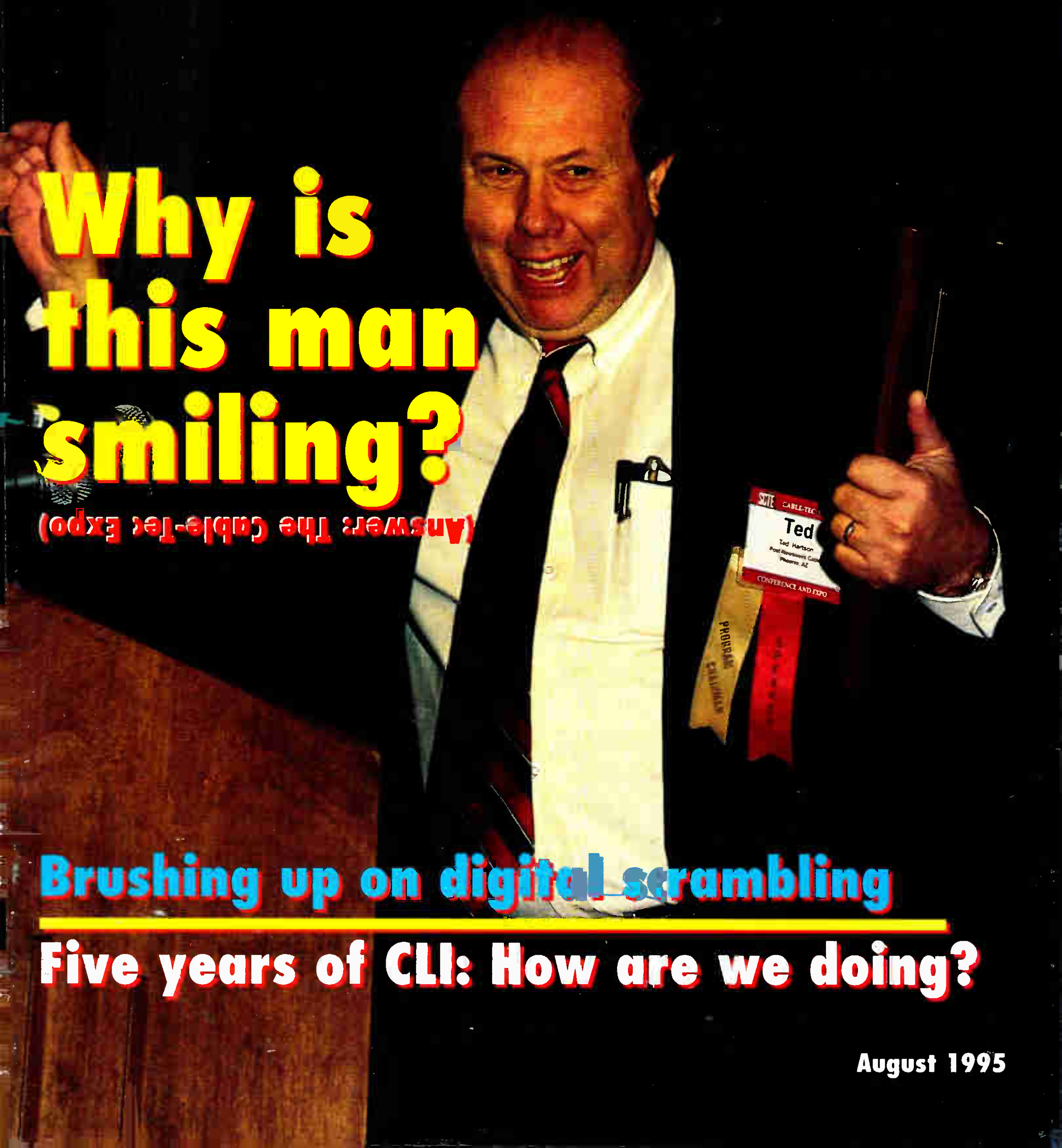
PBI

COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Telecommunications Engineers



Why is this man smiling?

(Answer: The Cable-Tec Expo)

Brushing up on digital scrambling

Five years of CLI: How are we doing?

August 1995

There Are Three New Ways To Provide Your Customers With Better Service

Sencore's "CHANNELIZERS" are designed to pinpoint RF video problems and performance test any RF Distribution System faster and more accurately than ever before.

Inspect
(SL750I)

Monitor
(SL750M)

And . . .

Analyze
(SL750A)

TECH CHOICE SYSTEM

Sencore Introduces The New "Tech Choice" Line Of CATV Instruments Featuring:

- Automatic measurements of both the audio and video carriers on all cable channels (FCC, HRC, IRC) including UHF. Simply enter the channel or frequency and the reading is displayed on the easy-to-read LCD display. *(SL750A Only)*
- Exclusive "on-channel" tests for C/N and HUM. No need to tune off-channel or remove modulation to make these important tests parameters. Gives you the reading you need when you need it.
- Simultaneously monitor the RF level of both your high and low pilot, with an exclusive pilot test. Makes all your system balancing a snap.

Best of all, Sencore's "CHANNELIZERS" are designed to stand up to everyday field use. The rugged light-weight cases protect your instrument from all types of conditions.

To find out more on how the "CHANNELIZERS" will make a difference in your testing, troubleshooting, and system maintenance call **1-800-SENCORE**, and talk with your Area Sales Representative about putting a unit in your hands and finding out for yourself.

SENCORE
3200 Sencore Drive, Sioux Falls, SD 57107
Direct:(605) 339-0100 Fax: (605) 339-0317

Reader Service Number 2

Call 1-800-SENCORE Today!
(736-2673)

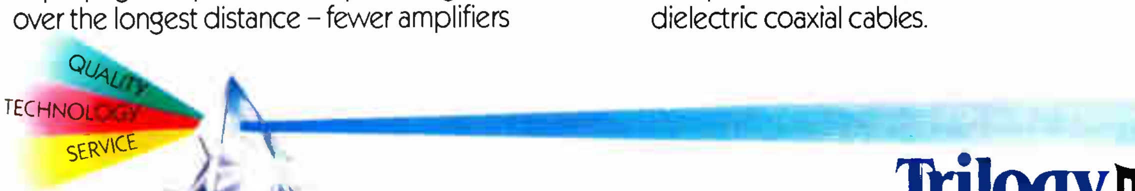
Perfection in Dielectrics.

Trilogy Communications built a better coaxial cable – MC² – and the CATV industry is letting us know about it.

The MC² air dielectric combines excellent product durability and flexibility with air-tight fully-bonded construction. Our 93% velocity of propagation provides the purest signal over the longest distance – fewer amplifiers means immediate savings.

All this plus the highly respected Trilogy program of delivery and service provides our customers with the attention and performance that are second to none.

Our most prized dynamics are your acceptance of our best effort so far – MC² air dielectric coaxial cables.

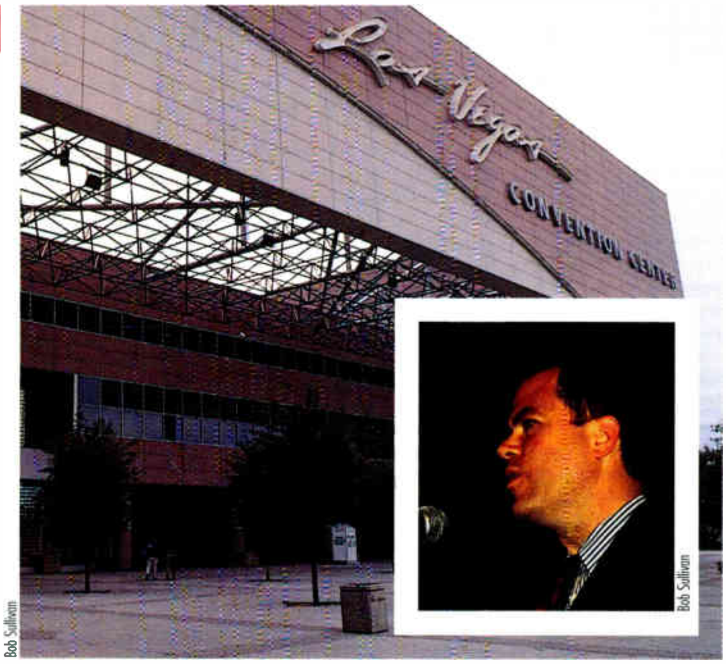


Trilogy
COMMUNICATIONS INC.

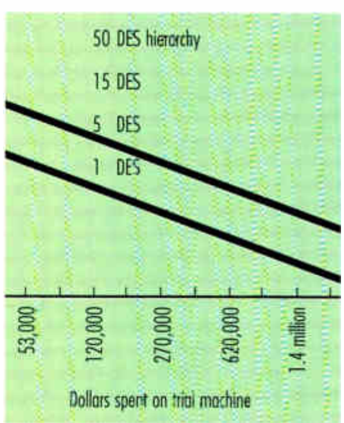
Reader Service Number 3

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 • Fax: 601-939-6637

DEPARTMENTS



Expo wrap-up • 22



Bits vs. waveforms • 72

Drop shield/test • 82

FEATURES

 Communications Technology™ (ISSN 0884-2272) is published monthly by Phillips Business Information Inc. 1201 Seven Locks Road, Suite 300, Rockville, MD 20852, USA. Editorial and sales offices located at 1900 Grant St., Suite 450, Denver, CO 80203 USA, (303) 839-1565. August 1995, Volume 12, Number 6. Second class postage paid at Rockville, MD, and additional mailing offices. POSTMASTER: Send address changes to *Communications Technology*, Phillips Business Information Inc., 1201 Seven Locks Road, Suite 300, Rockville, MD 20852.

LNDA™

The Perfect Drop Amplifier

- 10 & 20 dB gain-forward
- 5-40 MHz return available with or without gain
- Surface mount technology
- Regulated power inserter included
- Meets FCC specs without rebuilding
- Ultra low noise figure
- Excellent distortion specs

(315) 437-1711 **PICO** PRODUCTS, INC. (800) 822-7420

Reader Service Number 111

FAX (315) 437-7525

PICO PRODUCTS, INC. 6315 Fly Road, East Syracuse, New York 13057

EDITOR'S LETTER

Beware: Big Brother

A few days ago I became aware of an Occupational Safety and Health Administration inspection performed on one MSO's Midwestern system. The inspection resulted in the operator being cited for a "serious" violation and fined $2,500. At press time, the cable operator was scheduled to participate in a fact-finding conference with OSHA reps.

"So what?" you say, "OSHA busts companies on a regular basis for safety violations. If that system wasn't paying attention to safety, then maybe they should cough up the cash and make safety a higher priority."

And my response would be in complete agreement.

If that's what happened.

But that isn't what happened! I read a copy of the citation and was shocked (pun intended) by its content.

You see, the company in question allegedly failed to inform its employees about certain hazards relating to working on "electric circuits, parts or equipment that have not been de-energized." For example, the citation references regulations that state only "qualified persons" shall be "capable of working on energized circuits" using "insulation and shielding materials" to temporarily cover hot power lines. It also makes reference to testing power lines to see if they're energized and knowing the safe "approach distances to exposed energized overhead power lines and parts." This latter item relates to something in OSHA regulations called Table R-2, which specifies approach distances vs. power line voltages (100, 300, 600 volts, etc.). Because the cable company employees couldn't recite this table, the OSHA inspector felt the cable company hadn't been doing its job.

However, most of this stuff applies to power company linemen, not CATV technicians. Last time I looked, we didn't work with those bright orange insulators used to temporarily cover energized power lines. And I never knew a power company that would let us within NESC-specified distances of its power lines, let alone crawling to the top of the pole and measuring to

see if those lines are energized. For that matter, I don't know of any CATV outside plant personnel who could be defined as "qualified persons" who are "capable of working on energized circuits," with the possible exception of construction linemen who may have worked for an electrical utility in a past life.

When confronted with this information — the difference between a cable technician and power company lineman and what each does — the OSHA inspector basically said too bad, you should know this stuff. The MSO contacted OSHA offices in other regions of the country and they all said they thought the first inspector was nuts to try to apply these rules to cable. But the inspector is sticking to his guns.

I've been told that OSHA has fined companies for sillier things than this. Consider yourself forewarned. Big Brother is watching. I'll let you know how this turns out.

Women in Tech Award

In better news, Society of Cable Telecommunications Engineers' Bill Riker announced at Cable-Tec Expo a new industry accolade, "The Women in Technology Award," which will recognize and honor leading women in technology positions within the cable and telecommunications community. This is a joint venture between SCTE, Women In Cable and Telecommunications and *Communications Technology*. You can get more information and the nomination form if you turn to page 70.

Ronald J. Hranac
Senior Technical Editor

Power by Design

Standby Power Supplies Engineered for Today's Cable TV Networks

Small Simple Standbys™ from Power Guard will save you money, short and long term.

Since SSS™ is available in 3-6-9-12 or 15 amp ratings and in two or three battery configurations, you can maximize efficiency and reduce your power bills and battery costs by choosing the right model for each power supply location. If your power requirements change - simply upgrade the power module. Small Simple Standbys™ will grow with you.

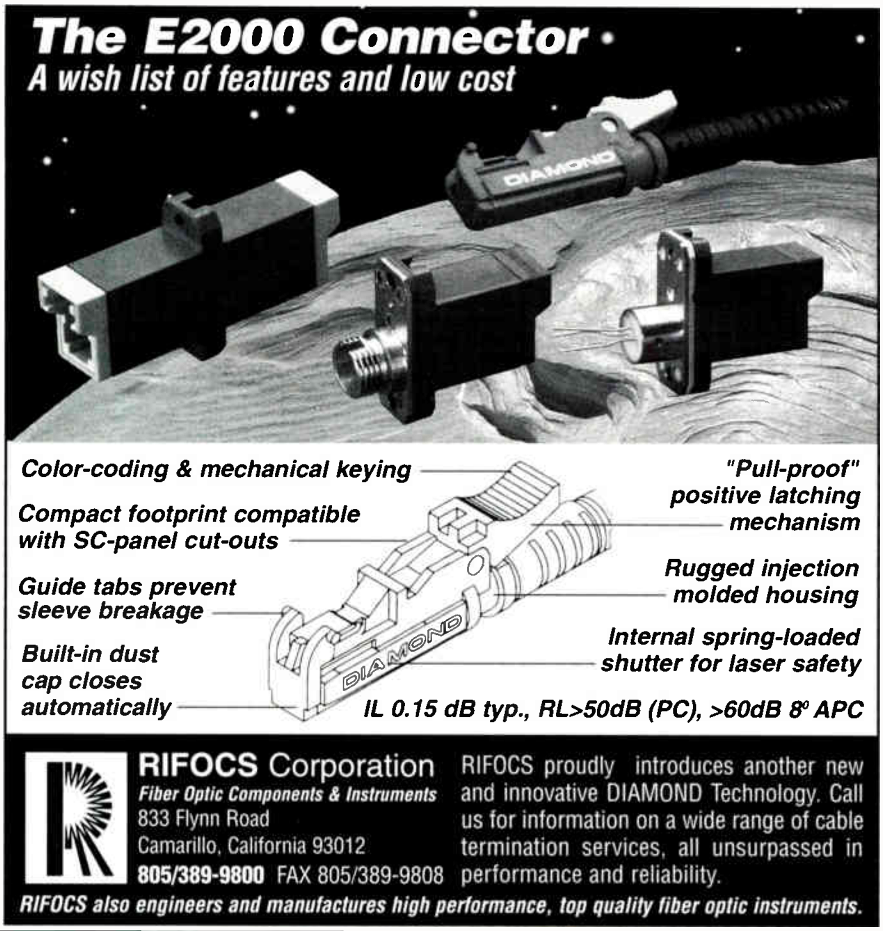
And because our studies have shown that most power supply locations actually use less than 9 amps of power - we strongly recommend that you consider our 24 volt units for those locations. You get an immediate 33% savings in battery costs and still have up to four hours of standby run time.

Small Simple Standby™ - The right product at the right time for the right price. No wonder we continue to be the fastest growing power supply company in Cable TV.

1-800-288-1507 **POWER GUARD** FAX 205-742-0058

Reader Service Number 7

Reader Service Number 202



Reader Service Number 203

COMMUNICATIONS TECHNOLOGY

A CT Publications Product

Editorial Director, Toni I. Barnett
Executive Editor, Wayne H. Lasley
Managing Editor, Laura K. Hamilton
Associate Editor, Shelley L. Ollig
Assistant Editor, Eric Butterfield
Senior Technical Editor, Ronald J. Hranac
East Coast Correspondent, Lawrence W. Lockwood
West Coast Correspondent, George Lawton
Technical Consultant, Michael Smith

Publisher, John O'Brien
Associate Publisher, Charles M. Castellani
Account Executives
Mike Elmer, (303) 837-8601, ext. 233
Tim Hermes, (301) 340-7788, ext. 2004
Rebekah Markheim, (303) 837-8601, ext. 204
Barbara Allen Miller, (303) 837-8601, ext. 213
Joe Rosone, (301) 340-7788, ext. 2028
Director of Marketing, Nancy Umberger
Marketing Manager, Gail Stouffer
Executive Assistant, Cindy Tandy
Administrative Assistant, Cathy Walker

Director of Operations, Blair Richards
Production Director, Marla Sullivan
Graphic Designer, Brad Hamilton
Advertising Production Team Leader and Administrator, Leona B. Russell
Advertising Production Assistant, Ian Coleman
Circulation Director, Maxine Minar
Subscription/Client Services
(800) 777-5006

CT Publications Corp.
A division of Phillips Business Information Inc.
CT Sales and Editorial Offices
1900 Grant St., Suite 450, Denver, CO 80203
(303) 839-1565 Fax (303) 839-1564
e-mail: CTmagazine@aol.com

SCTE National Headquarters
(610) 363-6888 Fax (610) 363-5898

Corporate Offices

Phillips Business Information Inc.
1201 Seven Locks Road, Suite 300, Potomac, MD 20854
(301) 340-1520 Fax (301) 340-0542

Paul R. Levine, Senior Publisher
(303) 839-1565

David J. Durham, Senior Vice President/Group Publisher
Thomas C. Thompson, President
Phillips Business Information Inc.

Thomas L. Phillips, President
Phillips Publishing International Inc.

PBI SCTE BPA INTERNATIONAL

Rebuild launched by US West subsidiary

Southern Multimedia Communications Inc., a subsidiary of US West, launched a massive rebuild and upgrade of the Atlanta metropolitan area GCTV and Wometco cable systems, which were purchased last year by US West. The systems pass approximately 1 million homes and serve nearly 500,000 subscribers.

A building in Cobb County will house the "superheadend" as well as the switching equipment that will make it possible for Southern Multimedia to offer local telephone service to its customers. The project will make the entire cable network capable of providing integrated video, voice, data and other enhanced services over an advanced, two-way system.

In other news, the company named Scientific-Atlanta a key supplier for upgrading the 12,000-mile cable network. S-A will supply receivers, stereo encoders and modulators for the headends as well as amplifiers for the distribution network. The new equipment is essential for upgrading the system to 750 MHz bandwidth to achieve high channel capacity and future interactive capabilities. The system will provide about 90 channels of traditional analog cable programs and eventually hundreds of digitally compressed services. Currently, Southern Multimedia customers can access 50 to 60 channels. Financial terms were not disclosed.

GTE files lawsuit against IT Network

GTE Main Street Inc. filed suit against IT Network Inc. and its subsidiary, Cableshare Inc., seeking a declaratory judgment from the U.S. District Court in Dallas that GTE Main Street does not infringe on three patents owned by Cableshare.

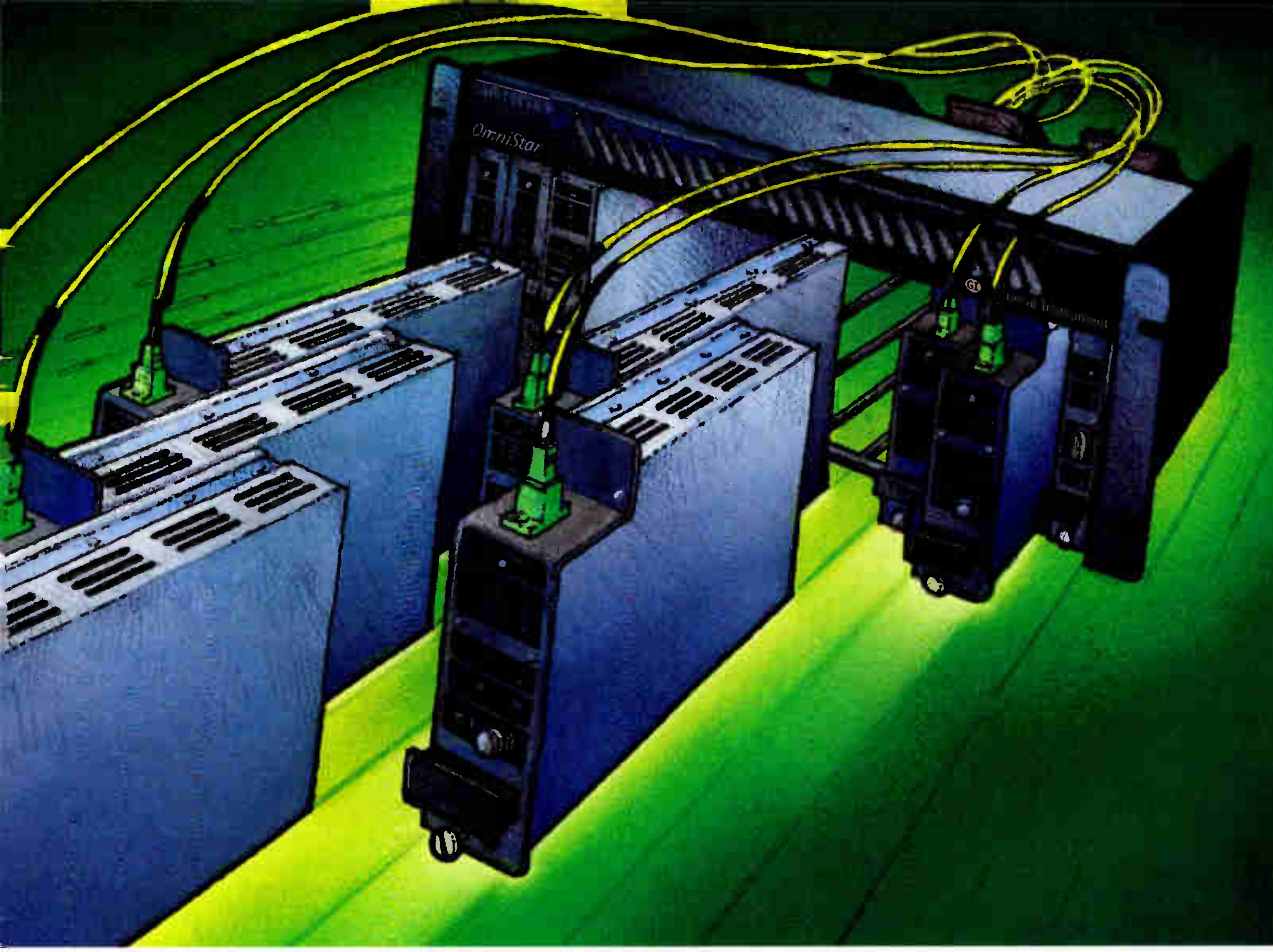
In its filing, GTE charged that over the past several months, Cableshare has told Main Street's current and potential customers that the GTE MS video delivery system infringes on Cableshare's patents. The filing stated that Cableshare continues to make the accusations despite the fact that GTE has notified Cableshare that GTE's outside counsel, Baker and Botts of Dallas, has provided GTE with an opinion that there was no patent infringement.

The filing further states that Cableshare's assertions resulted in substantial interference with GTE MS relationships with its customers, compelling GTE to go forward with its lawsuit. In addition, it said that IT Network had failed to make a meaningful response to GTE's offer to defuse the situation without litigation.

Bell Atlantic connects first VOD customers

Bell Atlantic Video Services connected the first of 1,000 households participating in the company's Stargazer video-on-demand (VOD) service, which offers access to more than 700 program choices.

The company began installing ser-



vice on May 24 for customers of its market trial in Fairfax County, VA. The company sent one direct mail piece to approximately 16,000 consumers in the trial area and received over 1,100 positive responses (nearly 7% response rate) indicating they would like to participate in the six-month market test.

GI, Samsung sign digital pact

General Instrument Corp. signed a definitive license agreement with Samsung Electronics for development of advanced digital video technology components, dual-model, MPEG-2/DigiCipher II decompression chips, which will be used in next-generation digital set-top terminals for the home.

In other news, sister publication *CableFAX* reported that GI is being increasingly dragged into DSC Communications' lawsuit against Next Level Communications, which centers on what information Tom Eams and Pete Keeler were privy to when they were employees of DSC, and whether that information was unique to DSC or publicly known, according to officials for both companies.

Sister publication *Fiber Optic News* reported that GI signed a deal to jointly develop NLC's switched digital video architecture, and has helped NLC's defense against DSC. However, GI also is jointly developing Mediaspan with DSC, through which it is developing telephony solutions over hybrid fiber/coax equipment.

• • •

NOTES

• The **Advanced Television Committee** of the **Electronic Industries Association** joined the **Grand Alliance**'s request for the **Federal Communications Commission** to require broadcasters to offer a minimum amount of daily high definition TV (HDTV) programming if the agency allocates any additional spectrum for advanced TV (ATV) services.

• **ADC Video Systems** was awarded a contract to supply its Homeworx HFC transmission system to **Comcast CableVision of Southeast Michigan Inc**. The contract, valued at $3.5 million, calls for a 2,200-mile build passing some 250,000 homes in southeast Michigan.

• Hybrid fiber/coax (HFC) and fiber-to-the curb (FTTC) provider **Ericsson Raynet** is laying off 300 employees at its Menlo Park, CA, facility as the venture continues to lose money. Instead of investing some $20 million into further development of an HFC solution, *CableFAX* reports that, according to insiders, the company wants to use those funds to roll out a switched digital video, FTTC system in 1997.

• Anaheim, CA-based **Datum Inc.** received a contract for $1 million-$2 million from **Time Warner's** communications unit for network synchronization equipment. The contract will be filled over a two-year period.

• **Toshiba America** established the **Advanced Information Technology Center** in Sunnyvale, CA, where the company plans to support and conduct research and development of next-generation multimedia-related technologies.

• **Sybase** and **Digital Equipment Corp.** will integrate Sybase's Intermedia and DEC's Mediaplex product lines into a hardware/software architecture for interactive TV services. The two companies expect to deliver this new interactive TV platform by early 1996.

Name

Company

Address

City State Zip

Phone

Fax

PLACE
STAMP
HERE

MHz
MEGA HERTZ
6940 South Holly, Suite 200
Englewood, CO 80112

Name

Company

Address

City State Zip

Phone

Fax

PLACE
STAMP
HERE

MHz
MEGA HERTZ
6940 South Holly, Suite 200
Englewood, CO 80112

Name

Company

Address

City State Zip

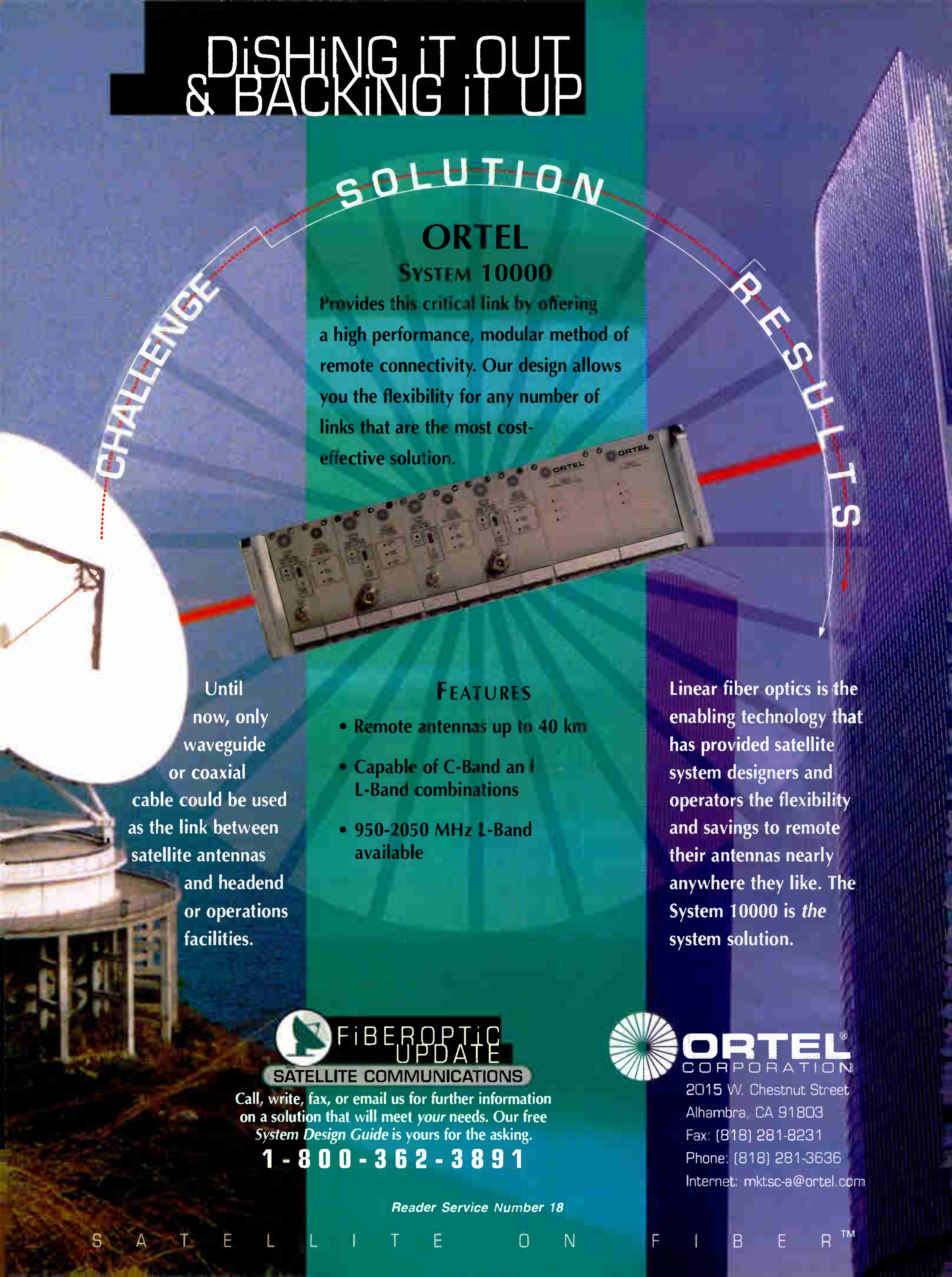
Phone

Fax

PLACE
STAMP
HERE

SPECTRUM

803 Forest Ridge
Suite 108
Bedford, TX 76022


DiSHiNG iT OUT & BACKiNG iT UP
SOLUTION
ORTEL
SYSTEM 10000
Provides this critical link by offering a high performance, modular method of remote connectivity. Our design allows you the flexibility for any number of links that are the most cost-effective solution.
CHALLENGE
RESULTS
ORTEL
Until now, only waveguide or coaxial cable could be used as the link between satellite antennas and headend or operations facilities.
FEATURES
• Remote antennas up to 40 km
• Capable of C-Band and L-Band combinations
• 950-2050 MHz L-Band available
Linear fiber optics is the enabling technology that has provided satellite system designers and operators the flexibility and savings to remote their antennas nearly anywhere they like. The System 10000 is *the* system solution.
FiBEROPTiC UPDATE
SATELLITE COMMUNICATIONS
Call, write, fax, or email us for further information on a solution that will meet *your* needs. Our free *System Design Guide* is yours for the asking.
1-800-362-3891
ORTEL® CORPORATION
2015 W. Chestnut Street
Alhambra, CA 91803
Fax: (818) 281-8231
Phone: (818) 281-3636
Internet: mktsc-a@ortel.com
Reader Service Number 18
SATELLITE ON FIBER™

Board elects SCTE officers

The Society of Cable Telecommunications Engineers board of directors elected the Society's officers for the coming year at its meeting held in conjunction with Cable-Tec Expo '95 at the Las Vegas Convention Center in Las Vegas, NV.

The Society's officers for the 1995-1996 term are: Chairman John Vartanian, Eastern Vice Chairman Steve Christopher, Western Vice Chairman Tom Elliot, Secretary Andy Scott, and Treasurer Robert Schaeffer.

Additional member of the Executive Committee is Michael Smith.

The current SCTE board of directors consists of: Region 1 Director Patrick O'Hare, Viacom Cable, serving California, Hawaii and Nevada; Region 2 Director Steve Johnson, Time Warner Cable, serving Arizona, Colorado, New Mexico, Utah and Wyoming; Region 3 Director Andy Scott, Columbia Cable, serving Alaska, Idaho, Montana, Oregon and Washington; Region 4 Director Rosa Rosas, Lakewood Cablevision, serving Oklahoma and Texas; Region 5 Director Larry Stiffelman, CommScope, serving Illinois, Iowa, Kansas, Missouri and Nebraska; Region 6 Director Robert Schaeffer, Star Cablevision Group, serving Minnesota, North Dakota, South Dakota and Wisconsin; Region 7 Director Terry Bush, Trilithic Inc., serving Indiana, Michigan and Ohio; Region 8 Director Steve Christopher, CommScope, serving Alabama, Arkansas, Louisiana, Mississippi and Tennessee; Region 9 Director Hugh McCarley, Cox Cable Communications, serving Florida, Georgia, Puerto Rico and South Carolina; Region 10 Director Michael Smith, Adelphia Communications, serving Kentucky, North Carolina, Virginia, West Virginia and District of Columbia; Region 11 Director Dennis Quinter, Berks Cable, serving Delaware, Maryland, New Jersey and Pennsylvania; Region 12 Director John Vartanian, Viewer's Choice, serving Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont; and At-Large Directors (representing the entire United States) Wendell Bailey of NCTA, Tom Elliot of TCI and Wendell Woody of Sprint.

Expo '95 breaks all records

A total of 6,800 people, including 3,900 registered attendees and 2,900 exhibitor personnel, gathered at the Las Vegas Convention Center in Las Vegas, NV, from June 14-17 for the SCTE Cable-Tec Expo '95, the most well-attended and widely acclaimed Expo yet.

These attendance figures represent a 30% increase over the statistics for Cable-Tec Expo '94, at which 2,800 attendees and 2,400 exhibitor personnel (a total of 5,200) were present.

The Expo's technical training got off to an early start when, for the first time at any Expo, preconference tutorials were held June 13 for the benefit of attendees who arrived early.

The Expo officially began with the Annual Engineering Conference, which was held June 14 in the convention cen-

channel Surfing

New

MicroStealth
Multi-Channel Testing -- for under $900

The Faster, Easier, Comprehensive signal level meter for cable TV installers.

Multi-Featured... For the first time, installers can check all channels quickly and accurately-ensuring FCC compliance and reducing subscriber callbacks. MicroStealth's scan mode displays multiple channels simultaneously on a single screen. Plus, measure up to 890 MHz for today's high bandwidth cable systems.

Easy Viewing... View the signal levels on a detailed, high resolution LCD display -- a feature, up until now, only available on higher priced signal level meters.

