CED

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Special pull-out section: 1992 Editorial Index

Stalemate: CATV and consumer electronics

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ILLEGAL CONNECTIONS

DELINQUENT ACCOUNTS

TRUCK ROLLS

THEFT

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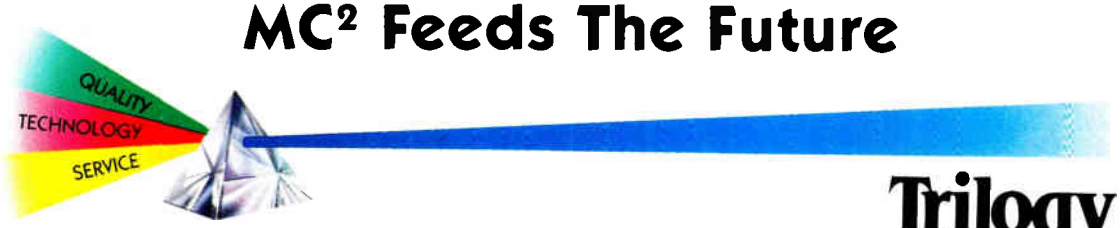

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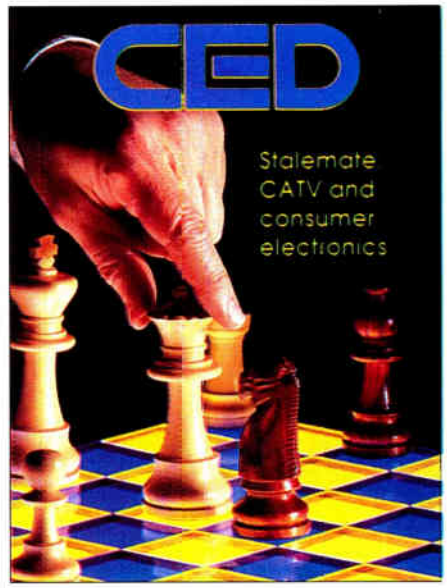
Circle Reader Service No. 2

December 1992 CED Volume 18, Number 13



About the Cover:
A smooth interface between consumer equipment and CATV is now the law. Photo by The Stock Market.

DEPARTMENTS

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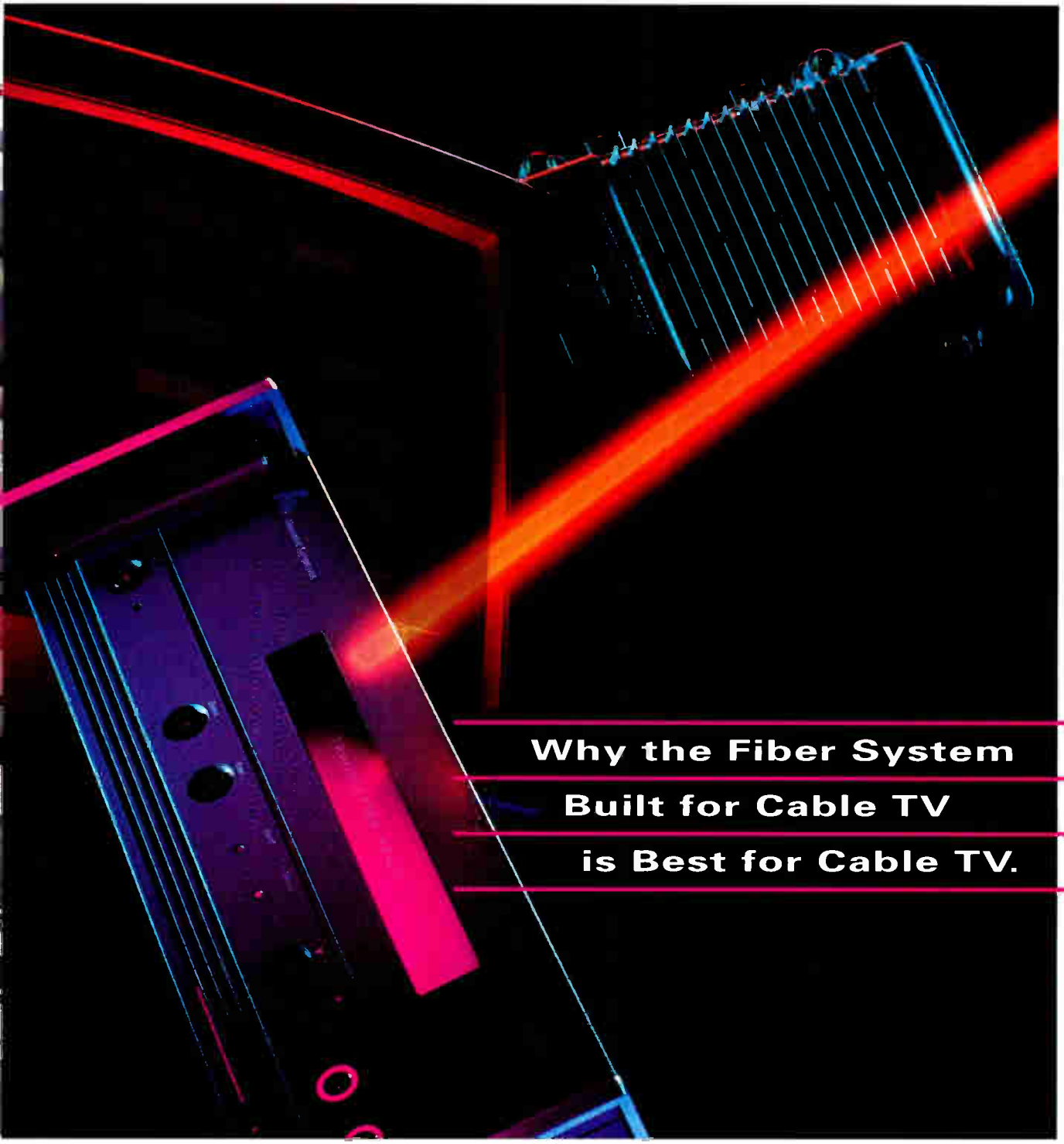
SCTE



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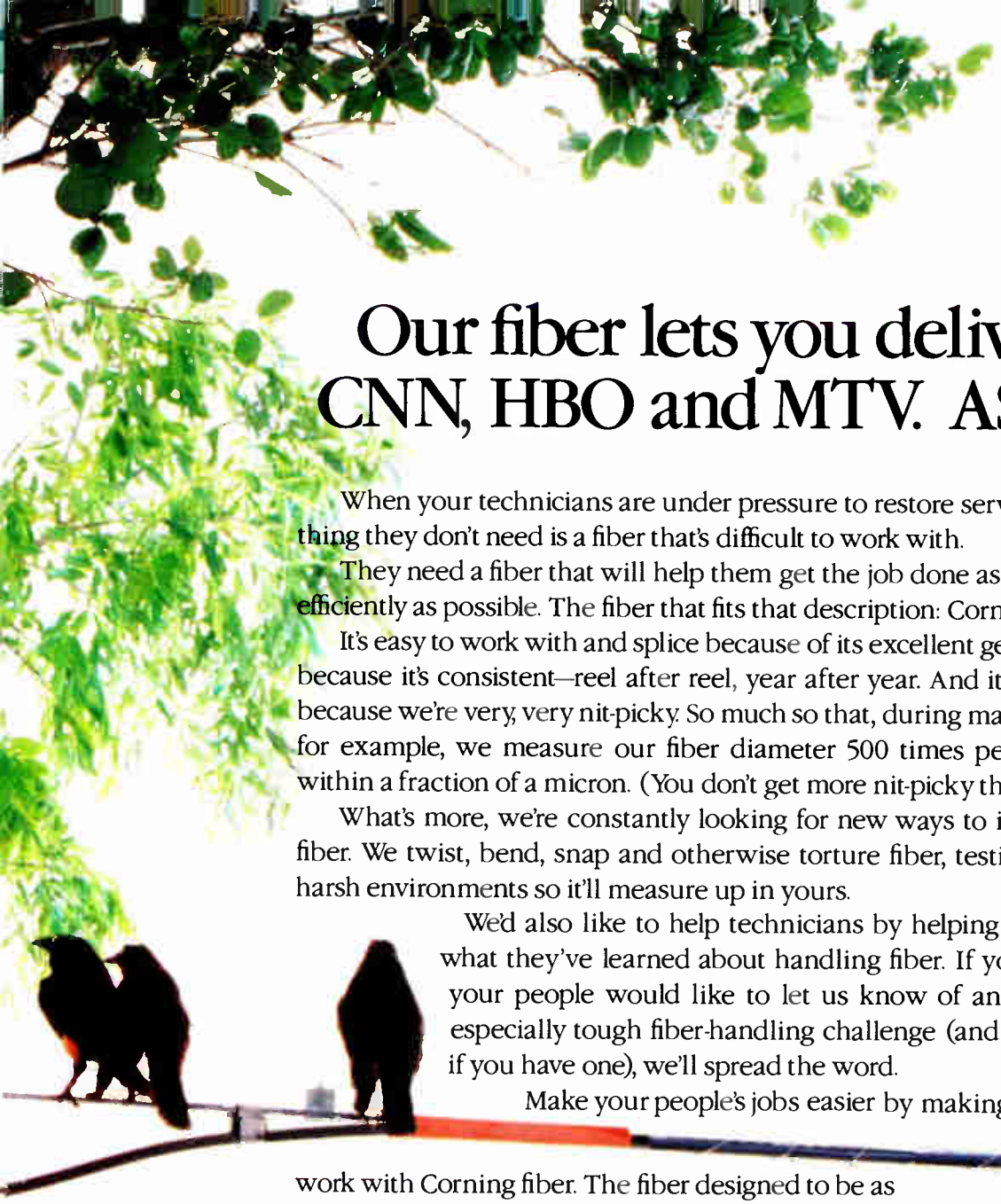

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CORNING

Circle Reader Service No. 4

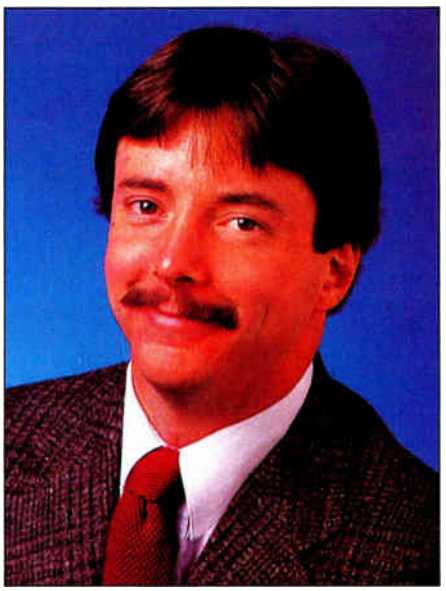
CED

How would you start all over again?

Think back to the time when the cable industry was still tiny and fledgling. Operators were just gaining the financial wherewithal to bid for franchises and wire the streets of America. Existing systems were constructed with poor quality cable, unreliable electronics and signal loss prohibited carriage of more than a few channels.

At the same time, imagine that same scenario knowing what we do now about technology. Imagine what it would be like to start over again, with a clean slate. What technology would you choose to build your system?

Compression? Certainly. Video compression is the application that will usher cable television into the digital era. Digitally-compressed signals sent over satellites, combined with two-degree spacing, promises to make hundreds of programming choices available to most cable systems. This capability is what will make video on demand a reality—and VOD promises to result in more revenue for cable operators at the expense of movie rental stores.



Wireless cable. What has become one of CATV's mortal enemies would instead be its cousin, I think. Why? Because it's less expensive than wiring every street in every town. Although it is dependent on line-of-sight, MMDS is a perfect complement to CATV in sprawling systems or those with a high concentration of multiple dwelling units. In areas where population densities won't support the wired alternative and MDUs demand signal security, MMDS would be perfect.

Direct Broadcast Satellite. Combine compression with high-power birds and you have the makings of a real winner. Narrowcasting would be tough, but if you could afford enough satellites, it's possible. Small, unobtrusive dishes are perfect for communities with strong covenants.

Fiber optics. Of course, any hard-wired system would be built on a fiber-optic platform that reduces (and perhaps eliminates) the need for active components. This, in turn, results in lower maintenance costs, better pictures and greater bandwidth. It also leaves the door open for a multitude of new services, including telephony, PCS and the like.

Satellite ad delivery. The national spot advertising market is huge and cable TV benefits from only a tiny fraction of the total dollars spent. Why? Because without national distribution, a media buyer can't reach the market segments he wants to hit. But with ad distribution via the sky, an advertiser can slice his audience any way he likes.

Sound like a fantasy? It's the situation many developing countries find themselves in right now. All over the globe—in the U.K., throughout Latin America, the Far East and scores of other regions, cable television is poised to explode by implementing new technologies that bring video to the masses cost-effectively. The difference is that these developing systems won't be *just* cable or *just* MMDS or *just* DBS—they'll be hybrid systems that take advantage of multiple technologies.

During the recent Jornadas de Television por Cable conference in Buenos Aires, Argentina, for example, operators from all over South America came to hear the latest about traditional CATV, wireless cable, DBS and compression. These operators realize viewers don't really care how they receive this week's top soccer match, they just want to watch the game.

If only we had it all to do over again. . . .

Roger J. Brown

Roger Brown
Editor

The fight was called in Round 5 because of snow.

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Circle Reader Service No. 65 – Literature

Circle Reader Service No. 66 – Demos

WAVETEK

PBS chooses GI/AT&T compression, Viacom takes S-A; what about TCI?

After a year's worth of waiting, the much-anticipated announcements regarding adoption of digital video compression systems were made last month.

Public Broadcasting Service (PBS) was the first to discuss its plans, and it chose equipment from General Instrument/AT&T. According to PBS officials, the network plans to install roughly 10,000 receivers and equip as many as five uplink sites with the gear over the next 18 months.

GI and AT&T had both been pursuing proprietary compression systems separately, but the agreement with PBS calls for co-development and support for a common set of integrated chips.

Next, Viacom International chose Scientific-Atlanta's MPEG-2 based compression system for transmission of Showtime and MTV to hotels and SMATV systems over Showtime Networks' transponders on Hughes' Galaxy V satellite. That agreement calls for delivery of equipment by the end of the first quarter of 1993. S-A was chosen by Viacom because it "is the first company to complete plans that meet our requirements for performance and interoperability with other suppliers' equipment," said Edward Horowitz, senior vice president of Viacom International.

Home Box Office was slated to announce its compression plans Nov. 12, but early speculation had it embracing the GI/AT&T approach. That leaves just Tele-Communications Inc., one of the three original participants in the CableLabs request for proposals, without announced plans for compression deployment. However, one person close to the subject said TCI was expected to also make its announcement in November.

Much of the discussion surrounding digital compression has centered on MPEG-2 compatibility. MPEG-2 is a worldwide compression standard presently being drafted by the Motion Picture Experts Group. That group favors an open architecture that allows multiple vendors to build compatible equipment. On the other side of the fence is the GI/AT&T group, which believes its proprietary system presents better pictures to the viewer.

The rub between what is MPEG-2 compatible and what is not primarily comes down to the inclusion of "B frames" in the compression algorithm. These B frames provide both forward and backward error correction that are intended to better predict scene changes in the video being compressed. The MPEG standard calls for the inclusion of B frames, while the GI approach does not.

A meeting of the MPEG group took place last month in London, where the issue of excluding the B frame provision was to be taken up. However, many who are close to the process said the provision for a new video "subset approach" favored by CableLabs said the proposal came too late in the standards-making process. As of press time, no information regarding the outcome of the London meeting was available.

Second DBS service coming

Cable television is getting more competition, but it has nothing to do with

the recent passage of any legislation.

Englewood, Colo.-based Echosphere announced an agreement with GE Astro Space to construct as many as seven high-power satellites for a new Direct Broadcast Satellite (DBS) service that will be operated by EchoStar Satellite Corp., an Echosphere affiliate.

A multi-million-dollar contract with GE calls for construction of seven Series 7000 satellites, the first of which will be launched into orbit in the latter half of 1995.

According to Charles Ergen, Echosphere chairman and chief executive officer, the new DBS service will offer "several hundred" channels of video, HDTV, audio and data services directly to the home via 18-inch receive dishes.

EchoStar has been assigned an orbital slot at 119 degrees west by the FCC for DBS provision. This is one of just a few slots that will allow high-power DBS signals to be delivered to the entire United States. The rest of the satellites will likely be used for other markets.

The Series 7000 satellite is the largest and most advanced in GE's fleet. Each bird will include 16 transponders with 120 watts of power each. Each satellite will use advanced jet thrusters in an integral bipropellant propulsion system that supports a 12-year design life.

Provided everything goes as planned, EchoStar will become the nation's second true, high-power DBS provider, joining Hughes' DirecTv, which is committed to a 1994 launch.

S-A to debut slate of products

Scientific-Atlanta will be taking the wraps off several new products at the Western Cable Show this month.

By far the most intriguing new product will be a new "dual wavelength" AM fiber supertrunk, which promises to deliver high-quality video via both the 1310-nm and 1550-nm transmission "windows" simultaneously through a technique known as wave division multiplexing (WDM).

The concept of WDM is one that has been explored theoretically at several industry conferences and seminars, however, this is one of the first products that takes advantage of the concept. By using WDM, operators can theoretically save money because fewer fibers and active components are needed than with digital or externally modulated systems.

Two variations of S-A's new supertrunk system will be available—a four-tier, two-fiber approach which offers supertrunk performance, but utilizes only two fibers instead of nine; and a seven-tier, four-fiber option provides performance comparable to digital fiber systems, according to S-A officials.

The supertrunk utilizes DFB lasers, which company officials say are less expensive than high-power externally modulated devices. To improve reliability, S-A also offers an optical switching option that will keep back-up lasers in permanent "hot standby" mode at 30 percent of the cost of the dual wavelength supertrunk.

The new supertrunk will be available in the first half of 1993.

Also set to debut at the Western Show are two new amplifiers and 750-MHz taps from S-A.

The new-generation amplifier, dubbed System Amplifier II, features a modular integrated amplifier unit, which eliminates multiple modules and interconnections, that is inserted in a new, improved housing design that will serve as

a platform for future upgrades from 550 MHz to 750 MHz and, eventually, to 1.5 GHz.

The new amp eliminates spark gaps and fuses, the primary cause of "nuisance" outages. Furthermore, new "Surge Resistant Circuitry" provides improved protection against outages resulting from lightning storms and power surges.

Also new will be a 750-MHz line extender and 750-MHz taps, both of which will allow cable operators to add bandwidth as well as "piggy-back" telephone signals and other services on the same cable.

FCC mandates EBS

The FCC has released a combined Notice of Proposed Rulemaking/Further Notice of Proposed Rulemaking (Docket 92-439) aimed at getting the cable and broadcast industries to comply with emergency broadcast system proceedings. Summarized, the NOPR will require broadcast and cable operators to purchase an estimated $50 million to $60 million worth of emergency alerting devices by 1994. Failure to comply with the proposed ruling, which will likely be finalized by the third quarter of 1993, could result in fines ranging from $5,000 to $25,000.

In essence, the NOPR calls for cable operators to voluntarily comply with the FCC's alerting guidelines. The catch? While *participation* is voluntary, actual equipment purchase is mandatory.

FCC Chief of Emergency Broadcast Systems Helena Mitchell says the document will likely go through a few revisions before it becomes final next year, and is soliciting cable industry input via the SCTE's Emergency Broadcast Subcommittee. In fact, the FCC is now waiting for the SCTE's reply comments, including design recommendations on a cable EBS device.

"We've already defined 10 universal characteristics that (the alerting equipment) must have," Mitchell says. Those characteristics include:

- A reduction of emergency warning time to the public by directly turning on and off radios and televisions in the home and office,
- A reduced dependency on human intervention at station and cable TV facilities,
- Multiple monitoring (to reduce dependence on one station),
- Capability for user-specific programming, so that EBS devices can automatically interrupt programming for specific types and levels of emergencies affecting certain areas,
- Ability to carry two-tone decode with an option to phase-in new decoder,
- Ability to phase-out two-tone decoding as an interstation signaling technique, plus the ability to shorten two-tone encoding as an alerting signal,
- A requirement for interoperability with local cable systems, new NOAA National Weather Service systems and Remote Pickup Equipment,
- Self-test capability,
- Silent test capability, and
- An integrated contact closure to activate other equipment.

Mitchell says the contact closure is important because in the event of an emergency situation, subscribers not currently watching television could be alerted as to the nature of the emergency.

Roger Paul takes award

Roger Paul, technical trainer and safety supervisor for Cox Cable's Spokane, Wash, system was named the winner of the first annual NCTI/CED Excellence in Technical Training Award during NCTI's two-day "Training '92" seminar in Denver in October.

Paul's training program was chosen out of a group of five nominees by a panel of judges, including: David Large, director of engineering at Intermedia Partners; Tom Jokerst, regional director of engineering for Continental Cablevision; Tom Brooksher, general manager of NCTI; and Roger Brown, editor of *CED* magazine.

Paul was chosen because his training program consists of a healthy mix of classroom and hands-on training. His program was designed to provide system-specific consistent, standardized and measurable training for each level of technical personnel. The levels included: Technical Service Specialist I (installation and repair of drops); Technical Service Specialist II (corrective plant maintenance); and Technical Service Specialist III (plant operation and verification).

Paul says he insisted upon, and received, top management support for his training program. Consequently, all levels of plant management and supervision have been subjected to his training courses.

And that's not a trivial matter. Spokane's TSS I course is three weeks long, including 80 hours of classroom/lab and 40 hours of field work; TSS II is two weeks long, consisting of 80 hours of classroom/lab/field work. To date, 28 TSS Is and TSS IIs (representing 97 percent of the system's TSS Is and 47 percent of TSS IIs have completed the first course, while 30 percent of the TSS IIs have completed their training. Classes scheduled for the remainder of the year will bring that number to 97 percent.

Furthermore, it appears the training has had real effect on operations. Cox Spokane's last customer satisfaction survey indicated that 96 percent of all service calls were being completed on the first call by the responding technician. Also, the safety program that has been integrated into the technical training process has resulted in 70 percent fewer job accidents and injuries, according to Paul. CED

Leslie Ellis (left) of CED magazine and Tom Brooksher (right) of NCTI congratulate Roger Paul of Cox Cable Spokane for being named winner of the first NCTI/CED Excellence in Technical Training award. Photo by Bob Sullivan.

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Equipment pictured in the TV screen (clockwise from top left): Headend equipment, Earth station, New 8600 set-top terminal on-screen display, "DJ" remote control for new DMX digital audio service, System Manager.

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Our customers are the winners.

Circle Reader Service No. 6

Roger Paul

Training keeps Paul all tied up

Roger Paul can tie lots of knots, and the people at Cox Cable in Spokane, Wash. know it. Two years ago, Paul demonstrated his knot-tying abilities in front of 13 Cox employees, who actively joined in on the process while carefully evaluating Paul's training abilities. Why? It was the exercise he had selected during an employment interview. At the time, he was looking to land a job at Cox as the company's professional technical trainer.

He got the job. Now, as technical trainer and safety supervisor for the system, Paul trains Cox's 44 technical staffers, and all 186 Cox system staffers on safety issues.

Paul was a good pick on Cox's behalf. He has over 20 years of experience in technical training, and calls himself a "professional trainer"—as opposed to a subject matter expert who took a sidestep into technical training simply because it was needed.

But why the knots? "I did that because what I wanted to teach was the process of teaching," Paul explains. "I chose knots specifically because technical training is an activity that requires hands-on interaction. I didn't want to teach something that would be technically over the heads of someone who was sitting there, or that would interfere with the process of teaching."

The process of teaching

The process of teaching, Paul explains, is roughly a three-step technique. "You tell the people what they're going to learn, show or demonstrate it to them, then have them do it," Paul says.

Of course, there's a lot more to technical training than a simple three-step process—that's why Cox wanted to hire a professional trainer to handle its Spokane training functions.

"A professional trainer can approach any individual from a half a dozen or more different directions to get them the information they need," Paul says. "Plus, there's the whole matter of setting up a training program: How to test, what activities to include in testing, employee motivation. That's what differentiates a professional trainer from a technically-inclined person who has moved up through the ranks. You can train a trainer on equipment; sometimes it's not as easy to train a technically-inclined person how to train," Paul explains.

With 20 years of technical training experience under his belt, Paul has admittedly seen a lot of change. "People's learning habits have changed over the last 20 years. Now, they're accustomed to the 30-second sound bite from the television. Attention spans are shorter; they're more visual. They're used to things being short and rapid-fire. I don't know if we could ever go back to the way it was before, lecturing in a classroom. There's a different approach now."

Part of that different approach includes a new spate of information relating to how people assimilate facts and knowledge. Although psychological and physiological learning processes have long been documented, a more recent cable slant is to apply that information when training.

Types of learners

"There are three types of learners: Auditory learners, who learn by listening; tactile learners, who learn by touching, and visual learners, who learn by seeing. And, there are those who learn best by combining those parameters. All of that has to be taken into account when standing in front of a trainee group," Paul explains.

Supplementing Paul's wealth of applied training experience are a series of master's-level training and development courses at Eastern Washington University, NCTI courses and an associate's degree in engineering technologies from the Capital Radio Engineering Institute—and those are just a sampling from a long list of college-level courses Paul has taken to hone his training skills.

Paul says most people don't stay in training as long as he has. In fact, he says that for most people, training is a transition into something else. "I enjoy it so much, I've chosen it as a career. I like training, because I work with people, and it gives me a chance to affect change," Paul admits. "If I do my job correctly, everything I do affects change. Either knowledge, skill or attitude changes. I like that."

Evidently, Paul's overall job satisfaction is paying off. In late October, he received the first annual NCTI/CED Excellence in Technical Training Award while attending the NCTI's Training '92 seminar in Denver. Paul's program was selected over four other submissions for reasons that become obvious: For starters, since the program was implemented, Cox's job-related injuries have been reduced by 70 percent.

Paul, who considers himself somewhat of a cable "rookie" and is exceptionally humble about his achievements, credits most of the program's success to Paul Workman and other Cox corporate and system-level staffers. "Paul Workman did all the work; I implemented it," Paul attests.

Regardless, the Cox technical training program is working, particularly considering that the Spokane system had no formal training effort before Paul's arrival. Now, system-specific, standardized and measurable training is available to all of Cox's plant operations technical personnel. On average, Cox staffers who go through Paul's technical training programs increase their knowledge by 30 points (as compared to pre-training tests).

What's next?

Paul is also in the process of supplementing his two existing technical courses with a fiber optics course—and he's keeping a close eye on digital technologies. "I want to get ahead of digital compression, so I don't have to worry about putting together a training program after it's out," Paul says.

Paul and his wife of 24 years, Jintana, spend the weekends scouting out potential sites for the construction of their "dream home," which is already in blueprint form. At home in Spokane with their two children, Brian and Tanya, Paul is a model citizen. He's active on a local citizen's advisory committee, coaches a girl's competitive soccer team and is an active role model with Boy Scouts of America. "And those are enough hobbies, thank you very much," Paul says with a smile.

Those Spokane Boy Scouts can probably tie some mean knots, too. CED

By Leslie Ellis

The Great "Hey, what's this battery for anyway?" Contest

Can You Find the Battery that's Right for Cable?

Test your cable battery knowledge. Here are four typical batteries now being used for standby powering purposes in the cable industry. Only one battery meets the demanding needs of cable. Can you find the cable battery—and match up the others with their intended uses? If you can (and we promise, it's not hard) you could be the lucky winner of a Macintosh® PowerBook™ 145 or an NEC® Ultra Lite™ SL-20 laptop computer (contest details below).

Dynasty Gel Batteries™—Valve regulated, low maintenance gelled electrolyte dissipates internal battery heating, provides immobilization for installation safety. Designed for float charging and exceptional service life. Chosen by more MSO's world-wide than any other. Has lowest cost-per-year.

A

Delco™—Low-cost liquid battery, designed for starting, lighting and ignition. Offers shorter service life in hot- weather. Since electrolyte is not immobilized, can be safety hazard in transportation and installation in aerial plant.

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C

MK Battery™—A sealed gelled electrolyte battery designed for deep-cycle applications such as marine cranking. Low maintenance. Phosphoric acid used as additive in gel to aid in deep cycle performance, but at the price of reduced service life on float charge.

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your answers

☐		**Cable**—Long 'idle times'; float charging typical; not a cycling application. Long periods between performance checks by maintenence personnel. Requires four to five years of service for reasonable payback on upfront battery costs.
☐		**UPS**—Long 'idle times'; normally room-temperature operation in computer rooms, headends or offices. Lower-cost batteries which are not suited for extreme environments may be used.
☐		**Marine**—Typical deep-cycle requirement; discharge to "flat" levels frequently; requires phosphoric acid to resist internal stresses. Cranking service common. Low cost, consumer product.
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[redacted] sion industry's systems. But many other issues are also in-

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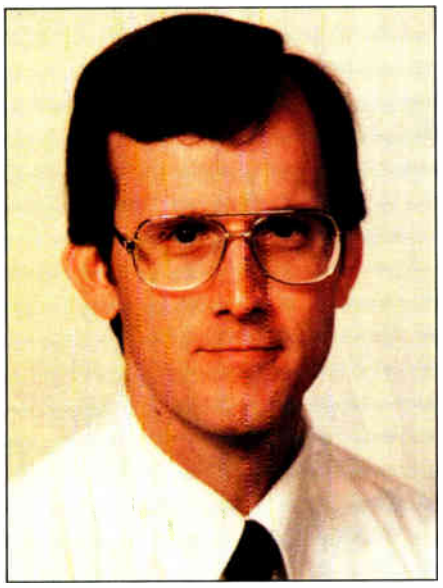

Asymmetrical digital subscriber line

Historical regulatory barriers to telco entry to video dial tone, as enforced by Judge Greene's interpretation of the 1984 Cable Act, are continuously being eliminated. Within the last couple of years, the FCC has allowed the telcos to enter the "information services" market, and just recently, with the passage of the 1992 Consumer Protection Act, has allowed them access to programming. Regulation is no longer an issue for the telcos. Their primary barrier to entry is now technology—the narrowband nature of their twisted-pair copper infrastructure.

