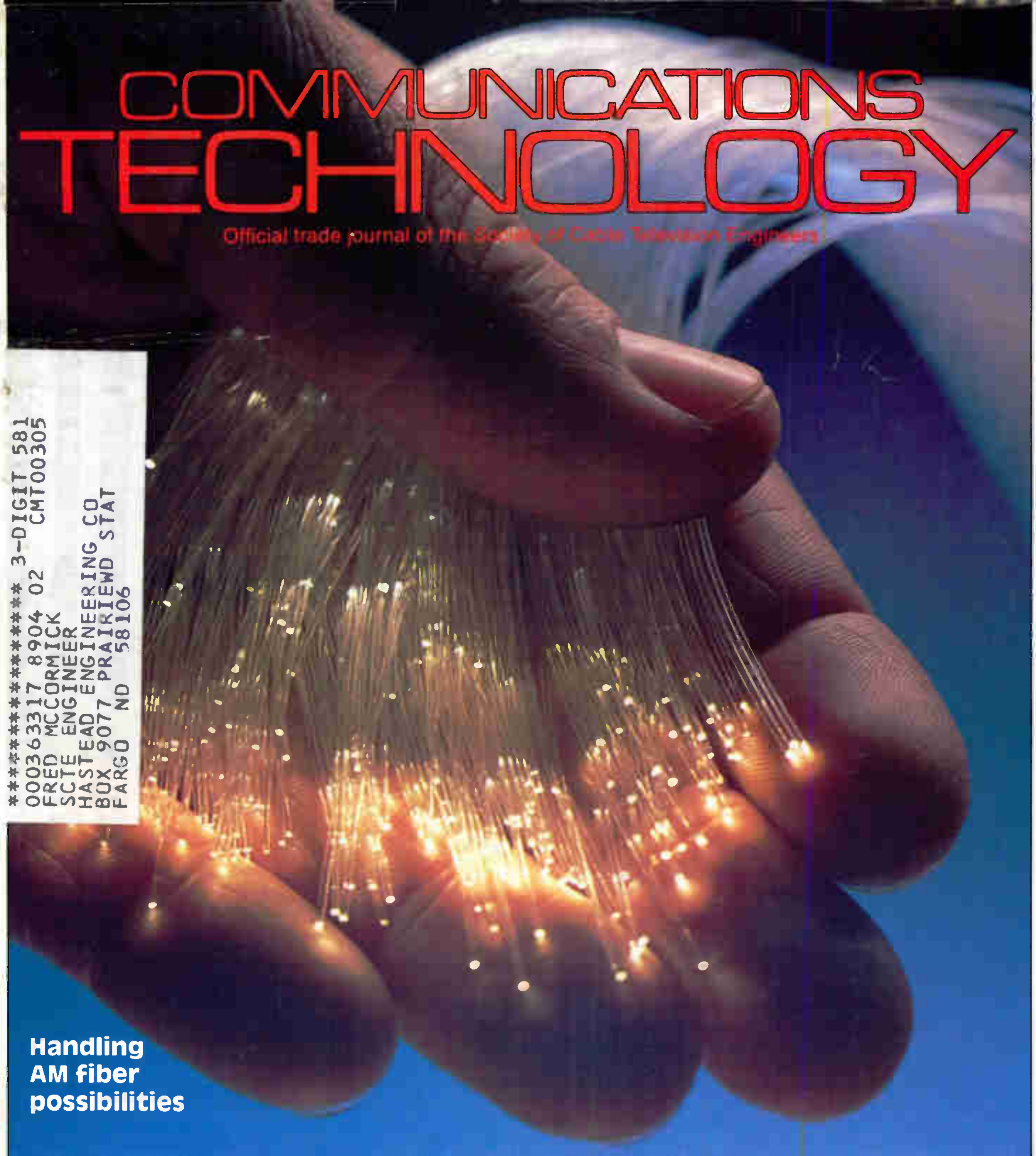
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

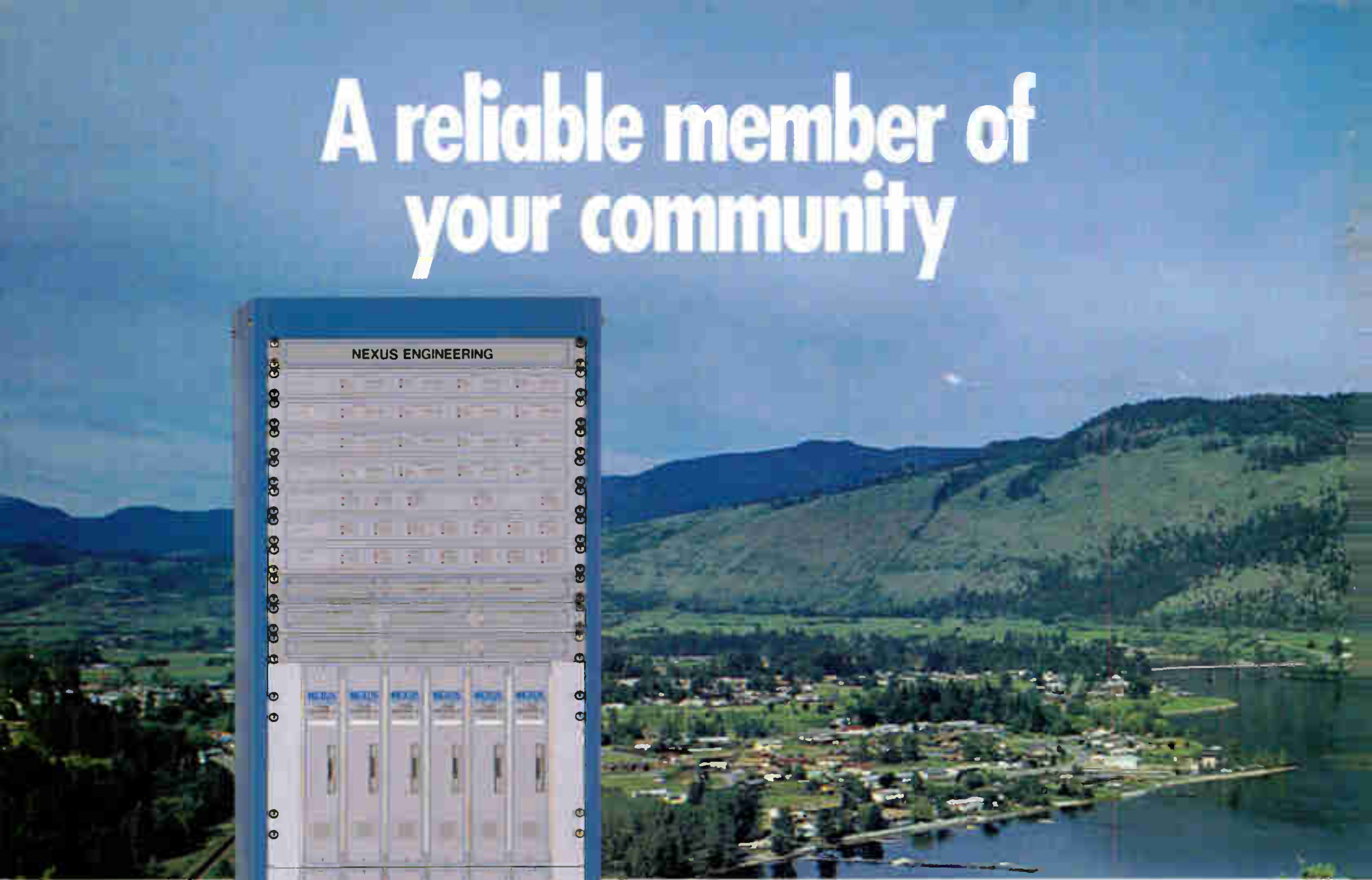


Handling AM fiber possibilities

Technical competition in Colorado

September 1989

A reliable member of your community



NX-100 CATV HEADEND

This 21 channel headend consists of:
— 14 Satellite receivers
— 12 VideoCipher II® descramblers
— 14 Television modulators
— 7 Off air processors
All in only 49″ of rack space.

Looking for a reliable, cost-effective headend? Look no further. The Nexus NX-100 integrated headend provides you with the solution. The NX-100 is based on the Nexus Series 100 product line, and features the revolutionary VCMB VideoCipher® Mainframe. The VCMB houses 6 VCII® descramblers in 12″ of rack space.

The NX-100:
- sets a new standard for reliability
- is compact and easy to install
- offers unbeatable value.

The NX-100 — the complete solution to all your headend requirements. And like all of our products, it is covered by the famous Nexus five-year warranty. Call or write for details.

Nexus — Definitely Ahead of Our Time

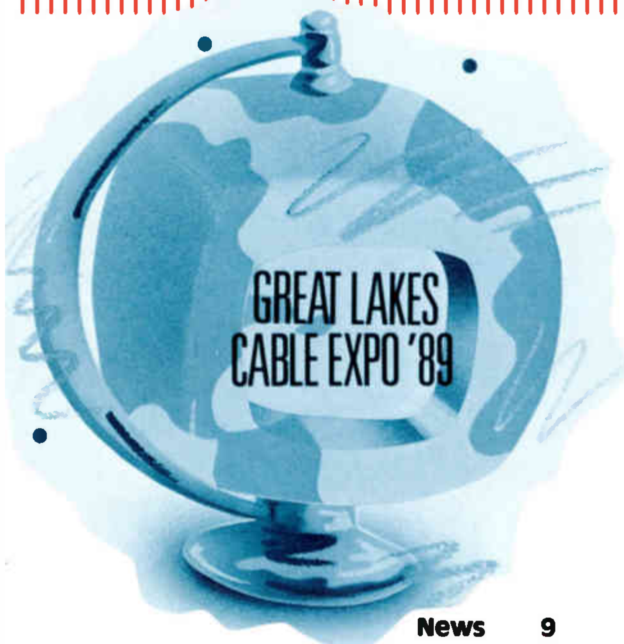
NEXUS ENGINEERING CORP.
PERFORMANCE YOU CAN ~~SEE~~ rely on

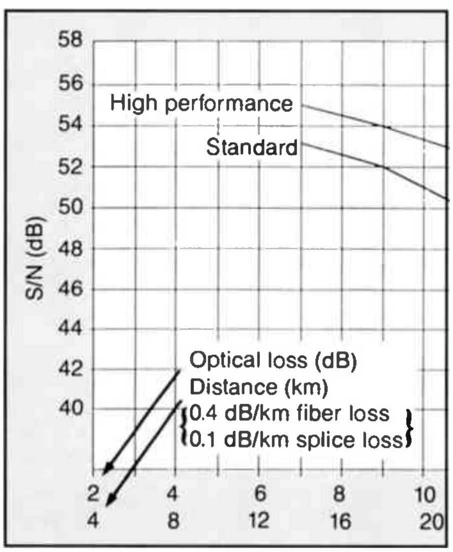
TEL: (206) 644-2371 BELLEVUE, WA. or (604) 420-5322 BURNABY, BC. FAX: (604) 420-5941
WRITE: NEXUS ENGINEERING CORP., 7000 LOUGHEED HWY., BURNABY, BC. V5A 4K4

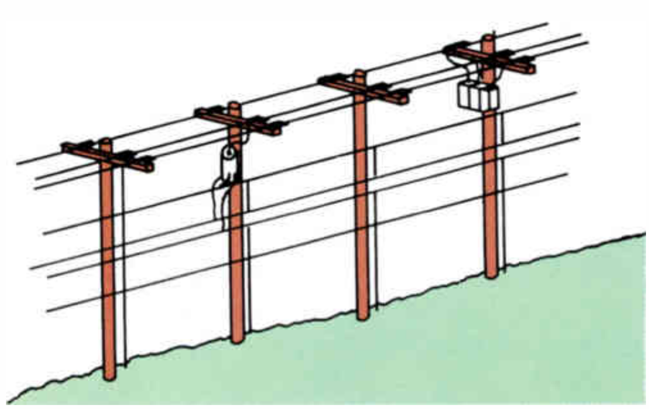
See us at the Great Lakes Show, Booths 403, 504. Reader Service Number 2.

CONTENTS

Departments

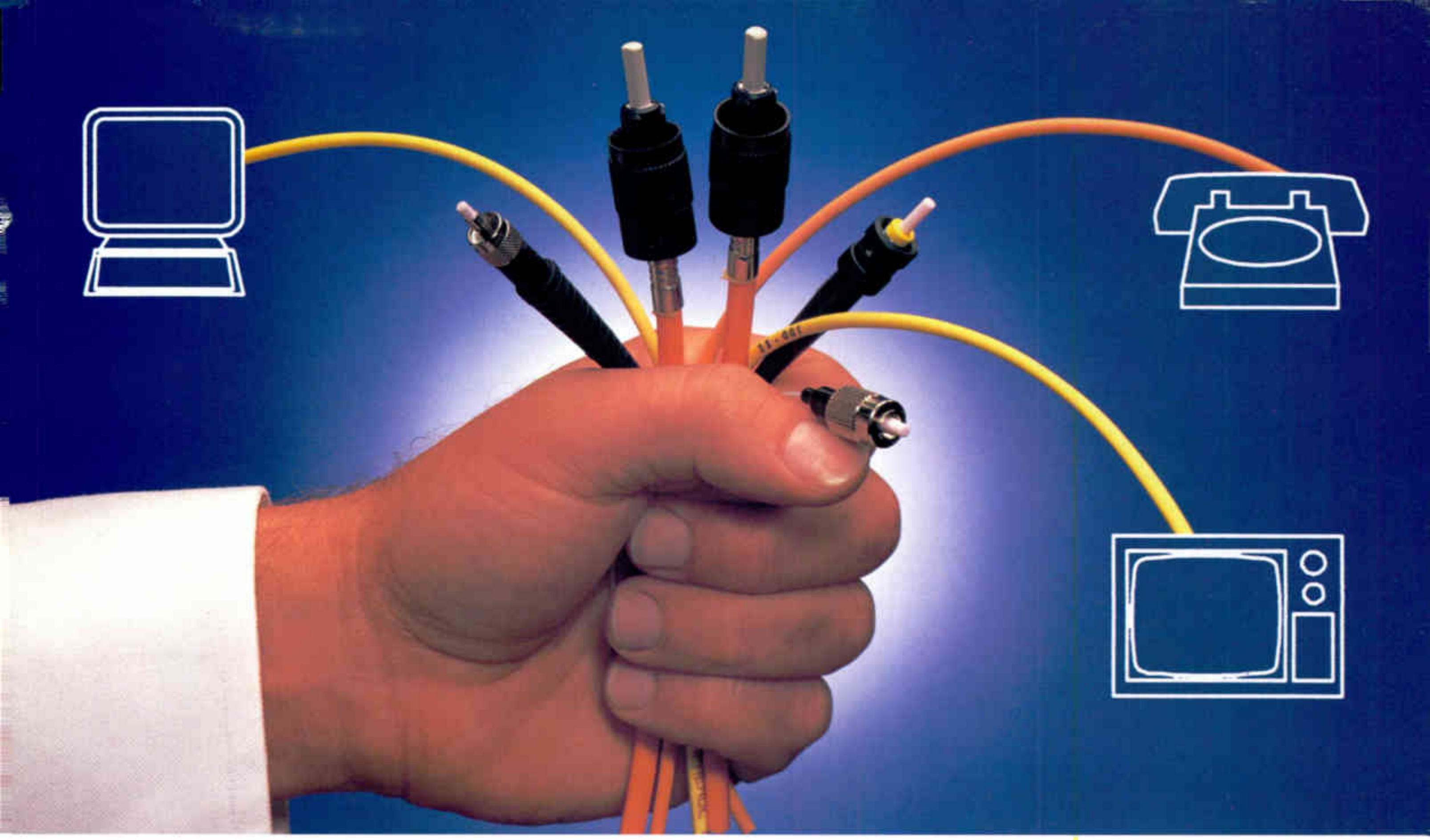






Features

© 1989 by Communications Technology Publications Corp., a division of Transmedia Partners I-L.P All rights reserved. *Communications Technology*™ (ISSN 0884-2272) is published monthly by Communications Technology Publications Corp., 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112 — or — PO Box 3208, Englewood, Colo. 80155, (303) 792-0023 September 1989, Volume 6, Number 7 Office of publication is 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112 Second-class postage paid at Englewood and Denver, Colo POSTMASTER: Please send address changes to Communications Technology, Box 3208, Englewood, Colo. 80155



Presenting the new major force in communications.

Take three of the most capable and innovative communications companies. Combine their resources. Blend in thirty years of cable experience. Now add the industry's strongest commitment to your success. That's the communications group of LPL Investment Group, Inc. . . . a single source for any of your communications needs.

Times Fiber Communications, for years the leading innovator in the cable television coaxial cable market, now couples its extensive communications marketing skills with the technology and manufacturing capabilities of ALS and Amphenol Fiber Optic products to add Fiber Optic Transmission Systems to its product offering. Call (800) TFC-CATV.

TFC TIMES FIBER COMMUNICATIONS, INC.®

American Lightwave Systems is a leader in fiber optic transmission and switching systems used for high quality video links, Broadband LAN extenders, and fiber-to-the-home systems. By utilizing a hybrid analog format instead of digital, ALS systems provide superior performance at lower cost. Call (203) 265-8802.

ALS AMERICAN LIGHTWAVE SYSTEMS, INC.

Amphenol Fiber Optic Products is a world leader in fiber optic connectors, couplers and cable assemblies, fiber optic adapters, and fiber optic cable repair systems. Call (312) 960-1010.

Amphenol

For additional information on our full range of products and services write:
LPL Investment Group, Inc., 358 Hall Avenue, Box 384, Wallingford, CT 06492.

LPL Technologies Inc.

Reader Service Number 4.

EDITOR'S LETTER

Keep your eyes on the competition

There's mighty fierce competition out there. Telcos, DBS, wireless cable and home video? No, I mean all of those technicians, engineers and others whom you might be competing against in a future Cable Games. (Games? you ask. What games?) The First Annual Cable Games took place July 20 at the Colorado Cable Television Association (CCTA) 1989 convention in Vail, Colo. Hosted by the CCTA, the event was presented by the SCTE Rocky Mountain Chapter, the CCTA, *CT* and *Installer/Technician* magazines and the National Cable Television Institute (NCTI).

The games, an idea suggested by Transmedia/CT Publications' Vice President of Marketing Marty Laven, presented perhaps the first opportunity to try a participatory, competitive event for the CATV technical community. It was truly an idea whose time had come, but the question (also in the minds of the ancient Greeks before the first Olympic Games) was: How do you make it work and succeed the first time?

Needless to say, it took months of planning and required a lot of hard work of the people, companies and associations dedicated to such an experiment. So, I'd like to acknowledge all of these contributors of time, energy and funds by name, as follows:

- *Cable Games Committee:* Co-Chairmen Steve Flessner (Tele-Communications Inc.) and Eric Himes (Magnavox CATV Systems). Committee members Doug Greene (Jones Intercable), Byron Leech (NCTI), Ray Rendoff (NCTI), Rebecca Scoggins (CCTA), Laven and I. Keeping the committee on track and the games running smooth were the unenviable tasks of the SCTE Rocky Mountain Chapter president, Ron Upchurch of United Artists (UA).
- *Vendors:* The following companies sponsored workstations and supplied both equipment and judges for the events: Anixter Cable TV, Comm/Scope, Gilbert Engineering, Jerrold, Magnavox, Raychem, Riser-Bond, Scientific-Atlanta and Tektronix.
- *MSOs:* Jones Intercable, TCI and UA sponsored the gold, silver and bronze medals as well as the traveling trophy.
- *Judges:* Ted Hartson of Post-Newsweek played the roles of emcee and officiating judge. Vendor judges were: Richard Covell (Jerrold), Bill Down (Gilbert), Chuck Fusco (Anixter), Dick Hughes (Raychem), M.J. Jackson (Gilbert), Mark Kulper (Tektronix), Herb Longware (Magnavox), John Ocak (Tektronix) and Jeff Pierce (Scientific-Atlanta).
- *Contestants:* The fearless 10 game players were: Romeo Battazzi, Paul Eisbrener and Greg Jolliffe (Columbine Cablevision); Eric Kesinger (Custom Enterprises of Colorado Inc.); Don Grooms and Robert "Fuzzy" Wignes (Jones Intercable); and Shawn Bargas, Paul Broeckect, Dick Hall and Greg Yslas (UA).
- *Audience members:* There were over 150 in the audience, but blame me for not being able to jot down everyone's name. So, instead of listing all but the one or two people I just couldn't identify (and you know who you are), I'll just thank the whole group for their enthusiasm and patience. And for leaving me the last finger sandwich at the hors d'oeuvres stand.

Rikki Lee

Richard Covell of Jerrold gives UA's Shawn Bargas some tips at the amplifier station during the First Annual Cable Games.

- *...But not least:* Ron Hranac of Jones claimed the dubious distinction of being "guinea person" for the games. As he blazed through the four events (drop cable splicing, .500/.750 cable splicing, amplifier testing and fault locating), Hranac proved that even a senior engineer can stay in excellent shape performance-wise.

For the lowdown and the highlights of the event, see the story on page 74.

A call to action

This month's "Technically Speaking" (beginning on page 16) features an talk with the new SCTE President Jack Trower. What will strike you the most in the interview—also echoed in his "President's Message" on page 88—was Trower's candid assessment of the apparently apathetic attitude of a large number of Society members. His statistic that only 1,100 of the more than 5,400 members are enrolled in the BCT/E Certification Program is staggering. Another idea brought up in the interview was the need for participation by members in the chapters and meeting groups.

So here are a few questions I'd like you to ask yourself:

1) Are you an SCTE member? (If so, that's great; if not, fill out the application on page 90.)
2) Is there a local chapter or meeting group in your area? If so, how many technical seminars do you attend each year? Do you allow your staff time off for meetings? (And if there's no group, why not help get one started?)
3) Is your headend tuned in to receive monthly Satellite Tele-Seminar Programs? (If not, what can *you* do about it?)
4) Does your support for the SCTE extend beyond your own participation? (For exam-

ple, do you post SCTE events and local meetings on your company's bulletin board? Do you urge your staff to apply for tuition assistance?)

5) Have you offered to give a presentation at a local meeting or other Society event? And is your Speakers' Bureau form on file at the national headquarters?
6) Are you enrolled in the BCT/E program? (If so, congrats are in order; if not, what are you waiting for?)

So, how well did you do? Hopefully, this little soul searching gave you a chance to pat yourself on the back. Or maybe it just brought the point home: Belonging to the SCTE means more than merely toting a membership card and exhibiting a framed certificate of membership on your office wall. It means attending, participating, even volunteering, in what the Society has to offer.

(We interrupt this letter for an important news flash: The SCTE has announced "Technology for Technicians II," a follow-up to the successful series of last year. First scheduled date is Nov. 13-15 at the Harvey Hotel in Dallas. Ralph Haimowitz, SCTE director of chapter development and training, will once again be the instructor. More details as they become available. We return you to our letter already in progress.)

If I am elected...

The SCTE is currently on the lookout for candidates to run for nine vacant positions on the national board of directors. The board must fill vacancies in eight of the Society's 12 regions (Regions 3, 4, 5, 7, 8, 10, 11 and 12) as well as one at-large position. Upon their election, directors will serve two-year terms beginning March 1990. Nominations will be accepted until Oct. 15. For more information or to recommend a candidate to the Society's Nominating Committee, contact SCTE national headquarters at (215) 363-6888.

In addition, the Society has issued its call for papers and workshops for the Annual Engineering Conference and Cable-Tec Expo '90 (June 21-24 at the Stouffer Hotel in Nashville, Tenn.). For more details, see "News" on page 9.

Dateline: Earth

We're pleased to announce *International Cable*, our new publication for the growing worldwide CATV market. *IC* is scheduled to debut at the 1989 British Cable Television Association show Nov. 20-22. Included in the first issue:

- perspectives from both U.S. and U.K. observers on technology, telcos, regulatory matters and others
- interviews with "movers and shakers" in the international market
- profiles of major countries, incorporating technology, programming and construction
- fiber optics here and abroad
- confessions of a traveling engineer
- the future of technology and competition in Europe
- doing business in Europe, Japan and the Third World
- and much, much more. Stay tuned.

Rikki T. Lee

Cable Labs and ATTC to test advanced TV

BOULDER, Colo.—Cable Television Laboratories and the Advanced Television Test Center (ATTC) announced a cooperative effort to test high definition and other advanced TV systems. In the agreement, Cable Labs will pay ATTC up to $2.5 million over three years for the use of its facilities and test signals.

ATTC will provide test signals to the various ATV systems operating in a simulated over-the-air broadcast environment and use them in tests to be conducted for the broadcasting industry. Cable Labs will run these signals through a cable and fiber-optic test bed approximating an actual CATV system. These tests will be used to develop data concerning the effects of ATV systems that are directly connected to CATV. Data will be compiled on the effects of cable retransmission of over-the-air broadcast signals.

In other Cable Labs news, the R&D facility hosted its first seminar, "Fiber Optics: Strategy, Tactics, Implementation," Aug. 6-8 for 100 attendees from 40 MSO member companies. The seminar was developed to provide education about CATV uses of fiber and was divided into three main segments: strategic planning, technical approaches and the practical experiences of member companies.

Comcast activates fiber-optic rebuild

WEST PALM BEACH, Fla.—Comcast Cable recently activated the first phase of its three-year fiber-optic interconnect project in this Palm Beach County system. Subscribers in the Jupiter, Fla., area are now receiving some signals via the interconnect. A minimum of 80 forward and 20 return channels can be transmitted among three fiber-connected hubs.

This application marked the entry of General Instrument's Jerrold Division into fiber construction. Comcast is the first operator to use technology from Jerrold's Cableoptics business unit.

C-COR, COMLUX plan digital fiber system

STATE COLLEGE, Pa.—C-COR Electronics announced an agreement in principle with Mountain View, Calif.-based COMLUX, which designs and manufactures of fiber-optic equipment. Under the agreement, the companies will jointly develop and produce a digital fiber system for transmission of TV signals with the features, performance and price for practical use in multichannel CATV trunk lines. The planned system will use off-the-shelf optical and digital video components used in broadcast TV equipment.

According to C-COR, these readily available high-power laser transmitters and sensitive receivers can provide a highly reliable TV transmission system capable of ranges of over 40 km without signal degradation or the need for repeaters. The planned technology, says C-COR, will be ideal for point-to-point and point-to-multipoint distribution systems. C-COR anticipates that the new digital technology will provide the quality needed for transmission of high definition TV.

In other developments, C-COR and the David Sarnoff Research Center recently completed testing of the first cable transmission of ACTV-I (Advanced Compatible Television-I), the initial phase of Sarnoff's advanced TV system. The signal was sent through cable equipment test facilities here at C-COR's headquarters.

Society seeks board candidates

EXTON, Pa.—The Society of Cable Television Engineers is seeking nominations for candidates to run for vacant positions on the SCTE board of directors in the upcoming national election. The board needs to fill vacancies in eight of the Society's 12 regions (Regions 3, 4, 5, 7, 8, 10, 11 and 12) as well as one at-large position. Upon their election, directors will serve two-year terms beginning March 1990. Nominations will be accepted until Oct. 15.

Also, the SCTE is soliciting proposals for technical papers and/or workshops to be presented at Cable-Tec Expo '90 in Nashville, Tenn. Technical papers that are accepted will be presented at the Society's 14th Annual Engineering Conference June 21. Submissions, which should include an abstract of the proposed paper or workshop, should be sent to Bill Riker, Expo '89 chairman, no later than Dec. 1.

UL, BSI sign pact to assist U.S. firms

NORTHBROOK, Ill.—On Aug. 7, Underwriters Laboratories and the British Standards Institution signed a joint Memorandum of Understanding that will provide assistance to the United States and other manufacturers interested in gaining access to the European Community (EC) after 1992. This agreement would lead to the acceptance of both UL's and BSI's evaluations of manufacturers' quality systems for registration to the International Standards Organization (ISO) 9000 Series Standards. The EC adopted the ISO 9000 Standards and identified them as European Norm (EN) 29000 Series Standards.

The ISO 9000 Standards provide models for various quality assurance system levels, as well as general guidelines for establishing and maintaining a quality management system. The UL/BSI joint memorandum is intended to provide a mechanism for either organization to evaluate a manufacturer's quality assurance system and register it with UL, BSI or both to ISO 9000 and EN 29000 Standards.

USWest, others win Hong Kong bid

HONG KONG—What is being called the "world's largest single CATV franchise" was awarded by the government to Hong Kong Cable Communications (HKCC), a consortium comprised of USWest International and four companies based in Hong Kong and Europe. In addition to winning the rights to provide cable TV to 1.5 million potential customers, the consortium also was awarded a license to provide data telecommunications services to businesses and residential customers throughout the territory.

Work on the project will begin immediately; service to Hong Kong customers is expected to be available in 1991. HKCC plans to install a digital network to provide CATV and high-speed data communications.

A 25 percent equity by USWest is seen as one of the major factors that gained HKCC the rights to this franchise. Other partners in the consortium include Wharf Holdings, a Hong Kong property development group (28 percent); Sun Hung Kai Properties, a Hong Kong construction firm (27 percent); Shaw Brothers, an Asian film/television production and distribution company (10 percent); and Coditel, a Belgian cable TV company (10 percent).

Great Lakes Expo sets tech agenda

COLUMBUS, Ohio—The cable television associations of Illinois, Indiana, Michigan, Ohio and newcomer Wisconsin will present "A challenging picture" at this year's Great Lakes Cable Expo. The regional show, scheduled for Sept. 20-22 at the Convention Center here, is expected to draw over 2,000 attendees for the first time. As usual, the show will feature technical workshops coordinated by the Society of Cable Television Engineers and its local chapters and meeting groups.

A brief agenda is as follows:

Wednesday, Sept. 20

8 a.m.-6:30 p.m.—Registration

9-11:30 a.m.—Keynote speaker Dr. Charles Nesson, "Changing ethics and values in America: Implications for television"

11:30 a.m.-1 p.m.—Lunch

1-4:15 p.m.—SCTE technical workshops (Each workshop is 50 minutes long; time constraints allow three workshops for attendees.)

- "CLI" with Vic Gates (Metrovision) and Jim Kuhns (Continental Cablevision)
- "Syndex" with Bob Caines (Monroe Electronics) and Wes Heppler (Cole, Raywid and Braverman)
- "Enhanced audio services" with Steve Fox (Wegener Communications)
- "Test equipment" with Steve Windle (Wavetek) and Terry Bush (Trilithic)
- "Rebuild/upgrade" with Ralph Duff and Joe Shanks (UA Cablesystems)
- "Preventive maintenance" with Jim Warner (Times-Mirror)

4:30-6:30 p.m.—Grand opening of exhibit hall with cocktail reception

7-11 p.m.—Dinner and entertainment

Thursday, Sept. 21

8 a.m.-7 p.m.—Registration

8:30-noon—BCT/E review courses (Each course is one hour long; time constraints allow three courses for attendees.)

- Category II: "Video and audio signals and systems" with Paul Beeman (Viacom Networks)
- Category III: "Transportation systems" with Tom Straus (Hughes Microwave)
- Category VI: "Terminal devices" with Ron Hranac (Jones Intercable)

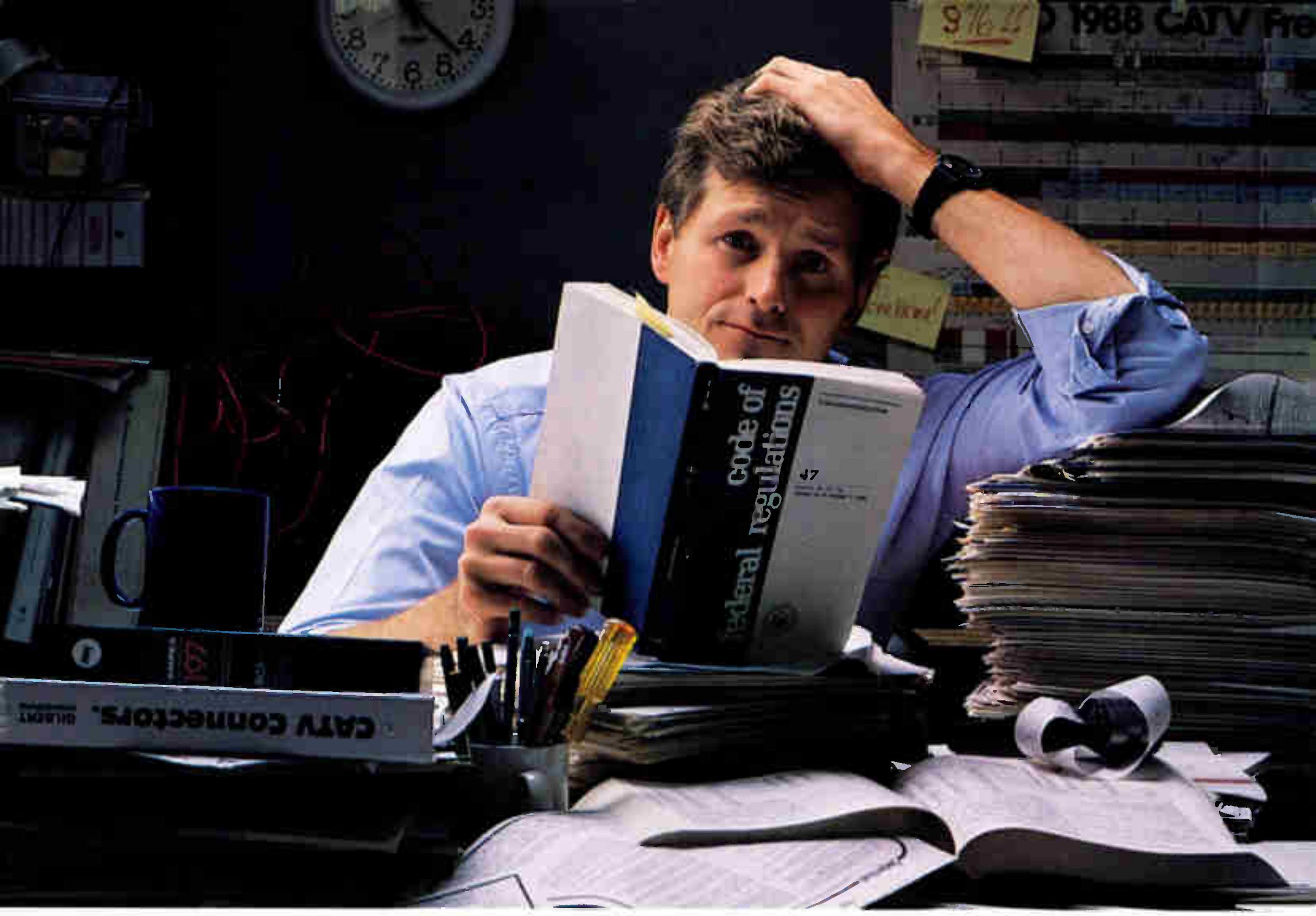
- Category VII: "Engineering management and professionalism" with Ralph Haimowitz (SCTE)

9 a.m.-noon—Exhibit hall open
Noon-1:30 p.m.—Luncheon with keynote speaker James Mooney (NCTA)
2-4:30 p.m.—BCT/E testing
2-4:30 p.m.—Management session, "Engineer/manager challenge" with Wendell Bailey (NCTA)
3:30-6:45 p.m.—Exhibit hall open with cocktail reception
7-11 p.m.—Dinner and entertainment

Friday, Sept. 22
8-10 a.m.—Registration
9-11 a.m.—Exhibit hall open
9:30-11:30 a.m.—Closing general session: "The politics of cable"

In addition, an ongoing hands-on fiber splicing instruction session will be presented by Anixter Cable TV/AT&T and Catel Telecommunications/Siecor Corp.