Easy to Use... With the press of a single button, cable installers can easily get a snapshot of the system's performance. There is even a one button *Go/No-Go* function so you can be sure you are within FCC compliance on every installation. MicroStealths are lightweight, rugged and water resistant, to withstand the abuse of every-day field use.

MicroPriced... The new MicroStealths are yours at unbelievably low prices. Even the enhanced MicroStealth MS1200 with 890 MHz frequency extensions, full scan mode, FCC *Go/No-Go*, and printer driver capability, is about half the price you would expect.

All the accuracy, speed and ease of use at a price you expect from a leader.

Call 1-800-622-5515

Wavetek...partners in productivity for over 25 years.

WAVETEK

ter and consisted of a full day of technical and management papers and panel discussions that were presented to a capacity crowd by many of the industry's engineering leaders.

A special highlight of the opening day of Expo '95 was the keynote address by Federal Communications Commission Chairman Reed Hundt that preceded the annual Awards Luncheon. In his address, videotaped in Washington, DC, specifically for the Expo, Hundt encouraged the cable telecommunications industry to participate in the commission's ongoing discussion of technical issues affecting the industry.

SCTE's Annual Awards Luncheon also was held June 14 and featured the presentation of numerous awards to Society members, including the recognition of James Haag as SCTE Member of the Year.

The 1995 luncheon also marked the official announcement of the Society's name change to the Society of Cable Telecommunications Engineers, approved by the SCTE board of directors in its meeting held June 13. It also was announced that SCTE had reached the milestone of having over 14,000 active national members.

On Thursday, 10 educational workshops were delivered to standing-room-only audiences. Up to 1,000 people were in attendance during each of the six workshop periods conducted on June 15 and 16.

Over 325 industry companies were on hand to display products and services on the Expo's packed exhibit floor, which opened Thursday.

Technical papers and workshop materials presented during the Engineering Conference and Expo have been collected in the *Cable-Tec Expo '95 Proceedings Manual*, a 430-page trade paperback that is currently available from the Society. In addition, the Engineering Conference and many of the workshops, including the special BCT/E tutorial sessions, were videotaped and are available for sale. For ordering information, contact SCTE national headquarters at (610) 363-6888.

Overall, the Expo was a resounding success that generated very positive responses and a great deal of enthusiasm among both attendees and exhibitors. Many attendees and exhibitors referred to it as "the biggest and best Expo ever" that offered excellent training opportunities in an exciting setting.

Cable-Tec Expo '96 will be held June 10-13, 1996, in Nashville, TN, and the Society's next national seminar, its annual Conference on Emerging Technologies, will be held Jan. 8-10, 1996, in San Francisco. (For full details on the Expo see the wrap-up that starts on page 22.)

Call for papers: Emerging Technologies '96

SCTE is currently seeking abstracts for technical papers to be presented at its 1996 Conference on Emerging Technologies to be held Jan. 8-10, 1996, in San Francisco. Topics of discussion will include digital compression and transmission, telephony, multimedia and future technologies.

Those interested in presenting technical papers at the conference should contact Roberta Dainton at SCTE by calling (610) 363-6888 or via fax at (610) 363-5898. Submissions should include an abstract of the proposed paper or presentation. The deadline for submissions is Sept. 1, 1995.

By Bob Luff, Chief Technical Officer, Broadband Group, Scientific-Atlanta

Do we need reverse band allocations?

Nearly every one of cable's future new revenue services is two-way and individually uses considerable return spectrum. These return spectrum uses include: digital telephony over broadband; subscriber command and control for video-on-demand (VOD) and interactive TV; games; high-speed digital data for cable modems; impulse purchases for analog pay-per-view (PPV) and shopping channels; utility meter reading and control; and home/business security.

Some or all of these reverse spectrum uses will require different modulation and technical performances. With all these developing uses for the return spectrum and different modulation technologies, will there be enough return spectrum for all of the uses? And will inefficiency — or worse, chaos — result if manufacturing and network operators don't agree on recommended reverse allocations for orderly coexistence of all these different needs and technologies in the reverse band?

What does reverse allocations mean?

Reverse allocations simply means reserving or assigning reverse spectrum for certain categories of uses or modulations. Where and how much spectrum is allocated for various return uses would be based on a number of factors including traffic estimates, specific modulation detail and required performance levels.

Spectrum allocations have been a widely accepted practice by the Federal Communications Commission for over-the-air transmission. This has been done to promote spectrum efficiency by matching and grouping similar needs and technologies together. Also, allocations prevent inadvertent hogging by one service because it initially launches sooner or has an initial high growth rate. Lastly, allocations are a tool to minimize interference between different uses of the spectrum by carefully positioning incompatible technologies away from each other or in reverse regions where impact is not a factor. For example, cable telephony with its potential safety-of-life uses should be allocated away from likely interference.

Is it too early?

Some argue that it might be too soon for reverse allocation. The industry is just beginning to use the return plant so little direct knowledge about real reverse characteristics is known. This is especially true considering the compounding fact that very little digital modulation is actually in use on reverse activated systems.

Also, the industry is just guessing on what the successful services will actually be and the usage patterns by the public. Trial data has not been able to add much information yet because of the low number of homes involved, lack of developed two-way services and artificial prices. Accordingly, any traffic analyses are at best only educated guesses. Lastly, it is argued that frequency agility — the ability to command a reverse module to operate on any frequency over a wide range of the reverse band — negates the need. That is, any return service could be dynamically assigned to operate on any reverse band frequency. Indeed, it is argued that frequency agility may make allocations unnecessarily restrictive or outmoded when combined with dynamic assignment capability based on actual real-time demand from all the upstream requirements.

A closing window of opportunity

But others argue that the industry must begin the reverse allocation process now or it will be too late and challenge that frequency agility is not the answer. They point out that full frequency agility circuit complexity and cost is significantly higher for every return module transmitter and that hundreds or thousands of agile

transmitters create unacceptable reverse system noise performance.

Some also fear that many services that require return frequencies will not desire to be pooled into a master dynamic spectrum assignment formula that may favor other services or the operator's income at their expense.

Many express concern that they would not feel comfortable linking all of the new two-way services to one "super software" dynamic return spectrum assignment manager until it is very well-tested and proven. They point out the industry's historical problems with complex software and point out that a crash here could cause all return services, including telephony, to stop. And, in a more competitive industry, recurring problems like that could be disastrous.

Also, if reverse allocations are not decided and encouraged to be used by equipment manufacturers and system operators, there will likely be haphazard deployments of reverse usage. The initial issue would be the higher equipment cost suggested already. Perhaps the inefficient placement of reverse services would not be felt at first when usage and penetrations were low. But as the usage and penetration grows, the industry would more quickly run out of reverse capacity triggering some combination of a costly reshuffling of reverse assignments, premature obsolesce of subscriber hardware or reconfiguring fiber nodes.

How big is the reverse?

This seems like an easy question. Haven't we all been using 5 to 30 MHz? Well that's not so anymore. In anticipation of more demand for reverse, various amplifier manufacturers are redesigning their products to increase reverse bandwidth. There is not much that can be done on the bottom end where 5 MHz appears to be the lower limit of drop cable shielding effectiveness. But, by designing sharper filters, the usable reverse might be extended to 40, 41 or 42 MHz.

There appears to be more support for 40 MHz at this time because of the need to meet the FCC performance for Ch. 2 flatness and differential phase requirements and because of the concern for interaction with the TV 41.75 MHz IF. The better filters slightly increases cost but usable reverse spectrum is increased by nearly 40%.

There also have been some trials at adding a second or replacement hyper-reverse band between 950 MHz and 1 GHz. Theoretically, by adding an optical node (and reverse laser) to the last amplifier, even higher upper-end reverse limits could be achieved.

There are some issues of course. To maintain a system's existing subscriber equipment currently operating in the subreturn, amplifiers would have to employee two sets of filtering. This poses cost, other performance and size trade-offs.

While hyper-reverse remains a possible future industry option most operators remain focused on maximizing subreturn capacity for now.

Rhyme or reason to allocation positions

It is not intended here to propose any specific reverse allocations. But a brief discussion of some of the issues may be useful to indicate the range of factors involved.

For example, allocations for high-speed modems might have to avoid the top of the return spectrum because the 40-52 MHz filtering results in significant delay performance for carriers operating in this in this area. Slower speed data for utility meter reading or traffic light control might be a better candidate.

Another concern is second harmonic energy of fundamental digital carriers placed in the 28 to 40 MHz region that could interfere with the low VHF downstream channels.

Keep in mind the need for the reverse transmitter modules and supporting set-top circuits to be as simple and inexpensive as possible. Therefore, filtering and shielding requirements will clearly influence allocation options. The hyper-reverse would eliminate the harmonic emissions concern since they would all fall out-of-band.

Another issue after determining where and how much spectrum should be allotted is the strategy of loading the segments. For example, it is likely that more spectrum will be allocated than actually utilized in each category for years. To give more future flexibility to possibly expand or shrink certain allocations as needs dictate, it would be useful to further adopt a plan to actually load or assign individual carriers within each sub-band from the bottom to the top or from the middle evenly in both directions. Such schemes would keep the boundary areas free of assignments facilitating possible future boundary adjustments.

Whose court is the ball in?

Assuming that reverse allocations are a good concept to pursue, what group should take on the task? The choices appear to be the National Cable Television Association Engineering Committee, the Society of Cable Telecommunications Engineers or CableLabs. CableLabs' charter does not permit it to actually set industry standards but nothing would prevent it from facilitating industry "good engineering practices" consensus on such issues. And, both NCTA and SCTE have proven records in such issues.

The FCC has been indicating an interest in looking into digital standards to promote interoperability, which could include reverse allocations. Recent statements from the FCC suggest, however, that it would prefer adopting finalized industry consensus. We probably agree it would be better for the industry to come to an agreement rather than having the regulatory bodies more involved.

Conclusion

It may be time to for the cable industry to seriously study the benefits of reverse spectrum allocations. Such allocations could lower the cost of reverse hardware, assist in orderly deployments and reduce the risk of interference to and from the emerging two-way services. An industry reverse allocation plan also would encourage more interoperability between vendor equipment. If we do not take up this responsibility ourselves, others may do it for us. But the question remains, who is going to pick up the ball?" **CT**

By Laura Hamilton, Managing Editor

Proactivity, balance

With the cable technical community contemplating a dynamic future replete with heady possibilities, one message kept rising to the surface at this year's Cable-Tec Expo: balance.

Impending decisions on digital, hybrid fiber/coax (HFC), telephony, cable modems and data delivery, new network architectures, powering schemes ... and on and on ... certainly can't be made in a knee-jerk fashion. However, the competition is already knocking persistently at cable subscribers' doors (and some of them are answering).

Most would agree that simply goaltending the cable market is not enough in today's ever-shifting communications arena. Consequently, the industry is not only protecting a premiere status as an entertainment delivery service, but also metamorphosing into the cable telecommunications industry. This entails proactive, timely business and technological determinations counterbalanced with well thought-out, concise engineering practices.

The Society of Cable Telecommunications Engineers Cable Tec-Expo '95 held in Las Vegas, NV, June 14-17, was just the forum to consider issues that no doubt promise to define "cable telecommunications" for

1

1) Las Vegas Convention Center — heart of the show. 2) Attendance was up 30% over '94. 3) Many attendees stayed at the Las Vegas Hilton. 4) The Annual Membership Meeting and House of Delegates. 5) SCTE President Bill Riker welcomes everyone. 6) New SCTE Chairman John Vartanian. 7) Tom Polis, Bill Grant and Tom Elliot at the SCTE Bookstore.

2

3

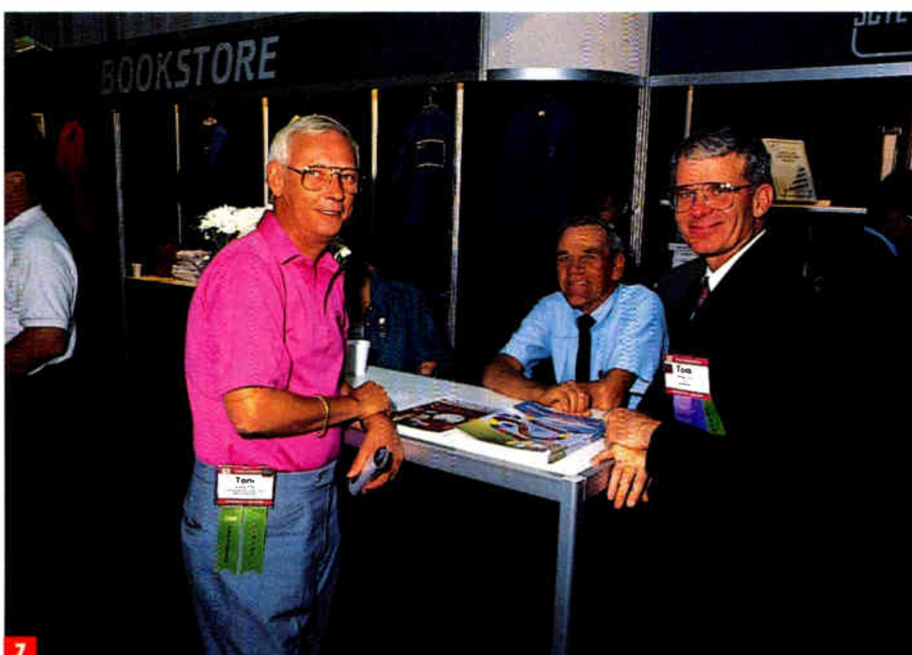
Photos by **Bob Sullivan**

propel SCTE Expo '95

4

5

6



7

years to come. In the following pages you'll find a comprehensive summary of all the show had to offer.

• First, the stats. A total of 3,900 attendees and 2,900 exhibitor personnel marked a 30% increase over last year — an obvious indication of a burgeoning industry. Coverage of the exhibitions begins on page 46.

• Those arriving the day before the official start of Expo had the chance to attend preconference tutorials that covered such diverse topics as safety and back care, consistent quality audio, learning strategies and public affairs programs. See page 36.

• Details on the Annual Engineering Conference start on page 24. Topics included improving system operations, tomorrow's broadband network, digital advances and cable/telephony.

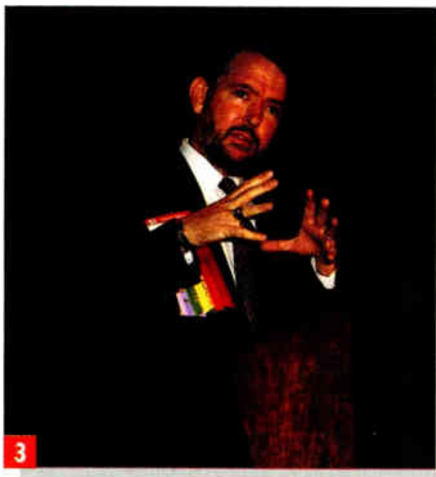
• The SCTE always uses the lunch break at the Engineering Conference to honor friends and members. Turn to page 32 for the accolades.

• Starting on page 36, you can read about all the workshops held at the show, which included presentations on HFC, basic digital, Broadband Communications Technician/ Engineer (BCT/E) certification, Emergency Alert System (EAS), FCC forms, network architecture, powering, practical networks, tests and measurements, and telephony.

• The social scene at Expo included Arrival Night, Welcome, international and ham operator receptions, the Annual Cable-Tec Games, Expo Evening and even a golf tourney. Turn to page 50.

This wrap-up was written with assistance from Assistant Editor Eric Butterfield, Executive Editor Wayne Lasley, West Coast Correspondent George Lawton, "International Cable" Editor Alex Swan and East Coast Correspondent Lawrence Lockwood (of TeleResources).

1) Bill Riker, SCTE president, kicks off the Engineering Conference. 2) Expogoers swarm in. 3) Ron Hranac of Coaxial International covered quality and reliability in the first session. 4) Cable telecommunications' technical community pack the conference.



Annual Engineering Conference: Building cable's future foundation

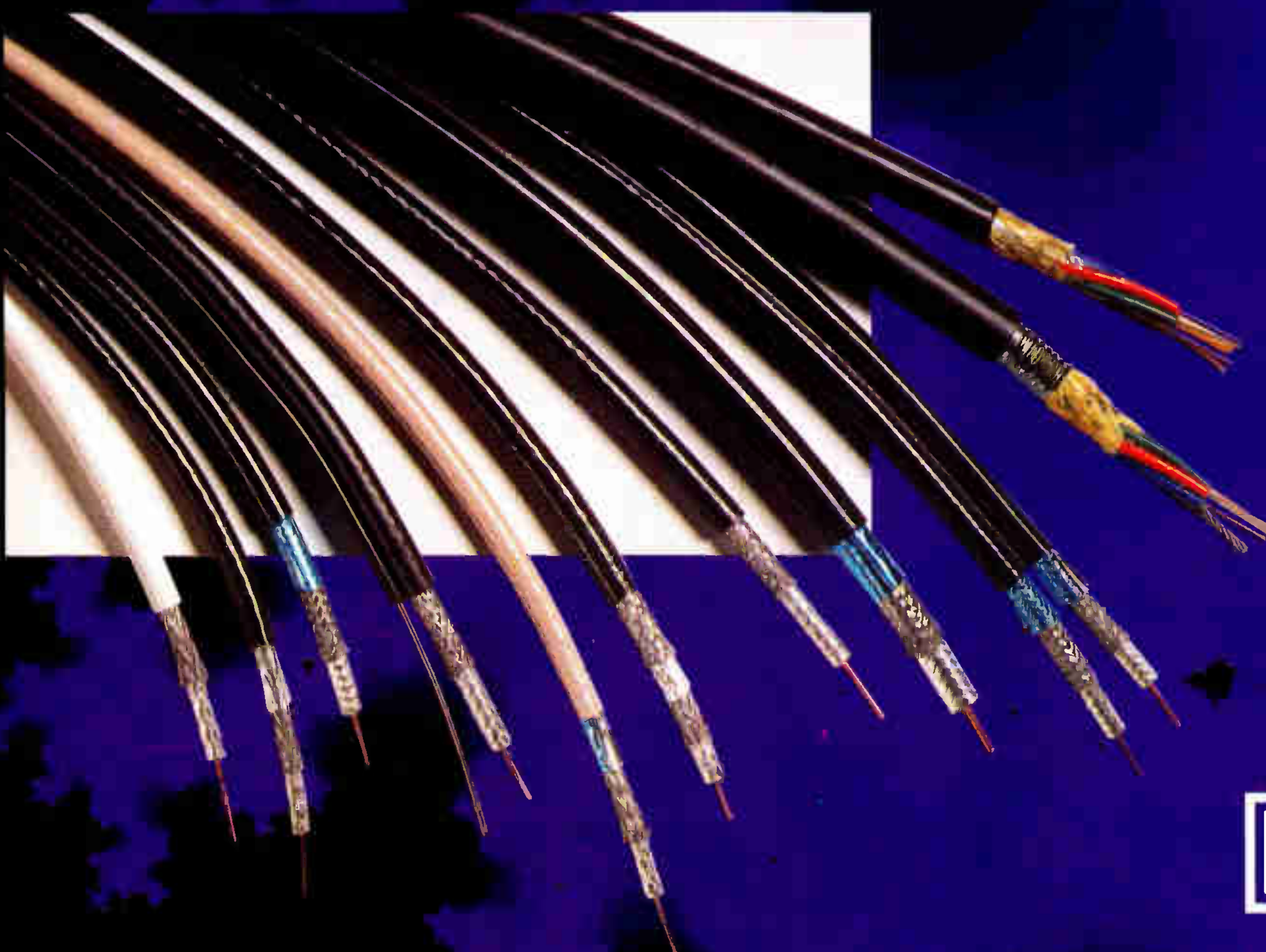
This year's Annual Engineering Conference at Expo focused on today's system operations and how they affect the way engineers are building networks for the future. It also delved into digital's advances and the promises of telephony over cable.

It kicked off with a session on "Improving System Operations, Building on a Firm Foundation." Pam Nobles, senior staff engineer at Jones Intercable, started off by stressing the importance of training, which can trim other expenses such as reduced service calls.

Syd Fluck of Hewlett-Packard addressed sweep testing in hybrid fiber/coax (HFC) networks. Although many cable operators are moving away from tree-and-branch architectures, Fluck says sweep testing can still play an important part in troubleshooting systems and preventive maintenance.

He said that many outside problems can be detected with sweep systems. If cable operators log

We Stock Belden® and So Much More.



Belden

TVC INCORPORATED

Belden® drop cable is manufactured to some of the industry's highest standards and is 100% sweep tested to 1 GHz. Belden offers the industry the lowest published structural return loss specs and outstanding product selection.

Call TVC today for fast delivery of Belden drop cable and well over 8,000 other top quality products.

Now, with offices around the globe, we reach farther than ever. But TVC is still as close as your phone.

NORTHEAST: HERSHEY, PA
(717) 533-4982 1-800-233-2147

WEST: SAN CLEMENTE, CA
(714) 361-2011 1-800-755-1415

SOUTHWEST: HOUSTON, TX
(713) 956-2984 1-800-346-3759

SOUTHEAST: SARASOTA, FL
(813) 371-3444 1-800-245-4423

EUROPE: SUSSEX, ENGLAND
(0)825 872848

CORPORATE OFFICE:
1746 E. CHOCOLATE AVENUE, HERSHEY, PA 17033

Reader Service Number 66

1) The "Improving System Operations, Building on a Firm Foundation" session included Syd Fluck of H-P CaLan, 2) Pam Nobles of Jones Intercable and 3) Bill Nash of TCI.

measurement data over a period of time, they can identify trends in performance problems before they turn critical.

Ron Hranac, vice president of engineering at Coaxial International, gave a presentation on quality and reliability in the cable industry. One problem is that cable operators often only log an outage when a piece of equipment breaks. But the customer will perceive an outage when a technician is changing the battery backup on an amplifier or any other repair that interrupts service.

Hranac said that 70-80% of all calls come from the drop. He noted that often a customer service representative (CSR) can troubleshoot a problem over the phone, preventing a costly truck roll to the customer's home.

The bottom line is reliability and quality, Hranac said, "If we cannot get them right today, our competition, DirecTv and wireless, will take our customers."

Bill Nash, director of training for TCI, discussed staff training in two-way cable plants, citing a TCI system in Mt. Prospect, IL, that used to have a bidirectional cable plant but was disabled a few years ago. When they went to reactivate it, it would not work. Over half of the houses were not able to communicate to the headend via the cable plant.

Eventually, the company created a card that contained information on return path signal levels, proper in-home converter wiring and converter diagnostics. This enabled technicians to diagnose problems that might affect the return path characteristics of the network. Also, the company integrated information from its billing system, trouble tickets and plant configuration into one application. This enabled it to spot problems geographically when trends emerged.

The one thing missing from the industry for bidirectional cable systems is a set-top box that can diagnose its connection automatically. Nash explained, "If we put a two-way box in, we need to know if it will work and quite frankly we cannot do that today."

Broadband networks

"Designing Tomorrow's Broadband Network," the second session of the Engineering Conference, was moderated by Hugh McCarley, director of engineering technology, Cox Communications. He had four presenters: Gaylord Hart, director, CATV product development, XEL Communications Inc.; Albert Johnson, president, Synchronous Communications; Mark Mylinski, associate product manager, General Instrument; and Andy Paff, executive vice president, Antec.

In Hart's presentation, "Technical Considerations for Deploying RF Data Modems on Broadband Hybrid Fiber/Coax Networks," he discussed various digital signal coding formats and their respective power spectra. He also reviewed several digital modulation techniques.

Johnson's covered "A Layered Architecture and Network Protection Issues in Optical Networks," where he described narrowcast techniques by wavelength division multiplexing a 1,330 nm signal into a main feed of a 1,550 nm transmission to a node and the receiver detecting both.

In "The Interactive Services Architecture," Mylinski discussed various approaches to interactive services architecture (ISA) to provide multiple services. He noted that this approach is particularly useful for a video-on-demand service.

The ISA in new broadband networks will provide: interconnection of headends, standard interfaces to switching systems, interconnection between various servers, preparation for becoming broadband network pro-viders, and automated service provisioning and transaction billing.

Paff identified "integration" and "interoperability" as the buzzwords of 1995 in his presentation on the "Integration of HFC into

ROCK SOLID PERFORMANCE

UNBEATABLE VALUE

Like Stonehenge, the PDI-60M agile modulator will stand the test of time. Using only the finest components, the PDI 60M will meet or exceed all FCC proof of performance tests.

The Passive Devices, Inc. PDI 60M offers the cable operator more performance value than any other modulator.

FEATURES :

Reader Service Number 112

- 60 dBmV output
- 70 Channels (500 MHz)
- BTSC Stereo Compatible
- Composite IF loop
- External selection of FCC offsets
- Digital display
- Push button tuning
- Two year warranty

For more information call us at
1-800-242-1606 • (407) 998-0600 • Fax (407) 998-0608
Hablamos Español E Falamos Portugues

PASSIVE DEVICES
pdi
INCORPORATED
electronics for telecommunications

1) Hugh McCarley of Cox moderated "Designing Tomorrow's Broadband Network," which included presentations by 2) Synchronous' Al Johnson, GI's Mark Mylinski, XEL's Gaylord Hart and Antec's Andy Paff.

the Public Network." In particular, applications must go somewhere beyond the headend, and regionalization and public network interconnections will become increasingly significant. He discussed the issues involved because integration is both a hardware and software issue.

Advances in digital

The third session, "Advances in digital technology," was moderated by Rex Bullinger, engineer, Hewlett-Packard. Four papers were presented from the following: M.J. Globuschutz, manager, broadband operations, US West Communications; Leo Hoarty, president and chief technical officer, ICTV Inc.; Brian James, director, ATV testing, Cable Television Laboratories Inc.; and James Radmann, operations and engineering manager, Milwaukee Cable Advertising.

In the "Video Dial Tone Operational Support System" presentation, Globuschutz noted that the operational support system (OSS) architecture for video services is a departure from the traditional telephony support system architecture. He then described an OSS architecture that US West decided to install in its Omaha, NE, system and how it incorporates control and billing of video services.

Leo Hoarty's paper, "The Smart Headend: A Novel Approach to Interactive Television," was presented by Dick Hale of ICTV. He described the technology of the ICTV system in providing interactive TV. The significant difference between other interactive systems — e.g., Time Warner's Full Service Network in Orlando — is that in an FSN-type the transmission to the home is a high-speed digital signal with considerable intelligence in the home (set-top) while the ICTV system puts most of the intelligence in the headend and transmits the video to the home in analog NTSC. He outlined the use of ICTV technology currently being deployed by Cox in Omaha.

Brian James presented his paper, "Modulating TV Signals on Cable Television Systems," in which he traced the history of various high definition TV (HDTV) proposals to the Grand Alliance System. He went into some detail describing the quadrature amplitude modulation (QAM) and vestigial sideband (VSB) modulation and tests of both by CableLabs and subsequent field tests of VSB in the Charlotte, NC, Time Warner system.

In Radmann covered "Digital Insertion and the Multi-Headend Environment," where he described how Milwaukee Cable Advertising uses digital commercial insertion.

Telephony comes to cable

In the last session, "Telephony and the Cable Industry," cable operators gave their perspective on deploying telephone technology in their systems. John Anderson, chief scientist for project engineering at Rogers Engineering, said that for cable operators to achieve a reliability of 99.99% or better, they will have to integrate OSS into their operations.

In the past, cable operators have been in a reactive mode in that they solve problems as they happen. For the high reliability required for telephone service, "We need a new service paradigm that is more proactive," said Anderson.

The key to proactive management is OSS. Noted Anderson, "Our network complexity is going up almost exponentially. Without OSS, our manpower will follow that curve, but we cannot afford to just throw more manpower at it."

Anderson defines OSS as software tools that enable or enhance business processes. There are five basic types of OSS: network management, billing systems, automated mapping/facilities management, field services management and customer telephone support.

Network management is actual-

Pushing World Limits of Technology and Commitment.

The Drake line of Modulators

Extensive channel capacity, BTSC stereo audio, up to 82 channels. **VM2552**

Frequency agility, +60 dBmV output, up to 82 channels, 550 MHz frequency. **VM2550**

Frequency agility, for systems up to 60 channels. **VM2410 A**

Frequency agility, for systems up to 23 channels. **VM2310**

The Drake line of commercial modulators exemplifies Drake's hard-won reputation for pushing ahead in technology while retaining a commitment to producing products of the highest quality and reliability.

Whether you utilize the VM2310 for smaller system distribution or meet the demanding requirements of stereo audio distribution in a large cable system with the VM2552, you can count on the consistent level of technology and commitment to quality for which Drake is well-respected. Technology and commitment that operators and installers have come to trust.

And the Drake line of commercial modulators are manufactured with a commitment to quality in America by an American company — Drake... a trusted world leader in communication equipment since 1943.

DRAKE ★ MADE IN AMERICA ★

DRAKE

R.L. Drake Company • P.O. Box 3006 • Miamisburg, OH 45343 • U.S.A.
Sales Office: 513-866-2421 • Fax: 513-866-0806 • Service & Parts: 513-746-6990 • In Canada: 705-742-3122

Reader Service Number 89

1) James Radmann of Milwaukee Cable Advertising at "Advances in Digital Technology" presentation. 2) "Telephony and the Cable Industry" featured Moderator Joe Van Loan of Cablevision, Thomas Staniec of NewChannels, Chris Barnhouse of Time Warner, Dave Hume of Motorola Multimedia Group and John Anderson of Rogers.

ly composed of a number of different components including fault management (which is what status monitoring did), configuration management, performance management, accounting management, security management and inventory management. Anderson noted that accounting management will be important for cable operators to bill customers by bit rate or usage packets.

On the subject of billing systems, Anderson noted, "The next major convergence is our engineering groups being converged with MIS and information technology groups. We will be billing by different pay methods ... Part of network management will have to feed billing information to provide this management."

Automated mapping/facilities management (AM/FM) is a technology that enables cable operators to link mapping and plant data. Anderson noted, "Once they are linked, you have a very powerful query tool. For example, you can tell which customers are fed off an amp."

Chris Barnhouse, vice president of technology at Time Warner Communications, gave a talk on TW's progress in deploying telephony systems. One of Time Warner's strengths for telephony deployment has been its clustering strategy. The company has a number of divisions with over 100,000 subscribers and some with as many as half a million subscribers.

Barnhouse said that they have made a decision to go after lifeline telephone services. At the time, there was a lot of talk about what a competitive telephone provider would look like.

One strategy might be to go in as a low-cost, low-grade provider of service. But this would lock them out of a large number of different customers and services. Noted Barnhouse, "We made a decision to go head-to-head with the local exchange carriers (LEC). There are some real stringent qualifications that go along with it."

Time Warner's market strategy will be to go to the customer with an integrated package. "We intend to go to the customer and provide a service we can deliver in a timely manner with feature capabilities that the LEC competitor will have trouble keeping up with," said Barnhouse.

Telephony over coax is not some sort of fundamentally new technology.

Barnhouse explained, "We believe we can move this stuff off the shelf and into production without having to invent anything."

Barnhouse said there are a number of open issues that need to be addressed for Time Warner to roll out commercial telephone service. For starters, although he believes it has solved the technical issues associated with putting power on the coax plant, it still has to deal with a number of operations and safety issues associated with it. It also is looking into the availability of low-cost long-term generators and power passing taps for the power.

Reliability is another area the cable industry needs to study in more detail. Barnhouse explained, "We have a dearth of information about the failure and reliability characteristics of various components of the cable." This is in stark contrast to the telephone industry, where they have years of data collected from every component in their networks.

Number portability is another open question. Barnhouse said, "One of the things we have to do to compete is allow the customer to take the number with them when they move. A couple of years ago there were no solutions. Today there are a number of solutions based on SS7 capability." Now there remains the political issue of settling on one scheme. — *GL, LL*

1) Powell Bedgood (center) accepts the Chairman's Award from Bill Riker (left) and Outgoing SCTE Chairman Tom Elliot on behalf of Crown Cable (now Marcus Cable). 2) Riker and Diana Riley induct Ted Hartson into the Hall of Fame. 3) Riker and Vic Gates (right) present Bela Zador with the Field Operations Award. 4) Outgoing SCTE Chair Elliot passes the gavel to new Chairman John Vartanian.

Honoring the Society's best

The SCTE held its annual Awards Luncheon at the break between the morning and afternoon Engineering Conference sessions. The following members and organizations were recognized:

- Expo Program Subcommittee members Ted Hartson and William Riker (co-chairmen), Roger Brown, Rex Bullinger, Paul Levine, Ginny Morris and Joe Van Loan received plaques for their efforts in creating the Cable-Tec Expo '95 technical program.
- The Program Subcommittee of the 1995 Conference on Emerging Technologies was recognized for efforts in the planning of the successful January 1995 conference. Receiving plaques were: Michael Smith (chairman), Jim Farmer, Paul Gemme, Hugh McCarley, Dan Pike and Jack Terry.
- The former Gulf Coast and Llano Estacado Meeting Groups were elevated to full chapter status in the Society.
- Outgoing members of the SCTE board of directors Steve Allen (Region 1), Pam Nobles (Region 2) and Bernie Czarnecki (Region 11) were recognized for their service to the Society.
- Ed Lowry, Wayne McKinney, Jeffrey Shearer and Brian Wilson were elevated to Senior member status in the Society.
- Dave Large was elevated to Fellow member status in the Society.
- Richard Amell, Robert Baker, Mark Bittner and Jim Farmer were recipients of Personal Achievement Awards. Created in 1986 as the Outstanding Achievement Awards and renamed in 1991, these awards recognize SCTE members who are outstanding in the performance of their respective jobs in the industry. →

1) Riker accepts a $2,500 check from Phillips Business Information's Paul Levine on behalf of "CT" magazine's Service in Technology winner. 2) Outgoing SCTE board members: Steve Allen, Bernie Czarnecki and Pam Nobles. 3) Riker congratulates Member of the Year James Haag.

• Crown Cable of Alabama, now operating under Marcus Cable of Alabama, was the recipient of the 1995 Chairman's Award.

• Bela Zador of Jones Intercable received first place in SCTE's fourth annual Field Operations Award competition. Mark Button of TCI of Denver and Peter Carr of DuCom Inc. were the second and third place winners respectively.

• Expo '95 Program Co-Chairman Ted Hartson was inducted into the SCTE Hall of Fame.

• Phillips Business Information's Paul Levine presented the SCTE with $2,500 for its scholarship fund in the name of Time Warner's FSN team. The team won *Communications Technology's* 1995 Service in Technology Award. (See the June 1995 issue of *CT*.)

• James Haag was the 1995 recipient of the Society's Member of the Year Award. The chairman of the Society's Interface Practices Subcommittee, he has been an instrumental force behind the subcommittee's productive establishment of numerous interface and connectivity standards.

SCTE board members

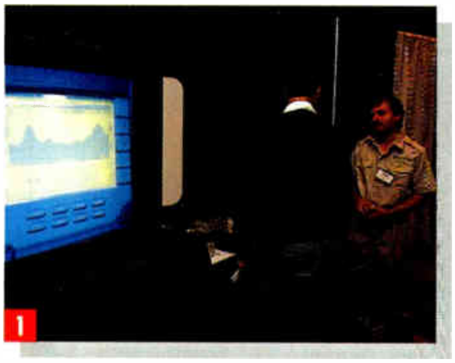
The Society's officers for the coming year were elected at Expo and recognized at the luncheon.