Asymmetrical Digital Subscriber Line (ADSL) is a technology that Bell Communications Research (Bellcore), a research organization owned jointly by the seven Regional Bell Operating Companies (RBOCs), has been working on for years to increase the one-way data-carrying capability of twisted copper pair.

Huge capital investment

Obviously, the telephone industry has a significant amount of capital invested in its copper plant. In fact, it has been said that its biggest asset (copper plant running to essentially all of the homes in the United States—over 100 million twisted pair) is also their biggest liability.

By Chris Bowick, Group Vice President / Technology, Jones Intercable

It is estimated that the RBOCs current investment in the local loop is about $58 billion. About 90 percent of this investment is in copper-based twisted pair.

Because of this significant investment in the very narrowband copper local loop, the Bell operating companies are very interested in deploying ADSL as quickly as possible. In fact, Bellcore, Bell Canada, and Ameritech teamed up for an ADSL field trial earlier this year, and Bell Canada, on its own, also has a field trial currently in operation.

In addition, Bell Atlantic has joined Nynex in announcing plans to enter the video delivery business via ADSL. They have asked the FCC for regulatory permission to conduct a trial of video on demand for up to two years using the technology. The trial would begin in the summer of 1993 and would involve 400 Bell Atlantic employees who live in the northern Virginia suburbs of Washington, D.C.

As mentioned earlier, twisted-pair is a very narrowband transmission media that is ideal for carrying low-frequency information, such as voice, but is simply incapable of carrying analog video. Nor is it capable of carrying, for any significant distance, digital data at rates higher than about 19.2 kB/s without a significant amount of modification (conditioning) of the twisted pair via a great amount of electronics on either end.

In fact, in order to establish a T-1 line (1.544 Mb/s) today over the local loop, the telcos must add a significant amount of conditioning to the line, add digital repeaters (analogous to amplifiers) and remove bridged taps and loading coils. This sometimes causes the telco to be extremely slow in provisioning such a service for a customer.

Capacity expander

ADSL, on the other hand, is a technique that will expand the one-way data-carrying capacity of a single twisted copper pair to about 1.544 Mb/s over a distance of about 18,000 feet through the addition of electronics both at the telco central office and at the subscriber's home.

The technology is one-way, from central office to the home, at 1.544 Mb/s, but in addition to the data-carrying capabilities, allows for the simultaneous carriage of traditional two-way telephony (POTS—Plain Old Telephone Service), and a two-way 16 kB/s control and data channel that could possibly be used for interactivity.

This technology, at first glance, might seem like a significant advantage to the telco. But while it's importance certainly shouldn't be underestimated, it's equally important to understand the strengths and weaknesses of the technology. Certainly, for example, 1.544 Mb/s is a significant increase in the data-carrying capacity of twisted pair. Such a data rate, when used in combination with compression and digital modulation techniques, will most certainly provide the capacity for delivering entertainment quality video into the home.

Using today's compression technology, a data rate of 1.544 Mb/s will be capable of delivering a single (1) movie into the home at a time with very respectable video performance—approaching that of a good quality VCR tape. Using such technology, combined with the telcos' well-known switching capability, and when combined with a mass digitally-stored library of movies and other entertainment, the telcos should certainly be capable of delivering switched video-on-demand (VOD) services, otherwise known as video dial tone, to the consumer within the next couple of years. This is a significant development!

Note also that the ADSL technology is not limited to the distribution of entertainment video (movies). In fact, an RFI distributed by Bellcore lists several potential applications of the technology including: the transport of a switched digital audio service of CD quality; the transport of electronic multimedia documents; the transport of switched distance-learning video services from education providers; the download of high-speed data; the transport of interactive imaging and gaming services.

Limitations

Note the limitations of the technology, however. ADSL, at 1.544 Mb/s will only allow for the delivery of a single movie or other video service to the home at a time. Homes having more than one TV or VCR operating simultaneously will not be able to watch two different programs at the same time. Every TV in the house must be watching the same (and only) service that is being delivered to the home at that instant. Nor will the consumer be able to watch one channel while taping another.

Another significant issue with the technology will be its delivered video quality. If movies are what is being delivered, then the video quality should certainly be acceptable to the average consumer. Full-motion, NTSC quality

Continued on page 80

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Anecdotes—I

Cable bashing is not exactly a new art form. It has been practiced vigorously throughout the history of cable TV.

Ed Craney

In 1953, Norm and Jack Penwell, Bruce Hamilton and I built the first CATV system in Montana, at Kalispell. Only a few experimenters had ever seen television in Montana before.

Ed Craney was considered then to be "Mr. Broadcasting" in the Inland Empire, comprising Montana, Idaho, eastern Washington and parts of Oregon. He had half a dozen radio stations and several TV stations, most of which used call letters "KXL[ ]," pronounced "K excel[ ]."

By 1955, he was complaining widely that the proliferation of CATV (pronounced "Cat-Vee") would destroy the television networks and "build a wall" around Montana, excluding out-of-state programs.

We also heard from other members of the loquacious group of CATV bashers, including Bill Grove of Cheyenne, Marshall Pengra of Tyler, Texas, Bill Putnam with a station in Greenfield, Mass., John Conan of Salinas, Calif., "Augie" Meyer of Champaign, Ill., Joe Sample and Frank "Skinny" Reardon of Billings and Butte, Mont., Art Mosby and later Dale Moore of Missoula, Mont., to mention only a few.

By Archer S. Taylor, Director and Senior Engineering Consultant, Malarkey-Taylor Associates, Inc.

NBC recommends CATV

Before we had even thought of CATV, Dick Gies and Fred Plummer were investigating the feasibility of starting a TV station in Kalispell. In response to their inquiry about a prospective affiliation, NBC Station Relations recommended CATV instead, calling the Kalispell market too small for advertising-supported TV. Fortunately for us, we started hanging cable in Kalispell before they did.

"Skinny" Reardon

It must have been about 1961 that "Skinny" Reardon built KGEZ-TV on channel 9 in Kalispell, as a companion to the well-established KGEZ radio. Just as NBC predicted, however, he could not generate enough advertising revenue to keep it going. So, after a year or two, he shut it down. The night the station went dark, Reardon went on the air on his own radio station with a tirade against the cable TV operators (me!) so virulent that the station manager cut him off for fear of lawsuits.

John Cohan

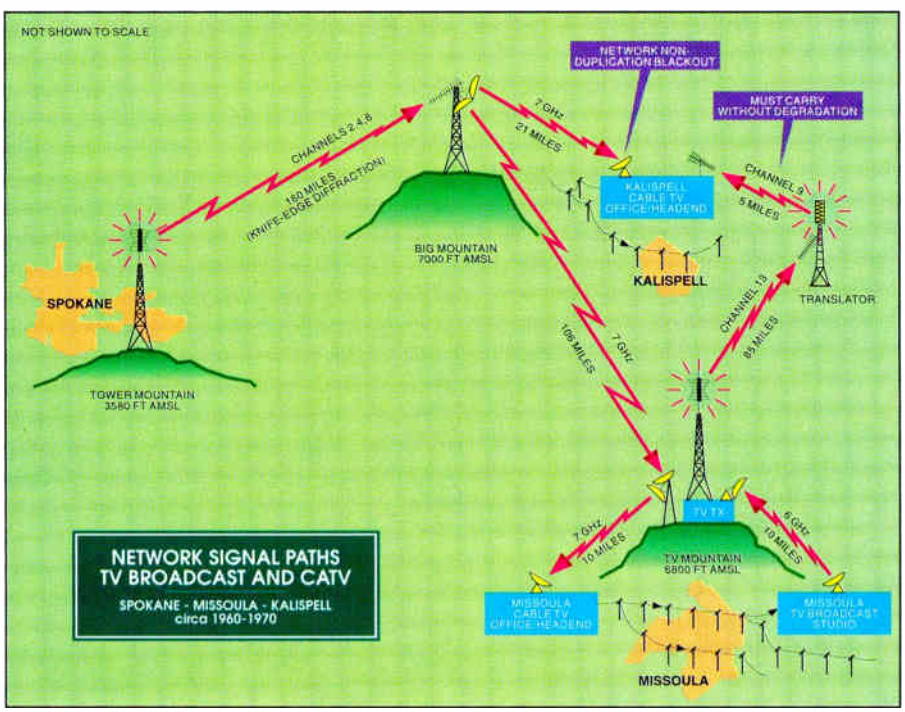
When John Cohan, owner of KSBW-TV of Salinas, Calif., was trying to block a cable franchise in Salinas, he sent a wire to Reardon asking him to testify to the city council about how badly he had suffered at the hand of CATV. Reardon, by then part owner of the cable system in Butte, wired back his willingness to come to Salinas; but he warned Cohan that he would have to tell the council that broadcasting and cable TV can live together. It is interesting to note that Cohan later became a cable TV operator in Salinas and Monterey.

Joe Sample

Once, early in the 1960s, Joe Sample, owner of TV stations in Billings and Butte, Mont., wrote to me as Secretary of the Montana Cable TV Association. He started his letter by saying that he really could not call us "thieves," because thieves work stealthily in the night, while cable TV brazenly steals programs publicly and in broad daylight.

Non-duplication

I love to tell the story about how the cherry-picker TV station in Missoula, Mont., acquired its network program signals. The cable TV company in Missoula (Gies and Plummer) received channels 2, 4 and 6 (ABC, CBS and NBC) from Spokane, Wash. on Big Mountain north of Kalispell, at 7,000 feet elevation and 160 miles from Spokane. The signals were relayed by microwave 106 miles (in one hop) to TV Mountain north of Missoula, on which the TV transmitter was sited. From TV Mountain they were relayed about 10 miles by microwave to the Missoula CATV headend. Using a Conrac demodulator, connected to an ordinary cable TV service drop, the TV station op-



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erator could select whichever channel carried the network program scheduled for broadcast in Missoula. After demodulation, the signal was relayed back to TV Mountain for broadcast on channel 13.

But the station outfoxed itself by demanding non-duplication of network programs. Missoula CATV was nothing if not law abiding, and dutifully blacked out the designated 30-minute time segments. After the local ad insert, however, the TV station operator was dumbfounded and bewildered with the discovery that he had lost his network feed!

Must-carry

Our system in Kalispell also got the three Spokane signals from Big Mountain, through a microwave power split. The Missoula TV station had exercised its "must-carry" rights on the Kalispell system. But since Kalispell was well outside the Missoula TV Grade B contour, we were required to carry the low power VHF translator. Then, the station complained to FCC that we—the cable operators—were deliberately degrading the signal by comparison with the same network on cable.

We explained to FCC that the network signals received off-air on Big Mountain were relayed by microwave to TV Mountain; then by microwave to the Missoula CATV headend; then modulated and transmitted through a service drop to the TV broadcast studio; then demodulated and relayed back to TV Mountain for broadcast on channel 13; then received at Kalispell and retransmitted on channel 9 by the translator which we were required to carry on the Kalispell system. It seemed obvious that there was no way this translator signal could by any stretch of the imagination equal the quality of the signal microwaved from Big Mountain directly to our headend. The FCC denied our petition for waiver! "Not proven."

Satellites have changed all this. But I doubt that cable bashing will disappear as long as broadcasters, cable, telcos and film producers compete for the dollars generated by distributing entertainment and information programs. CED

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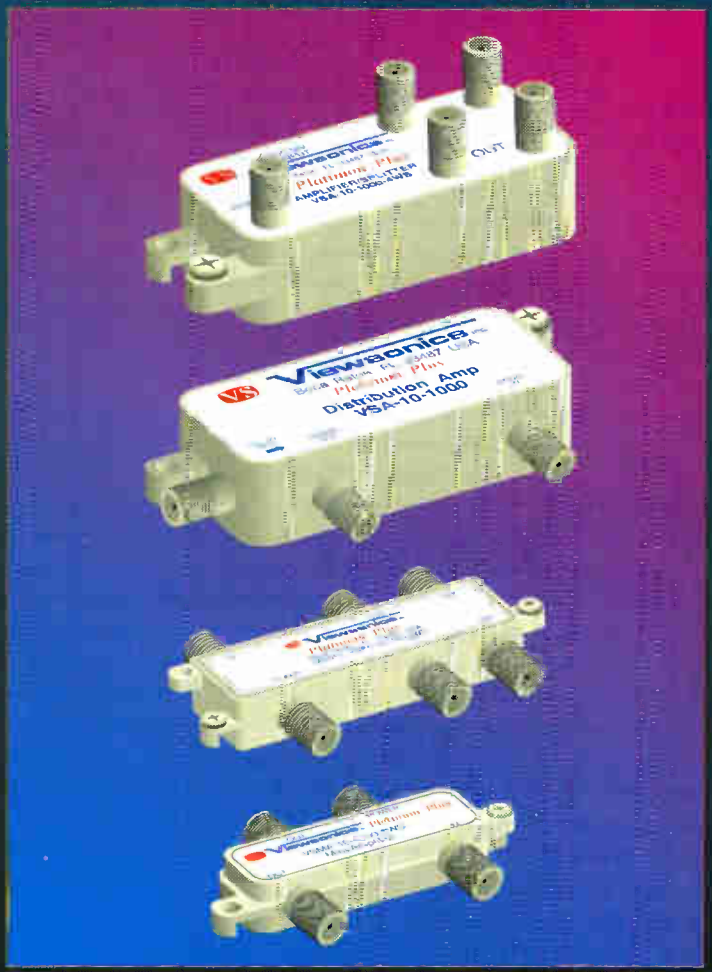

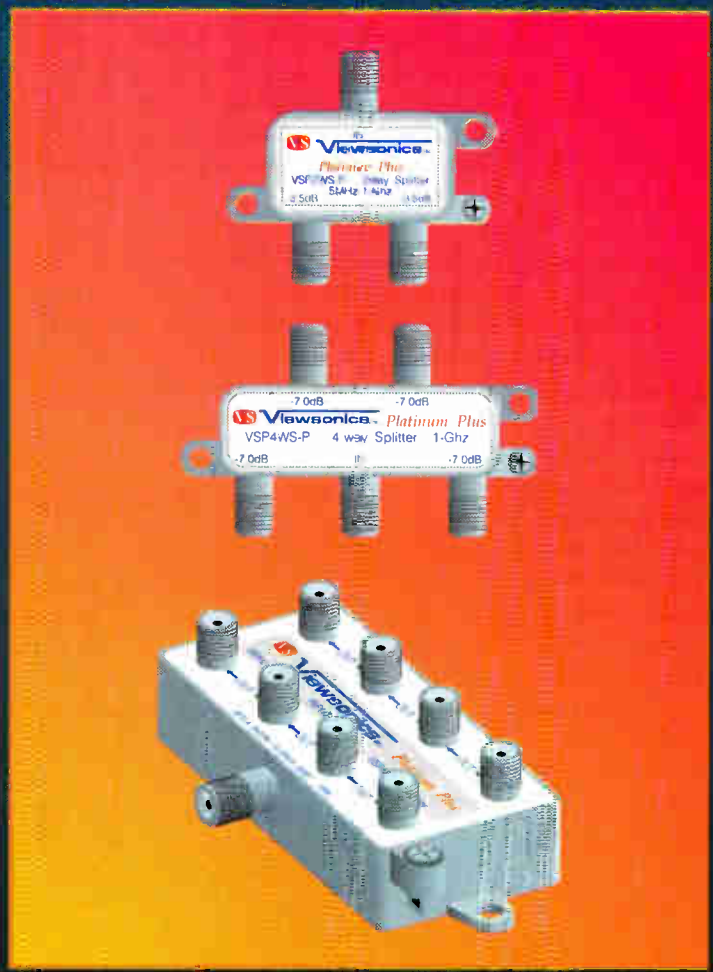

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External modulation: New flexibility in CATV network architectures

Significant advances in externally modulated Nd:YAG solid state laser transmitters, such as enhanced optical power and the amount of linear bandwidth make this technology an increasingly effective alternative for high-capacity transport and distribution of analog AM-VSB and compressed digital video channels.

Recent fiber links

In recent years, fiber optic AM CATV links have been deployed using directly-modulated distributed feedback (DFB) laser technology adapted from digital telecommunications applications. Some progress has been made in improving the capacity and signal quality of this technology. Although some additional advances can be expected, it will become increasingly difficult to overcome practical limitations on output power, linearity, channel loading and Relative Intensity Noise (RIN). This places limitations upon CATV operating architectures in the areas of link length, splitting, connectorizing, capacity and end-of line signal performance.

To expand flexibility in configuring network architectures, many operators are turning to high power diode-pumped solid state Nd:YAG lasers that are externally modulated with LiNbO3 (Lithium Niobate) modulators, which are linearized through advanced predistortion technology.

One such example is a YAG-link system for fiber-optic transmission of AM analog video. Since this external modulation system decouples the functions of light generation and modulation, operators realize added flexibility in optimizing their network architecture for a wider number of applications.

The advantages of this approach are in the high power and low RIN (Relative Intensity Noise) of the laser source, and the capacity and stability of the signal as it passes through a connectorized architecture with multiple splits.

Reduced network complexity

With closed-loop control of the external modulator operating characteristics, it is possible to actually eliminate composite second order (CSO) distortions in externally-modulated systems. For composite triple beat (CTB) distortion, either the predistortion[1,2] or feedforward[3] techniques can be used to achieve an acceptable level of signal quality.

The predistortion technique utilizes advanced electronic technologies to linearize the external modulator's performance before placing the signal into the network. Feedforward techniques rely upon additional laser and analog processing hardware to set up an optical correction signal that linearizes the transmitter's main laser output within a fixed window of distance out in the network.

When discussing how to place the benefits of fiber deeper into the cable plant, optical output power is one of the most critical parameters.

The predistortion approach to broadband linearization takes advantage of the fact that external modulators have a consistent and stable transfer characteristic, and are generally unaffected by optical power, temperature and aging.

Output power

When discussing how to place the benefits of fiber deeper into the cable plant, optical output power is one of the most critical parameters. Currently, YAG-link systems provide two outputs with 13 or 20 mW each, with CTB and CSO distortions of less than -67 dBc and -70 dBc respectively for a modulation index of 3.6 percent for 60 NTSC channels and 2.8 percent for 80 NTSC channels.

Furthermore, Nd:YAG technology is still just at the beginning of an improvement trend regarding optical power—reflecting the continuous advances in the ever maturing semiconductor laser pump technology, which will yield higher and higher optical powers, while retaining hundreds of thousands of hours of reliability. For example, 20 mW optical power per fiber is reliably extractable from 0.8 W semiconductor laser pump power.

As optical powers have increased even further, it was necessary to design the spectrum to prevent generation of Stimulated Brillouin Scattering (SBS), or fiber-generated back reflection—as would be the case with single line, externally modulated DFB lasers.

Since YAG-link is optically isolated from back-reflections, and its multimode, yet sufficiently narrow spectral characteristics, raise the SBS threshold, distortionless operation at very high power levels is achievable.

And because the externally modulated YAG-link is "chirpless" it also mitigates against signal dependent wavelength variation impairments encountered with DFB lasers—which result from multiple reflections, signal dependent splitting in fiber couplers and polarization mode dispersion.

What all this means for operators is that with the qualities of its YAG light source, complemented by the effectiveness of its modulation and linearization schemes and the sensitivity of its receivers, YAG-link systems have the unparalleled ability to place a high-quality signal at any point in the net-

By Emmanuel Vella, Harmonic Lightwaves, Inc.

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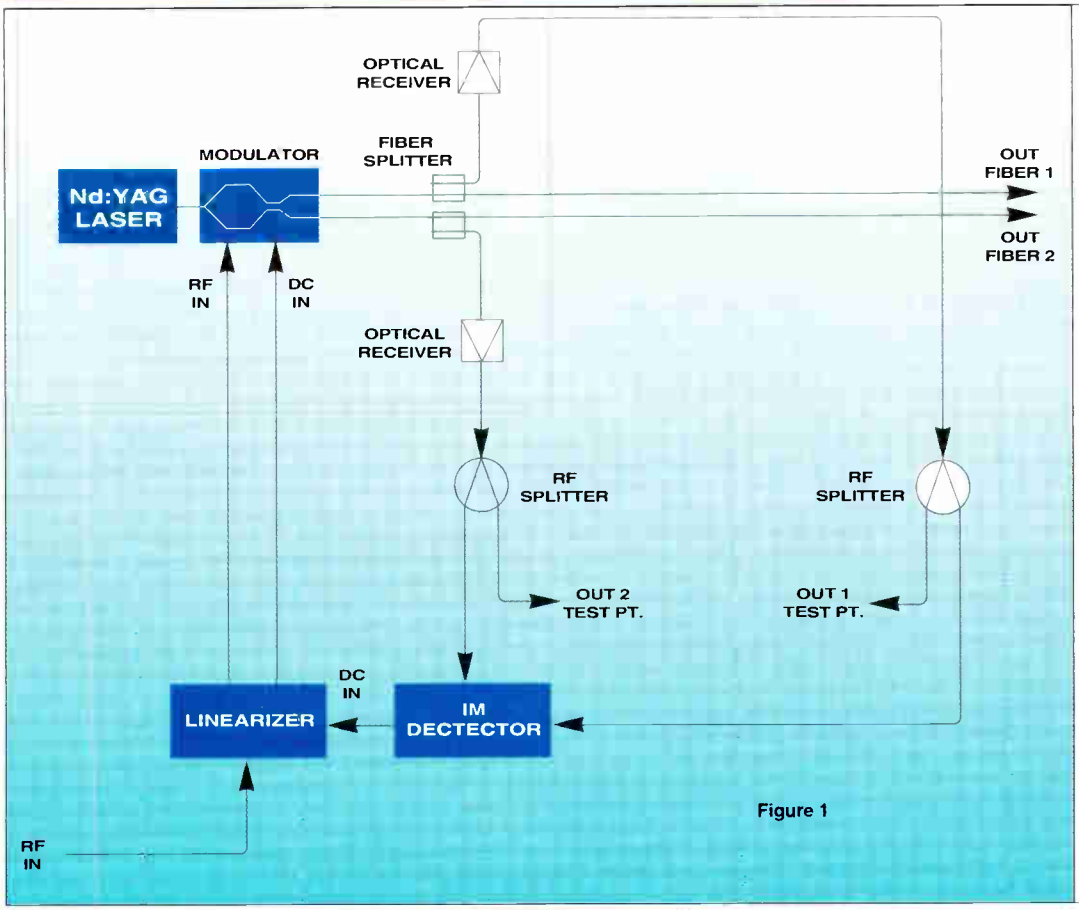

Figure 1

work, whether it is 30 km away or a pocket as small as 250 homes, or any combination of both.

In experiments using the new YAG-link transmission system, each of two fibers has been shown to carry 80 NTSC channels with CNR, CTB, and CSO specifications that exceed industry requirements.

Not only does this mean that improved signal quality will allows operators to carry more channels today, but it also opens the door for digitally compressed transmission in the future.

CATV to FITL networks

Another significant point regarding transition from CATV to FITL networks, the YAG-link receivers have built-in capabilities for return path transmission and remote network management, al-

lowing remote OA&M from the headend. This capability will permit dramatically reduced time and expense when undertaking network changes and maintenance.

Star-star-bus architecture

The recently developed Star-star-bus 500 (SSB), which allows fiber to be driven deep into the cable plant, is one example of an application that uses both externally modulated and DFB lasers. An externally modulated laser transmits to an intermediate point (Optical Transition Nodes) OTN's where the signal is then fed to a number of directly modulated lasers that extend the optical transmission to 500 home areas. This architecture has both present and future benefits.

Today, an operator can not only reduce node sizes and reduce link cost, but also gracefully position the cable plant for future opportunities since the placement of the OTN provides a strategic point for interconnecting a ring—when such architectures are adopted in the future.

The SSB architecture (see Figure 2) is a long reach, wide distribution area opto-electronic repeater architecture[4] based on a YAG-link Transmitter feeding two or more Optical Transition Nodes (OTN). The OTN optical receiver is used to drive several DFB laser links each terminating in a service area.

A noise and distortion cascading anal-

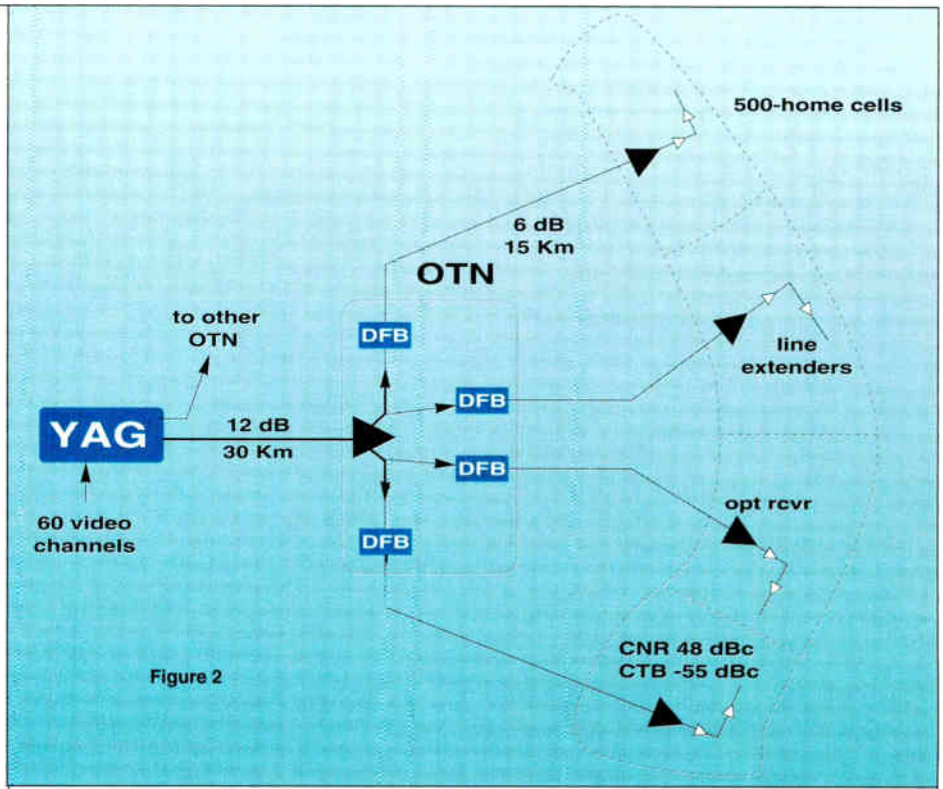

Figure 2

ysis for the chain composed of the YAG-link, DFB and two line extender amplifiers reveals excellent CNR and CTB characteristics to the subscriber. The system supplies the 80 NTSC channel performance described above to eight cells of 500 subscribers each over a total link budget of 18 dB, especially suitable for servicing sparsely populated areas remote from the head end.

An excellent alternative

The deployment of OTNs using the SSB architecture is an excellent alternative to the usage of fiber amplifier repeaters, and circumvents the problems associated with using fiber amps for video distribution, with DFB lasers and with fiber dispersion.

As an even higher-performance alternative, two additional YAG-links could be used in the OTNs in lieu of the DFBs, enhancing the total link budget to 24 dB (60 Km radius from the head end), or trading off some of the extended budget for better CNR or CTB or more splits.

Passive distributed star network

As the output power of the Nd:YAG based lasers continues its improvement trend, a PON (Passive Optical Network) architecture called Passive Distributed Star Network (PDSN) will become possible. PDSN amounts to removing active opto-electronic repeaters from the OTN and substituting passive optical splitters (see Figure 3).

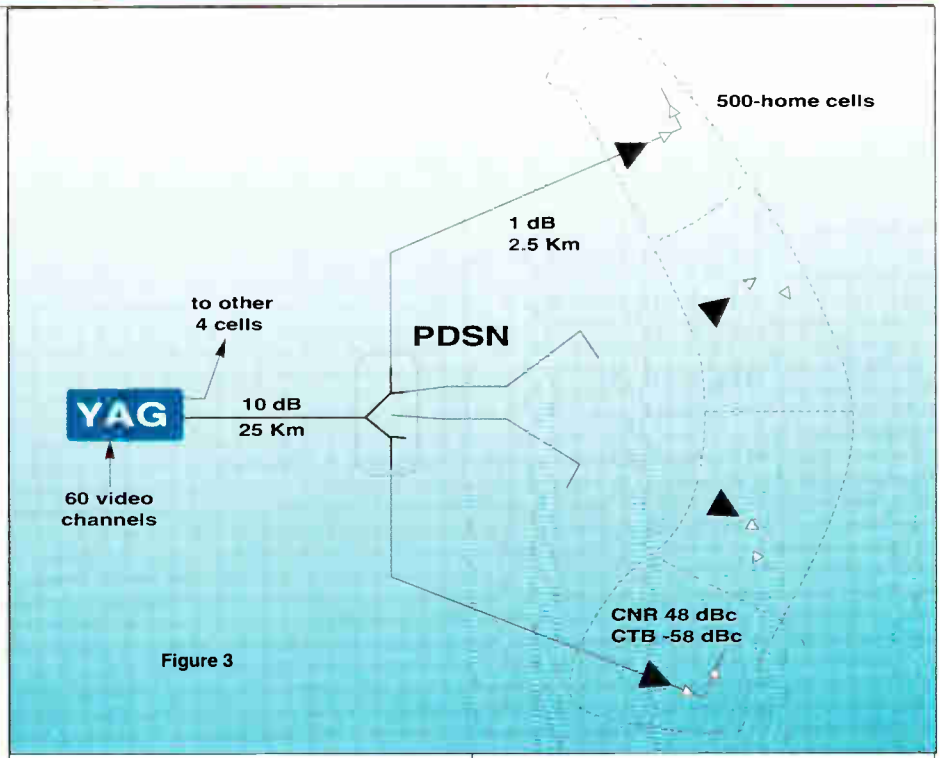

Figure 3

Although a passive splitting loss of 6.5 dB is introduced, opto-electronic repeater degradations of the order of 3 dB for CNR and 6 dB for CTB are eliminated, and the passivation of the OTN is an evident advantage.

Conclusion

For today's plant, externally modulated Nd:YAG solid state laser transmitters provide the technology to satisfy existing needs and position a plant to migrate gracefully into the fiber based networks of the future with their rich mixture of voice, video and data services.

