Phillips COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Telecommunications Engineers

SCTE Cable-Tec Expo registration inside

HFC

Blue sky? No more.

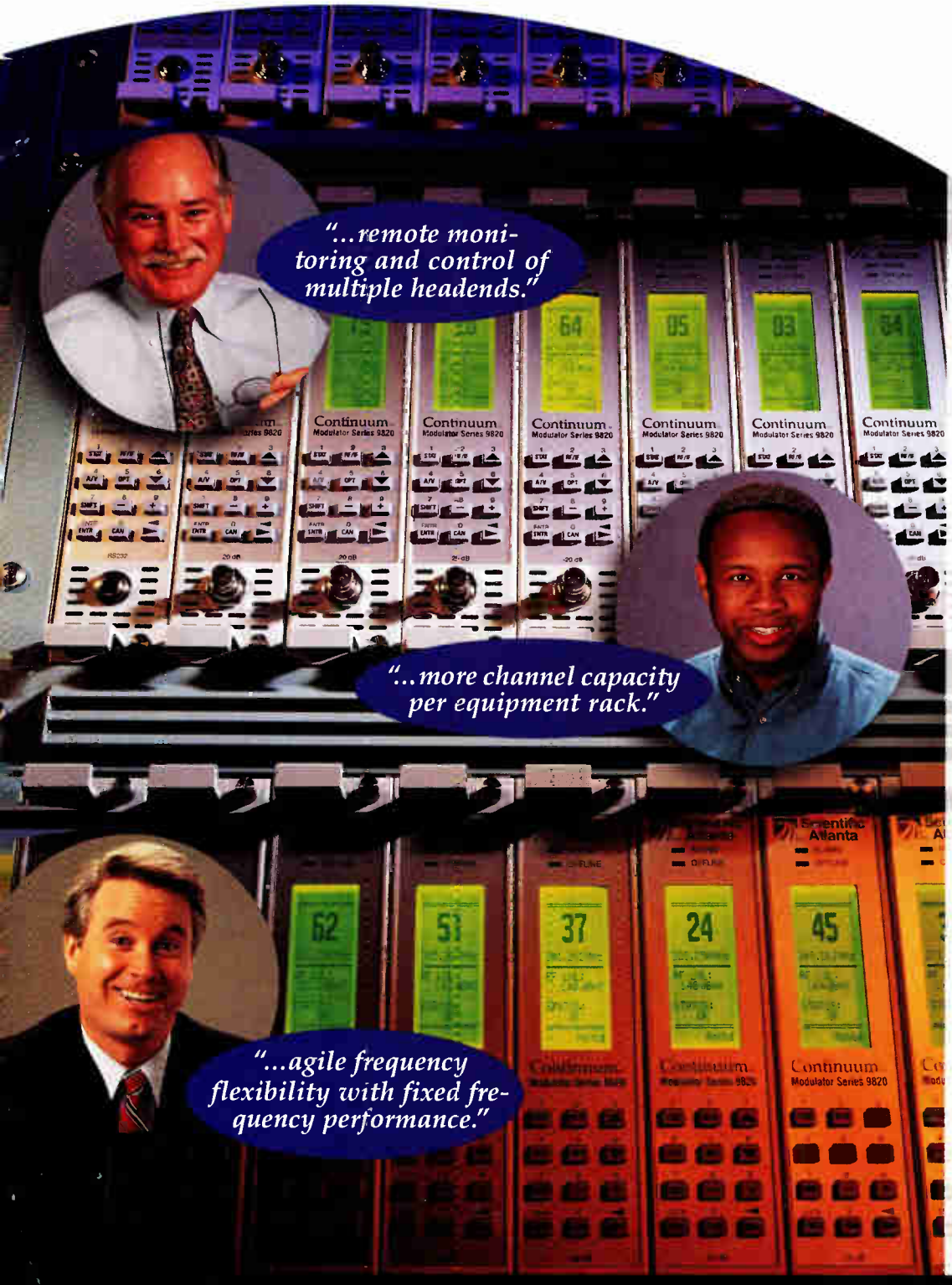
Also...

- Interactive TV focus
- Interview: CableLabs' Richard Green

April 1997

EXPECT MORE
FROM YOUR HEADEND.

Scientific Atlanta



Prepare to have your expectations exceeded. Our new Continuum headend system brings together everything you need to be a leader in video delivery services:

HARDWARE

- *Multiple functions in one chassis*
- *Universal AC and/or -48 VDC powering*
- *Space-efficient vertical packaging*
- *Front loaded, plug and play modules*
- *Comprehensive status monitoring*
- *NTSC and PAL formats*
- *Automatic, prioritized back-up*

SOFTWARE

- *Distributed client/server architecture*
- *Win95, WindowsNT, UNIX compatible*
- *Third-party interoperability*

And the list goes on. Call 1-888-HEADEND for the complete Continuum story, or visit us at http://www.sciatl.com.

Introducing: Continuum™ Headend System

Platform for the 21st Century

Reader Service Number 46

Look To Sencore/AAVS For All Your Video Testing Needs.

Photo Courtesy of Whitestone Corp.

Sencore/AAVS has the instrument to make your video troubleshooting journey easier and faster than ever before. Whether you're working with analog, CCIR601 composite or serial digital, or MPEG-2 compressed digital video – we offer unique and specialized instruments with exclusive tests and analyzing capabilities that will simplify your life – and ultimately make your customers happier.

Reader Service Number 2

SENCORE AAVS

3200 Sencore Drive, Sioux Falls, SD 57107

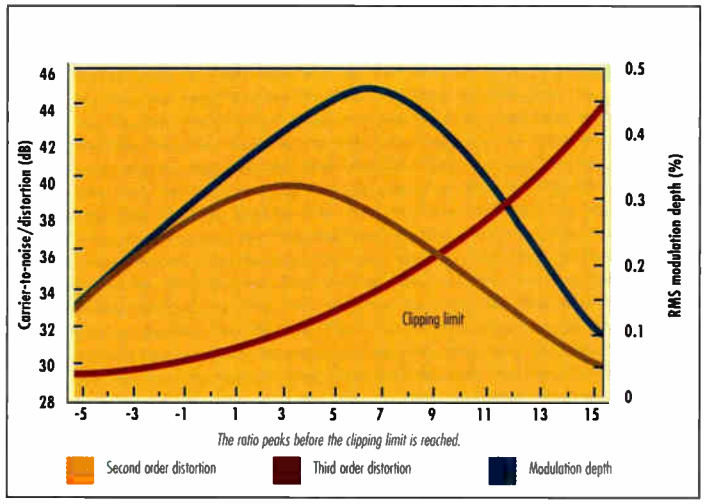
We are your complete video analyzing connection.

For more information on Sencore or AAVS's complete product line, simply call 1-800-SENCORE (736-2673), or 1-800-769-AAVS (2287) today.

CONTENTS APRIL 1997

DEPARTMENTS

SCTE News • 14



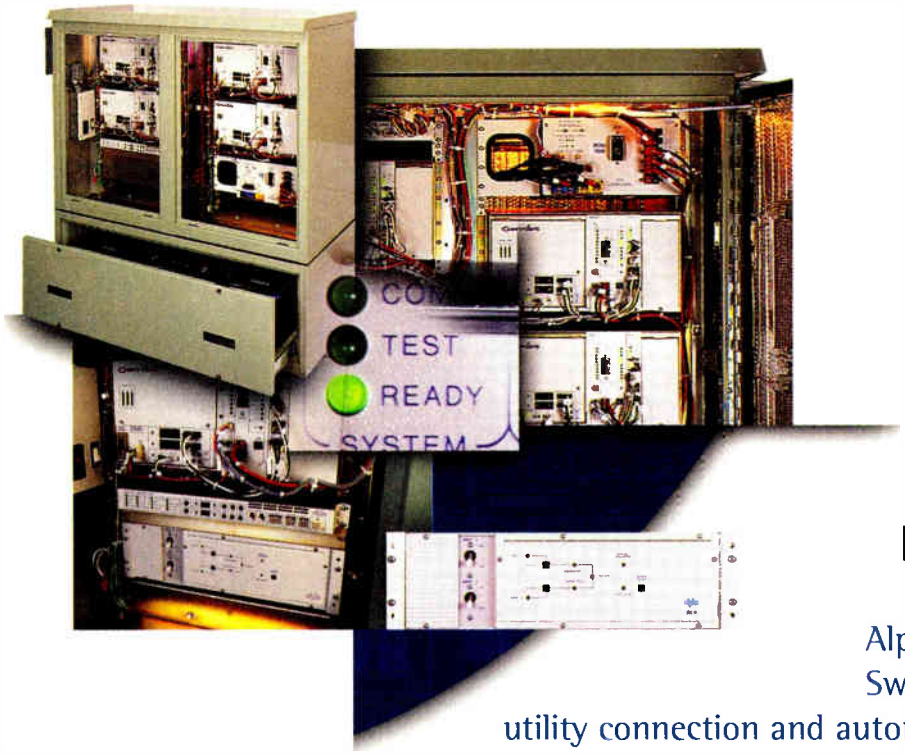
DFB in the return • 52

Digital video • 59

FEATURES

 Communications Technology™ (ISSN 0884-2272) is published monthly, except twice in July, by Phillips Business Information Inc., 1201 Seven Locks Road, Suite 300, Rockville, MD 20854, USA. Editorial and sales offices located at 1900 Grant St., Suite 720, Denver, CO 80203 USA, (303) 839-1565. April 1997, Volume 14, Number 4. Periodicals 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 20854.

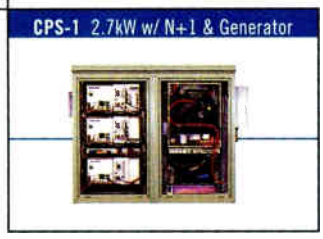
The [Power] of Systems.



Multiple POWER GRIDS

Alpha's Grid Transfer Switch provides dual utility connection and automatic transfer between primary and secondary utility grids.

The GTS works with Alpha's Genasys™ Power Node Systems by accessing the overlapping power grids that cover many cities to provide another cost-effective source of backup power. Used with standby batteries and engine generators, the GTS provides ultimate reliability with up to four independent sources of input power.



Alpha's full line of broadband power solutions - available from 1350 to 8000 watts - provide centralized node powering for enhanced revenue-generating and critical lifeline services. Flexible configurations include low-profile and minimum footprint designs, co-location of the fiber and power node and fully integrated engine generators. **Investigate the [Power] of Alpha @ 800-421-8089**

ISO 9001 REGISTERED COMPANY

ALPHA TECHNOLOGIES 3767 Alpha Way Bellingham, WA 98226 **Tel:** 360-647-2360 **Fax:** 360-671-4936 **Web:** www.alpha.com

Reader Service Number 5

EDITOR'S LETTER

Satellite must-carry?

From its inception, the Federal Communications Commission has used "protection of local broadcasting" to slow the growth and maturity of cable telecommunications. It's a pity the Commission hasn't been as vigorous when it comes to direct broadcast satellite (DBS).

The FCC has scrutinized cable must-carry issues for nearly 35 years. Consider this chronology: In 1962, the FCC began a case-by-case regulation of cable systems that used microwave relay systems to bring broadcast signals from distant cities (Carter Mountain Transmission Corp., 32 FCC 459). In 1963, the U.S. Court of Appeals affirmed the FCC position in the Carter Mountain Transmission Corp. vs. FCC. The decision was the foundation of the FCC's "economic impact" rules that restrained cable's growth in the next decade (321 F. 2nd 359-D.C. Cir.).

In 1966, the FCC extended regulation to all cable systems and required systems in the top 100 TV markets to obtain FCC approval to import distant signals via microwave (Second Report and Order in Dockets 14895, 15233, and 15971, 2 FCC 2nd 725). In 1969, the FCC required cable systems with 3,500 or more subscribers to provide local origination programming (First Report and Order in Docket 18397, 20 FCC 2nd 201).

In 1973, Congress passed anti-blackout legislation that required sold-out games in pro football, baseball, basketball and hockey be made available for over-the-air TV, rather than cable or pay TV. In 1974, the FCC repealed mandatory local origination rules but required operators to buy and maintain local origination equipment for community use. In 1980, the FCC repealed rules that limited a cable system's ability to import distant signals. But it also required program exclusivity on local cable systems.

In 1988, the FCC issued orders to reinstate syndicated exclusivity. This gave broadcasters the right to request that local cable systems "black out" certain programs carried by distant stations.

My point? What is the FCC doing to force the suppliers of direct TV via satellite to provide carriage of local broadcast signals? Cable systems are not allowed to simply supply a switch at the back of the TV sets.

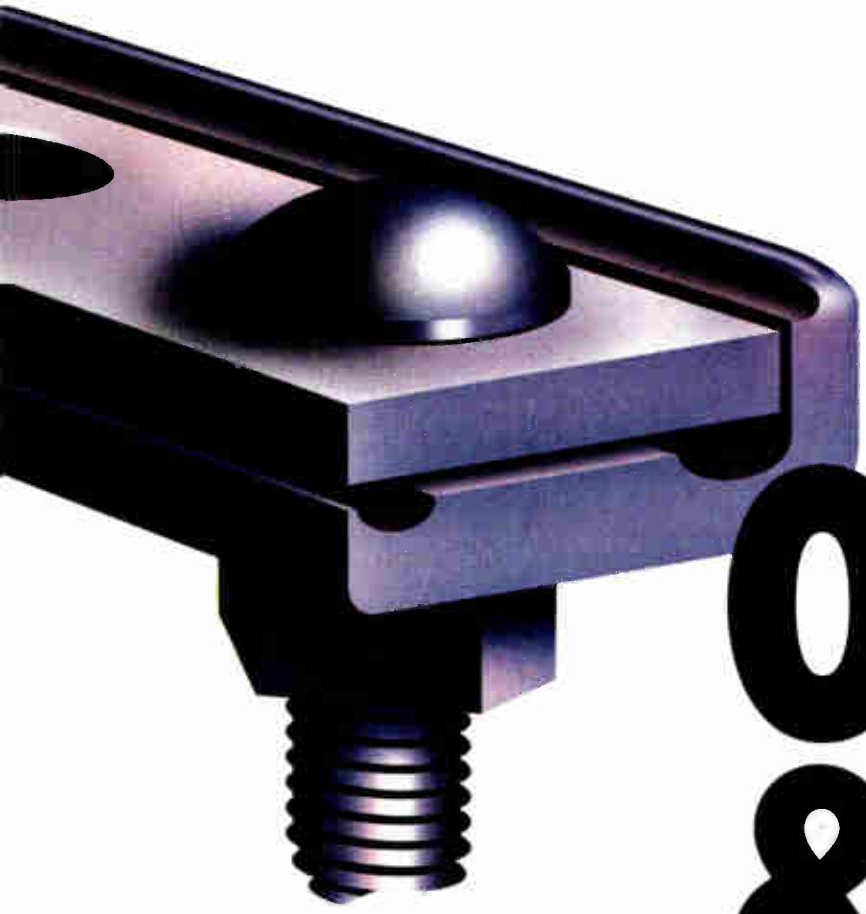
How important is the carriage of local broadcast signals to the customers? It must be pretty important: Recently, one of the largest regional Bell operating companies (RBOCs) decided against providing satellite TV service in one of the top-100 markets, reportedly because the local customers wanted to be able to receive local news and programming and were unwilling to put up with the inconvenience of using a switch.

And how about the FCC or other agencies studying the financial status of satellite TV companies in order to protect a citizen against waking up tomorrow and find out his satellite TV supplier has gone "belly-up" because it had to compete by giving away dishes and services to gain those new subscribers?

Why has there been no alliance with the broadcasters on the subject of noncarriage of local channels? Cable operators carry local broadcasts on their cable menus and always have. The FCC and the courts have said we should, in the name of serving the public and to protect the local broadcaster. Why aren't the local broadcasters screaming about direct satellite's failure to do the same?

Where's the FCC lately when regulatory playing fields need to be leveled?

Rex Porter
Editor



Over & Under

Wherever your system travels, we've got you covered. TeleWire Supply guarantees you fast delivery of a full line of products for both aerial and underground plant. From lashing wire to locking pedestals, we're your one-stop, one-call resource...whether your construction plans are up in the air, or on solid ground.

Satisfaction is always in stock.

TeleWire SUPPLY
AN ANTEC COMPANY

1-888-353-9473 • http://telewiresupply.com
Call for your free Product Catalog

Reader Service Number 151

COMMUNICATIONS
TECHNOLOGY

A CT Publications Product

EDITORIAL
EDITOR, Rex Porter
EXECUTIVE EDITOR, Alex Zavistovich
SENIOR EDITOR, Laura K. Hamilton
ASSISTANT MANAGING EDITOR, E. Brooke Gilbert
CONSULTING EDITOR, Toni Barnett
SENIOR TECHNICAL EDITOR, Ronald J. Hranac
TECHNICAL CONSULTANT, Michael Smith
INTERNATIONAL EDITOR, Alex Swan

ADVISORY BOARD
RICHARD GREEN, CableLabs (chairman)
JIM CHIDDIX, Time Warner
RICHARD COVELL, Ipitek
H. ALLEN ECKER, Scientific-Atlanta
JIM FARMER, Antec
RON HRANAC, Coaxial International
BOB LUFF, TV/COM International
DAN PIKE, Prime Cable
BILL RIKER, Society of Cable Telecommunications Engineers
MIKE SMITH, Adelphia Cable
TONY WERNER, TCI
WENDELL WOODY, Sprint/North Supply

ADVERTISING
MIKE ELMER, (303) 839-1565, ext. 34
DAVID GILLESPIE, (303) 839-1565, ext. 35
JOEL GORON, (301) 340-7788, ext. 2106
REBEKAH MARKHEIM, (303) 839-1565, ext. 33
EASTERN REGIONAL SALES MANAGER, Tim Hermes (301) 340-7788, ext. 2004
ADVERTISING PRODUCTION COORDINATOR, Denise Papathakis
DIRECTOR OF MARKETING & CIRCULATION SERVICES, Maxine Minar
MARKETING MANAGER, Allan Rubin
ADMINISTRATIVE ASSISTANT, Cathy Walker

PRODUCTION
SENIOR GRAPHIC DESIGNER, Maureen Gately
PRODUCTION MANAGER, Suzanne Hajec Roos
CIRCULATION MANAGER, Sylvia Sierra
READER SERVICE COORDINATOR, B. David Fisher
Subscription/Client Services—(800) 777-5006

BUSINESS
GROUP PUBLISHER, John O'Brien
PUBLISHER, Nancy Umberger
SENIOR PUBLISHER, Paul R. Levine—(303) 839-1565
GROUP EDITORIAL DIRECTOR, David Jensen
DIRECTOR OF OPERATIONS, Jim Colford
SENIOR VICE PRESIDENT/GROUP PUBLISHER, David Shaw

CT PUBLICATIONS CORP.
A division of Phillips Business Information Inc.
CT Sales and Editorial Offices
1900 Grant St. Suite 720, Denver, CO 80203
(303) 839-1565 Fax (303) 839-1564
e-mail: CTmagazine@aol.com

CORPORATE
THOMAS C. THOMPSON, President—Phillips Business Information Inc.
THOMAS L. PHILLIPS, President—Phillips Publishing International Inc.
TOM BURNE, Chief Financial Officer—Phillips Publishing International Inc.

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

SCTE BOARD OF DIRECTORS
At-Large Directors
WENDELL BAILEY, NCTA
TOM ELLIOT, TCI
WENDELL WOODY, Sprint/North Supply

REGIONAL DIRECTORS
PATRICK O'HARE (Region 1), Viacom Cable
STEVE JOHNSON (Region 2), Time Warner
ANDY SCOTT (Region 3), Columbia Cable
ROSA ROSAS (Region 4), Lakewood Cablevision
LARRY STIFFELMAN (Region 5), CommScope
ROBERT SCHAEFFER (Region 6), Star Cablevision Group
TERRY BUSH (Region 7), Trilithic Inc.
STEVE CHRISTOPHER (Region 8), CommScope
HUGH MCCARLEY (Region 9), Cox Cable Communications
MICHAEL SMITH (Region 10), Superior Electronics
DENNIS QUINTER (Region 11), Berks Cable
JOHN VARTANIAN (Region 12), Viewers' Choice

SCTE NATIONAL HEADQUARTERS
(610) 363-6888 Fax (610) 363-5898

Phillips SCTE BPA INTERNATIONAL

Standard and the FCC offer the perfect plan to improve your cash flow.

By now, the FCC's "Going Forward" rules are old news. But this unique opportunity to improve your cash flow, by adding up to 6 new channels, is as fresh as ever.

Here's the easiest way to take full advantage.

Plug in a channel today, cash in tomorrow.

Since the inception of our receivers and modulators, Standard has consistently advanced frequency-agile headend technology. With our any-channel-in, any-channel-out convenience, plus a whole host of options, you can be up and running in no time, to cash in on "Going Forward."

The easy way.

Start with our Agile IRD II, an RS 250 broadcast certified integrated receiver/descrambler that offers all the features you'll need: an industry standard dual conversion 70 MHz IF with TI loop, factory pre-calibrated video and audio controls and a fully synthesized PLL tuning circuit accurate to 100 KHz. And because the internal 950-1450 MHz active loop thru eliminates splitters and signal loss, adding multiple receivers is no problem. The IRD II is the receiver of choice when adding a channel.

Next, add our TVM550 series frequency agile modulator to achieve noise and spurious free performance, coupled with ultra-stable, artifact-free PLL synthesized tuning throughout the spectrum from 54 to 550 MHz. You want stereo? The TVM550S has stereo, eliminating the need for separate components, hassling with calibration, and additional rack space.

It makes sense.

Whether you add a single channel or the maximum six, generate the cash flow you need to upgrade your headend to the highest level of performance – Standard's Agile IRD II receiver and TVM550 series modulator.

Add a channel... the easy way. Call Standard today and go forward while it's still to your advantage.

The right technology... for right now.

Standard Communications

SATELLITE & BROADBAND PRODUCTS DIVISION

P.O. Box 92151 • Los Angeles, CA 90009-2151
310/532-5300 ext. 280 • Toll Free 800/745-2445
Fax: 800/722-2329 (Toll Free) • 310/532-0397 (CA & Int'l Only)

Canadian Address: 41 Industrial Pkwy S., Units 5 & 6
Aurora, Ontario Canada L4G-3Y5
905/841-7557 Main • Fax: 905/841-3693
Sales: 800/638-4741

Return on investment.

Retail cable modems announced

US Robotics says it will market its new cable modems directly to cable subscribers through retail outlets at a price "comparable" to analog modems. This is the first time a major modem manufacturer has said it would market the product this way, which obviously could save cable operators quite a bit in startup costs.

Full rollout of the products is scheduled for this Fall, and US Robotics is planning to run trials with a few operators this summer.

FCC sets rules for LMDS auction

The Federal Communications Commission issued much-anticipated local multipoint distribution service (LMDS) auction rules last month, and at least until the year 2000, cable operators and local exchange carriers (LECs) won't be joining in the fun that will be going on in their own backyards. The FCC ruled that cable ops and LECs can't bid on the LMDS spectrum within their own markets , but in 2000 they can purchase the 1,150 MHz licenses for each of the 984 basic trading areas.

The Commission put no limit on the number of licenses a company may acquire and also ruled that licensees must provide "substantial service" in their markets within 10 years.

Sprint drops video dialtone trial

Sprint recently decided to pull the plug on its video trial in Wake Forest, NC. The decision was good news to Time Warner, whose Cablevision Industries subsidiary was losing subscribers to Sprint's $29.95 48-channel package, which included two premium networks.

A North Carolina firm, Advantage Cable TV, provided the programming for the 750 MHz hybrid fiber/coax (HFC) overbuild and it offered to buy the network before Sprint made the decision to pull the plug on its 600 subscribers. Sprint sent its subscribers $100 each after they pulled out and has no more plans to offer video dialtone.

Adelphia keeps up modem rollouts

Adelphia Cable is continuing with its aggressive cable modem deployment schedule with a recent rollout of General Instrument's SURFboard modems in Northern Palm Beach County, FL. This follows the MSO's deployment of PowerLink modems in Buffalo, NY, Toms River, NJ, Pittsburgh and Coudersport, PA.

Adelphia Director of Digital Services Jorge Salinger told *CT* sister publication, *CableFAX*, "We have to

Is ingress making your return path a road to nowhere?

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

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

Now you can troubleshoot your system at all times. No matter how much ingress is present.

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

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

HEWLETT PACKARD

deploy quickly to stay ahead of the asymmetrical digital subscriber line (ADSL) curve."

He added that the company will upgrade its hybrid fiber/coax (HFC) plant in Buffalo to pass 65,000 households from the current 20,000 within the next three months.

US West plans cable investments

US West Media Group announced a plan to invest $1.2 billion-plus into U.S. cable TV operations, specifically in Continental and MediaOne, in the coming year.

The company plans to finance the venture largely through the sale of $1 billion worth of assets, possibly including stakes in the U.K. Flextech partnership, France's Bouygues Telecom and other small holdings.

MMDS hot on wireless modems

CorrectTV/Metro.Net, DirectNET and Selectview, three wireless companies hot on the idea of high-speed data delivery, announced orders for 60,000 wireless modems from Hybrid Network Technologies. According to the operators, they can enter a market with these modems and within a month, they can offer high-speed data since they don't have to upgrade plants to use the products.

The new Hybrid modems use 64-QAM (quadrature amplitude modulation) technology. Earlier versions used 4-VSB (vestigial sideband). The company says the products offer T-1 speeds, but their price is comparable to integrated services digital network (ISDN) technology.

Big box bust in Los Angeles

About 3,000 converter boxes were recovered and four people were arrested recently by the Los Angeles County Sheriff's Department.

The alleged cable theft ring's facilities in San Fernando Valley were raided following a six-month surveillance effort headed up by Continental Cablevision.

NOTES

• James Phillips left **Motorola** for **OmniView Inc.**, a company that produces 360° photographic images that can be viewed on CD-ROM and the World Wide Web. There he'll hold the title of chairman, CEO and president.

• **Cox Communications** selected **Harris Corp.**'s HNM enterprise network management package to manage its expanding operations venture in telecommunications. Cox plans to purchase multiple platforms for installation at its network operations center (NOC) being deployed in Atlanta.

• **AMP**, a supplier of interconnection products and systems, acquired **Fibernet**, a firm that designs, engineers and manufactures optical fiber systems, associated cabling hardware and test equipment.

• **Noyes Fiber Systems** recently received ISO 9001 certification for development of products for the fiber-optic industry. **CT**

Protect Your Investment!!!

SURGENDER™

Coaxial Surge Protection Device

Because it's not "if" you are going to get hit, it's when!

For more information on the Surgender call us or Surf The Web!!!

Our state of the art internet site has information and specifications on all of our fine products.

Ideal For Protecting:

Cable Modems ▪ Interactive Converters

Satellite Receivers ▪	Decoders ▪	Video Cameras and Monitors
Local Area Networks ▪	Television Sets ▪	Video Cassette Recorders
Projection TV's ▪	FM Receivers ▪	Home Entertainment Centers

PDI-Electronics For Telecommunications

1-800-242-1606 (561)998-0600 Fax (561)998-0608

http://www.pdi-eft.com E-Mail: PDI.Electronics@worldnet.att.net

PDI's Web site has animation and music that can only be seen and heard using Netscape Navigator or Microsoft Internet Explorer

electronics for pdi telecommunications

Sights from Orlando, FL, home of this year's Cable-Tec Expo.

Register now for Expo '97!

The cable telecommunications industry's premier hardware-oriented technical trade show and conference, Cable-Tec Expo, will be held June 4-7 in Orlando, FL. Society of Cable Telecommunications Engineers members were mailed registration packages, and the pack also is included in this issue of *Communications Technology* starting on page 94.

SCTE President Bill Riker announced that the Society will offer attendees "a superb technical program, as well as some new offerings designed to make it the most productive, educational conference to date."

Expanded exhibit hours top off the changes to this year's confab. Riker discusses other details of Expo '97 in "President's Message" on page 110.

See you in Orlando!

International chapter update

1996 was a very important and historic year for the Society of Cable Telecommunications Engineers' chapter development efforts, as it saw the inception of two international meeting groups. A significant amount of time and effort was allocated toward promoting SCTE on an international basis this past year. This effort was a direct result of requests expressing a need for technical training for cable telecommunications personnel based outside of the United States. SCTE has been working to establish relationships with several cable TV associations located within Mexico, Central America and South America. These associations include CANITEC from Mexico, TEPAL from Central and South America and ATVC from Argentina.

The Society's communication with these associations has been proceeding for the past two years. As a result of this contact, SCTE was and will continue to be invited to these groups' annual meetings and conventions. SCTE was recently represented at two of these international cable conventions—one in La Romana, Dominican Republic, for the TEPAL Cable Show; and the other in Buenos Aires, Argentina, for the ATVC/Jornadas Cable Show. At these events, the Society had the opportunity to meet with engineering and technical committees from these

Digital Ready for the Next Wave

NEW Wavetek Home Wiring Test System

Fault Location, Leakage, Ingress and Digital Tests in a Low-Cost Installer Meter!

Precision Testing... Be digital-ready to meet the expanding demands of the interactive revolution. With the CLI-1750 and LST-1700, you can ensure new or existing in-home wiring is ready for digital signals.

Only the CLI-1750/LST-1700 offers **FDR mode** for precise location of faults. FDR (unlike TDR) uses the *entire frequency range*, allowing you to detect cable cuts and kinks, bad connectors and splitters, plus other potential problems. You can even display a sweep response with this feature. This highly sensitive fault location helps maximize the use of existing home cabling.

Use the CLI-1750 with the LST-1700 Signal Transmitter to identify potential problems prior to activating these services. Limit subscriber callbacks and ensure optimal performance of new digital services.

Multi Featured... Along with in-home wiring tests, you also enjoy all the other great features you've come to expect from Wavetek meters:

- Frequency Agile Leakage Detection and Measurement
- Reverse Ingress Scan
- Digital Signal Measurement Option
- Simultaneous Multi-Channel Display
- Extensive Data Logging and Measurement Capabilities
- Go/No-Go Check for Compliance

Confidence... The Home Wiring Testing System is just part of the complete line of quality test and measurement equipment from Wavetek. Each delivers all the performance, precision, speed, and ease of use you demand — at a value you expect from a leader. Technicians around the world prefer Wavetek meters.

In the U.S. Call 1-800-622-5515

Worldwide Sales Offices

United Kingdom (44) 1603-404-824
France (33) 1-4746-6800
Germany (49) 89-996-410
Eastern Europe (43) 1-214-5110
United States (1) 317-788-9351
Southeast Asia (65) 356-2522
Asia Pacific (852) 2788-6221
China (86) 10-6500-2255
Japan (81) 0552-43-0310

WAVETEK

http://www.wavetek.com

Reader Service Number 15

organizations. Each is very interested in obtaining telecommunications technical training information for their operations personnel.

As a result of this interest, SCTE recently published two of its most popular technical training manuals in Spanish: TM-11S, *Identifying Pictures Problems in Cable Television Systems,* and TM-10S, *SCTE Installer Certification Manual.* In addition to talking about starting meeting groups of the Society in these countries, SCTE conducted very productive discussions on establishing promotion and distribution agreements between our organizations that would allow them to distribute SCTE technical publications to their members.

The first of the two new international meeting groups, the Central America Meeting Group, was established in Panama City, Panama. The group's board members all are employees of either Cable Onda 90, a cable operator in Panama, or Cable Color, an operator in Costa Rico. Anyone seeking information on the group's activities or wishing to become involved with the group's board of directors may contact its President Humberto Garcia at 011-507-264-7555 by phone or 011-507-223-7076 by fax.

The second new international meeting group was established in St. Johns, Newfoundland, Canada. The board members of this group are employees of the primary cable operator in the Canadian province of Newfoundland, Cable Atlantic. This group has named itself the Terra Nova Meeting Group. Members of this group's board of directors are very energetic and enthusiastic about making this new international meeting group a success. They have already held three technical training sessions since the middle of 1996 and they will soon be participating in the Installer Certification Program. Anyone having any questions concerning the Terra Nova Meeting Group or wishing to contact them should call the meeting group's vice president, Alfred Englehardt at (709) 753-7583, ext. 258, or fax to him at (709) 722-8384.

The Society will continue its efforts to work with the engineering

committees of cable organizations in Mexico and Argentina toward the goal of establishing SCTE meeting groups in these countries. Anyone interested in participating on the two existing international meeting groups or wanting information about starting other meeting groups outside the United States, please contact SCTE national headquarters at (610) 363-6888, fax to (610) 363-5898, or visit the SCTE Web site at http://www.scte.org.

Vendors' Day held in California

The Society's Central California, Golden Gate, Shasta/Rogue and Sierra Chapters held their Seventh Annual Northern California "Vendors' Day" event March 5-6 at the Concord Hilton in Concord, CA. First held in 1991, the event now attracts over 80 vendors and attendees from Northern California, Oregon and Nevada. Besides offering attendees the opportunity to witness demonstrations of equipment and services from industry exhibiting companies, the Vendors' Day also featured over 25 technical training sessions. For further information on what happened at the Seventh Annual Northern California Vendors' Day, contact Andy White at (707) 448-7478.

SCTE insurance now "three-in-one"

The SCTE Group Insurance Program is proud to present a unique "three-in-one" program to wrap around basic health insurance at an affordable rate. Called "Member Assistance," this new program combines hospital indemnity insurance with travel and personal assistance coverage. And it will be there when members need it—whether they are in the hospital, become ill or injured while traveling, or need confidential counseling assistance and referral services.

Member Assistance provides insured members with umbrella protection, including:

- **In-hospital** coverage to supplement medical insurance by helping pay the deductibles, insurance copayments and other "hidden" costs associated with a hospital stay;
- **Assist America** coverage to provide help with medical emergencies when traveling worldwide; and
- **Personal assistance** coverage, which offers a confidential hotline and referral service.

Backed by a leader in the industry, the Member Assistance In-Hospital coverage is underwritten by UNUM Life Insurance Company of America. The program's worldwide travel assistance services are provided by Assist America Inc., while Bensinger, DuPont & Associates provide the confidential, cost-free help for assessment and referral of personal and family problems.

To learn more about this program, call Seabury & Smith—SCTE's group insurance program's administrator—toll-free at (800) 424-9883. In Washington, DC, call (202) 457-6820. **CT**

By Rex Porter

Standards and beyond: Green pastures for CableLabs

Dr. Richard R. Green is president and CEO of Cable Television Laboratories Inc. (CableLabs). Prior to CableLabs, Green was senior vice president of broadcast operations and engineering at the Public Broadcasting Service. Before joining PBS, he helped organize and establish the Advanced Television Systems Committee.