SCTE officers for the 1995-1996 term are: Chairman John Vartanian, Eastern Vice Chairman Steve Christopher, Western Vice Chairman Tom Elliot, Secretary Andy Scott, Treasurer Robert Schaeffer, and additional member of the Executive Committee Michael Smith.

The current SCTE board of directors consists of: Region 1 Director Patrick O'Hare, Viacom Cable, serving CA, HI and NV; Region 2 Director Steve Johnson, Time Warner Cable, serving AZ, CO, NM, UT and WY; Region 3 Director Andy Scott, Columbia Cable, serving AK, ID, MT, OR and WA; Region 4 Director Rosa Rosas, Lakewood Cablevision, serving OK and TX; Region 5 Director Larry Stiffelman, CommScope, serving IL, IA, KS, MO and NE; Region 6 Director Robert Schaeffer, Star Cablevision Group, serving MN, ND, SD and WI; Region 7 Director Terry Bush, Trilithic Inc., serving IN, MI and OH; Region 8 Director Steve Christopher, CommScope, serving AL, AR, LA, MS and TN; Region 9 Director Hugh McCarley, Cox Cable Communications, serving FL, GA, PR and SC; Region 10 Director Michael Smith, Adelphia Communications, serving KY, NC, VA, WV and DC; Region 11 Director Dennis Quinter, Berks Cable, serving DE, MD, NJ and PA; Region 12 Director John Vartanian, Viewer's Choice, serving CT, ME, MA, NH, NY, RI and VT; and At-Large Directors (representing the entire U.S.) Wendell Bailey of NCTA, Tom Elliot of TCI and Wendell Woody of Sprint.

Women in Technology

Bill Riker, president of the SCTE, took advantage of the Expo to announce a new annual award, "The Women in Technology Award," which will recognize and honor leading women in technology positions within the cable and telecommunications community. It will create visibility for all women in technical careers within the industry. Candidates will be nominated through application, and the first award will be presented at this year's Western Show in Anaheim, CA. The award is a joint venture between SCTE, Women In Cable and Telecommunications and *Communications Technology*. (See pages 70-71 for more details and the nomination form.) — *LH*



"System Tests and Measurements" featured Rick Jaworski of Wavetek. 2) Antec's Shellie Rosser and Time Warner's Steve Johnson considered the "Emergency Alert System." 3) H-P's John Cecil talks about tests and measurements to a packed house.

Tutorials, workshops prime up Expoees

For the first time, the SCTE's technical program for its annual Expo began with a series of preconference tutorials the day before the Engineering Conference. Early arrivers to Las Vegas caught up on safety, audio quality, effective learning strategies and an industry public affairs program.

In addition to these tutorials, workshops, which have traditionally been one of the major focuses of SCTE's show, were offered both the second and third day of Expo. They covered topics for most every technical appetite including hybrid fiber/coax (HFC), Federal Communications Commission filing, telephony and much more.

Safety training, back care

Ralph Haimowitz, director of training at the Society of Cable Telecommunications Engineers, and Barbara Wyatt, a general manager at Tele-Communications Inc., hosted the preconference tutorial, "Safety Training Programs and Practical Back Care for Field Technicians."

Haimowitz stressed the importance of safety training with cost figures for employee injury, noting a long list of repercussive costs including: hiring and training a replacement, lost customer time and dissatisfaction, administrative paperwork, lost production time of other employees, extra work for other employees, increased insurance and worker compensation costs.

Although an accident may cost $10,000 on the surface, these hidden costs can add another $40,000 onto the bill. With customers paying an average of $44 a month for cable service and $40 of that paid out to cover direct expenses (programming, salaries, maintenance, etc.), that leaves only $4 per customer. At this rate, it would take 1,250 new customers just to cover one accident.

Wyatt reiterated the importance of safety with an instruction on back care, citing back and shoulder injuries as the most common in the cable industry. Proper lifting technique was discussed for a variety of situations: retrieving equipment from a truck bed, loading onto a cable stand, carrying ladders, drilling on the side of a home, installing an outlet and even shutting the vehicle door.

Wyatt instructed with slides of an installer in action, stressing that a back care program needs to show installers the technique, since most people have only been told.

Sound advice

The tutorial on audio — "Achieving Consistent-Quality Audio in the Multichannel Universe" — was chaired by Dom Stasi, vice president of network video services for TCI and had five presenters: Virgil Conanan, senior systems engineer, HBO Technology Operations; Russ Murphy, director of engineering and technical services, The Family Channel; Jennifer Hays of Music Choice; and Linc Reed-Nickerson, product marketing manager for RF and cable, Tektronix.

A key element in this tutorial was addressing the common customer complaint that the "loudness" of commercials is so often much louder than the program audio preceding and succeeding the commercial.

Conanan gave an overview of some of the basics of audio and its typical distribution. He then addressed a comparison of voltage levels vs. loudness levels and showed a new all-electronic Dorrough Electronics VU (volume unit) meter that visually displays the instantaneous peak (voltage) level of the audio and the "loudness" level.

Murphy spoke at some length detailing various psycho-acoustic fundamentals involved in the perception of audio. He had several examples of audio at different compression levels that were played back.

Hayes reviewed some of the basic fundamentals of digital audio and its applications in satellite-to-headend transmission of music particularly.

Reed-Nickerson outlined the requirements in setting up a stereo channel and the use of the Tektronix 760A in this operation.

Effective learning strategies

The lively "Effective Learning Strategies" tutorial featured veteran cable industry presenters Ron Hranac, vice president of engineering for Coaxial International, and Pam Nobles, senior staff engineer for Jones Intercable. They offered up advice garnered from their extensively earned speaking expertise. Participants left with plenty of ideas on effective training methods for workshop-type presentations.

Nobles focused her talk on specific

1) S-A's Greg Hardy detailed "Powering for Reliability." 2) H-P's Helen Chen covered the basics in "Digital Technology 101."

tions links for telemetry; 27) end of project.

Preparing for BCT/E testing

The "BCT/E Technical Certification" workshop at Expo was designed to help prepare attendees for Broadband Communications Technician/Engineer (BCT/E) certification testing with overviews of six of the seven categories.

Marv Nelson, director of certification programs for the SCTE, introduced the session with a review of the Society's testing program and the benefits of certification. An important change to note is that individual exam testing time is now limited to two hours.

Among the presenters were Harmonic Lightwaves' Paul Biederman, Antec's Bill Cohn, Dovetail's Robert V.C. Dickinson, Coaxial International's Ron Hranac, Ameritech New Media Enterprises' Jim Kuhns, SCTE's Marv Nelson, and Viewer's Choice's John Vartanian.

For example, in Kuhns' presentation, he stressed knowing three things: your references, your formulas and your calculator. It's one thing to know that the answer is in your references, but two hours is very little time to skim thousands of pages in search of it. Kuhns also said calculators with memory are not allowed nor is any other device that holds memory (e.g., laptop computer).

Kuhns covered a variety of general considerations including regulatory agencies and rules, noise and distortions, modulation techniques and measurements. In particular, attendees were told to prepare for questions about microwave, fiber-optic and satellite systems, and public switched networks.

Basic digital

The workshop "Digital Technology 101" was divided into two parts: "Digital Cable Theory" presented by Megel Brown of Comcast Communications, and "Testing Video on Cable TV systems" presented by Helen Chen of Hewlett-Packard.

Brown described some of the fundamentals of digital theory including pulse code modulation (PCM) of analog video. He also described the sampling and quantization of analog video to get digital video, fundamentals of digital compression, and the error coding required in transmission. He outlined digital multiplexing and made some comparisons of quadrature amplitude modulation (QAM) and vestigial amplitude modulation (VSB).

Chen described methodologies to test digital video. First she outlined the challenges to analog that are presented by digital. In the section on testing digital video, she showed test measurement results of power and spectrum of average power of digital video illustrating where the power and spectrum test points are. In her discussion of spectrum tests she listed ingress, noise and analog intermodulation product interfering with digital video signals. Also, she pointed out that composite second order (CSO) and composite triple beat (CTB) in a mixed analog/digital system and digital video spill-over into adjacent analog channels are important tests. She showed some actual tests displaying constellation/eye diagrams, 16-QAM and 16-VSB modulation.

EAS — Not too expensive

The Federal Communications Commission has adopted the Emergency Alerting System (EAS) to replace the existing Emergency Broadcasting System (EBS). In the EAS workshop, Ken Wright from Intermedia Partners, Frank Lucia of the FCC and Shellie Rosser from Antec, gave their perspective on what is involved for cable operators in complying with these new rules.

For starters, broadcasters have until July 1, 1996, because they have been doing EBS transmissions for some time, while cable operators have until July 1, 1997, because this whole area is new to them.

Lucia said that EAS would not require the standard two-tone decoders now used in the broadcast EBS. Rather, cable operators will use a new kind of digital decoder to receive emergency data. Lucia noted, "Since the signaling is digital, you can automatically develop audio or video streams based on the signal itself."

In fact, automation is important because the FCC is considering allowing unattended broadcast studio facilities, which would necessitate EAS equipment that could be activated with no human intervention.

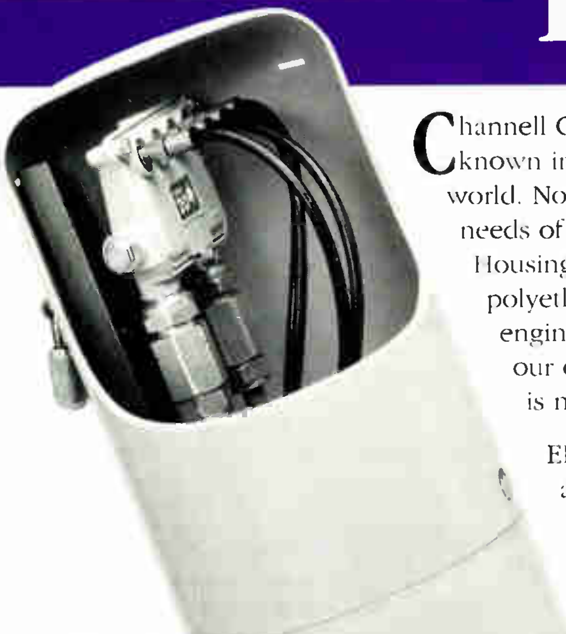
The two-tone signal itself will remain as part of the protocol for sending EAS messages and will be used to alert the slightly hearing impaired of the emergency.

Cable operators will only be required to be able to detect national emergency notification, emergency action termination, and monthly and weekly testing. However, once the infrastructure is in place, it will be easy for them to carry emergency messages from local sources about such things as tornadoes or floods.

There are still some questions with regard to the size of small operators that can be exempted from the rules, as well as the EAS rules applicability to cable competitors like multichannel multipoint distribution service (MMDS). Lucia noted that the FCC has not settled on an exact definition of small operator for the purpose of exclusion from the EAS rules. He did note that it may or may not correspond to the communications definitions of a small operator with respect to rate relief.

Lucia also said that they have not formulated a specific plan for MMDS operators. However, according to a letter he received from the Wireless Cable Association, wireless operators sounded positive about participating. Bell At-

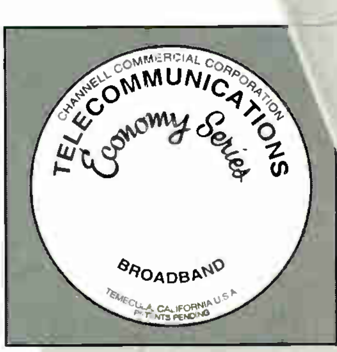
TAKE A GOOD LOOK AT OUR NEW POLYETHYLENE ENCLOSURES.

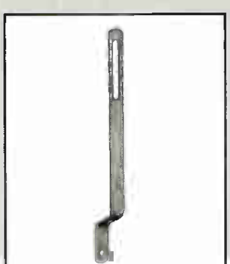


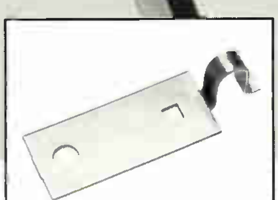
Channell Commercial's high quality ABS plastic enclosures are well known in the industry and are used extensively throughout the world. Now, we've added a new series of enclosures to meet the needs of our economy-minded customers: The Economy Pedestal Housing (EPH™) Series of high production, injection-molded polyethylene enclosures for housing taps and splitters. They're engineered and manufactured to our usual high standards in our own facilities, but designed for applications where security is not a major concern.

EPH Series enclosures feature constant wall thicknesses and include many of the other features found on our most popular Signature Series (SPH™) enclosures. These cost-competitive polyethylene enclosures have the highest possible UV protection, yet are far superior in design to any existing polyethylene enclosures found in the industry today.

When economy is a factor and security is not a major concern, take a good look at Channell's EPH Series of polyethylene enclosures. Call toll-free today for complete information.




Trap Mounting Bracket


Universal Locking Plate


Optional Trap Holder


Temporary Drop Entrance


Optional Wire Organizer

U.S.A.	800/423-1863 • 909/694-9160 • FAX: 909/694-9170
CANADA	800/387-8332 • 905/567-6751 • FAX: 905/567-6756
U.K.	+1 44 171 589 3304 • FAX: +1 44 171 589 1021
ISRAEL	972 4 341329 • FAX: 972 4 341387

CHANNELL
COMMERCIAL CORPORATION

Reader Service Number 125

S-A's Greg Hardy and Comm/net's Tom Osterman field questions on "Powering for Reliability."

lantic also has said it was interested in participating, but it had some concerns on how EAS will blend with its video delivery system. Direct broadcast satellite (DBS) will be approached by the commission for participation since it is a national network in scope.

Rosser talked about the technical requirements for receiving and relaying EAS messages over the cable system. The FCC EAS mandate gives cable operators two options for compliance. They can provide audio and video messaging on all channels, or they can send an audio signal on all channels with instructions to tune to one video channel with more information.

The first approach can be implemented for $5,900 to $9,500 per headend if it is already IF-equipped. In this scheme, a character generator creates an emergency information video stream. An IF processor bypasses all regular channels with the emergency information video stream.

The second approach can be implemented for $5,600 to $9,800 per headend. Rosser maintains this approach is less labor-intensive than the IF approach. However, the cable operator is required to supply special in-home devices for the deaf to receive this signal, which could add another $50 per deaf home passed. Considering that the average rate of hearing disability is 3%, that could add up significantly in a large system.

Walk on the filed side

At the "Inside FCC Form Processing" workshop, FCC representatives John Wong, Michael Lance, Priya Shrinivasan and Priscilla Wu briefly covered some problem areas many cable operators run into when filling out forms such as the basic signal leakage report.

Lance touched on some specifics of home wiring regulations mandated by the FCC. He also broached the topic of electronic filing. Although the FCC does see the benefit of electronic filing and has been looking into it, Lance summed things up with, "We've run into a lot of roadblocks." Don't look for the commission to be able to accept electronic filings immediately.

Shrinivasan gave tips on CARS and aeronautical notifications while Wu offered advice on filling out your Form 320 and 325.

The basic idea behind the workshop was a simple, familiar one (yet one that is often not adhered to): For faster service and less heartache from the FCC, review your forms thoroughly and make sure they're complete before you send them off.

Network architectures

Kenneth Metz of AT&T and Jeff Sauter of C-COR presented a workshop on network architectures in which they discussed some of the considerations in rolling out new services like voice and data applications on top of cable TV networks. Metz suggested that telephony is actually one of the easier services to deploy from a network architecture standpoint.

The key to this ease of deployment is the large base of SONET equipment on the market, which makes it easy to add and drop telecommunications signals in a ring architecture. In the headend, there needs to be a host digital terminal (HDT), which connects a telephone switch to the coax network. On the customers side, a network interface unit (NIU) is used to bring the telephone signal into the customer house.

Metz said the operational support systems (OSS) that support telephony are relatively new technology for the cable industry, although telcos have been using them for years. Personal communications services (PCS) is another technology that is being transformed by the cable industry because cable networks can deploy PCS without having to install 40-foot towers.

The most complicated service for these new networks will be real-time transaction bases services like video-on-demand (VOD). In addition, such service also would need a mechanism for encrypting all video and other communications to keep them secure. Metz said that there is a debate on whether to encrypt content before it is put on the server or as it is played to the consumer. Encrypting it beforehand may be cheaper to do, but it could make it available to less users.

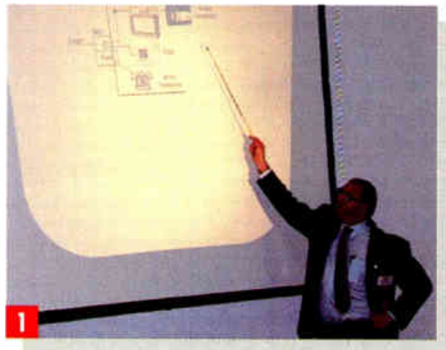
ATM is being considered for new cable services. Said Metz, "There is at least one MSO that wants to send ATM all the way to the home. But there is a 10% loss of capacity due to the ATM headers."

ATM would enable a cable operator to stream multiple channels of video from a server to a video module that would convert it into something that could run over the coax network. The video module would enable you to put six to eight MPEG streams onto one 6 MHz channel.

Sauter of C-COR said one of the largest differences in cable networks is area size. The smaller the size of the service area covered by a fiber node, the more capacity you have available per user, and the more reliable your network. However, there is a tradeoff

Ken Metz of AT&T and C-COR's Jeff Sauter answered questions and considered comments in the "Network Architectures" workshop.

1) AT&T's Ken Metz said telephony was actually one of the easier services to deploy from a network architecture standpoint. 2) "Practical CATV Networks" featured Bill Morris of Corning.



in that smaller sized service areas cost more per home.

In general, the cost of fiber-optic terminal components are going down so that it will eventually be cheap enough to bring fiber to very small node sizes. However, the high cost of lasers and receivers makes it too expensive today.

Sauter said, "If I had a fixed budget to spend on a project, I would figure out a way to spend as much of that money on glass and as little on terminal equipment as possible. I know the more glass I have, the more potential I have for new services."

More power

The "Powering for Reliability" workshop covered some of the issues involved in powering new HFC-based networks. Tom Osterman, president of Comm/net Systems Inc., said that reliability is more important than it ever has been as cable operators begin deploying telephony.

While cable systems currently operate at 60 VAC, 60 Hz, telephone electronics are generally powered by 48 VDC power supplies. But neither of these systems fully address the powering needs required by telephony over HFC. Consequently, Osterman said he is seeing a divergence of approaches in this area.

One approach that is being undertaken by Pacific Bell in its HFC telephony deployment is to use 90 VAC over the coax running at 1 cycle per second. The higher voltage lets PacBell drive the energy farther into the system with less amperage. It has chosen to go with 1 Hz AC powering because research has indicated that AC power supplies with less than 10 Hz are less likely to cause fatalities when accidentally touched. Osterman said, "There is an argument that a low frequency operation is safer. That is still controversial and you will find quite a few differences of opinion."

DC via the local loop is another option but then you can run into problems with corrosion. Osterman noted that advances in the manufacturing process and a better job at weather-hardening the plant could help reduce the corrosion problem.

Telephone systems require significant power for generating the ring on old telephones. This is changing with the advent of solid-state telephones. However, cable operators will have to be able to support the large installed base of existing phones. Initially, it was thought that each telephone would continually draw 5-12 watts of power. But Osterman said that many manufacturers are looking at creating systems that sleep when not in use, much like cellular phones.

Another concern is how you will protect other equipment connected to the coax powering system. If it is not properly grounded, the high power in these systems could destroy cable system equipment. Worse yet, if high power gets into the home, it could destroy a customer's digital set-top or a $2,000 home entertainment system.

You also need to worry about the customer. Osterman said he has heard stories about telephone customers putting 120 V across the telephone circuit just to see what they can blow out. He asked, "What will we do to protect our customers from doing the same thing?"

Greg Hardy, director of new business development at Scientific-Atlanta, explored some of the trends in powering components. He noted that RF amplifiers are now being produced to handle 15 amps of power vs. only 10 amps a few years ago. "If I can get 50% more current, I have a whole lot more flexibility in where I put power supplies," he said.

Another important feature that must be incorporated into the next generation of taps is AC/RF bypass operation. Otherwise, every time a technician opens a tap for repair, he could take out every single subscriber below that point in the network. This same phenomena is true for amplifiers. Hardy said that the cable industry needs temporary amplifiers for service needs.

How much power will these new networks take? Hardy said a telephony system with a 25-30% penetration rate over a HFC network will double the cost of powering a standard video network.

Practical networks

This workshop covered a number of areas of practical importance to cable TV engineers. William Morris, cable applications engineering manager at Corning, gave a presentation on "Working With Optical Fiber in the Field." He said that the cable industry currently consumes 32% of all fiber in the United States, which is as much as the regional Bell operating companies (RBOCs).

Morris covered all the basics involved in splicing together fiber-optic links. In addition, he covered some of the promising work going on in deploying 1,550 nm optical networks for cable TV. He said that 1,550 has been a problem in the past because of the high dispersion in that optical window. However, his company has perfected some techniques in producing low-cost dispersion-shifted fiber optimized for 1,550 nm communication.

Tony Nieves, product manager at Keptel, gave a presentation on customer demarcation. Although he cited a number of reasons for installing demarcation points, such as the ability to control egress and ingress on cable systems, the most pressing reason was that the 1992 Cable Act requires them.

Nieves estimated that 80% of all service calls are drop-related. The demarcation point serves as a convenient test

RF LiNK

The Right Technology at the Right Time

Standard Communications
SATELLITE & BROADBAND
PRODUCTS DIVISION

THE SHAPE OF THINGS TO COME

INTRODUCING THE FUTURE IN NETWORK MODULATOR SYSTEMS!!!

The future of CATV headends is NOW in your hands! Standard Communications Corporation's highly anticipated Stratum Modulation System offers you the first completely integrated, self-healing headend distribution system. Standard, a name synonymous with advanced headend technology, provides RF performance that is unequaled and unmatched. The Stratum's frequency agile modulators are designed to meet, or exceed the RF performance of the best fixed channel systems.

Stratum's unique design approach enables multiple RF channels to be combined in a master headend or remote digital hub, with rebroadcast quality noise and spurious performance. With the system's optional software remote control, you are able to operate and maintain multiple remote hub sites from one location. Also, The Stratum's built-in automatic back-up feature ensures continuous operation, even in the event of multiple failures, without external intervention.

We think the Stratum will revolutionize the future of cable headends---- we invite you to come see for yourself. Once you see what it can do, we think you'll agree!

A few words from Clayton Dore

Director of Sales & Marketing

Standard Communications has long been associated with the development and advancement of broadband headend equipment. A self appointed role, perhaps: but because of our advances, one now welcomed by our industry. We have delivered where other attempts have faltered. You have decided to incorporate Standard's innovative products into your systems and, with your continued support, we will deliver the next generation headend.. *STRATUM!!*

While our competitors were trying to determine how Standard Communications could engineer the industry's first single rack, integrated receiver descrambler (the Agile IRD II), we presented the first remote control, frequency agile modulator...the TVM450. The development of both the IRD II and the TVM450 came years before the industry was willing to accept remote control, automated switching, and redundancy as vital, integral elements of its future. The industry's philosophy concerning agile systems did not deter us from further developing the STRATUM Series. ***The STRATUM is the first, full featured, integrated, intelligent RF distribution system; a system that can detect,correct, notify, monitor and align, before the subscriber can reach the telephone to register his discontent.***

The STRATUM will again prove that frequency agile systems have become the industry standard.

RF LiNK

TECH LINE

Technical Analysis of the VSB-AM 550 MHz Headend

For many years to come, we anticipate as many as 78 analog VSB-AM TV channels to continue to be distributed throughout the system. These analog signals will have to coexist with various types of modulated carriers, both above and below the 50 to 550 MHz band. Whether driven by traditional satellite signals, off-air signal sources, or by the new digital superhighway, fixed and agile RF headend systems will share many of the same problems.

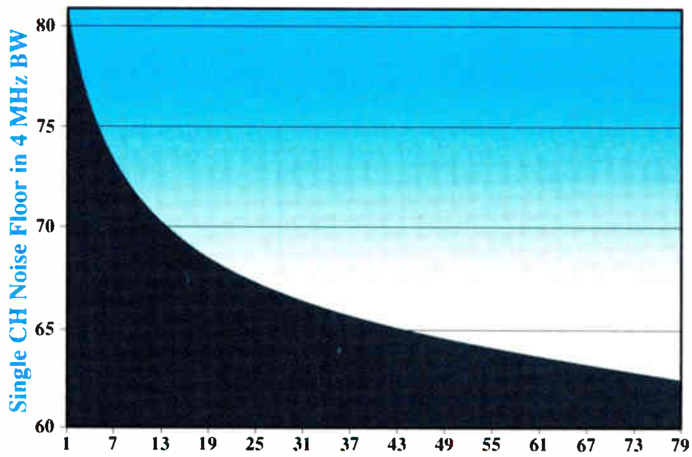
The big question of passively combining multiple TV channels is:" how are we going to deal with the broadband noise?"

Standard Communications was one of the first manufacturers to bring an agile CATV receiver to market - the Agile 24M. Prior to the introduction of this product, changing channels meant changing reference crystals and re-tuning the demodulator. Many people doubted an RF tuner synthesizer could be built with adequately low phase noise and sufficient long-term stability. The doubters were wrong. The current generation of satellite receivers are extremely agile and stable, with excellent phase noise performance.

A few years later, frequency agile modulators were introduced to mixed reviews. Unfortunately, some manufacturers jumped the gun and began marketing tuner synthesizers designed primarily for VCRs or set-top converters. These tuners provided agility, but at a significant cost in broadband noise. Also, because they were being pushed far beyond their design limitations, many other spurious signals came out in the modulator's final output. In the end, the industry labeled agile modulators, "for standby use only."

When I came to Standard in 1985, serious development of a frequency agile modulator line was just getting underway. Our biggest hurdles were broadband noise, phase noise, spurious suppression and long-term stability. Interestingly, these were the same hurdles Standard had already solved with the Agile 24M receiver. We suspected that with high-level mixing, dual IF filtering, precision PLL VCO synthesis and low noise amplification, a broadcast quality modulator could be developed. Little did we know it would take nearly five years to develop the attributes.

COMBINED NOISE OF SCC MODULATORS



The **TVM450** was finally introduced in 1990, and Standard has been improving on its technology ever since. We now market 550 MHz products and will be introducing 750 MHz products next year.

Standard developed an out-of-band noise specification for these products that will allow over 78 VSB-AM modulators to be combined by maintaining a C/N over -81 dBc (measured in a 4 MHz resolution bandwidth) for each modulator. As you can see from the chart, if every modulator maintains an out-of-band C/N of over-80 dBc, the combined analog RF system will have a C/N of -62 dBc, thus exceeding all NTC7 requirements and all set-top tuner noise thresholds. With spurious distortions below -60 dBc, -80 dBc noise performance, and RS250C video/audio specifications, we will have created an analog RF headend system capable of exceeding all of today's digital and analog requirements.

Warren H. Davis, Jr.
Director of Technology

Standard to Exhibit, Host Hospitality Suite at SCTE.

Finally, cable headend technology that has caught up to the 21st century! Come see Standard Communications full line of broadband cable headend products at the SCTE Show, Las Vegas, NV, on June 15-16, **Booth #291.** Whether integrating, automating, or building from the ground up, let Standard show you how to get a head start on the future.

Standard Communications will be hosting it's Hospitality Suite on Friday June 16, in the Las Vegas Hilton, from 6-9pm. Come by our booth during the show to receive your invitation!

COMPONENTS OF THE
STRATUM SYSTEM

NAM-550

Typically, the Stratum is thought of as a totally integrated system, offering eighty channels of RF modulation, with automatic backup and remote control abilities. However, the Stratum system is also comprised of multiple components, which may be configured to meet the exact requirements of the master headend or regional hub. In order to get the most out of the Stratum system, it is important to understand each of the components.

The three major components in the Stratum system are the frequency agile modulators (NAM550), the rack frame (NRF550), and the power supplies (NPS550). In addition, there are optional components, including the redundancy module (NSB550) and the remote control software.

The NAM550 module is a frequency agile 550 MHz modulator. Up to 8 modules (channels) can be housed in the NRF550 rack frame. There are three different variations of the NAM550 modulator: the NAM550-IF frequency agile IF upconvertor; the NAM550-BBV frequency agile modulator for baseband video and 4.5 MHz audio inputs; and the NAM550-BVA (pictured at left) frequency agile modulator for baseband video and baseband audio inputs (available October 1995).

The NRF550 Rack Frame holds up to eight NAM550 modulators and one NPS550 power supply. In addition, the NRF550 contains an 8x1 passive combiner and an interface for remote control. Like the NAM550 modulator, there are three varieties of the NRF550 rack frame: the NRF550-IF, to be used with NAM550-IF modulators; the NRF550-BBV, to be used in conjunction with NAM550-BBV modulators; and the NRF550-BVA, which is used with NAM550-BVA modulators.

The NPS550 (pictured at right) is the power supply for the NRF550 rack frame. Only one NPS550 is required per NRF550. There are two variations of the NPS550. The first is the NPS550-AC, which is for use with 110 VAC power sources. The second variation is the NPS550-DC, which is for use with -48 VDC power sources, and will be available in *October 1995*.

There are two optional components which, when added to the Stratum, enhance the system's capabilities. The NSB550 Redundancy Module Option gives the Stratum chassis the ability to re-route signals away from failed modulators, and toward designated back-up modulators. It may be added to any of the NRF550 series rack frames. Only one NSB550 is required per rack frame.

The second option is the soon to be released Windows® compatible software, which will allow the user to make adjustments to the Stratum system from a remote location. In fact, changes may be made to many headends from one location using this software. The Windows® compatible software will be available in *October 1995*.

NPS-550AC

NEW PRODUCT ANNOUNCEMENT

tandard Communications Corp.is proud to announce two new products, the **MT630** and the **SCM470**, designed for use in small to medium cable systems!

Agile IRD-SC (MT630)

The ***MT630*** is a compact 1.75" integrated receiver descrambler, designed specifically for small to medium capacity distribution systems. This receiver features 100 KHz PLL synthesized tuning, front panel signal strength meter and fine tuning control, providing unequaled performance in the harshest of headend environments. The MT630 has block conversion 950-1450 MHz RF input.

SCM470 Television Modulator

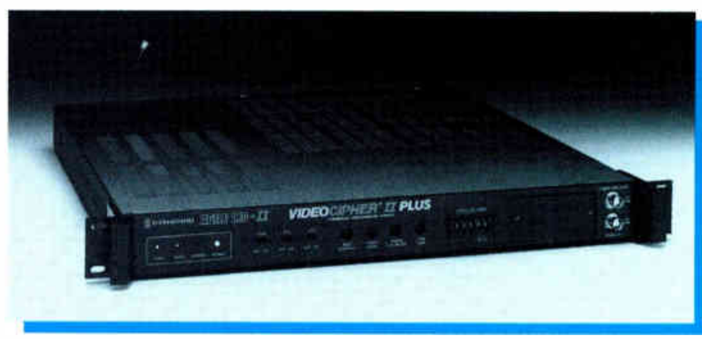
This is the perfect companion for the MT630 IRD. Designed for CATV and SMATV, this continuous duty cycle, VSB AM modulator provides ultra stable, virtually spurious free RF output. The RF output is frequency agile from 50-470 MHz, and has out of band noise specifications rivaling many fixed modulators. With optional BTSC and 4.5 MHz input or I.F. loop-through kit for scrambling systems, this is a versatile, economical solution for new systems or system rebuilds.

TVM550/550S

Frequency Agile Modulator

Standard's latest broadband modulator, the ***TVM550***, continues to impress system engineers with its unparalleled RF noise specifications and virtually spurious free performance. This kind of system performance was previously available only with fixed frequency modulators. The system has ultra-stable phase-locked RF circuitry, and is tailored specifically for the expansion of channels, the upgrading of headends, or the building of a complete system.

The TVM550 monaural configuration is competitively priced at $1,349. The TVM550S, with integrated BTSC stereo generator, is $1,985.



Agile IRDII

MT650-Integrated

The ***Agile IRDII***, a 950-1450 MHz RS250B rebroadcast- certified commercial grade satellite receiver and VideoCipher®RS descrambler module, fits in a single 19" EIA rack space. Dual band compatability ensures C or Ku-Band full or half transponder operation.

Additional audio subcarrier demodulator accessories allow for the processing of all major audio subcarriers.

Equipped with the VCRS descrambler module, the MT650 is competitively priced at $1,356. For services not VideoCipher®encrypted, the MT650 may be used as a full featured, stand-alone receiver for $759.

*VideoCipher® is a registered trademark of General Instruments Corporation

These products are backed by our Gold Standard Support Program which includes the Seven-Year Guarantee and Lifetime Loaner Program.

1) FCC representatives Priscilla Wu, Priya Shrinivasan, Mike Lance and John Wong gave form processing tips in their workshop. 2) Mike Smith proxied BCT/E testing.

›oint for verification of loop integrity. Vieves said it is time to develop standard installation procedures for network interface devices. In addition, :able operators should follow the SCTE specifications for network interface de-ices that serve as demarcation points nto the customer's home.

John Phillips, a product specialist at Siecor, gave a presentation on headend lesign. He said that cable TV fiber nanagement can be broken into four ategories: interconnect solutions, passive component solutions, splicing solutions and administrative solutions.

The interconnect solutions refers to he function of splicing the equipment o the fiber. The connection is not ıardwired to enable easier testing and naintenance. The passive component solutions help integrate WDMs, splitters and other passive components into he network. Ideally, these are selected n a package that is compatible with he total distribution system.

Splicing solutions provide a way of nterconnecting outdoor equipment to indoor cable in the headend. Administrative solutions consist of software for tracking and managing he fiber. Although this information an be maintained in paper format, it an typically get outdated.

Chuck Merk, vice president of engineering at Phillips Broadband Networks, gave a presentation on ATV broadband network reliability. He presented a technique for determining subscriber annual downtime aused by network failure. He did an nalyses of different architectures based on the failure rates of Phillips equipment.

Merk's results indicated that networks with redundant fiber substantially reduce network downtime. For xample, a passive network with no redundancy would be down an average of 46.9 hours annually vs. only 8 hours for a passive network with redundancy.

Tests and measurements

The "System Tests and Measurements" workshop was divided into three parts: "RF/Video Monitoring and FCC Reports" presented by John Cecil, Hewlett-Packard; "Reverse Path Testing" presented by Rick Jaworski, Wavetek Corp.; and "Quality Audio for Subscriber Satisfaction" by Linc Reed-Nickerson of Tektronix.

Cecil listed the agenda for system tests and measurements: video measurement techniques and accuracy; RF/video monitoring and data collection; data organization and FCC reports. The video measurements are differential phase, differential gain and chrominance-to-luminance delay inequality (CLDI). He talked about the accuracy of video measurements and combining accuracy of video measurements.

Cecil presented block diagrams of the test equipment configuration at the headend and discussed absolute measurements of DG (differential gain), DP (differential phase), CLDI and relative measurements of the same. He described improving relative DG and DP measurement accuracy.