By doing this, operators will not obsolete equipment, but rather, be well positioned to meet changing technological requirements as they develop down the road. **CED**

> It will be difficult to overcome DFB laser limitations in the areas of link length, splitting, connectorizing, capacity and end-of-line signal performance.

> In experiments using the new YAG-link transmission systems, each of two fibers has been shown to carry 80 NTSC channels with CNR, CTB, and CSO specifications that exceed industry requirements.

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4. M. Sparkman, "Extending the advantages of fiber optics." *CED Magazine*, May 1992.

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Re-regulation and the consumer interface

Compatibility mandated by law, but getting there won't be easy

With the passage of the cable reregulation bill this year, the neverending saga of the cable/consumer electronics interface has taken on a new dimension. The difficulty that cable subscribers have in using the advanced features of their TVs and VCRs is not just fodder for home video magazines; it's federal law. And its solution isn't just something for engineers and consumers to dream about; it's been mandated by Congress.

Yet despite this legislated cooperation and the efforts of people from different industries to reach common ground, a solution won't come easy. The economic interests of elements of the cable industry on one side, and consumer electronics marketers on the other, often clash. Also, when proposed solutions translate into lower profits, cooperation simply flies out the window.

"There are selfish interests on both sides that slow things down," says Julius Szakolczay, manager of advanced development for Mitsubishi Consumer Electronics. "Right now, I see a stalemate."

Wave the magic wand

The cable act directs that by next October, the Federal Communications Commission "in consultation with representatives of the cable industry and the consumer electronics industry, shall report to Congress on means of assuring compatibility between televisions and video cassette recorders and cable systems . . . ." Six months after submitting the report, the FCC has to issue regulations for guaranteeing this compatibility. Right now, given that intelligent engineers have been working on the problem for years, that sounds like a job for a magician.

In the bill, Congress acknowledges operators' need to protect signals against unauthorized reception. With the section inspired by Vermont Senator Patrick Leahy's TV difficulties, it also enshrines in federal law the hope that consumers will be able to watch one TV show while taping another, and that they be able to timer-record two consecutive programs on different channels.

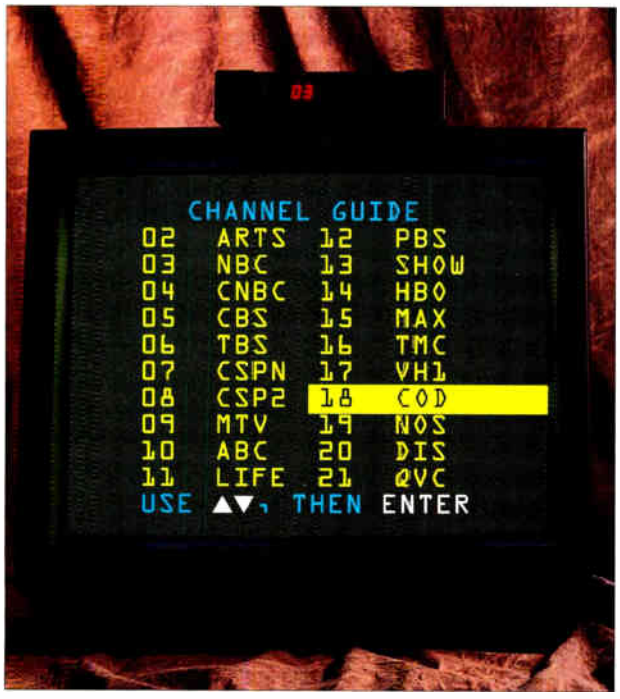
Industry efforts

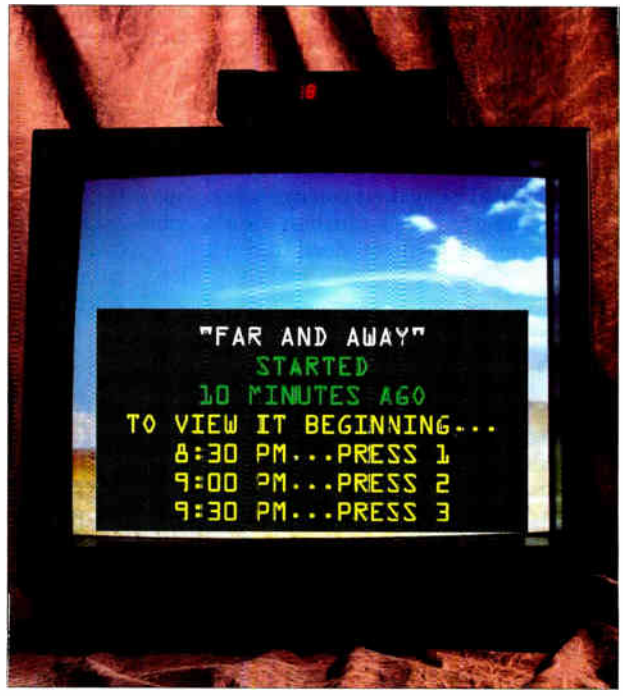
Taking up the lead position on the mission of solving the interface problem is a human interface: a 10-year-old joint engineering committee of the Electronic Industries Association (EIA) and the National Cable Television Association (NCTA).

Even before the cable bill passed, the EIA/NCTA Joint Engineering Committee was positioning itself to be the arena where the compatibility issues should be worked out.

As a prelude to making any recommendation, this group of cable industry and consumer electronics engineers is attempting to gather all relevant information about different possible solutions. "We're trying to assess all possibilities, including the bad ones," explains Doug Semon, director of new technology development for Viacom Cable and co-chair of the joint committee.

By George Mannes





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to the perceived improvements in the consumer interface." A convertor of the future might not deliver only digitized NTSC, but also data services that are normally delivered via personal computer, Moloney points out.

The outlook for widescreen, high-resolution advanced TV (referred to variously as ATV or HDTV) is different. Because there is no burden to make broadcast or cable-delivered HDTV compatible with current TV signals or current TVs, "It's a chance to start all over," Semon says.

Semon, Baggett and Mitsubishi's Szakolczay, among others, speculate that decoding electronics could be built into ATV sets. They envision a system in which operators would issue to subscribers system-specific "smart cards" similar to the VideoCipher RS system for satellite programming; therfore, if a security system is compromised, the cards could be de-authorized and new ones re-issued.

On the other hand, Scientific-Atlanta's Trimm is uncomfortable with a universal conditional-access standard. In addition, the watch-and-record problem doesn't change in the digital environment, he says: descrambling two channels simultaneously will still cost more than descrambling one. "When you go to digital, you have exactly the same problem, but the cost is bigger."

Some early work

In an attempt to facilitate a voluntary industry standard, the EIA's R4.1 Receiver Interface Committee is in the process of defining a voluntary standard for a "logical and physical interface" for ATV consumer electronics equipment, says consultant Bernard Lechner, a committee member. Rather than a set-top box for tuning and descrambling, the baseband interface standard would call for a "set-back" box that would only descramble signals, he says. This would eliminate consumers' inability to simultaneously watch and record different channels.

Lechner chairs an Advanced Television Systems Committee specialists group that has been investigating the idea of a conditional access standard that might build on the interface standard.

Although most people involved in the group consider such a standard desirable, Lechner says, achieving such a standard will be difficult: reaching such an agreement would be complex and require normally competitive parties to cooperate. "Cooperation is not their normal mode," he says.

Despite the cordiality and obvious desire of committee members to solve the interface problem, the actual implementation of a pre-HDTV solution faces some imposing hurdles—primarily money-related. "What's possible and what's economically feasible may be two different things," Semon says.

What will motivate people to implement a solution? A monetary pay-off, says Elliot Broadwin, general manager, High-End Color Television for Thomson Consumer Electronics (which makes GE and RCA TVs and VCRs). That means Thomson and other TV marketers will sell more sets while cable operators will give their customers increased satisfaction, he says. Asked whether the perfect solution would have both consumer electronics manufacturers and cable operators making more money, he responds, "The solution has to be in the best interests of both industries."

> "I don't think it's career-enhancing to tell the CEO of a cable company they're going to lose $0.6 billion a year when the manufacturers won't put two cents of shielding in their TV sets."

Most of the solutions, says Baggett, including interdiction or point-of-entry descrambling, will cause cable to lose two revenue streams: remote rentals and additional outlet charges. It's no small potatoes: Baggett estimates that cable operators pocket about $600 million a year from those two line items.

Meanwhile, Baggett complains about the interface problems associated with the shielding used in television sets, which is of substantially less quality

than that found inside cable convertors. "I don't think it's career-enhancing to tell the CEO of a cable company they're going to lose $0.6 billion a year when the manufacturers won't put two cents of shielding in their TV sets."

If cable has to spend a lot of money on the interface, he says, it's appropriate that cable be able to make money from offering such services as program guides, data services and telecommuting. "Our only insistence is the person who puts up the capital makes the money."

Industry friction

Meanwhile, people in the cable industry would like to "eliminate TV receivers from the face of the earth," reducing them to simple monitors,

> The core of the problem is the lack of a conditional access standard...because of fragmentation in the cable industry.

Szakolczay says. The conflict between the consumer electronics and cable industries, he says, is about "who is going to deliver, who is going to have control over . . . the value-added portion of the product . . . . Therein lies the battle."

Consumer electronics manufacturers are overwhelmed with the variety of configurations of the thousands of individual cable systems built across the country. "That's hard to swallow when you're trying to manufacture a cable-ready TV set," says Ralph Justus, director of engineering for the Consumer Electronics Group of the EIA. "TV manufacturers say, 'Give us TV-ready cable,' " he adds.

Jack Pluckhan, Panasonic's vice president of external affairs and the industry vice president of the EIA's Consumer Electronics Group, is sympathetic to the cable industry's need to secure its signals in apartment complexes and urban areas where piracy is a particular threat. But, he says, "I don't think it should be used as the reason for going as far as they have in restricting the real use of TV set and VCR features."

Lack of standards

"The core of the problem is the lack of a conditional access standard," Szakolczay says. "A receiver manufacturer does not have the option of building a freestanding product that will have full functionality . . . because of fragmentation in the cable industry," he says.

How will the FCC navigate the waters between the competing interests of cable companies on the one side and consumer electronics companies on the other—without the conflict ending up in court? "It's going to be a cute trick," Baggett says. "It's not hopeless, but unfortunately it's going to be a mess," says Szakolczay. CED

The 5-30 MHz return band: A bottleneck waiting to happen?

If the home of the future will receive advanced services such as PCN/PCS, interactive television and multimedia via the cable TV network, bi-directional transmission capability is a must. But is it possible?

Not now.

Operators and manufacturers estimate that somewhere between 1 percent and 10 percent of the nation's cable systems presently have active two-way communications—although many more are two-way capable, meaning that existing amplifiers are spaced sufficiently to allow for diplex filters that separate forward and reverse signals.

Operators including Time-Warner, Tele-Communications Inc. and Rogers Cablesystems are actively evaluating the viability of the 25 MHz of return spectrum between 5 MHz and 30 MHz. All agree that if not planned properly, the 25 MHz frequency slot could present a bottleneck. Their strategies include the addition of more return band at the top end of the available cable spectrum, the use of wave division multiplexing to maximize fiber optic capabilities and extensive network segmentation to enable frequency re-use.

Now: No bottleneck

Most operators and manufacturers agree that currently, there isn't a bottleneck in the 5 MHz to 30 MHz subsplit band. "There's not equipment out there today that's going to cause a problem," says Tom Staniec, director of engineering for Newchannels Corp. "But look at the cellular telephone industry: Five years ago, it wasn't even a business.

"The point is, what happens two years from now? The transmission capability is already available for those services, and chip prices will most likely drop. Will it be like cellular? Will it explode?" Staniec asks. "You've got to think about those things."

There are other factors that must be thought out, like data transfer from the home or business to the headend. "More and more people are operating on terminals," says Ed Callahan, vice president of technology at Optical Networks Inc. "The services today that require two-way aren't really a problem. But if you're talking about doing multimedia services to the home, you have to consider high- and low-speed data transfer, and how much bandwidth that requires in the reverse direction."

The actual return bandwidth specifications for the proposed new services are sketchy. "Return specs vary from manufacturer to manufacturer," says Staniec. "Our initial assessments, though, put PCS at about 18 MHz, and multimedia transmission at 6 MHz or more. So just with those two services, you're already up to 24 MHz, and that's not including the standard uses for the return band, like security systems and pay-per-view request transmissions. I'd say there's definitely the potential for a bottleneck in the return band."

> I'd say there's definitely the potential for a bottleneck in the return band.

Apparently, the largest potential bottleneck will emerge in traditional network topologies. "In the traditional tree-and-branch network, operators sometimes serve tens of thousands of subscribers off one particular trunk line," says ONI's Callahan. "When they activate the reverse path in the 5 MHz to 30 MHz subsplit, it requires a lot of maintenance, good design and good materials to overcome the ingress."

Doug Semon, director of engineering and technology for Viacom Cable, agrees: "In a system that isn't segmented, like with AML or fiber-to-the-feeder, there's a real problem with noise power addition, because all of the return signal information is funneled in one direction. Not only are the signals funneled together, but the noise is, too." Semon notes that the ingress from citizens' band radio falls right smack in the middle of that reverse path, as does short wave broadcast and some emergency communications services. "What you end up with at the headend is an unusable carrier-to-noise ratio."

Because of the reverse path limitations related to tree-and-branch network architectures, industry experts agree that fiber implementation and network segmentation is key. "Network segmentation is probably the most important consideration when looking at new services—that is, breaking the cable system down into small enough portions or nodes that you can do a lot of this frequency re-using and minimizing of interference from ingress," says Nick Hamilton-Piercy, VP of engineering and technical services at Rogers Cablesystems. "That's probably more important than any other factor when considering two-way communications."

"Two-way without fiber has never been viable except in a very limited number of locations," submits Geoff Roman, VP of technology and new business development for Jerrold Communications. "In tree-and-branch systems, the return bandwidth is a major issue. But I think if you start looking at fiber deployment with nodes of 2,000 homes or less, you dramatically increase the ability to re-use the 5 MHz to 30 MHz band within the system. Every fiber node can actually bring the return separately from that node back to the headend. It gives you a lot of headroom for growth."

Future services requirements

A number of future services promise to chew up significant portions of the return band. These include:

Multimedia. Most engineers cite multimedia-type applications as the largest potential "bandwidth hog." Multimedia, a term tagged to services such as data transfer of files from a residence to an office, interactive games and videoconferencing (to name a few) could present a bottleneck in the return direction simply because it requires transmission of composite video, audio and data in the upstream direction.

"Multimedia is definitely an issue," Hamilton-Piercy says, "because it requires the transmission of video from the home. It may be digital video, but it still takes up a lot of bandwidth."

How much is "a lot?" No one seems to know, for sure. But Newchannels' Staniec sees it this way: "There are broadband RF workstation multimedia systems available today which allow you to work at home at Ethernet speed, which is 10 Mbps. That's 10 Mbps, bi-directionally, and it's not scaled to how many users are on the system. That particular system eats up at least 6 MHz of your return band."

Still others say the asymmetrical nature of multimedia-type applications lessens the impact on bi-directional transmission. Many multimedia applications involve a subscriber request (which takes little bandwidth to transmit), followed by a "dumping" of the information requested. Because of that, some engineers aren't phased by multimedia's reverse band requirements.

"Multimedia represents a very trivial requirement on the return bandpass, because it is asymmetrical," says Roman. Again, though, the relative "fatness" of multimedia as a bandwidth hog depends largely on how it's used. Consider a worker who's at home and needs to transmit digitized photographs or to video-conference with a remote office. While most U.S. homes won't ultimately transform into video studios with excessive video transmission needs, there is the possibility that subscribers will buy into the "work-at-home" philosophy.

"It's really multimedia that will create a problem in the return band," stresses Colin Horton, product manager for C-Cor Electronics. "If a number subscribers being fed by the same fiber node need to send computer graphics or digitized photographs, and investigation shows that a lot of them could be transmitting at once, you might not have the bandwidth available for a high enough data rate to allow all that to happen."

PCS/PCN. Another service that requires bi-directional transmission is personal communications services (PCS). "Our traffic calculations show that there's enough bandwidth to support PCS with four amplifiers in cascade, and two line extenders–or maybe more, assuming 10 percent simultaneous utilization at any time," says Steve Dukes, director of advanced network development at CableLabs. "In that scenario, we could live with the 5 MHz to 30 MHz band for PCS."

For example, Dukes says, if 10 percent of the subscribers in a 2,000-subscriber node simultaneously picked up their PCS phones to make a call—or a total of 200 calls—the existing 5 MHz to 30 MHz return spectrum could handle it. In fact, Dukes says that the Labs' traffic engineering calculations show that up to 375 simultaneous calls could fit in the existing return band.

But at what point would the existing 5-30 MHz return band *not* be sufficient to handle bi-directional telephone or PCS traffic? Again, the answer depends upon several variables, including node size, subscriber penetration and the modulation technology used.

"There's a couple of ways to look at it," submits Time-Warner's Jay Vaughan, a senior project manager for the company. "You could use a real efficient modulation scheme, where you get a lot of data upstream in terms of speed and throughput. (In that scenario,) the cost of the in-home terminal equipment gets somewhat high.

"Or, you could spend less money, but you can't get as many users upstream at the same time," Vaughan says.

The strategies

Cable operators are already working

on methods to overcome any reverse path bottlenecks that may arise as future services become reality. Tele-Communications Inc., for example, plans to implement wave division multiplexing (WDM) technology to send both forward and reverse signals on one fiber, according to director of engineering Richard Rexroat. "We're working with a couple of manufacturers right now to come up with the reverse 1550s for us," Rexroat says.

"We'll send the downstream signals at 1310 nm, and the reverse at 1550 nm," Rexroat explains. "The advantage is that we're able to utilize the fiber to 100 percent, instead of just wasting fibers. It's more cost effective that way." Rexroat says the WDM concept has successfully completed testing in TCI's Chicago, Ill. system, and will be incorporated into all system upgrades and rebuilds going forward.

Because WDM technology is inherently lossy, TCI plans to "short-space" the active network devices. "By going to WDM, you have to plan for signal loss," Rexroat says. "It's a question of how you space your transmitters and receivers for the loss that you encounter."

Time-Warner, for its part, is considering setting aside a piece of bandwidth on the upper end of the CATV spectrum for return usage. According to Jim Chiddix, senior VP of engineering and technology, the company is investigating several high bandwidth scenarios, including the 800 MHz to 1 GHz band and the 1.1 GHz to 1.2 GHz band. "I think our networks are going to require more bandwidth in the return direction than the available 5 MHz to 30 MHz," Chiddix explains.

The Chiddix model, which he stresses is purely in the "idea stage," assumes all-digital return signals. "The cable losses are higher at the high end, but the amplification would be fairly simple. There are certainly technical challenges in doing that, with regard to amplifier design—building two amplifiers within those frequencies," Chiddix adds.

Some of those technical challenges include cost-effective amplifier design to enable operation at the high end of the frequency spectrum. C-Cor's Horton describes it this way: "Designing into the higher frequencies is almost a triplex situation. You'd still maintain the 5 MHz to 30 MHz spectrum, because the RF return would be needed. Then you'd start another reverse band somewhere up above your forward bandwidth.

"You're probably talking about a filter that costs more than an amplifier," Horton continues, "because you're talking about 200 MHz just of guard band. Physical size is also a factor. It can be done, but it's a question of how much people are willing to spend to do it."

Newchannels' Staniec has also evaluated the use of the top-end CATV frequencies for reverse information, but has several concerns. In his view, operators would essentially "box themselves in" on the high and low ends, thereby capping expansion potential. And, he says, 1-GHz passives are an issue.

"There's a couple of rubs when you start looking at the high bandwidth systems. One of them is the equipment specifications for passives," Staniec says. "When you look at it, you find that the sub-low band is no longer specified down to 5 MHz. It starts at 10 MHz, in some cases. So in essence, your tap is actually rolling off that low end band-edge."

The effect, Staniec adds, is a lessening of the already slim 25 MHz of return band to 20 MHz. "What can happen is, in digital signals, the bits can be altered. So you might completely lose the signal—or in a phone conversation, you might have snap, crackle and popping."

Another bi-directional alternative being investigated is frequency re-use, or

spatial multiplexing, instigated by Rogers Cablesystems' Toronto, Canada system. According to Hamilton-Piercy, frequency re-use is largely dependent on network architecture more than anything else. "We use no more than nine amplifiers in cascade—that's what we're segmenting the plant to, with no more than about 2,000 homes per node. We believe we can share that same return spectrum over and over again."

However, Hamilton-Piercy adds, the end of the decade may necessitate another look at additional reverse bandwidth signals located above 900 MHz. "At this point, we haven't made our mindset that that's necessary, but there's always that option. The difficulty with that is that you have to change out all your existing amplifiers for ones that can accommodate the filtering to allow that to occur. You'd really have to have a lucrative service to offset the difficulty and capital cost of doing that."

Meanwhile, CableLabs' network development group, chaired by Chiddix, has also started looking into reverse band options. On the digital end, it hopes to develop a recommended protocol for data transmission, and is currently investigating two methods: 19.2 Kbps transmission, and MPEG-2 applications of up to 10 Mbps that will support existing multimedia applications–which currently require transmission at 3 Mbps to 4 Mbps.

"We're looking for a block of spectrum in which to implement this," Dukes says. "Services like multimedia need more space allocated in the upstream. So this space (we're looking for) would be like a digital shelf space."

Also, Dukes says, as CATV system design progresses toward an all-passive network, the corresponding absence of active devices lifts some of the current coaxial restrictions.

"As passive coaxial network design starts to happen, operators could use low noise amplifiers to govern how the bandwidth is allocated—in both directions. That could include dynamic allocation for upstream multimedia information," Dukes explains.

Another option being discussed in engineering circles is an enlargement of the existing 5-30 MHz return band to 5-75 MHz, thereby eliminating standard VHF channels two, three and four.

"What you could do is move those channels up higher in the available bandwidth," says one engineer who prefers anonymity. "Of course, that opens up a whole set of political problems, with the broadcasters. But it's still an option."

Warranted concern

Manufacturers and operators agree that in light of emerging services, a second look at the 5 MHz to 30 MHz return band is warranted. "The lack of a bottleneck is not free," says Wendell Bailey, VP of science and technology for NCTA. "To handle it properly, we'll need more intelligence in the network."

Staniec's advice is to guard the existing 25 MHz of real estate: "You have to stake out your bandwidth, and not let anything encroach into it," Staniec says. He also recommends a bandwidth survey as a planning tool. "You have to ask yourself: Which of these services makes sense for my subscribers, and how much bandwidth does it need?" Staniec explains.

In Chiddix's view, it's not too early for engineers to start thinking about the technical challenges surrounding reverse signal transmission. "There are challenges here, but those challenges may be well worth our while to overcome someday. I always work under the assumption that problems can be solved, and work from there." CED

By Leslie Ellis


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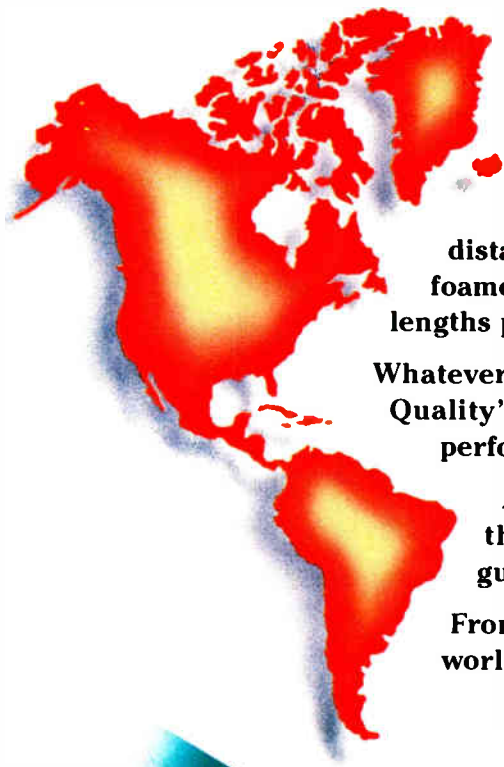

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1992 Editorial Index

Table of Contents

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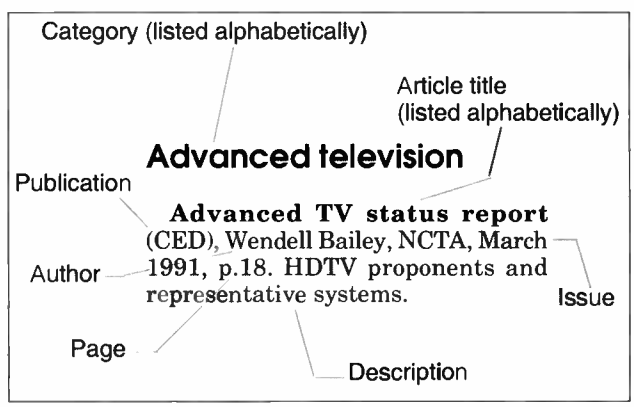
The index is divided into broad areas of interest, with articles that pertain to that subject listed alphabetically below. As shown below, the article title is shown in bold type, followed by the publication in which it appeared, the author who wrote it, the issue date and page number. In most cases, a short description of the article's subject matter is also included.



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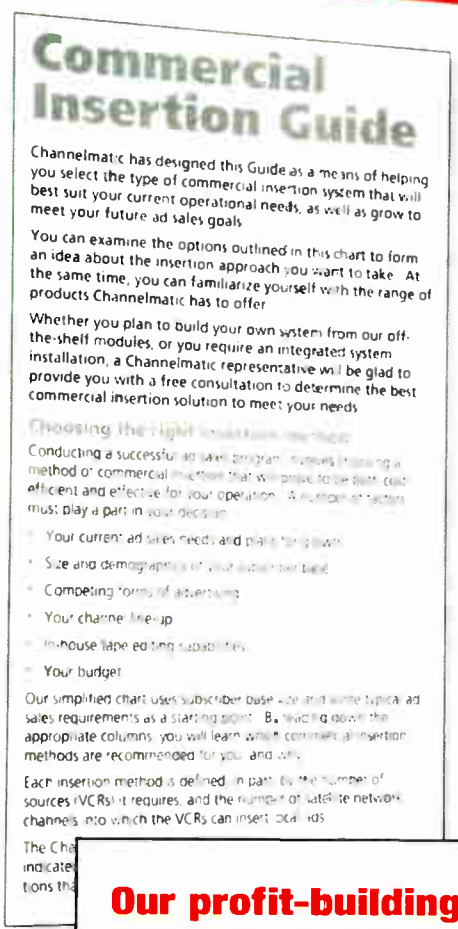

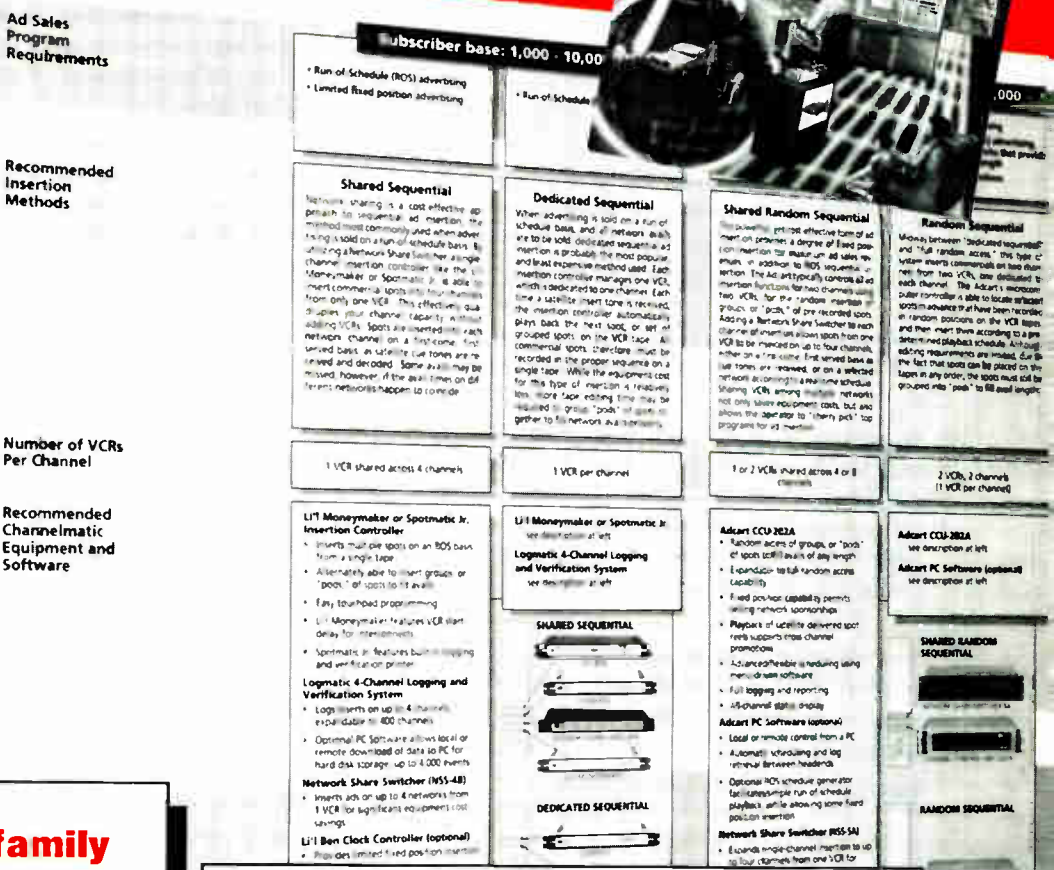

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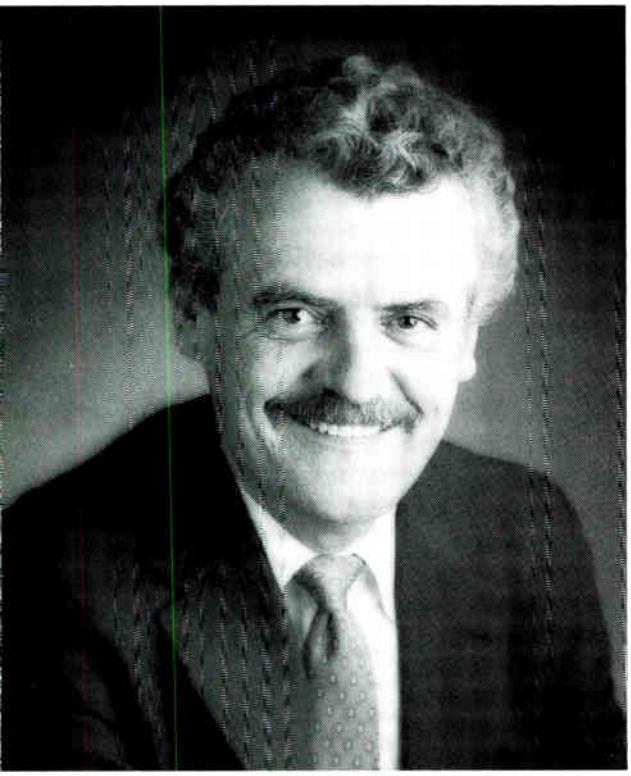

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Satellites

Bird watching (CV), Chris Nolan, *Cablevision*, March 9, 1992, p.19. Satellite and transponder changes may cost some operators money.