From 1980 to 1983, Green was director of the CBS Advanced Television Technology Laboratory in Stamford, CT. In addition to his work at CBS in digital TV and high definition TV (HDTV), Green participated in the international standardization efforts that date from the late 1970s and chaired the committee that eventually developed CCIR (now ITU-R) Recommendation 601, a worldwide TV standard for digital signals. He is currently vice chairman of SG9, an ITU-T committee charged with the responsibility of recommending worldwide standards for cable TV.

While at CBS, Green helped to produce the first series of experimental programs mastered in HDTV in the United States. He also assisted in the production of a series of HDTV programs in 1982 in cooperation with European broadcasters.

From 1977 to 1980, Dr. Green managed ABC's Videotape Post Production Department in Hollywood and from 1972 to 1977 did basic research in laser technology for the Hughes Aircraft Co. in Los Angeles. Green served as a senior staff scientist for Boeing Scientific Research Laboratories (1964-1972) and as an assistant professor at the University of Washington.

Green is a member of Phi Beta Kappa, the American Association for the Advancement of Science, the Society of Cable Telecommunications Engineers and the Society of Motion Picture and TV Engineers. He holds a B.S. degree from Colorado College, an M.S. degree in physics from the State University of New York in Albany and a Ph.D. from the University of Washington.

In an open-ended question and answer format with *Communications Technology*, Dr. Green provided a "big picture" overview of the latest CableLabs initiatives and outlined what's ahead for the cable industry.

Communications Technology: *Could you briefly discuss CableLabs' 1996 successful projects?*

Richard Green: I think the most important achievements in '96, of course, were standards. CableLabs certainly plays a role in these efforts and we try to be the coordinating agency for the development of standards, and these were really industry achievements. The two major ones, of course, were the agreement on digital/video compression and a standard approach to digital compression decoders so that we can have interoperability between different manufacturers and basically throughout the cable universe. The second one was the cable modem and getting an industry agreement on specification for the cable modem. There was a lot of hard work on the part of many people in the industry pulling together to make that happen.

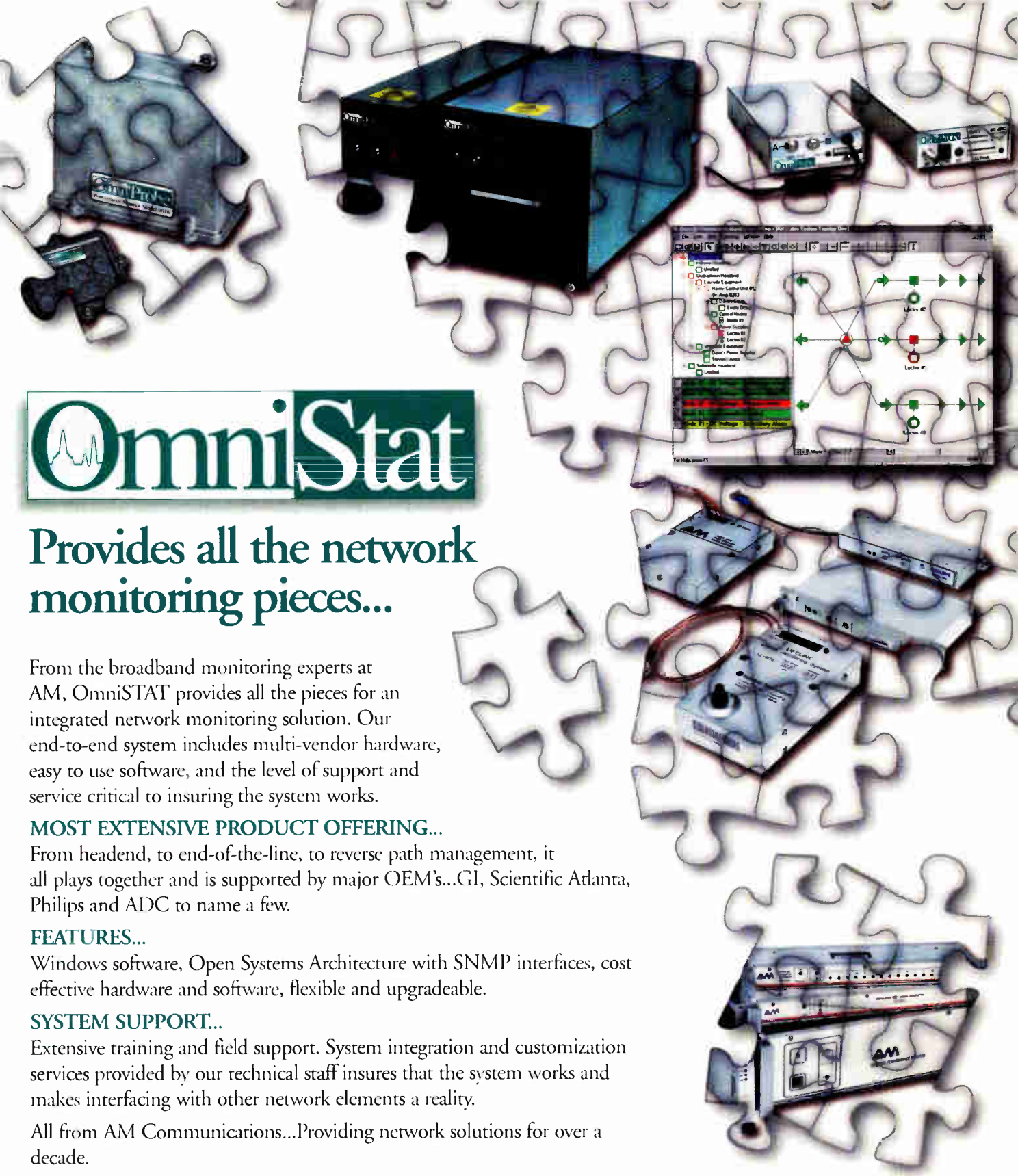
But of course, we have a lot of projects at CableLabs. Obviously, I would say that CableNet '96 was one of our signal achievements in that it was part of our effort to provide a leading edge in technology for the industry to give a look ahead at what technology holds in store for telecommunications and again incorporating those ideas into our plans in connection to our industry investment. The modem testing here at CableLabs certainly is an important element of our program.

The analysis and study of the return path was another achievement that I would point to in '96. What we've been able to do is collect very extensive data on the return path. The return path characterization tells you the basics you need to know to design equipment that will work well on the return path—the kind of fundamental knowledge that we didn't have before. We had a lot of anecdotal information, but now we have literally multiple gigabits of data on what the return path transition link is like and exactly what the noise looks like and mitigation strategy for digital signals, for example, that you can employ to correct those signals.

Another important achievement was the test equipment that was designed and constructed here, the continuous wave (CW) tester. There was no test equipment before that could capture and characterize even that. Now we can.

CT: *What is CableLabs' particular involvement in the specifications and the actual standards?* →

Rex Porter is editor of "Communications Technology." He can be reached in Phoenix, AZ, at (602) 807-8299 or via e-mail at tvrex@coax.com.



OmniStat

Provides all the network monitoring pieces...

From the broadband monitoring experts at AM, OmniSTAT provides all the pieces for an integrated network monitoring solution. Our end-to-end system includes multi-vendor hardware, easy to use software, and the level of support and service critical to insuring the system works.

MOST EXTENSIVE PRODUCT OFFERING...

From headend, to end-of-the-line, to reverse path management, it all plays together and is supported by major OEM's...GI, Scientific Atlanta, Philips and ADC to name a few.

FEATURES...

Windows software, Open Systems Architecture with SNMP interfaces, cost effective hardware and software, flexible and upgradeable.

SYSTEM SUPPORT...

Extensive training and field support. System integration and customization services provided by our technical staff insures that the system works and makes interfacing with other network elements a reality.

All from AM Communications...Providing network solutions for over a decade.

Guardrails for the Information Superhighway

100 Commerce Drive • Quakertown, PA 18951-2237 • (215) 538-8700

Reader Service Number 145

Green: Well, in the standards process, the fundamental step in moving toward a standard is getting an industry agreement. And that's our role. What we do is try to represent our operating companies in arriving at an industry agreement on what the standard ought to be and what the parameters should be. What are functional requirements? Once you've achieved an agreement throughout the industry, then the process moves out into what I call the "due process" world. CableLabs cannot determine a standard because we are not a due process organization. We are a membership organization that represents only one constituency—the operators. Once the operators have an agreement, then it goes into the due process organizations, which are the SCTE and the Institute of Electrical and Electronic Engineers.

These organizations are set up to represent local interests and to arrive at a standard specification beyond that role. At CableLabs we coordinate this process for the industry. We've been able to achieve several international standards by first getting an industry agreement, then working with the properly authorized standards organizations to get agreement in a broad field technical forum. We've then taken these to our State Department and they've become a matter of U.S. policy. Then we've taken them on to the International Telecommunications Union, where they've passed and become international standards.

CT: *Much is written and spoken about upgrading cable plants for high-speed data. And, of course, tightening a plant for high-speed data also tightens it up for other services. Why then aren't operators incorporating the use of addressable taps or interdiction to further modernize their systems?*

Green: I think what is very important to the industry right now is to study carefully the economic/technical equation for achieving the upgrade. It's very clear that we have a very powerful technology and we can provide the design and hardware that is available to employ and to upgrade cable plants to various end plants. We are in the process of doing that. Many MSOs are doing exactly that.

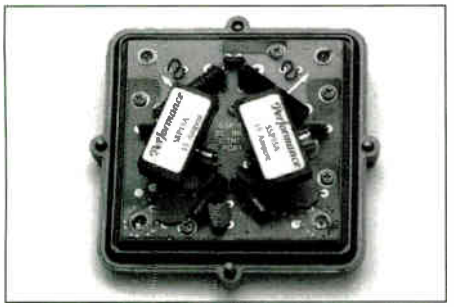
However, I think it's very prudent for an industry to keep reviewing the technology that's available, the technology changes, the economic changes, and in all cases, these are in a favorable direction—or in most cases, at least, they are in a favorable direction. The economics get more attractive, less expensive. The scale economics comes into play and that helps to reduce the operating costs as well as the capital costs for upgrading cable plants.

The new technology, as it comes along, has enormous impact on both the economics and the technical operation. We try to track those elements and make that knowledge available to our operators so that they know what's coming along. It's pretty clear that the economic equation is very

REPLACEMENT FERRO fits most manufacturers cabinets

The Performance Model FR2000 60V/16A Ferroresonant power supply is designed to replace or retrofit discontinued and obsolete power supplies. It fits most existing cabinet configurations and connects using existing wiring. Price is $299, call 800/279-6330.

Reader Service Number 115



SURGE-GARD protects against nuisance fuse blowing and resets in 60 seconds

Self-resetting circuit breaker fits fuse clips in Jerrold SSP power inserters. The Performance Surge-Gard replaces fuses in locations where they frequently blow for no apparent reason causing unnecessary truck rolls. Merely remove the undependable fuse and snap-in the Surge-Gard. Specify Model SG15A for 15 ampere protection. Cost only $17 (100 & up). Call toll free 800/279-6330.

Reader Service Number 116

VOLTEX CATV-27 Standby battery costs only $64.95

Best high temperature battery available!
Normally outlasts valve regulated gelled electrolyte batteries two to one in CATV applications and provides as much as 15% longer run time. By far the best battery value on the market today. Call Performance today for details 800/279-6330.

Reader Service Number 117

BATTERY TESTER checks 12 volt standby batteries automatically

The Performance Model BT 1200 universal battery tester checks gelled electrolyte and lead acid batteries in 10 seconds. Since batteries deteriorate gradually, regular testing with this unique device enables you to log changes in voltage levels as they occur. Having this history lets you know when to do preventive maintenance before a critical battery fails. Price is $250. Order today, call toll free 800/279-6330

Reader Service Number 118

important. You have to be very careful about the economics in doing these more advanced plants.

Operators are pretty thoughtful about how and when they are spending capital. They are more thoughtful than they have been over the last couple of years. That's a very healthy trend for the industry.

CT: *Some companies are pointing out that there are more practical uses for a tight cable TV plant than just data transmission. This translates to, "If there's no economies of scale, there is no improvement and it's got to pay for itself." Can you respond to this?*

Green: One of our projects here at CableLabs is to find uses and additional capabilities inherit in the hybrid fiber/coax (HFC) plant to offer new services that we hope are uniquely cable. One service that we're able to offer that we discovered early on is continuous activity. This means that when you connect your modem, you don't have to dial it up because it stays on all the time. It doesn't use network resources unless you're actually using it, and that's a much more modern concept than a dial-up switch network.

The old switch networks are having enormous problems in handling this new kind of desire in the market, which is being driven right now by data. That's representative of the kind of element or the kind of approach that we would like to take.

We want to find other things that the HFC plant is particularly adept at. And hopefully, too, also not only adept at it, but uniquely qualified to be able to do it, as it is in the connectivity.

CT: *Do you think that operators should be responsible for discussing the areas in which they are heading to their own engineering staff or does CableLabs serve to keep these kinds of things (such as addressable taps or interdiction) out in front of operators?*

Green: We're trying to look at the technologies and bring them to the attention of the operators where necessary. Some of those ideas may turn out to be very useful to the industry. In fact, I know some of them are usable and the question is, can

they be made economical soon enough to be useful to an operator?

These are complicated equations: They involve time, intellectual property and investment and development cycles—all of those kinds of things that we're learning to manage better. Part of our role here at CableLabs is to figure out how to better understand and manage the development cycles not only for the components of an HFC network, but for the services and the design as well.

CT: *Is there good use for us concerning acceptance of specifications and standards as we head further into 1997?*

Green: As I said earlier, I believe '96 was a good year and I think '97 is going to be equally triumphant in terms of our ability to specify, to come to industry consensus and to develop an industrywide approach to these new pieces of equipment—cable modems in particular. I would have to say that this industry is enormously successful in being able to propagate standards for the HFC plant. The great strength comes from the industry's engineering resources because all of those resources have contributed to development of industry consensus on these issues.

As an industry, we're lucky in a lot of ways because we've got a lot of technical talent. We're also lucky because we've got a group of entrepreneurial CEOs that see the need and the desire for having an industry consensus and an industry agreement on what these directions are. The industry is of the right size where agreement is possible. Larger industries, differently configured, find it's very, very difficult for them. The real achievement belongs in the technical community and reaching the technical consensus is the heart of developing these specifications.

CT: *The cable industry seems to have lost some of its interest in telephony. Does this indicate to you that engineering thinks telephony of tomorrow will a part of the computer/TV set and the days of separate telephone devices are numbered?*

Green: Well, first of all, you can't characterize the industry as losing interest in telephony. I think that our interest is maturing and migrating. We've always been hedged in telephony because we've got three ways to deliver: One is using the cable plant, another is using the RF spectrum, and the third is using what's been very successful—competitive access business.

The competitive access business can lead to resident telephony because if you scale it down from large entities such as big corporations down to local, you're finally into phone. We understand the economics of that very well. It's a way to be part of the telephony business and to use the business model that we understand and are successful at.

Personal communications services (PCS) business is developing well and will be an important revenue stream for the cable industry, too. HFC telephony will mature and migrate, as well. It's too early to tell but it does work.

Announcements from companies concerning their commitment to telephony means that they're migrating and shifting into other areas. They're looking at their resources overall and they're trying to match their resources to the marketplace and a business model. This is a very healthy maturing kind of process.

To answer your question about the computer/TV set, again, my feeling is that we ought to serve anything in the house that needs a connection to a telecommunications network—the TV set, the computer and the telephone. If consumers want to combine them, fine. If they want to keep them separate, fine. We'll serve it no matter how they want to configure it. It's prudent for us, though, at the same time, to be thinking about what the advantages are in combining services and in combining the hardware.

Presently, we have a request for information out on the next generation of consumer electronics and products. We want to take a look at what people are thinking about in terms of the migration of consumer electronics equipment. We're definitely watching those things. **CT**

By Alex Zavistovich

Care to dance?

During my mis-spent youth as a frustrated musician, I learned something important about human behavior: No one wants to be first on the dance floor.

I can understand. After all, what idiot wants to carry the weight of all those eyes judging his technique? Eventually, though, a brave soul will take the floor, putting his ego aside. You can feel the relief in the crowd—get a load of that guy!—as one by one people stake their own little place where the action is.

In cable, the siren song of data has been luring similar brave souls into the information market. This is great, but I wonder when the industry at large is going to catch on to the notion that the party has started and it's OK to dance?

It's easy to look at the whole issue of data delivery over hybrid fiber/coax (HFC) and say to yourself, "Sure, this looks like a great way to spend some money, but the payoff seems so far down the road, I'd better wait until somebody else makes a few mistakes first."

That's an isolated way to look at things. Remember, the Telecommunications Act of 1996 means everyone from the phone company to the electric company is eyeballing your market. If you don't want to start thinking about laying off technicians because of attrition, you need to look at the future of cable as being about more than just getting a clear signal to the subscriber drop. The future is two-way. Or better still, *all*-way, as in networking.

Business is big business

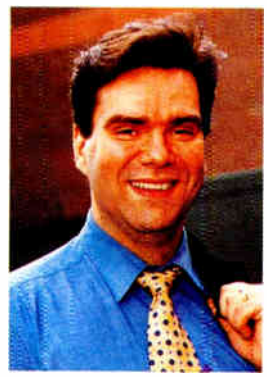
Cable modems are fast, but what's important is not necessarily how fast they are, but what you do with all that speed. The model here for me is networking and business applications, not necessarily entertainment. Businesses are always looking for ways to get things done faster, whether it's imaged document transfer, videoconferencing or work-at-home. That's where the money is.

At the Society of Cable Telecommunications Engineers' Emerging Technologies '97 confab in Nashville, TN, Douglas Wolfe of West End Systems talked about the overlooked work-at-home market. Integrated services digital network (ISDN) voice and data work-at-home service has monthly rates of nearly $300 for local access and more than $600 for long distance. That's at data rates of only 64 kbps to 128 kbps. Is it easier to find, support and maintain one work-at-home customer at $300 per month or 10 Internet access customers at $30 per month? Hmmm...

"If you're serious about data, you need to start now."

Of course, cable is stuck in a tough place when it comes to playing in this market. Misconceptions about cable network reliability mean many businesses are as timid as cable operators themselves when it comes to HFC as an architecture for their local and wide area network (LAN and WAN) applications. Also, in many areas, HFC has not been carried to office buildings, so the infrastructure is not quite in place for a full assault on commercial users.

So even though the big money may be in the business market, cable operators have to enter data through the entertainment doorway. Companies like Time Warner, Comcast, Continental and TCI are offering Internet access to the home, hoping that the buzz will be enough to buy them some time to build out their HFC networks so they can be full-fledged players in data delivery down the road. That's when they may really be ready to go after business opportunities.



The time is now

The problem is that cable's window of opportunity is closing. Less than a year after the dramatic explosion of cable modems onto the scene at the Western Show, financial analysts were already soft on the devices, in favor of asymmetric digital subscriber line (ADSL) technology from the telcos. At the recent COMNET show in Washington, DC, (a big event for networking), ADSL was everywhere. Cable modems? Nowhere.

The industry needs a better balance. It's one thing not to enter a market before you're ready; it's another to let an entrenched competitor blow doors on the hottest technology your industry has seen since addressable taps. That's what's going on in the business marketplace right now.

I know that money is tight, and it takes time to build HFC plant, to say nothing of activating the return path. Business people aren't going to consider HFC for their networks until they see someone else doing it. And cable's best bet for showing them is to make a go of Internet access to the home.

The thing is, if you're serious about data, you need to start now. The time for sitting on the sidelines is over. You can't really afford to wait, because your competition isn't, and they have a track record and an early lead.

The party has started. The band is playing.

Care to dance? **CT**

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

You know what you need. Now you know the one place to find it all.

Changing technology places new demands on CATV suppliers. That's why it's good to know there's a new choice. iCS. The reliable partner you need for the full range of products and repair services. You can depend on quick delivery of all the top brands. Plus materials management, financing, equipment leasing and exchange.

Ask iCS to simplify your life.

- All General Instrument linegear and addressable converters including digital
- All Scientific Atlanta linegear & addressables
- All CommScope P3, QR and drop cables, plus fiber
- All Digicipher MPEG-2 receivers
- Lectro and Powerguard power supplies
- Full line of drop materials to 1GHz
- Full line of refurbished gear
- 3M fiber products including splice enclosures.
- PPC and Gilbert connectors
- Repair of out-of-warranty GI, SA and other converters
- Authorized GI warranty repair facilities in North and South America
- All Diamond poleline hardware & installation materials
- DX Communications headend equipment

Sales
Deerfield Beach,Florida
800-327-4966
Carson, California
800-222-0052
Cleveland, Ohio
800-858-0830
Dallas, Texas
1-888-427-1144
Denver, Colorado
800-728-9887
Atlanta, Georgia
800-787-2288
Mt. Laurel, New Jersey
800-817-4371
DX Communications
954-427-5711

Repair
Prospect Park,
Pennsylvania
800-352-5274
Milwaukee,
Wisconsin
800-555-8670
Deerfield Beach,
Florida
800-865-3692

International Sales & Services
Buenos Aires,
Argentina
54-1-582-9695
Santiago, Chile
56-2-335-2070
Sao Paulo, Brazil
55-11-246-9994

iCS
ITOCHU Cable Services Inc.

Integrity, Commitment, Service

Reader Service Number 19

By Ron Hranac

Wake up, DBS is making moves

Just when you thought things couldn't get worse, they did. In case you've been living in a cave, EchoStar Communications Corp. and Rupert Murdoch's News Corp. tied the knot on Monday, Feb. 24. The other news is AT&T's announcement that it has invented a wireless technology for local phone service. More on this later.

The $1 billion merger makes News Corp. in conjunction with MCI Communications Corp. half owner of EchoStar, bringing together Murdoch's American Sky Broadcasting (ASkyB) and EchoStar's Dish Network. The Dish Network, as you may recall, is the North American direct broadcast satellite (DBS) provider that started the equipment price war late last year with its $199 package. MCI has been a News Corp. partner in ASkyB, and will own 10% of the new venture. News Corp. gets 40%, and EchoStar the remaining 50%.

The merged companies will form the backbone of a nationwide DBS service to be called Sky. What's scary about this is what these guys are talking about doing with their combined assets. Those assets include a bunch of transponders on seven satellites in key orbital slots. EchoStar already has access to a total of 91 DBS frequencies, and ASkyB brings to the table another 28. Plug in digital compression technology at, say, six channels per transponder, and you get potentially more than 700 channels. EchoStar's Charlie Ergen and News Corp.'s Murdoch have been saying Sky will provide a 500-channel service that includes local programming.

Assuming they can get past technological and regulatory hurdles, the threat of local programming in Sky's DBS service is one we should take very seriously. To date, one of cable's strong points has been the availability of local programming that can't be received on DBS. Obviously they won't be able to carry every local broadcast station in the country, but they conceivably could get most of the major market stations. That would allow local channels to be provided via satellite to as much as 75% of the United States. If they are able to pull this off, it might mean DBS competition just joined the big leagues.

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

5 million strong

I've said in these pages many times that DBS is serious competition. That industry is not yet three years old, and already it counts about five million subscribers. Still, there are a lot of folks in cable who don't seem to be too concerned about DBS. Frankly, I think this attitude is dangerous. I recently spoke with a manager at one MSO about our satellite competition. He commented that his company, which serves mostly small, rural communities has lost perhaps 6% of its subscriber base to DBS. In general, cable is still growing, but only slightly. I attribute some of our growth slowdown to DBS.

I think it's possible that we could lose a big chunk of our collective hides if Sky is able to pull off the retransmission of local channels. The real loser, though, would be multichannel multipoint distribution service (MMDS). Their claim to fame has been the ability to provide local content. But if satellite can do it too, why should consumers put up with MMDS's limited analog bandwidth of 30 or so channels? Even digital won't necessarily help MMDS. Assuming compression gives them a six-fold increase in channel capacity, Sky's capacity still will be a whole lot more.

Does all of this mean we should be quaking in our boots? Not necessarily. First of all, it won't be easy for Sky to get through the hoops necessary to carry local programming. Even so, we shouldn't discount the possibility that they'll be able to do it. Recent history has shown that it's not wise to underestimate Rupert Murdoch. He often gets his way in business. Second, if Sky does get the OK to carry local channels, it won't happen overnight. That gives us a useful window of opportunity. The question is whether or not we take advantage of that window.

Here's what I think we should do in the interim. Even if Sky doesn't get into the local channel business, we still should make an effort to head 'em off at the pass. First, we've got to put a greater focus on customer satisfaction. If we continue to give our subscribers reasons to switch to the competition, they'll do it. Mediocre customer service, endlessly rising rates, and a seemingly uncaring attitude are still too much a part of the way we do business. Did you know that the Dish Network is now offering $100 off of its regular $199 equipment package price to cable subscribers who show a copy of their current cable bill when they sign up for DBS service?

Second, we need to continue to work on quality and reliability. This means a properly trained staff; good installation and maintenance practices; and effective outage reduction and service restoration techniques.

Third, where it makes economic sense, upgrades should be part of our strategy. At the very least we need to make sure we have adequate bandwidth to offer a broad mix of analog and digital services. If fiber-optics deployment is part of that, all the better. Fiber-based architectures will give us room to navigate in the future when new technologies warrant smaller service areas. (A side note here: The president of a small MMDS

DX ANTENNA

There is no substitute for performance.

The DX Performance System: DSM-180 Modulator & DIR-657 B Receiver

Turn up the power on your network with the DX Performance System

The all-new DX Performance System is an integrated receiver/descrambler-modulator designed to maximize the performance of your fiber optic network, providing cleaner, crisper "signal purity" than ever before. This powerful addition to your head-end configuration is the next generation in a long line of breakthrough products from DX, the world's leading supplier of CATV head-end products. For pricing and vital statistics, call DX Communications now.

DX Communications: 1143 West Newport Center Drive Deerfield Beach, Florida 33442 1-954-427-5711

Reader Service Number 86

digital compression equipment supplier once told me that cable has to install fiber in order to carry compressed digital video because digital signals won't go through amplifiers. I'm glad we have such knowledgeable individuals selling advanced technology to our competition.)

Fourth, we need to roll out digital transmission on our networks as quickly as possible. This will allow us to increase our effective channel capacity, and provide new services such as pay-per-view (PPV) and near-video-on-demand (NVOD). These latter services have been doing well on DirecTv—they've been reporting buy rates in excess of 30%. We should be doing this, too. Allocating just 100 MHz for digital transmission at a six-to-one compression rate would result in nearly 100 new channels. More bandwidth and/or a higher compression rate would yield even more.

A suggestion...

Here's my band plan suggestion: Prepare for 50-750 MHz operation, using 50-250 MHz for a basic analog tier, and the remaining 500 MHz for digital services. This would allow us to provide about 28 analog TV channels plus FM, and another, say, 400 or so channels in the digital tier, plus cable modem service, etc. This definitely would put us on par with what Sky plans to do with its DBS service. E-mail me at rhranac@aol.com with your thoughts on this.

The other thing I mentioned at the beginning of this column is AT&T's announcement about a new wireless technology for local telephone service. As of this writing, I don't have all of the details, but it's my understanding that end-users would have a pizza-size box (about 13 inches square) on the side of their homes. The box would contain the wireless transceiver that would interface in-home telephone equipment corded and cordless phones, computer modems, and so forth with AT&T's network. This is probably more of a threat to incumbent local phone providers than it is to us, but if AT&T is able to get this technology beyond its planned test in Chicago later this year, it could put a crimp in cable's plans to offer local phone service.

I mention this mostly because it's an interesting approach to providing local phone service. This, too, won't happen overnight. AT&T would have a costly infrastructure to build, mostly in the form of fixed transmission sites and antennas to communicate with the on-home transceivers. Whether or not they will be able to lure enough customers away from the existing local providers to pay for the new technology is a big question that has yet to be answered.

Maybe there's an opportunity for cable companies and AT&T to work together on this one. Why not work out an arrangement where some of the transport infrastructure to and from transmission sites is via our network? If the fixed transceivers and antennas are small enough, how about hanging them on our strand or at our fiber node locations? Seems to me that this is something we should look at a little more closely. Then, rather than being a potential threat to our telephony plans, AT&T's technology could actually complement them. **CT**

Cable Professionals Only:

Leader Makes Your Wish List A Reality

☐ **Spectrum Analyzer**
overs 5 to 1030 MHz from narrow andwidth to full span. A variable arker indicates digital readout f designated frequency and level.

☐ **Multi-Channel Display**
Auto Channel Search sets up to 128 channel bargraphs. A variable marker has digital readouts of designated channel, frequency and level.

☐ **Single Channel Display**
Digital readouts include CH number, visual or sound carrier, assigned frequency, signal level and dual analog bargraphs.

☐ **C/N Measurement**
Measures the RF carrier level to system noise ratio to 50 dB range.

☐ **HUM Measurement**
Verifies FCC POP does not exceed 3% p-p of visual signal level.

☐ **FCC 24-Hour Tests**
Unattended tests can be set for recall, measurement, data-logging and storage.

☐ **Stability Mode**
Measures the min/max visual signal level to insure it doesn't exceed the FCC limit.

- ☐ Digital AC/DC Voltmeter
- ☐ Visual to Sound Ratio
- ☐ Visual to NICAM Ratio
- ☐ Display on PC via RS-232C
- ☐ Printouts Graphic and/or List
- ☐ Speaker with Volume Control
- ☐ Field Replaceable F Connector
- ☐ 50 Customized Preset Program Memories
- ☐ 512 Data Memories Maximum
- ☐ E²PROM lookup charts include Std HIS, Std EIA, HRC EIA and IRC EIA
- ☐ dBmV, dBmW, dBµV, dBµVEMF Eng Units
- ☐ Full Duplex Remote Control
- ☐ Peak or Average Detection and Max Hold Mode
- ☐ Switchable Backlight Display
- ☐ 12.5 and 25 kHz Offsets
- ☐ Sleep Modes

NEW

Cable TV Spectrum Meter Model 953

Optional Printer

Call toll-free

1 800 645-5104

In NY State

516 231-6900

LEADER
FOR PROFESSIONALS WHO KNOW THE DIFFERENCE

Leader Instruments Corporation, 380 Oser Avenue, Hauppauge, New York 11788
Regional Offices: Chicago, Dallas, Los Angeles, Atlanta. In Canada call Omnitronix Ltd., 416 828-6221

See us at NAB Booth #8760

Reader Service Number 30

By Justin J. Junkus

Hot convergence topics for a changing industry

One of my recent columns referred to convergence, and that started me thinking. Where is this concept going, especially in light of recent statements by some of the cable telecommunications industry leaders about returning to traditional business? What about the telephone industry side of the telecommunications business? What are telephony engineers thinking about now, and where does cable and broadband fit into their pictures of the future? Answers to these questions would give an industry pulse reading, and could be useful to the readers of this column as they plan for the future of cable telecommunications.

Telecommunications consultants like me have lots of ways to take the pulse of the industry, including attending trade shows and reading a wide selection of periodicals. My favorite, however, is to be part of the planning process for major industry conferences. Because the planning typically occurs six months to a year ahead of the actual show, and the planners are typically the people who steer the industry's direction, this is a good way to get a leading view of industry direction. One of the oldest conferences addressing issues and developments in telephony is the National Communications Forum held in Chicago in the fall of every year. The timing of its winter planning meeting was right for me to attend, contribute and find that pulse reading for which I was searching. The rest of this column shares the insights I gained in the process.

Jay Junkus is president of KnowledgeLink, a telecommunications consulting and training firm specializing in the cable telecommunications industry. He may be contacted at his e-mail address, jjunkus@aol.com for comments or further discussion.

Convergence redefined

First, convergence is alive and well, but redefined. Over the past few years, it has become fashionable to predict that all telecommunications carriers will be offering the same products to consumers, and that consumers will begin to see communications as a commodity product like bread or milk. In this scenario, price and service quality would determine which carrier

"What are telephony engineers thinking about now?"

would win the consumer's dollars. The business war was to be fought on two fronts: cable companies chopping away at local telephone access, and phone companies rushing to consumers as an alternate source of video entertainment. The visible impact at industry conferences over the past few years has been a large amount of cross industry information. Hence, there was a heavy emphasis on how to provide entertainment video over telco facilities at the telephony conferences, and how to provide telephony over cable at the cable industry events.

This year, leaders in both industries have been emphasizing concentrating on traditional strengths rather than becoming the universal provider for all consumers. What this means is that the overlap of the industries is not being defined in terms of one-stop shopping for all services, but rather in terms of two sources for a broadband-capable pipe to the consumer. Both the cable and the telephony sides of the telecommunications industry have evolved to seeing this pipe as a conduit that will be used for services that make sense for the particular carrier and its market.

Rather than seeing communications as a commodity, we are beginning to see it as a product mix that varies with the carrier. The products in that mix depend on tradition, company strengths, and what has been available to the consumer in an individual geographic market.

In telephony, that means that phone company strategies to capture market share are starting to look at which applications make sense for their particular embedded base. For telcos that have been overbuilding twisted-pair local loops with new hybrid fiber/coax (HFC) or switched digital video (SDV) networks, that means a continued emphasis on capturing video entertainment as a new market. For telcos with plant based solely on twisted-pair to the subscriber, it implies looking at applications where broadband over twisted-pair means data rather than video.

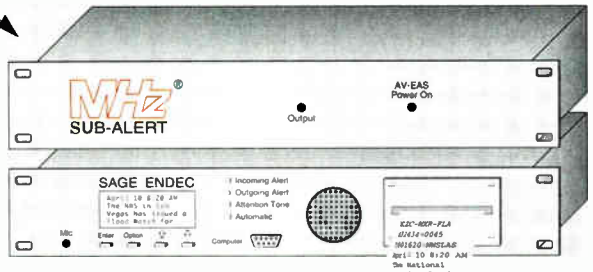
Emphasis switched

This shift in emphasis was apparent in the planning of the NCF sessions. While the planners have still included sessions on telephony over cable and video compression and delivery, there is far more interest in broadband wireline media as a way to provide access high bit rate information, rather than any particular content. Although voice telephony over cable is still important, other applications are now equally interesting to the telephony engineers and planners. Anything that can be related to the Internet is one example. →

Are You Ready for the FCC EAS Deadline?

You will be with this

Extraordinarily Powerful Audio and Video Package!!



IF, 4.5 MHz & Baseband Switching

Remote Editing

Channel Sharing with EAS Details

Longest Warranty

No Ad Insertion Crashes

Compatible with Data, Telephone & Internet Services

NO Computers Required

User Friendly

6 Monitoring Inputs

Highest Technical Specifications in the Industry

Genlock

Multiple CG Outputs

Compatible with SA, IRIS, IDEA/ONICS

FCC Compliance Guaranteed

Elimination of NOAA 1050 Hz Tone

Non Interfering

Remote Hub Site Control

Automated Weekly Tests

FCC Video Specifications

Telephone Access w/Voice Response

Local Franchise Compliance

Ease of Installation

No Bandwidth Limitations

All EAS Systems are not created equal!

