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COMMUNICATIONS TECHNOLOGY

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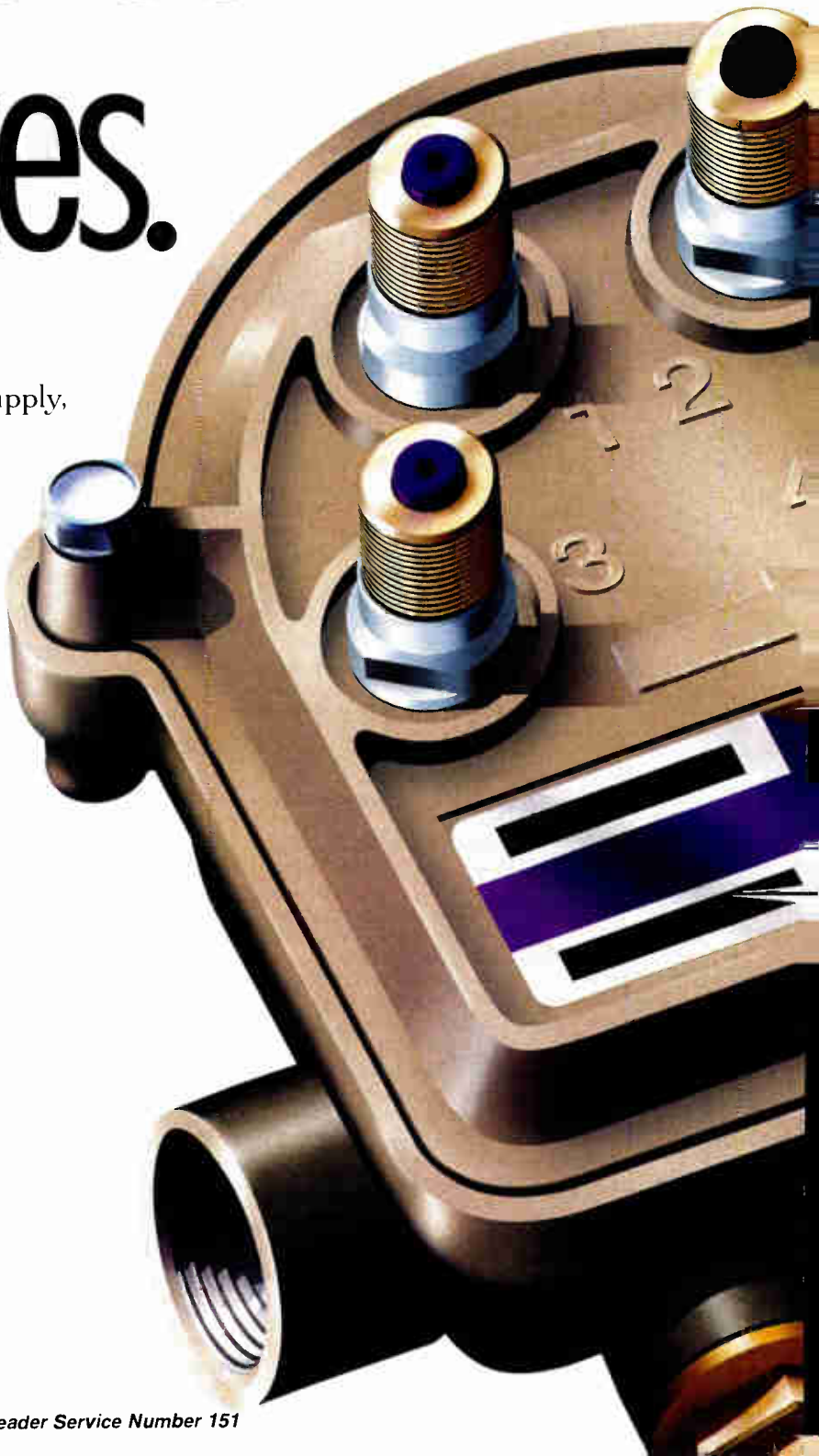

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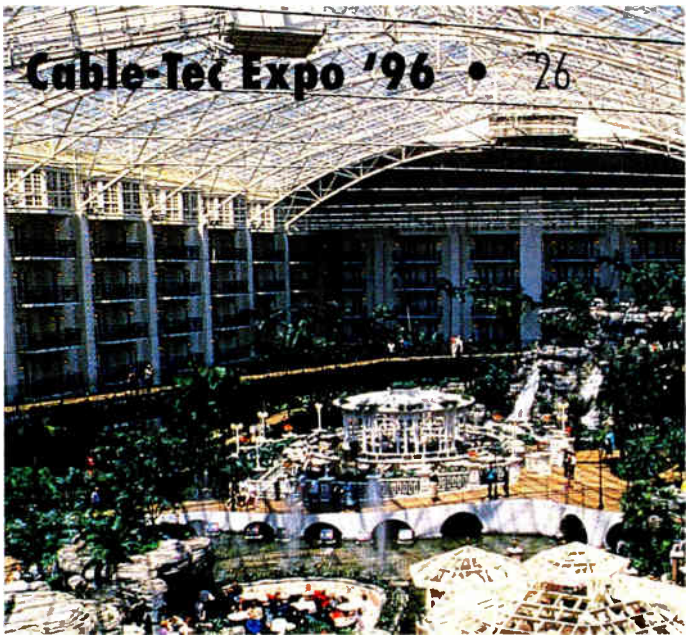

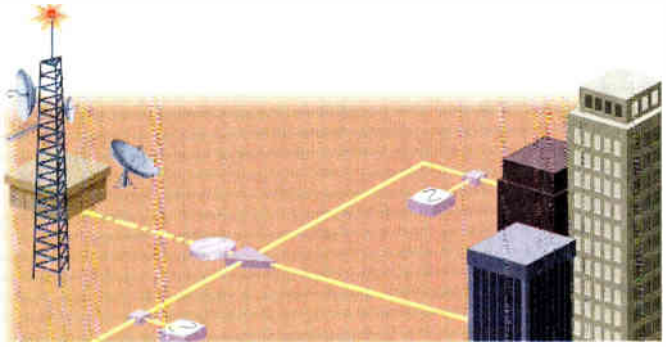

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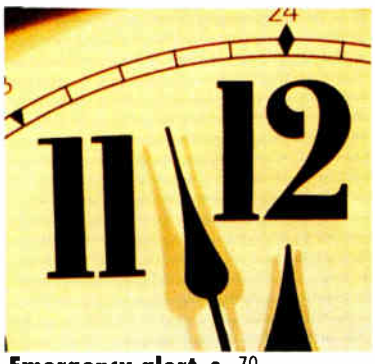

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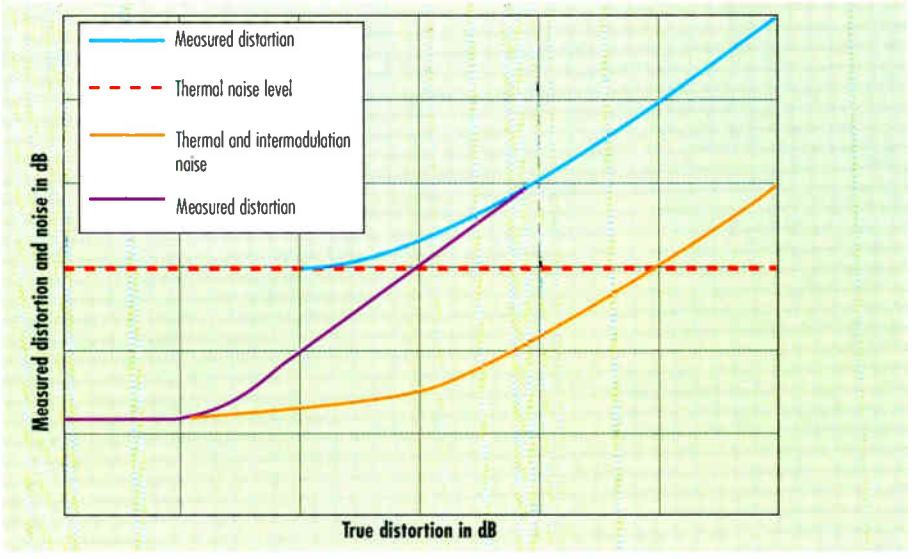

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Pioneers in engineering

What a show! Or maybe I should say, "What an Expo!" After all, there's shows, and then there's the Society of Cable Telecommunications Engineers' Cable-Tec Expo. I made the rounds of as many vendors as I could and, with the exception of some concerns about the "long and winding road to the convention center," the exhibitors had nothing but praise for Expo.

"There's shows, and then there's the Society of Cable Telecommunications Engineers' Cable-Tec Expo."

A highlight for me, and many of the engineers attending, was an event held on the final evening of the Expo. The Loyal Order of the 704 met in the Davidson Room and inducted about 30 new members. If you aren't familiar with the Loyal Order of the 704, I consider this to be the "Pioneers Club" for cable telecommunications engineers.

Unlike other pioneer groups, we don't believe in black tie or tails. We just get together for a good time of fellowship as old-timers relate some of their best stories about the trying conditions of the early days with the old and original pieces of test gear.

At this past meeting, we heard from technicians and engineers who began their careers as early as 1952. They spoke of times even before the 704, when they had to adapt early Simpson meters and do conversions from volts to dBs. Qualifying questions from the floor took us back to the days of ladder line, G-line, strip braid, tubes and tropo-scatter antennas.

As usual SCTE President Bill Riker was there to make sure we were treated to the best in services from the Opryland Hotel. The only setback to the meeting was that I was so busy at the microphone I didn't have the opportunity to record the names of the inductees for 1996. So, if you joined, please drop me a note so we can start a roster of members.

By the way, if you submit your name as an inductee, I'll expect to see your pin for verification at the next LO704 meeting. If you have 20 or more years as a cable technician or engineer and would like to join us next year, check the schedule of events at the 1997 Cable-Tec Expo in Orlando, FL, and make plans to attend our next meeting. You will hear some of the most interesting and funniest tales you ever heard. And, if you are interested in becoming a member and wearing the "704 Gold Pin," be prepared to address the group and explain exactly why you feel you qualify as a member.

As I said the LO704 meeting was a highlight for me at this year's show, but there were plenty of other high points as well. Be sure to check out the our Cable-Tec Expo wrap-up, which starts on page 26.

Rex Porter
Editor

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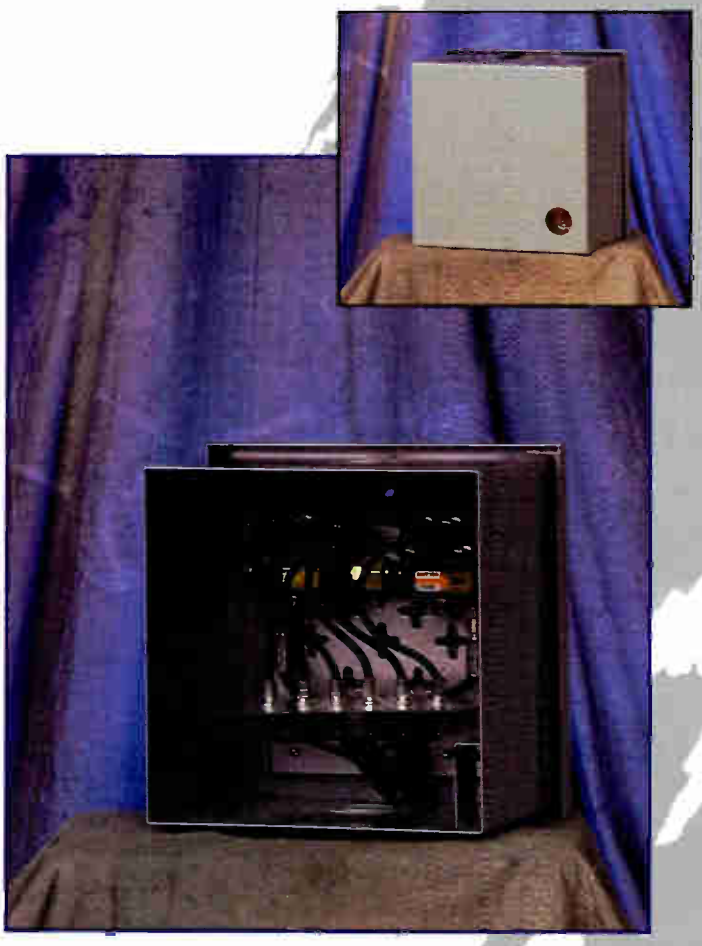

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Adelphia offers cable telephony

Adelphia Communications will begin offering local telephone service in its 11-state market this fall using Tellabs' Cablespan 2300 universal telephony distribution system. Adelphia's 750 MHz, two-way active cable systems will offer local telephony to up to 1 million of its cable TV subscribers within the next three years. Tellabs and Adelphia are negotiating a three-year supply contract valued at up to $50 million.

The pending agreement aims to ready the network for delivery of highly reliable residential "lifeline" telephone service. Earlier this year, Tellabs and Adelphia successfully completed a technical trial of residential telephony delivery in Adelphia's Dover Township, NJ, franchise.

Continental dials Down Under

Continental Cablevision Inc. and Optus Vision launched telephone service over their nationwide advanced broadband telecommunications network in Australia. This is the first large-scale commercial deployment of telephone service over a national broadband infrastructure.

The telephone service is being offered through Optus Vision, the $3 billion joint venture between Continental, Optus Communications, Publishing and Broadcasting Ltd., and the Seven Network.

The service is Australia's first significant competition in the local exchange market. Optus Vision's service features significantly lower rates for local calls than the dominant telephone carrier, according to the company.

The rollout of a national, two-way hybrid fiber/coaxial (HFC) network will pass nearly 3 million homes within three years, and when fully complete will serve most of the country's cities and towns. Major suppliers for the telephone portion of the network include Motorola and ADC Telecommunications. High-speed data services also will be offered over the network.

S-A and AM announce OEM

Scientific-Atlanta Inc. and AM Communications Inc. announced an OEM agreement under which S-A will market and sell AM's Omnistat status monitoring and control system. Under a concurrently announced joint development agreement, S-A and AM will jointly develop new transponder technology and potentially other products.

Jones offers local telephony in VA

Jones Communications of Virginia Inc., a subsidiary of Jones Intercable Inc., has been authorized to offer local telephone service to homes and businesses in northern Virginia.

The granting of local exchange carrier (LEC) status by the State Corporation Commission of Virginia is the final regulatory step in Jones' push to become a full-service telecommunications provider in Virginia. This broad regulatory authority will enhance Jones' ability to use its state-of-the-art broadband, fiber network, to deliver video, telephone and high-speed Internet connection to customers in Alexandria, adding additional communities later.

Continental, LANcity deploy cable modems

Continental Cablevision Inc. and LANcity Corp. signed what the companies say is the largest contract on record for extended deployment of cable modems. Per a two-year agreement, LANcity will supply Continental Cablevision with 50,000 LANcity Personal (LCP) cable modems for installation throughout Continental's systems in New England, Florida and Illinois.

People

• **ADC Telecommunications Inc.** appointed **Carlos Baradello** vice president of engineering for its Access Platforms Systems Division, where he will oversee the development of ADC's Homeworx HFC access platform.

• **General Instrument** appointed **Kenneth Pelowski** to the newly created position of vice president, corporate development.

• **Jones Intercable Inc.** promoted **Wayne Davis** to senior director of technical operations, and **David Feldman** to senior director of technology. Davis will serve all operating teams in the corporate engineering department. Feldman, formerly director of technology, will focus on technology specification and standardization.

• **Scientific-Atlanta Inc.** named **Brian Boso,** vice president of research and development for its broadband transmission systems division. Boso is responsible for all technology research, product development and engineering support functions within the company's transmission division.

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Annual awards at Expo '96 luncheon

The Society of Cable Telecommunications Engineers held its Annual Awards Luncheon June 10, the opening day of Cable-Tec Expo '96. The following members and organizations were recognized at the luncheon:

• Expo Program Subcommittee members Alex Best and William Riker (co-chairmen), Roger Brown, Paul Levine, Ginny Morris, Tanzy Wallace and Ken Wright received plaques for their efforts in creating the Cable-Tec Expo '96 technical program.

• The program subcommittee of the 1996 Conference on Emerging Technologies was recognized for its efforts in the planning of the phenomenally successful January 1996 conference. Receiving plaques were: Nick Hamilton-Piercy (chairman), Claude Baggett, Steve Johnson, David Large, Patrick O'Hare and Jack Terry.

• Outgoing members of the SCTE board of directors Andy Scott (Region 3), Rosa Rosas (Region 4), Terry Bush (Region 7), Michael Smith (Region 10) and Tom Elliot (At-Large) were recognized for their service to the Society.

• J.R. Anderson, Eric Brownell, Ted Hartson, Lorri Kaufman, James Oldham, Don Shackelford and Bruce Weintraub were elevated to Senior Member status in the Society.

• Ted Hartson was elevated to Fellow Member status in the Society.

• Tom Gimbel, Vern Goebel and Richard Pulley were recipients of Personal Achievement Awards. Created in 1986 as the Outstanding Achievement Awards and renamed in 1991, these awards recognize SCTE members who are outstanding in the performance of their respective jobs in the industry.

• Cox Communications was the recipient of the 1996 Chairman's Award in recognition of its support of the Society's training efforts, particularly through the participation of its personnel as speakers at national SCTE conferences.

• A.J. Genova of Continental Cable received first place in SCTE's fifth annual Field Operations Award competition. Kevin Smith of Bailey Cable TV and David Herman of Time Warner Cable were the second and third place winners respectively.

• Walt Ciciora, Ph.D. was inducted into the SCTE Hall of Fame. Ted Hartson was inducted at last year's conference.

• Alan Babcock was the 1996 recipient of the Society's Member of the Year Award in recognition of his service to the Society. The Chairman of the Society's Training Committee, he has been an integral force in the Society's development of training programs and services for the cable telecommunications industry.

SCTE board elects new officers

The SCTE Board of Directors elected the Society's officers for the coming year at its meeting held in conjunction with Cable-Tec Expo '96 at the Opryland Hotel Convention Center in Nashville, TN.

The Society's officers for the 1996-1997 term are:

Chairman: John Vartanian, Viewer's Choice

Eastern Vice Chairman: Hugh McCarley, Cox Cable Communications

Western Vice Chairman: Patrick O'Hare, Viacom Cable

Secretary: Norrie Bush, TCI of Southern Washington

Treasurer: Larry Stiffelman, CommScope

Additional Member of the Executive Committee: Wendell Bailey, NCTA

The current SCTE Board of Directors consists of: Region 1 Director Patrick O'Hare, Viacom Cable, serving California, Hawaii and Nevada; Region 2 Director Steve Johnson, Time Warner Cable, serving Arizona, Colorado, New Mexico, Utah and Wyoming; Region 3 Director Norrie Bush, TCI of Southern Washington, serving Alaska, Idaho, Montana, Oregon and Washington; Region 4 Director M.J. Jackson, Gilbert Engineer-

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ing, serving Oklahoma and Texas; Region 5 Director Larry Stiffelman, CommScope, serving Illinois, Iowa, Kansas, Missouri and Nebraska; Region 6 Director Robert Schaeffer, Star Cablevision Group, serving Minnesota, North Dakota, South Dakota and Wisconsin; Region 7 Director James Kuhns, Ameritech, serving Indiana, Michigan and Ohio; Region 8 Director Steve Christopher, Augat, serving Alabama, Arkansas, Louisiana, Mississippi and Tennessee; Region 9 Director Hugh McCarley, Cox Cable Communications, serving Florida, Georgia, Puerto Rico and South Carolina; Region 10 Director Maggie Fitzgerald, DAVI Communications, serving Kentucky, North Carolina, Virginia, West Virginia and District of Columbia; Region 11 Director Dennis Quinter, Berks Cable, serving Delaware, Maryland, New Jersey and Pennsylvania; Region 12 Director John Vartanian, Viewer's Choice, serving Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont; and At-Large Directors (representing the entire U.S.) Wendell Bailey of NCTA, Ron Hranac of Coaxial International and Wendell Woody of Sprint.

Call for papers: Emerging Tech '97

SCTE is currently seeking abstracts for technical papers to be presented at its 1997 Conference on Emerging Technologies to be held Jan. 9-11, 1997, at the site of the Society's recent record-breaking Cable-Tec Expo '96: the Opryland Hotel Convention Center in Nashville, TN.

Topics of discussion will include:

- Digital compression and transmission
- Telephony
- Multimedia
- Future technologies

Those interested in presenting technical papers at the conference should contact Roberta Dainton at SCTE by calling (610) 363-6888 or via fax at (610) 363-5898. Submissions should include an abstract of the proposed paper or presentation. The deadline for submissions is Sept. 1, 1996.

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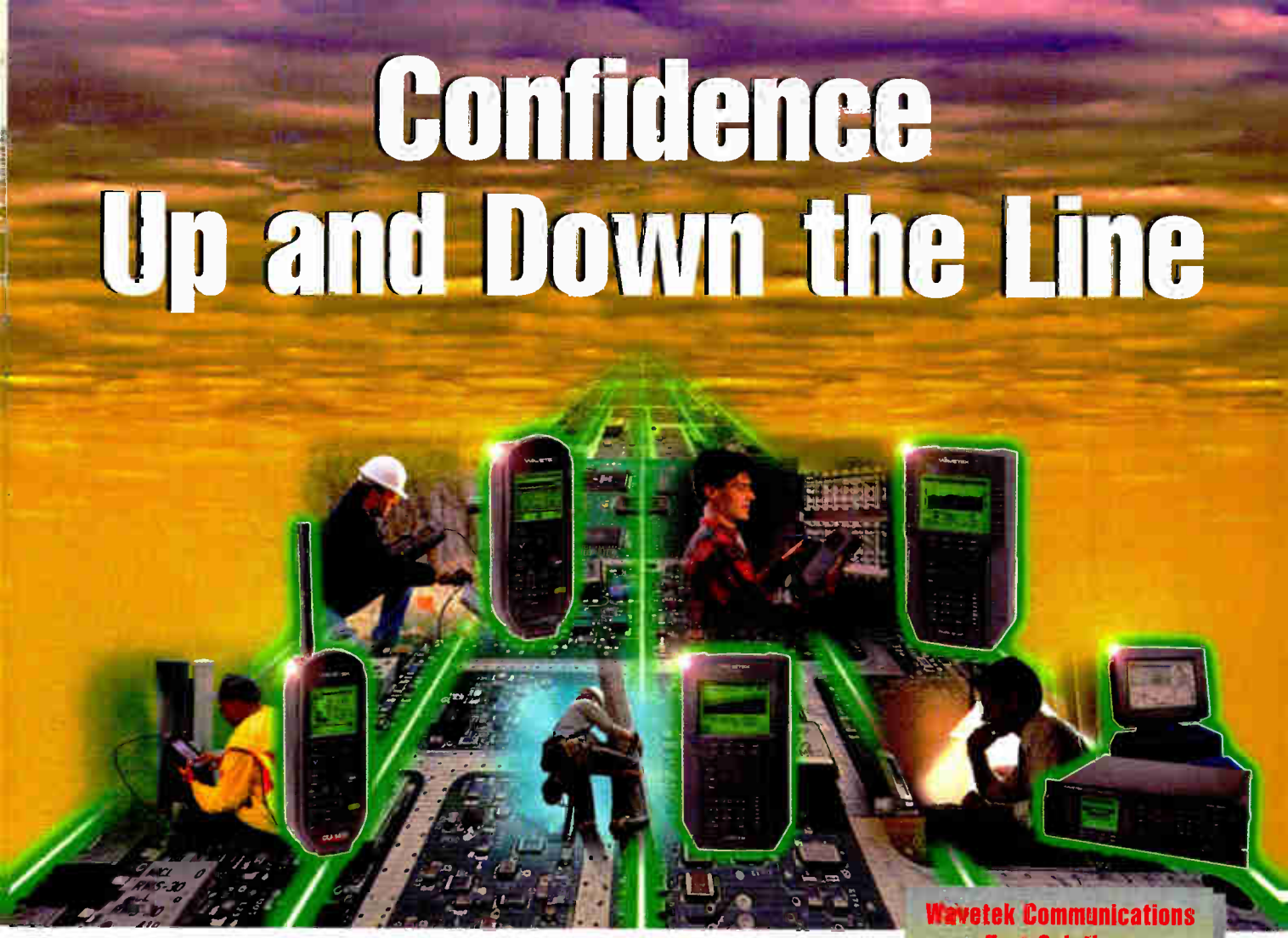

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By Ron Hranac

Combating impulse noise with common mode suppression

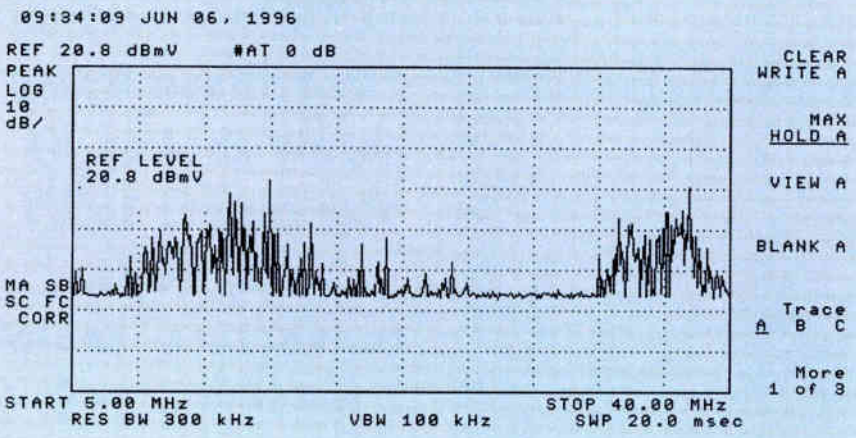
In last month's column I provided an overview of differential mode vs. common mode signals, how impulse noise can get into the drop as common mode currents, and how to effectively reduce or eliminate much of that noise using common mode suppression techniques. A couple weeks after writing the July column, I decided to include that information in the workshop Tom Staniec and I presented at this year's SCTE Cable-Tec Expo in Nashville, TN.

"Common mode suppression is not a magic fix-all for subscriber drop reverse path problems."

The original setup used in Japan was duplicated at Hewlett-Packard's facilities in Englewood, CO. Three of the accompanying figures are spectrum analyzer plots showing intentionally generated impulse noise with and without common mode suppression in

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

Figure 1: Impulse noise without common mode suppression



use. As before, a cable-compatible TV set was connected directly to the input of a spectrum analyzer via a length of drop cable. Instrument settings were as shown in the figures, including display max hold to capture as much of the impulse noise as possible. To generate impulse noise, the TV set was turned on and off repetitively.

Figure 1 shows the typical spread of impulse noise between 5 and 40 MHz using this particular configuration. The worst noise is between about 8 and 26 MHz, and also from 33 to 40 MHz. Common mode suppression has not been used in this example.

Figure 2 on page 18 shows the results of the same setup, except this time a common mode choke (technically an air-core balun) was made by coiling the drop cable at the input to the TV set. As I mentioned in last month's column, air-core baluns have been used by ham radio operators for years. The typical application is where an unbalanced feedline (coaxial cable) interfaces with a balanced antenna such as a half-wave dipole. The cable near the antenna feedpoint is coiled to form a choke that will suppress common mode currents induced on the cable's outer shield at the unbalanced-to-balanced junction.

As you can see in Figure 2 (on page 18), this technique also works well to suppress common mode problems in the CATV reverse path. Quite a bit of the impulse noise in the 19 to 26 MHz region has been reduced, along with a significant amount of the 33 to 40 MHz noise. Additional suppression occurred when we placed a snap-on ferrite core (the same kind used on computer cables) on the TV set's AC power cord. This is shown in Figure 3 on page 18. The remaining noise in the 8 to 16 MHz region is differential mode rather than common mode, and would have to be eliminated with a high pass filter. →

We tried a few different coiled cable configurations—for example, a flat coil instead of one that resembles a coil of rope—and could see no major difference in performance. According to *The ARRL Handbook for Radio Amateurs*, cable coiled as shown in Figure 4 will provide the best overall performance for broadband common mode current suppression in the 3.5 to 30 MHz spectrum. Take about 10 feet of coax and make a seven-turn coil that is 5.5 to 6 inches in diameter. You will need to tape or tie-wrap the coil to keep it from coming apart. The coil of cable should be located as close as possible to the device to which the cable is connected.