Cable satellites: The next gener-

ation (CT), Robert Zitter, Home Box Office, April 1992, p.26

Effects of two-degree satellite spacing (CED), Steve Havey, Scientific-Atlanta, November 1991, p.82. How the new satellite lineup will affect cable systems.

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SCTE

Accomplishments of the team (CT), Wendell Woody (President's Message), August 1992, p.94.

Addressing the weak link (CED), Bruce Habeck, Anixter Cable TV, Jan. 1992, p.64. Discussion of the value of an integrated drop system.

Board approves title changes for Society's leadership (CT), Wendell Woody (President's Message), January 1992, p.102.

Cable-Tec Expo '92: SCTE takes the Alamo (CT), Laura K. Hamilton, August 1992, p.26.

Conference success: Fiber Optics Plus '92 (CT), Ron Hranac, February 1992, p.18.

Current events preside over annual engineering conference (CT), August 1992, p.28.

Delaware Valley SCTE members consider the future (CED), Leslie Ellis, Managing Editor, October 1992, p.86. Coverage of Delaware Valley SCTE chapter meeting on emerging technologies.

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Digital techniques, Part 2 (CED), Randy Reynard, ONI, September 1992, p.86. A discussion of DS-1 and digital hierarchies.

Expo '92 offers technical spree (CT), August 1992, p.34.

Fake ballots caught in election (CT), May 1992, p.14.

Games held at Mid-America Show (CT), December 1991, p.16.

Hitting the floor (CT), August 1992, p.44.

Hranac named SCTE chairman, Wolfe is member of the year (CED), July 1992, p.56. Coverage of SCTE awards ceremony at Cable-Tec Expo.

Kickin' back in San Antonio (CT), August 1992, p.45.

The melting pot (CT), Wendell Woody (President's Message), July 1992, p.86.

New satellites and spacing: Issues facing CATV (CED), John Vartanian, HBO, December 1991, p.48. How two-degree spacing and new satellites will affect cable operators.

Operators prove fiber saves money (CED), Roger Brown, Editor, February 1992, p.54. SCTE fiber conference coverage.

Outages: Two strikes and you're outta there (CED), July 1992, p.55. Coverage of technical session on outages from SCTE Expo.

Picture quality: It just keeps getting better (CED), July 1992, p.53. Coverage of technical seminar at SCTE Expo.

Retired membership available from Society (CT), January 1992, p.20.

SCTE develops new mission statement (CT), Wendell Woody (President's Message), June 1992, p.144.

SCTE elects new board members (CT), May 1992, p.14.

SCTE escaping to the Alamo (CT), Wendell Woody (President's Message), March 1992, p.92.

SCTE Expo "hottest" show in years (CED), Roger Brown and Leslie Ellis, July 1992, p.40. Wrap-up of 1992 SCTE Cable-Tec Expo.

SCTE honors members' achievements (CT), August 1992, p.30.

SCTE making history (CT), Wendell Woody (President's Message), April 1992, p.86.

SCTE now 10,000 members strong! (CT), Bill Riker (President's Message),

September 1992, p.94.

SCTE remembers the Alamo (CT), Wendell Woody (President's Message), May 1992, p.110.

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SCTE voting time (CT), Wendell Woody (President's Message), February 1992, p.108.

Society presents awards at Expo '92 luncheon (CT), July 1992, p.14.

Title changes for Society's leadership receive board's nod (CT), January 1992, p.20.

Upgrading system specs and bandwidth in a tight budget (CED), Fred Rogers, Quality RF Services, March 1992, p.83. A simple IC changeout in your amps could get you more bandwidth and better pictures.

The year in review: Scholarship subcommittee (CT), Leslie Ellis, SCTE Scholarship subcommittee member, February 1992, p.23.

Status monitoring

Cable cos. eye telemetry comeback (MCN), Gary Kim, Aug. 10, 1992, p.5. Operators like ATC are looking at the benefits of a new telemetry system.

Network telemetry and control (CED), Chris Bowick, Jones Intercable, July 1992, p.18. The new need for status monitoring.

Network telemetry and control—more than just status monitoring (CT), John Brouse, July 1992, p.26.

Simplified return path helps reduce cost of status monitoring (CT), AM Communications, June 1992, p.40.

Status monitoring in CATV optical networks (CED), William Ellis, Augat Comm. Group, March 1992, p.32. Types of status monitoring available for use today.

Telephony

(Also see "Alternate access" and "PCN")

ALS launches digital net offensive (MCN), Gary Kim, June 8, 1992, p.32. ALS recasts itself as digital fiber equipment supplier for local loop voice, video and data services.

Architectural considerations for PCN (CED), Chris Bowick, Jones Intercable, June 1992, p.22. The migration paths toward PCS provision.

AT&T offers telcos cheap way to jump into cable (MCN), Fred Dawson, Nov. 18, 1991, p.91. AT&T project focuses on passive network for video and voice delivery.

CATV, telco alliances explored at ComForum (CED), May 1992, p.93. Coverage of National Engineering Consortium's Spring ComForum.

Cable gurus eye cordless phone strategy (MCN), Fred Dawson, July 13, 1992, p.28. Cable may embrace advanced cordless phones to get into telephony business.

Cable rethinks telco issue (MCN), Fred Dawson, Jan. 6, 1992, p.3. More cable operators think about telco joint ventures.

Cablevision touts mobile PCS advance (MCN), Fred Dawson, July 20, 1992, p.1. Cablevision Systems' test shows PCS can be performed even in cars.

Comcast makes case for telephony (MCN), Fred Dawson, Sept. 14, 1992, p.1. Comcast demos five-way phone conversation without using any telco facilities.

Continental hops on alt. access wagon (MCN), Fred Dawson, April 27, 1992, p.2. The MSO launches alternate access in Jacksonville, Fla.

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A new game in Britain, (CV), Tom Kerver, *Cablevision*, Oct. 19, 1992, p.50. British Telecom allies with cable instead of fighting it.

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MSOs race into telecom (MCN), Fred Dawson, Sept. 28, 1992, p.1. Dealmaking in telecom has stepped up.

Newchannels, Adelphia form N.Y. phone venture (MCN), Fred Dawson, Sept. 21, 1992, p.10. The two MSOs create an alternate access company in Syracuse.

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Personal communications networks (CED), C.R. Baugh, consultant, and Douglas Reudink, US West NewVector Group, June 1992, p.36. Review of the telephone features made possible by PCS.

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Times Mirror gets into telephony, interactive (MCN), Gary Kim, July 27, 1992, p.3. Michael Rose appointment signals shift in thinking for Times Mirror.

U.K. operators plan new voice strategies (MCN), Fred Dawson, April 6, 1992, p.2A. Strength of telephony in U.K. leads cable operators to build more advanced networks.

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Tests and measurements

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Credit where it's due (CED) Wendell Bailey, NCTA, November 1991, p.16. Praise for those who worked on the technical standards.

Do you know where your system is? (CT), Herb Longware, Magnavox CATV Systems, March 1992, p.16.

FCC checking operators on tech standards (MCN), Gary Kim, Sept. 28, 1992, p.36. The FCC has already dispatched inspectors to check compliance.

Firms eye automated performance testing (MCN), Gary Kim, June 29, 1992, p.28. How much will operators spend to perform the new FCC tests?

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Measuring and evaluating video signals in the headend, Part 2 (CT), Blair Schodowski and James O. Farmer, Scientific-Atlanta, September 1992, p.28.

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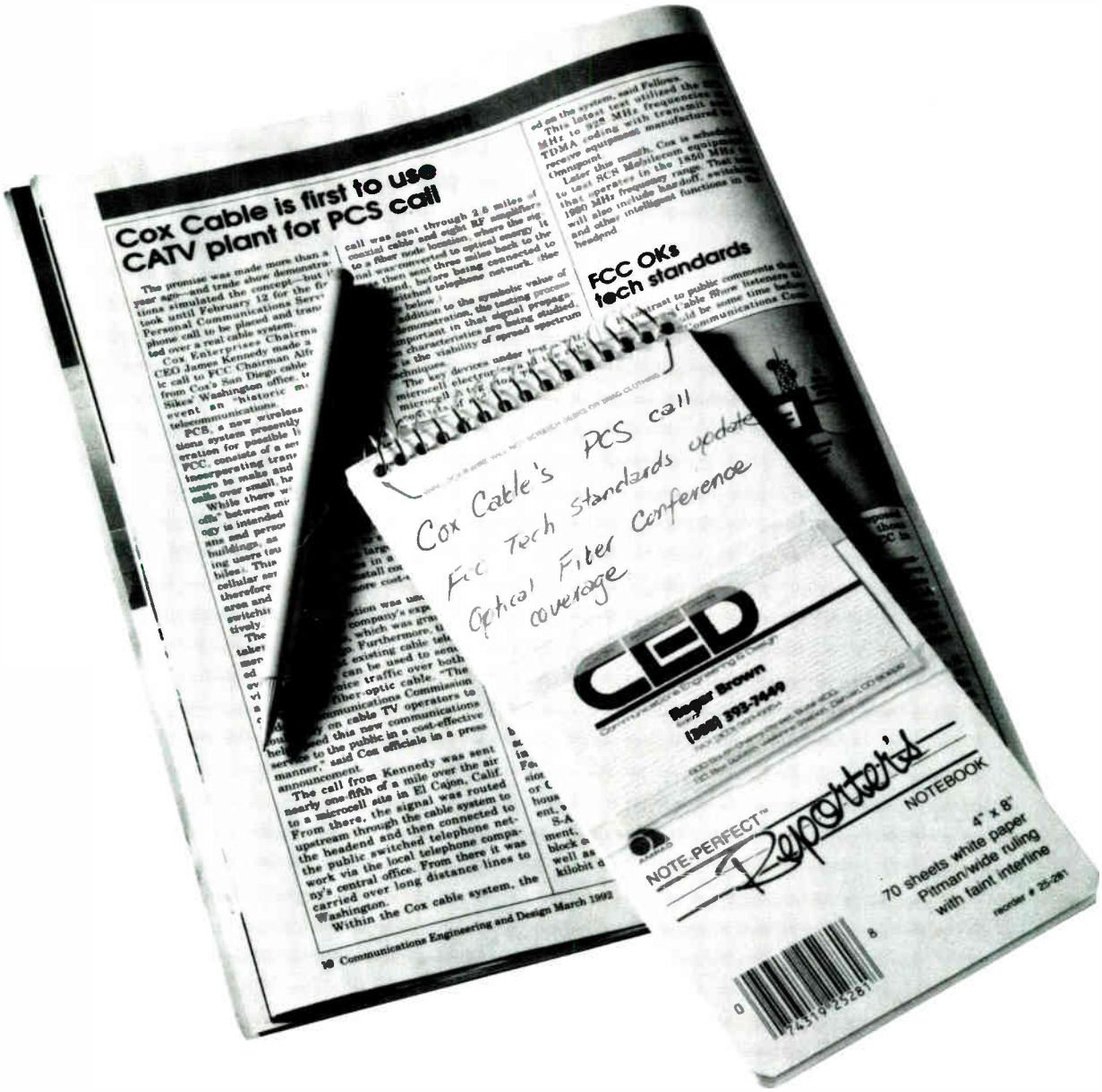

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To sweep or not to sweep (CT), Syd Fluck, Calan Inc., September 1992, p.26.

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Taking the pain out of the 24-hour test (CT), Rex Bullinger, Hewlett-Packard Co., July 1992, p.22.

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Trade show coverage

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Training and education

CATV dollars: Training offers the best bottom line return (CT), Ralph Haimowitz, SCTE, January 1992, p.36

Cable operators support in-house training efforts (CED), March 1992, p.94. Managers say they support efforts to train their people.

Certification for technicians:

Skill-based pay (CT), Pam Nobles, Jones Intercable, January 1992, p.38

Developing a technical training program (CED), Ron Wolfe, Time Warner National Training Center, October 1992, p.70. An eight-step plan for training program development.

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Mail-order knowhow (CV), Simon Applebaum, *Cablevision*, Dec. 2, 1991, p.34. How and when operators use NCTI for training.

Managing creative customer service (CED), Robert Gordon, Orion Business Services, October 1992, p.74. Analysis of how to better handle customer service issues.

Safe surroundings, (CV), Simon Applebaum, *Cablevision*, June 15, 1992, p.22. Jones Intercable expands its safety program to reduce accidents in the field.

Shortening the learning curve (CV) Chris Nolan, *Cablevision*, June 15, 1992, p.42. How much do technicians really need to know to keep the system running?

Training for technology (CV), Chris Nolan, *Cablevision*, June 15, 1992, p.36. Different approaches used to educate technical personnel.

Two-way communication

Austin, ATC see two-way two ways (MCN), Gary Kim, Sept. 7, 1992, p.37. Austin wants its full two-way service, even though there appears to be little demand.

Barriers to voice, other services, falling (MCN), Fred Dawson, May 4, 1992, p.108. Fiber is opening the return path option for cable operators.

Big blue sky (CV), Fred Dawson, *Cablevision*, July 13, 1992, p.24. Details of IBM's plan to integrate cable networks and home computers.

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California Viacom system to serve as lab of future (MCN), Gary Kim, Jan. 6, 1992, p.3. Viacom plans 1-GHz testbed in Castro Valley.

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Digital will present some headaches (MCN), Roger Brown, March 9, 1992, p.35. TCI study shows digital systems need tight plant to operate.

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Zenith introduces metro area data network (MCN), Gary Kim, Aug. 10, 1992. p.32. New network allows operators to provide PC data links across town.

Video compression

4-month compression window opens (MCN), Gary Kim, Aug. 24, 1992,

VIDEO COMPRESSION

p.61. Companies wanting to use satellite compression system can view the hardware over the next four months.

AT&T touts compression over copper (MCN), Fred Dawson, Feb. 10, 1992, p.26. New approach to ADSL improves the pictures sent over copper.

AT&T unveils compression system at National Show (MCN), Fred Dawson, May 4, 1992, p.8. New system comes from AT&T.

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Digital explosion (CV), Fred Dawson, *Cablevision*, March 23, 1992, p.30. The digital future appears chaotic.

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Mexico, Canada to go all-digital (MCN), Gary Kim, June 8, 1992, p.1. Multivision purchases DigiCipher equipment.

New hurdle seen for compression (MCN), Fred Dawson, Aug. 3, 1992, p.1. Three companies are "finalists" in CableLabs RFP project.

Oak group joins compression fight (MCN), Fred Dawson, Nov. 18, 1991, p.88. The Oak/C-Cube/Leitch consortium prepares to offer a compression scheme.

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Philips readies compressed video system (MCN), Gary Kim, June 29, 1992, p.28. Initial production scheduled for March 1993.

Programmers push compression (MCN), Fred Dawson, Aug. 10, 1992, p.3. Programmers heavily support using compression.

S-A/Zenith/AT&T combo spices up advanced TV race (MCN), Fred Dawson, Dec. 9. 1991, p.1. Zenith allies with S-A for compression, HDTV.

Scientific-Atlanta adds MPEG compression option (MCN), Gary Kim, June 15, 1992, p.45. S-A moves toward the MPEG standard.

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Star TV, Rainbow make move to digital (MCN), Gary Kim, July 20, 1992, p.5. Premium services for Asia purchase General Instrument compression gear.

This is only a test (CV), Chris Nolan, *Cablevision*, March 23, 1992, p.34. Cablevision Systems begins testing video compression.

Vyvx gets digital-to-home proposals (MCN), Gary Kim, Oct. 12, 1992, p.44. Four bids are returned for a digital-to-home video service.

Vyvx, PPV company eye compression (MCN), Gary Kim, May 18, 1992, p.40. Vyvx plans to issue RFP for compression.

Will cable, MPEG be able to meet in middle? (MCN), Fred Dawson, Sept. 14, 1992, p.40. Will MPEG be able to accommodate cable TV concerns? CED

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The use of fiber optics for video transmission has become commonplace in broadcast services, CATV systems and private networks. Analog AM fiber systems are replacing coax cable for local signal distribution within the CATV network while analog FM systems have been used in both CATV trunking and broadcast service applications.

However, another type of fiber optic system continues to grow in use and application—the more powerful, high performance systems that transmit video, audio and data signals in a digital format rather than AM or FM.

Fiber optic transmission of video by uncompressed digital modulation has rapidly matured to a competitive, high performance alternative to FM analog transmission. Digital products are readily available today that match, or exceed, FM in channel capacity per fiber with many additional advantages. Digital video fiber optic systems are now operating in many CATV, broadcast, government and educational environments which include, CATV headend interconnects, simple point-to-point broadcast links, and long distance regional hubs. This article will review the concepts and building blocks used to achieve these systems.

By Robert W. Harris, Product Manager, C-COR/COMLUX, Inc.

Digital video advantages

The word "digital" in fiber optic systems can cause confusion. For digital systems that are used today, it refers to a type of source and channel coding (or modulation). More specifically, it refers to pulse code modulation (PCM) that is linear (or uncompressed).

Digital as discussed in this article does not refer to compressed digital video formats used in switched systems, such as DS-3 or T1 video. Also, it does not refer to digital video compression that is being proposed in CATV for increased channel capacity. In fact, digital transmission in proposed CATV compression systems is "quasi" digital, because it uses either multi-level and/or multi-phase frequency shift methods (i.e., analog parameters).

Some of more well known advantages of high bit rate, uncompressed PCM

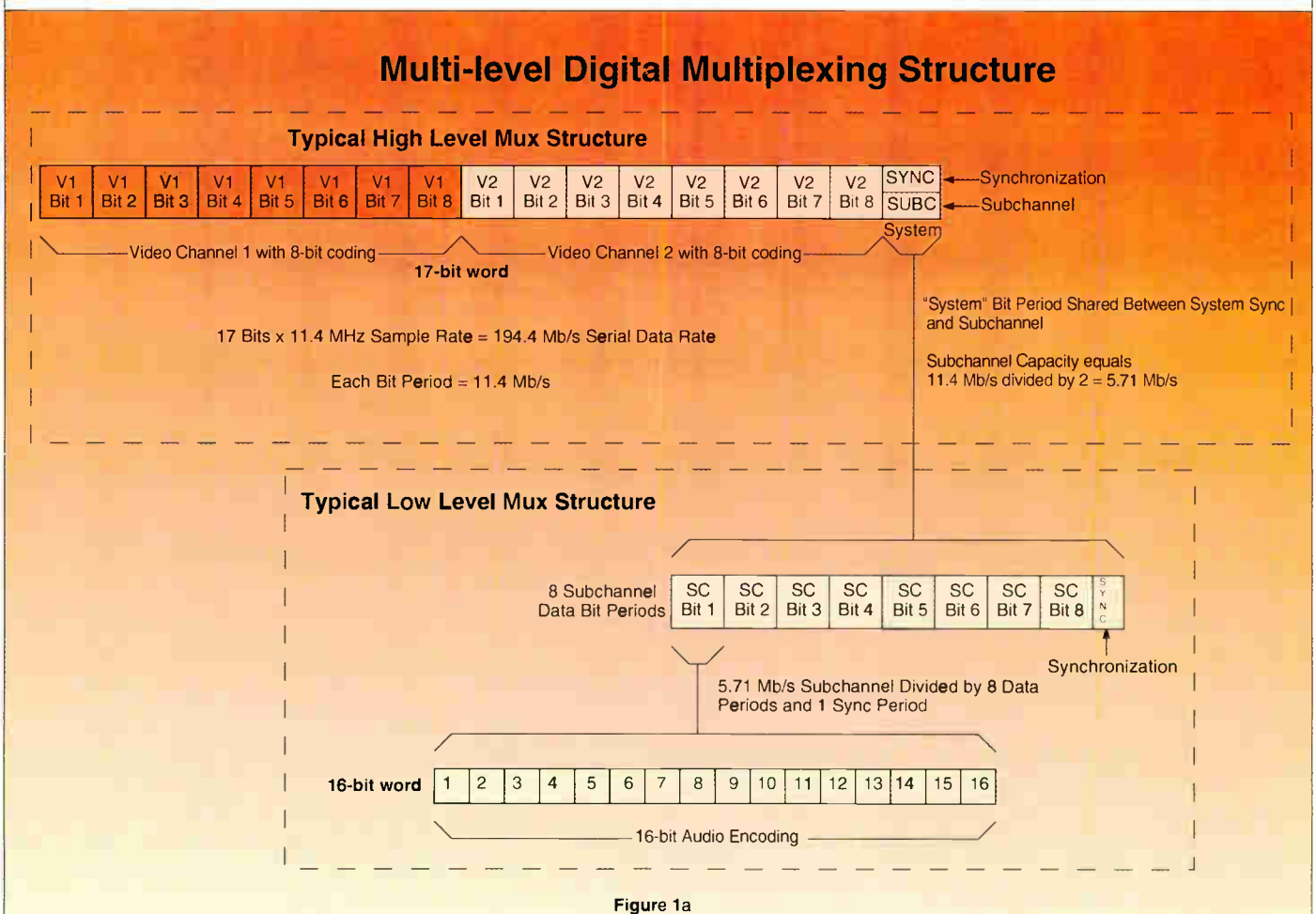

Figure 1a

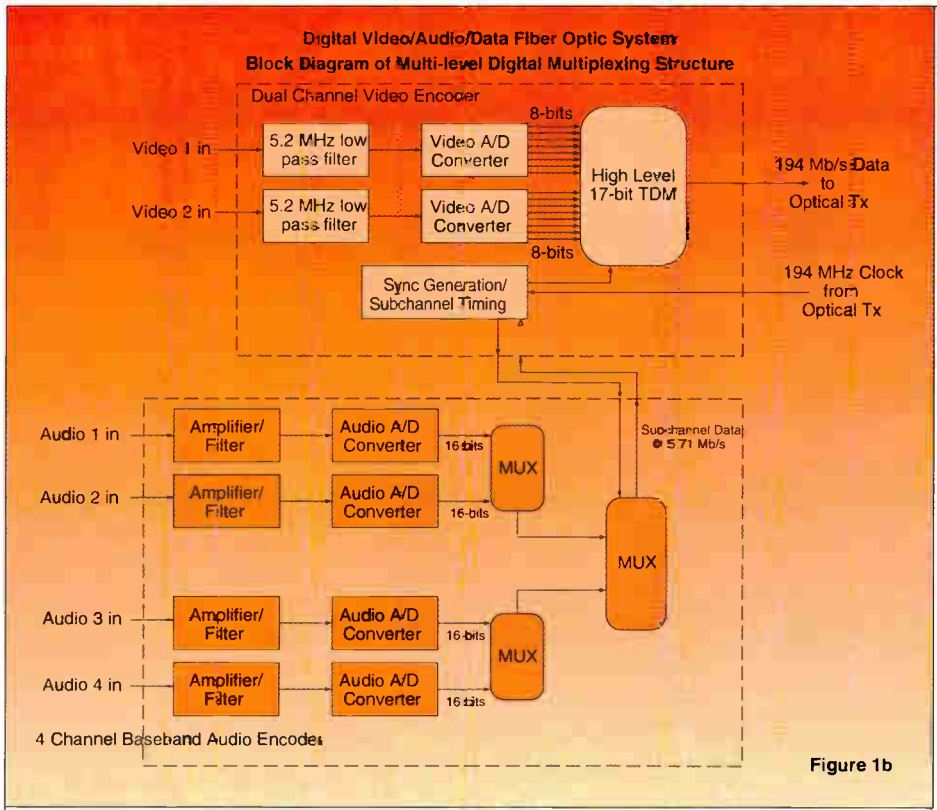

Figure 1b

transmission are:

- Signal performance unaffected by optical distance, splits, or repeats
- Very high signal performance unaffected by system expansion or additions
- Robust transmission format
- Transparent drop and insertion of video channels (digital multiplexing)
- Transparent addition of auxiliary data or audio services
- Cost competitive with multi-channel FM systems
- Small size and space required (less than 1/2 the space required for FM)

These advantages work to enhance practical and realizable digital networks in CATV systems. This is made possible through the "transparent" nature of digital networks. Digital functions such as switching, routing, multiplexing, drop and insert, and regeneration (repeating) work to transparently enhance, extend and enlarge digital networks transparently. Therefore, flexible networks

Digital transmission in proposed CATV compression systems is "quasi" digital, because it uses either multi-level and/or multi-phase frequency shift methods.

can be implemented to manipulate digital video, audio and data signals without degradation.

These attributes have been used in numerous CATV systems to realize many multichannel digital fiber optic applications such as point-to-point and point-to-multipoint interconnections, regional digital fiber backbones, redundant ring networks, and long distance intercity links.

Key elements

To be practical in a wide range of applications, digital fiber optic systems must be capable of transporting multiple channels of video and audio on a single optical fiber. Typical digital systems carry 16 channels per optical wavelength. Synchronous time division mul-

tiplexing (TDM) in the digital domain not only facilitates multichannel capability, but also allows every channel to be fully independent. With this, video channels can be added or removed from the optical transmission channel without affecting any other signal or other part of the system. TDM can also be applied to auxiliary services such as audio and data signals with the same advantages.

The key element in digital systems, therefore, is a synchronous TDM architecture. To gain maximum advantage, it must be efficient in its use of data "overhead" (e.g, channel synchronizing and management) and robust in its ability to be transmitted without errors. It must also have the ability to retain channel integrity and synchronization with any combination of input and output signals. A multi-level TDM hierarchy is also useful when systems must accept a variety of different signals. Figure 1a shows a multi-level TDM hierarchy that is used in one type of digital video fiber optic transmission system. Figure 1b shows a simplified block diagram of a multi-level multiplexing structure.

A second important element in a practical multi-channel digital system is to make the digital transmission ports accessible to any data format.

Digital data ports that accept any digital coding and framing pattern allows different types of signals to be transported in the same optical transmission channel without changing or affecting the rest of the system. For example, this facilitates using video codecs with different sampling accuracy, different coding formats (8-bit or 9-bit

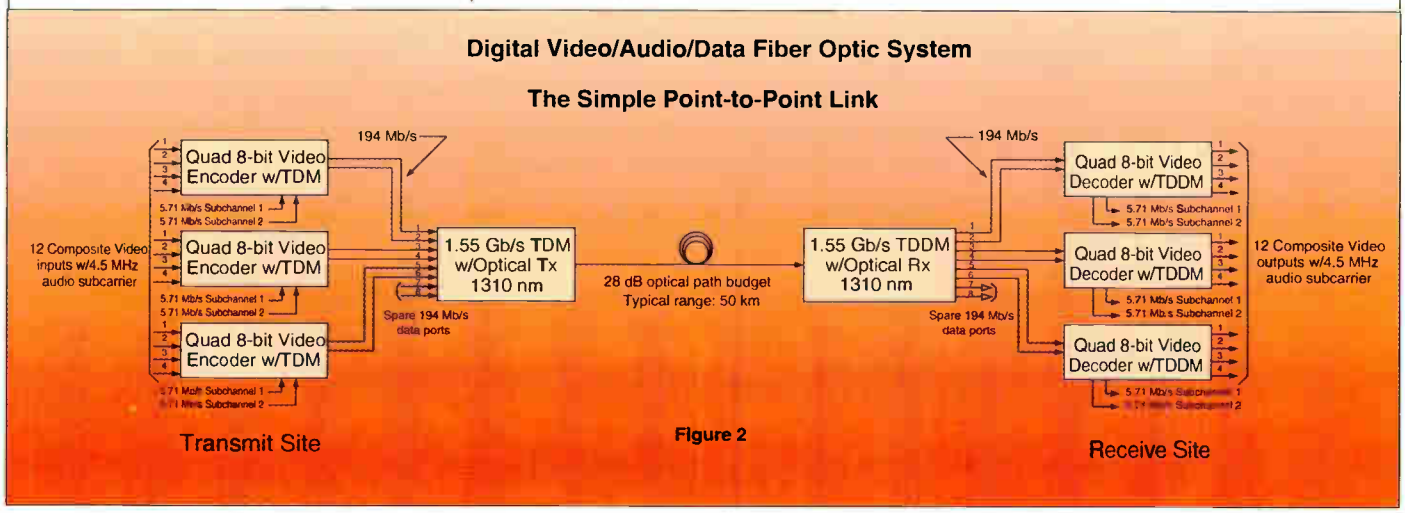

Figure 2

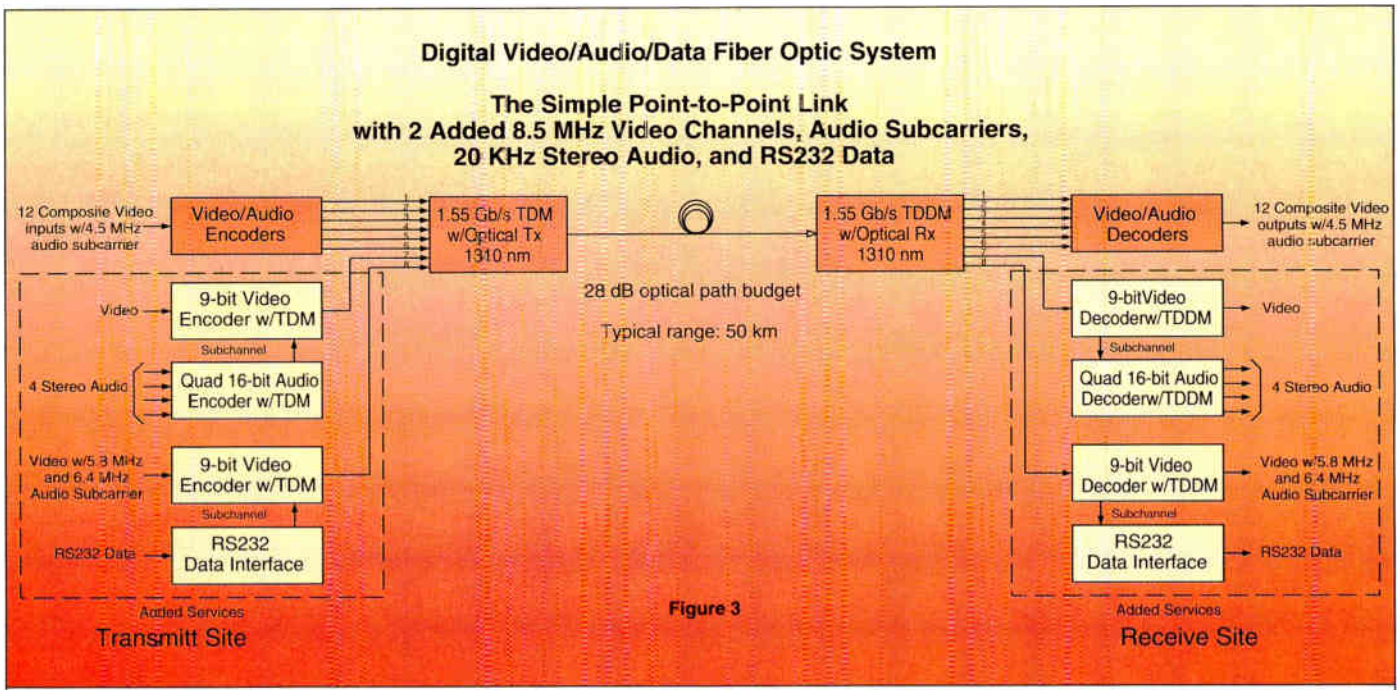

Figure 3

video), transporting digitized non-video signals, and adding future signals such as digitized HDTV or digitally compressed signals all in the same system.

