CED

THE MAGAZINE OF BROADBAND TECHNOLOGY / MARCH 1991

Is Your System Ready?

—Page 28

Give Your Subscribers Another Major Attraction.

The bigger the name, the bigger the attraction. It's what creates box office hits. Raises television ratings. Sells magazines. And makes Panasonic Cable Converters a major attraction to your subscribers.

Panasonic Cable Converters give you a unique selling advantage. Because Panasonic® is the most highly recognized name in the cable industry. The name customers select themselves for home and business electronics.

And Panasonic Cable Converters are designed for convenience and ease of use. With features like volume remote control, favorite channel memory, last channel recall, parental control and sleep timers. Plus all the quality and reliability you've come to expect from Panasonic.

Give your subscribers another major attraction. With Cable Converters from the company they're tuned into everyday. Panasonic.

For more information on Panasonic Cable Converters, call, NE 609-589-3063, MW 513-530-9216, SE 404-717-6845, W 415-736-4847

Panasonic
Video Communications

Reader Service Number 1

The Best Customers In America Deserve The Best Products.

Air.

The sophisticated dielectric of MC².

Conveys the signal faster. Undampened by foam. Without noise. Flat.

The air enclosed in short chambers. Hermetically sealed. Fully bonded to outer dielectric sleeve and center conductor.

Airtight. Inner strength and outer strength. Bending without creasing, cracking, leaking.

Wards off water. Or keeps it confined. No migration.

20% Fewer amplifiers needed over longer distances.

The Perfections Of Air Are Apparent

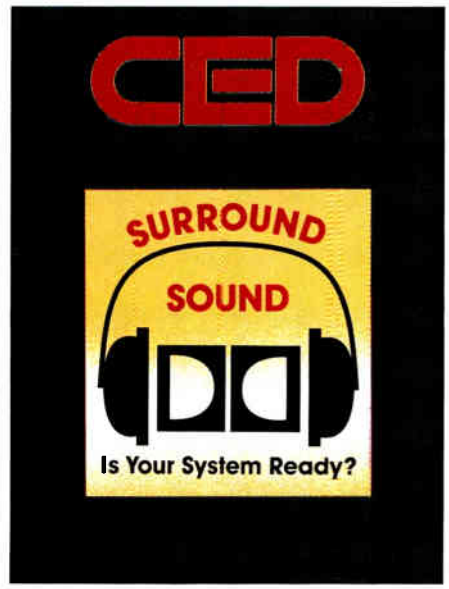
Trilogy COMMUNICATIONS INC.

Reader Service Number 2

Call or write for our free sample and brochure: TRILOGY COMMUNICATIONS INC., 2910 Highway 80 East, Pearl, Mississippi 39208
800-874-5649 • 601-932-4461

March 1991 | CED | Volume 17, Number 3

CED. (USPS 330-510) (ISSN 1044-2871) is published monthly except twice in May by Diversified Publishing Group, a Division of Capital Cities Media, Inc., 825 7th Ave., New York, NY 10019. ©March 1991, Volume 17, Number 3. Subscriptions free to qualified industry readers. All other U.S. domestic subscriptions are $48 prepaid. Foregin subscriptions are $69. for surface delivery or $96. for air speed delivery, prepaid in U.S. funds drawn on a U.S. branch bank. Second-class postage paid at New York, NY 10019 and additional mailing offices. CED is published on behalf of the cable television and broadband communications industries. POSTMASTER: Please send address changes to CED Circulation, P.O. Box 3043, South Eastern PA 19398. MEMBERS OF THE BPA.



About the Cover:
Surround Sound: Is your system ready? See page 28. Cover by Don Ruth

DEPARTMENTS

Headend Performance to Drive AM Fiber

Increased subscriber expectations and advanced television formats are creating new standards in RF performance. Conventional headend technology is becoming a weak link in advanced fiber distribution systems. That's why Nexus' engineers created the Series 2000 — to dramatically improve headend signal quality, reliability, maintainability and flexibility, to 1 GHz and beyond. See how you can maximize the potential of AM optical distribution — test drive the Nexus Series 2000 Headend System.

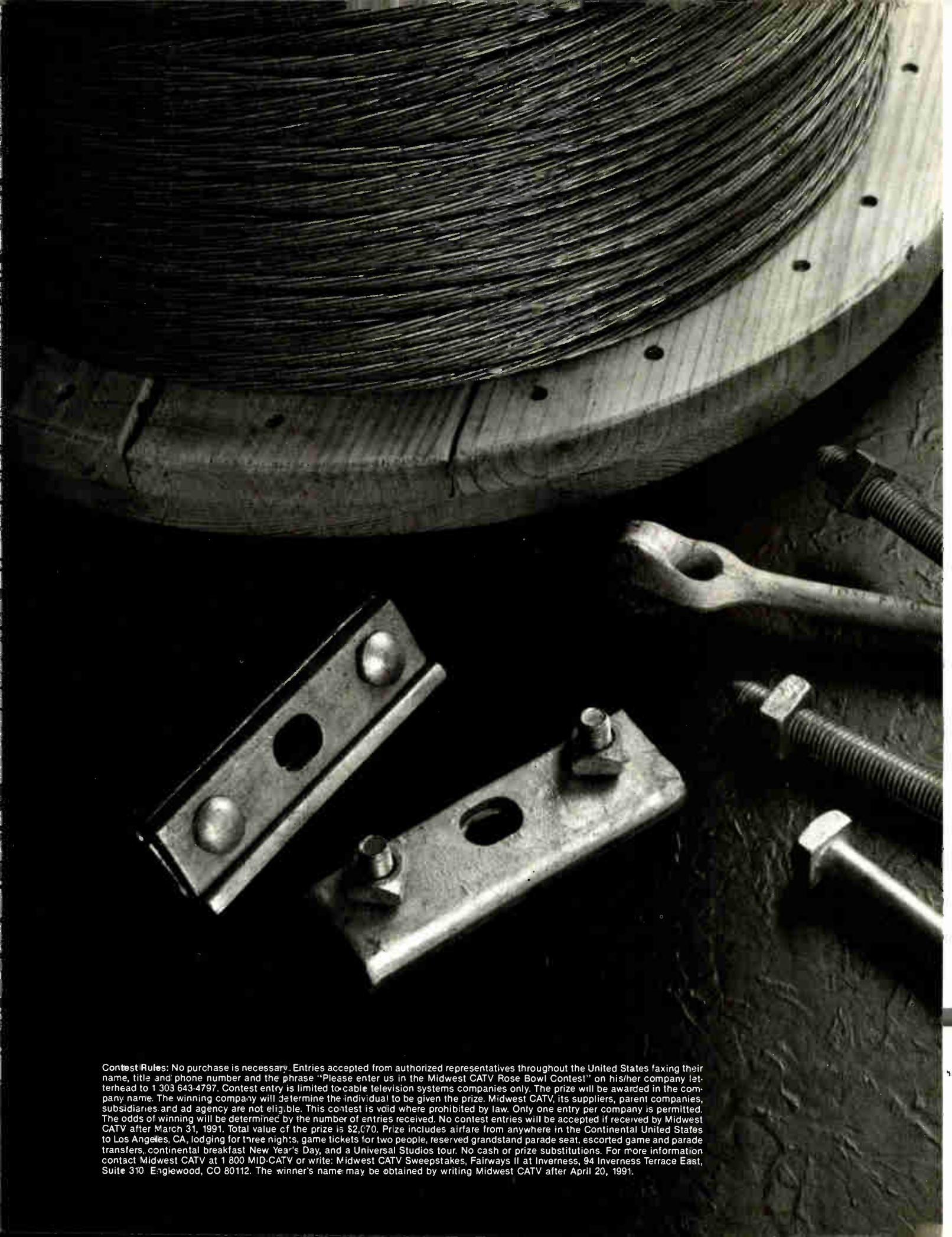
- +67 dB weighted SNR at 150 channels
- complete input signal format flexibility (including combined video and 4.5 MHz BTSC subcarrier)
- remote status monitoring
- computer controlled agile standby modulators
- fully redundant powering to each unit
- upgradable to all advanced television standards
- covered by the famous Nexus 5 year warranty

NEXUS
ENGINEERING CORP.

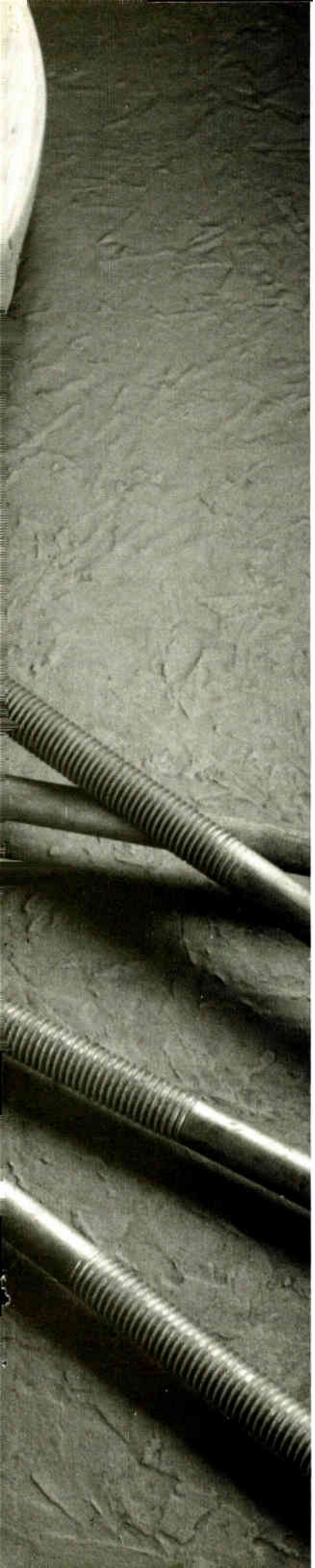
7000 Lougheed Highway
Burnaby, BC, V5A 4K4
Tel: (604) 420-5322
Fax: (604) 420-5941

Bellevue, WA
Tel: (206) 644-2371

Reader Service Number 3



Contest Rules: No purchase is necessary. Entries accepted from authorized representatives throughout the United States faxing their name, title and phone number and the phrase "Please enter us in the Midwest CATV Rose Bowl Contest" on his/her company letterhead to 1 303 643-4797. Contest entry is limited to cable television systems companies only. The prize will be awarded in the company name. The winning company will determine the individual to be given the prize. Midwest CATV, its suppliers, parent companies, subsidiaries and ad agency are not eligible. This contest is void where prohibited by law. Only one entry per company is permitted. The odds of winning will be determined by the number of entries received. No contest entries will be accepted if received by Midwest CATV after March 31, 1991. Total value of the prize is $2,070. Prize includes airfare from anywhere in the Continental United States to Los Angeles, CA, lodging for three nights, game tickets for two people, reserved grandstand parade seat, escorted game and parade transfers, continental breakfast New Year's Day, and a Universal Studios tour. No cash or prize substitutions. For more information contact Midwest CATV at 1 800 MID-CATV or write: Midwest CATV Sweepstakes, Fairways II at Inverness, 94 Inverness Terrace East, Suite 310 Englewood, CO 80112. The winner's name may be obtained by writing Midwest CATV after April 20, 1991.



Tackle a trip to the Rose Bowl courtesy of Midwest CATV.

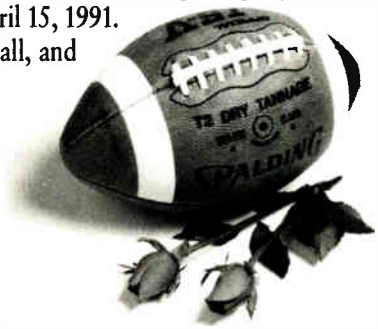
This month, the Midwest CATV Customer Incentive Contest is featuring a trip to the Rose Bowl! So, don't fumble your chance for some California sun, fun, and football.

You can enter the contest two ways. Option one is if you place your order for Florida Wire and Cable strand or hardware during March, your company is automatically entered. It's the best of both worlds. First, you get the highest quality strand made. Strand that's backed by 30 years of manufacturing experience, the industry's best warranty, and meets ASTM A-475 standards. Poleline hardware that conforms to ANSI C-135, NEMA and BELL specs. Products that have been hot dipped galvanized and made corrosion resistant. And, with a March order, you may win a trip to the Rose Bowl.

Option two for entering, is for you, the company's authorized representative, to fax us on company letterhead, via fax machine, your name, title, telephone number, and the phrase "Please enter me in the Midwest CATV Rose Bowl Contest." It's that easy!

Only one prize will be awarded. The prize includes roundtrip airfare from anywhere in the Continental U.S., lodging and tickets to the Rose Bowl in January, 1992. The winning company will be selected by April 15, 1991.

So get on the ball, and enter today!



MIDWEST CATV

a UNR Industries Company

More than supplies. Solutions.

1 800 MID-CATV

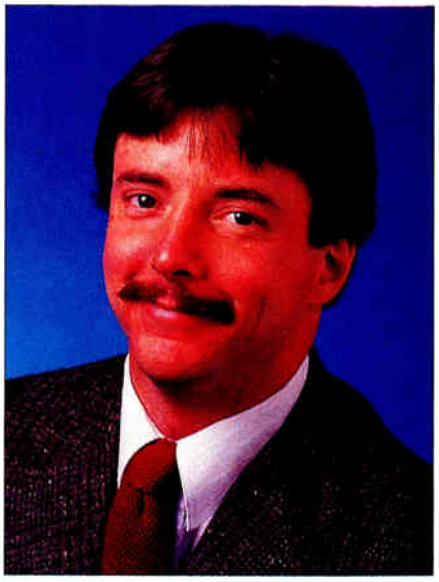
Denver, CO • Clarksburg, WV • Dallas, TX • Lafayette, IN
Ocala, FL • Phoenix, AZ • Pottstown, PA

Reader Service Number 4

Revisiting network redundancy

For cable operators who are used to the concept of less being more, the idea of network redundancy has been viewed as a needless, unjustifiable expense. And if one examines the history of CATV, it's easily understood why that notion is so. After all, CATV started as little more than a method to distribute broadcast television. Who could have predicted the American public would so fall in love with TV that it needed at least 35 channels?

When fiber optics burst on the scene, promises of increased bandwidth and improved pictures became the new rallying cry. A secondary benefit was a boost in reliability garnered through cascade reduction (even though the fiber backbone didn't reduce the overall *number* of active components, it just diminished the number *cascaded*).



Then, Jones Intercable and Rogers Cablesystems came up with revolutionary architectures that used redundancy as their cornerstones. Jones built fiber networks *in addition* to its existing coaxial systems and tied the two together with A/B switches (the Cable Area Network, it was dubbed). These switches kept signals flowing to subscribers even if the fiber network experienced a catastrophic failure.

Meanwhile, Rogers constructed elaborate bidirectional ring-type systems using FM and AM transmission schemes to deliver high-quality video and voice to residential and business customers. The rings ensured reliable signal delivery—an important part of voice provision.

Other U.S. operators, legislatively shut out of the voice provision business, focused on ways to integrate as much fiber into their networks for the lowest cost. Various iterations of fiber to the feeder concepts emerged and could be built at a cost rivalling traditional coax methods. A new quality benchmark had been reached for point-to-multipoint delivery of video entertainment.

Meanwhile, fiber electronics were found to be highly reliable. Early systems installed to back up microwave links themselves became the primary link, relegating microwave to the bench. As a result, redundancy was considered overkill. People privately began to wonder if the elaborate and more costly Jones and Rogers architectures were necessary.

But within the blink of an eye, cable MSOs were given the green light to pursue more than video. The door to Personal Communications Networks was opened, and the wireless technology has become the hottest blue-sky concept since videotext, attracting the attention of every major operator. Suddenly there was talk of numerous microcells, new pay-per-view ordering mechanisms and the possibility of voice and data provision.

It would seem that the redundancy argument should again rear its head as MSOs who operate in dense urban areas look toward American business centers as their new customers. Businesses demand digital, error-free and virtually 100 percent reliable data streams. Banks and other financial institutions bet their lives on it. They won't want to be customers without some form of insurance. So, what comes next for cable operators? The strategic thinker will be devising ways to make his system(s) more attractive to the new customer target—business and industry.

Roger J. Brown

Roger Brown
Editor

CED

William McGorry, Group Publisher
Robert C. Stuehrk, Associate Publisher

EDITORIAL
Roger Brown
Editor
Leslie Ellis
Managing Editor
Kathryn Berlin
Contributing Editor
George Sell
Contributing Editor

CONSULTING ENGINEERS
Chairman
Wendell H. Bolley, NCTA VP, Science and Technology

MEMBERS
Jim Chiddix, Senior VP, Engineering and Technology, ATC
Roy Ehman, Director of Engineering, Jones Intercable
Tom Elliot, Director of Research and Development, Tele-Communications Inc.
Jim Former, Principal Engineer, Scientific-Atlanta
Paul Heimbach, VP Engineering, Viacom Networks Group
Tom Jokerst, Regional Engineering Director, Continental Cablevision
Fred Kaiser, President, Alpha Technologies
Dave Lorge, Director of Engineering, Intermedia Partners
Robert Luff, VP Engineering and Technology, Jones Intercable
Ed Milner, VP Operations, Flight Trac Inc.
Joe Von Loan, Senior VP Engineering, CableVision Industries

PRODUCTION
Andy Cunningham, Production Director
Don Ruth, Art Director
Eloine Callahan, Production Manager

ADVERTISING
Cathy Wilson, National Sales Manager
Judy Medley, Account Executive

MARKETING AND SUPPORT
Michelle Pazar
Kendra Baldridge, SCTE Chapter Support

CIRCULATION
Michael Poplordo, Circulation Manager
Mary Keane, Fulfillment Manager

CAPTIAL CITIES/ABC, INC.
DIVERSIFIED PUBLISHING GROUP
Robert G. Burton, President
Dean E. Cherry, VP Finance
Mary Ellen Sack, VP Finance, CNC Group
Risa Leibowitz, Director of Finance
William McGorry, VP Group Publisher

OFFICE
Denver 600 S. Cherry Street, Suite 400, Denver, CO 80222 (303) 393-7449. Fax (303) 393-6654.

SUBSCRIBER SERVICES
(215) 630-9326

Sure to be cable TV's hottest rerun

SAM Jr. — back by popular demand

Wavetek is bringing back a classic: SAM Jr. This tough, proven, signal level meter offers a full tuning range of 10 to 450 MHz and wide measurement range of -35 to +60 dBmV.

Although most classics fall prey to price increases, this masterpiece returns with a price ***decrease***! SAM Jr. is the same, accurate, dependable SLM that we've produced in the past, ***but*** we're offering it at a reduced price of $840!

Standard features of the SAM Jr. include:

- Exclusive Lexan® case to withstand the roughest treatment
- Front panel calibration control for increased accuracy
- Gold plated attenuator switch contacts for longer life
- Rechargeable NiCad batteries and charger
- Completely waterproof when the lid is closed and latched

Let your subscribers enjoy the "classics" with the best cable performance. Contact your nearest representative or distributor for a free demonstration of SAM Jr. or any other Wavetek product.

800-622-5515

®Lexan is a registered trademark of General Electric Corporation.

Reader Service Number 5

WAVETEK®

The TVM450...

Full featured status indicator panel with automatic FCC offset and RF mute/PLL lock LED's.

Unique non-volatile microprocessor PLL tuning circuit allows only valid output channel selection.

LED RF channel output indicator is displayed in numeric CATV channels. RF channel output mutes during channel selection or catastrophic RF failures.

Front-panel controls are factory calibrated with precise center indents to guarantee exacting performance with minimum installation and set-up time.

No noise. No filters. No problems. No kidding.

Forget everything you've ever known about frequency agile modulators. You see, the TVM450 from Standard Communications is not a modulator. It's a revolution.

The TVM450 is the first 450 MHz frequency-agile modulator to challenge the RF performance of fixed channel modulators. The technically advanced PLL synthesized tuning process takes full advantage of Standard's High-Level Mixing (HLM). With six levels of filtering, and extremely stable RF circuitry, we can offer the industry out-of-band noise floor and spurious free performance previously available only with fixed frequency modulators.

The result?

Listen carefully. The final RF output signal meets all recommended NTC7 noise and spurious specifications for a 450 MHz CATV distribution system, and external bandpass filters are not required.

If you're thinking of rebuilding or upgrading your headend, this is one revolution you'll want to join.

On air. Off air. No error anywhere.

Inside the TVM450 is a non-volatile microprocessor tuning circuit which allows the utilization of a standard set-top converter channel format, while the optional PROM permits the installation of a custom set-top converter channel format. The TVM450 is frequency agile through Low VHF (2-6, Mid VHF (A-1), High VHF (7-13, Superband (J-W) and Hyperband (AA-ZZ). The front panel LED display indicates your real-life channel number, eliminating the need for look-up charts.

When the optional OAP450 off-air processor is added, the TVM450 becomes a internally phased-locked frequency agile off-air processor meeting all FCC offset and stability requirements.

It's a revolution.

Expansion slot allows options such as:
CSG60 integrated BTSC stereo generator module
OAP450 Off-Air I.F. processor module
CMA60 Monoral audio module
Internal space is provided for optional CRC450 RS232C remote control module

RF output purity, stability and video quality can be monitored with front panel video and RF output test ports.

FCC offsets are automatically selected via an internal microprocessor or custom programmed PROM. A rear panel switch is also provided for manual selection of required FCC offsets.

Left. Right. Mono. In Stereo.

The TVM450 Mono audio processing module features a 7-segment calibrated audio deviation meter, pre-calibrated front panel audio deviation control and an external BTSC input indicator.

With the unique integration of the GSG60 BTSC stereo encoder the TVM450 is the first agile modulator that puts stereo in its place.

Inside the Modulator!

This proven stereo unit will save you countless hours of tedious integration and set-up. The front-panel level controls are factory calibrated with precise center indents to guarantee exacting performance with minimum installation and set-up time.

For one unit, an entire headend or a complete network Standard's addressable Remote Alignment Control (RAC) option gives you multi-station access and status monitoring capability.

All of these powerful features are masterfully incorporated into one impressive piece of cabinetry. The front panel offers clear, precise control of all functions and direct reading of channel output.

When it's time to automate your headend, when it's time to rebuild or upgrade your headend there is no other choice.

The TVM450 is downright revolutionary.

Raise your standards.

Standard Communications

SATCOM Division
P.O. Box 92151
Los Angeles, CA 90009-2151
(213) 532-5300
(800) 745-2445
FAX: (800) 722-2329 (U.S.)
FAX: (213) 532-0397 (Int'l & CA)

Represented in Canada by:
DGH Communication Systems Ltd.
Scarborough, Ontario • 416/499-4746

Reader Service Number 6

CableLabs PCN conference attracts 100 industry leaders

More than 100 of the cable-television industry's most influential technical personnel gathered in Boulder, Colorado in mid-January for a Cable Television Laboratories information seminar focusing on personal communications networks (PCN) and their impact on cable systems. It was easily the largest seminar hosted by CableLabs to date.

PCNs, although not thoroughly defined, are digital wireless communications systems designed to allow users to make or receive telephone calls anywhere via an inexpensive handheld device.

In addition to information dissemination, the conference resulted in an information sharing agreement between CableLabs and Millicom Inc., a pioneering PCN and telecommunications company. According to a CableLabs press release, the relationship was established "to explore both the technical and economic feasibility...to validate the concept that the cable industry's infrastructure can play an integral role in the development and deployment of PCN services."

A number of issues surrounding PCN were discussed during the mostly tutorial two-day seminar, including PCN definition, vendor presentations, the regulatory environment, market projections and CATV's role in PCN.

Though little consensus was reached, MSOs shared information about their testing plans and heard from CATV equipment suppliers that "The building blocks are in place" to begin moving toward PCN implementation, said Richard Green, CableLabs president and CEO.

CableLabs has adopted PCN as its number-one priority in 1991, according to Green. Coordination efforts and information sharing is also ongoing with Canadian Cable Labs, which has been examining—and testing—PCN-like technology for several months.

The conference was the latest in a series slated by CableLabs that focus on important emerging technologies. The information sharing confabs are designed to help the industry build consensus and speak in a unified voice. They also keep technologists updated and aware of developing technology.

"It's important to be thinking and planning (for services like PCN) now that most operators have slowed down their rebuild agendas," said Nick Hamilton-Piercy, VP of engineering and technical services at Rogers Cablesystems in Canada. "That way, when construction begins, they'll be doing the right thing."

Gillett strikes out on own

In an announcement that took many by surprise, Thomas Gillett, formerly CableLabs' vice president of business development and technology transfer, left the R&D consortium and joined Media Management Services, a consulting firm. CableLabs will now be an MMR client.

Gillett said this venture will give him the opportunity to help cable MSOs explore PCN services and how they can be integrated into cable networks—something that was not possible when he was part of CableLabs, a membership organization.

Prior to CableLabs, Gillett was employed by GTE, for whom he designed the Cerritos project, and by AT&T.

GI, MIT to offer all-digital HDTV

Yet another advanced television proponent has joined the march toward development of an all-digital transmission format. The Massachusetts Institute of Technology has joined forces with General Instrument's VideoCipher division and formed the American Television Alliance.

The Alliance will jointly develop two digital simulcast systems and submit them for testing by the FCC. It wasn't immediately clear how the two systems will differ, but VideoCipher officials said they could share common elements but employ different scanning formats (such as interlace and progressive). The tests will take place during the time allotted for GI and MIT—September 1991 and March 1992, respectively.

"MIT wished to amend its FCC system submission to an all-digital format and, with our assistance, can now do so," said J. Lawrence Dunham, VideoCipher's president.

GI and MIT already share many common elements. Several VideoCipher executives and researchers received advanced degrees from MIT. Also, General Instrument has been a member of the Center for Advanced Television Studies, which in turn established MIT's Research Laboratory of Electronics, from which MIT's HDTV proposal grew.

NCTA slates 10 tech sessions

The National Cable Television Association's science and technology department has scheduled a full slate of 10 technical sessions during this month's National Show in New Orleans. Beginning late Monday, March 25 and continuing through Wednesday, March 27, the sessions focus on fiber optics, emerging technologies like digital transmission and video compression, as well as a panel on system plant expansion.

To assist you in planning your schedule while at the show, the tech session itinerary is listed below:

Monday, March 25
3 p.m. to 4:30 p.m., Room 43

Fiber optics performance. A discussion of fiber-optic system architecture and performance, measurement anomalies and product design relative to performance.