Figure 2: Impulse noise reduced by coiling coax to form common mode choke

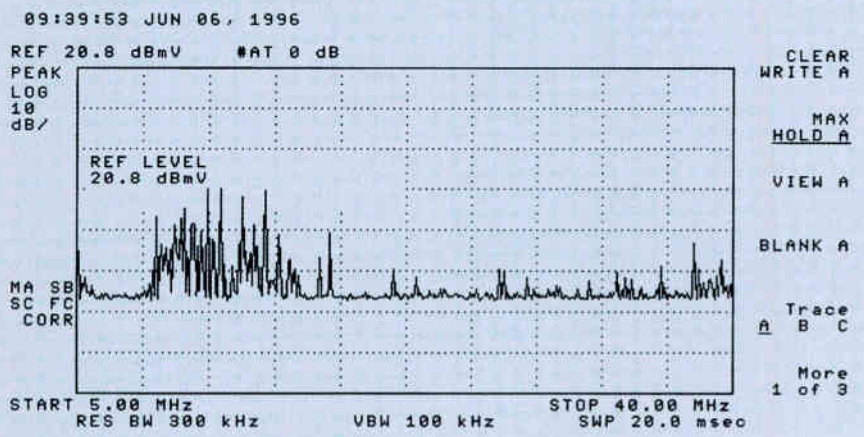


Figure 3: Additional improvement when snap-on ferrite core is added to TV set AC power cord

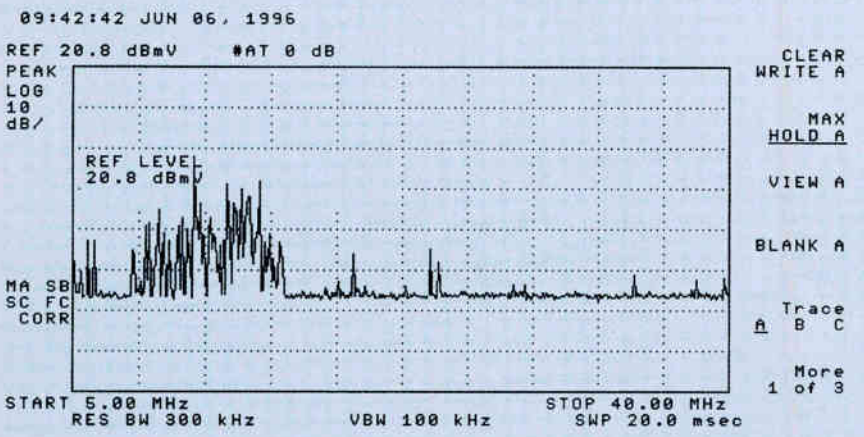
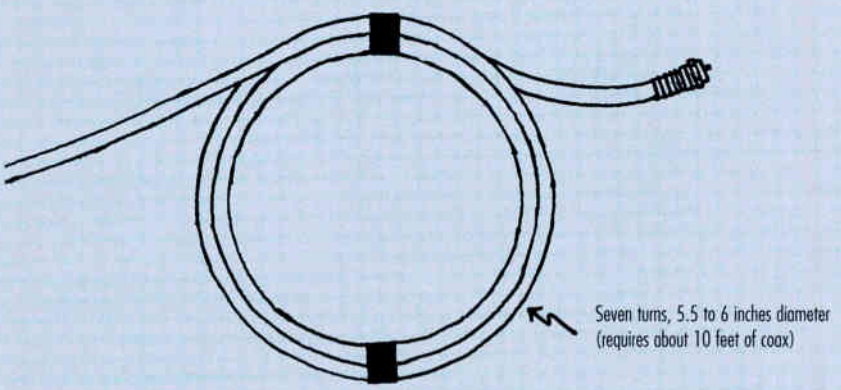


Figure 4: Common mode choke made from a coil of cable

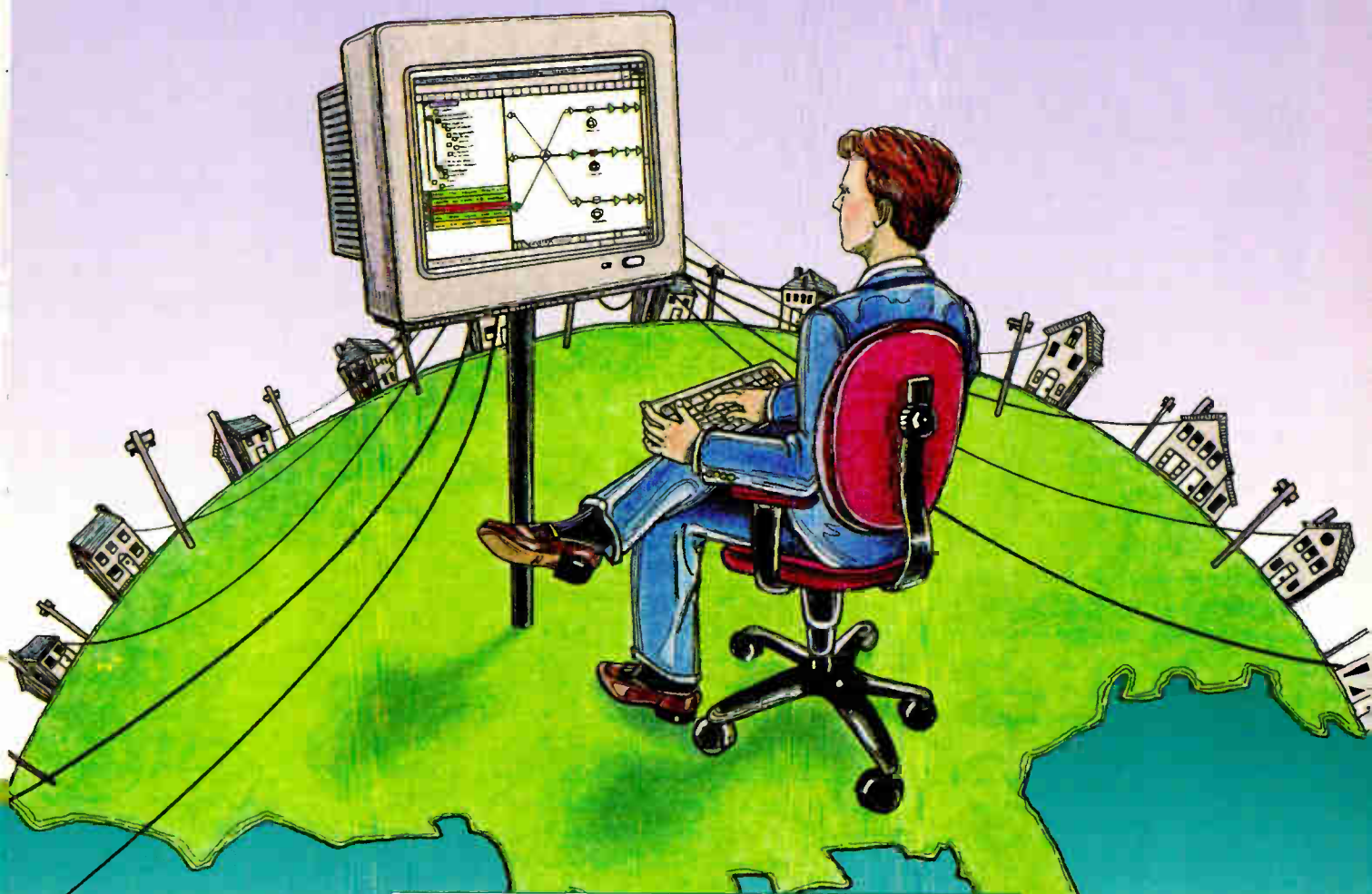


"Use these home brew chokes at the inputs to TV sets, VCRs, converters, cable modems, and other in-home devices where two-way operation is planned."

My recommendation is to use these home brew chokes at the inputs to TV sets, VCRs, converters, cable modems, and other in-home devices where two-way operation is planned. In some cases it also may be necessary to use snap-on ferrite cores on AC or DC power leads for some of these devices.

It's important to understand that common mode suppression is not a magic fix-all for subscriber drop reverse path problems. You still need to use high-quality drop cable and components, keep the connectors tight, install high pass filters where required, and do all of the other things necessary for successful two-way operation. (See "Two-way checklist" on page 6 of the December 1995 issue of *Communications Technology*.) Common mode suppression should only be considered as one more useful tool in your two-way toolbox. **CT**

CONTROL YOUR WORLD



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Reader Service Number 145

By Justin J. Junkus

Multiplexing fits 24 pounds of talk into a 1-pound bag

By now, cable telecommunications engineers have learned that no matter how much capacity you give to your subscribers, they want more. As a matter of fact, even after you give them more, they want to double what they have! The cable telecommunications industry has turned to digital compression and improved components to achieve more capacity. Telephony has done the same, but historically, a different digital technology called time division multiplexing was first employed to bring more capacity to the subscriber. Because time division multiplexing (TDM) is still a major part of telephony, this column will discuss how it evolved, and where it fits into today's telecommunications network.

Digital multiplexing for telephony began as a more efficient way to interconnect local telephone offices.

Service demands, especially in dense metropolitan areas have always driven the need to provide more than one voice telephone circuit on a pair of wires. Initially, telephony's response was the same as cable's—create a frequency division multiplexing scheme that shifts information to different carri-

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

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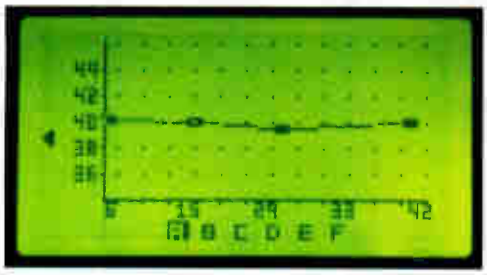

When equipped with the Multiplexer Option, the 9580SST accepts signals from up to 8 separate test points and analyzes sweep & ingress from each individually, returning data to as many as 6 SSR field units (A thru F) connected to it.

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Reader Service Number 146

@Home targets half million HHs

Comcast announced its will offer its @Home service to about half a million households in the Baltimore metro area and in Howard City, MD, within the next several months.

Areas that have upgrades completed will get a chance at the service first in which Comcast supplies unlimited Internet access with its local content.

Digital TV: A big yes in '97

The following was reported in "Communications Technology" sister publication "CableFAX" by Assistant Editor Steve Donohue.

Digital TV isn't another broken promise, say cable executives who predicted widespread rollouts in 1997 during a PaineWebber media conference last month.

Putting Internet access and telephony on the back burner, TCI instead hyped rollout of its AllTV digital system, now under beta test with 550 Hartford, CT, customers. Look for digital launches next month in Fremont and Arlington Heights, CA, as TCI seeks to move 150,000 digital set-tops per month. TCI said it will use Primestar to offer digital in systems under 5,000 subscribers. It will go digital in 55% of its systems, covering 5 million households.

Cox will focus on offering a complete digital package of cable, Internet and telephony this year, said the company's Vice President and CFO Jim Hayes. He said Cox will spend $650 million to $700 million in 1997 to upgrade to two-way 750 MHz lines, spending $500,000/node. Hayes added that the company was close to reaching an interconnection agreement with Bell Atlantic to offer telephony on the East Coast while it already has the West covered with the PacBell agreement.

US West said it will continue to cluster and look for acquisitions to offer video, voice and data. It said it will have 150,000 homes in Boston data-ready by the end of the year through its deal with Continental.

ADSL, cable modems: 20 million by 2001?

Internet Implications, a study by Communications Industry Researchers, predicted that ADSL and cable modems will be the choice of Internet access for over 1.7 million users in 1998 and will balloon to more than 20 million by 2001 with cable modems dominating.

The report noted that although most of the telcos are planning to use DSL technology, CIR believes it has inherent limitations in terms of speed, scalability and possibly cost that will limit its use.

"Within three to five years, telcos will begin to make a wholesale move

er frequencies. Then, use filtering to separate everything out at both ends of the line. While this worked fine for almost half a century, it had limitations. Frequency division multiplexing uses bandwidth rapidly, and requires a lot of equipment needing calibration and maintenance. It also is susceptible to noise and crosstalk, or undesired transfer of information from one circuit to another.

Digital technology provided an improved solution to increased capacity by making possible T-1 time division multiplexing. The idea behind TDM is that one voice-grade line can be shared by 24 separate conversations, by effectively assigning each conversation to the line only 1/24th of the time.

To do this, two things need to be accomplished. First, the information on the line must be digitized. Second, the line must be switched rapidly enough between the conversations such that no information is lost. The transistor made both possible through the speed of semiconductor switching.

You may recall from the April "Focus on Telephony" column that digitization is a three-step process. First, the amplitude of the signal on the line (e.g., the voltage representing the amplitude of the voice waveform) must be sampled at twice the rate of the highest frequency component of that signal. For a voice signal, that means you "measure" the voltage 8,000 times per second. This rate of twice the highest frequency is known as the Nyquist rate, after the mathematician who proved that no information is lost if you sample a signal at two times the highest frequency component. Second, the value of the sampled voltage must be rounded to a predetermined step interval. For example, if we choose our intervals as 5 millivolts each, and the sample voltage is 27 millivolts, we need to round up or down to either 25 or 30 millivolts for this sample. Finally, our rounded value must be converted to a binary number, since binary is the only numbering scheme recognized by digital technology. T-1 uses an 8-bit binary number to represent each sample value, so if we round down to 25 millivolts, the binary equivalent will be 00011001. This string of 0s and 1s is what is sent down the line to the receiving side as a series of plus, minus and 0 voltage levels. On the receiving side, the process is reversed, and the original signal is reconstructed. Notice that what appears on the line is truly a digital pulse, not a modulated carrier.

Since the line is being shared by 24 separate conversations, the T-1 equipment must sample 24 separate conversations 8,000 times per second, and place 24 strings of eight bits onto the communications line. The line rate for information on the line is therefore 24 conversations x eight bits per sample x 8,000 samples per second, or 1,536,000 bits per second. To keep track of when each sampling round of 24 conversations (called a frame) is completed, the equipment adds one bit per sample cycle, or 8,000 bits per second. Adding the information bits to the framing bits gives us the T-1 line rate of 1,536,000 plus 8,000, or 1.544 megabits per second. →

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Realize that the voltages being sent down the line must change at over 1.5 million times per second, and that the multiplexer only has 1/24th of 1/8,000th of a second to sample each line. This should help you understand why TDM was not used until the transistor was invented. The time taken by vacuum tubes and relays to switch connections is just too slow, and frequency division multiplexing was all that was available.

The local loop

So T-1 multiplexing solved the problem of metropolitan interswitch traffic growth and gave the phone companies a new way to fit 24 pounds of talk into a 1-pound bag! But what about the local loop? While the number of interswitch calls was increasing, the number of subscribers needing service also was growing. There are limits on the distance from a telecommunications switch to a subscriber's station set. There also are limits on the number of wires that can fit into the physical facilities installed on the right-of-way into new subdivisions and business parks. T-1 solves these problems too.

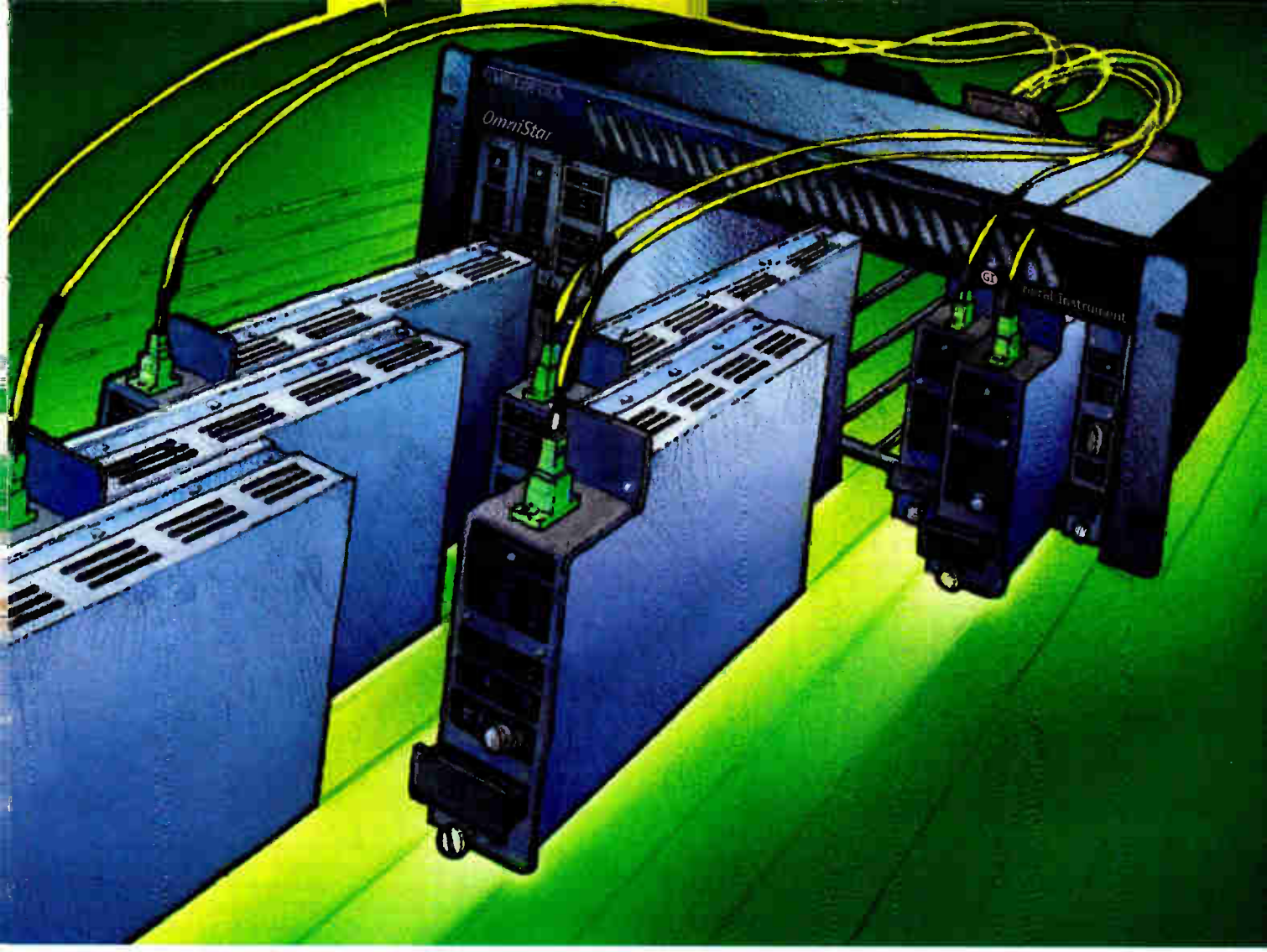
Pair gain systems are pieces of equipment that are installed on each end of one or more pairs of wire from the telecommunications switch. Unlike cable's line extender, a pair gain device is more than an amplifier. It not only increases the possible distance from a switch to a subscriber, but also multiplexes up to 24 lines onto the original pair that previously served only one. The equipment on the subscriber side of the pair gain system connects to 24 or more subscriber lines, and is known as a remote terminal. The equipment on the switch side, which presents the same number of lines to the switch as the number of subscriber lines on the remote terminal, is known as the central office terminal (COT). The pair that originally served only one line from the switch now carries a T-1 signal between remote terminal and COT, with 24 separate time slots. By increasing the number of T-1 lines between remote terminal and COT, the telephone company can increase the number of possible subscriber lines on the pair gain system. For example, the SLC-96 system introduced by the Bell System in the late 1970s has a capacity of 96 lines over four pairs connecting remote terminal and COT. Today's pair gain systems provide far more subscriber lines and functions beyond multiplexing.

Adding capacity on the loop side of the telecommunications switch, however, compounds the original problem of increased interswitch traffic. With the ability to connect more subscribers to a switch, the network side is presented with yet more traffic. The solution to this request for *more* is to further multiplex T-1 signals on the network up to higher digital rates. The first digital multiplexer to be used in the toll network (beyond local interswitch connections) was the T-2 multiplexer, with a data rate of 6.312 Mbps. This was followed by a 44.736 Mbps multiplexer, called T-3.

Growing upward was, in a way, easier than it was to provide T-1. For example, the T-3 rate is almost 29 times the T-1 rate. Both T-3 and T-1 are digital signals, so there is no need to sample, quantize, and then convert into binary. The bits from the T-1 signal are simply mapped from the T-1 line to positions on the T-3 line. Up to 28 T-1 lines can be multiplexed onto a T-3 line.

But wait! We said that the T-3 rate is almost 29 times the rate of a T-1 line. Why then are there only 28 T-1 signals in a T-3? The answer lies in how signals are synchronized or clocked as they move through a network. Because two T-1 lines are usually out of synchronization with each other, it becomes necessary to insert stuffing bits into the T-3 data stream as bits are mapped from T-1 signals to take up the spaces between the bit streams. Those stuffing bits are what makes the extra capacity necessary.

Here's one last word on TDM. As the Bell System introduced the various multiplexing rates, AT&T established a standard called the North American Digital Hierarchy that provided standard names for each of the rates. These rates are DS1, DS1C, DS2, DS3, corresponding to the T-rates with the same number. In addition, there is a DS4 rate of 274.176 Mbps. **CT**



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Reader Service Number 15

Cable-Tec Expo '96: The practical side of networking the future

By Laura Hamilton, Photos by Teryl Jackson

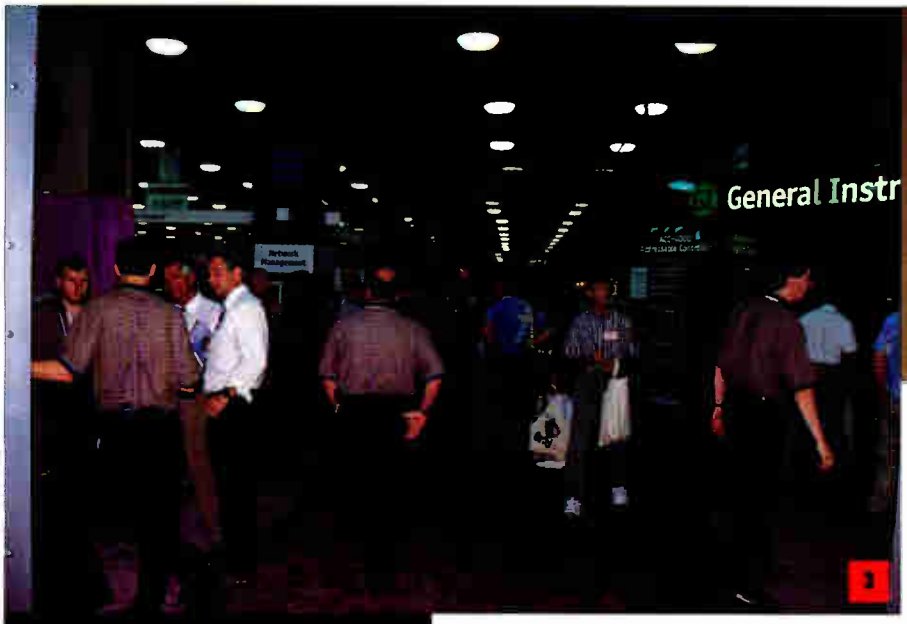
Even during the headiest periods of superhype-way frenzy, cable telecommunications engineers keep reiterating the same qualifying point: It's not all going to be built in a day.

That sort of practical future-think was a recurring theme at this year's Cable-Tec Expo. The Society of Cable Telecommunications Engineers' big yearly confab—long recognized as the premier technical show in the biz—was the largest ever with 4,000 registered attendees and 3,200 exhibitor personnel gathering at the Opryland Hotel Convention Center in Nashville, TN, from June 10-12.

Speaker after speaker gave a nod to the promises of high-speed data delivery, cable telephony and digital video, but kept coming back to the practical aspects of getting today's networks up to speed. New services mean new architectures. The techno-buzzwords of the day are reliability and availability. And if cable is going to be the answer to the World Wide Wait on the World Wide Web, the technical community has two-way delivery challenges like it's never seen before.

As for the sprawling show floor, it offered everything from an encouraging mix of new hardware for telephony and data delivery to the nuts and bolts of a cable sys-

Laura Hamilton is managing editor of "Communications Technology." She can be reached in Denver at (303) 839-1565, ext. 43.



tem. Over 325 companies offered attendees the opportunity to tweak the latest and greatest as well as check out the tried and true. What follows is a wrap-up of Expo '96: the pre-conference tutorials, the Engineering Conference, the workshops, the exhibit hall, the parties and more. So now, turn the page for detailed coverage on "the biggest and best Expo ever."

This wrap-up was written with assistance from following members of the "Communications Technology" editorial staff: Eric Butterfield, Rex Porter, Alex Swan and Alex Zavistovich. Also contributing were "CT" West Coast Correspondent George Lawton and "International Cable" Managing Editor Andy Jose.

1) The "World's Most Scenic Hotel," the Opryland in Nashville was home of Expo '96. 2) Familiar SCTE face, Diana Riley of Jerry Conn, cut a rug with friends at one of Expo's parties. 3) Over 325 companies highlighted their products and services on the show floor. 4) SCTE President Bill Riker congratulated Alan Babcock, SCTE Member of the Year. 5) The Cable-Tec Games had technicians from all over the country vying for national bragging rights. 6) After a full day of technology, many attendees relaxed with the "down home" sounds of Nashville, the heart of country music.

Courtesy Country Music Hall of Fame

Engineering Conference: Get real, get ready for the future

As a member of today's cable telecommunications engineering community, what would you say comes up most often in your conversations with colleagues? Data over cable? Return spectrum issues? Fiber? Video transport concerns?

If any of those topics make you want to hop on the nearest soapbox, the SCTE's Annual Engineering Conference is the place to get up to date and address the experts on where they think the industry is headed.

Kicking off this year's conference was an in-depth discussion on fiber-related issues. As cable operators begin to deploy two-way service on their networks, low-cost direct feedback (DFB) lasers promise superior performance for return path links than traditional Fabry-Perot (FP) lasers used for this purpose, according to Larry Stark, vice president of broadband market development for Ortel Corp. In his presentation, "Advantages and Performance of DFB Lasers for HFC Network Return Path Applications," Stark talked about the issues associated with both technologies.

Stark said, "The key performance difference between an FP laser and a DFB is mode distortion noise."

The FP laser concentrates its energy into a narrow band of four or five wavelengths using a built-in grating. However, the optical power of each wavelength fluctuates wildly, causing severe noise distortion at each wavelength. At the output, the noise effects cancel and good performance is observed. However, as the light travels down a length of fiber, dispersion

1) SCTE President Bill Riker welcomed attendees to Nashville with an overview of Expo.

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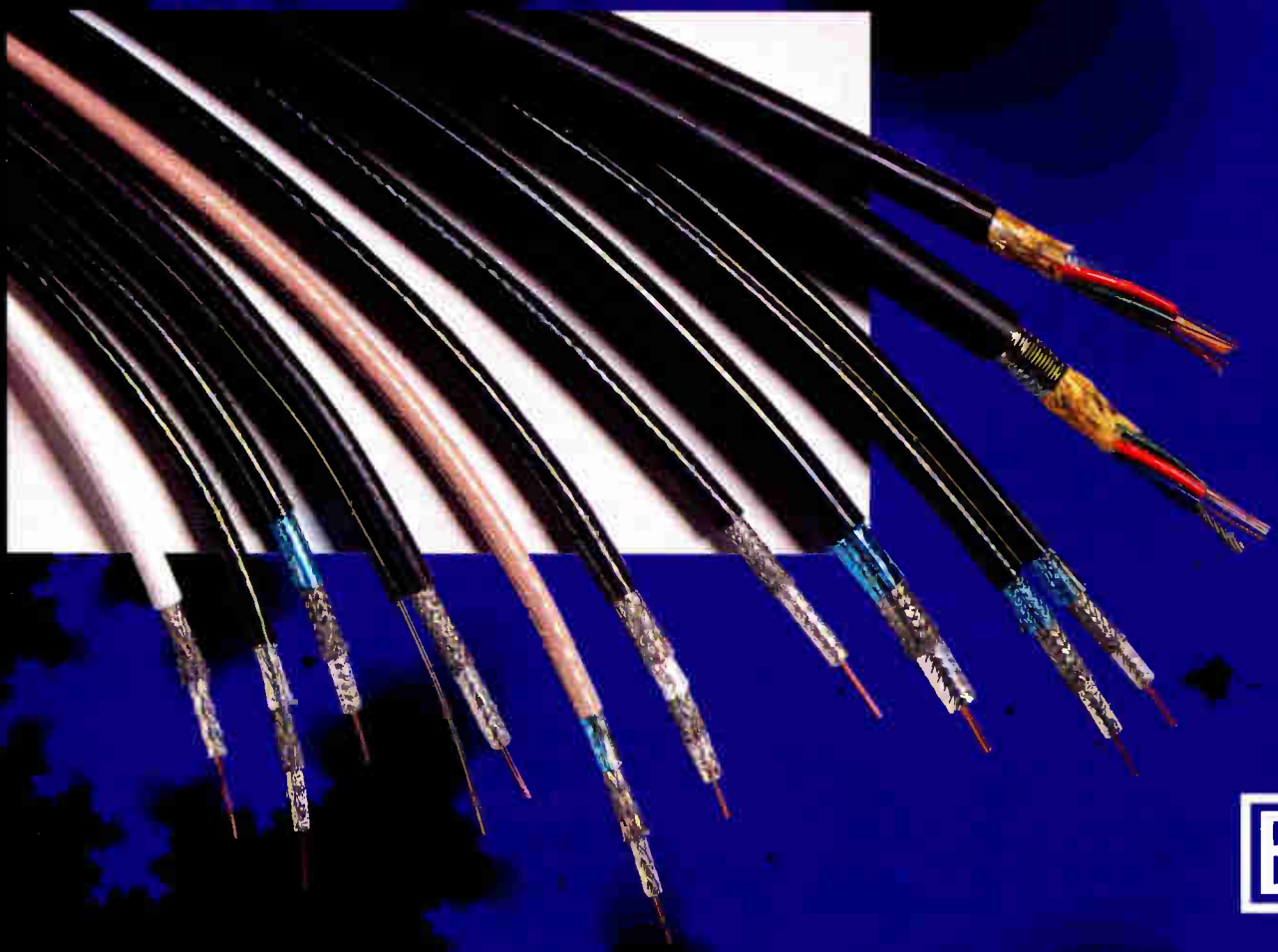

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causes the different frequencies to travel at different speeds so that at the end, the noise effects do not cancel each other out, causing performance degradation.

Another factor that affects return path performance is optical feedback. In severe cases, an air gap in a connector can make the link inoperable. More commonly, optical feedback caused by the fiber itself can interfere with the laser. However, these problems can be overcome by isolating the laser from feedback.

Temperature also can have an effect on performance. When DFB lasers are too cold, they can act like FP lasers. However, if the DFB laser is operated without cooling, the natural heat of the laser tends to keep it warm enough. Stark said that DFBs could operate at ambient temperatures as low as -40° C.

Stark concluded that the DFB laser avoids many of the shortcomings of FP lasers. Although the DFB lasers used for downstream applications may be too expensive, uncooled DFB lasers with internal optical isolators promise to provide a compromise between better performance and cost.

John Chamberlain, vice president of Norscan, talked about optimizing fiber-optic cable availability. He said, "The industry must not only build broadband platforms, but maintain those so that it can continue to bring broadband services into the home."

Even though fiber technology is quite reliable, optical outages result in 40% of projected hybrid fiber/coax (HFC) network downtime. This is because fiber tends to carry more traffic so a fiber cut will result in a loss to more people. In addition, it tends to takes longer to find and fix a fiber problem than a coax problem.

However, these problems can be mitigated by operators. A report from Bellcore showed that average downtime was 11.48 hours per cut in 1990, but that went down to 5.5 hours in 1995 due to new tools and service management techniques. Since digging accidents resulted in over 50% of all problems, most of these reductions came through practices designed to prevent cable cuts, or reduce their impact.

Chamberlain pointed out that it is now possible to reduce the other fraction of problems that are caused by rodents, fire, defective cable, floods, vandalism and other things, which on their own cause less than 7% of the problems, but together make up 1/4 to 1/3 of them. Using a new sensing technology developed by Norscan, it is possible to measure

2) Tony Werner (TCI), John Chamberlain (Norscan), Jerry Patton (Antec), and 3) Larry Stark (Ortel) conducted "Fiber Related Issues." 4) Albert Young of Cox and 5) Jack Terry of Nortel informed attendees about video transport.

damage to the cable's armor before it affects the cable.

Norscan's equipment sends a signal down the metal sheathing on the outside of the cable. Any damage to this sheath can be detected and located by changes in the signal.

Chamberlain claims that using preventive maintenance equipment on the fiber can reduce the average number of outages from 4.4 per 1,000 miles to a little over one. With an estimated repair cost of $20,000 each, that represents an average savings of $60,000 per year per thousand miles of fiber.