Jaworski discussed the limitation of the reverse path — i.e., poor carrier-to-noise (C/N) — due to the summing effect of noise from all over the system and ingress from other services in the reverse frequency range. Add to that the fact that more fiber and more hubs and nodes allow better performance and therefore more services. He specified the required reverse path measurements and frequency response in addition to the required reverse path measurements of noise and ingress. Jaworski showed methods of testing reverse sweep frequency response and methods of testing reverse sweep of noise and ingress and discussed sweeping multiple reverse trunks.

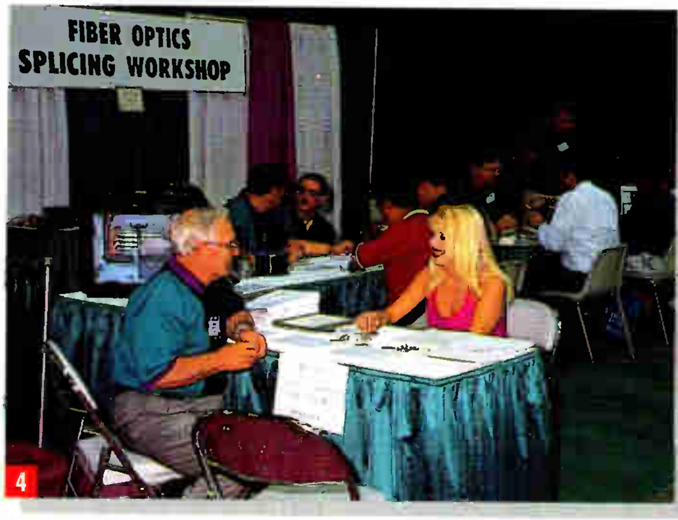
Reed-Nickerson focused on the problems of providing balanced loudness from channel to channel and proper level setting at the headend. He discussed understanding audio psychoacoustics and reviewed BTSC stereo and how to use Lissajous patterns for stereo setup and how to interpret the Lissajous display. He advised that the operator should "surf" the channels (just like subscribers do) to find any "too loud" or "too soft" channels that require adjustment.

Basic telephony

The "Telephony 101" workshop had three parts: "The HFC Network and Competitive Access" by J. R. Anderson with Antec; "Telephony 101: Basic Information, Facts and Figures" by Ralph Haimowitz, SCTE; and "A Primer on Telecommunications Switching" by Justin Junkus of AT&T CATV Switching Products.

Anderson discussed typical LEC (local exchange carrier) networking components and the proposed delivery of "access" traffic via the alternate broadband network detailing the fiber-optic broadband network components. He discussed power RF taps and outlined system maintenance considerations for broadband networks. Anderson emphasized that the quality of the drop system components must be high and all components specified for the best microreflection characteristics.

Junkus said the objectives of his presentation were to clarify the role of a telco network switch, describe a typical switch architecture, discuss traditional switch interfaces and transport, and introduce switch capacity metrics and telco applications. He then presented a review of current telecommunications switching in great detail, describing switch components as a special purpose computer with distributed processing architecture. He outlined switch applications along with customer service requirements. — *EB, LH, GL, LL, AS*



1) Expogoers converge on the 2) exhibit hall where over 325 companies displayed their wares. 3) and 4) Attendees performed their own fiber-optic splice at a workshop on the floor courtesy of AMP and Sprint/North Supply.

Record numbers on Expo floor

The SCTE Expo show floor is heralded by those in the cable technical community for its all-technical focus. A total of 3,900 attendees and 2,900 exhibitor personnel had the opportunity to exchange buzzwords and get hands-on with the latest cable telecommunications gear, and although this is the big draw, there's more going on in the exhibit hall than that.

Training lounge

A fiber-optic splicing workshop was offered at the show floor's technical training center. Attendees performed their own fiber-optic splice, courtesy of AMP and Sprint/North Supply, and toted off personalized certificates for their efforts.

SCTE bookstore

At the entrance to the exhibit hall was the ever-busy SCTE Bookstore. Expo '95 T-shirts were available for collectors, (how many do you have?), as well as manuals, templates, videotapes and more. New this year is the SCTE jacket and windbreaker. Call the SCTE at (610) 363-6888 if you missed your chance during the Expo to pick up Society fare.

Exhibitor training center

The SCTE offers vendors the opportunity to demonstrate their products in a formal presentations at the exhibitor training center, which was located at the back of the hall. The following participated:

• Ray Blair, technical sales representative from Sencore, covered simplifying installations with comprehensive pass/fail tests.

• "How To Double the Life of Batteries in Cable Power Supply Service" was offered by Dean Kinze of Cox Cable of Louisiana and A.J. Finnin of IDK Technologies. The

The AM Series
Standby Power Supply

The BPS Series
Broadband Power Systems

The FM Series
Uninterruptible DC Power Supply

The APC Series
Non-Standby Power Supply

The World Leader in Reliable Power

As cable television audiences around the world have come to expect reliable service, operators have come to depend on Alpha. The XM Series CableUPS® was the first UPS for broadband applications and has become the world standard for reliable communications powering, including the newest architectures. With a complete line of cable TV powering products ranging from power supplies to Amp Clamp™ surge suppressors and cable TV specific batteries, Alpha provides the world's cable operators with complete power solutions... and peace of mind. For more information, call:
1-800-421-8089

Enclosures
For Cable Television Applications

The CFR Series
UPS Systems for Headend & Office

Batteries
Cable Television Specific Batteries

The XM Series
60 & 90 VAC CableUPS® Power Supplies

The Amp Clamp™
Surge Suppression Product

Sales & service offices throughout the world

- **USA & LATIN AMERICA**
  Alpha Technologies
  Tel: (360) 647-2360
  Fax: (360) 671-4936
- **CANADA & PAC RIM**
  Alpha Technologies
  Tel: (604) 430-1476
  Fax: (604) 430-8908
- **UK & EUROPE**
  Alpha Technologies
  Tel: +44-1279-422110
  Fax: +44-1279-423355
- **GERMANY**
  Alpha Technologies
  Tel: +49-9122-997303
  Fax: +49-9122-997321
- **MIDDLE EAST**
  Alphatec
  Tel: +357-5-375675
  Fax: +357-5-359595

alpha ALPHA TECHNOLOGIES

Reader Service Number 27

1) Expogoers tweaked with the latest products on the show floor. Some of those participating in presentations at the Exhibitor Training Center included 2) Photon Kinetics' Darryl Rakestraw and 3) Cox Cable of Louisiana's Dean Kinzel and IDK Technologies' A.J. Finnin. 4) Hitting the floor.

demo detailed a comprehensive preventive maintenance program implemented by Cox that also employs IDK's Rejuvenator pulse amplitude charger/conditioner for batteries. (Look for an article on this in a future issue of *CT*.)

• Darryl Rakestraw of Photon Kinetics demonstrated the company's Model 7500 mini-OTDR. Introducing the unit as the first full-feature, full-function mini-OTDR, he highlighted its CATV installation and maintenance applications, in particular the unit's loss table that automatically calculates the reflectance of mechanical splices as well as optical return loss for the entire span.

• Moez Adatia, accounts manager for Gould Electronics, gave a presentation on optical components in CATV systems — fiber-optic splitters and wavelength division multiplexers. He covered advances in technology for splitting and tapping off light from optical fibers, as well as wave division multiplexers that can enable a cable operator to put two or more optical signals onto a single fiber.

• Siecor's Marty Anderson demonstrated the company's FuseLite fusion splicer and connector, conducting a direct fusion splice of a factory-polished connector. The ferrule-design connector contains a fiber polished in the factory, eliminating the need for field polishing, increasing termination quality and reducing connector installer time. This "near zero length" pigtail is available in single-mode and multimode versions, and FC, ST-compatible and SC options.

• Performance Cable TV Products' Jud Williams presented his company's Model PS7200 products in the "True Online Double Redundant UPS" tech demo. The technology can be pole- or ground-mounted for a variety of applications.

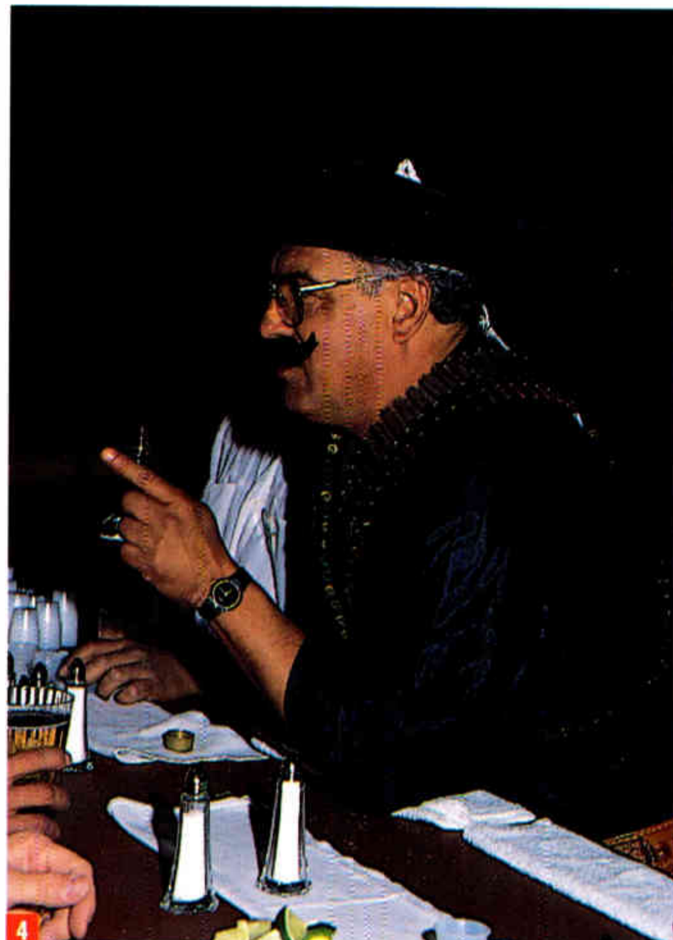
• Society staffers conducted two demonstrations designed specifically for its chapter and meeting group officers attending the Expo. Howard Whitman focused on "Using SCTE's *Interval* To Promote Local Chapter Activities" and Rick Bechtel covered "How To Form a Local SCTE Chapter in Your Area."
— EB, LH, GL, WL


Now's not the time to be scratching your head with questions.
HP CaLan for system sweep and level measurement.
Sixty feet up with your hands full. Let's hope you understand the ins and outs of your cable test equipment — or that your equipment is from HP CaLan.
Our easy-to-use, one button measurements give you accurate and repeatable results every time you take a reading. Plus, its abundant data storage capacity lets you capture the results of tough measurements for in-depth analysis in the comfort of your office.
So the only thing hard about these instruments is the case that surrounds them.
What's more, on those rare occasions our help menus don't have the answers you're looking for, our instant on-line assistance will
Providing you with quick answers whenever and wherever you need them most.
HP CaLan for low cost video quality assurance.
HP CaLan for all RF and video measurements.
To find out how HP CaLan can improve your cable TV testing ability (and maybe even get you home faster) call HP CaLan at 1-800-452-4844, Ext. 9424*.
There is a better way.
HEWLETT PACKARD
©1995 Hewlett-Packard Co.
5963-9745EUF
Reader Service Number 10

1

2

3



4

Expo Evening, a border party and casino night extravaganza, featured 1) gambling, 2) an Old West motif, and 3) "jailed" partiers put behind bars after having to face 4) the dreaded judge.

Viva Las Vegas

Aside from Las Vegas' obvious attractions — the gambling, the shows, the lights, the Elvis impersonators — Cable-Tec Expo attendees had plenty to keep them busy in the evenings after a full day of conferences, workshops and laps around the show floor.

Arrival Night, Welcome receptions

On Tuesday night, most Expogoers arrived in Las Vegas and were treated to the Arrival Night Reception by Wavetek RF Products. Food, beer and raffles make this a popular first-chance to socialize every year. The following night, Alpha Technologies, Nortel, Sprint, Times Fiber Communications and the SCTE sponsored a Welcome Reception, which featured the fourth National Cable-Tec Games.

Cable-Tec Games

Always a well-attended event at the SCTE's national show, this year's Cable-Tec Games featured the following events: "Go Fetch" (sponsored by TeleWire Supply) "Meter Reading" (Trilithic and Wavetek), "Cable Splicing" (CommScope and Gilbert Engineering) and "Cable Jeopardy" (National Cable Television Institute). Cable tech junkies showed off their cable expertise in an "Olympic-


1

3


5

style" competition for the chance to tote off medals and national Cable-Tec Games bragging rights.

The overall event was sponsored by the Society of Cable Telecommunications Engineers and Phillips Business Information's *Communications Technology*. Under the guiding hand of Barry Smith, the games were coordinated by the SCTE Cable-Tec Games Subcommittee and the Boulder Dam Meeting Group. Keeping things lively were masters of ceremonies Mike Phebus of Times Fiber and Steve Jaworski of the NCTI, who handled Cable Jeopardy duties.

2

4

6

1) Expo Evers enjoy libations. 2) Amateur radio operators met face to face at the Ham Reception. 3) Coaxial International's Ron Hranac (left) and SCTE's Marv Nelson (right) congratulate Bob Marzari, who walked away with the grand prize at the Ham Reception raffle. 4) Food and fun at Expo Evening. 5) The SCTE staff slows down for a second to pose for a photo. 6) The SCTE's Ohio Valley Chapter's John Schatz presented SCTE's Rick Bechtel and Bill Riker with a check for the new Society headquarters fund. →

1) The International Reception allowed attendees from around the world to meet and 2) be entertained. 3) Gearing up at the Welcome Reception, which included 4) and 5) the Cable-Tec Games.

Lakewood Cablevision's Jimmy Smith walked away the big overall winner. Second place went to Michael Clark of TCI. Jim Fronk of Multimedia took third.

As for individual events, the first, second and third place winners went as follows. "Go Fetch": Jimmy Smith, David Meszes and Steve Allen; "Meter Reading": Jimmy Smith, Ricardo Ortiz and Michael Clark; "Cable Splicing": Bart Hubbard, Michael Clark and Jimmy Smith; and "Cable Jeopardy": Doug Lanham, Steve Allen and Lee Skinnell.

SCTE meeting, reception

Just prior to the Welcome Reception, the Annual Membership Meeting and House of Delegates was held. Members got the chance to ask questions of the national SCTE board and staff, and meet other Society members.

On the last night of Expo, Friday, the Society hosted a reception for its chapters and meeting groups. The highlight was a $1,500 donation for the SCTE's new building fund from the Ohio Valley Chapter.

International, ham receptions

Belden Wire, *CT* sister magazine, *International Cable*, Electroline, Lindsay Specialty Products, Triple Crown Electronics and SCTE offered attendees the opportunity to hobnob with fellow members of the cable community from around the world at the International Reception.

At another party, Scientific-Atlanta provided refresh-





1) Another scene from the Cable-Tec Games. 2) Socializing at the Welcome Reception. 3) Wavetek offered food, drink and knowledge at its Arrival Night Reception as well as 4) entertainment and 5) a packed party.

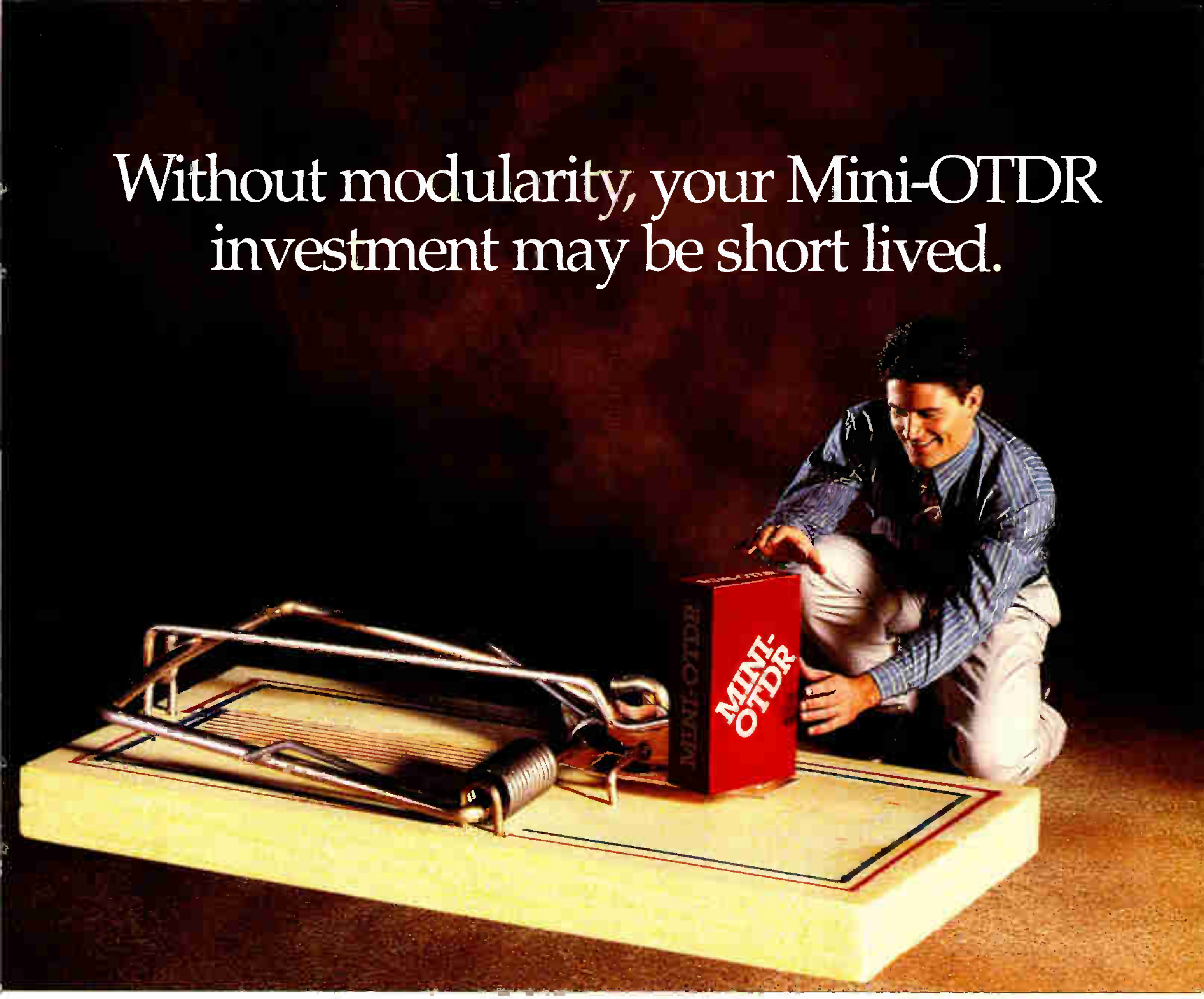
ments for amateur radio operators and those "just interested" at the Amateur Ham Radio Operators' Reception. Quite a few ham-related products were raffled off and lucky Bob Marzari from AMP went home with the grand prize — an ICOM amateur radio HF transceiver worth around $3,000 donated by Hewlett-Packard, S-A and TCI. Other companies donating prizes included by AeroTrack, Alpha, ARRL, Augat, Cable TV Supply, Coaxial International, CommScope, ComSonics/Westec, Comspec, Flight Trac, Ham Radio Outlet, Jerry Conn, Lindsay, NCTI, Philips, Pioneer, Preform, Standard, Tektronix, Texscan, Trilithic, Time Warner Cable and Zenith.

Expo Evening

Expo Evening is the big social event at the show, and this year attendees enjoyed a border party and casino night thanks to Antec. CommScope, General Instrument, Scientific-Atlanta and the SCTE. Expo Evers gussied up with bolo ties donated by Phillips Business Information and enjoyed barbecue and Tex-Mex food. The entertainment included a country band and casino games played with "SCTE bucks" for prizes.

Golf tourney

The Fourth Annual SCTE Golf Tournament marked the end of Cable-Tec Expo '95. Next year's Expo extravaganza takes place in Nashville, TN, June 10-13. See you there. — *LH*



Anritsu's MW9070 Modular Mini-OTDR. It answers your needs today...and tomorrow.

Don't fall into the trap of buying a Mini-OTDR with no future. There's only one Modular Mini-OTDR that won't let new technology pass you or your equipment by—and that's the MW9070. Modularity keeps you current with OTDR advancements in dead zone, dynamic range, etc. The mainframe and user interface are also a powerful platform, able to support other measurement applications you come up against down the road.

Maximum Modularity.

Only our MW9070 gives you the platform for the future with field-changeable components:

- Optical modules
- Battery modules
  - NiCd (rechargeable)
  - Dry Cell (alkaline)
- Visual light source— 635 nm
- Optical connectors

Upgrade in the field.

Hardware reconfigurations and software upgrades can easily be completed in minutes, so craftspeople will spend valuable field time *using* the MW9070.

Anritsu's MW9070 Mini-OTDR. The end of absolescence is just a phone call away.

For detailed literature or a hands-on demonstration, contact us at 1-800-230-AWSC (2972).

Reader Service Number 50

Anritsu Wiltron

- **U.S.A.** (800) 230-AWSC
- **U.K.** (0582) 418853
- **Italy** 06-502-26-66
- **Canada** (905) 890-7799
- **Germany** (0211) 679760
- **Japan** 03 3446-1111
- **Brazil** (021) 286-9141
- **France** (1) 64-46-65-46
- **Asia-Pacific** 81 (3) 3440-2770

By **Joshua L. Cohen,** Member of Technical Staff, **Mark H. Etzel,** Distinguished Member of Technical Staff,
David W. Faucher, Member of Technical Staff, **and Daniel N. Heer,** Distinguished Member of Technical Staff, AT&T Bell Laboratories

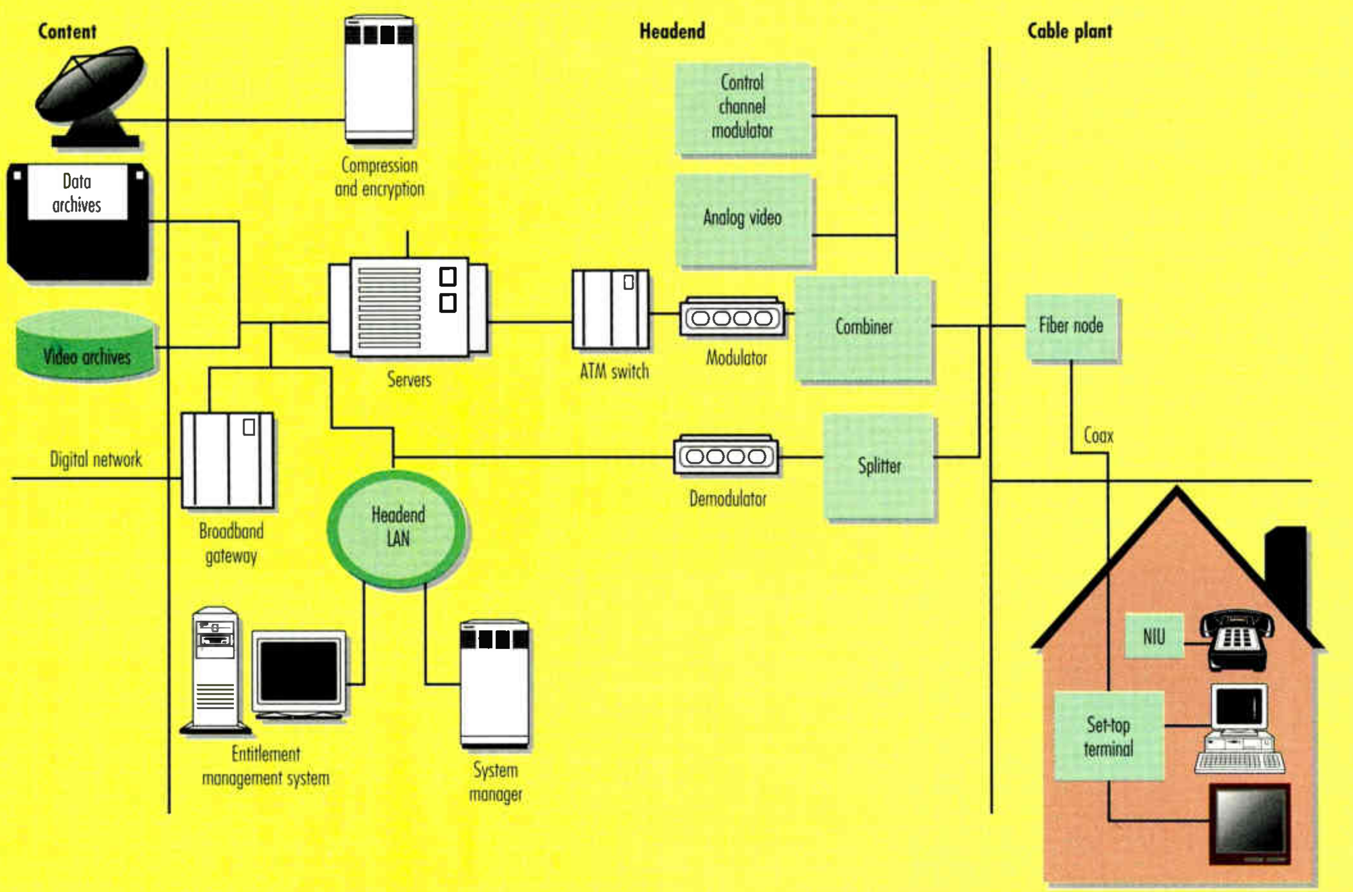
Security for broadband digital networks

Broadband networks are evolving rapidly with the introduction of hybrid fiber/coax (HFC) networks, wireless cable, direct broadcast satellite (DBS) and other broadcast and multiple access network approaches. The new network and transmission technologies allow an incredible amount of information to be provided efficiently to a large number of terminals. With these capabilities comes the need to secure the broadband networks in order to protect the value of the information supplied by the content providers and distributed by the service providers. At the same time, the public demands that personal or private subscriber information be protected as well.

Access to information involves not only providing physical access, but also identifying and encapsulating information in a form that permits access control. Generally, access control involves addressing information only to those who are entitled to receive it, managing the entitlements and identifying what was accessed by whom in order to permit proper billing. The same access control techniques also may be used to protect the privacy of subscribers.

This article addresses the means by which access to information transmitted over broadband networks can be controlled in such a way that these goals are achieved. It is important to understand that the security concerns, concepts, components and solutions presented here are applicable to broadband networks in general. As a

Figure 1: HFC network architecture



Reader Service Number 53.

specific example of a broadband network, we have chosen to highlight advanced cable systems and HFC networks in our discussions.

Advanced cable systems

Recent advances in cable system technology translate to numerous potential applications beyond simply broadcasting movies. The cable industry is now interested in providing a multitude of digital services to its subscribers. Broadcasting digital movies will be first, followed by natural extensions such as pay-per-view (PPV), video-on-demand (VOD) and enhanced PPV. But the new services will vary far beyond digital video, including the handling of subscriber input, published material and software distribution, home shopping, electronic commerce, electronic contracting, telephony and a host of other applications.

In order to offer these services, the current analog delivery systems must be upgraded. Consequently, the cable industry is in the process of conducting engineering trials to determine the best approach. At this time, the cable industry appears to favor modification of the present cable plant to an HFC configuration rather than wholesale replacement of the existing plant. The HFC network expands the use of the present cable plant by taking advantage of advances in video compression and modulation technology. These advances pack more information into the existing bandwidth so that instead of transmitting only analog video, the HFC network is able to transmit information for the variety of services mentioned before.

"Cryptographic keys must be protected from cradle to grave. They must never exist unencrypted in any accessible part of the broadband system."

As content and service providers make use of such advanced cable networks for these services, they will require reassurance that their valuable assets are protected from undesired access and that payment is appropriately received for services rendered. At the same time, subscribers will want reassurance that the information they enter regarding what they buy, what they watch and their credit details cannot be recorded, collected, and later used against them. These concerns are justified. The stakes are being raised both for those who wish to use the networks legitimately and for those who wish to abuse them.

Before discussing the particular security needs in such a cable system, however, it is imperative to understand the HFC network itself. The security system components for this network are addressed later.

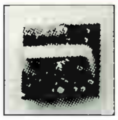
The HFC network

The HFC network consists of four

QRF

REPLACEMENT EQUALIZERS
QUALITY RF SERVICES, JERROLD, SCIENTIFIC ATLANTA, MAGNAVOX, TEXSCAN 'T SERIES', PATHMAKER AND RCA

QSA



Equalizer For
Scientific Atlanta Equipment
(330 and 450 MHz)

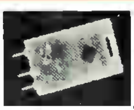
QSA-330 MHZ – $12.00*
Passband = 50-330 MHz
Flatness = ± .15 dB
Return Loss = ≥ -17 dB
Insertion Loss = ≤ 1 dB
Values 0, 3-30 in 1.5 dB increments

QSA-450 MHZ – $12.00*
Passband = 50-450 MHz
Flatness = ± .15 dB
Return Loss = ≥ -17 dB
Insertion Loss = ≤ 1 dB
Values 0, 3-30 in 1.5 dB increments

SXP-T-TOPS

For Scientific Atlanta Equipment
SXP T-Tops – **$1.75**
(with handle)
Values 0-20 dB in 1 dB increments

QSYL



PATHMAKER
$10.00
Available in the following bandwidths:
300, 330, 400 and 450 MHz
Nominal Values:
4, 7, 10, 13, 16, 19, 23 dB

QSYL-P

PATHMAKER PADS
$4.50
0 to 6 dB
9, 12 and 15 dB

QRCA

EQUALIZER $8.00
300, 330 & 350 MHz
3, 6, 9, 12, 15, 18, 21 dB

QRCA-P

PADS $5.50
0, 3, 6, 9, 12, 15, 18 dB

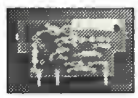
QMAGV

Replacement Equalizer For
Magnavox 5CE Series Adjustable
(330 and 450 MHz)
$14.00*

330 MHz – 0, 5, 8, 11, 14, 17, 20 dB
450 MHz – 0, 5, 8, 11, 14, 17, 20, 23, 26 dB

Return Loss = 16 dB All Values
Insertion Loss = =1.2 dB All Values

QMAG

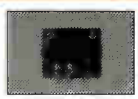


QMAG – 5EE Series
(Fixed Values)
(330 and 450 MHz)
$10.00*

330 MHz – 0, 5, 8, 11, 14, 17, 20 dB
450 MHz – 0, 5, 8, 11, 14, 17, 20, 23, 26 dB

Return Loss = 16 dB All Values
Insertion Loss = =1.0 dB All Values

QMAG-P

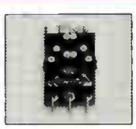


MAGNAVOX PADS
$4.50
0, 3, 6, 9, 12 dB

QTEX

TEXSCAN 'T SERIES'
$10.00*
Available in the following bandwidths:
330, 400, 450, 475
330-400 MHz – 4, 8, 12, 15, 18 dB
450 MHz – 4, 6, 8, 10, 12, 14, 16, 18, 20 dB
475 MHz – 4, 6, 8, 10, 12, 15 dB

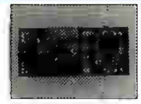
QTEX-P



TEXSCAN 'T SERIES' PADS
$5.50
0 to 6 dB
9, 12 and 15 dB

***DISCOUNTS AVAILABLE FOR QUANTITY**

QLX



Equalizer for
Jerrold JLX
(Replaces Jerrold EQ)
$6.75

(330, 350, 400, 450 and 550 MHz)
330-450 MHz – 0-30 dB 550 MHz – 0-24 dB

Available in 2 dB cable equivalent increments

QEP-ADP

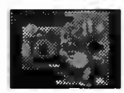
Fixed Value Equalizer System

Allows QLX to Replace SEP's

QEP-ADP - **$7.00** Plus QLX - **$6.75**
TOTAL - **$13.75**

QEP

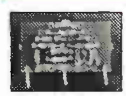
Trunk Equalizers (Replaces SEP by Jerrold)
(ST 20 and SJ Chassis Compatible - Available in one-way or two way...4's and 5's)



TL - 5 thru 11 dB
L - 10 thru 16 dB
H - 16 thru 22 dB
ST - 18 thru 25 dB

(300 through 450 MHz Bandwidths)
$15.00 all values

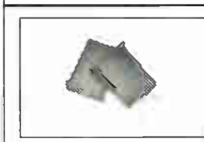
QEE



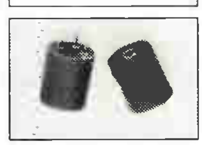
Line Extender Equalizers
(Replaces SEE by Jerrold)
270 MHz, 300 MHz, 330 MHz, 350MHz, 400 MHz
$5.00

450 MHz - **$6.00** 550 MHz - **$7.00**
600 MHz - **$8.00**

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



JXP PADS
$2.90
(0 to 20 dB in 1 dB steps)
Also available
JXP A's–750 MHz



SXP PADS
$1.75
(0 to 20 dB in 1 dB steps)

Quality RF Services is not a Sales agent for Jerrold Electronics

QUALITY RF SERVICES, INC.
850 PARK WAY
JUPITER, FL 33477

(800) 327-9767

(407) 747-4998
FAX (407) 744-4618

Reader Service Number 68

major elements: the content provider, the cable headend, the cable plant and the customer-premises equipment. The content providers supply information to the service providers at the headend. From the headend, the service providers, in turn, distribute the information via the cable plant to customer-premises equipment for the subscribers to use. Each of these four elements has several components, as shown in Figure 1 on page 58.

Content providers create the information transmitted over the network, and archive the information in data and video libraries. These providers use various means to deliver the information to the service providers including satellites, over-the-air, magnetic storage media and ATM (asynchronous transfer mode) networks.

The second element of the network, the cable headend, is the beginning of the HFC network and has many or all of the components shown in Figure 1 (page 58). The information from the content providers is received at the cable headend by the service provider. In order to make efficient use of the bandwidth in the network, encoders compress the information. Compression is performed either by the content providers before delivering the information or by the service providers at the cable headend, but always before the information is stored in order to achieve efficient digital storage. For video applications, encoders compress the large video bandwidth of 270 Mb/s down to the 3-5 Mb/s range. Advances have also been made in transport protocols. As an example, in addition to providing an efficient means for transmitting compressed video, the MPEG-2 transport protocol provides a means for transmitting access control messages and multilingual audio.

Video servers are the heart of the advanced cable network. These devices store large quantities of information and manage distribution of this information, whether it consists of audio, video, graphics, text or data. The video servers also provide the interfaces among many of the components at the headend. Some of the servers' functions include retrieval of archived data from video and data libraries, connection to the broadband gateway, routing of messages to specific subscribers and processing of messages from the system manager. In many cases, servers store compressed video from the encoder, but servers also must have the capability of receiving compressed video from the encoder in real time during the transmission of a live broadcast to a subscriber.

The broadband gateway receives digital data from outside the headend for immediate transmission to the subscriber. Alternatively, such digital data may be stored on the server or in a data or video archive library.

The system manager acts as the nerve center for the headend resources. It directly or indirectly controls resource allocation for video and telephony, tracks billing and monitors trouble reports. The system manager guarantees that a subscriber who has ordered a program receives that program whether it presently resides on the server, is retrieved from another server or library over the broadband gateway, or is received as an analog signal and compressed in real time by the encoder.