Another key element for a digital system is to provide an easy interface to existing CATV networks. This requires that the digital video encoders/decoders in a system be capable of accepting variations to the baseband video signal. This includes the addition of FM audio subcarriers to the video or, scrambling of the input video signal. The digital system should also include the ability to transport high frequency, non-baseband video signals such as video IF carriers or FM radio signals. Additionally, since the final signal format in CATV is VSB-AM, a valuable feature in a digital system would be the ability to output the VSB-AM signal rather than baseband

video.

These digital system considerations and others will be shown in their practical application to CATV networks in the examples that follow. Without sacrificing performance, the flexibility and expandability of a digital system is the key element in these examples.

The point-to-point digital video link

The simplest digital video system is a direct point-to-point link. Specifying this system requires information such as number of channels, desired signal format, transmission distance and optical fiber type or available optical window on the fiber. Figure 2 shows a 12-channel video system with a typical span length of up to 50 km, operating on a singlemode fiber at an optical wavelength of 1310 nm.

Fiber optic transmission of video by uncompressed digital modulation is a competitive, high performance alternative to FM analog transmission.

Encoders/ decoders

The video encoders/decoders digitize each channel with 8-bit accuracy at a sampling rate of 11.4 MHz in a video bandwidth of 5.2 MHz. Program audio in this example is a 4.5 MHz FM subcarrier that is composite with the video input signal, thus separate audio encoding is not required. The optical terminals operate at a transmission rate of 1.55 Gb/s with an optical span loss budget of 28 dB. The electrical interface to the optical terminals is eight digital ports, each with a data rate of 194 Mb/s. In this example using 8-bit video codecs, two digitized video channels are combined by TDM into one 194 Mb/s data stream.

It is useful to think of a portion in the system between its signal codecs and the optical terminals. In this example, the optical link has been established with a data capacity of eight independent, 194 Mb/s digital channels. These eight channels are combined by TDM in the optical transmitter to produce the 8 x 194 Mb/s = 1.55 Gb/s transmission stream. More transmission capacity is achieved with additional optical transmitter/receiver terminals.

With this partitioning in mind, the next step is to decide how to utilize the available 194 Mb/s data channels. In this example, 8-bit codes are attached to six of the eight digital channels, leaving two more 194-Mb/s data channels for future use. Also, each video codec has a TDM that creates another independent digital channel called a subchannel. The data capacity of this subchannel is typically between 5 Mb/s and 10 Mb/s and can carry separately digitized audio or digital data signals such as T1, RS232, digitized subcarriers, etc. In this example, the subchannels are not being used but are available for future use.

This simple link example shows how the "open" and expandable nature of the system is already in place. Future use of the spare "high level" 194 Mb/s ports or the "low level" 5-10 Mb/s subchannel ports will not affect any existing service or performance. Also, these additions can be made without removing the system from service.

Expansion considerations

Figure 3 shows added channels and services. Each spare 194 Mb/s port on the system is used by a 9-bit video codec with an 8.5 MHz input bandwidth. The input to the first 9-bit encoder is video plus two diplexed audio subcarriers at 5.8 and 6.4 MHz. Some of the subchannel capacity is used for digitized baseband stereo audio with a 20 KHz bandwidth. The second 9-bit encoder processes composite video and uses the subchannel for transporting RS232 control data. The system now carries both RS250C medium haul and RS250C short haul video as well as several channels of both diplexed audio and separate stereo audio and RS232 data.

Linking multiple sites

Many CATV networks require more fiber interconnections than one point-to-point link. It is common to link several receive sites with one transmit site. Receive sites can also be added along an existing route. Figure 4 shows an example of this point-to-multipoint configura-

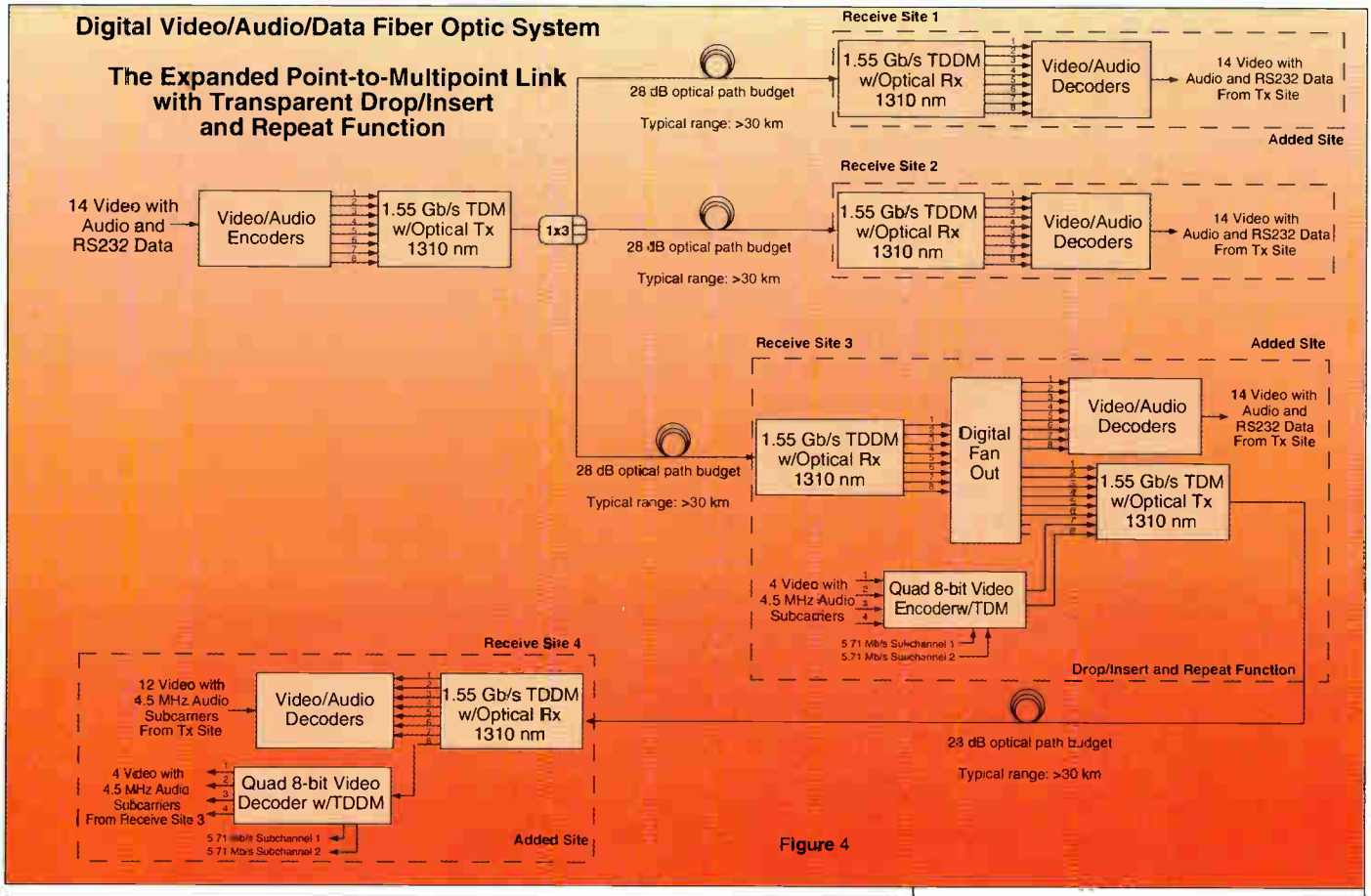

Figure 4

tion. In this example there are now three "end of line" receive sites and one intermediate receive site where a digital drop/insert and repeat function has been used. At this intermediate hub site, all channels from the headend are dropped for local distribution and then re-transmitted to the next site. Also, two 8-bit channels are added at this intermediate site for transmission to the next receive site.

In these examples, the added receive sites, the drop and insert function and the added video, audio and data channels have not changed the system performance or affected existing services in any way. Also, these additions can be made while the system is in service. Because the system is digital, no adjustments are required; no multichannel FM frequency plan is required; and the additional codecs can be directly plugged into the spare optical terminal ports without removing power. In systems with higher channel counts, the same results would be obtained by using multiple optical terminals and additional codecs.

Extending to regional sites

As CATV systems grow into regional networks and new customers are added,

there is often a need to extend a system over long distances and to provide services to new geographic areas. This requires the digital fiber interconnection to be extended. Figure 5 shows how the basic system is extended. A 200 km span, operating at the 1550 nm optical wavelength, has been added as an intercity link. A digital regenerator is used in the 200 km link, and since the signal remains in the digital domain without decoding, signal performance is unaffected. If required, a drop/insert and repeat function could also have been used at the regenerator site without affecting signal performance.

When new transmission links from the headend are required, the 194 Mb/s data channels from the video encoders can be "fanned out." This digital processing technique can be used to feed multiple optical transmitters without adding the expense of additional video encoders. The fanout devices can be added to the data path without affecting signal performance or disrupting existing operational service for any significant time.

CATV-based video fiber systems are evolving into multi-service communication networks with stringent up-time requirements.

Enhancing network operation

CATV based video fiber systems are evolving into multi-service communication networks that have stringent uptime requirements. It therefore becomes necessary to include system redundancy and provide remote monitoring functions. For example, a counter rotating digital redundant ring with automatic switching can be configured. The redundant components of this system are added at the digital level thus, signal performance is unaffected. Additionally, even if the optical path loss between the main and backup paths are different, the signal performance at the receive site will be identical regardless of which path is being used. Also note that channels can also be inserted into the ring by the same method as shown in Figure 4.

The examples have shown how a digital fiber optic system can be used to build up a comprehensive video, audio and data network. Further considerations would include bi-directional operation. This could be accomplished with point-to-point terminals operating on separate fibers or by using wavelength division multiplexing (WDM) to operate on a single fiber.

Interface considerations

Figure 3 showed how video codecs of different sampling accuracy and bandwidth could be added to the same transmission system. This flexibility can be extended to future signal codecs that could digitize signals such as HDTV, video IF carriers, and FM radio. These codecs would have a digital output that would be compatible with the digital ports on the existing optical terminals.

Synchronous interfaces can be developed for other digital signals such as compressed video and high speed data. These digital interfaces, or "gateway" devices, can also be developed to interface to emerging optical network standards such as SONET.

The gateway will synchronize and multiplex these new optical networks to existing proprietary digital systems to provide easy access on and off the different digital networks.

It should be noted that standard digital optical networks in the telecommunications industry are designed to carry a wide variety of different services. Many of these services have much lower data rates than uncompressed digital video signals.

When large numbers of high bandwidth uncompressed digital video channels are the main payload, it is often more efficient to retain a proprietary architecture within the digital system. Since the proprietary system has been designed specifically for high bandwidth digital video transport, this represents a highly cost effective solution. Gateways to SONET, compressed video, Eth-

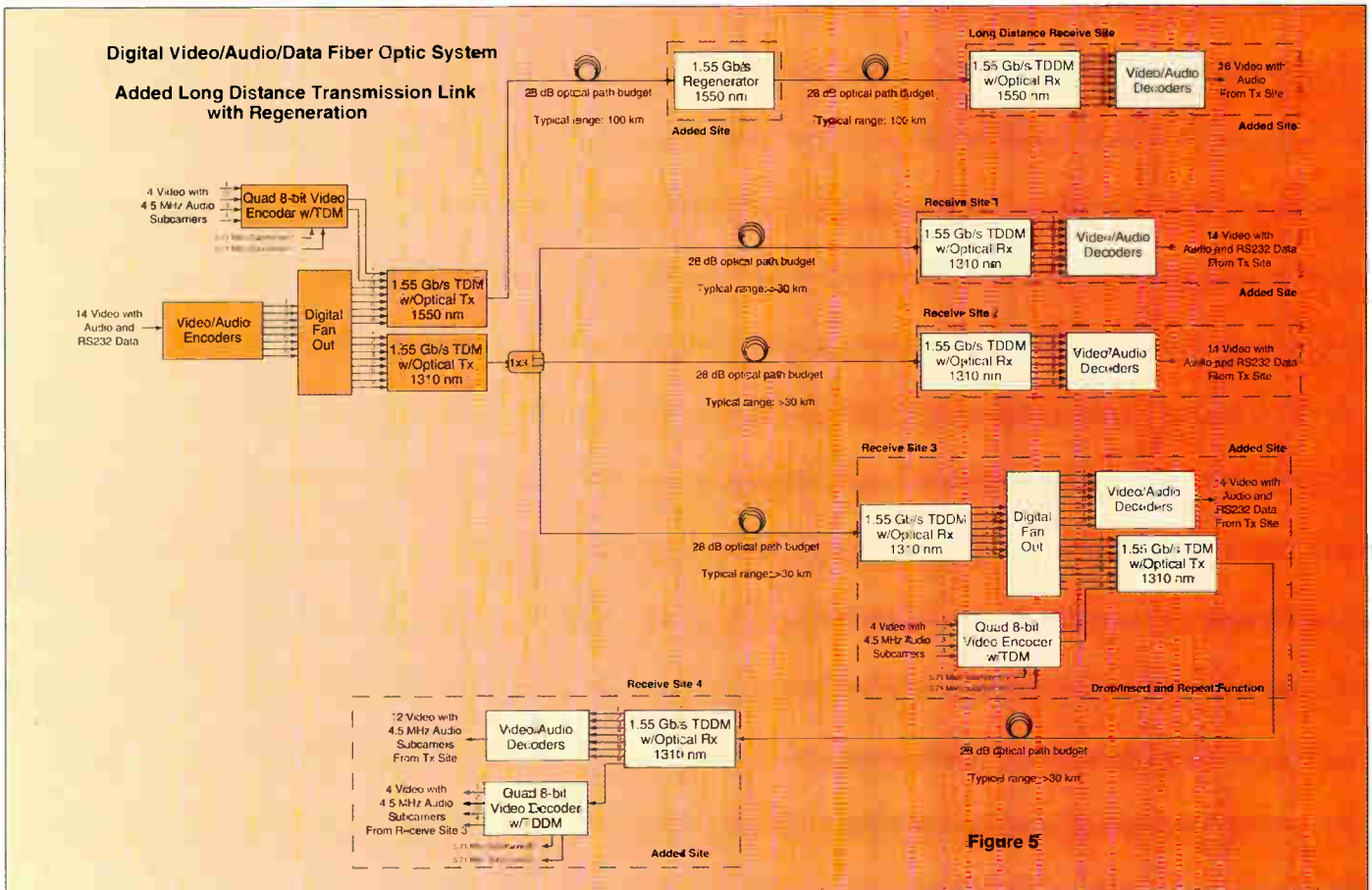

Figure 5

ernet, etc., can then be connected to spare optical data ports and data subchannels to transport any additional services.

Conclusions

Digital systems are now being used in a variety of CATV system applications to build video, audio, and data fiber optic communication networks. These systems deliver uniform signal performance independent of the number of channels transported, optical path loss and, the types of video, audio or data services carried on the network. These digital systems can be configured as simple point-to-point links and grow into more sophisticated multi-function networks. As new services are added and serving areas expand, system extensions are accomplished transparently without degrading the performance of existing services.

These attributes highlight the important concept that digital systems can offer a certain amount of "future proofing" in a constantly changing set of customer requirements. CED

The author wishes to thank Ken Regnier for his assistance in preparing this paper.

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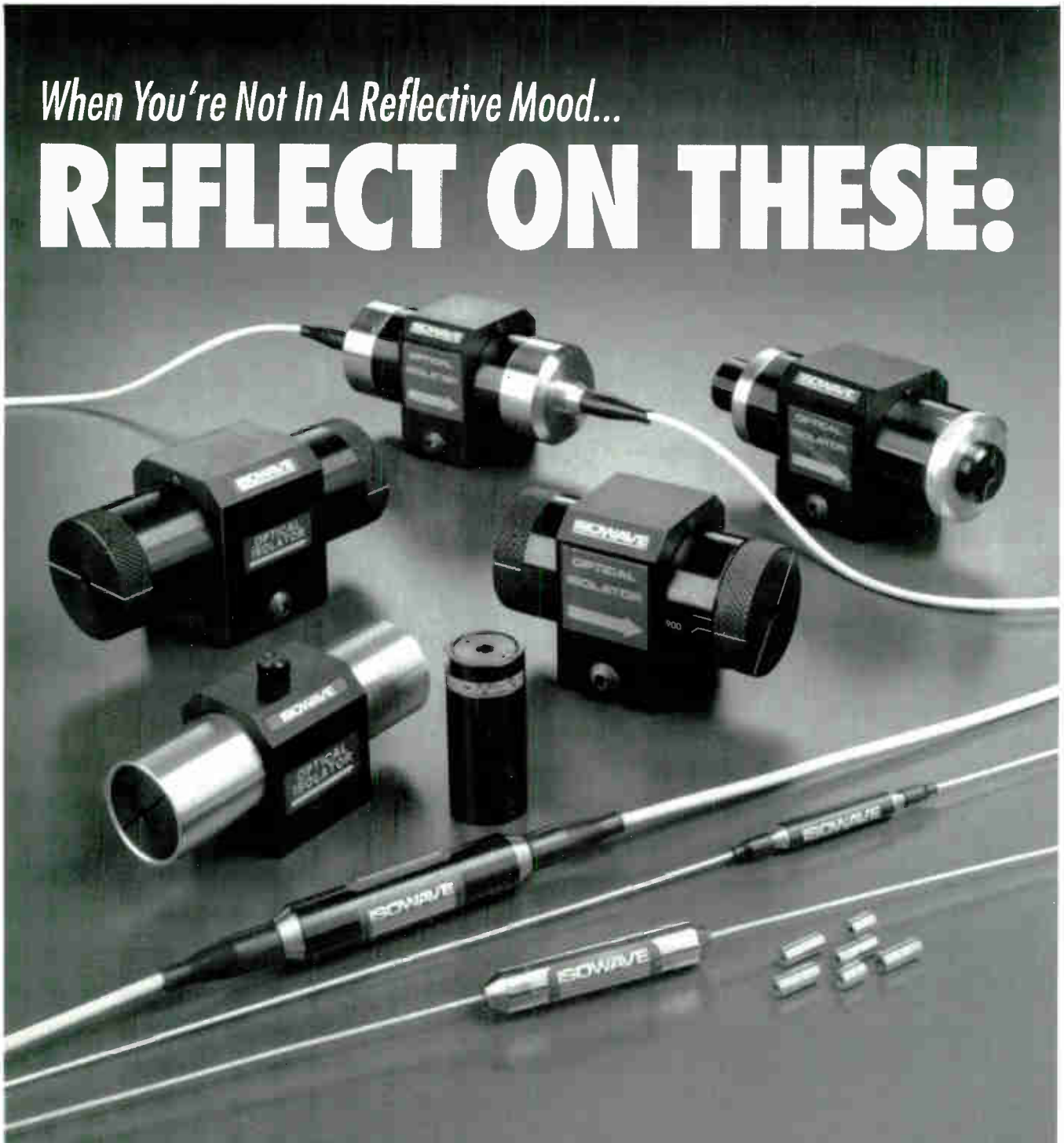

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Testing for FCC compliance

The FCC has reinstated proof of performance requirements that extend beyond the CLI (Cumulative Leakage Index) rulings. Most of the criteria in this standard must be met by December 30, 1992; proof tests must be done by January 30, 1993. All cable systems are to be in compliance, but those with 1,000 or more subscribers must prove compliance with periodic testing.

Proof tests must be done twice per year. In addition to proof testing, operators must be ready to show compliance on demand. A current listing of all channels carried must be on hand, and the proof test data must be kept on file at the operator's local business office for at least five years.

Although all subscriber terminals are to be in compliance, the proof tests must be performed at six widely separated subscriber terminal test points, plus one for each additional 12,500 subscribers above 12,500. (For instance, 12,501 to 25,000 subs means seven test points; 25,001 to 37,500 means eight test points.) Test points must represent performance at subscriber terminals most distant from the cable headend in terms of cable length.

Proof tests must be done twice per year. In addition to proof testing, operators must be ready to show compliance on demand.

There is some controversy about where the tests should be made—before or after the convertor. The FCC rules say the following tests must be performed at the subscriber terminal: visual signal level, aural signal level, amplitude characteristic (in-channel response), C/N, coherent disturbances, terminal isolation, and hum modulation.

By Steve Windle, Product Marketing Manager, Wavetek

Zero beat test block diagram

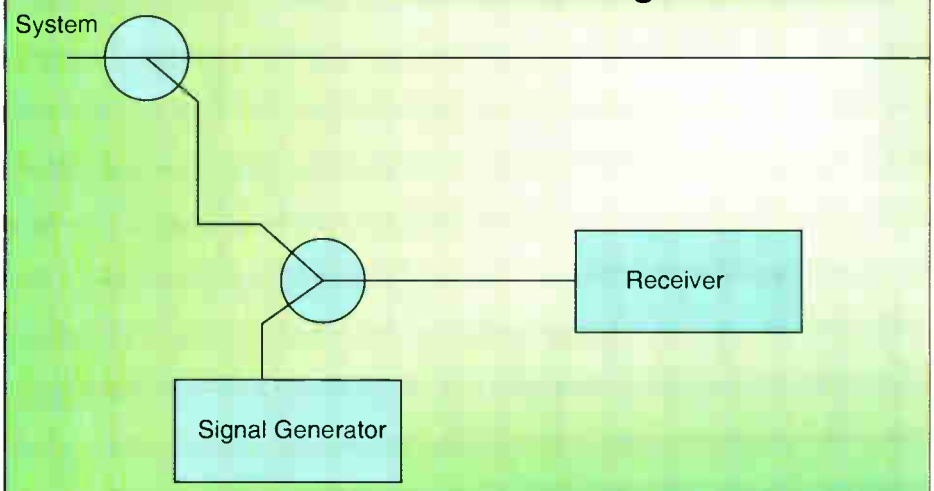


Figure 1

FCC Report No. DC-2267 *Action In Docket Case* says, "cable operators [are required] to conduct system-wide testing which uses convertors that reflect the type supplied to nearby subscribers when tests are performed outside subscribers' homes," "visual level variations measurements...may be made before the input of the convertor."

The instruments used to perform the tests must be identified in the records, with make, model, and most recent date of calibration (traceable). In addition, a description of test procedures used and a statement of the qualifications of the person performing the tests must be kept on file.

Table 1 lists the tests required and the number of channels on which the tests must be performed. Where the number of channels to be tested is indicated in this table as 4+, the requirement is for four channels plus one channel for each 100 MHz segment of occupied spectrum. (For example, if the cable system has a high end frequency in the 100 to 216 MHz range, five channels are to be tested; 217 to 300 MHz, six channels; 300 to 400 MHz, seven channels, and so on.)

Test	Number of channels
Intercarrier frequency measurement	4+
Video carrier level	ALL
24-hour Video Carrier Level Variation	ALL
Video to Audio Carrier Level Ratio	ALL
In-channel Frequency Response	4+
Carrier-to-Noise Ratio	4+
Distortions	4+
Isolation[1]	4+
Hum or Repetitive Transients	1

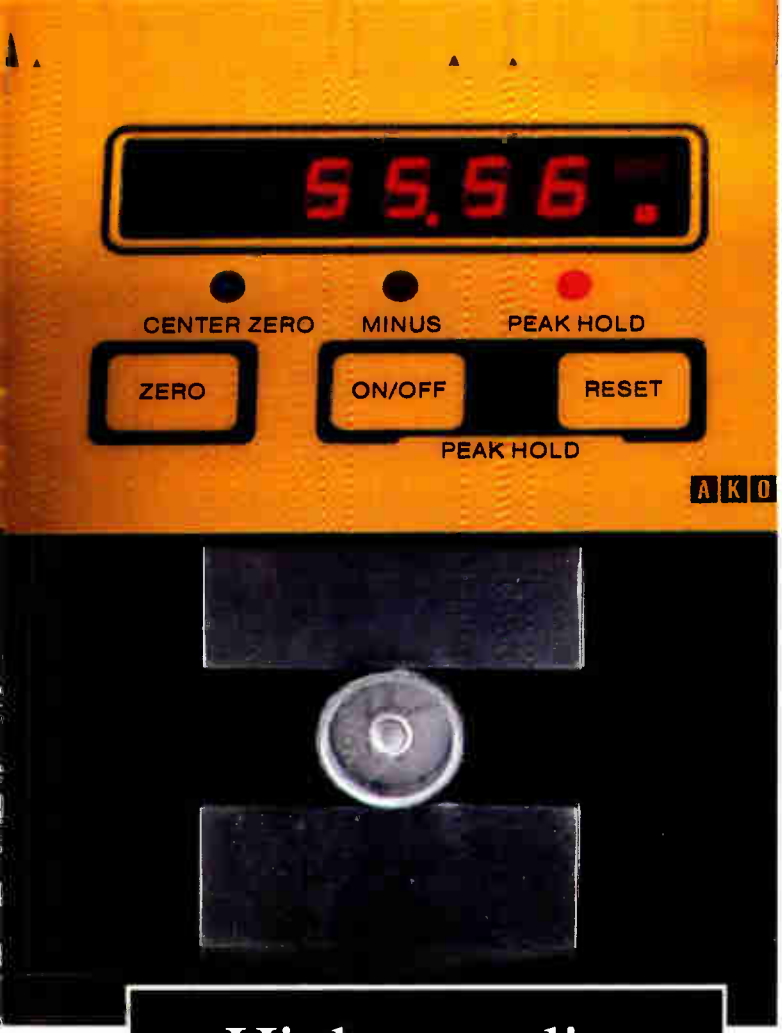
Table 1

The most time consuming of the tests, the 24-hour test, must be performed in January/February and July/August. These tests must be performed at six-hour intervals at a minimum, and include tests at the warmest and coolest times of day.

Probably the least familiar tests to most cable TV personnel are the base-

Intercarrier frequency measurement block diagram

Figure 2



A simple compression test dramatically demonstrates Times Fiber TX cable's (left) superiority over a leading competitor

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to comply with the new set of standards, operators will be required to conduct baseband video proof-of-performance tests. Specifically, these will include chrominance-luminance delay inequality, differential gain and differential phase measurements.

In order to create a uniform, nationwide scheme, the FCC said its standards will preempt local standards. However

rural cable systems serving fewer than 1,000 people will be allowed to negoti-
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In-channel response test block diagram

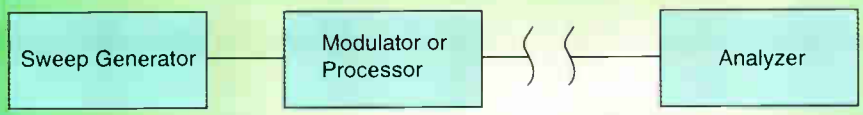


Figure 3

band video tests, which include chroma delay, differential gain and differential phase tests. Unfortunately, the cost of the equipment for verifying color standards can be expensive. Fortunately, these tests are only required once every three years, at the headend at the output of modulators/processors. However, a special report issued by the NCTA on May 21, 1992, says "Failure to comply with the standards could result in monetary forfeitures."

The tests

Intercarrier frequency measurement: (Must be 4.5 MHz plus or minus 5 kHz). This test may be performed quickly and efficiently in different ways. One method is to use an instrument designed to measure the frequency of TV carriers, which tunes to the channel to be measured and provides the video carrier frequency and the audio carrier frequency offset. This method is quick and easy, but calls for buying a relatively expensive specialized piece of test equipment. Another method is to use a spectrum analyzer with precise frequency accuracy and good frequency resolution and measure the frequency by the marker readout. This method is also quick and easy, but frequency measurement accuracy may be a costly option for the spectrum analyzer.

Intercarrier Frequency Measurement: One possible method is the "tried and true" zero beat method, which can be done using some basic test equipment that most cable systems have on hand.

One other possible method is the "tried and true" zero beat method, which can be done using some basic test equipment that most cable systems have on hand. The zero beat method calls for the use of a frequency variable signal generator, a signal level meter or spectrum analyzer, and a frequency counter. This method takes some time to set up, but if the test equipment is readily available at the system, no new equipment is needed. A block diagram of the system setup is illustrated in Figure 1. In the figure, which illustrates a zero beat test block diagram, the receiver may be a signal level meter or spectrum analyzer. The signal generator must be a synthesized source, or if not, at least relatively stable with regard to frequency and the output sampled with a frequency counter.