Topics and speakers:

- "All you ever wanted to know but were afraid to ask about measurement anomalies in broadband AM/VSB systems" by Edward Callahan, Anixter Technologies
- "Fiber optic cable designs: Advantages and disadvantages" by John Chamberlain, Comm/Scope Inc.
- "AM optical bridger networks for CATV" by Dr. Donald Raskin, Texscan Corp.
- "Impact of dispersion on analog video transmission" by Louis Williamson, American Television and Communications (ATC)

3 p.m. to 4:30 p.m., Room 44

At the end of the line: Cable, connectors and consumers. Issues of longevity, compatibility and standards in the house drop and its impact on subscribers will be discussed.

Topics and speakers:
- "F-connector corrosion in agressive environments—an electrochemical and practical evaluation" by Brian Bauer, Raychem Corp.
- "The RF bypass converter: An alternative broadband delivery mechanism" by Thomas Martin, Jerrold Communications
- "The 'Standard' inside wire" by Larry Nelson, Comm/Scope Inc.
- "Physical and media specifications of the CXBus" by Thomas O'Brien Jr., Jerrold Communications

Tuesday, March 26
8 a.m. to 9:30 a.m., Room 43

Fiber optic components. New developments for fiber optic components and their impact on system design and implementation.

Topics and speakers:
- "Lightwave multichannel AM/VSB video systems: Technology trends and limits" by T.E. Darcie, AT&T Bell Laboratories
- "An 80-channel high-performance video transport system over fiber using FM-SCM techniques for supertrunk applications" by Robert Kearns, GTE Laboratories
- "The role of a linearized external modulator in the video distribution network" by Yudhi Trisno, Jerrold Applied Media Lab
- "Stretching your fiber investment with new optical component technologies" by Curt Weinstein, Corning Inc.

8 a.m. to 9:30 a.m., Room 44

Picture quality testing. Panel focuses on various impairments and measurement methodology.

Topics and speakers:
- "Subjective assessment of cable impairments on television picture quality—a preliminary report" by Bronwen Lindsay Jones, Audio and Visual Perception and Psychophysical Measurement
- "A test system for controlled subjective testing of cable system impairments" by Joseph Waltrich, Jerrold Communications
- "Measurement differences with various chrominance to luminance gain and phase techniques" by Blair Schodowski, Scientific-Atlanta
- "Ghost cancelling and cable" by Nick Hamilton-Piercy, Rogers American Cablesystems Inc.

3 p.m. to 4:30 p.m., Room 43

Video compression. An overview of technical standards, specifications and applications in operating cable systems. Also discusses satellite environments.

Topics and speakers:
- "Scenarios for compressed video in cable practice" by Dr. Walter Ciciora, ATC
- "Suggested technical specifications for cable/satellite video compression systems" by Paul Heimbach, Viacom Networks Group
- "An overview of the JPEG and MPEG video compression specifications" by William Woodward, Scientific-Atlanta
- "A digital video compression system for satellite video delivery" by Michael Stauffer, Compression Labs Inc.

3 p.m. to 4:30 p.m., Room 44

Cable's challenges and opportunities—international and domestic. Covers new network configurations, construction techniques, and requirements that provide challenges. New applications, such as UHF carriage, PCNs and high-speed data are also discussed.

Topics and speakers:
- "PCN in cable-TV's stategic plans" by Archer Taylor, Malarkey-Taylor Assoc.
- "Technical issues in delivering programming to the international marketplace" by Wes Hanemayer, Turner Cable Network Sales
- "CATV construction—European style" by Machael Jones, Comm/Scope Inc.
- "User-friendliness: Technology and services" by Michael Dufresne, Les Enterprises Videoway

Wednesday, March 27
8 a.m. to 9:30 a.m., Room 43

System operations: Old and new technologies. Recommendations are provided for outage reduction, fiber operations and satellite changes.

Topics and speakers:
- "Outages: The issue of the '90s" by Bradley Johnston, Warner Cable Communications
- "Automatic level control issues in AM fiber systems" by Frank Little, Scientific-Atlanta
- "Field testing of fiber optic cable systems" by K. Charles Mogray Jr., Comm/Scope Inc.
- "Cable satellites: The next generation. Issues facing cable operators and programmers" by Robert Zitter, Home Box Office

8 a.m. to 9:30 a.m., Room 44

Digital video techniques and their applications in the cable system. What does digital signal transmission mean to the cable system and how is it applied?

Topics and speakers:
- "Digital video: Whatever happened to differential phase and gain" by Gerald Robinson, Scientific-Atlanta
- "A broadcasting industry perspective on digital HDTV" by Michael Rau, National Association of Broadcasters
- "Performance of digital modulation methods in cable systems" by Leo Montreuil, Scientific-Atlanta
- "The DigiCipher HDTV system: A cable perspective" by Robert Rast, General Instrument VideoCipher Division

11 a.m. to 12:30 p.m., Room 43

CableLabs update. CableLabs staff update on various projects.

Topics and speakers:
- "Advanced television research activities at CableLabs" by Craig Tanner
- "CableLabs 1991 advanced network development work" by Stephen Dukes
- "CableLabs science and technology for the CATV industry" by Thomas Elliot
- "Cable and the consumer electronics industry" by Claude Baggett

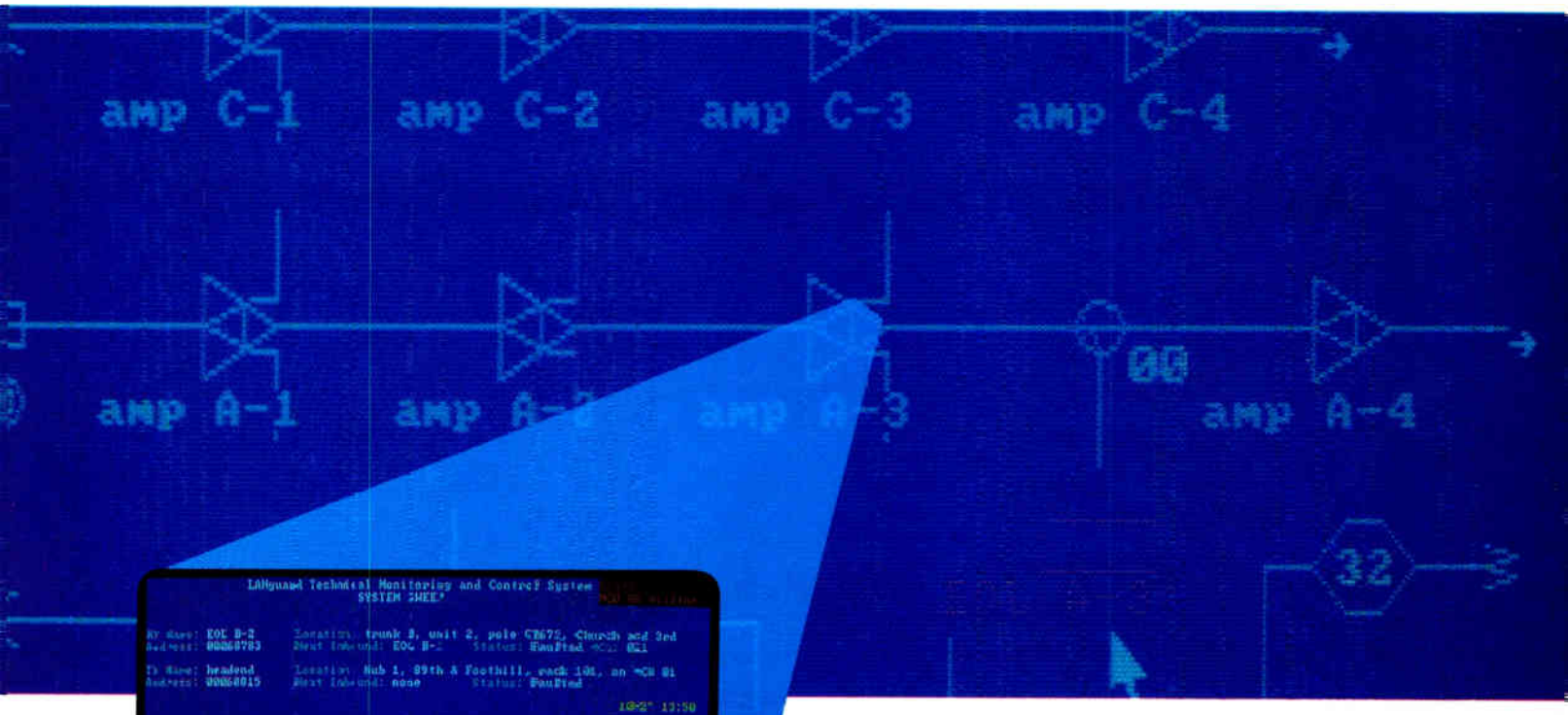
11 a.m. to 12:30 p.m., Room 44

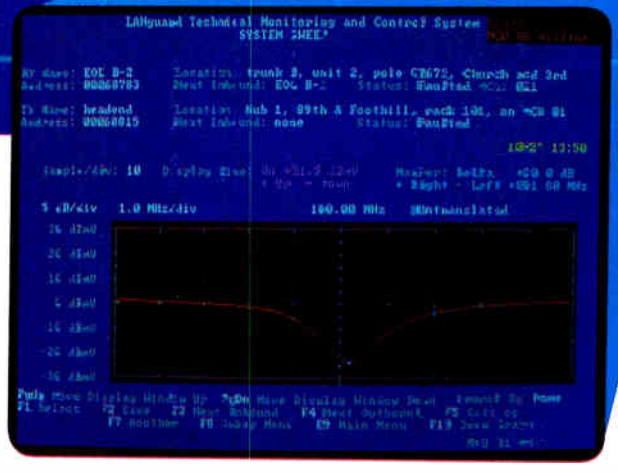
Plant builds, rebuilds and expansion: Are you ready?. The constant quest for practical system upgrades is discussed.

Topics and speakers:
- "Rebuilding and upgrading coaxial distribution networks with amplified taps—a highly reliable, cost-effective approach to building gigahertz-plus plant" by James Chiddix, ATC
- "Future hybrid AM/digital CATV systems" by David Grubb III, Jerrold Communications
- "Amplifiers for future networks" by Colin Horton, C-Cor Electronics
- "550-MHz upgrades with fiber: Selecting cost-effective architectures" by Jay Vaughan, ATC ■

—Roger Brown

Pinpoint Potential Problems *Before* They Happen...





Actual screens from the LANguard™ system depict topology and sweep analysis displays.

...With LANguard™ Status Monitoring

Using LANguard™ can mean the difference between facing irate subscribers due to prolonged service down time and having satisfied customers enjoying quality reception with minimal interruptions.

LANguard's™ ability to spot trouble before it becomes a problem is due to its many sophisticated, yet easy-to-use features including:

- ❑ Support For *All* Amplifiers and Power Supplies
- ❑ Auto Sweep and Spectrum Analysis
- ❑ Agile Frequency Monitoring
- ❑ Ability To Monitor Multiple Systems Simultaneously

plus much more...all without interrupting your signal.

With regulation on the horizon, you realize the importance of service excellence...and you can see the savings potential that comes with knowing exactly where breakdowns occur. More importantly, you have the peace of mind knowing that you can catch problems before they occur as LANguard™ watches each of your signals in relationship to the specifications *you define*.

LANguard™ status monitoring has a proven track record with many large corporations that depend on their network's integrity (downtime can literally cost them thousands of dollars *per minute*).

If you would like this kind of quality assurance for your CATV system, call us at (215) 536-1354 today. A FREE demo diskette is available that shows you, first hand, how powerful and how simple LANguard™ is to use for status monitoring excellence today... tomorrow...and for many years to come.

AM is vendor independent, providing components for virtually every CATV configuration.

AM Communications, Inc.
1900 AM Drive
P.O. Box 9004, Quakertown, PA 18951-9004
Phone: (215) 536-1354 Fax: (215) 536-1475

Reader Service Number 8

Brad Johnston

Leading Warner into the '90s

If there was a dictionary entry for "cable's customer service watchdog" a photo of Brad Johnston would likely accompany it. Johnston, senior VP of technical operations for Columbus, Ohio-based Warner Communications, enjoys climbing up on the soapbox and preaching the customer service gospel—which he certainly has the latitude to do. Among the feathers in his Warner cap is responsibility for engineering, human relations, purchasing, project management and customer service—quite a varied mix. "It gives me an excuse to do anything I want," Johnston laughs.

What Johnston wants is a more focused and manageable effort at serving Warner's more than one million subscribers. "I believe what drives the financials of the business, in the long term, is paying attention to the customer."

To do that, Johnston developed a comprehensive customer satisfaction program that touches on virtually all areas affecting the subscriber—installations, service calls, customer service, outages and picture quality. "To me, the first ingredient is the establishment of some standards. That's done in a very definitive way, and that information is relayed to the systems. We ask for their commitment and measure it constantly. It's not easy," Johnston says. "It takes a lot of detail."

The second ingredient to Johnston's customer satisfaction recipe is training. "The standards are just half the picture," Johnston continues. "Then you have to tell your people how to do it. This industry hires people for jobs knowing full well that they don't know how to do the job. It's incumbent on us, then, to give them training.

Two years ago, Johnston initiated a wage survey of Warner's customer service arm because he wondered if CSRs were being paid enough "for all the things we wanted them to do." The survey prompted an immediate increase in the wage scale of Warner's customer service staffers. "Then we said, 'Get your people certified and we'll move the salary ranges up again.' The systems did that, so this year we moved the (wage) grades up another level," Johnston says.

Interestingly, Johnston tied management bonuses to the standards/training program, instead of relying solely on bottom-line economic performance. "Overall customer satisfaction has to be an operating standard. It just has to be," Johnston emphasizes. "Tell the field what's important in a well-defined and measurable way, and they'll make marvelous progress. That's been proven at Warner."

Revelation

A relative newcomer to cable television, Johnston came to the industry in 1982 from Westinghouse Corporation, where he had spent 16 years working on naval defense projects. Armed with an electrical engineering degree from Michigan Tech, he spent 10 years with Westinghouse before going back to college to pick up a master's from MIT—where had an interesting revelation. "While at MIT, I had a chance to look around me and say, gee, what else goes on in the world? I decided that I'd really like to get involved in a non-defense business."

Johnston's goal to get out of the defense business eventually led to his decision to join Westinghouse's Group W Cable venture in 1982, where he joined the engineering force at New York City-based TelePrompter. Then, in 1986, he moved to Columbus to join Warner Cable.

Always taking the customer's side, Johnston quickly made note of subscriber grumblings about the presence of a converter in the home that "limits the subscriber's ability to use their VCRs, television sets and remote controls." So, in 1990, Johnston was instrumental in selecting and overseeing Warner's first interdiction installation in the company's Williamsburg, Va. system. "We wanted a system that would deliver a broadband signal into the home in a way that would directly interface with home entertainment equipment. Interdiction fit the bill," Johnston says.

Now that interdiction has "proved itself technologically," Johnston plans to install the technology in Warner's Akron, Ohio system this July to "see how it can change the financials of the business." The plan is to examine how interdiction will affect additional revenue—by packaging cable more cleverly.

More interdiction tests

"The test in Akron will be designed to find out what effect interdiction will have on economics, penetration, pay rates and buy rates on PPV," explains Johnston. "Why, we could even sell PPV event to non-subscribers, so long as they have a drop in the home. The technology allows us to package our goods in a much easier way, with more variety. We're moving into a much more transactional environment, and this technology is much more amenable to that."

When not speculating about cable television, Johnston is at home with wife, Peggy. An admitted gadget junkie, 50-year old Johnston chuckles as he rationalizes his purchases of a video disc player, surround sound decoder, personal computer and other hi-tech products because "I'm in the business." The Johnstons have two daughters—one in pre-medical college and one a junior in high school.

When asked about future projects, Johnston quickly dons his consumer advocate hat. "My pet peeves for '91 are billing problems and system outages," he warns. To that end, Johnston plans to lend his time and energy to CableLab's outage reduction task force, to which he was recently appointed chairman. And with his track record, Johnston will likely make major strides in that arena. After all, with his standards/training program firmly on its feet, all that's needed is a few more ingredients to stir up a reliable, measurable vision for cable's role in the 1990s. So—stand back. Johnston's on the soapbox again. ■

—Leslie Ellis

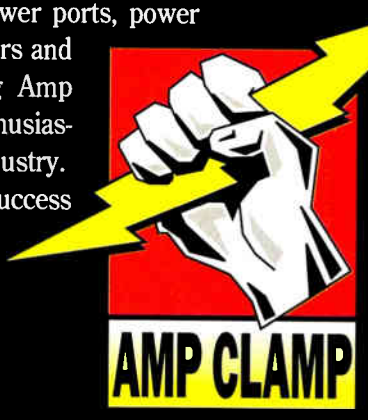
CAVEAT AMPTOR!

THERE IS ONLY ONE AMP CLAMP!

Since Alpha Technologies developed the Amp Clamp several years ago, lightning and surge damage to cable TV line equipment has been reduced by up to 90%. With installations approaching 100,000 units, and versions available for amplifier power ports, power inserters, splitters, couplers and taps, Alpha's pioneering Amp Clamp has gained the enthusiastic endorsement of the industry.

Let's face it, this kind of success invites imitation. And it invites concern that replicas of the original may not live up to Alpha's high standards of quality, workmanship and, most of all, performance.

When it comes to effective, reliable surge protection, there is only one Amp Clamp. And when it comes to complete power protection, there is only one company you can count on to back you up — Alpha Technologies.



USA
3767 Alpha Way
Bellingham, WA 98226
(206) 647-2360
Fax: (206) 671-4936

ALPHA TECHNOLOGIES

We're here to back you up.™

CANADA
5700 Sidley Street
Burnaby, B.C. V5J 5E5
(604) 430-1476
Fax (604) 430-8908

Advanced TV status report

As the world continues to debate and discuss the future of high definition television and how each of the significant players (such as cable, broadcast, satellite and videotape) will deal with the ultimate decision by the FCC on a proposed system, perhaps it is appropriate for us to take a moment and review the score sheet.

Fewer proponents

The last time I visited this subject in this column (*CED*, October 1990, p.18) there were 20 proponents to be considered. As the first of the test dates approaches (April 12, 1991), the field has narrowed to a total of six proponents. Of these six, four have announced they will test an all-digital system, and two will test analog systems. In the order that they will be tested, the remaining proposed technologies and their representatives are:

- Advanced Compatible Television (ACTV), David Sarnoff Research Center
- Narrow Muse, NHK (Japan Broadcasting Corp.)
- DigiCipher, General Instrument Corp.
- Spectrum Compatible HDTV (SC-HDTV), Zenith Electronics
- Analog Simulcast HDTV, North American Philips Consumer Electronics Co.
- Channel Compatible HDTV, Massachusetts Institute of Technology.

Recently, Zenith and North American Philips notified the Advisory Committee on Advanced Television that they would replace the analog-based systems previously submitted with all-digital systems for their proposed test date.

Testing of the digital systems is subject to certification by the Advisory Committee's system subcommittee. The ACTV system and the Narrow Muse system are both all-analog systems. If pre-certification and other details work out the way the respective proponents expect, then the DigiCipher, Zenith, Philips and MIT systems will all be fully digital.

Two camps

The four digital systems fall into two camps when it comes to scanning format. The 1050 lines, 59.94 field rate with a two-to-one interlace (1050/59.94, 2:1) camp includes both DigiCipher and Philips proposals, while the 787.5 lines, 59.94 field rate, one-to-one interlace (787.5/59.94, 1:1) camp includes the Zenith and MIT proposals.

Further, the ACTV proposal offers 525/59.94, 1:1 while the Narrow Muse plan is the famous 1125/60, 2:1. If all goes according to plan, the first system (currently ACTV) will begin testing at the Advanced Television Test Center (ATTC) in Alexandria, Va. on April 12, and the last system to be tested (MIT) will finish its testing on April 30, 1992. In between those two dates there will be tests by the ATTC on a test bed designed to simulate typical broadcast technology, and tests by Cable Television Laboratories Inc. on a special cable test bed built to deal with our concerns. In addition to the objective series of tests, there will be subjective viewing tests which will be conducted in Canada at the Advanced Television Evaluation Laboratory in cooperation with the ATTC and the FCC's Advisory Committee on Advanced Television.

There are many things which could impact the pacing of these tests. Although the dates mentioned above are agreed to with committed test slots for each proponent, not all segments of the project are exactly on schedule. One of the most important parts is the preparation of the image material which will be converted into television signals and then sent through the various test beds by each proponent system.

Video wrangling

This material was the subject of great debates about how it would be captured, what medium would be used, what format would be used, what the subject matter would be, who would decide what the subject matter would be and how much of each kind of subject would be captured and preserved. After all of the wrangling on these details, it is no wonder that the actual shooting of the sequences has gone slower than originally expected. Nonetheless, there are many professionals working diligently to get that part of the project back on schedule. Luckily, these are some of the best production people in the business and while their task is formidable, their talents are impressive and I have no doubt that the job will be done.

Once that material is ready and the tests begin, the humdrum but vital matter of day-to-day logistics will take on great importance. Each of the proponents has a move-in date prior to their scheduled test slot. The schedule is arranged to allow approximately 38 working days for the simulcast HDTV systems and approximately 43 days for those systems that involve EDTV or advanced NTSC systems.

Schedule is tight

Also, there is a certain amount of time at the end of the test period for each proponent to disassemble its equipment and pack it up for shipment before the next proponent moves its gear into the test beds. In addition to the video tests, we can't forget that audio is a part of this whole project—and that represents another part of the process that must be dealt with.

All in all, this schedule, spanning an entire year, is tight. It is designed to reflect the desire for a smooth operation with proponents making maximum utilization of the ATTC and CableLabs test facilities. At the same time, it is important that each proponent has a chance to show what it can do under circumstances that are as nearly equal as they can be.

Tied into this entire process are the field tests, which must be conducted by both broadcasters and cable operators. That information must be made available to the Advisory Committee, for use when it decides which proponent system is the best for all of the distribution systems delivering this new type of signal to the consumer in the next decade. ■

By Wendell Bailey, Vice President Science & Technology, NCTA

OPTICAL SOLUTIONS THAT OPTIMIZE PERFORMANCE.

Magnavox has a line of sophisticated fiber optic products, including transmitters, couplers and receivers, that work in unison with your RF equipment to bring cost-effective fiber optic quality to your coaxial system. The result is a system with higher subscriber satisfaction and plenty of room to grow.

AM fiber optic products are currently available in rack mount and strand mount configurations.

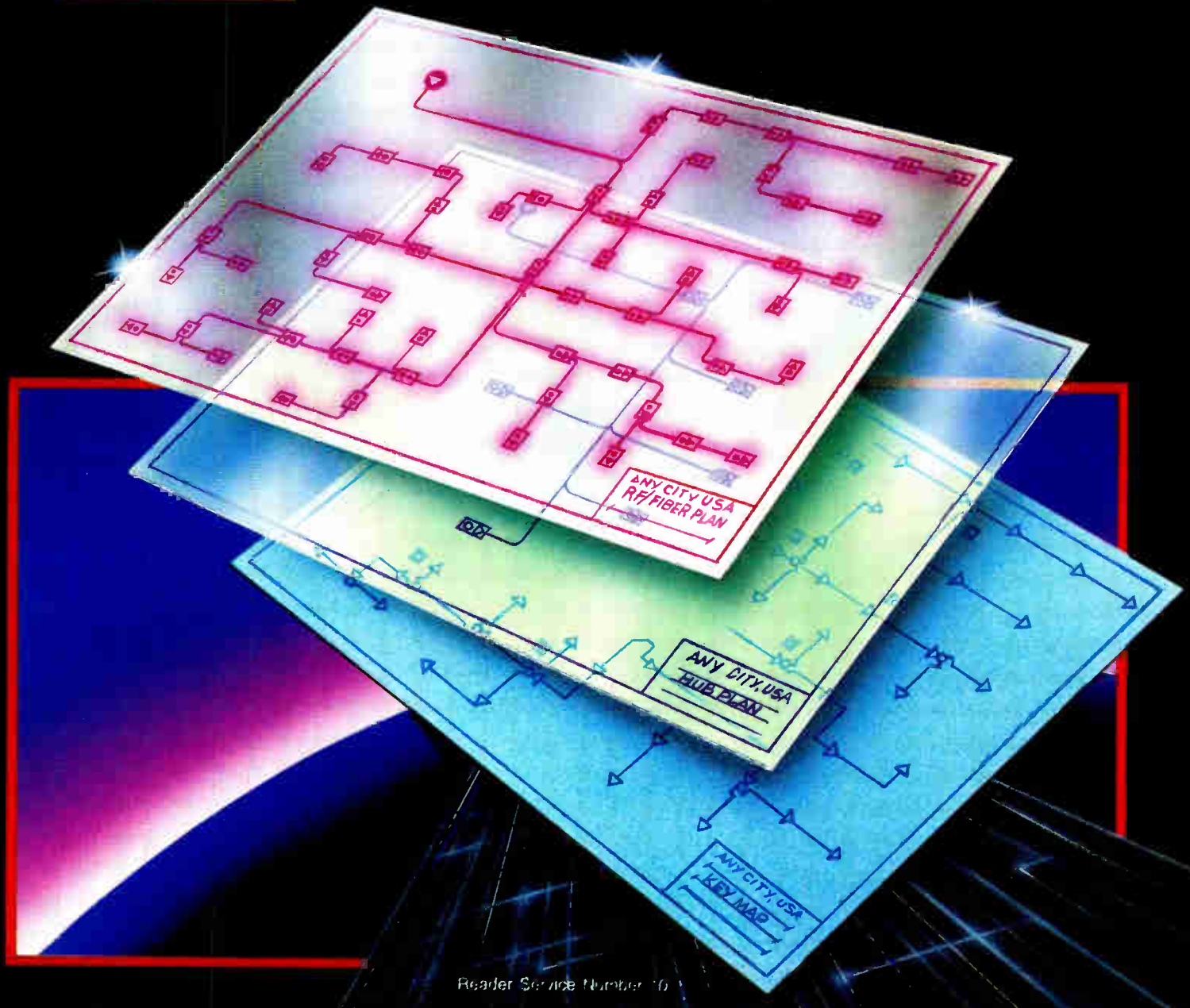
By upgrading with fiber optics you boost system capacity, reliability, quality and profits. By using Magnavox you get a quality system designed by fiber optic professionals.