The ATM switch receives the information from the server and transmits it to the appropriate modulator. Each

Reader Service Number 1

modulator places the information it receives in a different portion of the band. Combiners take the output of many modulators, along with analog video and control channel signals and combine them into one signal for transmission over the fiber cable. Thus, the modulators and combiners provide a means for efficiently sending multiple movies or other data over the same 6 MHz bandwidth presently needed to send a single analog channel. The splitters and demodulators perform the inverse operations of the combiners and modulators, respectively, for information flowing from the customer-premises equipment back to the cable headend.

The third element of the network, the cable plant, consists of fiber and coaxial cables. The fiber cable extends from the headend into neighborhoods where fiber nodes convert the optical signals to electrical signals. The electrical signals are transmitted over coaxial cables to the subscribers' homes. Each coax leg branching off the fiber node acts as a local area network (LAN) with up to 500 homes connected to it. In addition to allocating different portions of the spectrum for different movies, data, etc., from the headend to the customer-premises equipment, part of the spectrum is allocated for a control channel that operates in both directions. The downstream control channel provides a mechanism for the headend to send individualized messages to a subscriber without packaging these messages in MPEG-2 format. Similarly, the upstream control channel transmits requests and replies from a subscriber back to a component at the cable headend. The control channel contains messages with information on ordering, billing, security and subscriber registration. Truly interactive multimedia programming necessitates an upstream channel to allow remote users to play games with one another, to purchase items from home shopping channels, to order movies, and to use remote control for VOD VCR-like motion control.

The fourth element of the network is the customer-premises equipment, which resides at the subscriber's home and consists of one or more pieces of equipment depending on the services provided by the network. If telephony services are provided, a network interface unit (NIU) separates the telephony signals from the other cable signals and passes them to the subscribers telephony equipment (fax or telephone). The cable signals are passed to the subscribers set-top terminal (STT). The STT receives digital video, expands it and transforms it to an analog format for subscriber viewing. In addition, the STT is responsible for transmitting and receiving out-of-band signaling over the control channel, mentioned previously.

Security in advanced cable networks

As cable systems and the information they carry become increasingly attractive targets, the incentives for violators increase proportionately. Even now violators, or video pirates, are dedicated, technologically sophisticated and well-funded. A survey conducted by the National Cable Television Association concludes that $4.7 billion in unrealized revenue is lost annually due to cable piracy.[1]

Recently publicized incidents demonstrate that violators work out-

> **"Both the cryptographic algorithm and the method of key management must be secure to result in a secure cryptographic system."**

side as well as inside of existing systems. Several broadband systems have been broken in the United States and Europe despite the use of highly evolved protective measures.[2] Pirates have created software to defeat security measures and have stolen cryptographic keys.

Another approach to stealing services involves altering, spoofing or cloning service providers' terminal equipment. Approximately 20% of existing cable TV set-tops are currently lost or stolen.[3] It is understood that many of these units are then modified in order to obtain free services. *Multichannel News* recently reported armed robberies of set-tops from manufacturer depots motivated by the thieves' desire to resell the boxes at a premium after they were "chipped" or had their security controllers replaced.

To win the trust and confidence of those who will use advanced cable networks, it is necessary to successfully secure both the encryption algorithms and key management operational procedures used to protect the information on those networks. It should be noted that inadequate key management operational procedures have traditionally proven to be the weak link in security systems and particularly in securing existing cable video systems.

While the algorithms themselves can be attacked given sufficient processing power and sufficient time, design oversights open doors to much simpler and much less expensive intrusions. Examples of poor design include exposing cryptographic keys at any point in the network and weakly binding key management processes to the rest of the system. It is equally important to protect against altered or cloned terminal equipment. In the following sections, we address these concerns.

Cryptographic systems

Cryptographic systems have two basic components: the cryptographic algorithm and key management.[4,5]

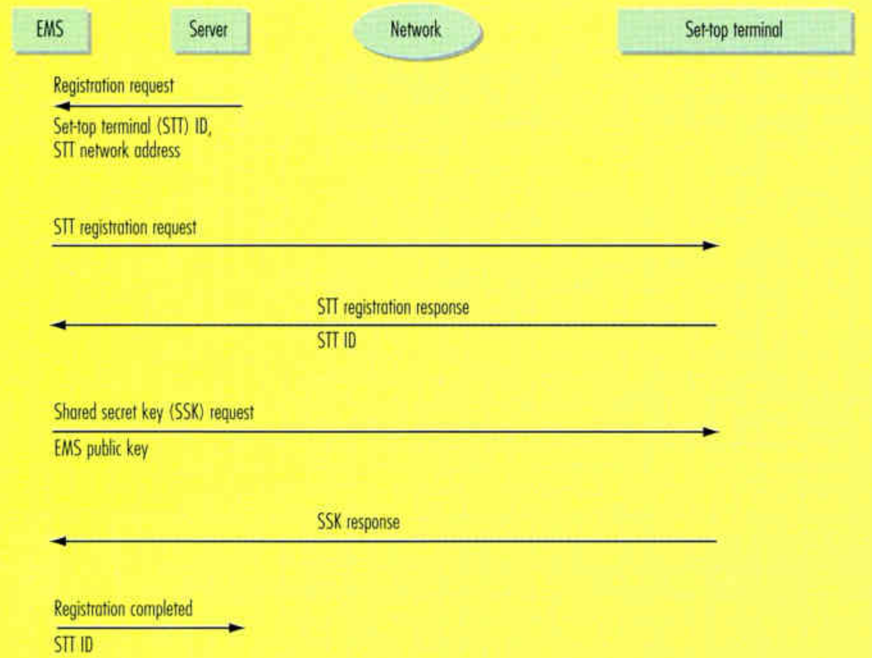
The cryptographic algorithm requires a digital key in order to encrypt and decrypt data. Encryption changes plaintext into ciphertext, while decryption changes ciphertext back into plaintext. There are two basic types of cryptographic algorithms: 1) symmetric key (aka single-key or secret-key algorithms) and 2) asymmetric key (aka two-key or public-key algorithms).

With symmetric key algorithms the sender and receiver use the same key for encryption and decryption, respectively. The data encryption standard (DES) is one of the best known examples of such a system. With asymmetric key algorithms, the sender and receiver use different keys for encryption and decryption, respectively. Rivest-Shamir-Adelman (RSA) is one of the best known asymmetric key systems.

Key management is the process by which the sender and receiver obtain their keys for a given cryptographic algorithm. This can be accomplished in many ways. For symmetric key systems, the key may be sent from one party to the other or the sender and receiver may negotiate a key without actually transmitting it. For asymmetric key systems, each individual keeps a private key, known only to the individual and publishes a corresponding public key. An individual's public key is then used to send data securely to that individual.

In practice, the computations involved in asymmetric key cryptographic algorithms make them too slow to encrypt and decrypt data at the rates required for the applications listed before. This is true for broadband networks in general and advanced cable systems in particular. Therefore, a symmetric key cryptographic algorithm is preferred. However, asymmetric key systems are ideal for key management. The sender and receiver may, therefore, readily use asymmetric key methods

Figure 2: Sample registration message flow



to obtain the keys needed for the symmetric key cryptographic algorithm.

As examples, the symmetric key may be transmitted using the RSA algorithm or negotiated using the Diffie-Hellman asymmetric key function. A combination of asymmetric key and symmetric key techniques is thus used to secure advanced cable networks. It is important to stress that both the cryptographic algorithm and the method of key management must be secure to result in a secure cryptographic system.

Network security components

In broadband network applications, the goal of security is to render the information unusable unless the recipient has the proper entitlement or authorized cryptographic key. The encryption process alters the information so that it is unintelligible when received at the subscriber premises. Decryption reverses the procedure so that a subscriber with the proper entitlement can use the information. Key management becomes the creation, protection, distribution and controlled access of entitlements, known as entitlement management. Ideally, the security system components within a broadband system should be added so that they function independently, interfering as little as possible with the standard broadband system components. At the same time, the security components must integrate easily.

In the HFC network example, cable headends often combine compression and encryption in one component as shown in Figure 1 (page 58). Since encrypted data cannot be compressed, the encryption of information follows compression. The information being encrypted is received at the headend as an analog signal or as a digital signal through the broadband gateway. The information may be prerecorded or live. Prerecorded information can be pre-encrypted when convenient and stored for later use, whereas live information must be encrypted in real time. Since pre-encryption is less costly it is generally preferred where possible. The encryptor may generate the entitlement used to encrypt a given piece of material, or may receive it from another component.

The decryption function resides in the customer-premises equipment, specifically in the set-top terminal. Decryption occurs in real time as the information is broadcast to the subscriber. Before decryption can occur, the subscriber must have received the entitlement for the information being received.

The entitlement management system (EMS) is a component of the cable headend as shown in Figure 1 (page 58). It has the responsibility of managing the entitlements for all the various stored encrypted information, as well as for live broadcasts. The EMS dispenses the entitlements to subscribers for information that has been ordered. In the same way that entitlements protect encrypted information, entitlements themselves must be protected. This also is a function of the EMS. As another part of the security solution, the EMS may have the responsibility of registering subscribers cryptographically as they join the cable network.

Network security concepts

Typically, the most vulnerable portion of any cryptographic system is key management. As mentioned earlier, key management has traditionally been the part of cable security systems most frequently and successfully attacked. The architecture of broadband systems, with multiple access protocols, is such that the network itself must be considered hostile or "untrusted." The EMS cannot rely on the cable plant itself for security. Moreover, the customer-premises equipment also must be considered to exist in an untrusted environment since pirates are known to modify set-top terminals. Therefore, the secure delivery of entitlements must be accomplished by careful design of the entitlement management procedures. Several new concepts and network capabilities provide the means for this design.

Earlier cable video systems did not possess the capability of supporting two-way communications. The upstream channel now allows not only ordering information, interactive transactions and virtual-VCR commands to be sent to the cable headend, but also allows interactive security protocols to be implemented. Interactive protocols allow authentication of both the headend and the subscriber, which is important for the distribution of entitlements and for thwarting spoofing attempts.

With today's technology, a new concept that makes individual addressing and authentication possible is the unique cryptographic address. Each decryption unit in the customer-premises equipment is assigned a unique signature, or fingerprint, that authenticates, identifies and validates that unit. This cryptographic address resides within the set-top terminal and must be protected from unauthorized access. The entitlement management procedures use the unique cryptographic address to deliver entitlements securely to valid users.

Combining the two-way communication channel availability and unique cryptographic addressing, entitlement management procedures authenticate and register individual customer-premises equipment in a secure manner. When the service provider connects new customer-premises equipment to the network, the EMS authenticates the new equipment using the unique cryptographic address. Registration follows, establishing a shared secret key or symmetric key between the EMS and the new equipment, using one of the asymmetric key methods mentioned before. The shared secret key established during registration is used later used to deliver entitlements securely. Using the unique cryptographic address and shared secret key established during registration also provides a means for protecting the subscribers' personal information and transactions.

Finally, the security system must be designed such that cryptographic keys, whether entitlements for encrypted information, or keys to protect entitlements themselves, cannot be compromised. If at any point throughout its existence an entitlement is compromised, then the security of the system is compromised as well. Therefore, cryptographic keys must be protected from cradle to grave. They must never exist unencrypted in any accessible part of the broadband system. Ideally, cryptographic keys are random numbers, encrypted immediately after generation without any human intervention.

Network security data flow

At the heart of one encryption system available today is an integrated circuit (IC) that implements the security concepts described in the previous sections. By examining the data flow within this system, we can see how broadband network security is achieved.

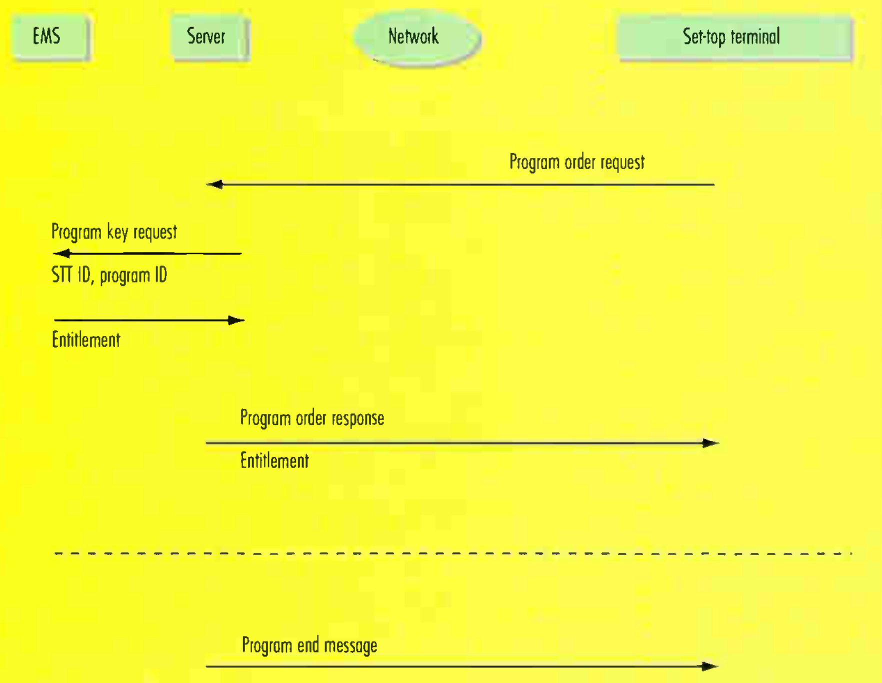
The initial commercial application of the aforementioned system is to secure digital video cable networks. Such networks are server-based and initially offer prerecorded program material. As mentioned earlier, program material arrives from content providers and is compressed before being encrypted. At the start of an encryption session the encryptor, which contains a security IC and supporting software, generates a random entitlement and uses it to encrypt the program material. The entitlement itself is covered (encrypted) and both the covered entitlement and encrypted program material are passed on to the video server(s). The video server(s) assign a program ID to both the entitlement and program, store the encrypted program material and pass the covered entitlement over the headend LAN to the entitlement management system (EMS).

The encryptor and EMS have previously established a common symmetric key or shared secret key, using their unique cryptographic addresses and public key cryptography techniques. Of course, the EMS also contains a security IC and supporting software. This allows the two network components to transfer entitlements securely. Once received, the entitlement is stored securely by the EMS. Given the covered entitlement and corresponding encrypted program material, the encryptor is capable of both decrypting and re-encrypting the program. In the former case, the program is returned to its unencrypted form. In the latter case, it is decrypted and then encrypted once again with a newly generated entitlement. This gives the service provider maximum flexibility with regard to managing program material.

At the opposite end of the cable network, set-top terminals are installed for new subscribers. Each STT also contains a security IC and supporting software. Upon installation, each STT is registered with the headend and assigned a network address. Each STT also participates in security or cryptographic registration, identifying itself by an ID derived from its unique cryptographic address and establishing a shared secret key or symmetric key with the EMS. At this point in the registration process, the set-top terminal may send its public key to the EMS, or the EMS may use the STT's ID to retrieve the public key from a previously populated data base of public keys for all valid STTs.

The system being considered here fully supports both of these cases, among others. Therefore it is only required that one asymmetric key, the EMS public key, be transferred during

Figure 3: Program order message flow



registration. One implementation of the registration process is depicted in Figure 2 on page 66. The shared secret key thus established allows entitlements to be transmitted securely from the EMS to that specific STT at a later time. Note that in Figure 2, message names appear above the arrows and associated data appears below the arrows.

Once registration is complete, subscribers may place orders for program viewing. Optionally, such orders over the upstream control channel may be encrypted. The video server receives the order and verifies the subscribers status with the system manager. Assuming the subscriber is in good standing, the server passes on the request to the EMS, identifying both the requested program and the requesting STT.

The EMS retrieves the appropriate entitlement, identified by program ID, as well as the appropriate shared secret key, identified by set-top terminal ID, from its data base. The EMS then uncovers (decrypts) the entitlement within its security IC, and recovers (re-encrypts) it with the shared secret key. The entitlement is now ready for transmission and only the STT that placed the order can uncover and make use of it. The EMS passes the covered entitlement back to the video server, which forwards it to the STT.

The set-top terminal receives the entitlement, loads it into its security

IC, and uncovers it with its shared secret key. The STT is now ready to receive and decrypt the encrypted program material. When the program concludes, or the entitlement expires, the entitlement is unloaded and deleted from the set-top's security IC. (Refer to Figure 3.) Note that in the figure, message names appear above the arrows and associated data appears below the arrows.

Summary

With the evolution of all types of broadband networks, the explosion in the number of services provided and the amount of information transmitted is just beginning. In this article we noted the need to protect the value of this information. Using the HFC network and advanced cable system as a primary example, we describe the components of a broadband system and considered the associated security problems. After discussing cryptographic systems in general, we examined the role of the various security components and their integration in a broadband system.

Specific security concepts are needed to protect a broadband system and its information. The example system described in this article provides an example of broadband network security protocols using these security concepts and we explained how it is applied to an HFC advanced cable system. The need for this type of security in broadband networks will continue to grow as more and more people gain access to the increasing volume of information these networks provide. **CT**

References

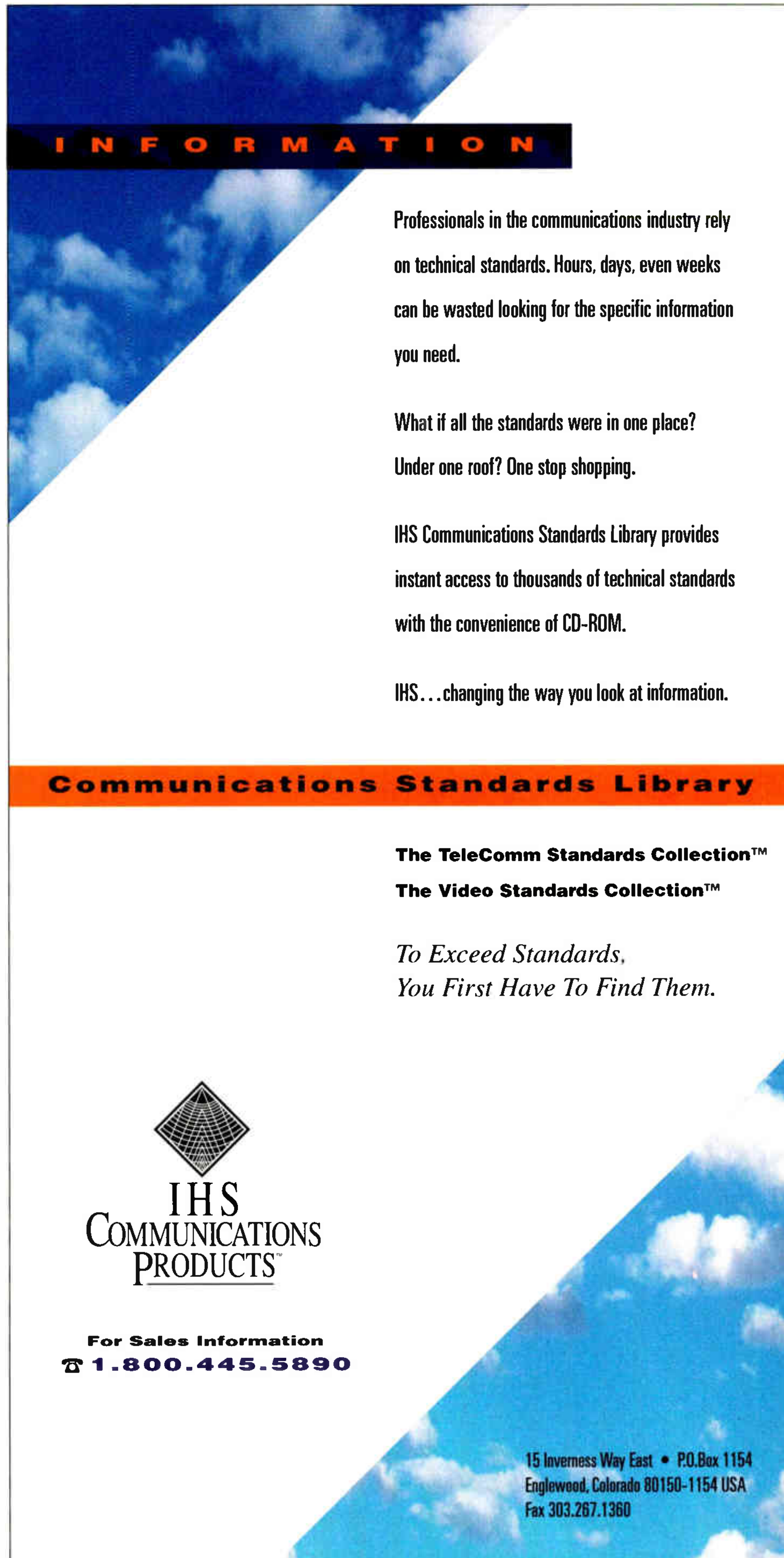
[1] "Piracy Survey," 1992, National Cable Television Association Office of Cable Signal Theft, 1724 Massachusetts Ave., NW, Washington, DC 20036.

[2] *European Scrambling Systems — Circuits, Tactics and Techniques*, John McCormac, Waterford University Press, 1994.

[3] *Comprehensive Security Seminar: Cable Theft*, Feb. 1-2, 1995, Philip S. Deming & Associates.

[4] *Applied Cryptography*, Bruce Schneier, John Wiley & Sons, New York, 1993.

[5] *Contemporary Cryptology — The Science of Information Integrity*, Gustavus J. Simmons, Ed., IEEE Press, New York, 1992.



Women in Technology Award

The recently formed Women in Technology Subcommittee is designed to identify women in technological jobs, create an awareness for issues and opportunities within their fields, and to develop support and network mechanisms within the Society of Cable Telecommunications Engineers. This subcommittee will work cooperatively with Women in Cable & Telecommunications.

Goals of the subcommittee are to promote and further technical achievements by women through providing an avenue for women to attain knowledge about telecommunications technology. Pertinent training issues will be identified. More women will be encouraged to participate in SCTE's training and education programs, as well as WIC&T's.

A data base of women in the industry will be created to help reach these goals. In addition to supporting existing women within our industry, it is hoped we will attract additional women professionals.

In order to create an awareness, the annual "Women in Technology Award" was established. The annual Women in Technology Award will recognize and honor leading women in technology positions within the cable and telecommunications community, and will create visibility for all women in technical careers within the industry. Each year it will identify and acknowledge the achievements of an individual woman within the industry's technical community who has demonstrated significant personal and professional growth, and has contributed significantly to the industry.

Candidates will be nominated through application. A four-person judging panel (three this year) will review applications and select the award recipient. This year's panel will be comprised of a representative from each *Communications Technology* magazine, Society of Cable Telecommunications Engineers and Women in Cable & Telecommunications. The previous year's winner will be a part of the panel in subsequent years.

In addition to public honors, a scholarship will be presented to the award recipient. The actual award will be determined by the judging panel and announced and presented at the Western Cable Show.

This award will be presented in conjunction with *Communications Technology* magazine.

Women in Technology Award Nomination Form

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

Objective: The annual Women in Technology Award will recognize and honor leading women in technology positions within the cable and telecommunications community, and will create visibility for all women in technical careers within the industry. Each year it will identify and acknowledge the achievements of an individual woman within the industry's technical community who has demonstrated significant personal and professional growth, and has contributed significantly to the industry.

Eligibility:

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

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

Name of Nominee: ______________________ Title: ______________
Company: ______________________________________
Address: ______________________________________
Telephone #: (___)__________ SCTE Member #: ________ WIC&T Member #: __________

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

____
____
____
____
____

Name of Nominating Person: ______________________ Title: ______________
Company: ______________________________________
Address: ______________________________________
Telephone #: (___)__________ SCTE Member #: ________ WIC&T Member #: __________

Mail or fax to be received by Sept. 15, 1995, to: Bill Riker/SCTE
669 Exton Commons
Exton, PA 19341
Telephone: (610) 363-6888
Fax: (610) 363-5898

By Eric Sprunk, Associate Director, Access Control and Security Technology, General Instrument Communications Division

Scrambling goes digital: Securing bits vs. waveforms

"We dedicate this ... to all the cats and all the mice working so diligently to better each other and without whom the cat and mouse game would not be possible." — from an "underground" book on video scrambling.

Since the introduction of the first pay TV systems in the 1960s and 1970s, it has been obvious that signal security is necessary. Piracy as a way to make money is too tempting for the unscrupulous and the pirate objective of unlimited access causes a substantial burden on the bottom line of pay TV. Some method of precisely controlling a consumer's access to the signal was mandatory to protect the basic revenue stream of a pay TV business. However, such a protection mechanism had to work within other cost bounds for it to be viable in the marketplace.

The psychological economics of security have always been problematic. It is human nature to believe that misfortune will always befall someone else and that preparing for problems is not as important as "alarmists" might have us believe. No one in the early days of pay TV knew how pervasive signal piracy would be so preparation was accordingly not excessive. Only after signal theft was born, grew and became traumatic was greater attention given to the basic problem. In 1994, the National Cable Television Association estimated that the cable TV industry lost $4.7 billion to signal theft.

This article describes the shift from the original analog signal protection techniques with which the pay TV industry grew up to the vastly more sophisticated methods used for digital data. The basic techniques of both types of technology are described along with the background forces motivating their development and use.

Analog vs. digital

Of course, we must begin with the most basic definition of terms. This article is not an engineering lecture. Strict use of terms and definitions will be relaxed in the interest of clarity. The terms analog and digital are defined here only in a qualitative fashion.

Analog derives from the common term analogy, which connotes strong similarity between two things. One could say that two analog quantities track or follow each other very closely or continuously, such as the brightness of the sun and the air temperature. Often this is because they are directly linked as when the sun directly causes changes in air temperature. There is no concept of quantitization or "rounding off" of numbers in the analog domain. A measurement of an analog quantity has an infinite number of digits beyond the decimal point. Similarly, temperature can be measured at any rate, fast or slow — once an hour or a million times a second.

> **"In 1994, the NCTA estimated that the cable TV industry lost $4.7 billion to signal theft."**

A temperature measurement such as "72.193976467638902° at 10:22-:06.9613320087455 a.m." is valid, no matter if there are 2, 20, or 200 digits of information to the right of the decimal. Most people do not care about more than the first few digits of these measurements, however, so there is a practical limit to the useful accuracy of any measurement. There also is a limit to the ability of an instrument to measure something, which could be due to internal heat generated by the device or a limited number of graduations on the readout dial. This practical limit on measuring any analog quantity has given rise to the entire digital world. In a nutshell, digital processing carries no more information than is of practical use for any system.

In the temperature portion of the previous example of "72.193976467-638902° at 10:22:06.9613320087455 a.m." we have said that only the "7" and the "2" have meaning to most of us, so in the digital domain all other digits can be dropped. Only "72" is sent, since most of us need no more information.

One could say that the world of digital technology pivots around "sending only the digits you need," hence its name "digital." Likewise, only the "10:22 a.m." portion of the time of the measurement has meaning, so the rest of the time reading is superfluous.

A digital system limits the accuracy of what is measured and how often measurements are taken since there always is a practical limit to both of these. In a very real sense, digital processing takes a basically infinite quantity and limits it to some finite range. As we will see later, this is necessary to apply advanced security techniques like encryption.

Analog signal security

When engineers first faced the signal security problem, engineering was predominantly analog. The easiest way to secure an analog signal was to manipulate one or more analog quantities. Therefore, a direct and economical method of controlling access was employed — a trap. A trap simply filters specific analog channels out of a cable signal before the signal enters the consumer's home. If a consumer elects to pay for a particular channel, then the cable company removes the trap and the consumer receives that channel. This method suffered from the obvious problem that the consumer could personally remove the trap with a reasonably small amount of effort, thereby defeating the system.

This flaw resulted in better analog technology sometimes called an interference or positive trap. Interfering signals were added to each secured pay TV channel, thereby preventing the simple removal of a trap by a consumer. Instead, the consumer had to add a trap to receive the signal, which was more difficult. But then a consumer could buy a trap on his own from the "black market" created because of demand for such devices.

Somewhat more sophisticated analog techniques were then developed. These advanced the concept of altering some important characteristic of a video signal in a predictable way. Such alteration would prevent a normal TV set from being able to receive the signal yet would allow inexpensive decoders to do so. Two basic methods of analog manipulation found widespread application, the first being sync suppression.

As the name implies, sync suppression suppresses synchronization information within a video signal. Sync information lets a receiving TV set determine the top, bottom, left and right sides of the video picture. This information is encoded in standardized pulses according to Federal Communications Commission and Electronic Industries Association definitions of a video signal called the horizontal and vertical sync pulses.

Generally, horizontal sync pulses are manipulated to secure the signal. This was done in several ways, including reducing the size or shifting the horizontal sync pulse, or by doing so dynamically in different ways over several seconds or minutes, or by adding information that prevented them from functioning normally. Sync suppression is in very wide use and produces the "torn" pictures most of us have seen when our TV sets attempt to receive such a scrambled signal.

The second method of analog scrambling is video inversion. This refers to swapping "up for down" in a video signal and has the effect of inverting sync pulses as well so it is naturally combined with sync suppression in many systems. Video inversion distorts the color and brightness of a video image so a decoder is needed to restore a viewable signal.

More advanced systems combine one or more approaches to sync suppression or video inversion — in some cases selectively turning one or more on or off across time as an additional challenge to signal thieves. In some cases "black boxes" that simply reinvert the video signal or add horizontal sync pulses can directly decode these systems. More advanced systems manipulate the signal in a complex way that deters simple direct decoding.

All analog systems employ these basic techniques or others of a similar ilk. They presented pirates with a formidable challenge and improved overall cable signal security. However, technology has continued to develop, which has helped provide the unscrupulous with a larger set of tools to foil such signal security techniques. Advanced digital techniques would greatly assist in combating this problem and several systems have made limited use of such techniques over the years. Since the use of digital techniques has been in manipulating analog, many limitations remain.

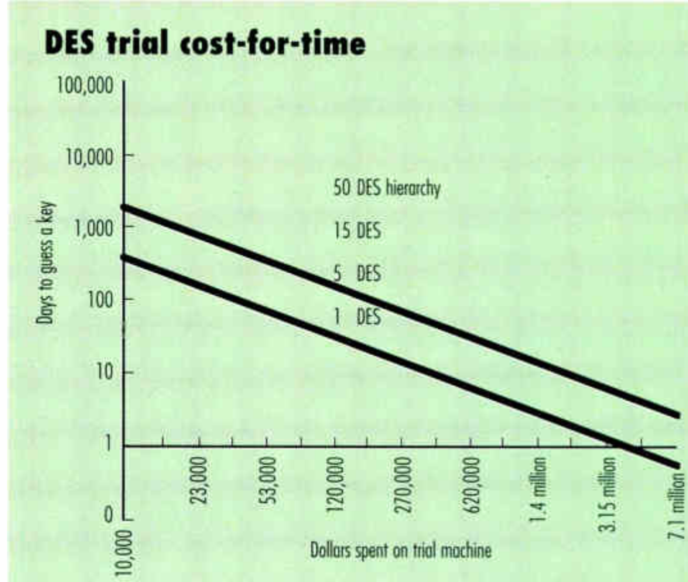
Hybrid scrambling systems

A hybrid system uses digital scrambling or encryption techniques to somehow enhance an analog scrambling system. The video signal itself remains in analog form and is never converted to a finite set of useful digits at a practical data rate. Instead, digital techniques have been used to:

1) Rearrange "pieces" of an analog signal such as individual video lines.

2) Control the way analog scrambling techniques are applied to a video signal.

3) Digitally encrypt important information, such as audio, necessary for a viewable program.



While these systems represented an advanced state of the art when introduced, the basic use of analog scrambling techniques limits the size of the challenge that can be placed before an attacker. This makes these systems vulnerable to technology developments the attackers can employ. These hybrid systems certainly use forms of signal alteration that present a substantial barrier to a pirate trying to directly reassemble a scrambled signal into useful form. However, only by using the third method listed before — digital encryption — is a truly huge barrier placed between the signal and the pirate. But, what does the term "digital encryption" mean?

Digital encryption

We have said the digital representation of signals describes an analog quantity as a series of numbers with finite resolution with these "digits" being sent at a finite rate of speed. You could say that a digital system uses a known and limited "alphabet" to describe things, such as the numbers 1 to 100 might describe the temperature in spring in most of California.

Such a limited set of numbers is useful if one wishes to use mathematical relationships to obscure the number in a controlled fashion that only you and your friends can understand. You might want to take the "clear" (unencrypted or plaintext) number for today's temperature (72°) and obscure it with a secret number (a key) that you have shared with your friends. This should allow you to produce a scrambled or encrypted version of today's temperature called the ciphertext. You want the math relationships to be such that only the key held by your friends allows someone to work backwards from the ciphertext to decode the plaintext.

Using multiplication as a trivial illustrative encryption function, let's encrypt "72" with a random key "31." This gives a ciphertext of 72 x 31 = 2,232, so you send your friends 2,232 in a message. Your friends take the 2,232 and divide it by their secret key 31, giving the temperature of 72. Someone who sees only the message has no idea where to start, so an eavesdropper cannot determine the temperature.

Of course, he could guess it is between 70 and 75, and then work backwards to guess your key of 31 rather easily. Since someone can always simply guess the key you used in this way, you want your key to be huge so there are too many to guess in a sane amount of time. This is where the nature of the mathematical algorithm comes in. It must be maximally difficult to know anything about the message you are sending and it must have maximally large keys to resist guessing.

There are many detailed technical requirements beyond these straightforward ones, of course, including things like the desirability of the ciphertext being the same size as the plaintext. The essence, however, is simply controlled obfuscation.

There are many terms for many aspects of encryption and there are many types of encryption on the market. All are comfortably wrapped in terminology and descriptions almost as obscure as encryption itself. There are public key algorithms, block ciphers, stream ciphers and PRBS generators. There are algorithms called DES and IDEA and SuperScrambling and GDES and FEAL and RSA and on and on. Fortunately, there are some excellent descriptions of the entire area available and the reader is referred to various books for elaboration, with particular emphasis on Bruce Schneier's *Applied Cryptography*.

Most commercial encryption systems today use one of a limited set of mathematical algorithms with a strong history behind them. Numerous new algorithms have been proposed over the years, with more coming out every day. Signal security is too important to risk based on the claims of a few individuals. Great care must be taken when encountering claims of "ultimate security" or "unbreakable algorithms." Not all algorithms are created equal and the flawed algorithm is the death of a system.

When hiring a bodyguard, most of us would seek someone with relevant experience. An actual combat veteran would be best and preferable over someone with even the longest list of credentials but no experience. It is the same with algorithms. New ones are extremely suspect since many have been proposed and broken in academic circles for years now.

DES algorithm security

The data encryption standard (DES) is without question the most studied and proven algorithm known having been in use since 1977 without known compromise. It was designed by the premier code makers and code breakers, the National Security Agency. The National Institute of Standards and Technology must recertify DES for government use every five years, and this was most recently done in 1994. There also are ways to enhance DES for greater strength than "vanilla" DES. Triple DES (which has a 112-bit key) is currently under consideration by the ASC X9 committee and is likely to be approved.

