COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of ion Engineers

Defining television's new look

umer-friendly technologies

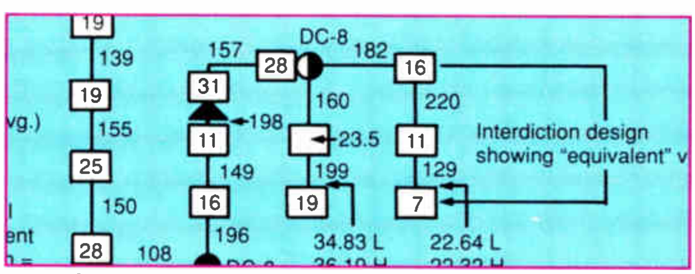
October 1991

Departments

Geri Saye

Back to Basics 69

CT's Lab Report 80



Interdiction 34

Features

©1991 by Communications Technology Publications Corp., a subsidiary of Transmedia Partners I-L.P. All rights reserved. *Communications Technology*™ (ISSN 0884-2272) is published monthly by Communications Technology Publications Corp., 50 S. Steele St., Suite 500, Denver, Colo. 80209, (303) 355-2101. October 1991, Volume 8, Number 8. Office of publication is 50 S. Steele St., Suite 500, Denver, Colo. 80209. Second-class postage paid at Denver, Colo., and additional mailing offices. POSTMASTER: Send address changes to *Communications Technology*, 50 S. Steele St., Suite 500, Denver, Colo. 80209.

EDITOR'S LETTER

An educational tragedy

By the time you read this, many of our nation's children will have finished their summer vacations and been back in school for a month or so. (Because of the time it takes to put together a magazine such as *Communications Technology*, I'm writing this just a few days after my own teenagers have gone back to high school.) Unfortunately, this year's annual return to the classroom was accompanied by some rather dismal news.

Earlier this summer the National Assessment of Educational Progress announced the results of a state-by-state comparison of U.S. eighth graders' math skills. How are our kids doing? Not so good: Only one student in seven was performing at grade level.

To add to this tragedy, in August it was announced that Scholastic Aptitude Test averages were down, with national scores for verbal skills sinking to an all-time low this year. Before we all run out and condemn the entire American educational system, I think a closer look will show that the roots of these problems are a little deeper: in the home.

There's no question that teachers are grossly underpaid for the jobs they have to do. After all, it's hardly fair that a basically unskilled truck driver can earn more than the people who educate our children. And yes, a few of the more talented teachers in education have gone to work in the private sector where wages are higher.

But when looking at the NAEP results, the states that did better were mostly those that spend *less* tax dollars per pupil. According to one source I read, socioeconomics appears to play a bigger part in higher test scores than educational or financial policy. States with better test results have "fewer broken homes, less poverty, more books per household and fewer urban schools." Education leaders also blamed television for playing a part in poor scores. Kids today spend less time reading and way too much time in front of the TV set.

While one may question the methodology of tests such as these, there is little doubt that American kids are way behind the kids of most other modern countries. I'm sure you've seen the statistics: The Japanese school year is around 240 days, while ours is a paltry 180 days. The average American pupil spends 25 or so hours in the classroom each week, but in most of Europe and in Japan that number is more like 40 hours a week.

Unfortunately it doesn't end in our schools. Our own cable industry largely gives only lip service to technical education. We have an estimated 40,000 people employed in the technical side of our business, and you'd be surprised at how many have never heard of organizations such as SCTE or NCTI. Of that 40,000, fewer than 25 percent are SCTE members; only about 2,500 are enrolled in the Society's BCT/E program, and another 1,000 in the Installer Certification Program. Over 7,000 have taken NCTI courses, but what of the other 33,000? How many regularly attend (or are allowed to attend) industry training seminars? For that matter, how many of our field personnel even know what Ohm's law is, let alone the correct way to put an F-connector on a drop cable?

No, I don't have the answer to the woes in education. But whatever the solution is, part of it will involve Americans making a *personal* commitment to education. If you're a parent, look a little closer at your involvement in your child's education. At the same time, look at the commitment you make to your own ongoing education as well as those who work for you. Without such a commitment to education, the competition will leave cable and our country in the dust.

Ronald J. Hranac
Senior Technical Editor

Available in 3,6,9,12 or 15 amps in both standby and non-standby models for all of your powering requirements; conventional or fiber.

SSS
SMALL SIMPLE STANDBY

POWER CAST

POWER GUARD

506 Walker Street, P.O. Box 2796, Opelika, AL 36801
205 742-0055 ▪ 800 288-1507

Reader Service Number 7

COMMUNICATIONS
TECHNOLOGY
A Transmedia Publication

Editor Emeritus, Paul S. Maxwell
Vice President-Editorial, Toni I. Barnett
Executive Editor, Wayne H. Lasley
Associate Editors, Shelley L. Bolin
Laura Hamilton
Senior Technical Editor, Ronald J. Hranac
Contributing Editors, Lesley Barnes
Ed English
Patrick J. Gushman (D.C.)
Chuck Moozakis
East Coast Correspondent, Lawrence W. Lockwood

President/Group Publisher, Paul R. Levine
Vice President-Sales, Charles M. Castellani
Account Executives, Barbara Bellomo
Patricia Linster
Bill Parker
Linda Sommer
Production/Traffic Manager, Mary Felker
Art Director, Brad Hamilton
Artists, Christine Henry

CT Publications Corp.
A subsidiary of Transmedia Partners-I, L.P.
50 S. Steele St., Suite 500, Denver, Colo. 80209
(303) 355-2101 FAX (303) 355-2144

Transmedia Partners-I, L.P.
Chairman, Terrence Elkes
Managing Director, Harry C. Gerhart
Executive Vice President, Paul R. Levine
Controller, Kenneth W. Edwards Jr.
Assistant to Controller, Nancy Parkin
Art Director, Christine Henry
Advertising Coordinator, Maria Sullivan
Marketing Assistant, Lisa Fink
Sales Support Manager, Sharon Brown
Circulation Manager, Mary Sharkey
Receptionist, Paula Turner

Advisory Board
Paul Barth, United Artists
Austin Coryell, Mile Hi Cablevision
Richard Covell, Texscan
Len Ecker, The Len Ecker Corp.
James Farmer, Scientific-Atlanta
Robert Luff, Scientific-Atlanta
Dan Pike, Prime Cable
William Riker, Society of Cable Television Engineers
Clifford Schrock, CableBus Systems Corp.
A.H. Sonnenschein, Hughes Microwave
Raleigh B. Stelle III, Valco Inc.
David L. Willis, Tele-Communications Inc.
Doug Wolfe, Corning Inc.

SCTE Board of Directors
At-Large Directors
Richard Covell, Texscan
Tom Elliot, TCI/CableLabs
Wendell Bailey, NCTA
Regional Directors
Tom Elliott (Region 1), Catel Telecommunications
Ron Hranac (Region 2), Coaxial International
Ted Chesley (Region 3), Rock Associates Inc.
Leslie Read (Region 4), Sammons Communications
Wendell Woody (Region 5), Anixter Cable TV
Rich Henkemeyer (Region 6), Paragon Cable
Victor Gates (Region 7), Metrovision
Jack Trower (Region 8), WEHCO Video Inc.
James Farmer (Region 9), Scientific-Atlanta
Michael Smith (Region 10), Adelphia Cable
Diana Riley (Region 11), Jerry Conn Associates
Walt Ciciora (Region 12), ATC

SCTE BPA

Adding a channel? Upgrading old receivers and modulators? Maybe looking to add BTSC stereo?

Plug into Standard.

Our Agile IRD II Receiver/Descrambler and TVM450 Modulator are perfectly matched to give you outstanding performance, utilizing a unique, precalibrated RF and video/audio level adjustment system. And all you have to do is plug 'em in.

Big performance, small package.

The Agile IRD II is a commercial C/Ku satellite TV receiver, designed to accept a VideoCipher® descrambler module —in a package only 1.75" tall.

As you'd expect from Standard, the Agile IRD II gives you solid 100 KHz PLL tuning, dual down-conversion to 70 MHz, and superb video specs. Intelligent design features include a 70 MHz IF loop-through for inserting TI filters, and an active 950-1450 MHz RF loop-through for expansion without signal splitters. You also get a familiar VideoCipher panel layout as well as a visual signal-strength alarm, and front-panel access to alignment controls, test points and the new VC II PLUS™ on-screen display.

Not just another modulator.

Need a modulator? Imagine a frequency-agile CATV modulator that rivals fixed-channel performance — and that's just for starters.

The TVM450's High Level Mixing method, among other engineering advances, all but eliminates out-of-band noise and spurious signals, so you can meet NCT-7 specs for the entire 450 MHz spectrum — without external bandpass filters. The TVM450's integrated CSG-60 BTSC generator puts stereo where it belongs — in the modulator. And whether you use stereo or mono, the TVM450's front-panel controls are factory-calibrated to radically simplify installation and set up, and so accurate you can even use a TVM450 to calibrate your receivers.

So advanced, they're simple.

There's more — much more — to the IRD II and TVM450 than we have room for here. We say they're so advanced that all you have to do to add a channel is plug 'em in, set 'em — and forget 'em.

But you don't have to take our word for it. Call Standard at 800/745-2445.

And we'll prove it.

Raise your standards.

Standard Communications®

SATCOM Division
P.O. Box 92151
Los Angeles, CA 90009-2151
(213) 532-5300 • (800) 745-2445
FAX: (800) 722-2329 (USA)
FAX: (213) 532-0397 (Int'l and CA)
Represented in Canada By:
DGH Communications Systems Ltd.
Scarborough, Ontario • (416) 499-4746

Plug in a new channel.

See us at the Atlantic City Show, Booth 557. Reader Service Number 8

RFP issued for digital system

BOULDER, Colo. — Cable Television Laboratories, Tele-Communications Inc. and the Viacom Networks unit of Viacom International jointly issued a request for proposal (RFP) that is intended to result in the acquisition of equipment for a digital compression program delivery system. TCI and Viacom intend to acquire digital compression devices that would allow cable TV program suppliers to provide multiple program services via one satellite transponder to CATV headends. The RFP details this as well as requesting designs for in-home decompression units for existing subscribers.

Letters of intention to respond to the RFP were due Sept. 16. A bidders' conference was scheduled for late September and the responses to the RFP are due at CableLabs on Oct. 31.

☛ ISS Engineering announced a price reduction on its frequency agile Series III modulator and GL1000A demodulator. As well, the company replaced reps in the CATV market with authorized distributors. Finally, ISS Engineering's new corporate address is 992 San Antonio Road, Palo Alto, Calif. 94303. The telephone is (415) 424-0380.

☛ Jones Intercable installed Magnavox CATV System's new AXIS addressable external interdiction system in its Albuquerque, N.M., system. This is one of several installations made around the country to field test the technology; results are expected by the year-end.

☛ ACS Communication Services was awarded the Fountain Hills, Ariz., rebuild by Dimension Cable (a division of Times Mirror). This contract is in addition to a recent award by Dimension to complete the balance of a Mesa, Ariz., system upgrade.

☛ Four Arizona residents were named in a 14-count indictment for alleged involvement in the sale of illegal CATV descramblers. Each faces up to 14 years in prison if convicted.

☛ Truckloads of cable decoder boxes were seized by authorities in San Francisco and Las Vegas, Nev., by federal authorities who estimate that a group of alleged pirates distributed up to 300 boxes daily. NCTA estimates a $100 million loss in revenue for the CATV industry. No arrests have been made yet.

☛ Diamond Communication Products acquired Parker Metals' MMDS antenna hardware line. Included are Parker's tooling capabilities and current inventory for these products.

☛ The Cable Television Administration and Marketing Society's Rocky Mountain Chapter announced its video training tape and leaders guide, *The mind, the body and the bottom line*. Produced for customer service representatives, telemarketers, installers and technicians, its focus is how to increase productivity through attention to wellness and stress management.

Correction/clarification

In Ron Hranac's article, "The mathematics of field strength measurements" (July 1991, *Communications Technology*), the term "480π" in Equations 6 and 8 should have been "$480\pi^2$."

New Horizons in Video Performance

The DIR-647 Integrated Receiver/ Descrambler from DX. It represents the latest in field-proven technology delivering the clearest, sharpest pictures possible.

At DX, quality and reliability are always in sight. For over 30 years our success in building high performance products has put us at the forefront of the satellite communications industry. DX combines the finest research and manufacturing with state-of-the-art technology to meet the growing demands of large CATV operators.

So for the highest level of video performance, look no further than DX. To arrange a free demonstration, call or write DX Communications, Inc. today.

DX ANTENNA

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

See us at the Atlantic City Show, Booth 347. Reader Service Number 11

Membership tops 9,000 mark

The national membership of the Society has passed the 9,000 mark. This represents a drastic increase from 1990's year-end membership count of 7,500, which represented an increase of 1,500 members over the 1989 year-end figure.

The 9,000 takes into account the 7,500 active members and the over 1,500 members that have joined the Society at the installer level since the introduction of the Installer Certification Program in 1989.

This growth can be partially attributed to the popularity and success of the Society's numerous programs and services, including the Chapter Development Program, Broadband Communications Technician/Engineer (BCT/E) and Installer Certification Programs and annual Cable-Tec Expo and Engineering Conference.

Reaching the 9,000 mark is an important event in the Society's history. It indicates the industry's growing appreciation of the training and services provided by the Society.

Colorado games better than ever

(Contributed by Shelley Bolin, CT Publications Corp.)

Sixteen CATV technical personnel competed for individual medals and the coveted traveling trophy for best team in the third annual Colorado Cable-Tec Games, coordinated by the SCTE Cable-Tec Games Subcommittee and Rocky Mountain Chapter and the Colorado Cable Television Association. Techs from teams representing Columbine Cablevision (Fort Collins), United Artists (Denver/Metro), Jones Intercable (Jeffco/Broomfield) and TCI (Pueblo, Boulder, Lamar, Steamboat Springs) tested their skills in four events: splicing, safety, terminology and test equipment.

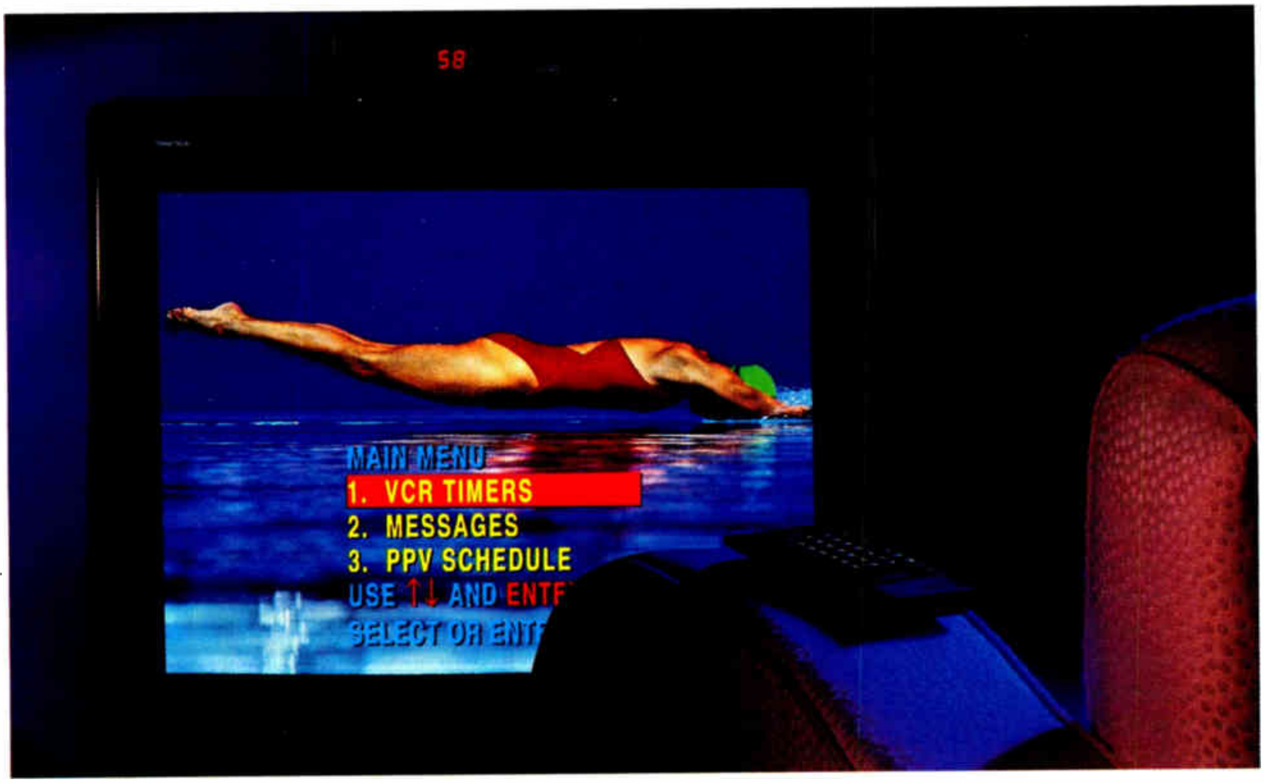
The events were hosted by Comm/Scope and Gilbert Engineering

Shelley Bolin

Raedine Watson of Sachs times Dave Krook in the safety event at the Colorado Cable-Tec Games.

(splicing), ComSonics and Riser-Bond/Mega Hertz Sales (test equipment), Jones Intercable and Sachs Communications (safety), and the National Cable Television Institute (terminology).

Points were awarded after each event based on speed, accuracy and performance. After scores were tallied, the gold, bronze and silver individual medals were awarded to: →



On-screen displays. Dual function remotes.

Jerrold's redefining the easy chair.

No matter where or how your subscribers watch TV, they want it easier. Who can blame them? Too often, their cable equipment doesn't offer all the features of the latest TVs or VCRs. Now Jerrold provides the features that make even the easy chair easier.

New on-screen displays establish a dialogue between converter and user. To make it even easier, we've investigated color coding this function. Our remotes control both the TV and converter. And they're compact, with larger buttons, to fit more comfortably in subscribers' hands. The more at ease subscribers are, the more they'll appreciate the services you provide.

Jerrold makes these new advanced, yet simpler features available so you can offer them to your subscribers today. After all, a happy subscriber is what we all want. We're ready now.

Call Jerrold at 1 800 523-6678.

JERROLD COMMUNICATIONS

Responsive

See us at the Atlantic City Show, Booth 329. Reader Service Number 14

• Splicing: First — Pat Wike (TCI-Steamboat Springs); second — Scott Adams (United Artists); third — Tom Lockwood (TCI-Boulder).

• Test equipment: First — Bill Dennis (Jones Intercable); second — Hugh Long (United Artists); third — Scott Adams.

• Safety: First — Dave Krook (United Artists); second — Jim Dyke (Jones Intercable); third — Tony Dreiling (Columbine Cablevision).

• Terminology: First — Tom Lockwood; second — Jim Dyke; third — Don Holland (Jones Intercable).

Shelley Bolin

Colorado Cable-Tec Games individual winners (top row, left to right): Pat Wike, Tony Dreiling, Don Holland; (second row): Tom Lockwood, Bill Dennis, Jim Dyke; (third row): Dave Krook, Hugh Long, Scott Adams.