MHz® MEGA HERTZ

Established 1975

http://www.megahz.com

"Unique" Products For the 21st Century!

DENVER ,CO
800-525-8386
FAX 303-779-1749

ATLANTA, GA
800-962-5966

ST. LOUIS, MO
800-821-6800

OCALA, FL
800-922-9200

INDIANAPOLIS, IN
800-761-7610

PHOENIX, AZ
800-883-8839

Reader Service Number 218

Because telephone companies have a large embedded base of twisted-pair access lines, asynchronous digital subscriber line (ADSL) is a hot technology topic. This technology promises rates up to 6.1 megabits per second over twisted-pair. The NCF planners asked for sessions on the two competing standards, carrierless amplitude and phase modulation and discrete multitone, as well as evolution plans of service providers and vendors. They also were interested in the practical experiences gained from the current trials of this technology, and what the trials say about future markets.

Asynchronous transfer mode (ATM) is another hot telephony topic. When you think about it, this makes sense, since ATM is typically associated with high bit rate data. Here, the planners want to become current on the technology, especially scaleablity, interworking of networks, and how operations and maintenance will be handled. Of course, practical applications of ATM are important, including videoconferencing, distance learning, work-at-home, electronic commerce, telemedicine, desk-top conferencing, local area network (LAN) emulation, and interactive video. Notice that interactive video is only one of eight opportunities listed by the conference planners.

Telephony in the RF spectrum is still a popular topic, but now it's not only telephony over cable, but also any form of wireless telecommunications that is being discussed. This is a new market opportunity for both telephone companies and cable companies. Markets and applications for the different technologies, such as personal communications services (PCS), cellular and wireless global system for mobile communications (GSM), are being proposed for panel sessions. Equally popular topics are technologies for wireless data access, smart antennas and the role of satellites in personal communications services.

The hook

Does this mean the two industries are no longer trying to get a share of each other's business? Not at all. Rather than bumping heads directly in areas that are the traditional strengths of the competition, each camp is looking at new applications that will "hook" the consumer—applications that the consumer doesn't necessarily associate as a strength in either industry.

Once that hook is set, the strategy may be to wean consumers to other services that the provider can offer. After all, if you are satisfied with Internet data access via a cable modem, why not try Internet phone to save long distance costs? And if Internet phone works well, then the cable company is probably qualified to provide local phone service as well. Similarly, if you download full motion video from the Internet on your phone line, complete with sound, why couldn't the phone company give you full cable TV? Convergence still operates, but now alternate service providers are looking at ways that first demonstrate creditability, and then lead to related sales of new services.

I'd like to add that telephony people are still very concerned about the regulatory environment and business issues that revolve around it. Telephone companies are required to unbundle the connection to their subscribers, called the local loop. This means that their competitors have been given the right to physical space in telephone company central offices and interconnection to their subscriber lines to provide new services.

To put this in terms more familiar to cable engineers, think of the potential implications if your cable company had to provide the telephone company with space in a headend, so that the telephone company could provide video programming to cable customers over the cable company's coax. Concerned telephone industry planners have asked for panel sessions to discuss the management of an unbundled customer loop, and how to train their installation and maintenance technicians to work with hardware, wiring and features provided by other communications providers.

So, some of the issues and topics in telephony have changed, but is still plenty of need to understand the noncable side of telecommunications. Because convergence and regulation are dynamic concepts, your education as participants in cable telecommunications needs to be just as continuous and dynamic. **CT**

Absolutely, positively, undeniably, unconditionally

the smartest TDR feature available today.

Intermittent Faults? No problem!

Riser-Bond Instruments introduces a new feature, INTERMITTENT FAULT DETECTION, for the highly popular Model 1205C Time Domain Reflectometer, Cable Fault Locator.

The Intermittent Fault Detection Mode (IFD) detects and displays intermittent faults, such as intermittent or bad connections, regardless of whether they are opens or shorts. With the Model 1205C's IFD, you do not have to second-guess where the fault is and set the TDR accordingly. Just connect the 1205C to the suspect cable. Once a fault is detected, you can reposition the waveform, zoom in, zoom out, increase or decrease the vertical gain, or move the cursors, all without losing the waveform!

Try that with any other TDR!

Visit our website at http://www.riserbond.com or E-mail us at email@riserbond.com

This is just one of the super features you get with a Model 1205C.

800-688-TDRs 402-466-0933 Fax: 402-466-0967

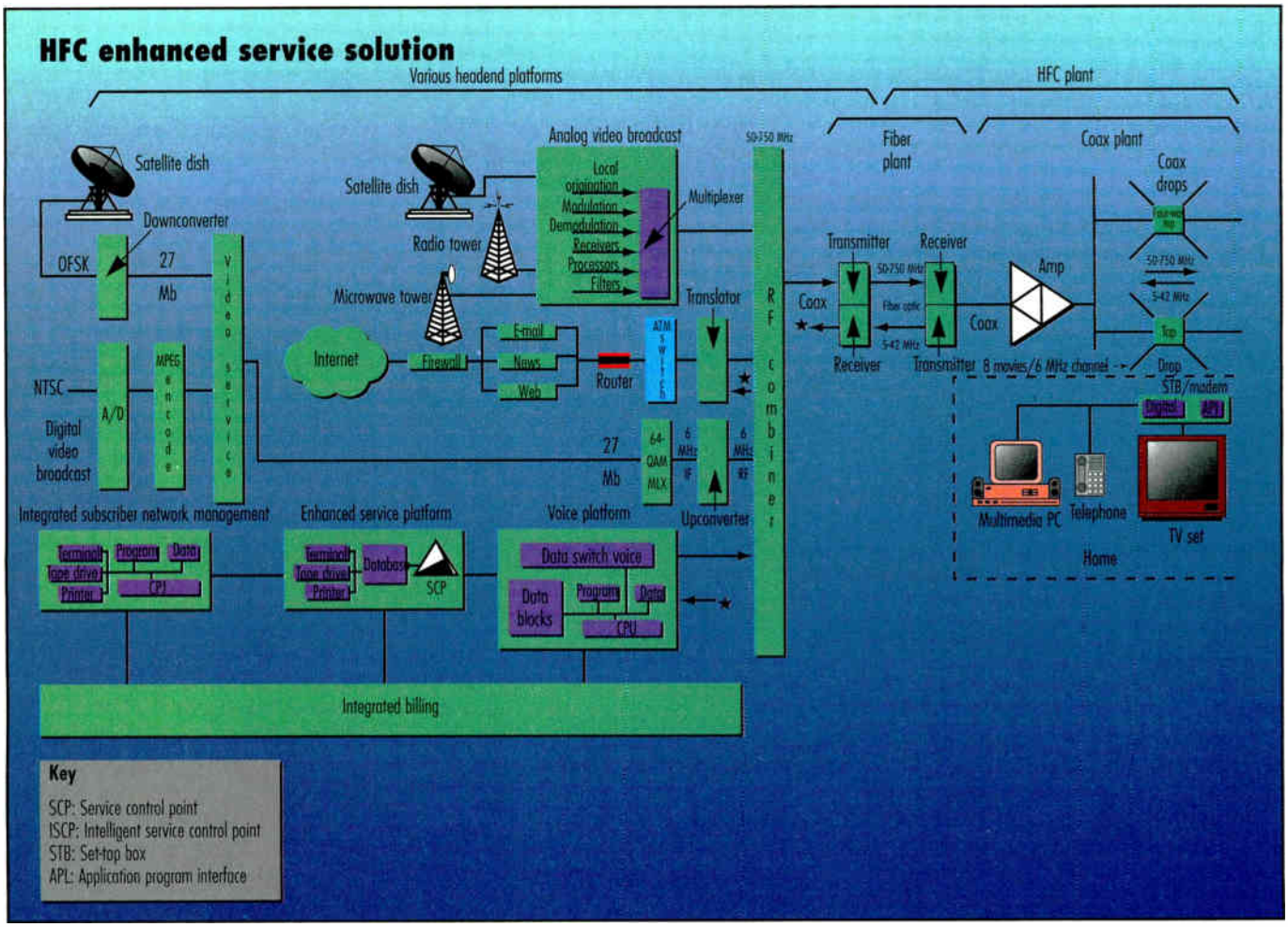
Call for a demonstration today!

Riser Bond INSTRUMENTS

Reader Service Number 103

By Bob de la Salle

HFC end-to-end: New frontiers in service



Now that convergence is upon us, cable operators will have to look at providing service enhancement capability over the hybrid fiber/coax (HFC) network equal and better to what the telcos are now providing over their networks. In order to be competitive, video and data services offered by cable operators will require what is referred to as "enhanced service" or advanced service capabilities. This enhancement capability will be needed for all offerings in a full-service environment.

Today, however, no single vendor can provide all the hardware and software products needed for an end-to-end enhanced service solution. Few technology companies are capable of providing complete system integration (SI) for all of these hardware and software elements.

Vendor partnerships and alliances will be needed for a complete solution, and are already starting to appear in the marketplace. This article will provide an overview of the components required for an end-to-end enhanced service solution implemented over an HFC network.

Bob de la Salle is senior network architect, telecommunications and media, for IBM Canada, in Edmonton, Alberta, Canada. He can be contacted at (403) 421-5734 or by e-mail at bobde@ibm.net.

The telephone companies are already providing enhanced or advanced voice service features that utilize high-speed access to large databases. The telephone user perceives this as being an instantaneous service. It allows the capability for advanced voice features such as interactive custom dialing, 1-800 and 1-888 dialing, local number portability (LNP), call centers, calling number ID, conference calling, telephone answering, and automatic alternate routing.

In a similar fashion, cable operators eventually will have to contend with new demand for advanced enhancements to their video and data services. Eventually all services provided by the cable operator will need to offer this high-speed access to large databases, just as the telcos are now offering over their advanced intelligent network (AIN).

Today, HFC end-to-end solutions (see accompanying figure) involve cable modems for data access to the Internet. Soon, the technology will involve a digital platform, with set-top boxes that will provide access to hundreds of digitally compressed movies or channels. In the longer term, these solutions will require integrated network and subscriber management, as well as billing for the complete HFC network, including analog video broadcast, digital video compression, Internet servers, video servers and hubs/nodes. Then there are fiber-optic transmitters and receivers, cable modems and set-top boxes as well as the cable plant.

Legacy solutions were not designed for transactional services, which all of these will become, requiring the capability to respond rapidly to subscriber or consumer market demand. Thus, high-speed access to a large integrated database

containing all relevant customer and service information will become imperative. Telecommunications and media services must provide a wide range of interactive capabilities to handle impulse requests from subscribers.

Enhancing services

Service enhancement allows an existing service to respond immediately to new subscriber requests. It provides the capability for that service to be changed on-the-fly. An enhanced service must have the capability to respond to subscriber interactive communications during delivery. That means during the short processing time in which the service is being set up.

This scenario necessitates high-speed access to very large databases that contain all relevant information for all subscribers and for all services. Powerful high-speed processors and high-speed access systems must perform thousands of database look-ups per second. These systems allow any interactive request to be interrupted by the subscriber at any time—including during the set-up time—to access a different database that can be triggered to start a new service activity process.

This enhanced or advanced service capability allows for instantaneous transactional customer requests. Specific inquiries can be made by the user from a set-top box or cable modem. Responses will not entail simple transactions that require a single database look-up. Rather, they will be complex transactions that involve three or more database look-ups per inquiry. These complex queries will have to be processed within milliseconds and will need nanosecond processing power to be accomplished successfully. This type of service enhancement will allow the implementation of many new and advanced services. More importantly, it will enable capability for rapid response to changing consumer market demands, such as electronic commerce over the Internet.

"Vendor partnerships and alliances will be needed for a complete solution, and are already starting to appear in the marketplace."

What comes first?

As each platform is activated, it eventually will be integrated with previous platforms. The deployment of the substantive platforms will, in all likelihood, occur in the following sequence:

1) Analog video broadcast
2) Residential data (Internet access)
3) Digital video broadcast
4) Integrated network and subscriber management
5) Business data access and work at home
6) Integrated billing
7) Enhanced service (real-time) platforms
8) Digital voice
9) Integrated voice, video and data billing

The first component is the traditional **analog video broadcast** network, which has been in place for many years. It includes all RF equipment from the headend to the TV set. Until recently, these legacy devices have been strictly one-way broadcast, over an all coaxial tree-and-branch topology. Today, a hybrid plant consisting of fiber-optic and coaxial cable (HFC) is primarily implemented over a star-and-bus topology. The need for real-time interactive capability has not been required so far, but the HFC deployment has prepared the network for the imminent influx of new interactive services.

The **residential data access** component will provide two-way data access over the HFC infrastructure for Internet services.

WEAPONS AGAINST INGRESS

A Technological Breakthrough For Your Front Lines

GUARDIAN

Tests The Shielding Integrity Of House Cabling
Tests The Performance Of The Return Path In The Subscribers Home

Most return path problems begin in the subscriber's home. Now you can equip your installers with the tools to help eliminate these problems during the installation.

The **Guardian RSVP** works with a TRILITHIC 9580 SST in your head end to determine whether the "launch level" needed from the set-top terminals or modems and the reverse path Carrier (Ingress + Noise) ratio are within user settable limits. Push the TEST button and within seconds the RSVP displays PASS or FAIL and presents the test data. Over 100 RSVP can share one 9580 SST.

The **Guardian Isometer** verifies that the house cabling and hardware are "hardened" against ingress. The Isometer is sensitive to a special "tagged" reverse frequency test signal generated by the RSVP. Just connect the RSVP to the subscriber's ground block and the Guardian Isometer detects any leaks.

What Could Be Simpler?

For More Information Contact Trilithic Today

317-895-3600 • 800-344-2412 • 317-895-3613(fax) • www.trilithic.com

TRILITHIC
9202 E.33rd Street
Indianapolis, Indiana 46236 USA

Reader Service Number 45

Components include a cable modem at the home and will require upstream transmission from the home to the headend. Servers at the headend will include a World Wide Web, e-mail and news server, as well as a firewall server.

Digital video broadcast includes MPEG-2 (Moving Pictures Experts Group) digital video compression, which will allow compression of up to eight or 10 movies into one 6 MHz channel on the HFC network. Traditional analog video will be digitized and then compressed into a signal occupying the same bandwidth as a traditional analog 6 MHz channel. A digital transport platform will be implemented from the video servers in the headend to a digital set-top box in the home. Services initially will be deployed in the broadcast mode and implemented as near-video-on-demand (NVOD). The subscriber will be able to select from multiple choices, but the movie would not run immediately. There could be a 10- to 30-minute wait. Upstream transmission will not be required on this platform, except for billing purposes, and can be done on a delayed basis.

An **integrated network and subscriber management** system will be needed once the previous three components are introduced. The next component, **business data access and work at home**, definitely will require guaranteed minimum bandwidth. In addition, packet counting per user will be needed. Asynchronous transfer mode (ATM) technology most likely will be the easiest way to facilitate these requirements.

"Ultimately, it will be the customers who decide which services they want, and thus they'll decide the systems providers they will need."

At this point, **integrated billing and enhanced service** platforms must be implemented. Besides the obvious complex billing function, real-time interactive services will require enhanced capability, providing the high-speed access to very large databases that contain all relevant information for all subscribers and for all services. Then, when **digital voice** is introduced, **integrated voice, video and data billing** must follow.

Critical systems

These full-service and multifunctional systems are becoming increasingly important in today's networked world. Ultimately, it will be the customers who decide which services they want, and thus they'll decide the systems providers they will need. **CT**

A Bright New Light in the Headend Universe

PULSAR

BARCO introduces PULSAR, a revolutionary modulator for CATV headend applications requiring high quality RF signal and automatic provisioning. PULSAR offers remote monitoring and control of all modulator functions. An intelligent "white limiter" and video AGC prevent overmodulation and automatically optimize video input signal levels.

Remote or Local Control

Easy-to-use front panel keys allow direct control of video and audio RF levels, modulation depth, frequency deviation, and input switching. An RS-485 interface allows remote control of the unit.

Maximum Flexibility

PULSAR operates with 110 Vac or -48 Vdc, making it compatible with both conventional CATV or Telco powering schemes. The modulators feature IF substitution and are compatible with all major scrambling techniques.

Find Out More!

PULSAR gives CATV operators and Telcos an entirely new dimension in signal and service delivery. To find out why PULSAR will transform the future of headend modulators, call 770/218-3200.

- High RF Output Over the Entire Frequency Range
- White Limiter and Video AGC
- Auto Set-Up, Auto Alignment
- Complete Software Control for Monitoring and Backup
- Fixed Frequency and Tunable Versions
- 110 VAC and -48 VDC Powering
- Unique In-Channel Tilt Control

PULSAR BARCO THE ULTIMATE MODULATOR

BARCO

3240 Town Point Drive
Kennesaw, GA 30144
Tel: 770/218-3200
Fax: 770/218-3250
www.mindspring.com/~barco

Reader Service Number 23

THE TEAM TESTER...

...TAKES INGRESS OUT OF PLAY

Wavetek's Multi-User Stealth Reverse Sweep

Multi-User Capabilities... Get the latest in Wavetek sweep technology. With the multi-user capabilities of the Stealth Reverse Sweep System, your sweep technicians can simultaneously perform reverse sweeps and help eliminate the impact of ingress on the measurement.

More Powerful... Engineered for powerful performance, the Stealth Reverse Sweep has +50dBmV output to ensure measurement capability, even in high ingress and noise environments or with high-loss test points. Sweep techs can quickly and easily perform sweeps, identify problem areas, and troubleshoot with the handheld Stealth.

The Stealth is precision engineered to save time, simplify testing, reduce fatigue, and gain comprehensive results. No wonder the Stealth is preferred by technicians around the world.

Greater Performance... Only with the Wavetek Stealth do you enjoy precise measurements of forward and return path alignment and...

- Up to 10 simultaneous users
- 50dBmV output to help eliminate corruption from ingress
- In-service signal analyzer for C/N and hum
- Noise and ingress spectrum display
- Automated 24-hour testing capability
- High-resolution, easy-viewing LCD screens
- Rugged/water resistant hand-held field unit

Confidence... The Stealth Reverse Sweep System is just part of Wavetek's complete line of quality test and measurement equipment. We pioneered the SAM ... Sweepless Sweep ... and, Return Sweep. Each product delivers all the performance, precision, speed, and ease of use you demand — at a value you expect – from the leader. We are your signal meter specialists.

Power up for the interactive revolution with the Stealth Multi-User Reverse Sweep System. In the U.S. call,

1-800-622-5515

Reader Service Number 55

Wavetek...partners in productivity for over 35 years

Worldwide Sales Offices

United Kingdom (44) 1603-404-824
France (33) 1-4746-6800
Germany (49) 89-996-410
Eastern Europe (43) 1-214-5110
United States (1) 317-788-9351
Southeast Asia (65) 356-2522
Asia Pacific (852) 2788-6221
China (86) 10-6500-2255
Japan (81) 427-57-3444

http://www.wavetek.com

WAVETEK

By Bob Vogel

Are you mastering the management of your domain?

The topic of network monitoring was not exactly at the top of everyone's priority list at the time many coaxial networks were initially being implemented in the early 1980s. But in today's arena, one can argue that network monitoring is an essential part of every network rebuild and deployment effort.

Operational support model

In current systems, the element manager serves as the basic single point-of-entry for any viable and accepted network monitoring solution. A more interoperable and consolidated system makes use of a domain manager, which is intended to ease the interface task by supporting multiple element management systems. The domain manager is responsible for the configuration and monitoring of the multiple network elements, thus providing an enterprisewide network monitoring architecture.

The benefit to implementing a domain manager is that it provides a single network monitoring system that supports the activities of a number of different classes of elements. Economies of scale are gained by moving in the direction of a single system that supports a consistent user interface for all monitoring operations, regardless of the device being operated upon. Interoperability is the key to the success of any new network monitoring and management system.

Domain manager

Within the defined architecture, the domain manager serves as the interface to the various classes of network elements in addition to providing an industry standard interface into the higher order network management system. It is the responsibility of the domain management system to provide a single and consistent platform, database, graphical user interface (GUI), and network interfaces for the support of the various network elements.

The primary objective of the domain management system is to provide a single point of access and a consistent graphical user interface in support of the network operations activities. Most important is the integration capability of the domain manager into higher order systems.

The system on which the domain manager operates is very important. Personal computers (PCs) seem to provide the most widely accepted, accessible and cost-effective solution for the role of the domain manager. This hardware platform, coupled with the industry-accepted Microsoft Windows NT operating system, provides a mature, standard, consistent, familiar and stable environment.

The domain manager GUI is the method by which network element specific status information is displayed. Within today's industry, the only true method of displaying this information is via graphical representations such as topologies, dials, gauges and alarm reports.

The database engine used by the domain manager is the single most critical aspect to the entire software platform. The database architecture must be modular enough to support either a centralized or distributed configuration.

In order for a domain manager to fulfill its architectural responsibility, it must support a standard and open interface to the higher order network management systems. The direction of today's market is dictating simple network management protocol (SNMP) as that interface. The management information base (MIB) defines the information exchange for the network agents, via the SNMP interface. The common point for information access, within the network management hierarchy, will be via the MIB. For this reason, all domain management systems must support a standard, open and document MIB and SNMP interface.

Utilizing a distributed client/server based architecture is the focus of any effective domain management system. The ability to implement software modules to support the function of GUI client, database server, and communications access agent on the various hardware platforms, throughout the system, is essential for a successful and scaleable architecture. This methodology provides the many-to-many relationship that is exploited by the various clients and the existing database servers. A distributed database architecture is a planned extension of this architecture. Naturally, this is dependent upon each system and its respective user base possessing the appropriate security privileges to access all respective data and information.

A clear relationship exists between the network design and the operational performance. By graphically representing the design and all status related information, it is possible to realize an objected oriented view of the monitoring network elements. This level of network monitoring can only be achieved a software platform that is open, documented and industry-accessible.

System monitoring

Providing a clean and intuitive user interface for the display of alarm and status information is an inherent piece to the domain management puzzle. Current advanced systems support correlation and root-cause analysis capability. In addition, all systems today must

Bob Vogel is vice president of marketing for AM Communications.

support protocol and application specific software download capability and frequency agility.

The monitoring of the various devices within the hybrid fiber/coax (HFC) plant can be categorized into the following components: power supplies, fiber nodes, amplifiers and line extenders.

The monitoring capability of any system will only be as robust as the devices and their respective designs. The domain manager system can only monitor the points that are exposed by the products that are being designed by the industry suppliers. Minimum monitoring points of power supply devices must consist of data carrier RF levels, temperature, AC voltage, AC current, battery voltage, and battery charge rate. Power supply monitors must support remote testing capability. Fiber node monitors must support receiver optical power, transmitter optical power, data carrier RF level, temperature, system AC voltage, and power supply DC current. These monitors must support control of redundancy switching capability, return noise isolation and remote testing capability.

Traditional amplifier monitors must support data carrier RF levels, automatic gain control (AGC) voltage, temperature, system AC voltage, power supply DC voltage, and power supply DC current. The amplifier monitor must control the return switch, bridger switch and station bypass. Lastly, many end-customers are beginning to monitor the line extenders that are deployed. Line extender monitors must support data carrier, temperature, system voltage and power supply. Typically there are not any control points within a line extender.

In addition to these monitoring points, every organization that participates within this marketplace must support a host of complimentary products that address headend monitoring, return path noise management and end-of-line. Clearly, return path noise management and inexpensive end-of-line monitoring is of significant interest within the industry. Any organization supporting network monitoring platforms that cannot offer these technologies is at a significant disadvantage. **CT**

VISIT US AT:
EUROCABLE '97 STAND 21
CEBIT '97 HALL 15 STAND G64
NCTA CABLE '97 BOOTH 5409

One Thing We Contributed to HFC Communications

TRIUMPH!

The triumph of powerful systems ***up and running***. The success of using our ***proven*** OFDM technology to provide efficient and reliable communications in the return path.

But reliability is only part of the picture. Access is the key. With West End's array of data, voice and Ethernet interfaces, you can now travel the world... in any form you choose.

Talk to us about the most powerful and sophisticated cable communication capabilities anywhere. For business or residential, data or voice services over cable networks, come share in the triumph — with West End.

WEST END
A Newbridge Company

Head Office 613 623-9600
Europe +44 163 347 9600
Americas 703 707-9600
Asia-Pacific 61 2 376 3600
e-mail: marketing@westendsys.com
Internet: http://www.westendsys.com

Circle Reader Response 75

By Axel Amelung

Future-proof your HFC system

For years, cable operators have successfully run networks with little or no monitoring systems. Today, operators recognize the need for automatic fault detection and network performance analysis. Recent and rapid changes in equipment, architectures and the services being delivered over broadband networks have made it necessary to consider management tools as part of the basic network.

Managing your hybrid fiber/coax (HFC) network with a modern system of hardware and software designed specifically for this purpose leads to immediate business advantages. It improves reliability by reducing network downtime, thus increasing service availability to the end customer. In addition, it calls for a smaller maintenance staff and reduces truck rolls, thus reducing the overall cost to maintain a network. The introduction of telephony and data services demands a tremendous increase in network reliability. Meeting this increased demand can only be achieved with the right management architecture.

Axel Amelung is the product specialist for network management systems at Philips Broadband Networks in Manlius, New York.

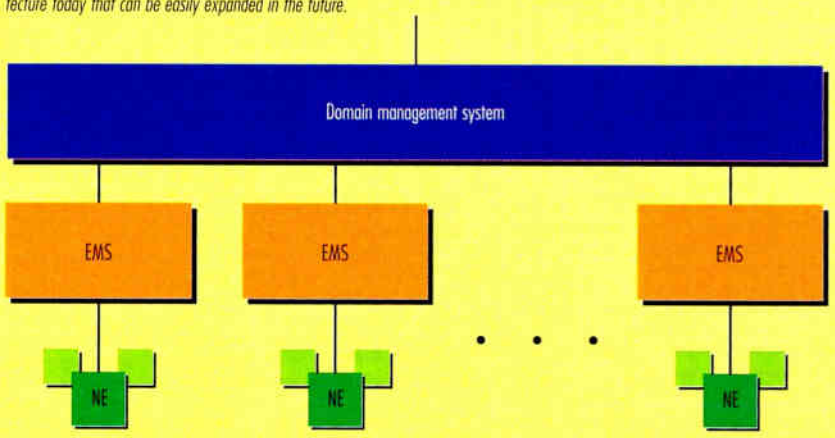
Basic requirements

To be a sound investment, management systems must be robust, flexible, scaleable, upgradeable and, of course, inexpensive. Consider the following points as you weigh your choices:

- Coping with ingress and its resultant noise is one of the biggest challenges facing operators of broadband access networks today. The management system should be fast and robust to meet this challenge.
- Operators need management systems to be flexible. Networks typically consist of equipment from many different suppliers. Getting separate management tools with each piece of network hardware is unacceptable to operators. Instead, operators prefer a single management solution flexible enough to work with equipment from a variety of suppliers.
- In addition to flexibility, operators need management systems that can grow. For instance, an operator may begin by managing only headends and hubs. Later, the operator could add end-of-line monitoring, and eventually a monitoring transponder could be added to every amplifier in the network. This growth should all be supported by the same base management system.
- Operators need a management system that can adapt to serve evolving broadband networks. When full service networks become a reality, operators need to have management systems in place that are able to monitor and control all the new services being delivered.
- Finally, since management in itself does not add new functionality for which operators can bill subscribers directly, it has to be inexpensive.

Figure 1: Domain management architecture

A modular management architecture uses element management systems (EMSs) to manage various network element groups. Each EMS is, in turn, managed by a domain management system (DMS). This approach lets operators create a flexible management architecture today that can be easily expanded in the future.



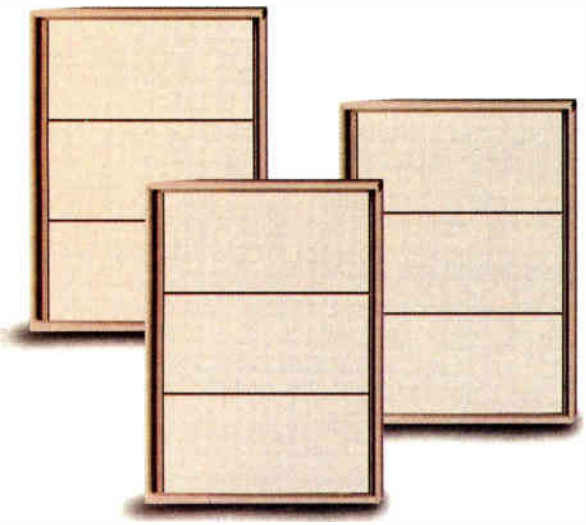
Management architecture

As broadband networks grow more diverse, the act of managing these networks becomes more complicated. In fact, there is no single solution available today capable of managing the full range of broadband network products, including microwave transmission devices, HFC transport gear, cable telephony products, and cable data equipment. Waiting for an all encompassing management system is not a practical answer. So, what are network operators to do? The solution is to establish a comprehensive and modular broadband network management architecture and invest in products designed to fit into this architecture. Figure 1 shows the basis of this architectural approach. Let's look at each element separately.

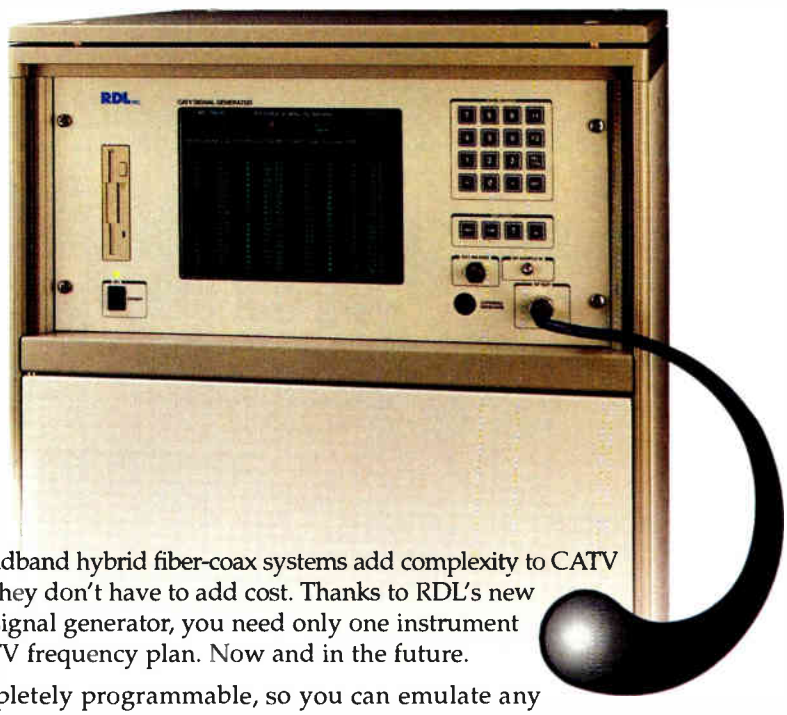
The element management system (EMS): The EMS is the foundation upon which the management system is built. Just as a chain is only as strong as its weakest link, so too a management system is only as strong as its weakest EMS. Each

TO TEST WORLDWIDE CATV PLANS...

You can buy
all these generators...



...or just one
RDL CSG.



- A cost-effective, future-proof CATV test solution.
- Can emulate any CATV frequency plan.
- Completely programmable.
- Generates coherent & free-running signals.
- Fully IEEE-488 controllable.

The latest broadband hybrid fiber-coax systems add complexity to CATV testing...but they don't have to add cost. Thanks to RDL's new CSG multi-tone signal generator, you need only one instrument to test every CATV frequency plan. Now and in the future.

The CSG is completely programmable, so you can emulate any standard test condition, generate phase-locked and unlocked signals, and automatically insert any power level and amplitude tilt your tests require.

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

So why buy racks of signal generators when one CSG can do their job and so much more?

For more information about the CSG, contact RDL at **(610) 825-3750**, or fax us at **(610) 825-3530.**

RDL INC. Frequency Generation and Noise Measurements for Critical Applications

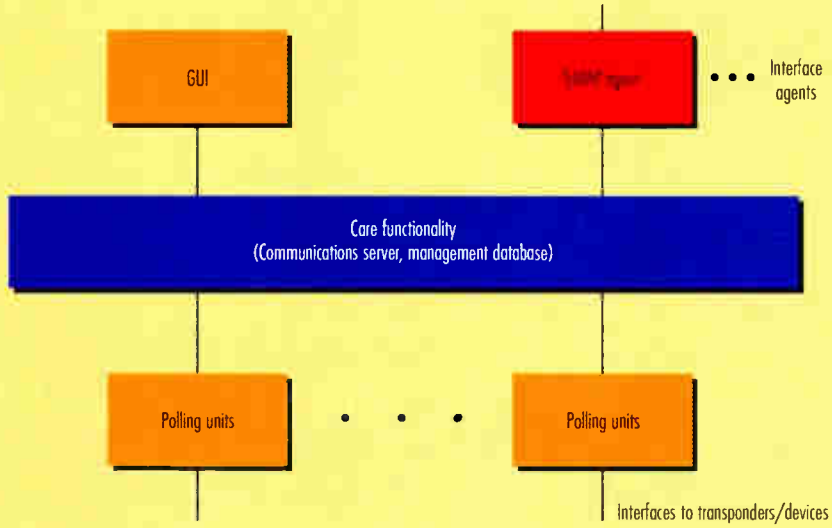
Korea 011 82 2-581 3037 France 011 3956 8131 UK 011 44 202 872771
Japan 011 81 3343 1800 Gemany 011 49 8641 5036

7th Ave. & Freedley St., Conshohocken, PA 19428
Telephone: 610-825-3750 Fax: 610-825-3530

Reader Service Number 80

Figure 2: Element management system (EMS)

Providing the basic management functionality for a dedicated group of network elements, the EMS is the foundation of any network management system.



EMS provides the basic management functionality for a dedicated group of network elements. For example, one EMS may manage headends while a second EMS manages cable telephony equipment.

Because the EMS is optimized for the network elements it manages, it usually contains proprietary technology. A typical EMS for HFC transport devices is shown in Figure 2. It should be possible to run all EMS components on a single computer. Polling units provide a dedicated interface to the elements being managed. The network elements are equipped with transponders that perform measurements in the devices and then communicate the results of these measurements, as well as alarms, back to the EMS. Various groups of network elements may have their own EMS.