DES uses a key between 0 and 72,057,594,037,927,951, which is 56 binary digits or bits. DES plaintext and ciphertext are between 0 and 18,446,744,073,709,555,711, which is 64 binary digits or bits. Given a plaintext and its associated ciphertext for an unknown key, DES requires (on average) 2^{55}, or 36 x 10^{15} guesses to determine a key. Under the same conditions, triple DES requires 2^{111} or 2.6 x 10^{33} guesses.

Copious academic analysis has been performed with none "breaking" the DES algorithm. Breaking an algorithm means finding a shortcut to determining the secret key with less effort than simply guessing all of them. The best method of attacking DES to date, from Shamir and Biham, requires four times the work to determine the key as guessing all keys would require, so DES is at least at this time considered secure. This is not to say that no one will come up with a tremendous breakthrough but many have tried and it is thought extraordinarily unlikely.

But how strong is an encryption algorithm of a given key size? Let's ignore history for a moment and presume that new algorithms are secure and subject only to key guessing as a means of attack. In this case we must assume someone knows the algorithm being used, has spent some amount of money to build a machine that will guess a key, and that a plaintext/ciphertext data pair has been obtained.

The question then becomes: How long will it take to guess the key in use? If this time-to-guess is too short, this attacker will know the key while it is still in use and valuable and might use it to steal something. If this time is long enough, we will all be dead and buried by the time someone guesses the key.

Most systems using cryptography do not simply encrypt everything under one key. Generally, a series of encryptions involving various messages is used with actual data being encrypted with keys that change rapidly. The rapidly changing keys are derived from the slowly changing ones and it is these slower keys that have "resale value." These keys-used-to-get-keys form a chain (or hierarchy in the accompanying figure on page 74) that must be used by anyone trying guess a key used higher up in the chain. Therefore, more processing is needed than for a single use of encryption. This is one of those "more is better" situations, where guessing just one key is not enough to break the system.

The figure describes the cost an unscrupulous attacker might incur to build a machine capable of guessing a DES key in a certain amount of time. Security parlance calls attempting to guess a key "trialing the algorithm." The machine is a "trial machine." The more money the attacker spends, the more DES key trialing machines he can obtain, and the faster he can guess a DES key in use. If this is at a low enough cost and in a short enough period of time, then the system is not secure.

An example data point on this graph might be the $620,000/100 days point. This means that someone can spend $620,000 on a special machine that can guess a key in a 15 DES operation system in 100 days of processing time. It follows that keys that can be guessed in this way must be used for much less than 100 days if one wishes to protect against an attacker who has $620,000.

By contrast, a similar graph for use of the Triple DES algorithm has absurdly large numbers. Using Triple DES in only a single location in a series of DES operations destroys the previously mentioned curve and places the cost of guessing even a single key outside the resources of even the U.S. government. For example, guessing a single Triple DES key in a single year would require a DES trial machine that costs about or $7.2 x 10^{20} dollars, or $721 million trillion. Systems that employ Triple DES obviously place an absolutely astronomical barrier before an attacker.

Though the quantities encountered in digital encryption systems are so large they are almost meaningless, let's try one last time to bring things down to earth. The most commonly quoted statistic is for guessing a single DES key at the (very high) rate of 1 million key guesses per second. On average, a key could be discovered in only 1,143 years under these conditions. The same condition for a Triple DES key requires 82.3 x 10^{18} years, which is billions of times longer than it will take for our sun to burn out.

One would think it easier to simply pay.

Digital encryption usage in pay TV

By now it is clear how huge a barrier the use of digital encryption creates. Of course, to use digital encryption for pay TV signals, the signals themselves must be digital.

Digitized audio has been employed in systems since about 1984. The digitized audio was transmitted at about 1 Mbit/s and was fully encrypted using the DES algorithm. Such systems demonstrated the applicability of digital techniques to pay TV.

Before 1990, it was not generally thought possible to transmit video signals digitally due to the huge amount of data required. A video signal requires roughly 150 to 200 Mb/s to transmit in raw form. This is vastly more than the approximately 12 Mb theoretical capacity of a TV channel, so it was not considered practical to transmit digitized video in cable systems or over-the-air. Without transmission, digital encryption was not possible.

In 1990, a team of General Instrument engineers led by Dr. Woo Paik proposed a system to compress TV signals into a fraction of this 150-200 Mb/s. This technology was proposed as part of the U.S. high definition TV (HDTV) competition and has since been incorporated along with contributions from other major players in the world of TV and technology. GI has applied this technology to regular TV signals as well and has marketed the DigiCipher I and II families of video compression products for both satellite and cable applications.

Given this tremendous compression technology and its use to create digital TV signals, the application of digital encryption to these signals became possible. Though the actual data transmission rate may seem large at 2 to 8 Mb, it is well within the performance of encryption technologies such as DES.

Basic digital video encryption

Let's consider a very basic and simplified access control system for use with digitized video. This article does not delve into the subject of video compression algorithms so it understates this pivotal function. Suffice it to say that a great magic takes place transforming the analog video signal into a stream of digital bits for further processing.

The GI DigiCipher II system carries streams of audio, video or other data in similar fashion. Using the MPEG-2 transport method, audio, video or other data (hereafter generically called "data") are carried in packets of 1,504 digital bits each. Many sources of such bits are combined together into a single cable, broadcast or satellite channel, so each stream of such bits is labeled with an ID. A single video or audio or data channel thus corresponds to a series of 1,504-bit data packets with the same ID.

The DES algorithm directly encrypts such a packetized bit stream. Different streams of these packets can be different movies or audio or data services, with each being offered to a wide audience. Because the encryption key for each of these streams is different, it allows each such stream to be handled and sold independently by the system. Multiple streams that are sold together, such as the audio and video for the same movie, can be encrypted with the same key or not.

To obtain service, it is paramount that payment or at least agreement to pay be in place. In that regard a good system will not function unless specific encryption keys are sent to each unit, since otherwise a nonrevenue-generating decoder will have an inherent ability to view a service. This is positive feedback where a decoder will stop working if it does not receive a key to renew its operation. A poor system will do the opposite with each decoder continuing to function until told to stop. This is negative feedback where blocking the message that tells the decoder to stop would be of great value to a pirate.

The decoder gets positive feedback when payment is received or assured. Authorization to function is then delivered individually to each decoder as a message that gives it one or more encryption keys and other information denoting the authorized services. Obviously, this message must be delivered in a secure form. The key or keys delivered in this message must be necessary to view the digitized and encrypted video services, and this key must be changed no less often than every few days or weeks. This is a user authorization key.

Each encrypted service must be protected with different encryption keys as mentioned previously. These video encryption keys should change as fast as possible, yet decoders with a user authorization key and appropriate "paid-for service" information must be able to derive them to decrypt the digitized stream of video packets. A simple system has the key used to decrypt the video itself encrypted with the user authorization key so that any decoder with this can access the video. A simple three-step process suffices to receive the video service in this case:

1) A given set-top, satellite or broadcast decoder receives and processes its own message conveying a copy of the user authorization key.

2) The decoder tunes to a desired encrypted video service and picks up another message with the video encryption key in that message except in encrypted form. The user authorization key is encrypted using the video encryption key.

3) The decoder uses the user authorization key it obtained in Step 1 to decrypt the video encryption key obtained in Step 2. The now-unencrypted video encryption key decrypts the actual digital video.

Comparing analog to digital

We are now in a position to compare the digital and analog systems as directly as possible. It is difficult to compare analog with digital unless one first describes analog scrambling in the same terms used to discuss digital ones. The best way to do this is to relate the ways an analog signal can be obfuscated to the effect of a digital encryption key, which is to form an equivalence between analog scrambling and some form of digital encryption.

First, before even estimating the size of the "analog key" used in analog scrambling, one must address the analog equivalent of a digital encryption algorithm such as DES. This is the "obfuscation function," which for digital systems is an encryption algorithm and for analog ones scrambling techniques such as sync suppression, video inversion or traps. DES is the way digital bits are obscured from easy interpretation. Sync suppression, video inversion or traps serve the equivalent function for an analog signal.

In the digital encryption case with a DES obfuscation function, there is no known way to determine the unencrypted data without the key. Examining the ciphertext tells nothing. But in the analog system, the obfuscation function can often be directly analyzed to the benefit of the pirate. In this regard the obfuscation functions available for analog scrambling are vastly weaker than for digital systems. The obfuscation function for analog can be broken in many or most cases, while for digital there are no cases known where this is true for DES encryption.

Let's now go beyond the basic weakness of the analog obfuscation function to derive the equivalent of a key for an analog scrambling system. Let's estimate how many ways there are to scramble or obfuscate an analog signal. Rigor is not employed here, since there is a point to illustrate. Let's assume that there are:

- 10 types of interference traps
- 10 types of sync suppressions
- 10 types of video inversions

If all of these are allowed to independently change, there are 10 x 10 x 10 = 1,000 ways to obfuscate an analog video signal. Each of these 1,000 ways is equivalent to "encrypting" the analog signal with a unique "analog key," though no actual encryption is used. The size of a digital key represents the amount of work one must do to decrypt the encrypted data and the equivalent to this is the amount of work one must do to discover the exact analog scrambling method used to obscure the video signal. The "analog key" defined here is really no key at all, but an amount of work that is associated with a certain sized key. This is necessary to translate analog "apples" to digital "oranges."

These 1,000 ways to scramble in analog (which is a fairly generous estimate) are equivalent to a 10-bit key for a digital system. Given this 10-bit equivalent key, then a perfect analog system has an "analog key" that is 46 bits shorter than a single DES true digital key. This means a single DES encryption is $2^{46} = 70.4 \times 10^{12}$ times more difficult to guess than an analog equivalent scrambled signal. To be even more generous, let's assume there are actually 1 million ways to obfuscate an analog video signal, which corresponds to a 20-bit "analog key." This means a single DES encryption would be $2^{36} = 67.1 \times 10^{6}$ times more difficult to guess than the equivalent "analog key." A Triple DES key is $2^{92} = 4.9 \times 10^{27}$ times more difficult to guess than the equivalent "analog key."

But, this last analysis assumed a perfect analog scrambling system where much of the analog scrambling could not be deduced from direct examination of the analog scrambled signal. Detailed analysis of the actual scrambled video signal can determine most of the ways to obfuscate an analog signal. This includes all of the contribution of the interference trap and much of the contribution of sync suppression and video inversion. This is equivalent to eliminating most of the 1,000 or 1 million ways, which we could approximate as eliminating all of one and half of the other two types of analog scrambling.

In the one assumed case of 1,000 ways to scramble in analog (that is a 10-bit "analog key") that would leave 5 x 5 = 25 "analog keys" that cannot be determined from direct analysis of the video signal. The real size of the "analog key" is less than 5 bits. Were these 25 "analog keys" trialed at a rate of one per second, the correct one would be found in an average of 12.5 seconds. In the case of the 20-bit "analog key", 50 x 50 = 2,500 actual "analog keys" would be left after analyzing the video signal. Trialing these could be done in about 42 minutes.

Comment on analog scrambling

This analysis has been deliberately brutal to analog scrambling to illustrate the motivations behind the evolution to digital systems. The analytic perspective employed in this article is necessarily worst-case and may underestimate the realistic security levels of modern analog systems. These have been analyzed from the viewpoint of a fully resourced, maximally qualified and determined attacker, which is never encountered in practice. However, this is standard security analysis and such is necessary to assess different digital systems.

Real-world analog systems are never attacked by large machines that guess thousands or millions of ways to reassemble a regular TV signal from the scrambled analog. It would be far cheaper to simply pay for the programming. Neither am I aware of any "black boxes" that have used such trialing techniques on any but the simplest systems. Usually a pirate attempts to alter a legal analog decoder to obtain free pay TV services. This is a very different attack than those described here. This article has discussed signal security in the context of scrambling and encryption while most attacks are actually electronic manipulation.

In a poorly designed system, such electronic manipulation may be trivial, and a pirate will certainly take advantage if that is so. If not, the next easiest course will be pursued. This inevitably leads the attacker to the analog scrambling barriers that are the primary subject of this article. For this reason alone, analog scrambling must evolve into digital encryption.

A different set of forces than scrambling and encryption drives electronic manipulation attacks. These forces have historically favored the pirate attacker. First among these is the pirate's ability to use the latest tools on the market, while a large, deployed base of a particular decoder and analog scrambling method can only evolve slowly. No sane businessperson scraps perfectly useful equipment on a regular basis without a very good reason, yet the pirate can upgrade gear to manipulate even a single decoder as often as needed.

Personal computers might serve as an illustration. A cable system deployed in 1986 would have been current with the original IBM PC XT, yet that same system is still working in 1995. The designers of that system likely did not anticipate a pirate with a 120 MHz Pentium PC attacking the system. In this regard pirates can sometimes be more technically agile than big companies or cable systems.

But there is a natural threshold in the war against electronic manipulation and that is the cost of tools to analyze or process custom chips. Secure chips raise the cost of electronic manipulation several powers of 10 over older analog systems, and some more current analog systems are incorporating these chips in recently marketed products.

Digital technology equalizes things to a great extent with the advent of secure custom chips and very strong encryption systems placing the largest barrier conceivable before the pirate. Piracy and security in pay TV is fundamentally an economic war, with victory going to the system that makes it more expensive to pirate than to simply pay the bill.

Of course even a secure chip can be misdesigned or have some fatal flaw. One must be very careful and use exotic and experience-based analysis on any secure system.

Conclusion

Analog scrambling systems were the natural approach to securing signals when they were deployed and they have evolved in response to increasingly sophisticated pirate attacks. Technology has advanced to the point where the basic nature and limitations of analog scrambling are, or will be, within reach of pirate attack very soon. The use of custom secure chips can assuage this somewhat but the basic limitations of analog scrambling cannot be improved beyond a certain level.

Digital systems have come on the scene as part of the video compression explosion that will radically expand the capacity of satellite, broadcast and cable distribution. Digital video allows the use of advanced encryption algorithms that are vastly stronger than any analog scrambling system and the use of such systems is timely given the continuing development of pirate attack technology. **CT**

By **Michael L. Lance, Priya Shrinivasan and Priscilla M. Wu,** Electronics Engineers, Cable Services Bureau, Federal Communications Commission

Signal leakage: Five years later

Signal leakage is to a cable engineer what a pot hole is to a highway repair crew. No matter what precautions and preventive measures are taken, the problem still persists. The best solution is to remain abreast of the situation by regularly monitoring and immediately fixing the leak (or pot hole) before it gets so big that it leads to much bigger problems (like accidents). Since the Federal Communications Commission signal leakage standards (§76.611-§76.617 of the FCC's rules) became effective on July 1,1990, the cable industry has been thrust into another phase in the seemingly never-ending journey toward the ultimate goal. That is, providing cable service that is not hazardous to over-the-air communications. So, how has the cable industry fared over the past five years? Let's take a look.

How it's done

The FCC places signal leakage among its important safety-of-life concerns and therefore routinely and randomly inspects systems across the country for signal leakage and other violations of the commission's rules. These investiga-

A quick field strength primer

By Ron Hranac,
Senior Technical Editor, *Communications Technology*,
and Vice President, Engineering, Coaxial International

Most measurements of signal leakage from the downstream spectrum are performed in the VHF midband. The most common part of the midband for leakage measurements is 108 to 136 MHz, which covers aircraft navigation and communications frequencies in the over-the-air spectrum.

Two field strength limits of concern to cable operators are 20 µV/m (microvolts per meter) and 50 µV/m. When we measure leakage with a half-wave dipole antenna and a signal level meter, we generally think in terms of dBmV (decibel millivolts). But don't despair, conversion between the two is relatively straightforward.

When we know a field strength in µV/m, we can use the following formula to first convert to µV (microvolts):

$$\mu V = \mu V/m \div (f_{MHz} \times 0.021)$$

Where:

f_{MHz} is the frequency in MHz

Then we can convert µV to dBmV with the formula:

$$dBmV = 20\log(\mu V/1{,}000)$$

Here's an example. Let's say we want to find out the level in dBmV of a 15 µV/m field strength reference at Ch. 14 (121.2625 MHz). We start by converting 15 µV/m to µV:

$$\mu V = 15 \div (121.2625 \times 0.021) = 15 \div 2.55 = 5.89\ \mu V$$

Now that we know the value in µV, we can convert it to dBmV:

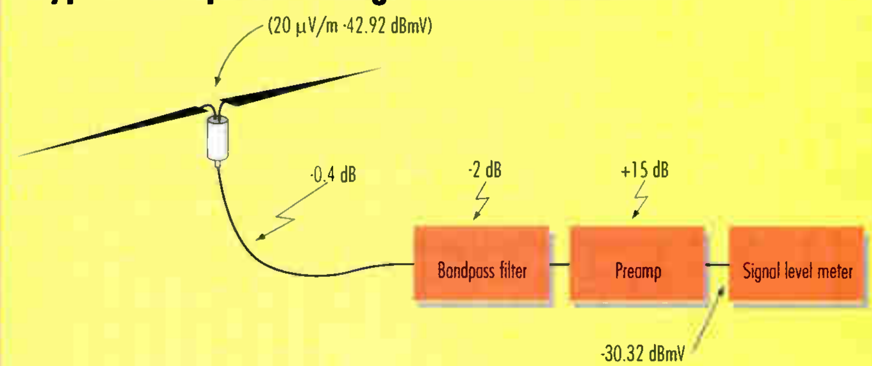
$$dBmV = 20\log(5.89 \div 1{,}000) = 20\log(0.00589) = 20(-2.22985) = -44.6\ dBmV$$

The accompanying table on this page shows conversions for the common midband frequencies in the aeronautical spectrum.

Finally, it's important to remember that the field strength figures we are discussing here are what would appear at the terminals of a resonant half-wave dipole antenna. You also have to consider the effects of other components between the antenna and signal level meter, such as the interconnecting cables, bandpass filter and preamplifier.

For example, the accompanying figure above shows what might be a typical setup used for leakage measurements. In this example, a field strength of 20 µV/m at Ch. 16's video carrier will produce -42.92 dBmV at the antenna terminals, but the signal level meter will read -30.32 dBmV. This is because of the balun, interconnecting cable and bandpass filter attenuation, plus the preamp's gain. **CT**

Typical setup for leakage measurements



Conversions for common midband frequencies in aeronautical spectrum

Channel	µV	dBmV	µV	dBmV
98 (A-2)	8.72	-41.19	21.79	-33.24
99 (A-1)	8.26	-41.66	20.65	-33.70
14 (A)	7.85	-42.10	19.63	-34.14
15 (B)	7.48	-42.52	18.71	-34.56
16 (C)	7.15	-42.92	17.87	-34.96

tions, coupled with the annual filings of the "Basic Signal Leakage Performance Report" (FCC Form 320), help us assess the progress of the industry toward curtailing excessive signal leakage.

Before we inundate you with statistics, we will begin by exploring some facets of our method of review. The Form 320 submitted to the FCC is processed on an individual basis. There are 30,000 registered communities, each receiving its own Form 320. So, how do we process the Form 320? Our first step is to group the forms by reference to the "primary" community unit (CUID), which is usually the location of the headend. Next, an initial review is completed for interference potential (e.g., $10\log I_{\infty}>64$) to isolate the cumulative leakage index (CLI) tests that fail. Any operator who fails the CLI test is immediately ordered to cease operation in the aeronautical band. Understandably, very few cable systems submit failed CLI tests that are self-incriminating. The next stop for the form is at the desk of the final reviewer who ensures overall compliance with the signal leakage rules and verifies that the information on the form is correct. After "passing go," the Form 320 is entered into our data base and then forwarded for filing to the cable reference room.

How cable did

How did the industry do? The accompanying table on this page shows the $10\log I_{\infty}$ (CLI) ranges with the percentage of annual Form 320 filings falling under each category. The last column identifies the percentage of cable systems performing airspace tests.

As the table shows, the industry had established a favorable trend until 1994 when the CLI results started to climb. We hope this climb is merely an aberration and 1995 CLI filings will once again revert to the downward direction. In general, the amount of systems falling in the upper CLI ranges has consistently decreased. Also, the number of systems performing airspace tests has steadily increased, both of which are good signs. An airspace test is considered to be the closest simulation of interference to what an aircraft may encounter while flying over a cable system.

Omissions, wrong info

The FCC Form 320s submitted by some cable operators continue to omit important or contain erroneous information. Therefore, the commission has taken further steps by sending deficiency requests out for corrections. As a result, deficiencies declined from 25% in 1993 down to only 8.6% in 1994.

Perhaps the most common deficiency we have seen is, surprisingly, not the miscalculation of the CLI but the misstatement of the testing period. Cable TV operators need only to submit one of the quarterly test results so the testing period would not exceed 90 days. The incorporation of this monitoring program into the daily activities of existing service personnel in the discharge of their normal duties will generally cover all portions of the system and will therefore meet this requirement.

Other common deficiencies, besides the omissions and typographical errors, include: using a test frequency outside of the 108-137 MHz range without a correlation factor; failing to test at least 75% of the cable plant; or failing to identify leakage sources greater than 50 µV/m.

Even today, with five years of filing experience, numerous system operators have been ordered to either cease operation in the aeronautical band or lower power on those carriers in the aeronautical band operating above 38.75 dBmV due to careless errors. For example, most of these systems listed improperly offset carriers on the Form 320. In these instances, we must act quickly to ensure interference-free over-the-air communications. Unfortunately, the improperly offset frequencies often stem from the system engineer's lack of careful review of the list of carriers on the submission, inclusion of an outdated list of frequencies, or failure to keep the headend equipment within specifications.

In the midst of a new era in telecommunications, it is easy to lose sight of the basic necessities required in a world of shared communications. The partnership forged between the cable industry and the FCC must continue its vigilance in signal leakage control. In doing so, we all move closer to the ultimate goal of a clean CLI track record by the cable industry, which will guarantee continued use of the aeronautical spectrum. Furthermore, a tight system in turn allows for the ease of conversion to digital delivery systems. **CT**

The views and opinions expressed in this article are those of the authors and not the FCC.

CLI test data — the first five years

	CLI>60	50<CLI ≤60	40<CLI ≤50	33<CLI ≤40	CLI = 0	% of airspace tests
1990	12.4%	38.4%	26.4%	7.7%	11%	4%
1991	7.7%	29.7%	26.5%	9%	21%	5.8%
1992	5.3%	27.2%	26.9%	9.4%	23.7%	7.5%
1993	5.1%	24.8%	26.8%	9.2%	24.4%	9.6%
1994	4.5%	25.1%	26.7%	8.4%	24.5%	10.8%

By Mark Bolar, Product Marketing Specialist, Broadband, Belden Wire & Cable Co.

Drop cable shielding/testing to minimize signal leakage

Since broadband systems were first put into use, system engineers have been confronted with problems of signal ingress and egress caused by electromagnetic interference (EMI). Effective cable shielding has become the perennial pursuit of industry technicians to minimize the effects of EMI. And, with the Federal Communications Commission's cumulative leakage index (CLI) standard, maximizing cable shielding effectiveness is even more critical today than ever before.

Defining EMI problems

EMI was first recognized in the early 1960s as interference problems broadened to encompass the entire electromagnetic spectrum. Prior to that, most interference problems were experienced with radio signals and hence were referred to as radio frequency interference (RFI). Today, EMI refers to electromagnetic interference in its broadest sense. Thus, within the nonionizing portion of the electromagnetic spectrum, all emitters, receptors and frequency bands are part of the EMI definition.

For this reason, such diverse problems as interference from ground loops, common impedance paths, direct magnetic/electric field coupling (AC hum), electrostatic discharge (ESD), power-line-conducted emissions or radiated emissions from all sources fall under the umbrella category of EMI.

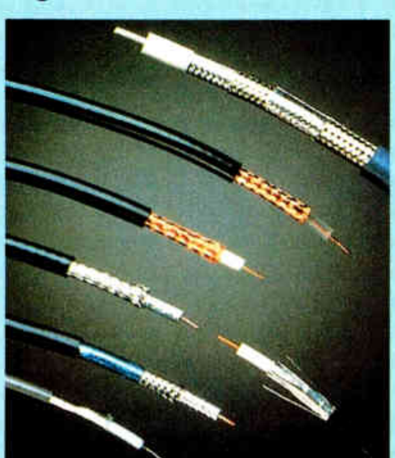


Figure 1: Shielded coaxial cable

Cable TV installations are regarded as closed systems and, as such, operators are allowed to use frequencies normally assigned to over-the-air communications bands — aircraft, FM, TV, ham, etc. For this reason, the drop cable used in these installations must provide adequate isolation to preserve the integrity of the system and to avoid interference with over-the-air communications. In addition, the expansion of the frequency spectrum utilized by CATV systems has caused the FCC to increase enforcement of emission regulations. Effective cable shielding increases the ability of cable engineers and technicians to design systems in compliance with these regulations.

Effective cable shielding

A cable shield is placed between the foam dielectric core and the outer jacket to contain the RF signal or keep out unwanted interference. Coaxial drop cable shielding is offered in a wide range of designs and configurations. Each type of shielding has its own distinct advantages and disadvantages that need to be considered when selecting the best and most cost-effective option for a given application.

The Society of Cable Telecommunications Engineers has adopted minimum shielding requirements for the CATV industry. An SCTE document, *IPS-SP-001: Specification for Flexible RF Coaxial Drop Cable*, outlines the following general requirements:

- *Standard shield.* Laminated shielding tape with bonding resin on one side plus 59% minimum braid coverage.
- *Tri-shield.* Laminated shielding tape with bonding resin on one side plus 59% minimum braid coverage, plus laminated shielding tape.
- *Quad-shield.* Laminated shielding tape with bonding resin on one side, plus 59% minimum braid coverage, plus laminated shielding tape, plus 32% minimum braid coverage.

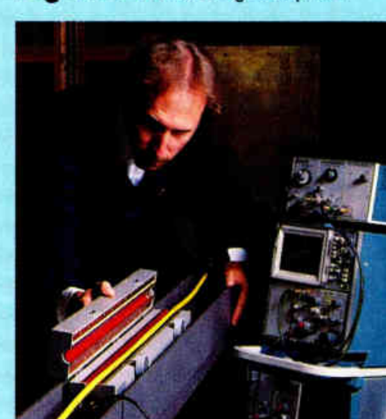
See Figure 1 for examples of shielded coaxial cable.

Foil/braid shield designs

Combination foil/braid shields are the optimum choice for broadband coaxial drop cables because they provide more than one layer of shielding for maximum shield effectiveness across the frequency spectrum. In combination shield designs, the foil shield consists of two layers of aluminum foil laminated to polyester or polypropylene film with a bonding resin. The braid shield layer, which provides superior structural integrity and flexibility, typically consists of 34-gauge aluminum strands, one set woven in a clockwise direction and interwoven with another set in a counterclockwise direction. Typical braid coverages range from 60 to 95%. Combination foil/braid shields offer the advantages of 100% shield coverage plus the strength and low DC resistance of braid.

System designers and installers may choose from a wide variety of combination shield designs depending on the severity of conditions and the application requirements. SCTE standard

Figure 2: Absorbing clamp test



MODULATOR 750 UHF

The Model 750UHF Modulator is especially designed for single channel full 60 dBmV (120 dBµV) output from 470 to 750 MHz no-compromise CATV professional service utilizing surface mount technology.

SPECIFICATIONS

PARAMETER	SYSTEM M/N	SYSTEM B/G	SYSTEM D/K China*	SYSTEM I
VIDEO SECTION				
Input: C3F Neg	NTSC	PAL	PAL	PAL
Input Impedance	75 ohms unbalanced	75 ohms unbalanced	75 ohms unbalanced	75 ohms unbalanced
Frequency Response	±0.5 dB	±0.5 dB	±0.5 dB	±0.5 dB
Bandwidth	4.2 MHz	5.0 MHz	5.0 MHz	5.5 MHz
Differential Gain	2% max	2% max	2% [illegible]	2% max
Differential Phase	2 degree max	2 [illegible]	[illegible]	2 degree max
Hum & Noise	-60 dB	-60 [illegible]	[illegible]	-60 dB
AUDIO SECTION				
Input: 50 Hz-15 KHz	0 dBm (.8V)	[illegible]	[illegible]	[illegible] (.8V)
Impedance	600 ohms balanced	[illegible]	[illegible]	[illegible]
Frequency Response	±1.0 dB	[illegible]	[illegible]	[illegible]
Frequency Tolerance, ±500 Hz	4.5 MHz	5.5 [illegible]	[illegible]	[illegible]
Frequency Deviation	±25 KHz	[illegible]	[illegible]	[illegible]
Harmonic Distortion	1% max	1% max	[illegible]	[illegible]
Preemphasis	75µs	50µs	[illegible]	[illegible]
IF SECTION				
Video IF Level	+37 dBmV +97 dBµV	+37 dBmV +97 dBµV	+[illegible] dBm[illegible] +97 dBµV	+3[illegible]mV +97 dBµV
Audio IF Level	+22 dBmV +82 dBµV	+27 dBmV +87 dBµV	+27 dBmV +87 dBµV	+27 dBmV +87 dBµV
Return Loss	>14 dB	>14 dB	>14 dB	>14 dB
IF Frequency				
Video Carrier	45.75 MHz	38.9 MHz	38.0 MHz	38.9 MHz
Audio Carrier	41.25 MHz	33.4 MHz	31.5 MHz	32.9 MHz
Video-Sound Spacing	+4.5 MHz	+5.5 MHz	+6.5 MHz	+6.0 MHz
Vestigial Sideband Width	0.75 MHz	0.75 MHz	0.75 MHz	1.25 MHz

NEW!

RF SECTION

Output Frequency	470-750 MHz
Frequency Tolerance	±2 KHz
Output Level adjustable	+60 dBmV max +120 dBµV
Output Impedance	75 ohms unbalanced
Spurious Output 470-750 MHz @+60 dBmV/+120 dBµV Output Level	<-60 dBc
Return Loss	>14 dB
Frequency Response	<2 dB

750 MHz RF MODULATOR

MECHANICAL AND POWER

Dimensions	Standard 19" (48.26 cm) Rack Mount, 1.75" (4.44 cm) High & 14" (35.56 cm) Deep
Weight	8 Pounds (3.6 kg)
Power	115/240 VAC 50/60 Hz 30 Watts
Operating Temperature	40° F to 110° F

CADCO BROADBAND COMMUNICATIONS

2405 S. Shiloh Rd. Garland, Texas, 75041

1-800-877-2288 FAX 214-271-3654 214-271-3651

Reader Service Number 40

Figure 3: Flex test procedure

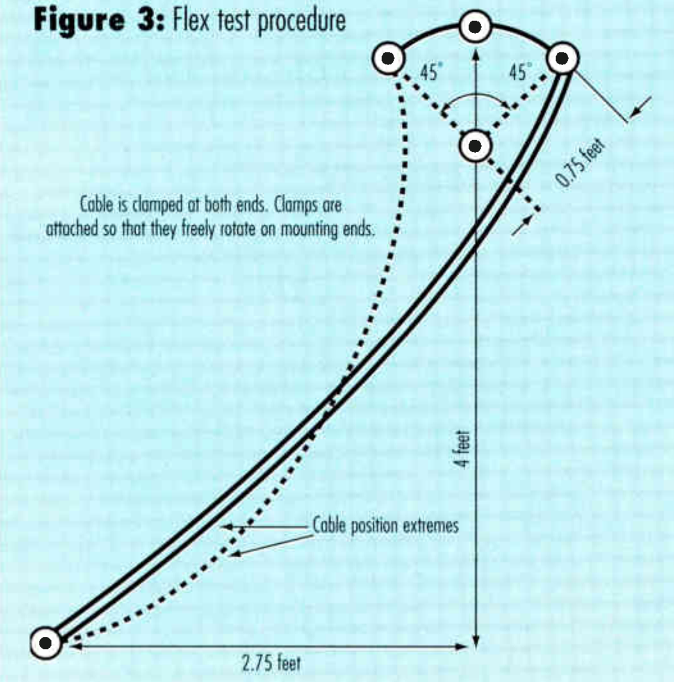
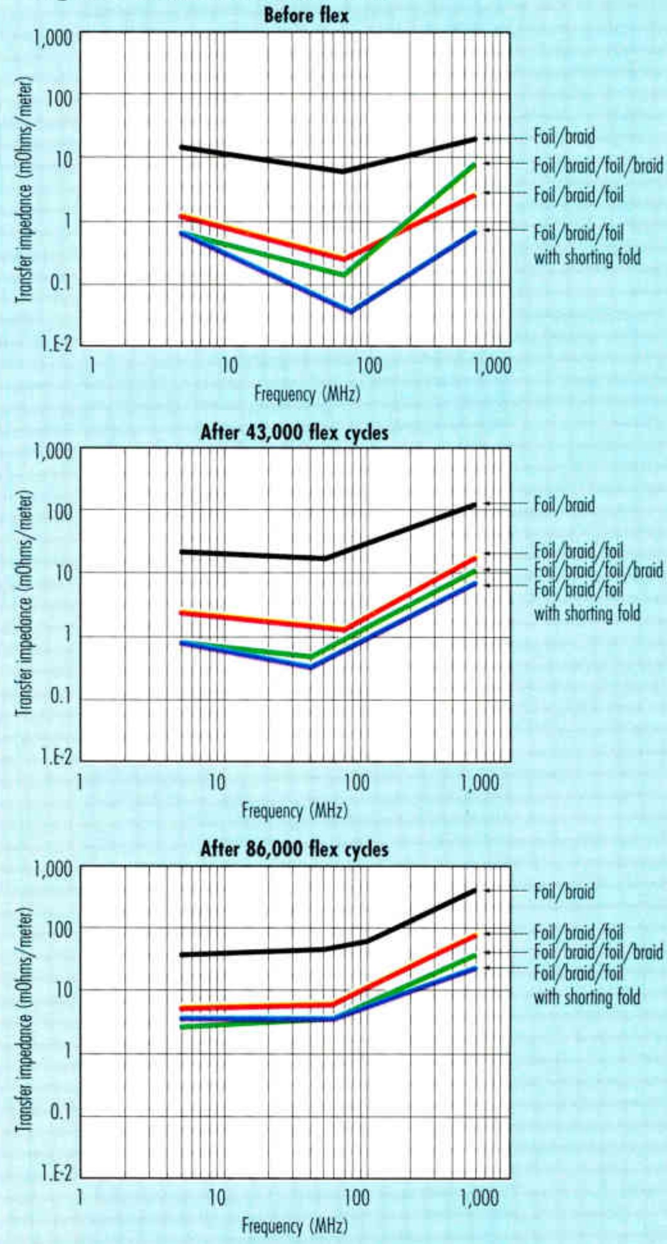


Figure 4: Flex test graphed results



shield, for example, is comprised of an inner layer of laminated tape (foil/film/foil) bonded with adhesive to the dielectric core plus an outer braid to protect against interference and increase tensile strength. SCTE tri-shield designs feature an additional layer of laminated tape for improved reliability, and SCTE quad-shield designs add a second outer layer of braid for greater strength and durability. Another combination shield consists of a bonded foil, medium to heavy coverage braid and a second foil with a shorting fold construction bonded to the outer jacket, which provides exceptional high-frequency performance.

The shorting fold construction technique maintains metal-to-metal contact thereby increasing the foil shield's range of effectiveness to higher frequencies. Without the shorting fold, a slot is created through which signals can leak and cause interference.