The United Artists team went home with the traveling trophy. Members were Adams, Krook, Long and Rob Wooldrik, and the coach was Ron Upchurch. The contestant with the highest individual score was Lockwood, who received an expenses-paid trip to next year's Cable-Tec Expo in San Antonio, Texas, courtesy of the Rocky Mountain Chapter.

Member of year nominations opened

The Society is seeking nominations for its 1992 Member of the Year Award. Presented each year at the Cable-Tec Expo, this award is given by the SCTE board to recognize a member for outstanding contributions to the goals and purposes of the Society.

All persons nominated must be active members of the Society. Nominations must be received in writing by SCTE national headquarters no later than March 1, 1992. All nominations will be presented to the board for consideration, and the selected person will receive a plaque recognizing this honor. For further information, contact SCTE national headquarters, (215) 363-6888.

Expo '92 call for papers, workshops issued

To get a head start on the planning of next year's expo, SCTE is soliciting proposals for technical papers and/or workshops to be presented at Cable-Tec Expo '92, June 14-17 in San Antonio, Texas. Papers that are accepted will be presented at the Society's 16th Annual Engineering Conference on June 14. Expo workshops are "hands-on" sessions that will provide attendees with in-depth instruction on technical procedures that are used in everyday practice.

Submissions, which should include a brief abstract of the proposed paper or workshop, should be sent to Bill Riker, Expo '92 chairman, no later than Dec. 1. For further information, contact SCTE national headquarters, (215) 363-6888.

Reader Service Number 15

CALAN
STAR 2010

SETS A NEW STANDARD IN CARRIER ANALYSIS

It's a data management system offering:

DATA COMMUNICATION
DATA ACQUISITION
DATA ANALYSIS

CALAN

CABLE AND LOCAL AREA NETWORKS
CALAN, INC.
Dingman's Ferry, PA 18328
1-800-544-3392 • In PA: 717-828-2356
FAX: 717-828-2472

CALAN's STAR 2010 SLMS (Signal Level Measurement System):

Opens a whole new era in carrier analysis for the cable industry.

First, it's simply the best level meter ever designed — covering the entire frequency range (5 MHz to 1 GHz) with unmatched speed (36 channels in less than 2 sec.), accuracy, stability, and simplicity of use.

It's also a data management system—incorporating computer interface, built-in comparison and analysis capability, and communications with PC's and printers.

STAR 2010 is field upgradeable, with provisions for user-installed software modules and plug-in option cards.

Priced right and portable. . .you can put STAR 2010 in the hands of every technician.

Spectrum Scan

Single Channel

Channel Scan

C/N and Hum Measurements

See us at the Atlantic City Show, Booth 114. Reader Service Number 16

HDTV images (left) show the fine picture detail achieved by tripling the number of lines transmitted in the same time frame as on current NTSC telecasts (right).

Zenith/AT&T Digital Spectrum Compatible HDTV transmission system

The anticipated 1993 selection of a high definition TV (HDTV) standard by the Federal Communications Commission has many talking about the effects of HDTV technology on the terrestrial broadcasting industry. There are more considerations, however, when comparing HDTV to current TV technology. Other issues include a discussion of how HDTV will affect the cable industry. Cable should benefit greatly from HDTV, particularly from an all-digital transmission standard. This article will explore:

- *General benefits of HDTV both in the terrestrial and cable environments.*
- *General benefits of a digital HDTV transmission system vs. an analog system.*
- *Specific benefits of the Zenith/AT&T Digital Spectrum Compatible HDTV system to both the terrestrial and cable environments.*

By Wayne Luplow
Division Vice President, R&D
Advanced Television Systems
Zenith Electronics Corp.

The thinking behind HDTV's expected success in terrestrial and cable environments is not mysterious: Television with unmatched picture and sound clarity should increase cable's popularity and strengthen the popularity of terrestrial broadcasts. For the cable industry, HDTV should excel in programming arenas on which cable already thrives, namely sporting events and premium movies. Sporting events, of course, are not limited to the professional level. HDTV broadcasts of Olympic events should achieve outstanding quality in the cable environment. As a result, it could easily increase the perceived value of premium pay-per-view and event program categories.

HDTV offers pictures of movie-theater quality, with sound that matches a compact disc. It will bring a more cinematic image into the viewer's home. Rather than a 4:3 aspect ratio used in today's television, the new HDTV standard will transmit TV pictures with an aspect ratio of 16:9, which emulates the wide screens used in movie theaters.

The cost of implementing HDTV in the cable environment could be less than its implementation in terrestrial broadcasting. The cost would be lower because high-power transmitters and antennas are not needed for cable. As a result, HDTV could be employed far faster in cable than in terrestrial broadcasting.

HDTV using a digital transmission system will bring error-free, noise-free and ghost-free images into the viewer's home. Today, cable transmissions can suffer from close-in ghost images. Unlike terrestrial broadcasts, where ghosts are measured in inches, these small cable ghosts result in fuzzy edges measured in fractions of an inch. Digital HDTV technology can eliminate ghosting, whether in cable or terrestrial applications.

Digital HDTV offers easier interfaces with other communications systems and delivery media such as cable, satellite, fiber and VCRs. It also offers advantages in concatenated

Jackson Tool Systems

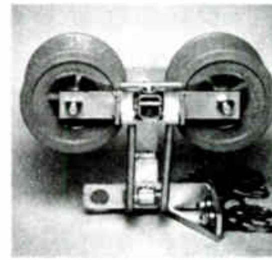
P.O. BOX 6 • CLAYTON, OHIO 45315 • (513)836-2641

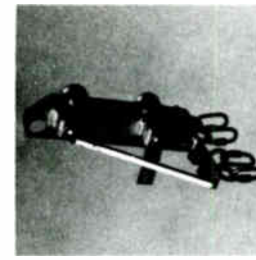
Tools For Your Aerial Construction Needs


1036-4


JP-6

(513)836-2641


3080


1080

CT 10/91

MEMBERSHIP APPLICATION

Make check payable to SCTE.
Mail To:

SCTE®
SCTE
669 Exton Commons
Exton, PA 19341

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

☐ Please send me further information on the Society of Cable Television Engineers

SCTE is a 501 (c) (6) non-profit professional membership organization. Your dues may be tax deductible. Consult your local IRS office or your tax advisor.

APPLYING FOR: ☐ INDIVIDUAL @ $40 SUSTAINING @ $250

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

☐ MR. ☐ MRS. ☐ MS. TITLE:________

NAME:________ (First Initial Last) TEL. #:________ (Area Code-Number)

EMPLOYER:________ (Company Name) FAX #:________ (Area Code-Number)

CO. ADDRESS:________ (Street/PO City State Zip)

USE HOME ADDRESS?________ (Street/PO City State Zip)

YOUR SIGNATURE:________ DATE:________

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

NAME ON CARD:________ EXP.:________

MASTERCARD NO.:________

VISA NO.:________

SIGNATURE FOR CHARGE AUTHORITY:________

Applications without payment will be returned. Applications from outside U.S., enclose additional $20 (U.S.) to cover mailing expenses.

☐ I am also an SCTE Installer Member. My Member Number is #________.

*** SPONSORING CHAPTER OR MEETING GROUP:________ ***

CT 10/91

COMMUNICATIONS TECHNOLOGY

Communications Technology is distributed ***FREE*** of charge to qualified cable TV personnel. Incomplete forms will not be processed.
I wish to receive/continue to receive ***Communications Technology.***
Yes ☐ No ☐

(please print or type)

Name________

Title *(please print or type)* ________

Company Name ________

Address________

City ________ State ____ ZIP ________

Signature ________ Date ________

(Signature and date required)

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 recommend products and/or services for purchase.
Yes ☐ No ☐

CT 10/91

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

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 specify)*

4. Please check the category that best descibes your job title/function.

☐ A. Corporate Management
☐ B. Management
☐ C. Programming
☐ Technical/Engineering
1 ☐ Vice President 3 ☐ Manager 5 ☐ Technician
2 ☐ Director 4 ☐ Engineer 6 ☐ Installer
☐ E. Sales
☐ F. Marketing
☐ X. Other (please specify)________

Place
Stamp
Here

Jackson Tool Systems, Inc.
P.O. Box 6
Clayton, Ohio 45315

Place
Stamp
Here

SCTE®

SCTE
669 Exton Commons
Exton, PA 19341

Place
Stamp
Here

COMMUNICATIONS
TECHNOLOGY

A Transmedia Publication
P.O. Box 9106
Plainview, NY 11803-9106

systems such as those used in the cable environment. Because of error correction technology used in digital systems, an error occurring early in the link would be corrected rather than transmitted to successive locations in the system. Programming via satellite also would be error-corrected before being sent from the headend.

The Digital Spectrum Compatible HDTV (DSC-HDTV) system, proposed by Zenith and AT&T, takes the advantages of digital transmission and adds unique characteristics: rapid recovery from channel or scene changes; friendliness with computer media because of progressive scanning and square pixels; and crystal clear pictures transmitted even at fringe reception areas.

Today's cable subscriber, who has a myriad of channels from which to choose, should enjoy complete image recovery in a fraction of a second with DSC-HDTV. The Zenith/AT&T system also is unique in that its images are progressively scanned and are generated with square pixels. Progressively scanned images eliminate the artifacts found in interlace scanned images, while square pixels perform better with computer graphics and special-effect TV productions.

For terrestrial broadcasting, the Zenith/AT&T system would produce clear pictures even at the outer edges (Grade-B contour) of today's typical terrestrial broadcast service area (55 miles from the transmitter), and only slightly degraded HDTV pictures to 70 miles. There would be no *sudden* loss of the HDTV picture at increasing distances from the transmitter. In NTSC broadcasts, the farther away the receiver is from the transmitter, the more snow and interference degrade the picture.

DSC-HDTV

The DSC-HDTV system is an all-digital simulcast system that would operate on a 6 MHz channel in the existing TV bands. The video source signal has 787.5 lines per frame, 59.94 frames per second, is progressively scanned at 47,203 Hz (three times the NTSC rate) and is of 34 MHz bandwidth. The aspect ratio is 16:9 and there are 1,280 x 720 active pixels in a frame; the pixels are square. Note that there are 1,575 lines displayed in 1/29.97 second, which is three times the number of NTSC lines in the same time.

The source signal's simple ratios to NTSC horizontal and vertical rates result in easy up- and downconversion between the DSC-HDTV and NTSC formats. Addition of high definition facilities to an NTSC broadcast station initially requires a transmitter and an antenna. This enables HDTV network program feedthrough. Local signals can be inserted with an upconverter, which will make NTSC programs and equipment usable for HDTV; purchase of additional HDTV equipment can be deferred. Upconverted signals are not of HDTV quality but are of NTSC studio quality when upconverted from component source signals. Such signals will include all the advantages of digital transmission: noise-free display (without interlace and other NTSC artifacts).

Using linear RGB source signals for DSC-HDTV, the color matrix produces chroma and true constant luminance signals. If all active pixels of an RGB video source were encoded at 9 bits, the total bit rate would be 1.49 gigabits/second. The source coding reduces this to 17.2 Mb/s. The total data rate is 21.52 Mb/s due to the addition of digital audio (four independent channels), captioning, text, forward error correction, cable decoder address, encryption and other ancillary data.

The digital nature of the HDTV signal lends itself to encryption and conditional access systems important to cable operators. Incorporation of conditional access in the HDTV signal means cable operators can protect an important source of revenue.

DSC-HDTV station coverage

The DSC-HDTV system allows noise-free and imperfection-free display of a received signal throughout a TV broadcast station's service area. Compared to an NTSC station with the same service area, the DSC-HDTV station radiates less power for two reasons. The DSC-HDTV transmission signal is more efficient and a digital receiver operates with a lower carrier-to-noise ratio. As a result, the DSC-HDTV transmitter can operate closer to a co-channel NTSC station (an NTSC station operating on the same frequency) than another NTSC station without increasing the interference into receivers tuned to the co-channel NTSC station and yet achieve an HDTV service area comparable to NTSC.

Studies have shown that for every current broadcaster to obtain a second channel for simulcasting HDTV, distances between stations operating on the same frequency will have to be reduced. In the most challenging situations, reduction of today's minimum of 155 miles to 100 miles will be necessary.

The decreased co-channel spacing does not cause unacceptable NTSC interference into DSC-HDTV receivers for three reasons. First, there is a newly devised interference rejection system; second, the receiver operates with a lower acceptable carrier-to-interference ratio compared to an NTSC receiver; and, third, a directional antenna can be used for the new service in very closely spaced transmitter situations.

Transmission system

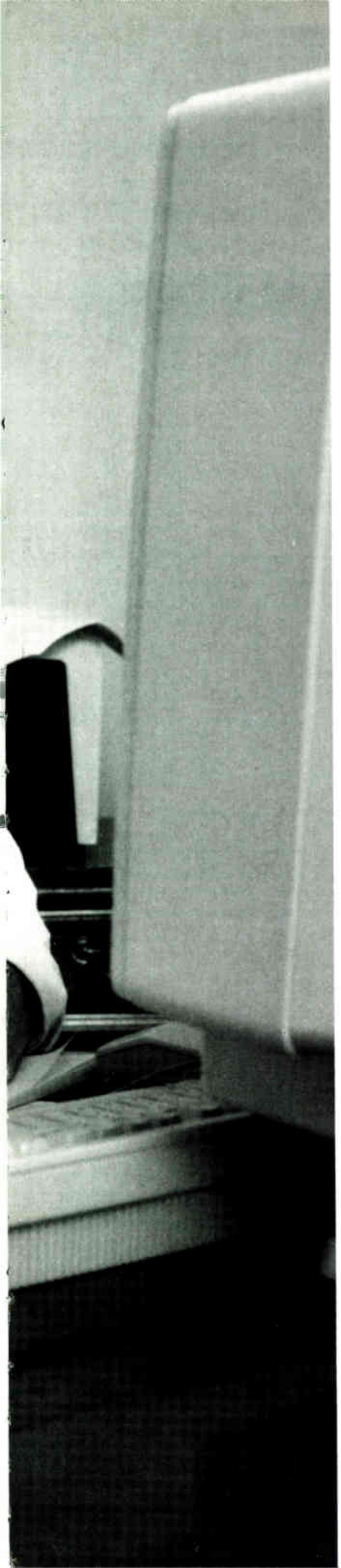
The FCC announced early in its HDTV system selection process that it strongly preferred a "simulcast" HDTV system. In a simulcast system, today's NTSC TV stations would continue to broadcast as they do now. HDTV would be broadcast simultaneously on currently unusable channels. The DSC-HDTV system uses a low-power transmitter and signal processing steps to avoid interference into NTSC channels. But preventing the strong NTSC signal from interfering with the weak HDTV signal proved to be a significant technical challenge.

The solution — a newly designed interference filter system — makes it possible to reap the benefit of a full-digital HDTV system without compromising performance. The design includes an interference filter at the HDTV receiver and a complementary filter in the HDTV transmitter.

Summary

The obvious benefits of digital HDTV include outstanding picture and sound, easier interface with computer, telephone, data and other communications systems, and interference-free signals for cable, satellite, fiber and VCRs. The Zenith/AT&T DSC-HDTV system adds progressive scanning to eliminate jagged edges and other picture-distorting problems, and square pixels to perform better with computer graphics and in special-effect TV productions. Because of unique transmission technology, DSC-HDTV would prevent NTSC and HDTV signals from interfering with one another.

(Continued on page 44)



Our System is Built with Better Hardware.

Hardware is vital to a strong system. The same is true for a distributor. Only *our* hardware is our computer system for customer support.

At Midwest CATV, our system provides all the necessary information for quick response to customer inquiries. We can check and verify inventory, determine the closest stocking facility to your destination and access up-to-date pricing information.

And, all of our offices nationwide are networked to our mainframe. This provides us with immediate access to account information, purchasing histories, freight costs, and contract requirements. Our salespeople can even access information directly from *your* office via a laptop PC.

You won't find our phone lines tied up between offices either. Our sales offices interact by electronic mail, keeping our phone lines open for customer calls.

Guess you might say we're user-friendly at Midwest CATV.

MIDWEST CATV

a UNR Industries Company

More than supplies. Solutions.

1 800 MID-CATV

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

The DigiCipher HDTV system

The American TeleVision Alliance's[1] (ATVA) DigiCipher system is one of six advanced TV systems being considered by the Federal Communications Commission as the next standard for broadcast TV in the United States. On Aug. 22, after careful review, the DigiCipher system was certified for testing by the Advisory Committee on Advanced Television Service. Testing will start Nov. 14 at the Advanced Television Test Center in Alexandria, Va. The DigiCipher system was the first all-digital proposal and will be the first of four all-digital HDTV simulcast systems to be tested. This article describes the DigiCipher system and its key features and provides some insight into how it works.