The zero beat test is done by first tuning the signal level meter to the frequency to be measured. A signal level from the generator at about 10 dB below the level of the carrier to be measured is optimal to avoid accidentally false zeroing on a sideband. Next, the output frequency of the signal generator is set close to the carrier to be measured.

When the test signal from the generator is within audio frequency range of the carrier to be measured, a tone will be heard. This tone is equal to the difference between the generator frequency and the frequency of the carrier to be measured. As the difference in frequency decreases, the tone will get lower in pitch. The test signal from the generator is adjusted until the tone quiets, or nulls, zeroing the beat product of the two carriers.

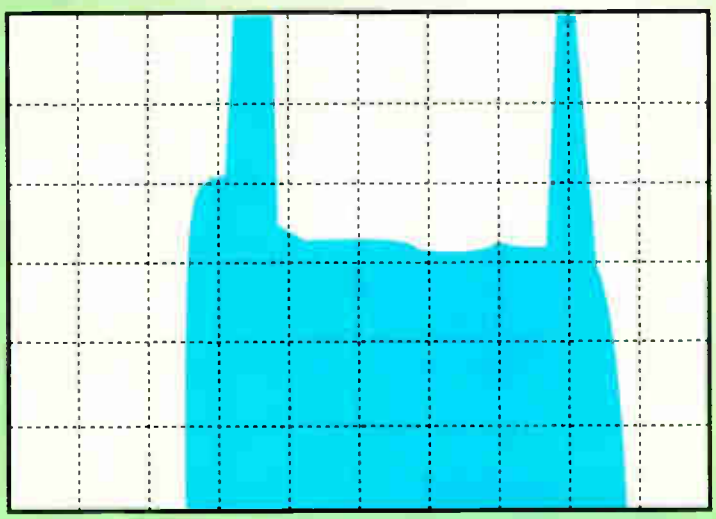
At this point the generator output frequency is equal to the frequency of the carrier to be measured. If the generator is a synthesized source with good accuracy the frequency is determined by checking the output frequency readout of the generator. Consistent measurements to within 10 Hz may be made using a signal generator. If the generator is not a high stability synthesized source, a frequency counter should be used to sample its output to determine the frequency.

When using a spectrum analyzer, gradually reduce the span and resolution bandwidth as the test signal approaches the signal to be measured. This helps to avoid accidentally false zeroing on a sideband.

Modulator swept response printout

2 dB/div, 10 MHz span

Sweep range: 50 kHz to 5 MHz
Sweep rate: set to fill response (in the 1 to 10 msec range)
Output level: set so 87.5% modulation is indicated on front panel meter



M1 23.6 dBmv 54.5 MHz
M2 - M1 - 01.8 dB 05.0 MHz 2 dB/div

Figure 4

To determine the intercarrier frequency, or the difference in frequency between the video and audio carriers, a channel selector (convertor), demodulator, and frequency counter are used. An intercarrier frequency measurement block diagram is illustrated in Figure 2. The rules dictate that the measurement be made at the subscriber terminal, in which case the test point may be the output of a convertor and the convertor shown in this setup is not used. The counter is connected to the 4.5 MHz subcarrier output of the demodulator.

Video Carrier Level: A signal level meter is a staple instrument for cable TV systems, and this test is definitely the most cut and dried of those required.

Video carrier level: Must be at least 0 dBmV at the output of the subscriber terminal, and at least 3 dBmV at the end of a 100-foot drop. Possibly the most accurate method for measuring video carrier levels is to use a signal level meter. A signal level meter is a staple instrument for cable TV systems, and this test is definitely the most cut and dried of those required. Most SAMs will allow the operator to tune up or down, channel by channel to read the video carriers. It's pretty simple to watch the meter to make sure it doesn't drop below a certain level, but proof requires that a historical record of the measurements be kept. Newer automated signal level meters make this process much more efficient.

24 hour video carrier level variation: Must be less than 8 dB within any six month period including the 24 hour period of this measurement; less than 3 dB from channel to channel, within 6 MHz nominal separation; and within 10 dB of any other video carrier, plus 1 dB for every 100 MHz above 300 MHz. The latter measurement translates to 11 dB for 301 to 400 MHz, 12 dB for 401 to 500 MHz, etc.

This test is very much like the video carrier level test, except for the fact that it is repeated at six hour intervals for 24 hours (the tests must include the warmest and coolest times of day). It's obvious that this test has the potential to be very time consuming. Many new signal level meters have suddenly appeared on the market to address this problem.

Video to audio carrier level ratio: Must be between 10 and 17 dB. The video and audio carrier levels on the cable system are usually maintained in the headend, and there is not much that would effect this in the cable system (except maybe poor in-channel frequency response, which is addressed in another test).

Still, to satisfy the FCC requirements, this ratio is to be measured in the field and documented. As mentioned previously, newer meters can be programmed to log this data. Some will even automatically calculate the V/A carrier lev-

el ratio on the data print-out.

In-channel frequency response: Must be +/- 2 dB from 0.75 to 5 MHz above lower channel boundary. Some of the tests, including this one, will prove to be a challenge to perform while the channel is in-service. The traditional method for making this measurement is to insert a sweep at the input to the modulator (must be low frequency sweep) or at the input to the processor (a variety of RF sweep generators will do this duty). The response is measured using a spectrum analyzer in the peak hold mode.

Figure 3 shows a block diagram for the in-channel response test. The sweep generator is baseband (sweep/function generator) for modulators and RF for processors. The analyzer must have a peak or max hold mode.

Figure 4 shows a typical modulator sweep reponse prinout. When sweeping a modulator and receiving the sweep on a Wavetek 1882A the following settings provide the optimal response (and peak hold is unnecessary):

Sweep range: 50 kHz to 5 MHz
Sweep rate: set to fill response (in the 1 to 10 msec range)
Output level: set so 87.5% modulation is indicated on front panel meter

A high level sweep system may be used to measure the response on processors, but remember, the receiver as a broadband detector only knows what frequency it's seeing by the data sent on the transmitter's data carrier. This means that the frequencies shown on the receiver will be those of the processor input, but the response will be that of the processor output.

The VITS multi-burst signal may be used to perform this measurement, but if a poor response is found, it may be present prior to entry into cable system. One way to remedy this would be to compare the measured response in the system to a reference measurement made in the headend. This method enables the test to be done while the channel is in-service, provided that the multi-burst VITS is present in the modulation.

Carrier-to-noise ratio: Must be 36 dB, then 40 dB, and ultimately 43 dB.

Carrier to noise test block diagram

Figure 5

A phone call to your tap manufacturer can often save a lot of time when preplanning for isolation tests.

The carrier-to-noise ratio is a comparison of the video carrier level and the noise measured over a 4 MHz bandwidth. This test is commonly performed with signal level meters, but the chal-

CED AD INDEX

lenge here has become finding a good place to make the noise measurement. To measure the C/N ratio of a specific channel the noise must be measured in that channel. Using currently available test equipment, this test must be performed by taking the channel out of service long enough to make the noise measurement at around 2 MHz above the video carrier frequency, or if the channel is turned completely off, at the video carrier frequency. The C/N test setup is shown in Figure 5. In the figure, bandpass filter help to avoid overdriving the input to the measurement receiver. The pre-amplifier boosts low test point levels to bring system levels within measurement range.

The typical C/N procedure is to tune to the video carrier for a reference level measurement, then tune off into the noise for the noise measurement. A correction constant is used to compensate for difference in resolution bandwidth of the receiver and the desired measurement bandwidth, as well as, peak vs. average detection. This constant is usually included when a C/N test function is used on the analyzer. Care must be taken to avoid making the noise measurement at a beat frequency, especially with a signal level meter, where the spectrum is unseen.

Terminal isolation test block diagram

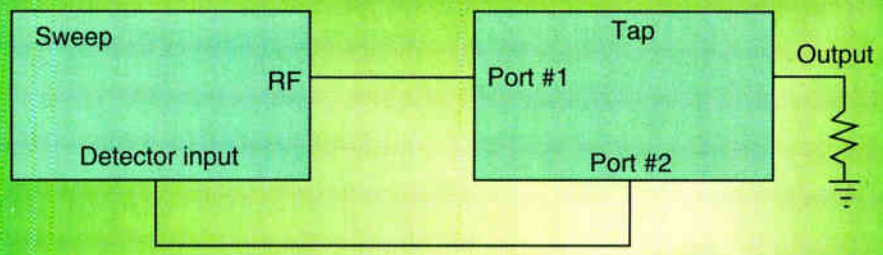


Figure 6

Carrier to interference: Must be greater than 51 dB for standard channel allocation, 47 dB for HRC. Video modulated channels may be used, as opposed to an expensive, cumbersome multiple carrier generator, but the results should be time averaged.

This interference is commonly called composite triple beat (CTB) or composite second order distortion. The test setup for the carrier to interference test is the same as that for C/N. The traditional test method is to tune to the video carrier for a reference level measurement.

For second-order distortion, with modulation off, a marker is placed 0.75 MHz or 1.25 MHz above the video carrier frequency to measure the distortion product. For third order (CTB), the video carrier must be turned "off" and the beat product is measured at the video carrier frequency. Composite beats form a mound as a composite of discrete distortion products, so the marker should be peaked on the beat to obtain the worst case measurement.

Now, to get the worst case measurement, this test is traditionally performed by removing all of the system carriers, and replacing them with a multiple carrier generator. The generator produces

discrete CW (unmodulated) carriers at video carrier frequencies. The CW carriers are at the max level at all times, where the video modulated carriers are at peak only during vertical or horizontal intervals, which are not synchronized from channel to channel on the system. It is recommended that a video filter be used on the spectrum analyzer to average out variations in level during this measurement.

Isolation: Must be at least 18 dB (see reference 1). A simple phone call to your test equipment manufacturer can often save a lot of time when preparing for this test. Or, sit down at a test bench and sweep 50 taps. Some sweep systems print out screen displays that can be easily be configured to show the worst case isolation. The setup is as follows depicted in Figure 6. The output and all ports not being tested are terminated in 75 ohm impedance. The isolation is the insertion loss measured from one port to another port.

Hum or repetitive transients: Must be less than 3 percent. Most signal level meters and analyzers require the use of a CW (unmodulated) carrier for this measurement. Many systems have a CW signal in the spectrum strictly for test purposes. Most signal level meters and analyzers designed for use in cable TV systems have a hum test function. In this case, the test is done by tuning to the CW carrier frequency and implementing the hum function. The hum percentage will be given on the display. The hum test may also be performed on the audio carrier with SLMs that have post detection filters at 60 or 120 Hz.

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E. Total Distribution *(Sum of C and D)*	15,170	16,698
F. Copies Not Distributed 1. Office use, left over, unaccounted, spoiled after printing	1,575	662
2. Return from News Agents	0	0
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> Most systems have the equipment required to make the tests.

Chroma delay, differential gain, and differential phase: Must be ±170 ns, ±20 percent, and ±10 degrees, respectively. These tests are typically done using video test signal generators, precision demodulators, waveform monitors, and vector scopes. They can be extensive, and since they aren't due for performance testing until 1995, they won't be covered in this article.

Conclusion

As shown in the procedures described above, most of the tests required for FCC proof of performance can be performed with readily available test equipment. Most systems have the equipment required to make the tests one way or another. Performing these tests frequently will help to ensure that the system is running well and will stave off outages and poor quality signals to subscribers. Test equipment manufacturers are rising to the challenge of providing equipment that makes these tests easier, more efficient and cost effective. In these exciting times many changes are in the wind. Keep an eye on the horizon.

References

1 This test may be bypassed, if manufacturer's specifications representing the results of a test of at least 500 units, or the results of cable system lab tests of at least 50 units are available. Thorough record keeping is recommended in all cases. CED

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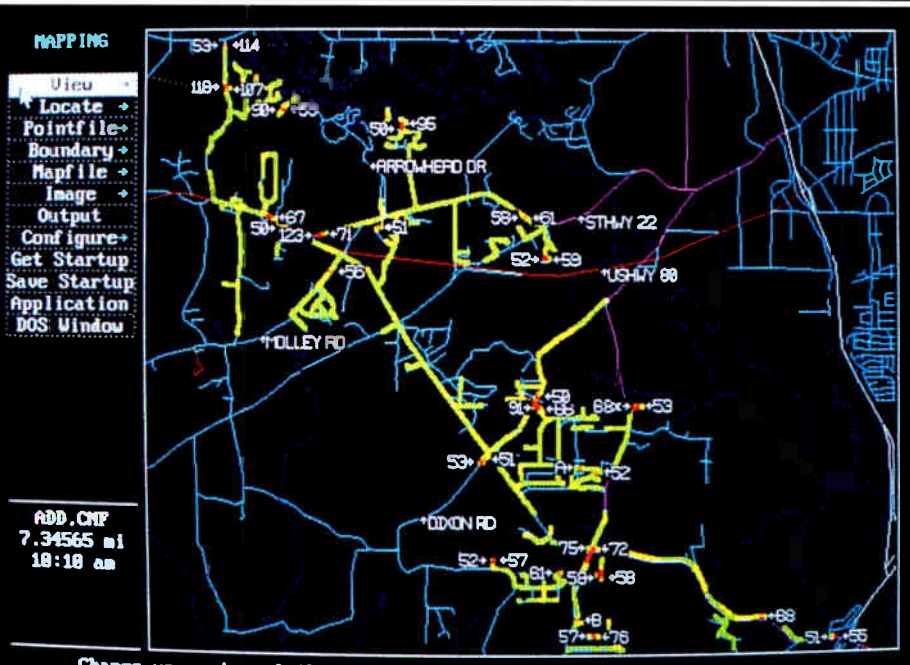

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Outages: A CableLabs update, Part II

Editor's note: *Last month's article on CableLabs' outage reduction task force defined outages, discussed outage tracking, system reliability and presented some models. This month's installment details the work of the plant powering working group and the outside plant protection working group.*

Plant Powering Working Group

Given the theme of reducing plant outages by any realistic means possible and thereby improving overall plant reliability, one must ask the question, "What new or improved methods can be applied to overall cable plant powering techniques, which will reduce exposure to plant outages from commercial power source(s)?"

Our approach to this question created research and investigation ultimately along three separate but related fronts:

1) New plant powering architectures which could significantly reduce exposure to loss of commercial power. This approach focuses primarily on "hardened trunk techniques," although improvements in current powering topologies can also reduce outage frequency,

2) Cooperation with the local power utility to better understand how the commercial power network design and power distribution principles affect cable plant reliability, and

3) Optimized application and operation of standby power supplies.

By the CableLabs staff

Cable plant powering architectures

Most cable plant power distribution designs to date utilize similar if not identical processes. The designer seeks to design a power layout for trunk and feeder systems simultaneously. Typical goals are the provision of adequate load voltages to each active device with uniform current distribution through the grid; all the while seeking to maintain a fairly moderate to heavy load on the power supply itself.

The major problem with cable plant powering is that the cable plant is optimized for distribution of RF (voltage) signals, not AC (power). Past techniques and future designs must ultimately deal with this basic issue in an optimized fashion.

Present methods of powering trunk and distribution systems have served the industry fairly well, but grapple with an inherent problem.

Coaxial cable sizes used for RF distribution, the placement and type of RF electronics, and the operator's design technique and percentage loading of main AC supplies all combine to create some rather healthy "power supply cascades."

Table 1 (which shows system reliability calculations) takes a fictitious cable system with a cascade of 25 trunk stations, one bridger and two line extenders, and varies the number of possible power supplies in cascade required to feed them and also compares these two conditions with a varying commercial power reliability assumption. Data shown are outages per month per worst case customer.

Table 1 brings one to the following basic conclusion: For commercial power loss rates that are deemed average at this juncture (around 30 percent per year per each power supply location), power supply cascades of about seven or less are mandatory to meet the 0.6 max outages per customer per month.

Power Sensitivity Chart

Power Supply Cascade Level

% Power Fail/Year	20	15	10	8	7	6	5	4	3	2	1
100	2.13	1.69	1.26	1.08	1.00	0.91	0.82	0.73	0.65	0.56	0.47
90	1.96	1.57	1.17	1.02	0.94	0.86	0.78	0.70	0.62	0.54	0.46
80	1.79	1.44	1.09	0.95	0.88	0.81	0.74	0.67	0.60	0.53	0.46
70	1.63	1.32	1.01	0.88	0.82	0.76	0.70	0.63	0.57	0.51	0.45
60	1.46	1.19	0.92	0.82	0.76	0.71	0.66	0.60	0.55	0.49	0.44
50	1.30	1.07	0.84	0.75	0.71	0.66	0.61	0.57	0.52	0.48	0.43
40	1.13	0.95	0.76	0.68	0.65	0.61	0.57	0.54	0.50	0.46	0.42
30	0.97	0.82	0.68	0.62	0.59	0.56	0.53	0.50	0.47	0.44	0.42
20	0.80	0.70	0.59	0.55	0.53	0.51	0.49	0.47	0.45	0.43	0.41
10	0.63	0.57	0.51	0.49	0.47	0.46	0.45	0.44	0.42	0.41	0.40
0	0.47	0.45	0.43	0.42	0.42	0.41	0.41	0.40	0.40	0.39	0.39

Table 1

Hardened trunk techniques

The term "hardened trunk" describes a general technique of separating trunk and feeder powering in the cable system. In other words, this technique provides separate power supplies for the trunk and the feeder systems. Further, a basic premise is that the trunk portion must experience very little downtime. If commercial power is found to not meet specific and critical reliability considerations, then standby powering should be seriously considered.

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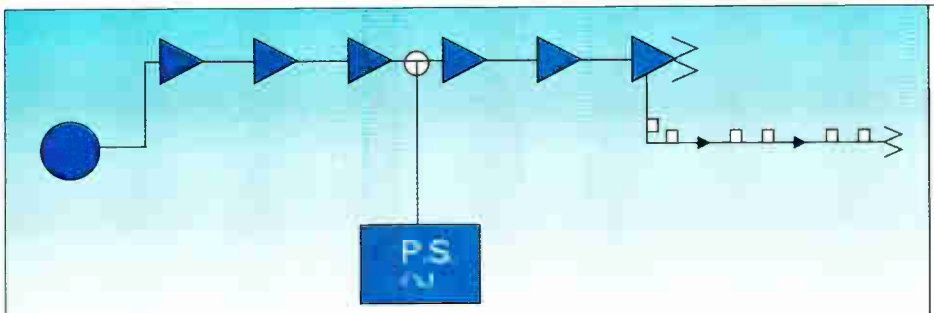


Cascade Diagram

Figure 4

Thus, the hardened-trunk powering system will often utilize standby power in crucial locations (in the trunk) to meet necessary reliability targets. With the local (feeder plant) supply, the power to the customer's home is often off when the local supply is off, and the customer therefore is unaware that a cable outage has taken place.

Figure 5 diagrammatically shows the hardened trunk technique. The use of this technique offers the following basic advantages:

- Significant reductions in power supply cascade depths. Typical cascade reductions are in the 60- to 75-percent range compared to normal designs. (Note that the overall number of supplies in the system will likely increase.)
- Allows standby power technology to be optimally applied and operated.
- May actually reduce capital needed to outfit the system, depending on the mix of standby (more expensive) with standard (less expensive) power supplies.

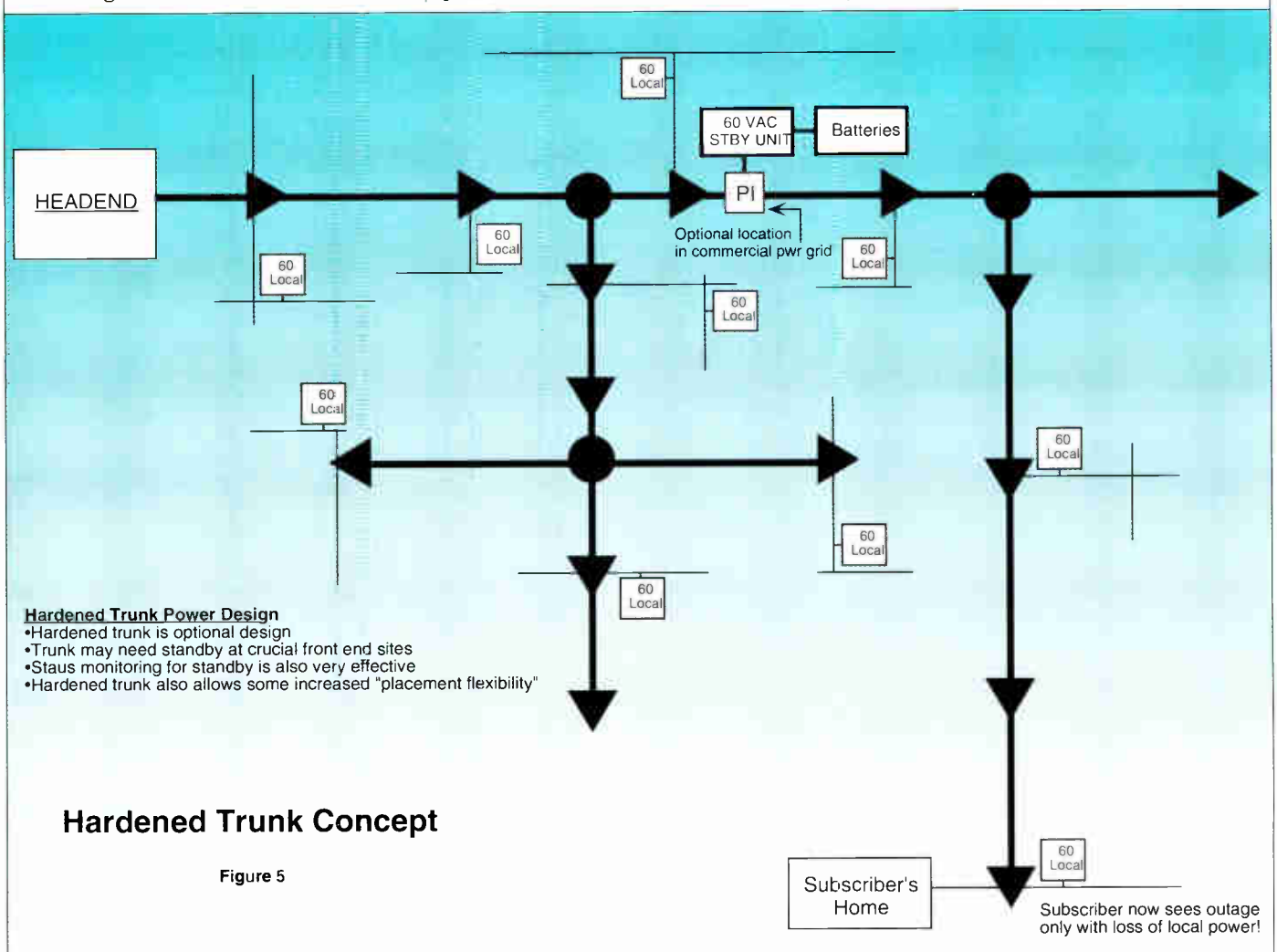
Working with the local utility

This section examines the local electric utility, which provides commercial power for the standard or standby supplies used in the cable system. How can we better understand their system layout and its implications for overall cable system reliability?

Figure 6 represents the typical commercial power distribution system. The front end of this layout, that closest to the substation or power source, is shown as three-phase while the remainder of the grid is shown single-phase for simplicity sake.

Keep in mind that the entire primary system is three-phase, connected in either wye or delta configuration. Most, if not all, of the components shown in Figure 6 will be present in a well-engineered power distribution system.

Basic principles of commercial power design are safety, the limitation of high fault currents to protect the system from catastrophic damage, and the ability to



Hardened Trunk Concept

Figure 5

restore service to the largest number of customers in the shortest time possible—even under the most severe conditions of weather or plant failure.

Given the architecture for power distribution in Figure 6, the following general guidelines can be given regarding CATV power supply placement:

- Where possible, keep power supplies close to substations, but on short side spurs to avoid the high fault/switching currents that can exist on main feeders close to substations. The preferred location for a cable TV power supply would be a short side spur that does not include a fuse or other protective device, as illustrated in section 1 of Figure 6.
- Avoid areas downstream of reclosers such as sections 2 and 3. They are normally utilized by the power company in high fault areas.
- If possible, avoid areas fed by sectionalizers such as section 4.
- Avoid distribution areas between load break switch points as in section 5.
- Lastly, where possible, avoid distribution lines protected by fuses. They are preferable, however, to recloser or sectionalizer feeds since they blow when fault current conditions occur downstream of the fuse location.

Generally speaking, feeder lines or spurs less than six pole spans in length do not have protective or switching devices installed. These are often optimal locations for CATV power supply placement, particularly where they extend from main lines close to substations.

Optimized standby power

Finally, much can and should be said regarding the optimized use of standby powering. This technology has been available for quite some time, but many operators have experienced less than successful results in applying this technology. This lack of optimal application and results has to do with the complexity of the technology, and in particular the correct selection and maintenance of batteries required in its use.

In this area there is much work remaining. Ultimately, the goal here is answers to past failures, and recommendations for change and optimal application in a cable system. Due to the detail and extent of research necessary in this area, a separate working group has been ultimately established to:

- Develop recommended standby and non-standby equipment specifications.
- Develop recommended application methods for both supply electronics and batteries, particularly charging circuits.

Outside plant protection

In this final section we'll concentrate on the research and recommendations of this outside plant protection working group. This working group was tasked with the responsibility to develop recommendations on equipment fusing, surge protection and bonding/grounding practices which could reduce outages. This working group was led by Roy Ehman, formerly with Jones Intercable, but now enjoying retirement. Roy has authored many papers on the outside plant protection subject, and readers are encouraged to obtain these articles for background information. Therefore, we will devote this section to the recommendations this working group has developed concerning plant voltage and current protection and not spend much time on background information.

Recommended protection

Cable system reliability directly depends on the reliability of plant amplifiers. CATV reliability analysis has shown plant amplifier failure rates must be at or better than 7 percent to achieve outage performance acceptable to the customer (less than or equal to 0.6/month/customer). This 7 percent amplifier failure rate includes all causes of failure—equipment, fuses, cut cables, etc.

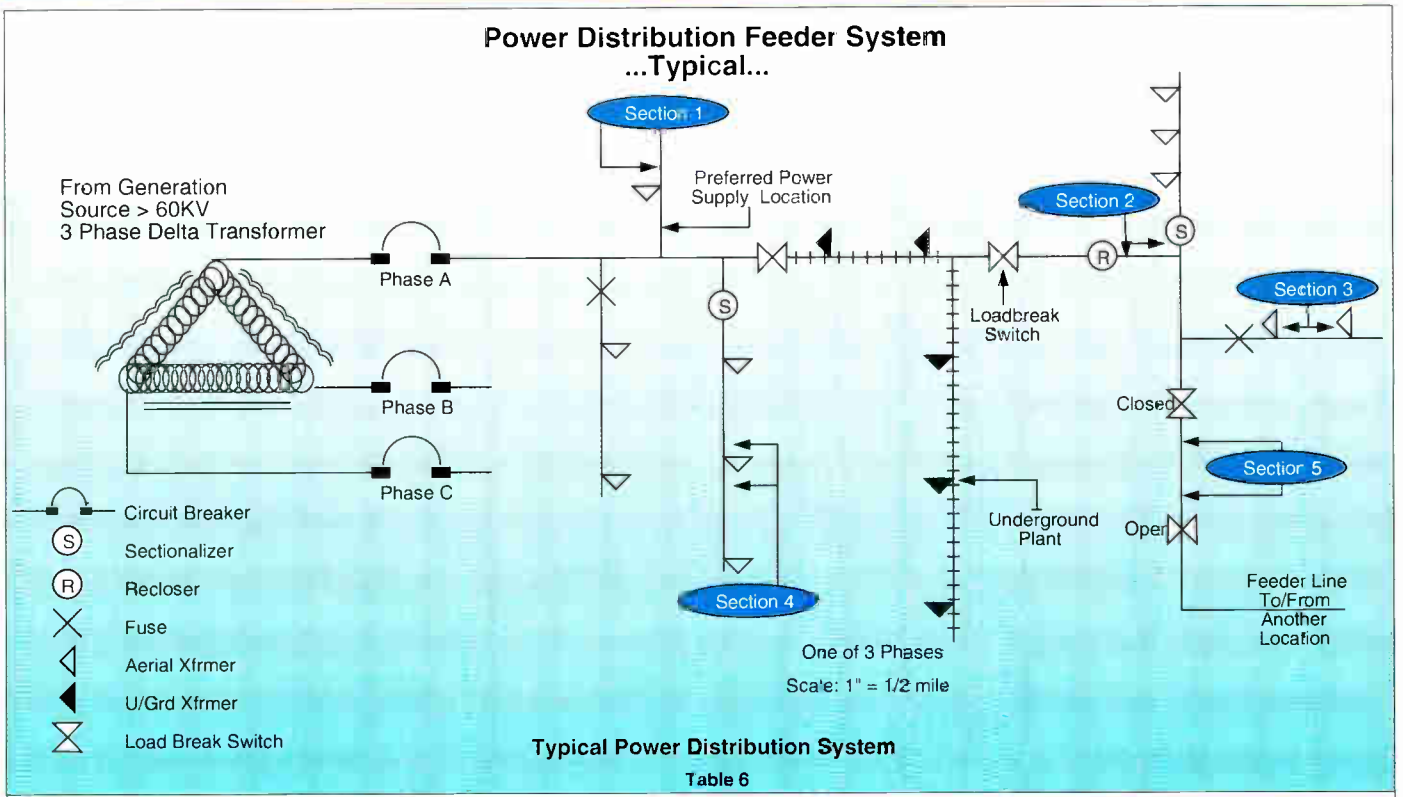
Achieving 7 percent or less failure rate requires effective protection from excessive voltage and currents. Excessive voltage conditions are typically a short duration condition such as a surge. Voltage surges are typically created by:

1) lightning,
2) operation of power system protection/switching equipment; e.g., vacuum breakers, and
3) operation of industrial loads such as arc furnaces, switching of large pumps, etc.