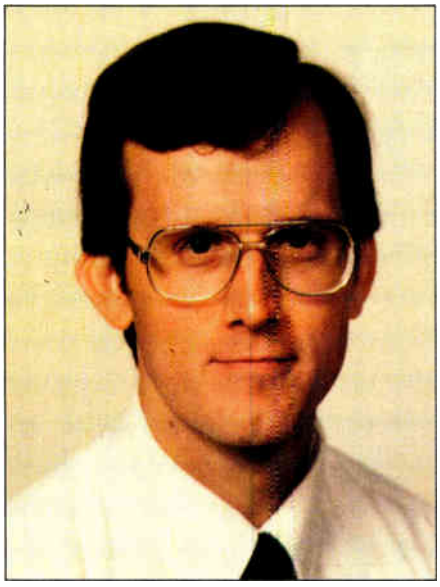
So, bring your cable system into the 21st century with the Magnavox Fiber Optic System. Call your Magnavox representative to find out more.

MAGNAVOX

CATV SYSTEMS, INC.

100 Fairgrounds Drive, Manlius, NY 13104
(315) 682-9105 Fax: (315) 682-9006
Call 1-800-448-5171 (In NY State 1-800-522-7464)





Introduction to digital

Digital transmission is fast encroaching on the analog audio and video worlds with which we have become so familiar. MSOs in conjunction with audio program providers and the major equipment manufacturers, are now launching new digital audio services. In addition, excitement about the application of compressed digital video in the broadcast, DBS, and CATV environment is spreading like wildfire throughout these industries.

With all of the excitement in these new technologies comes the inevitability of new buzzwords. Channel impairments that used to contribute directly to a degradation in video or audio quality now contribute to "bit errors" in a digital bit stream; system carrier-to-noise ratio (C/N) discussions have now gravitated to discussions of bit-energy-per-noise-power-density ratio (E_b/N_0, commonly called "E-B over N Zero"); satellite link threshold-extension discussion have likewise given way to high level discussions of various forward-error-correction (FEC) and error concealment schemes. AM-VSB and FM are being discarded for a plethora of digital modulation formats like QPSK, OQPSK, QPR, QAM, 16-QAM, etc. Because of the importance of digital transmissions systems to the future of the entertainment industry, I felt it would be a good idea to begin defining some of these buzzwords, thereby making them a little less foreign to the newcomer.

By Chris Bowick, Vice President Engineering for Headend Equipment, Scientific-Atlanta, Inc.

In the satellite environment for analog video and audio, for example, we have become familiar with the requirement to maintain reasonably high values of carrier-to-noise density (C/N_0) for good quality entertainment video and audio. Low values of C/N_0, close to the FM demodulator's threshold, can cause impulse noise "hits" or spikes in the video which can show up as either black or white "sparklies" in the picture. Of course, as the C/N_0 degrades even further below threshold, the impulse noise becomes so great that the picture can actually become lost in the noise.

In the digital realm, it may not be quite so obvious what might happen when the satellite link degrades[1]. In this case, the video and audio information. In this case, the video and audio information are carried as a serial stream of "bits," with each bit capable of taking on either one of two values, 1 or 0. As the noise in the link increases, one obvious result would be that the receiver is unable to distinguish between a 1 and a 0, producing what is commonly referred to as a bit-error. That is, a 1 is mistaken for a 0 or vice-versa.

If you divide the number of bit errors that occur by the number of bits transmitted you end up with a figure-of-merit for digital transmission called bit-error-rate (BER). In the digital *audio* realm, these bit-errors, if left uncorrected, could produce "clicks" or "pops" in the audio. In the digital *video* world, bit errors cannot be so easily described because of the multitude of video compression schemes being proposed—some being more susceptible to bit errors than others.

Some video compression systems may exhibit "impulse-like" noise with uncorrected bit errors, while others may tend to lose entire frames or significant portions of frames.

Error correction

One of the nice things about digital transmission is that many of the bit errors that may occur in a marginal link can actually be corrected or at least concealed from the viewer or listener. Various Forward Error Correction (FEC) schemes exist, for example, which allow the originating facility to add redundant bits to the transmitted digital information to aid the receiver in detecting when a bit-error has occurred.

If there are only a few errors, it is usually possible that the FEC code can actually correct the bit-error. Adding these redundant bits will, of course, increase the transmitted data rate, but it does allow for a far more rugged transmission system. The amount of FEC required in a system is dependent upon a number of factors, including the anticipated operating BER, and the importance of the information being transmitted.

You can imagine, for example, that error correction would be extremely important in digital transmission systems in which business data (i.e. money) transactions are taking place over the link. In this environment a bit-error simply cannot be tolerated.

As a result, extravagant FEC schemes would be utilized with one or more redundant bits transmitted for every data bit.

Here, the overhead for FEC could be as much as 100 percent or more, thereby doubling the transmitted data rate. For entertainment applications, however, the transmitted data is not as critical, and FEC overheads of 10 percent to 30 percent may be used.

Error concealment

In situations where there are simply too many errors to be corrected, especially in entertainment applications, there are additional methods that can be used to detect errors and conceal (rather than correct) them from the viewer or listener. This can be done by recognizing the bit-error and then interpolating between two "known-good" values, or substituting a previous "close" value such that the concealment is reasonably transparent to the viewer or listener.

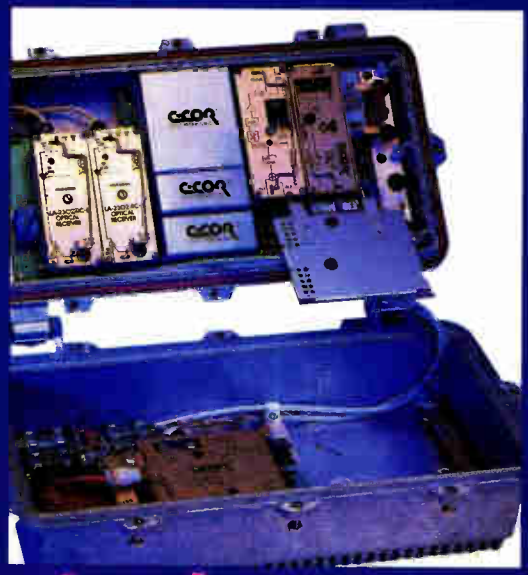
In the analog satellite applications, we maintain good signal quality by establishing and maintaining a reasonably high value of C/N_0. Similarly, in digital applications, we can improve the uncorrected BER by setting and maintaining a reasonably high value of E_b/N_0. Next month, we'll examine this important relationship between C/N_0 and E_b/N_0 in the analysis of the BER digital links. ■

Reference

1. Rovira, Lu, "Internal Technical Paper," Scientific Atlanta.

AM

Fiber optic transmission systems. Designed for the future. Available today.



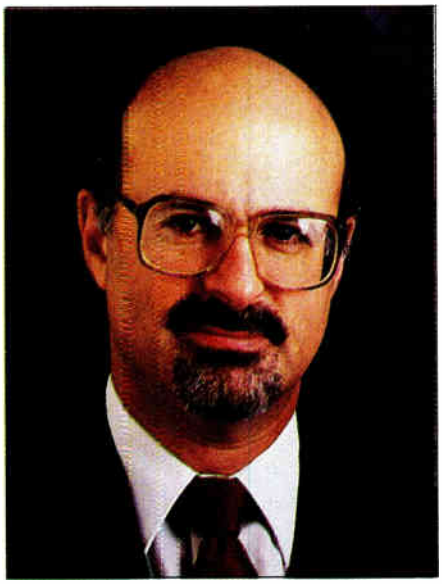
Flexible enough for all AM architectures. Simple enough for installation by RF technicians - no special AM training required. Reliable enough to carry the C-COR name.

Call today for more information about C-COR's comprehensive fiber optic product line.

C-COR ELECTRONICS INC

A World of Advanced System Technology

C-COR Electronics, Inc. 60 Decibel Road State College, PA 16801-7580 USA
814-238-2461 / 800-233-2267 / FAX 814-238-4065



Home taping of digital audio

In 1984, the Supreme Court affirmed that home taping of video programming is a legitimate activity that does not infringe on the rights of the copyright owners. You might have thought that decision, *Sony Corp. v. Universal City Studios Inc.*, had laid to rest the home taping controversy.

But no, here it comes again, and this time the focus is taping of audio rather than video. The issue has come up in the context of digital audio services and a home listener's ability to make "perfect" digital copies.

In 1988 and 1989, there was a controversy over home taping using new Digital Audio Tape (DAT) recorders. The recording industry was worried about home copying of music that was pre-recorded on DAT tapes and compact disks. That controversy was partially resolved by an agreement between the recording companies and the DAT manufacturers to incorporate a copy-management scheme into DAT recorders and DAT tapes. Nobody was thinking then about the home taping of CD-quality music delivered on digital cable TV channels or digital radio broadcasting services.

Of all the issues in this controversy, the central issues are whether digital audio broadcasting (DAB) will result in increased home taping, and whether record companies and artists will lose money if increased home taping cuts into record sales.

By Jeffrey Krauss, Independent Telecommunications Policy Consultant and President of Telecommunications and Technology Policy of Rockville, Md.

The forum for this current debate is the United States Copyright Office. The Copyright Office is an arm of the Library of Congress. The Copyright Office is responsible for registering copyrights, and it also acts as a policy advisor to the Congress. Acting in this advisory role, the Copyright Office issued a Notice of Inquiry last October on DAB and home taping.

The Copyright Office sought comments on a variety of issues including whether DAB will stimulate home taping, whether home taping of DAB will displace album sales, and whether there should be a copyright royalty tax imposed on sales of home taping equipment or blank recording media. The outcome of this inquiry could be a recommendation to the Congress on the need for new copyright legislation.

The industry players

Two sides have formed, one supporting home taping and one opposing it.

One side is led by the Home Recording Rights Coalition. HRRC includes a number of consumer electronics equipment manufacturers (Sony, Matsushita, Tandy, Thomson), tape manufacturers (3M, BASF, Ampex) and retailers (Sears). HRRC is "dedicated to promoting the public's right to use recording equipment for their personal edification and entertainment." The primary moving force behind the HRRC is the Consumer Electronics Group of the Electronic Industries Association.

Although the cable industry did not take a position, its interests clearly lie with HRRC. Consumer freedom to tape music broadcasts can help stimulate the growth of the new digital cable music services.

The other side is led by the Recording Industry Association of America (RIAA), which represents the recording companies; the American Society of Composers, Authors and Publishers (ASCAP), representing writers and publishers; and the AFL-CIO.

In addition, a new group (cleverly called the Copyright Coalition) was recently formed by ASCAP, Broadcast Music Inc. (BMI) and a variety of other composer and songwriter associations to address copyright issues raised by digital audio recording technologies.

Another player is the Office of Technology Assessment (OTA). OTA, like the Copyright Office, is an arm of the Congress. OTA does studies and issues reports on a wide variety of technological advances and their policy implications. In 1989, OTA produced a report on the effect of new technologies on copyright protection and home taping, covering both video and audio taping.

OTA found that home taping is time-consuming, inconvenient and tedious. Particularly for taping of music, few stations publish schedules and popular music is played at random, unscheduled intervals. OTA found that more than half of those people surveyed, 54 percent, said they had never recorded music from radio or television broadcasts.

OTA survey results

In addition, the OTA survey found that sound quality seems to have little impact on home taping. Only one-third of consumer tapers were aware of the most basic technological distinctions affecting the sound quality of recordings, such as the grade of blank tape.

The conclusion seems to be that analog sound recoding is good enough for most people, and the introduction of DAB is not likely to increase home taping.

The OTA survey also found that there were 439 million music tapings from radio broadcasts during the period covered by the survey. The Copyright Coalition uses these findings to support the position that there are large revenue losses due to home taping.

The Copyright Coalition reported on a home taping survey by the Roper Organization. The Roper survey found that two-thirds of home tapers would purchase recordings if they were unable to make tapes, and projected lost sales of 322.5 million albums and singles. The RIAA projected lost sales of $1 billion per year due to home taping, even using today's analog recording equipment.

In conclusion, the home taping controversy has not gone away. Digital home recorders are being sold, digital music transmission services are being offered, and more are on the way. This will surely lead to increased conflict in the House and Senate Judiciary Committees in the next few years, as the recording industry tries to prohibit home taping, and the cable, broadcast and consumer electronics industries try to protect the rights of consumers to make tapes. ■

IN AN ERA OF LIMITS BELDEN EXPANDS YOUR OPTIONS.

New Belden® Fiber Optic Supertrunk presents another option in a full line of cables for CATV. Since the 70's, when Belden first integrated fiber optic technology into large-scale communications networks, Belden innovations have kept customers a step ahead of technological and product requirements. Now the proven benefits of Belden fiber optic technology expand the options available to Cable Television Systems.

Full line selection, combined with unsurpassed service and technical support, give you the *Belden Quality Advantage*. That means long-term savings for your business. Compare Belden's documented performance benefits to those of any other cable manufacturer:

- **Guaranteed structural return loss values** of 23dB minimum on RG-6, RG-11 and RG-59 cables.
- **100% sweep testing** of every reel of Belden drop cable, from 5 to 750 MHz for RG-6, 5 to 550 MHz for RG-59 and RG-11.
- **SuperDrop™ Cables** are 100% sweep tested from 5 to 1,000 MHz, with guaranteed structure return loss of 26dB minimum.
- **Complete corrosion protection** provided by unique non-drip gel barrier in Belden's new line of aerial drop cables.
- **Highest shield effectiveness in the industry** provided by Belden's DUOBOND® PLUS - even greater than quad shield designs!
- **Fewer call-backs** because of Belden's tight dimensional controls and easier termination. Saves you money over the long run.
- **Turnkey system design and installation capabilities** with Belden's nationwide network of Authorized Systems Integrators.

For a FREE copy of Belden's CATV Catalog, FAX your business card to 1-317-395-9719 or call toll-free:

1-800-BELDEN-4

COOPER INDUSTRIES

BELDEN

Reader Service Number 12

Spread spectrum in personal communications

Personal communications means people communicating with people, without being tethered to a telephone jack, wherever they may be: at home, in the backyard, at the office, at the beach, in the grocery store, at the airport, in the car, or just walking down the street.

The Personal Communication Network (PCN) is today's hot buzzword in telecommunications. It is a subset of the family of Personal Communications Services (PCS) that includes cordless telephones as well as cellular telephones.

Digital privacy

PCN is a network of advanced digital tetherless telephones, technologically similar to the mobile cellular networks now operating throughout the world, but with much smaller base stations, or microcells, and handsets small enough to carry in a shirt pocket.

The digital mode assures much higher quality voice transmission and substantially greater privacy than is possible with the present analog cordless telephones.

PCN is being touted as a *radio drop* that would be cheaper than standard copper access lines for PBX or home telephone installations.

By Archer S. Taylor, Senior Vice President, Engineering, Malarkey-Taylor Associates, Inc.

Spread spectrum technology

No frequency bands have yet been allocated in the U.S. to PCN. It is virtually certain, however, that spectrum will have to be shared, initially at least, with other radio services, possibly the private operational-fixed microwave service in the 1850 MHz to 1990 MHz band. For this reason, spread spectrum technology is being seriously considered, here and abroad, to minimize the risk of interference between PCN and other services.

Spread spectrum is a technique developed for military use to neutralize the effect of enemy jamming. The two principal spread spectrum techniques are frequency-hopping (FH) and direct sequence (DS).

As the FH term suggests, the carrier frequency is *hopped* about in accordance with a predetermined but repeatable *pseudo-random* pattern. In order to receive the signal, the receiver must be able to replicate the precise hopping pattern as it tracks the desired signal. The receiver will be tuned to an interfering signal for only very brief intervals, if at all. Moreover, the transmitter will rest for such a short time on any particular frequency that it is unlikely to cause interference.

For *direct sequence*, the data stream is modulated with a very wideband, pseudo-random noise signal whose frequency and amplitude distribution are switched in a predetermined but repeatable pattern. The data stream is recovered at the receiver by synchronously demodulating with an identical pseudo-random signal.

CDMA and TDMA

Access for a multitude of channels can be created in three ways. Frequency Division Multiple Access (FDMA) is comparable to the familiar FDM multiple channelling used exclusively on cable TV networks, in which each channel is assigned a different carrier frequency.

For direct sequence spread spectrum, multiple channels can be transmitted either by Time Division Multiple Access (TDMA) or Code Division Multiple Access (CDMA).

In TDMA, each signal channel is assigned a specific time interval. The receiver is synchronized to the transmission so that it can respond only during the time interval designated for the particular desired channel.

In CDMA, a different pseudo-random noise pattern (or code) is assigned to each message channel. The receiver responds only to the particular channel for which the pseudo-random code matches the transmitted code. Any signal that has been modulated with a different pseudo-random noise signal, or none at all, will be completely obliterated by noise that is indistinguishable from the truly gaussian distribution. Thus, a fair number of digital messages can be transmitted simultaneously in the same frequency band, using CDMA, without mutual interference.

Reception of the spread spectrum signal, whether using TDMA or CDMA, requires knowledge of the precise frequency and amplitude distribution of the pseudo-random noise pattern. TDMA also requires appropriate time synchronizing data. Encrypting this information is a particularly effective way to assure the security of the desired signal against unauthorized reception without the encryption key. Privacy is an important feature of PCN not provided by analog cordless telephones.

Telco competition

The possibility that cable TV operators may be able to compete with the established telcos for personal communication subscribers is substantially enhanced by the probability that restrictions on telco entry in cable TV will be at least partially relaxed. Clearly, the trend, not only in the U.S.A., but all over the world, is to encourage competition in virtually every formerly monopolistic institution. It is simply inconceivable that telcos would be permitted to compete with cable TV without also permitting cable TV to compete for PCN subscribers.

Telephone companies, through established tariff procedures, obviously control the charges and terms for access to the Public Switched Telephone Network (PSTN). These are fairly well set for cellular systems, and not likely to change for PCN. However, telcos also control the charges for pole attachment and duct rental. Already, they have demonstrated apparently predatory tactics by charging as much as $120 per year for fiber optic pole attachments, compared with $5 for the cable TV on which the fiber cable is overlashed. This is intolerable, and must be confronted at the Congress, FCC, and perhaps in court. ■

CONTEC

Danny Cachuela, Chairman, Barry M. Pressman, VP, Sales & Marketing, and The ConTec Team.

THE CONTEC COMMITMENT: Promises Kept.

There's a new team at ConTec these days.

A team of experienced management professionals, regional sales managers, account executives, and trained technicians.

A team with the renewed drive to be the best. We call that the ConTec Commitment.

It reminds us every time we sell or service a piece of equipment, that your business depends on quality workmanship, rapid turnaround and professional account service. It's also a reminder to you of our pledge — that every converter, remote, and replacement part is warranteed to be a top performer in its league.

We're out to prove that the people at ConTec can make the difference.

Come meet us at the NCTA Show, Booth #3453, or call your ConTec regional sales manager for more information.

REGIONAL SALES MANAGERS:

J. Dalton Couig, Jr.
(413) 499-0905

Mike Hartnett
(708) 941-3574

W. Norman Miller
(602) 545-8429

Steve Kesten
(606) 278-0238

Donna Stone
(303) 699-7905

CONTEC INTERNATIONAL

Reader Service Number 13

A little more SLM history

As a cable pioneer, I felt it was my responsibility to make comments on an article in *CED*'s October 1990 issue, title "A historical look at signal level meters" (p.68).

While it was correctly stated that Ken Simmons created the Jerrold model 704 in the early 1950s, there was another company (Transvision) which marketed a signal level meter still earlier, in 1950. I know this because I acquired one of these dinosaurs at that time. I also recall having a slightly more sophisticated SLM made by "Simpson." Admittedly, these meters were only capable of indicating "relative signal strength" and did not have true signal level measuring capability of the Ken Simmons/Jerrold instrument.

My personal involvement began in 1951 when I founded Benco, and began to design and manufacture signal level meters and other CATV equipment in Canada. The first Benco model SLMs, the FSP-1 and FSP-2, where introduced in 1953-54.

Sadelco was incorporated in 1960 and we produced our first model, the FS-1 SLM, in 1961. These units were followed by models FS-2 and and FS-2B. The FS-2B became very popular with CATV operators and because of its success, Sadelco was approached by Jerrold to make a signal level meter with similar specifications on an exclusive basis for them.

The first Sadelco-made, Jerrold-labled FSMs were the Jerrold models 720 and 720B. These units were supplemented with a 300 ohm input version, Jerrold model AIM-718. In fact, more than 30,000 of these various Jerrold SLMs were made by us and many are still in use today.

In 1973, Mid-State introduced the SLIM referred to in the article by Doyle Haywood. The SAM series was made later by Mid-State, which was acquired by Wavetek. Another company making SLMs during this period was Texscan. This line was recently acquired by Trilithic, also the ComSonics Window and a new Sencore SLM made their debut. During this same (time) period, a U.S. patent was granted to me for the first signal level meter calibrator.

In June 1976, Sadelco made the industry's first SLM with a digital dB readout, for which I was granted another U.S. patent. Sadelco also introduced the Super 600 series SLM with a price range of $900 to $1,800, which was not considered "the lower priced segment of the market" as stated in the article by Haywood.

In 1982, Sadelco made the first hand-held SLM, the Sadelette, using a bar graph to indicate signal levels in dB.

Two brand new Sadelco digitals are coming on the market today. These units are user friendly, incorporating all the technically advanced features most often requested and are competitively priced.

H.L. Sadel, CEO
Sadelco Inc.

Frequency chart?

I find your publication a valuable tool for keeping abreast of the exciting and fast-paced changes in communication technology. Are the frequency allocation charts which you published available? Keep up the good work.

Jerry Hellman
Cyril Communications
Kenwood, Calif.

Thanks for the words of encouragement. The frequency allocation chart was published in August of 1990. Single copies of the charts are free; multiple copies are available for a nominal fee. Yours is in the mail.

Not a Dutchess

Just wanted you to know that in the October 1990 issue, in "In the News" (A step by step guide to flyover preparation, p.74) the picture of "the rear of Flight Trac's Beechcraft Dutchess aircraft, showing the protruding antenna system" is, in fact, not a Beechcraft. It is a Cessna 182 or maybe a 182. The other picture is certainly the cockpit of a Cessna aircraft. As a private pilot I know this. Just thought you would like to know.

James Hughes
United Artists Cableystems
Grand Rapids, Mich.

Good eyes, Jim. Thanks to you and a few other readers/pilots who wrote or called to let us know of our mistake. An editing error caused this miscue. ■

More space

That was certainly a nice article about satellite movements and changes by Leslie Miller in the the December (Western Show) Edition. I would like to make a few comments.

General Electric Plans. It is too bad that a G.E. spokesperson was not available for comment. The article could have more depth if G.E.'s satellite plans were included. I don't speak for G.E., but its publicly announced plans for satellites which would affect the cable industry are:

- Satcom C-1 was recently (successfully) launched, and a petition before the FCC requrested that it be placed at the 139 degree W.L. orbital slot instead of its assigned 137 degree W.L. slot, and it be used to pick up the traffic on Satcom F1R along with some new cable industry traffic. The same petition requrests the movement of F1R to the 131 W.L. slot to replace and retire Satcom F3R. These changes and movements are scheduled to occur by February 1, 1991.
- Satcom C-5 (Aurora II) is scheduled to be operational by August 1, 1991, at the 139 degree W.L. slot, and Satcom C-1 would be moved to 137 degrees.

Whether or not the FCC grants these petitions, Galaxy I will move to its assigned slot of 133 degrees from its current 134 degree slot.

- In 1993, G.E. is scheduled to operate Satcom C-3 and C-4 at the 131 degree and 135 degree locations. Cable programmers have reservations on both of these satellites.

Satellite spacing. I must correct some wording in the article. The now idle cable bill which the House of Representatives passed, did not contain any quantitative words on satellite spacing. It did contain words to the effect that the FCC shall not make any rules or policy that would hinder the use of four foot diameter dishes at C-band.

Some people in the industry think that this means that the FCC will have to revise the policy declared in 1983 from two degree spacing to three degree spacing between C-band satellites. The issue is not that clear cut—it is quite complex. There are some people (including me) who feel that four degree spacing may be required to account for differences in satellite characteristics and ground antenna performance to accommodate four foot diameter TVROs.

Norman Weinhouse
President,
Norman Weinhouse
and Associates

Set Your Editing On Auto Pilot

...Watch Ad Sales Take Off

Fly High With editExpress

editExpress is a computer based tape editor/compiler that streamlines spot reel editing, marking, and duplication. Tape management is *unbelievably* quicker, easier, and more accurate.

Profits Will Soar

Users report both faster turnaround and dramatically improved on-air video quality. The result—*Client Satisfaction*. You gain these benefits and reduce operator time by **50% *or more*.** Advertisers' satisfaction climbs while costs plummet.

Fly With The Best

Texscan designed *editExpress* for Cable Ad Sales from the ground up. Systems can grow with your needs—up to eight source and twenty record decks. User friendliness, flexibility, and reliability set it apart from competitors.

Backed by the Texscan reputation, *editExpress* saves time and helps you make money.

editExpress Benefits:

- Edit, mark, and duplicate spot reels in a single operation
- Organize tape storage & handling
- Improved video quality
- Automation reduces human error
- SMPTE Time Code for frame accuracy
- Interface Traffic and Billing directory files

Call Us Today For More Information

(800) 367-6011
(801) 359-0077

Texscan MSI

124 N. Charles Lindbergh Dr.• Salt Lake City, UT 84116

editExpress is a trademark of Texscan MSI
Runway photo courtesy of Evans & Sutherland

Surround sound: Is your system ready?

Throw a few speakers on either side of the couch, buy a roll of zip wire, connect everything together with a designated surround sound television or set-top decoder and—voila—theater-quality sound in the comfort of your living room. Right?

Not so fast. Although most surround-equipped sets technically require nothing more than a standard BTSC stereo signal, a recent Cable Poll™ survey revealed only 41 percent of cable systems are even equipped for BTSC transmission. And, audio experts argue that even those operators offering BTSC are not properly equipped to deliver surround sound because of the "excess baggage" on the audio signal.