By Robert M. Rast
Vice President, New Business Development, Advanced Television
And Dr. Woo H. Paik
Vice President, Advanced Development
General Instrument Corp., VideoCipher Division

The DigiCipher system provides an all-digital high definition TV (HDTV)

Figure 1: System block diagram

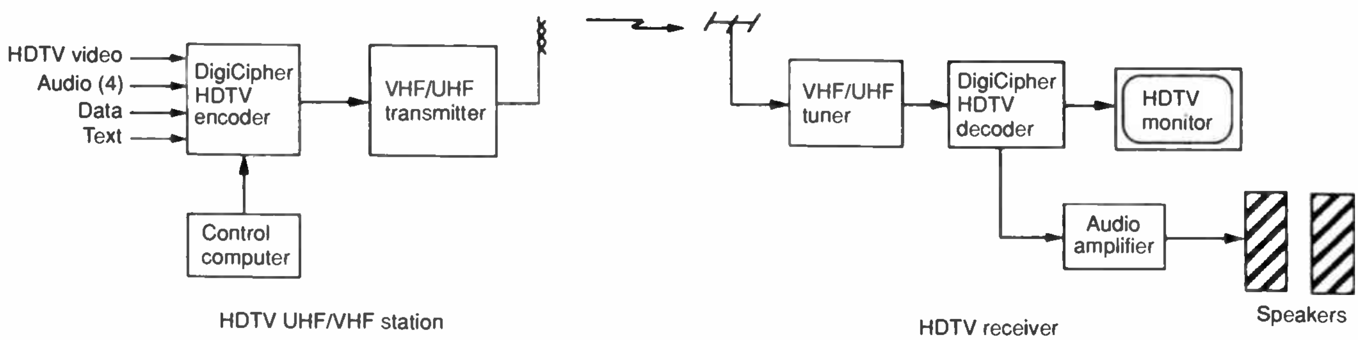
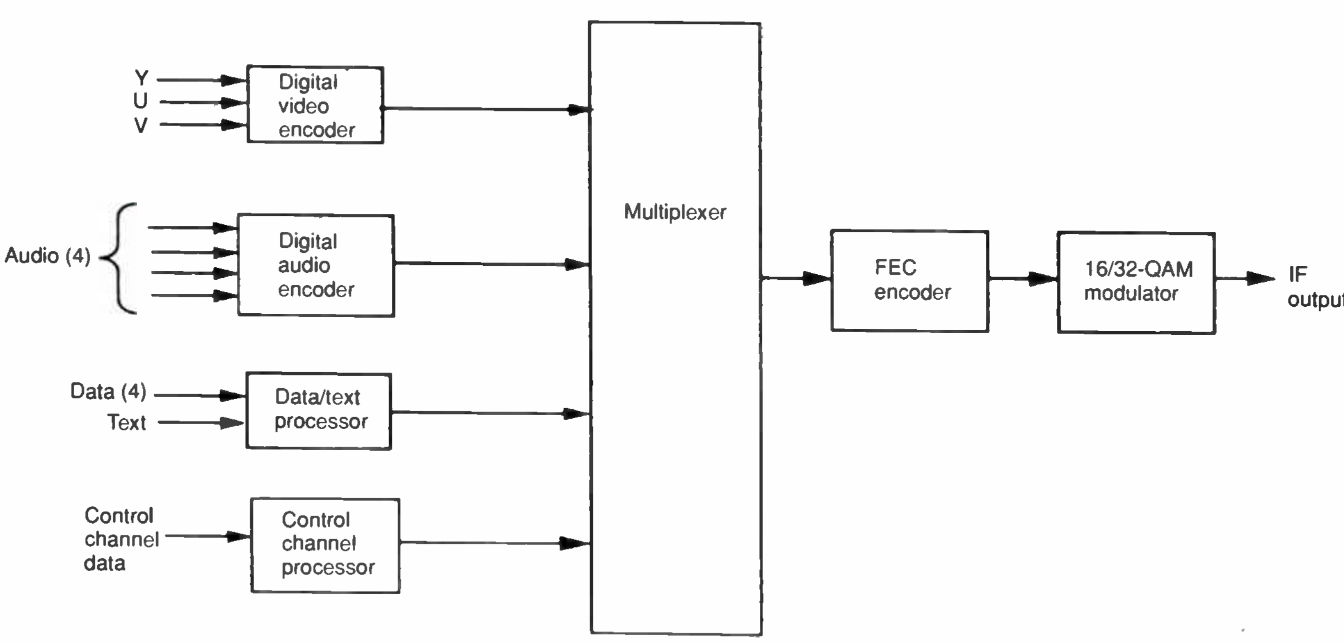
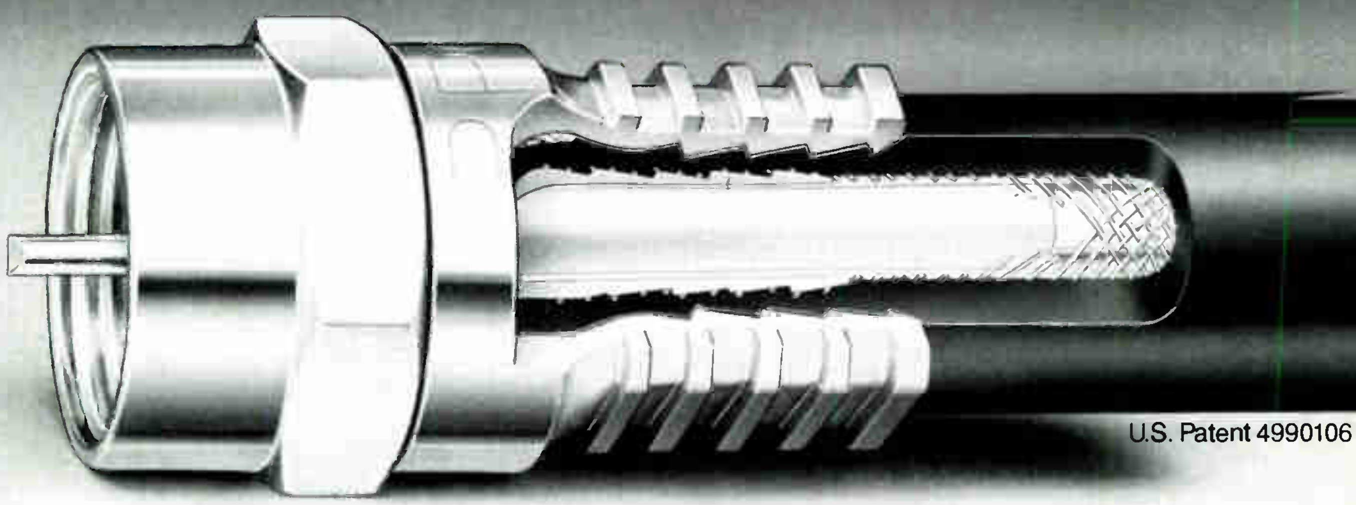


Figure 2: Encoder block diagram



THE NEW PPC SERIES OF UNIVERSAL "F" CONNECTORS



U.S. Patent 4990106

PPC gives you a better grip on the future!

Unique "Tite-Bite" inner teeth design firmly grasps and surrounds the braid and jacket during crimping for a 360° seal that does **not** squash or damage the dielectric. The new design virtually eliminates RF leakage and offers improved weatherproofing and better performance over current state of the art connectors.

A single connector for RG-6 or one for RG-59 accommodates a wide range of cable, from 40% through quad. Color coding the connectors (clear chromate conversion finish on the RG-6 and gold chromate conversion on the RG-59, along with individual identification, stamping of each connector) helps simplify and assure "consistency" throughout your drop cable installations.

Reader Service Number 20

See us at the Atlantic City Show, Booth 300, 302.

For Information Call Today!
1-800-468-2288

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

"The low power requirements mean that a DigiCipher HDTV signal can be carried on a channel that would otherwise not be usable."

signal suitable for transmission over a single 6 MHz broadcast or cable TV channel. It provides full HDTV performance with virtually no visible transmission impairments due to noise, multipath and interference. High picture quality is provided, but with a reasonable decoder complexity. With low signal power requirements and no carriers, the signal is ideal for simulcast HDTV and cable.

To achieve full HDTV performance in a single 6 MHz bandwidth, a highly efficient, unique compression algorithm based on discrete cosine transform (DCT) coding is used. The compression algorithm has been refined and optimized through extensive use of computer simulation.

For error-free transmission of the digital data stream, powerful error correction coding combined with adaptive equalization is used. Two transmission modes are provided, 32-QAM and 16-QAM. The mode is selectable at the encoder and receivers will be able to autoconfigure. At a carrier-to-noise ratio (C/N) above 16.5 dB, essentially error-free transmission can be achieved.

In the 16-QAM mode, the transmission is more rugged and has a lower threshold, 12.5 dB, but with a small sacrifice in picture quality. The 16-QAM mode is expected to be useful for those broadcasters that wish to maximize their service area, but that have transmit power restricted by co-channel spacings (which may be as low as 100 miles).

Network distribution via satellite uses QPSK transmission technology. As compared to FM-NTSC, there is no receive dish size penalty. At the receive location (e.g., a broadcast network affiliate or a cable headend) the satellite signal is received and demodulated, and remodulated in QAM for terrestrial transmission. No decoding or signal processing is required, but may optionally occur.

Table 1: DigiCipher system parameters

Operating Mode	16-QAM	32-QAM
Video		
Raster format	1,050/2:1 interlaced	1,050/2:1 interlaced
Aspect ratio	16:9	16:9
Frame rate	29.97 Hz	29.97 Hz
Bandwidth		
Luminance	21.5 MHz	21.5 MHz
Chrominance	5.4 MHz	5.4 MHz
Active pixels		
Luminance	960(V) x 1,408(H)	960(V) x 1,408(H)
Chrominance	480(V) x 352(H)	480(V) x 352(H)
Horizontal resolution		
Static	660 lines per picture height	660 lines per picture height
Dynamic	660 lines per picture height	660 lines per picture height
Sampling frequency	53.65 MHz	53.65 MHz
Colorimetry	SMPTE 240M	SMPTE 240M
Horizontal line time		
Active	26.24 μsec	26.24 μsec
Blanking	5.54 μsec	5.54 μsec
Audio		
Number of channels	4	4
Bandwidth	20 kHz	20 kHz
Sampling frequency	47.2 kHz	47.2 kHz
Dynamic range	90 dB	90 dB
Data		
Video data	**12.59 Mbps**	**17.47 Mbps**
Audio data	503 kbps	503 kbps
Async data and text	126 kbps	126 kbps
Control channel data	126 kbps	126 kbps
Total data rate	**13.34 Mbps**	**18.22 Mbps**
Transmission		
FEC data	6.17 Mbps	6.17 Mbps
Data transmission rate	**19.51 Mbps**	**24.39 Mbps**
QAM symbol rate	4.88 MHz	4.88 MHz
Adaptive equalizer range	-2 to 24 μsec	-2 to 24 μsec
System threshold		
Noise (C/N)	**12.5 dB**	**16.5 dB**
ATV interference (C/I)	**12 dB**	**16 dB**
NTSC Interference (C/I)	**0 dB**	**5 dB**

Note: The differences in the two operating modes are emphasized in bold.

DigiCipher system overview

Figure 1 shows a block diagram of DigiCipher hardware within a broadcast system. At the station an encoder would compress the HDTV signal and modulate it for digital transmission. At the home end, a decoder would demodulate the received signal and provide an analog, decompressed HDTV signal for display. It is assumed that decoders would be built into HDTV receivers.

The block diagram could be modified to reflect cable transmission by replacing the transmitter with a CATV modulator, and the over-the-air link with a cable system.

Figure 2 is a block diagram of the encoder. There are four types of signals transmitted in the channel. The HDTV video signal is processed in YUV rather than RGB form. Four separate digital audio channels are provided. Four 9,600-baud ancillary data channels are implemented, out of a total of 126 kbps reserved for applications such as teletext, captioning and program guides. An additional 126 kbps is reserved for control channel data (i.e., conditional access authorizations and keys).

The input signals are separately encoded and processed, and then combined into a single data stream by

(Continued on page 46)

The cable you're installing now may seem great today, but how's it going to hold up against tomorrow's heat? And the ever present gnawing by nature's pests? Install AT&T's fiber optic cable and you won't have to worry.

That's because all AT&T fiber optic cable is designed to withstand harsh temperatures, rodents, lightning, and a host of other environmental stresses.

Take a look at our LXE family of lightguide cable. Available in multiple sheath designs, each is made with a high-density polyethylene jacket to resist abrasions—making it easy to pull and inexpensive to install, too.

The LXE also allows for easy end-prep and midsheath entry. Rip cords lie beneath the jacket and armor, to allow for entry without damaging the fibers.

AT&T's fiber has the smallest mode field diameter of any standard single mode fiber available. Light stays more tightly confined to the fiber core, providing outstanding transmission performance—at both 1310 and 1550 nm.

And our D-LUX™ 100 coating offers excellent stripability, static fatigue performance, and aging characteristics, for superb splicing capabilities.

You'll find, too, that all our fiber optic cable is backed by the design expertise and technology of AT&T Bell Laboratories.

For more on cable that's at its best when the elements are at their worst, call AT&T at **1 800 344-0223, ext. 223.**

AT&T
Network Systems

Reader Service Number 19

SuperNTSC: Market-ready advanced TV

The Faroudja SuperNTSC TV system received a set of "real-world" trials and "shake downs" earlier this year. The implications of this product introduction on cable programmers, operators and broadcasters is significant. By "squeezing" the very most from today's NTSC TV transmission system, the various TV constituents deliver the best and most professional picture possible prior to the deployment of high definition TV (HDTV). The following is a report of the demonstration process and why this system is an important development.

By John Bringenberg
Manager, Strategic Planning, Tele-Communications Inc.

And Roy Moore
Engineering Manager, KPIX TV, San Francisco

The demonstration project was planned to present SuperNTSC as a viable and market-ready next step in the migration to HDTV. The Federal Communications Commission has slated mid-1993 to select a transmission standard for the next century. At least five different groups proposing different standards are participating in these government-supervised tests over the next 18 months. The sponsors of Faroudja Research recognize that true HDTV is some years in the future. Also, for several years after HDTV's commercial introduction, NTSC programming will still comprise a signifi-

Figure 1: Washington transmission setup

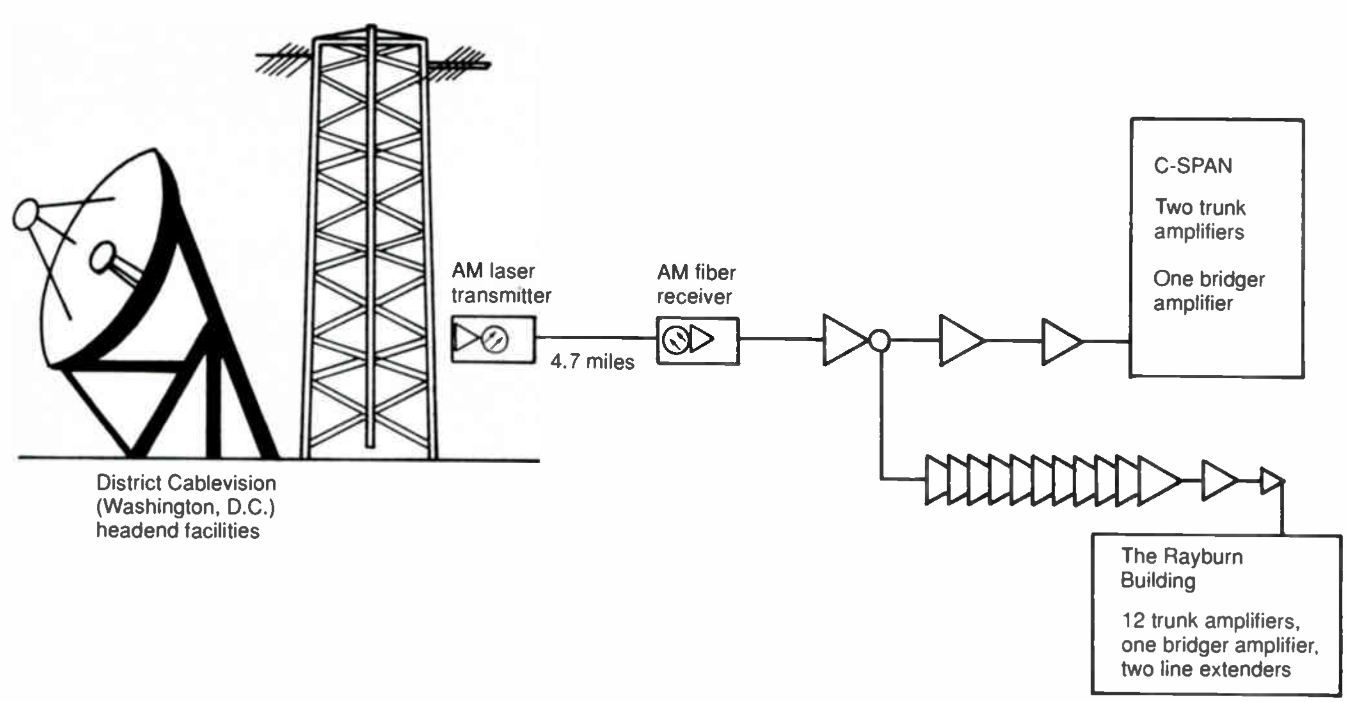
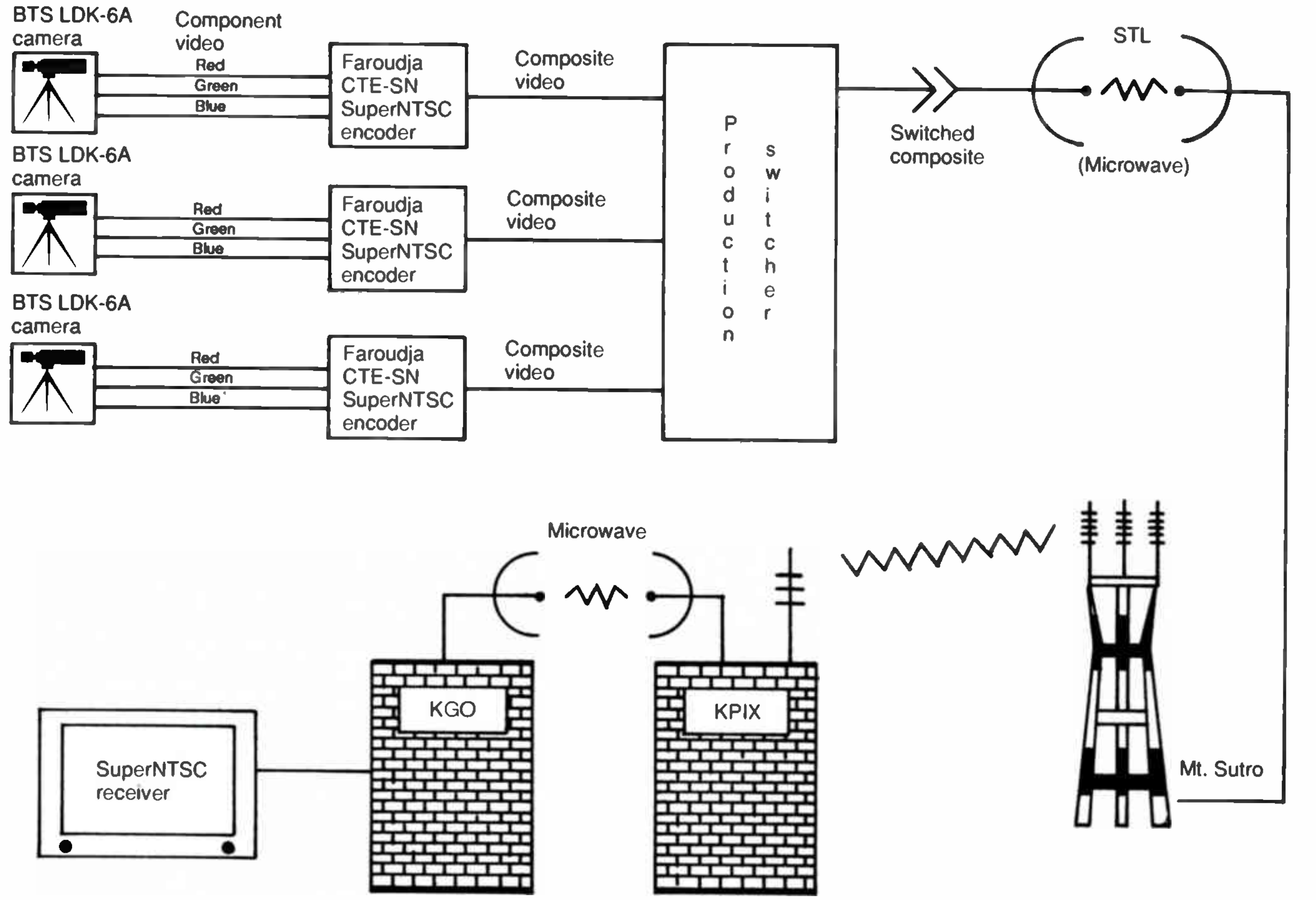


Figure 2: San Francisco transmission setup



cant share of the many programs in the marketplace. The demanding early adopters of the new HDTV standard TV receivers will certainly expect to see the very best picture on their expensive TV sets when they tune to a conventional NTSC program.