Foil/braid combination shields should be specified:

- For shielding against high-frequency radiated emissions coupling and ESD. It combines the low resistance of braid and 100% coverage of foil shields.
- When possible sources of interference include radio transmitters, TV stations, motor control circuits and computing equipment.
- For broadband, voice, video and data networks.

Advanced testing methods

Securing reliable and comprehensive test data is the surest and most effective path to selecting cable shielding that will combat the type of interference anticipated. Questions that need to be asked before choosing test methodology include: What kind of EMI is anticipated? What frequency range? Is ingress or egress the primary concern? The table on the opposite page presents the type of EMI problem each test measures, the operating frequency range and the ability of each test to evaluate egress as well as ingress.

Following is a description of several kinds of commonly conducted shield performance tests — their purpose, methodology and significance of results.

- *Transfer impedance test.* The transfer impedance test is the most widely accepted nonrelative or absolute measure of a shield's performance. It is used to evaluate cable shield performance against ESD and radiated emissions coupling at a frequency range of DC to 1,000 MHz. This testing method is recommended by the International Electrotechnical Commission as well as the military.

The transfer impedance value is dependent upon the sample cable's shield construction. The lower the transfer impedance value, the more effective the shielding. Theoretically, the absolute interference level of a cable can be determined using the transfer impedance value. The transfer impedance takes into effect the relationship between the two signal-carrying regions of a coax cable. The shield separates these two regions. Therefore, the transfer impedance test is a true measure of the shield effectiveness of the cable.

- *Absorbing clamp.* The absorbing clamp is an accurate, portable testing device that is effective at detecting radiation directionally as well as locally. It has a great capacity for electromagnetic

Test method comparison

Problems anticipated	Transfer impedance	Absorbing clamp	GTEM cell
EMI types			
ESD	•		
Electric field coupling			•
Radiated emissions coupling	•	•	•
Frequency range			
DC-100 kHz	•		•
15 kHz-30 MHz	•		•
30 MHz-120 MHz	•	•	•
120 MHz-800 MHz	•	•	•
800 MHz-1,000 MHz	•	•	•
Cable performance against			
Egress	•	•	•
Ingress	•	•	•

compatibility cable measurements in the frequency range of 30 to 1,000 MHz. It also is nondestructive to the sample. The test fixture clamps over the shielded sample cable and inductively detects signal leakage. The radiation values are then compared to those of an unshielded sample of the same length. Shielding effectiveness is defined as the difference between the two values. Figure 2 (page 82) shows the absorbing clamp test.

• *GTEM cell.* The GTEM cell is a rectangular transmission line segment that operates in the gigahertz transverse electromagnetic mode (GTEM). Cables, cable/connector assemblies and/or electronic devices are placed inside the chamber. The item under test can be subjected to a known field intensity provided by powering the cell or, alternately, the cell can be used as a detector to measure radiation emitted by the cable or device inside the cell. Frequency range covered by this method is DC to 1 GHz.

• *Flex test.* Shield performance during the life of the cable is an important consideration especially in drop cables. Flex testing is most commonly performed on aerial-installed CATV drop cables because vibration and sway from wind effects can cause degradation of shield performance over a prolonged period of time. Flex life is generally less critical for messengered than for nonmessengered cable because the rigidity of the messenger significantly reduces the amount of flexing and vibration the cable is subjected to.

To examine a cable's ability to withstand flexing in a laboratory environment, tests were conducted as shown in the Figure 3. With the cable mounted and flexed repeatedly between the extreme positions shown for the reciprocating arm, transfer impedance values are monitored at various frequencies. This type of testing can compare which types of cable shielding can withstand repeated flexing and still provide effective shielding. Figure 4 shows flex test graphed results.

Conclusion

The world of cable technology has become increasingly more complex since EMI problems were first discovered. Today, design decisions must take into account the convergence of data, audio and video signal transmissions. This evolution of technology and its resulting regulations has created a growing need for more sophisticated cable shielding and reliable testing methods. For these reasons, it's more critical than ever before for system designers to evaluate, right from the outset, the conditions of each application in order to specify the most appropriate shielding option. **CT**

By Robert V.C. Dickinson, President, Dovetail Surveys Inc.

Cable signal leakage — Has anything changed?

Unfortunately, the concerns over cable signal leakage have not gone away — particularly in the eyes of the Federal Communications Commission. The same rules are in effect for the cable operator and the same rigors of compliance remain. Nevertheless, a different perspective is developing.

In the early years of cable, signal leakage was something that few realized existed and virtually no one cared about it. When it emerged as a potential hazard to aviation communication and navigation circuits and other over-the-air radio services, the problem quickly developed into an industrywide "clean up and stay on top of" project. This generated all sorts of worry and expense lest the FCC should become offended and swoop down with fines and forfeitures. Now, with the widespread use of fiber optics and the increasing introduction of two-way services, control of cable signal leakage may be a key to successful interactive offerings for the cable operator rather than an onerous burden imposed by the feds.

Many a cable technician and manager have felt the burden of leakage control and the elusive nature of the leakage phenomenon. Training has often been difficult and monitoring and testing have become arduous tasks with few apparent benefits. The industry has shouldered the burden and by diligent effort and sheer persistence has presented passing grades to the FCC.

Some operators have recognized the benefits of a cleaner system as evidenced by better pictures and fewer subscriber complaints and have therefore more heartily embraced the program. However, some indications point to loss of leakage control priority in parts of the industry. This lack of priority cannot last too long if the operator does not wish the situation to get out of control — again. The entire process has become routine and automatic for many but continues to be a Class A burden to others. *Routine* and *automatic* are the only realistic solutions and must be sought after and maintained in an efficient manner.

Interactivity, fiber roles

Previously, interactive services were mentioned. Their time may have arrived according to some industry pundits. Maybe they have not really arrived, but still, they are not far off. Providing the return path for interactivity via upstream cable is certainly the desired mode of operation rather than the telephone, etc. Cleanliness of the upstream spectrum is a must for these applications.

Cable signal leakage control addresses "what goes *out*." "What comes *in*" is what disrupts the upstream signal flow and consequently the upstream services. "What comes in" utilizes the same cable system integrity imperfections as "what goes out" and is therefore tightly tied to signal leakage of the FCC variety. When there is a leak that can be detected at a given monitoring frequency, one can expect egress and ingress at virtually all frequencies from this source. Leaks detected in the aeronautical bands also may be detected at the sub-band frequencies used for upstream transmission. Leaks repaired for aeronautical frequencies are normally automatically repaired for the sub-band also.

The advent and increasingly widespread usage of fiber optics has changed the situation somewhat. In most cases, fiber has replaced CATV system coaxial trunk and thereby eliminated one potential source of ingress/egress. Many hoped that this would be a major factor in reduction of the required leakage control. True, replacement did reduce the amount of coax in the system. However, the trunk is not in the most sensitive area for leakage signal generation. Trunk levels are normally lower than distribution levels. Therefore, the resulting overall improvement has not been dramatic.

> **"Control of cable signal leakage may be a key to successful interactive offerings."**

In most fiber deployments, the system architecture has been altered by optical trunking to nodes that feed relatively small groups of subscribers (a few hundred to a few thousand). This means that the amount of possibly leaky feeder between the subscriber and the node (and hence the headend) is greatly reduced.

While not substantially affecting the egress situation (the same total amount of distribution plant is still there to leak), this change should represent an important factor in spurious signal interference in the upstream path. Even in view of these important improvements, many operators have found these results less than dramatic as well.

Due to the FCC's allowance of customer freedom to install and alter in-home wiring to their own whims there is much of the plant "antenna" that is beyond the control of the cable operator. This is a disturbing situation and seems to have resulted in a ingress intensity approaching that seen in older nonfiber networks of larger size. This is truly unfortunate since the reduced extent of the RF plant in a fiber node was expected to be a most important improvement in the upstream environment.

In light of these factors, what does the return path look like in terms of impairment to upstream transmissions? There has been a great deal of testing done by various players in the interactive services arena.[1,2,3,4] Although the actual profiles from various systems differ, the general results are about the same. There is great deal of garbage on the low end of the spectrum because of ingress.

The frequencies below about 15 MHz suffer from many interference sources with the most potent often being shortwave radio broadcast signals. These are in distinct frequency bands and vary in intensity depending upon time of day and propagation conditions. As many technicians have found, these broadcasts may be monitored on a properly adjusted spectrum analyzer. CB and amateur radio are still very prevalent and can be received at frequencies to 30 MHz in the sub-band. Auto ignition and powerline-related noise often extend well up into the sub-band. Generally it has been concluded that frequencies below 15 MHz may not be useful for any but the most robust upstream data signals (like converter response systems).

Filters outside the customer premises are a possibility to clean up selected portions of the band while allowing signals from within to use the unblocked bands. Implementation of services in the regions of the spectrum blocked by filters must then be performed from units mounted outside the dwelling in order to have access to the line side of these filters.

"Mixing" signals

In addition to the signals picked up from ingress, the "common mode" beats reported by experimenters many years ago have not gone away either. The term "common mode" is not universally used and is not totally descriptive. These signals are the result of the mixing of the downstream TV carriers in some nonlinear element(s) in the network creating spurious signals in the sub-band.

Since downstream TV carriers are spaced at 6 MHz, this process generates the familiar sum and difference products that are the ever-present second and third order beats. All of the beating carriers are higher in frequency than the band of interest. Therefore, only the difference products are observed in the sub-band.

Second order products by definition are the result of mixing two signals and therefore must be multiples of 6 MHz. The third order products can only be in the form of $f_1 - 2f_2$, $f_1 + f_2 - f_3$ or $f_1 - f_2 - f_3$ in order to lie in the sub-band. A little number juggling of the combination frequencies generated in the 6n + 1.25 MHz structure of the standard CATV frequency assignment will show that these third order beats lie at frequencies of 6n (1.25 MHz in the sub-band).

The result of all of this is the possible presence of a sub-band frequency comb with 6 MHz spacing and/or a beat pattern containing components at 6n *plus and minus* 1.25 MHz. Experience has shown that both patterns occur with varying amplitudes and at various times in the same system and at the same location.

The arbitrary amplitudes and ratios are rather mysterious and unpredictable. It also is good to note that the introduction of digital video can be expected to introduce additional second and third order products, which in this case will be more noise-like in character. Due to the expected lower levels, the effect should be secondary in the sub-band. In any event, the more downstream channels of any kind, the more products will be generated.

This mixing, which is the source of the higher order products, generally has to do with rectification in mechanical joints caused by minute semiconductor formations because of dissimilar metal and corrosion effects. These points are often associated connections in drop cables, tap plates, seizure connections, line terminators and the like.[5] With less homes in the fiber-optic node, it is much easier to locate and repair this type of problem. When ingress has been substantially reduced, this effect is more visible and more readily isolated. Sources of rectification have been located and repaired often to revert to the rectifying condition within a few days or weeks. Unfortunately, the same recurring phenomenon has been observed in repair of small leaks as evidenced by the reappearance of ingress signals in relatively short periods. There is still room for new innovative work in this entire area.

The reason for the previous diversion into discussion of internally generated spurious signals is to point out that confusion is possible initiating a search for ingress when the problem may be internal to the cable hardware rather than leak-related.

Changes have occurred

Well, has anything really changed? I think we can say that there have been substantial changes in the system architecture and usage that have shifted the balance and perspective of the leakage picture. These changes should produce greater impetus for tighter cable systems and the increased leakage control required to achieve them since they have the potential of improving our bottom line.

However, the main thrust remains unchanged from the regulatory side. *Aeronautical frequencies must be protected* and the industry must live under the current regulations for the foreseeable future.

Growing systems in urban areas will require more intense efforts because of the greater inaccessibility. Leakage from in-home wiring will continue to increase and be a touchy problem for the cable operator due to the possibility of customer offense.

Other pressures will make it difficult to maintain top priority for leakage control. Whether you see better leakage control as increased revenue or not you had better keep on top of it or the FCC may make it a source of expanding revenue in its own way.

The increasing use of the sub-band focuses more upon transmission quality than regulatory pressure. There are some advocates of abandoning this band in favor of much higher frequencies (i.e., above the downstream transmissions) where ingress interference is less severe. This has the advantage of more available spectrum that will be needed for new services. Others[6] suggest the use of a separate return cable allowing essentially symmetrical capacity and less interference from ingress. If you can stand the expense, this is the most elegant solution.

The big effort must remain the finding and fixing of leaks. It is essential to protect aeronautical services and avoid FCC intervention. We also can rightly feel that leakage control does affect our quality of service, our customer satisfaction and our ability to mount interactive businesses. For all of these reasons there should be no letup in our leakage control efforts.

In addition, new products (connectors, cables, instrumentation, etc.) are making leakage control somewhat easier and more effective and perhaps less expensive. The large amount of training from the Society of Telecommunications Engineers, the National Cable Television Association and cable operators has developed the exercise from an art toward a science. But it is still an area that must be given diligent and unrelenting effort. It should not be assigned a reduced priority. **CT**

References

[1] Kim, Albert, "Two-Way Plant Characterization," *National Cable Television Association 1995 Technical Papers*, page 171.

[2] Prodan, Richard, Chelelmal, M., Williams, T. and Chamberlain, C., "The Cable System Return Channel Transmission Environment," *National Cable Television Association 1995 Technical Papers*, page 141.

[3] Himayat, N., Eldering, C., Kolber, M. and Dickinson, E., "Characterization of Hybrid Fiber/Coax Return Systems," *SCTE 1995 Conference on Emerging Technologies Technical Papers*.

[4] Citta, R. and Mutzabaugh, D., "Two-Way Cable Plant Characteristics," *National Cable Television Association 1984 Technical Papers,* page 270.

[5] Campbell, George T., Viacom, *Common Path Distortion,* private communication.

[6] Switzer, Israel, P. Eng., "An Optimal 'Full Service' HFC Network," *National Cable Television Association 1995 Technical Papers*, page 108.

TDR

Riser-Bond Instruments introduced two features to its Model 1205C time domain reflectometer/cable fault locator. An enhanced fault dBRL mode and a newly developed intermittent fault detection mode (IFD) have been added to the unit.

With the fault dBRL mode activated, the unit automatically displays a fault severity reading, with the effects of cable attenuation cancelled out of the dBRL reading. This feature provides technicians with a quick and easy measurement of fault severity that can help determine at what point the fault is severe enough to fix.

The IFD mode can "baby-sit" a cable and will detect and display intermittent faults, whether they are opens or shorts. A unique function of the IFD feature is that the waveform can be manipulated, repositioned, zoomed in or out, and the cursors moved — all without affecting the IFD function.

Reader service #312

Headend products

General Instrument introduced the OmniStar next-generation system of 750 MHz cableoptics headend products, including the universal chassis, laser modules, network monitoring, power supplies and other configuration options.

According to the company, the OmniStar platform is the perfect solution for the next generation of broadband fiber-optic network applications where increasingly smaller node sizes and deployment of point-to-point lasers define needs for optimizing headend or central office space.

The platform provides headend rack-mount laser density for up to eight laser modules in a five-rack unit high space including ventilation spacing. This modular design offers user flexibility for application-specific configuration, making it ideal for telephony applications where redundancy capability and modularity are paramount.

The system incorporates the company's most advanced lasers. The seven distributed feedback laser models come in power ranges from 3 to over 12.5 dBm (2.5 to over 16 mW), in 2 dBm increments to facilitate system design and installation. According to the company, this variety of lasers offers the most cost-effective solution for an application based on design loss budget, performance criteria and splitting ratio considerations.

All laser modules accommodate separate broadcast and narrowcast inputs, eliminating the need for external combiners. The plug-and-play module is an integrated unit providing all optical, RF signal processing and control functions.

Reader service #311

Remote control

Scientific-Atlanta unveiled the AllTouch remote control, which it says is the cable TV industry's first universal remote to access its 8600^x advanced analog terminal as well as other consumer electronic devices, such as TV sets, VCRs and audio components.

A conventional remote control enables viewers to operate only one specific brand of VCR or TV set. With a universal remote, the viewer needs only one remote control to operate multiple consumer electronics devices. The AllTouch is the first universal remote that can control the advanced capabilities of the 8600^x home communications terminal as well as most major brand TV sets and VCRs. In addition, the unit can operate auxiliary devices, such as CD players, digital audio receivers and digital music terminals.

Within the unit is a library of TV, VCR and audio component codes. In addition to near-video-on-demand (NVOD) applications, for example, viewers can use the remote to command a VCR to rewind, play, fast forward, pause, stop and record. Other features include navigational control for interactive viewing guides and one programmable "hot key" for one-touch access to the customer's favorite channel.

Reader service #310

Variable attenuators

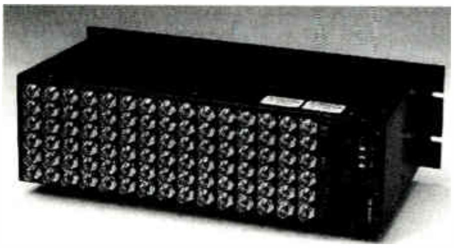
Laser Precision announced the DB-2900 series variable attenuators, consisting of models DB-2900C, DB-2910 and DB-2930. All three models are designed for bit error rate (BER) testing, optical loss margins measurement, optical power meter and test set calibration, system loss simulation and optical component testing.

The DB-2900C is designed specifically for use in CATV, high-speed telecommunications and high-speed analog systems. The DB-2910 provides an economical testing solution for LAN and standard telephony applications, while the DB-2930 is designed for use in multimode applications.

All models provide continuous attenuation with or without battery power. Unlike attenuators that use filters and step motors, the company says its patented mechanical beam blocker design permits attenuation in steps of a minimum 0.1 dB and ensures that signal ranging does not occur as a result of overshoot or undershoot.

All three models also offer the flexibility of operation at user-selectable wavelengths over their entire 60 dB range. In the DB-2900C, wavelength-specific characteristics, such as offset, are stored independently.

For CATV applications, the unit is terminated with angled polished connectors. For high-speed telecommunications systems, the attenuator is terminated with ultra polished connectors. Both connectors reduce reflectance at the bulkhead to help eliminate adverse effects on transmission performance. In addition, a variety of connector adapters are available.
Reader service #301



Video/IF switch

The EVS-30, new from Trilithic, is said to be a compact, cost-effective solution to Emergency Alert System (EAS) switching (FCC Part 73.G). Each 5.25-inch rack enclosure provides 30 independent A/B-type video/RF switches, all toggling on the closure of a single TTL contact.

Several EVS-30s may be chained together to switch as many channels as may be required. Each switch may be connected to one alternate source or to separate sources and may be configured to default to either the primary or EAS source on loss of power.
Reader service #306

Power node vault

Oldcastle Precast Inc. introduced the Power Node Vault. It offers cable and telephony providers a safe watertight environment for broadband power systems. Technicians and maintenance personnel can work on the systems at sidewalk level simply by opening the doors and activating the hydraulic lifting mechanism, bringing the entire system out of the ground.

The unit is designed for use in residential neighborhoods or downtown areas where above-ground equipment is either not aesthetically acceptable or may be subject to vandalism. Also, it can be used in highway applications where county or state highway departments will not permit above-ground roadside cabinets or structures.

Standard and optional equipment includes air conditioning, ventilation, electrical convenience outlets, telco demarcation panels, sump pumps, breaker and distribution panels. In addition, a variety of remotely monitored alarms are available to indicate power failure, intrusion, high temperature, low temperature or any other alarm function required by the service provider. Another option is a separate compartment providing housing for transformers, meter cans or generators. This compartment can be locked and keyed for access only by company personnel.

The unit is designed for use with preassembled cabinets as provided by various manufacturers, for either indoor or outdoor use. Any size broadband power system can be adapted easily to the below-ground vaulted system. In many cases, the unit can be easier for zoning and permit applications. Site work is as simple as excavation, crane and backfill, with no special requirements for concrete slabs or foundation work.
Reader service #309

Headend products

The latest generation of Commander 6 headend products from General Instrument features expanded bandwidth capabilities to 1 GHz. The series is part of the company's overall end-to-end systems solution.

New models include the C6M-II RF modulator with an agile output from 50 MHz to 1 GHz, designed to offer flexibility in broadband, multichannel headend systems. It allows for combined systems with up to 161 channels. The unit was designed to accept three different accessories simultaneously: the MOB module that allows for up to six switchable inputs; the C6-LLII option providing remote control and status monitoring capabilities; and the C6-SE integrated BTSC stereo encoder.
Reader service #305

Broadband power systems

Alpha Technologies introduced the BPS series of broadband power systems for use in combined and full-service broadband applications. The fundamental design premise for the line is flexibility and modularity. The company says the systems represent industry-leading power technology, consisting of an array of integrated powering components and packaging options that provide plant system engineers unprecedented flexibility in creating application-specific power solutions.

Equipped with programmable output voltage levels, the BPS allows the use of 90-, 75- or 60-volt output. An extensive menu of power system components can be used as functional blocks. System engineers can create a custom powering solution through a process of selecting the appropriate component blocks, then fitting them into one of several enclosure configurations. Thus, applications that lend themselves to central, large system powering can be created out of the same basic elements used to power a single coax feeder. As a result, operations, status monitoring, power supply modules and interfaces can remain standardized across the entire plant, helping reduce the overall cost of plant operations and maintenance.

The system is designed to work with any commercially and/or proprietary system available. Providing more than 100 different test functions and real-time data to the network manager, this system provides more monitoring capability and functional control from a remote site than any system available today.

Because power nodes are located in varying urban and suburban locations, both the large and small system enclosures are offered in standard and low-profile configurations. These enclosures are made of durable, weather-resistant aluminum and are available in standard sea foam green or optionally painted a variety of environmental colors.
Reader service #308

LAN/WAN call center feature

Telecorp announced the Phone Link feature to its System 9000 call center, opening the door to true local area network/wide area network (LAN/WAN) call center solutions.

Phone Link eliminates the need for dedicated or hardwired workstations in the call center. Any employee with access to a PC and a telephone can have the ability to log into System 9000. Until now, LANs have been able to handle only data — not voice. With Phone Link, the company uses the PBX and public telephone network as a transportation vehicle for voice.

The ability to log in ad hoc adds flexibility to what has traditionally been a closed system. If inbound call volume gets too large for the assigned calling group and extra help is needed to take calls, any employee on a PC can log in to assist with calls. If there are employees who spend only a portion of their day using the system, they can use the workstation in their office instead of physically moving to another location.

The company says the system makes feasible the monitoring of calls made by telemarketing agents working from home. The supervisor can even join conversations and coach the employee from a remote location.
Reader service #307

Filters

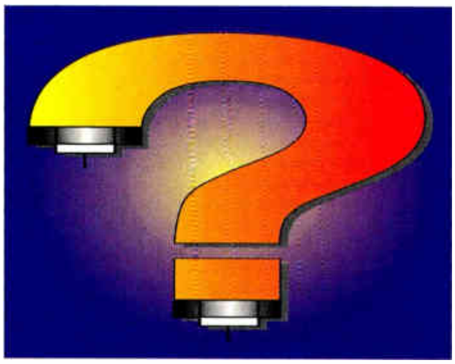
Passive Devices Inc. announced a line of 1 GHz channel elimination filters and custom tier filters. The PDI-CEF channel elimination filter is built around a unique hybrid filter circuitry designed to achieve the tightest specifications in the industry. All of the company's channel elimination filters include reinsertion circuits for customer convenience. This same hybrid circuitry is applied to the custom tier filters, which also are available up to 1 GHz.
Reader service #300

CABLE TRIVIA

By Rex Porter, CATV Consultant

Once again our historical guru (aka Rex Porter) has provided us with these trivia questions on the cable industry. Answers to last month's questions appear first. ("Cable Trivia" ran on page 84 of the July issue.) Look for answers to this month's questions in next month's issue (along with a new set of 10 questions). The person supplying the most correct answers (see additional requirements below) will be awarded an industry-related novelty prize (e.g., cap, water bottle, T-shirt).

Your answers need to be sent to: The Trivia Judge, *Communications Technology*, 1900 Grant St., Suite 450, Denver, CO 80203; fax: (303) 839-1564; e-mail: CTmagazine@aol.com. To be in the running for a prize, your answers need to be postmarked, faxed or e-mailed to us by the 20th of the month of the issue date that the specific trivia test appears in. The first person who sends in the most correct answers will be the award winner. Good luck!



Trivia test #1 answers

1) Panther Valley
2) Pottsville
3) Phelps/Dodge
4) 1976
5) Teleprompter
6) Jeff Marcus
7) ATC, TPT, TCI, Cox
8) Post-Newsweek
9) Irving Kahn
10) Scientific-Atlanta.

Trivia test #2

1) A member of the original Cable TV Pioneers, ______ ______, became the first general counsel for the National Cable Television Association.

2) The "______ ______" case drew national attention in the battle over the Federal Communications Commission's right to protect the local TV stations from "economic injury" caused by community antenna TV systems.

3) In 1948, Milton J. Shapp founded ______ Corp. with an initial investment of $500.

4) Constructing his Paradise Valley, AZ, system in the early years, Bruce Merrill, one of the original pioneers, started a company called ______ and produced the first full line of transistorized equipment.

5) Thirty years ago, the 1965 National Cable Television Convention was held in ______.

6) Twenty years ago, the 1975 National Cable Television Convention was held in ______.

7) Ten years ago, the 1985 National Cable Television Convention was held in ______.

8) The city with the most cable plant miles under single ownership (700+ miles) by 1965 was American Cable TV's system in ______, TX.

9) This company, which used the slogan "The House that Service Built," was a manufacturer in Hoboken, NJ, that changed its name from ______ to Vikoa Inc.

10) In 1968, he bought six small systems from United Video Systems in Kansas City, MO, and launched a major MSO. Betting against most other cable experts that the U.S. Supreme Court would rule a certain way in two major cases (and the court did), ______ ______ started and led ATC to become the fourth largest MSO by 1973. **CT**

Reader Service Number 236

COMMUNICATIONS
TECHNOLOGY

August 1995 GH1

Return this card for Free Information • Free Subscription

Mail or Fax today to 413-637-4343

The information at right must be completed to process your request.

☐ Yes, I wish to receive/continue to receive *Communications Technology.* ☐ No

Name________________________________

Title________________________________

Company________________________________

Address________________________________

City________________ State ______ Zip ________

Phone________________ Fax ________________

Signature____________________ Date________

(Signature and date required by U.S. Postal Service)

Circle Numbers for Free Information

1	27	53	79	105	131	157	183	209	235	261	287
2	28	54	80	106	132	158	184	210	236	262	288
3	29	55	81	107	133	159	185	211	237	263	289
4	30	58	82	108	134	160	186	212	238	264	290
5	31	57	83	109	135	161	187	213	239	265	291
6	32	58	84	110	136	162	188	214	240	266	292
7	33	59	85	111	137	163	189	215	241	267	293
8	34	60	86	112	138	164	190	216	242	268	294
9	35	61	87	113	139	165	191	217	243	269	295
10	36	62	88	114	140	166	192	218	244	270	296
11	37	63	89	115	141	167	193	219	245	271	927
12	38	64	90	116	142	168	194	220	246	272	298
13	39	65	91	117	143	169	195	221	247	273	299
14	40	66	92	118	144	170	196	222	248	274	300
15	41	67	93	119	145	171	197	223	249	275	301
16	42	68	94	120	146	172	198	224	250	276	302
17	43	69	95	121	147	173	199	225	251	277	303
18	44	70	96	122	146	174	200	226	252	278	304
19	45	71	97	123	149	175	201	227	253	279	305
20	46	72	98	124	150	176	202	228	254	280	306
21	47	73	99	125	151	177	203	229	255	281	307
22	46	74	100	126	152	178	204	230	256	282	308
23	49	75	101	127	153	179	205	231	257	283	309
24	50	76	102	128	154	180	206	232	258	284	310
25	51	77	103	129	155	181	207	233	259	285	311
26	52	78	104	130	156	182	208	234	260	286	312

A. Are you a member of the SCTE (Society of Cable Television Engineers)?
01. ___ yes
02. ___ no

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

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

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

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

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

G. What is your annual fiber-optic equipment expenditure?
66. ___ up to $50,000
67. ___ $50,001 to $100,000
68. ___ $100,001 to $250,000
69. ___ over $250,000

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

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

J. In the next 12 months, what cable services do you plan to buy?
86. ___ Consulting/Brokerage Services
87. ___ Contracting Services (Construction/Installation)
88. ___ Repair Services
89. ___ Technical Services/ Eng. Design
90. ___ Training Services

K. What is your annual cable services expenditure?
91. ___ up to $50,000
92. ___ $50,001 to $100,000
93. ___ $100,001 to $250,000
94. ___ over $250,000

L. Do you plan to rebuild/ upgrade your system in:
95. ___ 1 year
96. ___ more than 2 years

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

COMMUNICATIONS
TECHNOLOGY

August 1995 GH2

Return this card for Free Information • Free Subscription

Mail or Fax today to 413-637-4343

The information at right must be completed to process your request.

☐ Yes, I wish to receive/continue to receive *Communications Technology.* ☐ No

Name________________________________

Title________________________________

Company________________________________

Address________________________________

City________________ State ______ Zip ________

Phone________________ Fax ________________

Signature____________________ Date________

(Signature and date required by U.S. Postal Service)

Circle Numbers for Free Information

1	27	53	79	105	131	157	183	209	235	261	287
2	28	54	80	106	132	158	184	210	236	262	288
3	29	55	81	107	133	159	185	211	237	263	289
4	30	56	82	108	134	160	186	212	238	264	290
5	31	57	83	109	135	161	187	213	239	265	291
6	32	58	84	110	136	162	188	214	240	266	292
7	33	59	85	111	137	163	189	215	241	267	293
8	34	60	86	112	138	164	190	216	242	268	294
9	35	61	87	113	139	165	191	217	243	269	295
10	36	62	88	114	140	166	192	218	244	270	296
11	37	63	89	115	141	167	193	219	245	271	927
12	38	64	90	116	142	168	194	220	246	272	298
13	39	65	91	117	143	169	195	221	247	273	299
14	40	66	92	118	144	170	196	222	248	274	300
15	41	67	93	119	145	171	197	223	249	275	301
16	42	68	94	120	146	172	198	224	250	276	302
17	43	69	95	121	147	173	199	225	251	277	303
18	44	70	96	122	148	174	200	226	252	278	304
19	45	71	97	123	149	175	201	227	253	279	305
20	46	72	98	124	150	176	202	228	254	280	306
21	47	73	99	125	151	177	203	229	255	281	307
22	48	74	100	126	152	178	204	230	256	282	308
23	49	75	101	127	153	179	205	231	257	283	309
24	50	76	102	128	154	180	206	232	258	284	310
25	51	77	103	129	155	181	207	233	259	285	311
26	52	78	104	130	156	182	208	234	260	286	312

A. Are you a member of the SCTE (Society of Cable Television Engineers)?
01. ___ yes
02. ___ no

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

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

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

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

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

G. What is your annual fiber-optic equipment expenditure?
66. ___ up to $50,000
67. ___ $50,001 to $100,000
68. ___ $100,001 to $250,000
69. ___ over $250,000

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

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

J. In the next 12 months, what cable services do you plan to buy?
86. ___ Consulting/Brokerage Services
87. ___ Contracting Services (Construction/Installation)
88. ___ Repair Services
89. ___ Technical Services/ Eng. Design
90. ___ Training Services

K. What is your annual cable services expenditure?
91. ___ up to $50,000
92. ___ $50,001 to $100,000
93. ___ $100,001 to $250,000
94. ___ over $250,000

L. Do you plan to rebuild/ upgrade your system in:
95. ___ 1 year
96. ___ more than 2 years

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

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 788 PITTSFIELD, MA

POSTAGE WILL BE PAID BY ADDRESSEE
OUTSIDE U.S. PLEASE AFFIX POSTAGE

COMMUNICATIONS
TECHNOLOGY
Reader Service Management Department
P.0. Box 5360
Pittsfield, MA 01203-9788

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 788 PITTSFIELD, MA

POSTAGE WILL BE PAID BY ADDRESSEE
OUTSIDE U.S. PLEASE AFFIX POSTAGE

COMMUNICATIONS
TECHNOLOGY
Reader Service Management Department
P.0. Box 536
Pittsfield, MA 01203-9788

AD INDEX

It's so simple! To obtain additional information from any of the display advertisers appearing in this issue of ***Communications Technology***, please use one of the **Reader Service Cards** on the facing page (pass the others along). The ad index below has been expanded to include not only the page number of each advertiser, but also each corresponding reader service number to be circled on the **Reader Service Card**.

COAST CATV SUPPLY

IN STOCK
NEW & REFURBISHED
Amps, LE's, Taps, Splitters
Connectors & Headends
ALL BRANDS 270 TO 550 MHz
Call for updated price list

We Buy - Wanted: ALL BRANDS
YOUR USED OR EXCESS EQUIPMENT
Fax your used/excess list
(USA) 909-272-2360 Fax: 909-272-3032

The Business Directory

features:

- Products • Services
- Career Opportunities
- Training • Catalogs

Call 1-800-325-0156
To place your ad!

WE SELL SURPLUS NEW & USED

Connectors, Taps, Headend, Line Gear, misc.

TM BROKERS

5402 Highway 95
Cocolalla, ID 83813 USA
Phone: (208) 683-2797
(208) 683-2019
Fax: (208) 683-2374

---

dB-tronics

Cable Television Equipment Sales & Service Center

S-A SPECIALS !

Check Us Out For
Scientific Atlanta
Parts & Services

- ✓ Genuine S-A Parts In Stock
- ✓ Factory Trained Repair
- ✓ Sales of New & RMF Equipment
- ✓ Purchase of Wreck-Out & Excess Equipment
- ✓ 450 & 750 MHz Equalizers

CALL OR FAX US FIRST

Telephone: 803-574-0155
USA Toll Free: 800-356-2730
Fax: 803-574-0383

GENUINE Scientific-Atlanta PARTS

dB-tronics, Inc.
145 Tradd Street
Spartanburg, SC 29301
USA

VISA — *get converted !* — MasterCard

ROCKY MOUNTAIN JUMPER CABLES

Industry Service Since 1966

P.O. Box 9707 • Helena, MT. 59604

Custom Made Jumper Assemblies All Brands Fittings/Cable

- F Male
- F Female
- BNC
- PL
- RG - 59
- RG - 56
- RG - 11
- Other

Our jumpers never leave our plant during construction, insuring inspection of each phase of construction. Our quality control insures you of the lowest RF leakage possibe.
Call for pricing and free sample. (406) 458-6563

CABLE TECHNOLOGY ASSOCIATES

- Base Mapping
- Strand Mapping
- Digitizing Services
- LODE Data

- As-Built Mapping
- System Design
- System Walkout
- Design Engineering

Our team of quality, map production, design and software development professionals are here to help you with all your mapping projects from concept to completion.