Video transport

As cable operators seriously consider offering new services such as telephony, they need to build their networks so that they can fail gracefully. John Thoma, product line manager at ADC Video Systems gave a presentation on "Cost Analysis of

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Self-Healing Video Broadband Networks." He noted that a self-healing network has the ability to keep the network up even after a fiber cut or equipment failure.

A self-healing network is typically built in a ring configuration. If a break occurs somewhere in the network, traffic is routed away from the break around the ring.

Thoma looked at a number of options for self-healing networks. First, there is synchronous optical network (SONET), which is designed to carry digital telephony signals but is not as efficient for video.

Another option is ADC's DV6000 that can carry uncompressed video over a digital network. Like SONET, it uses an electrical switch to reroute traffic after a break occurs.

Thoma said that replacing the electrical switches with optical ones promises to be just as reliable, at less cost. He noted, "An optically switched universal uncompressed network gives lower cost and provides protection against fiber failure. It gives you lower capital costs and lower operating costs and greater flexibility."

In order to compete with the flood of new competitors, cable operators will need to offer more channels. Charles Kennamer, senior director of engineering at TCI, talked about how TCI's Headend in the Sky (HITS) will start delivering service to cable operators beginning this year.

Kennamer said, "We believe it is absolutely necessary to deploy digital over the next couple of years. Very few analog operators will have the capacity to compete with them (telcos, direct broadcast satellite and wireless cable) once they have grown in capacity."

HITS will deliver the programming to consumers as well as the software for communicating with the set-top. HITS also will handle the provisioning and customer support for those operators that want it. The initial service will have 30 to 40 channels of pay-per-view as well as a variety of other programming.

Using compression, anywhere from five to nine channels will ride in every 6 MHz of downstream spectrum on the cable system in a

6) Nick Hamilton-Piercy (Rogers Cablesystems), Thomas Moore (CableLabs) and Milo Medin (@Home Network) addressed data over cable.

27 Mbps payload. However, HITS is experimenting with some statistical multiplexing technology that will allow it to put 20 video programs on a single 6 MHz channel.

Kennamer said they will begin field testing the service soon, and will expand the scope of the trial to a number of employees over the summer. The first paying customers are expected to start signing up Oct. 20, 1996.

As cable operators roll out digital services, they risk deploying a number of digital platforms. Albert Young, engineering manager for commercial markets at Cox Communications said that this can lead to increased complexity in network deployment, training and maintenance, which can add up on the bottom line.

Another problem with multiple digital services is that they are not necessarily efficient at managing upstream bandwidth. Young noted, "When you allocate upstream spectrum for each individual service you may find you don't have enough spectrum to allocate. On the other hand, many of these services are bursty and by allocating a single data stream that is shared, you can get around that problem."

However, if you use digital platforms from different vendors, they may not share the spectrum like this. Young explained, "All of the digital systems are designed to work against analog video, but

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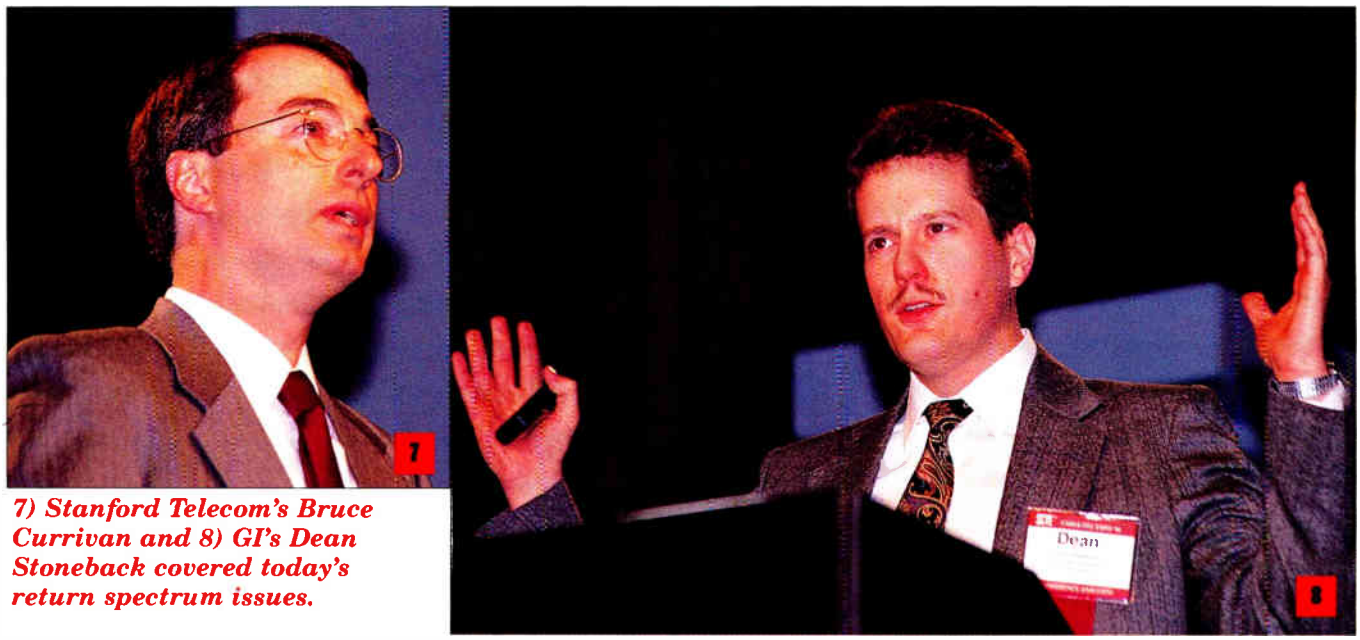

7) Stanford Telecom's Bruce Currivan and 8) GI's Dean Stoneback covered today's return spectrum issues.

not against each other. There may be interactions we have not predicted that may make it difficult to control."

Jack Terry, associate vice president at Nortel, gave his vision of the multiservice digital network. The basic notion is to deploy a single box called a network interface unit (NIU) at each home. Signals are sent from the consumer's equipment to the NIU using quadrature phase shift keying (QPSK). The NIU can then multiplex all upstream traffic from the home into a single digital stream, regardless of what kind of traffic it is.

Data over cable

The "Data Over Cable" portion of the Engineering Conference put a practical spin on high-speed data delivery hype. Ken Wright of Intermedia Partners moderated.

"Can we save the patient? Is it sniffles or Ebola?" asked Milo Medin of @Home Network. The patient in question was the Internet and its biggest symptom of sickness is what Medin called "Web snarl." Problems with the Net include the fact that router vendors are not keeping up with new hardware, overall Internet reliability is dropping and servers are having trouble keeping up. Medin suggested that servers must be used to reduce the amount of data transferred by caching and replication. He also said systems must take on more of an end-to-end approach to deal with reliability questions. "The patient is sick, but with prompt treatment, can

Is ingress making your return path a road to nowhere?

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

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

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

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

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recover," concluded Medin.

Tom Moore of CableLabs took up the "data delivery is more than just installing modems" cry. He suggested that the market is definitely ready and offered ideas on how cable systems could improve their data delivery potentials: design in operational flexibility; understand client/server traffic characteristics; and focus on network management.

Rogers Cablesystems' Nick Hamilton-Piercy gave advice garnered from his company's experience in its Wave data delivery system. He offered details on everything from marketing to network engineering and customer service.

Keynote speaker

Just prior to the last session of the engineering conference, National Cable Television Association President and CEO Decker Anstrom delivered a special keynote address. Speaking for the first time at an SCTE event, Decker focused on new opportunities created for the industry by the Telecom Act, and stressed the importance of technical training to the quality of our service.

The return spectrum

The Engineering Conference closed with "Return Spectrum Issues," with Moderator Alex Best of Cox Cable saying that despite Wall Street's hesitation, he always had faith in the cable industry's ability to tackle the technical issues at hand. "But the question I hear the most is, 'Can you make the return spectrum work?' "

The four speakers that followed answered that question with a resounding "yes." Brian Bauer led off the panel with a discussion of OFDM 32-QAM strategies, which offer "very efficient use of spectrum." One trial of advanced OFDM was conducted with no ingress filters in place, said Bauer: proof of the great possibility of making the return path work.

On the subject of ingress, Bauer acknowledged "a potpourri of things in the F-connector that cause corrosion." Although the F-connector has received a bad rap, Bauer placed blame on both the connector and a need for training.

9) The annual Membership Meeting and House of Delegates drew a large crowd to the Delta Ballroom at the Opryland Hotel.

Hewlett-Packard/CaLan's Jerry Green addressed alignment of the return path and amplifier ingress, in particular a trial in which the amps had to be turned off so ingress was low enough to begin. Green stressed that a lot of data has yet to be collected and evaluated in order to properly characterize the return path. Maintaining the return properly will require return sweep procedures on par with the forward sweep program, as well as the regular monitoring and blocking of incoming ingress.

"Although the F-connector has received a bad rap, Bauer placed blame on both the connector and a need for training."

To reduce overall ingress, said General Instrument's Dean Stoneback, it is important to achieve uniform signal loss to each tap port in the return path. (See "Return design for digital: Part 1" on page 80.) Stoneback recommended power allocation on a constant power per Hz basis. "All services must have some sort of power control loop," he said. As for the laser debate, Stoneback reported that Fabry-Perot lasers perform quite well in most applications and are very robust against large interference.

Bruce Currivan of Stanford Telecom rounded out the session with a discussion on the IEEE 802.14 channel model, time division multiple access (TDMA) and quadrature phase shift keying (QPSK) modulation, which he said has been proven robust.

But ask someone which upstream impairment is the worst, he said—ingress, impulse/burst noise or common path distortion—and you'll get three different answers. In conclusion, Currivan outlined the effects of channel characteristics on equipment design.

Proceedings manual

If you missed the Engineering Conference, all the papers presented (as well as papers presented at Expo's workshops) are available from the SCTE in the *Proceedings Manual: Collected Technical Papers*. Contact the Society at (610) 363-6888.—*EB, LH, GL*

SCTE's best take a bow

At the SCTE's Annual Awards Luncheon, the best and brightest of the membership as well as the Society's strongest supporters were honored in front of a veritable who's who in cable technology. On hand were such notables as TCI's Tom Elliot, the National Cable Television Association's Decker Anstrom and Wendell Bailey, re-elected Society Chairman John Vartanian, and Society veterans Walt Ciciora and Ted Hartson.

The honorees were as follows:

• Expo Program Subcommittee members Alex Best and William Riker (co-chairmen), Roger Brown, Paul Levine, Ginny Morris, Tanzy Wallace and Ken Wright received plaques for their efforts in creating the Cable-Tec Expo '96 technical program.

• The program subcommittee of the 1996 Conference on Emerging Technologies was recognized for its efforts in the planning of the phenomenally successful January 1996 conference. Receiving plaques were: Nick Hamilton-Piercy (chairman), Claude Baggett, Steve Johnson, David Large, Patrick O'Hare and Jack Terry.

• Outgoing members of the SCTE board of directors Andy Scott (Region 3), Rosa Rosas (Region 4), Terry Bush (Region 7), Michael Smith (Region 10) and Tom Elliot (At-Large) were recognized for their service to the Society.

• J.R. Anderson, Eric Brownell, Ted Hartson, Lorri Kaufman, James Oldham, Don Shackelford and Bruce Weintraub were elevated to Senior Member status in the Society.

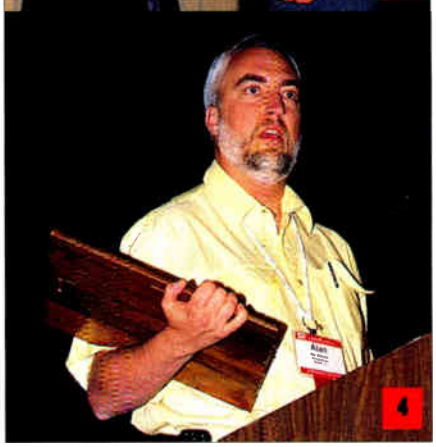
• Ted Hartson was elevated to Fellow Member status in the Society.

• Tom Gimbel, Vern Goebel and Richard Pulley were recipients of Personal Achievement Awards. Created in 1986 as the Outstanding Achievement Awards and renamed in 1991, these awards recognize SCTE members who are outstanding in the performance of their respective jobs in the industry.

• Cox Communications was the recipient of the 1996 Chairman's Award in recognition of its support of the Society's training efforts, particularly through the participation of its personnel as speakers at national SCTE conferences.

• A.J. Genova of Continental Cable received first place in SCTE's fifth annual Field Operations Award competition. Kevin Smith of Bailey Cable TV and David Herman of Time Warner Cable were the second and third place winners respectively.

• Walt Ciciora was inducted into the SCTE Hall of Fame. In 1988, SCTE created its Hall of Fame and honored Cliff Paul as its first inductee. The second inductee, Len Ecker, was honored at Cable-Tec Expo '91; Rex Porter, Jim Stilwell and Dave Willis were inducted in 1992; and in 1993, Steve Bell and James Grabenstein were inducted. Alex Best, Ron Cotten and William Grant were inducted at the 1994 Expo, and Ted Hartson was induct-



1) Consultant Walt Ciciora was inducted into the SCTE Hall of Fame by Diana Riley of Jerry Conn Associates and SCTE President Bill Riker. 2) Bill Riker welcomed John Vartanian of Viewer's Choice back as Society Chairman. 3) Alex Best (right) accepted the Chairman's Award on behalf of Cox Cable from John Vartanian. 4) Alan Babcock, chairman of the Society's Training Committee, was named Member of the Year.

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—GUINN LEVERETT
President, Belhaven Cable TV

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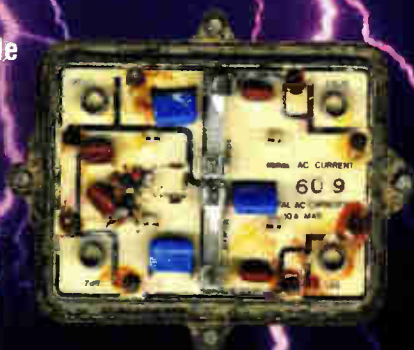

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5) Bill Riker (left) and CT's Paul Levine (right) with Dave Fellows of Continental Cablevision. Continental was this year's Service in Technology Award recipient. 6) Bill Riker (right) recognized Ted Hartson (center) for being elevated to Fellow Member status in the Society. Consultant Walt Ciciora offered his congratulations as well. 7) Riker showed off the invention of Continental Cablevision's A.J. Genova that earned him first place in SCTE's Field Operations Award. 8) Eric Brownell (Sonic Cable Television), Lorri Kaufman (Cable AML), James Oldham (Sprint/North Supply) and Bruce Weintraub (Cable TV Montgomery) were named Senior Members.

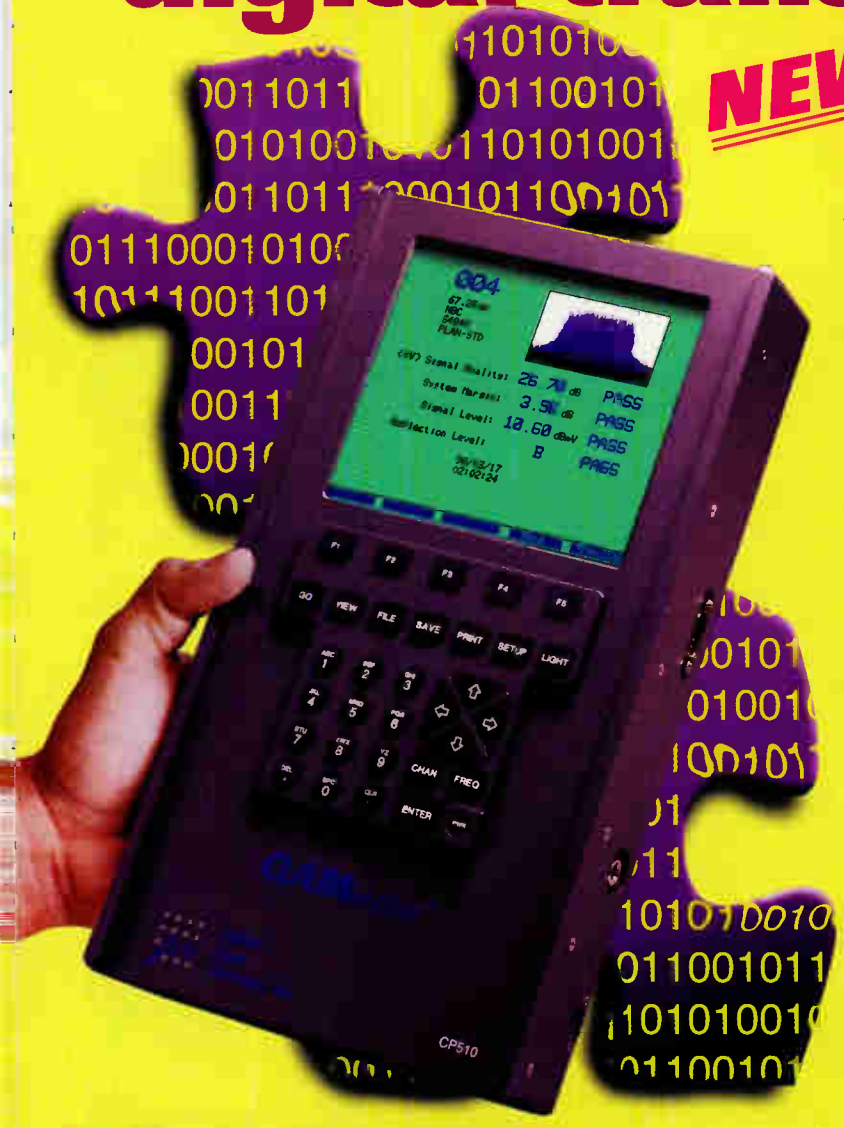
ed at last year's conference.

• Alan Babcock was the 1996 recipient of the Society's Member of the Year Award in recognition of his service to the Society. The Chairman of the Society's Training Committee, he has been an integral force in the Society's development of training programs and services for the cable telecommunications industry.

Service in Technology

Also at the luncheon, Paul Levine of Phillips Business Information (which publishes *Communications Technology*) presented a $2,500 check to SCTE President Bill Riker for the Society's scholarship fund. PBI's donation was made in the name of Continental Cablevision, which as you will remember from June's *CT* cover story, won the Annual Service in Technology award for its educational and engineering commitment to expanding and implementing new cable telecommunications technology. Amos Hostetter, chairman and CEO of Continental made a videotaped acceptance of the award and the company's Senior Vice President of Engineering and Technology Dave Fellows was on hand at the luncheon for the formal presentation.—*AJ, LH*

Don't be puzzled by digital transmission.



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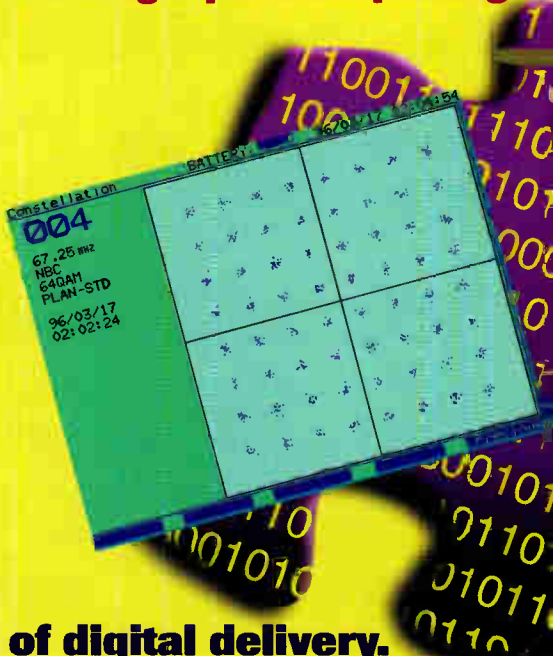

Avoid repeated service calls. The QAMalyzer™ provides a System Margin measurement to tell how close (in dB) your system is to freeze frame video failure. Conventional test equipment cannot provide these measures.

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toward the deployment of hybrid fiber/coax (HFC) networks," states the report.

Prime to test high-speed data

Prime Cable initiated a high-speed data-over-cable test with cable modem system manufacturer COM21 for Internet access field trials in Las Vegas.

This is COM21's first cable modem trial with a major cable operator, but the company also has field trials in Palo Alto, CA. Prime will deploy 50 COM21 ComPORT cable modems primarily to residential users and some business and commercial users in the Vegas area. The test will run through the first quarter of this year.

Prime's Senior Vice President of Science and Technology Dan Pike seems pleased with the asynchronous transfer mode (ATM) technology offered by COM21, commenting, "COM21 is the first ATM-based cable modem platform that offers the most scalable, cost-effective solution for multiple levels of service."

Digital ad sales: New Labs group

Cable Television Laboratories announced the creation of a new subcommittee to focus on issues associated with helping the cable industry derive ad sales revenues from digital programming.

Jay Vaughan, director of engineering and technology with Time Warner Cable, will chair the new group. Carol Derr, director of advertising technology with TCI Technology Ventures also will play a key role in the group, which is a subcommittee of the CableLabs Technical Advisory Committee.

CableLabs' engineering and digital network technologies departments will work with the subcommittee on hardware, software and digital systems integration issues connected with local advertising and substitute video insertion and program generation.

DBS users very satisfied

A recent Nielsen Media Research study revealed high satisfaction

Tech-hungry attendees pack workshops

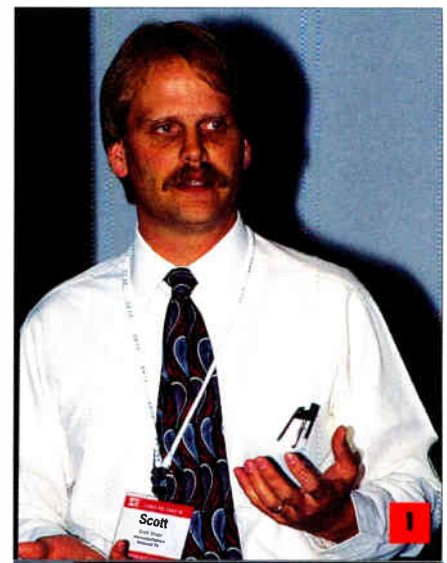
Workshops are the very heart of Expo. This year's confab boasted standing room only at its most popular workshops, which ranged from "Making Two-Way Work" to "Telephony 102." If you wanted to soak up the latest on cable telecommunications technology or address the industry's top technical experts on the likes of data transmission, digital technology, network management or regulatory issues, Cable-Tec's workshops were the place to be.

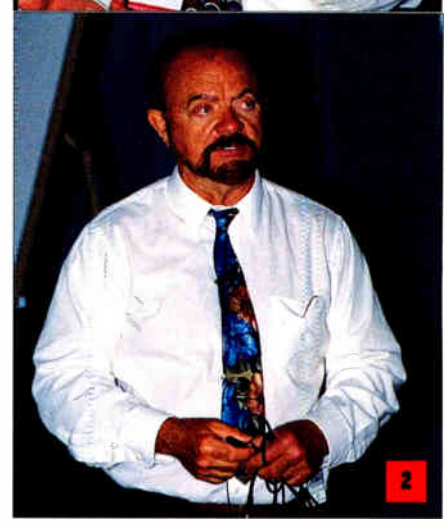
Take a look at the following list of workshops for an idea of the variety of top-level training offered at Expo '96:

- Cost Analysis of System Rebuilds
- Data Transmission "Byte to Byte"
- Digital Technology 102
- In-Premise Wiring Issues
- Making Two-Way Work
- Network Architectures 102
- Network Management
- Powering Issues
- Regulatory Issues
- Telephony 102

Also offered again this year were pre-conference tutorials for those who wanted to get to Nashville a bit early for the basics on the following:

- Achieving SCTE's Broadband Communications Technician/ Engineer (BCT/E) Certification
- Audio Quality in the Multi-Channel Universe (Part 2)
- Consumer Interface and the New Telecommunications Bill
- Justifying Training in Your Company's Annual Budget





1) Scott Shupe of Intermedia Partners addressed attendees in "Cost Analysis of System Rebuilds." 2) Richard Covell of Texscan covered data transmission topics "byte to byte."

Tutorials

More and more, you see certification listed as a preference (if not a requirement) in help wanted ads in

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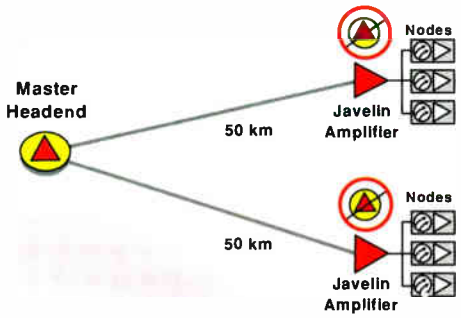

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the cable trade publications. The SCTE's BCT/E program is often called for by name in those ads. Vanguard Cable's Keith Hayes and Multimedia Cablevision's Vicki Marts provided pre-conference attendees tips on taking BCT/E tests at their tutorial.

"Audio Quality in the Multi-Channel Universe" featured HBO's Craig Cuttner, The Family Channel's Russ Murphy, Tektronix's Linc Reed-Nickerson, TCI's Dom Stasi and Dolby's Craig Todd. They discussed components of audio and tools and techniques for ensuring its quality as operators add significantly more channels.

Consultant Walt Ciciora said in the "Consumer Interface and New Telecommunications Bill" tutorial that a "vocal minority with a bad attitude" has pressured the Federal Communications Commission to "give consumer electronics a free ride and dump on cable." He stressed that cable's first goal in the regulatory free-for-all should be to protect the industry's right to scramble.

So you say you know you want to train your technical people but system management just won't budget for it? TCI's Alan Babcock, Jones Education Networks' Jim Honiotis and the National Cable Television Institute's Don Oden supplied tips on justifying training in your company's annual budget at their tutorial.

Workshops

All 10 of Expo's workshops are presented continuously over six periods, so engineers and technicians had plenty of today's hottest industry topics to pick from. What follows is an overview of each session.

Worried about the quality of your drop system and wondering how much peace of mind will cost you? You're probably not alone.

At "Cost Analysis of System Rebuilds," high-bandwidth, high-performance drop systems and the cost implications of implementing one were discussed by Dale Lutz of ETG and Scott Shupe of Intermedia Partners.

Attendees walked away armed with knowledge on how to ensure proper drop system operation for predictable forward path performance as well as ideas on how much money they'd need to slate for it.

3) Comcast's Megel Brown stressed digital signal quality.
4) Coaxial's Ron Hranac told attendees how to make two-way work.

Texscan's Richard Covell and DDW Service's David Devereaux-Weber took on "Data Transmission 'Byte to Byte'" They reviewed hardware used for data delivery over broadband networks and answered questions about content (including the Internet) that can be provided over these systems.

Going beyond the basics, "Digital 102" featured Megel Brown of Comcast and Hewlett-Packard's Don Gardina. They related key characteristics of digital video systems to the changes required when measuring digital signal quality. Cable modem technology, basic architecture, network protocols and plant operations also were detailed in this workshop.

Drop cable represents as much as 75% of the coaxial cable in today's systems and there may be as many connections in a single home as there are in a mile of the distribution system.

The "In-Premise Wiring Issues" workshop touched on these facts as well as updating attendees on SCTE standards and FCC policies. Barry Smith of Texscan and TCI's Neil Taggard also reiterated that in the system of tomorrow, the drop system will continue as a major element in reliability and performance.

Ron Hranac of Coaxial International (as well as *CT's* senior technical editor) and Tom Staniec of Time Warner took on one of today's most highly debated topics, "Making Two-Way Work." Hranac detailed reverse alignment difficulties, ingress, common path distortion, filter isolation, and interference from equipment located in subscriber's homes. Hranac commented, "Two-way will be the source of a lot of headaches, but the problems are manageable if operators are willing to commit the necessary time and resources."

Staniec made an interesting point when he said, "A 500-home node is the equivalent of 500 headends trying to simultaneously send signals back to a common point—the real headend."

The need to establish transmission level points at the inputs to reverse amplifiers was stressed by Staniec and he gave several real-world examples, which included displays from spectrum analyzer measurements made in operating two-way systems.

At the "Network Architectures" workshop, Kenneth Metz talked about the key attributes for qualifying network architectures: information capacity, transmission performance, system reliability and flexibility for future services.→

Can I Afford to Add Channels Now? You Bet.... And Tulsat is the Key

Many dollars can be saved when adding channels. Refurbished receivers, Videociphers, modulators, and processors can be the answer. With numerous headends being combined, quality used equipment is available at reasonable prices.

The key is where to buy. Tulsat provides new and refurbished equipment with warranty. Prices vary with supply and demand... NOW is a good time to buy as prices of receivers and VCII's are low.

Approximately 65% of the channels can use the less expensive "white label" VCII's. Identifing these channels can save hundreds of dollars. Basically, only "pay" channels or channels which have scrambled in the last three years require a plus or VCRS plus descrambler.

Tulsat's halfsize VCII chassis saves space. It also provides air control which keeps the temperature of the VCII down. Heat has been a major problem with VCII's.

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5) SCTE's Ralph Haimowitz and 6) FCC's John Wong addressed regulatory issues including safety and the Telecom Act.

Metz noted that errors caused by loss or noise can be corrected using a digital system. "In the digital world, it is possible to throw in a few extra bits in such a way that if errors occur, you can detect them, and in a lot of cases, correct them. It is really important in broadcast video because you do not get a second chance."

In a presentation on HFC return systems, Rembrandt Mayes looked at some of the issues involved in putting a return path on RF and fiber-optic networks. He noted, "It is easier to increase the capacity of fiber than RF. If you are pulling fibers and leaving spares, activating some for returns will allow you to support return paths without impacting your design. With RF, if we have to design return we are now limiting the forward capacity."

"Network Management," hosted by Pam Anderson of CableLabs and Terry Poindexter of Integration Technologies, examined what cable operators need to do to move from a single one-way broadcast service to delivering multiple two-way interactive services. The key will be effective network management. As users abandon the sedentary role of couch potato and become more active, more support will be needed.