While SuperNTSC had been successfully demonstrated over cable in cooperation with TCI's Sunnyvale, Calif., cable system, it had never been demonstrated in commercial application and "open-air" transmissions. In developing SuperNTSC, "televisionary" Yves Faroudja invented and patented improvements that are applied to the signal both at the production/transmission end of the path, and at the reception/display end. Between the two, SuperNTSC uses a totally conventional 6 MHz NTSC transmission signal. As a result, transmission improvements are available to all receivers, and reception improvements are made on all signals — SuperNTSC or not.

Over 3,000 Faroudja encoders are currently in use among video providers. Faroudja encoders often are used for demanding video production needs. Now, after several system refinements, Faroudja and his engineers have refined the SuperNTSC system down to a single-ended digital technology with all of the picture improvements occurring in the receiver itself. It works with any NTSC signal, although the use of the Faroudja encoder guarantees integrity of the NTSC signal. This means that it is now possible to have SuperNTSC work with any broadcast, cable, videodisc or quality videotape signal. And the separability of the encoder technology from the single-ended SuperNTSC chip set allows the technology to be evolved gracefully into the existing cable and broadcast infrastructure without significant dislocation of operations or major additional expense.

"It is realistic to expect to buy a SuperNTSC-compatible TV set for Christmas 1992."

The breakthrough in this single-ended technology approach is that it is now possible to reduce the prototype electronics to a mere chip or chip set that goes into the TV set at the point of manufacture. In normal TV set production quantities the added price to a TV set should be well under $75 — yet the set would rival the 35mm film look of HDTV sets in the eyes of the average consumer. This conclusion was born out in the four-city tests this past winter.

Objectives

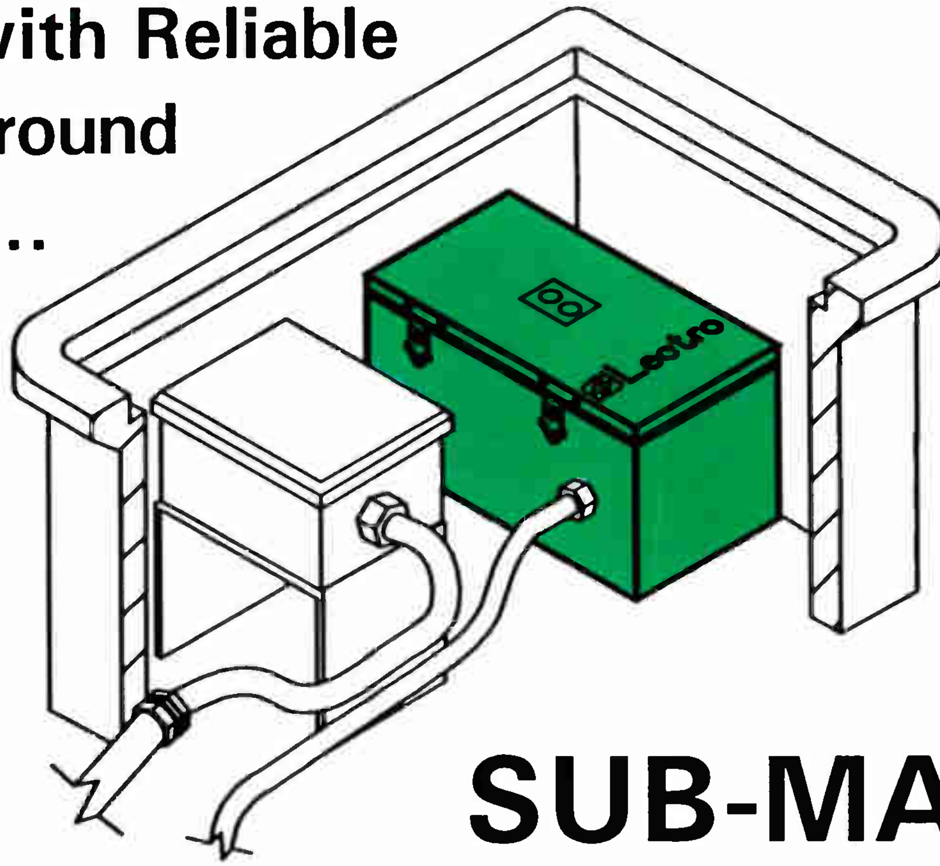
In order to maximize exposure and to exercise the technology under a variety of conditions, the sponsors determined a series of demonstrations in several U.S. cities would be necessary. The demonstration series had the following three major objectives:

1) To demonstrate that the technology could function under actual commercial broadcast and cablecast conditions without major operational dislocations.

2) To demonstrate the dramatically improved picture quality available using

(Continued on page 58)

Now Lectro Can Provide Your Plant with Reliable Underground Power...



SUB-MAX

- Meets NEMA 6P specs.
- Conforms to major utility company requirements.
- Range available to 18 amps.
- Stainless steel cabinet.
- Transformer heat sink to the cabinet.
- Visual LED indicators.

Lectro listened to your underground powering problems and developed the perfect solution - SUB-MAX. Designed to operate below grade level, the stainless steel cabinet is easily installed and meets major utility company requirements. SUB-MAX - the best way to go underground.

Reliable Underground Power for Your Cable Plant

Lectro

Lectro Products, Inc./420 Athena Drive
Athens, Georgia 30601 USA
Tel:(404)543-1904/Fax:(404)548-5493

For ALL Your Powering Solutions Call

1-800-551-3790

See us at the Atlantic City Show, Booth 600-602. Reader Service Number 18

An experiment in HDTV

By Wayne Davis
Fund Engineering Director, Jones Intercable

We've all heard it: The only way to get HDTV to the American public is to let the telcos into the video delivery business. The telcos have put forth much effort trying to make us believe that fact, even going as far as to say that the traditional coaxial cable system would be too antiquated to be able to deliver an HDTV signal to subscribers. Telcos would have us believe that their "one fiber to the home" is the only way the consumer will get HDTV.

What are the facts? Can an HDTV picture be provided today through a typical tree-and-branch coaxial cable system without significant impairment?

In order to evaluate the feasibility of HDTV services on cable, the National Cable Television Association—in cooperation with NHK (Japan Broadcasting Corp.); HBO; Jones Intercable of Anne Arundel County, Md.; and Media General of Fairfax County, Va.—set out to demonstrate through an actual test that HDTV could be transmitted over satellite and through a traditional cable system with acceptable results.

What is MUSE?

First, some background is in order. Several years ago, the United States, Canada and Japan proposed the 1,125 scan line/60 Hz field rate system as the unified international studio production standard for HDTV. In fact, limited programming has been produced using 1,125/60 cameras and equipment. Based on this system, NHK developed the MUSE (multiple sub-Nyquist sampling encoding) system that compresses the HDTV information for more efficient transmission. An HDTV signal has five times more information than our present NTSC signal. The MUSE system compresses the baseband bandwidth to only double a conventional NTSC channel, making it possible to effectively transmit the HDTV picture.

In April 1989 a MUSE-FM signal was uplinked to SATCOM K1 (Ku-band) from the HBO Communications Center in New York, then downlinked at cable headends at the Media General system in Virginia and the Jones system in Maryland. The signal was converted to MUSE-VSB/AM, combined with channels already on the system and inserted into the trunk. Sounds pretty easy, doesn't it?

When we were asked by the NCTA to take part in the test, we jumped at it. All of the receive site test equipment belonging to NHK engineers went to the Media General system first. We received a call from Media General telling us the equipment was on its way to Anne Arundel. When a 40-foot tractor trailer loaded front to rear, top to bottom with test equipment arrived (followed by seven Japanese R&D engineers), we knew this was no insignificant experiment. The test actually took four days to set up. All of the equipment had to be uncrated, checked for damage and calibrated. Because the test equipment, encoders, modulators, monitors, etc., had been shipped from Japan and many were one-of-a-kind R&D prototype units, it was necessary to bring from Japan two of nearly every unit used, should one fail.

This caused warehouse space to be at a premium during the experiment. AC power was also at a premium in order to power all of the test equipment and the encoders. Tripped breakers were fairly common during the course of the test, as were overtaxed air-conditioning units due to the buildup of heat from the 1.5 tons of equipment necessary to realize the test. Equipment setup and alignment meant many late nights with NHK engineers. Was it worth all the effort?

At test points in the system the recovered HDTV signal was decoded and displayed on an HDTV monitor along with a conventional NTSC TV set through a MUSE-to-NTSC converter. At both systems' TVRO sites, the satellite signal carrier-to-noise (C/N) ratios were greater than 23 dB and the system RF C/N ratios at the end-of-line test points were greater than 44 dB (8.1 MHz).

At the end of a 28-amplifier cascade the picture quality could only be described as phenomenal! While the TASO method for rating subjective picture quality somehow seems inadequate for rating an HDTV picture, the picture rated a grade 1+, with no perceptible interference and a picture of extremely high quality. All this was achieved on a conventional tree-and-branch coaxial system over 12 years old. The system wasn't special in any way other than it had been properly maintained.

"It isn't necessary for us to totally rebuild our plant, nor is fiber the only delivery method acceptable."

We will be ready

In spite of what the telcos have to say, the cable industry is ready now to deliver high quality HDTV. It isn't necessary for us to totally rebuild our plant, nor is fiber the only delivery method acceptable. The facts show that once an HDTV standard is adopted, the cable industry will be ready! **CT**

Reference

"HDTV MUSE Signals on Cables and Optical Fibers," Yozo Utsumi, Hiroo Arata, Mikio Maeda, *1990 NCTA Technical Papers*.

Reader Service Number 21

Consumer-friendly cable/telco integration: Today and tomorrow

By Dave Wachob
Director, Advanced Technologies
Jerrold Applied Media Lab

Improving consumer friendliness continues to be a central theme for operators in their quest for subscriber satisfaction. Subscribers, for their part, are faced with a plethora of consumer electronic devices, intended to improve their quality of life and add entertainment value. Cable has until now had varying degrees of success at interfacing with the myriad of consumer electronic products in a friendly fashion. The problem will be compounded in the future with the advent of digital compression/high definition TV, 1 GHz systems, interactive TV and a host of other new services all requiring some form of box in the home.

"(Remote control and cordless phone) integration makes sense since both products utilize similar keypad, microprocessor, packaging and battery technology."

Figure 1: Remote control/phone device

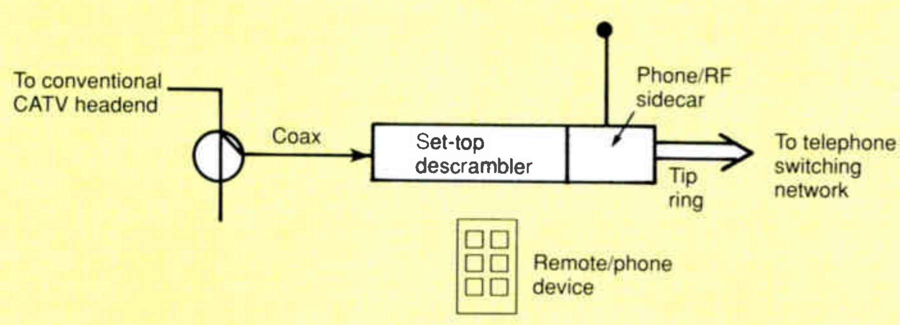


Figure 2: Enhanced services

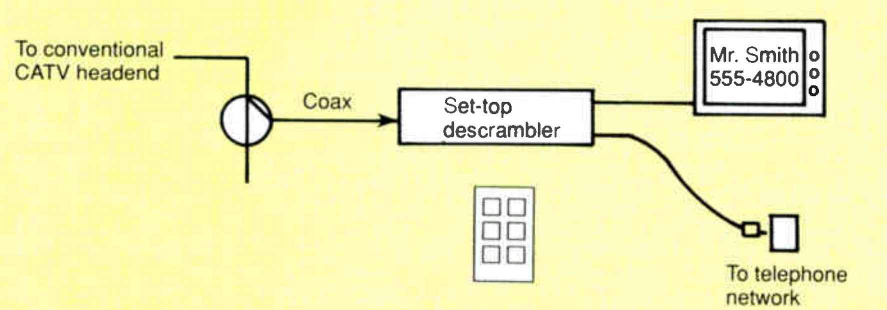
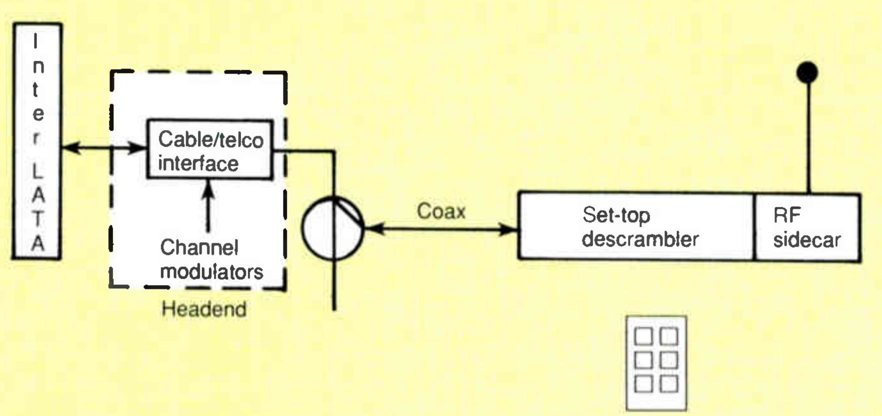


Figure 3: Cable telephony



On/off-premises attempts to solve the problem by moving the cable electronics outside the home. Concerns over security, powering, environmental performance and the flexibility to support the growing demand for addressable pay-per-view (PPV), however, has limited its market acceptance as a viable solution. The real solution entails solving the problem *in* the home, in a way that enhances the subscriber's perception and utility of cable, rather than detracts from it.

One such approach for improving the consumer's utility of cable integrates the functionality of a remote control and a cordless telephone into a single hand-held device. The integration makes sense since both products utilize similar keypad, microprocessor, packaging and battery technology. In addition, both products are oftentimes located and used within the proximity of the TV viewing room.

Using the existing phone network, the concept would be configured as in

(Continued on page 64)

BROADCAST PREMIER.

Presenting the Drake ESR 1240 Integrated Receiver/Decoder.

Drake has been in business long enough to know what you demand in an IRD.

The Drake ESR1240 IRD delivers high performance in an affordable, compact unit that combines a commercial grade satellite receiver with an integrated VideoCipher® II Commercial Descrambler Module.

The ESR1240 IRD uses a new low noise 70 MHz IF with threshold extension to provide the best possible picture and low data error rates under weak signal conditions.

Convenient front panel access.

The ESR1240 IRD's front panel design allows easy access to the descrambler module without having to remove the unit from its rack mounted position.

Two front panel LEDs show sync and authorization status of the descrambler module. A two-digit LED display indicates C band channel selection. Channels 1-24 can be tuned in by the ESR1240 IRD's front panel channel selection switch and fine tuning control.

VideoCipher® is a registered trademark of General Instrument Corporation. Ownership or possession of the ESR1240 IRD with a VideoCipher® II Commercial Decoder does not entitle the owner or possessor to receive descrambled signals without authorization by the programmer.

VideoCipher® II Decoder Module warranteed separately by General Instrument Corporation.

Complete video and audio reception control.

When a signal is received, video output is automatically switched between descrambled video and normal clamped video, providing crisp, clear video from either scrambled or unscrambled signals. Also, digital stereo audio is available with a choice of balanced or unbalanced outputs for left and right channels. The subcarrier audio demodulator is tunable from the front panel.

Famous Drake quality.

Backed by a one-year limited warranty, the Drake ESR1240 IRD complies with and exceeds the latest industry standards. All in a highly reliable, efficient and affordable unit designed with you, the cable operator, in mind.

Because Drake has made its business on knowing your business.

Contact us for the name of your nearest Drake distributor.

DRAKE®

R. L. Drake Company
P.O. Box 112, Miamisburg, Ohio 45342 U.S.A.
Sales: (513) 866-2421, Fax: (513) 866-0806
In Canada: (705) 742-3122
Service and Parts: (513) 866-3211

Made in America by Drake . . . a world leader in communication products since 1943.

Basic designs with interdiction technology

This is the fourth article in a series on CATV design. "Basic RF system design" appeared in the September 1990 issue, "Basic AC system design" in October 1990 and "Design considerations with fiber" in December 1990. Primary topics to be considered in this article are:

- *Basic interdiction concepts*
- *Differences in designing with interdiction*
- *Interdiction RF design considerations*
- *AC design considerations*
- *Final comments*

By Mark Bowers
Owner, CableSoft Engineering Services and CableSoft

Designing with interdiction needs to begin with some basics of interdiction technology. Interdiction technology employs a tap-like device at the pole or pedestal but the tap internally contains a broadband amplifier, interdiction oscillators that can be programmed to "interfere" with certain channels, a data receiver, and other active and passive components. Let's start this discussion with details on the tap.

Interdiction tap

The tap usually contains several oscillators, each of which cover an octave or range of frequencies or channels and all of which usually are contained within a plug-in subscriber module. Since the interdiction tap is addressable, each tap port can be addressed and programmed to pass some channels in the clear while others are jammed or interfered with. At the time this article was written, Scientific-Atlanta was the only company offering a fully developed interdiction device for installation in cable systems, therefore all information contained in this article pertains primarily to S-A's equipment and technology.

The S-A interdiction tap contains four interdiction oscillators that can cover a (selected) frequency range of 55.25 to 450 MHz. Jamming of up to 48 channels, all with maximum jamming per channel, can be configured. Future developments call for a 550 MHz unit that could interdict up to 52 channels — again with maximum jamming on each channel.

It is important to note at the onset that the interdiction tap or device is active in nature, as opposed to the passive multitap we are so familiar with and employ in current designs. Signals passing through the tap are sampled with a plug-in directional coupler (DC), then fed through an equalizer (EQ) into a broadband amplifier. After signals are pre-processed via the proper DC, EQ and amplifier, interdiction oscillator signals are injected within each channel as appropriate and selected by the operator. Since a broadband device is employed to process the CATV signals, it follows that the interdiction tap contributes some amount of noise and distortion to the signal(s) delivered the home. Basic specifications for the S-A Model 9504 tap are shown in Table 1. It also should be noted that, as is often the case with CATV electronics, the specs shown in Table 1 are worst-case, with typical performance better than shown. When calculating distortion levels, always use worst-case.

