF spectrum efficiently to be able to offer multiple services and thereby capture a majority of all new telecommunications revenue streams,

2) To power the network from a single location (fiber optic node) so that longer duration power outages can be handled with a backup generator, and

3) To keep the start-up costs low enough to be profitable in varying take-rate situations and have the flexibility to easily upgrade to meet market needs.

As the usage expands, new services and features will be added that will further differentiate the services offered over HFC. Both vendors of HFC equipment and service providers should thrive in this more competitive environment. **CT**

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

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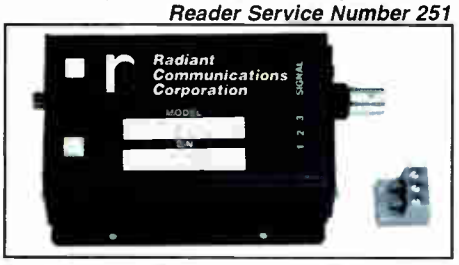

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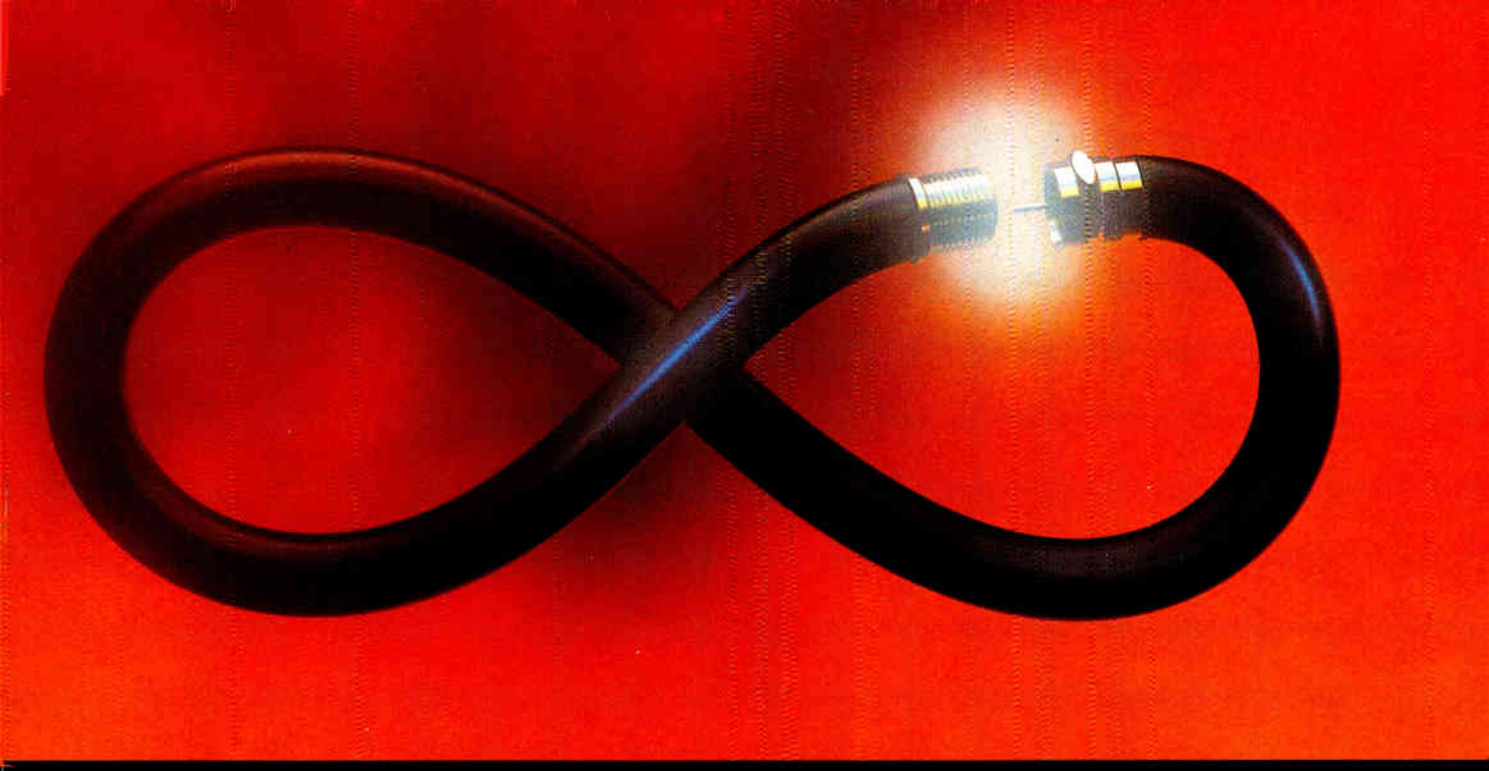

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What you never thought possible.™

By Dean A. Stoneback and William F. Beck

Return design for digital: Part 2

This is the second in a two-part series on system design considerations for delivery of digital services by cable. The series was adapted from a paper titled "Designing the Return System for Full Digital Services," presented by the authors at the Society of Cable Telecommunications Engineers' 1996 Emerging Technologies Conference in San Francisco. Part 1 (August 1996, page 80) discussed loss between amplifiers in the return path, as well as operating characteristics of Fabry-Perot vs. distributed feedback lasers. Part 2 addresses system design and setup. Copies of the original paper can be obtained from General Instrument.

Combining the information from Part 1 of this article with past return knowledge leads to the creation of rules for design and setup guidelines for return systems.

Noise

The fiber-to-the-feeder (FTF) designs of today show that the return lasers contribute a large percentage of the carrier-to-noise (C/N) degradation in the return path. Even the combined noise of 40-50 return amplifiers does not contribute much to the total C/N when compared to the return optical link.

Consider the following example: Remember that the channel power level is allocated based on channel spacing (192 kHz in Table 1), while noise is calculated based on the noise bandwidth of the receiver (128 kHz).

Table 1: Carrier-to-noise

Return hybrid noise figure	4.5 dB
Average hybrid input level	5 dBmV
Noise floor of a 128 kHz bandwidth	-74.2 dBmV
Link C/N for 192 kHz data at 6 dB link	43 dB
Amplifier C/N	74.2 - 4.5 +5-10* log(50) = 57.7 dB
Total C/N	**42.9 dB**

Headend combining also has a significant impact on overall system noise. Excessive combining should be avoided. Combinations of four or eight receivers at the headend may be permitted for initial service introductions, but a migration plan that removes the combiners in the future should be developed. In addition, combining return links of various path losses instead of grouping by distance may eliminate troublesome data paths. Grouping all long lengths together, for instance, means that combination will be certain to have the worst C/N ratio. For example: four links each at 35 dB C/N yields a composite of 29 dB C/N, where combining links of 43 dB, 41 dB, 38 dB and 35 dB yields 32.2 dB C/N.

Power considerations

Maintaining proper power levels is important. Here are some guidelines for system design:

A total RF power level will be specified for a particular laser transmitter module. This total power should be divided among all services on a constant power per Hz basis. The amount of power per Hz depends on the total bandwidth of a fully deployed return. In this example, the total power at a laser transmitter is 45 dBmV, the total deployed bandwidth is 35 MHz, and the power of a 192 kHz service is 23 dBmV.

If a particular system will not deploy the entire 35 MHz band-

Dean Stoneback is system engineer and William Beck is senior sales support specialist for General Instrument Communications. They can be reached at (215) 674-4800.

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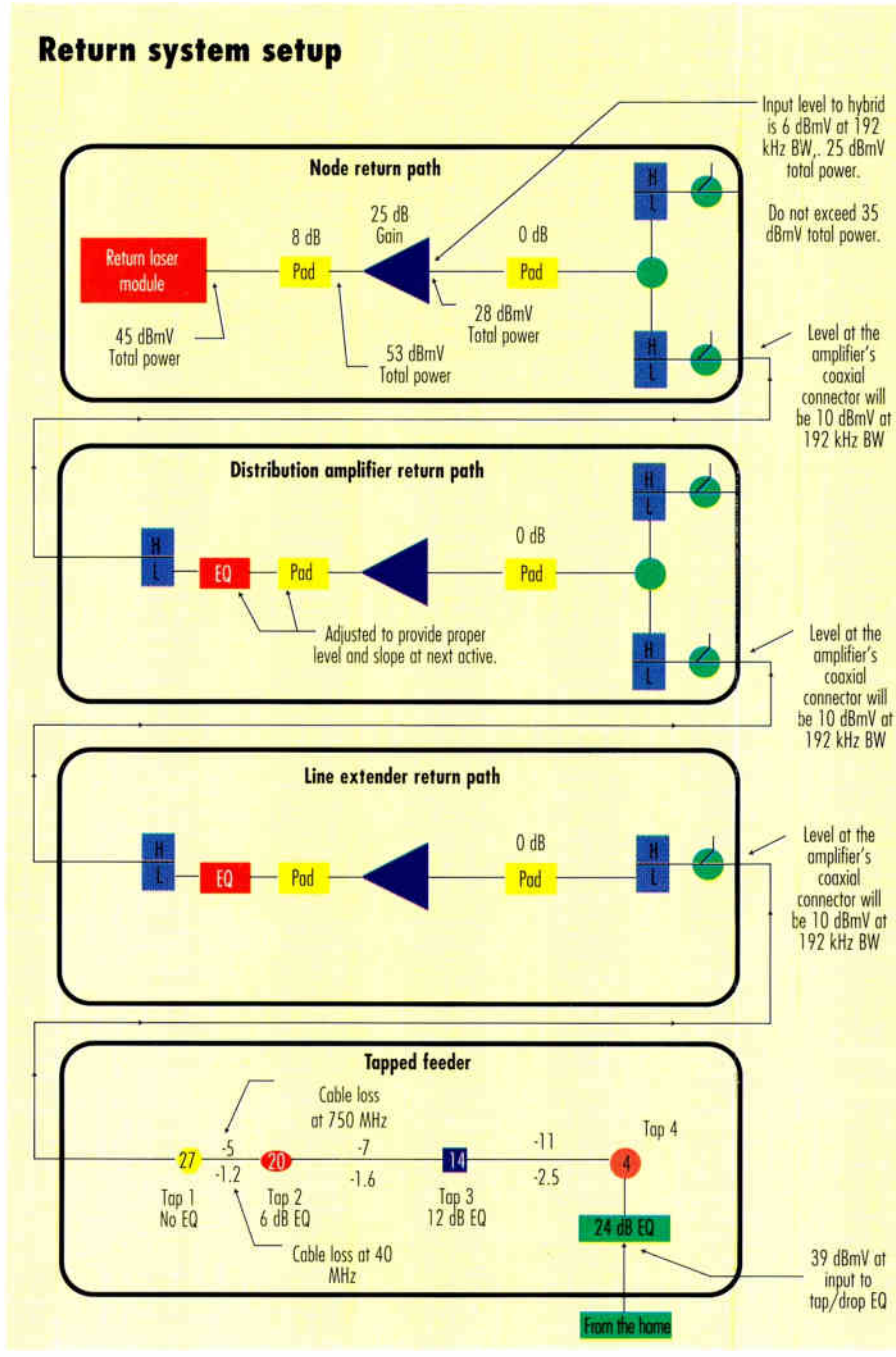

width, then the power per Hz value can be increased accordingly. However, if additional channels are added latter, the laser or amplifiers could be overdriven.

The return output level from the in-house devices should be injected at its mid- to high-level transmitter range. The highest operating level from the household establishes the best carrier-to-interference ratio.

The total output power from a return hybrid IC should not exceed 60 dBmV (-15 dBmV/Hz for a 35 MHz bandwidth). Levels higher than this will start to cause excessive distortion. Note that the entire data payload very seldom passes through any one hybrid. However, amplifiers that carry a large amount of data must be capable of these high levels.

When there is combining at the headend, any one laser does not carry the full payload. Therefore, the laser is even more robust against large interfering carriers than previously discussed.