SCTE Members

For further information contact:
Phillip Griggs (914) 762-8727 or
Vincent Kee (201) 434-7854
121 Bayview Avenue, Suite 102
Jersey City, NJ 07305

LEMCO Lemco Tool Corporation

Call for your free catalog **1-800-233-8713**
In PA, call collect: 717-494-0620

Exhibiting at the Eastern Show
Atlanta, Booth 633

T-500 $25.73
- Straight flute coring bit
- Dual cutting edges
- Three tubing cutters available

XL-500 $40.59
- Hardened steel, reversible stripping blade
- Dual edge, straight flute coring bit
- Longer bushing
- Large inspection window
- Adjustable center conductor stop

Lemco splicing tools... on the cutting edge

FCC COMPLIANCE
CALL 800-652-1082
PROOF-OF-PERFORMANCE

- COMPLETE FCC POP, RF, VIDEO & COLOR
- HEADEND DESIGN, SET UP, OPTIMIZING, PROOF
- CLI RIDE OUT WITH FCC 320 FORMS COMPLETED
- THE MOST AFFORDABLE WAY TO COMPLY WITH FCC RULES
- TEST RESULTS REPORT IMMEDIATELY AT END OF TESTS
- INDEPENDENT AND UNBIASED REPORTING
- RESULTS GUARANTEED TO BE READY FOR THE FCC & CITY

RELIABLE CABLE TV SYSTEM SERVICE INC.
4849 GRENADIER DR. SW
GRAND RAPIDS, MI 49509

GRANT PEARCE
SCTE BCTE-000098
616-538-1437

Professional Technical Services, Inc.
Since 1986

An Engineering Services Company dedicated to:

- Sweep - Balance - Proof
- CALAN Equipped - 1GHz
- Computerized Reporting
- Electronic Upgrades - Resplice
- Splicing & Activation
- System Maintenance and Repair
- 750 MHz Sweep Experience

Cincinnati, Ohio
Fax: 513-583-1140
800-457-4569

VISION SPECIALTIES
Authorized Parts Distributor for *Scientific Atlanta* *Panasonic*

Call for Catalog
(800) 233-8431
Rancho Cucamonga, CA

Cosmetic Replacement Parts
SA Cases, Jerrold Bezels/Cases
Overlays, Keysets, AC Cords
Electronic Components
Capacitors, ICs, Transistors
Diodes, VRs, Jerrold "A" PROM
New Panasonic Converters

Specialty Tools: Bits, TORX
Pioneer, Avsafe
New Remote Controls
Transformers, Batteries
Hardware
Screws/Washers,
Connectors, Rivets

MIDWEST CABLE SERVICES

- NATIONWIDE BUYERS -
CATV SCRAP CABLE AND USED LINE GEAR
P.O. Box 96, Argos, IN 46501
Phone: (219) 892-5537 • FAX: (219) 892-5624
(800) 852-6276

130 SPECIALIZED TRUCKS IN STOCK
1100

(10) Telsta-Versilift 1 Ton Buckets In Stock
(10) Digger Derricks Etc.
(50) 28 To 75 Ft Bucket Trucks In Stock
Call For Price List: (215) 721-4444 Fax: (215) 721-4350

Opdyke Inc.
Truck & Equipment Sales
3123 Bethlehem Pike
Hatfield, PA 19440 USA
We Buy Surplus Trucks

FCC PROOF OF PERFORMANCE TESTING

TSB

- **HEADEND SERVICES**
  - COMPLETE HEADEND RELOCATION SERVICE
  - RERACK AND REWIRE
  - OPTIMIZE
  - PROOF
- **FCC PROOF OF PERFORMANCE**
  - RF PROOFS
  - VIDEO TRIANUAL PROOFS
- **ON SITE TRAINING**
- **DESIGN AND DRAFTING**
  - RF PROOFS
  - AS BUILT MAPPING
  - SYSTEM DESIGN
  - MAP MANAGEMENT AND SYSTEM UPDATES

P.O. Box 305
Ipswich, S.D. 57451
(605) 426-6140
800-292-0126

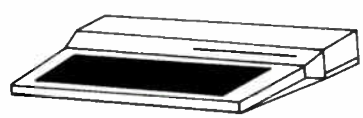
Quality Cable & Electronics Inc.
1950 N.W. 44th Street Pompano Beach, Florida 33064

Quality Cable & Electronics Inc.

Converters
Headends
Drop Material
Line Equipment

New / Used
All Equipment / Competitive Prices
Phone: 305•978•8845 Fax: 305•978•8831
Call or Fax us today with your request!
Credit terms available upon approval

AMS-1 CHARACTER GENERATOR



ATARI Computer and Software only $499.00!

OPTIONAL BATTERY BACKUP!

- *Character Generators*
- *VCR Controllers*
- *Video Switches*
- *Custom Hardware and Software*

Dickel Communicatons Co.
5208 East Hanbury St./ Long Beach, CA 90808
FAX 310-496-4716
Tel. 310-496-0674

Recycle Scrap CATV
MATEJKA
Cable Recovery Inc.
Coast to Coast Service

818 W. 3rd St. • P.O. Box 1224
Winona, MN 55987
Tel: (800) 831-2925
Buyers of Scrap CATV

John Caulfield
Fiber Optic Services Inc

- FIBER EMERGENCY RESTORATION KITS
- SYSTEM TRAINING ON EMERGENCY RESTORATION
- FIBER CONSTRUCTION AND SPLICING
- FIBER ENGINEERING AND DESIGN

Call: 1-800-651-7960

FIBER OPTIC SYSTEMS

Design • Installation • Testing • Full Turn Key Services

Applications:
Telephone • Cable TV • 802 Networks • Process Control • Security • IVHS • Educational Networks

Services Include:
System Engineering & Design • Outside Plant Construction • Project Management • Aerial & Underground Cable Installation • Systems Integration • Premises Wiring • Splicing • Termination • Testing • Activation • Training • Emergency Service

AXSYS Communications

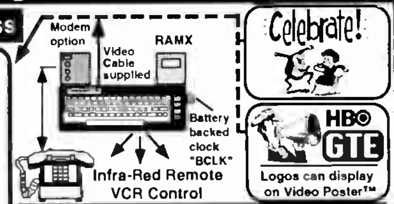
P.O. Box 571
Danielson, CT 06239-0571
Tel: 203-774-4102 • Fax: 203-774-4783

Planes 1057 • (1405) Buenos Aires
Repúbilca Argentina
Tel: 582-2915 • Fax: 582-1372

"Video Poster"™ Page Generator & Controller

MAC & IBM Modem Access

Local Weather
Temp:85 F Humidity 35%
Wind from SW @ 5 MPH
Baro Pressure 29.3 HG.
Graphics, Logos, Low cost ads
Update remotely via any computer!
Scrolling messages...
12:24:30 THURSDAY 3:21:94

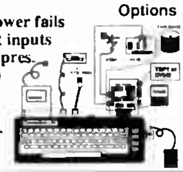


Basic system: $529.90 inc RAMX & C64 VHS instructional video, cable & manuals

•Hi-Res fonts, Video Page & Character Generator •Store more than 600 pages Logos & pictures on RAMX cartridge •16 colors, variable fonts, Crawl, Flash, Special effects •Two (240 ltr.) crawls per page •Accurate real time clock & date • Restores & displays pages, time & date even if power fails!• Low cost C64 computer (NTSC + Ch. 3/4 RF out) •100 Time & date control commands •Infra-red controls up to 8 VCR's • Program Video Poster™, using IBM or MAC via modem •Control external relays • Video Poster™ Instructions on VHS tape • *Ask about MAC & IBM Video Poster™ page design program "MACP" $179.95*

Model	Price	Description of "Video Poster" ™ Options: *Call for Demo tape*
RAMX	$349.95	Video Poster™; 600 page Battery backed RAM-disk, cables & manual
C64	$179.95	Refurbished computer, with power supply (1 year warranty all products)
Modem	$ 89.95	1200 baud Hayes modem for remote page transfer
BCLK	$ 69.95	Battery clock (with RAM) restores time & date if power fails
PK8	$179.95	Controls 8 relays + DVM2; "WX1 & WSDM "+ IR inputs
WX1	$189.95	Temp.+Humidity ; WX1B $249.95 inc. barometric pres.
WSDM	$279.95	Anamometor Wind speed and direction; (Req. PK8)
RAIN	$249.95	Rain gauge daily, yearly total s in .01" increments
1541	$189.95	Disk drive; unlimited back up for RAMX
TSP1	$379.95	Text-to-speech computer voice message each screen.
DVM2	$379.95	Page controlled Digital audio;10 messages, 2 min.
UPS1	$279.95	Uninterruptible power with 5 hour batteries

Options



NEW Apple™ Macintosh MAC Video Poster™ photographs & Graphics

√Multiple Graphics & Hi res photos display on all pages
√Create flash, crawl text with photo graphics display pages
√Remote control and page insertion via Macintosh
√Works with all new A/V Macs or NTSC display adapters
√Features all MAC fonts and 256 NTSC color resolution
Model "MACP" Video Poster™ for Macintosh $495.00

Engineering Consulting Tel: 714-671-2009 Fax: 714-255-9984
583 Candlewood St. Brea, Ca. 92621•Mastercard•Visa•Discover•Amex•PO•COD

DESIGN EXTENDER
THE MAPPING INNOVATORS

A Division of GLA International

Est. 1982

- Strand Mapping
- As Built Mapping
- Rebuild Mapping
- Fiber Optic Routing
- MDU Surveys
- Map Digitizing
- System Design
- FTF-FTSA Design
- Fiber Optic Design
- Lode Data - AutoCad
- Lynx, Focus, CableView
- Microstation (DGN) Experts
- File Conversions DWG - DGN - DXF
- CAD System Sales & Training

425 Woods Mill Rd. South Ste. 300 Town & Country, Mo. 63017
Phone: 314-579-4627 or 800-875-8786 Fax: 314-579-4628

TEST EQUIPMENT

Reconditioned Wavetek, HP, Tektronix and more. Signal Level Meters, Sweep Systems, TDR's, Power Meters, Spectrum Analyzers, Frequency Counters and Fiber Test Equipment. Guaranteed to meet/exceed manufacturers specs. 90 day warranty standard.

SATELLITE ANTENNAS

Used Scientific Atlanta, Andrews, Vertex, RSI and others. 7 meter and up.

PTL Cable Services Inc. USA • Phone (407) 747-3647 • Fax (407) 575-4635
BUY-SELL-TRADE

JONESURPLUS

WE BUY AND SELL QUALITY CATV EQUIPMENT

LINE AMPLIFIERS, TAPS, CONNECTORS
CONVERTERS - ALL TYPES AND MAKES
HEADEND EQUIPMENT

USA • (619) 757-3008 • Fax (619) 757-4048

IF YOUR LIGHT IS OUT, YOU COULD BE FINED!

Avoid Costly FCC Fines with CFT's

TowerSentry™

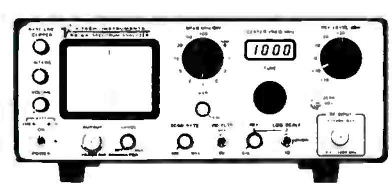
For more information on how to put TowerSentry™ to work for you, call...

1-800-448-8099

Tower Light and Transmitter Monitoring Specialists

PS -2A SERIES
PORTABLE SPECTRUM ANALYZERS

HIGH PERFORMANCE AND EASY OPERATION



Price $1895

- 0.1 - 1000MHz range in one scan.(0 - 100MHz in 11 selectable span widths)
- Measurable Range -108 dBm to +20 dBm
  -118 dBm to +20 dBm (optional PS-2A Special)
- 5 resolution bandwidths (10 KHz - 1 MHz)
- 50dB input attenuator in 10dB steps
- 2 / 10 dB LOG scale display with base line clipper
- 10 Turns tuning
- Built - in AM / FM demodulation with speaker
- Digital controlled center frequency display
- Tracking generator (optional PS 2A TG01)
- 3 way power sources (optional + 12 VDC battery)
- Compact size (10.3"W x 4.0"H x 12.3"D), light weight (approx. 10 lbs)

V. TECH Instruments, Inc. 171 Burns Ave.Lodi, NJ 07644
TEL:201-546-7635 FAX:201-546-7651

Wheeler Reeler

HYDRAULIC CABLE REEL TRAILER

Features:
- Easy, One Person Operation
- Designed With Low Center of Gravity
- Very Simple Maintenance
- Telescoping Loading Mechanism
- Versatility in Size of Spool
- Hoses & Wiring Protected Within Frame

SLABACH CONSTRUCTION COMPANY
215 14th STREET
KALONA, IOWA 52247
TELEPHONE (319) 656-3434
FAX (319) 656-5486

BOUGHT / SOLD / SERVICED

G. I. VideoCipher II	- $299	I	Standard 24 PC	- $225
Mag. 5-330 Trunk	- $299	N	SA 330 Trunk	- $199
Jerrold SJ Trunk 301	- $199		Syl/Tex 2000 Trunk	- $199
Jerrold SJ Trunk 400	- $299		Jerrold JLE-400	- $ 85
Magnavox 5LE330	- $ 85	S	Jerrold SJ 450 Trunk	- $435
SA Slimline 450 Trunk	- $435	T	Jerrold SLE/SLR	- $ 19
SA 8525 w/ Remote	- $ 25	O	Hamlin CRX	- $ 12
Pioneer BC-2002/2	- $1.99	C	Tocom 5503-A	- $ 40
Assorted Taps	- $1.50	K	C-Cor 450 LE NEW	- $175

MINIMUM QUANTITIES APPLY - CALL FOR COMPLETE INVENTORY LIST

WE SERVICE WHAT WE SELL! SINCE 1982

ARENA SERVICES, INC.

ALL TYPES OF EQUIPMENT NEEDED - FAX LIST

(610) 279-8000 • 800-WT ARENA • FAX 279-5805

FREE 44pg Catalog & 80 Audio/Video Applic.

OPAMP LABS INC (213) 934-3566
1033 N Sycamore Av LOS ANGELES CA, 90036

RF Networks

CABLE MODEMS

- QPSK to 10 Mbps
- Ethernet over Broadband 10BROAD36

(602) 861-3652
FAX: (602) 861-0251

LEE ENTERPRISE

A Division of Diamond W Investments, Inc.

623 4th STREET • P.O. BOX 590 • DESHLER, NEBRASKA 68340

DOWNSIZE VCII CHASSIS KIT ... $ 99.50
VCII REPAIR OR EXCHANGE ... $ 80.00 TO 135.00*
"ALL PARTS & RETURN SHIPPING INCLUDED ON VCII'S"
VCRS UPGRADE OR EXCHANGE ... $ 379.50*
VCII WHITE LABEL FOR SALE ... $ 225.00*

MODULATOR REPAIR ... $68.50*
PROCESSOR REPAIR ... $68.50*
RECEIVER REPAIR ... $68.50*

Female Business Enterprise • **Complete Cable Equipment Repair**

1-800-551-0096 1-800-551-0096 1-800-551-0096

* Return shipping and minor parts included in price

LASHER

Repair Service

10 Day Turnaround

CABLE KRAFT TOOL CORP.
1572 Cartersville Hwy.
Dallas, GA 30132

404-443-2624

CELEBRATING OUR 10TH YEAR OF CATV & TELEPHONE LASHER SERVICE

TRAINING

FIBERWORKS COMPREHENSIVE TRAINING PROGRAMS

DON'T BE LEFT BEHIND!

Keeping up with all the new technologies is a challenge in itself.
There is a way to take advantage of the leap in technology.
And it's called Fiberworks.

- Fiberworks is a comprehensive series of training courses about cable television, fiber optics, digital network systems, technology and deployment.
- Developed by ANTEC, the company that introduced fiber optics to the cable television industry, courses emphasize solutions for today's evolving networks.
- ANTEC training programs are accredited through the International Association for Continuing Education and Training (IACET) to award Continuing Education Units (CEU's) to participants.

For more information about course content, course customization and available dates, contact our Training Administrator at the ANTEC Technical Training Center in Denver, Colorado. Call 1-800-FIBER ME (1-800-342-3763).

ANTEC

Emergency Alert Systems By

IdEA/ONICS

Up to 90 Channels
14 day delivery
Compatible with all headends

Affordable

Video units also available
(701) 786-3904
Fax: (701) 786-4294

ASK ABOUT COMPLETE SYSTEMS TO MEET THE NEW FCC MANDATE

TKR Repair Center

Quality Repair at Competitive Pricing

REPAIRS & SALES

- *In Warranty Repair*
- *Jerrold Addressable Repair Specialist*
- *DP5, DP7 & DPV7 / Panasonic 1402, 1403*
- *Remote Repair (URC 450, 550)*

Free delivery & pickup in certain areas

For more inforamtion contact:

TKR Repair Center

Tel: (908) 583-2026 • Fax: (908) 290-1677

25 Industrial Drive • Cliffwood Beach, NJ 07735

TCI AFFIL.

White Sands

Jumper Cables

CUSTOM MADE CABLE ASSEMBLIES INCLUDING:

F to F, N to N, BNC, RCA, F-81

Gilbert AHS	RG-56	Belden
LRC	RG-59	Times
Off Shore	RG-11	Comm/Scope
Amphenol	RG-213	Intercomp
	RG-214	

We will make any cable assembly. Quick delivery on all colors and lengths.

Fax: (602) 582-2915, PH: (602) 581-0331

335 W. Melinda Drive, Phoenix, AZ. 85027 USA

BRIDGEPOINT

COMMUNICATIONS INC.

Aerial	Underground
New Build	Rebuild
Fiber Placement	Upgrade Splicing
Installations	Splicing

(214) 780-1988

DALLAS • HOUSTON • PHOENIX • BOSTON • HONOLULU

NATIONWIDE INSTALLATIONS

NaCom a contractor with over 24 years experience offering outstanding customer service for:

- Residential Premise Wiring
- MDU's
- Drop Buries
- DBS

Call (800) 669-8765 Ext. 3046

NaCom

BUILDING COMMUNICATION SYSTEMS THROUGHOUT AMERICA

CDS — CAD DRAFTING SERVICES, INC.

Charles Wright
(815) 698-2564
Rt. 116 & I-57, Central Plaza
Ashkum, IL 60911

- Base Mapping
- Strand Mapping
- Digitizing Services
- As-Built Mapping
- System Design
- System Walkout

Specializing in high volume precision drafting.

"Quality service for all your cable drafting and design needs."

Call for literature.

SCTE Member

COMMERCIAL ELECTRONICS, INC.

CATV ENGINEERING SERVICES

Your complete source of electronic components also specializing in

EQUIPMENT REPAIRS ◆ METER CALIBRATIONS ◆ FCC PROOF OF PEFORMANCE

FREE PICKUP IN 18 STATES

800-247-5883

EDJ COMMUNICATIONS INC.

David Sylvestre
203-953-9240

WIRELESS SERVICE

Area Evals
Data Base Information
Wireless Installs/Roof & Trees
MDU Prewire/Postwire
65' Tower Trucks for Site Surveys

CATV DESIGN ASSOCIATES, INC.

SCTE SUSTAINING MEMBER

SINCE 1979

- *Design*
- *Strand Mapping*
- *As-Built Mapping*
- *AutoCad Drafting*
- *Cad Training/Setup*
- *Scanning Services*

5524 Bee Caves Rd., Suite C1 • Austin, Texas 78746

Steve Williams
President

(512) 328 -2461 • Fax (512) 328-3009

LEMCO

CALL FOR YOUR CATALOG

800-233-8713

THE TOOLS OF THE TRADE

CCI — CABLE CONSTRUCTORS, INC.

COMPLETE TURNKEY CONSTRUCTION 1-800-338-9299

- Coaxial and Fiber
- Mapping and Design
- Member SCTE
- Splicing and Activation
- Fusion Splicing
- Aerial, Underground & Fiber Construction
- Material Supply
- Emergency Fiber Restoration
- System Sweep
- Proof of Performance
- Turnkey Headend
- Complete Turnkey Project Management

quality service performed on a timely basis

Need to hire technical people?

Call Rebekah Markheim at 1-800-325-0156 for Business Directory information!

Wanted!

Experienced long term help for Southeast rebuilds/upgrades

Aerial Crews
Underground Crews
Splicers
Installers
Field Engineers

CABLE MAN, INC.
Call (601) 374-5832
Fax: (601) 374-2198

Superior Jobs For Superior Candidates– From Techs To Execs

Positions Throughout The Broadband Industries

Mark Clancey is a former technician, engineering manager and executive, so _he knows your needs._

Phone: 714-488-8855 FAX: 714-488-8858
E-mail: broadband1@aol.com

Broadband Resource Group

P.O. Box 639, San Juan Capistrano, CA 92639

Peter Froehlich & Co. executive search

SCTE Sustaining Member

P.O. Box 339 Weatherford, TX 76086
(800) 742-4947 FAX (817) 594-1337

All levels of Technical Positions - Corporate to Hourly. Operations and Manufacturers

Call or Write. Fees Paid.

AEROTEK

ENGINEERING AND DOCUMENTATION SERVICES

currently has positions available across the country for:

Installers	Technicians	Audit
Coax Splicers	Fiber Splicers	Quality Assurance
Project Super	CATV Designers	CATV Trainer
R.F. Engineers	Cad Drafters	Field Walkout

Fax resume and salary history to Aerotek c/o Danny Kern
Fax # (214) 690-6014 or mail to: PO Box 831090
Phone # (800) 998-2742 Richardson, TX 75083

Continental Cablevision, a leading provider of quality cable services, is currently seeking qualified candidates for the following openings:

TECHNICAL OPERATIONS SUPERVISOR

Develop and manage a superior technical service team. The successful candidate will possess 5-plus years progressive experience as a CATV service technician; extensive working knowledge of CATV system design and operations and exceptional employee development/management skills and experience. Candidates must also possess excellent communication, interpersonal, and customer relations skills. A Bachelor's degree in a related area a strong plus.

SYSTEMS DESIGN SUPERVISOR

Develop and manage our construction design function. The successful candidate will possess a BSEE, supervisory and project management skills/experience. Candidate should also possess excellent organizational, communication and interpersonal skills. A working knowledge of CAD and 3-plus years experience as a project engineer in a related industry is a plus.

Continental Cablevision offers competitive compensation and excellent benefits. Qualified candidates should submit an application or resume with salary requirements to:

Continental Cablevision

H.R. Department
1520 West Main Street • Suite 201
Richmond, VA 23220

Continental Cablevision is an EOE/M/F/V/D

Career Opportunities - Southern California

Rossmoor Electric, Inc., an independent cable operator, serving 13,000 customers in the Southern California area, has openings for a Headend/Fiber Optic Facility Engineer and System Technicians. The system will undergo a 100% rebuild this Fall using Fiber to Feeder technology.

Headend/Fiber Optic Facility Engineer: The successful candidate will have 5+ years experience, a thorough knowledge in broadband system design and underground construction practices using coax and fiber technology including return. Experienced in the development of computer aided design system standards and a good working knowledge of AutoCAD, Lode Data, GIS mapping, SQL database structure and Lisp programming. A good working knowledge of FCC, OSHA and NEC rules and regulations. Excellent communication and managerial skills.

System Technicians: The successful candidate for this position will have strong technical experience in Headend operations, broadband video, fiber optic transport technology, FCC proof of performance procedures, troubleshooting and outage management. Experienced in sweep and balance procedures for fiber optic nodes, RF amplifiers and line extenders for both 750 MHz forward and 5-40 MHz reverse operation. Knowledgeable in FCC, OSHA and NEC rules and regulations.

A valid California drivers license and good driving record required, Qualified candidates should mail or fax resumes with salary requirements to:

Rossmoor Electric, Inc.
Attn: Personnel
23272 Vista Grande Drive, Suite A
Laguna Hills, CA 92653-1409
No phone calls please, resume receipt cannot be acknowledged.
An equal Opportunity Employer M/F/D/V

The following is a listing of some of the videotapes currently available by mail order through the Society of Cable Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers must add 20% when ordering.

☛ *Supervisory and Management Skills* — Rollins University Professor Dr. Bill Brown deals with such topics as employee turnover, absenteeism and poor job performance. How can you turn these problems around? Is money the answer? What do employees hope for in an ideal effective and motivating leader? This program provides insight to these problems that face every cable operator. (1 hr., 15 min.) Order #T-1074, $45. **(Reference for BCT/E Category VII)**

☛ *Data Transmission Techniques* — Andy Paff and Don Patton discuss alternative access and the CATV industry's competition with the telcos for the lucrative data transmission market, providing an analysis of the regulatory and operational problems that CATV companies will face in this market. Required equipment also is discussed. (70 min.) Order #T-1076, $45. **(Reference for BCT/E Category VI)**

☛ *Installing Fiber-Optic Cable* — If your system is planning to install fiber, or would just like to see the techniques, this presentation, which features Ken Carter, Larry Nelson and Dan Pope, is for you. This practical overview also offers solutions to common problems encountered in such installations. (1 hr.) Order #T-1077, $35.

Note: The videotapes are in color and available in the NTSC 1/2-inch VHS format only. They are available in stock and will be delivered approximately three weeks after receipt of order with full payment.

Shipping: Videotapes are shipped UPS. No P.O. boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: a $15 surcharge will be collected on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required, or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 669 Exton Commons, Exton, PA 19341 or fax with credit card information to (610) 363-5898.

August

13-15: Great Lakes Expo, Indiana Convention Center, Indianapolis. Contact (317) 845-8100.
13-15: Society of Cable Telecommunications Engineers technical sessions, Indiana Convention Center, Indianapolis. Contact Great Lakes Cable Expo, (317) 845-8100.
13: SCTE Old Dominion Chapter seminar, BCT/E Category IV tutorial, BCT/E and Installer exams to be administered, Continental Cable regional training center, Richmond, VA. Contact Margaret Fitzgerald, (703) 248-3400.
15-16: Antec Fiberworks training seminar, compressed video: Concepts and transmission, Denver. Contact Karen Olheiser, (800) FIBER-ME.
16: SCTE Ohio Valley Chapter seminar, Cincinnati. Contact Frank Adams, (216) 826-2941.
17: SCTE Great Plains Chapter seminar, system maintenance, Shaw Hastings Holiday Inn, Hastings, NE. Contact Randy Parker, (402) 292-4049.
17: SCTE Northern New England Chapter seminar, test equipment, Ramada Inn, Portland, ME. Contact Bill DeRochers, (207) 646-2672.
17: SCTE Ohio Valley Chapter seminar, test equipment, Cleveland. Contact Frank Adams, (216) 826-2941.
18: SCTE Great Plains Chapter testing session, BCT/E and Installer exams to be administered, Holiday Inn, Hastings, NE. Contact Randy Parker, (402) 292-4049.
20: SCTE Heart of America Chapter seminar, technology update, in conjunction with the Missouri State Cable Telecommunications Show, Tan-Tar-A Resort, Lake Ozark, MO. Contact David Clark, (913) 599-5900.
21-24: Antec Fiberworks training course, digital networks, Chicago. Contact (800) 342-3763.
21-24: Siecor training course, fiber-optic installation and splicing, maintenance and restoration for CATV applications, Keller, TX. Contact (800) 743-2671, ext. 5539.
21-25: General Instrument training course, broadband communications network design, San Francisco. Contact Lisa Nagel, (215) 830-5678.
22: SCTE Heart of America Chapter testing session, BCT/E exams to be administered, Lake Ozark, MO. Contact David Clark, (913) 599-5900.
22-24: C-COR training seminar, cable TV technology, Portland, OR. Contact (800) 233-2267, ext. 4422.
22-25: Antec Fiberworks training seminar, digital networks, Chicago. Contact Karen Olheiser, (800) FIBER-ME.
23-26: Rocky Mountain Expo, Snowmass Resort Convention Center, Snowmass, CO. Contact (303) 863-0084.
24: SCTE Greater Chicago Chapter seminar, installer basics, Holiday Inn, Willowbrook, IL. Contact Bill Cohn, (800) 544-5368.
24: SCTE New England Chapter testing session, BCT/E and Installer exams to be administered, Best Western, Marlboro, MA. Contact Tom Garcia, (508) 562-1675.
24: SCTE Shasta/Rogue Chapter seminar, BCT/E and Installer exams to be administered, Miners Inn, Yreka, CA. Contact Mark McIntosh, (503) 476-6362.
24-25: SCTE Rocky Mountain Chapter seminar, OSHA's view of the cable TV industry's safety record, hands-on demonstration of high-voltage safety equipment, and Cable-Tec Games, Snowmass Convention Center, Snowmass, CO. Contact Mike Phebus, (303) 795-1699.
25: SCTE Wheat State Chapter testing session, BCT/E exams to be administered, Great Bend, KS. Contact Jim Fronk, (316) 792-2574.
28-30: Eastern Show, Inforum, Atlanta. Contact (404) 252-2454.

Planning Ahead

Oct. 10-12: Atlantic Cable Show, Atlantic City Convention Center, Atlantic City, NJ. Contact (609) 848-1000, ext. 213.
Oct. 31-Nov. 2: Private Cable & Wireless Show, Miami Beach, FL. Contact (713) 342-9826.
Nov. 29-Dec. 1: The Western Show, Anaheim, CA. Contact (510) 428-2225.

By **Bill Riker,** President, Society of Cable Telecommunications Engineers

"Best hardware show in the biz"

The numbers are in. There was a total of 6,800 attendees and exhibitor personnel at Cable-Tec Expo '95, reflecting a 30% increase over last year's figures. Over 320 exhibitors presented their equipment and hardware in what one exhibitor representative referred to as "the best hardware show in the business." Once again in this column, I would like to thank all of the attendees, speakers and exhibitors who made this Expo the tremendous success that it was.

Keynote address

Cable-Tec Expo '95 was kicked off by our Annual Engineering Conference, which featured a videotaped keynote address by Federal Communications Commission Chairman Reed Hundt. In this presentation, he emphasized that in developing standards for the cable telecommunications industry, the FCC will need, and welcomes, input from people working in the industry to help guide the direction of these standards.

New headquarters

Expo '95 offered its 3,900 attendees the opportunity to enjoy a variety of unique offerings pertaining to the past, present and future of our industry. A booth in the registration area, at which plans for the new SCTE headquarters building were on display, offered a unique insight into the next milestone in the Society's future. The architectural designs were accompanied by an artist's rendering of the completed building and surrounding area. Currently, the project is proceeding as planned and the target date for completion is still December of this year.

Kudos

At this year's annual Awards Luncheon, held June 14, the opening day of Expo '95, Crown Cable of Alabama (now Marcus Cable of Alabama) received the 1995 Chairman's Award in recognition of its support of SCTE's Installer Certification Program. Many of the company's employees enrolled and were certified in the program over the past year and the company continues to strongly promote training and certification among its technical personnel.

James Haag received the 1995 Member of the Year Award in recognition of his extensive service to the Society. As chairman of the Interface Practices Subcommittee for the last three years and an active member of the subcommittee for the last five, he has played a major role in the subcommittee's prolific development of technical specifications and test procedures.

The fourth annual Field Operations Awards were presented in recognition of the technical ingenuity of SCTE members in the field. First place went to Bela Zador of Jones Intercable for his entry "The Cable Signal Status Indicator." Mark Button of TCI of Denver was awarded second place for submitting "The Line Tracer." Third place was awarded to Peter Carr of DuCom Inc. for "Adjusting Audio Level with a RMS Voltmeter." All 12 of this year's entries are being published in the Society's monthly newsletter, *Interval*, enabling our members to use the ideas in the field to the benefit of their employer and, ultimately, the subscribers, through improved service and efficiency.

Member meeting, training

The exchange of ideas, as exemplified by the Field Operations Award competition, is a crucial element of Cable-Tec Expo and the Society as a whole. The Society's Annual Membership Meeting, held June 14 following the Engineering Conference, provided an ideal forum for a candid discussion of SCTE's operations and programs.

The unique format for this meeting, whereby four board members from our 73 chapters and meeting groups read questions submitted by the chapters and general membership to a panel consisting of the Society's national board and staff, did the members a great service as it ensured that their questions and concerns were addressed in an orderly, concise fashion.

Questions raised dealt with Broadband Communications Technician/Engineer (BCT/E) testing, the new national headquarters building, the Society's financial statistics, providing Society material as computer data for chapter use, the activities of the national board, and many more issues of interest to the members. I feel that all questions were answered to the membership's satisfaction and the feedback and suggestions that resulted from this meeting will positively affect our future offerings as we enter a new era as the Society of Cable Telecommunications Engineers. (A full report on the Membership Meeting will appear in this month's special Expo '95 issue of *Interval*.)

Of course, the main purpose of any Cable-Tec Expo is training. Through four Engineering Conference panels, four preconference tutorials, 10 breakout workshops (one of which offered separate presentations on the categories of the BCT/E program), technical demonstrations by exhibiting companies, and ample hands-on demonstrations offered on the exhibit hall floor, I don't think any other trade show in the industry offers more, or better, cable telecommunications training.

If you weren't able to join us, you can still benefit from the training presented. Our 430-page *Cable-Tec Expo '95 Proceedings Manual*, which collects each of the papers from the Engineering Conference, as well as summaries and resource material for each of the Expo's training workshops and preconference tutorials, is currently available from the Society at a low show price.

In addition to this valuable resource, SCTE videotaped each of the Engineering Conference panels and many of the workshops and these videotaped presentations also are available from the Society. If you are interested in ordering these tapes, the proceedings manual or any of the Society's incredible array of technical training videos and publications, please contact SCTE national headquarters at (610) 363-6888.

I am delighted that so many of you could join for this year's conference, and appreciate your kind comments. I hope to see you at Cable-Tec Expo '96, June 10-13 in Nashville, TN. It is a great challenge to continuously improve upon the previous year's Expo, especially one as successful as this year's, but with all of your participation, I am certain it will continue to grow, and prosper. **CT**

Cheetah™

Finally, a Spectrum Analyzer for the End-of-Line

Cheetah PC-1000 Performs In-Service Distortion Tests

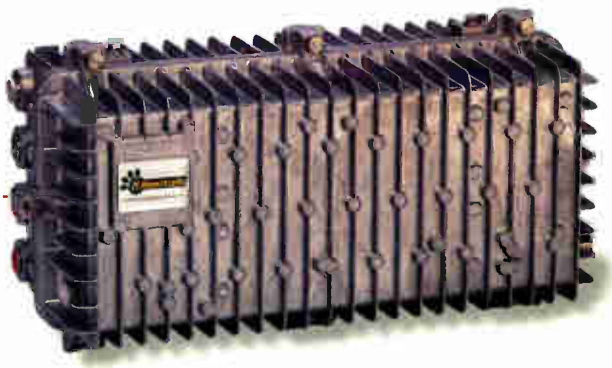
COMPLIANCE TESTING

A true end-of-line spectrum analyzer, the PC-1000 performs remote diagnostics, alarm monitoring and FCC compliance testing. You save the time and hassle of carting "portable" spectrum analyzers to the field to perform tests manually.

Place the PC-1000 at required FCC test points and other strategic locations for automated compliance testing. It completes non-interfering distortion tests including CSO, C/N, Hum and In-Channel Frequency Response. This provides you the ability to continuously monitor and alarm on distortion parameters without disrupting service.

Make the PC-1000 part of your status monitoring and performance measurement plans!

For more information, call **(813) 756-6000.**



- Full spectrum analysis capabilities
- 5 MHz-1 GHz operation
- Frequency agile RF data modems
- Automatic corrections for scrambled channels

SUPERIOR ELECTRONICS GROUP, INC.

6432 Parkland Drive ▲ Sarasota, Florida 34243 ▲ Phone (813) 756-6000 ▲ Fax (813) 758-3800

Reader Service Number 105


GO
LIKE
HELL
Building "the highway" comes down to attitude.