We will cover more on distortion analysis later in the article. There are

Figure 1: System area design

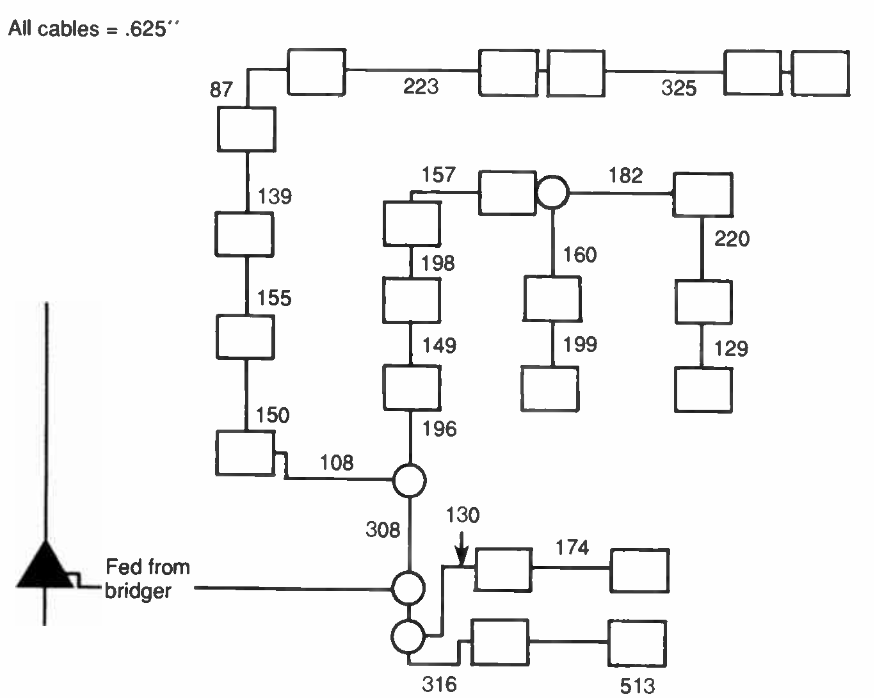


Table 1: S-A four-port addressable interdiction unit (Model 9504) specifications

Output level (nominal)
+16 dBmV @ 550 MHz
+15 dBmV @ 450 MHz
+14 dBmV @ 330 MHz

Output tilt (nominal)
+6 dB from 54-550 MHz
+5 dB from 54-450 MHz
+4 dB from 54-330 MHz

Required input level to device
+23 dBmV @ 550 MHz
+22 dBmV @ 450 MHz
+21 dBmV @ 330 MHz

C/N performance
-53 dBc (see Endnote 1)

Intermodulation distortion
CTB: -60 dBc
XMOD: -60 dBc
CSO: -60 dBc

some other differences between interdiction and designing with multitaps that need to be further examined and discussed.

Each addressable interdiction unit, besides the other circuitry mentioned, contains built-in AGC. The unit must achieve a fairly narrow amplitude window between broadband input signals to properly inject the interdicting carriers, hence the careful selection of DCs and EQs. Basic operation of the unit is therefore as follows: The input signals are sampled with a percentage of the signal routed through the tap leg of the DC into the EQ. Output of the EQ is the broadband signal, with approximately 5 dB of forward (positive) tilt across the entire spectrum. The interdicting carriers are then injected into this signal, keeping all resulting carriers within a fairly narrow amplitude range. If the interdiction technique is to achieve maximum jamming effectiveness, the relationship in amplitude between picture carriers and jamming carriers must be closely maintained; hence the aforementioned careful coupling, equalizing and amplification.

Figure 2: Sample interdiction design

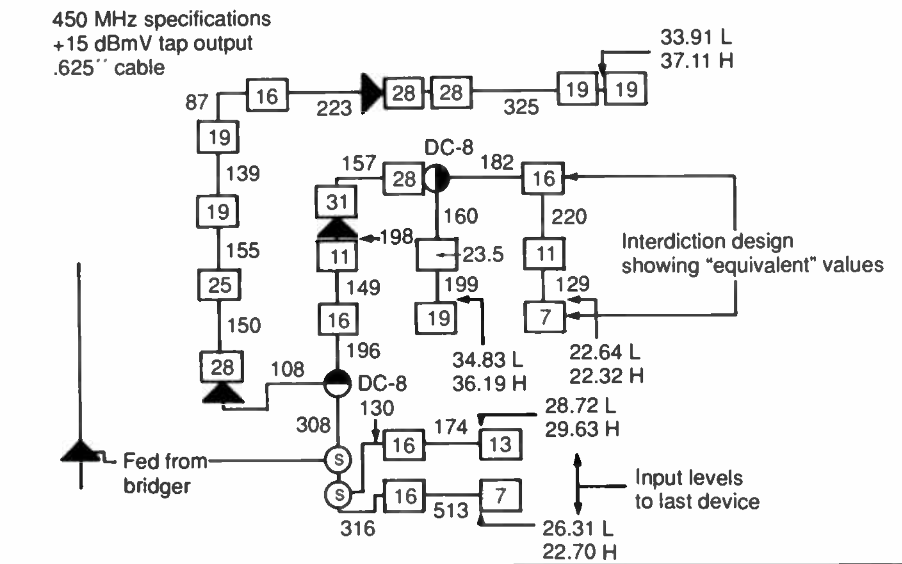
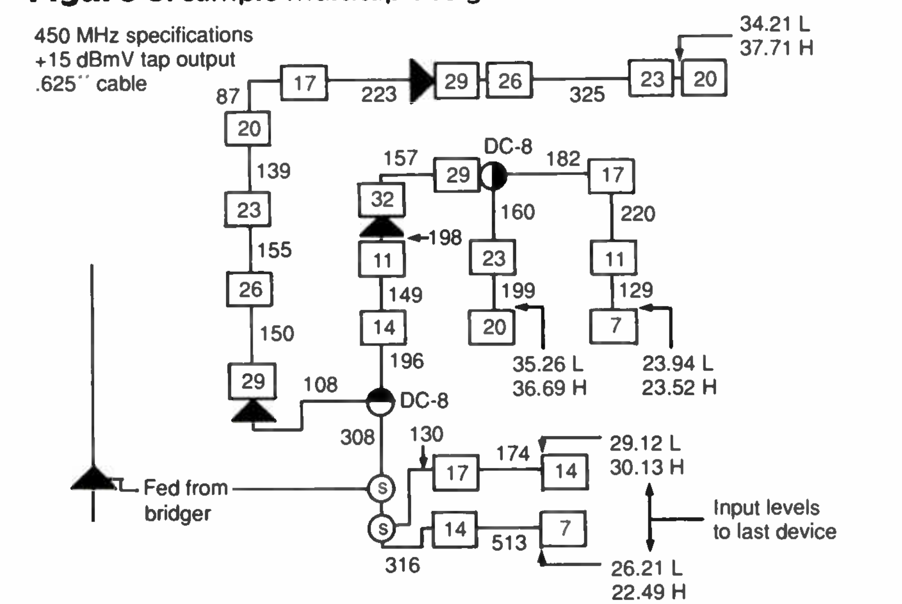


Figure 3: Sample multitap design 1



Hot taps

This raises a further issue — "hot taps." Since the unit has this carefully designed input/output range, hot taps are not possible. Interdiction tap outputs are defined and configured to those indicated in Table 1. This presents something of a dilemma for the designer. Levels are certainly adequate from the device for typical designs, but the technique of higher-than-normal levels fed from a two-port multitap into a long drop (hot tap) won't work.

In many cases, DCs will be employed for hot feeds as is often done in current designs; use of RG-6U and RG-11U for service drops also must be considered in many areas. Creative routing of drops will be discussed further because of the issue of tap port "inefficiency."

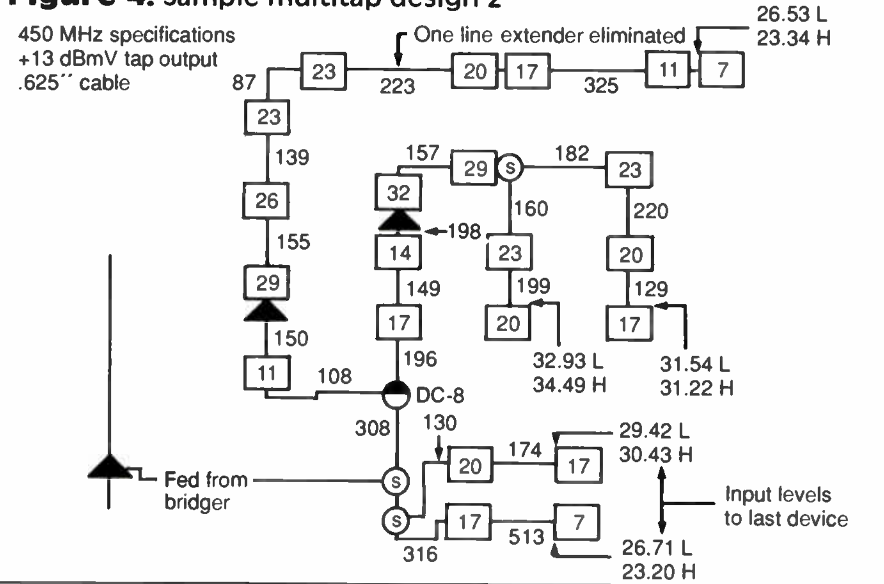
Differences in designing

There are several other concepts that deviate from normal design considerations. They are tap equivalency values, tap port inefficiency and distortion analysis with the interdiction device.

Tap equivalency value. A passive multitap comes in two-, four- and eight-port configurations and in manufactured assigned values. The overall tap value represents the loss of the device from input to tap port and includes the built-in DC value plus internal splitting (two-way, four-way, etc.). If you want a four-port 29 dB tap, you order that value!

In contrast, the interdiction device currently comes as a four-port unit only, without specific value. You then install a plug-in DC for the device that gives the unit an overall equivalent value as in a multitap. During the actual selection process you can choose actual DC values or design using equivalent tap values that represent the overall value of an interdiction tap with each available DC/EQ value. Table 2 shows necessary input levels for the device, DC values and representative equivalent tap values in each case. A design program can therefore be loaded with the equivalent values and designed from there, obtaining "approximate" design layouts. Care must be taken so that the program keeps the input levels to each tap within the proper and rather restricted range. Accurate designing requires the program to choose actual DC and EQ values through an iterative process, since the choice of the correct EQ will affect the correct DC to be installed. Scientific-Atlanta also offers use of a "table" that facilitates accurate designs. The designer calculates the input lev-

Figure 4: Sample multitap design 2



els to the interdiction unit, then uses the lookup table to select the correct DC and EQ.

Tap port inefficiency and long drops. Tap port inefficiency sounds like a rather obscure subject. The phrase has been coined to describe a phenomena that has been with us since multitaps came into use but has not caused concerns until now.

Tap port inefficiency describes the following effect: Normal multitap design involves placing two-, four-, and eight-port taps "close" to homes to be fed. Close would typically be defined as acceptable drop lengths to any home and normally fed with RG-59U cable, although there has been an industry movement toward RG-6U of late for many reasons such as lower loss at higher frequencies and greater physical strength.

Many times a two-way tap is placed where only one (potential) home is to be fed, a four-way tap where only two or three homes (potential) are to be fed, etc. It also should be understood that "potential" references "homes passed," and regrettably not all homes passed become active subscribers.

Both of these effects combine to form the following situation. Even if all homes passed became subscribers, not all tap ports would be used — some will still be vacant. Further, not all homes passed become customers. The effect is thus compounded. In typical designs examined, the tap port "efficiency" or usage rate can be as low as 50 to 60 percent to as high as 80 to 90 percent. This problem is complicated further with the interdiction device because a four-port interdiction unit is the only choice available.

With passive multitap design, which involves average costs of perhaps $15 to $20 per multitap including connectors, this inefficiency effect escalates the overall design cost slightly. With interdiction design, where the housing and motherboard alone may cost several hundred dollars (without subscriber modules), this creates a potentially serious cost escalation for the plant design. (See the accompanying sidebar on page 38 for more on actual cost projections.)

Methods to solve this problem are few at this point. Strategic placement of available four-port units is critical, especially in underground design. Where

Table 2: S-A tap specification/equivalency

Input level requirement dBmV @ 450	Input level requirement dBmV @ 550	Internal DC value (dB)	Nominal tap value (dB)	Max insertion loss (dB) 60 MHz	330 MHz	450 MHz	550 MHz
22	23	0	7	Terminating tap value			
23	24	1	8	Terminating tap value			
24	25	2	9	Terminating tap value			
25	26	3	10	Terminating tap value			
26	27	4	11	3.4	3.6	3.7	3.8
27	28	5	12	3.4	3.6	3.7	3.8
28	29	6	13	2.0	2.1	2.2	2.3
29.5	30.5	7.5	14.5	2.0	2.1	2.2	2.3
31	32	9	16	1.3	1.6	1.8	2.0
32.5	33.5	10.5	17.5	1.3	1.6	1.8	2.0
34	35	12	19	0.6	0.8	1.0	1.2
35.5	36.5	13.5	20.5	0.6	0.8	1.0	1.2
37	38	15	22	0.6	0.8	1.0	1.2
38.5	39.5	16.5	23.5	0.5	0.6	0.8	0.9
40	41	18	25	0.5	0.6	0.8	0.9
41.5	42.5	19.5	26	0.5	0.6	0.8	0.9
43	44	21	28	0.5	0.6	0.8	0.9
44.5	45.5	22.5	29	0.5	0.6	0.8	0.9
46	47	24	31	0.5	0.6	0.8	0.9
47.5	48.5	25.5	32.5	0.5	0.6	0.8	0.9
49	50	27	34	0.5	0.6	0.8	0.9
50.5	51.5	28.5	35.5	0.5	0.6	0.8	0.9
52	53	30	37	0.5	0.6	0.8	0.9
53.5	54.5	31.5	38.5	0.5	0.6	0.8	0.9

Table 3: Equipment examples

Push-pull equipment[1]	C/N	XMOD	CTB	DSO
System only	45.92	54.93	53.87	61.53
With interdiction	45.17	51.08	50.39	57.1
With baseband converter	45.22	51.75	51.16	57.1
FF and PHD equipment[2]	**C/N**	**XMOD**	**CTB**	**DSO**
System only	45.14	56.49	58.29	59.36
With interdiction	44.51	52.05	53.08	56.06
With baseband converter	44.55	52.81	54.16	56.06

[1]Equipment output levels were 31/44/40 for trunk/bridger/distribution
[2]Equipment output levels were 33/46/46 for trunk/bridger/distribution

the designer may feel free in multitap design to place a pedestal with multitap every two homes on lot lines, the cost of the four-port interdiction motherboard and housing makes this practice prohibitive. Every effort must be made to place four-port units where they can optimally serve four homes passed. Strategic use of slightly longer drops using RG-6U/RG-11U in lieu of RG-59U also can help to optimize tap placement. This problem is being addressed with single- and eight-port units under development. A single-port unit (SMU) is under development that would mate with an existing passive multitap. An eight-port unit is in preproduction, with full production slated for the end of September.

In a comparative pricing analysis conducted (keeping all other variables constant) this tap inefficiency problem can increase overall system equipment costs by as much as 5 percent or more as compared to a system that could achieve total tap port usage (the effect of port non-use due to less than 100 percent basic penetration rates is not included in this analysis — see Endnote 2).

Interdiction tap distortion considerations. Table 3 illustrates some sample system distortion results with and with-

Testing the economics of addressable interdiction

By Angela Bauer
Senior Market Specialist
Scientific-Atlanta Inc.

Addressable interdiction has a number of advantages for a variety of systems, including a short payback in many cases. To demonstrate the payback, which typically ranges from one to three years, Scientific-Atlanta has developed a Lotus-based economic model to help an operator decide if interdiction makes sense for all or perhaps just a portion of a system.

The model calculates the many factors in determining capital costs, operational expenses and additional marketing revenue of addressable interdiction's four-port unit vs. addressable set-tops or traps. These three figures determine the product's payback in years and the rate of return on the equipment.

Some key system parameters needed to compute capital costs include:

- Homes passed.
- Subscriber count.
- Plant miles.
- Tap inefficiency.
- Percent of underground plant.
- Cable-readiness of the subscriber base.
- Power supply price and size.

These figures will tell you the quantity of interdiction units, power supplies, additional pedestals (eight-inch pedestals are needed) and the number of converters (needed for tuning purposes for non-cable-compatible sets).

Operational expenses are composed of the following:

- Cost per kilowatt hour (powering costs).
- Metered or non-metered power supplies.
- Cost of truck rolls.
- Percentage theft on current equipment (set-tops).
- Reliability of drops, set-tops and traps.

Additional marketing revenue is derived from the following:

- Eliminating theft of basic service.
- Eliminating theft of pay service.
- Take rate of PPV and major events to entire subscriber base.
- Cash flow from instant installs (no backlog).
- Change in additional outlet and remote control revenue. (Interdiction systems have actually seen increases in these two parameters.)
- Potential growth due to customer satisfaction and marketing.

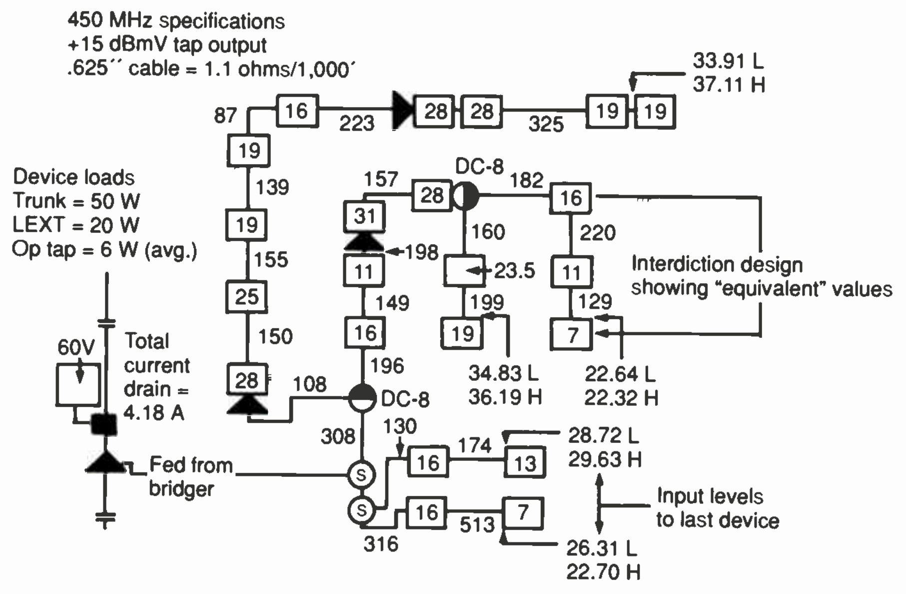
The economic model has been used by many operators, each one modifying it to suit their specific situation. Payback periods will vary — and, no, interdiction is not for everyone. However, many payback periods can be less than one year depending on some key variables such as density, churn, spin and theft.

Addressable interdiction can be deployed in target areas with these variables. One example is "pocket deployment" to areas with high churn or high theft such as apartment complexes or resort areas. Pocket deployment of interdiction works best with fiber-to-the-serving-area architecture where a clear signal to these targeted areas helps generate a quick payback.

Although addressable interdiction can require more upfront capital than conventional technology, the return on the investment and payback time often make it a good business decision.

For more information on how to plug in the parameters of your system to determine interdiction's payback, contact the author at (404) 925-6292.

Figure 5: Sample interdiction AC design



out the interdiction device employed in the system. The analysis in the table compares interdiction with a typical baseband converter.

The first example in Table 3 uses standard push-pull equipment with a cascade of 20 trunks, bridger, two line extenders and a single interdiction tap or baseband converter. Distribution power levels had to be reduced significantly in this push-pull example to maintain acceptable distortion levels in the design with introduction of the interdiction unit *or* the converter. Design efficiency and overall range of design would therefore be reduced as well. Since the interdiction broadband amplifier processes only the signals used internally to each tap, a maximum of one in cascade is all that is experienced for the signal delivered to any subscriber. The second example uses feedforward trunks and bridgers, plus parallel hybrid line extenders with a cascade of 20/1/2. Comparison is then made between introduction of a baseband converter vs. interdiction unit.