Revisiting the requirements stated previously, what qualities are desirable in an EMS? Return signal switches and dual receiver technology are available today to make an EMS robust against noisy environments. A fast and robust polling mechanism is the heart of an EMS. Operators should look for a polling rate that reports unresponsive devices and alarms within 20 seconds. Based on a client-server architecture, an EMS should be scaleable up to at least 30,000 devices. To manage upgrades and extensions, network operators require downloadable firmware and automatic transponder detection. As a standard interface to a higher layer domain or network management system, an

VCII Upgrades IRD Cards VCRS

Refurbished
SAVE $70 LIMITED OFFER
VCRS $529
VCII $249

VCII Upgrades
SAVE $50 LIMITED OFFER
VCRS
$289 WEDGE
Exchange for working White Label
$429 IRD CARD
Exchange for working White Label

VCII Repairs
MOST REPAIRS $93
VCRS PLUS VCII IRD's

1605 E. Iola
Broken Arrow, Ok 74012
TULSAT
800-331-5997

Signal Level Meters

Signal Level Meter
SAM 1's
NEW IN BOX & REFURBS
800-331-5997 1605 E. Iola Broken Arrow, Ok 74012
TULSAT

Sencore Hand Held Signal Level Meter
750 mhz Digital
REFURBS $699
800-331-5997 1605 E. Iola Broken Arrow, Ok 74012
TULSAT

5-450 mhz Signal Level Meter
SAM JRs
NEW IN BOX & REFURBS
800-331-5997 1605 E. Iola Broken Arrow, Ok 74012
TULSAT

BTSC Stereo SAP Stereo Agile Modulators

NEW and REFURBISHED
SCIENTIFIC ATLANTA
BTSC Stereo Encoding System

6380
Most Options in Stock
SAP
4.5 mhz
41.75 mhz
Baseband

8E
Plug-in Module for 6350
Easy Install
Channel Separation

6390
4 Channels Using One Headend Rack Space
$2995

1605 E. Iola
Broken Arrow, Ok 74012
TULSAT 800-331-5997

550 mhz Agile
STEREO MODULATOR
$1195
Drake VM2552
3 Year Factory Warranty

550 mhz Agile
AGILE MODULATOR
$599
Drake VM2550
3 Year Factory Warranty

TULSAT 800-331-5997

SA 6340
MODULATORS
$595
Chan. 2-13 and 17-22
Many used less than 2 months

Over 1500 in Stock
SCIENTIFIC ATLANTA
6380 Stereo
6150 Processors
6130 Processors
6330 Modulators
6350 Modulators
6250 De-Modulators

SA 9280
AGILE MODULATOR
Many used less than 2 months

EMS should provide a simple network management protocol (SNMP) interface. Finally, an EMS that runs on a standard PC computing platform offers an inexpensive solution.

In addition, network operators might need new EMSs to keep pace with the release of new network elements. A close partnership between the equipment supplier and the EMS supplier is absolutely necessary to keep the time-to-market as short as possible.

The domain management system (DMS): The DMS is a focused network management system for the domain of broadband access networks. As shown in Figure 3, the DMS provides three basic functions:

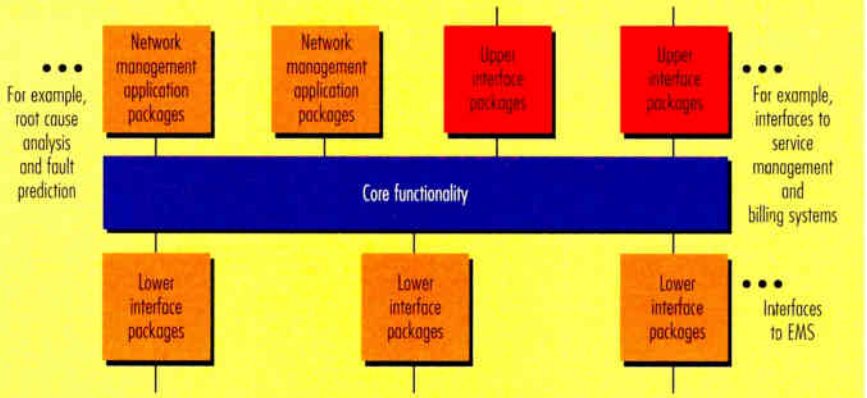
1) It integrates different EMSs. Typically, there are different EMSs for different manufacturers and different network devices. The DMS can cope with this variety. It also can easily integrate proprietary EMSs to support migration toward standard technologies.

2) It integrates multiple instances of the same EMS. This ability to scale allows the DMS to cope with large networks.

3) It provides value-added functions. For example, the DMS accommodates management application packages that perform activities like networkwide root cause analysis or fault prediction. In addition, the DMS provides interfaces to other management systems for service management, billing, or work flow management.

Figure 3: Domain management system (DMS)

The DMS integrates different EMSs, offers interfaces to other management systems, and provides value-added management functionality.



What additional qualities are desirable in a DMS? A modular DMS should be easily customized to meet an individual operator's needs. Like the EMS, a DMS should run on the inexpensive standard PC platform. Based on a client-server architecture, a DMS may be made up of a number of LAN-interconnected PCs. The most beneficial quality of a DMS is its flexibility. It adapts to network evolution on demand by simply integrating new EMSs on the one hand, and adding interfaces to higher layer management systems on the other hand.

Clearly differentiating between the DMS and its underlying EMSs is a key feature of this modular architecture. Keeping these two parts of the management solution separate, but connected with standard interfaces, is the basis of the architecture's power. Only when the EMS and DMS are kept separate do operators have a clean and easy way to add new EMSs to the architecture as the need arises. This cannot be achieved with a mixed DMS/EMS arrangement.

This domain management system concept is the basis of an inexpensive, integrated solution for broadband network management. It provides one point of focus for all network management functions required today in a modular architecture that is flexible enough to accommodate the needs of the future.

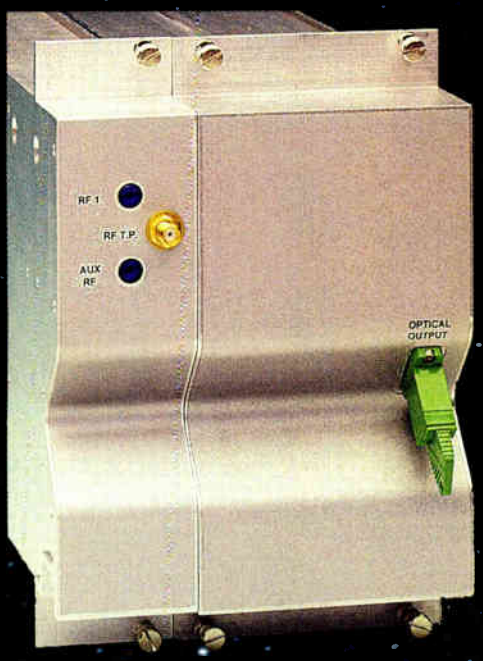
Standards

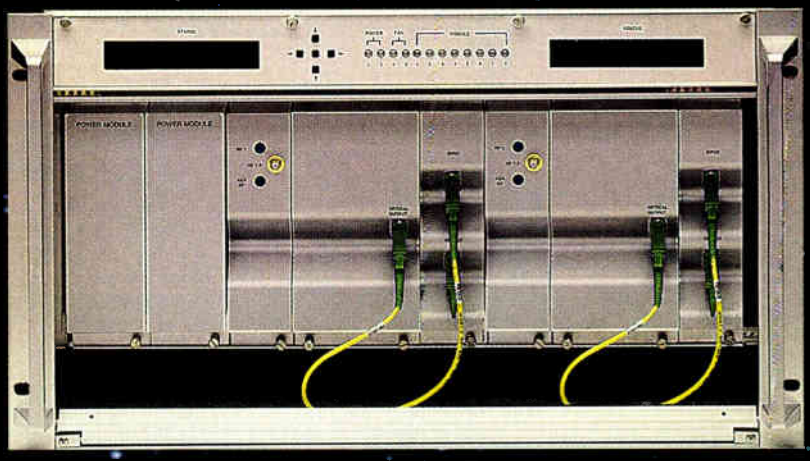
Standard interfaces are essential to operators building their network management architecture. Operators need network management system components that can be connected to each other and which can all be linked to common higher layer systems. Such interfaces can be most easily achieved when standard interfaces are used. Today's accepted industry standard interface is the SNMP. Its power is its simplicity, and this has already led to its widespread use. It might not be sufficient in the future, but until concrete demand is there, systems with interface extensibility are recommended.

Last year CableLabs became very active in producing a standard for HFC monitoring systems. Clearly, everyone benefits from this activity, and the architecture presented here is in full compliance with the CableLabs standards. **CT**

Altair & Antares

Superstars of 1550 nm Transmission





The External Modulation Transmitters with outstanding performance for supertrunking or direct distribution

The Altair External Modulation Transmitter is optimized for 80-110 channel direct distribution.

The Antares External Modulation Transmitter is designed for single or dual fiber supertrunking.

Both offer outstanding specifications and new system flexibility in architecture configuration, including dual transmitters in a single chassis. Both utilize the advanced monitoring of the Constellation chassis and the Hercules SNMP proxy agent.

CONSTELLATION
The modular fiber optic system

Synchronous
GROUP of Companies

77 Las Colinas Lane San Jose, CA 95119 (800) 659-6750 Fax (408) 362-4826

Reader Service Number 160

EXPAN
DEPEN
INCRE

HOMEWORX™ LINEAR OPTICAL TRANSPORT. DELIVERING

DABLE_
DABLE_
DIBLE_

THE HIGHEST PERFORMANCE TRANSMISSION FOR HFC

Future-proof your HFC broadband transmission network with exceptional performance and flexibility. A full suite of Homeworx transmitters and receivers offers the highest quality broadband, linear and RF signal transmission available.

- Superior CNR performance lowers equipment costs and covers longer distances.
- Network expansion without modifying existing cable plant protects capital investment.
- Comprehensive network management tools ensure dependable service delivery.

No matter what your need – supertrunking and distribution, broadcast or narrowcast, central office and node equipment, forward or reverse path, or 1310nm or 1550nm optical wavelengths – Homeworx has a system for you.

Why enter the future with anything less? Call us today at **800 366-3891**.

ADC Telecommunications®

W W W . A D C . C O M

Reader Service Number 147

By Lawrence A. Stark

Call for "max headroom": The DFB return path story

The return path network in hybrid fiber/coax (HFC) networks must perform well in order to enable the development of full service, interactive networks and enable MSOs to obtain new revenues from new services. The optical portion of this network has used low-cost Fabry-Perot (F-P) lasers in the past, when the data communications requirements were moderate. As MSOs add advanced services such as telephony, personal communications service (PCS), and high-speed data, new demands on signal performance call for a reevaluation of the appropriate laser for the return path.

The distributed feedback (DFB) laser avoids many of the shortcomings of F-P lasers. Uncooled DFB lasers, with internal optical isolators, may offer a suitable compromise between performance and cost. The RF performance attainable from uncooled DFB lasers exceeds that of uncooled F-P lasers by a significant margin, offering the MSO greater confidence and operating margins in two-way networks.

The most important technical issue in the relative performance of F-P lasers and DFB lasers is mode partition noise. F-P lasers typically emit light at 3-5 closely spaced wavelengths simultaneously. The optical power level of each wavelength fluctuates continuously causing severe noise and distortion at each individual wavelength.

At the output of an F-P laser, the noise and distortion from all combined wavelengths nearly cancels, and good analog characteristics are often observed at the output of F-P lasers, or after transmission through short fiber links with low reflection. To maintain good noise and distortion through longer links, all of the wavelengths from the F-P laser must be transmitted identically through the fiber link, with the same amplitude and the same time delay. In practice, this can be extremely difficult. One of the most serious problems is the effect of dispersion. Dispersion results in different delay times for each wavelength through the fiber. The differences in the transmission delay of individual wavelengths destroys the noise cancellation. Thus, a key strategy to improve return path performance is to eliminate mode partition noise. This is achieved with an uncooled DFB laser with an optical isolator.

To operate over a wide temperature range without a TE cooler requires a laser chip design that minimizes the effects of temperature changes on the properties of the laser chip. Changes in temperature affect the threshold current, laser slope efficiency, and linearity. Minor variations of relative intensity noise (RIN) and wavelength also are observed. With respect to the wavelength, the DFB grating, internal to the laser structure, serves to maintain the wavelength nearly constant although the intrinsic wavelength of the peak optical gain is changing. This results, in some devices, in a transition from DFB mode to F-P mode at very low temperatures when the difference between the optical gain peak wavelength and the DFB grating wavelength becomes too large. This tendency could be troublesome if not for the fact that the internal temperature rise in optical nodes caused by power supplies and hybrid amplifiers is on the order of 20°C, or higher. Therefore, uncooled DFB lasers will perform well, even in outdoor equipment specified for operation at ambient temperatures as low as -40°C.

The performance capabilities of return path laser designs have been analyzed using a combination of modeling and direct measurements. Direct measurements were used to determine levels of mode partition noise in uncooled F-P lasers, practical modulation depths for cooled and uncooled lasers, and the optimum coupled power for DFB and F-P lasers. Based on these measured parameters, link performance was modeled for a variety of link lengths and numbers of channels. In these calculations, F-P lasers were assumed to operate at room temperature at a wavelength 10 nm off from the zero dispersion point of the fiber. The output power levels for the modeling were 2 mW for an uncooled isolated DFB and 1 mW for an unisolated F-P.

The optical receiver was assumed to have a noise current of 5 pA/Hz$^{1/2}$ that can be realized relatively easily for the reduced bandwidth and linearity requirements of return path links. The RIN for F-P lasers, neglecting mode partition effects, was assumed to be -145 dB/Hz, which can be achieved with moderate selection of wafers.

The signal set that will be transmitted in the return path link will be multiple quadrature phase shift

Top 5 reasons to use DFB lasers in the return path

1) DFB lasers have no mode partition noise and a lower noise floor than Fabry-Perot lasers.

2) DFB lasers provide "max headroom" for protection against signal ingress effects.

3) DFB lasers provide a good balance between cost and performance, especially when considered over the life cycle.

4) DFB lasers enable the return path to carry more demanding date services.

5) DFB lasers thus enable new revenues from data services.

Lawrence Stark is vice president, broadband markets development for Ortel Corp. based in Alhambra, CA.

STANFORD TELECOM

ANNOUNCING TWO NEW PRODUCTS THAT WILL ENHANCE YOUR CABLE MODEM PERFORMANCE FOR THE UPSTREAM TRANSMISSION AND RECEPTION OF DATA IN HFC NETWORKS.

STEL-9257
Headend Demodulator Assembly

Our new hybrid fiber/coax headend receiver for demodulation of return path signals provides full programmability for compliance with IEEE 802.14 and MCNS industry standards.

- The STEL-9257 headend demodulator assembly offers a cost effective approach for your headend receiver requirements
- Burst QPSK signal demodulation
- Variable 256 Kbps to 5 Mbps data rate range
- Tunable 5 to 65 MHz RF input frequency
- Selectable packet lengths
- MAC friendly features

STEL-1109
Subscriber Modulator ASIC

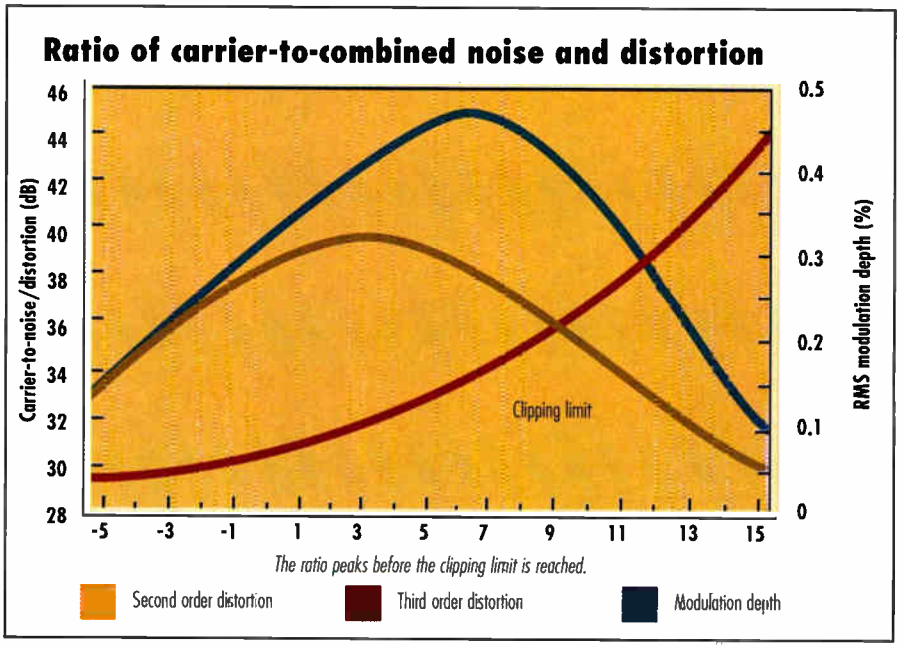
Our new modulator ASIC offers a complete solution for the transmission of return path data from your subscriber cable modem. The STEL-1109 includes:

- Selectable QPSK or 16 QAM modulation formats
- Reed-Solomon encoder
- On-chip 10 bit DAC
- Direct RF output covering 5 to 65 MHz.

Contact Us Today for Complete Information on Our Cost Effective Cable/Internet Access Products.

Stanford Telecommunications Inc. • 480 Java Drive • Sunnyvale, CA 94089
Tel: (408) 745-2660 • Fax: (408) 541-9030 • E-mail: tpg_marketing@stelhq.com • Internet: www.stelhq.com

Reader Service Number 138



keying (QPSK) or quadrature amplitude modulation (QAM) carriers. A useful way of characterizing the transmission path for these signals is the carrier-to-noise-plus-interference ratio—C/(N+I). This reflects the fact that random noise, harmonic distortion and intermodulation distortion can be combined together to predict the total degradation of the error rates of the demodulated signal.

Of considerable interest is the performance of return path lasers in the presence of signal ingress, particularly whether the laser is susceptible to clipping. Clipping occurs when the peak input current to the laser exceeds the current value at which the laser is biased above threshold. For AM video signals, the effects of clipping can be observed when the root mean square (RMS) modulation depth exceeds a value of approximately 25%. If there are N carriers of equal amplitude, then,

$$m_{RMS} = (N/2)^{1/2}\, m_i$$

Where:
m_i = modulation depth of an individual carrier

For QAM and QPSK carriers, clipping effects become significant at a lower input level, typically 20% total RMS modulation depth.

The accompanying figure shows the predicted C/(N+I) as a function of the input level for a case of 120 individual carriers with a 1 MHz measurement bandwidth. Individual curves are shown for carrier-to-noise + composite second order (CSO) and C/N + composite triple beat (CTB). Also shown is the total RMS modulation depth of the signal. The performance increases at low input power levels, peaks and then declines at higher power. Note that the maximum performance is achieved at a total RMS modulation depth that is well below the level at which clipping of the laser would be expected.

The high level of performance attainable with the uncooled DFB, relative to F-P lasers is due to the lack of mode partition effects. The C/(N+I) performance of a F-P will be significantly lower than that of the DFB shown before.

Excessive mode partition noise may only occur at temperature extremes, because the nominal wavelength of an F-P laser may fall within a few nanometers of the fiber zero dispersion wavelength at room temperature. F-P lasers have a temperature coefficient of wavelength of approximately 0.5 nm/°C. In outdoor environments, the temperature variation can approach 65°C, which results in a wavelength change greater than 30 nm.

Nevertheless, DFB lasers have a significantly lower noise floor, as a result of no mode partition effects. DFB lasers thus provide the maximum headroom, or protection, against ingress events. The "max headroom" effect is a compelling reason for deploying DFB lasers in the return path. **CT**

After a million miles of broadband networking

GI's broadband networking experience would span the distance between the earth and the moon 4 times.

238,857 miles

Now there's...

NETadvantage™

systems and services for reliable broadband networks

NETadvantage is your complete resource for broadband networking on the cutting edge. No other company in the world can match the depth and breadth of GI's analog and digital HFC networking experience.

In today's competitive broadband landscape, you need the **best networking support** you can get. From experts who've been there, seen it, done it. And, in a million miles of broadband networking, we've learned a few things along the way.

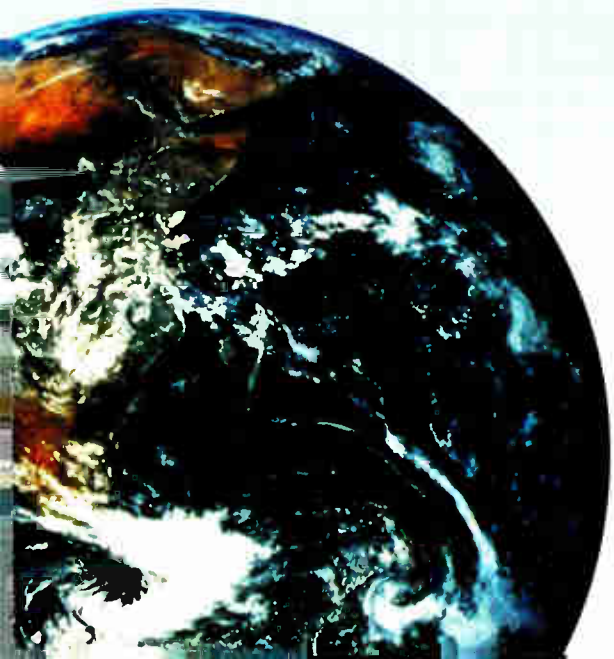
NETadvantage draws together valuable HFC planning and operational expertise with a suite of network design, monitoring and management products, intimate hardware knowledge, and an array of customer support services. **We focus on results** ...making sure your new build or network upgrade will generate revenue and keep generating revenues for years to come.

Your broadband network must succeed in today's sophisticated multivendor environment that supports interactive video, Internet access, information, and telephony options. An environment where the quality and reliability of the services you provide will differentiate winners from losers.

So give us a call. **We know what works.** And how to make it all work for you. Let us show you how ***NETadvantage*** can guide you securely into the future.

1-888-GEN-INST

http://www.gi.com

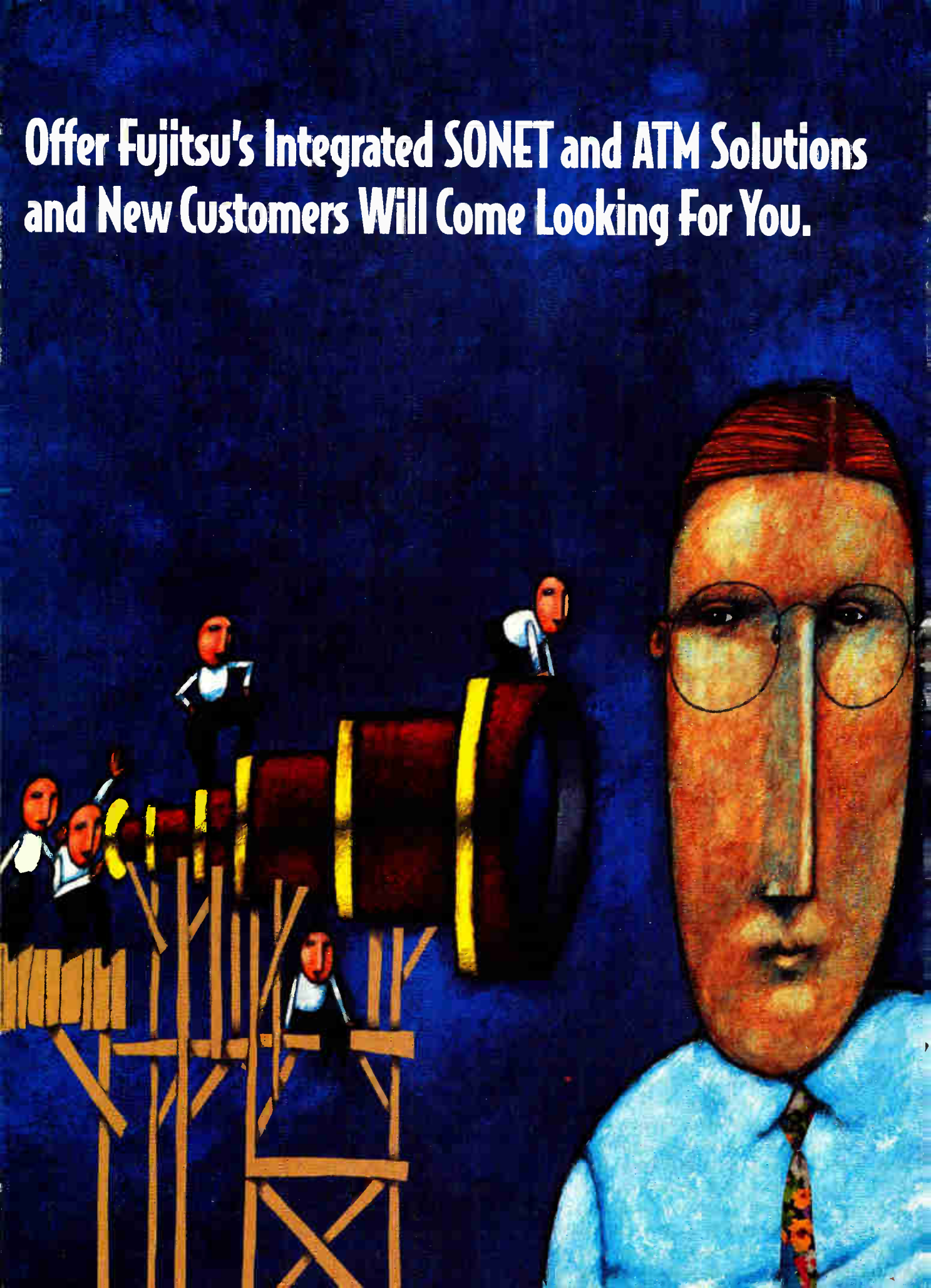


Reader Service Number 15

GI General Instrument

We're becoming NextLevel Systems, Inc.

Offer Fujitsu's Integrated SONET and ATM Solutions and New Customers Will Come Looking For You.



A Full Range Of Services and Network Solutions That Put You In View.

Here's a broadband resource with a broad range of products and service solutions. With Fujitsu's integrated ATM over SONET capabilities, you can offer the variety of network services that will have new customers knocking on your door. Transparent LAN, cell relay, high-speed Internet access, high capacity DS1/3 circuits, DSO-based SONET solutions and more. All designed with your profitability in mind.

The Experience and Strength To Keep You And Your Customers Covered.

Fujitsu is the largest local exchange network supplier of SONET technology in the U.S. Over 50,000 flexible, reliable and easily upgradable SONET systems are currently operating. And more are being created each day. Each system offering the optimal bandwidth utilization and survivability for which SONET is renowned. And all with Fujitsu networking features like software downloadable product enhancements and remote memory back-up for network restoration. From industry standard OC-192 to survivable DSOs, Fujitsu's got your network covered.

Features to Keep You In Front.

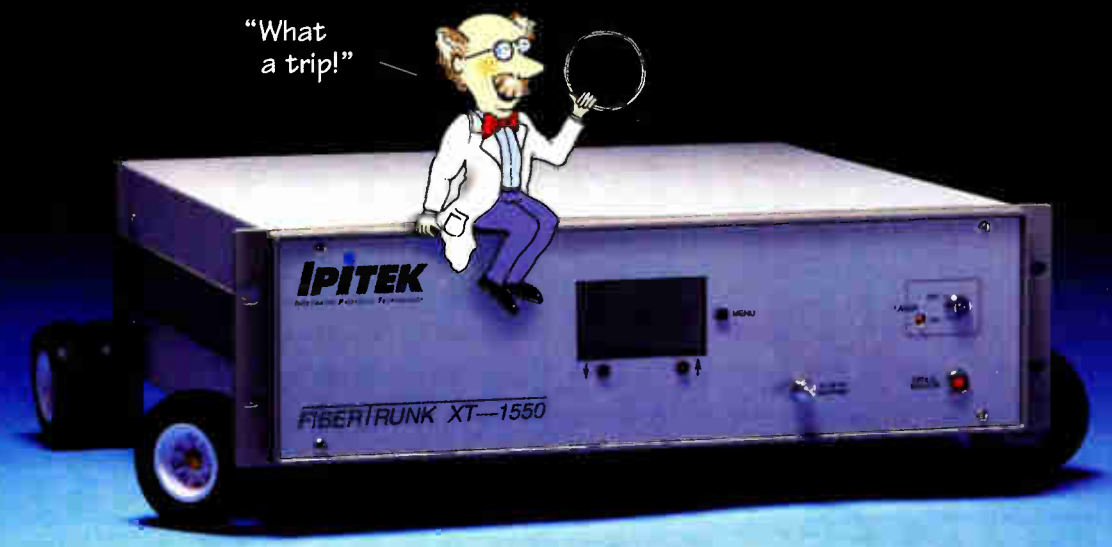
Fujitsu was the first supplier to increase the ease and efficiency of network management by offering full 7-layer OSI capabilities across our entire product line. Now we're the first to integrate ATM traffic into a SONET transport network which will give you optimal bandwidth utilization, lower network management costs and maximized network flexibility as you grow into the next century.

Call on the Company That Can Make It Happen.

Fujitsu has the expertise, the service support and the experience to help you grow your network. And consulting services that can show you where to find new customers and how to help new customers find you. Call 1-800-777-FAST or e-mail us at fast@fujitsu-fnc.com to find out what our ATM over SONET solutions can mean to your network and your bottom line

FUJITSU

Long distance carrier



If you're consolidating headends or need to move your signals further down the highway, check out our FiberTrunk XT-1550. It's a powerful, externally-modulated fiber-optic transmitter system for a variety of cable television applications. An operating wavelength of 1550 nm and built-in SBS suppression gives you the long distance coverage you need for today's architectures. A powerful, built-in optical amplifier produces up to 80 mW output and advanced circuitry assures very low CTB and CSO distortions.

With a bandwidth of up to 860 MHz, the XT-1550 series transmitters meet your analog and digital-RF transport needs, worldwide. This is a transmitter that is ideally suited for advanced hybrid fiber-coax architectures such as redundant rings, interconnects and high performance supertrunks.

IPITEK technology stems from a long heritage of research and development. With a large technical staff of engineers and scientists providing a strong foundation in optical technology, it's no wonder the IPITEK products enjoy proprietary advantages.

To find out more about the XT-1550 series, plus our expanding line of IPITEK analog and digital transmission systems and passive optical components, contact us for our information package at 888-4-IPITEK or E-mail us at ipitek@tacan.com.

WE'VE GOT CONNECTIONS

IPITEK

INTEGRATED PHOTONIC TECHNOLOGY

2330 Faraday Avenue, Carlsbad, CA 92008 • Tel: (619) 438-8362 • Fax: (619) 438-2412 • E-mail: ipitek@tacan.com

Reader Service Number 27

By John Mailhot

Do ITV dreams hang on a digital future?

In the early 1990s (a very long time ago in techno-years) the digital video landscape was dominated by the looming presence of several proprietary digital video delivery systems. Each promised to bring enhanced services—such as interactive TV (ITV)—to consumers and economic benefits to service providers. Most of these systems now lay stacked like junk cars in the backs of their development labs. What business calamity could have caused the stillbirth of so many well-funded, strongly marketed digital video delivery systems?

The digital video marketplace of yesteryear did not lack for technology, or for capital, or for good ideas. What hindered the market at that time was a business plan that worked and met the price-points of consumers. The digital delivery systems of that day simply were too expensive per subscriber to justify actual widespread implementation. The primary driver of this cost was (and still is) the cost of the consumer premises equipment (CPE).

In the telephony world, CPE costs were high for years, but consumers were shielded from these costs by the policy of leasing telephones at subsidized rates from the phone company (much like cable boxes today). The standardized nature of the telephone made conversion from this leasing model to a consumer-ownership model in the 1980s very simple. Consumers never feared that moving to another city would render their phones useless.

Even today, where local access competition is becoming reality, consumers do not worry about the obsolescence of their telephones. The effectiveness and value of this standardization was manifest. In a similar manner, consumers today purchase TV sets with the certainty that anywhere in North America, their TV investment will be compatible with the local broadcasters and (unscrambled) cable carriers.

Perhaps new digital video delivery systems and standardization efforts can make old ITV dreams a reality sooner than later.

Standards

As an industry, we are still searching for the best delivery path for bringing digital video content to consumers, and standardization again has a profound economic impact on the products. Digital video CPE cost is driven by integrated circuit (IC) developments and pricing models. The cost of the CPE is dominated by silicon. In the age of increasing complexity, the development investment to create silicon devices for CPE decoders is enormous. Silicon vendors will only make these investments when the certainty of standardization is on their side.

The MPEG-2 (Moving Pictures Experts Group) standard for video and audio compression and transport came at exactly the right time for our industries. It has provided the developmental certainty required for competition in the silicon marketplace, and is the basis for huge investments and product redirections

John Mailhot is the technical manager for the Digital Video Products Group at Lucent Technologies.

on the part of many of the formerly proprietary players of yesteryear.

MPEG-2 has allowed the cumulative volume of CPE decoder silicon to act collectively and has created a price and feature war among silicon vendors. Standardization of the video and audio layers in MPEG-2 has helped CPE vendors by reducing the cost of the decoder portion of the digital video CPE (and therefore the total CPE) to within grasp of the financial targets in many business plans. We see the fruit of this in the new product and service announcements every day.

The next step for the equipment industry is standardization of the premise access layers of these digital video systems. Whether access to consumer premise is by copper loop, terrestrial broadcast, coax, multichannel multipoint distribution service (MMDS), fiber or direct broadcast satellite (DBS), the cost of the access electronics is now the dominant factor in the cost of digital video CPE. Important progress has been made in standardizing some of these interfaces. Digital Video Broadcast, Digital Audio-Visual Council, Advanced Television Systems Committee, Society of Cable Telecommunications Engineers, Society of Motion Picture and Television Engineers, International Telecommunications Union and the Electronic Industries Association are all working (together and separately) on standardizing all of these methods of consumer access.

When the process is complete, silicon vendors will beat each other up on price and performance in the competitive marketplace, with the ultimate winners being consumers. I predict an explosion of digital delivery of video to consumers as soon as the prices of the CPE come down enough.

"The next step for the equipment industry is standardization of the premise access layers of these digital video systems."

In this future world, consumers will be able to choose from many access vendors, each offering some combination of telephony, data and video solutions. While each of the access vendors may use a different physical layer, the physical layers would be selected from a small number of competing standardized options. In some targeted neighborhoods, there might be traditional coax cable, fiber-to-the-curb, digital MMDS, and regular twisted-pair, all competing for the consumer's communications needs.