"Less is more when it comes to delivering surround," says Roger Dressler, technical director, Dolby Licensing Corporation (the company which sets surround performance specifications). Factors inherent to cable systems such as video sync suppression schemes, audio limiters, noise filters and other impedents can combine together to induce a variable "hum" or "buzz" instead of the intended multi-dimensional special effects and ambiance.

Satellite delivered surround sound

Most of the major broadcast networks tout surround availability on their more popular programs, including "Twin Peaks," "The Arsenio Hall Show," and "Late Night with David Letterman." In February, Home Box Office and Cinemax jumped on the surround sound bandwagon by offering more than 80 percent of their monthly movie lineup in Dolby Surround, as well as original programming and special events. The new service will be identified by a template (which reads: "In stereo and surround where available") that precedes every event that offers surround sound, at no additional cost to the operator.

Shipping surround sound over the satellite turned out to be fairly simple. "What we do is take additional audio information for the rear and center channels (for Dolby ProLogic, a new flavor of surround sound that includes a center speaker in addition to the two rear speakers) and encode that information onto the normal left and right carriers. There's no difference in terms of transmission," says John Vartanian, director of engineering, HBO. "So, for us to send it VideoCipher-encoded over the satellite, for the cable operator that's BTSC encoding in the headend, there's nothing additional he has to do other than the proper operation of the existing system."

Ned Mountain, VP of corporate marketing for Wegener Communications and chairman of the NCTA's subcommittee on audio quality, agrees. "For most systems, passing surround sound won't be a problem—as long as they already offer BTSC stereo and can provide 25 dB of separation."

Is cable equipped?

But can they? Opinions vary. "I've heard engineers laughingly say that they can hit maybe 19 dB or 20 dB of separation—on a sunny day," says John Kellogg, Dolby's director of technology marketing.

Although most operators agree that current BTSC encoding equipment and converters can readily pass the 25 dB specification, not all systems utilize the newer equipment. Other audio obstacles include baseband and volume control converters, which typically demodulate and remodulate the audio portion of the signal, causing reduced sound quality. "Most BTSC encoders will be lucky to get 18 dB of separation," says Dave Franklin, project engineer, American Television and Communications. "And a baseband converter will be lucky to get 18 dB."

Yet another hindrance to stereo surround sound is video sync suppression—the most common scrambling scheme used by addressable and programmable converters. "In this approach, timing and tagging information is amplitude modulated onto the sound carrier to tell the set-top converter exactly when to reinsert the synchronization information," says one cable engineer. "But most television receivers are sensitive to the amplitude modulation to some extent. What happens is, that energy that's amplitude

modulated to tell the set-top where the timing is (to recreate the picture) winds up in the BTSC stereo channel. That also happens to be the place where the surround information is. The end result is a buzz where the surround sound should be."

One way around the audio riddle are those technologies that fiddle the least with the signal—namely trap-based or interdictive technologies. "No matter what we do, somebody's going to invent some damn 'gee-wiz' thing that, if we do anything to the signal, we're going to interfere with it," says Brad Johnston, senior VP of technical operations for Warner and a catalyst to Warner's interdiction implementation in Williamsburg, Va. "We've found that interdiction is largely a customer satisfaction issue—it does the least to the signal while allowing subscribers to use the fancy equipment they've bought for their home."

Dolby Laboratories, an acknowledged leader in audio-related issues and equipment, started offering programs in surround sound nearly 10 years ago when company engineers discovered that its existing library of more than 3,000 VHS-format movies already had the surround information encoded on them. This stroke of luck in which the company "completely avoided the 'chicken-and-egg" syndrome by neatly laying eggs all over the place," led to development of the Dolby Surround decoder. The company quickly licensed the technology to the consumer electronics industry. To date, most major television manufacturers include the Dolby Surround decoders in their high-end sets.

Big things in small percentages

Indeed, according to Dolby officials, more than 3 million surround sound decoders have been sold worldwide to date, which translates to a tiny U.S. marketshare (less than three percent of existing TVs). Still, "big" isn't necessarily "better." The percentage of surround sound-equipped homes, although small, represents the cream of the home electronics market. Since Dolby Surround is usually just one of many features on a large, expensive set, the associated price tag is generally in excess of $700.

Certainly when subscribers sink their dollars into expensive, home theater-type equipment, they want it to work—and will be fairly agitated if the reason it doesn't is because of the cable system, to which they pay a sizable fee every month. After all, aren't these the folks who purchase premium channels and pricey pay-per-view events?

Wait for digital?

On the other hand, it may be prudent to wait for new digital audio solutions lurking around the corner. Because if 59 percent of non-BTSC subscribers are still paying their monthly bills, the problem may be one that can be tabled, temporarily—are at least until digital audio solutions are more firm. According to the National Cable Television Association's VP of engineering Wendell Bailey, next month marks the beginning of in-depth testing of a variety of high definition television and digital audio formats (see p.18.)

Perhaps what is needed is a solid set of audio practices at the major pulse points of the CATV signal: namely, the uplink, downlink, distribution and set-top device. "It's not entirely the fault of the operator," Kellogg says. "During (some tests that were performed with ATC), we found that the technicians were having to constantly adjust the headend audio levels. I mean, it's inexcusable that programs are sent up (to the satellite) with channels reversed, or 6 to 7 dB channel imbalances, or levels all over the place.

"In essence, cable needs a set of standards to keep the signal pure because the technology on the production side is growing in leaps and bounds, as are the consumer products. Consumers are getting used to excellent audio quality, with CDs and videodiscs. They want the same quality from their cable service," Kellogg continues.

Work under way

Indeed, recommended audio practices are under close scrutiny within cable's engineering community. The National Cable Television Association (NCTA) has an audio quality subcommittee dedicated to the topic. The subcommittee, chaired by Wegener's Ned Mountain, is currently working on "the satellite-delivered portion of the audio problem," Mountain says.

Granted, cable's goal to provide programming to as many homes as possible presents some inherent trade-offs—signals have to be secured, processed and distributed, which nixes the idea of a completely "pure" audio signal. But consumer electronics will undoubtedly forge on with products that make the home more and more closely resemble a theater. That means advanced audio and video quality at increasingly affordable prices. And with 59 percent of cable operators *not* providing BTSC stereo or surround sound, cable runs the risk of falling by the wayside of delivering signals of equally good quality. Does cable want to be viewed as the rusty pipe feeding the pipe organ? If so, it could be a very expensive trade-off. ■

—Leslie Ellis

Preparing the headend for surround

The engineers at Home Box Office recently published the following tips for cable operators to use as a guideline for the proper delivery of surround sound:

- With scrambled channels, verify with encoder and set-top converter manufacturers that all equipment is BTSC compatible.
- FM deviation of the CATV modulator's aural carrier must be accurate. Slight errors can reduce the audio channels' separation, resulting in improper surround sound decoding. If using a 4.5 MHz or 41.25 MHz aural carrier interface, the audio deviation will have been set internally to the BTSC encoder by the manufacturer. When using composite baseband audio as an input, the Bessel null technique or another accurate manufacturer-recommended method is necessary for setting deviation.
- Video sent to the BTSC encoder for sampling should be limited to 4.2 MHz with its sync pulses intact.
- If composite baseband audio input is used, the modulator's audio filter must have a bandwidth wide enough to pass the entire BTSC signal.
- Video modulation level should not be any greater than 87.5 percent. Overmodulation can cause audio buzz.
- BTSC generators have an internal 75 microsecond pre-emphasis network. When interfacing with composite baseband audio, the modulator's audio pre-emphasis network must be disabled.
- Any volume adjustments should be made at the audio input to the BTSC encoder, not with the modulator's aural deviation.
- Audio input levels should be properly set. If set too low, a degradation of the audio signal-to-noise ratio will result. High levels can cause audio distortion. ■

—Courtesy Home Box Office

Eagle's Outdoor Addressable Trap System

Try One "On the House"!

Eagle's new outdoor addressable Trap system is available, **now!** After conducting our own intensive lab and field tests for over eighteen months, we discovered this system offers so many benefits to cable systems and cable subscribers that the only way you can possibly appreciate them is to allow you to field test one in **your own system.**

That's why we've decided to make this offer. For a limited trial period, **We will install an Eagle Outdoor Addressable Trap Test System in your cablesystem at no cost or obligation to you!**

If you currently use a trap system or you're looking to replace your converter/descramblers don't miss this opportunity to try the most "user friendly" addressable system ever developed for the cable industry!

A "short list" of Outdoor Addressable Trap System features includes:

- 4 or 8 tiers of negative, positive or multichannel addressable filters; 256 combinations selectable
- Consumer friendly with VCRs, cable ready TVs and remote controlled TVs
- Controls signal delivery to multiple TVs from one trap switch
- Allows you to use your present negative or positive traps
- All service disconnect capability; over 80dB isolation
- No need to enter home for audits
- IBM PC or compatible computer control
- Compatible with billing systems
- Optional **Impulse Pay per View** unit allows subscriber to order premium programming without calling cable system
- Auto-dialer transmits customer usage back to system using store and forward techniques
- Pre-authorize customers for limited amounts of pre-paid programming
- Parental control of premium channels or all service

☐ **YES!** system or I a… replacing my existing converter/descramble…

☐ **YES!** I would like to take advanta… your FREE OFFER. Please co… me to schedule a **FREE trial installation** of Eagle's Outdoor Addressable Trap system.*

FREE TRIAL OFFER!

*Offer … limited and is at … discretion of Eagle Comtronics

Name _____

Cablesystem name _____

Address _____

City _____ State _____ Zip _____

Phone (…) _____

Mail This Coupon
or CALL TOLL FREE
800-448-7474 Today!

EAGLE COMTRONICS INC.

4562 Waterhou… Rd.
Clay, NY 13041
(315) 622-3402

In Canada: Desk … Sales
• Toronto • Vancou…

In Europe: Electr…
• 011-32-15-7…
• Norway • …
• W. Germany …

Reader Service …

Interdiction and the powering dilemma

Off premises—or *broadband* addressability is attracting a great deal of cable industry attention these days.

Interdiction involves using agile oscillators to prevent unauthorized programming from entering the subscriber's home and moves the addressable control and security function outside the residence. The resultant broadband signal offers consumer-friendly addressable control, improves customer service and creates a vehicle for new, dynamic approaches to proactively marketing cable television services.

The single most important benefit of any broadband delivery system is the transparent subscriber interface. It lets subscribers use the tuning functions of their "cable-ready" televisions and VCRs and gives them the flexibility to watch and record different services simultaneously.

There are significant implementation challenges associated with moving the security and addressable control functions outside the subscriber's home. The most significant is powering.

A microprocessor controlled converter's addressable functions require it to be plugged in and drawing a low level of power 100 percent of the time. As an integral piece of the home entertainment system, and, with an accessory convenience outlet, most converters operate without much thought or concern given to power consumption.

Moving the addressable control outside the subscriber's home raises the visibility and concern over how these devices are powered.

By Jack Bryant, Director, Product Management, Jerrold Communications Subscriber Systems Division

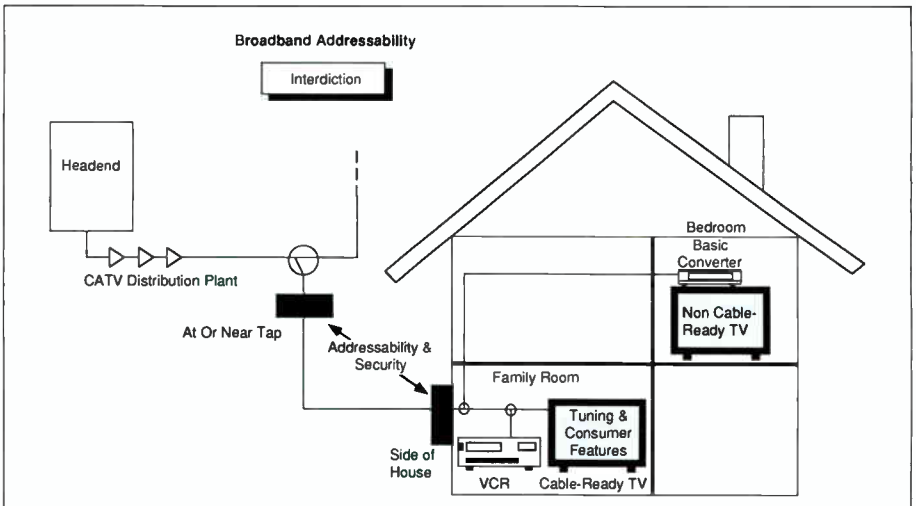


Figure 1

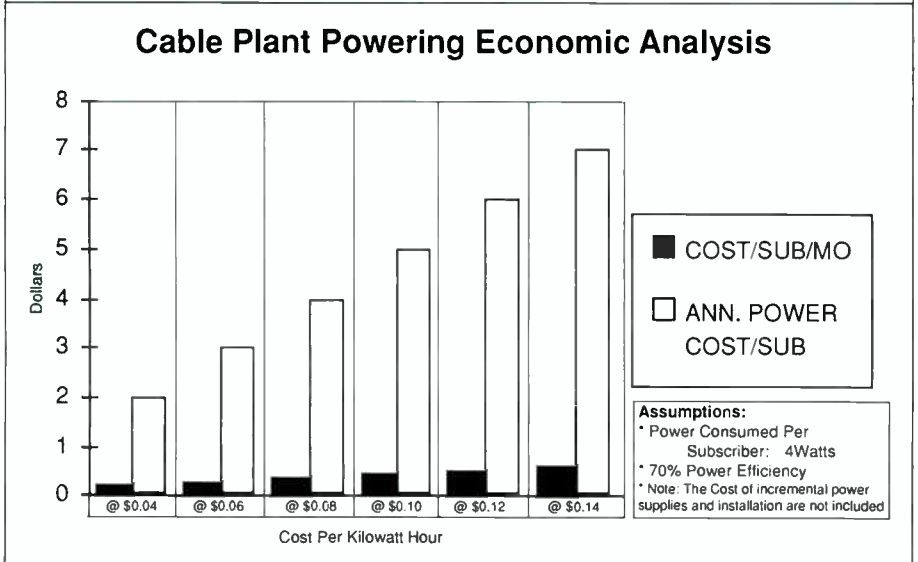


Figure 2

Cable plant powering

Cable plant powering is attractive because it allows the operator to remain completely out of the subscriber's home. With security electronics outside the home, the operator has reduced exposure to equipment theft. The operator can also offer expedient customer service by addressably controlling some connects and virtually all disconnects. Cable powering simplifies this process because there is no need to track transformers or worry about rewiring the subscriber's drop cable. From a service standpoint, all maintenance, troubleshooting and repair can be done without scheduling a subscriber visit.

The benefits of cable powering, however, do not come without significant expense and implementation consideration. The power passing capacity of bridger and distribution electronics forces a redesign and rebuild of the existing cable plant power grid.

Because active interdiction devices draw an average of 4 watts of power per subscriber, they require a significant increase in the number of power supplies. The specific number depends on the existing power capacity of the cable plant and whether the operator can completely redesign and rebuild the plant power grid. With the momentum in distribution focusing on reducing the number of actives and extending fiber applications out past the bridger, many operators have consid-

ered segregating trunk powering from feeder powering and looking at less costly, flexible ampere powering schemes for the feeder plant.

In any case, interdiction will require a significant increase in the number of plant power supplies, raising a reliability concern. The logistics and costs associated with installing and maintaining these power supplies also must be taken into consideration.

The biggest objection raised with cable plant powering is the increase in operating expense. Power companies vary in how they bill cable operators for power consumption. Some systems are bulk billed, based on the number of power supplies in the plant, while others are charged on a metered basis.

As shown in Figure 1, using an average power consumption of 4 watts per subscriber and assuming a 50 percent penetration, a cable operator can expect the plant power bill to increase significantly. Power rates also vary geographically. The national average falls between seven and eight cents per kilowatt hour.

Depending on existing plant power capacity and power design efficiency, design studies show cable-powered interdiction systems will double or triple the plant power bill (see Table 1). This mitigates the economic impact of some of the proposed operational savings associated with an interdiction system.

Home powering

Clearly, avoiding the incremental operating expense of plant powering provides an economic incentive to consider home powering. Home powering also avoids a redesign and rebuild of the power plant grid.

Again, these benefits do not come without some significant operating ramifications. A home power transformer may complicate the install and disconnect because of the need to track transformers and get access to the subscriber's home. Safety concerns, UL requirements and local wiring restrictions also must be considered.

As a politically sensitive issue, subscribers may object to powering the cable operator's equipment. With interdiction approaches involving tap replacement with shared electronics, this issue may be complicated by the fact that the amount of power being consumed varies for each subscriber depending on the length of the drop cable feeding the home.

Most home powering approaches involve inserting AC or DC power on the center conductor of the drop cable from an outlet-mounted transformer and running power to the side of the home or out near the tap. Studies have shown that adding electrical energy to the drop cable can detrimentally impact the reliability of the drop cable.

The electrical energy tends to accelerate the electrolysis already occurring between the dissimilar metals found in F-connectors and output ports. Home powering will put even more emphasis and attention on the need to effectively weather seal all exposed connections. Some applications of pulsed DC powering have shown promise in effectively combatting this electrolysis concern.

Another home powering concern is where to insert the power on the drop cable. Approaches using a separate twin lead power line married in messenger fashion to the drop cable have the benefits of not adding any power on the drop and not requiring the

installer to use power passing splitters. However, objections have been raised about the need to rewire every home to use this approach.

Home power transformers with a separate power inserter allow the installer to insert power as close to the subscriber's home as possible and give the operator the option to use either power passing or standard splitters in the home on a non-powered side of the drop cable. An AC outlet mounted transformer that has an input and output connector and AC convenience outlet with an integrated power inserter can be subscriber-mounted near the television set. This, however, requires a power passing splitter and elevates safety issues.

In all of these approaches it is very important that the cost of the home power transformer remains very low, without sacrificing safety or reliability. The importance of accounting for and tracking the transformer is reduced if it costs relatively little to replace. The transformer must be able to be secured to the AC outlet because this eliminates service calls for transformers that are not plugged in. A power indicator light on the transformer may be important if the transformer is located near the television set because it would allow a customer service representative to remove the transformer from consideration when troubleshooting a service problem with a subscriber over the phone.

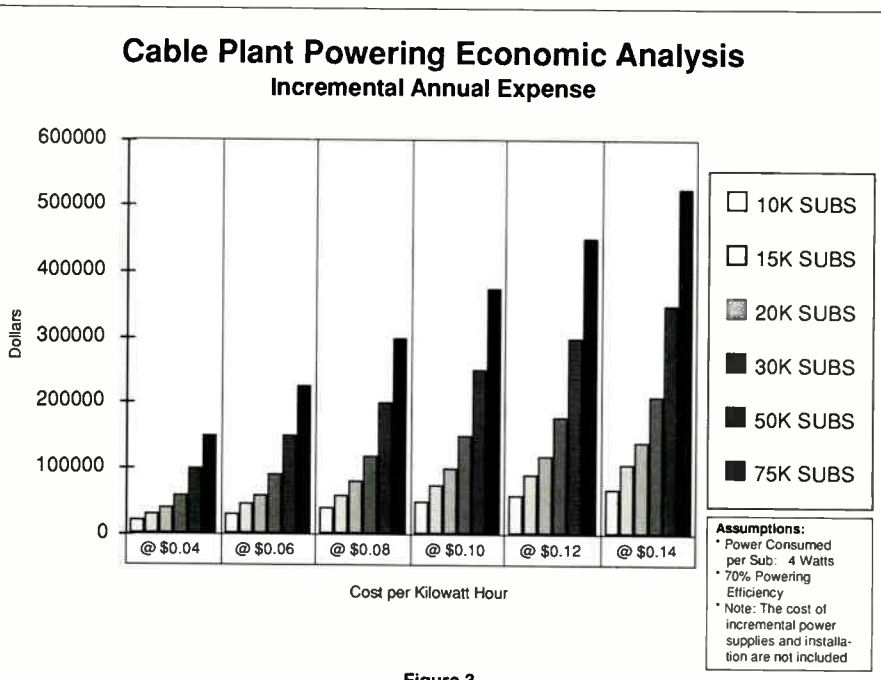


Figure 3

Hybrids and future considerations

It is possible with a tap replacement approach for the cable plant to power some of the shared control electronics while subscribers power only their

portion of the electronics. Unfortunately, this approach has all of the concerns and objections associated with home powering and the only benefit of reducing, but not eliminating, the incremental plant powering expense.

Future consideration may be given to integrating a home power transformer and power inserter into either a basic converter for subscribers without a cable-ready television set or into an impulse ordering device. The long-term viability of interdiction and the level of demand for this technology will establish the economic feasibility of these and other accessory products.

There does appear to be some consensus about power interdiction electronics in multiple dwelling applications. Because of the relatively high churn associated with the transient subscribers, there is no incentive to power from the dwelling or apartment. There is also no interest in rewiring an apartment building. Both factors tend to eliminate home powering as an attractive application for MDU applications.

In a majority of high density multiple dwelling applications there is easy access to power along the basement of the building or within the utility closets on each floor This makes a locally powered MDU device with an AC power cord viable in the majority of applications.

In lower density row or townhouse applications, the MDU enclosure may be mounted on an outside wall or the electronics may be mounted within a pedestal or vault. The logical choice is to power from the cable plant and design the feeder plant to accommodate the incremental power.

A multiple dwelling unit interdiction product should have the flexibility to be locally powered through an AC power cord or from the cable plant.

At this point there is no clear consensus favoring cable or home powering for interdiction. In each case it is important to analyze local powering costs, existing plant power capability, plant operating practices, installation techniques and the individual system's need or desire to rebuild the existing cable plant. Today, home powering is a much lower risk approach because it does not mandate tampering with interdiction. Further field trials should prove that for interdiction approaches to be viable over the long term, the ability to accommodate either home or cable plant powering will give the operator the flexibility to decide which approach will best fit each individual system's operating requirements. ■

ADVERTISEMENT

INTERDICTION AND POWERING CALLBOOK

The following companies have paid a fee to have their listing appear in the Interdiction and Powering Callbook.

Interdiction

Eagle Comtronics Inc. . . .(315) 622-3402
WATS . . . . . .(800) 448-7474
4562 Waterhouse Rd.
Clay, NY 13041
PERSONNEL: Alan Devendorf, President; Joseph Ostuni, VP/Sales and Marketing, Chester Syp, National Sales Manager
DESCRIPTION: Eagle's addressable trap system is consumer friendly and available today. It incorporates eight tier switching, impulse pay-per-view selection, negative, positive or multichannel trap control, home powering through drop cable, parental control, downloadable credit unit, IBM PC control, external billing compatibility, store and forward return, and is economically comparable to converter-descrambler system.

Jerrold Communications .(215) 674-4800
FAX . . . . . .(215) 443-9454
2200 Byberry Rd.
Hatboro, PA 19040
PERSONNEL: Ed Ebenbach, Jack Bryant
DESCRIPTION: Jerrold's Agile Jammer interdiction unit is flexibly designed to be mounted with an enclosure on the subscriber's home or adjunct to the tap in the distribution system. It is designed with technically superior video masking and eight oscillators cover 54 to 450 MHz. With the ability to pass 550 MHz, the Agile Jammer allows cable operators to secure any or all channels up to 450 MHz with complete video security and audio degradation.

More than supplies. Solutions.

Midwest CATV . . . . . .(303) 799-4343
FAX . . . . . .(303) 643-4797
P.O. Box 4543, Zip Code 80155
Fairways II at Inverness
94 Inverness Terrace East
Suite 310
Englewood, CO 80112
PERSONNEL: Chuck Krone; Scott Henry
DESCRIPTION: Midwest CATV is the exclusive distribtor of the MATRIX on premise addressable trap system. MATRIX is available in configurations for single family or M.D.U. applications. The MATRIX control system is transparent to both positive and negative traps and will accommodate any trap available in the industry today. With over three years of experience installing off-premise systems, our experienced staff can assist you with many of the start up concerns. For tomorrow's system today, call 1-800-MID-CATV.

Scientific-Atlanta, Inc. . . .(404) 441-4000
FAX . . . . . .(404) 925-6280
Box 105027
Atlanta, GA 30348
PERSONNEL: Steve Necessary; Mike Hayashi
DESCRIPTION: Scientific-Atlanta's interdiction technology is a highly secure and reliable alternative which provides a transparent consumer interface. Decreased operating costs, additional marketing opportunities and extra flexibility in your system are three major benefits. There is a family of products to suit your application—single subscriber, four-port, eight-port and MDU.

Powering

Alpha Technologies Inc.. .(206) 647-2360
FAX . . . . . .(206) 671-4936
3767 Alpha Way
Bellingham, WA 98225
PERSONNEL: Fred Kaiser, President; Bob Bridge, Sales Manager
DESCRIPTION: Alpha Technologies designs, manufactures and markets standby power systems, uninterruptable power sources, status monitoring systems, software and modems, batteries and CATV surge protection products for CATV systems domestically and internationally. Alpha is the world's largest manufacturer of 60 VAC products for CATV and broadband applications, producing AC power products in both 50 Hz and 60 Hz versions in Canada and the U.S.A. The company also owns and operates Argus Technologies, a specialized manufacturer of 48 VDC rectifier equipment for telephone central office power plant, and Flight Trac, Inc., providing flyover signal metering for cable TV operators. Jeff Geer, Product Manager, Larry Roper, Product Manager

Lectro Products . . . . . .(800) 551-3790
Connecticut . . . . . .(203) 875-8805
California . . . . . .(805) 251-8054
Kansas . . . . . .(913) 782-4309
Virginia . . . . . .(703) 273-5322
FAX . . . . . .(404) 548-5493
420 Athena Dr.
Athens, GA 30601
PERSONNEL: Michael R. Filkins, President; Mike Kearns, National Sales Manager
DESCRIPTION: Lectro manufactures a complete line of single ferro and dual redundant standby power systems and a full range of ferroresonant power supplies with otputs of 2 to 18 amps. A wide range of high quality products for U.S. and international markets are available including dual output for CATV and telephone system powering.