Since most current analysis of interdiction technology, whether financial or technical, is typically compared against one-way addressability, our examination of distortion additions with interdiction should be compared in a like manner. While comparable in noise addition with our typical cascades of equipment, degradation in distortions is slightly worse with the interdiction device as compared to the converter.

Several conclusions can be drawn from these examples, some obvious. The interdiction unit does contribute a measurable amount of distortion to the signal delivered to the home and when calculating overall system performance you should include this effect in the analysis carefully. Further, in the push-pull example, the introduction of converter or interdiction unit requires a significant reduction in system levels to keep overall distortions within limits. Again, this causes a significant reduction in overall plant design efficiency.

As a final note to this discussion, it also should be noted that the interdiction device only jams or interferes with the channels that the customer is *not* to receive. Because no scrambling and picture reconstruction take place in the channels the customer is paying to receive, overall picture quality is often noticeably better than in converter systems.

The primary purpose of the preceding analysis is to draw importance to the fact that distortion analysis in the system should always include that contributed by the interdiction tap or the converter. With careful analysis and system levels chosen, overall noise and distortions can be properly managed in the system.

Interdiction RF designs, layout

Now let's look at an interdiction design and compare it with multitap layout.

Figure 1 illustrates an area to be designed with interdiction technology. It represents a typical underground subdivision to be fed directly from a distribution leg at a bridger location. All cables employed in this subdivision design are .625-inch, third-generation type.

Figure 2 shows the same subdivision designed at 450 MHz with S-A's four-port addressable interdiction unit. Values shown on each tap housing are the "equivalent" values as discussed earlier (see Table 2 for associated internal DC values). The sample design involves almost one mile of underground cable and four line splits, with three line extenders resulting to feed this area. Other information shown on the drawing are input levels to the last device on each line and tap design levels.

Figure 3 illustrates the same 450 MHz design with S-A 450 MHz multitaps rather than interdiction units. As can be seen from comparing tap values and "last device on the line" readings, the design does not deviate significantly from interdiction assuming the same desired tap output requirements are kept. That is, the minimum acceptable tap output requirement is +15 dBmV in both designs.

S-A currently asserts that there are no significant variations in design efficiency between interdiction and multitap design. I agree with that assertion, assuming you always desire a +15 dBmV from the tap spigot at 450 MHz. If lesser tap outputs at 450 MHz are acceptable for some reason such as a particular system topology, improved efficiencies can be achieved.

As an example, Figure 4 illustrates the same area designed with multitaps, with a +13 dBmV output tap requirement at 450 MHz. In this example, one line extender can be eliminated from the subdivision design — a reduction from three to two.

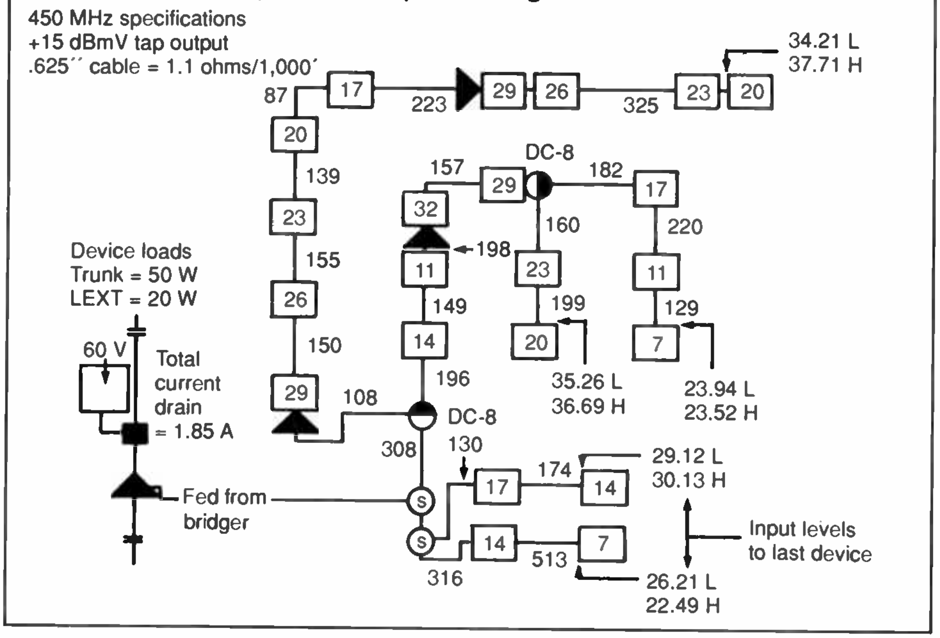
My point to all of this is severalfold and as follows:

1) Designing with interdiction is not significantly different than multitap design, given the caveats mentioned in this discussion. The addition of distortions and noise at the tap (an active device) must be analyzed carefully but can be managed as we do in any system.

2) The lack of a one- or two-port unit exasperates the problem of efficient tap port usage. While this problem has been with us for some time, the higher cost of the interdiction motherboard and housing represents a financial impact for the designer and cable operator that also must be considered. The

MADISON
AMES
NATIONAL
AVE.
NEW JER
RILL

Figure 6: Sample multitap AC design



designer must take great care in proper placement of taps, particularly in underground areas. Use of RG-6U (perhaps even RG-11U in some instances) and careful drop routing also will be key to an acceptable financial as well as technical design.

3) Since the input/output levels of the interdiction device are strictly controlled for jamming carrier insertion, some further limitations are placed on the system design such as lack of hot-tap availability. As shown by comparison in designs in Figures 3 and 4, that impact can be limited depending on desired tap output levels. Current estimates are that increases in required distribution electronics in interdiction design could be as much as 5 percent, depending on minimum (current) tap output requirements and the impact of the four-port only unit. Typically, the impact from required input/output levels is minimal; impact from tap port inefficiency in the four-port only unit is greater.

AC design considerations

An examination of the impact of interdiction taps on the AC powering grid also is in order, since many operators feel this is a primary stumbling block toward full-scale deployment of this technology.

Figure 5 illustrates power supply placement for the interdiction design shown earlier in Figure 2. One power supply (not surprisingly) will power this area including the trunk station with a total current requirement at the supply projected at 4.18 amperes.

By illustration, Figure 6 shows the same power supply placement with the sample multitap design shown in Figure 3. Here the power supply is loaded to a total drain of 1.85 amperes — an increase in total current load from multitap to interdiction of 126 percent. Each interdiction unit was assumed to have average loading (motherboard + housing + two subscriber modules); i.e., not worst-case scenario. If each device was fully loaded, the increase in power consumption would obviously be greater. Prudent AC layouts call for designing to 100 percent subscriber module loading even though this rarely would be experienced. That often brings the multitap to interdiction increase to the 200+ percent range!

Based on many sample designs accomplished, the overall power increase in typical system powering — with multitap design compared with interdiction — will usually be in the high 100 to 200 percent range. While this presents some problems for the operator and designer, they are manageable.

I further feel they are preferable to the different and more difficult-to-manage problems introduced with home powering via the drop cable. Careful placement of each main supply is necessary in optimizing the AC design, and this location is not always at the trunk station as has been typically done in the past. For example, with the power supply located at the 28 dB tap

and line extender at the left-center of Figure 5, total power supply load decreases to 4.09 amperes (a reduction of 2.4 percent), and minimum load voltage at any active increases to 58.78 V (an increase of 3.45 percent). Design placement efficiencies are therefore possible in interdiction and must be considered carefully by the designer with the increased powering requirements.

The previous percentages are small since only a very small area was considered. In typical designs, optimal placement can offer significant improvements.

Final comments

Interdiction technology represents an exciting new choice in signal security and addressable control of the signals entering the subscriber's home. While increasing the cost of plant design compared to one-way addressability, cost savings are incurred compared to the maintenance of converters and traps, and even offers the opportunity to vacate the converter business if desired. It offers a broadband nonscrambled signal to the subscriber with fully resolved consumer interface problems and increased consumer acceptance of our product(s).

In terms of AC and RF design considerations, new challenges exist here that do not exist in multitap designs. Some limitations in overall flexibility will occur given strict input/output levels, inability to use the hot tap technique, and present lack of a one- or eight-port unit. These problems are under resolution, and are manageable in the design process. I believe the overall advantages offered by interdiction far outweigh the concerns at this juncture.

Overall, designing a modern cable system offers many technical and economic challenges. Changes and evolutions in technology are occurring rapidly. The designer needs to keep abreast of these technology changes and be sure that the design tools employed offer enough flexibility to allow change and use of new technologies as well. Designing, whether with coaxial cables, fiber optics or with interdiction, requires the designer examine both technical and economic considerations in overall project scope. Future architecture designs also must always examine overall impact on total system reliability, which is key to our success in a more complicated and competitive environment. Development of reliability models for cable system design/architecture are therefore also needed and under development in the industry.

Your design package and program needs to offer traditional placement of equipment, but also should allow analysis of economic and technical opportunities in new technologies — fiber, interdiction, etc.

Endnotes

1) The -53 dBc carrier-to-noise ratio at specified input/output levels yields an "equivalent" noise figure measurement of around 27 to 28 dB for the device. It should be noted that the internal amplifier does not actually test to this noise figure. Rather, total performance of the unit with typical levels yields this "equivalent" number.

2) Sample designs conducted to examine tap inefficiency impact rates against total hardware costs yielded the following: An 8.25 percent increase in hardware costs was incurred, taking the tap inefficiency rate from 0 to 20 percent in a sample system with 20,000 homes passed, 80 percent basic penetration and 225 miles of plant. **CT**

Digital Spectrum Compatible HDTV

(Continued from page 19)

When cable systems add DSC-HDTV channels, their levels can be chosen so that the total mutual interference due to intermodulation distortion will be less than what exists today with all NTSC channels.

Any one of these benefits, of course, would bring a significant TV improvement. Combining all of them into one system could make HDTV a major technological development of the 1990s for both cable and terrestrial broadcasting. **CT**

Further reading

The following articles are recommended for more information about digital high definition TV and the Zenith/AT&T system:

1) Digital Spectrum Compatible HDTV, "Technical Description," published by Zenith Electronics Corp. and AT&T Bell Labs, Feb. 22, 1991.

2) "The Digital Spectrum Compatible HDTV Transmission System," by R. Citta, P. Fockens, R. Lee, J. Rypkema, Zenith Electronics Corp., *IEEE Transactions on Consumer Electronics*, August 1991 .

3) "A High Performance Digital HDTV Codec," by A. Netravali, E. Petajan, S. Knauer, K. Matthews, B. Safranek, P. Westerink, AT&T Bell Labs, *IEEE Transactions on Consumer Electronics*, August 1991.

4) "The Zenith/AT&T all-digital HDTV proposal," by L. Lockwood, TeleResources, *Communications Technology*, May 1991.


FEDERAL
EXPRESS
MAGNAVOX
CATV SYSTEMS

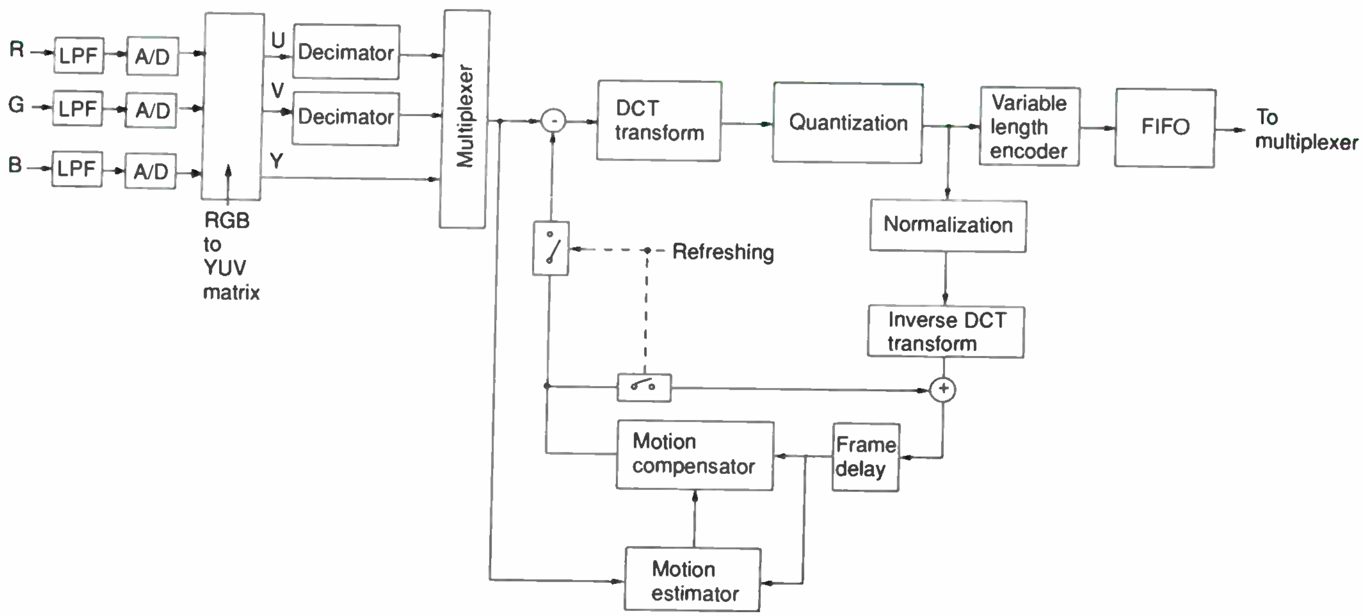
DigiCipher HDTV

(Continued from page 24)

the multiplexer. Forward error correction (FEC) is then added to the signal, and it is modulated in 16- or 32-QAM for transmission over the channel.

Table 1 presents the key system parameters, most of which are the same between the 16- and 32-QAM modes. DigiCipher utilizes an interlaced scanning format, as does NTSC, with double the number of display lines. The field and frame rates are the same as NTSC, to maximize compatibility between the formats. Bandwidths are about four times greater, yielding a doubling of the resolution. →

Figure 3: Digital video encoder block diagram



The data transmission rate in 32-QAM is almost 5 Mbps higher than in the 16-QAM mode, and that increased data rate is applied entirely to increasing the data rate for video. As a result, the 32-QAM provides a data rate for video that is almost 40 percent greater.

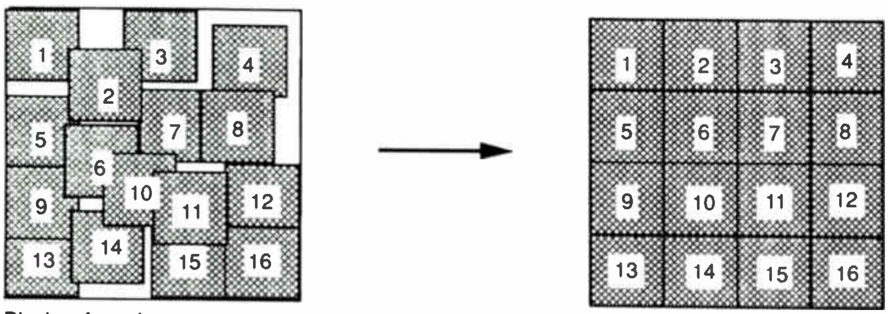
The table also provides system transmission thresholds. The powerful error correction coding and an adaptive equalizer, have provided a system with excellent performance in the 32-QAM mode, and exceptional 16-QAM performance.

Digital video processing

Uncompressed, an HDTV digital video signal would require about 1.5 gigabits per second. Compression by a factor of about 100 is needed to allow transmission in a 6 MHz channel. Figure 3 is a block diagram of the digital video encoder. The needed compression is accomplished in a number of ways. First, just as in NTSC, chrominance is transmitted with reduced resolution, since the eye cannot perceive detail in color as well as in black and white. The DigiCipher encoder reduces chrominance resolution by decimating the two chrominance signals by a factor of four horizontally, and two vertically.

The system uses differential PCM (DPCM) coding to eliminate the very substantial redundancy in the video material that exists frame to frame. As shown by the subtraction box, the previous frame signal is subtracted from the current frame and only the differ-

Figure 4: Using motion compensation to predict next frame

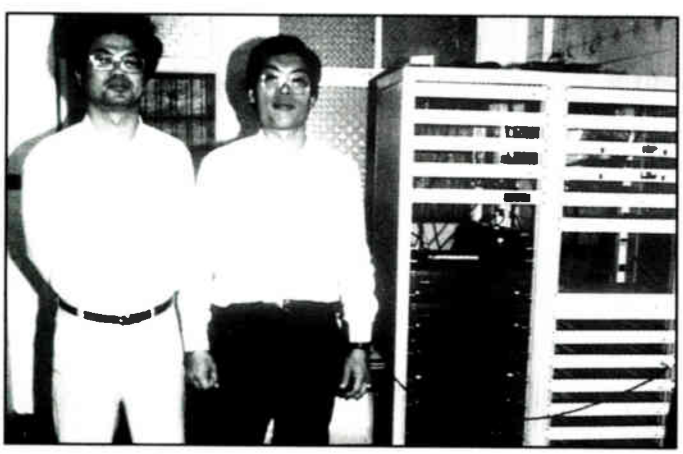


Blocks of previous frame used to predict next frame

Previous frame after using motion vectors to adust block positions

Table 2: Weighting table for DCT coefficients

16	16	19	22	26	27	29	34
16	16	22	24	27	29	34	37
19	22	26	27	29	34	34	38
22	22	26	27	29	34	37	40
22	26	27	29	32	35	40	48
26	27	29	32	35	40	48	58
26	27	29	34	38	46	56	69
27	29	35	38	46	56	69	83



ence signal is processed.

In TV images, most of the signal energy is typically contained in the DC and low frequency terms. Further, high frequency detail, particularly along diagonals, is not easily resolved by the eye, especially when motion is involved. The DigiCipher encoder takes advantage of this by processing the image in the frequency domain, by using discrete cosine transform (DCT).

DCT processing is done on the image in blocks of pixels that are 8x8 (horizontal by vertical). The transform yields an 8x8 set of coefficients for frequency terms. The coefficients are then divided by a set of weighting factors, shown in Table 2, which emphasize the DC and low frequency terms as compared to the high frequency terms, and slightly favor vertical frequencies as compared to horizontal. The result is further divided by an adaptive quantization factor, which adjusts the coarseness of resolution so that the compressed data flow matches the transmission channel capacity.

Both luminance and chrominance pixel blocks of size 8x8 are processed by DCT. However, because of decimation, eight luminance blocks are processed for each two chrominance blocks. Indeed, a set of luminance blocks 4x2 has the same size on the screen as a chrominance block, and is called a superblock.