Design

To ensure correct design, a rule of constant input level at the cable ports to each amplifier (regardless of type) is required. This is often referred to as unity gain. As is typical in return path

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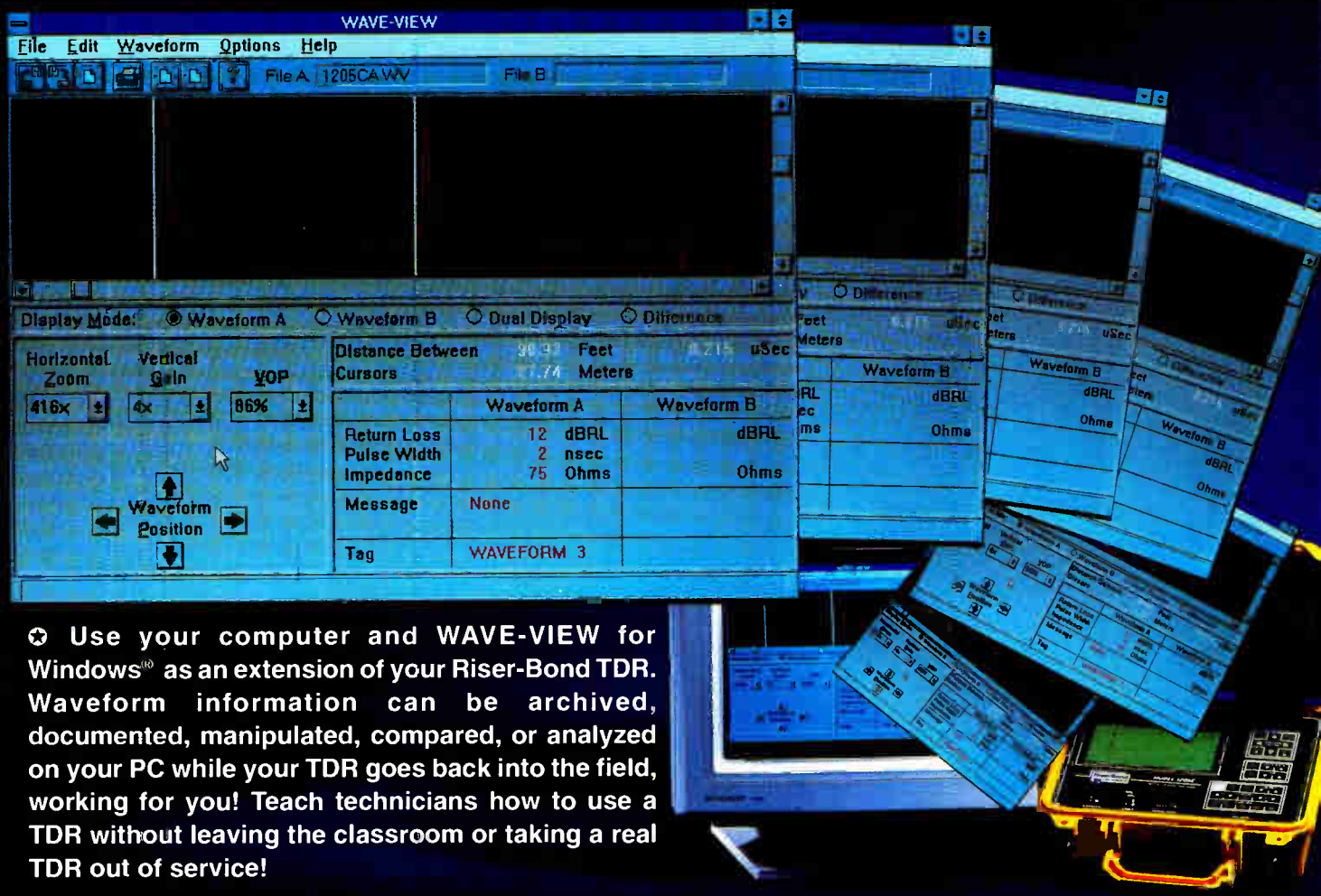

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Taking on two-way challenges

cryptography

January 1997

design, the equalization and padding must be done at the output of each station in order to assure that the input of the next station (moving toward the headend) is correct. Such post-padding is required because the output of any particular station can combine with the outputs of other stations (possibly through directional couplers) on its way to the next input. Unequal levels cannot be adjusted after they are combined.

This unity gain carries through to the node. The input to the node station should be at the same level as every other station. The levels inside the node are then adjusted to provide the proper level to the laser module. Since levels are apportioned on a constant power per Hz basis in the plant and the plant has unity gain, the levels at the laser also will have constant power per Hz.

The lowest cost design is achieved when return system levels do not dictate or select a tap value. The use of tap/drop equalizers allow any tap value from 29 to 4 to be used without impacting either the forward or return design.

The path loss from the tap/drop equalizer to the amplifier port will range from 23 to 30 dB, based upon 6 dB increments of equalizer values.

Careful attention must be given to gain variances throughout the plant. Table 2 shows how these variances can add up. The levels shown are for a set-top box with a 192 kHz channel spacing. Note that the set-top box is required to have an output level of 27 to 59 dBmV. This very large output range is required even after the tap/drop loss variance has been minimized by the addition of equalizers.

Table 2: Variance levels at the set-top box

Device	Nominal gain	Variance	Nominal input level	Low input level	High input level
Demodulator	—	-3 to +3	15	12	18
Optical link	5	—	10	7	13
Amplifier cascade	0	-4 to +4	10	3	17
Feeder to equalized tap port	-29	-23 to -30	39	26	47
Drop	-2	-1 to -3	41	27	50
In-house loss	-4	0 to -9	45	27	59
Final set-top levels	—	—	**45**	**27**	**59**

If plants have been poorly maintained or have never been properly set up, the required output range would be even greater. In such a plant, some set-top boxes would not be able to transmit their signals into the actives at the proper level.

Every service must have some type of power control loop to assure that all transmitted signals arrive at the actives at the proper level. Table 2 illustrates that there is a 21 dB tolerance at the tap (after being equalized by the tap/drop equalizer). This tolerance increases to 32 dB at the set-top box. There must be a

closed loop system that adjusts each transmitter to the proper level.

When combining optical receiver RF outputs, all links must be adjusted to have the proper output levels. The gain relationship from the laser input to the combined output must be identical for every link regardless of the amount of combining (if any).

Setup

For setup, the return signal generator should emulate subscriber terminal levels. In the example shown in the accompanying figure on page 50, 10 dBmV is present at the housing connectors. The signal generator should be set to 30 dBmV to overcome the directional coupler test point and simulate the signal of interest. The signal generator should never insert more than 45 dBmV total power into the laser. If the generator has eight carriers, for example, the level on each carrier should be equal to or less than 36 dBmV (10*log (8) = 9 dB reduction per carrier).

Normally all input pads in amplifier stations should be 0 dB jumpers. Extra loss should be inserted only in special circumstances such as to isolate a particular return path or to compensate for some other abnormality. Otherwise, all station padding should be done after the return amplifier.

A round robin sweep setup is recommended. Sweep signals are inserted at various locations in the return plant and are measured at the headend. The measurements are then transmitted in the forward path so the technician in the field can read them.

Alignment should begin by injecting a known level into the return laser transmitter. Proper gain is set by adjusting the RF level out of the optical receiver. If RF combining is used in the headend, output levels should be measured at the output of the combiner.

At all other stations, the signal should be injected at the forward path output port, and the gain should be adjusted at the equalizer and pad locations at the output of the amplifier.

Conclusions

The attractive new services being conceived for hybrid fiber/coax networks rely on the full use and deployment of the return path. With these new services, the demands on system design and performance criteria change. Modifying the HFC network so that the loss to any individual household will be constant across all frequencies lessens gain variance and raises a higher barrier to ingress. This reduction in gain variance is critical to maintaining correct channel levels at the lasers and demodulators.

The evaluation of lasers shows that one very economical method of transporting dense 5 to 40 MHz data payloads is to use a directly amplitude-modulated, unisolated, uncooled, Fabry-Perot laser. Further, the rule of constant power per Hz provides a way of allocating the return payload that allows for easy determination of channel levels and provides constant carrier-to-noise for every service. The once forgotten and largely ignored return path is becoming critical to the transport of tomorrow's services. Careful planing, installation and maintenance will allow the upstream system to perform the task. **CT**

By Jack Kouzoujian

Composite intermodulation distortion measurements: Part 2

The following is the second in a two-part series on extending the limits of composite intermodulation distortion measurements. Part 1 ran on page 84 in the August issue of "Communications Technology."

In Part 1, I presented a method for greatly extending the limits of composite distortion measurements and its use for measuring crossmodulation. This article analyzes this method. Although its circuit is quite simple, the results were not obvious until the analysis was completed and verified by actual tests.

Circuit description

Exactly how detectors behave with noise and noise-like signals seems simple but in reality is very complex. Fortunately there has been an analysis of a very similar problem. The circuit in Figure 1 closely resembles part of the Dicke radiometer circuit shown in Reference 12.

The Dicke radiometer was designed to measure temperature by measuring the magnitude of microwave thermal radiation from objects. Dicke's method was to alternately switch the receiver between an antenna and a termination. The output of the receiver was detected synchronously at the switching frequency.

Jack Kouzoujian is president and chief engineer at Matrix Test Equipment. He can be reached at (516) 472-0153.

The Dicke circuit is ideal for measuring small differences in noise levels. A modification of the Dicke receiver solves the noise floor problem.

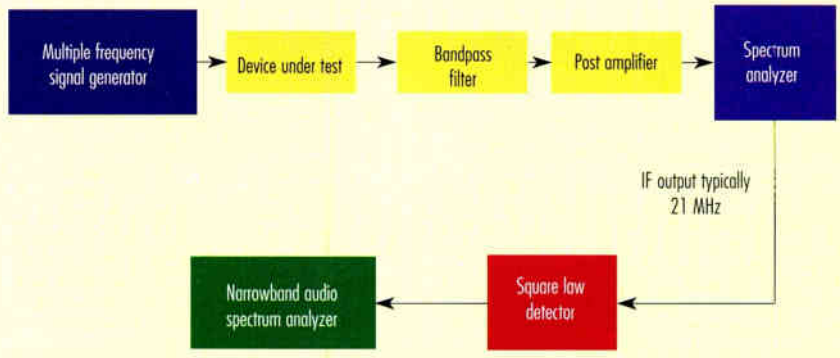
The equations for the Dicke radiometer indicate that the improvement in the measurement by using the circuit of Figure 1 compared to a system using no modulation is:

$$\text{Improvement} = \frac{\sqrt{2}}{\Pi}\sqrt{\frac{\text{(Predetection bandwidth)}}{2\ \text{(Post-detection bandwidth)}}}$$

$$\text{Improvement (dB)} = 10\ \text{Log}\ \frac{\sqrt{2}}{\Pi}\sqrt{\frac{\text{(Predetection bandwidth)}}{2\ \text{(Post-detection bandwidth)}}}$$

→

Figure 1: Intermodulation measurements method



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If we use the radiometer equations with a predetection bandwidth of 30 kHz, actually a noise bandwidth of 36 kHz, and a post-detection bandwidth of 1 Hz, we would expect to see an improvement of about 17.8 dB. This is very close to the actual measured values. (See Figure 2 in Part 1 of this article.)

The example chosen uses a post-detection analyzer bandwidth of 1 Hz. Other bandwidths as low as 0.1 Hz or as high as 100 Hz are quite practical. The measurement time is related inversely to the chosen bandwidth. With a 1 Hz bandwidth the measurement time is approximately 5 seconds.

Square law detector

The reason for the choice of the square law detector is two-fold. First, because the square law detector is square law throughout its operating range, it overcomes the small signal properties of the linear detector, which becomes square law with signal levels near noise levels.[4] The second advantage of the square law detector is that its output voltage is proportional to the input power. This is very important because the 1 kHz modulated distortions generate an output that is independent of any noise also present. This is not true of the linear detector where the output is a function of the noise level. It is interesting to note that even if a perfect linear detector were available, the square law detector would be preferred for this application.

Figure 2 on page 58 shows output voltage vs. input power for two types of perfect detectors. Note that the square law detector has a linear power-voltage relationship. This fact simplifies the measurement method.

The choice of the square law detector has solved the problem of the linear detector but has forced a requirement of greater dynamic range on the 1 kHz measurement. To some extent the dynamic range at the output can be decreased by changing the gain at the input to the square law detector.

One minor point must be considered when measuring composite distortions. The standard method for composite distortion measurements uses a spectrum analyzer. The definition of carrier to composite distortion assumes that the measurement is made using a spectrum analyzer in the log display mode. Spectrum analyzers, however, read noise and noise-like signals in error. Usually, when measuring noise with a spectrum analyzer, a correction factor of about 2.5 dB is used. This correction factor of 2.5 dB is not used when measuring composite distortion. Because the square law detector is truly measuring the carrier power to composite distortion power ratio, the noise levels read with the modulation method must be decreased by 2.5 dB if agreement with the spectrum analyzer method is desired.

$$\text{Composite distortion (dB)} = [20\log (V_{dm}/V_{cm})/2] - 2.5 \text{ dB}$$

V_{cm} = Square law detector output with 100% modulated carrier input.