- Zenith Electronics Corp. recently announced a $32 million agreement to supply two-way interactive cable TV decoders to KBLCOM Inc. The decoders will be installed in the MSO's San Antonio and other systems. Under the five-year agreement, Zenith will supply Z-TAC II baseband addressable decoders with two-way interactive capabilities, as well as Command Series two-way headend control equipment and PCC II remote control transmitters.
- Anixter Cable TV opened a new 62,000 square foot facility in the Atlanta area. The new service center houses a fully stocked inventory of CATV products as well as an expanded sales and technical support staff. The address is: 2100-A Nancy Hanks Dr., Norcross, Ga. 30071, (404) 840-7901.
- Hudson Supply Co., based in City of Industry, Calif., recently signed a multimillion dollar, 12-month agreement with Times Fiber Communications. The agreement includes an inventory commitment of about $500,000.
- Pioneer Communications of America announced the sale of BA-6000 addressable converters and an M3P addressable controller to Chronicle Cablevision in Maui, Hawaii; financial terms were not disclosed. The system also purchased BC-4500 standard converters for its basic subscribers. Also, Warner Cable Communications' Columbus, Ohio, system purchased 120,000 of two-way interactive BA-6000 converters and an M3P addressable controller.
- The Pennsylvania Industrial Development Authority recently approved $539,200 for the building of C-COR Electronics' new manufacturing facility in the Peterson Industrial Park of Tipton, Pa. Total project cost for the 40,000 square foot building —expected to be completed next April—is estimated at over $1.3 million. Also, C-COR announced the opening of a national accounts office at 5299 DTC Blvd., Suite 528, Englewood, Colo. 80111, (303) 694-1584.
- Richard Leghorn was recently awarded the New England Cable Television Association's prestigious Pioneer Award; he was only the second person in the association's history to receive the award. Leghorn is currently chairman, president and founder of Cambridge, Mass.-based Eidak Corp. and recently served as founding president of Cable Television Laboratories.
- AML Specialties of San Diego announced that it will offer to all CARS band AML microwave equipment users a new service contract. The contract encompasses all AML video distribution equipment that the company manufactures or provides a conversion for.
- North Branch, Mich.-based Line Techs Inc., which specializes in rebuilds, upgrades and system sweeps, was recently granted a contractors license for New Mexico. Also, the company moved its Southwest regional office to 110 Virginia, P.O. Box 669, McKinney, Texas 75069, (214) 542-7956.
- Effective Aug. 14, the Canadian Cable Television Association moved to new executive offices at Suite 1010, 360, rue Albert St., Ottawa, Ontario, Canada K1R 7X7; the telephone number remains (613) 232-2631.
- Ortel Corp. of Alhambra, Calif., recently named Visitron AB as its distributor in Sweden, Norway, Finland and Denmark. Visitron will represent Ortel's entire product line of lasers and photodiodes.
- John James CATV Service opened its doors at 1218 Franklin Circle N.E., Atlanta, Ga. 30324, (404) 636-1031. The company specializes in headend equipment repairs for CATV, MATV and SMATV systems.



Don't worry.

With the FCC's Compliance Regulations, the way you seek, find and document cable leakage will be under careful scrutiny. It's going to take more technician time. It's going to take more administrative time. So, to play by the new rules, it's going to cost you. But if you don't play by them and get caught, it will *really* cost you.

Welcome to that comfortable spot between a rock and a hard place.

But wait, compliance is simply a function of locating, documenting and repairing leaks. And locating and documenting leaks is simply a function of the right equipment.

Presenting the new *Wavetek Cable Leakage Instrument (CLI) Series.*

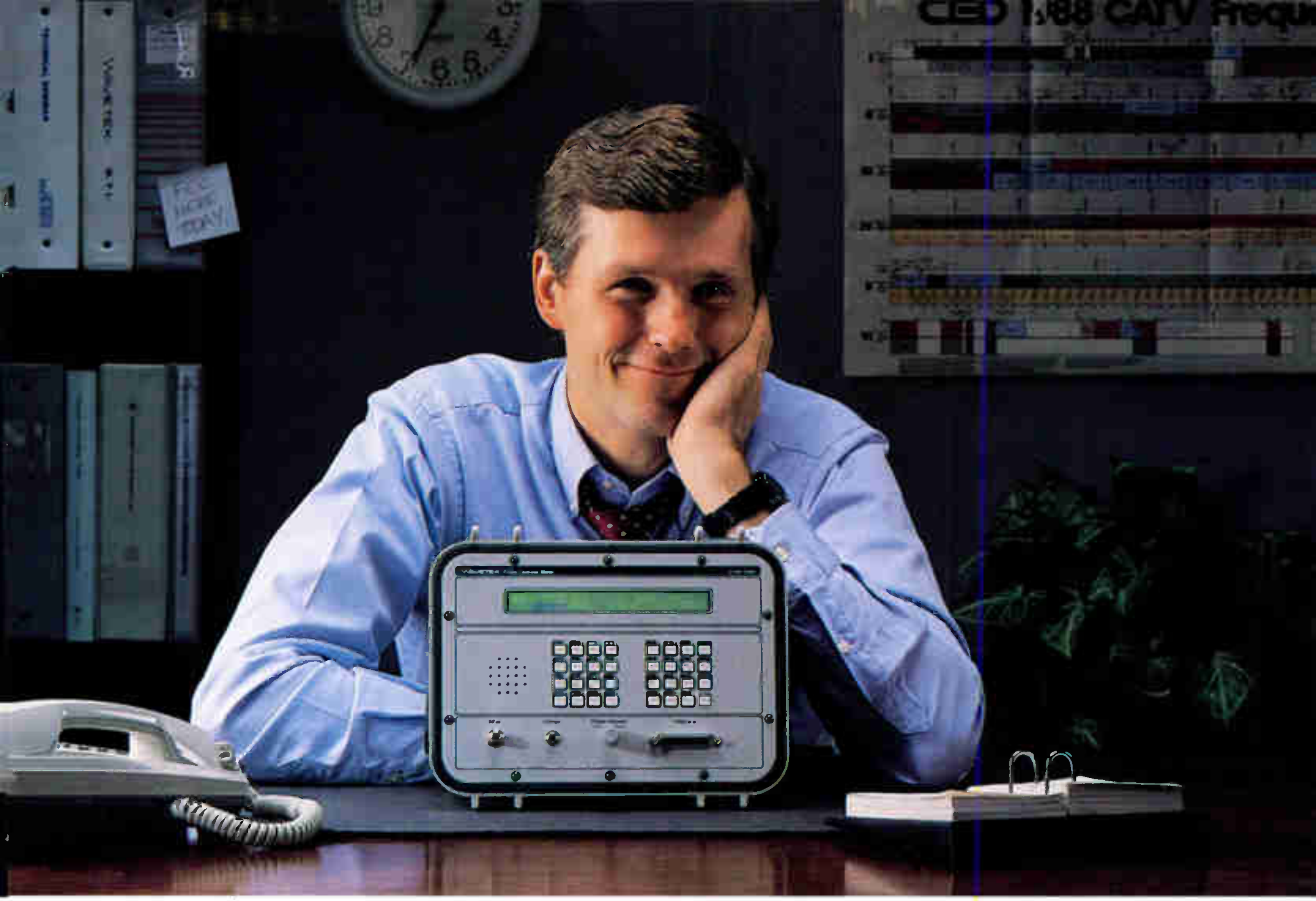
The new CLM-1000: Amazing.
If you had one instrument to buy to solve your leakage problems, this would be it. It measures field strength at any frequency from 50 to 550 MHz. At any range from 9 to 100 feet. And what it finds, it remembers, so you've got foolproof recall to simplify your documentation.

The end of calculated risks.
With just the push of a button, the CLM-1000 takes precise measurements. The dipole antenna receives signals as far as 30 meters and as weak as 20 μV/m. All you do is approximate and input the distance between the antenna and the leak. The system automatically converts the measurement to a 3-meter distance. No number crunching with conversion tables or formulas. No question about accuracy. All the information you need is displayed in an easy to read two-line LCD display, including analog level bar. Nine instrument stored setups simplify even the most complicated situations.

As easy as rolling off a log.
The CLM-1000 contains a complete logging system. At the touch of a button you can store all the measurement data, leak location, date and time of measurement. Then you can print it out on site, or save it for downloading to your office PC.


The CLM-1000 memory bank automatically provides a detailed log—just for the record.


CLM-1000 digital readout takes guesswork and interpretation out of settings and readings.



Be happy.

It's easy. And so is retrieval, which cuts data tracking time to a minimum. So you can say goodbye to recording errors.

For the record, the CLM-1000 is the most precise, versatile field strength meter you can buy.

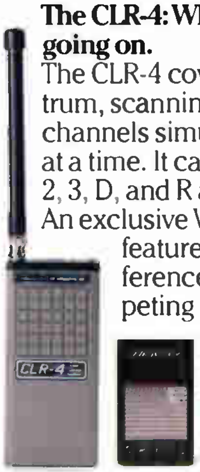
When second best will do.
For instances when you don't need all the sensitivity, memory and documentation capabilities of the CLM-1000, Wavetek has two new very trustworthy hand held CLI receivers. The CLR-1 and CLR-4. Both almost operate themselves and are virtually goof-proof.

CLR-1: One track mind.
Designed for easy, near-field use, the CLR-1 can detect and verify leaks at a subscriber installation or an amp. It tunes into one cable channel and gives you a precise reading. Locator tone pitch and LED readout verify leakage level. No knobs, no needles. And no signal generator is required.

All at a price that makes the CLR-1 impossible to do without.

The CLR-4: When there's more going on.
The CLR-4 covers the CATV spectrum, scanning four different channels simultaneously, or one at a time. It can tune channels 2, 3, D, and R as well as others. An exclusive Wavetek lock-out feature prevents interference from strong competing signals. LED's and locator tone pinpoint the leak source, quickly and precisely.

And all this technology is yours for a remarkably low price.



CLR-1 (right) and CLR-4 give you two very affordable and goof-proof ways to locate leaks.

Let the CLM-1000 do the walking, since it can detect and measure leaks up to 100 feet away.

Compliance made easy.
Although compliance is mandated by law, in the long run, everyone will benefit from it. And it doesn't have to be difficult. It's really just a matter of applying the right equipment. With Wavetek's new line of CLI's, you've got the right equipment.

Make it easy on yourself. Call Wavetek at 1-800-622-5515 for more information and the name of your nearest rep. In Indiana call 317-788-5965. Then, don't worry. Be happy.

Reader Service Number 13.

See us at the Great Lakes Show, Booths 116, 118.

WAVETEK®

Jack Trower: A local hero

"CT" recently interviewed the 1989-90 president of the Society of Cable Television Engineers, Jack Trower (corporate engineer for WEHCO Video, a Little Rock, Ark.-based MSO). In this conversation, Trower discusses his philosophy and goals for the Society.

CT: How did you know you were ready to run for president?

Trower: Well, I've been on the SCTE board of directors for over a year. One of the things I noticed was that we spent a lot of time on the board working on the micro level. We dotted every "i" and crossed every "t." We worried about a lot of little things instead of looking at some big-picture items and overall operations and planning for the Society. I'm an organization-type person; maybe somebody like me could go in there and do a little organization, make the board run more effectively and do some things we hadn't done before.

Also, chapters and meeting groups weren't getting their views heard at the board meetings. I got involved with the SCTE through the local group level. So I thought a person who understood what was happening at that level should be up there as president.

CT: But just how has your background at the local level helped to give you an insight on how you'd plan to run the SCTE?

Trower: First of all, I'm not going to run the SCTE. It's run by the Society's membership through the board of directors. We've got 15 people who sit on the board representing the members. Whoever's president is just a guide, not an all-powerful person. A president should do no more than to help funnel all the ideas into one area where we can concentrate on things and try to make the Society run more efficiently. My experience with the Razorback Chapter (and others) gives me a little more insight as to what we need to do to help the local groups become better as well as to influence more people to become members.

Bob Sullivan

"Installers are an important part of this industry and it's time we recognized that."

We had a tendency in the board to dictate back down to the chapters and meeting groups: You will do this, you will do that. And we needed to get away from that trend. With me up there being part of the focal point of stopping that trend, the board will be more responsive to the groups instead of the other way around. But I'm not the only person on the board who feels that way.

CT: A little while ago you referred to the micro level. Is there a macro level you want to see addressed?

Trower: Yes, there is a macro level. I plan on trying to put together some people in a committee to do some far range planning for what we want to do as a Society. Let's look at a three- or five-year time frame of where we want to go, instead of just doing it on a six month by six month or year by year basis. And not just in the endeavors of the Society but financially and everything else.

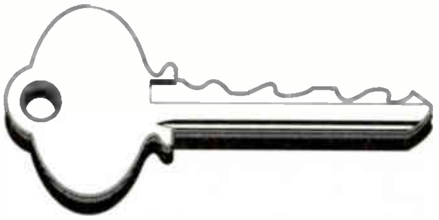
CT: Getting back to the local level: Do you hope to see an increase in the number of groups? If so, how can it be done?

Trower: We have to keep trying to explain that the meeting group is one way members can get their voice heard in the Society very quickly. Members must become aware of the benefits of training and the exposure to people who are very knowledgeable in the industry. It's all there for the asking if they'll just do a little bit on their own to put these groups together.

I'd like to see more people getting involved in the SCTE, not just carrying a membership card. We've got over 5,400 members now. Yet if you look at who's been doing things inside the Society, there's a cadre of people doing a lot of the work. Although we've added some new faces lately, we still could use the help of a lot more people. We've got to keep advertising or exposing people to the knowledge that the chapter and meeting group concept is very beneficial to them.

CT: What do you see as the role of the Society in the CATV engineering community?

Trower: The SCTE has to take some of the knowledge we have—and it is a vast amount—



Keys to Success

Open the door to more efficient system operations. Provide the right tools for the job to improve productivity and quality.

Attention to detail is a key to success.

for our new 1989 catalog or call 800-537-9995

Name/Title ______________________________

Company ______________________________

Address ______________________________

City/State/Zip ______________________________

Phone No. ______________________________

- Converter baskets and totes
- Cable office converter modules
- Converter cleaners
- Converter bags
- Remote control bags
- Truck converter cabinets
- Mailable converter containers

- Padded truck shelves for modules
- Pad and equalizer case
- Module bags
- Safe-D-Cal for trucks
- Installation drop box
- Equipment and converter tags

Cable Resources Inc.
Boston • New York

NEW

Pad and Equalizer Case

Amplifier equalizers cost over $20.00 each. Storing and carrying them is real problem for line technicians. Equalizers effect system response and are easily damaged.

The Pad and Equalizer Case provides individual slots for each piece. The case is small, durable and holds a lot of equipment. Offered for all major cable equipment manufacturers, call 800-537-9995 for information.

Cable Resources
925-9 Lincoln Ave.
Holbrook, N.Y. 11741

AFFIX
STAMP
HERE

and try to expose it to a greater number of people in the industry, be they SCTE members or not. If we do it right, then we will bring more people into the Society. And of course, better trained people are going to make for a better industry. The quality of our service that we're trying to sell our customers needs to be improved. We just don't have as good a product as we really should right now; there's a lot of room for improvement. If we don't improve our service, then the competition will do it for us.

CT: What is your agenda for the next year?

Trower: We've got some very successful programs—the BCT/E and Installer Certification Programs, chapters and meeting groups and the expo. We've got over 5,400 members in the SCTE but only 1,100 are enrolled in the BCT/E. So there's still room for improvement in getting more of the membership involved. The Installer Certification Program is gaining a lot of curiosity and enthusiasm; I'm hoping it's going to expose a lot of the younger people in the industry to the Society. Also, chapters and meeting groups seem to be going strong; we have over 50 of them.

So one of my goals as president is to try to strengthen these programs as much as possible. And we're going to start stretching out more from here. There'll be other things people will want to do—we've got a lot of visionaries in this organization. But I'm not necessarily a visionary; I'd just like to make sure everything we do is on a solid foundation before we start.

CT: What has been the response so far to your being elected president?

Trower: The initial response at the Annual Engineering Conference was surprise. But I've had a lot of support. I've received many phone calls and letters from industry people whom I respect. They're happy about my being elected, they're willing to help me and want me to call on them. And I intend to use every person I can find to help the Society become better. I've been to four local group meetings since the election; those people seem very happy because it's like one of their own is up there now. It's about time that someone who came up through the ranks is part of the situation.

CT: So do you intend to establish a special forum so members can give their input and express their needs?

Trower: One forum, as I mentioned in my first "President's Message" in *CT*, is to write or call me. But members already have a forum through their board of directors. The country is broken up into 12 regions and each has a director who is the voice of the members in that region. There's also three at-large directors. I'd like to see people communicate more with their directors; that's what they're there for.

CT: Back to the local level: Do you see a need to get members of local groups to volunteer as speakers at their technical seminars?

Trower: You know, one of the things a lot of local groups miss out on is the local talent. In most groups I've been to, everybody concentrates on bringing in an outside speaker—someone who's well-known in the industry, has a good presentation to make and is very enjoyable to listen to. The problem is this: If we expand the number of groups, pretty soon it'll be almost impossible to invite one of these popular speakers.

So we've got to start developing our own internal instructor core at each chapter and meeting group. There is a multitude of talent at these groups, even though many members are reluctant to give a presentation. Local groups need to get their people involved in this.

We've tried this out in Arkansas with the Razorback Chapter. It holds installer meetings in the months that we don't have regular technical seminars. These installer meetings usually take place on Saturdays. The instruction is for the installer and entry-level tech; the training is done by the chief techs from systems in Arkansas. What's happening is that when these chief techs practice giving their presentations they become more comfortable talking to their peers. And this benefits the systems because now they've got a technician who can talk to the city council without having to worry about stepping on his tongue.

CT: On another subject, do you feel it was a bit premature to make contact with the U.K. SCTE? Or should we continue our international relationship?

Trower: I don't think it's as important as it was beginning to be perceived to be. We ought to be communicating with our own people a little bit better instead of getting out there as quick. We'll maintain that communication with the U.K., although it won't be on such a high priority level. When (Immediate Past President) Ron Hranac handed the gavel to me in June, I discussed with him that we needed to maintain a U.K. contact. So I asked him to continue that liaison and not let it walk away from us. Eventually we'll need it, but we've got a lot of people in the United States to contact, too.

CT: Let's jump ahead to a year from now. What would you like to have accomplished as president?

Trower: In a year from now, I'd like to see the SCTE staff have more leeway to handle the day-to-day operations of the Society. Also, I want to see better involvement in the BCT/E program and to make sure we're exposing our membership to all the benefits of the program. I'd like to see more endorsements of the program from state associations, MSOs and other organizations. And I'd like to see the Installer Certification Program take off like great guns. Installers are an important part of this industry and it's time we recognized that to the point that we're able to get some qualified people.

CT: Finally, do you think as an industry we're too preoccupied with high definition TV and fiber, when there are more basic issues we've got to take on?

Trower: HDTV to me is a nice thing sitting out there. We're going to have to work on it, but I don't think we should put as much importance in it as we're seeing. With fiber, even a small company like WEHCO Video can see some of the benefits of AM technology; we're seriously looking at it. In general, though, we're still missing the need in this industry to make the service and the product we put in the customer's home better. And to do that we need to train our people.

Reader Service Number 17.

Asbestos and radon

This is the third in a series called "Pollution and probability," which discusses potential health hazards we face today.

By Isaac S. Blonder
President, Blonder Broadcasting Corp

How does one critique subjects in which the populace and the politicians seem to have lost any semblance of sanity and respect for science and, in their unreasoning panic, are passing vaporous laws and expending vast sums of money pursuing parlous programs? If logic is deemed passé, we need to heed the words of Lewis Carroll: "Contrariwise," continued Tweedledee, "if it was so, it might be; and if it were so, it would be; but as it isn't, it ain't. That's logic." We will thereby focus on what isn't.

July 6, 1989, was a day that will live long in the memory of mankind as a day of surrender by the Environmental Protection Agency (EPA) to the hysterical voices condemning asbestos as a primary cause of lung cancer, gastrointestinal cancer, mesothelioma and asbestosis. Major U.S. corporations have been forced into bankruptcy, accompanied by the loss of world markets and countless jobs for American workers, under pressure from the groundless lawsuits brought to our compliant courts by rapacious lawyers.

The sane voices of the World Health Organization and the International Labor Organization favor the continued use of asbestos. In the studies of workers and miners who have been truly identified as victims of asbestos, the most severe harm was associated with the blue and brown forms of asbestos. White, or chrysotile asbestos, which makes up 95 percent of that used in this country, is less hazardous and the exposure of the average citizen is very little. The natural occurrence of mineral fibers in our water, air and foot supplies is apparently higher than our ingestion of asbestos from the manufactured products banned by the EPA from using said "carcinogenic." One author commented that there seemed to be a threshold of tolerance by the lungs for foreign particles wherein the lungs are capable of expelling harmlessly the asbestos exposure of today.

The price we have to pay for the EPA surrender is enormous since no comparable substitute exists for asbestos. Our auto brakes will be less effective in accidents, wear out sooner and cost more. How do we replace the fireproof curtain in theaters? etc. and etc. It costs $30 a square foot to remove sprayed-on asbestos. The average single family home will face a removal cost of up to $2,000 before it will be legally saleable. Some public buildings would be better abandoned than rendered bereft of asbestos.

Let us not overlook in our cost analysis of the asbestos ban the accompanying legal bills. When you deal with a government agency on any subject that could trigger a criminal indictment, as is true here, the lawyers charge above $150 hourly and are buttressed with aides. A simple legal certification that a building meets EPA standards for resale will reach five figures, regardless of the value of the building and its cleanliness.

On to radon

Radon is a radioactive gas that occurs in nature. You cannot see it, smell it or taste it. Radon comes from the radioactive decay of uranium. Very little radon can be detected in the open air. It can be found in high concentrations in soil and rocks containing uranium, granite, shale, phosphate and pitchblende. Sometimes high concentrations of radon are present in basements of homes above radon generating sites. Radon itself is not poisonous to humans because of its transient nature as a gas, but it does break down spontaneously into radioactive daughter particles that could remain lodged in the lungs.

Miners who were exposed for years to high levels of radon are more likely to develop lung cancer, but the cause is clouded by the accompanying high level of dust particles and a clear charge of radon cancer is doubtful. Although New Jersey has natural radon levels seven times higher than Texas, the lung cancer deaths are statistically similar. Extensive studies done in foreign countries as well as the United States showed no correlation between the radon levels and the rate of lung cancers.

Another source of radon is groundwater. The current EPA standard for radium in groundwater —five picocuries per liter—if applied to radon, would force most homes to treat their water at a cost approaching $2,000. A similar price to certify the absence of radon also may be obligatory in some states as a requirement for the sale of your home.

The U.S. Department of Health and Human Services claims that there are 13,500 radon deaths a year. This figure is arrived at by statistical methods that are challenged by many reputable scientists. While I am not a reputable scientist of the caliber aforementioned, I have another measurement of the absence of confirmed deaths from radon cancer that I believe to be infallible: I live in New Jersey, which has both a high level of radon gas in basements and a population of litigious lawyers second to none. If any unfortunate individual has expired from radon, uncomplicated by other causes such as tobacco, one of our personal injury legal beagles (honed to the quick with his auto injury court cases) would have been headlined in our local press with a sob story about the gigantic award he wrung out of the criminal landlord for his deceased lung cancer client! No such story, therefore no lung cancer and no provable victims of solely radon poisoning!

Your Honors, I rest my case.

Fiber-optic product evolution

By Wendell Woody
Manager, Fiber-Optic Technology, Anixter Cable TV

Current fiber-optic technology and its applications in CATV were initially vendor-driven. Fiber was used to expand the market for wideband FM modulation and demodulation equipment and to improve upon the quality of those services being provided. However, system engineers have come to drive product development in recent years by identifying specific applications that could best be served with fiber. The evolutionary process has been interesting to watch. As vendors have responded with more flexible product offerings and improved operating specifications, system engineers have concurrently developed more innovative design topologies to maximize the performance of the new techology. The result has been the formation of a number of joint product development partnerships that have yielded exciting new system architectures and ever improving product performance.

The chronology of fiber applications (and the development of application-specific products) followed several stages:

1) replacing coaxial cable supertrunks
2) implementing headend-to-headend links for ad insertion
3) remoting satellite headend locations
4) implementing headend-to-hubs and hub-to-node sites
5) replacing microwave links
6) reducing long amplifier cascades.

These applications developed and expanded rapidly for two reasons: 1) the technology and equipment improved and 2) the cost of the equipment per channel decreased. Original cost was approximately $15,000 per channel with only four to eight channels per fiber and optical transmitter receiver pair.

For such FM on fiber systems today, that cost is less than $5,000 per channel and each transmitter/receiver pair carries 16 channels, for a greater distance and with much enhanced performance. A hybrid FM/AM-type fiber system was discussed for a period of time and touted to be available for $150 to $1,000 per channel at the receive site; this concept is now generally considered "Edsel" technology. Achievements in AM on fiber technology obsoleted the hybrid concept as an individual product. However, the hybrid system (using FM in conjunction with AM systems) will always be a useful design option.

"Significant commitments of resources have been made to develop CATV products by leaders in the telecommunications industry."

Figure 1: AM fiber backbone architecture

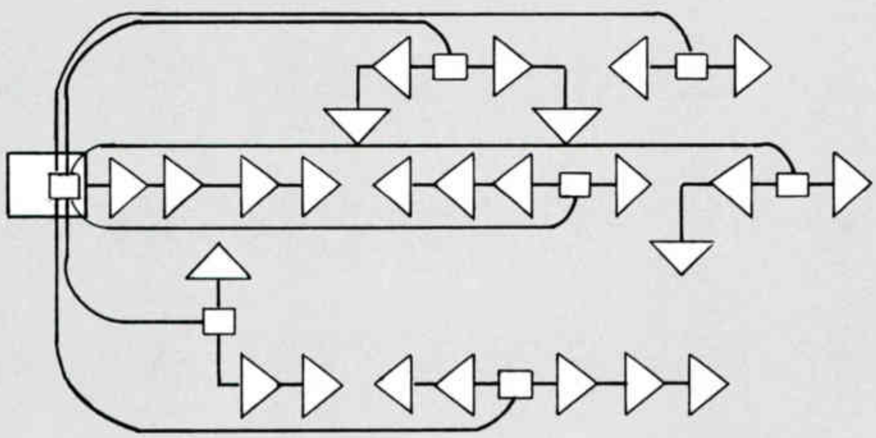
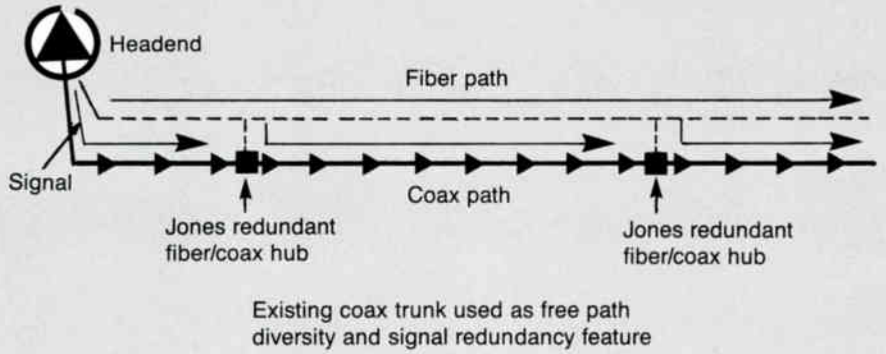


Figure 2: Jones Cable Area Network configuration



Complete system approaches

When MSO and other engineering managers became involved, they evaluated and employed niche applications for fiber in their systems. Next, they directed their thinking toward complete system approaches, establishing system and equipment specifications criteria for the new applications. These new elevated specs challenged both the equipment and component manufacturers of transmitting lasers and optic receiving diodes and generated a new wave of product development. Next, these engineers identified new architectural designs to employ their new desired equipment. Some, such as fiber backbone and Cable Area Network, are already becoming generic terms to the industry worldwide.

The AM fiber backbone (proposed by American Television and Communications Corp.) design uses fiber transmission as links to various nodes located throughout the feeder system at strategic points (Figure 1). At each node, an optical-to-electrical conversion takes place. The node feeds RF signal in all directions, requiring some of the amplifiers to be physically reversed. For this system to be the most desirable and flexible, the equipment at the node must be in either a trunk and feeder amp or a stand-alone housing offering a typical trunk output level to feed the coaxial plant. The fiber backbone facilitates significant reductions in amp cascades, accomplishing greatly improved end-of-line performance without rebuilding existing cable plant.

Jones Intercable's fiber architecture, the Cable Area Network (CAN), is an overlaid fiber system reaching various nodes in the cable plant (Figure 2). The fiber is routed parallel to the present coax but is several blocks removed, creating path diversity. Each node receives the new fiber signal and passes it forward to the next node in an express-through configuration, with an A/B switch to provide redundancy back to the coax in event of a fiber system outage. The switch is at RF and is automatically triggered by the loss of light to the optic receiver. When triggered, the A/B switch takes its input RF from the previous amp. This design requires no amps to be reversed and the original coax remains intact.

The largest Jones system utilizing CAN (Augusta, Ga.) is a hybrid FM/AM design to accommodate long distances between headend and service areas. In this system, FM is used to reach long distance hubs and then AM is deployed to the node locations. The AM optical transmitters use distributed feedback (DFB) lasers with superior linearity and transport 60 to 80 channels on a fiber.

The latest design is by Rogers Cablesystems of Toronto; its topology, Fiber Network Architecture, is hierarchical in configuration (Figure 3). The design somewhat parallels that used by cellular phone companies. The headend and the main hub sites are connected by a closed loop backbone fiber trunk line to provide redundancy; these key hubs are called *primary* hubs. The next level in the hierarchy is called *secondary* hubs, fed by a fiber supertrunk from their respective host primary hub. Secondary hubs also have closed loop links to provide redundancy. From the secondary hubs the network uses "super distribution" 1 GHz feeder equipment. The existing coaxial feeder design is modified to accommodate both VHF and UHF distribution to the home, which will support up to 150 TV channels.

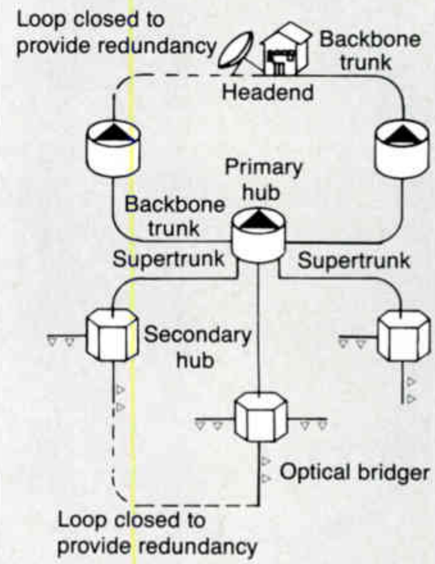
The Rogers architecture is designed to allow evolutionary growth in CATV capacity and quality. The fiber equipment is a combination of FM and AM; the coax feeder system performance at 1 GHz provides for increased channel capacity.

Other cable operators also are installing various fiber-optic applications. Supertrunking and microwave upgrades still represent the majority of activated fiber installations. Meanwhile, design applications and concepts that were generated by the cable industry's engineering management for new applications have catalyzed new development for the industry.

The CATV fiber evolution was placed back in the hands of the equipment and laser manufacturers to meet the industry challenge. Significant commitments of resources have been made to develop CATV products by leaders in the telecommunications industry. Zenith Corp. is under way with an AT&T Bell Labs joint venture to develop a HDTV system format for both the CATV and broadcast industry. The Jerrold Division of General Instrument announced a joint venture with Corning Glass Works, while Scientific-Atlanta and Catel are working with Japanese laser vendors.

Anixter Cable TV and AT&T recently entered into a partnership for the development of complete fiber-optic systems for the CATV industry. By involving another manufacturer (Texscan) and working with the engineering community in operating systems, a flexible fiber-optics product line was developed for use in any of the topographies designed by MSOs.

Figure 3: Rogers Fiber Network Architecture



Achieving the challenge

Industry vendors have now shouldered the application needs of system engineers with equipment designed to achieve the fiber-optic challenge. The pendulum now swings back toward the engineering management staff to integrate this new technology into the RF environment. The subscriber will benefit from improved picture quality and expanded services, while the operator will enjoy reduced maintenance expense and plant technology that is poised for the future.

O B L I G A T

Orville And Wilbur Wright Showed That Commitment To A Goal Is No Flight Of Fancy...

Jerrold Cableoptics™ Proves History Repeats Itself!

After nearly a decade of effort and experimentation – including over 200 wind tunnel tests – the Wright Brothers knew the reality of their vision was finally at hand. On a windy day in December, 1903, they seated their biplane on a rail embedded at the foot of Kill Devil Hill. The Wright Flyer was launched and 12 seconds later, the aviation age was born.

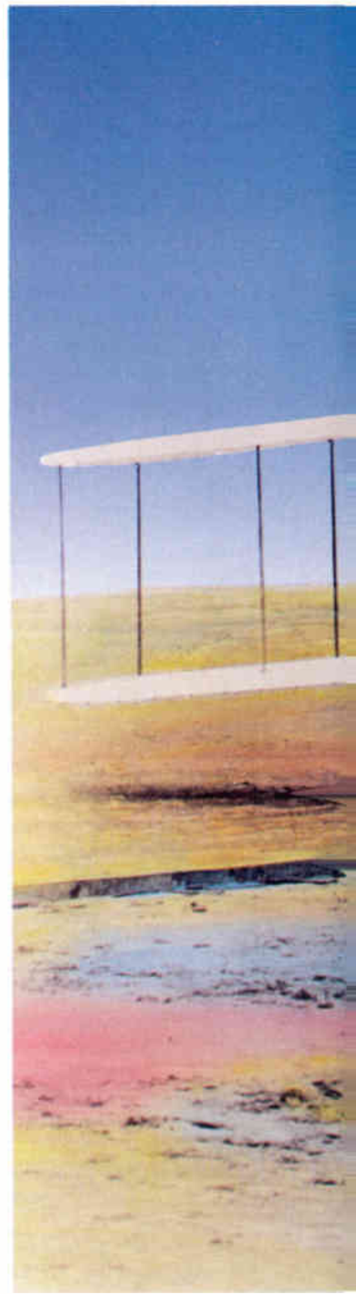
Wilbur and Orville knew all along that their plane would fly. But it took five years after Kitty Hawk to convince the skeptics of the practical value of what they had accomplished.

Today, there are scientists and inventors committed to a different kind of flight. The flight of television signals – not through the air or on wire – but as lightwave communication. These "Wilburs" and "Orvilles" are convinced that optical broadband signals will maximize clarity, increase the capacity and appropriately supplement current RF technology.

Jerrold's obligation is clear. Provide our scientists and technicians with substantial R & D investment. Bring products to market that totally integrate and enhance current RF transmission methods. And lead the cable industry into a new age of reliable, improved image quality and economic value.

Jerrold's commitment to the cable industry is over 40 years old. We launched the first successful cable TV system only through our determined effort to develop an amplifier that would deliver a clear signal. And time after time, we've been proven right as we helped bring cable television to homes throughout America.

At Jerrold, our vision of future cable television transmission through Cableoptics™ is as certain as powered flight was to the Wright brothers. And the future is just as bright.