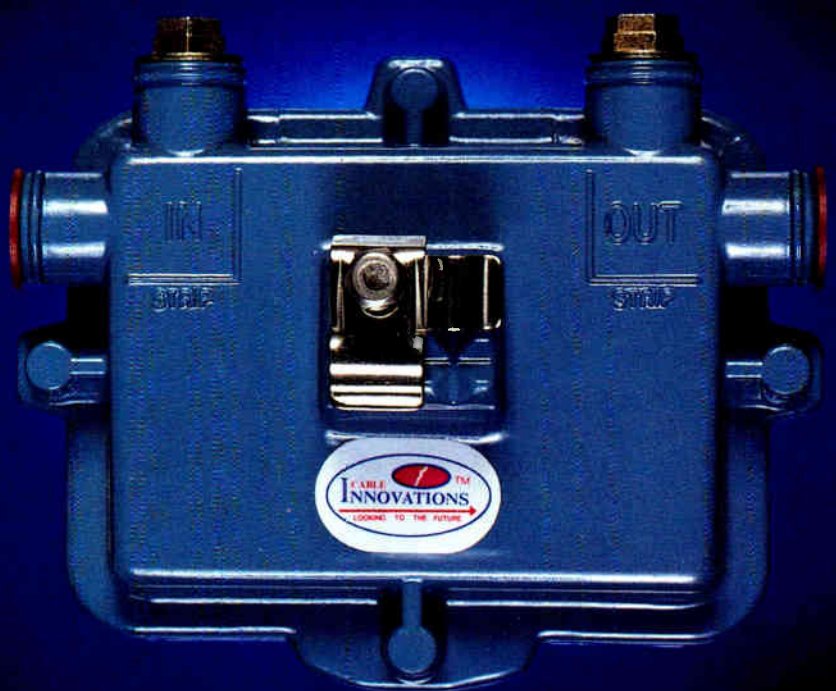
The headend must become a much more proactive data center, Anderson stressed, as cable modem architectures move from peer-to-peer to a master/slave configuration.

Although new management protocols are emerging for telephony, SONET, data and RF status monitoring, the search of a common protocol in the long term continues. And while many companies say their products are telecommunications management network (TMN)-compatible, the reality is that true TMN compliance has yet to arrive.

To get there, Poindexter highlighted today's cable/broadband environment and operations support systems (OSS). He noted the "incomplete" vendor-supplied element management systems (EMS) currently in use, pointing the way to a vendor-independent integrated subnetwork loop manager that will require less staff training, correlation of fault messages for the entire subnetwork, and reduced traffic between element management layer (EML) and network management layer (NML) systems. Successful implementation will require integration of network infrastructure design with network management.

As cable operators begin to roll out new services such as telephony, they will need more power, and probably need to reconsider their power distribution architecture. With that in mind, "Powering Issues" proved a popular workshop. →

The 99.99% Reliability Factor



[Cable Innovation's CLPS-4065 Surge Suppressor]

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

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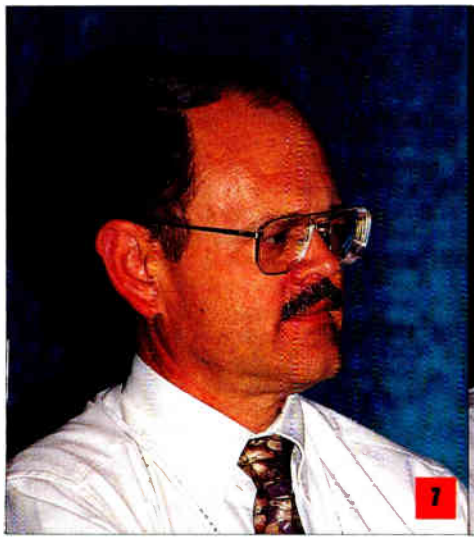

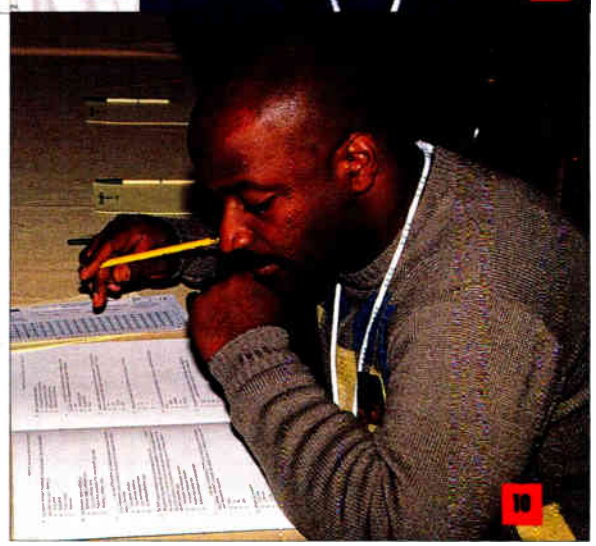

7) Jay Junkus and 8) Mike Sawyer of KnowledgeLink taught the basics of telephony. 9) Rembrandt Mayes of C-COR covered network architectures. 10) BCT/E tests were offered at Expo.

Tom Osterman, President of Comm/Net Systems said companies that deploy telephone services over their cable will need anywhere from 40% to 60% more power, depending on how they deploy the service. At the same time, they want the power system to support the same high degree of reliability expected for telephony.

To address the needs of both video and telephony, some operators have begun deploying some rather radical systems. Southern New England Telephone has deployed a 480 VAC three phase power system for its new video/telephony service. The power is carried to the local drop, where it is stepped down to 90 V.

Osterman said SNET even approached the local power company about developing a highly reliable power service for a premium. But the power company balked after a severe winter in which they lost power throughout their system for an extended period of time, and realized it did not need one more headache.

Andy Marsh of Lucent talked about successful elements for a next-generation power system. Marsh said the best system is one with a higher voltage since it makes it easier to deliver current down a long distance. When you upgrade the voltage, the downstream devices use less current, so you can send power over longer distances.

"Regulatory Issues" was presented by SCTE's Ralph Haimowitz, Time Warner's Steve Johnson, Kramer Monroe & Wyatt's Jonathon Kramer, and the FCC's Frank Lucia and David Sturdivant and John Wong. Not surprisingly, the spotlight was on the Telecommunications Act of 1996. Open video systems, commercial availability of navigational devices, home wiring and equipment reliability were discussed. In addition, the "low emphasis on safety concerns" was described as "an economic time bomb waiting to explode."

For cable operators considering offering telephony services over their networks, the "Telephony 102" workshop provided an overview that broadly examined areas including powering issues, switching, intelligent networks, and a transport explanation focusing on synchronous optical network (SONET).

J.R. Anderson of Integration Technologies explained power concerns for HFC networks. He cautioned attendees to guard against undesired transients when providing services over HFC. Sheath currents, or currents not attributable to the CATV plant, can inadvertently affect power in a system, Anderson explained.

Justin Junkus of KnowledgeLink explained the telephone switch's functions of processing calls, routing calls and providing features. For call processing, Junkus explained, the switch must provide dialtone and check a user's feature access and call privileges.

Junkus' colleague at KnowledgeLink, Mike Sawyer, went beyond the concept of the dialtone to intelligent networks. While dial tone is a basic and necessary service, Sawyer explained, increased revenues are derived from enhanced services. These services, which tend to be digital, require intelligent networks.

Nortel's Antonio Gutierrez provided an overview of SONET transport architecture. SONET signals are managed by their synchronous transport signal (STS) channels or time slots, he explained, each of which contains a virtual tributary to carry lower-speed signals. *—EB, AJ, LH, GL, AZ*

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Over 325 booths offer a technical buffet

Over 325 exhibiting companies and 3,200 exhibitor personnel packed the show floor at Cable-Tec Expo '96 with a full gamut of broadband network products and services. Attendees hitting the floor saw high-speed data delivery products, solutions for return path problems, fiber-optic equipment, test and measurement units, network management systems, powering options and more.

What follows is a few highlights of products unveiled at this year's SCTE show. For more new products and further detailed information on the ones listed here, watch *CT's* "Product News" department. (This month's starts on page 100.)

"Cold-sleeve" support was highlighted by **Advanced Custom Applications**. The unit is a user-friendly closing tool for the company's ULTRAsleeve mechanical fusion splice protection cover.

ADC Video Systems had a new video transmission system that supports both MPEG-1 and MPEG-2 encoding and decoding.

The Soloist digital video player came from **Adtec.** It's a professional MPEG digital playback device designed for use with the company's Ad-Maestro for commercial insertion or the Lite-Ning or Active 64-16 systems for local origination playback automation.

An emergency alert addressable messaging system was offered by **Albrit Technologies,** the Cable Envoy. The product displays alerts as crawls along with an audio override.

Introduced by **Alcoa Fujikura** was the latest version of the company's loose tube interconnect cable, the Node-Connect. It can serve in both indoor and outdoor applications. Also new was the company's FSM-30S ultra low-loss direct core monitoring PAS system.

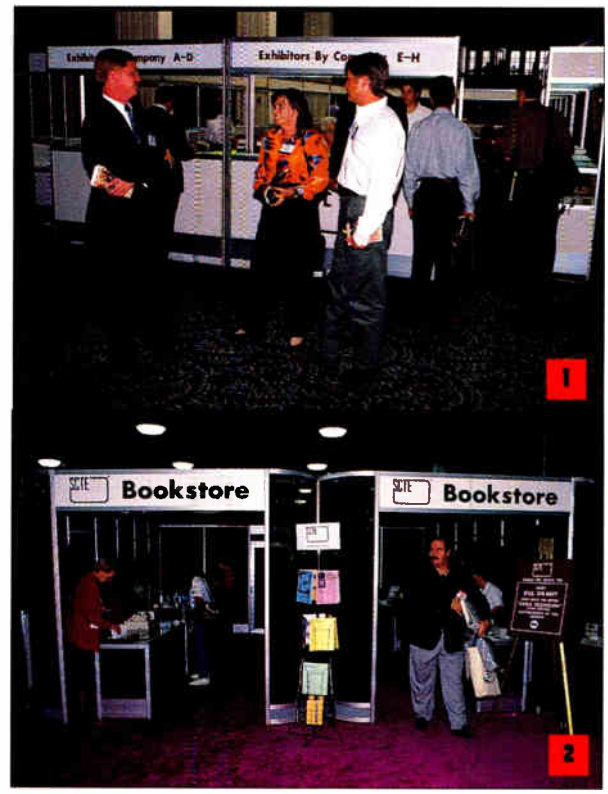
The Genasys line of power supplies was shown by **Alpha**. Features include modularity and uninterruptible power.

Those in the market for a new pulling lubricant could stop by **American Polywater's** booth. The Premise Lubet lubricant is for friction reduction on inside wire pulls in premise wiring.

A variety of new equipment was displayed by **Antec**. New products included Light Link, an integrated fiber management system, Laser Link and Laser Link II broadband optical transmitters and Midpak fiber splice closures.

Highlighted by **Antronix** and **TVC** was a dual compartment multi-tap housing for use in advanced networks and traditional high-density plant.

Applied Instruments offered three new models of spectrum analyzers. They have 75 ohm impedance and a built-in calibration standard.



1) Over 4,000 registered attendees swarmed to Expo. 2) The SCTE Bookstore offered everything from training videotapes to souvenir T-shirts and mugs.

Artel offered the new Megalink transport system. Functions include: as a D-1 component video fiber-optic transmission system; multiport repeater with no quality or signal loss; and as an interface to digital video switchers.

Launched by **ATx Telecom** was its new Javelin 1,550 nm trunk EDFA offering low-noise and compact packaging.

Avantron displayed its new 2000 Series portable spectrum analyzers. They weigh under 19 pounds.

Newly formed **Backdoor Inc.** made available a fully automated tap and audit management system with programmable hand-held computers for retrieving field data.

Barco unveiled its Copernicus headend server. The product offers advanced system control and high-performance features found in telephony operations.

The OBT-155 broadband transmission system was unveiled by **Bosch Telecom**.

A rack-mounted headend switching controller with modular plug-in upgrades to include performance status monitoring, advanced pay-per-view messaging and Federal Communications Commission-mandated Emergency Alert System (EAS) was introduced by **Cable Communication Systems**.

Cadco added two cable emergency alert systems to the market.

New software for fiber design and management was shown by **Cadix.** →

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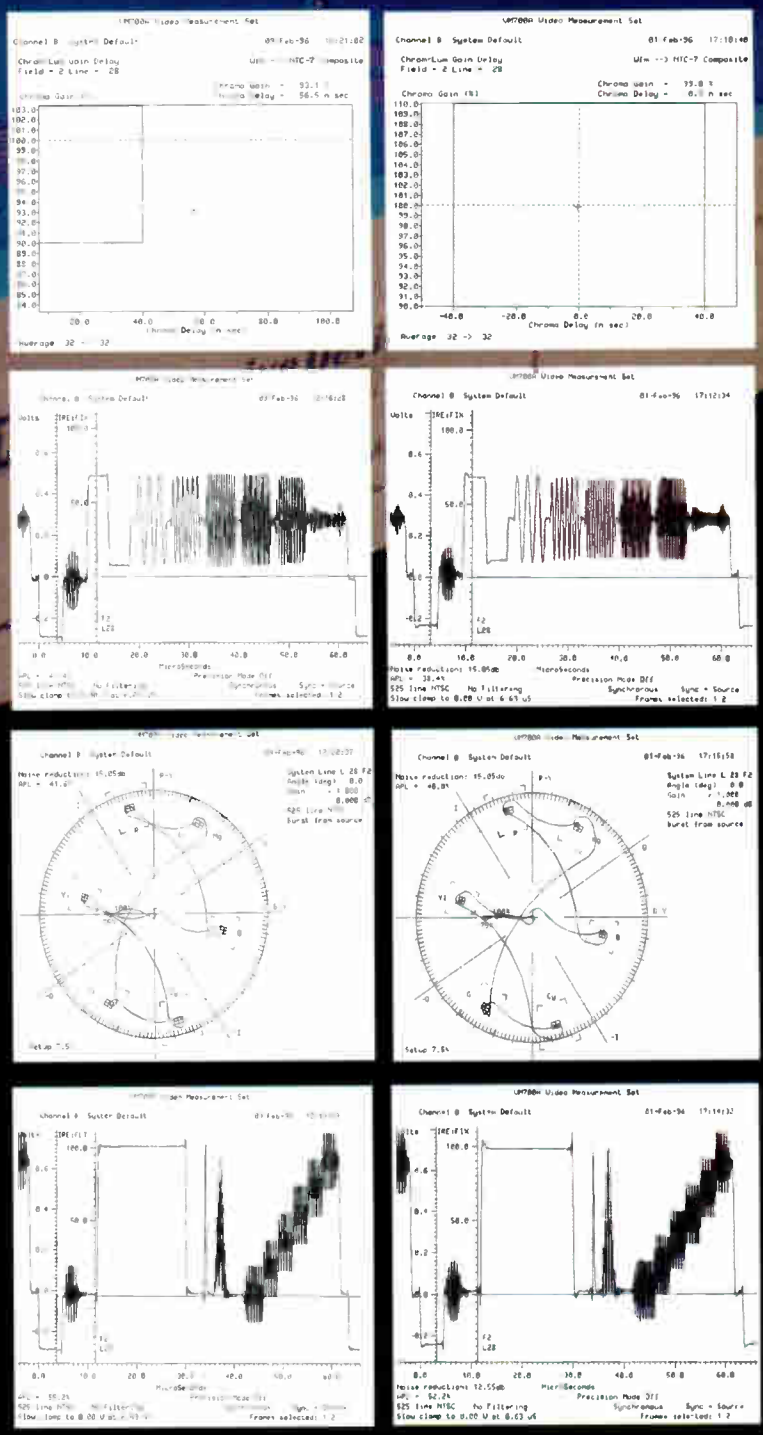

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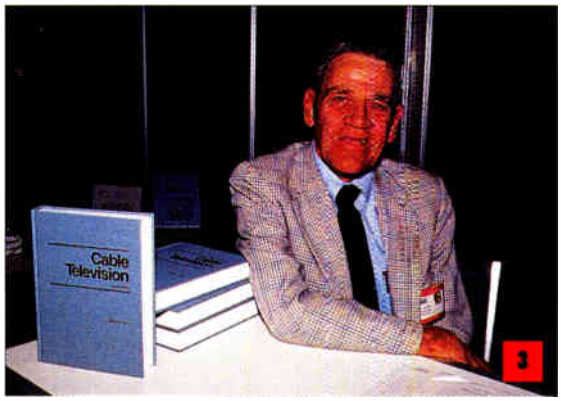

3) Author Bill Grant signed copies of "Cable Television" at the Bookstore.

The DLPS-15DF high pass filter with surge suppression was new from **Cable Innovations.** Surge suppression is accomplished with a silicon chip.

Cable Leakage Technologies' Wavetracker had new software and 2-5 meter positioned accuracy.

Channell Commercial showed its new 600 Series heat dissipation covers. They are available on the company's SP1010, SPH1212 and SPH1432 enclosures.

CommScope highlighted a new line of 50 ohm coaxial cables, Cell Reach.

A new line of universal remotes was rolled out by **Contec.**

New from **Dawn Satellite** was a line of block translators and downconverters for satellite receivers.

Electroline unveiled 90 V powering options for its line of passive and active multitaps, including the 1 GHz SuperTap and the compact addressable tap (CAT). Also new from the company was the addressable drop extender that featured an integrated drop amplifier with 18 dB gain, surge protection, equalization and internal power supply.

Fotec showed off a $239 fiber power meter, the FOtest'R.

The FiberSTAT fiber switch module was added to **GC Technologies** fiber monitoring and test system. It can monitor anywhere from two to 72 fibers.

A fiber-optic pulling capstan that can easily be used with existing pulling equipment was new from **GMP.**

On the local commercial insertion front, **Fox Electronics** introduced test equipment to troubleshoot such systems.

General Instrument displayed its new MegaStar 1,550 nm fiber-optic analogtransmission product family.

An expandable environmental cabinet was made available by **Hennessy.** The M-UCN modular design cabinet is constructed of aluminum and designed to meet Bellcore specifications.

Harmonic Lightwaves showed its new HLS 1000 splitter series. It 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.

New from **Hewlett-Packard** was a sweep/ingress analyzer designed to enable broadband communications engineers and technicians to test the forward and return paths and quickly troubleshoot their systems despite

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the presence of ingress. As well, H-P and Sarnoff announced the HP E6276A MPEG scope DVB, a real-time MPEG-2 analyzer for digital video broadcast systems and networks.

Highlighted by **ISC Datacom** was a new asynchronous cable modem. It is designed to operate at any data rate up to 19.2 kbps, protocol transparent.

Jameson introduced two lines of stringing blocks, Easy Rider and Versa Block. Also new were 60x and 90x corner blocks and two types of mounting brackets.

The new Xpress 12 x 1 serial video and audio switcher was at **Leitch's** display. It is a one-rack unit with a built-in analog video and audio monitoring output option. The company also came up with a serial protocol (SPT-1000-SXY) that allows Leitch's routers to be controlled by other makers' control systems and vice versa.

A new emergency alert system was unveiled by **Mega Hertz** and **Sage Alerting Systems.** It is said to be "the most advanced audio and video emergency alert system available for cable TV operators."

Motorola announced it agreed to license **Macrovison's** pay-per-view copyprotection technology. Motorola plans to incorporate the technology into its integrated circuits for the cable set-top, direct broadcast receiver, DVD and other markets.

The CMS 2000 from **Norscan** was on hand at Expo. It is a fiber monitoring system that provides early warning of any damage.

Ortronics showed its new Category 5 110 patch panels with hinged wire management. Designed for rear access applications where space is limited, the panels open down for easy termination.

The Supreme Series headend line was expanded by **Passive Devices** with a new, high-performance "T" channel modulator called the PDI 60 CMT. The PDI 60 AP agile heterodyne processor was rolled out by the company as well. It provides the operator with the option of cable-to-cable or UHF-to-cable, and is HRC-switchable. Also new was the Mighty Mod Plus SAW filtered, fixed channel modulator.

Phasecom showed its new P445 cable modem. Data transfer at 2.048 Mbps is offered. Also new were reverse channel spectrum organizer solutions.

Power Guard displayed its new Uninterruptible Common Ferro (UCF). It's a cable system-friendly 90 volt powering system.

The ER series standby power supply product family was new from **Powertronics.** It is designed for node powering in HFC architectures.

QEC announced its new Q-switch line of matrix RF switching systems was optimized for 16 x 16 modular building blocks.

Offered in 10 dB or 20 dB of gain, **Qintar** showed off its RAMP Series of house amplifiers.

Quality RF rolled out 550 MHz replacement line extender modules for Jerrold JLE, JLC, JLP, JLX and Pathmaker Plus PAL housings. They are offered with integral two-way filters and accept a transistor return from QRF. →

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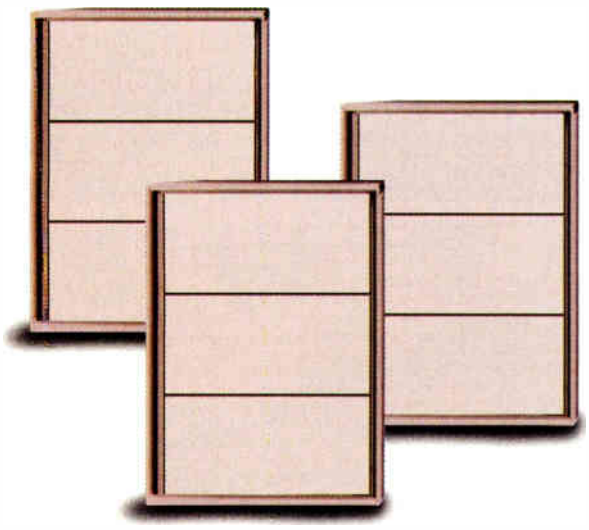

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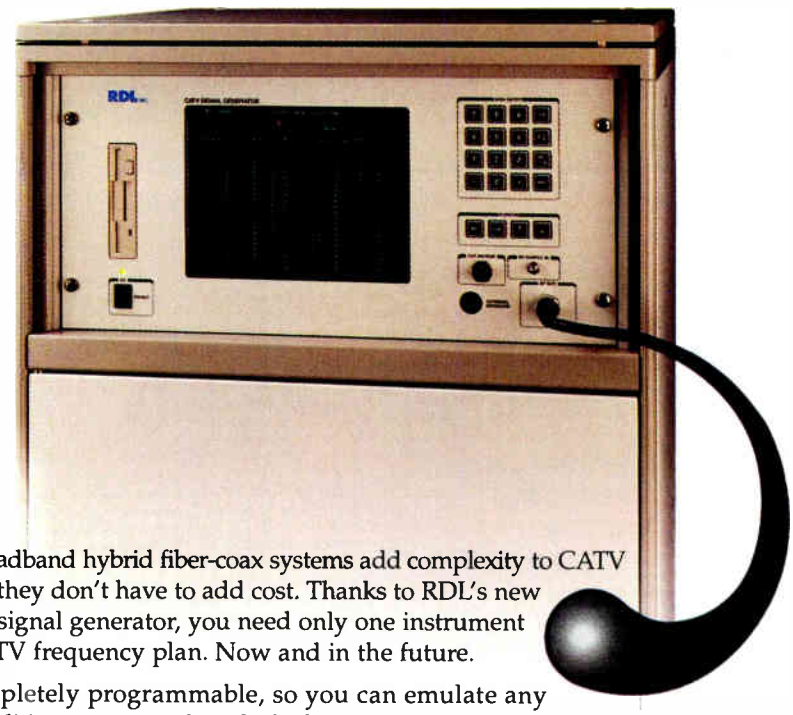

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Showed off by **Reltec** was the new Vortex power platform, an integrated power solution designed for the needs of DC-powered wireless and wireline applications.

Ripley showed off a new Cablematic tool. The universal drop trimmer (UDT) has interchangeable blade cassettes that perform to SCTE and Bellcore specs.

An exclusive 16-way splitter was made available by **RMS.** It's for use in multi-dwelling installs and also can be used as a headend combiner.

Sadelco added the Minimax 800 signal level meter to its bag of tricks. Digital tuning and an autoranging attenuator are featured in the product.

SeaChange Technology introduced MediaCluster, a technology said to allow its video servers to scale gracefully and share storage without replication.

Sencore took advantage of Expo to unveil its SL755 Director handheld MMDS digital signal level meter. It allows you to tune to any channel or frequency in the spectrum from 50-860 MHz.

A distribution agreement was announced by **Sprint/North Supply** to market a new emergency alert system. The MIP-921 encoder/decoder is from **HollyAnne Corp.**

Stanford Telecom unveiled the STEL-1108 applications specific integrated circuits modulator chip for hybrid fiber/coax (HFC) networks. The product is a complete quadrature phase shift keying (QPSK) modulator on a single chip that features clock speeds up to 126 MHz. The new STEL-9244 burst receiver for interactive CATV digital headend equipment also was on display.

Superior Electronics and **Scientific-Atlanta** announced an agreement to co-develop solutions to monitor and manage headend functions. S-A's analog headend management products and Superior's Cheetah HE-1000 headend signal analyzer will be integrated.

Antares, a new modular fiber-optic transmission system, was highlighted by **Sychronous.**

Demonstrated by **Tektronix** was a new digital channel RF measurement feature on its portable spectrum analyzer.

A new manual clip to attach drop cable was shown by **Telecrafter.**

A recently completed series of instructional videos on the subject of semi-flexible coaxial cable were offered by **Times Fiber.** The videos cover handling and storage, aerial and underground installation, and preparation for connectorization.

Unveiled by **Tekron** was the SMC system for emergency remote-controlled IF and baseband matrix switching.

Trilogy's new drop cable was on display. It was designed exclusively for the wireless and microwave TV industries and is messengered with built-in antenna discharge ground wire.

New from **Triple Crown** was the IMX Series of single hybrid indoor MDU amplifiers. Features include power doubling and add-on active or passive two-way operation.

Debuted by **Vela** were four-channel MPEG-2 decoder boards for ad insertion and near-video-on-demand. They allow insertion from a server in analog streams.

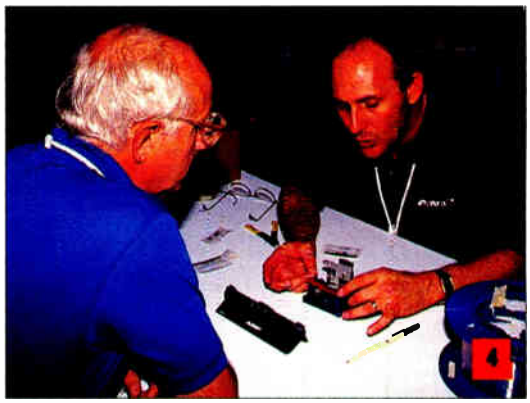
Video Data Systems showed its ViDStar, a new graphics video billboard and super controller for automated video presentation applications, and its new Series 800 micro playback system.

Highlighted by **Viewsonics** was its new return path amplifier series. The series is made in the company's mini-amplifier housing that is about the size of a three-way splitter.

Wavetek showed a new monitoring package, the CMS1000. It is made up of PC-based central monitoring software and remote monitoring units with the company's Stealth measurement technology. The company also announced it has incorporated a highly sensitive leakage detection mode and Micro-Stealth measurement technology into one product, the CLI-1450.

Fiber splicing

Checking out the latest in cable telecommunications products and services wasn't the only thing to do in the exhibit hall. For example, AMP and Sprint/North Supply gave everyone the chance to perform a splice at the special fiber-optic splicing workshop, which was located on the show floor. Personalized certificates were presented to successful participants to acknowledge their splicing expertise.



4) A fiber-optic splicing workshop was offered on the show floor.

Bookstore

The SCTE boasts some of the best technical training tools in the cable telecommunications business and at Expo you could peruse the Society's offerings at the SCTE Bookstore, located in the exhibit hall. If you ever wanted to meet the author of the classic, Cable Television, the SCTE Bookstore offered you your chance. Bill Grant was on hand to chat with attendees as well as autograph his book.

Exhibitor training center

A technical training center at the entrance to the exhibit hall allowed Expo exhibitors to offer formal presentations of their products and related technologies. Presentations included:

- "The Super Headend" by ADC Telecommunications
- "Understanding TDRs" by Riser-Bond Instruments
- "Crash Protection for CATV Systems-Powering Demo" by Exide Electronics
- "Balancing Bi-Directional HFC Systems" by Hewlett-Packard
- "Protection Connections Without Heat or Flame" by Contech Systems
- "Installation" by Diamond Communication Products
- "Implementation of EAS" by Mega Hertz
- "Inexpensive Digital Ad Insertion" by Adtec
- "Drake EAS Modulators" by R.L. Drake
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levels among direct broadcast satellite (DBS) users.

Out of the 2,394 Primestar subscribers surveyed, 48.9% gave their service the highest possible ranking. Over 77% gave the service a satisfaction rate of 4 or 5 on a scale of 1-5 with 5 being the most satisfied.

The study reinforces Primestar's own research the company collected last November, which indicated 93% of its customers were satisfied with the service and 76% were very satisfied.

In Primestar's research, the degree of satisfaction was based on 18 factors including picture quality (with 96% of customers being very satisfied), sound quality (95%), view feature (95%), and ease of use (92%).

ITV launched by GTEamericast

GTEamericast launched its GTEmainstreet interactive TV (ITV) service in Clearwater, FL. It is a joint venture between GTE, Ameritech, Southwestern Bell and Southern New England Telephone. Five hundred subscribers now have the service, but projections of 20,000 by the end of 1997 have been issued.

Occupying two channels on GTEamericast's 78-channel system, subscribers use a remote control with an alpha key pad as a keyboard to operate. Features include real-time stock quotes, weather forecasts, ticket purchasing and full-motion video games.

CT sister publication *CableFAX* reported that GTE's Al Giannotti said the goal is to draw subscribers from Time Warner's 730,00-subscriber base in the Tampa, FL area. Time Warner said it had no immediate plans to upgrade the MSO's Tampa system to support interactive TV, but there are plans in all of the systems to upgrade to support digital and TW's Road Runner Internet access service.

NOTES

• **TCI** named John Malone to the additional position of chairman of the company's board of

Hospitality Nashville style

What would Expo be without the chance belly up to the hors d'oeuvres tables and a do a little palm pumping with old friends at the show's social events? Plenty of receptions had attendees kicking up their heels or just plain ol' settin' a spell after a full day of cable telecommunications technology.

The traditional Arrival Night Reception sponsored by Wavetek RF Products was followed the next evening by the Welcome Reception hosted by Alpha Technologies, Harmonic Lightwaves, Hewlett-Packard, Sprint/North Supply and Times Fiber Communications. The Welcome Reception featured the Fifth National Cable-Tec Games.

1) Hot dogs and all the fixins were served at Wavetek's Welcome Reception. 2) Attendees flocked to Expo Evening.

Let the Games begin

Answer: It's caused by excursion modulation in a modulator.

Question: What is white compression?

"You got it. Sixty points to Lee Summers," bellowed Cable Jeopardy host Steve Allen. Summers, of Time Warner Entertainment in Memphis, TN, was the eventual overall winner at the Cab-Tec Games.