Power Guard . . . . . .(205) 742-0050
WATS (National) . . . . . .(800) 288-1507
FAX . . . . . .(205) 742-0058
506 Walker St.
PO Box 2796
Opelika, AL 36801
PERSONNEL: Curt B. Cope, C.E.O; Jerry Schultz, President
DESCRIPTION: Power Guard manufactures a full line of standby, non-standby and retro-fit power supplies for the CATV industry in 3 - 6 - 9 12 and 15 Amp versions. For added reliability Power Guard also manufactures a full line of Power Clamp crow bar surge protectors for all makes of power inserters, splitters, couplers, and power supplies. Mike W. Springer, Vice President, Sales; Dave Cushman, Director of Engineering; Gary Batson, Director of R and D. Regioal Offices: Richard A. Simile, Northeastern Regional Sales Manager; Ernie L. Cope, Southeastern Regional Sales Manager; Don Imbody, Midwestern Regional Sales Manager; John S. Demos, Sales Representative.

Fiber optic supertrunking: The state of the AM art

While most of the focus on fiber optics is on finding ways to integrate the technology deeper into the cable-television network, there continues to be a strong need for point-to-point, or supertrunk, applications.

It is expected this fiber supertrunk market will continue to be strong as operators "cluster" nearby systems and concentrate on reducing operating overhead by consolidating headend sites and other signal origination facilities. But what form will it take? Is high-quality FM and digital modulation methods the best bet? The answer may be surprising.

The market for supertrunking is small. There are approximately 1,000 cable systems with supertrunks of any type, whether AML microwave, coaxial or fiber optic, frequency modulation (FM), amplitude modulation (AM) or digital.

The most common use is for point-to-point distance linking of headends such as to transport signals in a regional system consolidation. Other uses may be headend to remote hubs, satellite earth station to headend links, or to provide multiple paths of redundancy for critical transmissions.

Historically, cable operators have relied upon over-the-air AML microwave transmitters and receivers for this application. However, AML experiences all the well-known problems: atmospheric attenuation and interference, path congestion and the expense of real estate.

But fiber optics has proven itself of general use in the cable television industry and much of that proving out was accomplished early through the use of short point-to-point applications, such as earth station to headend runs. That was followed by experimental testing in distribution systems to reduce amplifier cascades, and finally by a more mature use in fiber-to-the-feeder (FTTF) and fiber backbone architectures.

With the exception of satellite antenna to headend links, where FM will likely continue to predominate because the signals coming off of the satellite are FM, operators today are looking more and more to AM vestigial sideband (AM-VSB) over fiber for supertrunking.

Why AM? One essential reason is that television sets want to see AM signals. Any transmission format other than AM will, at some point in the signal transport chain, have to be converted to AM signals for reception in the home.

Up to now, the trade-off has been between FM's high quality (but high cost), against AM's more acceptable prices but lower quality. "Certainly if AM worked as well over as long a distance as FM," says Andy Paff, president of Optical Networks International, "it would have been a no brainer." Consequently, when it came to fiber supertrunking, FM was the logical choice.

However, this has changed.

By George Sell, Contributing Editor

JIM CHIDDIX

'It is possible to build an AM fiber link that is very high quality by using a number of lasers and breaking the spectrum down into a number of segments. You can achieve (high) C/N and intermodulation performance by limiting the number of channels on each laser.'

AM vs. FM and digital

AM has improved both in performance and costs. "The lasers are so much better: Higher output power, lower noise and lower distortion," says Dave Robinson, director of Jerrold's Cableoptics business unit. "The lasers are really designed for the trunking applications, but with reduced channel loading you can get performance on a supertrunk link that's not as good as FM or digital but the price differential is dramatic. An AM supertrunk link will cost only a fraction of an FM or digital supertrunk link."

The key has been improvements in laser technology. According to Larry Stark, director of marketing for Ortel Corp., the supplier of Jerrold's lasers, "What happened recently is the output power has about doubled and even in some cases tripled from values you saw in 1989-1990. Basically, the transmitters can now burn through all that extra link loss and still give the performance you want. I think people are seeing output powers now in excess of 5 milliwatts as opposed to 2 milliwatts two years ago."

With all the advancement in performance, AM is carving out a place in supertrunking. "I don't see FM or AML, for that matter, being eliminated entirely," observes Paff of ONI. "We've seen AM encroach on some of those traditional applications that have been historically AML and/or FM fiber optic supertrunk. Certainly the digital product that's out there today would be a further encroachment perhaps on the FM technology."

Jerrold's Robinson agrees. "(AM) will ultimately squeeze FM to a very small segment of supertrunk applications." FM and digital may always exhibit better performance but will also remain high cost in relation to AM equipment.

Where are those costs? For one, conversion electronics can be expensive. "If you look at digital and FM gear, it's somewhere between $3,000 and $5,000 per channel," Paff of ONI points out. "You can do the multiplication and understand what that breaks out to and compare it to a (AM fiber) product where you can put in a composite signal at one end and get it out at RF on coax at the other."

And, with FM and digital equipment, you pay more for real estate, because of the high component count at the receive site. As Paff explains, "You have to think about real estate costs

in addition to the modulators, demodulators, combiners and whatnot that are involved in an FM or, in a digital scheme, the D-A converters. The point is, you've got a lot of components and real estate. And when you're done, you're at baseband so you've got to find a way to get it into an AM-VSB format. So there are costs all along the way."

The performance criteria of a supertrunk link may also be met with AM by increasing the number of lasers and fibers and reducing the channel loading. "It is possible to build an AM fiber link that is very high quality by using a number of lasers and breaking the spectrum down into a number of segments," Jim Chiddix, senior vice president of engineering and technology for American Television and Communications (ATC). "You can achieve (high) C/N and intermodulation performance by limiting the number of channels on each laser and on each fiber to a relatively small number. Each time you cut the number of channels in half feeding a laser you can improve noise performance by 3 dB.

"And then something else interesting happens," Chiddix continues. "When we reduce the number of channels on a laser we will also increase the optical power per channel. That allows you to go farther. And that's exactly what you want with a supertrunk, to go long distances with a very clean transmission."

JOHN HOLOBINKO

'The bottom line on any cable TV system is reach—measured in terms of dollars per dB. At the same time the price of those lasers has either held steady or gone down.'

Clearly, it's the improvement in laser performance that's driving AM. "(Today you can get) better performance in every operating parameter out of the optical components of the system, as well as lower prices," says Chiddix. "Supplies are up, prices are down, specs are up, power's up, everything."

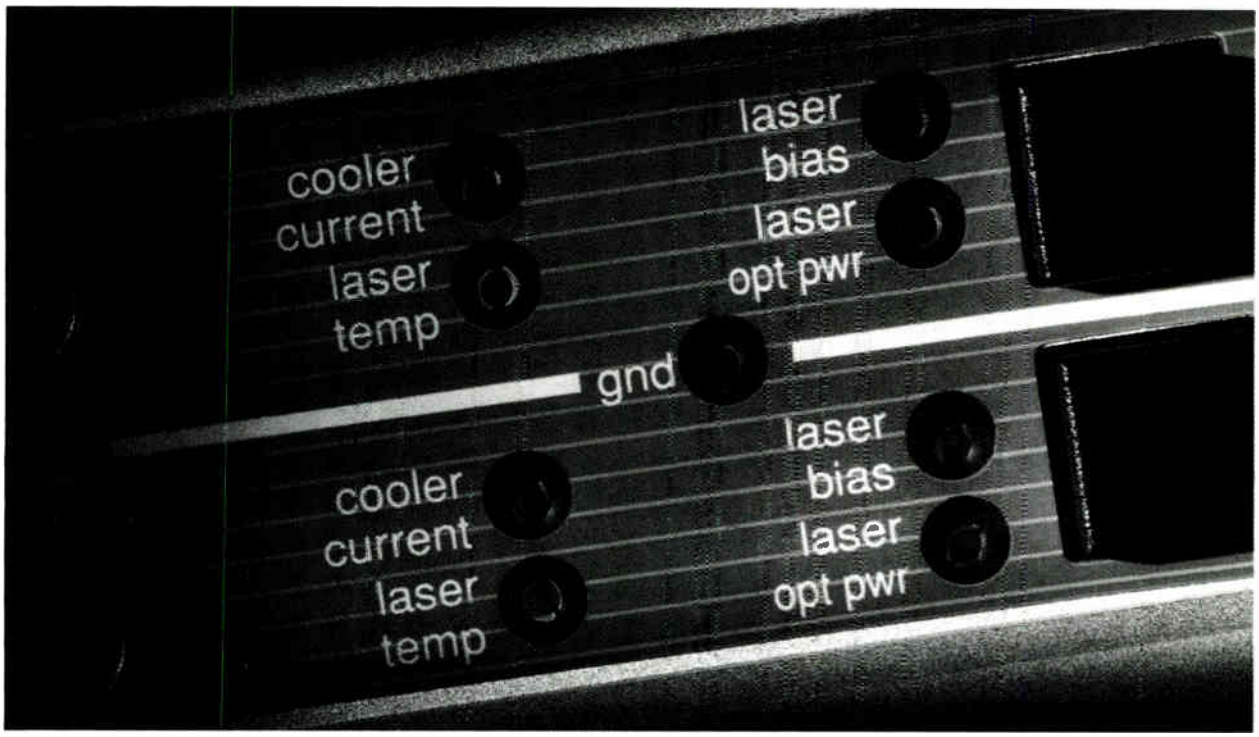
"The bottom line on any cable TV system is reach—measured in terms of dollars per dB," says John Holobinko, vice president of marketing and sales for American Lightwave Systems. Holobinko says that over the last year 1310 nm (wavelength lasers) have been increased in power between 3 dB and 4 dB while at the same time gaining slightly better linearity. "At the same time the price of those lasers has either held steady or gone down. Some of the costs per dB of those lasers has changed significantly."

And the reach of AM fiber is expected to improve. "Within a year you will see 1550 nm lasers being the next breakthrough for AM supertrunking," says Dave Fellows, president of the transmission systems business division of Scientific-Atlanta. "You will be able to go 20 or 30 miles with an AM link and still get pretty good performance."

1310 nm vs. 1550 nm

Lasers used for AM fiber supertrunking applications operate at the 1310 nm wavelength—but recent improvements in 1550 nm lasers and

Some call it the way of the future. We're ready now.



Fiber optics. For years it's been discussed at the trade shows and written about in the journals. But when the time for talk came to an end and the call went out for it to finally become a reality, you knew that Jerrold would respond.

Designed, tested, and perfected at our Applied Media Lab, Jerrold's breakthrough Cableoptics™ products include the STARLITE™ AM-550AT Advanced Transmitter that contains the first and only laser developed exclusively for cable TV. Complemented by our full line of STARLITE Receiver products, Cableoptics is serving fiber-to-the-feeder backbone and super trunk applications.

Jerrold has met the challenge. We can do it for you, too. Our Cableoptics engineers can provide a sample design and analysis to demonstrate the efficiency of fiber optics in your systems. To arrange an appointment, call 1 800 523-6678.

Responsive

JERROLD COMMUNICATIONS

Reader Service Number 20

fiber optimized at 1550 nm have sparked a debate about what technology to use for new fiber builds.

1550 nm lasers do not yet come near the performance specs of 1310 nm lasers. And operating a 1550 nm laser on today's normal fiber (which is optimized for 1310 nm wavelengths) will cause undesirable dispersion effects that, when converted to AM-VSB, will manifest themselves as second order distortion.

But not only will 1550 nm improve in terms of performance, particularly very low loss, but offer the possibility of optical amplification in the not too distant future, thus radically extending the reach of AM fiber transmissions.

The question then is whether to optimize today for 1310 nm or wait for further improvements in 1550 nm? The argument is somewhat clouded because there appears to be promising research into using compensation methods that will allow the use of either 1310 nm or 1550 nm or both on the same fiber. Some of the alternatives along with their trade-offs seem to be:

- Use a 1310 nm laser with non-dispersion shifted fiber, deal with second order distortions by an octave scheme or use of special circuitry, and expect new dispersion compensation methods to emerge for 1550 nm lasers.
- Optimize for 1310 nm lasers using today's dispersion shifted fiber with a dispersion null at the 1310 nm wavelength. But this will mean that using a 1550 nm laser on this fiber in the future will cause a dispersion effect that looks like second order distortion.
- Optimize for 1550 nm lasers using dispersion shifted fiber that has a dispersion null at the 1550 nm wavelength—which provides for the best use of optical amplifiers in the future. But this will mean use of a 1310 nm laser on this fiber will cause dispersion at 1310 nm.
- Use a specialty fiber known as dispersion flattened fiber which deals with dispersion at both wavelengths. But it is expensive and is supplied by one European company. Also, there may be availability problems, and it can be hard to work with since it introduces severe attenuation problems, negating the low loss, long reach feature of 1550 nm.

Holobinko believes optical amplifiers is the real interest of 1550 nm. "Today 1550 nm lasers do not have the output power that 1310 nm (lasers) do. Whereas you can buy 1310 nm today with output powers of 4 mW, 5 mW and sometimes 6 mW, about the best 1550 nm can do today is 2 mW or +3 dBm. So you have a good 3 dB to 5 dB disadvantage."

ANDY PAFF

'What I would say to an operator who is concerned about it, is don't get hung up in the technology and that side of the debate. Decide the fundamental premise that this is the glass we are going to use. Then I would make it incumbent on the vendor to come up with the solution.'

Holobinko argues that the gains made through lower attenuation at 1550 nm only makes sense if the link is 30 km long or more because the higher power 1310 nm lasers extend reach too.

Therefore, he thinks the real attraction to 1550 gear is optical amplifiers, which are being developed for use in the 1550 window.

The dispersion effect

Today's 1310 nm fiber, if driven by a 1550 nm laser, will experience a chromatic dispersion effect manifesting as second order distortion following conversion to an AM-VSB signal. This effect is a result of semiconductor laser operation. In the lexicon of the optical theoretician, lasers "chirp," a decidedly unscientific metaphor.

Lasers designed for signal transmission do not emit a signal at a tight wavelength. "If you have a 1550 nm laser and you put a sine wave into it, you get one nice clear color of light. It's infrared at 1550 nm," Fellows of S-A explains. "If you then modulate the laser, suddenly the laser does a thing called chirping which means it now begins to emit light at say 1549.9 nm to 1550.1 nm. The dispersion is the result of the delay induced when two light wavelengths travel at different speeds.

It must be understood that dispersion is not caused by fiber but by laser chirping. But fiber can be manufactured to deal with chirping. Dispersion shifted fiber will compensate for chirping at a specific wavelengths such as 1310 nm or 1550 nm.

"It's not obvious how a group delay could show up as broadband AM distortion," Fellows laments. "So for a while we operated under the theory that it wasn't going to hurt us. It's only within the last year of working with optical amplifiers at 1550 nm that we realized there is a problem."

But there is hope for a solution. "The nice thing about second order distortion is we know mathematically how it behaves," says Chiddix. "Therefore, it should theoretically be possible to predistort or compensate signals to exactly offset the generation of second order products."

One vendor that has been in the forefront of the research and development of 1550 nm laser/fiber systems for CATV is Synchronous Communications. "We've been spending a lot of time at 1550 nm,"

Vincent Borelli, president of Synchronous, relates. "And until we got our dispersion compensation circuits squared away, we found that for 1550 nm, long trunks weren't really applicable." Now, Borelli believes 1550 nm will be the wavelength of choice for AM supertrunking.

Holobinko says other emerging technology may quell the problem of 1550 nm dispersion effects. One is 1550 deep well lasers, which offer narrower spectral bandwidth. But optical amplifiers do not use deep well lasers, so the signal could not be repeated effectively.

With fiber that's dispersion shifted at 1310 nm, there are at least two techniques that are being proposed to compensate for chromatic dispersion at 1550 nm. "There's been some promising results shown with both varactor tank circuits located right before the laser. The other mode is a circuit made up of fiber directly after the laser that would provide an optical compensation," Holobinko says.

"They are being looked at seriously because there is a very large embedded base of fiber out there which happens to be zeroed around 1310 nm," Holobinko explains. "So if you want to go 1550 nm (in the future), and with a universe of fiber optic plant out there all ready to accept it, it's very wise if you have the ability to compensate for that dispersion."

The fiber question

With today's fiber optic cable optimized for 1310 nm, will any future application of 1550nm lasers mean that the installed base of 1310 nm fiber will be obsolete?

Most observers would say no. Regardless of when, where and how 1550 nm will find application, consensus is that it will not be revolutionary. Instead, 1550 nm will extend the use of AM fiber.

And all observers, whether they are proponents of 1550nm or question it, agree that 1550 nm technology will not be a replacement technology, in terms of embedded fiber optic plant, even though today's fiber is designed for 1310 nm lasers.

"There's a lot of architectural issues surrounding this debate," ONI's Paff urges. "At the device level the issue of second order (distortions) is one to be dealt with as a part of that mix at 1550 nm. Output power and linearity is another one and economical development of optical amplifiers. None of these are killer issues."

"1550 nm is not a revolution," says Fellows. "It's not going to suddenly halve the cost of your FTTF. What it's going to do is prove in some AM applications where they didn't prove in before—meaning longer distances at the edges of your system and also in some point-to-point supertrunking."

"I don't think we are well advised to wait for these refinements," Chiddix adds. "I think if you need to use fiber today, the stuff you can buy today works very well and is very cost-effective in applications. The good news is things are going to get even better."

But, Paff argues, "Right now we are very confident in the long term utilization of 1310 nm. At this point we see nothing at the lab level development of 1310nm that says anything is going to displace it. At least there is agreement on the fiber issue itself."

"I think my advice to an MSO would be first of all look at 1310 nm today," suggests Stark of Ortel, "and ask yourself does it give me significant performance improvements and can I install it cost-effectively? Never mind whether it's optics or anything. Look at it in a simple cost-benefit analysis. And if the cost-benefits are good then use it."

"What I would say to an operator who is concerned about it," says Paff, "is don't get hung up in the technology and that side of the debate. Decide the fundamental premise that this is the glass we are going to use. Then I would make it incumbent on the vendor to come up with the solution."

Even the strongest proponent of 1550 nm, Borelli at Synchronous, agrees it will not adversely impact today's fiber plant. "What really is nice about the 1550 nm concept is that by being able to use a compensation circuit for the dispersion, you no longer have to worry about what kind of fiber you already have installed. You can use your non-dispersion shifted fiber. Six months ago that wasn't the case."

Borelli, undauntedly bullish on fiber's future, recommends, "1310 nm is still a safe technology. If I were a cable operator and I was questioning whether I should wait until 1550 nm was readily available, I don't think I would be forced into a decision on that at this point. I think you can safely put in 1310 nm and at some point in time upgrade to 1550 nm."

Comforting words for cable's fiber planners. ■

What's a fuzzie? Customer service for field personnel

For years, all that really mattered in the cable business was that field personnel repaired the customer's cable. Today, however, cable customers want more. They are demanding better face-to-face customer service, especially when a technician must come on their property or into their home.

The need for improved customer service training recently became apparent to the technical manager of the service department for MetroVision of Prince George's County. The manager discovered that his employees were averaging one to three hostile encounters per week. These encounters ranged from customers telling technicians to leave the house, to customers physically threatening the technicians. The technical manager realized that something needed to be done to improve the customer service skills of the field technicians.

First, the technical manager identified a menu of the most common problem areas that needed to be addressed. The identification was based on the technical manager's observations and intervention in various "hostile encounters" and on suggestions from the technical supervisory staff.

Customers complained that the technicians were disrespectful, unprofessional, non-communicative, had invaded private areas, and had tampered with or disrupted property. Technicians, on the other hand, complained that the customers threatened them physically, were verbally abusive, questioned their competency and generally expected too much.

Luckily, MetroVision was planning customer service training for office personnel in the upcoming weeks. The technical manager decided that any training for field personnel should be specifically geared toward the field and the problem areas he had identified.

Next, the technical manager talked with a consultant who had agreed to do the training. The manager outlined these problem areas and the field-oriented approach he wanted to take. He stressed that he wanted something more than theory.

The consultant then developed a two-hour training session designed to improve field personnel awareness and skill level in the following areas:

- Non-verbal communication.
- Customer relations.
- Dealing with irate customers.

The technical manager strongly doubted that the class would work. Although he agreed with instructional design, he was concerned about his technicians' reactions to what could be interpreted as "sissy stuff."

The work done at MetroVision was more than just 'training,' but a series of actions taken to improve and change behaviors with the goal of improving customer service.

By Willis G. Smith, Technical Manager, MetroVision and George J. Takacs, Independent Consultant, Takacs Techniques

Goes for the training

The work done at MetroVision was more than just "training," but a series of actions taken to improve and change behaviors with the goal of improving customer service. The actions were successful because of a number of factors, including management involvement, encouragement of personal growth, a job-specific approach, student involvement and goal setting.

Management involvement

Management got involved in the development of the training and encouragement of skills imparted. In fact, the technical manager actively participated in the development of the training and in its reinforcement. If this one factor had not been present, the results would have been minimal.

The participants knew that everyone in the organization was attending customer service training. As a result, the participants did not feel isolated or picked upon. (Whenever one group is singled out for training, the members spend more time and energy trying to figure out why they have to go than they do on acquiring and applying new skills.) Just as important, the supervisors attended the class with their field service personnel. The supervisors led by example—not just words.

A common complaint heard by consultants from participants goes something like this: "What you are presenting is fine and helpful, but the person who really needs to be here is my boss." When this attitude is prevalent, the students resist some of what they are learning and don't feel comfortable talking to the boss about it. Here, the boss was present in the room learning the same information. Everyone shared a common experience that can now be referenced when discussing future problems.

Participants need feedback that management supports the skills being taught. An outside consultant cannot by his or herself cause change in an organization. Studies have shown that the immediate supervisor has the most effect on an employee. The employee follows the supervisor's lead when he or she determines what is important in a company. Employees respond more to the behavioral messages of a supervisor than to the verbal message.

What was interesting was that the group that did not have its supervisor present had the least questions, comments and enthusiasm. This group was, consequently, the most difficult to work with. Those group members are probably showing the least results.

Professional and personal growth

The workshop taught professional skills and personal growth skills. As Jan Carlzon, CEO of Scandinavian airlines, discovered in turning around his once troubled airline, training that provides for personal growth produces more results in the area of customer

SENCORE
3200 Sencore Drive, Sioux Falls, South Dakota 57107

Only The FS74A Allows You To See The Picture, Hear The Audio, Plus Measure The Critical Levels, Ratios, Hum And Noise In Just Seconds. . .

If you're like most companies, your present field strength meter will allow you to check signal levels only, but many troubles in cable systems just don't affect the signal level! So how can you ensure your customers are receiving the absolute best signal? Sencore recommends the following **1, 2, 3** Go-No-Go testing!

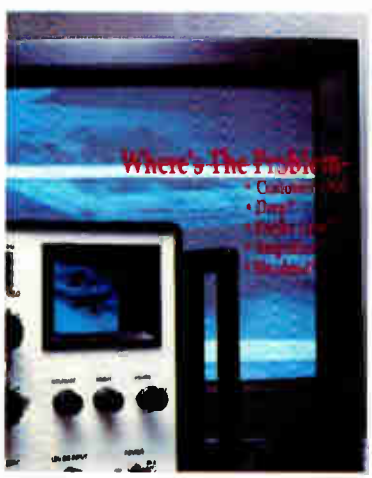
1 Sencore's New FS74A Channelizer Sr. allows you to measure signals all the way from the headend to the subscriber's tap, automatically and without any interpretations. Simply connect the signal and digitally tune through the channels in your system. You'll quickly read the video and audio levels of each and every channel from 5 to 890 MHz.

2 With the FS74A, hum and S/N tests are simple and error free. Simply tune to any RF channel, switch the function selector to either HUM or S/N and read the meter. There is no faster or more accurate method. (patented)

3 Use the FS74A Channelizer Sr. to actually view the video onthe exclusive built-in monitor. The FS74A passes a full 4 MHz of video so you will see the beat, ingress, or ghosting problems on the video monitor. You simply step through your sstem while viewing the monitor.

Plus, you get:

- FCC, HRC, and ICC cable shifting.
- Exclusive integrated AC and DC voltage measurements through the RF or DVM inputs.
- Portable — battery operation.



Ask for your **FREE** technical brochure!

For More Information Give Us A Call At 1-800-SENCORE! ext. 527 (736-2673)

Reader Service Number 23

Personal Communication Networks

What are the issues cable operators are mulling?

For something that hasn't even been defined yet, and given the cable industry's propensity to "wait and see" when it comes to technological innovation that promises to revolutionize the trade, it is highly surprising how quickly cable operators are jumping into the personal communications network (PCN) ocean with both feet.

Yet that is precisely what is happening. At least half of the Top Ten MSOs have already filed with the Federal Communications Commission for experimental PCN licenses, hoping to capitalize on the wireless technology as a way to improve the efficiencies of their networks. More are expected to follow suit.

A revolution?

Why? At the very least, operators see PCN as a way to offer two-way services like pay-per-view. At the most, PCN represents an opportunity to offer local loop telephony and data carriage for the lucrative business market—and maybe residential voice traffic as well. Involvement in PCN could be the method cable operators use to compete with the telcos for voice, which could be the quid pro quo for allowing telcos to provide information services, like video.

What all the fuss is over is a low-power, digital, wireless transmission method that resembles cellular telephone. However, PCN differs from cellular in that the cells are much smaller, which in effect increases the number of potential simultaneous users, and requires less power. Because each cell is so small, the pocket-sized handsets used can also be low-power and therefore less expensive than today's portable cellular units. Ultimately, according to Stuart Lipoff of Arthur D. Little, handsets are expected to sell for under $100 and monthly usage fees will be less than $25.

If PCN services strike a chord with the public, it is expected to evolve from little more than a telepoint service typically located in high traffic areas and tied to the local public switched telephone network to a multi-channel mobile- or base-originated service with high-speed switches capable of rapidly "handing off" signals from one cell to another.

A good fit

Cable operators fit into the picture because many believe the CATV network is ideally suited to support the PCN infrastructure. As operators install fiber cable deeper into their systems to improve pictures and add channel capacity, PCN microcell receive sites can be co-located with fiber receivers, lending cost efficiencies to network construction, some say.

> Involvement in PCN could be the method cable operators use to compete with the telcos for voice.