Excessive current conditions are created by electrical shorts which are longer duration events. A typical cause of high current is a short circuit of the coax from a cable cut or maintenance activity, or electronic component failures in a shorted condition.

Examination of present voltage and current protection practices has found the following deficiencies:

- Surge voltages blow fuses ("nuisance" fuse blowing).
- Fast blow fusing used incorrectly to protect from long duration high currents.



Typical Power Distribution System

Table 6

• Excessive use of fuses; e.g., fuses to route power.

Cable operators are recommended to implement the following voltage and current protection. This recommendation is based on analysis, surge testing and very successful field testing.

Surge voltage protection

Vendor is to certify amplifiers to the following:

1. Amplifier passed five 6,000-volt impulses (3,000 Amperes) per ANSI/IEEE C62.41-1980 Category B2 test. Amplifier tested in configuration simulating cable plant installation.

If surge protection device(s) and/or input current carrying capacity is changed, the equipment is to be retested.

Vendor to certify this in writing and provide detailed testing documentation/report upon request.

2. Surge protection device(s) operating characteristics will not materially change when subjected to 10 voltage surges of (1) above spaced one millisecond apart.

This condition is difficult to test, therefore certification can be by engineering analysis. The analysis is to account for, among other things, voltage drop across the device, subsequent heat build-up and associated device operating characteristic changes.

Vendor to certify this in writing and provide detailed testing or analysis upon request.

3. Certify the number of "Impulse Life") 6,000-volt impulses (3,000 Amperes) per ANSI/IEEE C62.41-1980 Category B2 the surge protection device(s) can withstand. The recommended minimum is 5,000. Certification to be based on published device specification or specific life tests.

Vendor to certify this in writing.

> For average commercial power loss rates, power supply cascades of seven or less are mandatory.

Surge voltage protection

Recommend for all trunk amplifiers and line extenders where there is known surge problem.

1. Install solid-state surge protection where the surge protection is certified by the vendor to meet the following:

A. Pass a series of five 6,000-volt impulses (3,000 Amperes) per ANSI/IEEE C62.41-1980 Category B2, I./above.

B. Vendor to certify surge protection device(s) minimum "Impulse Life" per I.3 above; recommended minimum is 5,000.

2. Remove gas discharge tubes.

Note: Most amplifier manufacturers have developed kits that will meet these criteria. Additionally, other vendors have kits available to back-fit surge protection.

Excessive current protection

1. Plant AC power supply output protected at 150 percent to 200 percent of power supply rating with slow blow (MDL) fuse.*

2. Trunk power pack input protected just under current carrying capacity of amplifier with slow blow (MDL) fuse.*

3. Feeder protected at 150 percent of normal operations with slow blow (MDL) fuse.*

4. Line extender power input protected just under current carrying capacity of amplifier with slow blow (MDL) fuse.*

5. All other fuse locations to have buss bar.

* If circuit breaker is used, the rating to be as noted above and opening/trip characteristics to be that of a slow blow (MDL) fuse. CED

References

1. Rana Arons, "Consumer Reports Readers: Satisfaction with Cable TV Lowest in Survey History," Consumers Union Newsletter, August 21, 1991.

2. Bradley Johnston, "Outages: The issue of the '90s," 1990 NCTA Technical Papers.

The future of the cable drop

Editor's Note: *Consistency in the drop portion of the cable network has become an increasingly important issue for the cable industry recently, as digital transmission becomes a near-term reality. The SCTE, CableLabs and NCTA all have subcommittees investigating recommended practices and standards that will help cable operators deal uniformly with new quality issues. Although it is the policy of this magazine not to publish product-specific articles, the work done by Anixter Cable TV and equipment manufacturers in this area merits review.*

It's just what anyone would want. A solution to an immediate problem that also takes advantage of future opportunities. That's why Gary Wesa, at Time Warner Cable's Green Bay, Wis. system, agreed to test an integrated drop system that calls for high-quality hardware and improved craftsmanship to improve the integrity of cable system drops.

Not that Green Bay has severe drop problems. On the contrary, the system's percentage of drop-related service calls is below the industry average (28 percent vs. the national average of 80 percent.[1]) Wesa, the system's chief engineer, and his staff have always focused on the quality of drops. Steve Hartig, install supervisor, gained his experience from Time Warner's installation training and helped Wesa upgrade Green Bay's installation standards three years ago. They wrote an installer's manual containing detailed pictures for each aspect of a drop installation and created a Q/C checklist.

By Bruce Habeck, Regional Technical Manager, Anixter Cable TV

The major issue

Hartig emphasizes training and craftsmanship by hands-on supervision and uses the Q/C form in the field. "It comes down to craftsmanship. You have to train the people in QC to make sure they are consistent with the standard." A significant percentage of installations are field checked. To enforce quality workmanship from contract installers, Green Bay contractually reserves the right to "charge-back" for faulty or inferior work.

So what did Wesa want from the IDS program? "We have had pretty good drop installation standards, but if there are some things that we can learn and do better, that is what we are looking for," Wesa says.

Green Bay's interest in improving drops, what is often called the "weakest link" in a cable system, coincides with that of others in the industry. The National Cable Television Association (NCTA), the Society of Cable Television Engineers (SCTE), and CableLabs all have committees addressing different issues and portions of the drop.

The performance of drops will become even more critical when the industry begins to exploit future technologies. Unlike analog signals, which degrade to a still-viewable picture when connections aren't secure, digital signals will be subject to a complete loss of picture or frozen frames of still images, under the same conditions. According to Tom Elliot, vice president of technology at TCI, cable operators should consider "permanent drop systems" to address this issue.[2]

A systems approach

Green Bay's beta test equipment consisted of a complete integrated drop system (IDS), from the tap to the customer interface equipment. In much the same way that a headend is installed as a system, the IDS approach takes a comprehensive approach to drops. Specifications for each element of the drop system must meet or exceed those of the FCC and SCTE and when combined, and are designed to ensure reliability, performance and compatibility with enhanced technologies such as HDTV and digital compression. (See Table 1 for examples.)

Continued on page 80

IDS requirements (partial)

Cable	Minimum 60% braid
	Messengered aerial cable
	Flooded underground cable
	Polyethylene jacketed underground cable
	Indoor cable CATV-V rated
	Sweep tested 5 MHz to 1 GHz
	Drop cable dimensions meet/exceed SCTE specs
Passives	110dB EMI shielding
	Chromate treated zinc housing
	1/2" long mechanical "F" ports
	Raised cast port values
	Heavy duty ground block with rounded slot
Connectors	Circumferential seal at outdoor cable interface
	Meet/exceed SCTE standards for male "F" interface connections
	Shield effectiveness 80 dB or better at 1 GHz
	Outdoor connectors to withstand a 4 foot waterhead for 24 hours
	One size fits all RG-59 cable and one size fits all RG-6 cable
Hardware	All plated hardware must meet galvanizing specs
	Use formed or UV molded cable clips
	No staples or clips that require a hammer for installation
	Use feed through bushings at entry points
	All grounding devices be U.L. listed/approved

What safety tools do managers need?

Some believe the safety tools management need are statistics. Here's but one example: The telephone communications industry employs nearly eight times as may workers (910,000) as the cable industry (128,000 when combined with other pay TV services). But, according to the U.S. Bureau of Labor Statistics, cable workers lose three times as many workdays (a steady 96.2 in 1989 and 1990) per 100 full-time workers as the telcos (30.8 in 1989 and 37.3 in 1990) because of work-related injuries. Enough said?

But let's not spend much time looking at cold and inanimate gross figures for the cable industry as compared to related or similar industries.

Invariably, a manager looking at comparative costs and rates will come away saying, "O.K., maybe we're not doing as well as some related industries, but we're sure doing better than petrochemical or special product sawmill workers." This is not the impression a reader should be left with, however, because even one accident is totally unacceptable and potentially tragic.

Picking the wrong person

While all high-level managers will express genuine concern for the safety of workers, most will delegate the responsibility to someone else. That someone else is generally an appropriate managerial person. But more often than not, the person delegated by management to handle the responsibility of worker safety will be a top technically-trained professional. The rationale for this, of course, is because accidents occur in the field, let the supervisor of those workers be responsible for their safety.

Wrong!

As Ralph Haimowitz, the Society of Cable Television Engineers' director of training points out, "Management continously picks the wrong people to be their safety coordinator for their system." Haimowitz says managers assume most accidents are likely to occur among the technical people who are out driving and climbing and working with tools and heavy equipment and using hazardous materials.

"I agree with that," says Haimowitz. "But the person who heads up the safety program for the system should be an administrative person, because that person is responsible for seeing that the safety program is carried out, appointing a safety committee within the system, seeing that the OSHA reports are filled out and filed, that OSHA 200 is posted on the appropriate employee bulletin boards, that the OSHA posters are displayed and that the OSHA books and manuals are in a file that's accessible, that the hazard communications program files are available and accessible, and meets with an OSHA inspector and shows them the proof of all this, and sees that the training files are kept and maintained.

They end up putting all the safety responsibility onto some chief tech or director of technical operations, who is already responsible for the maintenance of the entire system—but this is an administrative function, not a technical function," Haimowitz emphasizes.

Proper structure

"The technical people should be represented from each technical section on the safety committee, and the technical supervisors should keep the training files for each technical section: That's it," Haimowitz continues. "However, most managers will turn around as say, 'because most of the accidents are going to happen in your department, you're going to be the safety person for the system.'

"Yet Murphy's Law says that when an OSHA inspector shows up, it's going to be the day when you have seven channels off the air and the person in charge of safety is going to be out there trying to fix it. The manager will be squalling on the telephone, saying, 'help! The OSHA guy is here!' Then you have to make a choice: Do you want seven channels back on the air, or do you want to meet with the OSHA representative? The manager is going to want the channels back on the air; the OSHA representative is going to want to talk to the safety director. They name the wrong guy, consistently," Haimowitz stresses.

What management has done when they load a technical supervisor with safety responsibilities is remove a highly trained and highly paid person from his or her area of expertise and saddle him or her with time-consuming tasks best handled by a person well-trained in administrative task performance.

And there is the danger that when a technical supervisor is loaded with administrative tasks, he or she will grudgingly and half-heartedly carry out that task, not because he or she is shirking the responsibility, but because in reality, the tasks just not his or her so-called "cup of tea." Expertise is a terrible thing to waste.

The proper tool = money

What will wake up management to the realities of the workplace, and how can the unacceptable conditions which lead to cable's high accident rate be changed?

"Managers need to know they're responsible," says Haimowitz. "They can't say they've appointed a safety coordinator who is responsible. Because OSHA will hold the managers responsible; they will say that managers are responsible for seeing that safety is provided for employees. It won't be the safety coordinator who goes to jail if OSHA decides to bring charges of criminal negligence. It will be against the manager."

Besides the heart-felt sentiments executives express about workplace accidents, what else can motivate top management to take actions that, in the real world, will bring about a reduction in accidents?

Well, what is most often forgotten is that top executives are workers, too. And like any worker, an executive cannot do his or her job right without the proper tools. If the tools of top management are data and financial information, what specific data and information does management need to perform their job as it relates to cable safety?

Safety, like most anything in business, has its bottom line. Seconna Blair, Jones Intercable's manager of FCC compliance and quality assurance, observes that "we all have to respect the fact that we're in the business to make money. We have to show the savings (of safety) and what it's going to do for us as a company."

In the next article in this series on safety, we'll be focusing on direct costs of safety programs and the negative cost impacts of unsafe operation as well as the long-term savings obtained from a safe and efficient workplace. Specifically, we'll be examining how safety figures into the balance sheet of cable system operations. CED

By George Sell, Contributing Editor

It's like the "Wild West" in Argentina

It was held in Buenos Aires, Argentina, but North American cable television equipment manufacturers, programmers and experts all flocked to the third annual Jornadas de Television por Cable conference in late October to discuss digital video compression, scrambling, addressability, telephony and a host of other technical issues.

Once the language barrier was overcome, the Jornadas show could have easily been mistaken for a regional trade show in the United States. Familiar companies were everywhere: Jerrold, Scientific-Atlanta, Philips Broadband, Times Fiber, Gilbert, Lindsay, Triple Crown and Holland hardware was on display in several booths.

Exequiel Gutnisky, 1st VP ACTV.

About 1,000 attendees

Official attendance figures were unavailable at press time, but officials said they had registered nearly 800 visitors from Argentina, Chile, Brazil, Uraguay and Paraguay on the opening day of the frantic three-day confab. More than 90 exhibitors were on hand for all 26 hours of the show, and they often found cable operators waiting for them in the morning and staying well past the 8 p.m. closing time.

The Jornadas Show featured products manufactured in the U.S.. Photos by Rob Stuehrk.

Those operators came asking some timely questions. "They have the same questions and problems that U.S. operators have," said Geoff Roman, VP of technology and new business development at Communications. "They want to know about new amplifier technology, where fiber plays in their network, what's the best evolutionary approach to compression, things like that," Roman added.

Jerrold caught the attention of many attendees by holding a live demonstration of its DigiSat video compression system, which was sent over PanAmSat to the show.

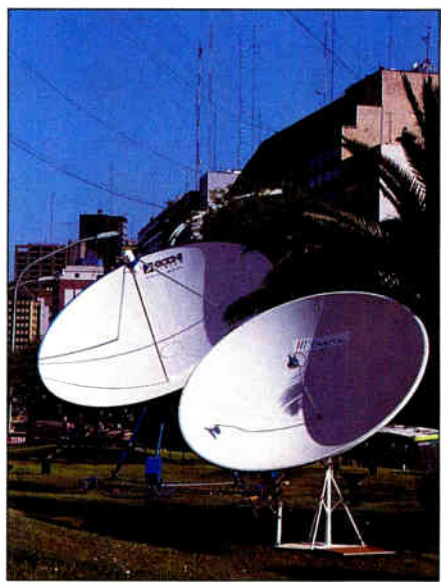
Indeed, the word on the show floor was that compression technology is likely to be used throughout Latin America 1) by entrepreneurs who want to bring video entertainment to the masses via small satellite receive dishes, 2) by the Mexican government in schools and 3) in Brazil by TV Abril and Globosat, a large wireless operator and network, respectively.

Others were attracted to Argentina because the country is rebuilding a lot of plant that has been in place for 15 years or more. "It's like the wild West here," said Michael Holland, president of Holland Electronics. He said Argentina resembles the U.S. marketplace some 15 years ago, when distributors and manufacturers were jockeying for position in a marketplace poised to explode.

Still others came searching for addressable wireless systems that can be deployed faster and less expensively than coaxial or fiber-based systems. Both Jerrold and S-A were in attendance, touting their wireless product.

Cable in South America is clearly preparing to grow. Issues holding back its development include a lack of satellite space (which holds back development of more programming), high transmission fees and lack of signal protection. All are issues that will be addressed by a new trade association—the Asociacion Argentina de Television por Cable (ACTV)—that grew out of the merger of two rival associations.

According to Exequiel Gutnisky, president of cable operator Cablex and 1st vice president of ACTV, the new trade group and its 400 member companies will begin lobbying the Argentine government to streamline the licensing process, loosen programming restrictions and reform the industry's regulatory structure.



Satellite programming was a major issue during the Jornadas Show.

The merger is a "very useful" fusion of cable operators that represents roughly 3 million subscribers, according to Gutnisky, who said this year's show was roughly twice the size of the 1991 confab. In fact, many attendees said the show has outgrown the Sheraton hotel at which it was held, but hasn't yet grown large enough to be moved to the convention center. CED

By Roger Brown

SCTE®

Following is a list of SCTE technical seminars with contact name. If available, location and seminar topic are also listed.

December 5 *Florida Chapter* BCT/E and installer exams to be administered in all categories at both levels. To be held at Dynamic Cable, Hialeah, Fla. Contact John Tinberg, (407) 747-4998.

December 7-9 *Technology for Technicians II Seminar* "Hands-on Technical Training Program for Broadband Industry Maintenance Technicians and System Engineers," to be held at the Harvey Hotel in Dallas, Texas. Contact SCTE headquarters at (215) 3363-6888.

December 8 *Chattahoochee Chapter* "Emerging Technologies and Developments" with Alex Best of Cox Cable, and "FCC Reregulation" with Tim Holtzman of ONI. To be held at the Perimeter North Inn, Atlanta, Ga. Contact Hugh McCarley, (404) 843-5517.

December 8 *Desert Chapter* "Customer Service for Field Personnel." Contact Greg Williams, (619) 340-1312, ext. 277.

December 9 *Central Indiana Chapter* BCT/E exams to be administered in all categories at both levels. Contact Greg Nydegger, (219) 583-6467.

December 9 *Florida Chapter* "FCC Compliance" with Dave Spallinger of Continental Cablevision, James Goins of TCI and additional speakers to be announced. To be held at the Holiday Inn in Lakeland, Fla. Contact John Tinberg, (407) 747-4998.

December 9 *Inland Empire Chapter* "Construction Standards, Equipment and Safety Practices" with Mic Davis of Quality Services Corp, Paul Cota of Cox Cable, Roger Paul of Cox Cable, Dan Middleton of Specialty Communications and Chris Jasper. BCT/E exams to be administered in all categories at both levels. To be held at Shep Rock Hanger, Coeur D'Alene, Idaho. Contact Butch Boyd, (208) 667-5521.

December 9 *Michiana Chapter* BCT/E exams to be administered in all categories at both levels. Contact Russ Stickney, (219) 259-8015.

December 9 *Miss/Lou Chapter* Installer and BCT/E exams to be administered in all categories at both levels. To be held in Gulfport, Miss. Contact Dave Matthews, (504) 923-0256.

December 9 *Boulder Dam Meeting Group* "Signal Meters—Basics to Expert Operation" with Al Silva of Wavetek, Inc. To be held at Prime Cable in Las Vegas, Nev. Contact Devon Kampshoff, (702) 384-8084, ext. 252.

December 10 *Central Indiana Chapter* "Safety" with speakers to be announced. Contact Gregg Nydegger at (219) 583-6339.

December 10 *Chesapeake Chapter* Installer exams to be administered. To be held at the Holiday Inn, Columbia, Md. Contact Jennifer Wardrop, (410) 461-7017.

December 10 *Music City Chapter* "Non-interfering Sweep and Getting to Know the Sweep Analyzer," with Bob Glass of Jerry Conn Associates. To be held at the Ponderosa Steak House, Nashville, Tenn. Installer and BCT/E exams to be administered in all categories at both levels. Contact Dale Goodman, (615) 244-7462.

December 10 *Northern New England Meeting Group* "Dig Safe" and "Underground Construction." To be held in Portland, Maine. Contact Bill DesRochers, (207) 646-4576.

December 10 *Shasta/Rogue Meeting Group* "Bench and Field Sweep" with Al Silva of Wavetek. To be held in Redding, Calif. Contact Dan Barger, (916) 547-5438.

December 11 *Hawaii Chapter* Scheduled speaker: Ron Wolfe, SCTE Member of the Year. BCT/E exams to be administered. Contact Michael Goodish, (800) 836-2888.

December 11 *Adirondack Meeting Group* "FCC Rules and Regulations" and "Tests and Measurements" with Jim Miller of dB Communications. To be held at the Hotel Saranac, Saranac Lake, N.Y. Contact Rick Knapton, (518) 891-2810.

CABLE '93 NCTA THE NATIONAL SHOW SAN FRANCISCO

CALL FOR PAPERS

Summaries of proposed technical papers of interest to the cable television engineering community are being solicited by the National Cable Television Association's Science and Technology Department. **Deadline is January 6, 1993.**

Next year's National Show will be held in San Francisco, Calif., June 6-9, and will feature a 12-session technical program. Product pitches and previously published works will not be considered. Multiple entries from a system, manufacturer or individual are acceptable.

Interested parties can submit a one-page summary to Katherine Rutkowski, Director, Technical Services, NCTA, 1724 Massachusetts Ave. N.W., Washington, D.C. 20036. Inquiries will be fielded at (202) 775-2627, or faxed proposals sent to (202) 775-3698. Again, submission deadline is January 6, 1993.

RETURN PATH

Customer service

This month, we'd like your thoughts about your system's customer service track record. Many in the industry believe that in a future filled with competition from telcos, DBS, MMDS and other video providers, cable operators will be forced to provide excellent customer service or risk alienating their present customers.

To respond to the survey, simply make a copy of this page, fill out the questionnaire and return the survey to our offices (via fax to 303-393-6654 or mail to 600 South Cherry Street, Suite 400, Denver, CO 80222). We'll tally the information and print the overall results in a future issue.

So, if you've ever wanted to add your input to the industry's conventional wisdom surrounding these issues, now is the time to do it.

Please answer the following questions as honestly as you can. Remember, no names will ever be used.

	Yes	No	Don't know
1. How many subscribers does your system serve?			
2. How many customer service representatives does your system have on duty during its peak time?			
3. Does your system have live CSRs answering telephones later than 5 p.m.?			
4. If so, how late is the phone answered?			
5. Is your business office open on Saturdays?			
6. Is your business office open on Sundays?			
7. Do your CSRs have authority to adjust customers' bills when they are disputed?			
8. Does your system use an automated response unit during normal business hours?			
9. Does your system use an automated response unit overnight and during weekends?			
10. Does your system have a policy to complete all service calls within 24 hours?			
11. Does your system offer subscribers a choice of when they'd like to have service performed?			
12. Does your system perform routine service calls after 5 p.m.?			
13. Does your system offer its employees incentives for providing good customer service?			
14. Does your system offer effective customer service training on an ongoing basis?			
15. On a scale of 1 to 10, with 10 being highest, where do you think customer service ranks as a priority to your system's management?			

Please provide the following information:

Your title _____

Your job function _____

The size of your system (# of subs) _____

The length of your CATV career (years) _____

The state in which you work _____

Your MSO (optional) _____

RETURN PATH

Work environment/leadership survey results

Most cable systems could benefit from improved people skills, according to the results of our September "Return Path" survey.

As seen in the tabulation below, which shows the precentage of respondents who marked each response offered, the overwhelming majority of readers gave their immediate supervisor below-average marks for effective communication and positive reinforcement.

At the system level, employees generally believe they are working in a safe environment, but are underwhelmed with their financial compensation. Responses were split over system manager accessibility and his/her ability to plan for the future.

Finally, corporate headquarters took a beating over their internal communication policies, training programs and ability to change according to the needs of their subscribers. However, responses were split over customer service innovation and practices.

	Poor	Good	Very Good	Excellent	Don't know
Your supervisor(s):					
1. Has your supervisor clearly communicated the results expected of you?	37	44	19	-	-
2. Does your immediate supervisor provide positive reinforcement for a job well done?	56	19	19	6	-
3. Does your immediate supervisor provide you with timely information?	50	25	25	-	-
4. Do you feel your supervisor cares for you as a person?	25	25	38	6	6
Your system:					
1. How does your pay compare to similar jobs in other nearby cable systems?	44	19	19	-	19
2. How would you evaluate your system's record of promoting the most qualified people?	50	19	12.5	12.5	6
3. How are the physical working conditions at your system—are they safe?	13	31	31	25	-
4. Evaluate the accessibility of your system manager.	25	19	12.5	37.5	-
5. How well does your system manager plan for the future?	25	19	6	25	19
Your corporate headquarters:					
1. Evaluate your company's concern for providing good customer service.	6	31	31	25	6
2. How well does your company keep you informed of its policies and practices?	56	-	31	13	-
3. Evaluate your company's efforts to innovate in customer service practices.	19	25	19	25	12
4. How would you evaluate your overall satisfaction with your company?	31	25	19	25	-
5. Evaluate your company's training programs.	38	31	13	12	6
6. How well does your comapny respond to the changing needs of subscribers?	44	19	12	13	12

The CABLE POLL

Midwest CATV • CED • Cablevision

Outages remain an operational headache

Consumer Reports beat up cable operators last year regarding system outages—perhaps the biggest single subject often cited by consumers as reasons why they're dissatisfied with their cable service.

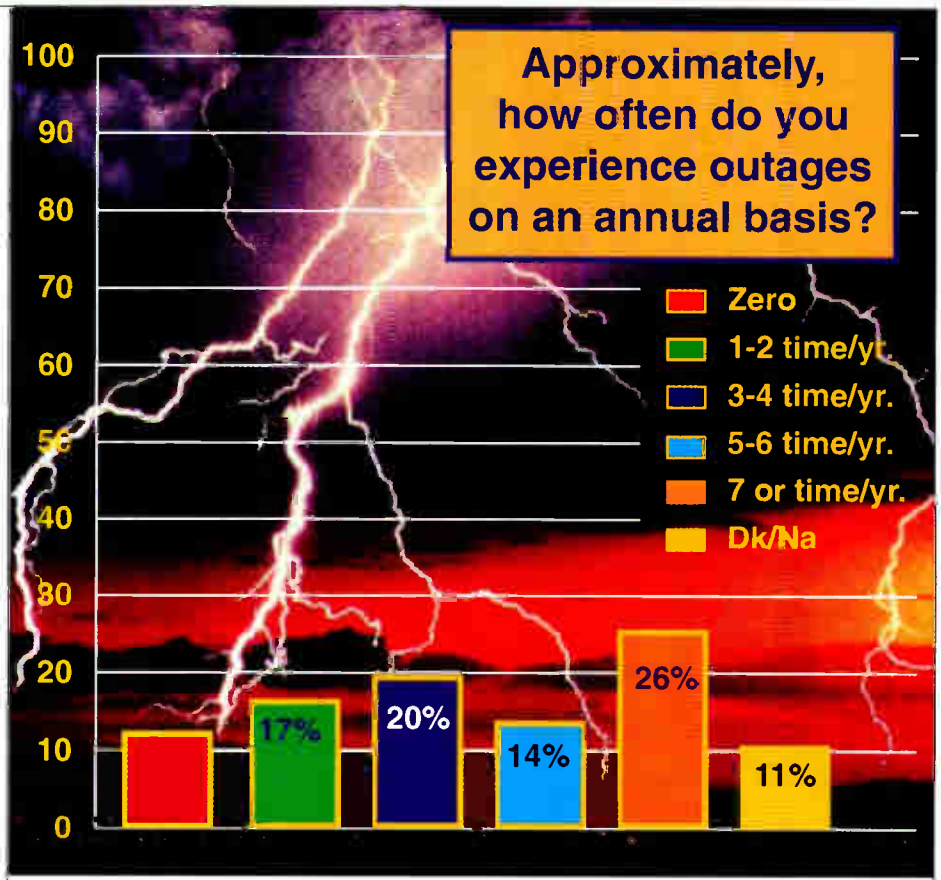
According to the results of the latest CablePoll©, cable viewers may not be getting much relief.

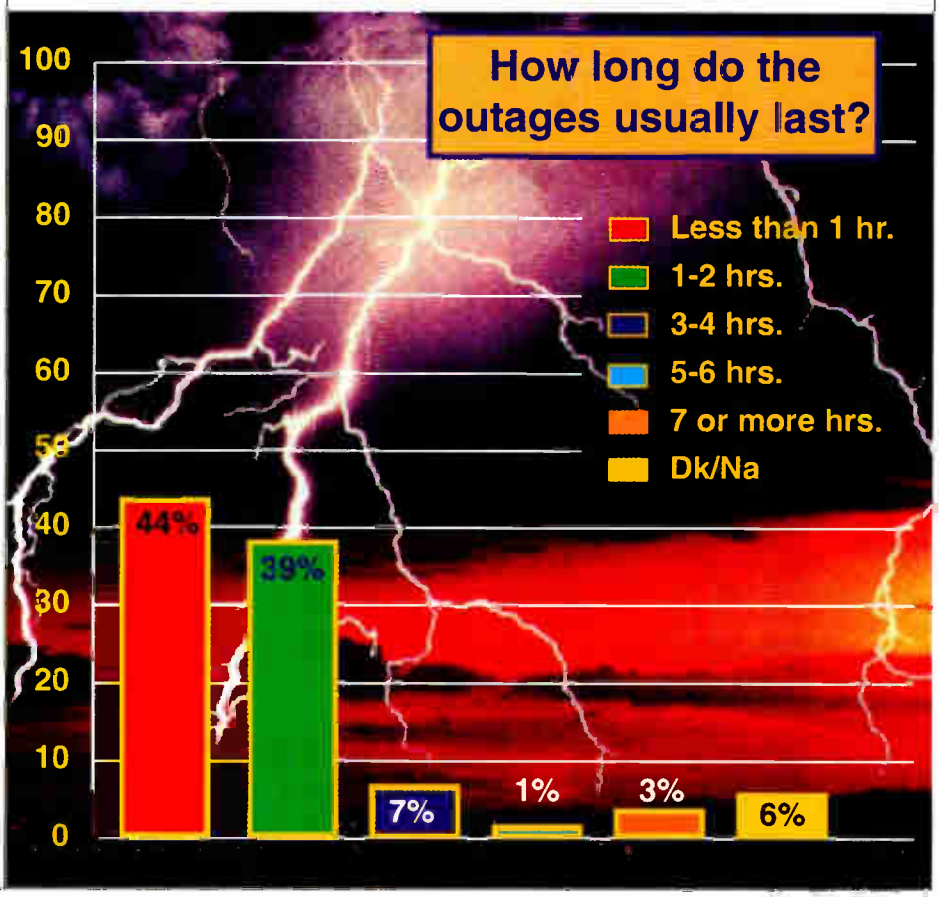
Fully 40 percent of the 200 general managers who were interviewed said their systems experience outages at least five times a year. For one-quarter (26 percent) of those interviewed, the news was even gloomier: their systems go out seven times or more over a typical 12-month period.

The good news is that the outages don't typically last very long. Almost half (44 percent) of the respondents said they're outages usually last for less than an hour; an additional 39 percent said they last between one and two hours.

The primary cause of outages are electrical storms. With an estimated three-quarters of the country's cable plant hung on poles, this should come as no surprise. But perhaps cable operators could show more interest in reducing the number of outages they suffer. According to the Poll, roughly half (52 percent) of those questioned said they were either "somewhat interested" or "very interested" in installing outage reduction equipment, including status monitoring devices, which alert the operator to a change in the system's performance. But the other half (43 percent) said they weren't very interested in those devices.