The competition, which took about three-and-a-half hours, was

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comprised of five events ranging from Cable Jeopardy to trunk/feeder cable splicing. Roughly 50 cable technicians from around the country competed in teams of five. Other events included meter reading, OTDR and "Go Fetch" in which participants had to scrabble through a wooden box and identify various pieces of cable equipment.

While a good time seemed to be had by all, the cable technicians were intent on showing their stuff. So intent in fact, that one participant continued splicing his cable despite the blood flowing from his thumb.

Over at the meter reading table, Sencore's Alan Baarson looked on as a technician raced against the clock. "This stuff stretches their knowledge a little bit," said Baarson, noting, "It's not necessarily something they do on a daily basis, but it's something they need to do." Baarson said Sencore is trying to get more involved with SCTE at a local level and "it just kind of carried over to the national shows."

Participants in the games donned T-shirts and baseball caps with the "Cable Guy" logo on it, in good-natured recognition of the new Jim Carrey movie. Despite the industry's attempt to make light of Carrey's newest role, evidence of cable's real feelings often arose. This was the case when Jeopardy's Allen quipped: "Folks, anybody who would play 'Dumb and Dumber' and 'Pet Detective' doesn't have a lot of credibility. Really, don't take it too seriously."

Winners for the Games are as follows:

Overall: 1st) Lee Summers, Time Warner Entertainment; 2nd) Doug Hamilton, Paragon; 3rd) Dan Kowal, Charter Communications.

Go Fetch: 1st) Steve Dyche, St. Joseph Cablevision; 2nd) Steve Strouth, Time Warner Enter-tainment; 3rd) Thomas Saylor, Tech Services.

Splicing: 1st) Doug Hamilton; 2nd) Dan Kowal; 3rd) Jimmy Smith, Lakewood Cablevision.

Jeopardy: 1st) Thomas Saylor; 2nd) Steve Georgia, TCI; 3rd) Lee Summers.

3) There were plenty of vittles to choose from at Cable-Tec's parties. 4) and 5) Tech types battled it out at the National Cable-Tec Games for bragging rights.

Black Box: 1st) Maylo Zubik, Time Warner Entertainment; 2nd) Mark Hood, Friendship Cable; 3rd) Thomas Saylor.

OTDR: 1st) Doug Hamilton; 2nd) Dan Kowal; 3rd) Jimmy Smith.

SCTE Member Meeting

Just prior to the Welcome Reception with its Cable-Tec Games, many SCTE members joined together at the Annual Membership Meeting and House of Delegates. There they had the opportunity to meet the Society's national board of directors who fielded questions and addressed concerns of the membership.

Subcommitte meetings

Also getting together at Cable-Tec Expo in Nashville were members of the SCTE engineering subcommittees. With the introduction of two new groups, the Society now boasts seven subcommittees working on development of technical standards.→

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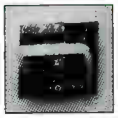

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300, 330, 400 and 450 MHz
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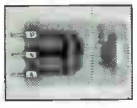

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9, 12 and 15 dB

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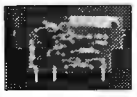
550 MHz – 2, 5, 8, 11, 14, 17. 20, 23, 26, 29 dB



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Return Loss = 16 dB All Values
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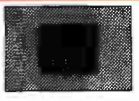
QMAG-P



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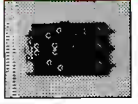

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550 MHz – 0-24 dB
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(0-24 dB, in 2dB increments)

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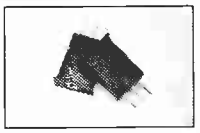
Values: 6 dB, 12 dB, 18 dB, 24 dB



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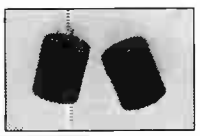

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All attendees were invited to sit in on these meetings.

Subcommittees and their chairmen are as follows:

- Data Standards (Chairman David Fellows of Continental)
- Digital Video (Chairman Paul Hearty of General Instrument)
- Emergency Alert System (Chairman Steve Johnson of Time Warner)
- Maintenance Practices and Procedures (Chairman Bruce Weintraub of CTM)
- Material Management/ Inventory (Chairman Tom Gimbel of Helicon)
- Interface Practices (Chairman Jim Haag of Time Warner)
- Design and Construction (Chairman Keith Burkley of Time Warner)

For more details on how you can get involved with any of these subcommittees, contact the SCTE at (610) 363-6888. Meetings are usually scheduled for major cable telecommunications trade shows (including Cable-Tec Expo).

Ham reception

At their annual Expo reception, amateur radio operators ("hams") employed in the cable industry matched call numbers with faces over refreshments served courtesy of Scientific-Atlanta. A highlight was the ham-related door prizes giveaway. Dozens of prizes were awarded, but lucky Scott Roach of Pioneer (KB8SSI) trotted off with the big prize: an IC-736 transceiver SM-20 deluxe microphone donated by TCI and S-A.

"SCTE LIST" party

Dubbed the Online.users@expo.com Reception, at this gathering "SCTE LIST" group members met face to face rather than modem to modem. The group consists of over 700 engineers and technicians who exchange information and ideas through the resources of the Internet.

Loyal Order of the 704

This private reception was open only to cable pioneers with 20+ years in the industry. For more details, see Rex Porter's "Editor's Letter" on page 6. →

6) Cable technicians fielded tough questions for "Cable Jeopardy." 7) Augat's Steve Christopher congratulated Games winner Lee Summers, along with Phillips Business Information's Paul Levine and Texscan's Barry Smith. 8) Amateur radio enthusiast Scott Roach (KB8SSI) accepted the big door prize from Ron Hranac (N0IVN) at the Ham Reception.

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Reader Service Number 26

Expo Evening

The big shindig proved to be "Expo Evenin' on Hickory Ridge." Expo Evers hunkered down with barbecue and down-home country-style food in a hillbilly setting. Many donned country music bandannas and did some boot stompin' to the sounds of Tim Watson and Blackcreek.

Sponsors for the party included Antec, CommScope, General Instrument, Scientific-Atlanta and the SCTE.

And more ...

Other social events at Expo included a Christians in Cable Breakfast as well as the Fifth Annual SCTE Golf Tournament, which has come to traditionally mark the end of Expo.

Next year, cable's technical community will meet in Orlando, FL, from June 4-7 for Cable-Tec Expo '97. See you there.

Emerging Technologies

You won't have to wait until next June for the next SCTE conference.

9) Rex Porter (at mic) inducts 20+ year veterans into the Loyal Order of the 704 at a private reception.

From Jan. 9-11, 1997, the Society will be holding its Conference on Emerging Technologies where it held this year's Expo—the Opryland Hotel Convention Center in Nashville.

Topics of discussion will include digital compression and transmission, telephony, multimedia and future technologies.

If you are interested in presenting a technical paper at the conference, contact Roberta Dainton at (610) 363-6888. Submissions should include an abstract and the deadline is Sept. 1.—*AJ, LH*

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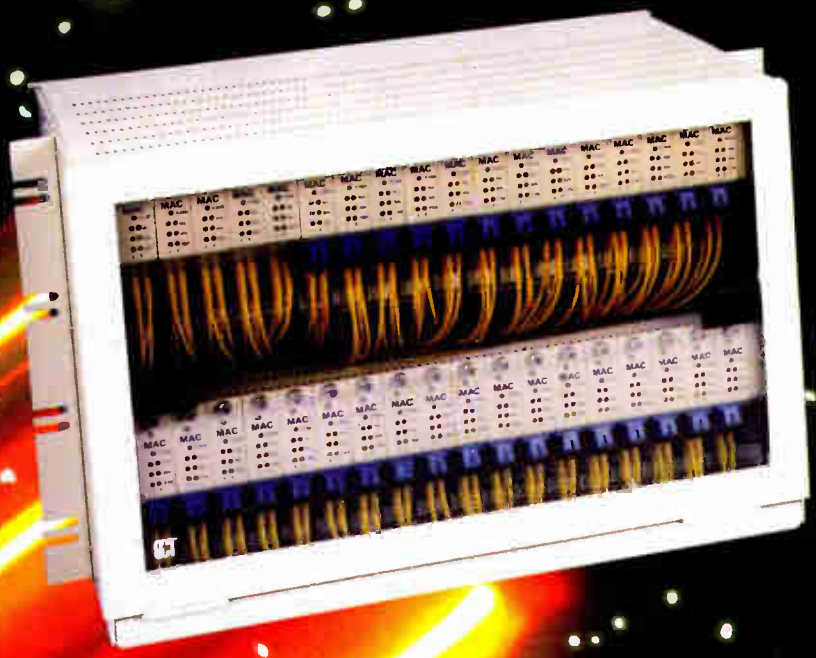

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By Alex Zavistovich

The 11th Hour

Don't let the EAS deadline catch you off-guard

"Griffey's rounding third after belting a long fly ball deep into right field! Here's the throw to the plate—it's going to be a close one! The crowd's on its feet, and the call is ..."

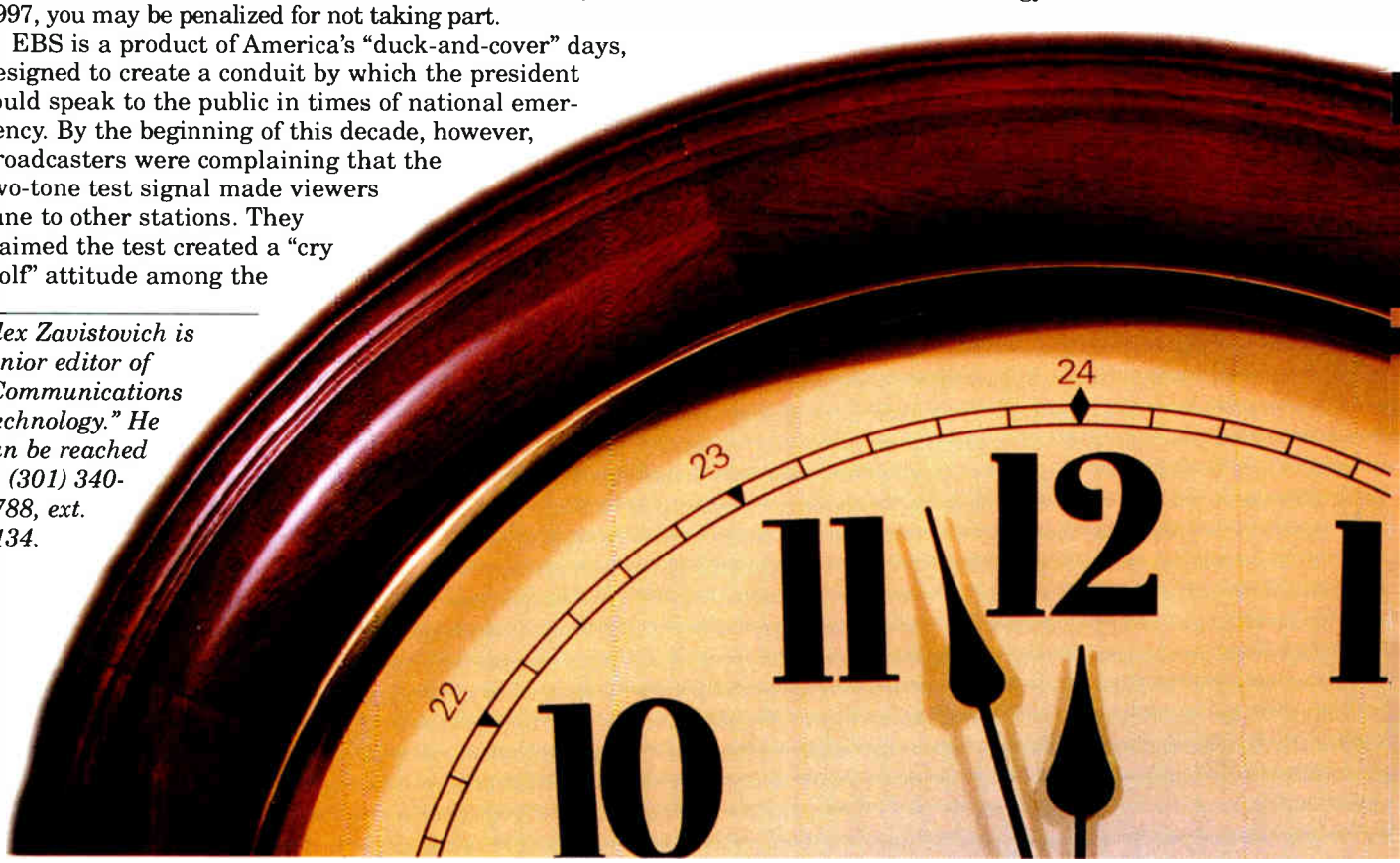
"THIS IS A TEST. For the next 60 seconds, this station will conduct a test of the Emergency Broadcast System. This is only a test."

The intrusive two-tone alert signal punctuating Emergency Broadcast System (EBS) announcements has ruined many a ball game over the years. The good news for viewers is this tired old system has been replaced by a souped-up enhancement that will eventually make the two-tone signal a thing of the past. The bad news for operators is compliance is mandatory for most systems. After July 1, 1997, you may be penalized for not taking part.

EBS is a product of America's "duck-and-cover" days, designed to create a conduit by which the president could speak to the public in times of national emergency. By the beginning of this decade, however, broadcasters were complaining that the two-tone test signal made viewers tune to other stations. They claimed the test created a "cry wolf" attitude among the public, which was just as apt to ignore a real emergency alert as a test.

The Federal Communications Commission took on the revamping of the EBS during Al Sikes' chairmanship. Sikes applauded the effort to create an Emergency Alert System (EAS) successor to the EBS, emphasizing its importance to cable as a means of establishing parity with broadcasters.

In the early fight for a succeeding technology, two systems stood toe-to-toe: The National Weather Service's Weather Radar Specific Area Message Encoder (WRSAME), supported by TFT Inc., and the Radio Broadcast Data System (RBDS) from Sage Alerting Systems. Limited to broadcast applications only, RBDS did not answer the bell in the final round. In a 1994 ruling, the FCC named WRSAME technology as the basis for EAS.



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

That encode/decode protocol is now promoted by Sage, TFT and a handful of other vendors, including Mega Hertz, Information Age Systems and StarNet Development Inc.

Under the terms of the FCC's ruling, EAS participants must monitor at least two sources for EAS information, and decode and respond to header information encoded in the EAS's frequency shift key transmission. Audio override must be provided for all channels, with emergency-specific video and audio on one channel, and some means of alerting for the hearing impaired must be included. Cable systems must be able to generate an alert themselves.

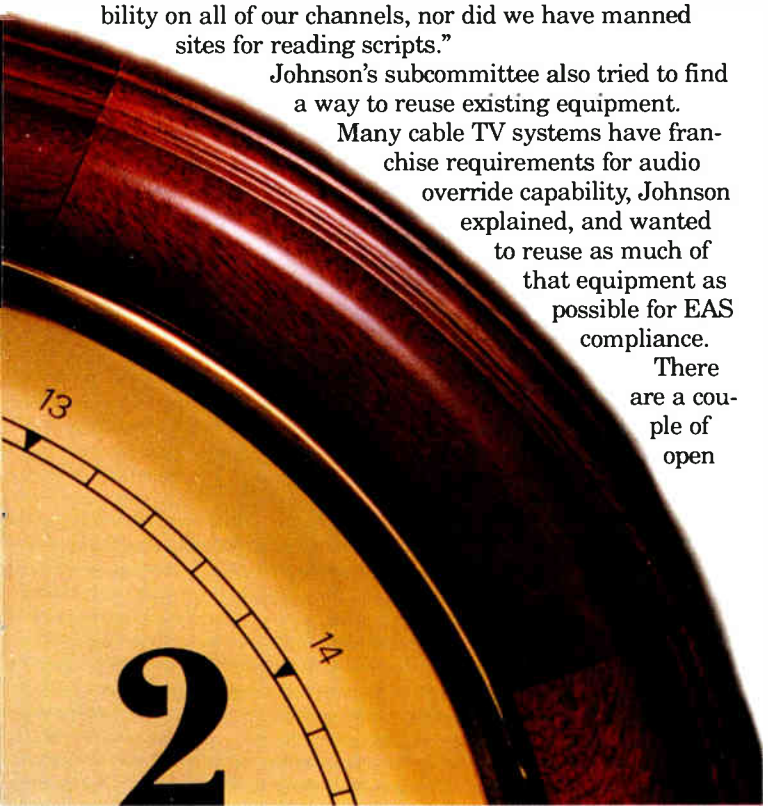
"For cable operators, the entire ruling process has been an uphill struggle to educate the FCC on the difference between cable and broadcasting operations."

Uphill struggle

The entire EAS ruling process has been an uphill struggle to educate the FCC on the difference between cable and broadcasting operations.

Steve Johnson is a senior project engineer for Time Warner Cable in Denver. Since 1992, Johnson has served on the Society of Cable Telecommunications Engineers' EBS Subcommittee, working with the FCC and coordinating with vendors to find cost-effective solutions for complying with the EAS program.

Early on, said Johnson, "the FCC was treating cable TV like a broadcaster with 50 to 80 channels. They were saying, 'We'll just have them put a crawl on when the alert comes down, maybe have them read a script.' We had to educate them that cable operations didn't have crawl capability on all of our channels, nor did we have manned sites for reading scripts."



Johnson's subcommittee also tried to find a way to reuse existing equipment. Many cable TV systems have franchise requirements for audio override capability, Johnson explained, and wanted to reuse as much of that equipment as possible for EAS compliance. There are a couple of open issues the Commission still must address as far as cable is concerned. Chief among those, according to Johnson, is participation of small cable systems, and the definition of what a small system is. Until that's resolved, Johnson said, cable systems will hesitate to buy equipment.

Last December, the National Cable Television Association and SCTE met with the FCC to air their concerns about the EAS ruling. Following the meeting, the Cable Services Bureau proposed a definition to the Compliance Bureau (under which the EAS is included), suggesting a definition of a small cable system as 5,000 subscribers, and offering provisions for participation.

The recommendation would have systems over 10,000 subscribers provide video and audio override on all channels. Systems of 5,000 to 10,000 would have audio on all channels and video information on one channel. At the year 2001, those systems would have to move to video and audio on all channels. Small systems would be under no FCC obligation to participate in EAS but could do so on a voluntary basis.

The FCC says there are some 11,000 headends in the United States. As many as 30-40% of those, Johnson estimated, serve fewer than 5,000 subscribers and may therefore be exempt. Of course, that means at least 60-70% will have to adopt the system in some manner.

Crime and punishment

Cable systems have been slow to comply with the FCC's implementation date for EAS until a final report and order clarifying exempt systems has been issued. And yet, the window is closing.

Frank Lucia, acting chief for EAS in the FCC's Compliance and Information Bureau, conveyed a sense of urgency about delivering the final report and order. At press time, a version of the report was being circulated in the Commission, but had yet to be adopted or released. "We're getting to within a year of the deadline," said Lucia. "We have to do something soon."

Regardless of the outcome, many system operators would do well to adopt EAS, if only to avoid penalties imposed by the FCC. There is not much chance of an extension of the FCC's deadline. "Factors that might possibly affect a cable operator's ability to comply by the deadline are whether sufficient equipment is available for every operator that requires it, and how long it would take to install necessary switching equipment," explained Lucia. "If those can be satisfied by the deadline, we wouldn't have a reason to move the date."

Lucia would not comment on enforcement action likely to be taken by the FCC. However, David Sturdivant, an electronics engineer in the compliance division, noted that operators found to be out of compliance with the EAS requirement may initially have to pay a fine. The fine

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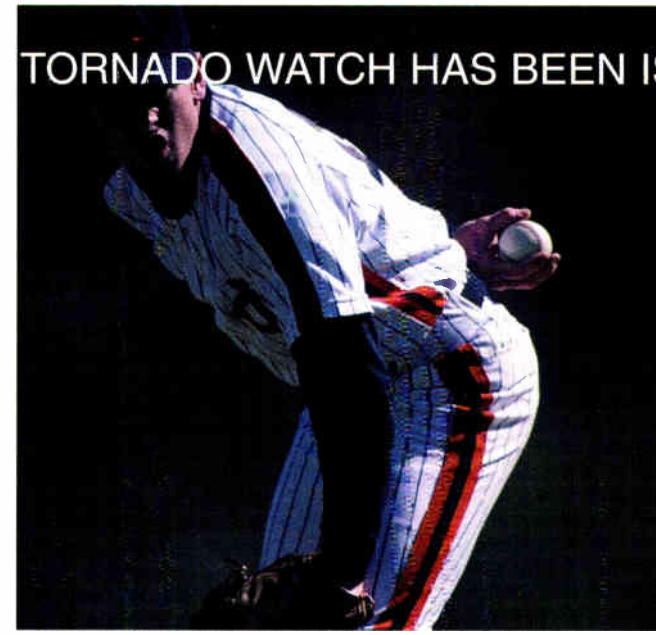
amount was recently challenged by the National Association of Broadcasters, he said; the FCC's entire original fee schedule is being overhauled.

Whatever the fine, however, it is likely to be greater than the cost of the mandated equipment. According to John Winston, assistant bureau chief for information at the FCC, a fine may be imposed if the operator has EAS equipment and chooses not to participate in a national emergency alert. What's more, the cable operation will be



EAS technology allows alert messages to crawl across programming.

required to go dark for the duration of the emergency, ostensibly to limit the possibility of viewers in the stricken area missing information of impending danger.

Plug-and-play

One player in the EAS encode/decode marketplace, Sage Alerting Systems Inc., has teamed with Mega Hertz to facilitate its entry into the cable market. Gerald LeBow, president of Sage, said the company sees three distinct markets for its "Endec" technology: cable, broadcast and public safety. While each segment has different requirements, LeBow noted, "We consciously designed the box to function in all three environments."

In its simplest interpretation, cable compliance with EAS requires three pieces of hardware: an EAS encoder/decoder, a switching device and a character generator. In the partnership between Sage and Mega Hertz, Sage provided the Endec while Mega Hertz designed the switching boxes. For character generation, Video Data Systems co-developed software and hardware modifications to its products for the cable environment. "With the Endec, the VDS 840 EAS character generator and the Mega Hertz switching system, it's all plug-and-play," said LeBow. The system can be configured to send audio and video and assign a video details channel and crawl specifications.

Steve Grossman, sales and marketing manager for Mega Hertz, noted the company's EAS package, dubbed the Sub Alert System, includes a CPU, enabling it to grow

and monitor all types of sources, not just what the FCC has required.

Mega Hertz focuses on switches that can simultaneously switch audio and video, composite IF and separate audio/video IF sources. More importantly, said Grossman, the system is compatible with data transfer and telephony technology. The current alerting system uses a trunk switch that shuts off signals coming to or leaving the headend. According to Grossman, that could cause disconnection of cable modems; a subscriber downloading information while a system is conducting an alert could possibly lose his work. The Mega Hertz Sub Alert System only switches what is wired to the system.

LeBow noted that the Sage system also can be used with other switching devices, such as Iris Technologies' Video Commander visual routing system, which he called "very intuitive." Iris Technologies President Jerry Salandro agreed, saying, "If a customer has our system, he can be in compliance with the EAS, providing he has an EAS system and character generator. The Visual Commander gives users the capability of routing what's coming to all modulators in a headend."

Iris Technologies, said Salandro, provides a flexible means of directing sources at the headend. "EAS is not a major issue for our customers," he conceded. "Most just want to solve the problem because it's a requirement mandated by the FCC. We show them how they can run their headend more efficiently. After that, it's no big deal to solve the problem of EAS compliance."

As for the fate of Sage's RBDS system that lost to WRSAME as the FCC-approved EAS protocol, it may be down, but it's far from out. LeBow explained that the two technologies, while separate, can be combined to create a more powerful system: For example, in Contra Costa County, CA, 10 TCI and Viacom headends get EAS information by monitoring RBDS sideband signals from five primary FM stations in the San Francisco area.

The challenge of participation

Monitoring information sources points out cable's challenge in participating in EAS. As Darryl Parker, director of sales and marketing for TFT, put it, "Cable has a much tougher job than broadcasting does. Broadcasters only have one channel to worry about."

Broadcasters can get emergency information by EAS, teletype, news services, even from its listeners. Cable doesn't have that advantage because it has no operators. Cable needs an automatic system to take in and process information, said Parker.

In TFT's marketing scheme, there's a natural liaison between cable systems and emergency managers. Parker explained, "Using EAS not only gives emergency managers access to broadcasters but to the cable community as well. Emergency managers never before had a way to get to the person watching tonight's pay-per-view movie. EAS gives them the vehicle to do that."

TFT is partnering with Salt Lake City-based Information Age Systems in the cable market. "IAS manufactures switching systems required by cable operators for EAS implementation," said Parker. "They use our engine, the EAS 911 encoder/decoder, to drive their system. We receive the information from EAS protocol sources, or we generate it locally in the box, then furnish it to an external

device. The device comes back to our unit for a pre-announcement message header and two-tone information, then goes through its interrupt routine."

IAS President Bruce Robertson explained that the company provides monitoring receivers with the TFT unit as part of its basic package. However, with other manufacturers such as Gorman-Redlich Manufacturing and MTS vying for FCC certification, IAS has established protocols to work with other systems as well.

According to Robertson, IAS sells the 700 Series. The model 790 is a multiple receiver package; the 701 is a systems controller with character generator and audio; the 720 is an IF modulator. Model 770 provides IF switching, and 771 offers baseband switching. For the hearing impaired, IAS offer three options: a full-screen message switched at IF; a full-screen message switched at baseband; or a crawling message provided with the All-Channel Message System manufactured by StarNet Development Inc.

Multiple system operators ought to put in one or two systems, Robertson encouraged. "Time is short," he explained, particularly for bringing local and state emergency communications committees up to speed. "Emergency committees need cable's assistance to train them in the system's use," he explained. Without it, EAS runs the risk of repeating the same problems associated with the original EBS system—it may be abused or never used.

Pulling double duty

Despite the impending deadline, early adopters of EAS in cable are few and far between. A common objection is that operators can't justify the expense for a product that doesn't really do much when there is no emergency. Some in the industry, therefore, are creating alerting devices that can serve more than one purpose. The All-Channel Message System (ACM) is typical of this trend.

Bill Robertson, vice president of engineering and product development for SDI, described ACM as a patented multichannel character generator that can serve up to 128 channels. Used together with the TFT encoder/decoder and IAS's receiver product, information can be handed off to ACM, then formatted in audio and video and presented on all channels simultaneously.

According to SDI's Robertson, the benefit of ACM is it doesn't only have to be used for EAS. "As a multichannel character generator, it can be used for a host of applications, such as pay-per-view promotion or messaging," he said. ACM also is not as invasive as other systems, Robertson maintained. "With this system, you can gauge the relative level of emergency, escalating from a crawl to an audio alert with crawl. You can run these messages across all channels, local broadcasters and premiums, before anyone else does."

Another multipurpose alerting system comes from Cable Communication Systems. So new it was unnamed at press time, the company's system has a front end based on a rack-mounted PC running Windows 95 or Windows NT. Company president Arthur Leisey said the device uses Best Software Solutions' EAS software to run TFT encoding and decoding in the background, while the rest of the computer can be used for other applications, such as the company's advanced pay-per-view messaging.

Also new is the Cable Envoy addressable messaging system from Albrit Technologies Ltd. With this alert system, video and audio override messages can be injected into any channel's program signal, for display of text in crawl, full page or multipage formats. Not only can the Cable Envoy provide video and audio emergency advisories, it can be used to notify cable subscribers of program channel changes, promote pay-per-view services and insert advertising supplements and special programming.

Market acceptance

Why does the cable industry seem so determined to push the envelope for EAS compliance? Sage's LeBow noted that operators were never very enthusiastic about the system: "These were not smiling faces that said, 'What a neat service. We'll finally have parity with the broadcasters.' "

For TFT's Parker, part of the resistance stems from "the misconception that cable systems will be interrupted for any and every emergency transmitted over EAS." That's not true, he said. "Cable operators will be able to decide which events and locations will interrupt their systems.

"If marketing people knew what they could do with the EAS technology apart from actual alerts, it would be more than just a thorn in their side."

The unit may record the message, but if it hasn't been designated for alert notification, there will be no interruption of service. EAS will really get rid of the 'cry wolf' syndrome," Parker added.

According to Grossman of Mega Hertz, some cable operators still hope the rules will not apply to them, and are opting to put off any work until 1997. Depending on the FCC's final decision regarding size exemption, whoever waits until 1997 will be scrambling to comply by July 1. "We're prepared for that," Grossman assured, "but it would be nice if we could spread out demand. We just don't anticipate that occurring, though."

Time Warner's Johnson agreed. Time Warner is in hold mode, he said, gathering information related to its needs. He is concerned that if everyone sends a purchase order out on January 1, vendors won't be able to meet the demand immediately.

Ask SDI's Robertson about the market acceptance of EAS, and he'll shrug: "It's FCC-mandated, and nobody likes to have things shoved down their throat. But the new EAS ruling is so much better than EBS. EBS was meant to be an alert mechanism for radio. We've come a long way in technology since then.

"If marketing people knew what they could do with the EAS technology apart from actual alerts, it would be more than just a thorn in their side. It's going to be a positive thing for consumers. They'll be getting more and better information instead of that silly EBS tone, which is really just a tune-out factor." **CT**

TIME IS RUNNING OUT

Less Than 341 Days Until EAS Affects You!

The old Emergency Broadcast System (EBS) has been blown out the window and replaced by the new Emergency Alert System (EAS). And you have less than 341 days to comply*. It means you're going to need some new equipment. But don't panic. We know what you're thinking – wouldn't it be nice if there was an emergency alert system that could contribute to your overall operation? Because, let's face it, most of the time, most emergency systems sit idle.

Well, SDI has just the solution.

Our ACM (All Channel Messaging) system will handle all the video and audio requirements of an Emergency Alert System for even the largest cable systems, but that's not the best thing about it. When ACM is not busy blowing tornado sirens, flash flood or severe thunderstorm warnings, you can put it to work flashing the community bulletin board or local sports scores. Better yet, use it to advertise and switch that pay-per-view special. We're serious: this is the one emergency system that has enough force to pay for itself. And that's not just a lot of hot air. ACM is a proven system, currently in operation at hundreds of facilities around the country.

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By Eric Wentz

Power:

New ideas on broadband reliability

The changes witnessed in the broadband industry in recent years have had a dramatic effect on the way the world communicates, is educated and entertained. Pay-per-view (PPV), video-on-demand (VOD), personal communications services (PCS) and Internet access are all still relatively new additions to the vast array of voice, video and data services. The "sky's the limit" optimism for the future is being greeted by an audience seemingly numb to disbelief.

Admittedly, the world today is much different than it was just a few short years ago. Consider the fax machine, the cell phone, and the proliferation of computer networks, all of which have had a dramatic effect on the civilized world. Many more opportunities are poised on the horizon—along with their accompanying questions and delivery challenges.