V_{dm} = Square law detector output with distortion input.

*Note that $20\log(V_{dm}/V_{cm})$ is read from the audio analyzer and has a negative value.

Measurement of crossmodulation

There are two definitions for crossmodulation. One definition relates the modulation sideband magnitude to the CW carrier magnitude. The other more common definition relates magnitude of the modulation sideband to the sideband of a 100% amplitude-modulated carrier. Both of the above definitions assume 100% downward modulation. For our example we will use the more common second definition of crossmodulation.

"Exactly how detectors behave with noise and noise-like signals seems simple but in reality is very complex."

The circuit shown in Figure 1 was designed to solve the particular problem of composite distortion measurements. If we compare this circuit with the circuit used for crossmodulation measurements, we find the only difference is the type of detector used.[13]

When measuring crossmodulation great care is taken to verify that the detector is operating in the linear mode. For our example, great care is taken to operate in the detector in the square law mode. We will show that the square law detector can be used to make crossmodulation measurements with results similar to that of the linear detector except for a 6 dB offset.

Figure 3 on page 60 is a presentation of a carrier with some degree of crossmodulation.

Crossmodulation (dB) = $20\log \Delta/A$ [13]

The audio analyzer can display 20log of the ratio of the distortion square wave to carrier square wave at the detector output as:

Audio analyzer reading = $20\log(2\Delta/A)$

The 2Δ term is a direct result of the square law detector. A linear detector would have an output of Δ.

$20\log(2\Delta/A) = 20\log 2 + 20\log(\Delta/A)$

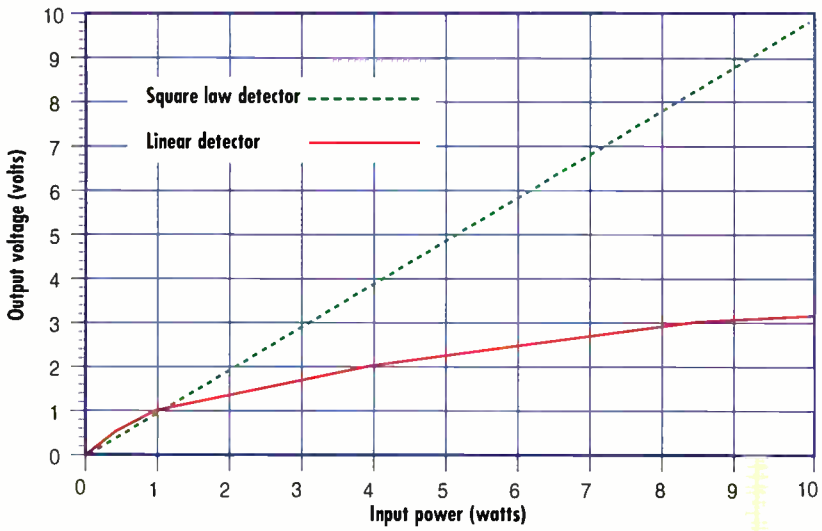
$20\log(2\Delta/A) = +6\text{ dB} + 20\log(\Delta/A)$

$20\log(\Delta/A) = 20\log(2\Delta/A) - 6\text{ dB}$

*Note that $20\log(2\Delta/A)$ has a negative value.

→

Figure 2: Square law and linear detector characteristics



Crossmodulation [20log(Δ/A)]

20log(Δ/A) = audio analyzer reading - 6 dB

Crossmodulation (dB) = 20log(2Δ/A) - 6 dB

A = Square law detector output with 100% modulated carrier input.

2Δ = Square law detector output with CW carrier and distortion input.

*Note that (20log(2Δ/A) is read from the audio analyzer and has a negative value.

Practical implementation

All of the items in the block diagram of Figure 1 (page 54) except the square law detector are commercially available.[5,6,7] Here the spectrum analyzer functions only as a frequency converter and so must have available a low frequency IF output port. The square law detector was not available so one was designed for this application using a high-frequency four-quadrant multiplier.[8,9] For our particular example, the IF frequency was 21 MHz, but operation at other frequencies proved to be satisfactory.

There are several choices for the type of low-frequency analyzer. The best choice seems to be the FFT type because it provides the greatest versatility in bandwidth choice and averaging availability. FFT type analyzers offer several window functions but the equivalent noise bandwidths may not be made clear. They do however provide a noise density function that displays noise in a 1 Hz bandwidth. For our example we used the spectrum display mode to measure reference and distortion magnitudes and the noise density mode to measure noise levels. The window function chosen was "flat-top" because it provided best accuracy when measuring the reference.

For composite distortions, calibration is done by inserting a carrier on the measurement channel, 100% amplitude modulated by a 1 kHz square wave, and recording the magnitude of the 1 kHz at the audio analyzer. The carrier is now removed, all other carriers are modulated, and the magnitude of the 1 kHz is again measured. One half the difference in dB (a negative number) - 2.5 dB is the composite distortion. Figure 2 shows the results of actual measurements on a typical amplifier.

For crossmodulation, calibration is done by inserting a carrier on the measurement channel, 100% amplitude modulated by a 15.750 kHz square wave, and recording the magnitude of the 15.750 kHz at the audio analyzer. All carriers are now modulated with 15.750 kHz except the test channel which is operated CW. The magnitude of the 15.750 kHz is again measured. The difference in the measurements (a negative number) - 6 dB is the crossmodulation.

Although the measurements and analysis presented here are for a single device, the technique is applicable for any combination or cascade of components. **CT**

References

[4] S. N. Van Voorhis, *Radiation Laboratory Series*, McGraw-Hill, 1948; *Microwave Receivers*, Volume 13, pages 210-212.

[5] Matrix Test Equipment Inc., Model SX-16 Multiple

REPLACEMENT FERRO fits most manufacturers cabinets

The Performance Model FR2000 60V/16A Ferroresonant power supply is designed to replace or retrofit discontinued and obsolete power supplies. It fits most existing cabinet configurations and connects using existing wiring. Price is $295, call 800/279-6330.

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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 $230. Order today, call toll free 800/279-6330

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We Promise you Reliability.
We Promise you Quality.
We Promise you Service.
We Promise you Value.

It's all part of our tradition...

Since 1985 we have been dedicated to these principles. From the beginning our goal has been to create a power supply that was, first and foremost, dependable. That has become our abiding tradition...one we renew each and everyday.

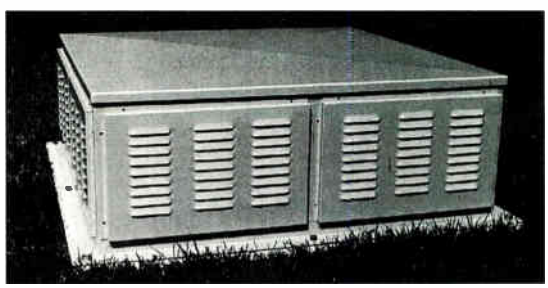

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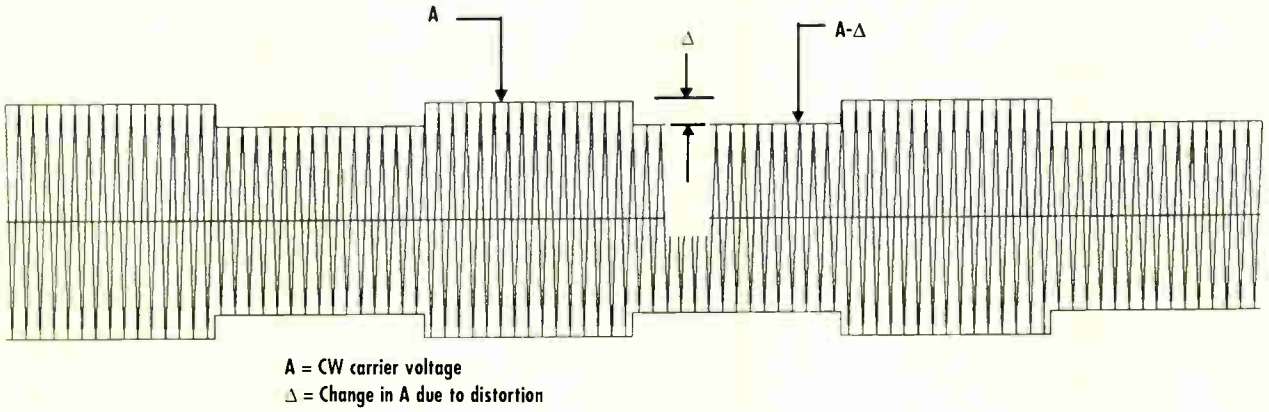
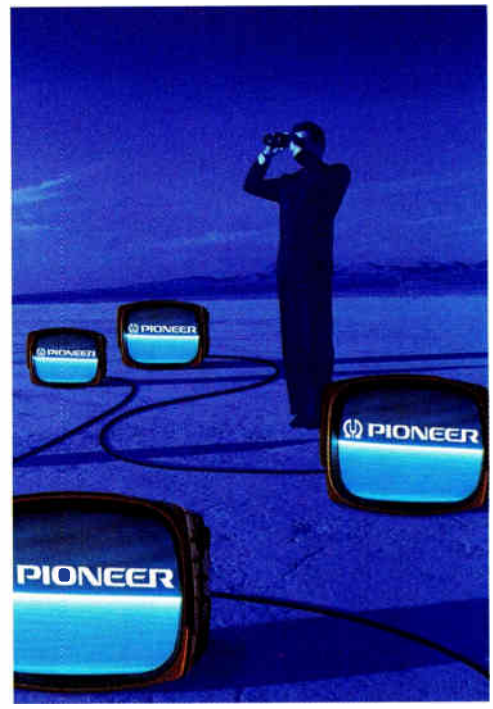
Figure 3: A carrier with some cross modulation



Frequency Signal Generator data sheet.
[6] Hewlett Packard, Model 8590 Portable Spectrum Analyzer, Table 1-2 characteristics.
[7] Stanford Research Systems Inc., Model SR 760 FFT Spectrum Analyzer operating manual.
[8] Analog Devices, data sheet part number AD834, *Design-In Reference Manual,* 1994.
[9] Matrix Test Equipment Inc., Model SQ1, Mean Square Module data sheet.
[10] Hewlett Packard, Application Note 150-4, Spectrum Analysis ... Noise Measurements, April 1974, page 8.
[11] Mischa Schwartz, *Information Transmission Modulation and Noise*, McGraw-Hill, 1959, pages 164-165.
[12] Merril I. Skolnik, *Radar Handbook*, McGraw-Hill, 1970, pages 38-14, 38-20.
[13] *NCTA Recommended Practices For Measurements On Cable Television Systems*, Second Edition, pages I.B.3, 5 and 6.