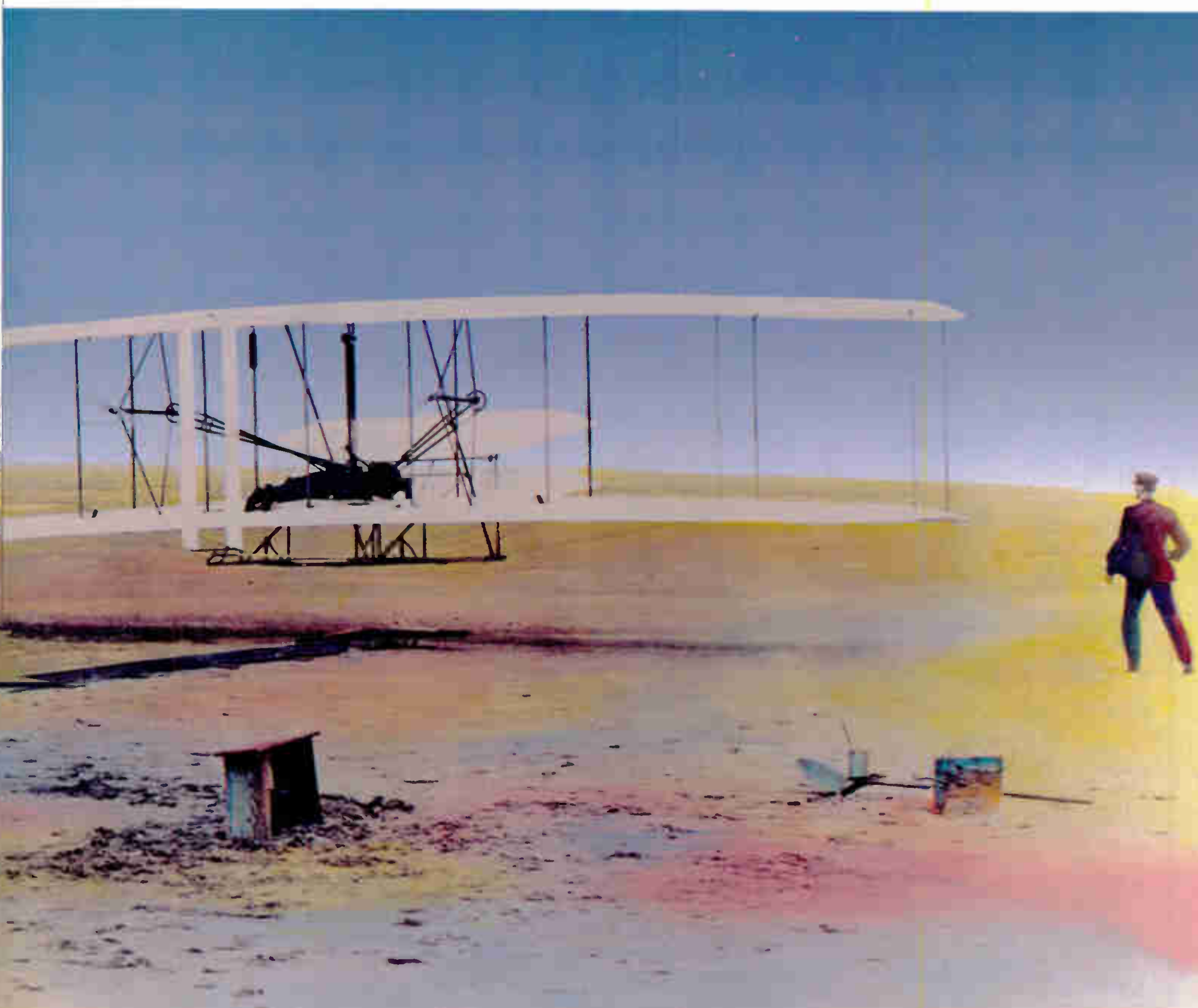


CABLEOPTICS
JERROLD

GENERAL INSTRUMENT

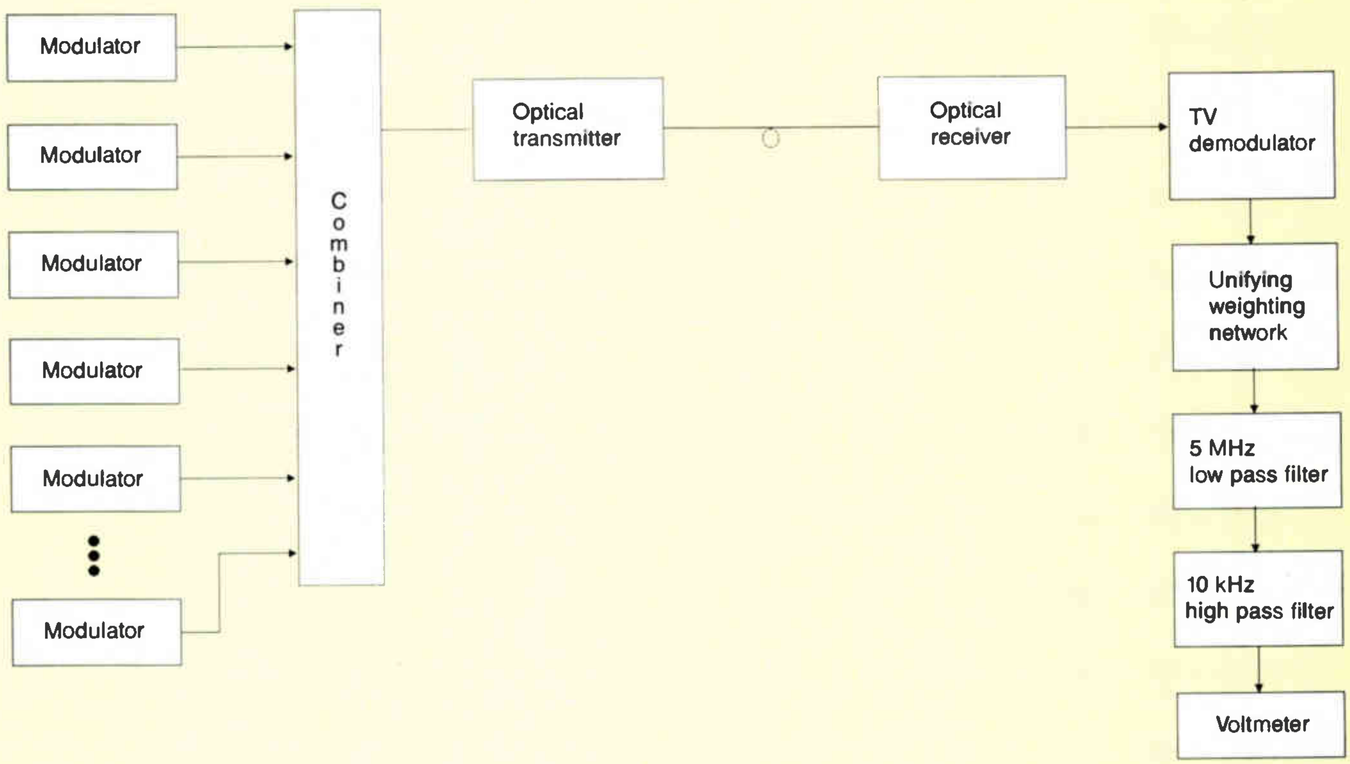
2200 Byberry Road, Hatboro, PA 19040 215/674-4800

I O N



Reader Service Number 22.

Figure 1: RS-250B S/N test setup



VSB/AM on fiber— The quiet revolution

The technology to transmit VSB/AM (vestigial sideband/amplitude modulated) signals on fiber has developed virtually overnight. Only two years ago, experts in the industry held little hope for this technology. Today, high quality AM fiber equipment is being produced and installed in CATV systems. The primary factors influencing this "quiet revolution" are discussed in this article, along with some projections regarding the future of the technology.

By James D. Hood
President and CEO, Catel Telecommunications Inc.

At the 1987 National Show session on fiber optics, laboratory test results of VSB/AM transmission over fiber were presented. One panelist described data on "typical" lasers he had tested with four channels over 8 km of fiber. The result: a 53 dB signal-to-noise ratio (S/N) and −55 dBc beats. He observed that the level of the beats increased rapidly as the number of channels increased, indicating substantial non-linearities in the operating characteristics of the lasers and detectors.

It would have been easy to conclude right then that VSB/AM fiber systems would be impractical for some time. Nevertheless, the ultimate simplicity of such a system continued to encourage a few intrepid researchers to pursue this technology. Over the next year, two significant events dramatically altered the perceived viability of this approach. First, one group of researchers ascertained that energy reflected back into the laser from connectors, splices and so on affected AM system performance. Second, a new generation of distributed feedback (DFB) lasers appeared on the scene with higher linear operating characteristics than previously available.

Reflections from connectors

One research group found that energy reflected from the connectors back into the laser was significantly reducing the performance of their experimental AM system. When the researchers replaced all the connectors with fusion splices, they obtained dramatic improvement in the carrier-to-noise ratio (C/N), composite triple beat (CTB), second-order distortion and other typical parameters. Reflected energy disrupts laser operating modes; it also significantly alters laser operating characteristics. Later work has indicated that the reflected signal must be kept at least 35 dB below the output level of the laser. Control of the reflected signal will be discussed later; it is clear, however, that the <35 dB reflected signal level can be achieved in practice using reasonable construction techniques.

The second major factor in achieving today's technology was the availability of DFB lasers. Although these lasers were being developed for

on tap at Toner

XMT SERIES
2-Way, 4-Way, 8-Way
5-550 MHz Multi-Taps

- ☐ Plated Solid Brass F Connectors
- ☐ Baked Acrylic Corrosion Coating
- ☐ Stainless Steel Mesh RFI Gasket
- ☐ Neoprene Weather Gasket
- ☐ Stainless Steel Hardware
- ☐ Sealed F Ports
- ☐ Plastic Cover Over PC Board

Toner
cable equipment, inc.
800-523-5947
IN PA 800-492-2512
FAX 215-675-7543
969 Horsham Road
Horsham, Pennsylvania 19044

GET "MUGGED" BY TONER AT GREAT LAKES SHOW IN BOOTH 352

Reader Service Number 25.

use in digital telephony, early tests on DFB lasers indicated a higher linearity than the Fabry-Perot (F-P) lasers used in FM fiber systems. Tests of the new generation DFB lasers proved that their linearity and bandwidth were significantly improved over any previously tested devices. The DFB lasers were more sensitive to reflection than the F-P devices, but the earlier work done on the reflection problem had provided the solution to minimize reflected energy.

As is typical in any product evolution, when we evaluated increasingly advanced lasers for the AM fiber system, it became apparent that the detectors and amplifiers also needed development. So today's product represents the net result of optimizing laser, detector, amplifier and fiber installation techniques. Yet with all of these improvements, the number of channels per fiber must still be balanced against such critical performance parameters as C/N, CTB and second-order distortion. Both laser and detector non-linearity is the primary factor limiting the number of channels per fiber. Non-linearities in both devices generate second-order, third-order (and so on) products. If the channel plan is chosen carefully, the second-order products can be filtered out; however, some third-order products will fall in-band of any channel plan. Based on the characteristics of production lasers and detectors evaluated to date, 18 channels per fiber appear to be an optimum configuration.

The output power of lasers and the operating characteristics of detectors have continued to improve, resulting in better optical loss budgets. The devices we tested 18 months ago gave satisfactory performance over 7.5 dB of optical path loss (approximately equal to a path length of 15 km). Today, equivalent performance can be obtained at 11 dB (22 km) path loss. A recently introduced product gives satisfactory performance at up to 13 dB path loss.

One problem that persists in evaluating VSB/AM on fiber is lack of a consistent standard for testing. Questions include whether S/N or C/N is the best performance parameter for evaluating a VSB/AM fiber system. In CT's May 1989 issue, Lawrence Lockwood pointed out that the RS-250B baseband S/N is more nearly a measure of the true quality of a TV picture. Figure 1 shows the test setup used to measure the RS-250B S/N. The more common technique for evaluating AM transmission performance is to measure channel C/N at its associated radio frequency. There is a mathematical relationship between RS-250B S/N and the NCTA's C/N based on factors that are defined for each standard, including the bandwidth used in making the measurements. Figure 2 shows the test setup for performing C/N and CTB measurements.

The filters used in making these measurements must accurately reflect the definitions used in the standards to assure accurate test results and correlations. Proper laboratory and field test setup and techniques must be used to establish performance specifications for AM fiber products and to assure correlation of test results. High quality modulators should be used to produce the VSB/AM signals, thus minimizing the effect on test results. The carrier should be modulated for S/N or C/N measurements and be unmodulated for CTB measurements. The modulators should be measured prior to inclusion of the fiber equipment and their performance characteristics factored out to determine the performance of the fiber link. The S/N shown in Figure 3 was measured using the setup shown in Figure 1. A modulated signal was used in accordance with the RS-250B definitions. The CTB shown in Figure 3 was measured using the setup shown in Figure 1 with an unmodulated signal.

"One problem that persists in evaluating VSB/AM on fiber is lack of a consistent standard for testing."

The price/performance curve has moved very rapidly over the last two years. The two products depicted in Figure 3 represent the latest in VSB/AM fiber equipment. The cost per channel of this equipment depends on system configuration, channel loading and options. In general it can be considered in the $500 to $600 per-channel range for the optoelectronic portion of the system. This does not include the fiber cable and its installation.

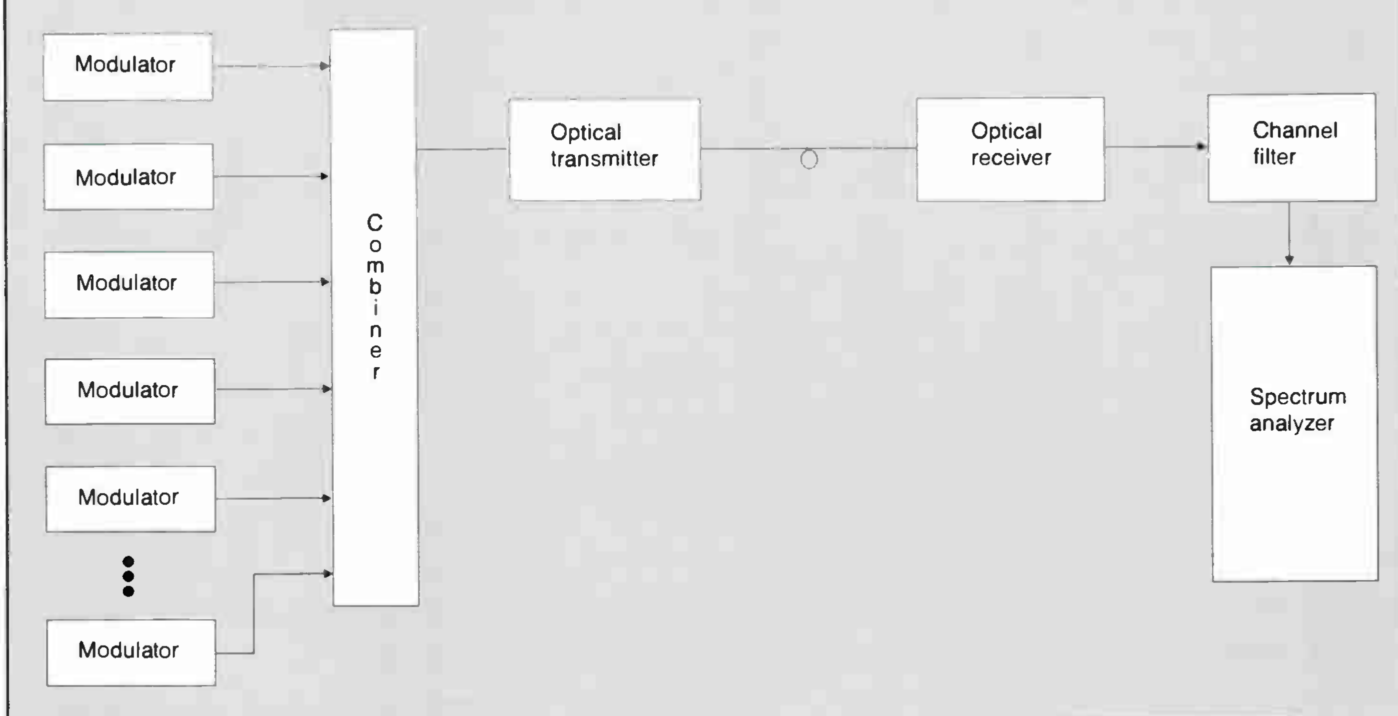
A look toward the future

So what lies ahead? First, the rate of performance will slow considerably. The two primary events that brought us to the present performance level were 1) understanding/solving the reflection problem and 2) introduction of the new DFB lasers. The reflection problem is essentially behind us. We know how to build the fiber plant to minimize reflection. Low reflection connectors, splitters and mechanical splicers are available. Isolators are available if reflection on the fiber cable is a problem.

Laser and detector performance are the current limiting factors in overall system capability. The critical parameters are linearity and output power vs. noise floor of the laser, as well as linearity and operating characteristics of the detectors. The detectors used in the newest products appear to be near the theoretical limit for noise and provide excellent system performance. Near term, it is reasonable to expect improvements in detector linearity that will permit more channels per fiber and/or longer paths. Whereas it is reasonable to assume some improvement in laser linearity, the next major step in "source" improvement will probably come from higher power lasers using external (rather than direct) modulation. Tests to date show that external modulators have performance-limiting non-linearities; this suggests that directly modulated lasers are the preferred optical sources today.

Progress over the next two years will slow dramatically compared to the past two years. The

Figure 2: C/N and CTB test setup

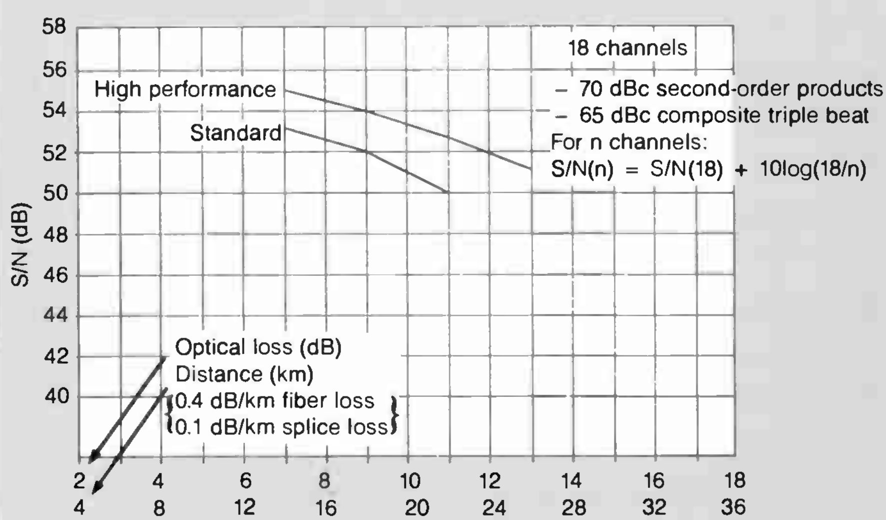


gradual improvement in laser and detector performance will benefit cost and/or performance of VSB/AM systems. However, the "ideal" specifications of 55 dB C/N, 65 dB CTB and 60 to 80 channels per fiber will probably not be achieved through this process.

The cost of a fiber link is heavily influenced by performance requirements and manufacturing volume. It is one of the more interesting aspects of fiber to the home that the closer the technology to the subscriber, the lower the performance requirement. This happens because there are fewer active devices between the fiber system and the subscriber's TV set. Thus the closer the technology comes to the sub, the higher the potential product volume.

If this sounds like the classic "chicken or egg" problem, it probably is. Costs will not decrease substantially until volume increases—but volume will not increase substantially until costs decrease. This type of problem is usually solved one step at a time over a long period, rather than in one dramatic breakthrough. Just as improved system performance will evolve over the next few years, so will the cost per link decrease over the same time frame. Whereas the improvement in VSB/AM performance over the past two years can be considered revolutionary, the improvements over the next few years will likely be evolutionary.

Figure 3: Standard AM fiber systems design performance vs. distance



Long Distance or Short, an ADVANTEST® OTDR can Provide the Answers.

The Q8450A has the wide dynamic range required to handle measurements both on intercontinental submarine optical fiber cables and on medium-length repeaterless optical fiber communications cable runs. For high-resolution measurements on fibers used at subscriber sites and within stations, as well as on medium and short length fibers used in maritime and aeronautical applications, the natural choice is the Q8460. Both these reflectometers features plug-in configuration that ensures the flexibility to accommodate a variety of fiber types and wavelengths. See your sales representative for more details on how these easy-to-use fiber reflectometers can provide solutions for your fiber-measurement problems.

New TQ8450A
Optical Time Domain Reflectometer

Enables measurement between widely-spaced repeaters in optical fiber communication systems

- Wide dynamic range: 28 dB (1.3 μm SMF) and 27 dB (1.55 μm SMF)
- Accommodates 0.85- μm multimode fibers through 1.3/1.55 μm single-mode fibers
- Plug-in configuration for expandable measurement functions
- Math function can be set at 3 points
- Large printed output at high speeds using built-in printer
- 1-m reading resolution
- High-repeatability measurements

Ideal for fault detection in exchanges and at subscriber locations

- 5-cm reading resolution
- 0.5-m reading accuracy (Plus measurement distance $\times 2 \times 10^{-5}$m)
- Near and dead zone: 3 m (MMF Q84606) 10 m (SMF Q84601)
- Wide dynamic range: 16 dB (Q84606)
- 32-frame waveform memory
- Built-in high-speed printer for easy-to-read records
- Reflection mode ideal for fault-point measurements

Q8460 **New**
Optical Time Domain Reflectometer

ADVANTEST®

Advantest America, Inc. 300 Knightsbridge Parkway, Lincolnshire, IL 60069, U.S.A. Phone:(312)634-2552 Facsimile:(312)634-2872

Advantest UK Limited CI Tower, St. Georges Square, High Street, New Malden, Surrey, KT3 4HH, U.K. Phone:(01)336-1606 Facsimile:(01)336-1657

Reader Service Number 28.

Fabry-Perot vs. distributed feedback

By Larry Stark
Director of Marketing, Ortel Corp.

Since December 1987, one of the hottest topics for discussion in the industry has been AM (amplitude modulated) fiber-optic links. Almost every facet of our industry is expected to benefit from the use of these new transmission systems to improve picture quality, add new services, upgrade plant architectures and boost CATV's competitive stance.

Until fall 1987, it was commonly believed that VSB/AM (vestigial sideband/amplitude modulated) signals could not be satisfactorily transmitted on a fiber link with a count higher than two or three channels per fiber. Early experiments with AM transmission had been discouraging, and FM (frequency modulated) links seemed to be the only promising application of analog fiber links. So in December 1987, we demonstrated an experimental link using a Fabry-Perot (F-P) laser with 42 channels transmitting over a 6.5 km link. Comparing the output picture quality from the link, it was difficult to distinguish the fiber-transmitted picture from the original coaxial cable feed. This simple demonstration convinced observers that previous concepts concerning AM fiber technology were wrong and that the potential for cost-effective AM links for use in signal distribution was quite real. Although there are still a few who doubt the practicality of AM fiber links, it is now almost unanimously agreed that widespread installation of AM systems is no longer a question of how but when.

As interest in AM on fiber has grown, attention has been focused on the performance requirements for CATV lasers. Claims and counterclaims have been made regarding noise, linearity, output power, optical loss, connectors and much more. To add to the confusion, two different types of lasers have been proposed for use in AM systems: F-P and distributed feedback (DFB) lasers.

To make informed decisions, engineers need to learn about this new technology, including the pros and cons of each laser type. F-P and DFB lasers each have significant operating advantages for specific applications. This stems from fundamental differences in the design of each laser. By understanding these differences, the CATV link parameters of each laser are easy to comprehend.

When all is said and done, there is no "best" laser type. The DFB is the high performance workhorse for AM CATV trunking where long distances and/or high channel counts are required. On the other hand, the F-P laser is a highly cost-effective device to use in short links or links with relatively few channels.

What is a semiconductor laser?

The heart of the matter is a chip of indium gallium arsenide phosphide (InGaAsP), which is built to channel electrical current through an active region a few tenths of a micron (millionth of a meter) thick, 1 to 2 microns wide and several hundred microns long. Electrically, the laser behaves like a PN diode, similar in behavior to its silicon counterparts in electronic circuits.

Inside the active region, however, electrons and photons interact to produce an effect called "stimulated emission" of photons. This means that the presence of a few photons tends to generate even more photons as electrons change energy states within the active region. This process produces optical gain, amplifying light in the active region. To make this into a laser, an optical cavity also is required, which brings us to the most significant difference between the DFB and F-P lasers.

In F-P lasers, the optical cavity is created by the partial reflection of light at the semiconductor/air interface at each end of the active region. Resonance occurs at optical wavelengths that are an exact submultiple of twice the cavity length. Since the cavity is several hundred wavelengths long, there are many closely spaced resonances. This results in the characteristic multimode operating frequency of the F-P laser.

On the other hand, in DFB lasers, the cavity is created in a very different way. An optical grating, similar in structure to an old-fashioned washboard, is formed along one sidewall boundary of the active region. The distance between the grooves of the grating is carefully controlled, to be equal to one-half of the desired optical wavelength. Due to the multiple reflections, the grating creates strong back reflection of optical signals at a specific wavelength that is twice the distance between grooves. This results in the desired cavity effect but at a very well-defined wavelength; hence, there is only one wavelength of oscillation in the DFB laser. Typical optical spectra for DFB and F-P lasers are shown in Figure 1, illustrating the multiple mode and single-mode operation.

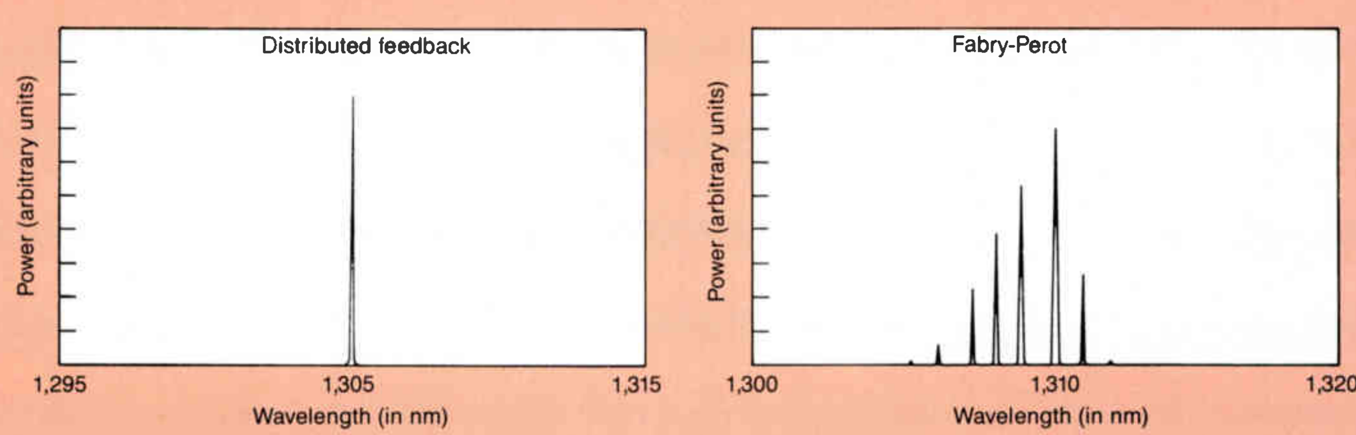
Once the optical gain process and the cavity are created, laser action occurs when the net gain overcomes the losses in the cavity. The gain is a function of the DC current through the active region. At a certain current (the threshold current), this gain overcomes the losses and the device begins to emit coherent light. Typically the threshold current is 20-30 mA and the laser is operated at 50-60 mA.

The major parameters for a fiber CATV link are frequency response, gain (or loss), number of channels, signal-to-noise ratio, distortion (composite triple beat, composite second order, cross-modulation) and transmission distance. Several of these parameters depend on photo-diode and receiver design, but the laser remains the device that demands the most attention to meet the required link characteristics for CATV systems.

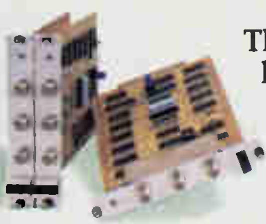
The key parameters for a laser for CATV systems are: output power, frequency response, noise (relative intensity noise or RIN), distortion (or linearity), RF input signal level, the optical isolator (or lack of) and the optical connector. The only significant difference between DFB and F-P laser types is the laser noise and the necessity to use an optical isolator with a DFB. In the other parameters, there are no significant differences. Let us review these briefly.

1) *The output power* of each laser type is comparable, limited primarily by the ability to couple light into a fiber. Various coupling schemes are in use with more effort being devoted to DFB coupling, which has resulted in more power. DFBs are aiming for output powers of 4 mW,

Figure 1: Optical spectra of F-P and DFB lasers



Introducing Syndex peace of mind... it's all in the cards.



The Trilithic 7RS is a modular headend reconfiguration system. With it you gain total control and unmatched programming flexibility–Syndex or no Syndex.

Modular. Flexible. Expandable. Trilithic offers you a broad range of modular, interchangeable switch cards. You have the flexibility to tailor the 7RS functions to suit your needs and expand it whenever necessary. Much like a headend, the variety of configurations is almost endless.

Technology Working For You. The technology used in the 7RS puts total control at your fingertips. It can be operated manually or through any IBM compatible computer under control of scheduling software or by keyboard command for general reconfiguration.

Hardware options and Software functions

Our vast array of cards execute the following switching and other functions:

- Stereo Audio
- Baseband
- RF
- Contact Closures
- Satellite Receiver Frequency Tuning
- And much more

Our switching products interface with "CASEY"* software which offers features such as:

- Scheduling
- Contract information
- Trilithic switch interface
- Management reports
- Program data base interface
- Plus a lot more

* Trilithic is an authorized stocking distributor for "CASEY" software.

"CASEY" is a trade name of Telecommunication Products Corp.

For more information, about the Syndex solution, call or write:
Trilithic ■ 3169 N. Shadeland Avenue ■ Indianapolis, Indiana 46226 ■ 317-545-4196
800-344-2412 Outside Indiana ■ FAX: (317) 547-2496 ■ TELEX 244-334 (RCA)

TRILITHIC

Reader Service Number 29.

and F-P lasers are available today with more than 10 mW CW power.

2) *Frequency response performance* presents no measureable difference. Both laser types are capable of operating well into the microwave range.
3) *Linearity:* Much has been said and written about the linearity of lasers, mostly about DFBs. There has been an impression created that F-P lasers somehow lack in linearity performance. But highly linear F-P lasers provide composite triple beat and second order values that are the equal of DFB products available today. The reason for preferring DFBs in CATV trunking systems is not due to linearity. In fact, some experiments indicate that F-P lasers may be actually more linear than DFBs.
4) *RF signal level:* The RF signal power needed to drive a laser is dependent on the laser bias current, much as the bias current on a transistor determines its signal handling capability. F-Ps and DFBs operate at very similar current levels, so there is no significant difference in the RF signal levels.
5) *Connectors and optical isolators* are a related issue. Both F-P and DFB lasers are highly sensitive to optical reflections. Most fiber-optic connectors result in reflections from 25 to 30 dB down from the incident signal, although some are available with reflections down by more than 45 dB. However, an unavoidable source of reflections, even without any connectors, comes from fiber itself. Over long lengths of fiber, the optical signal is subject to backscattering due to the random molecular structure of glass. This phenomenon produces a "dull glow" of reflected light back to the laser. For distances less than 1 km, this is not significant; for long fibers, the integrated reflection power is appreciable, even more than from the connectors.

This leads us to the first major difference between the two laser types. It has been found experimentally that DFB lasers are highly sensitive to the distributed reflections from the fiber, so much so that optical isolators are absolutely required for high performance operation. These isolators add significant cost to the laser. F-P lasers, however, while sensitive to the back reflections, exhibit the useful property that the sensitivity is virtually eliminated when a sufficiently strong RF signal is applied to the laser. In practical terms, this means that a CATV link with a F-P laser will not exhibit excess noise due to backscattering when an RF signal is applied.

6) *Noise* in lasers is expressed as RIN, which is the square of the amplitude of the noise fluctuations divided by the square of the DC optical power. Mathematically we have:

$$\text{RIN} = \frac{<\Delta P>^2}{P_o^2} \quad \text{dB/Hz} \qquad \textbf{(1)}$$

The value of knowing the RIN is that the carrier-to-noise ratio (C/N) of a single channel can be calculated from the following expression:

$$\text{C/N} = \frac{M^2}{2\text{RIN} \times B} \qquad \textbf{(2)}$$

where:
M = modulation depth of a single carrier
B = noise bandwidth

For a 40-channel operation, most lasers will operate with M = .05 per channel. Thus, with a RIN = −155 dB/Hz and B = 4 MHz, expressing C/N in dB:

$$\text{C/N} = 10\log \frac{(.05)^2}{2(3.16 \times 10^{-16}) \times (4 \times 10^6)}$$

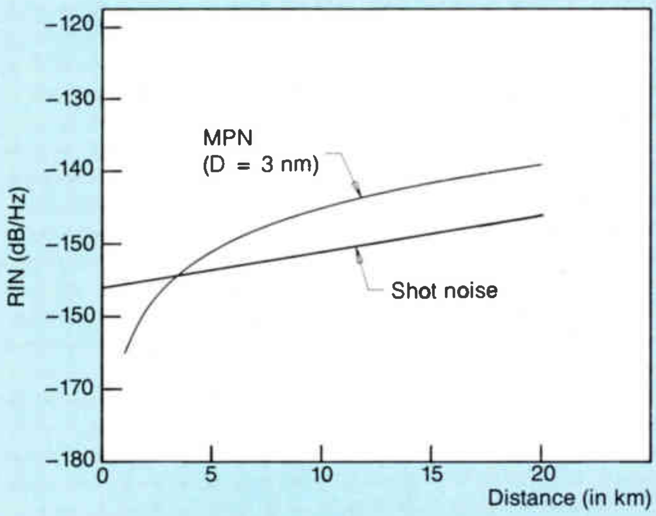
$$= 59.95 \text{ dB}$$

This expression does *not* include receiver noise, which will lower the value for C/N to somewhere in the mid-50s.

It is in laser noise that the differences between DFBs and F-Ps are most apparent, although in a subtle way. In our experience, DFB and F-P lasers have basic RIN values nearly equal when measured in the laboratory. Why then are DFBs so strongly preferred? The basic answer is in a phenomenon called *mode partition noise* (MPN). This effect traces back to the multimode character of the F-P laser. In effect, F-P lasers oscillate at several optical frequencies or modes. Taken individually, each mode is quite noisy, but the noise of all modes taken together is quite low. In other words, the noise of all the modes cancels almost perfectly. Any transmission


CATV
Underground
Television
Cable
Do Not
Disturb

Figure 2: RIN due to receiver shot noise and mode partition noise



mechanism that affects all modes equally will not affect the MPN, since the cancellation will not be affected. Conversely, any mechanism that transmits the modes unequally will tend to destroy the cancellation, causing an increase in laser noise.

In links greater than 3 to 4 km, dispersion is such a mechanism. Dispersion is the tendency of signals at different optical wavelengths to propagate at different velocities in the fiber. In the 1,300 nm range, single-mode fiber presents zero dispersion to optical signals. The zero dispersion point (ZDP) is approximately 1,312 nm, varying slightly from one fiber manufacturer to another.

Since F-P lasers have several modes, spaced by about 1 nm, the highest wavelength will always propagate at a different velocity than the lowest, leading to dispersive effects. If the center of the spectrum is exactly at the ZDP, the total dispersion is minimized. If the center wavelength is offset, however, dispersion will cause a significant increase in MPN over long distances. Since DFBs have only one oscillation mode, they are immune to this effect.

With F-P lasers, the effect on MPN is significant. A good rule of thumb for estimating the effect of MPN is to assign a RIN value due to MPN, as follows:

$$\text{MPN} = -145 + 20\log(DL/30) \quad \text{dB/Hz} \tag{3}$$

where:
D = wavelength offset from ZDP (in nanometers)
L = link length (in kilometers)

A graph of RIN vs. distance is shown in Figure 2. It is instructive to compare the MPN with the shot noise in the laser, which is the absolute lower limit for link noise. Below about 4 to 5 km, MPN is less than the shot noise and so can be considered negligible. Given Formula 3, MPN can be minimized by controlling either D or L; i.e., operate the link close to the ZDP of the fiber or operate over short links. Operating close to the ZDP is practical and can be accomplished with help from your laser supplier.

Summary of findings

F-P lasers are quite useful, especially in applications where the link distance is short, as in fiber to the home installations. F-P lasers can operate without optical isolators, while isolators are required on DFBs. The strength of the DFB lies in its insensitivity of RIN to distance, due to its single-mode operation. This results in the highest performance links over long distances with 40 or more channels. F-P lasers will find most application in systems with shorter distances and/or fewer channels.

JULY 1990

Three unique tools to revolutionize your drop connector installations; everything you need to

STOP SIGNAL LEAKS

By July 1, 1990, excessive signal leakage must be eliminated and then effectively contained to meet the minimum FCC cable operating specifications. PPC offers the **only** tools you'll need to get the job done.

These three unique tools, in conjunction with PPC's CFS-6U and/or CFS-59U connectors, will assist you in making all the necessary drop connector installation procedures required for **both** RG-6 and RG-59 cable, and they work universally! On single braid or tri-shield, from 40% braid right up to and including quad cable, this one tool set and our patented connectors consistently provide positive and leak free connections.

For free information illustrating with clear, step-by-step photographs how to make cable preparation and connector installation simple and easy, write PPC or call toll free today: 1-800-468-2288.

The best connections in the industry.

PRODUCTION PRODUCTS COMPANY
Division of John Mezzalingua Associates, Inc.
One Mezzy Lane Manlius, New York 13104

See us at the Great Lakes Show, Booth 111. Reader Service Number 32.

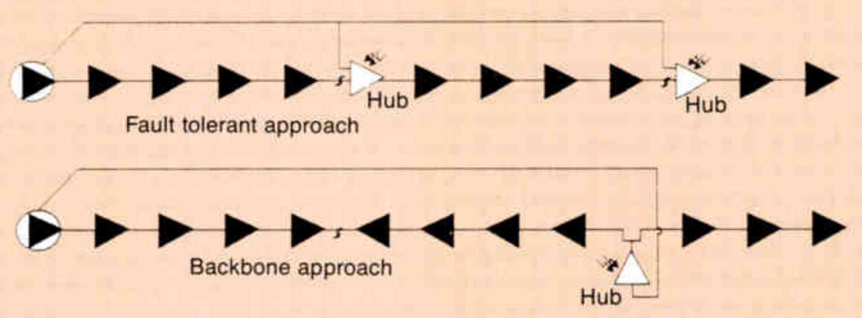
Considerations for an AM-on-fiber upgrade

By Richard Haube
Fiber-Optic Product Specialist, Magnavox CATV Systems Inc

A fiber-optic overlay may be a "wild goose chase" if we do not exactly define its purposes. Even if we fully agree on what the system will accomplish, we must discern if fiber is the cost-effective solution. To do this, we must analyze requirements to maximize the advantages of both fiber technology and RF amplifiers. These are the areas being explored in using the performance of today's AM (amplitude modulated) and FM (frequency modulated) fiber products in upgrades.