Eric Wentz is the marketing communications manager of Alpha Technologies in Bellingham, WA.

Amid the uncertainties, however, the need for reliable uninterruptible power is greater than ever.

Today, more than any other time in the industry's history, power is playing a critical role in ensuring the reliability of communication services. System reliability is no longer a target—it's a requirement—and service providers have made it one of their primary concerns. (See Figure 1.)

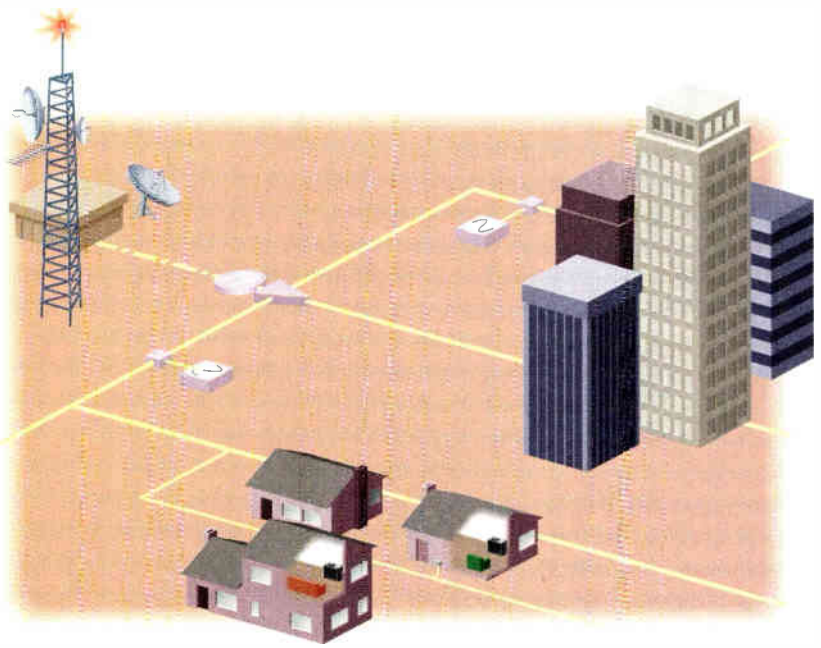
"The need for reliable uninterruptible power is greater than ever."

Increased end user demands and the sophistication of the networks have dramatically decreased power disturbance tolerance levels. The delivery of additional services generally increases power requirements. Adding to this challenge is the continuing question of the quality and reliability of most commercial utility power.

Acceptable standards far surpass the "annoyance test" of having to reset a digital clock or losing the dramatic ending of a PPV event. Likewise, providing "lifeline" services such as traditional telephony, paging and 911 requires absolute and unquestioned reliability. While analog technology once tolerated momentary power interruptions, the complex digital stream is much more susceptible to power interruptions of any length.

Today's communications customer cares little whether a power disturbance was caused by a spike due to lightning, a transient harmonic brought on by utility switching, or a sag resulting from increased single-point utility demand. The consumer doesn't care if the problems can be traced to the utility provider, the environ-

Figure 1: Broadband powering



ment, or the end-users themselves. The result is interrupted service caused by what may have been a very brief and very avoidable power disturbance.

The service provider may get a nasty call from an angry customer, or worse yet, may never hear about the problem and simply lose the customer altogether. Establishing a reliable source of clean, uninterrupted power becomes the service provider's responsibility.

Evolution of powering

Broadband powering has evolved over the past 30 years primarily within the cable TV industry. Initially, cable systems were powered at 30 VAC with power supplies located or distributed as required throughout the system. Given the technology and the service expectation of the day, this approach represented a safe and effective solution. As amplifier technology advanced and power levels increased, however, designs became voltage-limited. Without much fanfare, system operators moved up to 60 VAC, and it quickly became the industry standard for broadband powering.

At this voltage, it was assumed that the problem of voltage limitation would be eliminated for good. Today's increased power requirements as well as the previously mentioned reliability issues, however, have brought powering back into the forefront of industry discussion. Many service providers are actively deploying or considering increased voltage systems (90 VAC) as well as the migration to alternative powering topologies, including centralized node powering.

Distributed powering

Distributed powering (Figure 2 on page 78) has been the architecture of choice for cable TV networks since the advent of the industry. This powering method consists of power supplies being placed at appropriate locations throughout the system. The power supplies are housed within enclosures and are usually backed up by a string of batteries. The enclosure, power supply and battery string comprise a stand-alone power system that provides the appropriate power to nearby signal amplifiers and other system actives. The number and location of power supplies depends on the power requirements of the delivery

system. Enclosures can be strategically placed and added to the system as the subscriber base increases, and can be pole-, wall- or ground-mounted.

Several considerations have made distributed powering a proven method in the past and a viable option for system expansion and/or upgrades. The enclosures used in a distributed powering architecture are typically smaller—and less conspicuous—than those used in alternative centralized node applications (to be discussed later in more detail). Several distributed enclosures, however, are required to provide the equivalent power of a single centralized node system. The real net effect is a "dilution" of visible hardware intrusion, not really a reduction. This option, however, can prove important in meeting the specific needs of some service areas.

The placement of power supplies within a distributed system is not extremely critical, allowing some flexibility in their location and installation. Most cable technicians also are familiar and comfortable with distributed powering technology, which could ease personnel training requirements to service and maintain the system.

On the other hand, it is often difficult and time-consuming to service a distributed powering system as a whole, because of the many different power supply locations. Additionally, the increased reliability demands of today's communication delivery systems require the integration of technology not economically feasible in a distributed architecture.

Centralized node powering

Centralized node powering (Figure 3) utilizes a single location for both the power system and the signal fiber node. The fiber node and the power system can be housed in either separate enclosures or co-located in a single enclosure, providing flexibility to meet specific system requirements.

Centralized node architectures are typically designed to provide signal to a 200-2,500 home serving area. The number of homes powered by a single node depends on the services provided, their corresponding power requirements and subscriber density. Historically, telephony has been powered in a similar manner, but centralized node powering is a relatively new method for powering video service.

The reduced number of power supply locations in a centralized node system offers many economic advantages. Installation costs are lowered for a given home serving area as are maintenance and other life-cycle costs. Higher overall operating efficiency also can be achieved through balanced loading, reducing overall operating expenses.

The critical importance of appropriate battery selection and maintenance cannot be overemphasized. Regardless of the powering topology, batteries provide the first-line defense to utility instability or loss, and ensure that system actives receive the necessary and appropriate power.

Too often, service providers

Figure 2: Distributed powering

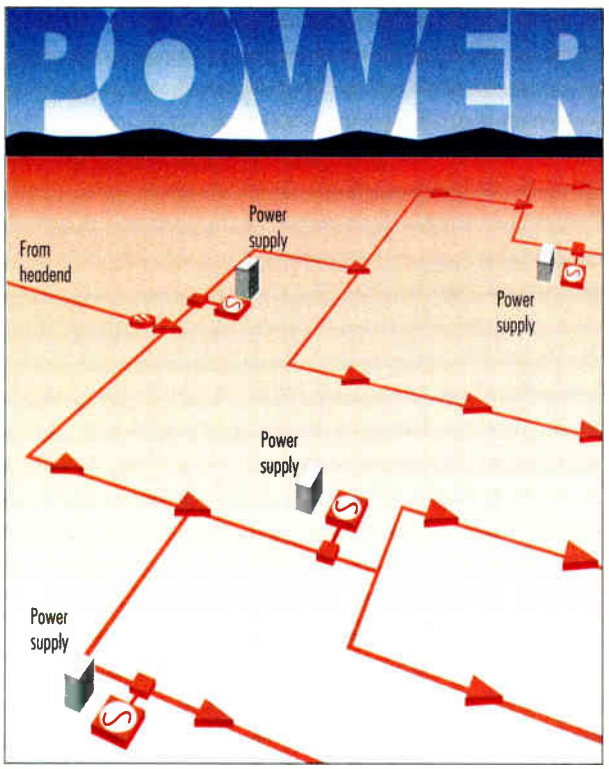
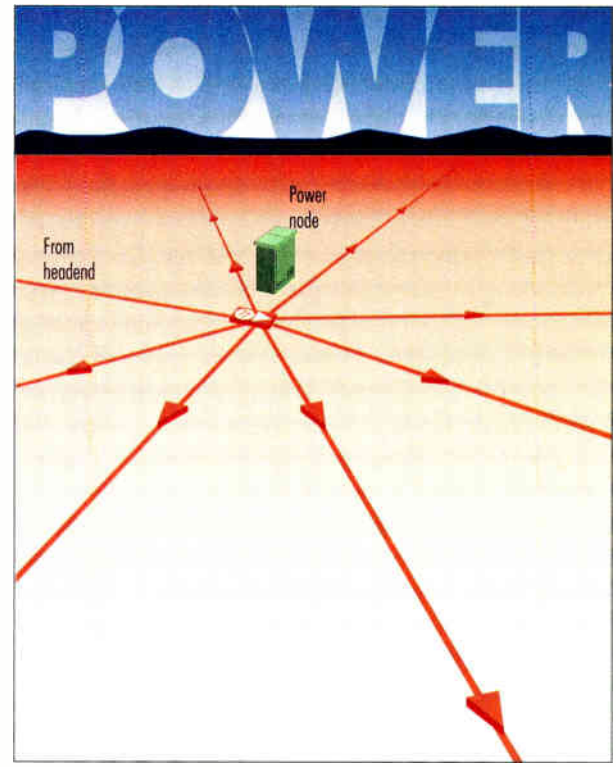


Figure 3: Centralized node powering



falsely consider battery selection a noncritical decision, sometimes making cost or other nonperformance issues the primary criteria. Gel cell batteries, designed specifically for float-service, broadband applications, have been shown to provide the longest life and most reliable performance—as well as the safest application. Battery selection remains a critical element in centralized node powering, but this approach allows the consideration of several additional backup powering options, all serving to increase and enhance reliability.

Because fewer power supply locations are required in centralized node powering, several advanced reliability features can be considered that would not be economically feasible with multiple smaller enclosures.

Backup engine generators, which run on natural gas or propane, can be incorporated in addition to battery backup, adding reliability during extended utility outages. Environmentally controlled cabinets can be integrated to prolong the life of batteries and system components, adding both increased reliability and decreased overall cost-of-ownership.

Dual power grid switching also is a viable option as part of a centralized approach. An integrated power grid switching capability that allows the use of a secondary power grid for additional backup power will increase reliability.

Since centralized node powering usually utilizes multiple power supply modules within a centrally located enclosure, it also becomes practical to integrate an additional power supply module to back up the others, providing N+1 redundancy. This kind of backup becomes critically important as lifeline services are added to the traditional video service.

This type of powering architecture also simplifies and enhances interactive status monitoring and control, which are crucial for alerting technicians of power problems before they impact performance.

All of these advanced features as well as the overall component count reduction serve to make the system more reliable.

"Environmentally controlled cabinets can be integrated to prolong the life of batteries and system components, adding both increased reliability and decreased overall cost-of-ownership."

Summary

While distributed powering architectures will continue to serve the industry for many years, increased power and reliability requirements have made alternative approaches necessary. Centralized node powering represents one alternative that meets these challenges very well.

While the future of communications remains uncertain, the question of uninterruptible power at least is partially closed. It's needed, and it better be reliable. **CT**

By Dean A. Stoneback and William F. Beck

Return design for digital: Part 1

This is the first 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 discusses loss between amplifiers in the return path, as well as operating characteristics of Fabry-Perot vs. distributed feedback lasers. Part 2 will address system design and setup. Copies of the original paper can be obtained from General Instrument.

The upstream portion of a hybrid fiber coax (HFC) system has been given comparatively little attention over the years. Now that advanced services such as telephony and interactive digital networks are being implemented for this pathway, more is being learned about improving the upstream path.

The amount of loss in the return direction from a particular tap port to the input of the next amplifier station has been largely ignored in system designs. Significant improvements in performance can be realized by controlling this loss, particularly regarding gain variance. Using the proper laser to carry data payloads also can improve system performance while keeping costs in line.

Gain variance

The gain from a subscriber terminal device to the headend varies with time, temperature and location. A major component of the overall system gain variance is the difference in cable and passive loss from each tap port to the next upstream active. HFC network design induces a variance of return signal level over the transmission path because the tap values are selected to provide proper drop levels at forward frequencies.

Examining a tapped feeder line from a line extender, the forward signal at each successive tap port in the string is designed to have the same level at the highest design frequency. The forward system is designed this way to ensure a proper forward level to each household. However, for every other frequency in the passband the tap output level increases at each successive tap. This is because the loss of every frequency but the highest channel is less through the path. The downstream loss will be controlled due to the tap port output specification imposed by the system design, while the upstream path loss will vary widely with every tap. Figure 1 shows a tap string with a 750 MHz and 40 MHz loss comparison; the loss figures are charted in Table 1.

At 40 MHz, the signal loss variance between tap ports is 17.7 dB. In addition to the widely varying loss of the return path due to the tap design, other variables such as differences in the in-house splitting loss, drop length, system flatness, link loss difference, ambient temperature changes and headend receiver

"To properly assign all the data channels to the total available power, we recommend assigning power on a constant power per Hz basis."

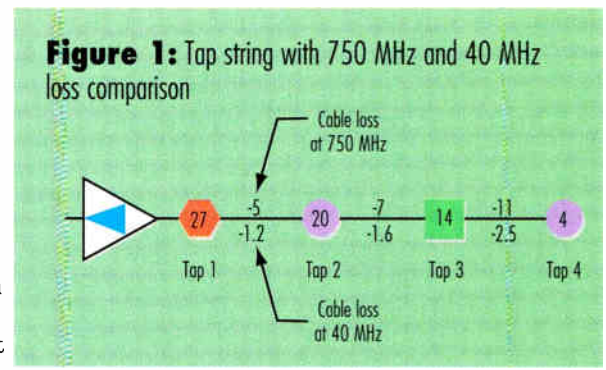


Figure 1: Tap string with 750 MHz and 40 MHz loss comparison

Table 1: Tap string loss comparison

	Loss from active to tap port at 750 MHz	Loss from tap port to active at 40 MHz
Tap 1	27 dB	27 dB
Tap 2	25 dB	21.2 dB
Tap 3	26 dB	16.8 dB
Tap 4	27 dB	9.3 dB
Difference between Tap 4 and Tap 1	*0 dB*	*17.7 dB*

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.

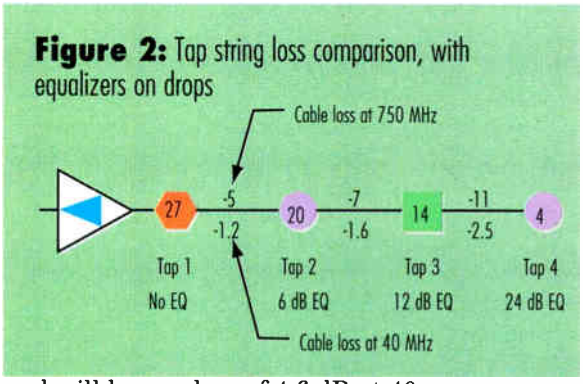
tolerances all add to the level variance of the return path.

The single largest piece of variance is in the feeder design. By achieving a uniform signal loss to each tap port, the total variance can be brought down to a manageable level.

There are two basic methods for adding loss to the return path in the feeder system. One is to diplex within a tap/drop device and add some flat loss in the return band. The other is to deploy an equalizer.

The device that adds flat loss in the return path is more difficult to manufacture, but does allow the loss chosen for the return path to be fully independent of the forward path. The equalizers proposed would be designed to cover the entire forward and return spectrum (5 to 750 MHz). Therefore, the equalizer will simultaneously correct the loss variance of the return path and flatten the forward path. This equalizer will be specified by the amount of cable loss it equalizes. For instance, a 6 dB equalizer will correct for 6 dB of loss at 750 MHz and will have a loss of 4.6 dB at 40 MHz. The equalizers will add about 1 dB insertion loss. Therefore, the actual losses of a 6 dB equalizer will be 1 dB at 750 MHz and 5.6 dB at 40 MHz. Figure 2 considers the previous example again, but this time adds equalizers to the drops; the loss figures are charted in Table 2.

Figure 2: Tap string loss comparison, with equalizers on drops



The use of tap/drop equalizers could be done within the tap itself (prior to the port splitting network), at the tap port, individually per home at the network interface device (NID), or at the ground block. The equalizer reduces the loss variance for the communication path.

Lasers and power per channel

A fully loaded return system will contain many different services to be carried by varying modulation schemes of differing bandwidths. How will the proper level for a particular channel be assigned? Since the amplifiers used in the return path have a very large dynamic range, the limiting factor for determining the proper power per channel will be the laser. Therefore, this analysis will begin by considering how much total RF power will be modulated onto the laser.

A total power must be chosen that will keep the laser far enough away from significant clipping so the data gets through without excessive errors. The level at which the bit error rate (BER) suddenly gets poor ($> 10^{-6}$) was defined as the crash point. The optimum total power was chosen to be about 7 dB below this point to allow proper headroom for level variations and large impulses or ingress. This maximum level was determined by laser clipping.

To properly assign all the data channels to the total available power, we recommend assigning power on a constant power per Hz basis. First, divide the total available power into 1 Hz increments (many spectrum analyzers have a feature that will show noise in a 1 Hz bandwidth). The allotted power per Hz is assigned to each channel based on the bandwidth occupied by the channel. For instance, if channels are spaced 1 MHz apart, they would each receive 10 x log(1 MHz/1 Hz) = 60 dB more power than the per Hz value.

There are many reasons why channel power should be allocated on a constant power per Hz basis:

- All services have the same carrier-to-noise, regardless of their bandwidth. There is no need to specify a particular bandwidth when measuring C/N.
- The spectrum will look relatively flat when viewed on a spectrum analyzer. Since most digital modulation schemes have a noise-like spectrum, the apparent level on a spectrum analyzer display depends on the resolution bandwidth setting on the analyzer. If all channels are operating at the same power per Hz, they will all appear at the same level on the display.
- Power allocation is simplified. The power assigned to any new service is easily calculated based on the channel spacing bandwidth of that service.
- Very narrow channels that will be subjected to less ingress energy receive less total power. Broad channels that are subject to more ingress energy receive more total power.

Types of lasers

What type of lasers are required to properly transport large amounts of data in the return path? The main issues are:

- Fabry-Perot (FP) or distributed feedback?
- Isolated or unisolated?
- Cooled or uncooled?

Industry opinions are divided over whether FP lasers can carry large data payloads adequately. Based on tests of many different laser samples, we have determined that FP lasers can perform quite well in most applications.

The primary advantage of a distributed feedback (DFB) laser is its lower noise floor (RIN). Recall that there is a maximum amount of power, defined by clipping, which can be modulated onto a laser. The maximum level must be chosen so that there is some headroom before clipping causes poor BER. Some additional headroom also must be added so that a high-power interferer will not cause the entire return path to "crash" due to severe clipping. Once this optimum total power level is determined, the only way to

Table 2: Tap string loss comparison with equalizers

	Loss from active to EQ out at 750 MHz	Loss from EQ out to active at 40 MHz
Tap 1	27 dB	27 dB
Tap 2	26 dB	26.8 dB
Tap 3	27 dB	27 dB
Tap 4	28 dB	28.8 dB
Difference between Tap 4 and Tap 1	*1 dB*	*1.8 dB*

directors, replacing Founder and Chairman Bob Magness, who died in November. Malone will continue his current position as president and CEO of TCI.

• **Society of Cable Telecommunications Engineers** Senior Member and **Catel Telecom** Vice President Dick Old passed away in November. A memorial fund was established to support the American Lung Association. Send contributions to: Dick Old Memorial Fund, c/o Macy & Son, 135 N. Evan St., McMinnville, OR 97128.

• Last month, **TCI** announced that about 2,500 employees will be laid off, which is approximately 6.5% of the MSO's work force, and the top 200 salaried positions will have their paychecks voluntarily frozen or cut between 5% and 20%. The moves are expected to cut overhead by an estimated $100 million per year.

• **Harmonic Lightwaves** opened a new regional office in Philadelphia, which will serve as a direct sales, technical and field support center for the eastern United States. It is located at 600 W. Germantown Pike, Plymouth Meeting, PA 19462. Phone and fax are (610) 940-1711 and (610) 940-1707, respectively. The announcement follows closely behind the company's opening of its 110,000-square-foot facility in Sunnyvale, CA.

• **Channel Commercial** entered into an agreement to acquire **RMS Electronics**. Financial terms were not disclosed, but the closing of the deal was expected to occur some time this month.

• **GI** recently offered royalty-free licenses to essential patents necessary for conforming to the ITU-T Recommendation J.83, Annex B and SCTE DVS 031 standards for digital cable transmission. The patents will be licensed to all companies that agree to cross-license, on reciprocal terms, any relevant patents they may have that are necessary to conform to the ITU J.83B standard.

• In Glasgow, KY, **Glasgow Electric** (a utility that distributes electric power from the Tennessee Valley Authority to some 6,000 customers locally) is a new Internet uplink site using **Zenith Electronics** cable modems. Back in 1988, the utility built its own broadband cable system to help monitor industrial meters and study consumption rates. Now Glasgow Electric is using that network to offer high-speed Internet access using Zenith's HomeWorks Universal cable modems.

• **TeleWire Supply**, a division of **Antec**, and **Alcoa Fujikura** announced the formation of a strategic distribution program. TeleWire will become a stocking distributor within the cable TV industry for Alcoa Fujikura's fiber-optic fusion splicer products.

• **Tektronix** and **ADC Telecommunications** recently made a technology transfer agreement under which ADC is licensed to manufacture and sell optical test access units (OTAUs) using patented Tektronix mechanical fiber optical switch (MFOS) technology. The OTAU is an access mechanism that connects test equipment to portions of fiber, and together with MFOS technology, is said to enable cost-effective remote testing and monitoring of fiber networks.

• **C-COR Electronics** will provide 550 MHz RF and fiber-optic equipment to **Charter Communications** (headquartered in St. Louis) for upgrade projects in Guntersville, Albertville and Arab, AL. Optical nodes, trunks, bridgers and line extenders will be installed in the 1,047-mile upgrade that is expected to be completed this year.

• Recently added to the collection at the **National Cable Television Center and Museum**—which is being built in Denver—were the first issues of *Community Antenna Television Journal (CATJ)*, one of the first publications dedicated to the technical and engineering side of the cable industry. *CATJ*, launched in 1974, included articles by Kyle Moore and Ben Campbell, the first two presidents of the Cable Telecommunications Association, then known as the Community Antenna Television Association.

increase performance further is to lower the noise floor.

The following observations were made after testing unisolated FP lasers with data loading in the 5 to 40 MHz band. (The loading consisted of at least one actual QPSK signal combined with band-limited noise to complete the filling of the 5 to 40 MHz spectrum):

- The suggested optimum operating point allowed for a very large interfering carrier without causing significant clipping. A single interferer could have more energy than the entire combined payload without causing significant BER degradation.
- If the laser was not fully loaded, the interferer could be even larger (as much as 20 dB larger when the payload was less than 10%) before uncorrected BERs became worse than 10^{-5}.
- The entire fully loaded payload could go 5 dB higher and more than 5 dB lower before uncorrected BERs fell below 10^{-6}.
- Once levels were more than 5 dB below optimum, spurious emissions from the laser began to cause some errors, especially when the laser was very hot. In many cases the levels could go down to 15 to 20 dB below optimum before BERs deteriorated, but not always. When spurious emissions were very bad, an optical isolator was placed after the laser. This usually allowed levels to be lowered about 3 dB more (because spurious emissions decrease when the laser is isolated from the fiber).

In tests, DFB lasers showed no better immunity to high drive levels since clipping occurs regardless of the laser structure. However, the levels were able to go several dB lower than with an isolated FP laser. This is because DFB lasers have much lower RIN than FP lasers. This increase in dynamic range, however, must be reconciled with the increase in cost. Since FPs are more than adequate to handle 35 MHz payloads, the extra cost does not seem to be justified.

A separate test was conducted to compare DFBs and FPs for high bandwidth loading. The test was done over the 5 to 200 MHz band, with the QPSK channel being measured at 200 MHz. The DFB performed better in these tests than the FP product for two reasons. First, as the payload bandwidth increases, the power per Hz goes down, since total power must remain constant. Therefore, the level of each channel goes down. Since the noise floor (RIN) of the DFB is much lower, suitable carrier to noise can be attained at lower carrier levels.

Second, the power of an FP laser is distributed in many optical modes. As the light propagates through fiber, these modes travel at different speeds. The result is a degradation known as mode partition noise. This effect gets worse as the RF frequency increases, since this noise is proportional to the square of the frequency. Therefore, a channel at 200 MHz will be affected significantly more than a channel at 40 MHz. Mode partition noise also gets worse as the laser's wavelength moves away from the fiber's zero dispersion point, such as when the laser is very hot or very cold.

Isolated or unisolated?

The main purpose of an isolator is to reduce the laser's reaction to reflections from connectors and fiber backscatter. In general, DFB lasers are more susceptible to backscatter than FPs. When these reflections hit the laser they cause the laser to emit a sudden burst, or "spur." Since only angle polished connectors (APC) are recommended for use in the CATV plant, there should be no significant reflections from connectors. As mentioned in the previous section, isolators were added to the FP lasers when the spurs were limiting performance. This condition always occurred when the laser drive levels were significantly lower (10 to 20 dB) than the optimum level. Since drive levels will not deviate so far from the optimum drive level, isolators do not appear to be worth the additional cost.

Cooled or uncooled?

When lasers get very hot or very cold, they suffer from several impairments. Distortion, spurs and RIN can all increase and slope efficiency will change significantly. All these effects are undesirable. The solution is to control the temperature of the laser.

This solution must be scrutinized carefully, however. Laser coolers require a large amount of current at a relatively low voltage (2-3 volts) and must be driven by a controller circuit. Even if the low voltage is derived from an efficient switching regulator, the cooler still requires a significant amount of power from the system power supply. In addition, such a regulator and the drive circuitry take up space and cost money. For these reasons, cooling is not desirable.

In summary, evaluation of lasers shows that the most economical method of transporting dense 5 to 40 MHz data payloads is to use a directly amplitude modulated, unisolated, uncooled, Fabry-Perot laser.

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By Jack Kouzoujian

Extending the limits of composite intermodulation distortion measurements: Part 1

The following is the first in a two-part series on extending the limits of composite intermodulation distortion measurements. Part 2 will run in a future issue of "Communications Technology."

Intermodulation products that are the result of two frequencies are well- known. The resultant second order and third order intermodulation products of two frequencies A and B are:

A+B and A-B (For second order)

2A-B and 2B-A (For third order)

For many frequencies the predominant and important distortion products are:

A+B and A-B (For second order)

A+B-C (For third order)

When a system uses many equally spaced frequencies such as a cable TV system, there may be hundreds or even thousands of distortion products.[1] These distortions are usually referred to as composite distortions because they are a composite of many discrete distortion products.

Just as in discrete distortions we have composite second order (CSO) for second order distortions, and composite third order, also known as composite triple beat (CTB) for third order distortions.

In a normal cable TV frequency allocation, the third order products fall in clusters around the carriers while the second order products are in clusters 1.25 MHz above and below the carriers.

These distortion products are usually measured by loading an amplifier with a given number of equally spaced CW carriers. One carrier is left off and the distortion products that exist in the band of the missing carrier are measured.[2] Figure 1 is a block diagram of a typical distortion measurement configuration.

Because the frequencies of the carriers are not exactly equally

Figure 1: Typical configuration for intermodulation measurements

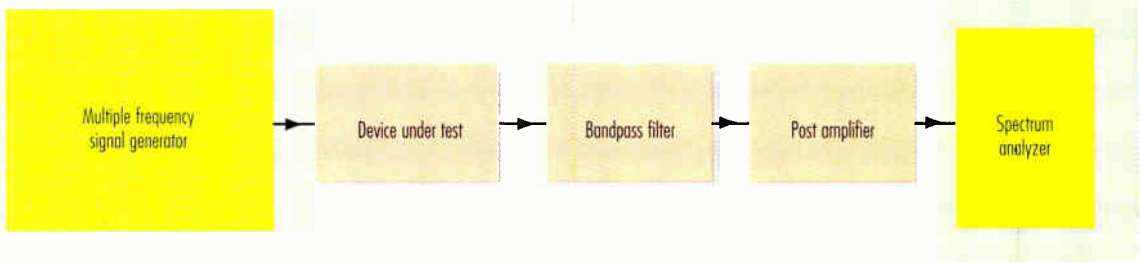
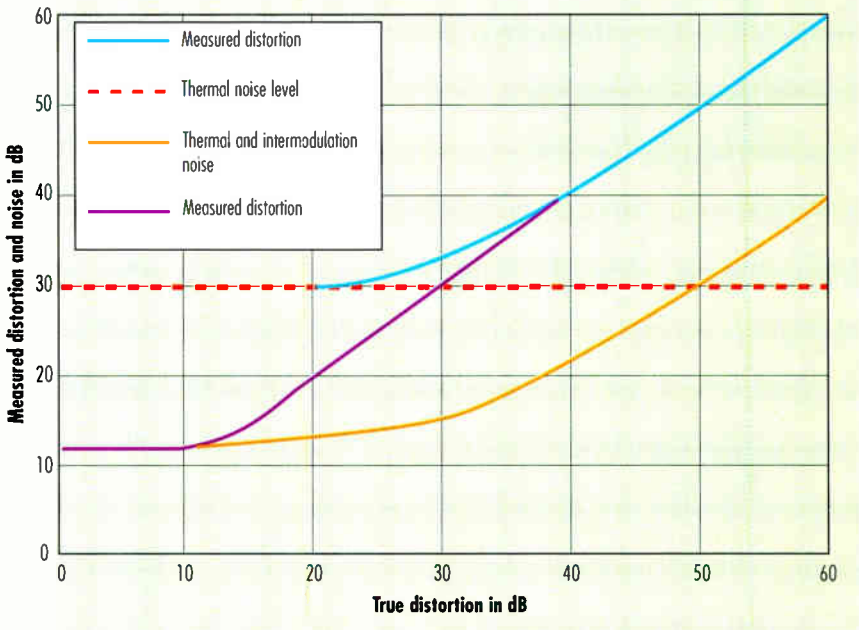


Figure 2: Actual and measured distortion and noise



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

spaced, the distortion products fall in a finite bandwidth. This mandates that a finite bandwidth be used for the measurements. The typical bandwidth used to make this measurement for a cable TV system is 30 KHz.[2] For other situations, such as a cellular telephone amplifier, the products may be much closer together and so allow the use of a narrower resolution bandwidth.