As the Federal Communications Commission moved recently to formally adopt the ATSC standard for advanced TV (ATV) service in the United States, we applauded not just because it validates our years of active work on ATV, but more importantly because it signals the beginning of a new era of digital video products, marked by interoperability and feature-richness that comes only from standardization.

With the final negotiations and compromises between the computer and broadcast industries in the last days before adoption of the high definition TV (HDTV) standard, we see at last the glimmer of convergence. The economics of silicon standardization will drive the computer industry and the broadcast TV industry toward common video compression methods and common audio compression methods, in order to reduct the cost and improve the economics of both industries.

In the early 1990s, the industry buzz was ITV. Perhaps now, in the late 1990s, the technology and standardization have improved the economies of scale to the point that the old dreams of ITV will finally overcome their economic realities and succeed in the consumer marketplace. **CT**

Call EARLY for same day shipping on many items!

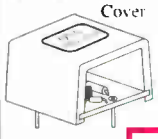
QRF

Ask us about 550 MHz for Jerrold SJ & SLR Housings

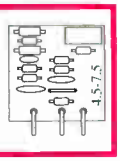
REPLACEMENT EQUALIZERS AND PADS
QUALITY RF SERVICES, JERROLD, S/A, MAGNAVOX, TEXSCAN "T-SERIES", PATHMAKER, RCA & *AUGAT*

SA Equivalent EQs

QRF EQ's for Scientific Atlanta
330, 450, 550 & 750 MHz
$9.00 w/handle - **$11.00** w/cover
Flatness = ± 0.15 dB
Return Loss ≥ -17 dB
Insertion Loss ≤ 1 dB
Values 0 to 30, in 1.5 dB steps
30 & 42 MHz Reverse EQ's

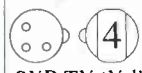


***NEW!* QSA2V**
Variable Reverse 42 MHz EQ for S/A System Amp II for only **$11.00** each



QSARE response EQ (450 or 550) - **$25.00**

SXP-T-Top Pads for Scientific Atlanta & *Augat*
SXP-T (Blue) 600 MHz, $1.75
0 to 20 dB in 1 dB steps.



SXP-TY (Yellow) 860 MHz
0 to 13 dB in 1 dB steps, $2.14
SXP-TY (Yellow) 860 MHz, 14 to 20 dB , $2.64

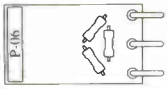
For Pathmaker

QSYL EQ's $10.00
300, 330, 400 & 450 MHz
Nominal Values are:
4, 7, 10, 13, 16, 19, 22 and 25 dB

QSYL-P Pads $4.50
0, 1, 2, 3, 4, 5, 6 dB
9, 12 and 15 dB

For TEXSCAN

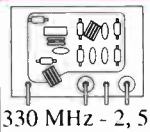
TEXSCAN "T-SERIES" EQUALIZERS
$10.00
Bandwidths are 330, 400, 450 & 475 MHz
330-400 MHz values: 4, 8, 12, 15, 18 dB
450 MHz - 4, 6, 8, 10, 12, 14, 16, 18, 20 dB
475 MHz - 4, 6, 8, 10, 12, 15 dB



TEXSCAN "T-SERIES" PADS - $5.00
0, 1, 2, 3, 4, 5, 6 dB
9, 12 and 15 dB

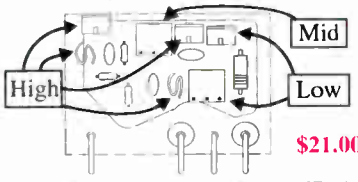
RCA EQ's & PADS AVAILABLE

For Philips/Magnavox

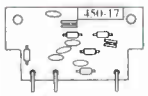


QMAG-6 for 62E Series
Replacement EQ's for Philips
(330, 400, 450 and 550 MHz)
$10.00
330 MHz - 2, 5, 8, 11, 14, 17, 20, 23 dB
400 MHz - 2, 5, 8, 11, 14, 17, 20, 23, 26 dB
450 MHz - 2, 5, 8, 11, 14, 17, 20, 23, 26 dB
550 MHz - 2, 5, 8, 11, 14, 17, 20, 23, 26, 29 dB

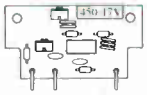
QMAGRE Response EQ
Exclusively available from QRF!



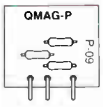
$21.00
600 MHz response EQ with 4 or 7 dB slope.
Useful in 6-series tapped trunk and feeders.



QMAG for 5EE Series
Fixed EQ's for Magnavox
(330, 400 and 450 MHz)
$10.00
5, 8, 11, 14, 17, 20 dB values - All frequencies
Return Loss ≥ -16 dB, Insertion Loss ≈ 1 dB

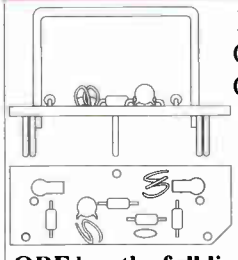


QMAGV for 5CE Series
Variable EQ's for Magnavox
(330 and 450 MHz) **$14.00**
5, 8, 11, 14, 17, 20, 23 dB Values
Return Loss ≥ -16 dB, Insertion Loss ≈ 1 dB



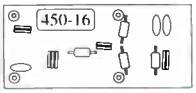
Use our QMAG-P for 4-A Pads
4-A Pad (0, 3, 6, 9, 12 dB) **$4.50**
6-A Pad (0-20 dB, 1 dB steps) **$1.75**
7-A & 9A Pad (0-20 dB) **$2.90**

NEW! For AUGAT



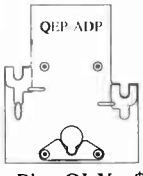
NEW from QRF!
QAE 750 MHz EQ
QAE 860 MHz EQ
Available in 1.5 dB values, 0 to 21 dB with handle. **$9.50**
QAE top view, shown without #871 handle.
QRF has the full line of pads for Augat.

QLX EQ's for Jerrold

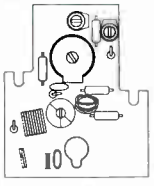


Equalizer for Jerrold JLX
(Replaces EQ & SEA)
ALL in 2 dB increments.
ONLY 1 dB insertion loss for all models!
(330, 350, 400, 450, 500 and 550 MHz)
330-450 - 0-30 dB 500 MHz - 2-22 dB
550 MHz - 0-24 dB **$6.75 each**
600 MHz $7.50 **750 MHz $11.00**
600 & 750 MHz in 2 dB steps, 0-24 dB

QEP-ADP for SJ

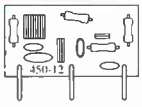


Fixed value equalizer adapter allows **QLX** to replace SEP-*. NO alignment! Lower Cost! Lower Insertion Losses! ***EASY*** installation!
QEP-ADP $7.00 each
Plus QLX - **$6.75** Total is only $13.75

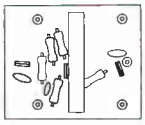


QEP Variable trunk equalizer for Jerrold SEP. Available in 1 & 2-way versions ... 4's, 5's
TL - 5 thru 11 dB
L - 10 thru 16 dB
H - 16 thru 22 dB
ST - 20 thru 25 db
(300 through 450 MHz Bandwidths)
All ranges are **$15.00** each.

QEE & New QXEE



Line Extender Equalizers
(Replaces SEE by Jerrold)
270, 300, 330 & 400 MHz
All values $5.00 each!
450 MHz - **$6.00** 550 MHz - **$7.00**
QEE values: 6, 12, 18 & 24 dB
NEW!* QEE-42** MHz ***Reverse EQ - **$7.00**
Reverse values 2, 4, 6, 8, 10 & 12 dB



QXEE replaces Jerrold XEE
550 MHz - **$8.25**
Used in **XQLE** Line Extender
Values: 3, 6, 9, 12, 15, 18 dB
Also available in 630 MHz

Jerrold pads, 0 to 20 dB in 1 dB Steps

JXP-* to 550 MHz **$2.90**

JXP-A-* 750 MHz **$2.90**

SXP-* **$1.75**

***DISCOUNTS AVAILABLE FOR QUANTITY**

Quality RF Services is not a sales agent for Jerrold, Scientific Atlanta, Magnavox, Texscan or RCA.

VISA MasterCard For inside USA Shipments only.

American Express cards are accepted for ALL World-Wide Shipments!

QUALITY RF SERVICES, INC.
850 PARKWAY STREET
JUPITER, FL 33477
800-327-9767
NEW Florida Area Code!
561-747-4998
FAX 561-744-4618

Reader Service Number 89

By Barak Kassar

If you think interactive TV is impractical, then read this

Some say that television was never meant to be "un-interactive." More than half a century before its commercial debut, many popular periodicals depicted it as an interactive medium. For example, in 1879, *Punch* magazine published a drawing in which a couple relax at home while talking with their children (who are in Ceylon) via a large flat screen mounted on the wall. *(Editor's note: If you'd like to see this drawing as well as many other interesting photographs and facts on information age inventions and visions, pick up "InfoCulture: The Smithsonian Book of Information Age Inventions" by Steven Lubar, published by Houghton Mifflin Co., Boston and New York, 1993. The drawing referenced is on page 244.)*

Despite these futuristic visions—and excluding a few cul-de-sacs with advanced TV here and there—television developed as a one-way street. The reason has more to do with the economics of technology than anything else. Traditional over-the-air broadcasters could essentially add a customer without incurring a cost. Once a show was on the airwaves, the broadcaster's cost to deliver it was the same if one million or 10 million people watched.

Cable is not that simple, of course. It does cost to add a customer. However, on any one night, once all the trucks are safely parked in the lot, the marketing department has gone home, and the customer base moves from prime rib to prime time, the cable business looks a lot like the broadcast business. Once you modulate CNN onto Ch. 49, it costs the same if one or two million of your subscribers tune in.

Barak Kassar, a senior manager at Wink Communications in Alameda, CA, can be reached at barak.kassar @wink.com. Information on Wink ITV can be found at www.wink.com.

Text and icon overlays like these make your system "enhanced" and don't require a return channel.

Enhanced broadcasting

Until recently, making television two-way entailed a radical departure from the aforementioned powerful economic model—including a massive revamping of the nation's entire video and telephony infrastructure. It is easy to understand why many interactive experiments did not roll out on the right side of the test-bed.

But technology has evolved over the last few years that proves that interactivity can work if it closely models the broadcast medium and leverages existing infrastructure. Enter a concept called "enhanced broadcasting," which more and more cable operations are embracing.

The following three simple points seem to indicate that interactivity in the form of "enhanced TV" could be finally poised on the edge of mass deployment:

1) Studies have shown that cable customers want more from television than passive entertainment.

2) As operators spend more money on their networks and commit capital to hybrid fiber/coax (HFC) infrastructures, they want greater return on their investment.

3) Recent infrastructure-friendly technological innovations make interactivity possible at a palatable price.

These factors are paving the way for enhanced TV and at least two million U.S. cable customers are expected to have this form of interactive TV by the end of this year.

More, more, more

Giving consumers more. We all know that people like to relax in front of their TV sets, but consumer tests prove that if people can "do a little more" while still relaxing, they perceive a much greater benefit.

Of course, in order for customers to "do a little more" in front of their

sets, the cable system has to "do a little more" to offer such options as:

- Electronic program guides
- Local information on-demand
- Product purchases directly from the home—without moving away from what is being watched

New infrastructure-friendly technology makes existing cable plants and existing low-cost converter technology capable of delivering on a great deal of the interactive promise. By closely following the broadcasting model and return communication optimization techniques to use existing infrastructure efficiently, cable TV is finding ways of adding interactive elements to its core business.

In many instances no return is required at all. That may sound too good to be true, but as the accompanying sidebar details, it is possible.

Any system capable of enhanced pay-per-view can today handle the interactive ordering of steak knives, magazines or even premium channels. Home shopping highlights why so much was spent in hot pursuit of the elusive dream of interactive TV. Many advertisers would be willing to pay a premium for a commercial that allows viewers to buy their product immediately, with a click of the remote, at the moment they were moved to do so by the highly persuasive art of TV advertising. And since it is the cable operators' equipment and infrastructure that is facilitating the transaction, the operator will bring in new revenue.

The same technology used to insert The Weather Channel content (referenced in the accompanying sidebar) can be used to overlay a buy button on the commercial. Whenever you poll for pay-per-view orders you also pick up the fact that the product was ordered, send the customer's billing information to the manufacturer and then be paid for it.

While enhanced broadcasting can help operators retain subscribers and generate revenues, the application of the technology is not purely commercial. News can be enhanced with extra information or polls or soaps can be enhanced with information on missed episodes. The possibilities are unlimited—the costs are not. The software added to the set-tops requires no extra hardware.

"At least two million U.S. cable customers are expected to have interactive TV (in the form of enhanced broadcasting) by the end of this year."

Satisfying Webheads

Another important trend in ITV is the promise of delivering the Internet to the TV set. The jury is still deliberating on this very new concept, but one popular theory is that the TV set's current cultural position in the home, as a shared family experience, does not lend itself to the intensely personal experience of following the links of the World Wide Web wherever they may take you. Technologic Partners wrote that the Internet is a "lean-in" experience and television is a "lean-back" experience and concluded that the way to make the Internet on TV sets successful is to pair it with enhanced broadcasting technology that is fully integrated with the viewing experience.

Summary

With the recent proliferation of entertainment and news options, programmers have been seeking ways to keep people tuned in. Many more channels exist, movie theaters are going strong and the popularity of the great outdoors is at an all-time high. Enhanced broadcasting is one of the ways that television will maintain its position as the most dominant communications medium ever. And with two million U.S. cable customers expected to have enhanced broadcasting by year end, television is well on its way to retaining this title. **CT**

No return? No problem...

It sounds like a contradiction in terms, but you don't have to be "two-way" to be "interactive."

For example, let's consider a child's program that focuses on lions. A small interactive overlay can be displayed on the TV screen that tests kids' knowledge while they are watching the animals roam the plains of Africa. Using remote controls, kids can answer multiple choice questions. Since the questions, correct answers and responses such as "Good job" or "Sorry, try again," can be cached in the 32 kilobytes of RAM reserved for enhanced broadcasting into many popular cable converters, there is no need for a return channel.

Even rapidly changing data, such as weather, sports and stock market information does not require a return channel to give customers what they want. Take The Weather Channel, which is using enhanced broadcasting techniques to give viewers local weather-on-demand.

Using simple design tools, The Weather Channel creates an enhancement that consists of a series of interrelated overlays with text and icons. The enhanced content is stored on a server either at a local or regional headend or at the networks national uplink facility. The servers serve the content into the most popular brands of data insertion equipment at the appropriate times.

Hardware vendors, such as General Instrument, Scientific-Atlanta and Pioneer sell analog and digital converters capable of displaying the overlays and allowing viewers to interact by clicking on the remote. Weather data does not need to be entered by hand. Broadcasting servers are capable of using the Internet as a convenient dynamic data library. The Weather Channel simply tags the HTML content on its web site to allow the content to be automatically re-purposed in the enhanced broadcasting medium, and blended with its video offering on the TV set.

At TV/COM, we specialize in product leadership. Yours.

The Digital Solution by TV/COM. And You.

At TV/COM, our digital solution is a leadership package for your products and services. Complete with features to maximize your product's performance and the support services to keep you responsive to your customer's needs.

Our Innovation Will Keep You Ahead.

TV/COM's engineering team assures our products meet your evolving needs.

TV/COM has always been an innovator in the cable and satellite industry, starting in the 1970's as Oak Communications, manufacturing the first cable converter and first addressable decoder. In 1981, Oak pioneered encryption-based conditional access and security technology. In 1991, Oak became TV/COM and began leading the market with standards-based digital video compression system, developing the first dynamic Satellite Smart Card. Today, TV/COM is a major contributor to ISO MPEG-2 and DVB standards, as well as a supporter of DAVIC, TIA and INTELSAT efforts.

Our Engineering Team Tailors Solutions For You.

At TV/COM, we understand your service needs. We offer you end-to-end solutions that satisfy the most stringent security and control requirements, helping you minimize operating costs and maximize service quality. Plus a team of engineers specifically focused on new technology central to your success—from cable and satellite headend system and conditional access software, to set-tops and PC/TV. When TV/COM customers needed a faster QPSK Modulator supporting data rates up to 90 Mbps, they got it. And you can too. But only with TV/COM.

QPSK Modulator ensures your systems' optimum performance.

Hyundai Set-Top provides you the best value solution.

Our Experience Spans Over Many Industries.

It's easy to see TV/COM is no ordinary manufacturer for cable, satellite, PC and terrestrial solutions. We have the resources of Hyundai Electronics, an $80+ billion, worldwide corporation involved in more than 40 business areas, ranging from fabrication, petrochemicals, engineering and construction, to automobiles, finance, insurance and securities. Its subsidiaries also include computer systems, telecommunications products, systems ICs and MPEG chips. We offer the personal attention solutions you need.

HYUNDAI

Call TV/COM today at (888) 998-8266 for more information. Protect your leadership and enhance your system, software and set-tops with the solution you helped us design. From TV/COM, the company that does more for you than just manufacture headends and set-tops.

TV/COM
A Subsidiary of Hyundai Electronics
17066 Goldentop Road
San Diego, CA 92127
www.tvcom.com

See us at NAB Booth S6156 and Cable & Satellite, London Booth 470

By Eric Wentz

Broadband gets power hungry

Change is the only constant is an oft-used but appropriate theme for the broadband industry. Changes and developments seem to occur almost daily, affecting everything from the business structure of the industry to the technology required to deliver new and enhanced communication services. Expanded video offerings such as pay-per-view (PPV) and video-on-demand (VOD), as well as Internet access and telephony are regular topics of discussion. And while few would disagree that it's an exciting time to be involved in the industry, the volume and extent of change has created both opportunity and challenge.

System reliability is one of the most critical technological challenges facing today's broadband communication service provider. The world's communication infrastructure supports more business, entertainment and education than at any other time in history. Billions of dollars are transferred daily. Thousands of lives depend on the immediate and unquestioned forwarding of emergency response information. Data is retrieved and sent from one side of the globe to the other with hardly a thought of the sophistication of the delivery network.

It's no longer merely an inconvenience to have communication services interrupted. Downtime is simply not an option. Power disturbances—originating from either the utility provider or a secondary source—have been clearly identified as one of the most common causes of downtime.

Today's communication service customer cares little whether a power disturbance is caused by a spike due to lightning, a transient harmonic brought on by utility switching, or a sag resulting from increased single-point utility demand. It simply doesn't matter to the consumer if the problems can be traced to the utility provider, the environment, or the end users themselves. The result is interrupted service to the customer caused by what may have been a very brief and very avoidable power disturbance. The service provider may get a nasty call from an angry customer—or worse yet—may never hear about the problem and simply lose the customer altogether. With this in mind, the responsibility of establishing a reliable source of clean,

"Just a 5% gain in power supply efficiency when multiplied over 200 power supplies results in an average power cost savings of $50,000 per year."

Eric Wentz is the marketing communications manager for Alpha Technologies, which offers standby, nonstandby, and uninterruptible power supplies, surge suppressors, enclosures, batteries and accessories. The company is headquartered in Bellingham, Washington and can be reached at (800) 421-8089.

uninterrupted power shifts from the utility to the service provider—who in turn looks to industry powering experts for solutions.

But what determines reliable power? Reliable power begins with a power system designed specifically for the application. This commitment to application-specific technology must be carried all the way through to component specifications, manufacturing standards, operating efficiencies and maintenance programs. The key issue is technology appropriate for the application.

Technology continues to change and develop, and new technologies emerge. In the future, even more than in the past, broadband network designers will be faced with questions of appropriate technology. There may be a perceived need to consider new or alternative technology—perhaps smaller, lighter and cheaper. But do such proposals represent appropriate technology for the application? To answer this question, one must recognize the unique nature of broadband powering. Broadband power requirements are unique—very unique. Knowing the demanding characteristics of these delivery networks is essential to properly evaluating proposed solutions.

Nonstop power

Uninterruptible power supplies (UPS) systems were introduced to the broadband communication industry in the late 1980s. Until that time, traditional cable TV content and its delivery system could easily accommodate the 8 to 12 milliseconds transfer time typical of standby power systems. Traditional telephony delivery systems had adopted UPS-grade power much earlier as a requirement to providing more critical voice services.

"Downtime is simply not an option."

In recent years, as combined voice, video and data services emerged as the communications content of the future, it became very clear that even milliseconds of interruption in power could have serious consequences on digital signals. Power systems were developed to meet the extreme environmental conditions of broadband applications as well as the new requirements of seamless power transfer to and from system batteries that constituted the primary backup power source.

Today, UPS-grade power systems with backup power capabilities are a baseline requirement for broadband networks. The backup power component of these systems also has been dramatically improved, incorporating integrated engine generators, dual power grid switching and enhanced thermal battery management. Such improvements provide much longer backup runtime in the event of extended utility power outages as well as enhancing battery life—both contributing to improvements in the overall reliability of the network.

Making certain power remains constant during the transition from utility to battery, however, is not enough. Equally important is the nature of that power and the effect of the transition on power characteristics. Without output waveform control, unstable power can introduce frequency transients and other disturbances that can interfere with the signal and the operation of processing equipment.

The output waveform can be distorted when utility power is interrupted and the backup inverter takes over, but it also can be interrupted when transferring back to utility power. It is important that the power system have the capability to analyze the utility waveform to make certain it is stable before switching back to utility power. Then, when the transition is made back to utility, it also is important that power from the power supply's inverter is synchronized with the utility power waveform. Some power supply circuitry available today thoroughly analyzes utility power and provides a synchronous, seamless transfer—from utility to inverter and from inverter back to utility—without compromising efficiency or battery life.

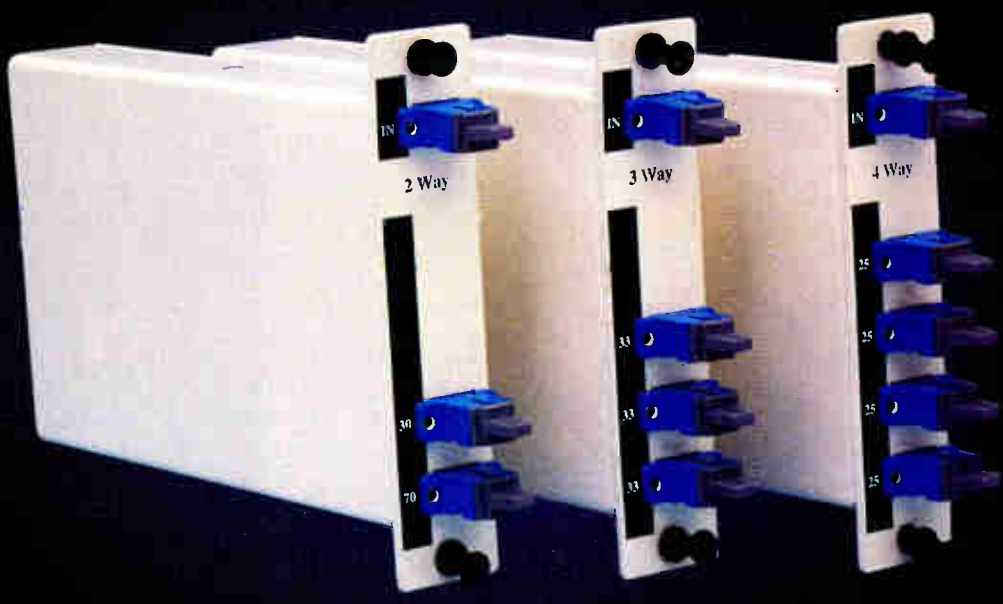
More power

The increased number of communication service users, and the added sophistication of the networks used to deliver these services has resulted

Reliability + (Price + Delivery) - Headaches =

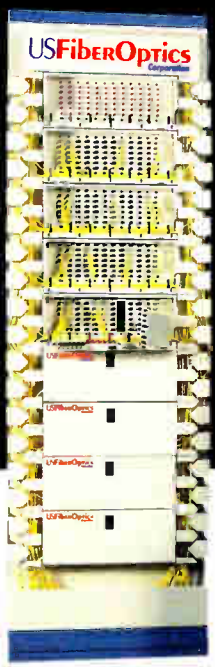
USFiberOptics • 1-800-US FIBER

Splitter Modules



Fiber Optic Splitter Modules distribute a common signal amongst multiple cables, allowing you to minimize the cost of expensive transmission equipment in your CATV system. U.S. Fiber Optics' Splitter Modules are designed to fit into most rack mountable shelves for use in both 19- or 23- inch racks.

- Manufactured to Meet All Bellcore Specifications
- Customizable to any Split Ratio
- Simultaneous Operation at 1310 nm and 1550 nm
- Any Number of Output Ports, from 2 to 10 or more
- SC, FC, or ST Connectors, Standard or Angled Polish



U.S. Fiber Optics offers a complete line of Fiber Optic Splitter Modules, Pretermination Shelves, Splice Shelves, Optical Transition Vaults, and Cable Assemblies for complete interconnect solutions in headends or central offices. For a complete 40-page catalog or for a distributor near you, call 800-US FIBER.

USFiberOptics℠ Corporation

E-Mail: USFiber@erols.com
www.usfiberoptics.com

9017 Red Branch Road, Columbia, MD 21045
(410) 884-7500, fax (410) 884-7501

Gold Distributors:
US: TeleWire Supply (800) 428-7596
Canada: Trispec Communications (514) 328-2025

Reader Service Number 121

in a dramatic increase in power demand. Because power requirements and their associated costs are increasing, the power efficiency of each component in the system is carefully scrutinized by system designers. This is especially true of larger systems where efficiency losses can be high. Conservative estimates have shown that just a 5% gain in power supply efficiency when multiplied over 200 power supplies results in an average annual power cost savings of $50,000 per year—or $250,000 over five years. Many networks require far more than 200 power supplies, greatly increasing the importance of this consideration. It is clear that efficiency is an important criteria in power supply selection.

"It simply doesn't matter to the consumer if the problems can be traced to the utility provider, the environment or the end users themselves."

Full and partial

While power supply efficiency has become a familiar topic, the issue goes much deeper than just a single efficiency rating. Broadband power loads are not constant. Telephony and other related communication services, for example, can double the power load during peak demand periods. Since it is unusual for a power supply to operate consistently at 100% load, it is important to evaluate efficiency in partial, full and even overload operating conditions.

One of the most important and unique characteristics of broadband powering is this high level of load variation. This condition, when combined with wide variations in utility input voltage typical of broadband applications, places additional demands on the power system. Wide differences in utility voltage can reduce the life of the power system and severely impact the reliability of the delivery network if appropriate provisions have not been included in power supply design. At the same time, broadband power supplies are subject to extreme load variations caused by changes in user demand as well as system startup demands. Appropriate power supply technology must effectively tolerate such load variances.

A wide input voltage window must be an integral part of effective broadband power system design. Power systems with a narrow input voltage window switch to batteries more frequently, reducing the life of both the power system and the battery. A wide input voltage window translates directly into longer battery and system life, especially in areas experiencing frequent reduced voltage brownout conditions.

Unlike other power applications, broadband systems are subject to unusually high peak demands. Appropriate power systems are designed to operate effectively up to 150% of normal demand, creating greater efficiency in system design and stable operation in short, peak demand conditions. A broad efficiency range ensures the lowest possible operating costs—even during these high-load conditions. This capability not only helps ensure reliable operation in extreme conditions, but also reduces capital costs by eliminating the need to "over-power" a system to protect against outage in peak demand situations.

Summary

Broadband power requirements are unique. In light of recent and ongoing industry developments, clean, quality power is needed with more reliability than ever before. Where analog technology once tolerated momentary power service interruptions, the complex, vulnerable digital stream is much more susceptible to power interruptions of any length. Knowing the demanding characteristics of these delivery networks is essential to properly evaluating proposed powering solutions. **CT**

Integrated Supplier

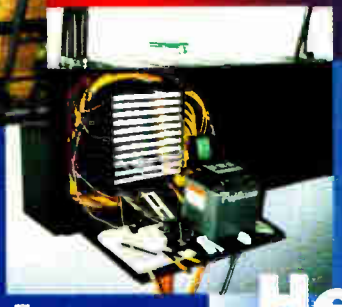
E F & I

Engineering, Furnish & Install

- Service Cables
- Patch Panels
- Splice Boxes
- Patch and Splice Panels
- Splitters
- WDM's
- Preterminated Cables
- Fiber Identifier Software
- Fusion Splicers

FIBER MANAGEMENT SYSTEMS

Alcoa Fujikura Ltd. (AFL) is the leader in the CATV industry providing passive fiber optic products and installation services to build or rebuild your headend. From adapters and pigtails to splicers and fiber management systems, AFL is your source for helping you achieve your goals. AFL also provides the engineering, furnishing and installing (EF&I) services to complete your project in the most economical, timely manner.
Call (800) 235-3423 for more information.



From the **Headend** to the **Node**

ISO 9001

ALCOA

Alcoa Fujikura Ltd.
Telecommunications Division
1-800-AFL-FIBER

Reader Service Number 117

To create the right equipment for the telecommunications industry, you have to learn an important part of communication.

LISTENING.

You're looking at the Altec AP38 Cable Placer. It was designed by our engineers. But it was created by the people who use it. At Altec, we solve problems by listening to our customers. Then we manufacture equipment solutions that work. The Altec AP38 is a perfect example. Built to place both fiber and coax, this machine offers 38 feet of working height and a side reach of over 25 feet, so it can handle all your upgrade and new build projects. Combined platform and fairlead capacity totals 650 pounds, with sideload capacity of 500 pounds. The platform even rotates a full 180° to keep the operator in the right working position. The Altec AP38 is a real piece of work. And it's just one part of a whole line of Altec equipment designed to respond to a changing telecommunications industry. Give us a call and we'll respond to you, too. Problem solved. 1.800.958.2555 or http://www.altec.com.

Altec

Reader Service Number 118

ATLANTA • BIRMINGHAM • DALLAS • DENVER • INDIANAPOLIS • PORTLAND • WEST PALM BEACH • CREEDMOOR, NC

Dixon and Pomona, CA • Millbury, MA • Plains, PA • St.Joseph, MO • Milton, ON • Surrey, BC • Winnipeg, MB

By John Barsellotti and Brian Langlais

Overcoming return path headaches with OFDM

The following article examines orthogonal frequency division multiplexing modulation (OFDM), and defines its characteristics in comparison to other modulation techniques. Particular emphasis will be given to evaluating, and comparing how various modulation schemes perform in the cable return path.

Currently, the cable industry has serious difficulties achieving high spectral efficiency in the return path because of ingress effects. Also, the typical return path is constrained to 5 to 35 MHz, and is shared amongst many growing interactive services. To effectively operate in this spectrum there is a need for a spectrally efficient, yet robust modulation scheme. One such scheme is OFDM.

Typically, two-way cable systems are designed downstream in the 50 to 550 MHz range, and upstream in the 5 to 35 MHz range. Traditional coaxial cable trunks and bridger amplifier structures are being rapidly replaced by analog AM fiber-optic distribution nodes. Most new upgrades have optical nodes of typically 5,000 homes, with plans to achieve optical nodes in the vicinity of 500 homes. Smaller nodes are dictated by the emerging two-way services requirements. Also, reducing the node size is important in limiting the return band ingress funneled upstream. Because of the ingress, only the high end of the return band (18 to 35 MHz) has been typically considered for "reliable" data communications. However, OFDM is well suited for this "unwanted" 5-18 MHz portion of the return band.

John Barsellotti is vice president of technical planning and Brian Langlais, P. Eng., is the senior system designer for West End Systems Corp. based in Arnprior, Canada

Most ingress enters the cable plant from the customer premises, either from defective equipment or poor connections. Primary ingress sources are ham radio, citizens band radio and shortwave audio broadcasts, in the 5-20 MHz band. Distant short-wave broadcasts tend to affect the entire cable plant, while ham, and CB interference are localized problems. This narrowband ingress is generally identified by interference with a slow variation with time (seconds).

"OFDM efficiently uses cable forward path bandwidth holes to fill in the complete cable spectrum to maximize revenue."

Another primary ingress source is 60/120 Hz types of broadband impulsive emissions from electric motors. Impulse noise is spectrally like a random comb generator, with power decreasing with increasing frequency. This broadband ingress is generally identified by interference with a fast variation with time (e.g., 1 msec spike repeated at 120 Hz). This form of interference originates from electrical arcing or the ionization of air. Impulse interference is more of a problem at the low end of the return band (5 to 18 MHz).

Ingress can be controlled to some extent with high pass filters installed at "all" home demarcation points. However, this complicates the installation of multiple interactive services at the premises. Ingress directly into the cable distribution plant also is a problem, but this can be monitored with cable leakage detection devices, and becomes an ongoing plant-hardening effort.

Modulation techniques

Various implementations for return path data/telephony/video transmission fall into the following categories:

- **Single carrier BPSK/QPSK:** Single carrier modulation (SCM) binary phase shift keying (BPSK) simply flips the phase of a constant amplitude RF carrier 180°, when the input serial bit stream changes state. With appropriate Nyquist filtering, BPSK will pack up to one data "bit per second" in "one Hz of RF bandwidth" (1 bit/Hz). SCM quadrature phase shift keying (QPSK) generates one of four possible constant amplitude states, which are equally spaced at 90°. QPSK transmits 2 bits at a time and achieves up to 2 bits/Hz spectral efficiency.

QPSK using time domain multiple access data multiplexing is the most common method used for cable telephony. These systems usually have 24 telephony channels (T-1) in approximately 2 MHz of RF bandwidth. Remote modems will accumulate data for a 2 msec frame duration, and then "burst" the data out. Since the headend modem cannot acquire the signal instantaneously, a time guardband is required around each channel to allow the receiver to settle. SCM systems are vulnerable to impulse noise, and high level narrowband jammers. If these modems switch to a clean channel

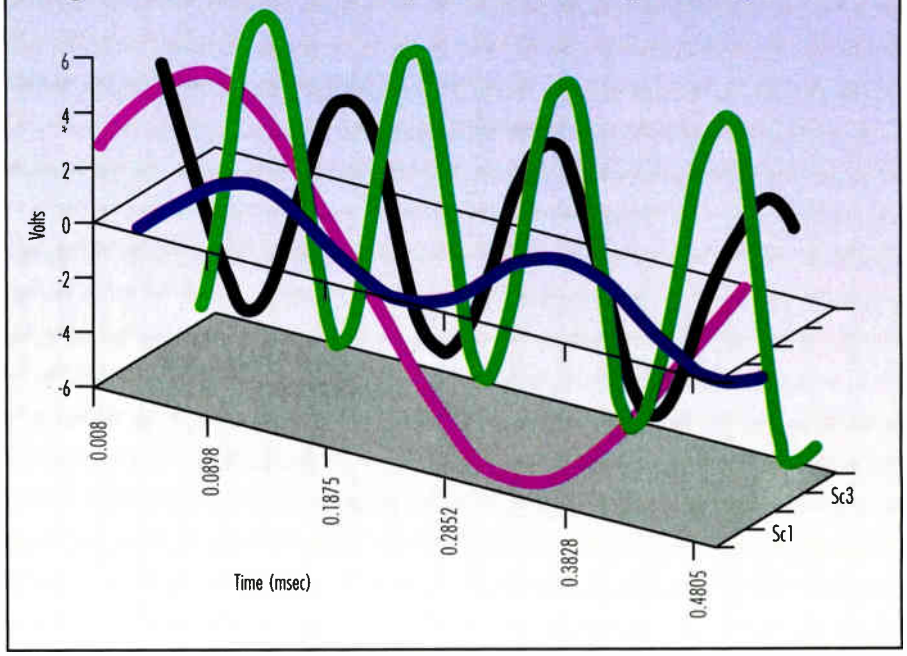
because of ingress, they leave large areas of wasted bandwidth behind. Also, because of the inherent short symbol time downstream, intersymbol interference (ISI) echoes are a problem requiring the modems to be limited to BPSK/QPSK (1-2 bits/Hz) without adaptive equalizers.