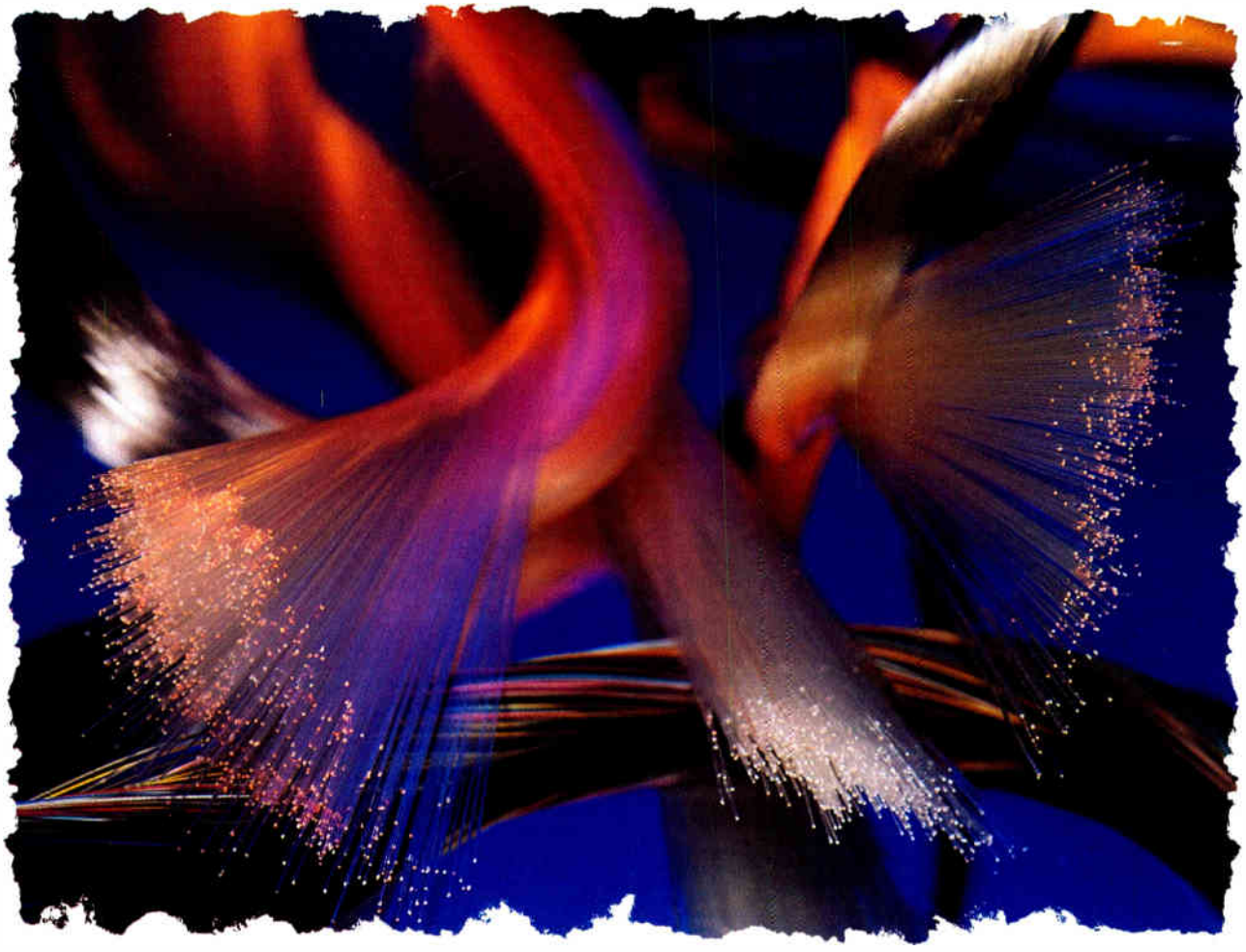
WE PIONEERED INTERACTIVE CABLE TELEVISION IN 1977. SINCE THEN, WE'VE ALWAYS HAD A VISION OF THE FUTURE.



Our commitment to the cable industry began nearly two decades ago. In fact, Pioneer introduced the world to interactive cable television back in 1977 with the first two-way addressable terminal. And over the years, we've worked closely with our operator partners to deliver products. Not promises. Today, as we enter the unpredictable era of digital communications, Pioneer is again poised to lead the way. Delivering on a promise of superior engineering, superior products and superior service. If you're looking for a cable partner with a vision towards the future, come to Pioneer. PIONEER®

Northeast, 201-236-4186; Southeast, 614-777-7260; Mid-Atlantic, 614-777-7258; Central, 614-777-7257; West, 310-952-3063.

Reader Service Number 192



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ALCATEL

By Keith R. Hayes

BCT/E Certification: Part 2

This is the second in a two-part article discussing the Society of Cable Telecommunications Engineers Broadband Communications Technician/Engineer (BCT/E) Certification Program. Part 1 ran in the June issue of Communications Technology on page 154.

The basics behind BCT/E references is: Bring 'em. Know 'em. Use 'em. The more the merrier. Some categories require such a broad range of knowledge that you may need four or more reference sources for access to most of the formulas, calculations or standards you might need.

"Don't just study the areas you think are applicable to the tests. Read the whole darn thing!"

Bring what you need to a particular exam, but you *must* know where to find it. For example, it's probably a waste of time looking up third order distortion formulas in the *NAB Engineering Handbook*, just like you won't find satellite/TVRO calculations in Ken Simons' *Technical Handbook*. Think you know the frequency of the colorburst of channel T4 HRC? Don't guess. Look it up and validate your assumption.

As you gain access to reference materials, don't just study the areas you think are applicable to the tests. Read the whole darn thing! You will be surprised what

Keith Hayes is director of operations for Vanguard Cable Corp. in Atlanta. He is certified by the Society of Cable Telecommunications Engineers in both its Broadband Communications Engineer and Broadband Communications Technician programs.

WOMEN IN TECHNOLOGY AWARD NOMINATION FORM

This award is co-sponsored by the Society of Cable Telecommunications Engineers, Women in Cable & Telecommunications, and Communications Technology.

Objective:

The annual Women in Technology Award will recognize and honor leading women in technology positions within the cable and telecommunications community, and will create visibility for all women in technical careers within the industry. Each year it will identify and acknowledge the achievement 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.

Eligibility:

- ☞ Open to all women in a technical field of cable TV and telecommunications
- ☞ Current national SCTE member
- ☞ Current national WIC&T member
- ☞ Demonstrates meaningful contribution to the industry
- ☞ Exhibits high level of knowledge, skills and professionalism
- ☞ Commitment to community and/or professional activities that serve to enhance the perception of the cable industry in general, and women in technology specifically
- ☞ BCT/E program involvement or equivalent

To nominate a person for this award, please provide the following information:

Name of Nominee: _____
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Address: _____
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_____
Telephone: _____ SCTE Member#: _____ WIC&T Member#: _____

Why are you nominating this person? (Attach additional sheets if necessary.)
_____
_____
_____
_____

Name of Nominating Person: _____ Title: _____
Company: _____
Address: _____
Telephone: _____ SCTE#: _____ WIC&T#: _____

Mail or fax to be received by October 1, 1996, to: Bill Riker/SCTE
669 Exton Commons
Exton, PA 19341
Telephone: (610) 363-6888
Fax: (610) 363-5898

you will learn. As an example, in the *NAB Engineering Handbook*, you will find an excellent reference for lightning protection, and in *Broadband Coding...* by Bernhard Keiser, there is an excellent description of video coding and digitization. All of a sudden a Category III reference can be used for Category II.

Formulas: CTB, cross-mod, look angle, distance and bearing, picoJoules to megawatts, you will find that all that math you hated in high school and college will pay off now, once you extract it from the cobwebs in your head. Maybe you'll even figure out that plain and spherical geometry and trigonometry really are two different things, and that pies aren't round, $\prod r^2$! (I know that's old!) You not only need to know where to find the formula, but how to work it. Practice! One thing I found helpful on some of the more intricate equations was preparing a step-by-step worksheet to help solve the problem rapidly. Also know the relative ranges where the answer should be. If you solve a geosynchronous TVRO/satellite slant range problem and the answer comes out to 13,000 miles, you can be sure that either you solved the problem incorrectly or that you are definitely not looking at a bird in geosynchronous orbit.

Calculator: Your formula says arcTangent. Your calculator key says Tan-1. What to do? How do you use parentheses? Here's a good one: How do you prove to the proctor that all memories are cleared? My suggestion would be to practice likely calculations and have your calculator's instruction manual with you during the examination. After all those other reference books, the weight of this little dude won't matter much. If you live on the borders of paranoia, you might even bring two calculators in case Murphy's Law presents its ugly head and sucks the life out of your brand new battery.

"You not only need to know where to find the formula, but how to work it."

The testing process

I have heard frequent comments regarding the difficulty in finding exam times and nearby locations. On average, I was able to track down an exam location every other month. Following are a couple hints that may speed you through the tests.

Go local first: Obviously the first place to start is your local SCTE chapter. If the exam times, places and dates don't fit your schedule, contact the chapter's board of directors and ask if they will consider changing them or offering them more frequently. My local chapter, the Chattahoochee Chapter, has offered tests on Saturdays. Maybe your chapter would consider offering them at night.

Regional: The SCTE has a lot of chapters and meeting groups. Many parts of the country are within a four- to six-hour drive of two or more meeting locations. Hopefully you can take the time off work (really no more than attending a local chapter meeting) to go on a test-taking road trip. (Somehow I don't think this is what they had in mind in *Animal House!*) Also check with your state and regional Cable Television Association to see if tests will be offered at state and regional shows.

For those of you who are too far from a chapter, give SCTE a call. They will provide proctors anywhere in the country if there are 15 or more who wish to test.

The best place to get in your test-taking time with the least effort is Cable-Tec Expo. Tests usually are conducted on two different afternoons during Expo, and on a Saturday morning either before or after the show. You literally could take all seven tests at

TOPLESS SPLITTERS

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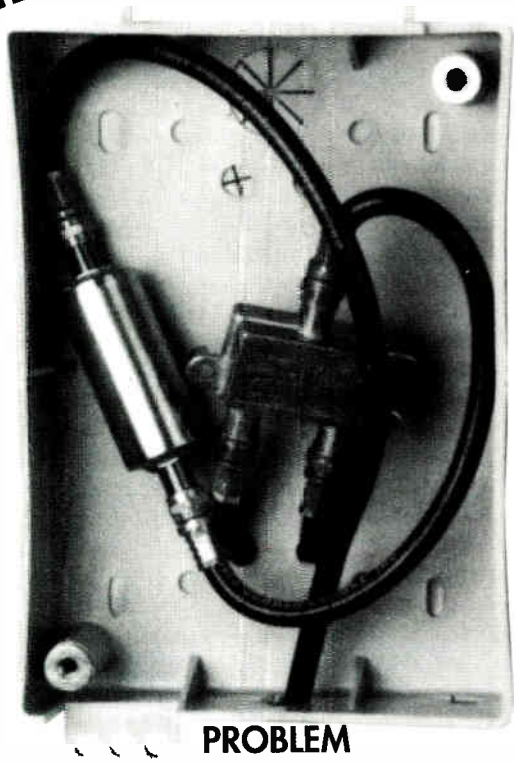
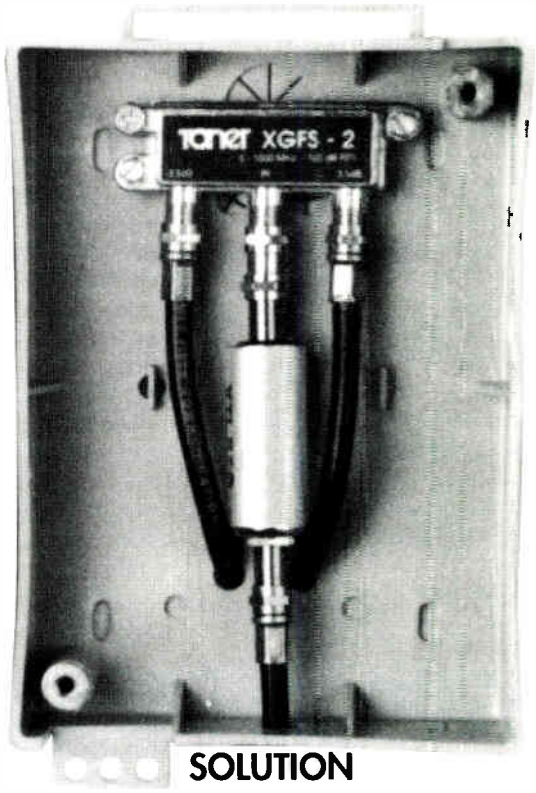


PROBLEM



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one Expo if you were prepared. Often, tutorials on one or more of the BCT/E categories are presented at Expo, so you can get in a last-minute refresher course.

Maintaining certification

One of the key assets of the BCT/E program is its requirement that participants continually acquire knowledge to remain certified. This increasing knowledge is demonstrated by acquiring recertification units (RUs) for the triennial recertification requirement, which can come from national/chapter membership, presentation of programs at chapter/regional meetings, and attendance at seminars to name a few. See the 1995 *Interval* for more in-depth information.

According to the *1995 SCTE Membership Yearbook*, almost 17% of certified technicians and engineers have failed to meet requirements and become uncertified. Don't make the mistake of assuming one test certifies you for life, either at a category or complete level. Recertification revalidates all of the hard work you put into testing.

In brief, 12 RUs are required for technician recertification, and 21 RUs are needed for engineers. If you are a chapter and national member, at one RU/year each, you are 28% of the way toward engineer recertification and 50% of the way toward technician recertification. Add two chapter meetings or Expo/Emerging Technology days per year, at one RU each, and you've got the technician recertification wrapped up, and have met more than 70% of the engineer recertification requirements. A couple of additional meetings, a presentation or an article will wrap it up.

Certified: A closer look

There are 130 certified engineers (about 1% of the Society's membership), 395 certified technicians (a little over 3%) and 65 folks (about 0.5%) who have certified at both levels.