Even more telling was operators' unfamiliarity with the outage reduction task force at Cable Television Laboratories. Nearly 80 percent of the GMs polled said they had little or no knowledge of the group or its efforts, while 15 percent were only somewhat familiar. A paltry 4 percent were very aware of the task force. CED





Training heats up in Denver

More than 75 attendees showed up for the National Cable Television Association's "Training '92" seminar in Denver recently. Indeed, the most often heard comment heard at the confab went something like this: "I can't believe I'm seeing so many CATV trainers in the same room—I thought I was one of a handful."

At the two-day event, attendees were heaped with specific CATV training tips and case-studies, from both a technical and customer-service approach. In one technical session, TKR Cable's Manager of Training and Safety Jim Hurley presented his technical training program—he calls it a "blueprint" for technical training.

Hurley, whose technical training program was nominated for the *1992 Excellence in Technical Training Award*, says the N.J.-based system had a plethora of problems which ultimately led to his hire as trainer.

"I came on board in 1988, and realized there were major challenges in front of us. We had no formalized training program; NCTI course completion was less than four percent; we had an 85 percent turnover rate. It was pretty bad," Hurley recalls. "Our customers were majorly dissatisfied with us—their impression was that the (cable) warranty lasted as long as they could see the CATV van's rear lights going down the street."

To make matters worse, internal motivation was at an all-time low. "Everybody was dissatisfied with everybody, and everything," Hurley remembers.

Hurley started the mammoth task by developing a mission statement—which is still in use today. He conducted a needs analysis, prioritized it, then put together a five-year business plan, complete with budgets and milestone activities.

The most important part of the whole process, Hurley says, was top management support. "Mercifully, the system manager was behind the training effort 110 percent," he says. "Then we took it to the next level: The supervisors. You cannot train in a vacuum; the supervisor has to be involved all the way. If they don't coach and cheerlead, you might as well take those training dollars, turn them into cash, take them out to the parking lot and set them on fire."

To start with, Hurley identified three priority training courses: Safety, essential job skills and overall product knowledge. "We started off by training 320 employees on things like how to cut a fitting. Also, 20 percent of the trainees never had cable. They had never even seen it—so they didn't know what they were selling," Hurley laments.

Next, he implemented developments and standards training. "I wanted them to get a good base of solid engineering practice," Hurley explains. "That included product application." Hurley's training approach is self-paced and "completely hands-on."

"Very often, we have classes of two to three people, with a specialized trainer," Hurley says. "We train until a skill is mastered—sometimes it's a scheduling nightmare, but not always."

The results

Now, TKR's training efforts have moved beyond the rudimentary to a more evolutionary stage which includes a lot of reinforcement training. He trains field employees, non-technical employees and service employees within the company's 13 systems. As a result of the program, which is now in its fourth year, employee churn is less than 10 percent. Employees are much more satisfied, Hurley says, and are asking for more training. Customer satisfaction has risen considerably, as has overall safety awareness.

What did it cost? "My analysis is that training costs equal about 27 miles of plant, comparatively," Hurley says. "In 1988, if we spent $25 on employee for training, that was a lot. Now, we spend $820 to $1120 per employee, per year on training, or about $1.33 per customer, per year."

Overall, Hurley says the program is definitely working. "We're tracking with our mission statement and business plan," he says. "It's really exciting to see the changes. Of course, it's not all attributable to training—but I'd like to say that (training) has something to do with it."

New products

Feedforward trunk line amp

New from **C-Cor Electronics** is its FT549 feedforward trunk line amplifier, which uses 33 dB spacing to provide distortion performance benefits over push-pull or parallel hybrid devices. The 33 dB reach of the unit at 55 MHz enables a system to perform bandwidth upgrades without the need to move amplifier locations, C-Cor officials submit. The FT549 complements C-Cor's existing line of feedforward trunk line products. For more information, contact C-Cor at (800) 233-2267.

New conduit system

Arnco has announced its new conduit system, called "Smooth-cor," which uses corrugated polyethylene conduit with a smoothed inner wall. Company officials say the main advantage of the new conduit is the eliminated need for expensive custom bends and sweeps, and that a single installer can effectively maneuver the conduit around obstacles, corners or up/down grades. Adhesives aren't required, because of the conduit's water-tight mechanical connections. For more information, contact Arnco at (800) 321-7914.

Extended-coverage MMDS relay

New from **Communications and Energy Corp.** is its Model 900 antenna, the "LongRanger," which retransmits an MMDS or ITFS signal into a valley or other area where direct reception is blocked or weak.

Connected to a pencil-beam direct receive antenna through an amplifier, it retransmits over a wide angle into the valley. The antenna is intended for use in California's "beambender" system or similar relay systems. Vertical and horizontal beamwidths are five degrees and 90 degrees, respectively, for a gain of approximately 20 dBi. Polarization is user-selectable, and bandwidth range is 2500 MHz to 2700 MHz. For more information, call (315) 452-0709.

New tool for MC^2 cable

The **Cablematic Division** of **Ripley Co.** has announced availability of a double-helix design combination coring/stripping tool for all sizes of Trilogy MC^2 cable. A 45 degree bevel cut of the sheath makes connector interfacing easier, company officials submit, while eliminating potential O-ring damage. The tools, dubbed "CST," are available in either a fixed "T" handle or a ratchet "T" handle version. For more information, call (203) 635-2200 or fax inquiries to (203) 635-3631.

People in the news

Jim (Randy) Randolph has been named president of **Cadco, Inc.** Randolph was chosen by Cadco's board of directors to head the company, following the death of former president William T. Barnhart. Randolph's experience spans more than 30 years in microwave and cable television systems engineering and management.

Julie Phillips has been promoted to the position of director of student services for the **National Cable Television Institute (NCTI)**. A 12-year veteran of the Institute, Phillips most recently served as senior student services representative.

Julie Phillips

In her new position, Phillips will oversee all of the grading functions, student progress reporting and customer service functions for NCTI.

The NCTI's Student Services Department grades about 15,000 exams each month from the Institute's 7,500 students throughout the U.S. and abroad.

P.W. Blubaugh

US Conec Ltd. has announced key personnel appointments for the new business, which was formed in July. **P.W. "Bill" Blubaugh**, formerly of Siecor Corp, has been named president. **John A. Midkiff** is director of operations, **Dr. Toshiaki Satake** is director of new product development, and **Toru Arikawa** is director of manufacturing technology. Siecor exec **Gregory B. Kosty** will serve as the US Conec board chairman. US Conec is a newly-formed equity company of Siecor, NTT and Fujikura. The company will develop, manufacture and market fiber connectors and accessories for use in telecommunications, data communications and specialty fiber optic applications.

Dr. Toshiaki Satake

Toru Arikawa

Bruce Robertson

Bruce Robertson has been named Chief Operating Officer (COO) of **Ad Systems Inc.**

Robertson comes to Ad Systems from Computer Video (Comp-U-Vid), where he was president. In his new role, he will be responsible for the implementation of new policies, procedures and programs for the company.

Emily and Glyn Bostick, founders of Microwave Filter (MFC), have left the company to organize a new firm, called **Communications & Energy Corp (CE&G)**. CE&G will offer products to niche markets in the communications industry, including cable TV, in-house cable and LAN systems, TV, FM and MMDS broadcast facilities, satellite reception. It will also produce commercial mobile radio products.

Jorge Vespoli has been promoted to president of **Scientific-Atlanta**'s Satellite Communications Division. Vespoli will oversee the day-to-day operations of the Division's domestic and international satellite communications, including technical, sales and support employees.

Most recently, Vespoli was VP of systems engineering for SA's Network Systems Group.

Bob Beaury has been elected president of **Broadband Networks Inc.**, a fiber optic communications equipment manufacturer located in State College, Pa. Beaury was formerly VP, sales and marketing for the company.

Walter Perlowski

Walter Perlowski has been named Inmarsat terminals product manager for **ViaSat Technology Corp.** In his new role, Perlowski will be responsible for marketing Inmarsat earth stations and other Inmarsat-compatible products.

CED

Continued from page 18
video, on the other hand, such as sports, will most likely not be of acceptable quality, at least in the near term.

This is partially due to the fact that movies are inherently easier to compress than video because of the difference in frame rate between the two media. Movies consist of only 24 frames-per-second (24 still pictures presented to your eye every second) compared with 30 frames per second for video. Thus with movies, there is much less (20 percent) information to compress up front. In addition, movies have traditionally been produced as "soft" images when compared to the "crisp" delivery of most video information, thus further reducing the information content, and hence the data rate required for transmission.

The bottom line is that it is unlikely that ADSL will be capable of delivering video entertainment, within the next couple of years, much beyond movies and "talking heads" (educational programming and news) at an acceptable picture quality to most discerning subscribers. Note, however, that compression technology and digital modulation techniques are very rapidly improving, and it is expected that within the next few years, full-motion video at an acceptable video quality to the average consumer, will be possible.

In fact, using compression combined with a new modulation technique called "carrierless, amplitude modulation, phase modulation" (CAP), we can expect that eventually the telcos will be able to simultaneously deliver not just one, but two VCR quality movies into the home at 3 to 4 Mb/s; either that or a single, full-motion, NTSC quality program.

The cost of deployment of the technology might also be another barrier to entry for the telcos. Initial cost estimates for ADSL are that the electronics at both ends of the twisted pair, in total, will cost between $500-$700 per home (assuming one twisted pair per home). The cost will be distributed with roughly $400 in the telco central office and $200 in the home. This cost does not include the digital storage libraries and other associated electronics that will be necessary at a central distribution facility, probably the central office, to provide switched video on demand that can then take advantage of the new data carrying capacity of the twisted pair. CED

Reference

1. Yokel, Larry, "The Telco Local Loop and Bellcore-proposed ADSL/HDSL Technologies," CableLabs Report (Limited Distribution), August 1992.

Continued from page 71
compression. (See Table 1 for examples.)

An Integrated Drop Standards Committee, comprised of a diverse group of suppliers, defined the drop specifications and installation standards that are embodied in the IDS menu of choices for drop cable, grounding and sealing equipment, drop passives, taps and hardware.

However, the IDS committee didn't stop with identifying and testing quality drop equipment and hardware. It also recommends installation procedures, standards and grounding methods to ensure integrity of an Integrated Drop System. The IDS program provides regular training classes to certify both in-house and contract installers in quality installation procedures. The on-site classes are given twice a year to reinforce the training and to train new employees and new contract installers.

NCTA, SCTE and CableLabs all have subcommittees which address various issues relating to the drop.

Additionally, "Train the Trainer" programs are offered to ensure that IDS customers are equipped to continue in-house training that is consistent with the program. IDS classroom and hands-on training covers product applications, high frequency installation techniques, grounding, cable preparation, connector interface, system testing, drop maintenance and troubleshooting. IDS training also stresses the importance of a disciplined approach to field Q/C.

In Green Bay's case, the IDS drop standards are not too different from what Wesa already had in place. Wesa wanted to be sure that "whatever we were doing it was the right thing for the next 20 years."

As Wesa points out, Green Bay is a trapped system—so it has occasions to check drops when it upgrades or downgrades services. But in an addressable system, the integrity and reliability of drops become even more significant since changes in service are done remotely so that a drop may not be touched for years.

The test site

The Green Bay test is being conducted in a recently constructed area with about 160 IDS drops installed to date. Gary predicts another 150 customers will come on line in the test area in early 1993. Drops installed outside the test area during the past six months are used for tracking drop-related trouble calls against the test area. Trouble call reasons are reported using detailed "fix codes." Wesa has instructed the field to return any IDS components that may have caused a service call. So far, nothing faulty has been returned.

Gary has taken installation Q/C a step further. He has given the installation Q/C checklist to all CSRs to report installation comments such as when customers "are unhappy about the way the job was installed, the way the installer acted, or if the installer wasn't able to answer a question about pay-per-view."

Some early benefits

Although Green Bay plans to track the test area for at least a year, it has already seen benefits from installing IDS. "We switched over to a new attachment clip per IDS recommendations and our contractors loved it," Wesa said. "We brought it into our in-house people, and that one item makes everyone's job easier.

"Another new product we liked from the IDS program was the indoor F-fitting. Although I was apprehensive at first, I found I really liked the fitting and may consider using it more in the future. We also adopted a new installation procedure: we use a five-inch loop now inside a CATV house box instead of the four-inch loop we were using."

IDS is helping operators address the issue of quality drop installations. Wesa concluds, "I would not hesitate to tell anyone that if they installed the drops according to these standards, they can be assured that their service calls are going to go down. Without a doubt." CED

References

1. Lemaire, Smith and Drum, "The Indoor Challenge: The Rising Trend Toward Problems with In-Home CATV Wiring and Connectorization," *1990 NCTA Technical Papers*.

2. *MultiChannel News*, March 9, 1992.

New traps from Eagle

Eagle Comtronics has introduced a new family of premium channel trapping devices which it calls "Quantum Trap." The line, which includes negative traps, positive traps and sideband interdiction system decoding filters, deliver 50 to 100 percent improvement in lower adjacent audio performance, officials say. Also, the traps may be used on higher frequencies (including UHF) than previous negative trap models.

The increased channel capacity is made possible by Eagle's new circuitry and design, which results in narrow operation. Upper video attenuation is minimized between -1.0 dB and -1.5 dB. For more information, call Eagle officials at (800) 448-7474.

Messengered drop clamp

New from **Sachs Communications** is its SCO2MFA drop clamp for messengered drop cable. The new clamp offers a more broadly curved messenger bearing surface, with an indented guide so that regardless of movement, the messenger won't encounter sharp edges or chafe. Also, the SCO2MFA offers a side feed of the drop cable itself, which officials say speeds the installation of RG-59, RG-6, quad or 11-type cables—including dual cables. For more information, call Sachs at (303) 790-7330.

Tower grounding device

New from **Lightning Master Corp.** is a tower leg ground strap, designed to provide economical, low impedance grounding for a variety of towers. The new strap is available in four sizes and is constructed of copper, with plating to assure dissimilar metal corrosion problems. The straps are secured to the tower legs with all-stainless steel clamps and are available in sets of three (one for each tower leg). For more information, call Lightning Master Corp. at (813) 447-6800.

Fiber microscope

Fotec Inc. has introduced a multipurpose fiber optic test tool that can be used to test fiber optic connectors and cables. The V400 microscope can view connectors in three ways, officials say: In the direct mode, it allows seeing how well the fiber fits in the connector, or if there are any scratches in the polished surface. The microscope can also illuminate the core of the fiber while in the direct mode, which identifies any cracks in the fiber which may have been introduced during polishing. In the third, angle viewing mode, polish irregularities are identified. "Zoom" capabilities are also included, with a 60x to 100x range. The microscope sells for $75. For more information, call Fotec's Bill Pierce at (800) 537-8254.

Fotec's V400

Enhanced OTDR

Tektronix has announced an enhanced version of its "FiberMaster" optical time domain reflectometer (OTDR). The enhanced unit includes a function which marks events, thereby automating the link characterization process. With the enhanced OTDR, all measurements are conducted automatically. Events, which are characterized as splices, connectors, or actual breaks, are marked on screen by triangular markers and displayed simultaneously with the results of automatic distance, loss and return loss measurements. For more information, call Tek at (800) 833-9200.

Tektronix' FiberMaster™ OTDR

OFI tone detection kit

New from **Noyes Fiber Systems** is a kit including the company's OFI-200 and OLS2-300, with accessories, for dark fiber tone identification. When the OLS2-300 laser source is modulated (at 2 kHz) from the central office or headend, the signal is detected by the OFI-200 optical fiber identifier at remote splice locations or cutover points within the fiber network. For more information, call Noyes' Mike Schneider at (603) 528-7780.

Fiber fault locator

Laser Precision Corp. has introduced its FL-550 fault locator, designed to identify breaks or faults in optical fiber cable in less than 60 seconds. The locator is equipped with 1310 nm singlemode optics which provide 19 dB of dynamic range, and a distance range of 40 km. Applications include the testing of fiber-to-the-home, CATV and LAN testing, singlemode cable testing and fault location/cable length measurements. For more information, call Laser Precision at (315) 797-4449.

Laser Precision's FL-550

Deals and other news

PPC settles suit against LRC

Production Products Co. has announced a settlement of its patent infringement suit filed earlier this year against **LRC Electronics**. (The suit had charged that LRC's "Multi-fit" F-connectors infringed upon a patent issued to PPC in 1991 for its "universal" F-connector.)

In the settlement, LRC has agreed to stop manufacture and sale of the Multi-fit connectors which have the design accused of infringement. Also, LRC has agreed to pay an undisclosed amount of money to PPC.

A similar patent infringement suit filed earlier this year by PPC against **Pyramid Connectors Inc.** remains pending in U.S. District Court for the Northern District of N.Y.

New contractors association

The **Power and Communications Contractors Association** has announced formation of a new association, specifically for CATV contractors. Dubbed the "Cable TV Contractors Council," the new association hopes to serve as a liaison between cable contractors and MSOs, and will focus on ways to improve contracted service to MSOs—including safety and customer service-related issues. The association had its first meeting at the Atlantic City Cable Show, and will meet again prior to next year's SCTE Expo in Orlando, Fla. For more information, contact Mike Strother at (703) 823-1555. CED

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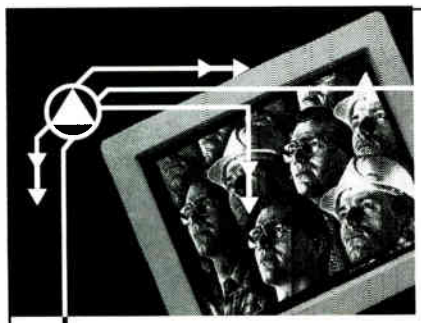

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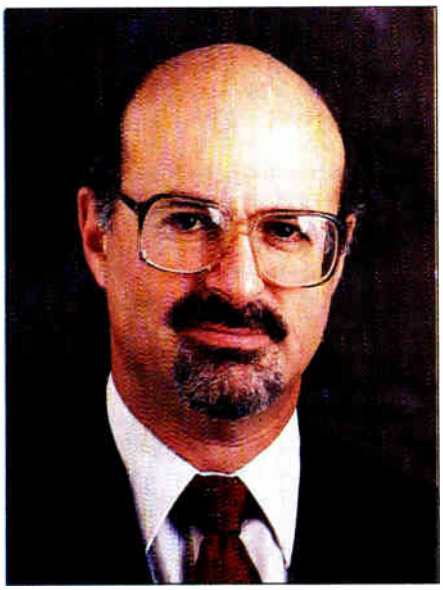

Aftermath of the Cable Act—what's next

Now that cable TV re-regulation has been enacted into law, the focus has shifted to the Federal Communications Commission for implementation. The FCC must conduct about 20 to 25 different proceedings and investigations that are required under the law. Some of these will result in new FCC regulations, while others will result in reports to Congress that could eventually form the basis for additional legislation. Here's what happens next.

FCC rules and regulations

The FCC acts as a legislative body when it adopts rules and regulations. The FCC's rules and regulations have the force of federal laws. The cable bill requires the FCC to adopt regulations in a number of areas, including rate regulation, must-carry, retransmission consent, satellite program distribution and TV receiver remote controls. For the most part, these new regulations will appear as amendments to Part 76 of the FCC rules.

Rules are adopted or amended in a proceeding called a rulemaking proceeding. Government agencies such as the FCC must give notice of proposed rules before they are adopted, and must allow the public to comment on the proposals.

In order to begin a rulemaking proceeding, the FCC Commissioners must first vote to adopt a document called a Notice of Proposed Rulemaking (NPRM). This document lists the proposed new rules and asks for public comments on the proposals. It specifies the date comments are due, and the date reply comments are due. It tells where the comments are supposed to be filed, and how to get copies of comments others have filed. It contains the name and telephone number of the FCC staffer who can provide clarifications and status information about the proceeding. And it establishes the docket number and name, which must be included in comments so they are filed properly.

A number of NPRMs on cable TV issues will be adopted by the FCC commissioners in meetings during November and December. These meetings are open to the public, and are occasionally televised by C-SPAN. A staffer presents the issues raised in the NPRM, and then the commissioners, seated on a raised dais at the front of the room, discuss the issues and the proposed rules. Then they vote to adopt the document.

When the FCC adopts an NPRM, it first issues a news release, usually the same day. This is a one- to three-page document that contains a summary, but not the details. The full text of the NPRM comes out three to four weeks later, depending on the backlog in the FCC's printing department.

The due date for comments is normally 60 days or 90 days after the text of the NPRM is released, but the cable bill has specified deadlines for final FCC action that will shorten these normal time frames. Don't be surprised to have as little as 30 days to file comments for those provisions of the law that require new FCC rules within 180 days (by early April, 1993), and even less time for provisions that require FCC action within 120 days (by early February).

Filing comments

Any company or individual is permitted to file comments in FCC rulemaking proceedings. Normally, a company's law firm or general counsel prepares and signs the filing, after input from other company representatives. It is not uncommon to see comments prepared by individuals on their own behalf, particularly in proceedings that deal with topics such as amateur radio, the home satellite dish industry or communications for the disabled. Normally, however, the FCC pretty much ignores comments filed by individuals.

Copies of comments filed by other parties can be ordered from a duplicating contractor who, for a fee, can retrieve copies of any document filed at the FCC. After reviewing the other comments, parties often file reply comments that disagree with the positions of other parties. Reply comments are normally due 30 days after the comments are filed, although for some of these cable proceedings you might be lucky to get 15 days. What's that you say? Not enough time? Just ask for an extension. The FCC will be happy to issue a response that boils down to "that's too bad."

The decision

Broad policy decisions at the FCC are made at the top—by the five commissioners. But complex details are decided by the staffers, and then ratified by the commissioners.

One or more staffers are assigned to read through the comments and the reply comments, and to prepare a summary of all the positions taken. They also prepare the first draft of a decision, which is reviewed first by their boss (usually a branch chief), and then sent up the organizational chain (the division chief, then the bureau chief, then the assistants to the commissioners). It is common for the draft to be sent back to the original staffer for rewriting several times along the way, although there won't be time for that with these Cable Act dockets.

The FCC decision in a rulemaking proceeding is usually called a Report and Order. It usually consists of a summary of the filed comments, a thorough discussion of each of the new rules and the rationale for adopting them, and then the full text of the new rules themselves. Just like an NPRM, the Report and Order must be adopted by a vote of the five FCC commissioners. While the new rules have the force of law, the Report and Order contains the background that tells what those legalistic words *really* mean.

Over the next few months, you can expect thousands of trees to be sacrificed so we may have copies of the many NPRMs the FCC adopts, and the comments that are filed by cable operators, broadcasters and electronics manufacturers. The FCC needs to move fast to start more than 20 proceedings that will lead to adoption of the new regulations required by the Cable Act. I hope you're a fast reader. CED

By Jeffrey Krauss, independent telecommunications policy consultant and President of Telecommunications and Technology Policy of Rockville, Md.

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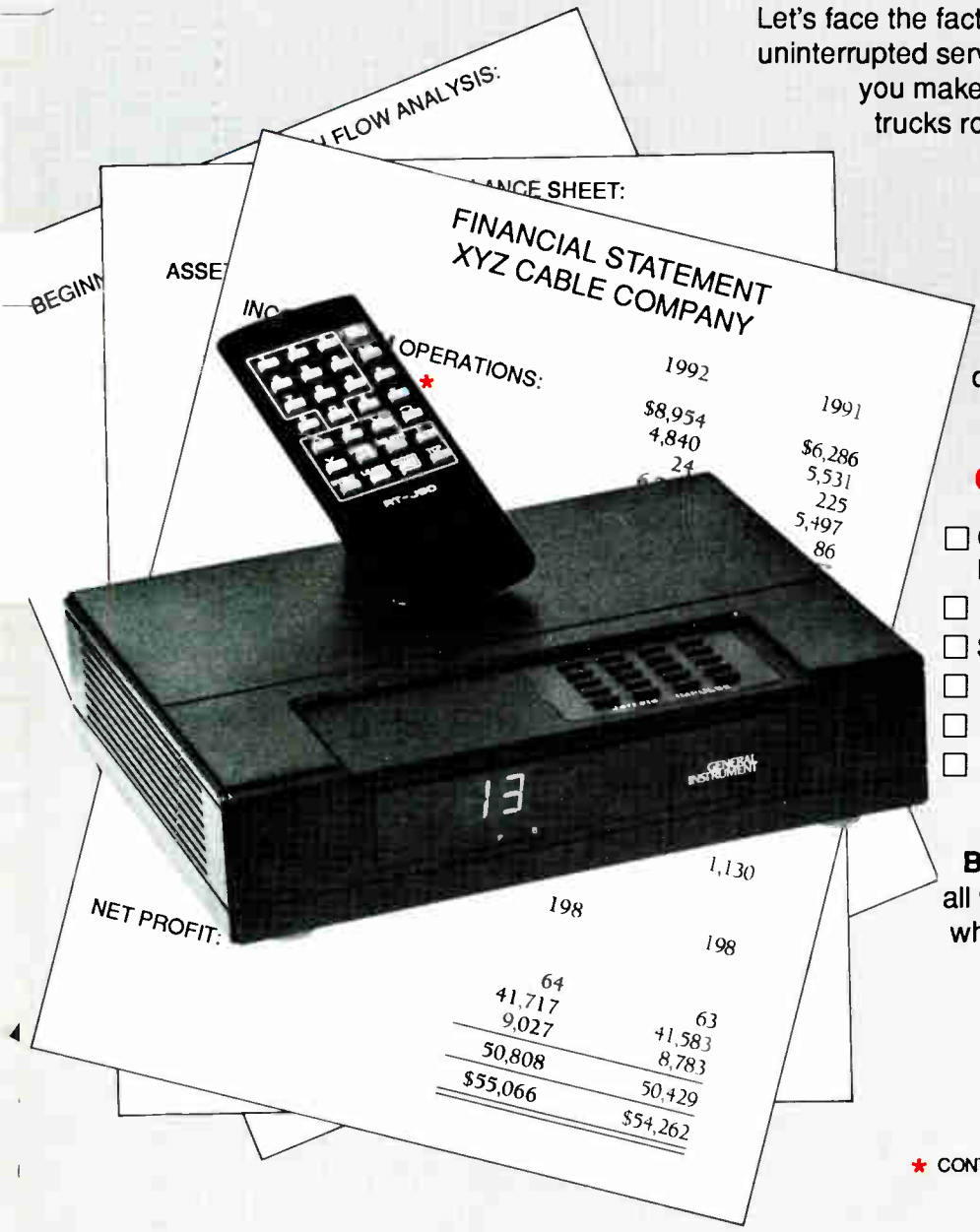

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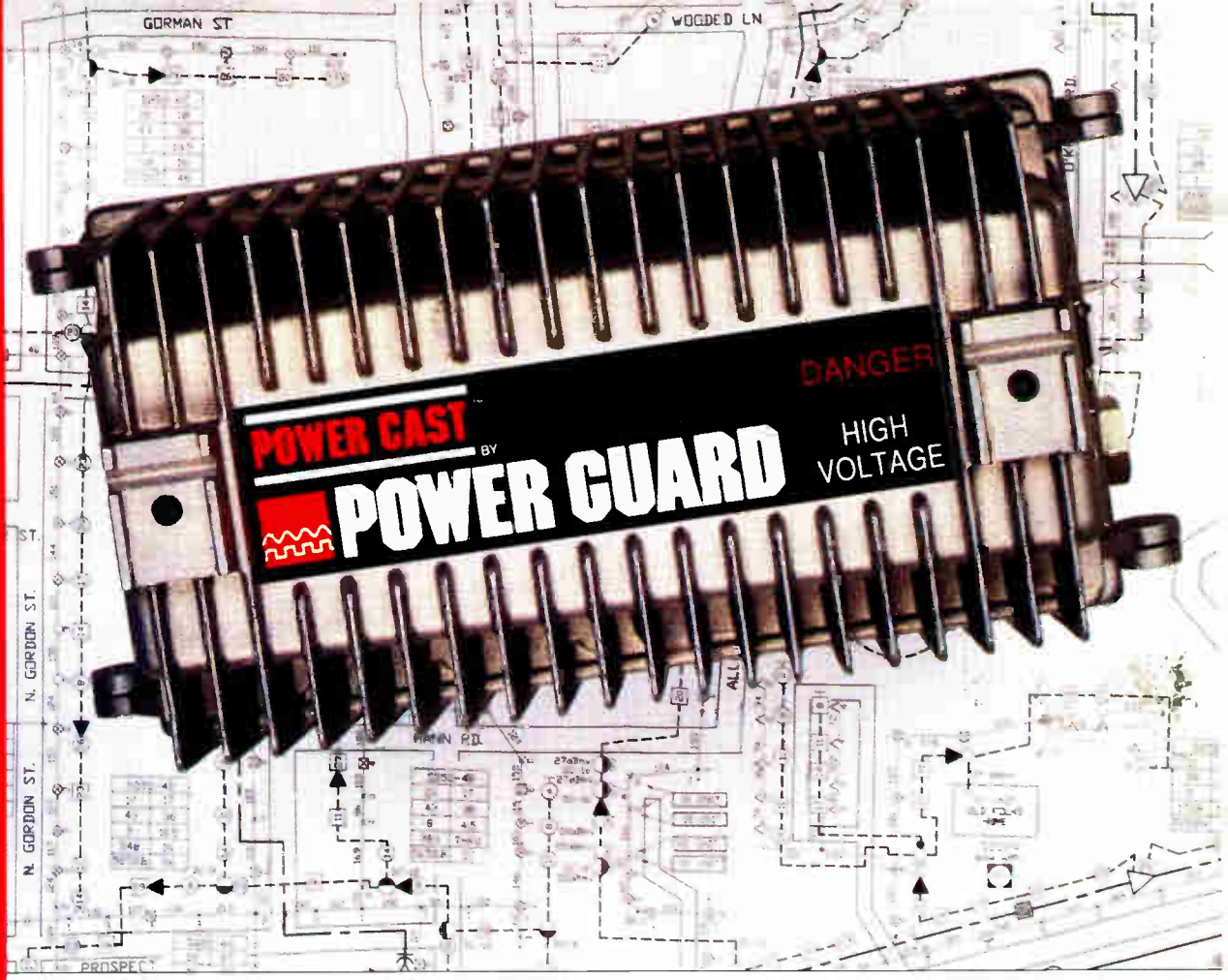

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