• **Multi-carrier CDMA:** In code division multiple access modulation (CDMA) the data channels all share the same RF frequency band, but are channel multiplexed by a "repeating" pseudo random (PR) code modulation. CDMA receiver inputs that follow different PR code sequences appear as noise sources, while the desired signal is fully recovered. CDMA can be robust to ingress sources, but these systems tend to trade off bandwidth for noise immunity, just like classical FM quieting.

Most CDMA techniques simply toggle the RF carrier phase 180° in response to the state of the PR code. Usually a data bit of payload is transmitted in a PR code period, so RF spectral spreading increases with longer codes. The ratio between the PR code rate and the data rate is like a spreading factor (sometimes called process gain), which decreases the spectral efficiency. Therefore, a receiver simply inverts the signal in synchronism with the PR code, which will de-spread the desired signal. The presence of other PR uncorrelated signals require the CDMA system to have precise power control to be sure the modems each contribute equally to the noise floor.

CDMA systems are not spectrally efficient (typically less than 0.1 bits per Hz), but can be reliable in ingress environments. The received signal-to-noise ratio (S/N) is usually lower with CDMA because of the cross-correlated brother modems. This low S/N prevents CDMA from tracking out low-cost TV tuner phase noise imperfections. (Carrier PLL has narrow bandwidth.) CDMA systems don't require exotic adaptive equalizers, because phase shifted echoes will not correlate with the on-time PR codes, plus the low data rates tend to be immune to ISI.

Figure 1: Four OFDM subcarriers symbols each representing 5 bits using QAM



• **FSK systems:** SCM frequency shift keying (FSK) modulation modems have had the longest life in two-way cable systems to date. These modems transmit one of two discrete frequencies representing the two states of a serial bit stream. This modulation technique is generally used for cable active element status monitoring (amplifiers, optical nodes, etc.). SCM FSK has low bits per Hz similar to CDMA systems, but is not as immune to ingress because of lack of FM quieting (narrowband FM). However, these modems are low-cost and have high reliability, so if bandwidth becomes plentiful, they could look attractive again.

• **Multi-carrier OFDM architecture:** OFDM is being considered for broadcast high definition TV (HDTV) transmission in Europe and Japan. Furthermore, it is being used for digital audio broadcasting (DAB), and asymmetrical digital subscriber line (ADSL), which allows video data rates over a telephony twisted-pair. OFDM is a multicarrier modulation scheme (MCM) while most others are SCM. This means that data is transmitted on several RF carriers (or subcarriers) instead of one. (This is like water flowing through several small pipes, instead of relying on one big pipe.) OFDM tends to be more robust against time domain impulse interference because of its long symbol time, which tends to average out these effects. OFDM modems require more hardware for the fast fourier tranform (FFT) modulator, but this is traded off in the equalizer hardware requirements of high-capacity SCM modems.

OFDM has lower subcarrier power levels that are more vulnerable to discrete carrier jamming than high-level SCM signals. However, individual subcarriers can be remapped to a clear channel. Furthermore, these narrowband jammers tend to stay in one spectral area for a long time, so remapping OFDM is effective. Also, signal cancellation technology can be used to remove the narrowband jammer at the headend. By contrast, complete SCM channels can be rendered useless by a single narrowband interference signal. Each OFDM subcarrier is a sinusoidal wave modulated in amplitude and phase to represent an "N" bit binary word. The number of signal vectors needed to represent this binary word is 2^{Nth}, and this modulation is referred to as "2^{Nth}-QAM" (quadrature amplitude modulation).

The value of "N" is limited by received Gaussian noise, tuner phase noise, ISI, and the required bit error rate (BER). Ideally, SCM

Figure 2: Simplified block diagram of OFDM modem

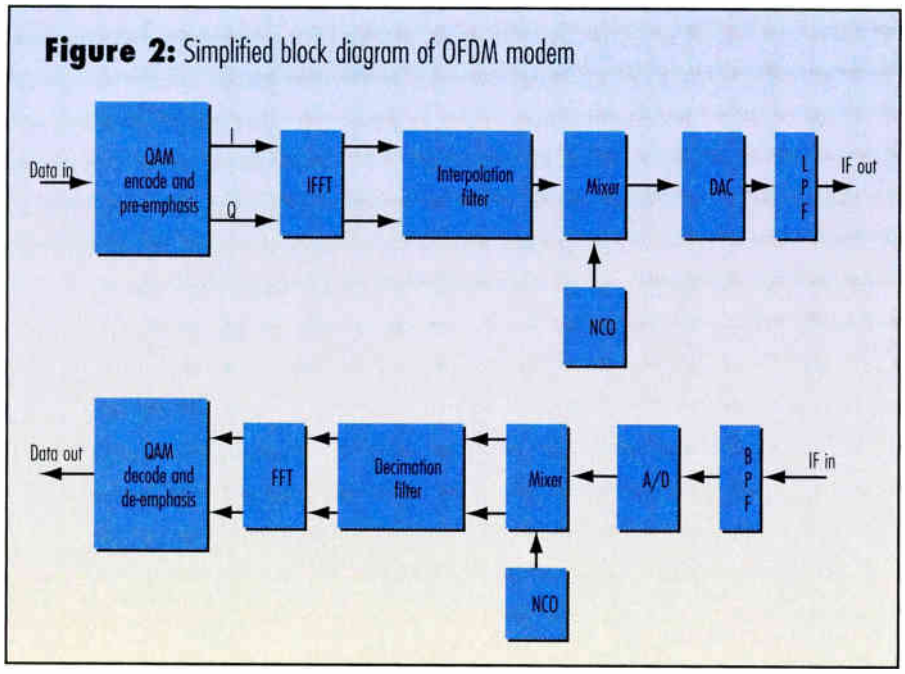
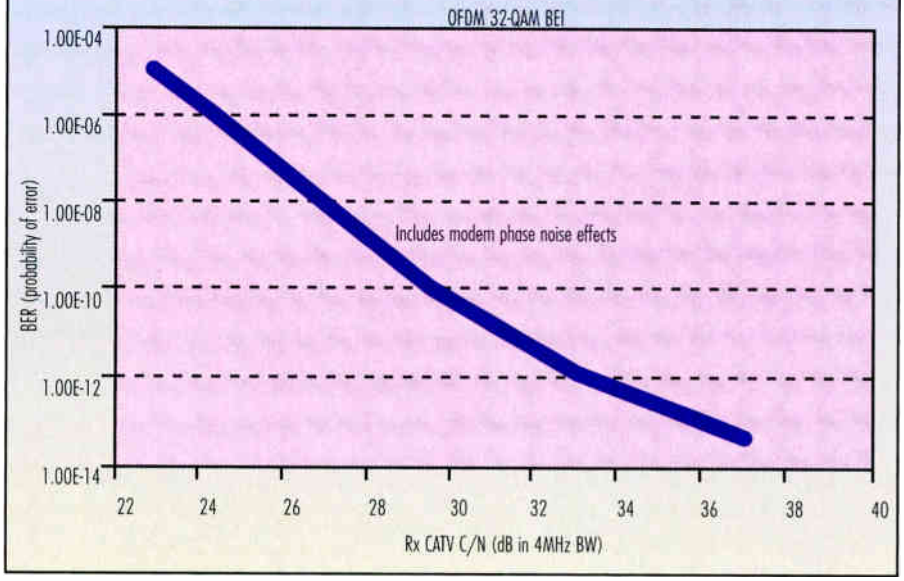


Figure 3: OFDM 32-QAM BER response including typical tuner phase noise



QAM systems with Nyquist filtering can achieve up to N bits/Hz spectral efficiency (with no ingress!), which is the same as OFDM. OFDM is typically generated by a DSP software FFT algorithm. The QAM vector of an OFDM subcarrier is simply set by writing the appropriate amplitude, and phase value into an inverse fast fourier transform (IFFT) frequency bin input. The IFFT transmitter produces a time series signal representation of the summation of all the individual subcarriers from the modem, which is illustrated in Figure 1 on page 73.

Return cable plants typically have a 33 dB video carrier-to-noise ratio (C/N) in 4 MHz of RF bandwidth. This C/N allows 32-QAM upstream with a bit error rate (BER) of better than 10^{-10} with no forward error correction (FEC) code, which is shown in Figure 3. Removing FEC significantly lowers the modem cost and power consumption. Since the cable systems are already operating at these S/N, why not make use of the capacity? The S/N downstream are typically higher so the same argument holds. OFDM systems use S/N monitoring to ensure the BER on a per subcarrier basis (2 kHz bandwidth increment), and remaps to a new RF "clean" channel automatically. This gives the return path 5 bits per Hz gross data packing factor that becomes 4.5 bits per Hz net, after allowing for the overhead of control and synchronization. In the cable forward path it is possible that more than 256-QAM per tone (8 bits/Hz) will yield acceptable performance. OFDM uses a large number of subcarriers spaced close together (typically 3,000 tones in a TV channel). This results in a long symbol period compared to SCM systems with the same payload. Since the symbol time is much longer than dominant echo paths, plant ISI is minimized, and the expensive adaptive equalizers required in SCM systems are not required.

The OFDM data carrier waves are frequency spaced by the inverse of the symbol time, with subcarrier power spectra completely overlapping each other, such that each adjacent tone is positioned in its neighbor's spectral "null." This "null" is always exactly at the symbol clock frequency from the center of the channel, and is present in all QAM power spectra. This spectral "null" creates the orthogonality window when the modem's are symbol synchronized. This spectral "null" positioning is illustrated in Figure 4 on page 76. OFDM modems can employ a time guard band between symbols (cyclic prefix) that eliminates the need for an equalizer. In typical cable systems, 99% of echoes are less than 1.5 µsec in duration. If the cyclic prefix time is made 1.5 µsec this represents less than 1% overhead for a typical OFDM modem. This cyclic prefix is simple with negligible cost. Furthermore, the cyclic prefix allows for some time domain symbol drift, with no orthogonality spectral leakage penalty This is illustrated in Figures 5 and 6 on page 78.

The subcarriers become orthogonal when the symbol update is simultaneous on all channels. When not synchronized, the FFT receiver spectrum will be distorted by the unwanted sin(x)/x spectral leakage,

MEET THE FCC EAS DEADLINE WITH

TWISTER

CADCO Systems' EMERGENCY ALERT SYSTEM

The ***TWISTER*** **Emergency Alert System (EAS)**
is specially designed for the Cable Industry and provides the following features
in a **SINGLE** $3^1/_2$" vertical, 19" rack mount unit at very **ECONOMICAL** pricing.

- **MICROPROCESSOR CONTROL**
- **CHARACTER GENERATOR**
- **FM BROADCAST RECEIVER**
- **AUDIO INPUT**
- **RS-232 PORT**
- **TELEPHONE INTERFACE**
- **IF MODULATOR**
- **RELAY SWITCHING**
- **NATIONAL WEATHER SERVICE (NWS) RECEIVER**
- **AUDIO STORAGE**
- **PRINTER**
- **UNATTENDED OPERATION**

WHY CADCO SYSTEM'S *TWISTER* ?

GUARANTEED FCC COMPLIANCE ◆ VERSATILE FEATURES ◆ USER FRIENDLY OPERATION

HANDLES ALL SWITCHING REQUIREMENTS ◆ READY FOR LOCAL, REGIONAL, AND STATE USE

HIGH QUALITY AND RELIABILITY ◆ NO COMPUTER EQUIPMENT REQUIRED ◆ EASY TO INSTALL

LOW COMPETITIVE PRICING ◆ MINIMUM SPACE REQUIREMENTS ◆ REMOTE SITE HUB CONTROL

STATE OF THE ART TECHNOLOGY ◆ ADVANCED CATV COMPATIBLE ◆ LONG-TERM WARRANTY

CADCO Systems, Inc. is an American manufacturer of TV and Cable, MMDS, and LPTV Broadband Electronics Equipment which meet the **U.S. NTSC** and **INTERNATIONAL PAL** and **SECAM** Standards. **CADCO** offers a professional line of **QUALITY**, **DEPENDABLE**, and **FLEXIBLE HEADEND PRODUCTS** including:

- **FIXED/AGILE MODULATORS**
- **AGILE DEMODULATORS**
- **FIXED/AGILE PROCESSORS**
- **CHANNEL CONVERTERS**
- **TRANSLATORS**
- **COMBINERS**
- **FM EQUALIZERS**
- **FM PROCESSORS**
- **IF and RF CHANNEL SWITCHES**

MINI HEADEND SYSTEMS
Select Cable Services **(SCS)**

This system was specially developed as a modular interface between Cable Systems and Distribution Systems used in:

- **HOTELS**
- **COLLEGES**
- **HOSPITALS**
- **SCHOOL DISTRICTS**
- **APARTMENT COMPLEXES**

CADCO SYSTEMS, INC.

(800) 877-2288

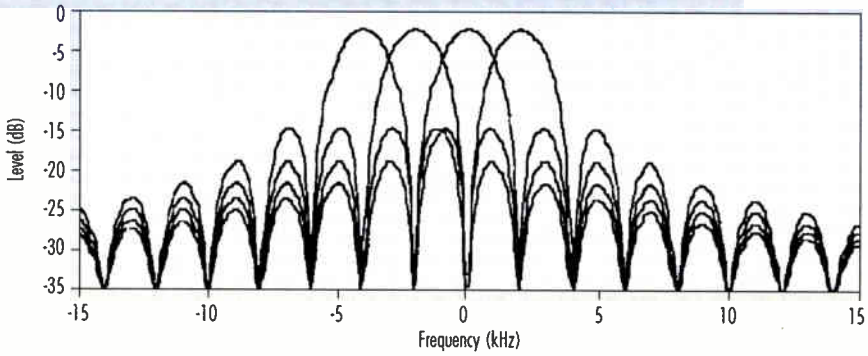
2363 Merritt Drive
FAX: (972) 271-3654

Garland, TX 75041
(972) 271-3651

HTTP://WWW.ONLINETODAY.COM/USERS/CADCO

Reader Service Number 29

Figure 4: Efficient OFDM four subcarrier spectral overlap characteristic



instead of clean discrete "QAM" vectors. This symbol alignment noise leakage effect is illustrated in Figure 6. This sin(x)/x roll-off is based on subcarriers spaced 2 kHz apart, so this gives the RF spectrum a natural quick roll-off characteristic as illustrated in Figure 7 on page 80.

All return band OFDM modems must be individually phase-locked to the headend by a remote synchronization algorithm to ensure the return signal is received coherently at the headend. The remote modem FFT is generally smaller, only having to process the set of subcarriers being used, but the number of tones can vary with bandwidth demand. To reduce the demodulator complexity, a dedicated pilot subcarrier is added to the OFDM spectrum by the transmit IFFT algorithm. The power of the pilot is less than 0.4 dB of the total spectrum of a 256 kb/s modem, but this power ratio decreases proportionally with higher data rates. Having continuous pilots allows the downstream receivers to track out TV tuner phase noise variations in real-time, which in turn allows each subcarrier to achieve its maximum signal quality.

OFDM power control

An OFDM modem can put out very large time domain impulses if the subcarriers are all set to the same QAM value (comb generator). Therefore, OFDM subcarriers are scrambled to avoid large time domain voltage peaks to minimize hardware nonlinear distortion effects. MCM systems are more susceptible to nonlinear distortion than SCM systems because of the MCM signal having a Gaussian distribution. (This includes CDMA, which also is MCM.) However, several SCM modems on a cable system will generally give the same distortion. Individual subcarrier data scrambling gives the modem a constant average power for ease in cable alignment, plus the scrambling polynomials are dynamically variable, which could be used for data security encryption.

Forward in-band interference

Forward path video carrier composite triple beats (CTBs) will interfere with the low-level OFDM subcarriers. Typically, 2 kHz spaced OFDM tones will be individually suppressed 35 dB relative to an adjacent video picture carrier power, and these discrete picture carrier CTBs can be expected to be only 17 dB lower in a typical cable system (CTB-52 dBc). These CTB jammers will be mapped around just like the return ingress.

Benefits of OFDM

- At this time OFDM can achieve more than 5 bits/Hz in the existing cable return, with the upper limit not capped by ingress.
- OFDM is very immune to impulse interference. Single frequency interference can easily be mapped around or handled by reducing the throughput on affected subcarriers.
- OFDM experiencing higher than normal S/N can be operated at higher than normal throughput (i.e., higher QAM levels). →

Traps Connectors Taps DCs Service

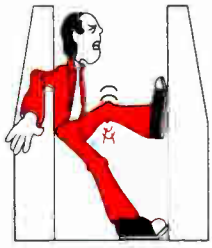
New & Refurbished
Taps/Splitters
300-1000mhz
OVER HALF A MILLION IN STOCK
WE SWEEP ALL TRAPS AND TAPS BEFORE SHIPPING
800-331-5997 1605 E. Iola Broken Arrow, Ok 74012
TULSAT

Modulators VCII's Processors
IRD Cards Receivers Line Gear
FACT Average Repair Charge
LESS THAN $100.00 Including Parts
800-331-5997 1605 E. Iola Broken Arrow, Ok 74012
TULSAT

New Repairs Refurbished
Receivers
IRD'S & DIGICIPHERS
800-331-5997 1605 E. Iola Broken Arrow, Ok 74012
TULSAT

Over A Half Million
IN STOCK
New & Refurbished
TRAPs
NEW CONNECTORS
New & Used Traps
Pos, Neg & Tiering
Taps & Traps
Large Inventory
Popular & Hard to Find Sizes
WE SWEEP ALL TRAPS AND TAPS BEFORE SHIPPING
1605 E. Iola
Broken Arrow, Ok 74012
TULSAT 800-331-5997

Is your headend cramped for space?



Try our half-sized chassis.

THERMOSTAT CONTROLLED FAN
SAVES RACK SPACE

1605 E. Iola
Broken Arrow, Ok 74012
TULSAT 800-331-5997

Feed Forward Power Doubling Reverse

NEW and REFURBISHED
SCIENTIFIC ATLANTA

Trunks	Bridgers	Line Extenders	Passives
373920 550FF	370660 550PH	372393 550PH	Taps 1ghz
347099 550FF	344000 550PP	372391 550PP	Taps 750 mhz
234420 450PP	370664 450PH	372392 450PH	Taps 600 mhz
372398 450FF	376141 450PT	503148 750PH	Splitters
372397 450FF	499939 450FF	232700 Housing	DC's
372376 450FF	System Amp II 550 & 750 mhz		Two Ways
373166 Housing	More than 2500 in Stock		Three Ways
343890 AGC			P/S Inserters

1605 E. Iola
Broken Arrow, Ok 74012
TULSAT 800-331-5997

550-750 MHZ
SCIENTIFIC ATLANTA
SYSTEM II
Triples
Duals
Singles
Quads

450-550 MHZ
FEED FORWARD & POWER DOUBLING
Scientific Atlanta
C-Cor
Magnavox
Jerrold

1605 E. Iola
Broken Arrow, Ok 74012
TULSAT 800-331-5997

New & Refurbished
MAGNAVOX
TRUNKS
5T550 6T550 8T550
5T450 6T450 8T450
5T440 5T330 8T330
BRIDGERS
5B550 6B550
5B440 5B450
5B330 5B300
EQ's 7MC Pads 8HE's

300-450 mhz
SYLVIANIA
TRUNKS
156 155 186
177 163 154
152 153 505C
BRIDGERS
277 215 214
213 211 233
245 231 235
P/S EQ's Pads DC's

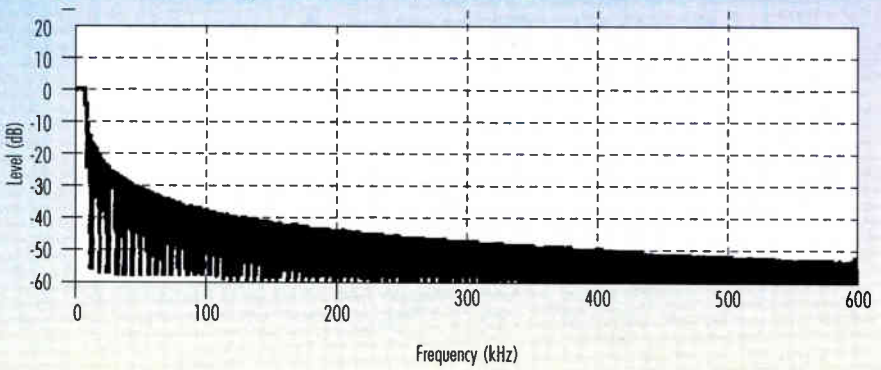
1605 E. Iola
Broken Arrow, Ok 74012
TULSAT 800-331-5997

REFURBISHED
RECEIVERS
SCIENTIFIC ATLANTA
9640 $295 (MIN QTY 10)
9630 $199 (MIN QTY 10)
9500 (9530 or 9531) $295
6650 $225

REFURBISHED
RECEIVERS
STANDARD
32CK $275
40CK $325
JERROLD
C4R $295 (MIN QTY 5)

1605 E. Iola
Broken Arrow, Ok 74012
TULSAT 800-331-5997

Figure 7: Band edge OFDM natural spectral roll-off characteristic



modem block diagram is shown in Figure 2 on page 74. The headend and remote modems currently share the same digital data service (DDS) circuit cards but the RF modules are different because of the frequency bands, and tracking filter economics requirements.

The transmitter DDS system includes OFDM modulator, sample rate interpolation, frequency upconversion (variable), and mixers/combiners to shift the digital signal to an intermediate frequency (IF). Next, a single digital-to-analog converter is used to produce an analog IF signal that is ready for cable upconversion. The transmitter requires no high "Q" analog filter tuning with all artifacts close to the signal passband filtered in the digital domain. This produces a spectrally pure signal with precise orthogonality. The transmitter first IF filter is the sampling harmonic rejection low-pass filter, but the frequency plan was selected to move the terms far from the desired spectrum to ease filtering requirements. Furthermore, the channel impulse response was selected so that the ISI transient is significantly less than the cyclic prefix time guard band f or the whole family of modem bandwidths.

The IFFT modulator is implemented with a stand-alone digital signal processor (DSP). The DSP takes in a serial bit stream and scrambles the stream on a subscriber basis. This serial bit stream is broken into 500 µsec parallel data sets to feed the IFFT (150 bits for 30 subcarriers using 32-QAM). Each tone uses 5 bits of this data to map 1 of 32 possible QAM signal vector values to the tone. All transmitter unwanted spurious emissions are measured 55 dBc below the average QAM subcarrier levels, and no expensive analog filters are required. The signal is upconverted, and gain is set by control of the controlling DSP. The current transmitters allow for 40 dB of plant variation with maximum output power of 55 dBmV, assuming a 6 MHz bandwidth. A small modem's power is reduced linearly by the bandwidth reduction ratio. Furthermore, the remote transmitters are designed to allow modems to be deployed in all consecutive modem frequency channels with the noise build-up controlled.

The receiver uses a single analog to digital converter following a sharp IF bandpass anti-aliasing filter to sample the signal. This IF is sub-sampled at more than four times the IF bandwidth from the cable RF tuner. The final conversion to baseband is completely digital with a set of in-phase and quadrature-phase mixers (I&Q), with the mixer sum frequency products being digitally filtered again.

The OFDM receiver is the interesting piece of the puzzle. The demodulation brain is a DSP, which has four primary tasks. The first task is a simple FFT algorithm, which is performed on the input time signal series on a continuous basis, except during the cyclic prefix time guardband. The second task is converting received FFT data vectors into 5 bits of data per subcarrier, unscrambling the data, and merging the data into the various user interface modules.

The last two tasks are the DSP/RF carrier phase tracking loop, and the OFDM symbol centering tracking loop. These are modeled after standard servo control PLLs, which allow the modem to optimize phase noise tracking, and to maintain synchronization under cable harsh environmental conditions. OFDM synchronization upstream is completed by a remote control algorithm to maintain orthogonality of many smaller remote modems to a large headend modem. Individual signal quality errors are measured at the headend, then signal level, frequency, or symbol time adjustments are implemented by the remote modems to maintain a locked condition.

Summary

Field experience has verified that OFDM is a very robust modem technology especially to impulse jamming (including in-band TV channels). As predicted, it can operate in virtually any mismatched condition in the field. Cable phase imperfections and passband ripples have not been a problem to date. Predicted BER was verified, and the ingress detection algorithms are currently in the testing stages. We have demonstrated that OFDM modems can be practical, and this predominantly digital modulation process will handle production modem volumes with ease.

References

[1] Bergland, G.D. "A guided tour of the fast Fourier Transform," *IEEE Spectrum*, Volume 6, pages 41-52, July 1969.

[2] Bingham, J.A.C. "Multicarrier Modulation for Data Transmission: An Idea whose Time Has Come," *IEEE Communications Magazine*, pages 5-14, May 1990.

[3] Jacobsen K.S., and Cioffi J.M., "An Efficient Digital Modulation Scheme for Multimedia Transmission on the Cable Television Network," *NCTA Technical Papers,* pages 305-312, May 1994.

[4] Kim, A.J. "Two-Way Plant Characterization," *NCTA Technical Papers*, pages 171-183, May 1995. **CT**

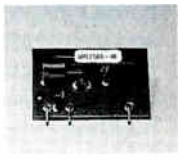
MAIN LINE

A LEADER IN THE DISTRIBUTION OF NEW AND REFURBISHED EQUIPMENT FOR ALMOST TEN YEARS, IS NOW MANUFACTURING A COMPLETE LINE OF :

REPLACEMENT PADS, EQUALIZERS, AND PLUG-INS

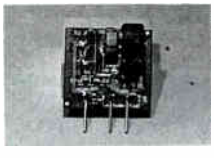
THAT MEET OR EXCEED FACTORY SPECIFICATIONS.

SCIENTIFIC ATLANTA, GENERAL INSTRUMENTS/JERROLD, TEXSCAN/PATHMAKER, AND PHILIPS/MAGNAVOX


FORWARD EQUALIZERS FROM 300 MHZ THRU 750 MHZ. CUSTOM APPLICATIONS TOO!

REVERSE EQUALIZERS IN ALL POPULAR RANGES AND VALUES

COMPENSATORS, JUMPERS, INTERSTAGE EQUALIZERS, AND THERMALS.

PADS TO 1 GIG.


REMEMBER MAIN LINE FOR ALL YOUR NEW AND REFURBISHED EQUIPMENT NEEDS!
WE CAN SAVE YOU TIME AND MONEY!





PRICE, DELIVERY, QUALITY GUARANTEED!

CALL US FOR COMPLETE PRODUCT LISTINGS AND PRICING

PHONE: 800.444.2288/310.715.6518
FAX: 888.4.MAINLINE/310.715.6695
EMAIL: MAINLINE@WORLDNET.ATT.NET

Mainline Equipment is not a sales agent for S/A Jerrold, Magnavox or Texscan

Reader Service Number 212

Alarm tracking

The FLX remote site monitor and controller from Barnett Engineering is capable of monitoring and reporting up to 240 alarm conditions of all types, including digital, analog, loss of events, totalizers and RF power.

Alarms can be monitored, announced and acknowledged over telephone lines, mobile radio systems, alpha-numeric pagers, RS-232 ports and cellular telephones. The product monitors battery voltage, current, room temperature and loss of periodic function, such as tower strobe lights.
Reader service #312

Laser diode modules

The Electronic Device Group of Mitsubishi Electronics America introduced a family of optical laser modules for cost-effective fiber-in-the-loop (FITL), synchronous optical network (SONET) and passive optical network applications.

Among its features are a plastic molded package and a maximum tracking error of 1.5 dB across an operating temperature range of -40 to +85°C. The family also offers signal line and package electrical isolation, high-speed response and a choice of optical output power levels.
Reader service #311

Splice closures

The new UCTL and UCAO optical splice closures from Siecor Corp. are said to provide easy installation and environmental protection of optical fiber splices.

The UCTL is a mid-sized canister closure with user-friendly approaches into the dome seal and cable entries; it can accommodate up to 192 single fiber splices. The UCAO is a compact hinged closure suited for in-line or drop and insert applications; it can accommodate up to 60 fiber splices.
Reader service #310

Return path laser products

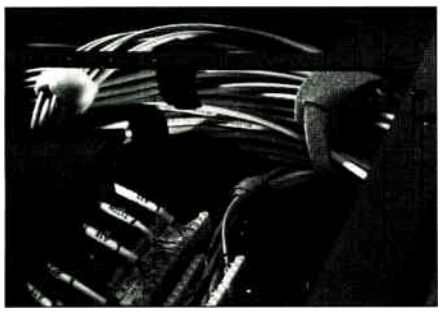
Ortel Corp.' new products for return path applications include the Model 1651/B lasers that provide up to 200 MHz of bandwidth they are uncooled versions of Ortel's distributed feedback (DFB lasers.

The return path lasers are designed for operators who are planning to provide upstream AM video signal transmission along with data signals, such as telephony or high-speed modems. The new lasers use a proprietary new high temperature DFB chip design, which minimizes the variation in chip performance over wide temperature ranges. The product consists of a pigtailed DFB laser in a cylindrical package with an internal optical isolator and a monitor photodiode.
Reader service #309

Optical receiver

A new optical return receiver was developed by the Synchronous Group for use in cable applications Called the Polaris, the receiver provides space efficient design for completing the loop in the fiber-optic based systems.

The product's modular format was developed as part of the new Constellation series of optical products, which allow integration of many optical elements into a common intelligent platform. The Polaris includes modules that have either two or four optical receivers per module. This allows up to 32 optical return receivers in 12.25 inches of rack space.
Reader service #308



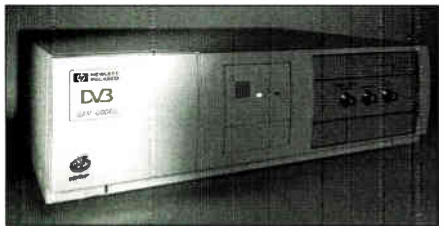
Cable ties

Tyton Corp. introduced the Grip Tie, a Velcro brand hook and loop fastener tie. The product is a one-piece, fastening device that prevents over-cinching of bundles and is suited for Category 5 or fiber installations where transmission may be affected through tie over-tightening. The Grip Tie is securely installed and can be quickly released for repetitive access to cable and wire.
Reader service #307

Digital solutions

News Digital Systems, a provider of end-to-end solutions for digital broadcasting developed the System 3000 transcoder for cable operators who are transitioning to and providing digital and interactive services.

The transcoder accepts an incoming MPEG-2 data stream from satellite or terrestrial communications systems and outputs the signal in a suitable format for wireline or wireless digital delivery over cable networks.
Reader service #306



Test source

To assist cable operators in bringing digital video products and services to market, Hewlett-Packard offers its HP E4441A Digital Video Broadcasting quadrature amplitude modulation (DVB QAM) coder. The test source is designed to help set-top box and device manufacturers develop and produce high-quality DVB-Cable (DVB-C)-compliant equipment.

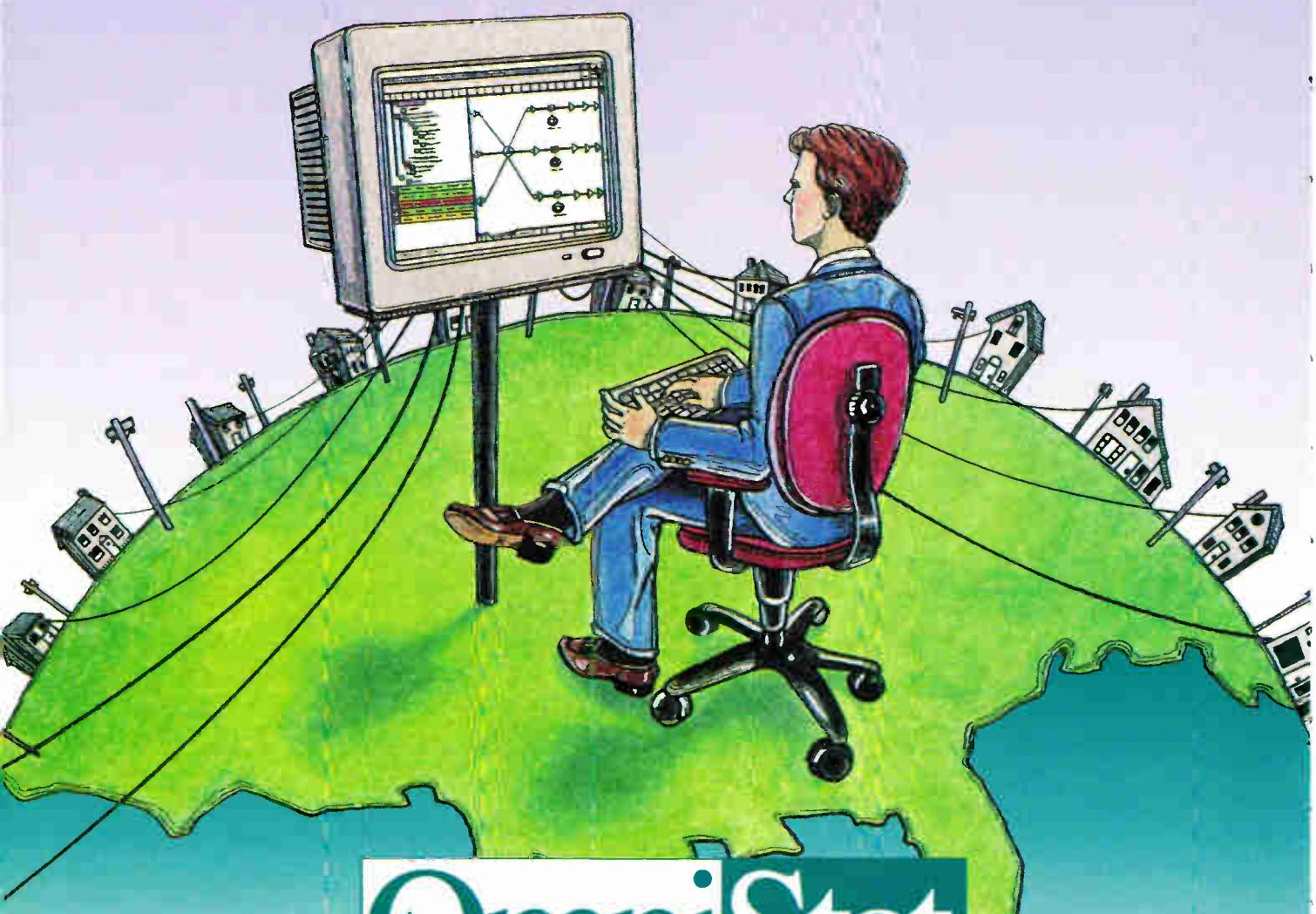
The coder operates in conjunction with H-P's family of ESG signal generators to provide a reference radio-frequency (RF) signal. The H-P E4441A also is designed to help cable operators optimize network performance and manage interoperability issues. Additionally, the product can be configured to perform a variety of tests to give users maximum test coverage.
Reader service #305

Digital storage

B+K Precision introduced its Model 5150, four-channel, 150 MHz digital storage oscilloscope. It features a 50 GS/s sampling rate for repetitive waveforms and a 200 MS/s sampling rate for nonrepetitive waveforms.