While the composite is interesting (e.g., there have never been more than 25 engineers or more than 75 technicians certified in any one year), what is really neat is the diversity of backgrounds, employers and responsibilities of the participants: corporate engineers, research scientists, technical managers, headend techs, line techs, etc.

The relatively low number of completely certified engineers and technicians somewhat belies the interest in the program. In fact, more than 4,800 of the Society's members have enrolled in the program, more than 32% of the Society's membership, a number that is growing each year.

Several different areas, such as line/maintenance tech, can benefit from completing certification in one or more categories, but not necessarily the whole process. Look at yourself, your current responsibilities, your future goals, and decide what is best for you.

One change that was made recently to the program needs to be remembered, though. Prior to

1995, there was no time limit on the testing process. You could take one test, wait five years before testing again and gain certification. Now candidates are required to meet the recertification requirements discussed earlier if three years elapse in their certification participation.

A word to management

I have often wondered why many of the industry's known leaders have not pursued certification. It was good to see that SCTE's current chairman, John Vartanian of Viewer's Choice, was certified recently as a BCE. Here is a challenge to the leaders of the broadband engineering community: Practice what you preach! Your company's technical ads seek BCT/E certification. Shouldn't you lead by example?

Why should system or company management support BCT/E certification? This is a many faceted question with no one answer for every situation. In a variety of situations BCT/E certification not only can, but will, be beneficial to company performance.

The small system: You pass 1,000 homes on a lake and have 720 customers. One tech does it all. You ask yourself, how can the time away from work and the hundred plus dollars of registration and testing fees ever repay themselves? Well, let's look at one example: Your longest trunk run (underground, of course) develops an intermittent low frequency rolloff between the first and second amps, affecting more than 50% of your subscribers. Because you are small, you don't have a TDR, so you are facing the prospect of calling in a consultant with a $200 minimum to determine the problem. As you consider the impact on your cash flow, and the fact that the consultant probably won't arrive until after the big football game is broadcast on Channel 2, your tech arrives from yet another walkover of the intermittent span. He informs you that he couldn't find any signs of digging, and has respliced both connectors again.

All of a sudden, you see his face brighten up. He tells you that he just remembered a formula for determining distance using voltage drop that he learned while studying for the Category IV exam. He gets the VOM out, makes the measurement and calculates, and determines that the problem must be in the last 200 feet of the run. He goes out, digs up a 10-foot section, and finds a bad splice. Some new cable, connectors, and heat shrink, and you are back in business. Darn good investment.

The big system: You are battling an overbuilder who keeps stealing your best techs with offers of higher salaries. You can't justify increasing your entire salary base, because it will hurt cash flow without increasing productivity. What to do?

The BCT/E program is inexpensive, basically self-taught education that increases tech performance. Maybe this is the answer.

You create a bonus program that pays your techs $100/com-

pleted category, then bump up their salary $1.00/hour upon full certification. It doesn't take long before you start to see results, as problems decrease, customers are happier, and market share increases. Your MSO congratulates you on your competitive response and success.

The manufacturer: You are an amplifier and passive manufacturer, and are in a dead heat for being awarded a 1,000-mile rebuild. You know your product performs well and is priced competitively with your competition. You've got to find an edge to convince the buyer to go with you.

You assemble your engineering staff and ask for the thousandth time, where do we have an advantage? One of your engineers, the only BCE, suddenly says, "I saw a reliability formula last week as I was going through some of my reference material. Let's look at their MTBF numbers vs. ours, and factor in the new longer life capacitors we are using in our power supplies." He runs the numbers, and you are able to go to the buyer and convince him that your equipment will last significantly longer than the competitor's. Sale closed.

New industry entrants: Your company just decided to move out of a computer environment into the broadband industry with an Ethernet-speed broadband modem. How do you convince the engineers and the corporate offices that you and your company know what you are doing? Having some certified BCTs or BCEs on your technical staff certainly couldn't hurt.

A word to BCEs and BCTs

You've completed the long road to certification and are making plans to start documenting your recertification requirements. What to do next?

Consider keeping your knowledge fresh by passing it on to other technical folks in the industry, maybe by providing training classes at your company. If you are a BCE, become an authorized BCT/E tutor and proctor, thereby helping others succeed. Try authoring a paper for a technical journal on a subject you found difficult while studying for the exams, or help a friend study. Whatever it is, do it.

You BCEs may consider joining one of the category working groups, or the curriculum subcommittee that I chair to further improve the BCT/E program. The rewards from helping others succeed are at least as good, if not better, than succeeding yourself. Give back a little of what you have been given.

Applicability to other industries

BCT/E certification cuts across the many industries that are converging on telecommunications. LMDS/MMDS operators will definitely use most of Category III as well as others, data networking companies would benefit from Category V, and production houses will see the necessity of Category II. Don't assume that certification is not for you if you are not directly in the broadband industry.

Conclusion

While the process was intense and frustrating at times for me, and I imagine for most participants, it was also fun, worthwhile and rewarding. It gave me an incredible sense of satisfaction to demonstrate I was one of a few to complete the certification process. What an incredible thrill to put BCT or BCE, or both, on your business card!

On your mark, get set, study! See you in the ranks of the certified! **CT**

The author wishes to thank Marv Nelson, SCTE vice president, technical programs, for his review of this paper.

References

[1] Society of Cable Telecommunications Engineers, 140 Philips Road, Exton, PA 19341-1318, (610) 363-6888 or (800) 542-5040.

[2] SCTE *Interval*, June 1992.

[3] SCTE *Interval*, June 1995.

[4] Kuhns, Jim, "BCT/E Category III Tutorial," *1995 SCTE Cable-Tec Expo Technical Papers.*

Cable preparation tools for the reel world

It's a fact:

Installers prepare all types of telecommunications and CATV cables faster, more accurately and safely with Ripley Tools than with old-style knives. They're durable, American-made tools for both universal uses and one-of-a-kind applications. So get on a roll with Ripley. Call today for a free Ripley catalog 1-800-528-8665.

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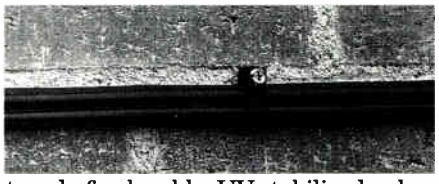
Reader Service Number 205

Cable clip

Whether attaching single or dual cable, with or without messenger or ground wire, Telecrafter Products says its new Flex Clip will provide long-lasting, damage-free holding power in virtually all drop installations.



This adaptable cable clip, manufactured of a durable, UV-stabilized polyethylene, wraps around the cable, adjusts to size and clamps into place without crimping or damaging the cable. A combination slotted Phillips hex-head screw is preinserted into the Flex Clip, making attachment quick and easy. The clip is available with screws in two lengths, 1/2-inch or 7/8-inch screw-in depth, for secure cable installations on any surface.
Reader service #312

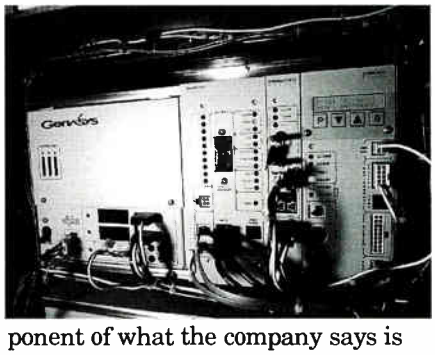
Configuration software

TriSetup from Trilithic is a new Windows-compatible software that allows a technician to use a PC to configure any of the company's Tricorder II, III or III-VIA. The software is said to ensure that every Tricorder in the system is set to the same leakage frequencies, contains the same learned channel plans, user memories and all other configuration parameters.

The operator uses TriSetup's keyboard routine to assemble a configuration that meets system requirements, then dowloads the configuration to the Tricorder at the click of a mouse. Multiple configurations can be saved to disk for later use, and the user can upload a configuration from one Tricorder and "cross-pollinate" the information into others.
Reader service #300

Power supply

Alpha Technologies announced the Genasys line of system solution power supplies. The units are the core component of what the company says is the industry's first fully integrated, multiredundant power system.



Designed to meet centralized node power requirements from 1,350 to 8,000 W, the units incorporate uninterruptible power, user-selectable output voltages, complete modularity and

"We really aim to please our subs, so we shoot the lines every three months."

— P. "Taz" Bartlett
Technical Operations Manager, Harron Cable, New York Region

"Every quarter we test our fiber optic COAX system and compare current trace signatures to the originals to spot problems before our subs view them. We're shooting Laser Precision's mainframe and Mini-OTDRs, which let us pinpoint faults, too.

"Their OTDRs help us prevent and solve problems—real fast. Once, after we got a loss-of-signal indication, our repair crew was at a customer's burning house before the firemen put out the blaze!"

Harron looks like heroes to their subs.

Harron Cable, an MSO, is unbelievably dedicated to customer service. When they recently rebuilt their entire Utica, NY system, everything was state-of-the-art—including their fiber optic test equipment.

"I couldn't imagine running a quality cable company without Laser Precision OTDRs," added Bartlett.

For over two decades we've made nothing but fiber optic cable test equipment to help the CATV industry look good. Literally.

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several enclosure packaging options. This flexibility supports efficient operation within a current network while allowing the powering component of the system to grow incrementally with the addition of expanded services and increasing subscriber penetration.

Genasys can be configured with primary and secondary utility grid inputs, standby batteries and a fully integrated engine generator, providing up to four independent sources of input power. The system's integrated design allows seamless, automatic transfer between these input power sources, ensuring clean, reliable uninterrupted output power.

Complete input and output isolation provide the industry's best surge and lightning immunity, according to the company. Hot-swappable modules, front panel connections and test points allow simple on-line maintenance. The system is designed for the future, built to support expansion and easy to upgrade.

Reader service #311

Relay interface

Norscan's 2000 relay interface units create maximum efficiency for rack-mounted office tone location

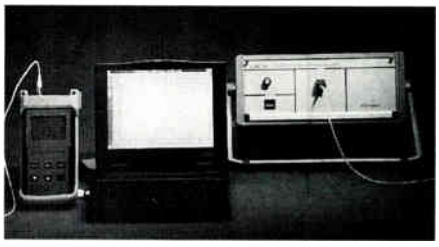
transmitters and cable monitoring systems. In normal operating mode, the unit effectively grounds the cable armor, per NESC code, while allowing cable monitoring signals to pass.

When remotely activated, the switch allows tones generated from rack-mounted equipment to be placed on the armor, allowing for remotely activated tone and fault location. The unit also allows the tone to be switched to any one of four individual cable armors, allowing the maximum automated use of the office-mounted tone generator.

Reader service #310

Optical fiber analyzer

EXFO E.O. Engineering introduced the Gap PMD II analyzer for testing polarization mode dispersion (PMD) in optical fibers.



The deployment of higher bandwidth transmission equipment can be limited by the performance of fiber cables. Information transmission at such speeds can limit the propagation of the optical signal in the fiber itself. This may limit the sensitivity of the receiver and the efficiency of the network by creating distortion and high error rates. This limitation, called PMD, is mainly due

DWDM TESTING NOW BELONGS IN THE FIELD WITH EXFO

DWDM optical transmission technology and multi-wavelength network design call for a radically new type of instrument. To test networks as they are being deployed, you need a sophisticated optical spectrum analyzer (OSA) that is built to operate reliably

Answering this challenge, EXFO has applied its test equipment engineering expertise to develop the **world's first truly field-portable Mini-OSA.**

Featuring field-proven ruggedness, portability, and ease-of-use, EXFO's dedicated OSA module answers the requirements for large scale DWDM system installation where it counts: outside of the laboratory.

Designed as a cornerstone of the **FTB-300** Universal Test System, the OSA module complements the selection of test components that includes

- **OTDR**
- **automated loss/ORL test set**
- **visual fault locator**
- **optical switch**

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EXFO Electro-Optical Engineering

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MAIN OFFICE, 465 Godin Avenue, Vanier, Que., Canada, G1M 3G7 Tel.: 418-683-0211, Fax: 418-683-2170

to the dispersion of the two fundamental polarization modes of the lightwave propagating in the fiber-optic cable. As such, the cable must be carefully characterized in order to control, minimize or improve the PMD limitation.

The analyzer, with a convenient hand-held source, is the fiber solution for these high-speed communication networks. Its PMD range, 0.1 picoseconds (ps) to 100 ps, makes the unit ideal for all types of measurements, both in the factory and in the field, according to the company. The unit is portable, fast and vibration-resistant.