Since there is no such thing as a typical CATV system design, a fiber overlay will be unique to every application, depending upon the architecture and engineering performance requirements. Let's briefly set our performance goals, review the available options and determine the most intelligent and cost-effective solution.

Figure 1: Two fiber overlay architectures



Setting system goals

Any investment needs to be justified to ensure a good return; the investment in fiber should increase the quality and quantity of services as well as improve reliability. Choosing the engineering parameters is the first step. Deciding upon the bandwidth and future channel loading is obviously important.

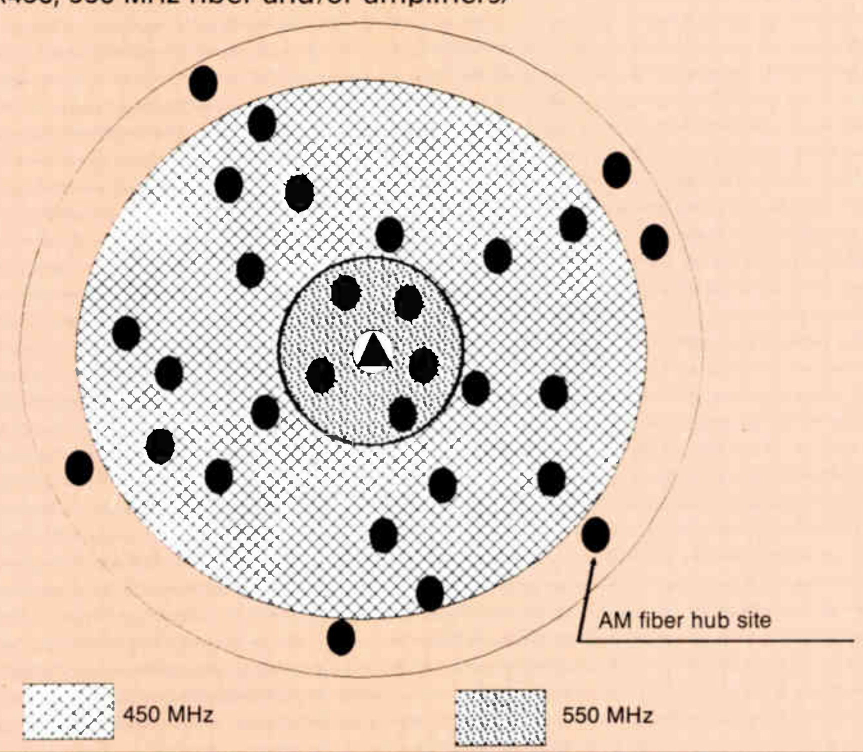
An upgrade/rebuild analysis may need to be conducted. Most operators would prefer to upgrade rather than rebuild from a cost as well as a construction standpoint, if the future bandwidth and operational requirements can be accomplished. Since a substantial amount of system assets is in the coaxial cable, fiber may be more practical for an upgrade (as opposed to a rebuild) from a cost standpoint.

In addition, noise and distortion parameters must be established, from the headend to the set-top converter (if used). You may want to consider maximum channel loading at the maximum amplifier bandwidth capability to account for future expansion. Improved signal quality is also very important.

What about plant maintenance? Although it has been said that fiber plant requires less maintenance due to fewer electronics per area covered, the fiber overlay will still require some of the RF amps of the original system. Maintenance may play an extremely important role in highly populated metropolitan areas.

Reducing the affected area of trunk outages (thus improving system reliability) is yet another key factor to consider. Innovative architectures, such as those using RF switches for redundant paths, may play a very important role in a successful upgrade. Once again, this approach benefits some systems more than others, depending upon the percentage of trunk outages as a function of total outages. The possible increase of upgrade cost for applying this method also should be considered.

Figure 2: Performance comparison (450, 550 MHz fiber and/or amplifiers)



Reviewing the options

Two key architectures are among those being used to integrate fiber products with an existing coax plant: the fiber backbone and the fault tolerant or redundant approach (Figure 1). Once the system goals have been established, you might have decided on a particular architecture from an engineering but not an economic standpoint. For this reason, it may be interesting to explore the two architectures first; however, there is data to be gathered, such as:

1) Determine the maximum distance that the fiber will be required to cover.
2) Decide on the optical equipment.
3) Decide on the RF equipment and cascade length based on the required overall system performance minus the optical performance.

Determine the system extremity; this will provide you with an approximate distance for calculating the total optical link loss. A preliminary loss figure for the fiber cable, number of splices (in this example, fusion splicing) and the number of connectors (if applicable) is required at this time. An average fiber loss figure to use is approximately −0.5 dB/km at 1,310 nm, based on fiber cable loss of −0.4 dB/km at 1,310 nm and −0.1 dB splice loss. The determination of this loss will provide the basis for the AM fiber performance.

You might ask why the extremity is used, since a limited or short cascade to that extremity will follow the fiber hub site. Given an average cascade of six amps spaced at 2,000 feet each, a 2 dB optical loss margin is derived for future splices. The AM fiber performance calculation will be based on maximum optical link loss (to include the safety margin) and channel loading per optical transmitter.

The performance specs of the AM fiber link may indicate that the system requires the improved performance benefits not achievable with today's AM fiber systems. In other words, if the optical link loss denotes an optical performance close to the required system performance, adding the RF amps and the converters may inhibit the chance of meeting those engineering system requirements. At this time, the application of FM fiber technology or equivalent may help in meeting the required performance (obviously at additional cost). It is also important to use an optical receiver that has the required RF output level compatible with the trunk and feeder.

As previously mentioned, the required system performance minus the optical performance

"We must analyze requirements to maximize the advantages of both fiber technology and RF amplifiers."

defines the RF electronics requirement. Calculating the maximum cascade of amps (trunk and line extender) with margin for the set-top will enable us to begin placement of the AM fiber hub sites. This is accomplished by overlaying the fiber hubs at the predetermined cascade lengths on the current trunk maps. This strategic placement should be performed looking at the backbone approach along with a duplicate set of maps for the fault tolerant (redundant) approach. We should now have two scenarios of a fiber overlay upgrade predicting the number of hub sites required for each architecture.

Now it is necessary to calculate the fiber link loss of each hub. This is done in order to use optical couplers to provide the minimum amount of optical transmitters for an efficient design. The couplers also may be applied to hubs in a common geographic area, since some of the couplers will be placed in the field to make the most efficient use of fiber count in the cables. Once again, the maintenance/reliability issues should be discussed regarding the placement of the couplers in the headend or in the field.

If the engineering parameters did not define maintenance and redundancy issues as a priority, a closer examination of the required fiber equipment can be conducted at this point. This examination should determine exactly what today's AM fiber equipment contributes to system performance when applied to 450 and 500 MHz. Figure 2 denotes the current number of hub sites required within a system reaching approximately 34 amps in cascade at the extremities. The darkened regions (450 and 550 MHz) denote the system performance of the amps (without fiber) that equals or surpasses the fiber/amp performance combination. As noted, the 550 MHz overlay complements more of the system territory than does the 450 MHz overlay.

Justifying the upgrade

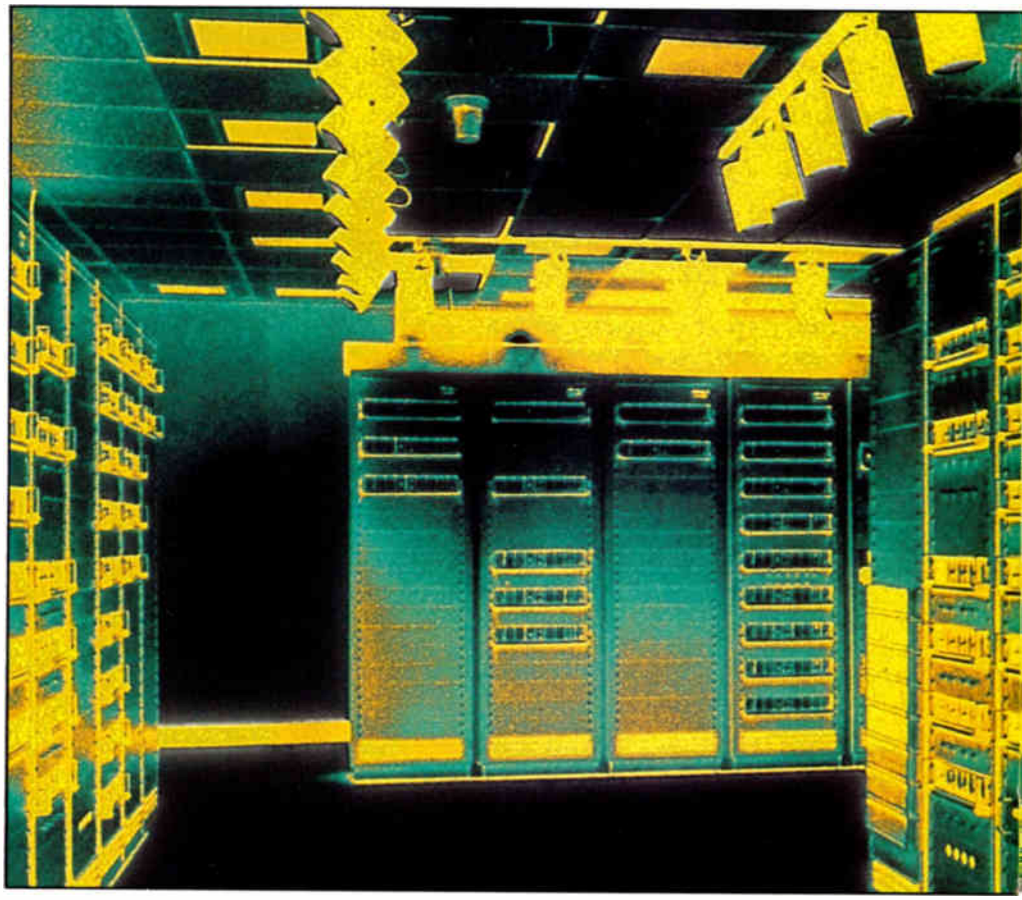
The cost of the improved performance and reliability may or may not justify the fiber upgrade. However, these systematic approaches may narrow the options and help make a decision to benefit your system.

Small systems—The last frontier

This is the sixth in a series of articles designed to help the small system operator or entrepreneur avoid some basic (and perhaps fatal) mistakes. This installment begins a discussion of headends and signal processing. Editor's note: Any opinions expressed are those of the authors, based on their experiences in building small systems.

By Bill Grant
President, GWG Associates

And Lee Haefele
President, Haefele TV



The primary concern in any CATV system is the signal we deliver to the subscriber. The quality and variety of these signals can determine the economic success or failure of the operation. Think of the signal as "product." This is a business term with all the connotations of inventory, product and delivery costs, product quality, selling price, and ultimately profit and loss as in any other business.

In the earliest days of CATV, the only source of product was commercially broadcast off-air signals; we were obliged to go to great lengths to acquire them. Towers several hundred feet high or headends located on hilltops were common. Later it became possible to subscribe to common carrier microwave delivery of distant signals or even to construct private microwave links to acquire and transport them. The advent of satellite signal access has been perhaps the single, most important development in the business. It certainly is critical to the practicality of small system development.

Off-air and satellite signals

Modern technology does not preclude the use of off-air signals, however, and the least expensive source of product for the operator is still the local broadcast signal. Potential subs are accustomed to these, expect them to be available and, in many cases, will be quite critical of how well the system maintains these signals. The wide variety of signals that satellite access makes possible somewhat relieves the operator of the burden of struggling to receive distant, marginal off-air signals. Still, the locals must still be acquired and carried.

Although the off-air reception facilities can be limited to pole or small tower antenna supports in most cases, high quality, heterodyne signal processors should be used. Typical costs for an off-air signal should fall into the range of $600 to $800 per channel including antenna, mounting and signal processor.

In most instances it is relatively easy to provide a separate dish antenna and access to three individual satellites as well as to produce good clean signals. But the variety of product that is available can be really confusing. What is required here is more a sound business judgment than technical competence. All satellite signals are processed in essentially the same way regardless of the individual nature of the programming they carry. However, the manner in which these different programs are handled and offered to the subscriber will have a profound impact on the economic viability of the system.

Interconnection at both video and audio that occurs with satellite reception does introduce some complexity into the system maintenance program. In processing off-air signals using heterodyne equipment, the maintenance program can be limited to measuring RF signals alone. This is a simple procedure and requires only a signal level meter. But when video and audio signals are introduced, the question of

Courtesy Scientific-Atlanta

measuring the amplitude of these signals must be addressed; such measurements may not be quite as easily performed. There is also the question of adjusting the depth of modulation of the new RF carriers that are generated within the headend modulators.

It may not sound very scientific (and many people may take exception to this), but our experience has shown that such adjustments can be performed adequately—not precisely but adequately—by simply eye-balling the picture of the generated RF carrier on a TV set. This must be done with care; some experience or instruction is also important, but this method does not introduce any exotic or new test equipment or procedures.

Which product format the operator decides upon and how it is presented to the subscriber for sale have an impact at each and every subscriber station. If the format requires a sophisticated and expensive set-top terminal, this cost must be incurred at every station. In smaller systems such a cost can be unbearable. This is where the real *difference* between the successful entrepreneur and the well-intentioned (and even perhaps technically competent) amateur becomes apparent. What signals you carry and sell as well as how you package them for sale will have much more impact on the success of the business than how you design or construct the plant.

The second most important business judgment required is really an extension of the first:

"All new plant should be designed for a minimum of 300 MHz—even in small systems."

How many channels must the system be able to carry? This must be considered whether or not the system actually is filled to that capacity initially. Requiring more transmission capacity equates to a higher bandwidth along with higher transmission losses. Studies have shown that a 35-channel system with a 300 MHz bandwidth will cost about 10 to 15 percent more than a 21-channel system limited to 220 MHz. Although we have no supporting data, it seems reasonable to expect a similar cost penalty if the system is increased from 35 channels (300 MHz) to 52 channels (400 MHz).

All new plant should be designed for a minimum of 300 MHz—even in small installations. Some state regulatory agencies even require 300 MHz as a minimum. We qualify this somewhat in the case of a *very* small system or an unusual equipment purchase opportunity that might present 220 MHz equipment and hardware at an extremely advantageous price. Even in such cases we would recommend designing the system for equipment spacing on a 300 MHz basis so that a subsequent upgrade would be possible.

One instance where constructing plant with greater bandwidth or where implementing a trunk/feeder design might prove advantageous would be where the system might (logically or predictably) be purchased later and incorporated into a larger system in the immediate area. In such situations it might be wise to design and build the plant in a manner that would facilitate subsequent consolidation and thus increase the sales value of the resultant system. But such instances would probably be rare and are not the primary subject of our discussions.

Satellite receiving antennas

In dealing with satellite receivers, it is important to decide how many satellite feeds are being considered and what size parabolic antennas are required. There is little need to have access to more than two satellites in any application. It is preferable to rearrange the services offered rather than incur the additional cost of a third dish. We know of a small but profitable system with a single dish; the system carries only 12 channels but still offers more than one tier.

The use of smaller dishes is a very questionable economy. If market penetration is important to smaller systems, product quality should not be compromised at all. In any event we do not find any truly significant cost savings possible with smaller dishes. Antennas should always measure 12 feet (3.7 meters) or more. One antenna—installed and equipped with feed horn and electronics for both polarizations—providing access to 24 television signals might cost between $2,000 and $3,000.

The quality of any dish is largely a matter of design and construction. Dishes that are not mechanically strong may distort with wind or snow load; this will degrade the quality of the received signals. Although some dishes may be labeled "commercial" quality this is no guarantee that they will actually stand up better. The best approach is not to buy any dish that you do not know has been used in your area with good results. Our experience has largely been with antennas mounted in northern New York. Other areas of the country may have different requirements; the reader is advised to solicit information on local experience before making any commitment.

Mathematics for calculating CLI

By James H. Kuhns
District Technical Trainer, Continental Cablevision of Michigan

Much has been written about the cumulative leakage index (CLI), how to do it and what happens if you don't. The purpose of this article is not to rehash those issues but to give the reader who doesn't have a strong math background the necessary skills needed to use the CLI formula. Even though a computerized program (such as the SCTE's *CATV Wizard*) may be used to assist in performing calculations, it is considered good engineering practice to have at least a general knowledge of the mathematical functions used in the program.

Percentage of system checked

To find what percentage of the plant has been checked, divide the number of plant miles checked by the total plant miles.

Given:
Total plant miles = 450
Plant miles checked = 410
Miles checked ÷ total miles = percentage **(1)**
410 ÷ 450 = 0.9111

By moving the decimal point two places to the right we get 91.11 percent. The Federal Communications Commission requires that a minimum of 75 percent (0.75) of the plant miles be checked annually. So, a sufficient portion of the plant has been checked to accurately calculate the CLI.

Converting dBmV to µV/m

If a signal level meter (SLM) has been used to determine the strength of a leak, it is necessary to convert the SLM reading from dBmV to µV/m prior to calculating the CLI. The variables used in each of the three methods presented will be as follows: frequency = 109 MHz (This is the frequency in megahertz at which the leak was detected.) and dBmV = −17 dBmV (This is the strength of the detected leak in dBmV measured by the SLM.).

Method #1: This is definitely the most involved and complicated method of converting dBmV to µV/m. When working with a complex math formula always start at the innermost set of parentheses and work outward, as in the following example:

$$\mu V/m = (0.021 \times \text{frequency}) \times (1{,}000 \times 10^{(dBmV \div 20)}) \qquad \textbf{(2)}$$

Starting at the innermost set of parentheses:

−17 ÷ 20 = −0.85

Therefore:
$10^{-0.85}$ (10 to the power of −0.85) = 0.1412538

So:
µV/m = (0.021 × 109) × (1,000 × 0.1412538)
= 2.289 × 141.25375
= 323.32983

To find $10^{-0.85}$ using a calculator enter "10" then press the "y^x" key. Enter ".85" then press the "+/−" key. Press the "enter" key. The display should read "0.1412538."

Method #2: To calculate µV/m involves the use of Table 1, which converts dBmV to µV. Checking the table we find that −17 dBmV equals 141.3 µV. Using the frequency of 109 MHz we now have the following:

µV/m = (0.021 × 109) × 141.3
= 323.4357

Notice that the first part of this formula is the same as the first part of Formula 2. The last part of the formula—1000 × $10^{(-0.85)}$—is nothing more than the conversion of dBmV to µV found in Table 1. Due to the rounding off of the µV numbers in Table 1, the µV/m in Method #2 is slightly different than the µV/m in Method #1. This difference is not significant enough to ultimately affect the final CLI calculation.

Method #3: The third and easiest way to calculate µV/m from dBmV is found in Table 2. This table is computer-generated using Formula 2 and allows us to read directly the dBmV to µV/m conversion. Looking at the table we see that −17 dBmV equals 323.33 µV/m. The following IBM Basic computer program will generate the table used in Table 2:

```
10 A$ = "###         #######.##        ###         #######.##"
20 INPUT "Frequency in megahertz"; FREQ
30 LPRINT "Frequency in megahertz"; FREQ
40 LPRINT
50 LPRINT "dBmV            uV/m            dBmV            uV/m"
60 LPRINT "_____________________________________________________"
70 FOR DBMV = -60 TO 0 STEP 1
80 UVM = (.021 * FREQ) * (1000 * (10^(DBMV / 20)))
90 UVM2 = (.021 * FREQ) * (1000 * (10^((DBMV + 60) / 20)))
100 LPRINT USING A$; DBMV; UVM; DBMV + 60; UVM2
110 NEXT DBMV
```

This program can easily be adapted to a variety of personal computer and calculator formats.

In all three methods of calculation µV/m is frequency-dependent. It should be noted at this point that there is a fourth method, although not recommended, of converting dBmV to µV/m. And while this method doesn't involve any complex mathematical formulas, it does involve a certain amount of risk taking on the part of the user. Unfortunately, despite the risk, someone will probably try it.

Method #4: Don't worry about it. The FCC will do the calculation for you (cost to be determined at the time of measurement).

Squaring microvolts per meter

A common mistake made when dealing with a number such as 50^2 is to multiply by 2 rather than square the number. Squaring a number is nothing more than taking that number and multiplying that number by itself. The following example shows the correct and incorrect ways to square a number: Correct: 50^2 = 50 × 50, or 2,500. Incorrect: 50^2 = 50 × 2, or 100. As you can see, the difference between the correct and incorrect answers is quite large. Fortunately, the calculator makes squaring numbers relatively foolproof. To square a number using a calculator enter "50" then press the "x^2" key. The display should read "2500."

After measuring the leaks and converting them from dBmV to µV/m it is necessary to square and sum the leaks to arrive at the figure that will be used in the actual CLI formula. A certain amount of confusion seems to arise at this point that can best be explained by two examples, one correct, one incorrect. In both examples we have found three leaks. Each leak is 50 µV/m.

Correct summing of leaks:

Leak #1	50 $\mu V/m^2$ = 2,500
Leak #2	50 $\mu V/m^2$ = 2,500
Leak #3	50 $\mu V/m^2$ = 2,500
Total sum of leaks	7,500

Incorrect summing of leaks:

Leak #1	50 µV/m = 50
Leak #2	50 µV/m = 50
Leak #3	50 µV/m = 50
Total sum of leaks	150^2 = 22,500

The problem with the second example is that we summed and squared rather than squared and summed (as we did in the first example). There is, you can see, a very big difference. For CLI you always square and sum; failure to do so can give you a CLI figure that looks like the national debt.

The mathematics behind the CLI formula might seem complex at first glance, but try not to let it overwhelm you. Work through it one step at a time and you'll be surprised just how easy it can be. So, take out that calculator right now.

Table 1: dBmV to μV conversion

dBmV	μV	dBmV	μV
−60	1.00	+1	1,122
−59	1.12	+2	1,259
−58	1.26	+3	1,413
−57	1.41	+4	1,585
−56	1.58	+5	1,778
−55	1.78	+6	1,995
−54	1.99	+7	2,239
−53	2.24	+8	2,512
−52	2.51	+9	2,818
−51	2.82	+10	3,162
−50	3.16	+11	3,548
−49	3.55	+12	3,981
−48	3.98	+13	4,467
−47	4.47	+14	5,012
−46	5.01	+15	5,623
−45	5.62	+16	6,310
−44	6.31	+17	7,079
−43	7.08	+18	7,943
−42	7.94	+19	8,913
−41	8.91	+20	10,000
−40	10.00	+21	11,220
−39	11.22	+22	12,590
−38	12.59	+23	14,130
−37	14.13	+24	15,850
−36	15.85	+25	17,780
−35	17.78	+26	19,950
−34	19.95	+27	22,390
−33	22.39	+28	25,120
−32	25.12	+29	28,180
−31	28.18	+30	31,620
−30	31.62	+31	35,480
−29	35.48	+32	39,810
−28	39.81	+33	44,670
−27	44.67	+34	50,120
−26	50.12	+35	56,230
−25	56.23	+36	63,100
−24	63.10	+37	70,790
−23	70.79	+38	79,430
−22	79.43	+39	89,130
−21	89.13	+40	100,000
−20	100.0	+41	112,200
−19	112.2	+42	125,900
−18	125.9	+43	141,300
−17	141.3	+44	158,500
−16	158.5	+45	177,800
−15	177.8	+46	199,500
−14	199.5	+47	223,900
−13	223.9	+48	251,200
−12	251.2	+49	281,800
−11	281.8	+50	316,200
−10	316.2	+51	354,800
−9	354.8	+52	398,100
−8	398.1	+53	446,700
−7	446.7	+54	501,200
−6	501.2	+55	562,300
−5	562.3	+56	631,000
−4	631.0	+57	707,900
−3	707.9	+58	793,300
−2	794.3	+59	891,300
−1	891.3	+60	1,000,000
0	1,000		

Table 2: dBmV to μV/m conversion

Frequency in MHz = 109

dBmV	μV/m	dBmV	μV/m
−60	2.29	+1	2,568.30
−59	2.57	+2	2,881.68
−58	2.88	+3	3,233.30
−57	3.23	+4	3,627.82
−56	3.63	+5	4,070.48
−55	4.07	+6	4,567.16
−54	4.57	+7	5,124.43
−53	5.12	+8	5,749.71
−52	5.75	+9	6,451.28
−51	6.45	+10	7,238.45
−50	7.24	+11	8,121.68
−49	8.12	+12	9,112.67
−48	9.11	+13	10,224.59
−47	10.22	+14	11,472.18
−46	11.47	+15	12,871.99
−45	12.87	+16	14,442.61
−44	14.44	+17	16,204.88
−43	16.20	+18	18,182.18
−42	18.18	+19	20,400.74
−41	20.40	+20	22,890.00
−40	22.89	+21	25,683.00
−39	25.68	+22	28,816.80
−38	28.82	+23	32,332.98
−37	32.33	+24	36,278.21
−36	36.28	+25	40,704.83
−35	40.70	+26	45,671.55
−34	45.67	+27	51,244.33
−33	51.24	+28	57,497.08
−32	57.50	+29	64,512.79
−31	64.51	+30	72,384.53
−30	72.38	+31	81,216.80
−29	81.22	+32	91,126.72
−28	91.13	+33	102,245.90
−27	102.25	+34	114,721.80
−26	114.72	+35	128,719.90
−25	128.72	+36	144,426.20
−24	144.43	+37	162,048.80
−23	162.05	+38	181,821.80
−22	181.82	+39	204,007.40
−21	204.01	+40	228,900.00
−20	228.90	+41	256,830.00
−19	256.83	+42	288,168.00
−18	288.17	+43	323,329.90
−17	323.33	+44	362,782.00
−16	362.78	+45	407,048.30
−15	407.05	+46	456,715.50
−14	456.72	+47	512,443.10
−13	512.44	+48	574,970.90
−12	574.97	+49	645,127.60
−11	645.13	+50	723,845.80
−10	723.85	+51	812,167.90
−9	812.17	+52	911,266.90
−8	911.27	+53	1,022,459.00
−7	1,022.46	+54	1,147,218.00
−6	1,147.22	+55	1,287,199.00
−5	1,287.20	+56	1,444,261.00
−4	1,444.26	+57	1,620,488.00
−3	1,620.49	+58	1,818,218.00
−2	1,818.22	+59	2,040,074.00
−1	2,040.07	+60	2,289,000.00
0	2,289.00		

Take Another Look--

That's where we put the VideoCipher® II Descrambler module on the new ISS GL-5020 receiver– up front– where it belongs.

Now there's no need to climb behind the rack in the dark with a flashlight. That's because our VideoCipher® II Descrambler slides out the front, giving you fast, easy access to the address number through a translucent front panel window. Our clear, concise operator controls are all color-coded for band selection (C or KU), and input format either by transponder or direct frequency input. And custom circuitry using high-performance filters and precision operational amplifiers assure you of broadcast-quality video.

With all of these features up front, we had to design the back of our receiver to live up to it. . .
We did.

Up Front.

The ISS GL-5020 receiver has the cleanest rear panel design in the industry. That makes it simple to connect and easy to read. For special applications we offer as a standard feature remote-controllable RS-232 ports– making the back of our receiver as efficient as the front.

The new GL-5020 receiver carries on the ISS Engineering tradition of innovative feature design, technical excellence, and post-sale support. In fact, ISS Engineering is the only U.S. company to offer a FULL THREE-YEAR PARTS AND LABOR WARRANTY. Plain, simple and effective. No forms or questionnaires to fill out, no conditional extensions or additional payments, just ISS quality. All of these features are good reason to Take Another Look at ISS.

For more information, please call or write:

ISS Engineering, Inc.
1047 Elwell Court
Palo Alto, CA 94303

ISS West
Toll-free (800) 227-6288
(415) 967-0833 FAX (415) 967-0772

ISS East
Toll-free (800) 351-4477
(205) 853-6919 FAX (205) 854-4581

ISS
ENGINEERING, INC.
We Simply Bring Communications Down to Earth.

**VideoCipher® is a registered trademark of General Instrument Corporation.*

Reader Service Number 39.

Delivering ad insertion cues over satellite

This is the second installment of a three-part series, which began last month, on commercial insertion.

By Steve Fox
Marketing Manager-Cable, Wegener Communications

A number of cable networks now allow their affiliates to insert local commercials at the headend before delivery to subscribers. In the past two years, as local ad insertion has become an increasingly important revenue source, a larger percentage of systems is taking advantage of this opportunity.

Networks control insertion timing by sending cues along with their programming to the headend. The cues in turn trigger the local equipment used to insert the commercials. In order to provide local insertion, the headend must have the equipment required to decode the cues, VCRs to play the ads, commercial controllers to control the VCRs and printers to log commercial activity.

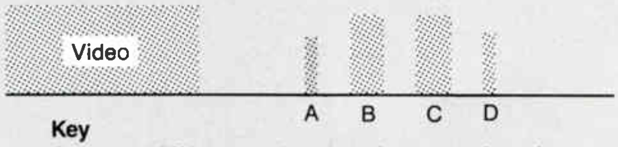


Figure 1: Unscrambled satellite baseband signal

Key
A = 5.715 MHz narrowband analog cue subcarrier
B = 6.2 MHz wideband analog cue subcarrier
C = 6.8 MHz program audio subcarrier
D = 7.3575 MHz digital cue carrier

There are a number of ways by which the networks transmit cues to the headend. Non-scrambled networks use an analog or digital subcarrier and either mix cues with program audio or transmit cues as a separate subcarrier. Scrambled networks combine cues with the program audio output of the descrambler or use a separate subcarrier for their cues. Three types of subcarriers are used: wideband audio (such as 6.2 or 6.8 MHz), narrowband analog audio (such as the 5.715 MHz subcarrier used by Lifetime) and narrowband digital. Figure 1 shows an unscrambled satellite baseband signal with the location of some of the cue subcarriers currently used by programmers.

There is some confusion about the descriptions programmers use to describe the various analog methods of transmission. Three terms are generally used; their definitions follow:

1) *Audible* cues are transmitted along with program audio and can be heard by the subscriber.
2) *Inaudible* cues are transmitted within the standard 50 Hz to 15 kHz program audio bandwidth. They are transmitted on a subcarrier separate from program audio and are not heard by the subscriber.
3) *Subaudible* cues are frequencies outside the 50 Hz to 15 kHz range and are filtered from program audio where required. Subaudible cues also are not heard by the subscriber.

Contact closure method

MTV was the first cable network to transmit cues for local ad insertion. The method employed is still in use today by MTV and VH-1. Both services scramble program audio and video, while a separate unscrambled audio subcarrier is transmitted for cues. MTV uses a 6.62 MHz subcarrier (which is also used to deliver Viacom Networks' promotional audio), while VH-1

Figure 2: Headend contact closure interface

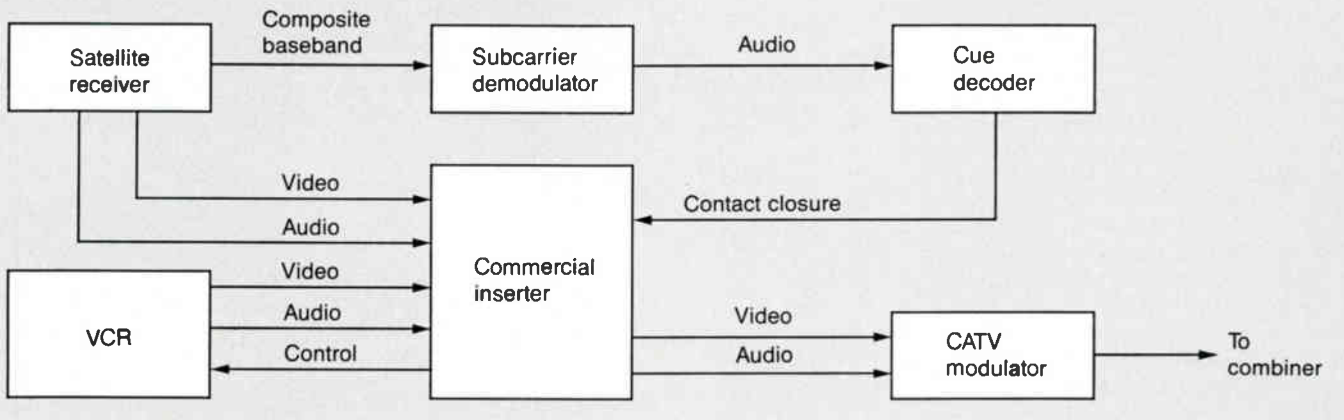


Figure 3: Headend program audio interface

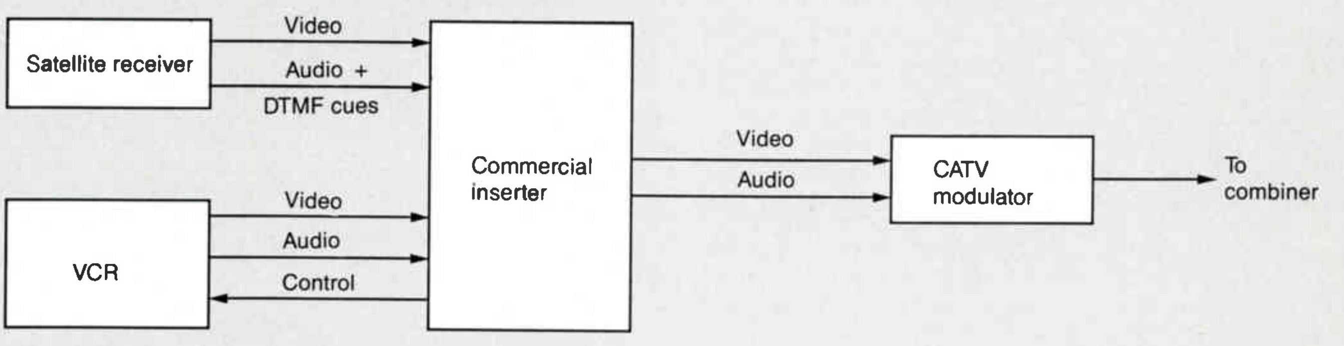
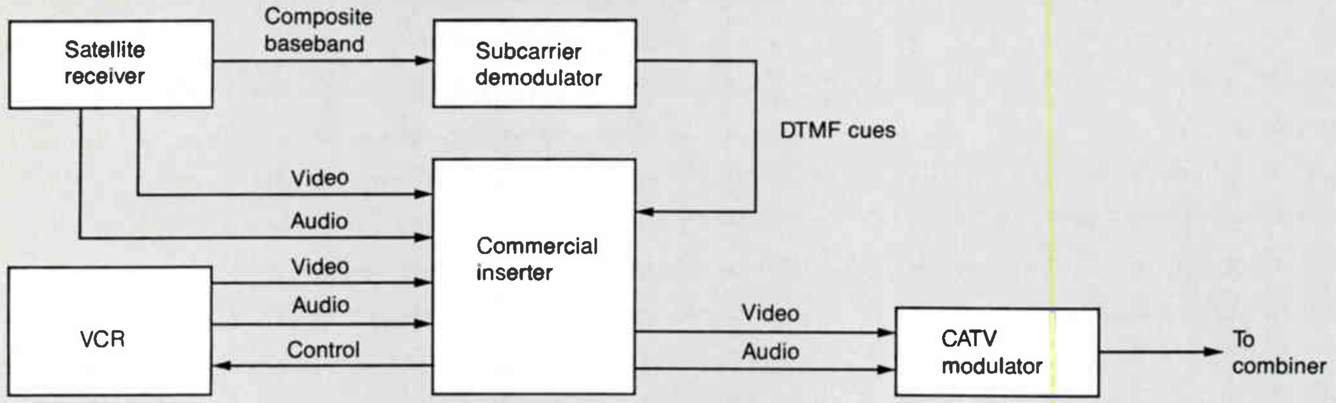


Figure 4: Cues on a separate analog subcarrier



uses 6.8 MHz. The bandwidth of the transmitted program or promotional audio is filtered to the 50 Hz to 15 kHz spectrum at the uplink. A separate 19 kHz fixed-frequency tone is summed with the filtered audio and transmitted as the cue. This cue is used for preroll and insertion and transmitted for the entire preroll and insertion interval.