Another feature is automatic set-up of timebase, vertical sensitivity and trigger parameters.
Reader service #304

CONTROL YOUR WORLD



OmniStat

Next Generation in Status Monitoring

The new OmniSTAT network monitoring system from AM puts you in control. Designed to monitor your entire system, including most all major equipment, OmniSTAT is flexible, simple and cost effective. Its modular, scalable architecture allows you to get started at a price which fits your budget today, yet anticipates the performance and interoperability you'll need for tomorrow's requirements.

The OmniStat System includes the easy to use OmniVU software, a Windows based, open architecture system that's powerful and will integrate easily with your operational support systems. Our OmniProbe monitors feature downloadable software and frequency agility. And our new OmniMCU is a PC based control system with practically unlimited capacity.

Because OmniSTAT is the system of choice by the major equipment OEM's, you can be assured that the system works right today and tomorrow.

From AM Communications...the monitoring standard for over a decade.

AM COMMUNICATIONS

GUARDRAILS FOR THE INFORMATION SUPERHIGHWAY

P.O. Box 9004, Quakertown, PA 18951-9004

215-536-1354 • **1-800-248-9004**

http://www.amcomm.com

Reader Service Number 127

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: 860-774-4102 • Fax: 860-774-4783

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

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

WE BUY & SELL SURPLUS NEW & USED

Connectors, Taps,
Headend, Line Gear, Misc.

TM BROKERS
5402 Highway 95 - Cocolalla, ID 83813
Tel: (208) 683-2797 or (208) 683-2019
Fax: (208) 683-2374
SEE INVENTORY ON HOME PAGE
EMAIL:moorst@comtch.iea.com
HOME PAGE:http://www.iea.com/-moorst
We Accept M/C or Visa

FREE
WAVETEK Meter

with your repair or sales orders
We Buy, Sell & Repair
CATV EQUIPMENT
Call for Details

RMT ENGINEERING
800-228-0633
E-mail info@rmteng.com
Web site http://www.rmteng.com

INSPECT • PAINT • REPAIR • RE-GUY • LIGHTING • ANTENNA
FEEDLINES • ANALYSIS • ERECT • DISMANTLE • LINE SWEEPING

HERMAN J. JOHNSTON
PRESIDENT
MOBILE (502) 830-2584
RES (502) 830-9246

NATIONWIDE TOWER COMPANY

BROADCAST • C A T V • MICROWAVE
CELLULAR • PCS • WIRELESS TOWERS

P.O. BOX 130 • POOLE, KENTUCKY 42444
TEL (502) 533-6600 • FAX (502) 533-0044 • hgnwt@aol.com

CableTools™ CAD

Only $895.00

Works with any version of AutoCAD®, even *LT*!

Complete CAD System:
CableTools CAD
AND AutoCAD LT 2.0
♦ $1295.00 ♦

Easy to setup and learn
Includes utilities · Map Stat, Outage Tracker, Street List, Noise & Distortion Calc, more!

We also provide CATV Design & Drafting Services

Visit our website or call for a FREE demo
www.GoldComInc.com

2246 Garwood Rd, Sicklerville, NJ 08081
(609) 346-2778
fax: (609) 782-0841

GoldCom Inc.

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

BUY | SELL | REPAIR | MFG | UPGRADE | Scientific Atlanta

dB-tronics

Upgrading or adding channels?
Contact us for all your equipment needs.

- Magnavox Upgrades
- System Managers
- Addressable Converters
- S-A, C-COR Mag, EQ's

LATE BREAKING NEWS!!! 1,000's of S-A FF Stations Available ...CALL for details

864-574-0155 • Fax 864-574-0383 • e-mail sales@dbtronics.com
http://www.dbtronics.com

Emergency Alert Systems By

IDEA/ONICS

TO MEET THE FCC MANDATE or For local franchise requirements Complete Audio and Video or Audio only systems available. *Compatible with all headends.*

Affordable

IDEA/ONICS

The Pioneers in Emergency Alert Systems
(701) 786-3904
Fax: (701) 786-4294

When You Need Quality and Dependability, You Need

RITE CABLE CONSTRUCTION, INC.

Specializing in

Telecommunications Construction – Including Strand Mapping, Asbuilt Mapping, Fiber Optic Routing & Design, Splicing Schematic, Map Digitizing, System Design, Project Management, Fiber Splicing & Testing, Aerial & Underground Construction, Coaxial Splicing & Activation, System Sweep & Proof of Performance Testing, Complete Residential Installation, MDU Pre-Wire/Post Wire & Material Management.

"Do it the RITE way the first time."

Les Smith, President
P.O. Box 3040 (32723-3040)
1207 S. Woodland Blvd., Suite 1
DeLand, FL 32720

1-800-327-0280
Fax: 1-904-738-0870

CAREER OPPORTUNITIES

CONNECT WITH EXCELLENCE

In the rapidly evolving world of telecommunications, Continental Cablevision is forging ahead to create a world class presence. We have the following positions available in our Western Regional headquarters in El Segundo, California.

Fiber Engineers

Selected individuals will join our fast-paced environment and focus on fiber optic network planning for delivery of broadband services of fiber topology including FTN locations, node locations and fiber splicing documentation, and determining fiber optic cablesizes and quantities to meet current technical deployment requirements. Qualified candidates must have a minimum of 3 years. experience designing fiber optic networks, a minimum of 2 years experience creating and maintaining databases, preferably Dbase, Sybase or Oracle, and a minimum of 5 years experience engineering broadband network architectures for delivery of video, data and telephony. Must have experience in an Excel, Word, Windows 3.1 and Windows NT client/server environment and AutoCAD or Microstation. BDEE degree preferred.

Designers

Individuals will review contractor design and CAD digitizing; verify that RF broadband is in adherence to regional architecture and design specifications; digitize CAD maps in Microstation or AutoCAD per quality control design requirements; develop, review and approve HFC architectures, ensuring specifications are adhered to; ad coordinate and verify primary and secondary power supply locations; and review RF design maps ensuring new power supplies are located in approved locations. Qualified candidates must have a minimum of 3-5 years of broadband design experience in hybrid fiber coax (HFC), fiber-to-the-feeder (FTF) and all current broadband architectures for video, voice and data transport, experience in using Lode Data Design software in the design of small to large RF networks, and AutoCAD drafting experience, Microstation and exposure to signal and/or Focus a plus. In addition, a minimum of 2 years in developing noise and distortion specifications in hybrid fiber coaxial networks, experience in the Cable TV or Telecommunications Industry, and experience in an Excel, Word, Windows 3.1 and Windows NT client/server environment

Project Engineer

Individual will provide engineering support to the Regional Construction Services (RCS) department through the coordination of activities between RCS and other engineering entities, interface with the Regional Design and Engineering departments and participate in projects as assigned, and be responsible for project schedules and timelines. Qualified candidates must have a minimum of 5 years cable TV operation related and/or engineering experience and knowledge of HFC architecture, fiber optics, headend operation and system performance testing.

Construction Services Manager

Individual will be responsible for the completion of rebuild, upgrade and fiber projects for the Western Region, with the combination of overseeing and coordination of all aerial and underground construction which will include fiber and coaxial cable placement, fiber splicing and node activations, power supply construction, and make ready engineering and rearrangements ensuring proper construction practices are employed with compliance with all regulations and policies. Qualified candidates must have a minimum of 3 years experience in a technical management position, demonstrated leadership and team building activities, and working knowledge of G.O. 95, and 128 regulations. College degree preferred.

Fiber Optic Technician

Individual will be responsible for splicing optical cables in accordance to network architectures that will be implemented for rebuild, new build and upgraded projects. This will include fusion splicing of outside plant fiber optic cables and optical intrafacility cables in headends and hubs and building fiber management systems in headends or hubs which involves installation of fiber distribution frames, connector panels, coupler chassis, coupler modules, opto-electronic devices and optical jumpers. Qualified candidates must have 5 years technical Cable TV experience, 2 years maintenance technician level desired, knowledge of system performance testing or node optimization, fusion splicing machines and fiber test equipment, and familiarity with CATV construction with an emphasis on fiber optics.

Construction Technician

Individual will perform quality control inspections of utilities, plant construction, and M.D.U. construction verifying accuracy and compliance with company design and construction specifications. Qualified candidates must have 2 years of Cable TV technician or construction experience, pole climbing ability, and experience with various meters and hand tools. Flexible hours required, including weekends and nights.

Construction Coordinator

Individual will assist in the coordination, preparation, activation and completion of different phases of assigned construction projects. Qualified candidates must have 3 years of Cable TV technical or construction experience, pole climbing ability, and experience with various meters and hand tools. Supervisory experience a plus. Flexible hours required, including weekends and nights.

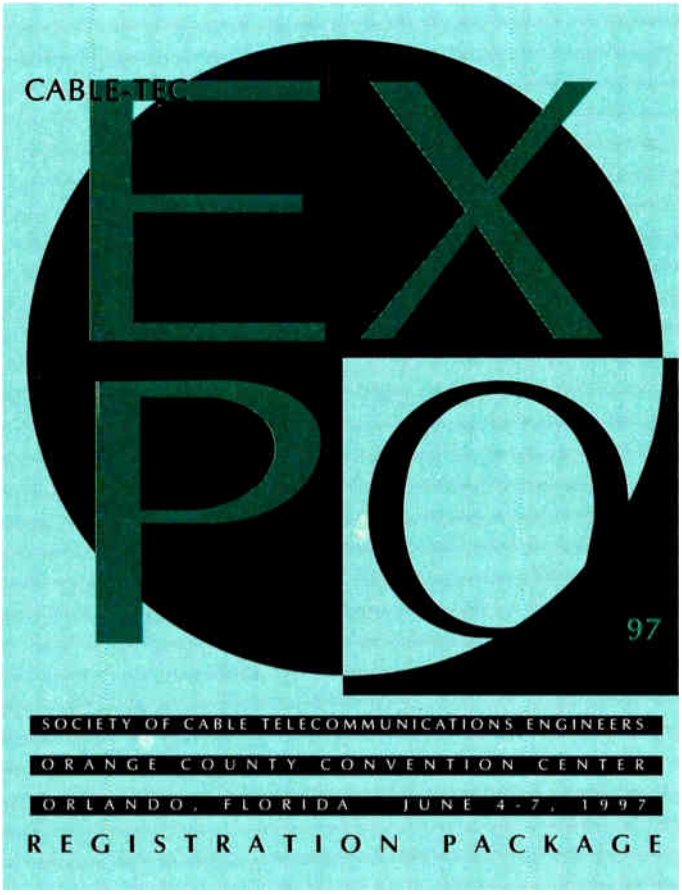
Interested candidates for the above positions may submit a resume with salary history (will not be considered if omitted) to: **Continental Cablevision, Attn: LHB/CT, 550 N. Continental Blvd., Suite 250, El Segundo, CA 90245.** For further information please phone our **Job Hotline (800) 203-5969.**
Continental Cablevision encourages diversity and supports a drug-free environment.

Please visit us on the World Wide Web at: http://www.continental.com

Continental Cablevision®

AD INDEX

RR#	ADVERTISER	PAGE #
147	ADC Telecommunications	50,51
117	Alcoa Fujikura	69
5	Alpha Technologies	5
118	Altec	70,71
145,127	AM Communications	19,86
151	Antec/Telewire	7
50	Aska Communications	32
191,35	Aurora Instruments	46,48
223	Avcom of Virginia	79
23	Barco	39
79	Cable AML	54
29	Cadco	75
40,41	Channell Commercial Corporation	23,22
86	DX Communications	27
4	Frontline Communications	10
42	Fujitsu Network Transmission Systems	56,57
15	General Instrment Corporation	55
200	GMP	20
10	Hewlett Packard	11
19	iCS	25
81	Integral Corporation	17
27	Ipitek	58
28	ITW Fastex Distribution	16
101	Klugness Electronic Supply	12
30	Leader Instruments Corporation	29
185	Lode Data	60
212	Main Line	81
201,211	Mega Hertz	8,16
219,218	Mega Hertz	42,31
220,216	Mega Hertz	46,66
130,140	Mega Hertz	68,76
132,139	Mega Hertz	79,84
31	Mega Hertz	109
224	Microwave Filter	28
53	Monroe Electronics	42
16,26	MultiLink	6,112
112	Passive Devices	13
124	Performance Cable TV Products	21
69	Power & Telephone Supply Co.	38
89	Quality RF Services	61
80	RDL, Inc.	45
68	Rifocs Corporation	8
103	Riser Bond Instruments	33
54	Sadelco	85
46	Scientific Atlanta	2
—	SCTE	94,95
—	SCTE	36,96
—	SCTE	97,98
—	SCTE	104,99
—	SCTE	100,101
2	Sencore	3
13	Standard Communications	9
138	Stanford Communications	53
95	Superior Electronics	111
160	Synchronous Group, Inc	49
18	Telecrafter Products	14
83	TEMS(Ge Capital)	107
126,123	Toner Cable	102,106
45	Trilithic	37
44,46	Tulsat	47,77
120	TV/COM International	64
121	U.S. Fiber Optics	67
299	Viewsonics	105
15,55	Wavetek	15,40
75	West End Systems, Inc.	43



A MESSAGE FROM THE PRESIDENT

Enclosed is everything you need to register for our 21st Annual Engineering Conference and 15th annual Cable-Tec Expo®. I hope this information will convince both you and your management of the valuable benefits to be gained through your attendance this year.

The entire program has been designed to be the most cost-effective means of obtaining the maximum technical training for all levels of technicians and engineers working in the field of broadband telecommunications.

The Engineering Conference, while geared toward engineers, will contain topics of interest to all levels of our membership. Three pre-conference sessions and two panel discussions featuring engineering visionaries will explore current issues that will impact future directions taken by our industry.

The Expo itself will offer a total of ten technical training workshops, which are listed on the following pages. No other activities will be scheduled during workshop periods in order to maximize attendance and participation.

In response to attendee and exhibitor requests, this year s Expo will feature 16 full hours of exhibits over three days. Exhibitors have been encouraged to gear their booth presentations toward hands-on demonstrations, and a Technical Training Center on the exhibit floor will feature additional equipment demonstrations.

We invite you to join us in Orlando for Cable-Tec Expo® 97.

Best Regards,

Bill

William W. Riker

DATES

Registration and Pre-Conference Sessions, June 3, 1997 ¥ Annual Engineering Conference, June 4, 1997
Technical Workshops, June 5-6, 1997 ¥ Exhibits, June 4-6, 1997 ¥ Certification Testing, June 5-7, 1997

LOCATION

Orange County Convention Center Orlando, Florida

HISTORY

Cable-Tec Expo® 97 is the 15th annual convention/trade show sponsored by the Society of Cable Telecommunications Engineers, Inc. The show has proven to deliver the latest information on technological advancements and applications in a format that provides training through technical workshops and instructional hardware exhibits.

The Annual Engineering Conference will be SCTE s 21st yearly conference dedicated to current engineering issues, including digital technology and data transmission over broadband telecommunications systems. 1997 marks the 28th anniversary of the Society as a leader in technical training for the industry, with this year s Expo offering additional opportunities for exposure to the newest trends in the expanding telecommunications arena.

PROGRAM

The Annual Engineering Conference consists of three hours of technical papers including such topics as digital deployment, system reliability and cable modem technology. Speakers will include many of the industry s engineering leaders. The annual membership meeting, held at the conclusion of the day, will afford attendees the opportunity to meet with members of SCTE s national Board of Directors and local Chapter representatives.

Cable-Tec Expo® follows the Engineering Conference, and is comprised of practical workshops offering interactive technical training combined with hardware displays on the exhibit floor. The workshops, technical in nature, feature presentations dealing with the proper design, operation and maintenance of broadband telecommunications systems. No other activities are scheduled during these sessions in order to guarantee maximum attendance and participation.

ATTENDANCE

Attendance is open to individuals within the CATV industry as well as those involved in broadband telecommunications who wish to capitalize on the opportunity to learn about the latest industry developments. Over 4,000 registered attendees are expected from all levels of cable television, telco and related businesses, including non-technical professionals.

TRAINING

As with all SCTE programs, the main purpose of Cable-Tec Expo® 97 is to provide the maximum amount of training opportunities for the lowest possible cost. The event has been coordinated to fulfill this purpose, as it offers a wide variety of informative, up-to-date technical training programs. Additionally, Expo 97 will give attendees the opportunity to prepare for and participate in the Society s Broadband Communications Technician/Engineer (BCT/E) and Installer Certification Programs, gaining valuable knowledge and practical skills in the process.

EXHIBITS

The exhibit floor has a focus on education, with many industry suppliers presenting live technical demonstrations of their products. Over 350 hardware exhibitors are expected to reserve space on the Expo 97 Exhibit Floor. Exhibits will include all types of products, supplies, services and equipment used in the design, construction, installation, repair, maintenance and operation of broadband telecommunications systems. The exhibit floor will also feature a Technical Training Center for additional hardware and test equipment demonstrations.

REGISTRATION

Complete and return the Attendee Registration Form. Use a separate form for each attendee. Photocopies are accepted. SCTE will not accept registrations by phone.

Payment must accompany forms in order to be processed. SCTE will accept registrations by FAX only when paid by credit card. If forms are faxed, DO NOT MAIL THE ORIGINAL.

Non-members wishing to join SCTE may complete the included membership application and submit it with the registration form. Individuals submitting a completed membership application with payment are eligible for SCTE member registration rates. Annual member dues are $40 within the Continental U.S., $60 outside the U.S. (including Canada).

REGISTRATION TYPES

FULL REGISTRATION: Includes Pre-Conference Sessions, Engineering Conference, Technical Workshops, Exhibits, and Annual Awards Luncheon.
EXPO ONLY: Admittance to Technical Workshops and Exhibits.
SPOUSE REGISTRATION: Includes Pre-Conference Sessions, Conference, Workshops, Exhibits, and Annual Awards Luncheon.

DEADLINE FOR PRE-REGISTRATION

MAY 1, 1997
Registration forms must be received at SCTE prior to this date. Forms received after May 1 will not be processed, and individuals must register on-site in Orlando at the on-site rate.

DEADLINE FOR CANCELLATIONS/SUBSTITUTIONS

MAY 9, 1997
All requests for cancellation must be received in writing prior to MAY 9. All requests for cancellation will be subject to a $50 cancellation fee. NO REFUNDS WILL BE GIVEN AFTER MAY 9.

All requests for substitutions must be received in writing prior to MAY 9. After this date, substitutions must be processed on-site at the Registration Assistance Booth. Written company authorization and a $5 processing fee are required.

DRESS CODE

Since the primary purpose of Cable-Tec Expo is education, we urge you to dress in a manner that is comfortable and conducive to your getting the most out of the program (slacks, jeans, short sleeve shirts — NO shorts or tank tops).

REGISTRATION FEES

	PRE-REGISTRATION UNTIL MAY 1, 1997		**ON-SITE**** AFTER MAY 1, 1997	
	Member	Non-Member	Member	Non-Member
Engineering Conference and Expo*	$240	$340	$290	$390
EXPO only	$190	$290	$240	$340
Spouse Registration*	$95	$95	$95	$95

* Includes ticket to the Awards Luncheon on June 4. Additional luncheon tickets are available for $25 each.
** Admittance to the Awards Luncheon is not guaranteed, but will be made available as seating permits.

ADMISSION

Admission to all events will be through color coded badges to be picked up at the registration desk upon arrival.

EXPO '97 PRELIMINARY PROGRAM

PRE-CONFERENCE SESSIONS

Tuesday, June 3, 1997

- **Preparing for Technical Certification at the Service Technician and Telephony Levels** with Alan Babcock, TCI (Moderator); Dennis Quinter, Time Warner Cable; Andy Scott, NCTA; and Gary Selwitz, Raystay
- **Technical Standards Development** with Ted Woo, Ph.D., SCTE (Moderator); Jim Haag, Integration Technologies; Paul Hearty, General Instrument; Steve Johnson, Time Warner Cable; Rich Pulley, Comcast; and Bruce Weintraub, Southwestern Bell
- **Data Network Protocols and Telephony Acronyms Explained** with Marty Glapa, Lucent Technologies; and Bill Winslow, Sprint North Supply

ANNUAL ENGINEERING CONFERENCE

Wednesday, June 4, 1997

- **SESSION A: Preparing for Digital Deployment** with Jim Ludington, INT2 (Moderator); Yvette Gordon, Time Warner Cable - Full Service Network; Keith Kreager, Antec Network Technology; Van Macatee, TCI; and Todd Ortberg, ADC Telecommunications
- **SESSION B: Cable Modem Technology and Product Strategy** with Richard Prodan, Ph.D., CableLabs (Moderator); Doug Jones, US WEST; Milo Medin, @Home; and John Linebarger, Comcast

EXPO WORKSHOPS

Thursday-Friday, June 5-6, 1997

- **Cable Modems—Are They Plug and Play?** with Johan Davalos, Hewlett-Packard; and Angel Orrantia, Intel
- **Digital System Deployment and Measurements** with Zulfakir Ali, General Instrument; Rick Jaworski, Wavetek; and Bill Wall, Scientific-Atlanta
- **Inside Wiring Options** with J.R. Anderson, Integration Technologies; and Jay Junkus, Knowledgelink
- **Making Two-Way Work (Part II)** with Ron Hranac, Coaxial International; and Tom Staniec, The Excaliber Group
- **New Revenue Opportunities** with Tom Donahue, Broadband Networks; Bill Karnes, ISC Datacom; and Jay Kirchoff, Moore Diversified Products
- **Powering for Reliability** with Mark Alrutz, CommScope; Steve DuChene, Time Warner; Dave Johnson, Cox Communications; and Dan Kerr, Continental Cablevision
- **Project Management of Your HFC Upgrade** with Walt Colquitt, Optel; and Jim Ludington, INT2
- **Return Path Problems and Their Solutions** with Dean Stoneback, General Instrument; and Tony Werner, TCI
- **Quality Audio in the Headend** with John Beyler and Craig Cuttner, HBO; Russ Murphy, The Family Channel; Linc Reed-Nickerson, Tektronix; and Dom Stasi, TCI
- **Surge Suppression, Fusing and "Slugging"** with Jack Coghlan, Transtector; John Downey, C-Cor; Bruce Kaiser, LightningMaster Corp.; and Oleh Sniezko, TCI

TRANSPORTATION

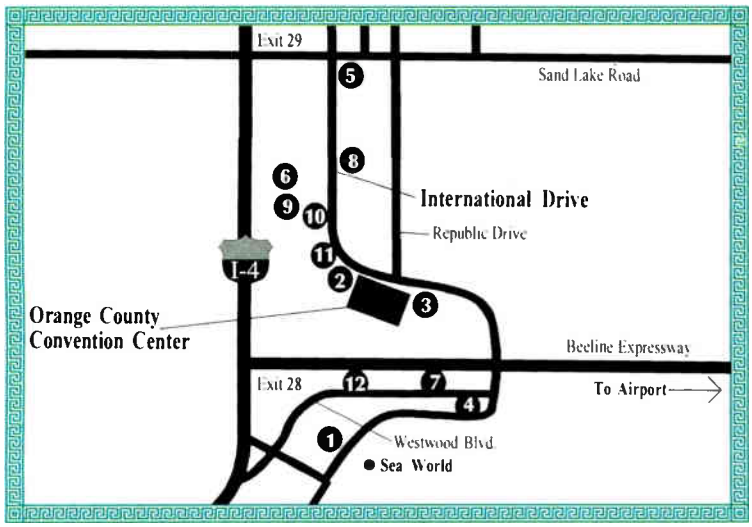
SCTE has made special arrangements for discounted airfares to Cable-Tec Expo through Executive Travel Associates (1-800-498-2270). Budget Rental Car will also be offering discounted rates to Expo 97 attendees (1-800-772-3773 Refer to Meeting #T436983)

ENTERTAINMENT

The Orlando Visitors Bureau will maintain a booth in the Convention Center and can make reservations for area attractions, dining, nightlife and sightseeing activities.

ORLANDO AREA ATTRACTIONS

MAGIC KINGDOM • EPCOT CENTER • DISNEY/MGM STUDIOS • UNIVERSAL STUDIOS • SEA WORLD • WET 'N' WILD CHURCH STREET STATION • BLIZZARD BEACH • TYPHOON LAGOON • CYPRESS GARDENS • KENNEDY SPACE CENTER BUSCH GARDENS • BELTZ FACTORY OUTLETS • PLEASURE ISLAND • DISNEY VILLAGE



EXPO HOTELS (as numbered on map)

1 **Renaissance Orlando Resort** (Co-Headquarters,$142 Single/Double - 700 Rooms) Four-star, four-diamond luxury resort; five restaurants and two lounges; pool/jacuzzi, tennis, fitness room and volleyball; licensed Shamu s Playhouse day care; one mile to convention center

2 **Clarion Plaza Hotel** (Co-Headquarters, $109 Single/Double - 650 Rooms) Three restaurants, 24-hour deli and one lounge; Backstage (popular nightclub); pool/jacuzzi; walking distance to convention center

3 **Omni Rosen Hotel** (Co-Headquarters, $134 Single/Double - 600 Rooms) Two restaurants, two lounges and 24-hour deli; pool/jacuzzi and health club; walking distance to convention center

4 **Sheraton World Resort** ($87 Single/Double - 400 Rooms) One restaurant and one lounge; three pools/jacuzzi and fitness room; one mile to convention center

5 **Orlando Marriott** ($81 Single/Double - 400 Rooms) Two restaurants and one lounge; three pools/jacuzzi and health club; one mile to convention center

6 **Radisson Barcelo Hotel** ($75 Single/Double - 200 Rooms) Two restaurants and two lounges; pool/jacuzzi and health club; 1/2 mile to convention center

7 **Wynfield Inn** ($54 Single/Double - 150 Rooms) Pool/jacuzzi; one mile to convention center

8 **The Castle** ($109 Single/Double - 125 Rooms) Two restaurants and two lounges; pool/jacuzzi and fitness room; 1/2 mile to convention center

9 **Courtyard by Marriott** ($89 Single/Double - 100 Rooms) One restaurant and one lounge; pool/jacuzzi; 1/2 mile to convention center

10 **Embassy Suites Orlando South** ($132 Single/Double - 100 Rooms) One restaurant and one lounge; complimentary buffet breakfast and cocktail hour; pool/jacuzzi and fitness room; 1/2 mile to convention center

11 **Quality Inn Plaza** ($55 Single/Double - 100 Rooms) One restaurant and one lounge; pool/jacuzzi; walking distance to convention center

12 **Hawthorn Suites** ($115 One Bedroom Suite - 80 Rooms) Complimentary continental breakfast; pool/jacuzzi; one mile to convention center

HOTEL RESERVATIONS

Reservations will be accepted only with paid attendee registration forms. No reservations will be accepted by phone.

Hotels are assigned first come, first served based on availability. Every effort will be made to honor your hotel request. However, SCTE reserves the right to place your reservation where rooms are available.

Housing reservations (with accompanying attendee registration form) must be received by MAY 1, 1997. After that date, please call SCTE for housing availability information. Assignments will be made on a space available basis after MAY 1, 1997.

Beginning MAY 9, 1997, reservations must be made directly with the hotels.

CONFIRMATIONS

You will receive written acknowledgement of your Expo attendee registration from SCTE.

Confirmation of hotel reservations will be sent to you directly from the assigned hotel.

Do not call SCTE for hotel confirmation numbers.

HOTEL DEPOSITS AND GUARANTEES

A deposit of one night s room rate **by credit card only** must be included with the hotel reservation.
Credit card information to charge room deposit must be complete on the housing form. Failure to fill out all information will delay processing of reservations. SCTE is not responsible for the cancellation of reservations due to failure to follow hotel deposit procedures.

CANCELLATIONS AND CHANGES

Hotel cancellations must be received in writing by SCTE prior to MAY 9. After that date, cancellations must be made directly with the hotel.

Any requests for changes in arrival/departure date or substitutions must be made in writing and received by SCTE prior to MAY 9. After that date, all changes must be made directly with the hotel, subject to availability.

Please Note: Cancellation policy is three days (72 hours) prior to arrival for all Orlando hotels. If a reservation is cancelled any time after the stated policy, no refund of the deposit will be granted.

EXPO '97 SCHEDULE OF EVENTS

	REGISTRATION	TRAINING	EXHIBITS	TESTING	SPECIAL EVENTS
Tuesday, June 3	Attendee Registration 1 - 7 p.m.	Pre-Conference Sessions 2 - 5 p.m.			SCTE Engineering Subcommittee Meetings 2 - 5 p.m. Arrival Night Reception 6 - 8 p.m.
Wednesday, June 4	Attendee Registration 7:30 a.m. - 5 p.m.	Engineering Conference 8:30 a.m. - 12 p.m.	Exhibit Hall Open 2 - 6 p.m.		Awards Luncheon 12 noon - 2 p.m. SCTE Annual Membership Meeting 4:30 - 5:30 p.m. Welcome Reception and Cable-Tec Games 7 - 9 p.m.
Thursday, June 5	Attendee Registration 7:30 a.m. - 5 p.m.	Expo Workshops 8 a.m. - 12:15 p.m.	Exhibit Hall Open 11 a.m. - 6 p.m.	BCT/E and Installer Certification Testing 10 a.m. - 2 p.m.	Expo Evening at Rainforest Café 7 - 9 p.m. (Sponsored by Antec, CommScope, General Instrument, Philips Broadband and Scientific-Atlanta)
Friday, June 6	Attendee Registration 7:30 a.m. - 3 p.m.	Expo Workshops 8 a.m. - 12:15 p.m.	Exhibit Hall Open 11 a.m. - 4 p.m.	BCT/E and Installer Certification Testing 10 a.m. - 2 p.m.	Exhibitors' Reception 3 - 4 p.m. Ham Radio Operators' Reception 6 - 8 p.m. Closing Night Reception 6 - 8 p.m.
Saturday, June 7				BCT/E and Installer Certification Testing 9 a.m. - 12 noon	Golf Tournament 8 a.m. - 2 p.m.