Results can be viewed and stored on the notebook computer. They are expressed in the form of an interferogram onto which a Gaussian fit is performed automatically, thus eliminating the need for any operator calculations. Two values are expressed: the total measured PMD in the fiber (in picoseconds) and the normalized value (PMD/km).

Reader service #309

Spectrum analyzer

Tektronix's 2715 portable spectrum analyzer now features digital channel RF measurements. With the new software and digital RF measurement feature, the unit is a powerful RF test and FCC proof-of-performance tool for cable TV and telecom system operators planning to add digital channels or other digitally modulated video services.

Measurements include: digital channel averaged power, which verifies transmitted signal level by measuring the averaged power across the bandwidth of the digitally modulated carrier; desired-to-undesired signal power ratio, which provides information about transmission path quality by comparing modulated signal power to intermodulation distortion and noise distortion power in the channel; and adjacent channel leakage, which verifies spectral integrity of digital modulators by comparing signal leakage into adjacent channels to the test channel's averaged power.

Reader service #308

ASCI modulator

Stanford Telecom introduced the STEL-1108 modulator chip for hybrid fiber/coax cable TV networks. The new chip is a key component in the transmission of digital video, telephone and data from subscriber premises (homes, business, etc.) to CATV headend equipment.

Building on the success of the previously issued STEL-1103, the chip provides better performance in clock rate, duty cycle and burst capability, along with lower power consumption. Among other improvements, the STEL-1108 can operate in continuous mode, allowing use for both burst and point-to-point systems.

The STEL-1108 is a complete QPSK modulator on a single chip that features clock speeds up to 126 MHz. It operates at up to 12.6 Mbps in QPSK mode. A 126 MHz quadrature NCO provides digitally modulated carriers from DC to 50 MHz continuous mode, which simplifies upconversion of signals to higher frequencies. The device incorporates dual 32-TAP

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You want **versatility.** Masterack modular construction allows you to design a service vehicle to fit your own needs. Pre-planned interior kits, ladder racks, and a full line of accessories are available. You want **dependability.**

Masterack equipment is proven day and night, through many years of rugged service. Whether you need to upfit one vehicle or one hundred, our goal is complete customer satisfaction. You want **value.** Masterack equipment is economical because we manufacture parts for thousands of users and we stock parts so you can quickly get yours. For innovative, quality products and complete installation services combined with custom design services and in-stock pre-planned vehicle interior systems, **you want Masterack.**

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Reader Service Number 90

FIR filters that are programmable for digital spectral shaping, and interpolation filters that eliminate unwanted alias energy. In addition, the unit can operate in burst or continuous mode. The device is contained in an 80-pin PQFP surface-mount package.
Reader service #307

Splitter

Harmonic Lightwaves' HLS 1000 Series splitter can be custom-configured into a variety of split ratios, allowing one transmitter to supply up to 16 separate nodes or receivers, at power levels optimized for the operator's application. Splitters can be custom-made for each application, which allows for maximum system performance and lowest system cost. In addition, each unit is individually tested and labeled with its measured loss.

In conjunction with the HLS 1000 Series, the company also announced the HLP 1000 fiber/component management platform that provides easy access and modularity in a convenient rack-mount unit. With removable front and rear doors, and top and bottom fiber access, the HLP 1000 is designed to hold up to 72 ports for fiber distribution and 72 splices.
Reader service #306

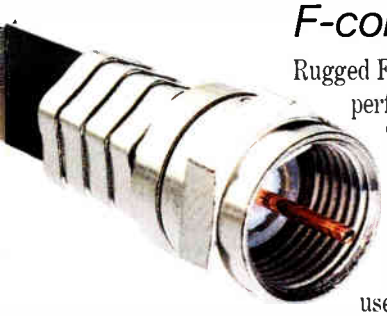
Trunk EDFA

ATx Telecom Systems announced its Javelin 1550 Series 40-trunk erbium-doped fiber amplifier (EDFA). Based on 980 nm technology, this high-performance unit offers low noise and compact packaging at the lowest cost per dBm available, according to the company. This EDFA has an output power range of +13 to +15.5 dBm and enables future upgrades of an architecture such as narrowband wave division multiplexer.

The unit's efficient optical amplification of broadband multicast signals, combined with the low cost of the unit, results in a significantly reduced cost per node. The unit can be deployed in conjunction with other Javelin Series products, including the Javelin 1550 transmitter, the Series 30 Transmit EDFA, and the Series 10 distribution EDFA.
Reader service #305 →

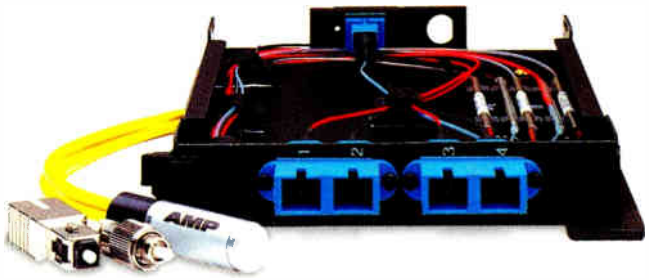
Wherever there's cable, there's AMP to manage it, terminate it, and keep it on the job.

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



F-connectors

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

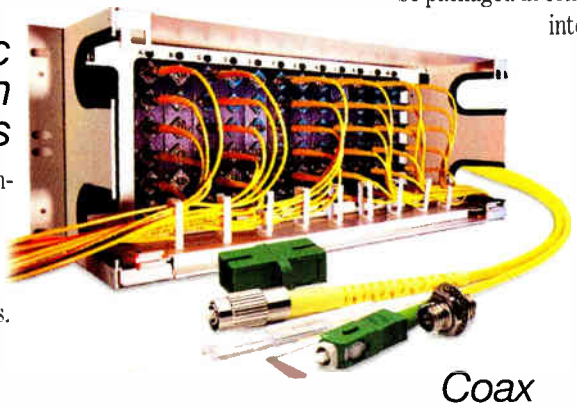


Fiber Optic Control Devices

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

Fiber Optic Interconnection Devices

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



Coax Coupling Closures

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

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

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25	51	77	103	129	155	181	207	233	259	285	311
26	52	78	104	130	156	182	208	234	260	286	312

A. Are you a member of the SCTE (Society of Cable Telecommunications Engineers)?
01.__yes 02.__no

B. Please check the category that best describes your firm's primary business (check only 1):
Cable TV Systems Operations
03.___ Independent Cable TV Syst.
04.___ MSO (two or more Cable TV Systems)
05. ___ Cable TV Contractor
06. ___ Cable TV Program Network
07. ___ SMATV or DBS Operator
08. ___ MDS, STV or LPTV Operator
09. ___ Microwave or Telephone Comp.
10. ___ Commercial TV Broadcaster
11. ___ Cable TV Component Manufacturer
12. ___ Cable TV Investor
13. ___ Financial Institution, Broker, Consultant
14. ___ Law Firm or Govt. Agency
15. ___ Program Producer or Distributor
16. ___ Advertising Agency
17. ___ Educational TV Station, School, or Library
18. ___ Other (please specify)_____

C. Please check the category that best describes your job title:
19. ___Corporate Management
20. ___ Management
21. ___ Programming
Technical/Engineering
22. ___ Vice President
23. ___ Director
24. ___ Manager
25. ___ Engineer
26. ___ Technician
27. ___ Installer
28. ___ Sales/Marketing
29. ___ Other (please specify)_____

D. In the next 12 months, what cable equipment do you plan to buy?
30. ___ Amplifiers
31. ___ Antennas
32. ___ CATV Passive Equipment including Coaxial Cable
33. ___ Cable Tools
34. ___ CAD Software, Mapping
35. ___ Commercial Insertion/ Character Generator
36. ___ Compression/Digital Equip.
37. ___ Computer Equipment
38. ___ Connectors/Splitters
39. ___ Fleet Management
40. ___ Headend Equipment
41. ___ Interactive Software
42. ___ Lightning Protection
43. ___ Vaults/Pedestals
44. ___ MMDS Transmission Equipment
45. ___ Microwave Equipment
46. ___ Receivers and Modulators
47. ___ Safety Equipment
48. ___ Satellite Equipment
49. ___ Subscriber/Addressable Security Equipment/ Converters/Remotes
50. ___ Telephone/PCS Equipment
51. ___ Power Suppls. (Batteries, etc.)
52. ___ Video Servers

E. What is your annual cable equipment expenditure?
53. ___ up to $50,000
54. ___ $50,001 to $100,000
55. ___ $100,001 to $250,000
56. ___ over $250,000

F. In the next 12 months, what fiber-optic equipment do you plan to buy?
57. ___ Fiber-Optic Amplifiers
58. ___ Fiber-Optic Connectors
59. ___ Fiber-Optic Couplers/Splitters
60. ___ Fiber-Optic Splicers
61. ___ Fiber-Optic Transmitter/Receiver
62. ___ Fiber-Optic Patchcords/ Pigtails
63. ___ Fiber-Optic Components
64. ___ Fiber-Optic Cable
65. ___ Fiber-Optic Closures & Cabinets

G. What is your annual fiber-optic equipment expenditure?
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H. In the next 12 months, what cable test & measurement equipment do you plan to buy?
70. ___ Audio Test Equipment
71. ___ Cable Fault Locators
72. ___ Fiber Optics Test Equipment
73. ___ Leakage Detection
74. ___ OTDRs
75. ___ Power Meters
76. ___ Signal Level Meters
77. ___ Spectrum Analyzers
78. ___ Status Monitoring
79. ___ System Bench Sweep
80. ___ TDRs
81. ___ Video Test Equipment

I. What is your annual cable test & measurement equipment expenditure?
82. ___ up to $50,000
83. ___ $50,001 to $100,000
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85. ___ over $250,000

J. In the next 12 months, what cable services do you plan to buy?
86. ___ Consulting/Brokerage Services
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88. ___ Repair Services
89. ___ Technical Services/ Eng. Design
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L. Do you plan to rebuild/ upgrade your system in:
95. ___ 1 year
96. ___ more than 2 years

M. How many miles of plant are you upgrading/ rebuilding?
97. ___ up to10 miles
98. ___ 11-30 miles
99. ___ 31 miles or more

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99. ___ 31 miles or more

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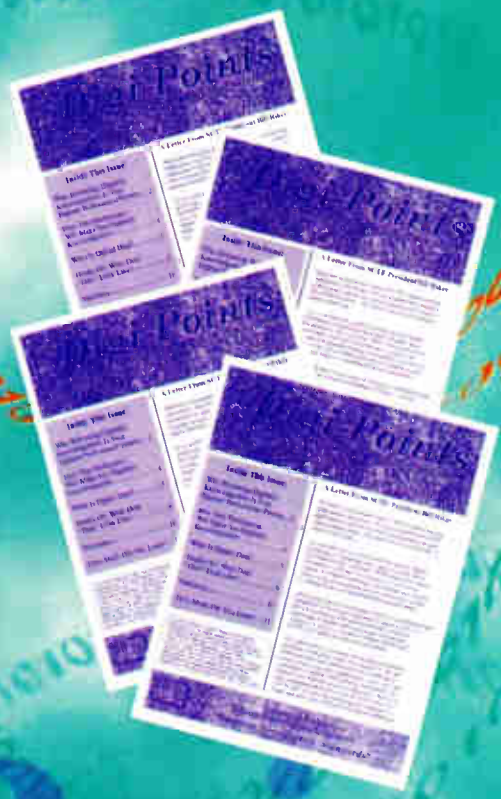
SCTE has created a new publication, *Digi-Points*, to help you become more proficient in digital technology. This vital new technology is impacting every aspect of cable, from the headend to the subscriber, and will enable us to deliver many of the new products and services needed to remain leaders in broadband telecommunications. *Digi-Points* directly addresses Category V of SCTE's BCT/E Certification Program, "Data Networking and Architecture," and will help you achieve certification in this category. Subscribers will receive 12 monthly issues of *Digi-Points*, along with a full-size binder for your collection, for only $60—just $5 an issue! So don't miss your chance to stay on top of digital technology—order *Digi-Points* today!



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EDITOR'S LETTER

Hope for a happy new year

Well, let's hope we fare better in 1997 than we did in 1996. Let's hope this year, when cable engineers begin to test and evaluate even newer equipment and ideas, the industry spokespeople won't descend on Wall Street to sell our research and development efforts as something just over the horizon, again.