Regardless of how PCN evolves, there are a number of issues that have to be addressed before cable operators become comfortable with the concept. In their FCC filings, MSOs plan to address a number of issues, including:

- The best frequencies to use to send and receive signals.
- The effect of various terrains and population densities on signal propagation.
- The amount of power needed to "cover" an area.
- Use of the wireless network as a return path.
- Antenna directivity, gain and polarization effects.
- Handoff and control algorithms.
- Spread spectrum and coding techniques.
- Costs associated with "the last mile," network set-up and cell interconnection.

Finding spectrum

Perhaps the earliest experimental testing will focus on precisely where to place PCN signals. The ramifications are critical. If cable operators can successfully transmit data for backhaul uses over the Cable Television Relay Service (CARS) band (12.7 GHz to 13.5 GHz), a spectrum space often not shared with anyone else, a major regulatory obstacle will have been hurdled early.

However, the CARS band is not expected to be suitable for base-to-handset transmissions because of the concern that high-frequency signals will be unable to penetrate office buildings effectively.

In addition to the CARS band, most operators plan to experiment with the 1.85 GHz to 1.99 GHz band, considered by most PCN experts to be the frequency band of choice. In fact, this is the spectrum space the FCC expects to eventually allocate for PCN use, according to its Notice of Inquiry. However, this area is shared with private operational-fixed microwave users, which forces the use of spread spectrum technology to avoid interference.

Other bands that will be experimented with by various operators include spectrum that falls into an area assigned to unlicensed spread spectrum uses under FCC Part 15 rules: 902 MHz to 928 MHz (shared by many users, including medical, industrial scientific and radio frequency location); 2.4 GHz to 2.4835 GHz (to allow tests of shorter wavelengths to avoid interfering with fixed mobile radio users; and 5.725 GHz to 5.85 GHz, where point-to-point interconnection of cells using spread spectrum high speed data

Continued on page 70

Panasonic® just erased the last advantage videotape had over videodiscs.

Presenting the LQ-4000, the first rewritable optical disc recorder/player.

You've never worked this fast. You've never worked this easy. Because you've never had a tool with the speed and flexibility of Panasonic's new LQ-4000 rewritable.

It makes post-production and commercial insertion editing with tape seem like slo-mo.

Forget tape shuttling. Forget degraded picture quality. Panasonic gives you unparalleled speed and outstanding clarity.

You can access any frame or section of the disc in an average of 0.7 seconds. And play selections at up to 10 times the normal speed (up to 300 frames/second).

You still write to or from all your familiar formats, like S-VHS, Analog RGB, Dubbing and Composite. And the LQ-4000 uses standard RS 232/422 and I/O Interfaces. Best of all, the picture is always near-broadcast quality (420 lines in Hi-Res mode), whether you're rewriting to disc for the first time—or the millionth.

The Panasonic® LQ-4000 Rewritable Optical Disc Recorder.

Tape has met its master.

For further information on the LQ-4000 or player-only units, call toll-free **1-800-742-8086.**

Peripherals, Computers, Printers, Copiers, Typewriters & Facsimiles

Panasonic
Office Automation OA

ODR2-CED

Reader Service Number 25

PCN: Is it really a business?

A.D. Little survey says there is a huge market waiting

Last September, Millicom Telecommunications released the results of a PCN demand analysis study it commissioned Arthur D. Little Inc. to perform. The study separately surveyed both residential (600 interviews) and business (400 interviews) segments nationally and took small samples (100 interviews each) in Orlando, Florida and Houston—two cities where Millicom will conduct beta tests of PCN.

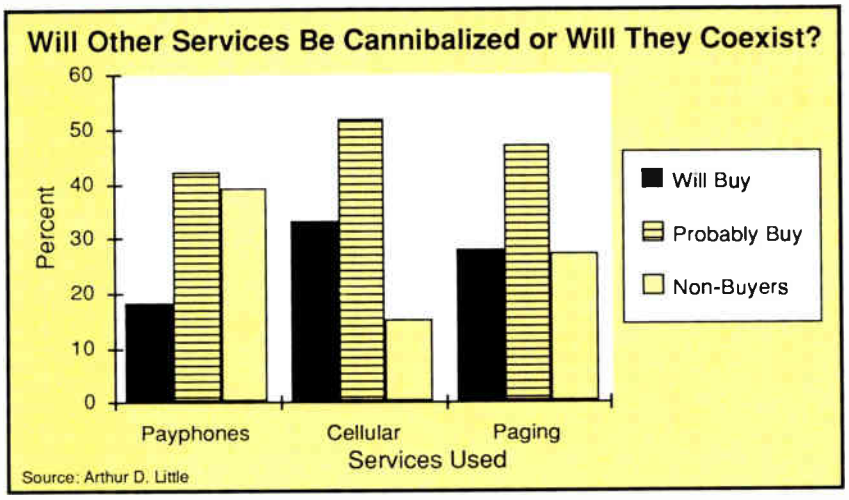


Figure 1

Nationally, as many as 40 percent of all households indicated they are likely to subscribe to a new service with the basic attributes of PCN. This is nearly double the normal acceptance rate found for new services at this stage. And the interest cuts across all soci -economic strata in a relatively uniform manner, a most unusual demographic phenomenon.

The residential surveys revealed:

- The potential subscriber group of 41 percent at the lowest price combination is equivalent to 37.3 million residential telephone access lines.
- The level of interest declines as the premium over existing telephone services increases from $10 to $40 per month.
- The level of interest is much less sensitive to an increase in the initial purchase cost of the access device from $100 to $250.
- Of the potential subscriber group, 75 percent said they would subscribe within the first year of availability.
- Potential subscribers are likely to already have or use other advanced telecom devices or services such as answering machines, cordless phones or personal computers.
- 18 percent of potential subscribers come from existing cellular users yet two-thirds perceive PCN will replace cellular service and they generally perceive that PCN could replace their regular telephone service, payphones, pagers, and cordless phones to a large degree rather than being additive.
- Even at the highest price level, the demand in both Houston and Orlando is 50 percent greater than in the national sample.

The business survey revealed:

- Business users are somewhat less likely than residence users to subscribe to PCN.
- More than one in three firms would buy PCN at the lowest level of monthly premium and set price and more than one in four at the highest.
- Of potential business users, 68 percent said they would subscribe within the first year of availability.
- Most business buyers will commit to PCN with one to five units initially, but larger firms expect to buy in quantity.
- Demand profiles are similar for large and small firms, but at the lowest price combination, large firms are 42 percent more likely to buy than small firms.
- At the highest price combination, small firms are more likely to buy and show a preference for the higher priced device.
- PCN may cause significant dislocation among existing telecommunications services and devices since 28 percent of business users would replace regular telephone service, while 68 percent think it will be additive.
- Six in 10 potential subscribers expect PCN will replace existing cellular and paging services; four in 10 expect PCN to replace payphones; and only two percent think it will be supplemental.
- By a margin of 2 to 1, PCN buyers expect PCN to displace cordless telephones rather than supplement them.

According to the study analysts at Arthur D. Little, the survey results understate the national demand for PCN. Since the Houston and Orlando demand level is 50 percent higher than the national sample, the assumption may be taken that with advance publicity "demand for PCN may be even higher than reflected in this (national) survey—that education of consumers will result in more subscribers both initially and in the long term."

—George Sell

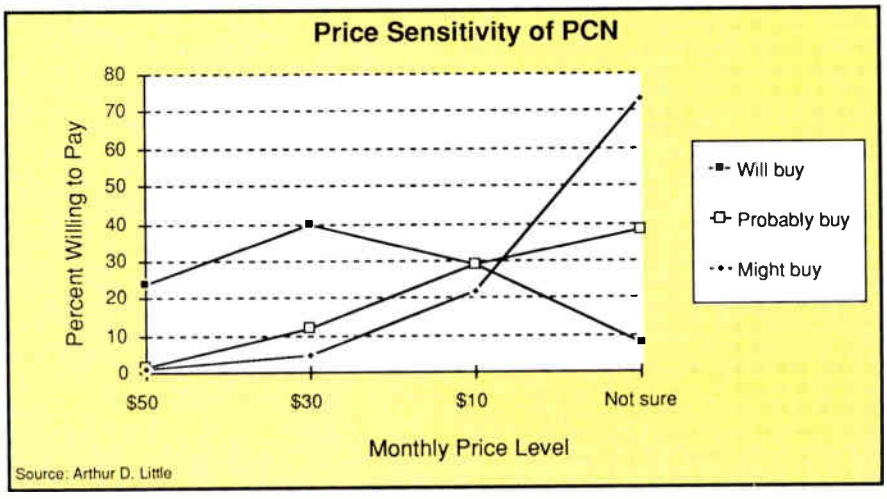


Figure 2

Catch us on local cable.

Tek's CATV System Sweep with its compact, lightweight design makes a big difference up there on the pole. And none at all in your subscriber's picture. It's virtually *non-interfering*.

You can leave the 2721 Transmitter running continuously once it's installed. It won't show a glitch. And with the 2722 Receiver—about the size of a SLM—you get long-term memory for over 50 waveforms, data entry with alpha-keyboard convenience and a high-contrast LCD display viewable in direct sunlight, no hood required.

No need to hassle with instant photographs either. With our low-cost PC download software you can transfer waveform data and text entries to your PC and reconstruct it all easily in Lotus 1-2-3® spreadsheets—for permanent records and planning.

You owe it to yourself and your technicians to get the full story on the 2721/2722 and other CATV products from Tek. Because when it comes to test and measurement, we really perform!

1-800-426-2200 Ext. CATV

Tektronix®
COMMITTED TO EXCELLENCE

Reader Service Number 26

Continued from page 66
interconnection where CATV connections aren't possible.

Spread spectrum

Regardless of where in the frequency plan PCN is allocated spectrum, it will no doubt have to share that space with other users. In order for more than one service to coexist without interference, spread spectrum technology will be needed. There are two primary techniques to achieve spread spectrum: frequency hopping and direct sequence.

Taking the latter first (because this is the method cable operators are examining), direct sequence calls for wideband modulation of the data stream in a repeatable pattern. It is recovered by demodulating with an identical signal. Conversely, frequency hopping methods bounce the carrier frequency in a predictable pattern. To receive the signal, the receiver simply follows the pattern.

Multiple direct sequence data streams can be transmitted and recovered via "time" (time division multiple access or TDMA) or "code" (code division multiple access). In TDMA, each channel is given a specific time interval and the receiver is coordinated to respond only during the time the desired channel is operating. In CDMA, a different noise pattern, or code, is assigned to each channel. The receiver then responds only to the matching code. Everything else is covered by noise. (For a detailed discussion of spread spectrum technology, see Archer Taylor's column on page 24 of this issue.)

Naturally, a number of tests related to signal power and propagation will provide valuable information regarding a PCN network construction. One of the biggest issues—which so far has elicited varying opinions from personal communications experts—relates to the number of receive sites. Published estimates for a large city run from several hundred to several thousand and, no doubt, hinges directly on population density, topology, environment and other subjects.

Alternative Development Scenarios
Cost Perspectives

System Alternative	Startup (10K Subs)		Midterm (200K Subs)		Longterm (7M Subs)	
	Total $ Million	$/Sub	Total $ Million	$/Sub	Total $ Million	$/Sub
Cellular	25	2500	240	1200	-	-
PCS	136	13600	231	1155	3631	519
Telepoint	0.7	70	14	70	490	70
Telepoint + Paging	1.7	170	18	90	630	105

Source: Arthur D. Little

Table 1

Cost issues

The network's ultimate cost will depend upon the capability built into it. To perform like a cellular system, which is capable of passing along signals from one cell to another as vehicles pass through them, closely-spaced microcells will need high-speed switches because vehicles will be passing through cells much more often. Even if PCN is limited primarily to pedestrian or static users, there will be instances when hand-offs will be necessary. These switches will dramatically impact the cost of the network. However, PCN experts believe the cost of the network will still be lower than its cellular cousin, thereby resulting in lower costs for the service and, because it's a low-power service, handsets will cost less, too.

Another major determinant of a PCN's economic viability over cable is the amount of plant restructuring necessary to integrate the service. Clearly, cable operators are moving in the right direction by installing fiber in their systems, which avoids the upstream interference woes often suffered with coax, say the experts. But is fiber to the feeder necessary? Many observers think so. American Television and Communications aims to find out in its St. Petersburg, Fla. test. ■

—Roger Brown

MICRO-BEAM®... A Commitment to Service.

Channel Master® believes that customer service shouldn't be a "High-Cost" option. That's why MICRO-BEAM system specialists offer more customer services **at no extra charge** than anyone in the business.

Total Customer Service

- **2 Year Warranty - Includes Parts and Labor.**
- **24 Hour On-Site Service - 7 Days a Week.** (Continental U.S. Only)
- **System Design/Path Feasibility.**
- **On-Site Training.**
- **FCC Application Assistance.**
- **Equipment Installation and Path Alignment.**
- **Fastest Lead Time in the Industry. Equipment and Spare Parts are In-Stock Ready to Install.**

MICRO-BEAM allows you to cost effectively consolidate system equipment into a single headend. 1, 2, 5 & 10 watt high performance CARS-BAND microwave systems can be designed in a variety of hub configurations delivering up to 80 channels.

For more information about the MICRO-BEAM service advantage, contact:

Jim Crownover
MICRO-BEAM Sales Manager.

See us at the NCTA '91 Show, Booth #1745.

Channel Master® Division of Avnet, Inc.
P.O. Box 1416, Industrial Park Drive, Smithfield, NC 27577
Phone (919) 934-9711 • Fax (919) 989-2200

Reader Service Number 28

Commercial insertion in smaller markets

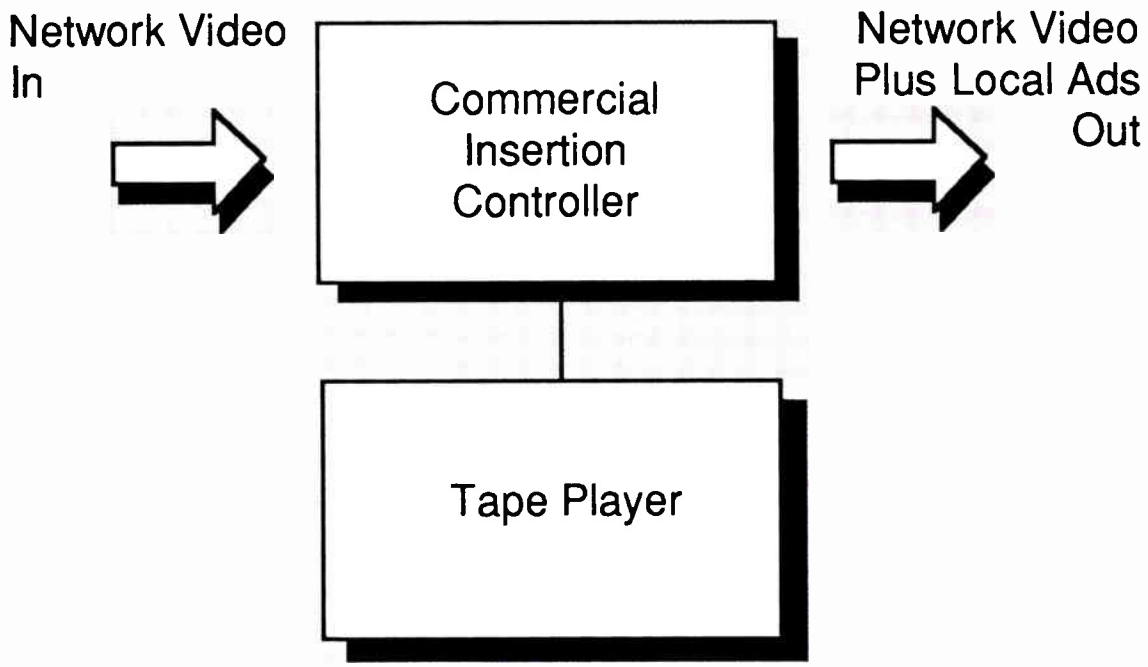


Figure 1

Local ad sales is a rapidly growing revenue source for cable television operators. This is true in part because a well-managed ad sales operation is highly profitable, and in part because ad sales is now getting significant MSO attention as an incremental revenue opportunity not subject to political backlash in these days of congressional focus on subscriber rates.

Local ad sales organizations have been so successful in major markets that most MSOs have established a corporate staff position to direct progress. Major market operations can

By Bill Dawson, and Linda Arnold, Texscan Corp.

generate enough revenue to squeeze, in effect, an additional month's income out of each year. According to Cable television Advertising Bureau projections, overall CATV advertising revenue will grow at a healthy 15 percent compounded annual rate at least through 1994, and local spot advertising represents the fastest growing segment.

While the 800 or so systems larger than 20,000 subscribers serve more than 60 percent of the nationwide subscriber base, there are nearly twice as many systems in the 5,000- to 20,000-subscriber range. But revenue potential in smaller systems is limited. Advertisers buy "eyeballs." Fewer viewers means fewer advertising dollars are available. Consequently, operators in smaller communities generally have modest capital budgets which will buy equipment with only limited performance and expansion potential. Simple commercial insertion controllers for sequential or random sequential insertion using 3/4-inch tape players is the most widely installed approach for small market commercial insertion.

The two fundamental ways to minimize capital equipment costs are to share tape players across many networks and utilize Run of Schedule (ROS) operation. The drawbacks are that spots may be missed unless one VCR is dedicated to each network (or a mutually exclusive pair of networks) and there is no ability to charge higher rates at premium times, such as during major sporting events. The major disadvantage of this approach is the lack of ability to quickly change the schedule, a key feature of most random access designs.

New approaches for the '90s

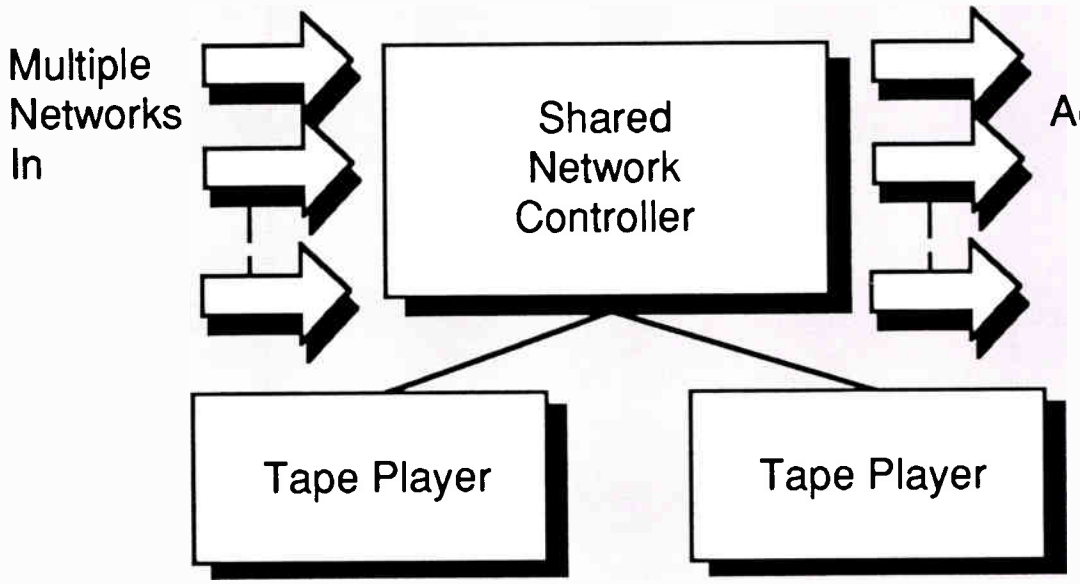
Shared equipment. Recent product offerings from the commercial insertion equipment suppliers give small system ad sales organizations significant improvements in control and flexibility. They will be able to offer better service to their clients at lower cost, and probably increase revenue in the process.

In a sophisticated, full random access commercial insertion system, the large number of VCRs needed typically accounts for nearly half of the headend equipment cost. The secret to stretching capital equipment dollars is to get the most network coverage out of the smallest number of tape machines. With the new generation of programmable shared network controllers and switches now available from several suppliers, operators can now cover more networks with an investment in only a few VCRs. Depending on the model, you may also be able to switch between ROS and random sequential on a programmable timetable to gain the capability to charge premium prices for spots aired during special events.

Simplified operation. More manufacturers now offer simplified tape marking with their small market systems that helps to reduce the time and equipment necessary to build tapes with only a playback deck and a 5850-type recorder. No tape marks, directories or full-blown edit suites or marking systems are necessary.

Increased automation. Automated systems for tape preparation decrease staffing requirements. PC-based markers, compilers and editors all work to streamline operations. Some can be expanded to grow as the demand of the operation grows. An investment in this class of equipment is particularly helpful to an interconnect, which services many headends, even though each headend may be small.

New formats. The Super-VHS format is maturing, and the high-end consumer camcorders and editing equipment



Programmable Shared Network Controller
Allocates Tape Players
To Network on Programmed Schedule

Figure 2

which are now becoming available will allow many smaller systems to set up in-house production capabilities.

Hi-8 is gaining popularity as an "acquisition format" even in demanding news gathering assignments. For advertising applications, the small size and excellent video quality is particularly well suited to on-site production at a local merchant's shop.

But automated players for commercial insertion at the headend are not yet available, and reliability and ruggedness in the demanding headend environment have yet to be proven. If and when appropriate players become available, Hi-8 could gain acceptance in the headend because these machines would certainly be much smaller than today's 3/4 inch machines, allowing more networks to be installed in existing headend buildings.

Easier in-house production services. Operators no longer need full scale production facilities to create spots for clients. People with the necessary artistic and video production skills are also more readily available, because of the popularity of home video. In addition to the new video formats, titlers, effects generators, and other production tools are available to give local ads a more polished look. For a really lean operation, pre-packaged motion video backgrounds are available which can be converted to ads with just titling equipment. The continuing development of S-VHS and Hi-8 equipment will make in-house and production equipment increasingly easier as time passes.

Interconnect considerations

Commercial insertion installations may either be standalone, tied to a larger adjacent market, or integrated into a small interconnect. Standalone operations have the most flexibility in equipment choice, because interconnected markets must incorporate the small market within their current operation. But a standalone operation must have its own tape production facility and management structure, both of which add capital and operating costs. Consequently, there has been a strong tendency to bring small market ad sales efforts under the umbrella of a larger nearby operation.

Be careful with compatibility when selecting equipment to add to an interconnect. Some products are incompatible with existing tape preparation systems or traffic and billing software. Care must be taken to ensure that operations will not be disrupted nor additional work created when adding a smaller market headend to an existing advertising operation.

As an interconnect of small systems grows, it takes on the nature of a larger operation. Compromises necessary for these types of systems in terms of flexibility, quality and/or reporting may not satisfy the requirements of an increasingly sophisticated advertiser—even in smaller markets.

Support services from networks include sales seminars, which are held across the country, and monthly ad sales kits which include programming schedules, quantitative and qualitative research data for target clients, and advertiser solicitation tapes to air on the system. Some networks also provide "hotline" services for telephone consultations. In selective cases, on-site training is also available for local management and sales personnel. These services can be invaluable in developing and maintaining credibility with advertisers within the community.

The equipment supplier is also an integral member of the team, because systems put in place must not only mirror the requirements of the local advertising community, but also must allow the operator room to grow as his operation matures. Typically, a commercial insertion equipment supplier will provide system configuration services. As the customer, operators need only describe their needs in general terms, and suppliers will recommend equipment best suited to the job.

The traffic and billing software supplier can assist by providing reports that will satisfy local advertisers and agencies and yet fit well within the overall management system of the ad sales organization. Traffic functions can now be handled on PC-based systems specifically designed for smaller market applications. Reasonably priced billing software packages, either standalone or integrated with trafficking software, are also available from a number of sources. These software packages provide maximum efficiencies for a modest investment, and can help "professionalize" the ad sales business.

Suppliers in the commercial insertion industry have made great strides in developing systems that will help smaller operators accomplish all major functions found in the largest advertising business.■

Back reflection in CATV systems

The cable television industry is in the stages of undergoing a capability expansion by using optical fiber to provide additional channels of video programming as well as some form of high definition television (HDTV).

Without going into great depth about the advantages of the various fiber topologies, implementing optical fiber offers the following:

- Exceedingly high potential information bandwidth.
- Low loss.
- Small size.
- Rugged physical/chemical properties.
- Electromagnetic interference immunity because of its dielectric nature.

However, as with any system, there are losses which must be examined so that design requirements are met. For a CATV system, back reflection is a primary concern because the very high frequency analog signals make the corrupted signal particularly difficult to recognize at the receiver. This article focuses on some of the causes of back reflection and presents the instruments needed to test a system incorporating fiber at both its installation and maintenance stages.

What back reflection is

Back reflection, also commonly referred to as back scattering or return loss, is defined as the ratio of the light scattered in the opposite direction of propagation to the light in the original direction of propagation. It results from the fiber's intrinsic properties as well as from components within the system. Rayleigh scattering is a type of scattering caused by inhomogenities in the fiber much less than a wavelength in size, such as refractive index fluctuations from density and compositional variations in the fiber.

Much of this light will enter the fiber cladding and be dissipated. In a good quality fiber, the actual amount of backscatter light captured by the core and carried back toward the transmitter due to Rayleigh scattering is very weak; typically in the order of 65 dB below the transmitted signal. It is therefore known that the components in the system are the key factors contributing to the reflection loss. Potential sources of these reflections typically include the packaging optics, the in-line optical isolator, connectors, splices and the detector PIN. These sources produce back reflections which are classified as Fresnel reflections. These reflections occur at the planar junction of two materials having different refractive indices.

Splicing refers to an interconnection method for joining the ends of two optical fibers in a permanent manner while a connector is a disconnectable device used to join a fiber to a source, detector, or another fiber; the latter is designed to be connected and disconnected with ease. Splices and connectors aim to couple light from one component to another with as little disturbance as possible, therefore precise alignment of the mated fiber cores is desirable.

Exfo's variable back reflector

Splices and connectors are required for various reasons. For example, in a long link, because fibers are offered at limited lengths, they must be spliced end-to-end. Connections are also required to be made at building entrances, wiring closets and couplers. The most common type of splice is the fusion splice which uses an electric arc to weld two glass fibers together. The fusion splicers available today are extremely efficient, thus rendering the amount of back reflection at the splice negligible.

Connectors and mechanical splices are therefore seen as the main contributors to back reflection. The causes of reflection are due to a change in refraction index caused at a discontinuity by either lateral displacement, end separation, angular misalignment or surface roughness. All of these backscatter light, since each involves having the electromagnetic light wave travel from one medium to another of different refractive index.