CABLE-TEC EXPO '97 EXHIBITORS

(as of February 21, 1997)

A.B. Chance Co.
ABC Cable Products
ACP International
ACT Communications Inc.
ADC Telecommunications Inc.
AM Communications
AML Wireless Systems
AMP
ATCi
Action Triangle Inc.
Adams Global Communications
Adirondack Wire & Cable
Adrian Steel Co.
Advanced Custom Applications
Alcatel
Alcoa Fujikura Ltd.
Allied Bolt Inc.
Alpha Technologies
Altec Industries Inc.
Aluma-Form/Dixie
American Digital Cartography
American Polywater Corp.
Antec/Network Technologies
Applied Instruments Inc.
Arena Services Inc.
Aria Technologies
Arnco Corp.
Arris Interactive/Antec
Arrow Fastener Co. Inc.
Atlanta Graphic Solutions Inc.
Aurora Instruments Inc.
Avantron Technologies Inc.
Bekaert Corp.
Belden Wire & Cable Co.
Ben Hughes/Cable Prep
Blonder-Tongue Laboratories
Broadband Networks Inc.
Budco
C-Cor Electronics Inc.
C-Pro Inc.
CADD Services Group Inc.
CED Magazine
C.I.S. Inc.
Cable AML Inc.
Cable Constructors Inc.
Cable Converter Service Corp.
Cable Innovations Inc.
Cable Leakage Technologies
Cable Link Inc.
Cable Source International
Cable Spinning Equipment
Cable Technologies
Cable Yellow Pages
Cabletek Wiring Products
Cadco Systems Inc.
Cadix International Inc.
Can-Am Services Inc.
Canusa-EMI
Champion Products
Channel Master
Channell Commercial Corp.
Channelmatic Inc.
Chy Firemate Co. Ltd.
Coast CATV Supply Inc.
CommScope
Communication Associates
Communications Technology Magazine
Comsonics Inc.
Comtech Services
Condux International Inc.
Contec L.P.
Contech Systems Inc.
D.A. Technologies Inc.
dB Tronics
DLS Electronics
Data Voice Systems
Dawn Satellite Inc.
Diamond
Diamond Communications Products Inc.
Digital Systems/Antec
Dimensions Unlimited Inc.
Dur-A-Lift Inc.
E-Z Trench Manufacturing Co. Inc.
Eagle Comtronics Inc.
Earthvision Systems Ltd.
Electroline Equipment
Epitaxx
Equipment Technology Inc.
Exfo E.O. Engineering
Exide Elect. Emerg. Tech/Lectro
Fiber Optic Network Solutions
Fibertek Inc.
Flight Trac Inc.
FM Systems Inc.
Force Inc.
GLA International/Design Extender
GMP
GN Nettest-Laser Precision Division
Gemini Innovations
General Instrument
George Ingraham Corp.
Gilbert Engineering
Golden State Engineering
Gould Fiber Optics Division
Graybar Electric Co. Inc.
Harmonic Lightwaves
Heart Interface Corp.
Hennessy Products
Herman Electronics
Hewlett-Packard Co.
Hukk Engineering
I.C.M. Corp.
iCS Inc.
IDK Technologies Inc.
IRIS Technologies Inc.
ISC Datacom Inc.
Insulation Systems
Integration Technologies/Antec
Ipitek Inc.
JM Telecom Inc.
Jackmoon USA Inc.
Jameson Corp.
Jebsee Electronics Co. Ltd.
Jerry Conn Associates Inc.
John Weeks Enterprises
Jones Broadband International Inc.
Kennedy Cable Construction
Klein Tools Inc.
Knaack Manufacturing Co.
Knowledge Link Inc.
LEL Computer Systems
Leaming Industries
Leitch Inc.
Lemco Tool Corp.
Lindsay Electronics
Line-Ward Corp.
Lode Data Corp.
Logogram
Lyn-Lad Truck Equipment
MK Battery
Main Line Equipment
McGrath Rentelco
Mega Hertz/Spectrum
Midwest Cable Services Inc.
Mobile Tool International Inc.
Molex Fiber Optics
Monroe Electronics Inc.
Moore Diversified Products
Motorola
Multilink Inc.
NCA MicroElectronics
NCS Industries Inc.
NII Norsat International Inc.
NST Network Services Inc.
NaCom
Neptco
Newhall Pacific Inc.
Newton Instruments Co. Inc.
Norscan Inc.
Noyes Fiber Systems
O.G. Hughes & Sons
Oldcastle Precast Inc.
OptiVideo Corp.
Ortel Corp.
Ortronics Inc.
P-T Technologies Inc.
PCI Technologies Inc.
P.D.Q. CATV Supply Inc.
PPC
Passive Devices Inc.
Pelsue Co.
Pencell Plastics Inc.
Peregrine Communications Inc.
Performance Power Technologies
Philips Broadband Networks
Photon Kinetics
Photonic Components Inc.
Pico Products Inc/Pico Macom Inc.
Pioneer New Media Technologies
Pirelli Cable
Power & Telephone Supply
Powertronics Equipment Co.
Precision Valley Communication
Preformed Line Products
Primus-Sievert Inc.
Progressive Electronics Inc.
Pyramid Industries
Qintar Inc.
Quality RF Services Inc.
Quazite
R.L. Drake Co.
RDL Inc.
RF Networks Inc.
RTK Corp.
Radiant Communications Corp.
Radiodetection
Raychem Corp.
Reliable High Performance
Reliable Power Products
RELTEC
Ripley Co./Cablematic Division
Riser-Bond Instruments
Roadshow International Inc.
Rohn
Rox System/NMP Corp.
Sadelco Inc.
Sandmartin Co. Ltd.
Sargent Quality Tools
Satcon Technology Corp.
Satellite Engineering Group Inc.
Scientific-Atlanta
Scott Cable Communications
SeaChange International
SecaGraphics Inc.
Sencore Inc.
Senior Industries
Siecor Corp.
Signal Vision
Sprint/North Supply
Standard Communications Corp.
Statcon Technology Corp.
Steelweld Equipment Co. Inc.
Superior Electronics
Synchronous Communications
Synertech
TVC Inc.
TW ComCorp.
Taco/Wade Antenna Products
Tailgater Inc.
Technical Response Services
Tektronix Inc.
Telecrafter Products
Telewire Supply/Antec
Tellabs
Terayon Corp.
Thomas & Betts
Times Fiber Communications Inc.
Tollgrade Communications Inc.
Toner Cable Equipment Inc.
TowerSentry Inc.
Transtector Systems Inc.
Trilithic Inc.
Trilogy Communications Inc.
Triple Crown Electronics
Tulsat
Tyton Hellermann
U.S. Cable Inc.
U.S. Electronics
Unicor Inc.
Universal Electronics
Video Data Systems Inc.
Videotek Inc.
Viewsonics Inc.
Voltex Batteries Inc.
Wavecom Electronics Inc.
Wavetek
Wegener Communications Inc.
West End Systems Corp.
Westec Communications
Worldbridge Broadband Services
Zenith Electronics Corp.

SCTE®

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS

140 PHILIPS ROAD ¥ EXTON, PA 19341-1318
EXPO HOTLINE: 610-363-3822
office phone 610-363-6888 ¥ fax 610-363-7133
SCTE Website: http://www.scte.org

CABLE-TEC EXPO® '97 ATTENDEE REGISTRATION FORM

Badge Information:

Complete a separate form for each registrant. Photocopies are accepted. Do not use this form to register exhibitor personnel. **PLEASE TYPE.**

Name:_____ Nickname:_____

Title:_____ Company:_____

Address:_____

City:_____ State:_____ Zip:_____

Telephone:(_____)_____ Fax:(_____)_____

SCTE Member #:_____ Amateur Radio Call Sign:_____

Registration Instructions:

¥ SCTE will accept registrations by fax ONLY when paid by credit card. **DO NOT mail original if already faxed.**
¥ Registrations received after May 1 will NOT be processed. After May 1, attendees must register on-site at the on-site rate.
¥ All requests for cancellation must be received in writing. A $50 processing fee is applicable to all canceled registrations. No refunds will be granted after May 9.
¥ Name substitutions must be received in writing at SCTE prior to May 9. After that date, substitutions must be processed on-site at the Registration Assistance booth accompanied by a $5 processing fee and written company authorization.
¥ Registration forms accompanied by a completed SCTE membership application and dues payment are eligible for the member rate.
¥ Sustaining membership qualifies only **one** representative from that company to register at the member rate.

Registration Fees:

	PRE-REGISTRATION UNTIL MAY 1, 1997		ON-SITE AFTER MAY 1, 1997		
	Member	Non-Member	Member	Non-Member	
Engineering Conference and Expo	$240	$340	$290	$390	$_____
Expo only	$190	$290	$240	$340	$_____
Spouse Registration	$95	$95	$95	$95	$_____

Spouse Name:_____

Additional Luncheon Tickets $25 each $_____

TOTAL ENCLOSED: $_____

Method of Payment:

Fees are payable to SCTE by Check (in US dollars), VISA, MASTERCARD or AMERICAN EXPRESS. Registration fees or credit card information must accompany this form in order to process registration. **DO NOT INCLUDE HOTEL DEPOSIT WITH PAYMENT.**

❒ Check ❒ VISA ❒ MASTERCARD ❒ AMERICAN EXPRESS

Credit Card Number:_____ Expiration Date:_____/_____/_____

Cardholder Signature:_____ PRINT Cardholder Name:_____

DATE RECEIVED

FOR SCTE USE ONLY
SCTE Member: ❒ Yes ❒ No Batch #:_____
Date Processed:_____ Check #:_____
Amount Received:_____ ❒ VISA ❒ AMEX
Member Included: ❒ Yes ❒ No ❒ MASTERCARD

CABLE-TEC EXPO® '97 ATTENDEE HOUSING FORM

Attendee Information:

Complete a separate form for each reservation. Photocopies are accepted. Do not use this form if you are requesting an exhibitor room block. **PLEASE TYPE.**

Name:_____

Title:_____ Company:_____

Address:_____

City:_____ State:_____ Zip:_____

Telephone:(_____)_____ Fax:(_____)_____

Hotel Instructions:

¥ Housing reservations are accepted only with paid Expo registrations. Registration forms with payment and hotel reservation requests must be received at SCTE by MAY 1, 1997. Hotels are assigned first-come, first-served based on availability.

¥ A deposit of one night s room rate must accompany reservation request. Credit cards only must be used to guarantee room. Please fill out complete credit card information below.

¥ SCTE will send written acknowledgment of your attendee registration. Confirmation of housing will be sent directly from the hotel.

¥ All cancellations, substitutions, or changes must be submitted in writing to SCTE prior to **MAY 9**. After that date, all changes must be made directly with the hotel, subject to availability. CANCELLATION POLICY IS THREE DAYS (72 HOURS) PRIOR TO ARRIVAL FOR ALL ORLANDO HOTELS. If a reservation is canceled any time after the stated policy, NO REFUND OF THE DEPOSIT WILL BE GRANTED.

Hotel Options:

¥ Please indicate first, second and third choices.

_____**Renaissance Orlando Resort**	_____**Orlando Marriott**	_____**Courtyard by Marriott**
_____**Clarion Plaza Hotel**	_____**Radisson Barcelo Hotel**	_____**Embassy Suites**
_____**Omni Rosen Hotel**	_____**Wynfield Inn**	_____**Quality Inn Plaza**
_____**Sheraton World Resort**	_____**The Castle**	_____**Hawthorn Suites**

Arrival/Departure:

Arrival Date:_____ Departure Date:_____

Day:_____Time:_____ Day:_____Time:_____

Type of Accommodations:

Number of Persons:_____ Room Type Requested: ❒ Two Double Beds ❒ King Bed

If sharing a room, print additional name here:_____

Special Requests:_____

Payment Instructions:

You must guarantee your room reservation by providing credit card information and signature below.

❒ VISA ❒ MASTERCARD ❒ AMERICAN EXPRESS

Credit Card Number:_____ Expiration Date:_____/_____/_____

Cardholder Signature:_____ PRINT Cardholder Name:_____

Return completed registration and hotel form with appropriate fees to: SCTE • ATTENTION: CABLE-TEC EXPO '97
140 PHILIPS ROAD • EXTON, PA 19341-1318
or FAX TO: 610-363-7133

QUESTIONS? CALL 610-363-3822

BOOK SHELF

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.

☛ *How To Fill Out Form 320*—John Wong of the Federal Communications Commission's Cable TV Branch gives a detailed explanation of how to properly and accurately fill out the FCC Form 320 for cumulative leakage index (CLI). This exclusive video presentation answers numerous questions commonly asked about CLI. (1 hr.) Order #T-1081, $35.

☛ *Getting It Right the First Time: Field Supervision Techniques*—Wendell Bailey, Alan Babcock, Dana Eggert and Kathy Keating discuss the responsibilities and skills needed of cable installation personnel. Includes information on hiring, training and motivating installers. (1-1/2 hrs.) Order #T-1083, $45.

☛ *CLI Ninjas*—Have some fun! Here's a chance for you to review the FCC's Form 320 for CLI. The "CLI Ninjas," Brian James and the FCC's John Wong wrap up signal leakage issues and focus on questions and problems encountered with the form. (1-1/4 hrs.) Order #T-1086,$45.

☛ *Fiber-Optic Testing*—Mark Connor and Louis Williamson discuss fiber-optic test equipment and its use during installation and maintenance of a CATV system. (1 hr.) Order #T-1087, $35.

☛ *Painless Technical Writing*—Bill Cologie and Rikki Lee address the issue of overcoming the fear of writing and putting ideas on paper. They also discuss preparing memos, reports and technical articles in a CATV-specific environment. (1-1/4 hrs.) Order #T-1089, $45.

☛ *Signal Leakage Equipment Calibration*—Don Runzo and Steve Windle focus on different aspects of signal leakage equipment calibration, including receiver measurement accuracy, setting up a calibrated leak and calibrating the vehicle-mounted leakage test system. Internal and external calibration and wave propagation are covered. (1 hr.) Order #T-1090, $35.

☛ *Video and Audio Measurements*—Ron Hranac and Steve Johnson demonstrate headend video and audio measurements, covering video level, video depth of modulation, audio level and audio deviation measurements with actual test equipment. (1-1/4 hrs.) Order #T-1091, $45.

☛ *Fiber for Management*—Continental Cablevision and Paragon Cable present real-life case histories that examine the "dollars and sense" of fiber usage in cable TV transmission systems and rebuilds. (3 hrs.) Order #T-1093, $75.

☛ *Fiber Project Management*—Representatives from AT&T Bell Labs, Cable Constructors and CommScope speak respectively on lightguide cable construction guidelines, fiber construction and fiber cable placement. (3 hrs.) Order #T-1094,$75.

☛ *Fiber for Engineers: Performance Issues*—Representatives from Jerrold Communications, Scientific-Atlanta, Engineering Technology Group, Cencom Cable Associates, Continental Cablevision and New-Channels Corp. discuss fiber from an engineer's viewpoint, focusing on such issues as upgrades, "star" architectures, fiber deployment, plant upgrade, rebuild, extension and design. (3 hrs.) Order #T-1095, $75.

☛ *New Developments in Fiber*—A series of exciting, groundbreaking new fiber products, concepts and plans are presented by Sumitomo Electric, AT&T Bell Labs, C-COR, Scientific-Atlanta, Synchronous Communications and ATC. (3 hrs.) Order #T-1096, $75.

☛ *One-on-One with John Wong of the FCC: A Candid Interview*—This presentation deals with the CLI issue one year after the July 1990 deadline. Wong discusses the progress the FCC has made with 1990 filings, as well as what it expects for 1991. Many "gray areas" also are clarified during this interview, such as dealing with the new definition of a cable system, when subsequent filings should be made, how to deal with new plant extensions and rebuilds, how the FCC views leaks that occur after CLI tests have been successfully completed and how Part 15 affects MATV and SMATV operations. Many other topics also are covered, including where cease and desist operations are imposed and CARS microwave licenses. (1 hr.) Order #T-1097, $35. →

CONNECT WITH THE FUTURE

A NEW ERA IN COMMUNICATIONS

How will the future of communications technology shape *your* world? You won't need to wait long to find the answers. See the impact of tomorrow's technologies *today* at SUPERCOMM '97. It's the *only* event where you can explore the whole world of communications under one roof.

SUPERCOMM '97 will be the largest annual communications event with more than 650 exhibiting companies and 200 world-class educational programs, seminars, tutorials, workshops and forums led by industry experts. No other event delivers the insights you need to help solve your most critical business problems.

Plan Now to Attend the Most Important Communications Event of 1997!

SUPERCOMM '97 is a "must attend" for those who need to gain the competitive edge in:

- ATM
- Cable TV
- Computer Telephony
- Fiber Optics
- Internet & Intranets
- Multimedia
- Networking
- Public & Private Networks
- Satellite Communications
- Software
- Wireless & PCS
- And much more!

SUPERCOMM Educational Programs Developed and Presented by:

- IEEE Computer Society – Internet Computing Conference (IC '97)
- International Communications Association
  - Annual SuperConference
- International Engineering Consortium
  - Communications Forum
  - SUPERCOMM Executive Program
- MultiMedia Telecommunications Association
  - Annual Business Solutions Conference
- SUPERCOMM/Phillips Business Information
  - Global Telecom Market Forum
- TIA/Committee T1 – Wireless Standards Seminar

EXPLORE THE WHOLE WORLD OF COMMUNICATIONS

SUPERCOMM '97

JUNE 1-5, 1997 *10-Year Anniversary* NEW ORLEANS

For registration information, use the form below or call 1-800-2-SUPERC. Outside the U.S., 1-312-559-3327. Or FAX form to 1-312-559-4111.

To exhibit, call 1-800-COMM-NOW. Outside the U.S., 1-703-907-7480. Or FAX form to 1-703-907-7746. Exhibit space is over 90% sold out!

For up-to-the-minute information about the SUPERCOMM '97 exhibition and conferences, visit www.super-comm.com!

WBT

Fill Out and Mail Today! SUPERCOMM '97
549 W. Randolph, Suite 600, Chicago, IL 60661-2208 USA

Name_____

Title _____

Organization _____

Address _____

City _____ State _____

Zip/Postal Code _____ Country _____

Phone _____ Fax _____

E-Mail _____

Interest: ___Attending Exhibition ___ICA ___IEEE ___SUPERCOMM/Phillips
___Exhibit Space ___IEC ___MMTA ___TIA/Committee T1

☛ *OSHA Regulations: Safety in the Workplace*—Ralph Haimowitz and Roger Keith ask the questions: Are you ready for the compliance officer's visit? What does OSHA require of you as an employer? What records should you maintain on each employee? What do you do if you get a citation? This program will provide valuable insight into these questions, and more. (1 hr.) Order #T-1098, $35.

☛ *Satellite Proof-of-Performance Measurements*—Doyle Catlett, John Vartanian, Scott Grone and Kevin Hatch cover the installation of multiple-setting antenna feed systems, as well as proof-of-performance testing procedures. They also provide many maintenance tips that will improve system performance in years to come, and address replacement satellites, the required spacing changes and the impact these changes will have on headends. (70 min.) Order #T-1099, $45.

☛ *Painless Technical Speaking*—Doug Ceballos and Rikki Lee discuss ways to prepare to give a presentation, deal with factors such as stage fright, use visual aids effectively and make public speaking opportunities positive, rewarding and enjoyable experiences. (1 hr.) Order #T-1100, $35.

☛ *Practical Technical Calculations Made Easy*—This program covers basic definitions and calculations as only Richard Covell can. He begins with Ohm's law and proceeds to discuss the use of logarithms, dBs, dBmVs, return loss and various distortions including second and third order. Noise figure also is discussed in detail. (45 min.) Order #T-1101, $30.

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, 140 Philips Rd., Exton, PA 19341-1318 or fax with credit card information to (610) 363-5898. **CT**

SCTE MEMBERSHIP APPLICATION

NAME:_____ PHONE:_____
MSO:_____ FAX:_____
COMPANY:_____ TITLE:_____
ADDRESS:_____
CITY:_____ STATE:_____ ZIP:_____
ON-LINE ADDRESS:_____ HAM RADIO CALL SIGN:_____

Affiliation: ❑ Cable ❑ Telephone ❑ Other:_____

Job Description: ❑ Manager/Administrator ❑ Operations ❑ Financial ❑ Installer ❑ Sales ❑ Construction ❑ Engineer ❑ Technician ❑ Other:_____

Membership Type: ❑ Individual @ $40 ❑ International @ $60* ❑ Sustaining Member Co. @ $250
**Applicants from outside the U.S. include an additional $20 for mailing expenses.*

Make checks payable to SCTE, or include MasterCard or Visa information below. Please make payments in U.S. funds, drawn on a U.S. bank. SCTE is a 501 (c) (6) non-profit professional membership organization. Your dues may be tax deductible. Consult your local IRS office or tax advisor. Additional member material will be mailed within 30 days. Dues are billed annually.

An Individual SCTE member will receive all standard benefits of membership. A Sustaining member is listed under the company name and has one contact person who is afforded all benefits of an individual membership. Sustaining member companies are given discounts while exhibiting at the SCTE Cable-Tec Expo.

Type of Card: ❑ MasterCard ❑ Visa Card#:_____

Exp. Date:_____ Signature:_____

Sponsoring Chapter or Meeting Group:_____

Sponsoring Member:_____

Send Completed Application to: SCTE, 140 Philips Road, Exton, PA 19341-1318 or Fax to: (610) 363-5898

Complimentary Subscription Application

❑ YES! I want to receive/continue to receive a **FREE** subscription to *Communications Technology*, SCTE's Official Trade Journal. ❑ NO

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

B. Please check the category that best describes your firm's primary business (check only one):

Cable TV Systems Operations combined
03. ❑ Independent Cable TV Systems
04. ❑ MSO (two or more Cable TV Systems)
05. ❑ Cable TV Contractors
06. ❑ Cable TV Program Networks
07. ❑ SMATV, DBS Operator
08. ❑ MMDS, STV or LPTV Operations
9A. ❑ Microwave
9B. ❑ Telecommunications Carrier
9C. ❑ Electric Utility
9D. ❑ Satellite Manufacturer
9E. ❑ Satellite Distributor/Dealer
9F. ❑ Fiber-Optic Manufacturer
10. ❑ Commercial TV Broadcasters
11. ❑ Cable TV Component Manufacturers
12. ❑ Cable TV Investors
13. ❑ Financial Institutions, Brokers & Consultants
14. ❑ Law Firm or Govt. Agencies
15. ❑ Program Producers, Distributors and Syndicators
16. ❑ Advertising Agencies
17. ❑ Educational TV Stations, Schools and Libraries
18. ❑ Other (please specify)

C. Please check the category that best describes your job title: (check only one)
19. ❑ Corporate Management
20. ❑ Management
21. ❑ Programming

Technical/Engineering
22. ❑ Vice President
23. ❑ Director
24. ❑ Manager
25. ❑ Engineer
26. ❑ Technician
27. ❑ Installer
28. ❑ Sales
29. ❑ Marketing
30. ❑ Other (please specify)

D. Which one of the following best describes your involvement in the decision to purchase a product/service? (check only one)
31. ❑ Recommend
32. ❑ Specify
33. ❑ Evaluate
34. ❑ Approve
35. ❑ Not involved

New Products

Oscillators

2-Way Amplifiers

Return Amplifier

48 - Way Active Return Band Multi-Port Isolator

Achieve 60dB isolation between all outputs.
5 to 40MHz - Gain 0 or 10dB in a 19" Rack.

VS Viewsonics inc.

1 800 645-7600 1 561 998-9594 Fax 1 561 998-3712
E-Mail: viewson@ix.netcom.com
http://www.viewsonics.com
6454 E. Rogers Circle Boca Raton, Florida 33487 USA

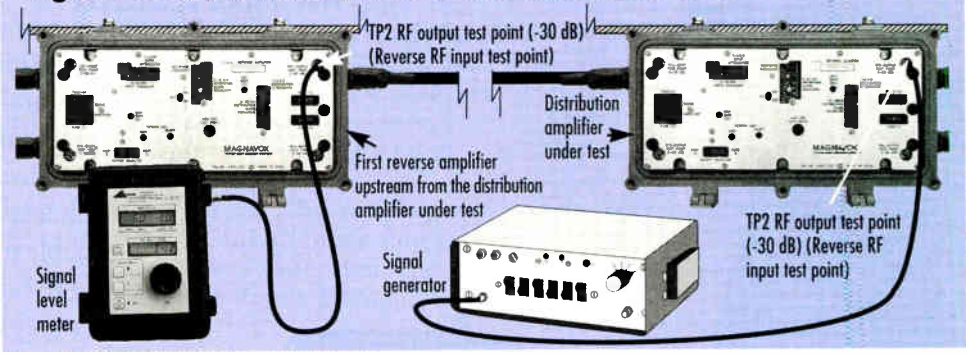
Reader Service Number 299

By the National Cable Television Institute

Return path in distribution amps: Part 2

This concludes the series on distribution amplifiers with a look at rough balancing the reverse RF carriers. Although it specifically focuses on the Philips 750 MHz Global Network Amplifier (GNA), many of the procedures are similar with other amps. Its purpose is to provide useful information complemented by training suggestions to reinforce the material in a classroom setting. The top portion is excerpted from NCTI's System Technician Course. The hands-on training suggestions are modeled after NCTI's facilitator training courses for administering hands-on labs.

Figure 1: Setup for measuring reverse RF carrier levels on Philips GNAs



To connect the required test equipment (Figure 1) for adjusting the reverse slope control: 1) connect a jumper cable between the RF output port of a signal generator and the reverse RF input test point (TP2) of the distribution amp (DA) under test; and 2) connect a jumper cable between the SLM RF input port and the reverse RF input test point (TP2) of the first reverse amplifier upstream of the DA under test.

To measure the reverse RF signal levels for adjusting the reverse slope control: 1) use your system's design map to determine the required highest reverse video carrier level, and add 30 dB to that carrier level (to include the test point attenuation) to obtain the required highest reverse input test point carrier level; 2) set the signal generator to inject the required highest reverse input test carrier level; 3) measure the highest and lowest reverse carrier levels with the SLM and add the 30 dB test point attenuation to both readings to obtain the actual highest and lowest reverse carrier levels; and 4) subtract the actual highest from the actual lowest reverse carrier levels to obtain the actual slope at the first reverse amplifier upstream from the DA under test.

If the actual slope is not within your system's requirements, adjust the reverse slope control (Figure 2) while monitoring the lowest reverse video carrier with the SLM until the slope is within your system's slope requirements.

Adjusting reverse gain control

This procedure uses the same setup shown in the Figure 1. To adjust the reverse gain control: 1) measure the highest reverse video carrier level and add the 30 dB test point attenuation to obtain the actual highest reverse carrier level; 2) use your system's design map to determine the system-required highest reverse video carrier signal level; and 3) adjust the gain control (Figure 3) as required while monitoring the highest reverse video carrier with the SLM so that the actual highest reverse video carrier level matches the system-required highest reverse video carrier level at the upstream amplifier.

Figure 2: Adjusting reverse slope control

Figure 3: Adjusting reverse gain control

Next month's installment will begin a new series on the return amplifier module in trunk/bridger amps.

Hands-on performance training

Proficiency objective: *Rough balance the reverse RF carriers in your distribution amplifier(s).*

Summarize the main steps that are required to rough balance the reverse carriers in your system's distribution amplifier(s).

Make sure students understand why the signal level meter is connected to the upstream amplifier and not the amp under test.

Demonstrate the measurements, calculations and reverse slope adjustment (or installing a reverse equalizer, if applicable), and then have students do the same.

Repeat this method for the reverse gain control (or reverse attenuator pad, if applicable).

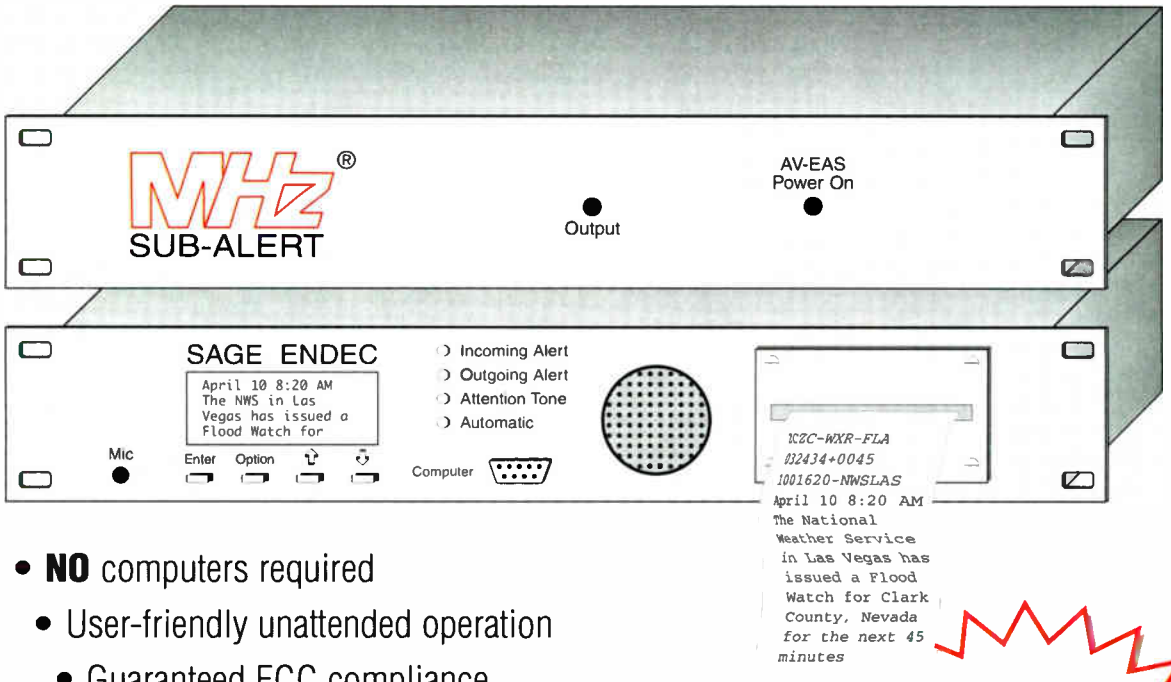
If your system uses more than one type of DA, have the students rough balance the reverse carriers on all types.

Verify that each student can rough balance the reverse RF carriers in your system's distribution amplifier(s). **CT**

Are You Ready for the FCC EAS Deadline?

You will be with this

Extraordinarily Powerful Audio and Video Package!!



- **NO** computers required
- User-friendly unattended operation
- Guaranteed FCC compliance
- Ready for state and local requirements
- Highest technical specifications in the industry
- More standard features, benefits and solutions!
- Compatible with advanced CATV requirements
- The only system to address all switching requirements
- Provides EAS Alerts in remote hub sites without equipment duplication
- Capable of overriding hundreds of channels
- Compatible with SA CommAlert, Idea/onics and Iris systems
- Longest warranty available
- Competitively priced and in stock!

All EAS Systems are not created equal!

MHz® MEGA HERTZ®

Established 1975

http://www.megahz.com

"Unique" Products For the 21st Century!

DENVER ,CO
800-525-8386
FAX 303-779-1749

ATLANTA, GA
800-962-5966

ST. LOUIS, MO
800-821-6800

OCALA, FL
800-922-9200

INDIANAPOLIS, IN
800-761-7610

PHOENIX, AZ
800-883-8839

Reader Service Number 31

By Bill Riker

What's special about Expo '97?

It seems like I am asked virtually year-round about SCTE's Cable-Tec Expo—when the next one is, where it will be located, what topics we plan to discuss, and what's "special" about this year's event. As our industry's premier hardware-oriented technical trade show and conference, the Expo is on a lot of people's minds, especially during the spring season.

That's why it pleases me to be able to provide you with this update on what I'm certain will be the biggest and best Cable-Tec Expo yet. We are delighted to be returning to Orlando, FL, (site of our Expos in 1987, 1989 and 1993) for Expo '97 on June 4-7.

If you read last month's "President's Message," you know that there's been a revamping of the Expo '97 schedule to allow for more exhibit hall hours. If you didn't, here's the premise: based on requests from exhibitors and attendees alike, who felt they needed to spend more time in the exhibit hall, we have restructured the Annual Engineering Conference to make it a half-day of panel discussions that will lead up to the opening of the Expo Exhibit Hall one day earlier.

In previous years, the exhibit hall didn't open until the second day of Expo. But with the expansion that we've experienced on the exhibit floor in recent years, both in terms of the number of exhibitors and the amount of floor space used, a new approach was needed. It makes good sense—the sheer enormity of the hall we now occupy, coupled with the detailed hands-on demonstrations offered by our exhibitors to attendees, necessitates more exhibit floor hours.

Of course, the main purpose of Cable-Tec Expo is training, and the 1997 edition will be no exception to this rule. The technical program we have assembled for Expo '97 begins with three preconference tutorials. These worthwhile "brush-up" courses, to be held on June 3, will include:

- "Technical Standards Development" with SCTE Director of Standards Ted Woo, Ph.D. (moderator), Jim Haag, Paul Hearty, Steve Johnson and Rich Pulley;
- "Data Network Protocols and Acronyms Explained" with Marty Glapa and Bill Winslow; and
- "Preparing for Technical Certification at the Service Technician and Telephony Levels" with Alan Babcock (moderator), Dennis Quinter, Andy Scott and Gary Selwitz.

Each of these tutorials will have special relevance to those active within the Society. The first will explore an area the Society has placed great emphasis on in recent years—the creation and evaluation of industry technical standards. Data was the theme of our 1997 Conference on Emerging Technologies, and the second session will delve further into this hot topic. The final tutorial listed will introduce our two new specialized levels of technical certification to be available through the Society.

Even though it has been shortened to create more exhibit hall hours, our 21st Annual Engineering Conference, set for the morning of June 4, will still pack lots of educational punch. Its two cutting-edge panel discussions (and tentative list of speakers) will be:

- "Preparing for Digital Deployment" with Jim Ludington (moderator), Yvette Gordon, Keith Kreager, Van Macatee, Todd Ortberg and Brett Price; and
- "Cable Modem Technology and Product Strategy" with Richard Prodan, Ph.D., CableLabs (moderator), Doug Jones of US WEST, and representatives from @Home, Comcast On Line and the MCNS Committee.

Our breakout Expo workshops give attendees the chance to choose from 10 sessions offered over six classroom periods. This year's excellent line-up of courses (and tentative speakers) will be:

- "Cable Modems—Are They Plug and Play?" with Johan Davalus and Angie Orrantia;
- "Digital System Deployment and Measurements" with Zulfakir Ali, Rick Jaworksi and Bill Wall;
- "Inside Wiring Options" with J.R. Anderson and Jay Junkus;
- "Making Two-Way Work (Part II)" with Ron Hranac and Tom Staniec;
- "Managing Your HFC Upgrade" with Walt Colquitt and a speaker to be announced;
- "New Revenue Opportunities" with Tom Donahue, Bill Karnes and Jay Kirchoff;
- "Powering for Reliability" with Mark Alrutz, Steve DuChene, Dave Johnson and Dan Kerr;
- "Quality Audio in the Headend" with Craig Cuttner, Russ Murphy, Linc Reed-Nickerson and Dom Stasi;
- "Return Path Problems and Their Solutions" with Dean Stoneback and Tony Werner; and
- "Surge Suppression, Fusing and 'Slugging' " with Jack Coghlan, John Downey, Bruce Kaiser and Oleh Sniezko.

Each of these workshops is geared toward the grass-roots people of our industry: the operational personnel who keep our industry up and running.

Expo registration packages, which include everything you need to sign up, have been sent to all active SCTE members. The package also appears in this issue of *Communications Technology* on starting on page 94. But if you have any further Expo-related questions, please call our Expo Hotline at (610) 363-3822, fax to (610) 363-7133 or visit our Website at http://www.scte.org. **CT**

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

CheetahNet™... The Difference is Striking

Examine CheetahNet™ carefully and you'll see that its speed, reliability and inspired design are striking. CheetahNet is exactly what you need for fault detection and network performance analysis. Featuring a powerful, open-systems architecture, CheetahNet integrates with third-party software systems and monitors multi-vendor HFC plants.

Versatility

Whether you prefer the power of UNIX or the ease-of-use of Windows NT, CheetahNet is compatible. It works equally well on either platform.

Speed

CheetahNet collects and cross-correlates analog parameters from third-party systems, performance monitoring data and multi-vendor network status. You'll identify degrading systems, instantly detect faults and determine the root cause of major failures.

Reliability

From the headend to end-of line, CheetahNet monitors the entire plant. Even on the return path, CheetahNet automatically isolates sources of ingress.

CheetahNet fills a critical gap in network monitoring. No other system even comes close. Extraordinary innovation has made the Cheetah System the standard for monitoring the world's largest broadband networks.

(941) 756-6000

Reader Service Number 95

SUPERIOR ELECTRONICS GROUP, INC.

6432 Parkland Drive • Sarasota, Florida 34243 • (941) 756-6000 • FAX: (941) 758-3800

Cheetah™

Easy Does It

With STARFIGHTER™ Low-Count Fiber Optic Splice Cases

Preparation time is minimal. They're fast and easy to install and re-enter. No special tools are required. And they don't require mastic sealant, heat shrink or drilling. For fiber optic splice cases, the answer is easy!

Starfighter™ fiber optic splice cases increase your productivity and lower your costs. Plus, with Starfighter™, you can count on a fiber closure that is both reliable and technician-friendly. Each splice case incorporates the same basic design that the telecommunications industry has trusted for over twenty years!

To find out more about our broad product family, our associated product accessories and all of the custom options to choose from, call us today! It's as easy as that!

Meets Bellcore Specifications

Multilink™

Engineered to Make the Difference

Operations and Distribution Center
580 Ternes Avenue, P.O. Box 955,
Elyria, OH 44035
Phone (216)366-6966
FAX (216)366-6802
24-Hour Voice Messaging
Worldwide Distribution

Reader Service Number 26