If we learned anything in 1996, it should be that we can't simply shout to the world that we can provide new services, such as digital TV, data transmission or telephony, without also shouting the fact we also need the time to design around specifications and standards. And we must train a nation of "cable TV" technicians to become a nation of "telecommunications" technicians.

As we move closer to the end of this century, the work of the engineers and technicians in the cable telecommunications industry becomes more important to the careers of everyone in our business. With all of the "bad press" generated by Wall Street hand wringers, we can take pride in the composure within CableLabs, the Society of Cable Telecommunications Engineers and the American National Standards Institute as they work in concert to provide training, specifications and standards—determined to provide full-service networks that will interface with all segments of the communications world.

Our engineers are working feverishly to provide the services needed in the future. But they will not "rubber stamp" the use of equipment, platforms, compression methods, protocols or systems that will create chaos in the marketplace.

Let's get behind them. Let's make sure MSOs and independent systems belong to CableLabs. Let's check to see how many of our technicians and installers belong to the SCTE, how many installers are certified, and how many engineers and technicians are SCTE Broadband Communications Technician/Engineer (BCT/E) certified. Ask how many of your own system personnel are enrolled in a National Cable Television Institute course.

"Let's hope we fare better in 1997 than we did in 1996."

There's lots to do in 1997. If you want to court Wall Street, go ahead. But cable's research and development is dedicated to producing proper services and equipment with which to woo the public.

Thanks to the engineers and technicians of our industry for keeping us moving forward during the tumultuous year of 1996. And best wishes to us all for the coming year.

Rex Porter
Editor

drop trimmer

Ripley announced a Cablematic tool to save time and reduce tool costs for drop cable installation. The universal drop trimmer (UDT) has interchangeable blade cassettes that perform cable industry standard preparation to Society of Cable Telecommunications Engineers and Bellcore specifications: 1/4-inch braid preparation for Series 59, 6, 7, 11 cables and 1/8-inch braid preparation for Series 59, 6, 7, 11 cables.

Eight color-coded cassettes are clearly marked with the cable series type and braid preparation dimensions for easy identification and are available for Series 59 /6 (standard, tri- and quad-shield cable); Series 7 (standard, tri- and quad shield cables); Series 11 (standard, tri- and Trilogy quad-shield cable); and Series 11Q (Belden, Comm/Scope and Times Fiber quad-shield cables).

The UDT is supplied with two cassettes assembled in the tool while a unique storage compartment holds two extra cassettes. The tool's high-impact polymer construction is compact, lightweight and is furnished in high-visibility red. Blades are enclosed inside the cassettes to assure safety. No special adjustments of extra tools are required.

Reader service #304

Fiber-optic transmission

The Synchronous Group announced the Antares modular fiber-optic transmission system. Antares is designed to provide higher end-of-line performance with minimum fiber use. In addition, the modular design offers the service provider great flexibility in system design and configuration. Antares includes a new externally modulated transmitter (EMS) module and a companion erbium-doped fiber amplifier (EDFA).

The design allows the operator to configure a dual transmitter system, with each 750 MHz transmitter carrying up to 40 analog channels. The output of the dual EMS transmitters is combined in a decrease wave division multiplexer module and amplified by the EDFA. The entire signal is carried over a single fiber to the receiving location. Performance of the system results in received carrier-to-noise of 55 dB, composite second order and composite triple beat of -70 dBc and cross modulation of -65 dBc.

Antares also may be configured as a dual transmitter system with an internal optical switch for full backup and automatic protection switching. It also may be configured for operation as two independent transmission platforms.

Reader service #303

Splitter

RMS Electronics introduced its 16-way splitter/combiner for use in multi-dwelling installations that also can be used as a headend combiner.

The 9016K 1 GHz Plus splitter/combiner features performance from 5 to 1,000 MHz, with a frequency response better than +/-1 dB across the passband. It has a low-profile design with dual grounding points and F61 connectors with neoprene seals. The unit comes with the company's lifetime guarantee.

Reader service #302

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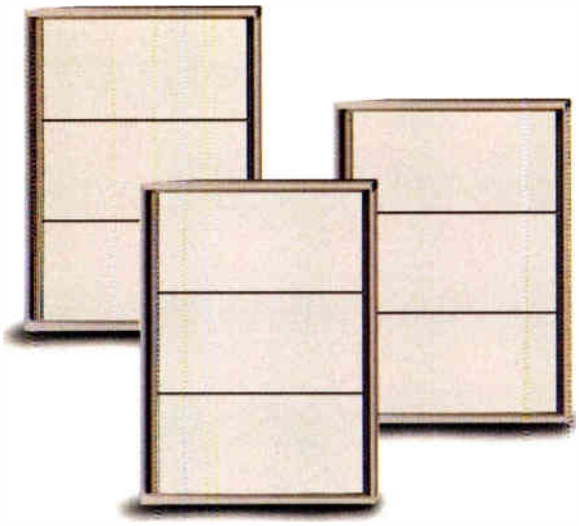

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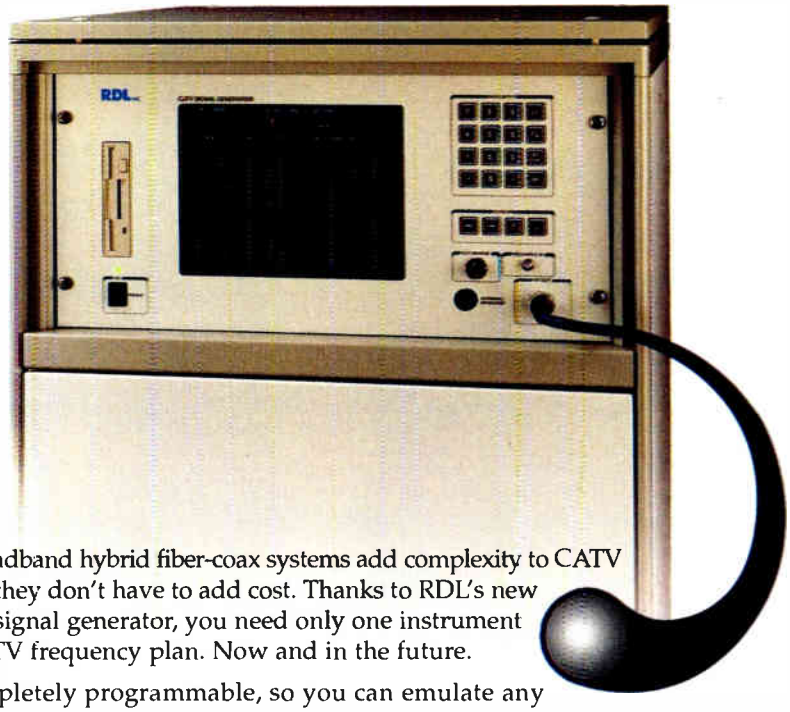

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The CSG includes IEEE-488 capability as a standard feature too, so it's as proficient in a large ATE system as it is in the lab. And only the CSG gives you the option to include the effect of carrier phase in CATV measurements, an essential tool if you're building amplifiers and other active components for HFC service. Best of all, the CSG is easily expandable, so you can buy an IRC generator today and inexpensively make it a PAL generator tomorrow.

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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.

☛ *Digital Compression*—This presentation featuring Bob Luff provides an introduction to digital video and compression. Topics include: weaknesses of analog NTSC video, why digital compression is necessary, intraframe compression vs. interframe compression, vector quantization concept, DCT (discrete cosine transform), how digital compression may be implemented cost-effectively in CATV systems, where will the digital signals be located in the frequency spectrum, what will the next generation of digital set-top converters be like, and digital audio. (105 min.) Order #T-1147, $45.

☛ *Extension Ladders*—This is a course designed to provide thorough and comprehensive instruction on the safe use of extension ladders. It includes segments on ladder positioning, transporting and carrying, securing, climbing and safety. Produced by the Atlee Cullison Training School. (35 min.) Order #T-1043, $145. *(Reference for Installer Certification.)*

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.

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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.

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08. ❑ MMDS, STV or LPTV Operations
9A. ❑ Microwave
9B. ❑ Telecommunications Carrier
9C. ❑ Electric Utility
9D. ❑ Satellite Manufacturer
9E. ❑ Satellite Distributor/Dealer
9F. ❑ Fiber-Optic Manufacturer
10. ❑ Commercial TV Broadcasters
11. ❑ Cable TV Component Manufacturers
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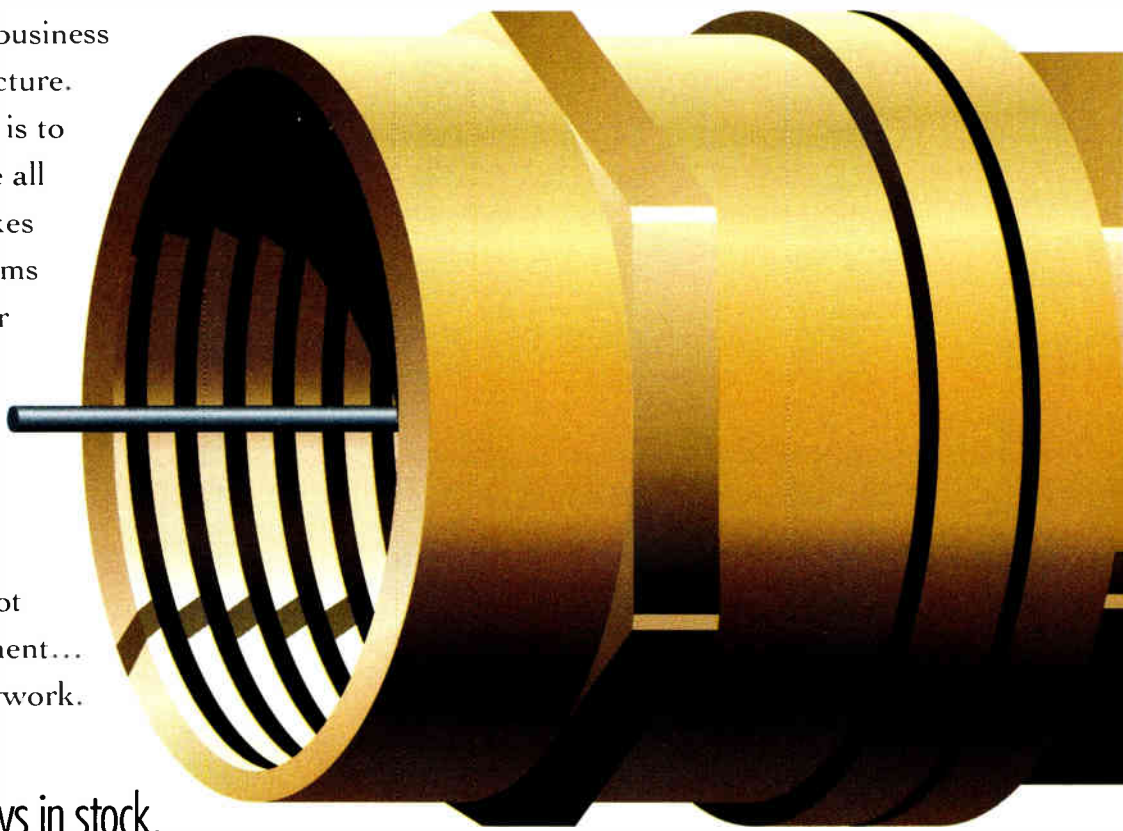

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Reader Service Number 151

September

9-12: The Light Brigade training course, fiber-optic design, installation and maintenance, San Francisco. Contact Lisa Johnson, (206) 251-1240.

9-20: FiberLight International fiber-optic technician training course, Estes Park, CO. Contact (970) 663-6445.

10: SCTE Desert Chapter seminar, basic troubleshooting, El Rancho, Beaumont, CA. Contact Bruce Wedeking, (909) 677-2147.

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

Planning ahead

Oct. 13-15: Atlantic Cable Show, Baltimore, MD. Contact (410) 266-9111.

Oct. 22-24: Mid-America Show, Kansas City, MO. Contact (913) 841-9241.

Dec. 11-13: Western Cable Show, Anaheim, CA. Contact (510) 428-2225.

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

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

10-12: SCTE Wheat State Chapter, BCT/E exams, Wichita, KS. Contact Joe Cvetnich, (316) 262-4270.

10-13: Antec Fiberworks seminar, "Fiber-Optic System Training," Antec Training Center, Denver. Contact Patricia Sturmon, (847) 439-4444.

11: SCTE Southern California Chapter meeting, Charter Cable Office, Alhambra, CA. Contact Tom Colegrove, (805) 252-5280.