Lateral displacement refers to the misalignment of two fibers from their center axes. Light is backscattered if the wave should exit the core of one fiber and hit the cladding of the next. End separation is a common problem with many connectors or mechanical splices. The two fibers which are to be connected in this case do not make physical contact, thus leaving an air gap. Back reflection occurs at both the exit from the first fiber and at the entry of the second fiber, even if an index-matching oil is used. For a glass fiber having a refractive index of 1.475, the reflection loss caused by an air gap is about 0.163 dB. The total effect over the two joining fiber is then 0.326 dB of reflection loss. Furthermore, back reflection at an air gap may create constructive or destructive interference and additional losses may result.

Losses are minimized by using index adaption liquid which reduces the beam divergence. The refractive index of this liquid or gel is very near to that of the fibers. Reflections are, however, not entirely suppressed, as the liquid which is usually chosen is one having a refractive index equal to the average refractive index between the fiber core and cladding.

Angular misalignment is not as common as lateral displacement. It occurs when the ends of mated fibers are not perpendicular to the fiber axes, thus leaving an air gap. Surface roughness suggests that the fiber has not been polished down to a flat surface free of residual particles; geometrical patterns of the EM waves are therefore disrupted and reflections will occur at the fiber endface.

Measurement equipment

CATV systems operate at VHF and

By Vedrana Stojanac, Sales Engineer, Exfo E.O. Engineering

UHF frequencies, typically at 300 MHz to 400 MHz with the newest systems operating at 550 MHz. The influence of back reflection at this speed is substantial. Problems may arise as the reflected light will travel backward toward the transmitting laser. The laser is a semiconductor diode having an optical cavity required for lasing. At low drive currents the laser acts as an LED, while operating at its threshold level will induce lasing action. It is then biased just below the threshold current to make it work in its linear laser mode.

Having a light pulse return to the laser will result in a varying power level of the signal, rendering the laser unstable. To protect the transmitters, they are always specified to operate up to a certain back reflection tolerance which is a function of the operating wavelength. When installing a fiber link, attenuation is a parameter which needs to be measured—a power meter and dual-wavelength laser source combination built into a single unit works well to minimize the number of instruments carried out to the field.

Exfo's variable optical attenuator

In dealing with back reflection, three instruments are recommended: a back reflector, a back reflection meter and a variable attenuator with low back-reflection characteristics. A variable back reflector serves to simulate a certain amount of back reflection into a fiber. When looking into purchase of these components, several items are important to keep in mind. First, look for a variable back reflector that is calibrated at 1300 nm and 1550 nm with a preliminary dynamic range of -8 dB to -55 dB at a resolution of 0.02 dB. Also, select a unit with a high quality filter and star coupler, which minimizes loss with respect to the number of terminal ports.

Variable back reflectors

A variable back reflector is a unit that is designed to generate a calibrated level of optical reflection back into the fiber. The user can then set the unit to the selected level of reflection to determine the tolerance of transmission equipment to back reflection; the level of excess reflectance the transmission system could tolerate is then identified. This test should be performed by the original manufacturer of the transmission equipment. It is also useful in the field at the time of installation to verify manufacturer specifications.

Back reflection test set

Back-reflection generated by the network itself should also be measured during the network's installation. Such measurements determine whether or not the new fiber meets the requirements for the transmitter to work adequately.

Other indispensible instruments for the proper testing of a CATV fiber link are optical variable attenuators. These are necessary to simulate loss in the fiber thereby testing the system's dynamic range. However, such attenuators should not create optical reflectance which would, in turn, influence the transmitters. One very important specification to look into when selecting a variable attenuator is its level of reflectance. Many transmitters will not tolerate a back reflection of -20 dB to -25 dB, so look for low back reflectance.

In conclusion, CATV systems are unarguably turning to fiber optics as part of their future architectures. Improvement in picture quality and extended services will directly result. The quality of fiber optic test equipment has also facilitated this transition, as it provides full testing capability. This equipment, specifically the variable back reflectors, back reflection meters and variable attenuators having applications in long haul and FDDI (fiber distributed data interface), may help reduce problems associated with back reflection. ■

WHAT'S AHEAD

SCTE

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

March 7 *Upper Valley Meeting Group* "New transportation tecynology," including "DBS" presented by CableLabs (tenative) and "MMDS" presented by the SCTE's Ralph Haimowitz. To be held at the Holiday Inn, White River Junction, Vt. Contact Matthew Alldredge, (802) 885-9317.

March 9 *Chaparral Chapter* Contact Brian Throop, (505) 761-6289.

March 10-11 *Old Dominion Chapter* Holiday Inn, Richmond, Va. Contact Margaret Davison-Harvey, (703) 248-3400.

March 12 *Chattahoochee Chapter* "Digital fiber optic technology for audio and video applications." Contact John Williamson, Jr., (404) 376-5259.

March 13 *Dixie Chapter* Contact Rickey Luke, (205) 277-4455.

March 13 *Michiana Chapter* "Microwave," with Dane Walker of Hughes Aircraft Co. To be held at the Signature Inn, South Bend, Ind. Contact Russ Stickney, (219) 259-8015.

March 13 *Oklahoma Chapter* Contact Arturo Amaton, (405) 353-2250.

March 13 *Smokey Mountain Meeting Group* Information to be supplied. Contact Grant Evans, (615) 247-2183.

March 13 *South Jersey Meeting Group* "OSHA regulations and recordkeeping" with Hank Deloof of OSHA, "Safety Products," with Janette Flannigain of Orr Safety, "Safety Training" with James Hurley of TKR Cable and Henkels and McCoy, and "Ladder Safety," with Tom Bechler of Batavia Ladder. Contact Kevin Hewitt, (607) 886-7228.

March 13-14 *Big Sky Chapter* Consecutive meetings for installers to be held March 13 (Ramada Inn, Billings, Montana) and 14 (Colonial Inn, Helena, Montana). Contact Marla DeShaw, (406) 632-4300.

March 14 *Tennessee Chapter* "Installation troubleshooting," to be held at the Airport Hilton, Memphis, Tenn. Contact Dan Shackelford, (901) 365-1770.

March 14 *Wheat State Chapter* Speaker: John Ridley of Jerrold Communications. To be held at the Red Coach Inn, Wichita, Kan. Contact Mark Wilson, (316) 262-4270.

March 16 *Cactus Chapter* "Signal Leakage and Frequency offsets." Contact Harold Mackey Jr., (602) 866-0072, x282.

March 17 *New York City Chapter* Contact Rich Fevola, (516) 678-7200.

March 20 *Appalachian Mid-Atlantic Chapter* "SCTE and the training it provides," to be held at the Holiday Inn, Chambersburg, Penn. Contact Dick Ginter, (814) 672-5393.

NCTI

The following training courses have been announced by the National Cable Television Institute (NCTI):

March 12-13 OSHA Compliance Seminar for CATV Operators, Dallas, Texas.

March 14 Fundamentals of Supervision Seminar for CATV Personnel, Dallas, Texas.

April 9 Fundamentals of Supervision Seminar for CATV Personnel, San Francisco, Calif.

April 10-11 OSHA Compliance Seminar for CATV Operators, San Francisco, Calif.

For more information on NCTI's new training seminars, contact Michael J. Wais at (303) 761-8554, or fax inquiries to (303) 761-8556.

SIECOR

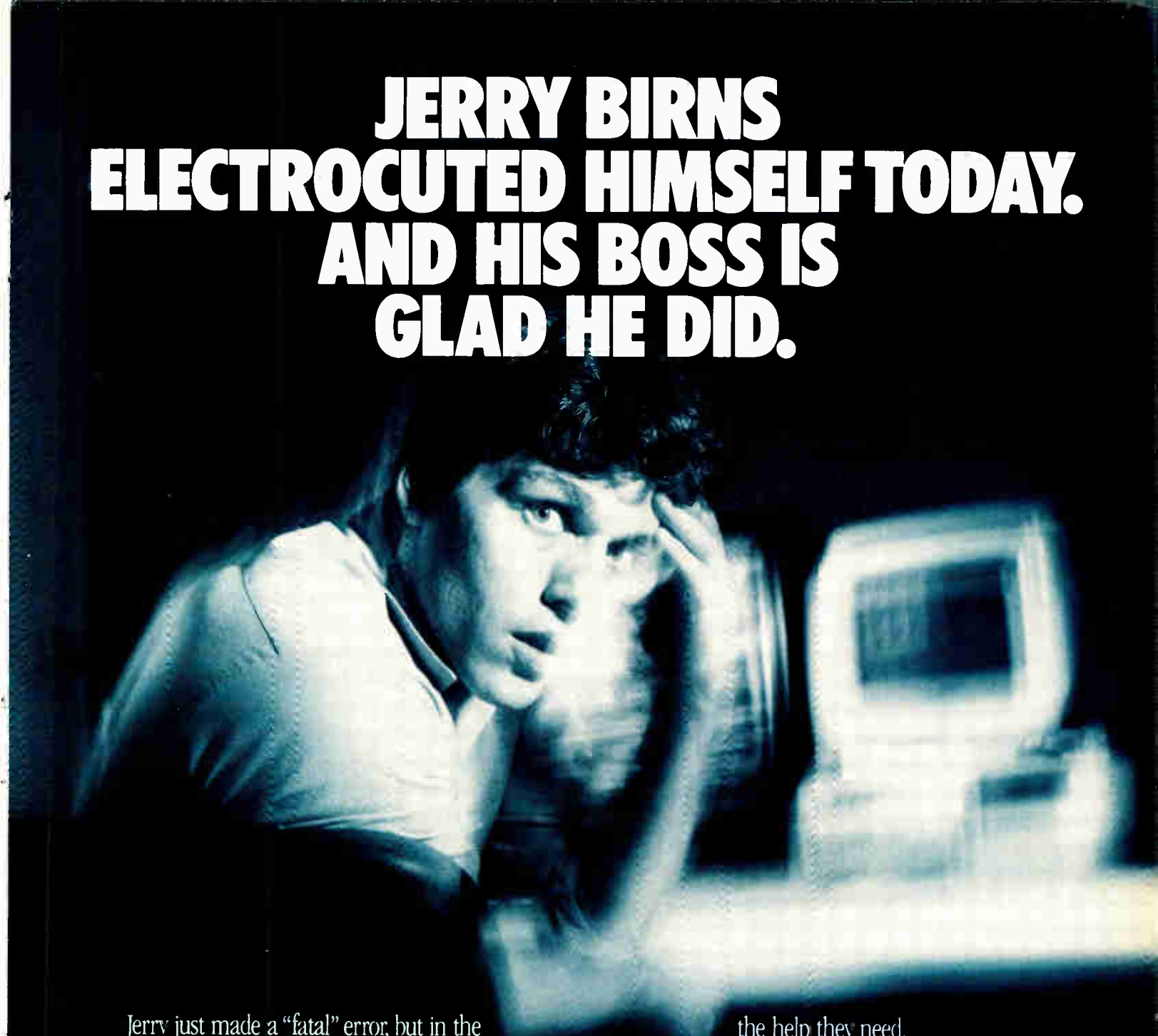
Siecor Corp. will sponsor a four-day, hands-on fiber optic training program designed for craftsmen and contractors who install, splice and test fiber optic cable in a cable television environment. Following is the date for the program "Fiber Optic Installation, Splicing, Maintenance and Restoration for Cable TV Applications." For info call (800) 634-9064.

Trade Shows

National Show **March 24-27** New Orleans, La. Contact NCTA, (202) 775-3669. *SCTE Cable-Tec Expo* **June 13-16** Reno, Nev. Contact SCTE, (215) 363-6888.

Cabletelevision Advertising Bureau (CAB) Show **New York Ciky** April 7-9 Contact CAB, (212) 751-7770 x.29.

JERRY BIRNS ELECTROCUTED HIMSELF TODAY. AND HIS BOSS IS GLAD HE DID.



Jerry just made a "fatal" error, but in the safety of a simulated work environment. What better way to learn about *the myth of insulated gloves?* It's just one of the many, many interactive exercises in the new technical training series from Mind Extension Institute™ Inc.

This is interactive-video training at its best. The student is truly involved every step of the way; responding to questions, making decisions and correcting mistakes. And, because the instruction is self-paced and one-on-one, anyone at any time can get just the help they need.

The new courses include General Safety, featuring the top ten safety issues in cable, and Installer Training, a nuts-and-bolts course that will challenge even the seasoned installer.

You take care of the hands-on training, we'll take care of the rest. Call now and take advantage of our free demonstration and special introductory pricing. 1-800-833-DISC.

MIND EXTENSION INSTITUTE™ INC

Produced in cooperation with: Alpha Technologies, Anixter Cable TV, AT&T CATV, Inc., Channell Commercial Corporation, Comm Scope, Inc., Eagle Comtronics, Inc., Gilbert Engineering Co., Inc., Integral, Magnavox CATV Systems, Inc., Scientific-Atlanta, Inc., Trilithic, Inc.

The CABLE POLL™
Midwest CATV • CED • CableVision

Stereo: Still muffled

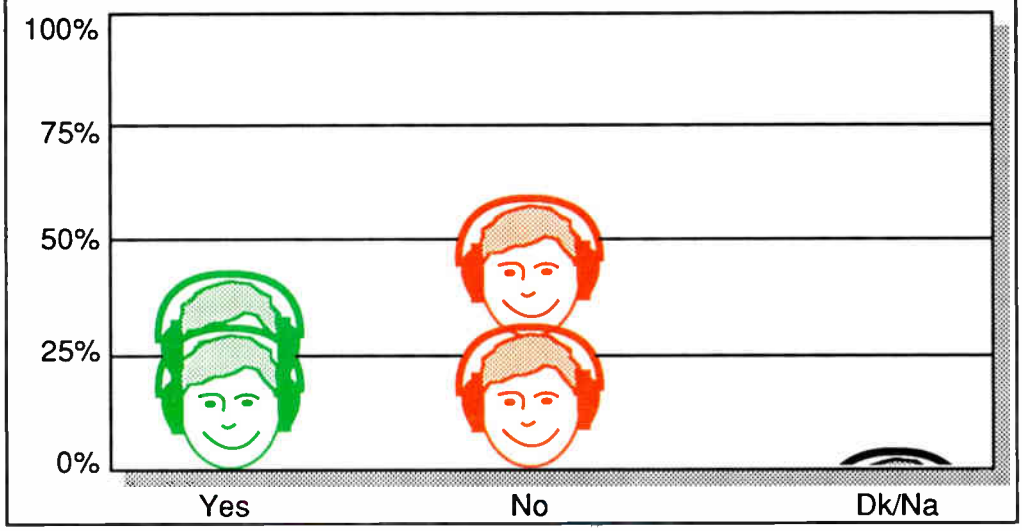
Despite growing consumer interest in stereo television sets, it appears that many cable operators—especially those in systems serving fewer than 50,000 subscribers—fail to provide stereo audio services to their subscriber base.

Recent statistics compiled by the Electronic Industries Association show that annual sales of stereo-equipped television receivers have increased from fewer than 5 million in 1988 to more than 6.6 million in 1990. But it appears cable isn't keeping pace with this trend.

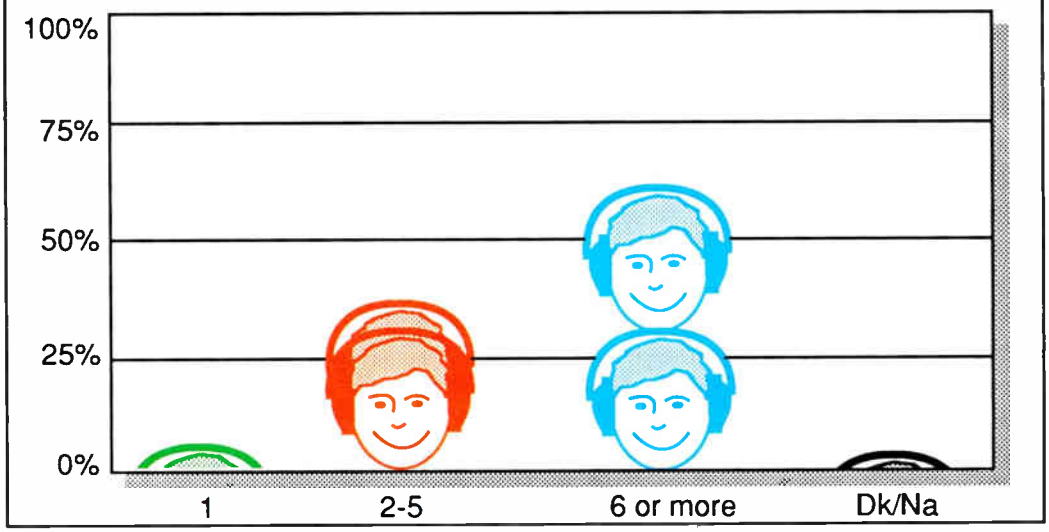
According to the September 1990 Cable Poll of 402 general managers, just 41 percent said their systems are equipped to provide stereo audio. Of these GMs, most—54 percent—provide stereo for six or more services, while 34 percent offer two to five stereo-equipped channels. About 7 percent provide only one service in stereo. Currently, about 20 cable programmers, all the major broadcast networks and a growing number of independent stations transmit in stereo.

A system's size is a key determining factor on whether or not stereo audio services are provided. More than 70 percent of GMs overseeing systems with more than 50,000 subscribers said their

Do you currently provide BTSC stereo audio services to subscribers?



On how many channels do you currently provide stereo audio services?



operations provide stereo audio. On the other hand, only 23 percent of managers running operations with fewer than 10,000 subs deliver stereo.

The number of channels encoded in stereo is also based on the quantity of subscribers served. As would be expected, larger systems carry more stereo-equipped channels. Almost 70 percent of larger operations deliver six or more stereo services, while only 39 percent of small systems provide that level of service.

Instead, the survey showed that small systems are more likely to furnish from two to five stereo channels.

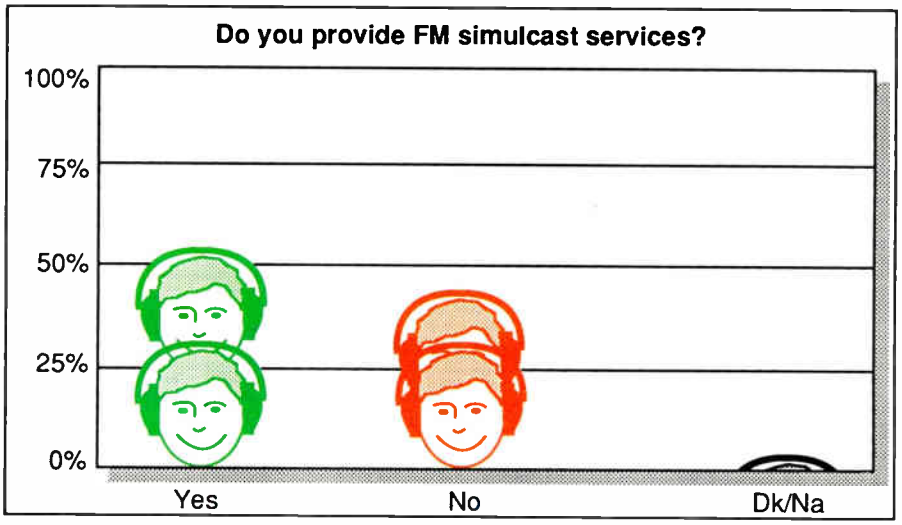
FM simulcast services, meanwhile, remain a popular offering. Some 54 percent of managers offer FM audio, and the bulk of these run systems with more than 50,000 subscribers. But FM is also fairly common for smaller operators; 47 percent say they provide such services.

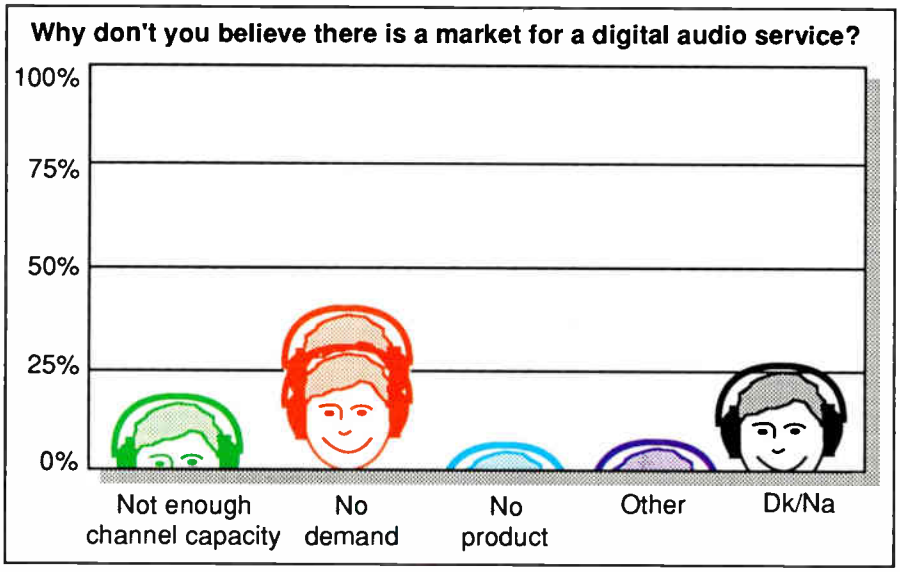
Even as managers assess the future of cable-delivered stereo audio, a new product—digital audio—is making its debut. But managers appear to be unsure about the service's potential, with most feeling there isn't enough subscriber demand to support a premium audio programmer.

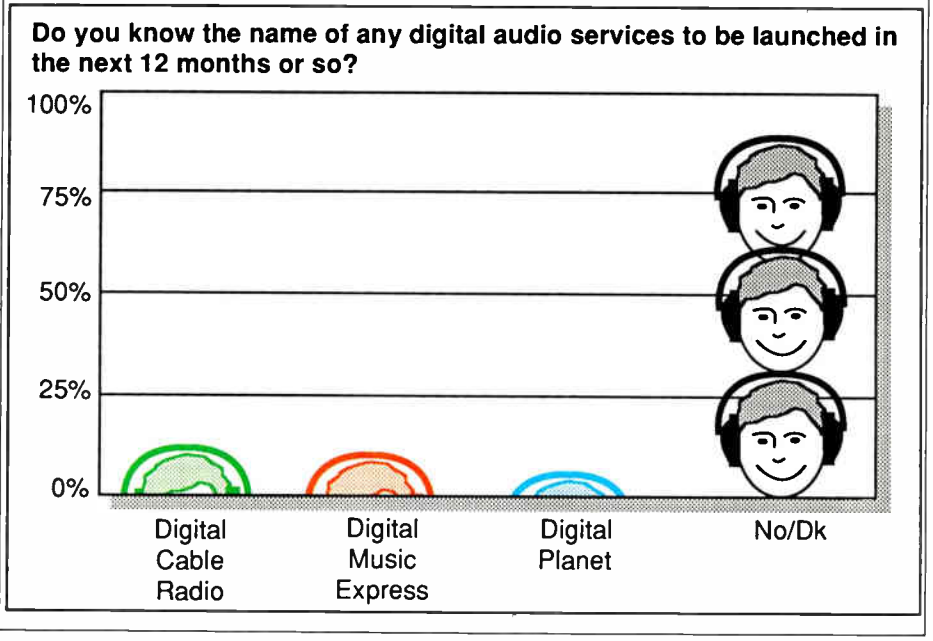
Asked why they didn't plan to offer a digital service, 43 percent of GMs said they didn't believe demand existed. Another 19 percent cited channel capacity as a problem, while 26 percent couldn't list a specific reason. Five percent said there wasn't any usable product available.

While product availability is a problem, name recognition is a larger obstacle facing digital audio providers. A whopping 87 percent couldn't identify by name the three companies—Digital Cable Radio, Digital Music Express and Digital Planet—that currently are tapping the digital services market. Of those who were familiar with the firms, Jerrold Communications' Digital Cable Radio had the highest name recognition—possibly because it is the only one of the three that has launched a service. Digital Music Express—backed by International Cablecasting and Scientific-Atlanta—was identified correctly by 11 percent and Digital Radio Labs' Digital Planet was recognized by 8 percent.

In this category, managers at larger systems were far more apt to distinguish by name the firms. Of small-system operators, fewer than 5 percent were able to recognize any of the companies. ■







Orbital spacing debate continues

As expected, home satellite dish manufacturers including General Instrument and eleven others are opposing two-degree satellite spacing in the orbital arc. The group has reportedly asked the FCC to initiate rulemaking toward the re-adoption of three degree spacing of C-band satellites.

The group argues that wider spacing will allow higher-powered C-band satellites to reach smaller dishes—four feet or less—without interference. Such a move to widen the satellite spacing will benefit the sales of home dishes. Conversely, leaving the birds at two-degrees could damage the home dish business, as the smaller backyard-type dishes have a wider beamwidth which could pick up interference from adjacent satellites, particularly if the satellites are spaced at two degrees.

Sources close to the controversy predict that the FCC may soon re-examine the spacing issue as it begins to feel "more heat" from the backyard dish industry and its congressional supporters. In fact, observers foresee a forthcoming public announcement in which the FCC will state its intention to re-examine the orbital spacing issue, in response to comments from Congress and dish owners.

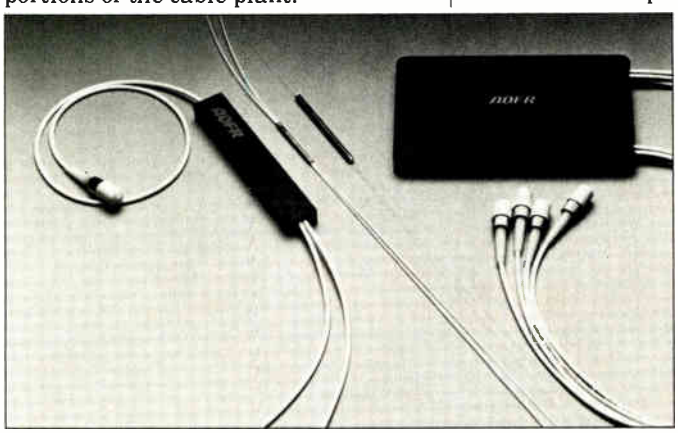
New products

In a recent announcement, **Alpha Technologies** has created versions of the Alpha Amp Clamp which install in eight power inserters offered by various manufacturers. The variations on the basic design enable use of the circuitry in couplers and splitters, which allows operators to extend power protection further into the distribution portions of the cable plant.