Figure 5: Field processing

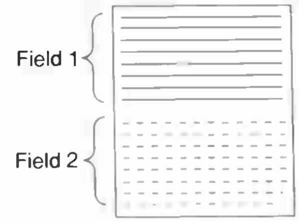
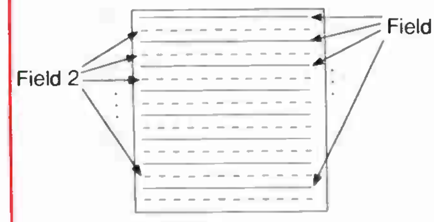


Figure 6: Frame processing

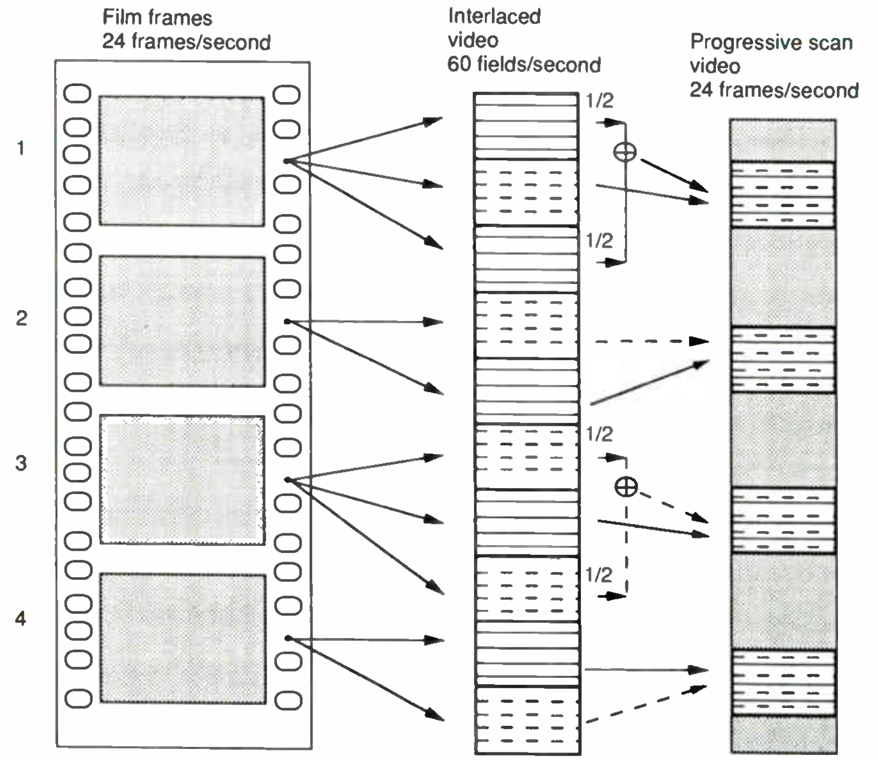


DPCM is much more efficient if motion compensation is included to track objects moving from frame to frame. DigiCipher encoding incorporates motion compensation at the superblock level. The search algorithm seeks the best match between a luminance superblock in the current frame, and a translated superblock within +31/-32 pixels horizontally, and +7/-8 pixels vertically, in the previous frame. These limits allow the tracking of objects moving at 0.68 picture widths per second and nearly 0.25 picture heights per second. The overhead to send a motion vector is 10 bits per superblock. Figure 4 illustrates the concept of blocks translating from frame to frame.

In cases where DPCM coding is less efficient than PCM, DigiCipher encoding adaptively switches, on a superblock basis, to PCM or intraframe coding. When PCM is used, no motion vector is sent. For most material, DPCM is used more than 85 percent of the time. However, during scene changes, the DPCM rate can drop to below 10 percent.

PCM coding also is used to refresh the picture. Refreshing allows the system to overcome uncorrected transmission errors and to acquire the picture

Figure 7: Conversion of film to interlaced video and restoration of progressive scan

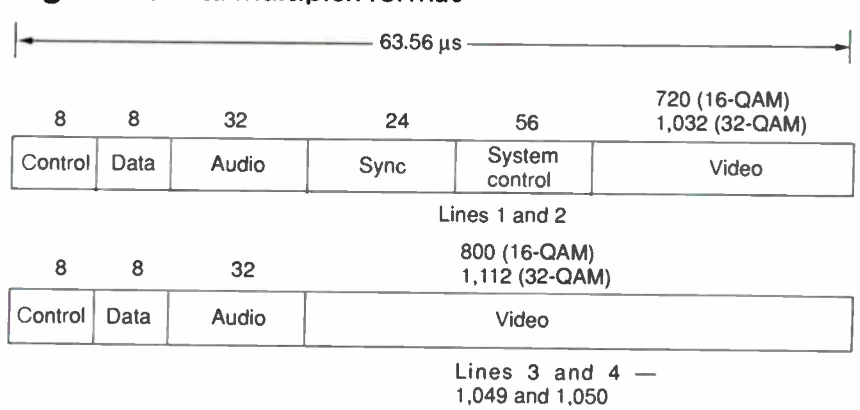


when a channel is first tuned. The picture is refreshed each 0.37 seconds, by continuously transmitting a portion of the picture using PCM.

The system also adaptively switches between processing the fields independently or interleaved into a frame. Frame processing works better when there is little or no motion, whereas field processing works better in detailed moving areas. Both types of processing are done and compared in the encoder, on a superblock basis, with the selection being made based on which achieves minimum error. Figures 5 and 6 illustrate field and frame processing, respectively.

A lot of the material used in television is initially captured on film, typically at 24 frames/second. It is converted to video using a process called three-two pulldown. The DigiCipher encoder recognizes three-two pulldown video material, and converts the signal back into its original 24 frames/second mode before compressing and transmitting. After the signal is decompressed at the decoder, it is converted back to 60 fields/second video, using the three-two pulldown technique. Eliminating

Figure 8: Data multiplex format



The FiberHub System: Future Ready With Unlimited Flexibility

The FiberHub Network It Lets You Decide

IPITEK, an innovator in broadband analog transmission, introduces the new FiberHub Optical Repeater System, a high performance and uniquely adaptable network for AM fiber optic cable TV distribution.

The FiberHub is designed for versatility – with a range of components to help you build a complete fiber network. Whether you are installing a backbone supertrunk, sending fiber to a feeder, or reaching all the way to a line extender, the FiberHub system can help you accomplish your objectives.

Completely modular and fully connectorized, the FiberHub network can increase your optical link budget to 18 dB, while minimizing the number of active electronic devices between the source and the subscriber. That means less noise and distortion, improved reliability and lower maintenance costs. Subscribers at all reception points, even the last links, consistently receive a top quality picture.

From Point-to-MultiPoint The Capability to Custom Configure

Fiber optic supertrunks and trunks for point-to-point applications have been available in the cable industry. With the new FiberHub network, however, you can now extend the reach of your AM fiber optic system by providing *point-to-multipoint* optical transmission.

The number of receivers utilized in your present network may have been limited by your system layout and link budget. With the new FiberHub and related IPITEK optical couplers, it is now possible to expand your network to 16 or more receivers, all equipped with status monitoring transceivers. Additionally, the FiberTrunk 2400 headend transceiver and all hub sites can also be equipped with status monitoring.

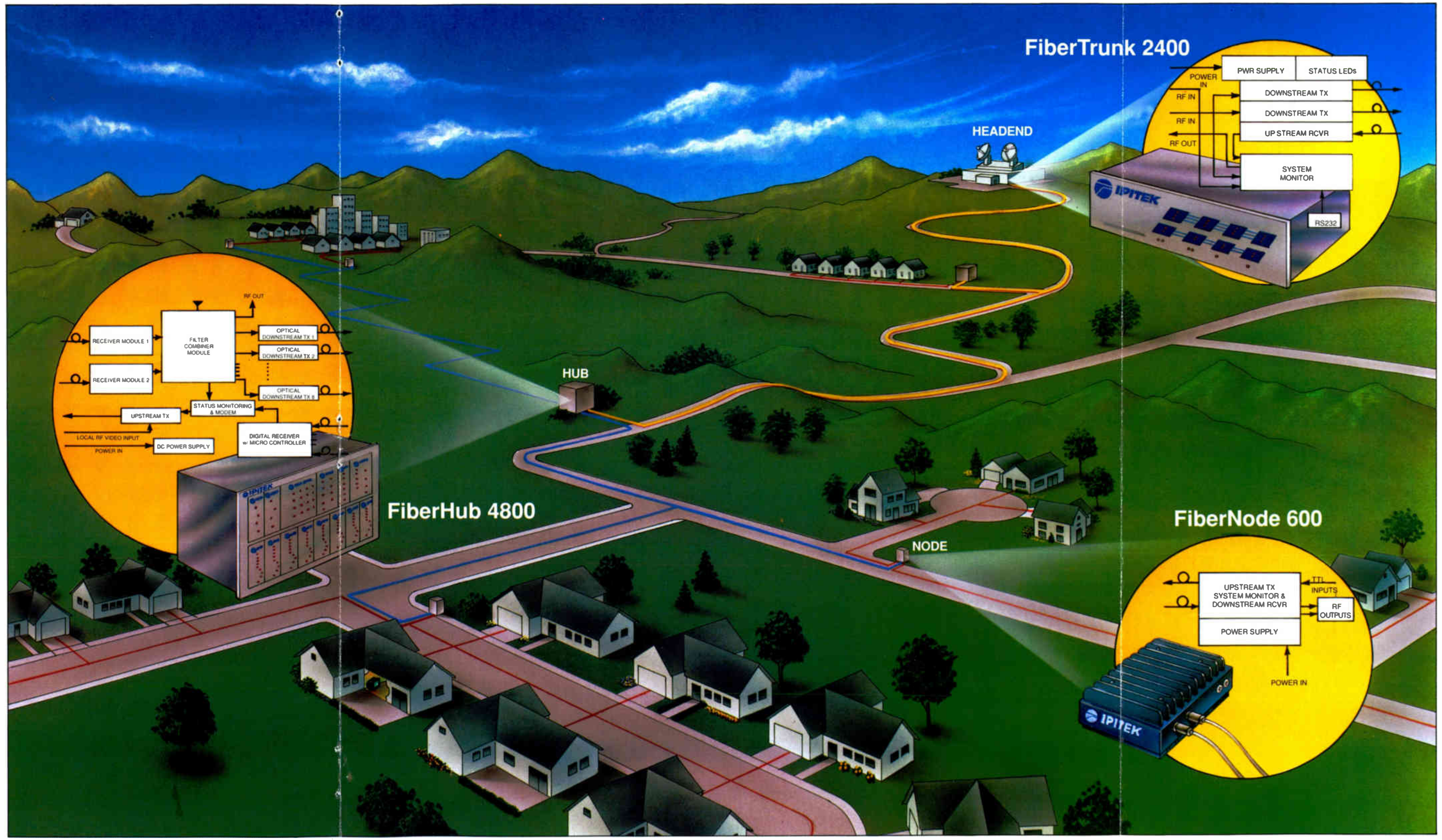
Anticipating Rising Industry Standards

At IPITEK we are committed to developing innovative new products that anticipate rising industry standards.

The key to this concept is the ability to upgrade your system—as newer technology becomes cost effective. The IPITEK modular system design offers unlimited flexibility to replace fiber components and reduce the risk of obsolescence.

Additionally, IPITEK products are engineered for easy installation and reliable operation in all environments.

FiberTrunk 2400
Rack Mount • Plug in up to 4 Transmitters and 2 Receivers per Unit • Plug in Status Monitor



FiberHub 4800
Repeats the Optical Signal • Plug in up to 8 Transmitters • Plug in Status Monitor

FiberNode 600
Low Cost Optical Receiver • Outdoor Mount • Digital Status Monitor

The FiberHub System Design The Architecture That Works For You

The FiberTrunk 2400

The FiberTrunk 2400 is a modular, high performance, low noise/low distortion fiber optic analog dual transmitter with optional upstream receiver. It is designed for use in a FiberHub System, but can be utilized in other networks.

The FiberTrunk 2400 can accept up to four plug-in optical transmitters and two upstream receiver/status monitor modules. A redundant power supply can also be installed for increased reliability.

And, as the technology evolves, higher capacity modules can be integrated into the system to raise the performance, yet still preserve your initial investment.

The headend-mounted transceiver can be used with IPITEK's Model FT-1200-DRT or FT-600-SRT plug-in receivers. The coaxial trunk or supertrunk can be upgraded from RF to fiber optic by installing simple plug-in modules.

Designed for ease of operation and dependable performance, the FiberTrunk 2400 is shipped pre-calibrated to eliminate adjustments and fine tuning at installation sites. Power- and temperature-stabilized lasers assure consistent system performance.

The FiberHub 4800

The FiberHub 4800 can double your link budget to more than 18 dB, with outputs in eight different directions.

The plug-in optical transmitter modules offer top-grade DFB performance through proprietary feedback circuitry. No field adjustment, code or optimization is necessary to activate this system.

Varying channel loading is accommodated automatically through optical feedback and pilot tone AGC.

When used with any IPITEK optical receiver, the transmission bandwidth of 600 megahertz is flat within ±1 dB, which allows effective application in the most demanding environments.

The FiberNode 600 Receiver

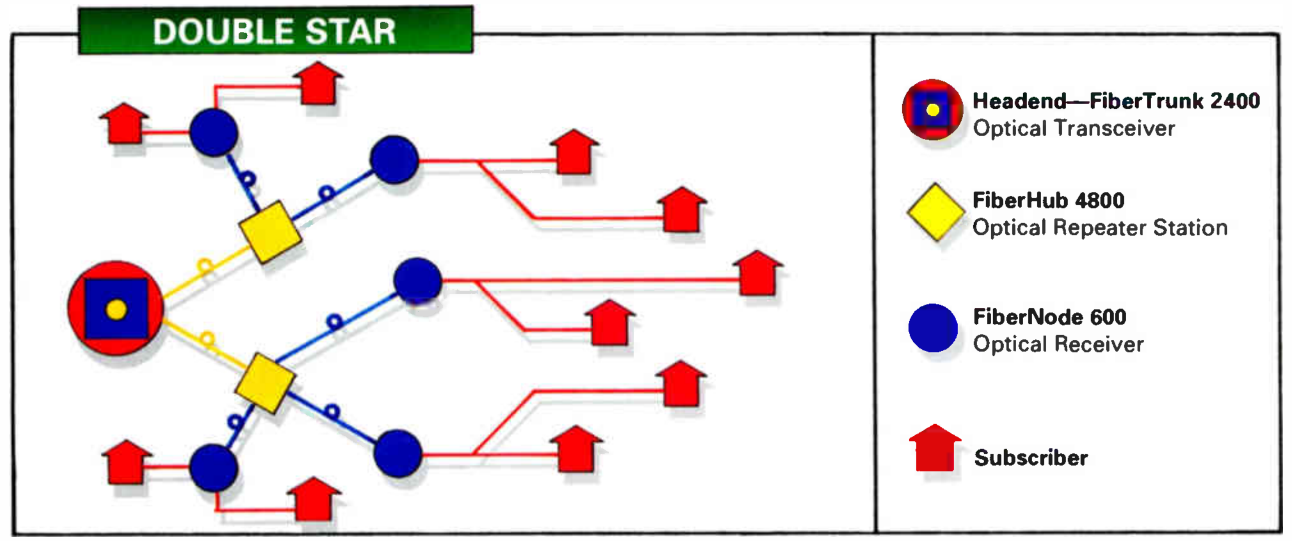
The FiberNode 600 is a highly linear, wideband optical receiver with AGC and built-in RF amplification. It delivers two outputs of +38 dBmV, flat to within ±1 dB over the entire 600 megahertz bandwidth.

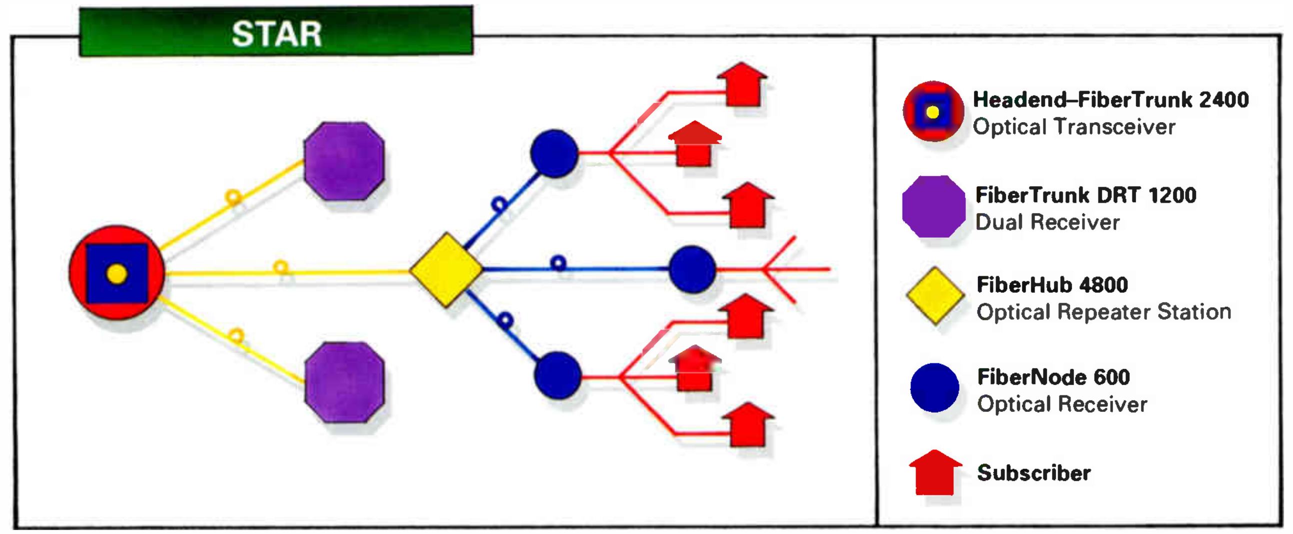
An optical upstream status monitor board plugs directly into the FiberNode 600 to send status monitor data at up to 19.2 KBaud, and receives command and control data from an FSK carrier of 24.5 megahertz.

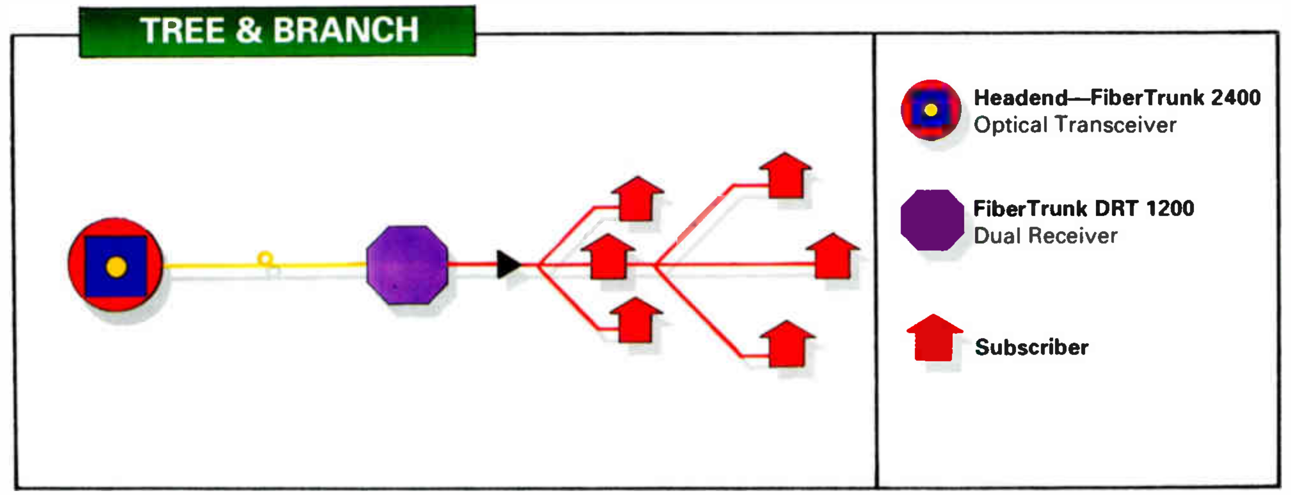
Enclosed in a weatherproof, RF-tight housing, the FiberNode 600 Optical Receiver can be strand, pole, pedestal, or wall mounted.