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

11-13: Philips Mobile Training Seminar, Minneapolis. Contact (800) 448-5171.

11-13: Scientific-Atlanta technical course, "Operating Hybrid Fiber/Coax Systems," Atlanta. Contact Kim Davis-Mitchell, (800) 722-2009, press 3.

12: SCTE Satellite Tele-Seminar Program, "Painless Technical Writing (Part II)" and "Practical Technical Calculations Made Easy," to be shown on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Contact SCTE national headquarters, (610) 363-6888.

12: SCTE Greater Chicago Chapter seminar, BCT/E Category V tutorial, data networking and architectures, Hilton Hotel, Arlington Heights, IL. Contact Joe Thomas, (815) 356-6105.

12: SCTE Rocky Mountain Chapter seminar, status monitoring, Denver. Contact Mike Phebus, (303) 795-1699. →

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Reader Service Number 46

14: SCTE Cascade Range Chapter, BCT/E exams, Beaverton, OR. Contact Cindy Welsh, (503) 667-9390, ext. 226.
16-17: SCTE Regional Training Seminar, "Introduction to Data Communications," SCTE national headquarters, Exton, PA. Contact SCTE national headquarters, (610) 363-6888.
16: SCTE Old Dominion Chapter seminar, status monitoring and BCT/E Category I tutorial, signal processing centers, BCT/E and Installer exams, Richmond, VA. Contact Margaret Fitzgerald, (800) 231-0237.
16-19: The Light Brigade seminar, fiber-optic design, installation and maintenance, Los Angeles. Contact Lisa Johnson, (206) 251-1240.
17-18: SCTE Cascade Range Chapter second annual Northwest Tech Days and technical programs, Red Lion Inn, Kelso, WA. Contact Cindy Welsh, (503) 667-9390, ext. 226.
17-18: Broadband for Residential Customers seminar, Nikko Hotel, Atlanta. Contact (800) 647-7600.
17-19: General Instrument seminar, "Digital Network Engineering Training," Chicago. Contact Lisa Nagel, (215) 830-5678.
18: SCTE Golden Gate Chapter seminar. Contact Mark Harrigan, (510) 927-7060.
18-20: Philips Mobile Training Seminar, Detroit. Contact (800) 448-5171.
18-20: SCTE Regional Training Seminar, "Technology for Technicians II," SCTE national headquarters, Exton, PA. Contact SCTE national headquarters, (610) 363-6888.
19: SCTE Gateway Chapter seminar, BCT/E and Installer exams, Overland Community Center, Overland, MO. Contact Chris Kramer, (341) 579-4627
19: SCTE Penn-Ohio Chapter seminar, converging technologies, Sheraton Inn North, Pittsburgh, PA. Contact Marianne McClain, (412) 531-5710.
20: SCTE Chaparral Chapter meeting, TVI, Albuquerque, NM. Contact Rick Padilla, (505) 761-6290.
20: SCTE Piedmont Chapter vendor show and BCT/E exams, in conjunction with the Palmetto Chapter, Myrtle Beach, SC. Contact Mark Eagle, chapter voice mail: (919) 220-3889.
23-24: Antec Fiberworks seminar, "Compressed Video: Concepts and Transmission," Antec Technology Center, Atlanta. Contact Patricia Sturmon, (847) 439-4444.
23-25: SCTE Chattahoochee Chapter technical sessions, in conjunction with the Eastern Cable Show, BCT/E and Installer exams, Atlanta. Contact Johnny Ray, (770) 977-6916.
24: SCTE Desert Chapter, BCT/E and Installer exams, Colony Cablevision office, Palm Desert, CA. Contact Bruce Wedeking, (909) 677-2147.
25: SCTE New England Chapter, Installer exams. Contact Tom Garcia, (508) 562-1675.
25-27: Philips Mobile Training Seminar, Cincinnati. Contact (800) 448-5171.
25-27: HFC '96 workshop, high integrity HFC networks, jointly sponsored by SCTE and IEEE Communications Society, Ventana Canyon Resort, Tucson, AZ. Contact Anna Riker, (610) 363-6888.

SEE THE TRAINING COLUMN ON PAGE 92

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Reader Service Number 125

The return path — A quick quiz

With all the talk about cable modems, telephony and the like, the importance of a properly operating return path will become a necessity for any cable system looking to these services as new revenue sources. This month's installment is designed to test your knowledge on a variety of aspects involving the return path. The following questions have been culled from several lessons in NCTI's System Technician and Fiber Optic Technician courses. The answers will appear next month. © NCTI.

1) The return amplifier module
A) Is used during an unexpected loss of AC input voltage to the trunk amplifier station or trunk amplifier component failure.
B) Amplifies the forward frequencies (5 MHz to 300 MHz).
C) May have an equalizer located on the input or output of the return amplifier.
D) Receives data signals sent by the headend, converts these signals to amplifier station tests, and transmits the answers back to the headend for translation.
E) Both A and B.

2) In the return amplifier,
A) The B+ (OUT) voltage from the trunk module is monitored for loss of signal to the amplifier station.
B) The thermal-compensated gain control compensates for changes in return signal level due to temperature variations.
C) The return feeder switch allows the forward RF signals from the bridger diplex filter to combine with the forward trunk RF signals.
D) The high and low pilot carrier frequencies from the sampled trunk output signal are detected and routed back to the forward trunk amplifier to automatically adjust the gain and slope.
E) Both C and D.

3) Which of the following statements is true?
A) Pilot carrier frequencies are used by the return amplifier to monitor the and automatically adjust the trunk output levels.
B) The address switch identifies the amplifier station to the headend as one or more amplifiers in the system with that address.
C) The improvement of distortions in the return amplifier module is due to the higher levels of cable loss, the need for more amplifiers, and sending more channels upstream.
D) The return RF signals may be data (status monitoring signals and/or customer impulse pay-per-view buy signals) or a return video carrier signal.
E) Both B and C.

4) Reverse optical transmitters
A) Convert a reverse optical signal to RF signals.
B) From most manufacturers are not aligned at the manufacturing plant.
C) Have DC voltage test points with VDC outputs that are calibrated to an optical power level in dBm.
D) Have specifications that include channel capacity, transmitter optical input power level, and transmitter RF output signal level.
E) A and D.

5) The return path link
A) Provides one of the most common uses of rack-mount AM optical receivers.
B) Has an RF output that is supplied as an RF input signal to an optical laser in the OTN for signal distribution to optical nodes in the fiber serving areas.
C) May be installed in the headend to transmit the full bandwidth of 550 MHz AM VSB analog television signals or 860 MHz AM VSB analog and digital signals via FM optical signals to another headend.
D) Always has the return signals transmitted on a sepa rate optical fiber in a different optical cable than the optical cable that houses the forward optical fiber.
E) Both B and C.

6) The node status monitoring controllable function that allows pinpointing which node is transmitting return path signals with interference is the
A) Amplifier cover status.
B) Bridger switch.
C) RF amplifier module station mode.
D) Tamper switch.
E) Standby power supply conditions.

7) What is the optical power level in dBm for a reverse optical transmitter module when: 1) the module's DC voltage/optical power test point ratio is 1 VDC = 0.1 mW; 2) the test point measurement is 3.8 VDC; and 3) the optical power in dBm equals 10 log (test point voltage x 0.1)?
A) 5.80 dBm.
B) 4.20 dBm.
C) 0.38 dBm.
D) -0.38 dBm.
E) -4.20 dBm.

8) When connecting a rack-mount AM return path optical receiver,
A) Fusion splice an optical fiber pigtail to the desired return path optical fiber.
B) Connect the RF output cable to the receivers optical input port.
C) All optical receivers require an AC power cord, RF input, and optical output connections.
D) Connect the pigtail optical connector to the RF out put port.
E) Route the connectorized end of the fiber pigtail through the rear of the receiver's adapter chassis and connect it to the optical output connector.

9) The RF level limiter in a reverse optical transmitter module
A) Protects the laser against an RF input signal that exceeds a certain level.
B) Prevents the reverse RF signals from interfering with the forward RF signals.
C) Controls the optical output power level of the laser by compensating for temperature changes and slight variations in the received RF signal level.
D) Decodes monitored data and sends it to the PC for analysis.
E) Emits a modulated optical signal, usually 1,310 nm in wavelength. CT

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Reader Service Number 55

By Bill Riker

Get involved with your Society

As a Society comprised of volunteers, membership participation is vital to SCTE's momentum. The Society was established by our industry to serve the industry, and in this spirit of service, member participation is crucial in guiding the Society's future directions. One clear way of influencing our future is to serve on the Society's national board of directors. Nominations are now being accepted for the 1997 election. The seats that will be open are: Region 1—Serving California, Hawaii and Nevada; Region 2—Serving Arizona, Colorado, New Mexico, Utah and Wyoming; Region 6—Serving Minnesota, North Dakota, South Dakota and Wisconsin; Region 9—Serving Florida, Georgia, Puerto Rico and South Carolina; Region 11—Serving Delaware, Maryland, New Jersey and Pennsylvania; At-Large Directors—Two positions open, can be from any region.

The entire membership can vote for the two At-Large Director positions on the ballot, but only members with an open director's seat in their own region can vote for that region. Serving on the board is demanding, but as previous board members will tell you, it is well worth the effort. Anyone interested in nominating someone should contact either Roberta Dainton or myself no later than October 1. We can be reached at SCTE national headquarters, (610) 363-6888.

Another important area in which you can make a contribution is to speak at an SCTE national conference. We recently announced a call for papers for our next national event, the Society's 1997 Conference on Emerging Technologies, to be held Jan. 9-11, 1997, in Nashville, TN.

We are presently seeking abstracts for technical papers to be presented at the conference, which will include such topics as digital compression and transmission, telephony, multimedia and future technologies. While we are not requiring submission of completed papers at this time, we are seeking informative abstracts that clearly describe the content and themes that you would present and discuss at the conference. Parties interested in presenting technical papers at the conference should contact Roberta Dainton at (610) 363-6888, or fax submissions to her at (610) 363-5898. All submissions should include an abstract of the proposed paper or presentation.

In addition to the Conference on Emerging Technologies, we also have announced a call for papers for CableTec Expo '97, to be held June 4-7 in Orlando, FL. You can take advantage of this forum by serving as a panelist in one of our four Engineering Conference panels, to be held the first day of Expo '97, or as a presenter in one of the 10 breakout workshops that have attracted standing-room-only audiences at past Expos.

If you have an idea for a paper or workshop for Expo '97, please send it to my attention at SCTE, 140 Philips Road, Exton, PA 19341-1318, or via fax, (610) 363-5898. Our deadline for abstracts is December 1.

There are plenty of opportunities to participate in other ways, such as serving on our technical subcommittees, which are working to develop standards for the telecommunications industry. Presently, our new Digital Video Subcommittee is holding a call for participants to serve in the subcommittee's five working groups: Video and Audio Services—Chairman: Craig Cuttner, HBO, (212) 512-5249; Data and Transport Applications—Chairman: Tom Elliot, TCI, (303) 267-5222; Network Architecture and Management—Chairman: Nick Hamilton-Piercy, Rogers, (416) 391-7225; Transmission and Distribution—Chairman: Richard Prodan, CableLabs, (303) 661-3739; and Encryption and Access Control—Claude Baggett, CableLabs, (303) 661-3807.

The subcommittee is responsible for identifying and developing standards necessary for digital TV services delivered by cable. Its working groups will focus on specified areas of this hot new technology, which promises to have a tremendous impact on the telecommunications industry for many years to come. With this subcommittee and the Society's new digital newsletter, *Digi-Points*, SCTE is gearing up to play a key role in the digital revolution.

The Digital Video Subcommittee, which met for the first time June 9 at Expo '96, encourages participation by representatives of cable system operators, equipment developers and other interested parties in its efforts. Due to the imminent deployment of digital services, the group has the goal of completing much of its work by the end of the year.

The Digital Video Subcommittee also has issued a call for proposals and contributions concerning digital video standards and practices in the areas covered by the subcommittee's five working groups mentioned above. For further information on either the call for papers of the call for proposals, interested parties can contact either Subcommittee Chairman Paul Hearty at (619) 623-2935 or SCTE Director of Standards Ted Woo at (610) 363-6888.

In closing, I sincerely hope members take full advantage of all of the aforementioned opportunities to make a contribution to your Society. In order to serve the evolving telecommunications industry, we must continue to draw upon our members to ensure the Society achieves its goal—to be the industry's premiere provider of technical training, certification and standards. CT

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

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