Figure 2 illustrates the basic headend configuration used to receive MTV or VH-1 cues. Composite baseband either from the satellite receiver or looped from the descrambler is input to the subcarrier demodulator. The demodulated 19 kHz tone is output to a tone decoder, which provides a relay closure to the ad insertion controller. The controller operates a VCR loaded with commercial audio and video and routes the appropriate programming (network or commercial) to the TV modulator for output to the subscribers.

DTMF (dual tone multifrequency) is the cue method used by most cable networks. (DTMF tones also are used by touch-tone telephones.) Two tones rather than a single tone are transmitted simultaneously (dual tone—if you press a key on a touch-tone telephone you will notice the resulting tones sound distorted) and a four dual tone sequence is transmitted in rapid succession to start local ad insertion preroll. A different four dual tone sequence is transmitted to end the break. For example, a "6-8-3-#" dual tone sequence might be transmitted to start preroll and a "6-8-3-*" sequence to end the insertion period and return to network programming.

Several networks transmit DTMF along with program audio. If the network is scrambled, the descrambler monaural output provides both program audio and cues. If the network is not scrambled, both program audio and cues are output by the satellite receiver. Figure 3 shows the headend configuration for a DTMF/program audio interface. The system operates much like the contact closure system, except that the cue decoding cir-

Now in stereo.

A stereo generator ought to do more than just light the MTS indicator on a subscriber's television set.

It ought to provide clear channel separation, a crisp audio signal, and reliable performance.

It ought to have advanced features like built-in commercial insertion, a 4.5 MHz output and an AGCL circuit.

And a real DBX® noise suppression system instead of an imitation.

It ought to save precious rack space. And it ought to save money.

Fortunately, one stereo generator does all that. And more. The new CSG-60 from Standard Communications.

The CSG-60 is almost half the cost of conventional units when you purchase them two at a time in the convenient side-by-side rack mount. It has features found only on much more expensive units. And because it's from Standard, you can count on set-it-and-forget-it reliability.

To get the full story on the CSG-60, contact the SATCOM Division for the Standard representative near you.

DBX is a registered trademark of DBX, Inc.

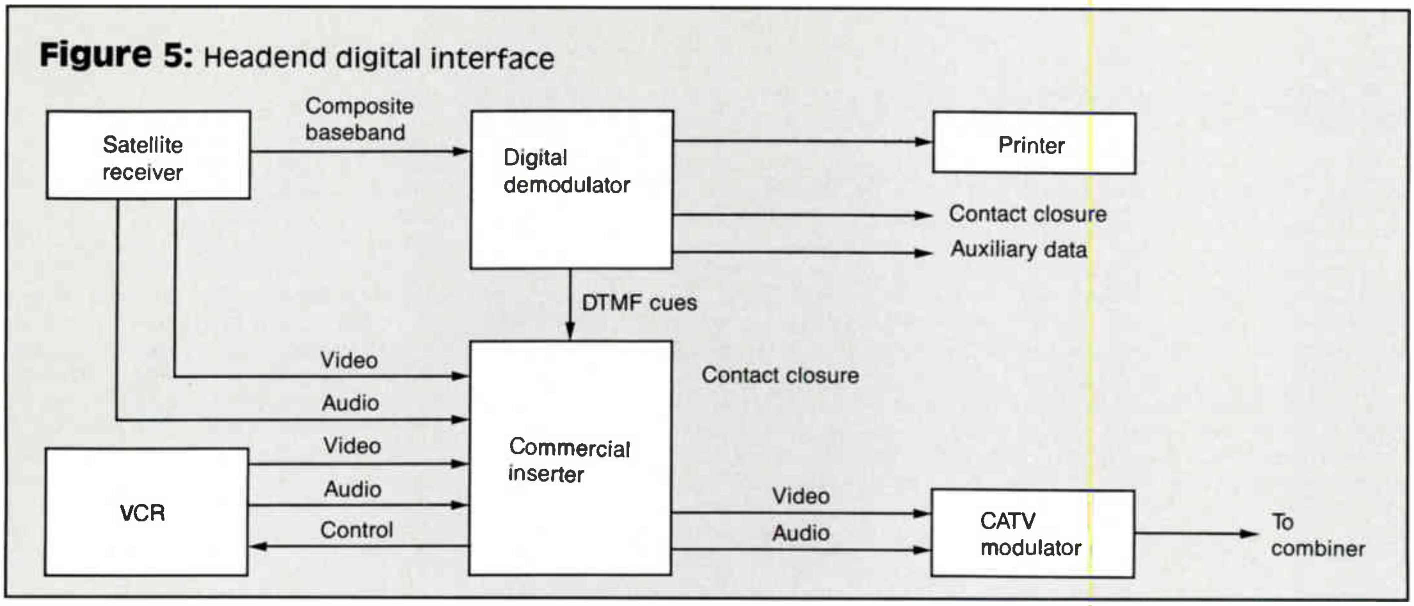
Standard Communications
SATCOM Division

P.O. Box 92151
Los Angeles, CA 90009-2151
Telephone: (800) 243-1357
In California: (800) 824-7766
(213) 532-5300 • Telex: 67-7173

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

Reader Service Number 41.

Figure 5: Headend digital interface



cuitry is a part of the ad inserter and two momentary DTMF cues are used rather than a closed relay.

Other networks transmit DTMF on a separate subcarrier, often so the tones cannot be heard by subscribers, who sometimes find them objectionable. When a wideband subcarrier is used for cues, typically it is located at 6.2 MHz. Use of a 6.2 MHz subcarrier frequently requires an external demodulator to decode the cue, however. A few scrambled networks have begun transmitting DTMF at 6.8 MHz, allowing the cable operator to use the audio demodulator built into satellite receivers while keeping the cues off program audio. In all cases where a separate subcarrier is used, the cue is transmitted in the clear and does not require the use of a descrambler.

Still other networks use a separate narrowband analog subcarrier for cue transmission in order to reduce satellite power and bandwidth requirements.

The headend configuration used for DTMF cues transmitted on a separate subcarrier is shown in Figure 4. Operation is similar to that used when DTMF is transmitted on program audio with two exceptions: A separate demodulator is required to receive the cues and the commercial inserter must be configured to accept separate program audio and cue inputs.

Several networks have begun transmitting cues on a separate narrow-

(Continued on page 110)

Multiple satellite reception

By Gary S. Hatch
Director of International Sales and Marketing
Antenna Technology Corp.

Fast moving developments in satellite-delivered programming have left many cable engineers confused about their reception options. Engineers are often faced with conflicting decision-making criteria. One says, "Keep the cost down." Another says, "Invest now to avoid future obsolescence." As the cable industry continues to mature, professionalism seems to be gaining ground and long-term planning is taking precedence over "the quick fix." One thing is certain: The ever increasing need for receiving signals simultaneously from multiple satellites is upon us.

An analytical engineer might boil down satellite earth station options to the following:

1) The traditional method would be to use single parabolic antennas, which is very effective for many CATV systems. In most small systems of 30 channels or less the profit potential from tiering, pay-per-view and other pay services is reduced due to the size of the subscriber base and channel capacity. In this case, when the decision is made to pull in programming from another satellite, the addition of a single parabolic earth station is a prudent choice. Clearly, the utilization of commercial earth stations in this manner results in excellent antenna efficiencies.

2) The second method to receive programming from more than one satellite would be to use a cost-effective multiple beam parabolic retrofit. These are available in a dual-, triple- and, for some cases on very large and efficient reflectors, up to a five-beam configuration. Commercial grade retrofits for the most part are designed to see adjacent satellites within a 12° view arc.

3) The third option is to use a full arc spherical earth station. This type of antenna can offer simultaneous access within a 70° view arc to all 35 satellite positions in the C- and Ku-band frequencies.

Competitive edge

Initially, limited satellite programming only required the logical use of one single parabolic earth station. However, within a few short years, the cable industry witnessed a proliferation of satellite-delivered programming. These programming services are now available to create basic and pay cable, high penetration tiers and pay-per-view, to mention just a few. As well, limitations of satellite capacities and price negotiations among satellite companies and programmers have dictated that programming be scattered across the American satellite belt.

For the most part, today's cable programming is received from these satellites: Satcom F1R, Satcom F2R, Satcom F3R, Satcom F4, Galaxy I, Galaxy III, Westar IV, Westar V, Telstar 303, Spacenet I, Spacenet II and Spacenet III. The FCC is continuing to allocate new slots to replace older satellites and add new satellites to meet demand. This may cause even more confusion for cable engineers trying to provide consistent programming to their subscribers.

Recent commitments by MSOs and manufacturers to fiber technology have made 1 GHz technology (100-plus channels and services) a reality. This may cause engineers planning upgrades to rethink their current satellite downlinking systems to competitively match the increasing channel capacity opportunity.

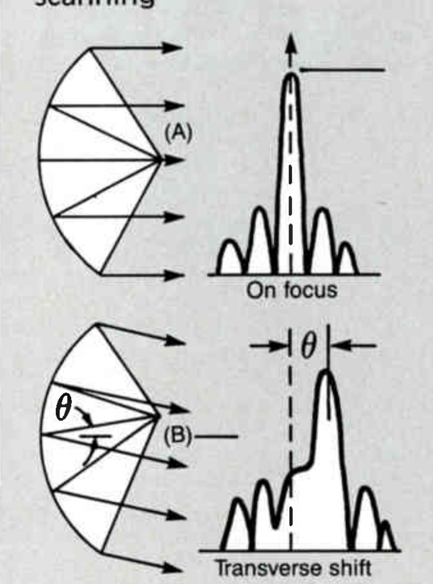
In accordance with filling channels, the ability of a CATV system to offer appropriate programming to specific market areas may significantly affect long-term profits. It has been shown over the last few years that most of the upcoming pay-per-view, teleconferencing and special event programming is found on different satellites, which in most cases have been non-cable ones. The simple ability to simultaneously receive all of these services can create otherwise unavailable profit opportunities.

More and more, however, operators recognize the profit potential of different pay and specialty services and, consequently, the need to provide additional satellite reception capability. There is no question that initial costs for a CATV system capable of maximizing profits are higher, but the extent of short- and long-term benefits may justify such a decision. The importance of flexible pay service tiering should not be underestimated; many operators have found that the basic fee covers operational costs but flexible tiering and other pay services provide the big profits.

Flexibility for change

Over the next several years, more satellites will be launched and others turned off creating many changes. Existing parabolic technology would dictate building an "antenna farm" to make up for flexibility limitations. Retrofit technology commonly calls for reworking older already existing parabolic antennas to a multiple feed system. Often, space for two or three parabolic antennas is either not available or the real estate has higher value for an alternate use. Even with sufficient space, creation of an antenna farm may be aesthetically undesirable. Additionally, many local ordinances make it difficult to get even one antenna installed and nearly impossible to get a second or third installed.

Figure 1: Parabolic beam scanning



On the other hand, a spherical full arc antenna occupies the space of approximately one and a half parabolic antennas of equivalent size. To receive new satellites or programs, a user simply adds another feedhorn along with the appropriate electronics. Consequently, many full arc antenna users maintain at least one spare feed on the shelf for changes or special events. This allows easy access to programming without interrupting existing channels.

Many cable companies have found that profitability does not stem from the number of subscribers that initially add a service. Instead, long-term retention is the key. As programmers move to other satellites and cannot be quickly recovered, dissatisfied customers cause a drop in retention, which has proven to be paramount in today's cable business.

Since most operators are faced with the need to view multiple satellites, it is important to understand the differences, applicability and tradeoffs between parabolic scanning and spherical scanning with a full arc reception antenna. These technical differences are especially important now that the FCC has begun implementation of closer satellite spacing.

Parabolic scanning

As with all antennas a retrofit system does have practical limitations when used on parabolics. This is due to the gain of the off-boresight feed, which is not the same as the gain of the boresight feed because of phasing problems and overall reduction in the amount of surface illuminated. Figure 1 shows parabolic beam scanning or parabolic multiple beam operation. A feed placed at the focal point *A* receives a beam from the reflector as shown. Displacement of the feed in a transverse plane to receive an adjacent satellite *B* produces a linear phase shift across the aperture, thus changing the direction of the beam by the angle θ.

In the opposite direction of the shift, a coma lobe, the combination of the main beam and first side lobe, is introduced and shifts the main beam, degrading the gain. Hence, multifeed parabolic antennas produce maximum narrow gain only on axis. Off axis, directivity is reduced, beamwidth broadens and the coma lobe broadens. The amount of degradation is commonly dependent on three factors: 1) the focal length-to-diameter ratio (f/d) of the antenna, 2) surface accuracy of the antenna and 3) the distance in degrees of the off-boresight the antenna is illuminating.

A commercial grade 5-meter antenna of 0.38 f/d will have an off-boresight degradation of approximately 0.5 dB at 3° and 1.8 dB at 8° from a boresight gain of 44 dBi. Similarly, a 5-meter antenna with a 0.30 f/d will have an off-boresight performance of 0.5 to 0.7 dB at 3° and 2.7 to 3 dB at 8° degradation from the boresight gain of 44 dBi. These two examples show how antennas of similar physical size but different designs in depth have vastly different performance when utilizing a multiple feed retrofit.

Performance of the antenna is in large part dependent upon surface accuracy. Older antennas may have had different tolerances to begin with or have lost their parabolic shape due to insufficient structural back support or poor installation. This deviation from a perfect parabola surface is especially critical with the use of a multibeam retrofit. Experience has proven that an antenna with a poor surface accuracy does not perform as well off-boresight and could cause a multitude of satellite signal performance differences to the CATV system attempting to "get by" with a retrofit.

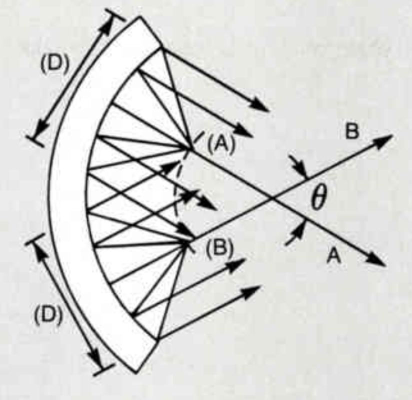
Other areas that should be considered are the increasing prominence of terrestrial interference (TI) and adjacent satellite interference, which in part correspond to the particular side lobe suppression for a parabolic retrofit. For example, when you retrofit an existing cassegrain-type antenna, your chances for acceptable adjacent satellite isolation and acceptable performance in a TI environment are less with the cassegrain than with a prime focus antenna. Side lobe levels will be approximately 9 to 13 dB down for a typical 5-meter cassegrain and from 17 to 22 dB down for a prime focus retrofit.

Another important consideration is that many retrofits do not meet the FCC 2° spacing requirement. However, it has been proven that (although not FCC licensable for TVRO protection) a very accurate 3.7-meter antenna can provide acceptable satellite discrimination if everything is perfect. The problem with 2° satellite spacing on most retrofit antennas is that the actual main lobe beamwidths do not fall within the required envelope at the 1° points on the plot of the log theta curve.

Spherical scanning

Spherical beam scanning is shown in Figure 2. Here a feed illuminates only a portion of the reflector, the area represented by the aperture *D*. The feeds are placed along an arc such that the *A* aperture produces a beam in the *A'* direction, while a feed looking at a reflector segment *B* produces a beam in the *B'* direction. Here the feed illuminates the reflector consistently for all beam positions until one starts to actually look over the edge of the reflector. Scanning is only limited by the physical size of the reflector and that point at which the opposite edge of the reflector begins to block the reflected waves from the operational zone. No coma lobe is produced since the feeds are always on-focus.

Figure 2: Spherical beam scanning



Employing a quasi-parabolic antenna that utilizes the on-focus beam principle in the elevation plane and spherical beam scanning in the azimuth plane can achieve the best of both worlds. From a technical standpoint the primary limitation of this design is spherical aberration. In order to collimate energy from a plain wave to a point source through a single reflecting surface, Fermi's principle of least path dictates a parabolic reflector. A spherical reflector is a deviation from a parabolic reflector having aberration. The greater the curvature, the more loss in gain and the higher the side lobe performance of the antenna.

The classic approach to the solution of spherical aberration problems has been the choice of a large radius of curvature; the larger the radius of curvature, the less the spherical aberration. However, large radius of curvature implies large structure. Large structure is counter to the desires of a practical antenna system. Large radius of curvature also dictates large focal length or large f/d, usually on the order of one. Thus, a 16-foot diameter antenna would have a 16-foot or more focal length. This does not lead to practical structures.

A more practical approach to the problem has involved integrating the feed structure design of the required radiation characteristics and matching them to the reflector surface to provide optimum performance and a minimization of the spherical aberration.

Meeting demands

In the past few years, it has become obvious that satellite/CATV programming demand is increasing. This is due in part to new technologies, increased channel capacities, programmer movements, new programming, FCC intervention and increasing competition in the marketplace. This has created the need to receive programming from multiple satellites. Consequently, flexibility, capability and technical performance of the satellite receive system will be key elements to financial success in today's competitive cable industry. The professional CATV engineer should strive for the most efficient, professional system design that takes into account present and future needs. Ultimately, today's decisions will dictate tomorrow's profits.

Games technicians play

Story and photos by Rikki T. Lee

Like a skier at the Winter Olympics, the First Annual Cable Games schussed its way into the record books. Over 150 attendees witnessed this technical competition July 20 during cocktails, hosted by the Colorado Cable Television Association (CCTA) at its 1989 convention in Vail. The idea for the games was conceived by Transmedia/CT Publications Division's Marty Laven and brought to life by the Cable Games Committee, under the auspices of the Rocky Mountain Chapter of the Society of Cable Television Engineers.

In Cable Games Stadium (the Ballroom of Marriott's Mark Resort), tables were arranged in a large rectangle, setting the stage for contestants to prove their skills in each of four events (drop cable splicing, .500 and .750 cable splicing, amplifier testing and fault locating). Nine judges, provided by vendor sponsors, waited patiently at their stations; nearby were score sheets, stop watches and all the accouterments necessary (connectors, cable, test equipment, etc.) for their respective event. Participating vendors were Anixter Cable TV, Comm/Scope, Gilbert Engineering, Jerrold, Magnavox, Raychem, Riser-Bond, Scientific-Atlanta and Tektronix.

Columbine Cablevision's Greg Jolliffe and Jones Intercable's Robert Wignes compete in the .500/.750 cable splicing event.

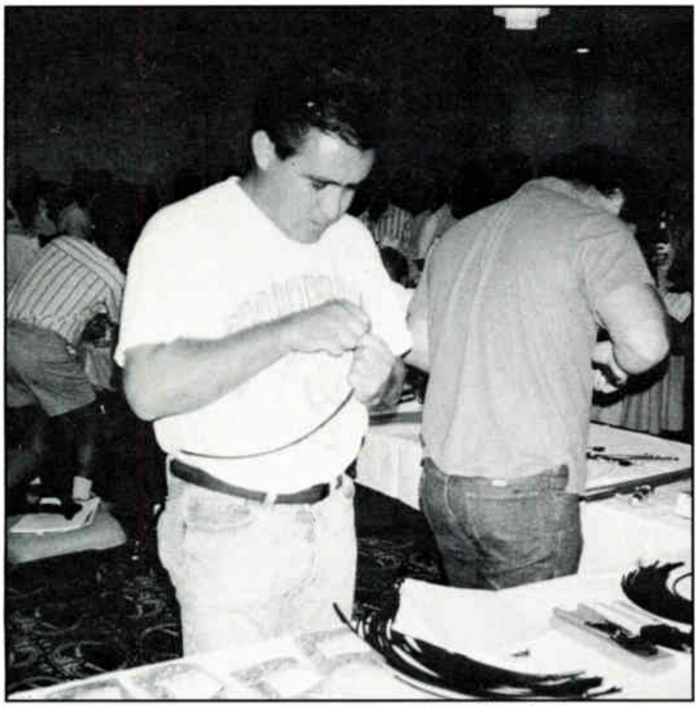
Taking their starting positions

At 5 p.m., the contestants, 10 technical trailblazers, took their seats at desks in the center of the rectangle. The lineup: Shawn Bargas, Paul Broeckect, Dick Hall and Greg Yslas from United Artists (UA); Romeo Battazzi, Paul Eisbrener and Greg Jolliffe from Columbine Cablevision of Fort Collins, Colo.; Robert "Fuzzy" Wignes and Don Grooms from Jones Intercable; and Eric Kesinger of Custom Enterprises of Colorado Inc. These pioneers appeared undaunted at their fate (although they had been told little about what to expect), since visions of the awards ceremony blossomed in their heads. A few moments before, each entrant had eyed the array of awards on display: large, beribboned gold, silver and bronze medallions (first, second and third place in each event) as well as a gold-plated cup (to the company with the highest aggregate score). Award sponsors were Jones Intercable, Tele-Communications Inc. and UA.

However, before the official competition could begin, Ron Hranac of Jones—fresh from the MSO's Engineering Conference on the other side of the mountain in Breckenridge, Colo.—volunteered as the "guinea person" (as nicknamed by Ted Hartson). Hranac made a speedy trial run around each of the stations—splicing, crimping, tightening, locating, etc. Following his flawless performance (an inspiration for the participants to do their best), Hranac mused, "I think it's a pretty fair accomplishment that a senior-level engineer can still correctly install an F connector on RG-59 in less than 30 seconds with a pocket knife and pair of crimpers."

Post-Newsweek Cable's Hartson officiated the games and was faced with the most difficult job of all: keeping up the interest of mostly non-technical attendees. "I wanted to make sure everyone was having a good time," he said. "This was a fun event but not one that lent itself to audience participation." So, emcee Hartson maintained one high energy level with a non-stop, tireless, humorous monologue, as well as providing color commentary and "live" interviews with audience members. (It worked: Almost no one left the room until the games were over.)

At about 5:30, Hartson shouted, "Let the games begin!" Contestants attacked the first of four rounds at their assigned station; judges started their watches and rated each man's performance on a 25-point scale. For example, at both of the cable splicing events, points were awarded for proper preparation of cable, installation of the connector and proper dimensions of the prepared end. In the amplifier testing event, skills included checking the input and output levels, tightening enclosure bolts and test point seizure port plugs, applying silicone grease on gaskets and O-rings and performing general maintenance. Finally, at the fault locating stations, contestants had to find four well-hidden flaws in a 150-foot cable using a time domain reflectometer. In all four events, judges noted each participant's accuracy and speed, which were factored into the final score.



United Artists' Shawn Bargas races against the clock in order to rack up a high score in the drop cable splicing event.

At 6:15, with the grueling timed rounds now a fleeting memory, contestants returned to their desks for a breather as well as a tie-breaker: a written multiple choice test on amplifier knowledge and system troubleshooting. For example, one question asked: "The function of a diplex filter on the input of a trunk amplifier is:

"a) to separate the reverse and forward bridging amplifier signals

"b) to act as a buffer between the different stages of amplification in the amplifier

"c) to combine the reverse signal back onto the forward cable and block the forward signal to the reverse amplifier."

With time running out, the Cable Games Committee tallied the totals based upon scores submitted by the judges. Winners of the medals and traveling trophy were announced later that evening at the Showtime party, which proved to be accessible only by ski lift or gondola. The winners in each category were as follows:

Event: Drop cable splicing. First place: Greg Yslas. Second place: Dick Hall. Third place: Paul Eisbrener.

Event: .500/.750 splicing. First place: Dick Hall. Second place: Paul Eisbrener. Third place: Greg Jolliffe.

Event: Amplifier testing. First place: Greg Jolliffe. Second place: Dick Hall. Third place: Paul Eisbrener.

Event: Drop cable splicing. First place: Greg Jolliffe. Second place: Romeo Battazzi. Third place: Dick Hall.

Everyone's a winner

In addition, all 10 players received a certificate (suitable for framing) just for participating. Initial reaction from the contestants was that their experience was rewarding. And, whether a recipient of gold, silver, bronze or nothing, each contestant felt like a winner. Unfortunately, security guards prevented reporters from entering the locker rooms, so in-depth interviews with the players were impossible.

It was evident that UA's Hall performed with the most mettle, since he took home the most metal—namely, four medals. He was immediately followed by three each for Columbine's Jolliffe and Eisbrener. And if you hadn't already guessed, Columbine also copped the cup—the much-coveted traveling trophy that will remain on display for a year at the Fort Collins system.

In closing, this year's Cable Games were brought to you by the SCTE Rocky Mountain Chapter, the CCTA, the National Cable Television Institute and *CT* and *Installer/Technician* magazines. Join us next year for the *Second* Annual Cable Games.

COMMUNICATIONS TECHNOLOGY

Upcoming editorial focus

October (Atlantic Show, Mid-America Show)
Advanced TV and HDTV

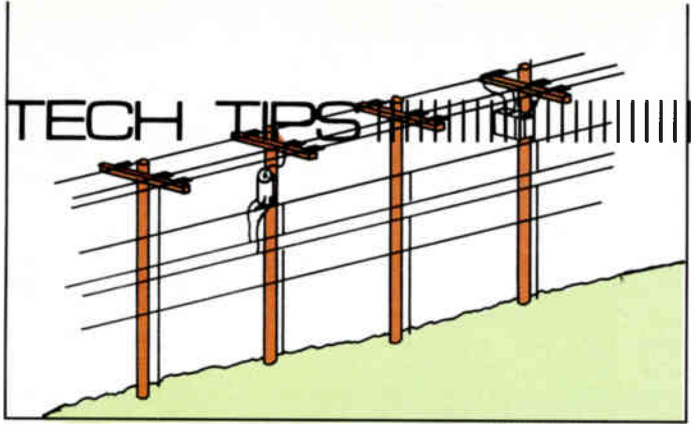
November
Tests and measurements
Index to articles

December (Western Show)
The 1990s and beyond (Futures topics)

January 1990
Professionalism and management
Microwave applications

For editorial information, contact:
Rikki Lee, Editor
(303) 792-0023

For advertising information, contact:
Neil Anderson, National Sales Manager
(303) 792-0023



Reducing longitudinal sheath currents in transport trunks

By Ron Hepler
Group Engineer, Prime Cable

Often it is the transport trunk that evidences the greatest susceptibility to the destructive effects of LSC (longitudinal sheath currents). These effects include blown fuses, shorted and burned RF bypass capacitors, shorted gas diodes, open circuit board traces, shorted DC powerpacks and overheated power transformers. Using AC circuit analysis of the network as well as field application it can be demonstrated that selective bonding will reduce LSC on transport trunks employing jacketed cable. This will extend work previously done on the subject.

Why transport trunks?

Transport trunks are often attached to the same pole line that carries the three-phase Wye-connected primary linking a utility substation with a residential service area or industrial complex. The National Electrical Safety Code (NESC) requires that the CATV messenger be bonded to the utility neutral at least four times per mile. This bonding creates a parallel network in which neutral current, related to phase imbalance, is shared between the neutral conductor, CATV strand, coax sheath and earth, according to their relative resistance values. The semirural utility primary reaches farther than its urban counterpart due to less branching and reduced load

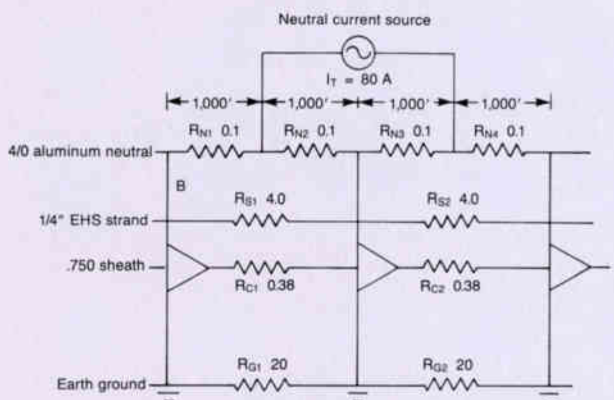
Table 1: Resistance of network conductors

Description	Ohms per 1,000 feet
4/0 aluminum	0.1
1/4" EHS strand	1.84 - 2.48
.750 coax sheath	0.19

Table 2: Significant variables used in Figures 1-4

- I_N: Current flowing in utility neutral conductor
- I_B: Current flowing in the bond between utility and CATV
- I_S: Current flowing in CATV strand
- I_G: Current flowing in the earth
- I_C: Longitudinal sheath current on CATV coax

Figure 1



$$R_{PN} = 1 \div \left(\frac{1}{R_{S1} + R_{S2}} + \frac{1}{R_{C1} + R_{C2}} + \frac{1}{R_{G1} + R_{G2}}\right)$$

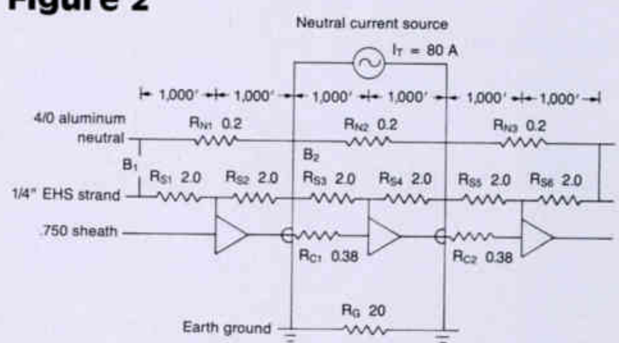
$R_{PN} = 0.68\ \Omega$
$R_{SN} = R_{N1} + R_{PN} + R_{N4}$
$R_{SN} = 0.88\ \Omega$
$E_T = I_T \times R_T$
$E_T = 13.04$ V
$I_B = I_T - I_N$
$I_B = 14.8$ A
$I_S = E_{PN} \div (R_{S1} + R_{S2})$
$I_S = 1.26$ A
$I_G = E_{PN} \div (R_{G1} + R_{G2})$
$I_G = 0.25$ A

$R_N = R_{N2} + R_{N3}$
$R_N = 0.2\ \Omega$

$$R_T = 1 \div \left(\frac{1}{R_N} + \frac{1}{R_{SN}}\right)$$

$R_T = 0.163\ \Omega$
$I_N = E_T \div R_N$
$I_N = 65.2$ A
$E_{PN} = I_B \times R_{PN}$
$E_{PN} = 10.06$ V
$I_C = E_{PN} \div (R_{C1} + R_{C2})$
$I_C = 13.24$ A

Figure 2



$$R_N = 1 \div \left(\frac{1}{R_{N2}} + \frac{1}{R_{S3} + R_{S4}} + \frac{1}{R_G}\right)$$

$R_N = 0.189\ \Omega$

$$R_{EO} = 1 \div \left(\frac{1}{R_{N3} + R_{S6}} + \frac{1}{R_{S5}}\right)$$

$R_{EO} = 1.048\ \Omega$

$$R_T = 1 \div \left(\frac{1}{R_N} + \frac{1}{R_{EP}}\right)$$

$R_T = 0.177\ \Omega$
$I_N = E_T \div R_{N2}$
$I_N = 70.9$ A
$I_G = E_T \div R_G$
$I_G = 0.6$ A
$E_{EI} = I_C \times R_{EI}$
$E_{EI} = 5.21$ V

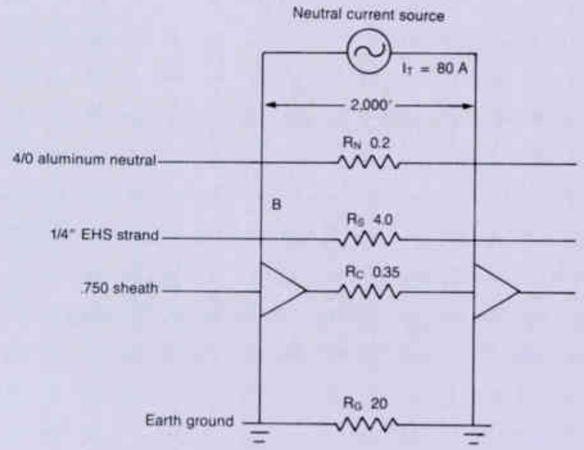
$I_{B2} = I_{RS2} + I_S + I_G$
$I_{B2} = 6.75$ A

$$R_{EI} = 1 \div \left(\frac{1}{R_{N1} + R_{S1}} + \frac{1}{R_{S2}}\right)$$

$R_{EI} = 1.048\ \Omega$

$R_{EP} = R_{EI} + R_{EO} + R_{C1} + R_{C2}$
$R_{EP} = 2.855\ \Omega$
$E_T = I_T \times R_T$
$E_T = 14.18$ V
$I_S = E_T \div (R_{S3} + R_{S4})$
$I_S = 3.55$ A
$I_C = E_T \div R_{EP}$
$I_C = 4.97$ A
$I_{RS2} = E_{EI} \div R_{S2}$
$I_{RS2} = 2.6$ A

Figure 3

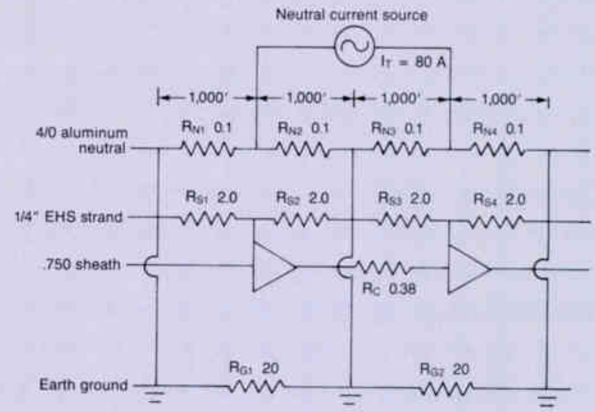


$$R_T = 1 \div \left(\frac{1}{R_N} + \frac{1}{R_S} + \frac{1}{R_C} + \frac{1}{R_G}\right)$$

$R_T = 0.126\ \Omega$
$I_N = E_T \div R_N$
$I_N = 50.43$ A
$I_G = E_T \div R_G$
$I_G = 0.50$ A

$I_B = I_T - I_N$
$I_B = 29.57$ A
$E_T = I_T \times R_T$
$E_T = 10.09$ V
$I_S = E_T \div R_S$
$I_S = 5.04$ A
$I_C = E_T \div R_C$
$I_C = 26.54$ A

Figure 4



$$R_{SC} = 1 \div \left(\frac{1}{R_{S2} + R_{S3}} + \frac{1}{R_C}\right)$$

$R_{SC} = 0.35\ \Omega$
$R_N = R_{N2} + R_{N3}$
$R_N = 0.2\ \Omega$
$R_{SN} = R_{N1} + R_{PN} + R_{N4}$
$R_{SN} = 4.12\ \Omega$
$E_T = I_T \times R_T$
$E_T = 15.26$ V
$I_B = I_T - I_N$
$I_B = 3.7$ A
$I_G = E_{PN} \div (R_{G1} + R_{G2})$
$I_G = 0.36$ A
$E_{SC} = E_{PN} - [(R_{S1} + R_{S4}) \times I_S]$
$E_{SC} = 1.17$ V
$R_S = R_{S1} + R_{SC} + R_{S4}$
$R_S = 4.35\ \Omega$

$$R_{EN} = 1 \div \left(\frac{1}{R_S} + \frac{1}{R_{G1} + R_{G2}}\right)$$

$R_{PN} = 3.92\ \Omega$

$$R_T = 1 \div \left(\frac{1}{R_N} + \frac{1}{R_{SN}}\right)$$

$R_T = 0.191\ \Omega$
$I_N = E_T \div R_N$
$I_N = 76.3$ A
$E_{PN} = E_T - [(R_{N1} + R_{N4}) \times I_{SN}]$
$E_{PN} = 14.52$ V
$I_S = I_{SN} - I_G$
$I_S = 3.34$ A
$I_C = E_{SC} \div R_C$
$I_C = 3.08$ A

density. Likewise, the number of CATV trunk amplifiers fed from a single ferroresonant transformer is increased, compared to conventional distribution due to the reduced power load of not having to support bridgers and line extenders. The collocation of these conditions invites the destructive effects of LSC. We know from previous treatments of the subject of LSC that neutral currents can range from 50 to 150 amperes during the quiescent state and rise to 300 A or more during fault conditions. Values in this range will be used in the analysis.

The resistance values of the conductors are listed in Table 1. The resistance of EHS (extra high strength) strand varies with manufacturer so a typical value of 2 ohms per 1,000 feet was selected. Bonding conductors and devices include #6 bare copper wire, K1 bonding clamps (neutral to strand) and aluminum amplifier housings (strand to coax sheath). To simplify calculations without biasing the results, all bonding conductors, devices and connections will be assumed to have zero resistance. Other factors that will be ignored include inductive and capacitive reactance, coupling and multiple phasing; they have little or no effect on the conclusion presented here. Earth resistance will be assumed to measure 10 ohms per rod totaling 20 ohms from one rod to another. Table 2 lists the significant variables used in the analysis.