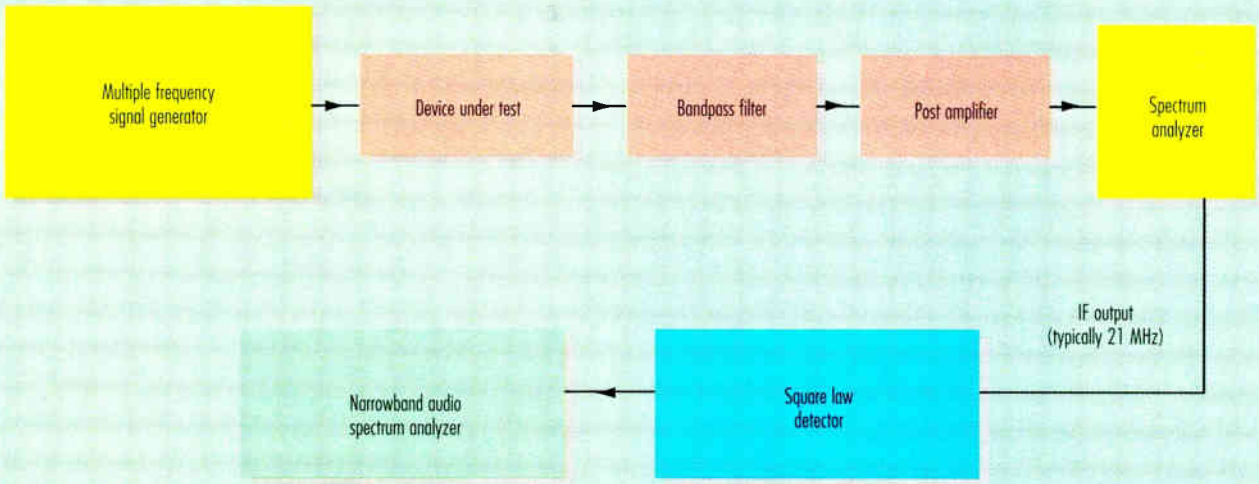
Given a fixed bandwidth and a fixed system noise figure, the magnitude of the smallest measurable distortion also is fixed.

Any measured distortion is the sum of the actual distortion and the system noise. If the distortion level is much greater than the system noise level, the measurement of distortion is straightforward. As the distortion level approaches the system noise level, the magnitude of the measurement is limited by the noise. (See Figure 2.) The system noise is determined by the noise figure of the particular hardware and the configuration of the system. Reference 3 listed at the end of this article is an excellent tutorial source providing insight into some of these results.

Figure 2 shows the expected and measured third order distortion as a function of the actual distortion. Thermal noise and intermodulation noise limits also are shown. Second order distortion would have a similar curve but with a different slope. The method presented here is directly applicable to second order distortion measurements.

It may seem unnecessary to be concerned with distortion levels that are near the noise levels. There are many instances where it is important to know the actual distortion magnitude even though it may be below the noise level. The most common example of this is in a cascade of amplifiers such

Figure 3: Modulation method of intermodulation measurements



as in a cable TV system. Here, as we add amplifiers to the cascade, the third order distortion products add as voltages while the noises add as powers. The net result is distortion levels that are difficult to measure in a single amplifier may be fatal in a cascade.

It would seem that a correction factor could be used to compensate for the noise addition to the distortion being measured. This was found to be impractical, first because low-frequency fluctuations in both noise level and the system gain cause errors in the result, and second, as the distortion levels becomes smaller, the linear detector in the spectrum analyzer becomes a square law detector further degrading the quality of the measurement.

If the resolution bandwidth of the spectrum analyzer is reduced in an attempt to reduce the noise level and so improve the quality of the measurement, the number of distortion products being measured also is reduced, resulting in no improvement in the quality of the measurement.

Another method used to overcome the noise limitations is to make the measurements at a carrier level higher than normally used. For third order distortion, the distortion increases by 3 dB for every 1 dB increase in signal level. It should be possible to make a measurement at a higher carrier level, extrapolate back and calculate the distortion that would have existed at the lower carrier level. This method is successful with well-behaved amplifiers but fails if used, for example, with feedforward amplifiers because the distortion products in feedforward amplifiers are not well-behaved.

Overcoming limitations

The limitations in the measurement can be overcome if the following three changes are made. (See Figure 3 on page 84.)

1) Amplitude modulate the carriers with a square wave at some low frequency (1,000 Hz).

2) Replace the linear detector (demodulator) with a square law detector (also known as a quadratic detector and as a mean square circuit).

3) Follow the square law detector with a narrowband low-frequency spectrum analyzer tuned to 1,000 Hz.

Circuit description

Modulation of the carriers is the key to this method. If all the carriers are 100% amplitude modulated with a 1 kHz square wave, the distortion products also will be 100% amplitude modulated with a 1 kHz square wave. If we extract the 1 kHz component of the demodulated signal with a narrowband device, we see an improvement in the measurement because reducing the bandwidth after the square law detector reduces the noise without altering the signal. The frequency of the modulation is chosen to be high enough so that low-frequen-

cy variations are no longer a problem and low enough so that the signal we are trying to measure is not dispersed by the modulation to frequencies outside of the predetection measurement bandwidth. (See Figure 3 on page 85.)

At first glance it would seem that using a 1 Hz low pass filter at the output of the detector with no modulation would be equivalent to a 1 Hz bandwidth bandpass filter at the output of the detector with modulation. If this were the case then the modulation method would show no improvement but rather a 3 dB degradation in performance. The main reason that the modulation method improves the measurement is related to the fact that noise produces a DC output from the second detector of the spectrum analyzer. It is the DC component of the detector output that sets the spectrum analyzer noise floor. Without modulation, small signals add only a small component to the DC of the second detector. Reducing the video bandwidth or using video averaging does not improve the noise floor caused by the DC component. Furthermore, the DC component contains low-frequency fluctuations caused by noise and gain fluctuations. These low-frequency fluctuations are commonly called 1/f terms because their magnitude increases as the frequency decreases.

A mathematical analysis of the circuit of Figure 3 for composite distortion and cross modulation yields the results that follow:

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

Where:

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.)

Cross modulation (dB) = $20\log(2\Delta/A) - 6$ dB

Where:

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

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

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

A complete analysis of the circuit shown in Figure 2 on page 84 will be presented in a future article. **CT**

References

[1] Matrix Test Equipment Inc., Technical Note, MTN-108, *Some Notes on Composite Second and Third Order Intermodulation Distortions.*

[2] *National Cable Television Association Recommended Practices For Measurements On Cable Television Systems*, Second Edition, Pages I.B.1 pages 1 and 2.

[3] Raoul Pettai, *Noise in Receiving Systems*, John Wiley & Sons, 1984.

By John Dahlquist

Why HFC and why now?

An important trend in cable TV system architecture is the migration from coaxial cable networks to a combination of coax and fiber, or hybrid fiber/coax (HFC). These blended architectures promise the advantages of coax coupled with the advanced benefits of fiber. But before system operators jump on the HFC bandwagon, it is important to know what forces caused the emergence of HFC, what benefits such an architecture offers over other systems, and what its long-term viability is.

Before the advent of HFC architectures, cable system operators provided one-way, basic and premium services via a tree-and-branch coax architecture. This architecture utilizes trunk amplifiers, in cascades varying between 16 to 30 or more units, to transport signals from the headend through the franchise area to the extremities of the system. Bridger amplifiers, located in the trunk amplifiers, are used to launch high-level signals from the trunk for local distribution via feeder cables. In the feeder, cascades of two line extenders are used to maintain appropriate signal levels to provide services to subscribers.

Tree-and-branch coax systems offer many advantages: Coaxial cable is comparatively inexpensive, it offers huge bandwidth, and it is the existing architecture in the majority of the nation's communities. But the weak point in the coax chain is its need to re-amplify signals many times to give them enough energy to get through the network. In a typical architecture, a signal might pass through 20 or more amplifiers before arriving at an end-of-the-line subscriber, a mere eight to 10 miles away. Each one of these amplifiers causes a degradation in picture quality.

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The use of many amplifiers can cause a significant difference between what was initially transmitted and what is delivered to many subscribers. In addition to signal degradation, there is the issue of amplifier failure. If any one amplifier in a system fails, regardless of its location in the network, total transmission failure results for all subscribers beyond the failed amplifier. Statistically, the odds of system failure increase with the number of amplifiers; some portion of a transmission path with 20 amplifiers is 10 times more likely to fail than is a path using only two amplifiers, all else being equal.

"HFC networks can conduct analog or digital communications, or both at once, with the potential to deliver more than 500 compressed digital channels."

Beyond basic architecture

Even with its drawbacks, tree-and-branch coax architecture enabled the CATV industry to achieve greater than 60% penetration of U.S. TV households, proving itself to be an efficient architecture for delivering basic and premium entertainment services to subscribers. As system development progressed, more channels were added at higher RF frequencies. More customers in remote locations subscribed to CATV systems. And as operators offered services such as pay-per-view, and consumers began paying more for their subscriptions, system reliability became more crucial.

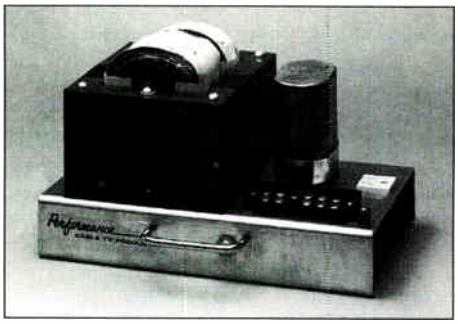
To meet the demands of transmitting more channels over greater distances, coax system operators needed to add even more amplifiers to their already long cascades. Adding more channels affects a coax system in two ways: The more channels a system carries and, accordingly, the greater its highest frequency, the more densely amplifiers need to be placed in order to maintain signal quality. Thus, higher frequencies require more frequent amplification, and amplification causes signal degradation. It was obvious to the cable industry that to continue to grow and develop new services, system architecture had to change.

The technological limitations of coax, combined with higher quality requirements set by the Federal Communications Commission, made the time ripe for change. Standard coaxial cable couldn't respond simultaneously to the quality and quantity demands being placed upon it. A new technology would bring the answer: fiber optics.

Key to broadband transport

Fiber-optic transmission systems are emerging rapidly as the key transport technology in broadband communications networks. Compared to traditional coaxial cable networks, fiber-optic technology provides higher bandwidth for information transmission, superior quality and reliability, and lower maintenance costs.

HFC, as the name suggests, combines fiber-optic communications with conventional coax technology. The fiber-optic technology introduced into CATV architectures is substantially different from standard telephony and fiber-optic data communications transmission technology. In standard fiber-optic



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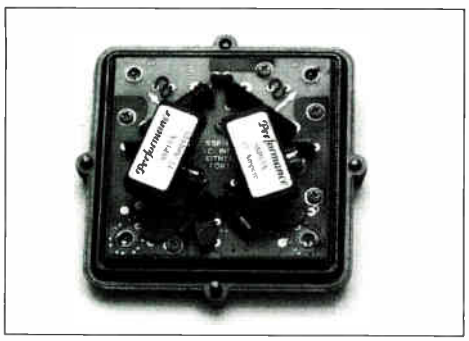

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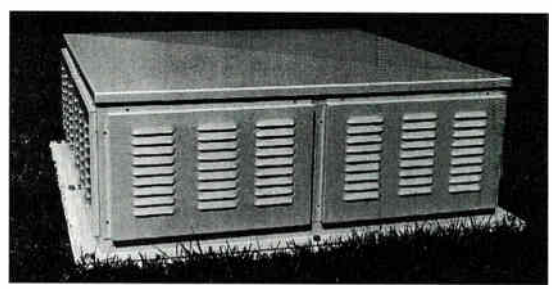

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telecommunication networks, lasers convert an electrical pulse, or on/off signal, into light pulses to convey digital signals. RF analog signals are waves with varying degrees of intensity, rather than a series of on/off pulses. To use a familiar metaphor, a typical light switch offers two discrete choices—on or off, like a digital signal. Some fancier "dimmer" switches offer both on and off, as well as a variety of light intensities in between, like RF analog.

Operators can seamlessly integrate linear optics into an existing coaxial network. In an HFC network, radio frequency signals are converted into optical signals at the headend, where the network operator receives satellite and broadcast video signals and processes them for transmission across the network. The optical signals, modulated to transport information, are then transmitted through fiber-optic cables to optical nodes spread throughout the network. At each node, designed to serve as few as 100 homes, the light-based signal is converted back into RF signals. These signals are then transmitted over existing coaxial cable to individual homes. Because fiber can conduct a signal much farther than can coax (for example, typically 15 miles vs. one-half mile for coax before re-amplification), fewer amplifiers are needed in the overall architecture, thus increasing system reliability and signal quality.

While fiber has many strengths, there are several drawbacks that make it currently impractical for use as a complete replacement for coax. One, fiber is quite expensive compared to coax. Secondly, coax already passes the majority of the nation's homes. Finally, subscriber equipment (such as TV sets and set-top boxes) accept RF, not light signals.

The advantages of a hybrid architecture of fiber and coax are many. HFC offers robustness, high bandwidth, and low cost of coax, with the high quality and reliability of fiber. In addition, while standard fiber-optic telecommunication systems cannot transmit analog signals, linear optical systems can transmit digital signals. Thus, HFC networks have the versatility of conducting either analog or digital communications, or both at once, with the potential to deliver more than 500 compressed digital channels. And HFC is ideal for providing high-performance, two-way communications to meet the needs of an emerging class of broadband interactive applications such as video-on-demand (VOD), Internet access and telecommuting.

Deregulation of the cable and telecommunications industries via the Telecommunications Act of 1996 now allows telcos to enter the video and data services market, resulting in greater competition to MSOs. Concurrently, CATV providers can now offer competitive access provider (CAP), data and telephony services. Both these elements contribute to the need for CATV operators to offer inexpensive, high-quality, high-speed video and data applications. HFC, with its low cost, high reliability and high quality, is the answer. **CT**

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Reader Service Number 86

By Dan Harris

Primer on baseband digital transmission on single-mode

This installment of "Ask A Fiber Expert" offers tips to "analog engineers" on tackling the differences between AM/VSB and baseband digital.

• I'm installing 1.5 Gbps baseband digital links between primary headends to transport voice, data and video over distances in excess of 50 km. Do you have a few tips for analog engineers like myself who are faced with getting these links up and running?

Dan Harris is market development engineering manager of broadband technology for Corning Inc. For more details, contact the Corning Optical Fiber Information Center at (800) 525-2524.

As cable TV systems evolve from their initially conceived function of distributing broadcast video to becoming full service communications networks, the types of signals carried on their fiber/coax infrastructure will become increasingly diverse. With services such as Internet access, interactive video and telephony coming on-line in a hurry, cable engineers now must deal with both baseband and subcarrier modulated digital signals in addition to relatively friendly amplitude modulated vestigial sideband video (AM/VSB).

Many experienced cable TV technologists are scratching their heads as they try to make their new systems work because of the differences between AM/VSB and baseband digital. These differences range from elemental components deployed in the systems to the metrics used to quantify overall system performance. The following are three attributes of practical digital transmission on fiber that might seem foreign and at times even counter-intuitive to the analog engineer:

1) Signal-to-noise ratio (S/N) needed to maintain acceptable bit error rates (BERs). →

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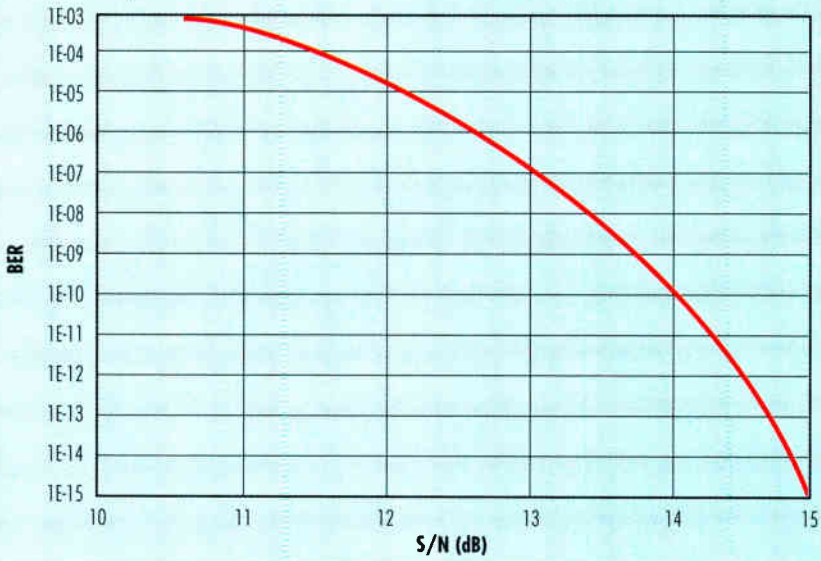
Figure 1: Bit error as a function of signal-to-noise ratio for a binary digital transmission system



2) The effect of single-mode fiber dispersion on system performance.

3) The spectral character of Fabry-Perot lasers in high bit rate applications.

Bit error rate

In AM/VSB transmission, signal quality is measured in terms of noise, quantified by carrier-to-noise ratio (C/N), and distortion, which is characterized by composite second order (CSO) and composite triple beat (CTB). Digital transmission quality, however, is quantified by a single metric, bit error rate (BER). This simply is the probability that any one given bit in the transmitted sequence will be misinterpreted at the receiver. BER is dependent on the S/N at the receiver; this dependence in a typical binary ("on/off") transmission system is illustrated in Figure 1.

We define S/N as the ratio of average received signal power to root mean square (RMS) noise power. For most practical receivers, this definition of S/N is equivalent to the ratio of signal energy in each bit to the noise power spectral density. Accordingly, if the peak optical power remains constant as bit rate is increased, the energy per bit decreases while the noise power spectral density remains the same. Therefore, we must either increase the optical power at the receiver or reduce the noise to maintain the same BER.

Clearly, the required S/Ns for acceptable bit error rates (10^{-6} through 10^{-15}) are on the order of 10 to 20 dB, which is much less than the customary AM/VSB C/N requirement of 45 to 50 dB. As a result, the required receiver sensitivities are typically -30 dBm to -40 dBm, well below the 0 dBm required for AM/VSB.

One result of the receiver's low power requirement is the noise character of a digital system. Specifically, typical cable TV links are limited by either photodiode noise (also called shot noise) or in longer links, relative intensity noise (RIN) from reflections in the fiber. For baseband digital systems, received powers are low enough that both shot noise and RIN often are insignificant, leaving thermal noise in the receiver as the dominant noise source.

Dispersion

Dispersion creates CSO distortion in AM/VSB systems, which worsens as optical power increases. Therefore, any attempts to increase C/N by increasing optical power must be weighed against the potential increase in CSO. For digital systems, dispersion results in an effective reduction of optical power at the receiver—the so-called dispersion power penalty—caused by pulse spreading. Counter to AM system behavior, the effects of dispersion in a digital system actually can be offset by increasing optical power.

Dispersion penalty is dependent on the following:

1) The spectral width of the

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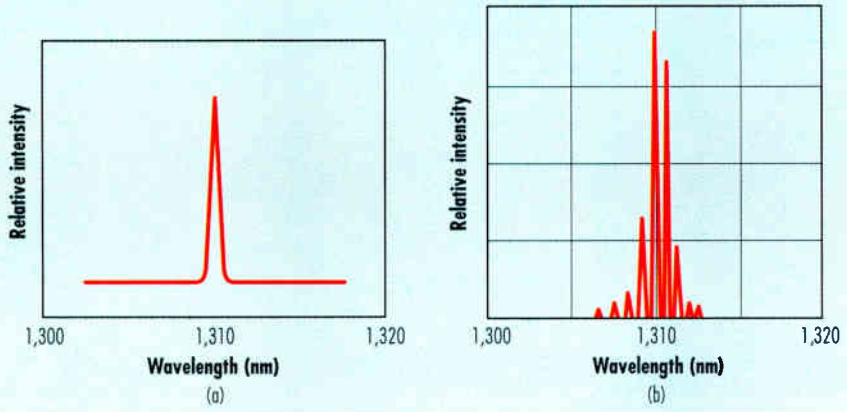
Figure 2: Typical spectral characteristics for a Fabry-Perot laser under (a) continuous wave and (b) high-speed digital modulation



source (the full width at half-maximum designated by $\Delta\lambda$). (Spectral width should be determined for the laser under modulation, since effects like "chirping" can effectively broaden the spectral width.)

2) The dispersion coefficient for the fiber at the center wavelength of the source (D).

3) The length of the fiber span (L).

4) The system bit rate (B).

Typical digital systems are designed to accommodate a dispersion penalty of 1 dB, a condition which is satisfied provided that:

$\Delta\lambda \times D \times L \times B < 0.5$.

If the 1 dB condition is not met and there is insufficient power margin to compensate for additional dispersion penalty, the system will exhibit a higher BER than expected.

Be careful of units when making this calculation. In particular, dispersion is typically quoted in ps/(nm x km), which implies the bit rate must have units of terabits per second for proper canceling of units.

Fabry-Perot lasers

Because of the relaxed linearity and power requirements for digital transmission, some systems do not require distributed feedback (DFB) lasers. In many cases, less costly Fabry-Perot lasers are used instead. The spectral nature of a Fabry-Perot laser is quite different from that of a DFB laser. Although in continuous wave operation Fabry-Perot lasers have a single mode, they exhibit a multimode character under modulation. (See Figure 2.) To complicate matters, this multimode structure is unstable: While the sum total of power contained in the modes remains relatively constant, the distribution of power among the modes fluctuates in a random fashion. This phenomenon is known as mode hopping. (Note that mode hopping occurs so rapidly it cannot be observed with the naked eye, as it is displayed in real time on an optical spectrum analyzer.)

Mode hopping in conjunction with dispersion in a single-mode fiber will cause laser mode partition noise (LMPN). LMPN is a type of RIN that can limit bit rate and/or transmission distance in many systems. Since LMPN is a relative intensity noise, increasing optical power will not improve system performance if the system is LMPN limited. The primary means of eliminating LMPN is to use a source that operates at a wavelength where there is no dispersion in the fiber (this is called the zero-dispersion wavelength and is designated by λ_0, which typically is near 1,310 nm for standard single-mode fiber).

Theoretical calculations plotted in Figure 3 on page 98, show the maximum LMPN limited bit rate length product for a BER of 10^{-9} on standard single-mode fiber is about 300 Gbps x km when the source is a 1,310 nm Fabry-Perot laser with a spectral width of 2 nm. Alternatively, the limit for a 1,550 nm Fabry-Perot laser with the same 2 nm spectral width on standard fiber is only about 4.6 Gbps x km. Basically, this indicates the LMPN distance limit for 1

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Clear Alarm Notification. The 3SM tracks system performance to pre-established limits set to FCC or individual system standards. Alarm conditions are easily viewed on system software that may also be programmed to page technicians.

Priced Right. The CMS 1000 was designed from the ground-up for region-wide headend data gathering. By designing with a focus, Wavetek makes the CMS 1000 System available to you at a small fraction of the cost of traditional monitoring.

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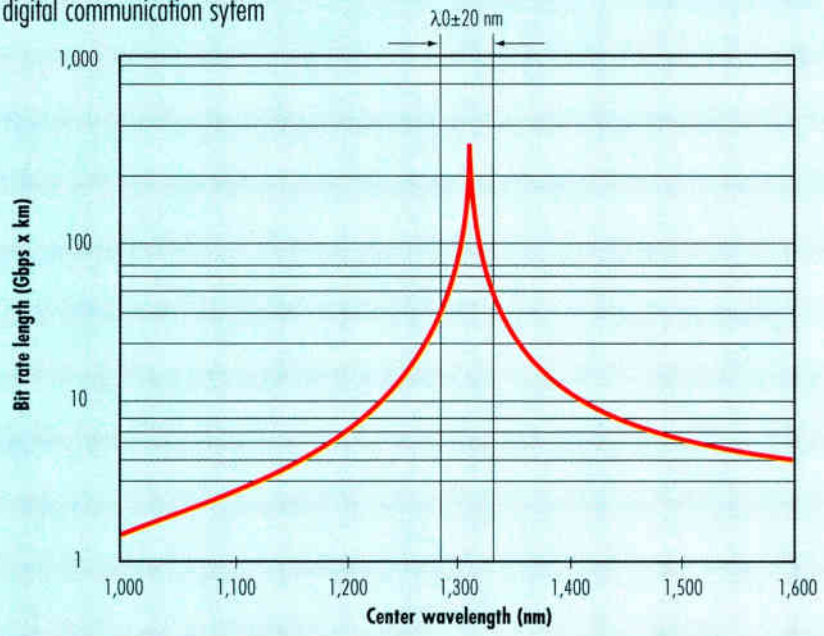
Reader Service Number 51

Gbps transmission would be about 300 km for the 1,310 nm Fabry-Perot laser, but only 4.6 km at 1,550 nm; since the thermal noise limit for digital transmission distance is typically on the order of 100 km, the 1,550 nm system is severely limited by LMPN on standard single-mode fiber. (Note that since this LMPN limitation is caused by high dispersion in standard fiber at 1,550 nm, it can be overcome by using a 1,550 nm optimized fiber solution, such as dispersion shifted fiber or a dispersion compensating module. Fiber solutions optimized for 1,550 nm operation will be addressed in an upcoming "Ask a Fiber Expert" column.)

Figure 3: Theoretical calculation for maximum bit rate length product in a baseband digital communication sytem



In addition to the limitations described in the previous paragraph, laser manufacturing tolerances can introduce LMPN problems even when the sources are designed for the zero-dispersion wavelength.

In Figure 3, the LMPN distance limit is reduced to one-tenth of its maximum value over the typical ±20 nm specification range for Fabry-Perot laser center wavelength. Therefore, the center wavelength of a Fabry-Perot laser should be only a only a few nanometers from the zero dispersion wavelength of the fiber, especially in long-distance, high bit rate applications.

In summary, baseband digital over fiber does indeed have a few characteristics that are significantly different from its AM/VSB counterpart. The S/N and, in effect, received optical power needed for an acceptable bit error rate is typically 30-40 dB lower than that required for analog video. Also, dispersion-induced distortion in baseband systems actually can be offset by increasing the received optical power, as opposed to the AM/VSB condition where signal degradation due to distortion gets worse at higher received powers.

As a result of the moderate source power and linearity requirements, inexpensive Fabry-Perot lasers are sometimes used in baseband digital systems. These lasers tend to exhibit a fair amount of mode hopping under modulation, however, that can create mode partition noise in single-mode systems which may limit overall performance. **CT**

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Optical transmitters

Antec Corp. announced a cost-effective, higher-performance family of 750 MHz capable Laser Link II 1,310 nm optical transmitter lasers for the broadband industry.

The opto-electronic product line includes nine different varieties of laser transmitters. While the new product line will replace the existing Laser Link products, it will be completely backwards-compatible with the currently installed Laser Link II base.

The new platform allows for consistent carrier-to-noise and distortion performance over varied loss budgets. Five of the nine modules are low-power lasers designed for use in shorter fiber routes, or to segment programming to a specific node serving 250 to 1,000 customers.

Three of the nine are medium-power lasers designed for use in medium-length fiber routes, or in applications where an operator decides to split the optical output of the laser and, as a result, feeds more than one node with a single laser.

The last module is a high-power laser for use in longer fiber routes, or to feed several nodes with a single laser.

Reader service #312

Network monitoring

Superior Electronics Group Inc. announced that its CheetahNet network monitoring software now includes full integration with third-party operational support systems.

CheetahNet will share data with Cabletron Spectrum network management, Remedy trouble ticketing and CIS Focus CAD design systems. A live demonstration conducted at SCTE Cable-Tec Expo monitored and captured alarms from a working Alpha power supply and Scientific-Atlanta amplifier.

CheetahNet provides the capability to continuously monitor plant performance, including non-interfering distortion measurements, and is designed to be scalable to expand as operations network requirements and service offerings evolve. In its initial version, the system provides complete network management functionality for analog video services.

Reader service #311

Line extenders

Quality RF Services introduced 550 MHz replacement line extender modules for Jerrold JLE, JLC, JLP, JLX and Pathmaker Plus PAL housings. The modules are offered with integral two-way filters and accept a transistor return from QRF. The QJLE joins the company's QLEP and OSJ family of upgrade modules for Jerrold Starline SLR and SJ housings. This is a new module design, not an upgrade kit for older JLE chassis.

Reader service #310

90 V taps

Electroline announced 90 V powering options for its line of passive and active multitaps, including the 1 GHz SuperTap and the compact addressable tap (CAT). The new powering options allow two-way operations at the higher power configurations cable TV and telcos are adopting to their new hybrid fiber/coax (HFC) networks.

The 90 V SuperTap comes in a variety of configurations, featuring models that block or pass power on all or some of the ports. A four-port version, for example, can pass power on all four outputs, block power on all four outputs, or pass power on only two of the four outputs. The 100% power-passing version is suitable for telcos that will have 100% telephony penetration.

The company's CAT addressable tap with internal signal amplification also is available in a new 90 V configuration. The CAT is used especially in multiple dwelling units and now features an extra connector port, allowing connection of up to three additional switchbacks, without the need for extra addressable control or powering circuitry.

Reader service #309

Cable modem

ISC Datacom's new asynchronous cable modem is designed to operate

at any data rate up to 19.2 kbps, protocol transparent. This modem meets NEMA traffic control temperature requirements and is well-suited to many data applications.

FSK modulation provides reliable data transfer under severe noise conditions.

Reader service #308

Fusion splicer

New from Alcoa Fujikura is the FSM-30S, an ultra low-loss direct core monitoring PAS system. Features include a four-inch LCD monitor offering high-visibility in direct sunlight and a faster splicing and heat shrink cycle.

Another feature is automatic compensation of arc conditions for temperature and pressure. The splicer has increased programmability, increased data storage capability and new specialty splicing modes such as controllable attenuation.

Reader service #307

Receptacles

The Ortronics 106 duplex-type receptacles are designed to mount into single- or dual-gang gem boxes, poke throughs, pedestals and power poles. Offered in combinations of up to four terminations, the receptacles meet all FCC Part 68 specifications and are ANSI/TIA/EIA-568A compliant. The face plates feature a labeling field over each of the plate's screw mounting holes.

Reader service #306

Headend receiver

The Wireless and Cable Products Group of Stanford Telecom introduced the STEL-9244 burst receiver for interactive CATV digital headend equipment.

The unit is a standard board-level QPSK headend receiver that operates in the 5-40 MHz range at 2.56 Mbps. The device provides digital signal processing to demodulate signals optimized for upstream transmission over HFC systems. The receiver is suitable for both telephony and data applications.