Alpha Amp Clamp versions are also being offered for amplifiers which incorporate the power inserter circuitry within the amplifier housing. Cable system operators are invited to contact Alpha on any special Amp Clamp requirements they may have, as the company will develop new versions on a "first come, first served" basis. For more information or to discuss custom requirements, contact Alpha at (206) 647-2360, or fax inquiries to (206) 671-4936.

AOFR has announced a new wideband and wavelength flattened single mode coupler. The wideband coupler offers a modified coupling ratio that provides a "relatively flat coupling characteristic" in single mode fiber from 1250 nm to 1600 nm. The characteristic, company officials say, offers companies the same coupling performance in both the 1310 nm and 1550 nm wavelength windows. The new wideband (WB) couplers will benefit system designers by enabling them to incorporate upgrades and expansion without having to purchase new couplers. If, for example, a system was initially designed to operate at 1310 nm, the wideband coupler provides and expansion and upgrade option to 1550 nm.

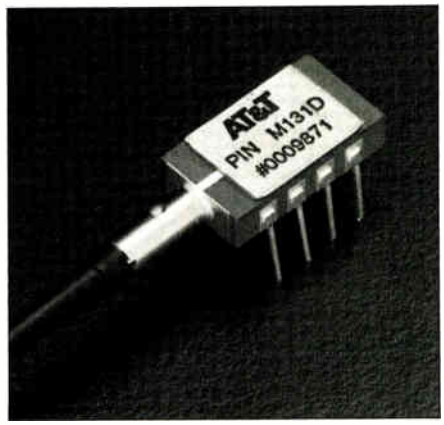
Wavelength flattened (WF) couplers are also available from AOFR, which have little wavelength dependence at either the 1310 nm or 1550 nm wavelength windows. The WB and WF couplers are used for splitting and combining, and are available in tree and star configurations. The 2 x 2 and 1 x 2 couplers are available with coupling ratios from 10:90 to 50:50. All AOFR couplers are manufactured using fused biconic taper technology, which gives an all fiber construction with low excess loss, high directivity, and low backscatter.



AOFR's single mode coupler

Several different coupler packages are available from AOFR, including a small, "tubular package," with acrylate or 0.9 loose tube buffer pigtails; the "ruggedized package," which allows buffer or 3mm Kevlar reinforced cable pigtails in 2 x 2 and 1 x 2 configurations; and the "FO-1 Fiber Organizer Package," which provides for loose tube buffer or cable pigtails in star and tree configurations. For more information on the couplers, contact Dr. Peter Jacob at (214) 644-1394.

New from **AT&T Microelectronics** is an analog photodetector which converts optical energy into electrical



AT&T Microelectronics' 1310 Astrotec® long-wavelength P/N photodetector

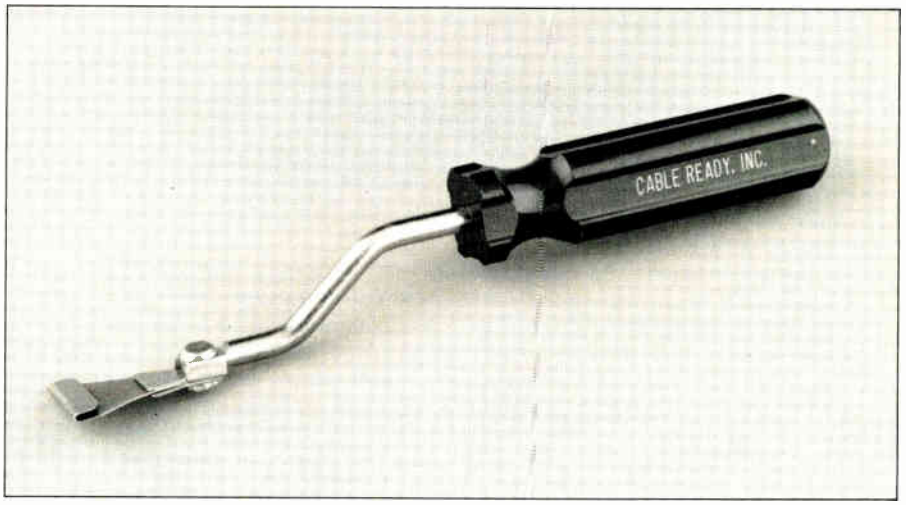
energy. The 131D Astrotec Long-Wavelength PIN Photodetector was developed specifically for applications such as CATV, which requires high bandwidth, high sensitivity, high linearity and low noise. The improved bandwidth of the 131D is achieved through low capacitance. It is packaged in a low-profile 8-pin DIP (Dual In-line Package), and samples are available for $450. For further information, call (800) 372-2447.

Cablematic Division of the Ripley

Cablematic's new crimp tool

Company has introduced a new "full cycle" crimp tool which ensures positive completion of the crimping process. Designed for cable television installers, the tool is designed with a ratchet-type mechanism to ensure complete, full cycle crimp connection by preventing early release by the operator. The crimp tool also has an "escapement feature" which allows the installer to abort and restart the crimping cycle. Cablematic's new device features a toggle design, allowing for maximum crimping force with less hand pressure and operator fatigue. The handles are made of durable plastic and are dipped to proven them from sliding off, and a full adjustable star wheel does not require removal. The tool is manufactured of allow steel jaws and heat treated pins. And, in compliance with SCTE recommendations, hex sizes are stamped directly on the tool. The available sizes are: CR360R (.360 hex), CR596QR (.384/.324 hex) and CR596QLR (.360/.324 hex). For more information on Cablematic's new crimp tool, call (203) 635-2200, or fax inquiries to (203) 635-3631.

Cableready, Inc. has introduced a new access key to provide re-entry and access to installed systems. The patented



Cableready's access key

entry key releases installed molding to allow system personnel quick entry into the system for modifications or maintenance, while keeping "pirates" out. The product has a 15-year warranty. For more information, call Cableready at (800) 222-2142.

Fast Forward Video has introduced its model F30 time code generator/reader/character inserter. The F30 generates longitudinal time code in the SMPTE drop-frame, non-drop frame and 24 additional frame formats. The unit also reads time code forward and reverse from one thirtieth to up to ten times play speed, and superimposes time code information on video for "window dub" copies. The unit is priced at $1495. For more information, call (714) 852-8404.

At-home SAT course from MEU

New from **Mind Extension University** is a live and interactive

CAREER MARKETPLACE

Channel Master®

SENIOR SATELLITE DESIGN ENGINEERS

FOR ASSIGNMENT IN MALAYSIA

A leading manufacturer of Consumer Electronics is currently seeking qualified engineers to work in its Satellite Receiver Design Lab. Experience in state-of-the-art satellite receiver design is essential.

Management position available.

Send resume and salary history in confidence to:

Channel Master
P.O. Box 1416
Smithfield, NC 27577
Attention: Manager, Human Resources

E.O.E. M/F/H/V

The World's Leading Manufacturer of TV Reception Products Since 1949.

Leader in the placement of Cable Television Professionals
Call toll free 1-800/433-2160; In Texas call collect 817/599-7623. FAX 817/599-4483.

RP TEST ENG—Digital R & D project for the industry, Rocky Mts. $75K
REGIONAL ENG—Top 10 MSO needs your talent for multiple rebuilds and upgraders in the NE. $55K
SALES ENG—Top Fiber Manufacturer needs your knowledge and contacts in the data industry. Dallas, $55K + Bonus.
RF DESIGN—Product design and testing, International travel. $50K
TECHNICAL MGR—Coastal SE location. Top MSO. $40K
SALES ENG—Construction knowledge and industry contacts are your ticket to $70 Base + equity.
DIR OF ENG—High profile position MW location AML a must. $60K
PLANT MGR—Single largest system for mid-sized MSO. Deep South $38K
RF DESIGN—Multiple listings presently Cellular, Cable, Data Manufacturers, locations nationwide. $40-$70K
CHIEF TECH—Multiple systems, addressability, Mid Atlantic locale. $35K
HEADEND/MICROWAVE TECHS—Multiple opportunities nationwide, top 10 MSO's, top benefits. $25-$40K
LINE & SERVICE TECHS—Jobs nationwide companies will relocate. Call for your geographic preference. $8-15/HR

JIM YOUNG & ASSOCIATES
One Young Plaza 1235 Ranger Highway Weatherford, TX 76086
Call for information about these and many other opportunities nationwide.

STAFF ENGINEER

Continental Cablevision the #1 cable television operator nationwide for the third successive year currently has openings in our engineering department. Responsibilities include the design, maintenance and repair of cable TV reception facilities and/or video production facilities. Qualified candidates must have 7 years cable TV/broadcast experience with technical engineering responsibilities. EOE/AA.

Send Resume To:
CONTINENTAL CABLEVISION
1945 North Helm Ave.
Fresno, CA 93727

Attn: Human Resources

THE cma GROUP
RECRUITING AND SEARCH

Operations Engineering
Corporate-Regions
Systems

JIM CAHOON
Cable Operations and Engineering Since 1966

7100 E. Belleview, #102
Englewood, CO 80111

Ph: (303)779-8890
Fax: (303)779-8139

BakerScott & Co. EXECUTIVE SEARCH
1259 Route 46 Parsippany, NJ 07054 201 263-3355
Specialists in the COMMUNICATIONS INDUSTRY
CABLE TV/BROADCAST DIVISION TELECOMMUNICATIONS DIVISION
POSITIONS AVAILABLE AT ALL LEVELS OF MANAGEMENT, COAST TO COAST
Call or write in CONFIDENCE
FEE PAID
"WE DON'T TALK CABLE, WE KNOW CABLE"
PRINCIPALS DAVID ALLEN & JUDY BOUER

EQUIP. FOR SALE/RENT

EMERGENCY ALERT SYSTEMS
by
Idea/onics
69 channels 14 day delivery
compatible with all headends
—AFFORDABLE—
(701) 786-3904
24 and 88 channel units also available

EQUIP. FOR SALE/RENT

AERIAL BUCKET TRUCKS
Large selection geared for CATV
STANDARD TRUCK & EQUIPMENT CO.
1155 Hill St. S.E.
Atlanta, GA 30315
Phone: 1-800-241-9357

BUCKET TRUCKS

WANTED:
SURPLUS CABLE EQUIPMENT
Jerrold, Oak, Hamlin & Scientific Atlanta equipment.
Highest Prices Paid
Cable Equipment Brokerage Co.
(818) 709-3724

PROFESSIONAL DIRECTORY

ANDREWS CABLE CONSTRUCTION INC.

BUILDERS OF UNDERGROUND CABLE SYSTEMS

Including Fiber Optic • Electric • Telephone
Throughout the United States

- Back Hoe
- Trenching
- Vibratory Plowing
- Horizontal & Pneumatic Boring

"GUARANTEED WORK - COMPLETED ON TIME!"

585 E Main St. Canfield, Ohio • Phone (216) 533-9000 FAX (216) 533-9285

VIDEO PAGE GENERATOR

NTSC or PAL Video — CART #1

3 Letter Sizes
240 Ltr Crawls
Autoload
DISK
COMMODORE 64

C64 Displays & sequences 1000 pages, Hi Res. color display, scroll, flash, crawl, vary height, 24Hr. clock+date, Generate color Bars! Modem multipage transfer. Weather screen, External relay control, time and date page activation. Model "VIDG" ...$189.95

C64 12 VDC Switching Power Supply for Zero down time.60 hz. xtal. Model DCPS $129.95

Digital Record and Playback Messages 30/60 sec.Mic & Spk. jacks,1W.audio;1Meg RAM; Hi Fi audio Model DVM $179.95

ENGINEERING CONSULTING
583 Candlewood St. Brea, Ca. 92621
Tel:714-6712009 ** Fax:714-255-9984

TOUCHTONE CONTROL

CART #2 — Headend Remote Control !

Touchtone Programmable Sequence Generator

C64 & "TPSG" Control relays remotely from Keyboard or external modem, Daily, weekly, monthly events, 28 touchtone digits per event. Program100's of TSDQ + QUAD+ RL4, Model "TPSG"... $189.95

TSDQ QUAD RL4F

"TSDQ" 4 digit touchtone decoder, single momentary or latching relay "TSDQ"....$89.9
Expand with "QUAD" 4 relays & control all from one location. "QUAD"...$99.95; "RL4F" Switches Baseband Video or R.F. >65 DB Isolation DC to 600 MHZ; 4-75Ω coaxial Relays per board with "F"connectors "RL4F" $199.95
model "RD10" $129.95 option answers tel. line

Low cost headend products & solutions
Ask for free catalog
Mastercard Visa Amex COD & P.O.

TSB, Inc.

- Design, Strand Map, As-Builts
- CAD Drafting Service
- Headend Racking and Renovations
- CLI • Audits
- Onsight Technical Training
- Structural Analysis of Towers

PO Box 244 Yankton, SD
(605) 665-1393 57078

Advanced Cable Services

A Division of Cable Services, Inc.

Established in 1979

REPAIR / BUY / SELL

Converters & Distribution Equipment
P/U / Delivery, Central-Eastern United States

WATS (National) . . . . . .(800) 654-7956
FAX . . . . . .(904) 728-6738

NaCom

BUILDING COMMUNICATION SYSTEMS THROUGHOUT AMERICA

- Full Installation Services
- Converter Exchanges, Audits, Special Projects
- MDU, SMATV, LAN, Pre/Postwiring
- Aerial/Underground Construction (Including Fiber Optics)
- Strand Mapping (AutoCAD & LYNX)
- Field Engineering, Make-Ready, As Builts
- RF Design (CADSUM II, LYNX, & LODE DATA)
- CLI Detection/Correction

1900 E. Dublin-Granville Road, Suite 100A, Columbus, OH 43229
• (614) 895-1313 • (800)669-8765 • FAX (614) 895-8942

dB-tronics

C.A.T.V. EQUIPMENT REPAIR 1-800-356-2730

- AFFORDABLE, QUALITY RF REPAIRS: Converters, Line Equipment, Headend Equipment and F.S. Meters.
- We are THE leaders in SA addressable converter repairs. (Check our prices on 8500's, 8550's and 8580's)

SPECIALS

8550 "IR" cap modification $6.00 ea.*
Line Extender and Bridger repairs $19.50*
SA Channel "ID" Proms $1.25 ea. Blank
$3.25 ea. Programmed†

* Call for details
† Cable systems only

get converted!!

FELIX COMMUNICATIONS CORP.

" One Source Accountability From Towers to Taps"

Automated Mapping Cable Construction
Broadband Design Facilities Management

Two Route 9 Wappingers Falls, N.Y. 12590
Phone (914) 298-7515 Fax (914) 298-7998

White Sands

Jumper Cables

Custom connectors and cables for all aspects of CATV.
Gilbert AHS
Magnavox
Pyramid F59-81
LRC and others
All types of cable from Belden
Times
Comm Scope
Quick delivery on all colors with lengths from 6" to 15'

Write or call: (602) 581-0331
335 West Melinda Drive, Phoenix, AZ 85027

Video compression artifacts

Video watchers (as opposed to television watchers) have become accustomed to looking for video artifacts. These are strange little defects in the picture that normally don't appear in nature. The reason television works is simply because the artifacts are tolerable to most television viewers. At normal viewing distances, almost no one except the video engineer is aware that they exist.

In fact, the definition of the normal viewing distance is that distance at which the artifacts are not visible. That distance is measured in units of picture height. NTSC is meant to be viewed at more than five times the picture height. If the normal viewing distance is eight feet (96 inches), this will be five picture heights if the picture is 19.2 inches high. In the 4 x 3 aspect ratio, a 19.2 inch high picture measures 32 inches in the diagonal. So at eight feet, you should be watching a maximum size TV of about 32 inches. Anything bigger and you should be seeing artifacts.

Discrete cosine transform

One of the more common video compression algorithms is based on a version of the Fourier Transform applied to the amplitudes of the picture elements. The Fourier Transform converts amplitude information into frequency or spectral content information. A computationally convenient form of the Fourier Transform is the Discrete Cosine Transform, or DCT. It allows transformation from amplitude to frequency and back again in a practical digital integrated circuit. The idea behind the use of transforms is that when information is deleted in the transform, the artifact that is created in the picture is spread around in the picture in a manner that is less noticeable.

Most of the video compression schemes break the picture into rectangles, usually eight lines high and eight picture elements wide. (SkyPix has chosen 16 x 16). The signal compression is done within these blocks. When the DCT is used in the blocks, under certain circumstances, the low frequency components are different from block to block. This can make the boundaries of the blocks very visible. The picture looks as if it were made up of blocks or mosaic tiles. This image defect is called *blocking* or *tiling*. It can be very visible in red areas of the picture.

A good movie for noticing this is "The Hunt for Red October." In this movie, there are scenes inside a submarine under battle conditions. The inside of the submarine is illuminated with only red light. Block boundaries stand out. Another useful test image would be a person playing with a yo-yo, flipping it in large circles. The thin line of the string spans many blocks. It is possible for some blocks to do a better job of reproducing the string than others.

When insufficient data is available for the correct creation of a block, there are several choices. One is to hold the block from the previous frame and hope there was so little change that the error won't be detected. This generally works except when an error has also been made in the block. I've seen frozen blocks of the wrong color hang in the picture for a while. In this case, the strategy fails and the result is rather unpleasant.

If insufficient information is provided to create the whole picture, the picture from the previous frame will often be displayed until enough data has been received to create a complete new image. The consequence of this is a halting motion which appears stroboscopic. The result looks like a disco scene with flashing strobe lights. This defect is different from others in that it is more visible from a distance than close up.

Killer bees and puddles

Perhaps the most interesting and difficult to minimize artifact of DCT compression is what is called "the attack of the killer bees." A complete Fourier series is an infinite list of mathematical components.

To be distortionless, the series must be very long. To be practical, the series must be short. To bridge the distance between theoretical and practical, some terms of the series are discarded while others are rounded off. The result is a form of distortion in the reconstructed image.

To the video engineer, this form of image distortion looks like "ringing." It is the ripple in brightness that follows a sharp edge in a picture. The major difference between ordinary ringing and this DCT distortion is that in this case, the "ringing" is in all directions. The effect is easily seen in two situations: sharp edges of high contrast and high contrast credits at the end of a movie.

When doing tests of video compression, try to have a situation with high contrast scrolling letters on a background with quite a bit of action. Look closely at the letters. In severe cases, the letters will appear as if they have just been placed into puddles of water and have ripples issuing from their edges.

The second thing to look for is sharp edges of high contrast in the picture itself. There may be ripples or little fuzzy artifacts or something that looks like a swarm of insects—hence the description "killer bees"! A particularly interesting case is the scene in "Top Gun" where the entire sky is blank except for one little airplane. The aircraft occupies just one of the blocks. Within the block, surrounding the plane are little specks that look like our friends, the killer bees. All other blocks are clean. The pilot of that aircraft appears doomed.

One last point. When watching video compression demonstrations, there may be a temptation to show off your knowledge of artifacts. This has a major disadvantage, in that you'll lose the ability to test whether more casual observers notice or are bothered by these artifacts. For that reason, it's probably best to keep the mouth closed and the ears open. ■

By Walter Ciciora, Vice President of Technology, American Television and Communications

U T I L I T Y P R O D U C T S

Anixter Cable TV stocks the complete line of Utility Products pedestals because they're made to last. Made to last, because it's just good business to protect valuable equipment inside quality enclosures.

Utility Products are made to outlast the equipment inside. They average 25 years in use. Buy today and don't think about replacement until 2015.

Utility Products' nine-step finishing process generates a high gloss weather-fighting finish that resists corrosion and the onslaughts of acid rain, pollutants and other atmospheric contaminants.

For more information about the full line of Utility Products pedestals, call the Anixter Cable TV distribution center in your area.

RELIANCE COMM/TEC + ANIXTER CABLE TV

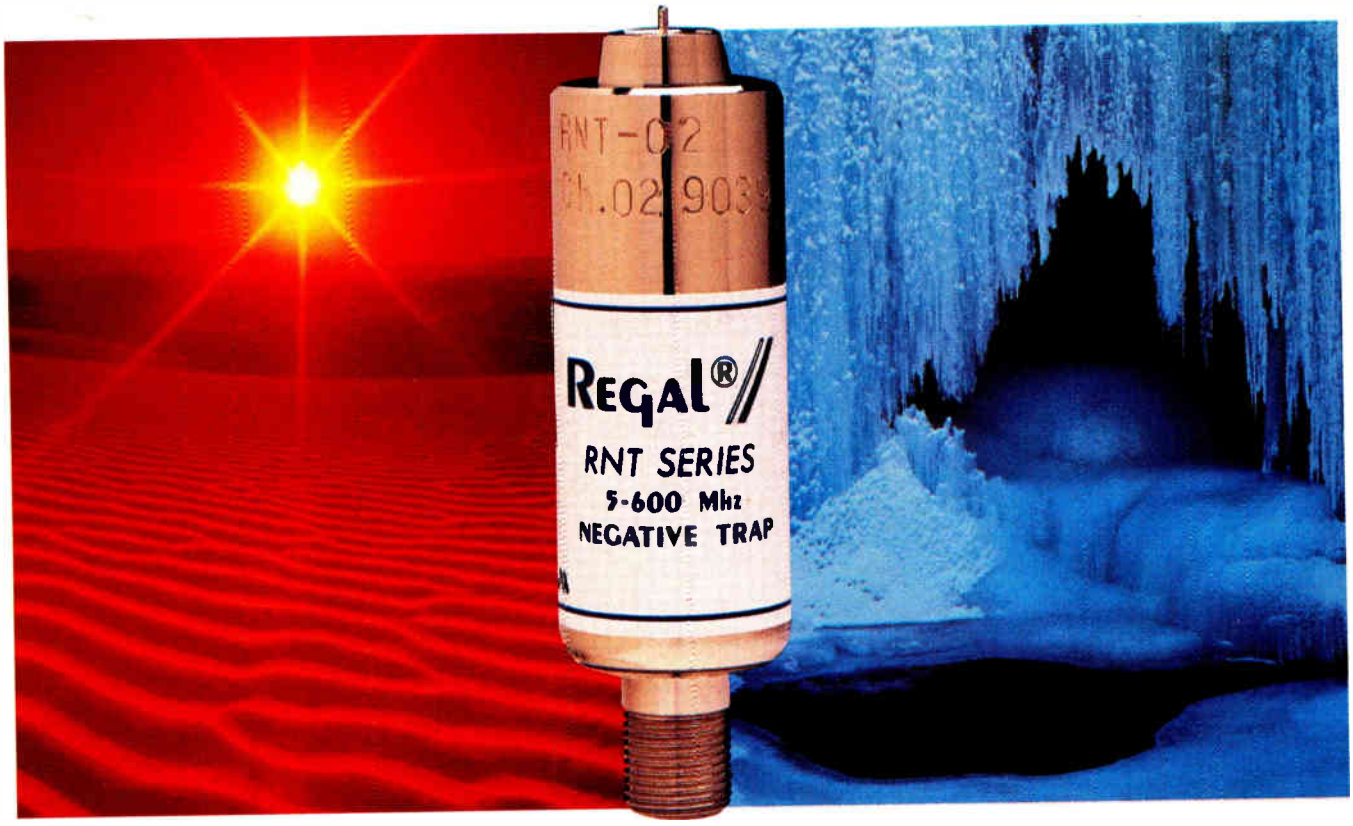
WEST-ANAHEIM: (714) 779-0500, (800) 854-0443; **DENVER**: (303) 740-8949, (800) 841-1531; **SEATTLE**: (206) 251-6760, (800) 426-7665; **MIDWEST-CHICAGO**: (708) 350-7788, (800) 544-5368; **CLEVELAND**: (216) 526-0919, (800) 321-8068; **DALLAS**: (214) 446-CATV, (800) 231-5006; **IRON MOUNTAIN, MI**: (906) 774-4111, (800) 624-8358; **SKOKIE, IL HDQTRS**: (708) 677-2600; **EAST-ATLANTA**: (404) 840-7901, (800) 242-1181; **LONG ISLAND, NY**: (516) 293-7788, (800) 645-9510; **NEW JERSEY**: (201) 328-0980, (800) 631-9603; **ORLANDO**: (407) 240-1888, (800) 477-8396; **CANADA-CALGARY**: (403) 250-9646; **MONTREAL**: (514) 636-3636; **TORONTO**: (416) 625-5110; **VANCOUVER**: (604) 321-5865.

In an emergency, weekends and holidays or after 5 P.M. call toll free 1 (800) 323-8166.
CORPORATE OFFICES, ANIXTER CABLE TV, 4711 Golf Road, Skokie, IL 60076, (708) 677-2600

Reader Service Number 40

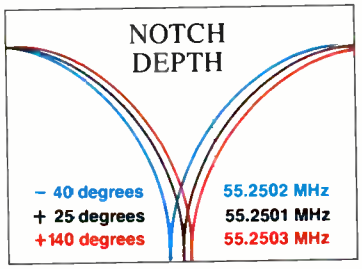
REGAL presents a new era in negative trap technology

A trap for all seasons



Engineered to eliminate notch drift over temperature

We designed thermally compensated components to meet our specifications for temperature stability and then used state-of-the-art robotic manufacturing techniques to ensure a perfectly repeatable product, trap after trap. But advanced circuitry is not enough.



We also designed a new dual sleeve housing which eliminates the need for O-rings and provides greater than 125dB EMI isolation at a full 600 MHz bandwidth. Closed cell foam encapsulation, compressed rubber grommets at both ports and a special UV-cured epoxy stop moisture ingress and provide an environmental barrier that is virtually impenetrable.

For maximum stability and design flexibility, use Regal – the new standard in trap technology.

REGAL® Technologies Ltd.

1-800-36-REGAL

CORPORATE HEADQUARTERS: CHICAGO: (708) 675-2266, (800) 367-3425; **SALES OFFICES: ATLANTA:** (404) 449-0133, (800) 752-9810; **DALLAS:** (214) 466-0227, (800) 448-0881; **SAN DIEGO:** (619) 584-4617; **ENGINEERING GROUP:** (303) 740-6262, (800) 222-0508.

Reader Service Number 41