Analysis

Figure 1, which closely resembles a recent field study, includes 4,000 feet of aerial trunk. The bonds are located at the amplifier stations in compliance with generally accepted wisdom and specifications as outlined in many construction manuals currently in use. Assuming 80 A of total neutral current applied, the coax sheath would carry 13.24 A or 16.6 percent of the total.

Figure 2, representing the same section of plant, has the bonds relocated to the midpoints of each of the cable spacings. This bonding scenario employs the high resistance steel strand to limit current that is transferred to the coax sheath via the bonds. The coax jacket, normally assumed to be a negative factor when dealing with LSC since it insulates the sheath from the strand, is transformed into an integral part of the formula for limiting LSC. With the same total neutral current applied as in Figure 1, the sheath current would be limited to 4.97 A or only 6.2 percent of the total.

The top segment of Table 3 illustrates the results of the network calculations. In the center are actual field measurements. Utility neutral current measurements were not made for safety reasons due to the neutral conductor's location above the phase conductors. Since the measurements were made on an operating system, it was not possible to isolate the area in question from the remainder of the plant. The lower segment of the table depicts the currents that would be expected in case of a fault causing 300 A of total neutral current to flow in the network. In all cases, the reduction in LSC is quite significant; it is demonstrated that field measurements agree closely with calculated results.

"Selective bonding will reduce LSC on transport trunks employing jacketed cable."

Figure 3, like Figure 1, has the bonds installed at the amplifiers, but the location of the amplifiers relative to the source of the neutral current would probably be considered worst case. In the 80 A quiescent state, LSC of 26.5 A is calculated. In the 300 A fault condition, LSC of 99.5 A would be expected.

Figure 4 introduces midpoint bonding to the situation identified in Figure 3. In this case the resultant LSC is reduced by 88 percent. Table 4 illustrates the dramatic change.

Other considerations include:

1) Some neutrals use a 1/0 conductor with twice the resistance of 4/0. This would cause a larger percentage of neutral current to flow as LSC.
2) Two bonds at adjacent poles near the midpoint would be needed to achieve compliance with the NESC 92C3 requirement of four bonds per mile. This would complicate the network calculations but would have little effect on the result.

The concept of midpoint bonding is most effective in the circumstances described. It would certainly be less effective and could conceivably have some negative results if used in conjunction with unjacketed cable or in areas of conventional distribution. It also is not recommended that this bonding scheme be used in lieu of other surge suppression techniques. On the contrary,

AM OVER FIBER, FM/VSB-AM HYBRIDS, FM FIBER SUPER TRUNKS

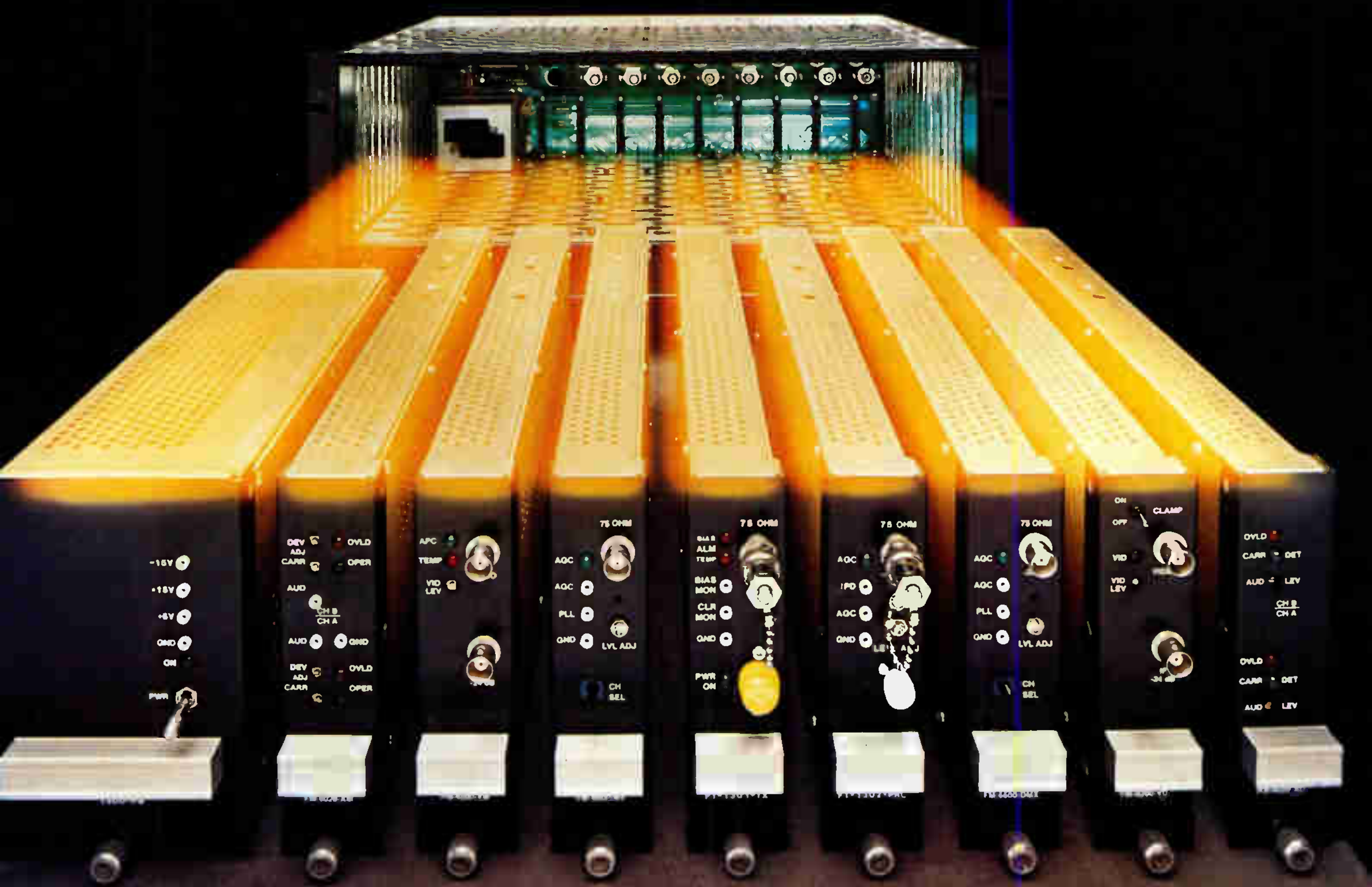
WHICH SYSTEM IS RIGHT FOR YOU?

Planning to rebuild or expand? There is no better time to explore the advantages of fiber optic transmission. A fiber system can improve your delivered signal quality, and improve overall system reliability.

No company offers more CATV fiber solu**tions than TFC.** We know that no single system or technology is best for all applications. Our first CATV fiber system was placed in service in 1978. Today we offer systems with multiple fiber technologies, each with its own advantage for CATV applications.

Call us to discuss your specific requirements. Let us put our eleven years of CATV fiber experience to work for you. We'll answer your quesitons on all phases of a fiber optic system, for which technology is best to planning the actual installation.

Call us at 203-265-8510



See us at the Great Lakes Show, Booth 117.
Reader Service Number 47.

TFC
an LPL company

TIMES FIBER COMMUNICATIONS, INC.
358 Hall Avenue, Wallingford, Connecticut 06492

Table 3: Data comparison of Figures 1 and 2

	Total neutral current	Maximum bond current	LSC	Strand current	Ground current
Figure 1 calculated	80	14.8	13.25	1.26	0.25
Figure 2 calculated	80	6.75	4.97	3.55	0.6
Difference		8.05	8.27	2.29	0.35
Percent of change		−54	−62	+182	+140
Figure 1 measured	Not made	14.0	13.5	1.25	0.1
Figure 2 measured	Not made	4.5	5.5	3.4	0.25
Difference		9.5	8.0	2.15	0.15
Percent of change		−68	−59	+172	+150
Figure 1 calculated	300	55.5	49.7	4.7	0.94
Figure 2 calculated	300	25.3	18.6	13.3	2.25
Difference		30.2	31.1	8.6	1.31
Percent of change		−54	−63	+183	+139

Table 4: Data comparison of Figures 3 and 4

	Total neutral current	Maximum bond current	LSC	Strand current	Ground current
Figure 3	80	29.57	26.54	5.04	0.50
Figure 4	80	3.70	3.08	3.34	0.36
Difference		25.87	23.46	1.70	0.14
Percent of change		−87.50	−88.40	−33.70	−28.00
Figure 3	300	110.90	99.50	18.90	1.88
Figure 4	300	13.90	11.60	12.50	1.35
Difference		97.00	87.90	6.40	0.53
Percent of change		−87.50	−88.40	−33.70	−28.00

Note: In Tables 3 and 4, all units are in amperes.

multiple levels of protection offer the greatest assurance of reduced equipment failures.

To summarize, longitudinal sheath currents in CATV transportation trunks employing jacketed cable can be dramatically reduced by relocating the bonds between the utility vertical and the CATV strand from amplifier locations to cable midpoints. This demonstrates that generally accepted wisdom and common practice may not always be universally beneficial.

Acknowledgments: I would like to thank Dan Pike as well as the engineering staff of Prime Cable of West Houston, Texas, for their contributions to this article.

References

1) "Longitudinal Sheath Currents in CATV Systems," James C. Herman and Jacob Shekel, *1975 NCTA Technical Papers.*
2) "Sheath Current Phenomena," Austin Coryell, *Communications Technology*, April 1986.
3) "Shared Environments and Sheath Currents," J. Richard Kirn, *Communications Technology*, August 1987.
4) *National Electrical Safety Code* 1987 Edition, American National Standards Institute, The Institute of Electrical and Electronics Engineers Inc.
5) *IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems* 1982 Edition, The Institute of Electrical and Electronics Engineers Inc.

COMMUNICATIONS TECHNOLOGY

A Transmedia Publication

Editor-in-Chief, Paul S. Maxwell
Vice President-Editorial, Toni I. Barnett
Executive Editor, Wayne H. Lasley
Editor, Rikki T. Lee
Contributing Editors, Shelley L. Bolin
Dennis R. DuBé
Tonya Elliott
J.L. Freeman
Patrick J. Gushman
Clay Jackson
Jill A. Nieman
Paul Noglows
Janet C. Powell
Tom Rees
East Coast Correspondent, Lawrence W. Lockwood
Editorial Assistant, Chuck Grossman
President/Group Publisher, Paul R. Levine
Vice President-Sales, Charles M. Castellani
Vice President-Marketing, Martin L. Laven
National Sales Manager, Neil Anderson
Account Executives, Barbara Allen Bellomo
Lu Ann Curtis
Diane Means
Patricia A. Wilbourn
Circulation Manager, Mary L. Sharkey
Circulation Assistant, Kathleen Jackson
Production Manager, Maria Sullivan
Traffic Manager, James Watts
Art Director, Sharon F. Lasley
Assistant Art Director, Brad Hamilton
Artists, Christine Henry
Mike Mathis

Transmedia Partners-I, L.P.

Chairman, Terrence Elkes
President, Paul S. Maxwell
Executive Vice President, Paul R. Levine
Senior Vice President, Patrick J. Gushman
Vice President-Group Publisher, David J. Topus
Vice President-Operations, Michael McCready
Controller, Kenneth W. Edwards Jr.
Assistants to Controller, Crystol Hanson
Nancy Parkin
Marketing Director, Cynthia L. Cole
Administrative Assistant, Marie T. Beert
Executive Secretary, Barbara Moir
Receptionist, Jane Duesing

CT Publications Corp., a unit of Transmedia Partners-I, L.P.
12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112
Mailing Address: P.O. Box 3208, Englewood, Colo. 80155
(303) 792-0023 FAX (303) 792-3320

Washington Bureau
1926 N St. N.W., Second Floor, Washington, DC. 20036
(202) 223-0970
New York Bureau
401 Park Ave. S., New York, N.Y. 10016
(212) 545-5206

Picture quality and fiber

By John Simons
National Account Sales, Times Fiber Communications Inc.

As we move into the 1990s, CATV operators will need to become more concerned about growing competition for revenue from other non-cable video sources.

While current VCRs can produce a picture comparable to that of NCTA's recommended engineering practices for cable systems, Super-VHS VCRs will produce pictures that are of higher quality than this current standard. This is where the subscriber will see the difference. If this scenario is plausible, then we need to understand what elements in the CATV system degrade picture quality and look at potentially feasible solutions.

Abiding by current NCTA recommended engineering practices, a CATV system is required to deliver signals with a carrier-to-noise ratio (C/N) of about 43 dB to the subscriber. The following are sources of noise whose contributions degrade the picture a subscriber views:

- Earth stations
- Headends
- Amplifier cascades

In addition to these sources, variables that impact on cable performance include equipment operating levels, climate conditions (affecting microwave) and geographic location (affecting satellite reception).

For example, in an average system for a satellite-delivered channel the earth station will contribute a 52 dB C/N and a 30-amplifier cascade will contribute a 44 dB C/N. Using these numbers, the overall C/N would be 43 dB at the input to a converter. However, what the subscriber sees depends not only upon signal input levels but the noise figure of the converter as well, and may be something less than 43 dB.

Now, by including the typical operating parameters of a converter with an input level of zero dBmV and a noise figure of 14 dB, the overall C/N delivered to the input of a subscriber's TV set is as follows:

- System C/N of 43 dB
- Converter C/N of 45 dB
- TV set input C/N of 41 dB

A subscriber, equipped with Super-VHS equipment, would see a difference between CATV of 41 dB and Super-VHS of 47 dB.

A consumer can purchase a Super-VHS VCR and a reasonable high resolution TV set for a price range between $1,100 to $1,800, depending upon features. If HDTV (high definition TV) enters the real world where a consumer can purchase these electronics, we will have to work harder to improve picture quality. Current estimates are between $4,500 and $6,500 for an HDTV set and VCR.

A study recently published by one potential HDTV supplier showed that with its proposed format a CATV system would have to deliver a 3 dB better signal for HDTV carriage. Now, instead of delivering a 47 dB C/N signal (to compete with Super-VHS), cable systems would have to deliver a 50 dB C/N signal for the same level of perceived quality that HDTV will offer.

Possible considerations to provide a higher quality picture for the subscriber include larger satellite dishes, lower noise LNAs, shorter cascades, varying operating levels, higher tap levels and low noise figure converters.

Once you've determined the C/N to deliver to the input of a subscriber's set, it is a matter of determining what the new C/Ns from the various components that make up the system would yield. You can then calculate the resultant C/N from all the individual C/N contributions with a power addition formula. For purposes of this example, I picked about 47 dB as a target. The resultant individual C/Ns from system components could look as follows:

- Earth station 56 dB
- Hubs 54 dB
- Amplifier cascade 49 dB
- Converter 55 dB

The combination of these improvements will now deliver signal with a 46.5 dB C/N to the TV set.

Employing AM fiber-optic technology could allow the operator to reduce the amplifier cascade from 30 amps to only 10 or less. Before the development of AM fiber technology an operator would have had to use FM technology to achieve this reduction in cascade. However, FM hub trunking on a widespread basis would have been cost-prohibitive. Also, an FM fiber system requires a large enclosure to house all the signal conversion electronics required. Basically, AM technology only requires light-to-RF conversions. Therefore, hub electronics can be placed in strand-mounted amp housings or a small pole-mounted cabinet.

Current realistic AM fiber C/N specifications for 20-40 channels are in the low 50 dB range. For total AM fiber hub integration into CATV systems the C/N should be a minimum of 54-55 dB. This could be accomplished by reducing the number of channels onto an AM optical transmitter or waiting for further laser technology developments. By the end of 1989, we will see price vs. performance nearing practical targets.

When comparing AM vs. FM fiber for hub sites, the FM technology can cost up to three or four times per channel. However, FM is still the best choice for systems that require long transport distances from headend to hub sites, followed by long amplifier cascades. Additionally, FM fiber systems will continually be improved in both the areas of packaging and cost.

In the late 1970s, FM fiber systems only delivered four channels about three miles. Now, repeaterless FM fiber systems can go up to 25 miles with 18 channels per fiber, while current AM systems provide run lengths up to approximately 10 miles with 20-40 channels per fiber. Depending on performance requirements, the current costs for AM can range from $600 to $1,400 per channel to a hub location. The reason for the cost spread is that you may have to halve the number of channels per fiber to achieve a desired performance, thus doubling the cost of the AM optoelectronics.

So far this discussion has keyed on C/N as the major limiting factor in delivered video performance. In addition to C/N targets, other distortion performance targets could be as follows:

- Cross-modulation 65 dB
- Composite triple beat 65 dB
- Second order 60 dB

In summary, fiber-optic technology could bring the following benefits to the cable operator and ultimately the subscriber:

Uniform performance—Nearly every subscriber in the system could receive the same level of picture quality service. Currently, subscribers living farthest from the headend receive lower degrees of quality.

Uniform system reliability—No longer will the outage of the closest trunk station affect all subscribers. With hub service areas, there will be a perceived increase in reliability.

Deliver high quality pictures—Fiber technology will enable the CATV system to deliver the same quality of picture as other sources of video services, such as Super-VHS, etc., which is our common objective.

This article is based on an SCTE technical seminar presented at the 1989 Texas Show.

Faroudja and IDTV

Some of my past columns (December 1987 and November 1988) have presented brief descriptions of most of the candidate high definition TV (HDTV) transmission systems. Another system for improved TV (not "true HDTV") has burst upon the scene and warrants similar examination.

By Lawrence W. Lockwood
Principal Scientist-Video Technologies, Contel Corp.
East Coast Correspondent

A demonstration of the Yves Faroudja system for improved TV transmission, called "SuperNTSC," at the National Association of Broadcasters show this year in Las Vegas produced pictures of startling quality. They were particularly startling because they were shown in a hall that was overflowing with HDTV exhibits, which not only permitted but almost dictated their comparison—and SuperNTSC looked *very* good in comparison. A large-screen presentation looked almost like movie theater quality. SuperNTSC also was demonstrated (off the exhibit floor) at the National Cable Television Association (NCTA) show in Dallas again with an enthusiastic reaction.

Improved definition TV

Faroudja's SuperNTSC is in reality a well-developed and operating improved definition TV (IDTV) system. (IDTV has been discussed in this column in May 1988.) As noted in the previous columns, IDTV is a likely step on the way to "true HDTV." A realistic assessment of a time frame for a substantial penetration of HDTV into the American market indicates that it is going to be a number of years at the very least. A thoughtful analysis and outline of a possible schedule for substantial acceptance of HDTV by the American public was presented in Walt Ciciora's May 1989 column in *CT*. He states there "it is rational to expect that it will be between 12 and 15 years before commercially significant penetration of HDTV receivers is achieved." Another estimate was given in a paper presented at the NCTA national convention that concluded (assuming an HDTV standard is accepted in two years) the market (general public) penetration in 15 years will be 10 percent[1]. With this time frame in mind it appears even more probable that some IDTV scheme will achieve large public acceptance and reasonably soon.

There are a number of IDTV schemes; they all transmit in a standard NTSC channel and can be received by any current NTSC receiver. However, all IDTV schemes use various digital signal processing techniques on the NTSC signal to improve the picture and to get the most out of its inherent capabilities. Some IDTV schemes only process the signal in the receiver—others process both at the transmission end and at the receiver. SuperNTSC permits and recommends both. The maximum improvement is obtained when SuperNTSC modifications in the TV signal are made at the transmitter and received on a receiver incorporating SuperNTSC circuits. However, any current standard TV receiver will show a slight picture improvement when receiving a transmitted SuperNTSC signal; conversely, a SuperNTSC receiver will slightly improve a current standard non-improved signal.

All proposed IDTV systems use at least one signal enhancement technique: comb filtering. Some use an additional technique: progressive scanning. Faroudja's SuperNTSC uses both.

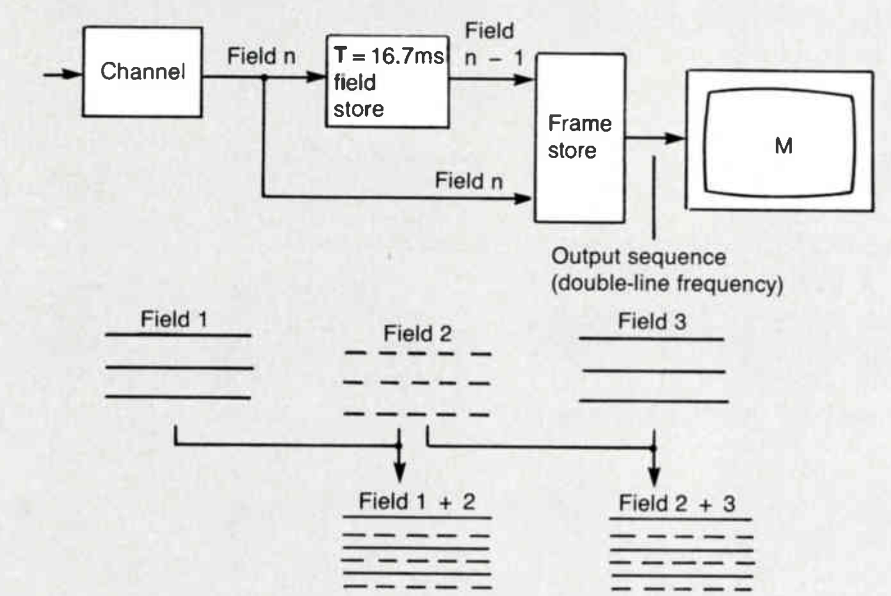
Progressive scanning

Progressive scanning differs from the current NTSC interlaced scanning standard in that instead of completing a full 525-line frame scan in two 1/60th-of-a-second fields of 262.5 lines each, progressive scanning completes the 525-line frame each 1/60th of a second. It speeds up the scan so that a full 525-line frame is continuously scanned each 1/60th of a second rather than the interlaced frame each 1/30th of a second consisting of two interlaced fields of 1/60th of a second each. If the camera is progressively scanned, a full frame of 525 lines is generated each 1/60th of a second. However, to comply with NTSC transmission standards the signal must be transmitted at an interlaced rate of one frame per 1/30th of a second consisting of two interlaced fields. One way of accomplishing this is to use a frame store. Every other 1/60th of a second a progressively scanned frame is written into the store and then read out as two 1/60th-of-a-second interlaced fields for transmission.

The reasoning behind a progressive scanning system is that in interlaced systems, the line flicker caused by interlacing reduces the effective number of lines by approximately 0.6 (known as the interlace factor; it is different from the Kell factor). For moving pictures, interlace scanning produces additional motion related artifacts, which reduce the subjective vertical resolution and picture quality[2,3].

A simplified method of reconstructing the signal to produce a progressive scan for the display is shown in Figure 1. This methodology would correctly reconstruct a signal that was

Figure 1: Receiver progressive scan reconstruction



originally progressively scanned and sent as previously described. However, this technique would suffer artifacts due to motion if applied to a signal that was generated by an interlace scan. In that case added logic can be used to interpolate between successive lines in a field to generate the other interlaced field.

Faroudja also increases picture quality by "line doubling." He uses a frame store in the receiver to transcode a 525-line, 2:1 interlaced image into a 60 Hz display with 1,050 lines and a 2:1 interlace. He states that if progressive scan is used in the camera, vertical interpolation is made easier in the line doubler, and an apparent vertical resolution of the order of 440 lines is observed without visible artifacts (ragged or "stepped" diagonal transitions). The results are comparable to those obtained with some HDTV systems.

In the horizontal domain a frequency response of 4.2 MHz is certainly not satisfactory. He claims "the subjective sharpness may be significantly improved by the combination of two techniques: detail processing in the encoder luminance path and spectrum expansion in the decoder."

The number of permutations and combinations of schemes to specifically accomplish the progressively scanned display as sent through an NTSC standard interlaced transmission channel is quite large.

Comb filtering

At this point it would be well to review several fundamentals involved with the production/transmission of color in the NTSC standard. The color information (carried on the color subcarrier) is contained in the same frequency range as the luminance information and traditionally the separation of the chrominance information from the luminance information has been accomplished by the use of overlapping low-pass (luminance) and band-pass (chrominance) filters. The result of this crude separation has been image quality degradation in the form of "cross-color" and "dot-crawl" along with certain bandwidth restrictions and transient response problems that result in restricted system performance.

The IDTV systems use comb filtering to improve the separation of the chrominance and luminance information. The separation utilizes the fact that the color subcarrier frequency is shifted 180° in successive lines. This shift was specified in the development of NTSC color to reduce the visibility of the subcarrier. As shown in Figure 2, a frequency that is an exact harmonic of the line scanning rate produces a noticeable vertical grid, whereas signals of a frequency halfway between the harmonics of the line scanning rate give a much less visible pattern. Tests have shown that an interfering signal at an odd harmonic of half the line-scanning rate may have approximately five times the voltage of a signal that is at a harmonic of the line scanning rate, for equal visibility[4].

To utilize this property of the color TV signal to enable a better separation of chrominance and luminance information a comb filter was developed. (See Figure 3.)

Figure 2: Pattern visibility

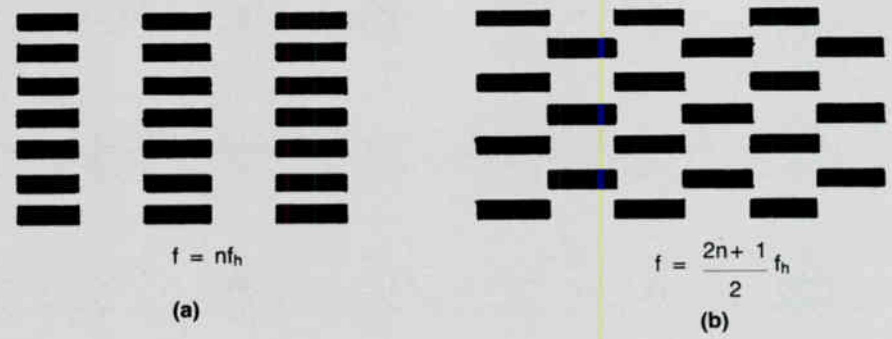
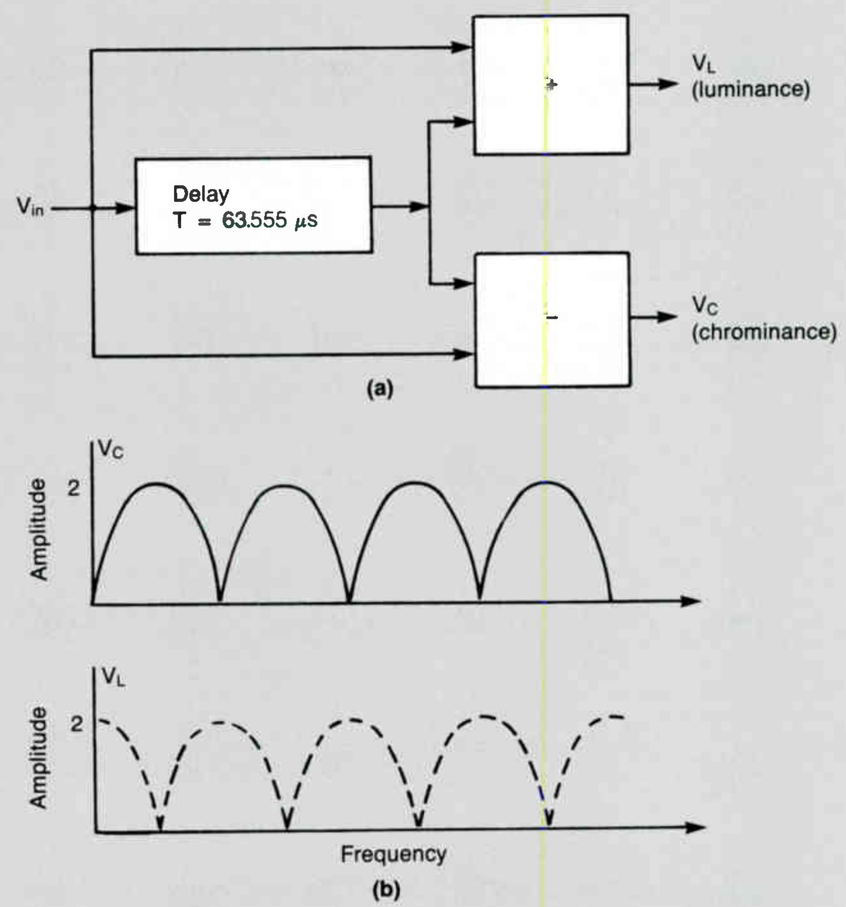


Figure 3: Simplified comb filter: Block diagram (a); outputs V_L and V_C (b)



This filter delays the composite video signal one horizontal scan period (63.555 μs) and then adds or subtracts it to or from the undelayed composite signal. The summation process results in reinforcement of the luminance information and cancellation of the color subcarrier since it is purposely synchronized such as to be 180° out of phase from one line to to the next. Color dot crawl interference is eliminated. The subtraction process results in cancellation of the luminance components and reinforcement of the chrominance information. The filter is so named because the amplitude response characteristic of the comb filter resembles the teeth of a comb.

It must be emphasized that progressive scanning and comb filtering are not new or unique to SuperNTSC. Both techniques have existed for some time. However, to achieve the results shown in SuperNTSC requires further refinements. →

Faroudja is reluctant to discuss specifics of his system—he says, "I will not work on anything that is not patentable" and not all his patents on the perfections he applies to the principles of enhancement have been issued yet. As an example of further improvements possible, it is recognized that existing intrafield comb filters are not perfect, exhibiting some residual cross-color effects in areas of diagonal detail and some cross luminance at sharp vertical chroma transitions. Further improvements may be realized by use of interframe techniques (i.e., frame memories). These temporal comb filters completely separate the chrominance and luminance signals at all spatial angles in still pictures with no loss of vertical resolution in the luminance channel. However, some degree of motion compensation is required when decoding pictures with motion.

Conclusions

Faroudja's SuperNTSC produces pictures of amazing quality that are perfectly compatible with standard NTSC. To achieve this quality he processes the signal with generally accepted techniques; i.e., progressive scanning and comb filtering. Faroudja declines to discuss in detail the improvements to these techniques that he uses in SuperNTSC—however, to mix a metaphor, the proof of the pudding is the picture—it works and works *very* well.

SuperNTSC has had limited tests in both broadcast and cable. Tele-Communications Inc. tested it on its Sunnyvale, Calif., system through an 18-amplifier cascade. Under the relatively controlled conditions of these tests it performed admirably. However, much more extensive field tests are required before commitment to wide-scale operation is justified.

There is no question that under controlled conditions it produces amazing pictures. However, in the rough real world of signal transmission, either terrestrial broadcast or cable, many other criteria must be factored. As an example, concerns have been expressed about its requiring such a clean, low noise system that most current CATV systems would derive not benefits from its use—but a lot of expense. Perhaps this may be a further driving element to the incorporation of fiber optics in CATV distribution systems.

Regardless of the concerns (many justified, and which might also apply to any HDTV transmission scheme) regarding its adoption as the next step on the path to some form of HDTV, Faroudja's SuperNTSC merits close observation of its future development.

References

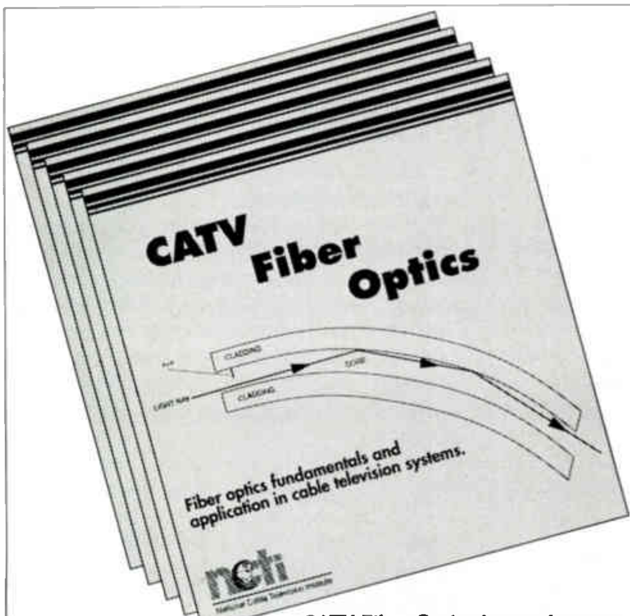
[1] "Relative Cost Implications for Implementing ATV Proponent Systems in a CATV System," S. Rosser, G. Hart and R. Horchler, *1989 NCTA Technical Papers*.

[2] "The Evolution of Video Technologies," H. Gaggioni, *IEEE Communications Magazine*, November 1987.

[3] "The Kell Factor: Past and Present," S. Hsu, *SMPTE Journal*, February 1986.

[4] *Television Engineering Handbook*, K. Benson, McGraw-Hill, 1986.

(Views expressed here are the author's and do not necessarily reflect those of Contel.)



CATV Fiber Optics is a major new course from NCTI. Its 22 lessons cover virtually all aspects of fiber optics and its use in cable TV.

Now you can learn Fiber Optics from the industry's broadband training source!

Introducing NCTI's CATV Fiber Optics

Fiber Optics is undeniably a part of cable television technology. If your system isn't already involved in fiber, chances are it will be in the next three years. And, if you're like most of us, your training and experience is in coaxial cable-based systems, not optics.

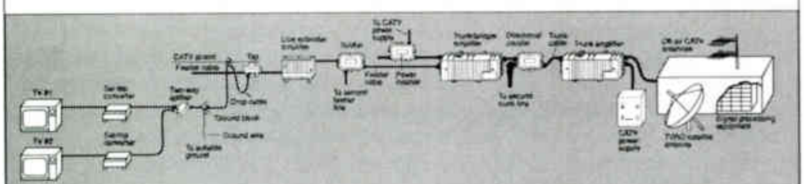
CATV Fiber Optics, can bring you into the age of optics. It provides you with a thorough understanding of fiber concepts from transmission and attenuation to bandwidth and dispersion. It will bring you up to speed with the application of fiber from cabling basics and types of lasers, to amplifiers and splicing. Finally, it will complete your knowledge of fiber use in cable television systems with a review of fiber architectures, modulation techniques, RF interfaces, components, testing and monitoring, construction and maintenance.

And best of all, it is an NCTI self-study course. That means you decide when and where to learn about fiber optics. You don't have to travel to an expensive seminar. You can learn in the convenience of your office or home.

For a limited time only! Pre-publication discounted price...$295*

* Regular price is $345. Pre-publication discount applies only to enrollments received before October 1, 1989.

NCTI Career Path Courses



NCTI offers five career path courses to help develop your expertise in all areas of the cable plant.

Installer
Installer Tech
Service Tech
System Tech
Advanced Tech

In addition, NCTI's CATV System Overview provides an excellent opportunity for non-technical and new employees to learn about the technical side of the cable business, and Broadband RF Technician provides employees with extensive electronics training a complete understanding of cable television technology. Use the coupon at the right to order your FREE Training Kit. TODAY!

Please rush me the following:

- ❑ More information on CATV Fiber Optics.
- ❑ A complete Training Kit with information on all NCTI courses.

Name____________________

Title____________________

Company____________________

MSO affiliation____________________

Address____________________

City__________ State_____ Zip______

Daytime phone____________________

CT 9/89

Mail this form to:

National Cable Television Institute
P.O. Box 27277, Denver, CO 80227
(303) 761-8554

Reader Service Number 48.

BCT/E certification—It's for you!

By Jack Trower
President, Society of Cable Television Engineers

One of the most important programs of the Society is the Broadband Communications Technician/Engineer (BCT/E) Certification Program. The goals of the program are very beneficial to the membership.

The BCT/E program has been established to help SCTE members raise their professional status by providing a standard of competence. It allows recognition of those individuals who have demonstrated the knowledge, experience, responsibility and ethics required of a professional at the level at or above those standards. Through the BCT/E program, the Society can encourage the continued development of its members. The program also is designed to help management assess the competency of individuals working in or applying for technical positions.

Less than 30 percent

With all the benefits that members can achieve from this program, it confuses me as to why less than 30 percent of our membership are enrolled. Does this mean that nearly 4,000 members feel that they already have the knowledge, experience, etc., that the program calls for? If this were the case, I would think these individuals would want to become certified, since it would be so easy for them to do so.

Perhaps a lot of members are in my situation. At this stage of my career I did not feel the need to certify. I did, however, want to know what the technical people in my company were being tested on. What do you think happened? Even though I knew I stayed on top of the technical standards and progress in the cable industry, there were areas that I did not know as much as I thought I did. Hence, I needed to improve my knowledge in those areas. Certification became a benefit by getting me up to speed with what was happening in the industry. Another benefit is that when technical personnel from my company come into my office they can see the certificate on my wall and know that "I practice what I preach."