Reader service #305

Processor

New from Passive Devices Inc. is the PDI 60 AP agile heterodyne processor. The device provides the operator with the option of cable-to-cable or UHF-to-cable, and is HRC-switchable.

Reader service #304

Playback/messaging

Video Data Systems unveiled the Series 800 micro playback system, which allows the user to add automatic playback from an industrial-quality VCR to an alphanumeric display, thereby imparting a new dimension of live video and audio to a message channel.

This economically priced, true turnkey, fully automated video playback and messaging system is ideal for hotel/hospitality, schools, corporations, hospitals or any place an economical playback/messaging system is utilized.

The system comes complete with a full-color character/messaging generator, a commercial VHS recorder/player, complete automation software package and all cables and connectors. It is shipped in a plug-and-play configuration for ease of use and convenience.

Reader service #303

MMDS SLM

Sencore introduced the SL755D Director hand-held MMDS digital signal level meter (SLM). The unit is designed to answer the need for an SLM that will measure digital signal levels for the expanding plans of MMDS operations.

The product tunes to any channel or frequency in the 50-860 MHz spectrum. It also provides an easy-to-use antenna peaking bar graph designed to make antenna alignment a snap. The unit also powers up both downconverter and digital decoder.

Unique channel planning capabilities allow the customization of the unit for specific system needs, offering eight preprogrammed channel plans. The unit can be tuned by channel or frequency in order to measure data carriers or offset frequencies.

The back-lit LCD display is easy to read, even in bright sunlight or the dark of night. There are no confusing scales to interpret or additional attenuators to add or subtract from the reading. Attenuation is automatic and provides direct signal measurements from -35 dBmV to full +60 dBmV.

In addition to digital and analog signal measurements, the unit is able to measure percentage of hum, audio carrier level and video carrier level to ensure signal quality.

Reader service #301

Pulling capstan

A fiber-optic pulling capstan that can be used easily with existing pulling equipment, winches and capstan drives in a special "accessory approach," is now available from GMP.

The new capstan can be quickly mounted on existing equipment without special modification or new pulling gear. The company says the capstan is very easy and safe to use, pulling the cable with synthetic rope or Muletape—or pulling the cable itself directly.

Durably constructed of aluminum alloy, the capstan has a .25-inch (635 mm) working diameter and pulls with 600 pounds-force (2,700 newtons) and 600 fpm speed.

The capstan can be set up easily as a mid-assist booster for use in pulling longer continuous lengths while keeping the pulling tension below the minimum threshold. It also can be easily coordinated with quadrants, sheaves and other company accessories.

Two versions are available: with or without an integral torque limiter that limits the pulling tension to a calibrated maximum, typically set at the factory at 600 pounds-force. Either unit can be easily mounted on a 2-1/16 inch (63 mm) diameter drive shaft with either a bayonet or cross-pin-type connection.

Reader service #300

Power meter

Fotec announced the FOtest'R CATV fiber-optic power meter. Besides testing cable TV transmission networks, technicians need a power meter for safety reasons: CATV systems now have high optical power levels that may be hazardous to one's eyes.

The FOtest'R CATV uses a new design that allows measurement of very high power levels, simplifying the product design and reducing cost. The unit measures higher power than any other hand-held fiber-optic power meter (up to +26 dBm), according to the company.

The unit is designed to be splash-proof, comes with a shock-absorbent case and offers a five-year recalibration interval.

Reader service #299

Leakage/SLM

Wavetek incorporated a highly sensitive leakage detection mode and MicroStealth measurement technology into one unit—the CLI-1450 leakage detection and signal level meter. This lightweight hand-held meter features a sensitive leakage detector that finds and measures cable leaks, and includes all the features of MicroStealth SLMs: multichannel measurement displays, a go/no-go quick check function, and high-resolution LCD.

The meter can be used with leakage GPS tracking systems. In addition, the headend video "tagging" option differentiates leaks in overbuilt systems, increases detection range, and limits false alarms.

Reader service #298

Tele-seminar dates announced

The Society of Cable Telecommunications Engineers is proud to announce the following satellite teleseminar programs. These technical training programs may be downlinked by any cable system and recorded for immediate and future employee training purposes.

Since its introduction in 1984, this Society program has provided training on a variety of topics for the industry's technical benefit. Tele-seminar programs are presented on the second Tuesday of each month. They will air on the following dates from 2:30-3:30 p.m. ET on Transponder 14 of Galaxy 1R:

- January 9—Telephony 102 (Part Two) and BCT/E Category I Overview (Part One)
- February 13—BCT/E Category I Overview (Part Two)
- March 13—BCT/E Category IV Overview
- April 10—BCT/E Category V Overview
- May 8—Regulatory Issues
- June 12—Digital Technology
- July 10—In-Premises Wiring Issues
- August 14—Video Transport (Part One)
- September 11—Video Transport (Part Two) and Return Spectrum Issues (Part One)
- October 9—Return Spectrum Issues (Part Two)
- November 13—Fiber-Related Issues
- December 11—Data Over Cable (Part One)
- January 8, 1998—Data Over Cable (Part Two)

For further information on the program, visit SCTE's Web site at http://www.scte.org, or contact SCTE national headquarters by calling (610) 363-6888 or via fax at (610) 363-7133.

HFC '96 workshop a huge success

SCTE, in cooperation with the Institute of Electrical and Electronics Engineers Communications Society (IEEE ComSoc) presented an advanced technical workshop on high-integrity hybrid fiber/coax (HFC) networks, titled "HFC '96," on Sept. 25-27 at the Loews Ventana Canyon Resort in Tucson, AZ.

Common approaches to high-integrity HFC network design were discussed, and workshop sessions dealt with spectral integrity and protection, survivable network configurations, powering, encryption and security and tele-communications services network integrity specifications.

"This topic appeared to be very significant within the cable industry," stated Inter-Society Technical Committee and Workshop Chairman Jack Terry, who is assistant vice president of broadband access technology at Northern Telecom in Atlanta. He added, "This topic was chosen to help hybrid fiber/coax (HFC) become the broadband access media of choice as we move toward the end of this decade."

Key issues covered included: standards and technical requirements for telecommunications; transmission spectral integrity; transmission availability and security; specific HFC broadband services requirements; and traffic predictions, network sizings and modulation techniques.

Communications and Publications Chair Curtis Siller, principle engineer with Lucent Technologies, stated that there were the following three primary challenges of HFC to be addressed:

1) The role of standards and the need for collaboration in this effort among the different industry standards bodies.

2) What services will HFC networks support? Will they be integrated, will they be carried on separate RF channels and will they be transported using asynchronous transfer mode (ATM), circuit mode and/or variable length packets?

3) The upstream noise

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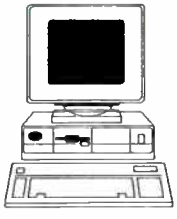

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32. ❑ Specify
33. ❑ Evaluate
34. ❑ Approve
35. ❑ Not involved

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The purpose of this workshop is to bring together experts to assess the issues and determine economic ways of optimizing HFC network design to ensure that HFC networks become the broadband two-way access networks of choice as we enter the next millennium.
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- **Powering**
- **Encryption & Security**
- **Telecommunications Services Network Integrity Specifications**

PROGRAM OUTLINE

Wednesday, Sept. 25
- ***Registration and Tabletop Displays***

Thursday, Sept. 26
- ***Review of Standards and Technical Requirements for Telecommunications Services***
- ***Transmission Spectral Integrity***
- ***Transmission Availability and Security***

Friday, Sept. 27
- ***Specific Broadband Services Requirements***
- ***Traffic Predictions, Network Sizings, Modulation Techniques***
- ***Parallel Breakout Sessions***

For further information, fax this form to SCTE at (610) 363-7133 or call (610) 363-6888.

Name: _____ Company: _____

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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.

☛ *Tech Re-Act*—This presentation by Michael Lance and John Wong of the Federal Communications Commission, deals with how the Cable Act of 1992 will affect you and your system. It reviews the tests required and their frequency, as well as new technical requirements mandated by the law. Topics include: Emergency Alert, home wiring, anti-buy through provision, program access regulations, must-carry rules, retransmission, defining a principal headend and ADI (area of dominant influence). (75 min.) Order #T-1145, $45.

☛ *Test Procedures Under Technical Reregulation*—This program, featuring Terry Bush and Syd Fluck, provides an overview of the new testing required by the FCC, as well as recommendations on how to perform these tests. Topics include: carrier frequency, signal levels, signal level variations over time, in-channel response, carrier-to-noise, distortions, hum, baseband video and leakage. (70 min.) Order #T-1146, $45.

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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August

8: SCTE Satellite Tele-Seminar Program, "Painless Technical Writing (Part I)" from Expo '90 in Nashville, TN, to be shown on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Contact SCTE national headquarters, (610) 363-6888.
8: SCTE Music City Chapter seminar, BCT/E certification exams, Nashville, TN. Contact Rodney Lanham, (615) 645-8296.
8: SCTE North Central Texas Chapter seminar, the return path and two-way systems. Contact Lynn Watson, (817) 790-7557.
10: SCTE Llano Estacado Chapter seminar, conversions. Contact Bob Baker, (505) 763-4411.
11-13: North Carolina/South Carolina Cable Telecommunications Associations joint summer meeting, Radisson, Myrtle Beach, SC. Contact NCCTA, (919) 839-0304.
12: General Instrument seminar, Broadband Network Overview, Hatboro, PA. Contact Lisa Nagel, (215) 830-5678.
12: SCTE Delaware Valley, AMAC and Pocono Mountain Chapters seminar and 2nd annual golf outing, Royal Oaks Country Club, Lebanon, PA. Contact Chuck Tolton, (215) 657-5850.
12-13: SCTE Regional Training Seminar, "Introduction to Telephony." Contact SCTE national headquarters, (610) 363-6888.
12-15: The Light Brigade seminar, fiber-optic design, installation and maintenance, Minneapolis, MN. Contact Lisa Johnson, (206) 251-1240.
12-16: General Instrument seminar, Broadband Communications Network Design, Hatboro, PA. Contact Lisa Nagel, (215) 830-5678.
12-16: Siecor seminar, Hands-On Fiber-Optic Installation for LANs (multimode and single-mode), Hickory, NC. Contact 1-800-SIECOR 1, ext. 5539.
12-23: FiberLight International seminar, Fiber-Optic Technician Training, Dublin, CA. Contact (970) 663-6445.
13: SCTE Chattahoochee Chapter seminar, computer-aided software for broadband applications, BCT/E and Installer certification exams, Calhoun, GA. Contact Johnny Ray, (770) 977-6916.
13-14: Antec Fiberworks seminar, Compressed Video: Concepts and Transmission, Sheraton Suites Hotel, Elk Grove Village, IL. Contact Patricia Sturmon, (847) 439-4444.
13-15: SCTE Wheat State Chapter seminar, BCT/E certification exams, Wichita, KS. Contact Joe Cvetnich, (316) 262-4270.
13-16: Siecor seminar, Hands-On Fiber-Optic Installation for LANs, Keller, TX. Contact 1-800-SIECOR 1, ext. 5539.
13-16: Siecor seminar, Hands-On Fiber-Optic Installation for LANs, Princeton, NJ. Contact 1-800-SIECOR 1, ext. 5539.
14-16: SCTE Regional Training Seminar, "Technology for Technicians II," Jackson, MS. Contact SCTE national headquarters, (610) 363-6888.
14: SCTE Southern California Chapter seminar, Comcast Cable Office, Ontario, CA. Contact Tom Colegrove, (805) 252-5280.
15: SCTE New England Chapter vendor day and technical program, Best Western, Marlboro, MA. Contact Tom Garcia, (508) 562-1675.
15: SCTE Razorback Chapter seminar. Contact Jack Trower, (501) 327-8320.
15: SCTE Rocky Mountain Chapter seminar, BCT/E and Installer certification exams, TCI office, Wheatridge, CO. Contact Mike Phebus, (303) 795-1699.

Planning ahead

Sept. 25-27: HFC '96: High Integrity Hybrid Fiber/Coax Networks, jointly sponsored by SCTE and IEEE, Tucson, AZ. Contact (610) 363-6888.
Oct. 13-15: Atlantic Cable Show, Baltimore, MD. Contact Cable Television Association of Maryland, Delaware, DC, (410) 266-9111.
Dec. 11-13: Western Cable Show, Anaheim, CA. Contact (510) 428-2225.

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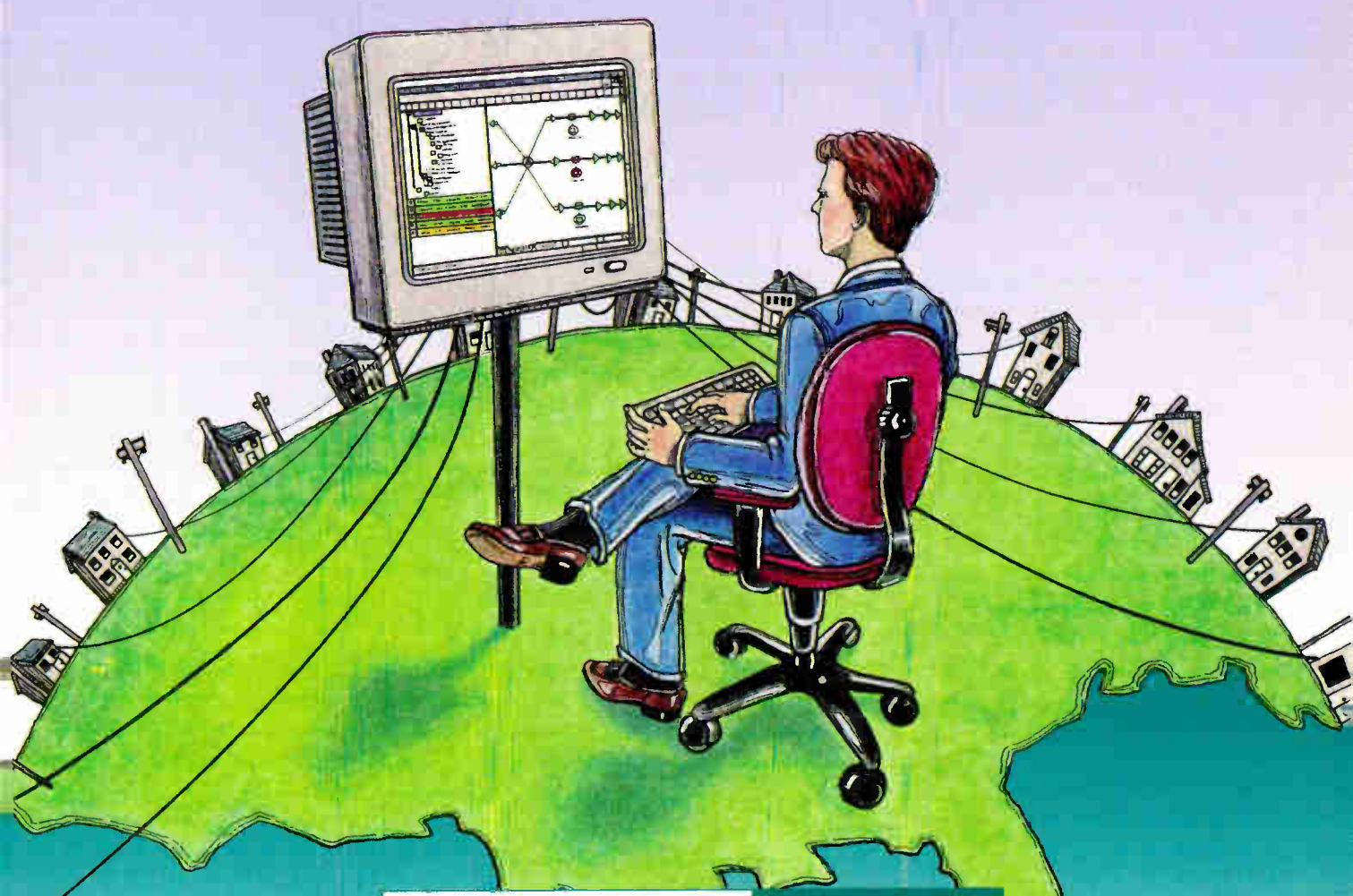

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Reader Service Number 145

Rex Porter

Trivia quiz #9

Our history guru (aka Editor Rex Porter) has provided us with these trivia questions on the cable industry. Answers to the last set of questions appear first. (The last "Cable Trivia" ran on page 192 of the June issue.) Look for answers to this month's questions in a future issue (along with a new set of 10 questions). The person supplying the most correct answers will be awarded a special Trivia T-shirt. You may only win once per calendar year.

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

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

Trivia #8 answers

1) Category VII
2) Optical fibers
3) George Acker
4) Grunt
5) Ron Hranac
6) Ron Cotton
7) Adelphia
8) Trygve Myhren
9) Glenn Jones
10) Chuck Dolan

Trivia #9

1) More than 20 years ago, he began providing coverage of government on his C-SPAN channel, bringing legislative events into the home and the classroom. He is:
A) Ted Turner
B) Bill Daniels
C) Brian Lamb
D) Jeffrey Reiss

2) Since 1982, this company has spent millions of dollars to train the techs of this industry by traveling the nation in their mobile training center. Its corporate name has changed, but we still remember them as:
A) Oak Industries
B) Magnavox
C) Jerrold
D) The Drop Shop

3) Five years ago, the SCTE awarded first place prize in a classic equipment competition to Par Peterson for a Model 222 12-channel trunk amplifier. It was manufactured by:
A) Jerrold
B) Ameco
C) Spencer-Kennedy Labs
D) Entron

4) Second place in the aforementioned classic equipment competition went to Ken Degraffenreid for a Tele Trol Model TM modulator. It was manufactured by:
A) Jerrold
B) Ameco
C) Spencer-Kennedy Labs
D) Entron

5) Third place in the aforementioned competition went to Jack Gobbo for an early 1960 power supply, ATPS. It was manufactured by:
A) Jerrold
B) Ameco
C) Spencer-Kennedy Labs
D) Entron

6) A member of the founding class of the cable pioneers (1966), he earned a BSEE from the University of Houston. In 1950, he hooked up his very first customer, Paris Wainscott, and a few of his neighbors. Needing an amp for Ch. 5 (the system's only channel), the cable pioneer designed and built his own. With Ed Parsons in Oregon, John Walson and Bob Tarlton in Pennsylvania, he became one of the early cable operators in America. He is:
A) Charles Clements
B) Sandford Randolph
C) Bruce Merrill
D) Archer Taylor

7) We all know that Warner won the franchise in Milwaukee in 1982. But, in a "Truman-Dewey" goof, *Cablevision* magazine announced the franchise was awarded to another MSO. The company incorrectly headlined as the winner was:
A) Cox
B) Cablevision
C) Viacom
D) Cablevision Industries

8) In 1989, John Brouse, senior project engineer for Jones Intercable of Broward County, came up with a solution to severe outage problems due to lightning. He installed these devices and they worked so well that equipment manufacturers decided to market them. They are known as:
A) Rod pods
B) Amp clamps
C) Zap straps
D) Lug plugs

9) In September 1957, this was the first town in America to test the marketability of pay TV. Henry Griffing, president of Video Independent Theatres, was convinced people would pay extra to receive commercial-free motion pictures by cable. The experiment continued for three years and then closed. That town is:
A) Bartlesville, OK
B) Austin, TX
C) White Plains, NY
D) Irvine, CA

10) The first program ever originated for distribution by HBO was delivered by microwave to customers. The program was:
A) The Pajama Game
B) You Bet Your Life
C) News and Views
D) The Pennsylvania Polka Festival

And the winner is ...

Bill Cody of Belden Wire and Cable wins Cable Trivia #8. Look for your T-shirt in the mail, Bill!

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Optical node status monitoring: Part 3

This is the final installment of a series on status monitoring in optical nodes. Material is adapted from the "Optical Node Return Operations" lesson in NCTI's Fiber Optic Technician Course and modeled after its new facilitator training courses for administering hands-on labs in a classroom or field setting. © NCTI.

The monitored optical node parameters will vary from brand to brand and model to model. Monitored optical node modules and switches include: 1) optical receiver modules, 2) reverse optical transmitter modules, 3) RF amplifiers, 4) A/B switches, and 5) the node's DC power supply.

Parameter ranges

Most node status monitoring modules use a 0-5 VDC range for measuring most parameters. A parameter measurement — whether a power level in dBmV, a current level in amperes, a temperature in degrees Fahrenheit, or an on/off tampering status — is translated by the status monitoring module into a DC voltage between 0 and 5 V. When this data is received by the status monitoring system software, it is translated back into dBmV, A or °F units for analysis.

Hands-on performance training

Proficiency objective: *Determine monitoring parameters and ranges for a node status monitoring system.*

Provide each student with a copy of the monitoring parameters and their ranges for your system's current or planned status monitoring system.

Discuss each monitoring parameter and its range. Explain how to interpret the data for each parameter and its importance.

As you discuss each parameter monitored, briefly relate how that parameter was checked prior to using a status monitoring system.

Verify that each student understands the monitoring parameters and their ranges for the node status monitoring system.

Finally, use the accompanying review questions to test students. Add some questions pertinent to your system's node status monitoring system. CT

Review questions

1) How does optical fiber make node status monitoring systems very reliable?
2) The four types of digital signals that make status monitoring absolutely essential because they require a higher standard of signal transmission reliability are: 1)_____ , 2)_____ , 3)_____ , 4)_____.
3) The four basic elements of a status monitoring system are: 1)_____ , 2)_____ , 3)_____ , 4)_____.
4) The three basic functions of a node status monitoring module are: 1)_____ , 2)_____ , 3)_____ .
5) The monitored data signals received by the node status monitoring module from select node modules and switches are typically _____ signals.
6) The node status monitoring module sends a _____ data signal to the reverse optical transmitter in the optical node.
7) The DC voltage range that most parameter measurements are translated into by most node status monitoring modules is between ___ and ___ volts.

Answers to review questions

1) Optical fiber makes node status monitoring systems very reliable because optical fiber itself and fiber-based topologies have simplified and improved return path communications.
2) Four types of digital signals that make status monitoring absolutely essential because they require a higher standard of signal transmission reliability are: 1) digital video, 2) voice transmission, 3) data transmission, and 4) personal communications services (PCS).
3) Four basic elements of a status monitoring system are: 1) node status monitoring modules, 2) a master controller for communicating with the node status monitoring modules, 3) a personal computer (PC), and 4) a software program for analyzing the monitored data.
4) A node status monitoring module: 1) receives signals from the headend PC and master controller containing status monitoring instructions, 2) collects monitored data from modules and switches in the optical node, and 3) routes the collected monitored data to the node reverse optical transmitter module for transmission on the reverse optical fiber.
5) The monitored data signals received by the node status monitoring module from select node modules and switches are typically analog signals.
6) The node status monitoring module sends a digital data signal to the reverse optical transmitter in the optical node.
7) Most parameter measurements are translated into a DC voltage between 0 and 5 volts by most node status monitoring modules.

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Reader Service Number 103

By Bill Riker

Cable-Tec Expo '96: A round-up of knowledge

Cable-Tec Expo '96, was held June 10-13 at the Opryland Hotel Convention Center in Nashville, TN.

It is SCTE's largest event of the year, consisting of four days of intense activity in which the cable telecommunications technical community gathers to exchange information, gain knowledge of current technologies and plan for the industry's future. This year's event was our biggest Expo ever, with 4,000 registered attendees and 3,200 exhibitor personnel present.

Although Expo officially kicked off on June 10 with the 1996 Annual Engineering Conference, it actually began a day earlier, when we presented a series of pre-conference tutorials. These tutorials addressed "Achieving BCT/E Technical Certification," "Audio Quality in the Multi-Channel Universe," "Consumer Interface and the New Telecommunications Bill" and a topic of special interest to SCTE members, "Justifying Training in Your Company's Annual Budget."

June 9 also saw the first meetings of two new SCTE engineering subcommittees. The Data Standards Subcommittee will work to advance the industry's interest in and knowledge of medium- and high-speed data delivery, while the Digital Video Subcommittee will develop standards for digital video signal delivery in coordination with the National Cable Television Association, CableLabs, the Federal Communications Commission and other organizations.

The following morning, our milestone 20th Annual Engineering Conference addressed such vital topics as "Fiber Related Issues," "Video Transport," "Data Over Cable" and "Return Spectrum Issues." While the conference featured notable moderators such as Tony Werner of TCI, Nick Hamilton-Piercy of Rogers Cablesystems, Ken Wright of Intermedia Partners and Expo '96 Program Co-Chairman Alex Best of Cox Cable, a true highlight was the keynote address by NCTA President and CEO Decker Anstrom.

Speaking for the first time at an SCTE event, Decker focused on new opportunities created for our industry by the Telecom Bill, and stressed the importance of technical training to the quality of our service.

Following the Engineering Conference, SCTE held its Annual Membership Meeting and House of Delegates. The Society's board and staff answered questions submitted by members and our 75 chapters and meeting groups, as well as from those in the audience.

Another special event of June 10 was our Annual Awards Luncheon. High points included the naming of Alan Babcock as 1996 SCTE Member of the Year and the announcement of Cox Communications as recipient of the 1996 Chairman's Award.

Expo '96 began on June 11 with the premiere of 10 breakout workshops that were offered concurrently over three periods, with another three opportunities to catch them the following day. Hot topics addressed included data transmission, digital technology, how to make two-way transmission work, telephony, system powering and industry regulation.

Many workshops hosted standing-room-only crowds. If you didn't get to Expo, you still can benefit from its training through new videotapes from the 1996 Engineering Conference and workshops that will soon be available from the Society. Also available from SCTE is the *Cable-Tec Expo 1996 Proceedings Manual,* a 714-page manual that includes papers from each Engineering Conference presentation, in addition to summaries and handout material from each of the 10 Expo workshops and four preconference tutorials. For information on these Expo '96 materials, please contact SCTE national headquarters at (610) 363-6888.

June 11 also saw the opening of our largest Expo exhibit floor to date. This was the first event to be held in the Opryland Hotel Convention Center's new, greatly expanded and improved exhibit hall, and over 325 industry manufacturers and service providers enjoyed the opportunity to meet with Expo attendees and update them on their latest offerings.

This year's Expo Evening featured authentic hillbilly scenery, music and cuisine. My thanks to sponsors ANTEC, CommScope, General Instrument and Scientific-Atlanta, whose support helped make the evening so enjoyable for all present.

Along those lines, I'd also like to thank AMP/Graybar, Alcatel, Alpha Technologies, *Communications Technology* magazine, Electroline, Harmonic Lightwaves, Hewlett-Packard, Lindsay Specialty Products, Power Guard, Sprint North Supply, Times Fiber Communications and Wavetek RF Products for their participation as sponsors of Expo receptions. We greatly appreciate these companies' generous support.

Most of all, I want to thank you, the members, attendees and exhibitors who made Expo '96 such a successful round-up of technical knowledge. I look forward to seeing all of you at Cable-Tec Expo '97, to be held June 4-7 in Orlando, FL, as well as our next national event, the 1997 Conference on Emerging Technologies, for which we will return to the Opryland Hotel on Jan. 9-11. See y'all there! CT

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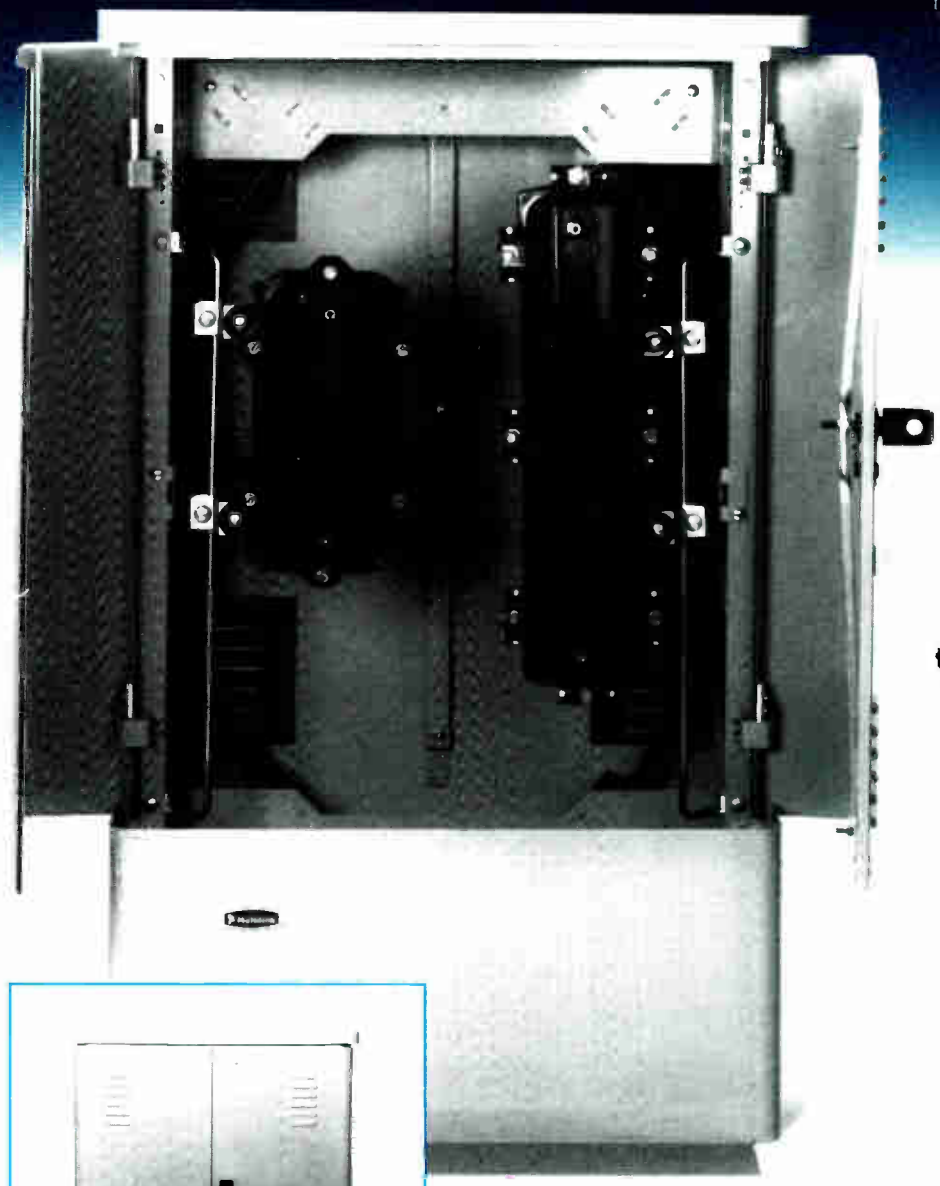

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