Maybe the tests are not being made readily available to our membership. In the past year only about 60 percent of chapters and meeting groups held at least one testing session. Yet the certification process is one of the main reasons we have chapters and meeting groups. Providing testing at least once a year is an ongoing requirement for chapter status. Last year the board of directors approved a resolution that tests be administered at least three times a year by all chapters.

Is there a reason we are not adhering to the once-a-year requirement? Part of the reason, I think, is that we are not planning meetings far enough in advance to prepare for a testing session. I also have found that chapters are reluctant to hold testing because normal attendance at their meetings dwindle when tests are administered. There are solutions to these problems (but I prefer to call them "opportunities"):

1) Plan your meetings a year in advance. You don't have to pick your subjects, just the dates and a format. Plan each alternate meeting as one where tests are available. Have both a morning and an afternoon subject. Make the BCT/E tests available in another room, allowing both a morning and an afternoon testing session. With this format a member can choose either a training session and a testing session, two training sessions or two testing sessions. It will allow something for everyone and help keep attendance up.

2) Designate someone to complete the necessary paperwork for the tests and establish a calendar showing the dates that paperwork must be submitted. It is necessary that a request for certification tests be received by national headquarters at least 45 days prior to the testing date. This is to ensure test availability and to

SCTE

MEMBERSHIP APPLICATION

APPLYING FOR:

______ INDIVIDUAL @ $40*

______ SUSTAINING @ $250**

Please print or type information. Data will be used exactly as it is submitted here.

NAME: ____
First Initial Last

EMPLOYER: ____________________ TEL.: ____________________
Company Name Area Code—Number

CO. ADDRESS: ____
Street/PO City State ZIP

USE HOME ADDRESS? ____
Street/PO City State ZIP

YOUR TITLE: ____________________ FOR HOW LONG? ____________________

YOUR SIGNATURE: ____________________ DATE: ____________________

Complete the information below. Enclose full payment or charge to MasterCard/VISA shown below:

NAME ON CARD: ____________________ EXP.: ____________________

MASTERCARD NO.: ____________________ IB NO.: ____________________

VISA NO.: ____

SIGNATURE FOR CHARGE AUTHORITY: ____

I hereby apply for membership in the Society of Cable Television Engineers Inc., and agree to abide by its bylaws. Further member materials will be mailed to me within 45 days. Payment in U.S. Funds is enclosed. I understand dues are billed annually.

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.

Make check payable to SCTE. Mail to: **SCTE, 669 Exton Commons, Exton, PA 19341.**

*/** Applications without payment will be returned. Applications from outside U.S./Canada/Mexico, enclose additional $40 (U.S.) to cover mailing expenses. Sustaining Membership is non-voting and not corporate or group-type category.

secure a proctor, if needed. Chapter presidents may be proctors but meeting groups must have a regional director, member of the national staff or other approved proctor assigned. This takes time to organize. A requirement for the number of tests must be submitted two weeks prior to the testing date. Whoever does the requesting should be reasonable in the number of tests requested. Some chapters have requested 50 copies of a category, only to have four or five tests administered in that category. The time between the request and the notification of the required number of tests should be used for preregistration or to determine an accurate number of tests needed.

These rules are absolutely important to the program. Requests for waivers to these time requirements are detrimental to the program. I have directed the national staff to require strict adherence to the rules in order to maintain the credibility of the BCT/E program. The certification process must never be compromised in any way.

If you, as a member of the Society, are not presently enrolled in the BCT/E Certification Program, I encourage you to look into it. If we believe that the goal of the SCTE is to improve the CATV technical community, then we need to involve ourselves in the Society's programs. By your involvement you will help improve this technical community by increasing your own knowledge or by identifying and suggesting ways to improve the BCT/E program based on your own experience in it. It's easy to sit on the sidelines but much more fun to be in the game. You will find it more rewarding, too.

DX does it again!

Introducing the new DIR-647 Integrated Receiver/Descrambler

For over 30 years, DX has been at the forefront of technological advances in the satellite communications industry.

The DIR-647 represents our latest innovation and reflects our unwavering commitment to excellence. It's the newest, most advanced commercial IRD available, measuring a space-saving 3½" with a host of features, including C/Ku-band compatibility, that ensure maximum flexibility and efficient operation.

Over the years, DX research and manufacturing has continued to meet the critical demands of large CATV operators by introducing high-performance products unsurpassed for reliability, quality, and value. The DIR-647 is the latest in a long list of breakthrough solutions in satellite communications, and has been engineered with one goal: to help you deliver the clearest, sharpest pictures possible.

The DX challenge

Call us. We'll prove to you how superior the DIR-647 really is, and what it can do for your cable system. Write or call DX Communications, Inc. today.

DX ANTENNA

Ahead in Satellite Communications Technology

DX COMMUNICATIONS, INC.
A Subsidiary of C. Itoh & Co. (America) Inc.
10 Skyline Drive, Hawthorne, NY 10532 • (914) 347-4040
Manufactured by DX Antenna Co., Ltd., Japan

Reader Service Number 56.

Video generator

Team Systems' Astro VG-814 programmable video generator is said to simulate any Japanese, European or American high definition TV (HDTV) standard. The VG-814 produces RGB output using virtually any resolution, aspect ratio, frame rate or bandwidth. Scan can be non-interlaced or interlaced with sync/video or separate sync(s) and video. With the video generator, the user can create a series of standardized tests with different picture content, color balance and average picture levels.

Programmed from the front panel, the VG-814 stores and recalls up to 40 programs or patterns, including 15 factory-installed, user-defined fixed patterns. Available patterns include programmable color bars, gray scales, cross hatches, dots, circles, characters and multibursts. Several of these patterns can be superimposed to create appropriate test signals for different applications. Center marker, borderline, diagonal lines and circles are individually calculated for the selected aspect ratio. Pixel by pixel control over the entire 2,048 by 1,280 graphics plane enables creation of any special test pattern.

For more data, contact Team Systems, 2934 Corvin Dr., Santa Clara, Calif. 95051, (408) 720-8877; or circle #128 on the reader service card.

FO receivers

The TransHub III and III-HP from Catel are strand-mounted fiber-optic receiver packages designed to take this technology deeper into typical CATV systems. Distances of up to 20 km are said to be achievable with excellent quality. According to Catel, cost-effective fiber builds and rebuilds can be accomplished to within a few amplifiers of the the subscriber. One unit delivers up to 73 channels at 18 channels per fiber with a fiber loss budget of 11 dB or more with trunk output levels and signal-to-noise ratio of 55 dB or more. Composite triple beat is −65 dBc typical; second-order products are at −70 dBc.

For further information, contact Catel, 4050 Technology Pl., Fremont, Calif. 94537-5122, (415) 659-8988; or circle #133 on the reader service card.

MultiPort decoder

The Jerrold Division of General Instrument Corp. announced a decoder that serves as an EIA (Electronic Industries Association) MultiPort between CATV and cable-compatible consumer electronics equipment. The Impulse 7400 (Model DPBB) allows subscribers to use all the built-in features of cable-compatible TVs and VCRs, even on scrambled channels. Now housed in a Jerrold converter shell, the device serves as an interface between the incoming cable with the TV/VCR, reading the addressable information and decoding scrambled channels.

For more details, contact Jerrold, 2200 Byberry Rd., Hatboro, Pa. 19040, (215) 674-4800; or circle #113 on the reader service card.

CATV enclosures

A new line of CATV enclosures is available from White Storage & Retrieval Systems, designed for multiple dwelling unit (MDU) applications. The line includes splitter boxes, sliding lid boxes and three series of high-security double boxes. These enclosures are of all-galvanized steel construction and feature a selection of colors and prewiring.

For more details, contact White Storage & Retrieval Systems Inc., 30 Boright Ave., Kenilworth, N.J. 07033, (201) 272-6700; or circle #115 on the reader service card.

Coax cable

Alpha Wire announced a complete line of coaxial cable products said to accommodate faster signal speeds over greater distances with less signal loss. The line consists of standard RG coax, twinaxial, triaxial, MATV and CATV cables and others. The line includes shielded products specifically designed to meet FCC RFI/EMI emission controls, tougher fire regulations in plenum installations and industry demands for higher density wiring.

For additional information, contact Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, N.J. 07207-0711, (201) 925-8000; or circle #140 on the reader service card.

Test reference

Developed especially for HRC systems, the Model FTS 1060 from Frequency and Time Systems provides a reference for broadcast frequencies designed to help CATV operators meet the FCC's ±1 Hz requirement. Features include two 6.0003 MHz outputs, a low aging rate of ±0.06 Hz per year and 115 VAC operation.

For more information, contact Frequency and Time Systems Inc., 34 Tozer Rd., Beverly, Mass. 01915-5510, (508) 927-8220; or circle #116 on the reader service card.

AD INDEX

Off-air Ch. 9

By Steven I. Biro
President, Biro Engineering

This is the eighth in a series of maps with technical and program parameter listings for off-air Channels 2-69, designed to be used when the cable system experiences co-channel interference. With this information, the headend technician can pinpoint the closest (i.e., the most probable) offenders, determine their directions and start the verification process with the rotor-mounted search antenna. Based on the tabulated technical information, the search can be concentrated on the most powerful stations or those that have the highest transmitting antenna towers.

The computer program for the maps was developed and data for the listings was collected by the staff of Biro Engineering, Princeton, N.J. The information is accurate as of Sept. 1, 1988.

Key to listing

Call letters: Ch. 9 station identification

City: Station location or the area served by the station

Network affiliation:

C/A	CBS and ABC programming
C/N	CBS and NBC programming
A/N	ABC and NBC programming
ACN	ABC, CBS and NBC programming
ED	Educational station (PBS)
IND	Independent station
CBC	Canadian Broadcasting Corp.
CTV	Canadian Television Network
RRQ	Reseau Radio Quebec
TVA	Canadian Independent Programming
SRC	Societe Radio-Canada
SP	Spanish language programming

Power: The effective visual radiated output power (in kilowatts)

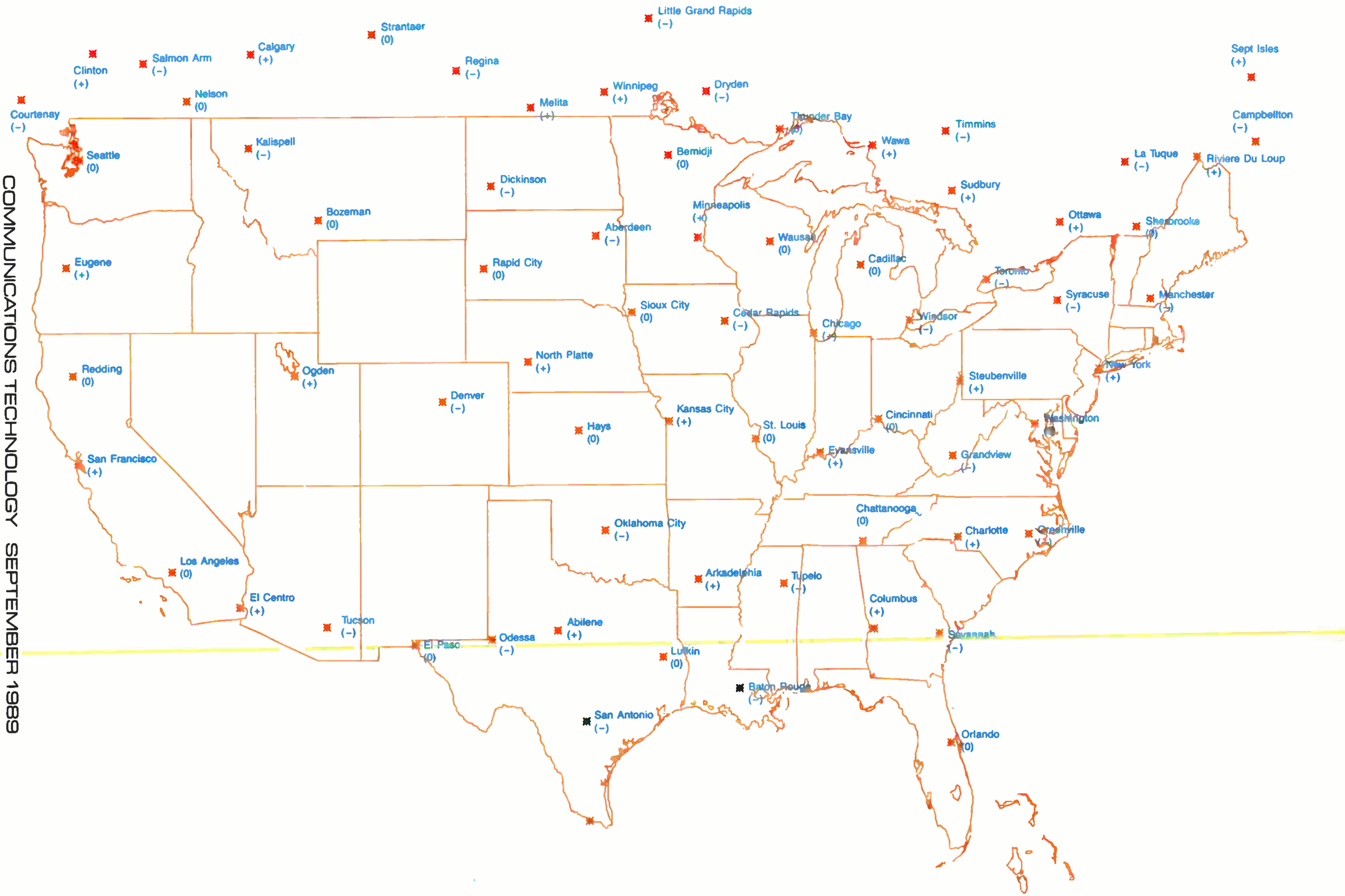
Offset: The offset frequency of the station

0	No offset
–	−10 kHz offset
+	+10 kHz offset

HAAT: Transmitting antenna height above average terrain (in feet)

Call letters	City	Network affiliation	Power	Offset	HAAT
KUAC	Fairbanks, Alaska	ED	47	+	500
KGUN	Tucson, Ariz.	ABC	110	–	3720
KETG	Arkadelphia, Ark.	ED	316	+	1080
KECY	El Centro, Calif.	CBS	316	+	1601
KHJ	Los Angeles	IND	141	0	3180
KIXE	Redding, Calif.	ED	115	0	3590
KQED	San Francisco	ED	316	+	1670
KUSA	Denver	ABC	316	–	950
WFTV	Orlando, Fla.	ABC	316	0	1570
WTVM	Columbus, Ga.	ABC	316	+	1650
WVAN	Savannah, Ga.	ED	316	–	1050
KGMD	Hilo, Hawaii	CBS	10	0	1
KGMB	Honolulu	CBS	209	–	1
WGN	Chicago	IND	110	+	1360
WNIN	Evansville, Ind.	ED	316	+	580
KCRG	Cedar Rapids, Iowa	ABC	316	–	2000
KCAU	Sioux City, Iowa	ABC	310	0	2020
KOOD	Hays, Kan.	ED	316	0	1090
WAFB	Baton Rouge, La.	CBS	316	–	1670

Call letters	City	Network affiliation	Power	Offset	HAAT
WWTV	Cadillac, Mich.	CBS	316	0	1635
KAWE	Bemidji, Minn.	ED	316	0	1080
KMSP	Minneapolis	IND	316	+	1438
WTVA	Tupelo, Miss.	NBC	316	–	1780
KMBC	Kansas City, Mo.	ABC	316	+	1070
KETC	St. Louis	ED	316	0	1078
KUSM	Bozeman, Mont.	ED	1	0	25
KCFW	Kalispell, Mont.	A/N	27	–	2794
KPNE	North Platte, Neb.	ED	316	+	1020
WMUR	Manchester, N.H.	ABC	282	–	1030
WWOR	New York	IND	48	+	1640
WIXT	Syracuse, N.Y.	ABC	80	–	1525
WSOC	Charlotte, N.C.	ABC	316	+	1190
WNCT	Greenville, N.C.	CBS	316	–	1890
KDSE	Dickinson, N.D.	ED	214	–	806
WCPO	Cincinnati	CBS	316	0	1019
WTOV	Steubenville, Ohio	NBC	316	+	950
KWTV	Oklahoma City	CBS	316	–	1520
KEZI	Eugene, Ore.	ABC	316	+	1769
KABY	Aberdeen, S.D.	ABC	316	–	1390
KBHE	Rapid City, S.D.	ED	38	0	650
WTVC	Chattanooga, Tenn.	ABC	316	0	1040
KRBC	Abilene, Texas	NBC	316	+	850
KTSM	El Paso, Texas	NBC	316	0	1910
KTRE	Lufkin, Texas	ABC	158	0	670
KTPX	Odessa, Texas	NBC	316	–	1270
KLRN	San Antonio	ED	306	–	960
KULC	Ogden, Utah	ED	166	+	2931
KCTS	Seattle	ED	316	0	830
WSWP	Grandview, W.V.	ED	316	–	1000
WAOW	Wausau, Wis.	ABC	316	0	1210
WUSA	Washington, D.C.	CBS	316	0	770
CBRT	Calgary, Alberta	CBC	178	+	1135
CFJC	Clinton, British Columbia	CBC	1	+	1700
CBUT	Courtenay, British Columbia	CBC	3	–	483
CBUC	Nelson, British Columbia	CBC	2	0	1377
CHBC	Salmon Arm, British Columbia	CBC	5	–	1
CBWZ	Little Grand Rapids, Manitoba	CBC	3	–	300
CKXT	Melita, Manitoba	CBC	1	+	215
CKND	Winnipeg, Manitoba	IND	325	+	907
CJCB	Antigonish, Maritime Provinces	CTV	260	0	902
CBAF	Campbellton, Maritime Provinces	CBC	100	–	775
CKLT	St. John, Maritime Provinces	CTV	325	+	1361
CBNA	Mt. St. Margaret, Newfoundland	CBC	29	+	931
CBWD	Dryden, Ontario	CBC	16	–	569
CBOF	Ottawa, Ontario	SRC	252	+	1394
CKNC	Sudbury, Ontario	CBC	293	+	627
CICO	Thunder Bay, Ontario	ED	32	0	780
CICA	Timmins, Ontario	ED	30	–	706
CFTO	Toronto	CTV	325	–	1532
CBLA	Wawa, Ontario	CBC	32	+	581
CBET	Windsor, Ontario	CBC	182	–	631
CBGA	Gaspe, Quebec	SRC	6	+	1400
CBME	La Tuque, Quebec	CTV	1	–	344
CIMT	Riviere Du Loup, Quebec	TVA	49	+	1149
CIVG	Sept Isles, Quebec	RRQ	246	+	718
CKSH	Sherbrooke, Quebec	SRC	325	0	1900
CBKT	Regina, Saskatchewan	CBC	250	–	675
CBKS	Strantaer, Saskatchewan	CBC	323	0	1225
XERV	Reynosa, Mexico	SP	36	0	275
WSUR	Ponce, Puerto Rico	SP	58	–	2775


Little Grand Rapids (–)
Strantaer (0)
Calgary (+)
Salmon Arm (–)
Clinton (+)
Regina (–)
Sept Isles (+)
Nelson (0)
Courtenay (–)
Winnipeg (+)
Dryden (–)
Melita (+)
Campbellton (–)
Thunder Bay
Timmins (–)
Wawa (+)
La Tuque (–)
Riviere Du Loup (+)
Seattle (0)
Kalispell (–)
Bemidji (0)
Dickinson (–)
Sudbury (+)
Bozeman (0)
Minneapolis
Aberdeen (–)
Ottawa (+)
Sherbrooke
Wausau (0)
Cadillac (0)
Eugene (+)
Rapid City (0)
Toronto (–)
Syracuse (–)
Manchester
Sioux City (0)
Cedar Rapids (–)
Windsor (–)
Chicago
North Platte (+)
Redding (0)
Ogden (+)
Steubenville (+)
New York (+)
Denver (–)
Kansas City (+)
St. Louis (0)
Cincinnati
Washington
Hays (0)
Evansville (+)
Grandview
San Francisco (+)
Chattanooga (0)
Oklahoma City (–)
Charlotte (+)
Greenville
Los Angeles (0)
Arkadelphia (+)
Tupelo
Columbus (+)
El Centro (+)
Tucson (–)
Abilene (+)
Odessa (–)
El Paso (0)
Savannah (–)
Lufkin (0)
Baton Rouge
San Antonio (–)
Orlando (0)

COMMUNICATIONS TECHNOLOGY

Name ______
Title ______
Company Name ______
Address ______
City ______ State ______ ZIP ______
Phone Number (____) ______

FREE INFORMATION

Reader Service Card

September 1989 (Valid until November 1989).

Simply circle the number(s) below corresponding to products of interest!

1 SCTE

2	16	30	44	58	72	86	100	114	128
3	17	31	45	59	73	87	101	115	129
4	18	32	46	60	74	88	102	116	130
5	19	33	47	61	75	89	103	117	131
6	20	34	48	62	76	90	104	118	132
7	21	35	49	63	77	91	105	119	133
8	22	36	50	64	78	92	106	120	134
9	23	37	51	65	79	93	107	121	135
10	24	38	52	66	80	94	108	122	136
11	25	39	53	67	81	95	109	123	137
12	26	40	54	68	82	96	110	124	138
13	27	41	55	69	83	97	111	125	139
14	28	42	56	70	84	98	112	126	140
15	29	43	57	71	85	99	113	127	141

CT 9/89

COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

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

Name ______
(please print/type)
Title ______
(please be specific)
Company Name ______
Address ______
City ______ **State** ______ **ZIP** ______
Signature ______ **Date** ______

1. Are you a member of the SCTE (Society of Cable Television Engineers)?
Yes ☐ No ☐

2. In the performance of my job, I authorize, specify or purchase products and/or services.
Yes ☐ No ☐

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

- ☐ 1. Cable TV Systems Operations
  - ☐ a. Independent Cable TV Systems
  - ☐ b. MSO (two or more Cable TV Systems)
- ☐ 2. Cable TV Contractor
- ☐ 3. Cable TV Program Network
- ☐ 4. SMATV or DBS Operator
- ☐ 5. MDS, STV or LPTV Operator
- ☐ 6. Microwave or Telephone Company
- ☐ 7. Commercial Television Broadcaster
- ☐ 8. Cable TV Component Manufacturer
- ☐ 9. Cable TV Investor
- ☐ 10. Financial Institution, Broker, Consultant
- ☐ 11. Law Firm or Government Agency
- ☐ 12. Program Producer or Distributor
- ☐ 13. Advertising Agency
- ☐ 14. Educational TV Station, School or Library
- ☐ 15. Other ______ (please describe)

CT 9/89

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 127 DES PLAINES, IL

POSTAGE WILL BE PAID BY ADDRESSEE

ONETAP® CLIP
ITW Linx.
Communications Products
201 Scott Street
Elk Grove Village, Illinois 60007

ONETAP CLIP NEEDS NO HOLES

NO MORE HOLES TO DRILL!

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 1571 ENGLEWOOD, CO

POSTAGE WILL BE PAID BY ADDRESSEE

ct PUBLICATIONS CORP.

P.O. Box 3208
Englewood, CO 80155-9929

Place Stamp Here

ct PUBLICATIONS CORP.

P.O. Box 3208
Englewood, CO 80155-9929

μV/m to dBμV/m conversions

By Ron Hranac
Jones Intercable Inc.

A commonly used method of expressing RF field strength is microvolts per meter (μV/m). In fact, two Federal Communications Commission standards for CATV signal leakage are 20 and 50 μV/m. International standards often go an additional step and express field strength as decibels relative to 1 μV/m, or simply dBμV/m. The table below provides conversions between dBμV/m and μV/m in 1 dB steps from −40 to +60 dBμV/m. The following formulas were used to create the table, and examples of their use follow.

$$\text{dB}\mu\text{V/m} = 20\log\left(\frac{\mu\text{V/m}}{1\ \mu\text{V/m}}\right)$$

$$\mu\text{V/m} = 10^{\left(\frac{\text{dB}\mu\text{V/m}}{20}\right)}$$

dBμV/m	μV/m	dBμV/m	μV/m	dBμV/m	μV/m	dBμV/m	μV/m
−40	0.01	−14	0.1995	12	3.981	36	63.096
−39	0.0112	−13	0.2239	13	4.467	37	70.795
−38	0.0126	−12	0.2512	14	5.012	38	79.433
−37	0.0141	−11	0.2818	15	5.623	39	89.125
−36	0.0158	−10	0.3162	16	6.310	40	100
−35	0.0178	− 9	0.3548	17	7.079	41	112.202
−34	0.0199	− 8	0.3981	18	7.943	42	125.893
−33	0.0224	− 7	0.4467	19	8.913	43	141.254
−32	0.0251	− 6	0.5012	20	10	44	158.489
−31	0.0282	− 5	0.5623	21	11.220	45	177.828
−30	0.0316	− 4	0.6310	22	12.589	46	199.526
−29	0.0355	− 3	0.7079	23	14.125	47	223.872
−28	0.0398	− 2	0.7943	24	15.849	48	251.189
−27	0.0447	− 1	0.8913	25	17.783	49	281.838
−26	0.0501	0	1	26	19.953	50	316.228
−25	0.0562	1	1.122	**26.02**	**20**	51	354.813
−24	0.0631	2	1.259	27	22.387	52	398.107
−23	0.0708	3	1.413	28	25.119	53	446.684
−22	0.0794	4	1.585	29	28.184	54	501.187
−21	0.0891	5	1.778	30	31.623	55	562.341
−20	0.1	6	1.995	31	35.481	56	630.957
−19	0.1122	7	2.239	32	39.811	57	707.946
−18	0.1259	8	2.512	33	44.668	58	794.328
−17	0.1413	9	2.818	**33.98**	**50**	59	891.251
−16	0.1585	10	3.162	34	50.119	60	1000
−15	0.1778	11	3.548	35	56.234		

Examples

Problem: You have just located a leak in your system that is 37 μV/m. What is that field strength in dBμV/m?

Solution: Use the formula:

$$\text{dB}\mu\text{V/m} = 20\log\left(\frac{\mu\text{V/m}}{1\ \mu\text{V/m}}\right)$$

$$= 20\log\left(\frac{37\ \mu\text{V/m}}{1\ \mu\text{V/m}}\right)$$

$$= 20\log(37)$$

$$= 20(1.5682)$$

$$= 31.36\ \text{dB}\mu\text{V/m}$$

Problem: National standards for signal leakage in your overseas cable system require that the field strength of any leaks over a certain frequency range not exceed +13 dBμV/m at a measurement distance 10 meters from the cable. What is that limit in μV/m?

Solution: Use the formula:

$$\mu V/m = 10^{\left(\frac{dB\mu V/m}{20}\right)}$$
$$= 10^{\left(\frac{13}{20}\right)}$$
$$= 10^{0.650}$$
$$= 4.467\ \mu V/m$$

Problem: What would be the corrected dipole level, in dBmV, for the previous problem if the measurement frequency is 124 MHz and the distance at which the leak is measured has been changed to three meters (disregarding effects of reflections from nearby objects)?

Solution: First, convert the leak's field strength from μV/m to microvolts (μV) using the formula:

$$\mu V = \text{microvolts per meter}/0.021/\text{frequency in MHz}$$
$$= 4.467/0.021/124$$
$$= 1.715\ \mu V$$

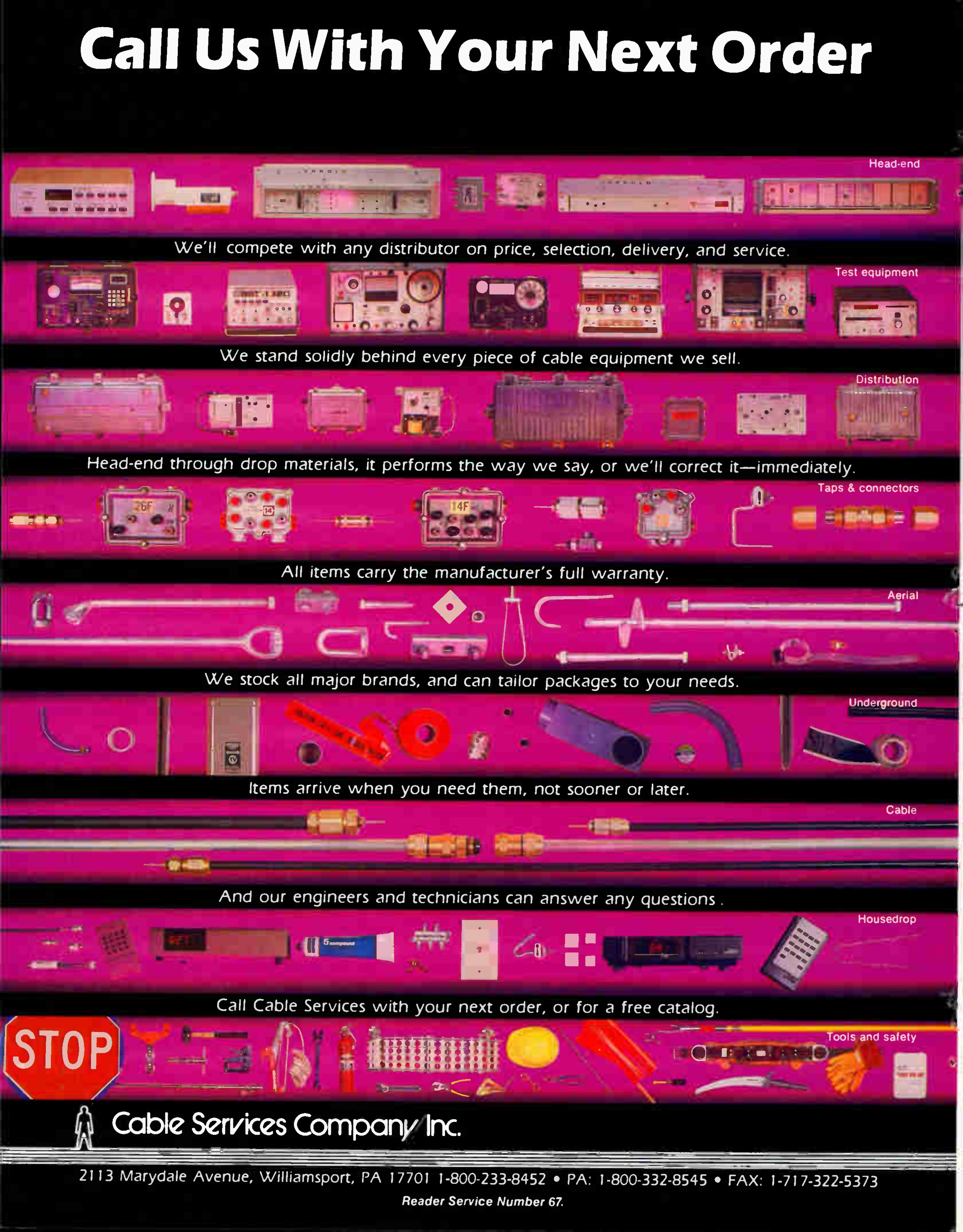
Next, convert from μV to dBmV using the formula:

$$dBmV = 20\log\left(\frac{\mu V}{1{,}000}\right)$$
$$= 20\log\left(\frac{1.715}{1{,}000}\right)$$
$$= 20\log(0.001715)$$
$$= 20(-2.765625)$$
$$= -55.31\ dBmV$$

This is the corrected dipole level 10 meters from the cable. To determine what the theoretical level would be three meters from the cable, you need to calculate a distance correction factor to add to the 10-meter level using the formula:

$$\text{Distance correction in dB} = 20\log\left(\frac{\text{measured distance}}{\text{reference distance}}\right)$$
$$= 20\log\left(\frac{10\ \text{meters}}{3\ \text{meters}}\right)$$
$$= 20\log(3.33)$$
$$= 20(0.5229)$$
$$= 10.46\ dB$$

Adding this correction factor to the 10-meter dipole level will provide the three-meter measurement level: $-55.31 + 10.46 = -44.85$ dBmV.



Call Us With Your Next Order
Head-end
We'll compete with any distributor on price, selection, delivery, and service.
Test equipment
We stand solidly behind every piece of cable equipment we sell.
Distribution
Head-end through drop materials, it performs the way we say, or we'll correct it—immediately.
Taps & connectors
All items carry the manufacturer's full warranty.
Aerial
We stock all major brands, and can tailor packages to your needs.
Underground
Items arrive when you need them, not sooner or later.
Cable
And our engineers and technicians can answer any questions .
Housedrop
Call Cable Services with your next order, or for a free catalog.
STOP
Tools and safety
Cable Services Company Inc.
2113 Marydale Avenue, Williamsport, PA 17701 1-800-233-8452 • PA: 1-800-332-8545 • FAX: 1-717-322-5373
Reader Service Number 67.

Help Wanted

UVC

LINE/MAINTENANCE TECHNICIANS

Experienced for 450 MHz addressable systems in Central Massachusetts (immediately) and So. New Hampshire. Responsibilities include: system preventative maintenance/system sweep, leakage, outage control, design of line extensions.

Please send resumes with references to: **United Video Cablevision, Inc., 7 Lomar Park, Pepperell, MA 01463 Att: Joan.** Equal oppty. employer M/F/H/V. Minorities encouraged to apply.

MAINTENANCE TECHNICIAN

Continental Cablevision of Fresno, California is seeking qualified candidate for technical position. A thorough knowledge of Trunk and Distribution Maintenance is a must. Call or send resume to:

Continental Cablevision of Fresno
1945 N. Helm Ave.
Fresno, CA 93727
(209) 252-8210

Palmer CableVision

Headend/Microwave Technician
Fast growing Palm Springs area Cable Company has full time openings. Challenging position, advancements, and good benefits. Must have a valid drivers license and good driving record.

Send resume to or call:

Palmer CableVision
Personnel
41-725 Cook Street
Palm Desert, CA 92260
(619) 340-1312

Call
(303) 792-0023
for classified ad placement!

UNDERGROUND PERSONNEL AND SPLICERS NEEDED

Long-term employment
CONTACT:
EARLY & SONS
(508) 374-8033
Fax (508) 374-1876

Wanted to Purchase

Scrap Problem
No Problem

Best prices for reck out
COAXIAL CABLE

Iron Man Metal's
(619) 329-IRON

Best service with
MOBIL COILER FOR
ROAD SIDE PICK UP

Fully Licensed
Insured and Bondable
Reference Available

Equipment Repair

CABLE WAREHOUSE & REPAIR

BUY, SELL AND RECONDITION CATV EQUIPMENT

CALL OR WRITE
CABLE WAREHOUSE & REPAIR
2042 TIFFIN AVENUE
FINDLAY, OHIO 45840
419-422-3242

Ask for Tom

QUALITY REFURBISHED CATV EQUIPMENT
(614) 221-3131
CABLE LINK, INC.

REPAIR OR REMANUFACTURE THE AMERICAN WAY

American Instrument Repair Service Company
303 762 9045
2895 WEST OXFORD #7
ENGLEWOOD, CO 80110
1/800-289-2477

SALES AND DISTRIBUTION:
Fiber-optic—Test Equipment, Fusion Splicers, Cleavers, Pulling Equipment, Marking Tape, Duct Plugs.
Tools—Pneumatic, Hydraulic, Hand.

CABLE LOCATION EQUIPMENT

REPAIR/REMANUFACTURE OF:
Water Pumps, Generators, Air Compressors, Air Dryers, Heaters, Blowers, Van & Trailer Modules, Refurbish and Retrofit.

REPAIR/CALIBRATION OF:
Test Equipment.

"The Cable Equipment Repair People"

- Line Amplifiers and Headend Equipment Repaired All Makes And Models
- Signal Level Meters Repaired and Calibrated
- Flat Rate Labor Plus Parts

For reliable, guaranteed repairs, please send your cable equipment to ACS.

ADVANCED CABLE SERVICES
Division of Aaron Communication Services Inc.
2045 S. Valentia St., Suite 4
Denver, CO 80231
FAX: (303) 337-3084
Call (303) 337-4811

ACS
We Market Used Equipment

Commercial Video Cypher Repairs
Fast Turnaround — **Tulsat Corp.**
1575 N. 105th Ave., Tulsa, OK 74116
(918) 836-8348

Wanted To Purchase or Trade
Dead or Alive VC II's
Red, White or Yellow Label
(918) 836-8401

Equipment For Sale

END OF SUMMER SALE

Biddle 433F TDR	$1995
Riser Bond 2901B+ TDR (New)	$649
Comsonics SA 440B w/stor. MF 450 MHz Spec. Analyzer	$1995
TEX VSM2E 1000 MHz Spec. Ana.	$1495
TEK 7L13 w/MF 1800 MHz Spec. Analyzer	$4995
TEK 147A Vid. Test Gen. w/Noise Meas.	$1495
TEK 1430 Noise Meas. Sys.	$1295
TEX Spectrum 700, 600 MHz FSM	$895
Wavetech Bench Sys.	$1495

EMS
(800) 234-7434

Equipment For Sale

AMS ANTHONY'S MANUFACTURING SERVICE

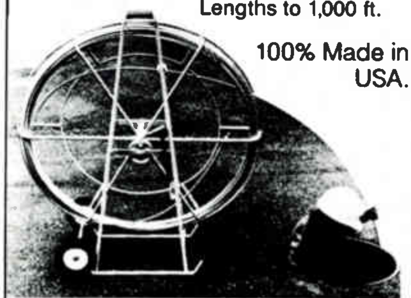
PLOW BLADES
Irrigation/Wire/Combination
For Any Machine—For Any Application
(800) 383-PLOW
(719) 475-PLOW P.O. Box 17701
Colorado Springs, CO 80935

MAKE YOUR TIME PAYOFF

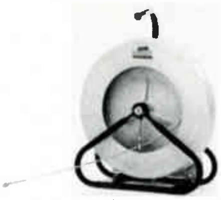
CONTINUOUS FIBERGLASS DUCT ROD AND PAYOUT REEL
It is ideal for use in the installation of Fiber Optic cable and Standard Pair cable . . . Extremely handy in occupied ducts . . . entire unit is portable . . . used from Manhole to Subsidiary Ducts and at poles away from the street location, straightaway runs, in buildings, etc.

Big Buddy®
Lengths to 1,000 ft.

100% Made in USA.



Little Buddy®
Fish conduit as small as ¾".



- Lengths to 300 ft.
- Now high impact polymer cannister
- Tool weighs only about 20 lbs.

Field repair/accessory kits included with all rodders.

JAMESON
CORPORATION • SINCE 1956
P.O. Box 240277 Charlotte, NC 28224
Telephone 704/525-5191 FAX 704/522-6161

To Place A Classified Ad Call Barbara Bellomo at 1-303-792-0023

Professional Services

ANALOG RF DIGITAL ENGINEERING RESOURCE

30 YEARS EXPERIENCE
FOR DETAILS CALL OR WRITE

SERENICS, INC.
129 SOUTH TAFT AVENUE
CHALFONT, PA 18914
TELEPHONE (215) 822-8249

CABLE SEARCH ASSOCIATES
Professional Search and Placement
Call or Write
WICK KIRBY
(312) 369-2620
P.O. Box 2347
Naperville, IL 60565

EJB MANUFACTURING CO
5662 LaRibera, Suite E
Livermore, CA 94550
(415) 443-8619

- Foldup & Carry Cable Caddy
- Aluminum Cable Clips—Single & Dual
- Mini Wrench 7/16"—Plastic or Aluminum
- Jumpers Any Size
- VCR Switch Kits
- "Work Area" Signs
- Aluminum Tie Strap Holder

Cable Technical Services

- Construction
- Engineering

Contact: **Jerry Blount**
214-241-4169

P.O. Box 29085, Dallas, TX 75229

CABLE CONSTRUCTORS, INC.
IRON MOUNTAIN, MICHIGAN
COAX - FIBER
QUALITY SERVICE PERFORMED ON A TIMELY BASIS
- SINCE 1957 -
MAPPING - DESIGN - CONSTRUCTION - ENGINEERING
CABLE CONSTRUCTORS, INC.
1-800-338-9292
KLUNGNESS ELECTRONIC SUPPLY (KES)
1-800-338-9299

SYSTEMS WEST

- CATV/LAN Design
- Base/Strand/Asbuilt
- Digitizing/Scanning
- Applications Programming
- CAD Sales/Training/Rentals
- AutoCAD CATV Software
- AutoCAD Specialist
- Mobile Operator

22 Banyan Tree • Irvine, CA 92715 • (714) 857-2885

215-676-9161

TONY MESSINA
CATV CONTRACTOR

For All Your Design Needs, Big Or Small

P.O. Box 639
Huntingdon Valley, PA 19006

SYSTEM DESIGN
DRAFTING

- Aerial & Underground Construction
- Strand Mapping
- System Design
- Residential & MDU Installations
- Subscriber Audits
- Proof of Performance
- Fiber Optics and L.A.N. Services

Cablemasters Corp.
Our Name Says It All

Contact:
Bernie Czarnecki
(814) 838-1466
P.O. Box 219
Lake City, PA 16423

"Driven By Excellence"

- Aerial Rebuilds/Newbuilds
- Fiber Optics
- Upgrades
- Underground

ECC *Excel* **Cable Construction, Inc.**

P.O. Box 57245
Jacksonville, FL 32241-7245
(904) 260-3499

R. R. (Rich) Barks
E. D. (Dan) Stone
National Sales Representatives
Cable Television
Services

1111 Woods Mill Road
Ballwin, MO 63011
(314) 891-4123
1-800-443-0738

Fiber Optic and Coaxial System Designs
Turnkey Installation Services
On Site Project Management
System Design (D3 Program)
CLI Surveys (including MTCE Services)
Mapping Services (Base, Strand, As Built) Linex CAD System

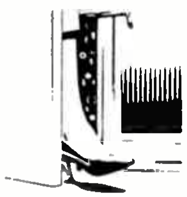
AT&T

- Aerial - Underground Construction
- Mapping Services (Base, Strand, Asbuilt)
- System Design (Coaxial, Fiber, LAN)
- On Site Project Management
- Engineering Services
- MDU Prewire/Postwire
- Drop Services
- All Phases Fiber Optics

ROCKY MOUNTAIN
COMMUNICATIONS, INC.

P.O. Box 452
Kiowa, Colorado 80117
(303) 621-2820

Let your classified ad get through the door!



Call (303) 792-0023 for placement!

CT PUBLICATIONS CORP.

Barbara Allen Bellomo
Classified Ad Manager

COMMUNICATIONS TECHNOLOGY • INSTALLER/TECHNICIAN

12200 E. Briarwood Ave. • Suite 250 • Englewood, Colo. 80112 • (303) 792-0023
Mailing Address: P.O. Box 3208 • Englewood, Colo. 80155
TELEFAX (303) 792-3320

September

Sept. 6: SCTE North Country Chapter technical seminar on signal processing centers, Sheraton Midway Hotel, St. Paul, Minn. Contact Doug Ceballos, (612) 522-5200.

Sept. 6-9: Hawaii Cable Television Association annual convention, Hyatt Regency, Waikoloa, Hawaii. Contact Kit Beuret, (808) 834-4159.

Sept. 7: SCTE Mount Rainier Chapter technical seminar on signal processing centers. Contact Sally Kinsman, (206) 821-7233.

Sept. 8-11: National Association of Telecommunications Officers and Advisors annual conference, Hyatt Regency at Gainey Ranch, Scottsdale, Ariz. Contact (602) 991-3388.

Sept. 9-12: Pacific Northwest Cable Communications Association annual convention, Cavanaugh's Inn at the Park, Spokane, Wash. Contact Dawn Nielsen, (509) 765-6151.

Sept. 10-12: SCTE Dakota Territories Meeting Group technical seminar on CLI, Sylvan Lake Lodge, Hills City, S.D. Contact A.J. VandeKamp, (605) 339-3339.

Sept. 11-12: Wisconsin Cable Communications Association annual convention, Concourse Hotel, Madison, Wis. Contact Lynne Walrath, (608) 256-1683.

Sept. 11-13: Wireless Cable Association convention, Hyatt Crystal City, Arlington, Va. Contact (202) 452-7283.

Sept. 11-14: Siecor Corp. technical seminar on fiber-optic installation and splicing for LAN, building and campus applications, Hickory, N.C. Contact (704) 327-5539.

Sept. 11-15: Hughes Microwave technical seminar on channelized AML equipment, Torrance, Calif. Contact (213) 517-6244.

Sept. 12: SCTE Florida Chapter's Central Florida Group technical seminar, Holiday Inn North, Lakeland, Fla. Contact Denise Turner, (813) 626-7115.

Sept. 12-14: Magnavox CATV technical seminar, Columbus, Ohio. Contact Amy Costello Haube, (800) 448-5171.

Sept. 13: SCTE Florida Chapter's Gulf Coast Group technical seminar. Contact Denise Turner, (813) 626-7115.

Sept. 13: SCTE Oklahoma Chapter technical seminar on fiber optics, Applewoods Restaurant, Oklahoma City. Contact Herman Holland, (405) 353-2250.

Sept. 14: SCTE Golden Gate Chapter seminar on equal employment issues, Italian Gardens Restaurant, San Jose, Calif. Contact John Parker, (408) 437-7600.

Sept. 14: SCTE Gateway Chapter technical seminar. Contact Darrell Diel, (314) 576-4446.

Sept. 14: SCTE Big Country Meeting Group technical seminar, San Angelo, Texas. Contact Albert Scarborough, (915) 698-3585.

Sept. 16: SCTE Cactus Chapter technical seminar. Contact Harold Mackey Jr., (602) 866-0072.

Sept. 17-19: Kentucky Cable Television Association annual convention, Marriott Resort, Lexington, Ky. Contact Randa Wright, (502) 864-5352.

Sept. 18-20: Magnavox CATV technical seminar, Detroit. Contact Amy Costello Haube, (800) 448-5171.

Sept. 19-21: C-COR Electronics technical seminar, Dallas. Contact Binky Lush, (814) 238-2461.

Sept. 20: SCTE North Country Chapter BCT/E testing. Contact Douglas Ceballos, (612) 522-5200.

Sept. 20: SCTE Razorback Chapter technical seminar, Days Inn, Little Rock, Ark. Contact Jim Dickerson, (501) 777-4684.

Sept. 20: SCTE Dairyland Meeting Group technical seminar. Contact Bruce Wasleske, (715) 842-3910.

Sept. 20-22: Great Lakes Expo, Convention Center, Columbus, Ohio. Contact Dixie Russell, (614) 272-0860.

Sept. 20-22: SCTE Great Plains Meeting Group technical seminar on signal leakage and CLI compliance, Red Lion Inn, Omaha, Neb. Contact Jennifer Hays, (402) 333-6484.

Planning ahead

Oct. 3-5: Atlantic Show, Convention Center, Atlantic City, N.J.

Oct. 17-19: Mid-America Show, Hilton Plaza Inn, Kansas City, Mo.

Dec. 13-15: Western Show, Convention Center, Anaheim, Calif.

Feb. 21-23: Texas Show, Convention Center, San Antonio.

May 20-23: National Show, Convention Center, Atlanta.

June 21-24: Cable-Tec Expo, Nashville, Tenn.

Ad insertion

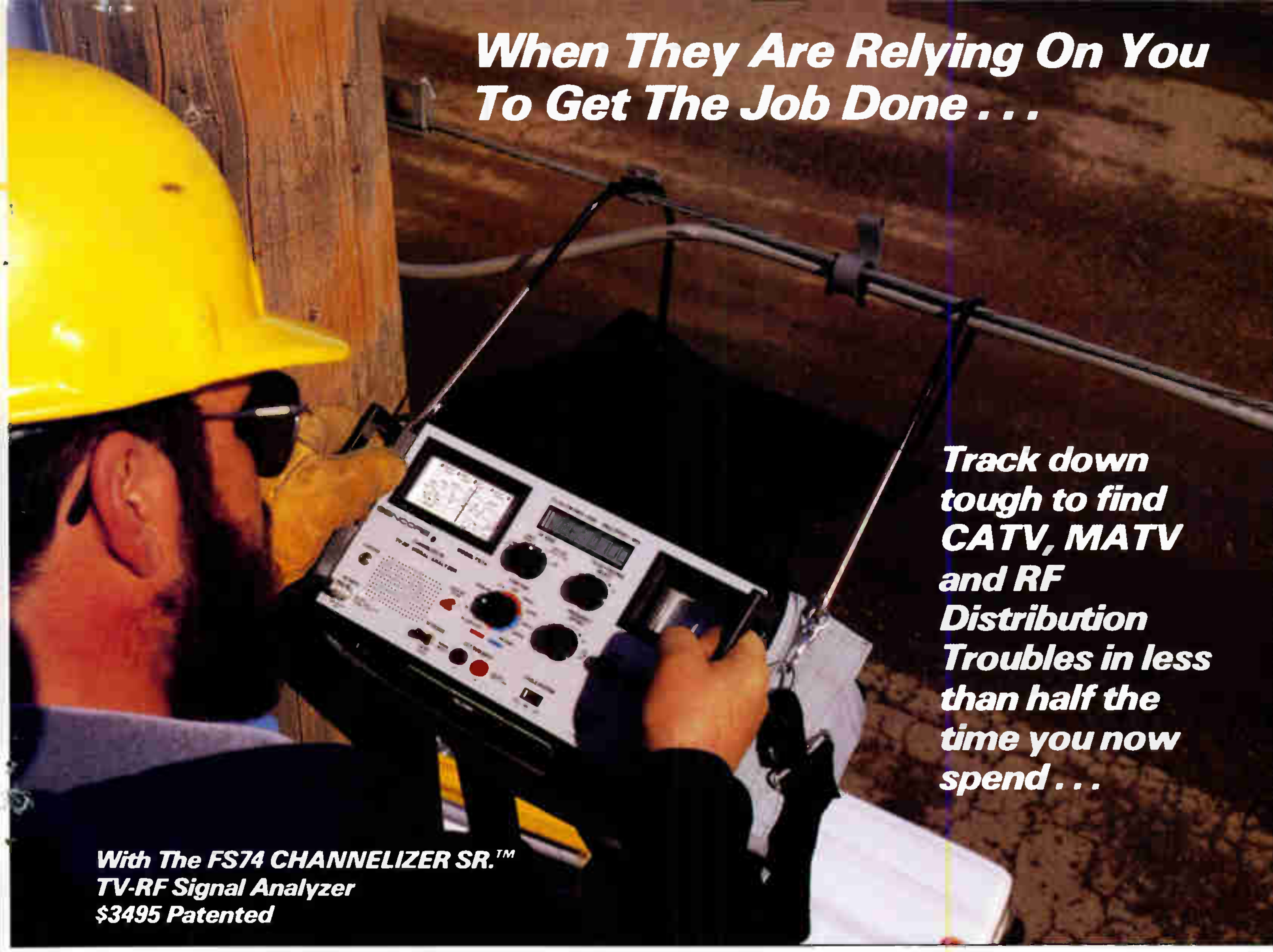
(Continued from page 71)

band digital subcarrier. In addition to removing cues from program audio, digital transmission provides the programmer with options not available with analog systems. These options include cue tiering (the ability to transmit different DTMF sequences for different functions), addressing and the transmission of electronic mail to headend printers.

Figure 5 shows the basic headend configuration for a digital cue system. A digital demodulator outputs DTMF to the commercial inserter, which functions identically to the analog subcarrier system previously described. An RS-232 data output to a local or remotely located printer provides hard copy information transmitted by the network. Additional data outputs, a contact closure or other functions can be digitally controlled from the uplink to provide a number of other capabilities at the headend.

Ensuring success

Local ad insertion has sustained significant growth both by cable programmers and systems over the last few years and will continue its rapid pace. Commercial controllers are becoming more complex and cue transmission systems increasingly sophisticated. New companies are available to provide headend services ranging from advertising production to complete turnkey equipment installation, maintenance and operation. You will find that local commercial insertion can become an important revenue enhancement for your system. Understanding both the equipment and methods involved will help ensure your success.



When your customers are relying on you to get the job done, you need reliable and accurate test results . . . without having to worry about calculations that can add errors and time to your system tests.

The FS74 CHANNELIZER SR. eliminates errors and saves you time with 100% automatic and exclusive tests you can trust.

- All Channel DIGITAL tuner (5-890 MHz) covers all Sub-band, VHF, UHF, FM Cable Channels.
- Exclusive Frequency offset readout alerts you to carrier shifts.
- Integrated Wide-band monitor lets you see the system problems your customer sees that regular TVs don't.
- 5uV sensitivity (-46dB) with autoranged attenuators make CLI tests a snap.
- Automatic S/N and Hum tests on any IN-USE channel.
- Built-in DVM tests AC/DC Voltage and resistance.

The FS74 CHANNELIZER SR. gives you one integrated CATV and MATV troubleshooting and performance testing system that you can rely on to get the job done . . . fast.

Reader Service Number 61.

Call 1-800-843-3338 or write for a 10 Day Video Preview on the FS74!
(In Canada, call 1-800-851-8866)

SENCORE

3200 Sencore Drive Sioux Falls, South Dakota 57107

ATV and the consumer electronics interface

By Walter S. Ciciora, Ph.D.
Vice President of Technology
American Television and Communications Corp.

"The ultimate disaster would be to need another $100 ugly box on top of the ATV receiver because we didn't prepare."

Advanced TV (ATV) and its ultimate version high definition TV (HDTV) are almost certainly a part of our future. What isn't certain is how or when. As I've stated before in this column, I believe it will take years—perhaps as many as 12—to reach 1 percent market penetration and 15 years or so to reach 10 percent penetration. The biggest danger in these projections is that we conclude that we have all the time in the world. In the area of the consumer electronics interface, work needs to be done now. Standards setting and relationship building between the two industries takes years.

There are three areas of concern: what needs to be done 1) at the headend, 2) in the outside plant and 3) in the home. The standards selection process will control the first two items; our relationships and cooperation with the consumer electronics industry will govern the last.

Outside the home

Our hope for the headend is that most of our current satellite receivers and modulators will work. If not, modification kits would be desirable. In the worst case we may have to replace some of this equipment. This would be an unwelcome expense but probably not a disaster.

We would like the outside plant to pass the signal without having to be modified. This occurs in two stages. First, will the signal pass and produce an acceptable picture on relatively small screens? Second, will it produce competitive, even great pictures on really big screens? The answer for most of the ATV proponents is probably "yes" to the first question and likely "no" to the second.

But that's fine. The first ATV receivers are likely to be very expensive and of relatively small screen size. Penetration will take quite a while. If the signal can pass through unmodified cable systems as they exist five or six years from now, subscribers will be well-served, no major capital outlays will be required and subscription rates will not be affected. This last point is important since 99+ percent of subscribers won't have ATV receivers for at least 10 years. They won't be happy paying more so that less than 1 percent of their well-to-do neighbors can have ATV!

The second step comes when the penetration of ATV receivers is 10 percent or so and really large screens become available. Then it will be very important to have lower noise and distortion. Noise that is just little dots on today's screens will be large dancing blobs on the big ATV screen. Estimates on the required improvement in signal-to-noise ratio range from 3 to 10 dB. Similarly, composite triple beat and other results of non-linearities will have to be suppressed.

If these improvements are required over a span of 10 or 15 years, the normal evolution of hardware and the normal upgrade of cable systems should accommodate it with very modest expense and little hassle. I believe most cable systems will be ATV-ready before most subscribers can afford to buy ATV receivers. But that's *if* the standard selected isn't unfavorable to cable. That's where our investment in Cable Labs should really pay off.

Inside the home

The third area of major concern over ATV is in the home. Converters and converter/descramblers have been a real headache for the cable industry. While they have brought benefits (such as addressability), converters and descramblers have been the source of substantial problems. They are a major capital expense, as an operating expense their repair and maintenance are beyond expectations, they are a reliability hazard and they are the major cause of consumer electronics interface problems. And in the era of ATV, they should be unnecessary.

Our goals in working with the consumer electronics industry include a suitable MultiPort plug for descrambling, adequate tuning range for cable's 1 GHz systems of the future, solid tuner performance for quality pictures, no direct pickup problems, a friendly interface to the VCR and a convenient way of doing pay-per-view through the consumer's remote control. In the event that an augmentation channel approach to ATV becomes the standard, we need an appropriate way of controlling the second tuner.

As I mentioned in a previous column, cable *may* need to have its own transmission standard in order to compete with pre-recorded media such as discs and tapes. This will be the case only if there is a difference noticeable by the consumer between the pictures produced from an ATV VCR and those from cable. This is not expected to be the case on moderate-sized screens but becomes a concern when truly big screens become available in the home. In that environment, the special cable signal probably should be a compatible augmentation channel for the basic ATV signal. In this way, adapter boxes can be provided on an interim basis to feed the video inputs of older ATV receivers. By that time, if we have an excellent working relationship with the consumer electronics industry and if cable penetration reaches the 75 to 80 percent levels, new "cable ready" TVs will have all the correct circuits built in.

If we can achieve a scrambling standard, perhaps the descrambler will be built into the TV set. At this point it is not perfectly clear whether this is a good idea or not. We have plenty of time to work this out, as long as early receivers and VCRs have a MultiPort plug to accept external descramblers.

There is a good reason to be optimistic that we can evolve in a rational manner. However, there are many ways to get off the track. The ultimate disaster would be to need another $100 ugly box on top of the ATV receiver because we didn't prepare.

The importance of cooperation

Like it or not, we are currently setting precedents that will impact our ability to work with the consumer electronics industry on ATV. A pattern of cooperation (or lack of cooperation) is being established. The principal item is the EIA MultiPort. The consumer electronics industry has made major investments—measured in tens of millions of dollars—in putting the plug on the back of selected TV models. The ball is now in our court to harvest the results. If we take advantage of this opportunity, the cable industry will benefit as well as our subscribers and the TV manufacturers. Most importantly, we will be paving the way for future cooperation with the consumer electronics industry over ATV.

IMPORTANT NEWS FOR CATV SYSTEM OPERATORS.

WESFLEX. HORIZON CABLE.

Your Number One CIC Connection In The Western States.

Wesflex and Horizon Cable/TVC Supply companies are teamed up to deliver affordable and reliable CIC materials on time—when and where you want them. From trunk to distribution to drop cable protection conduit, we have it all.

Better protection for your buried cable plant translates into better signal quality, better reliability, better subscriber service and better return on your investment.

That's why CATV Systems Operators in the West rely on FLEX-CON™ Conduit to protect their buried cable plants. Friendly to fiber and coax, FLEX-CON™ can be your strongest link from headend to hub to home.

Get the facts about prices and delivery on our FLEX-CON™ Conduit with cable installed, drop-in or empty with pull cords. Call Wesflex, Inc. or Horizon Cable/TVC Supply—**Your Number One Cable Connection.**

TVC SUPPLY COMPANY INC.

1716 E. Chocolate Avenue
Hershey, PA 17033
Telephone: 717/533-4982
Facsimile: 717/533-6592

HORIZON
CABLE · SUPPLY

1021 Calle Recodo
San Clemente, CA 92672
Telephone: (714) 361-2011
Facsimile: (714) 361-2106

WESFLEX
INCORPORATED
A UNIT OF UTILITECH SERVICES CORPORATION

1880 Garden Tract Road
Richmond, CA 94801
Telephone: 415/233-6670
Facsimile: 415/237-7322

Reader Service Number 62.

What's the CATV business?

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

Some 25 or so years ago, the cable industry yearned to become as essential to the public as the telephone. A few systems actually provided the only way people could receive television at all. But while they enjoyed 80 or 90 percent penetration, others had to survive with the 35 or 40 percent who did not mind paying a small fee for more (or better) television.

So the search began for ways to convert the broadband spectrum into increased penetration. We reached out farther and farther for distant channels with mountaintop antennas, microwave and massive parabolic "tropospheric scatter" reflectors. We developed mechanical monster weather boards, pointed cameras at the news wire teletypewriter and even televised the colorful action in a tropical fish tank.

Then came "auxiliary services": non-video, generally non-entertainment telecommunications, based on the new bidirectional technology. Ideas tumbled out in great profusion. Remote home security alarm, meter reading, direct merchandising, home banking, games, electronic mail, opinion polling, traffic signal control, automatic vehicle location and the list goes on.

Research Council

A special affiliate of the National Cable Television Association was formed, called the Research Council. Leonard Reinsch was chairman and Frank Nowaczek was executive director. The council was directed to investigate and evaluate whether auxiliary services could increase penetration and provide new revenue streams. We looked at home security and discovered what the industry learned 10 or 15 years later. Home security is another business, with its own structure, responsibilities and liabilities. We were advised of the liability that would result in the event of a fire or break-in when the cable plant was out of service because of power failure, blown fuse or even a collision between a truck and a telephone pole. When we connected an automatic telephone dialer backup as required by the Underwriters Labs, we discovered that it was cheaper and more reliable than our own lovely cable system.

Meter reading and load management also looked like a natural. All we needed was to devise a simple magnetic sensor to count the revolutions of the damping disk in the meter. A piece of cake. But again, what happens when the system is down—would the utility customer get free service? So we found that we would need storage devices to record usage during the system downtime. And how can you be sure there is no cumulative loss of counts for some reason? So we needed some kind of automatic recalibration technique to get back on track. In those days, meters could be read manually for 25 to 50 cents a month; how could you beat that? So where was the profit?

Irving Kahn demonstrated his Key TV at the Miami NCTA convention in 1960. The viewer had a control box with two buttons marked "A" and "B." The product—such as a ball point pen that would write underwater—was displayed on the CATV downstream channel. If you want to purchase a red one, press "A"; blue, press "B"; and if you want a green one, press both buttons together. The service never materialized.

A well-financed venture recently proposed a modernized, high-tech version of Kahn's Key TV merchandising idea, using the touch-tone telephone keypad to communicate with a computer catalog of merchandise. It was a great idea but it would require enormous catalog preparation, warehousing and delivery facilities. Perhaps it failed because of awkward technology that could have been overcome eventually. But maybe it was just too great a leap forward in lifestyles to be easily accommodated by an unsuspecting public. Yet even this did not rely on the upstream capability of the cable plant. It used the telephone instead.

A dreary record

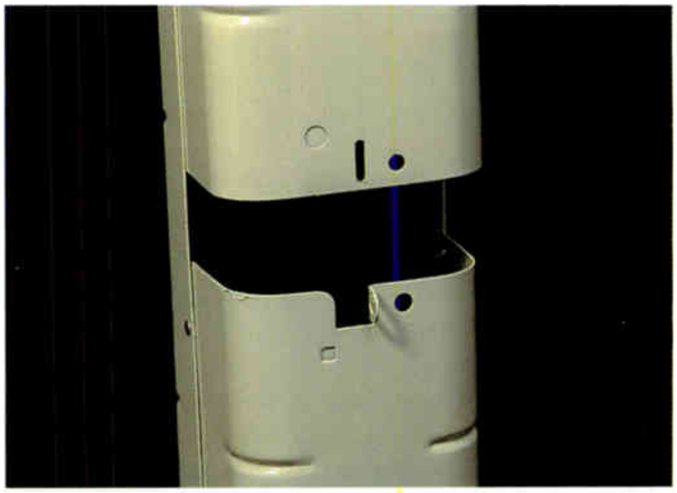
Maybe this dreary record is telling us that access to a diverse complement of entertainment, real-time news reports and information of general interest like weather, health and legislative activity is, in itself, a successful enterprise without the complexities of inefficient and largely useless two-way capability. But if some of us want to be in the remote home security business, the merchandising business or even the telephone business—go to it. The synergism between such non-entertainment and the cable business is not really any less evident than it is between the car rental business and the TV networks. It may be that some of the fiber already being installed by cable operators could be used for commercial telecommunications. I suspect, however, that such services are more likely to utilize the spare fibers in the cable than to multiplex services directly onto fibers intended primarily for CATV.

The cable industry has done a superb job of providing a diverse basket of entertainment and informational services to the home. Broadcasters cannot match the special interest niche-type programming that attracts subscribers to cable TV even while they spend most of the time viewing mass appeal network programs. Videotapes provide an enormous variety of programming, some of which is not available either on cable or off-the-air. But they cannot provide real-time news, sports or special events. Cable TV is the only medium capable of doing it all.

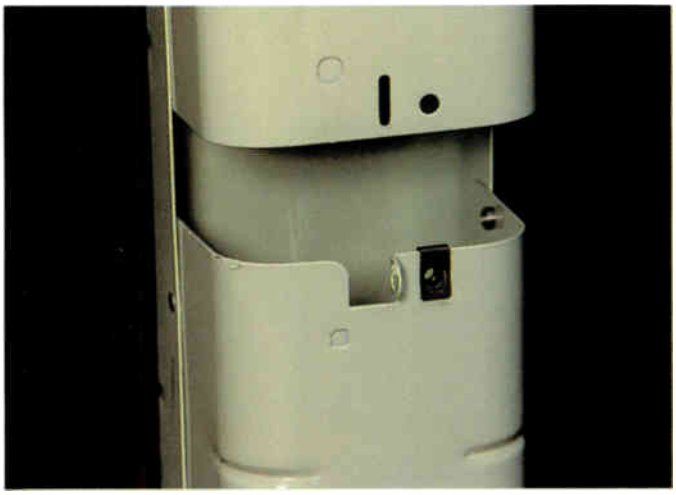
We should keep our eyes on the ball. If this industry is to continue to prosper, it must continue to improve the quantity and quality of its product and service to its customers. The status quo is not good enough. Neglecting our basic business while looking for new fields to conquer could expose our flanks to the predators waiting out there for the opportunity to attack.

FAST FIELD SECURITY FOR YOUR CABLE TV PEDESTAL

Pedestal cover with knock out in place.



Knock out is easily removed with hammer and ordinary screwdriver.



Locking clip fits over pedestal in seconds.

Star Lock is tightened and removed only with special screwdriver type key for maximum security.

Only Reliable pedestals come with factory-provided knock outs for installing **Diversified Control Systems** Star Locks.

A small but important feature... because it provides maximum security for cable TV pedestals or apartment boxes fast and easy right in the field.

Hasp broken or missing? No problem. Diversified's Star Locks are designed to deliver a secure closure without using the hasp.

It's a great combination: Star Locks and Reliable Electric, the best-selling pedestals in the industry. And you can get them both from one trusted source: Anixter Cable TV.

RELIABLE

RELIANCE COMM/TEC

+

ANIXTER® CABLE TV

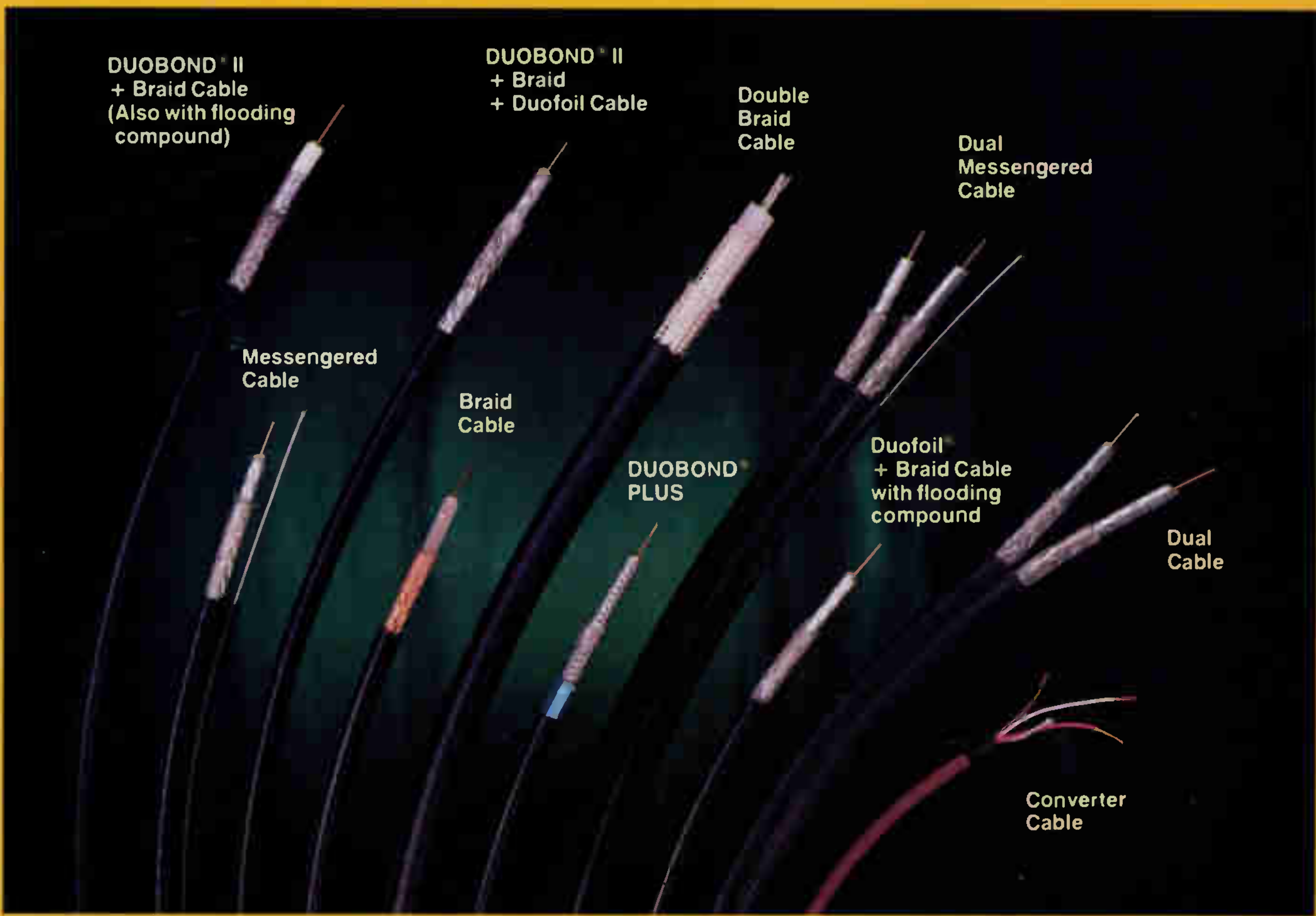
WEST-ANAHEIM: (714) 779-0500, (800) 854-0443; **DENVER:** (303) 740-8949, (800) 841-1531; **SEATTLE:** (206) 251-6760, (800) 426-7665; **MIDWEST-CHICAGO:** (312) 364-7000, (800) 544-5368; **CLEVELAND:** (216) 526-0919, (800) 321-8068; **DALLAS:** (214) 446-7337, (800) 231-5006; **IRON MOUNTAIN, MI:** (906) 774-4111, (800) 624-8358; **SKOKIE, IL HDQTRS:** (312) 677-2600; **EAST-ATLANTA:** (404) 995-5110, (800) 241-5790; **LONG ISLAND, NY:** (516) 293-7788, (800) 845-9510; **NEW JERSEY:** (201) 328-0980, (800) 631-9603; **TAMPA:** (813) 626-7115, (800) 282-9164; **CANADA-CALGARY:** (403) 250-9646; **MONTREAL:** (514) 636-3636; **TORONTO:** (416) 625-5110; **VANCOUVER:** (604) 321-5885

In an emergency, weekends and holidays or after 5 P.M. call toll free 1 (800) 323-8166.

CORPORATE OFFICES, ANIXTER CABLE TV, INC., 4711 Golf Road, Skokie, IL 60076, (312) 677-2600

Reader Service Number 63.

When yesterday isn't good enough.



Anixter Cable TV stocks Belden drop cables

SERVICE. So many suppliers use that word. But only one lives up to it. Anixter Cable TV. Anixter stocks the complete line of Belden drop cables, ready for immediate delivery from a location near you. No minimum orders...and no minimum quantities. Just Belden quality. Every day.

ANIXTER CABLE TV

WEST-ANAHEIM: (714) 779-0500, (800) 854-0443; **DENVER:** (303) 740-8949, (800) 841-1531; **SEATTLE:** (206) 251-6760, (800) 426-7665; **MIDWEST-CHICAGO:** (312) 350-7788, (800) 544-5368; **CLEVELAND:** (216) 526-0919, (800) 321-8068; **DALLAS:** (214) 446-CATV, (800) 231-5006; **IRON MOUNTAIN, MI:** (906) 774-4111, (800) 624-8358; **SKOKIE, IL HDQTRS:** (312) 677-2600; **EAST-ATLANTA:** (404) 995-5110, (800) 241-5790; **LONG ISLAND, NY:** (516) 293-7788, (800) 645-9510; **NEW JERSEY:** (201) 328-0980, (800) 631-9603; **ORLANDO:** (407) 240-1888, (800) 477-8396; **CANADA-CALGARY:** (403) 250-9646; **MONTREAL:** (514) 636-3636; **TORONTO:** (416) 625-5110; **VANCOUVER:** (604) 321-5885.

In an emergency, weekends and holidays or after 5 P.M. call toll free 1 (800) 323-8166
CORPORATE OFFICES, ANIXTER CABLE TV, 4711 Golf Road, Skokie, IL 60076, (312) 677-2600

See us at the Great Lakes Show, Booth 541. Reader Service Number 64.