IPITEK®

Point-To-MultiPoint Transmission







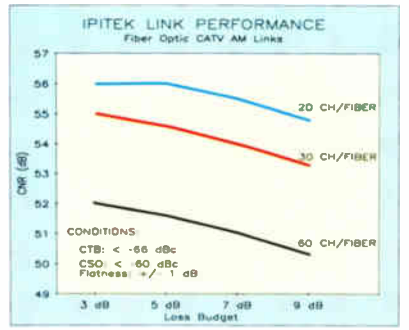
FiberHub Network System Characteristics

Optical Performance

Optical Connectors	FC-PC Super Polish, Single Mode
Return Loss	>40 dB
Optical Fiber	CCITT Single Mode (Matched Cladding, Non Dispersion Shifted)
Emission Wavelength	1310 nm, Nominal
Side Mode Suppression Ratio	>32 dB

RF/Video Performance

Bandwidth	45 MHz – 600 MHz
Input/Output Impedance	75 ohms
Input RF Signal Level	+10 ±0.25 dBmV (per Channel)
Return Loss	≤16 dB
RF Connectors	F-Type



Administration and Maintenance

Transmitter Status Monitoring Indicators

Tx Power On	
Input Modulation	Low Normal High
Laser Warning	Temperature (Adversely High) Lifetime (Optical Power Degradation)

Receiver Status Monitoring Indicators

Rx Power On	
Carrier Status	Low Normal High
Alarms	No Carrier
Test Point	–20 dB, 75 ohm RF (F-Type connector)

Environmental Requirements

Operational Temperature	10° to 40°C
Operating Humidity	95% Non-Condensing
Storage Temperature	–55° to 75°C, 24 hours –40° to 65°C, 1 year
Storage Humidity	95% Non-Condensing
Barometric Pressure	N/A
	(110 or) 220 VAC ±10%, 50-60 Hz

Specifications are device dependent. Please call our applications center to optimize your design.

About The Company

IPITEK Division and TACAN Corporation are privately owned and headquartered in Carlsbad, California. TACAN was founded in 1983 to meet a market demand for the development of innovative communications equipment, based on state-of-the-art technology.

IPITEK provides fiber optic-based products and services to major communications companies worldwide.

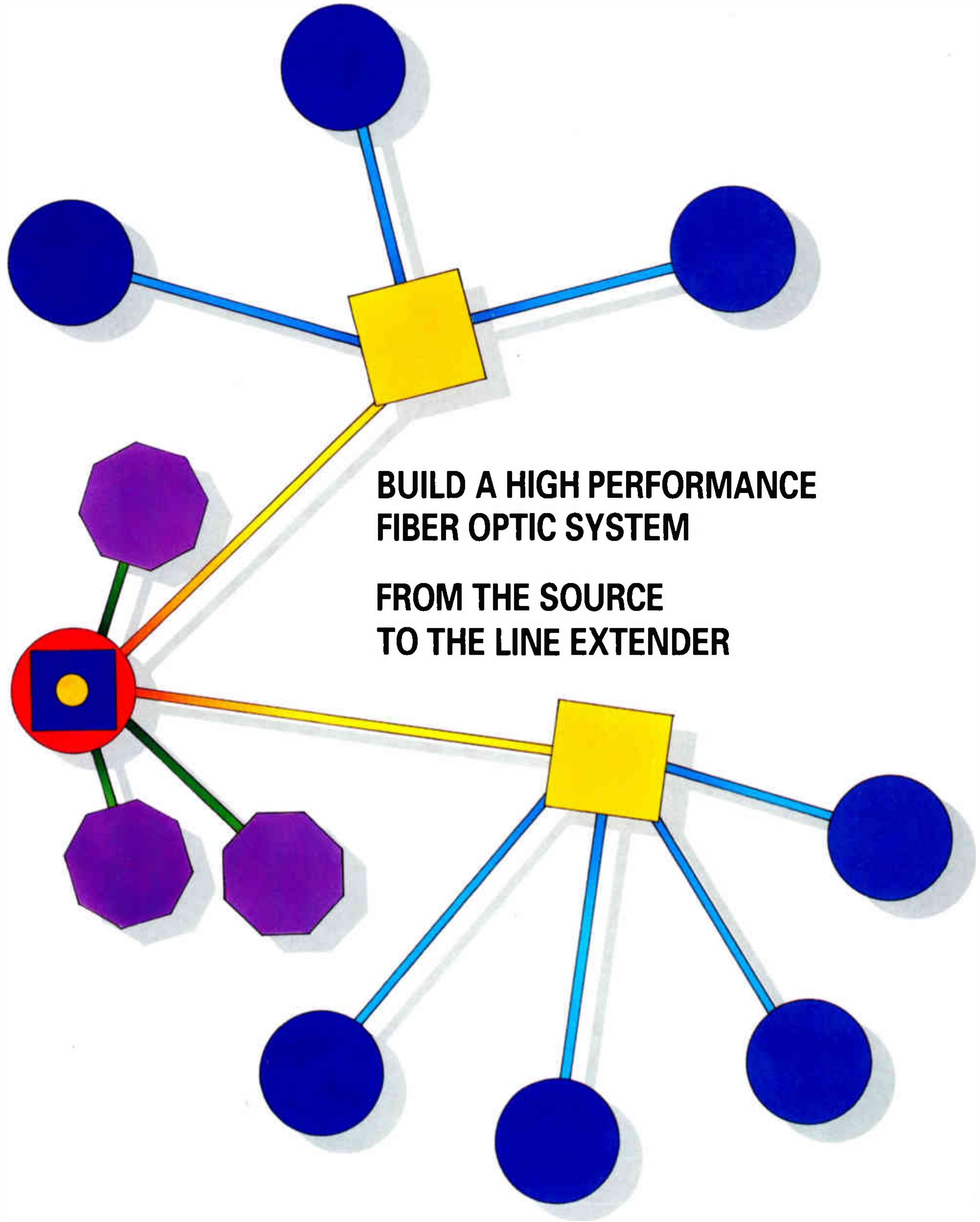
TACAN, IPITEK's parent company, is committed to a sophisticated program of intensive internal research and product development in the fields of ultra-high-speed electronics, fiber optics and laser/electro-optics. A highly-trained team of technical and support personnel assures customers they will receive full-featured products backed by solid quality control and comprehensive after-sales service and support.

IPITEK®

2330 Faraday Avenue
Carlsbad, California 92008
(619) 438-8362
FAX: (619) 438-2412

IPITEK Division and TACAN Corporation reserve the right to improve and modify the features and specifications of products without prior notification.

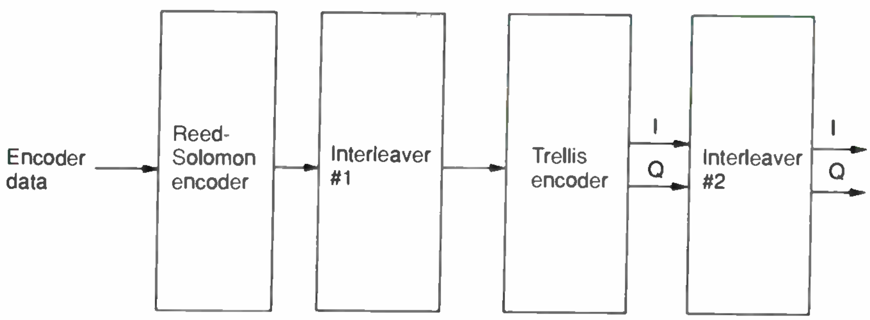
Printed in U.S.A.
FH 069100



IPITEK

In Switzerland call Ascom Kablevision (01-823-1111)

Figure 9: FEC encoder



the redundant fields and processing on a frame basis yields higher picture quality through the compression. Figure 7 shows the three-two pulldown process and recomposing the signal into its 24-frame progressive mode.

Digital audio and data services

The DigiCipher HDTV system can allocate data capacity to support various services such as additional audio channels, "5.1" (left, right, left rear, right rear, center, and subwoofer) surround sound system (e.g., Dolby AC-3), descriptive video, special audio for the hearing impaired, expander control data, program guide, closed captioning, program mode control, conditional access and teletext. The encoder can adaptively allocate unused data capacity back to the video processor to optimize video performance. The prototype DigiCipher system developed for FCC evaluation provides the specific capabilities described next.

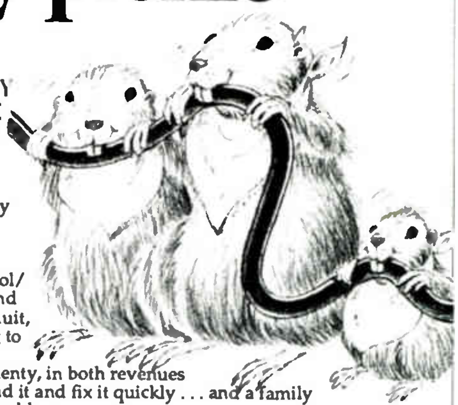
The audio channels use Dolby Laboratories' AC-2 digital audio system, which combines highly efficient data compression with professional quality audio transparency. AC-2 uses frequency-domain processing in a multiplicity of narrow bands to take full advantage of psychoacoustics and noise masking. Four independent audio channels are provided. As well, 125.87 kbps is designated for data services, enough for 13 9,600-baud data channels. Four such channels are implemented in the prototype. An additional 125.87 kbps is designated for the control channel (i.e., conditional access).

Data multiplex format

The data structure organizes data into lines corresponding to an NTSC video line. Prior to application of forward error coding at the encoder, each line includes 848 information bits for the 16-QAM mode, or 1,160 information bits for the 32-QAM mode. Figure 8 shows the line format. As shown, the 1,050 lines are identical in format, except for the first two lines. Those lines contain a 24-bit frame synchronization sequence, and 56 bits of system control information.

Digital transmission

Channel coding, a QAM modulator and an adaptive equalizer are the key



Introducing the first play-it-again SAM.

Meet new LINE SAM® from Wavetek.

The first signal level meter with "learn" and "repeat" modes for fully automated testing.

On cue, LINE SAM automatically runs a programmed sequence of tests—again and again. Saving you time—and money. You can even program for unattended, time-delayed testing.

Without missing a beat, the LINE SAM stores up to 80 sets of test point data for 100 channels. And downloads to a PC or printer for spectrum or tabular printout. Comparing amplifier specifications couldn't be easier or more accurate!

LINE SAM. Easy. Accurate. Cost-efficient. For field or headend testing, we're playing your song.

Call Wavetek today at 1-800-622-5515—in Indiana, 317-788-5965—and ask for LINE SAM. This could be the beginning of a beautiful friendship.

See us at the Atlantic City Show, Booth 400, 502.

Reader Service Number 37

WAVETEK

elements of DigiCipher transmission. The channel coding technique is powerful to maintain a very low error rate. The modulation technique must be efficient to maximize the information bit rate that can be supported in the 6 MHz channel. Adaptive equalization is employed to handle multipath (reflections) found in the broadcast environment, and microreflections found in cable transmission.

The DigiCipher system uses concatenated trellis coding and Reed-Solomon block coding to protect against the effect of channel impairments. Concatenated coding is one of the most powerful error correction techniques and it offers error-free operation at low C/N and carrier-to-interference ratio (C/I). Interleaving provides particularly strong performance against impulse noise, such as brush noise. Noise pulses as long as 3 µs can be handled effectively.

Figure 9 shows the block diagram of the FEC encoder. The decoder reverses the process. Figure 10 shows DigiCipher's theoretical and measured C/I performance. The system threshold is approximately 12.5 dB C/N for 16-QAM and 16.5 dB C/N for 32-QAM, average signal power to average noise, with noise bandwidth of 5 MHz. At this threshold there will be one uncorrected error per minute, with most errors not visible due to error concealment. For reference, 16-QAM uncoded performance is shown, illustrating the substantial coding gains obtained.

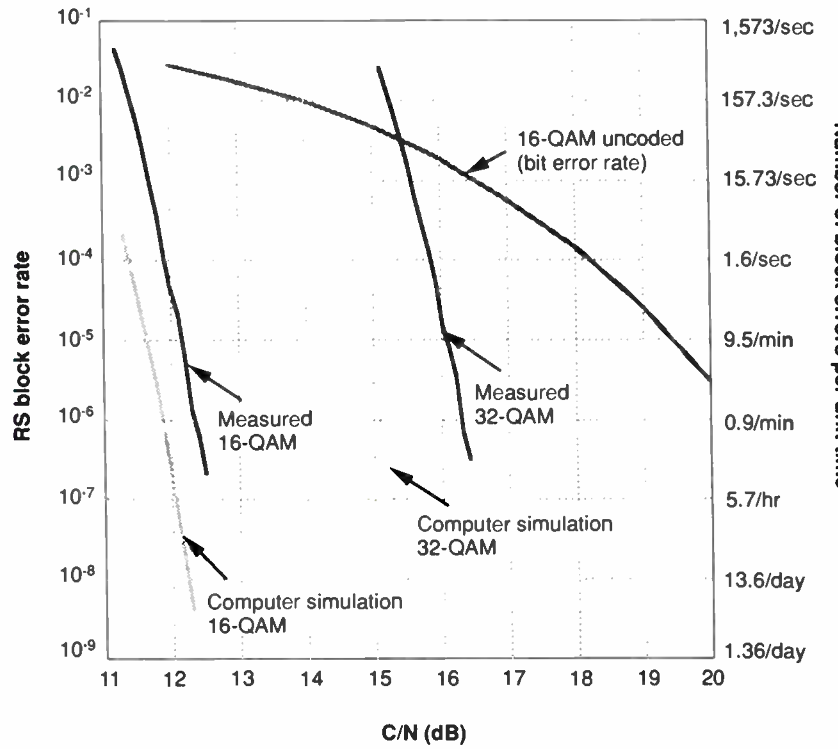
The 16/32-QAM is used, with a symbol rate at 4.88 MHz. The 16-QAM has an extremely low threshold, thus providing a greater broadcast service area, while 32-QAM provides a 40 percent greater bit rate for video, with a 4 dB higher C/N threshold. Consumer HDTV receivers will be able to automatically detect the transmitting mode and will autoconfigure.

Figure 11 provides the signal constellations of the QAM signal for both modes. Figure 12 shows the output spectrum of the encoder. Note that the output spectrum is well contained with the 6 MHz bandwidth.

The DigiCipher HDTV receiver uses a 256-tap adaptive equalizer to handle multipath distortions. Figure 13 is a block diagram of the adaptive equalizer. The effective range of the equalizer is -2 to +24 µs. The multipath can be as high as -6 dB for close-in echoes (-2 to +4 µs) and -12 dB for long echoes (beyond +4 μs). The adaptive equalizer also compensates for non-ideal frequency response or group delay distortions introduced in transmission. Note that the requirements for multipath correction in digital transmission are substantially less than in analog transmission. Multipath need only be below, or corrected to be below, the noise threshold of the receiver. Thus, multipath more than 20 dB below the signal level is not a problem.

In the presence of an interfering NTSC signal, the adaptive equalizer creates notch filtering at the visual, color and audio carrier frequencies. This contributes to a superior NTSC interference rejection capability. The system can operate almost error-free at 0 dB C/I in the 16-QAM mode and 5 dB C/I in the 32-QAM mode, where C is the average carrier level of the DigiCipher signal, and I is the peak sync level of the NTSC interfering signal (both at the tuner input).

Figure 10: Performance of DigiCipher transmission system



Broadcast coverage

The FCC intends to authorize HDTV as a simulcast service, meaning that each existing station will be given a second channel (within the existing broadcast TV bands) to use for broadcasting HDTV. Broadcasters will want the HDTV service areas to be comparable to existing NTSC service areas and yet will want to minimize interference into NTSC service from HDTV service, and vice versa. The result is a need for a rugged and yet benign service.

Co-channel spacings for the current NTSC service are 155 miles or more. To make the HDTV service viable, HDTV to NTSC spacings may have to approach 100 miles. Analysis of the DigiCipher system reveal that equivalent service areas can be obtained for spacings as close as 115 miles for 16-QAM transmission, and 128 miles for the 32-QAM mode. This is true even though radiated power for the DigiCipher signal is at least 10 dB lower than for NTSC.

Cable transmission

DigiCipher technology will provide major benefits in cable transmission. There are no carriers in the DigiCipher signal. Indeed, the signal looks like shaped noise. The low C/N thresholds mean that the signal can be transmitted 20 dB or more below NTSC transmissions. The result will be very high quality pictures that minimally powerload the cable system and do not contribute to intermodulation distortion.

The low power requirements mean that a DigiCipher HDTV signal can be carried on a channel that might otherwise not be usable. Given that the signal is digital, secure encryption can be readily obtained.

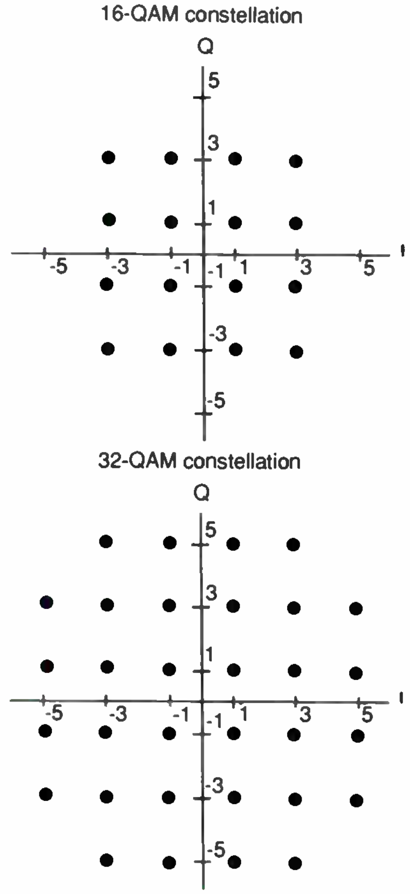
Satellite transmission

DigiCipher HDTV signals can be transmitted over C- or Ku-band satellite channels using QPSK modulation. With a threshold of 7.5 dB in a 24 MHz bandwidth, there will be no dish size penalty as compared to current FM-NTSC practice.

Summary

In mid-1990, General Instrument's entry into the broadcast HDTV standards competition with an all-digital system caused quite a stir. By the end

Figure 11: Signal constellations of 16- and 32-QAM signals



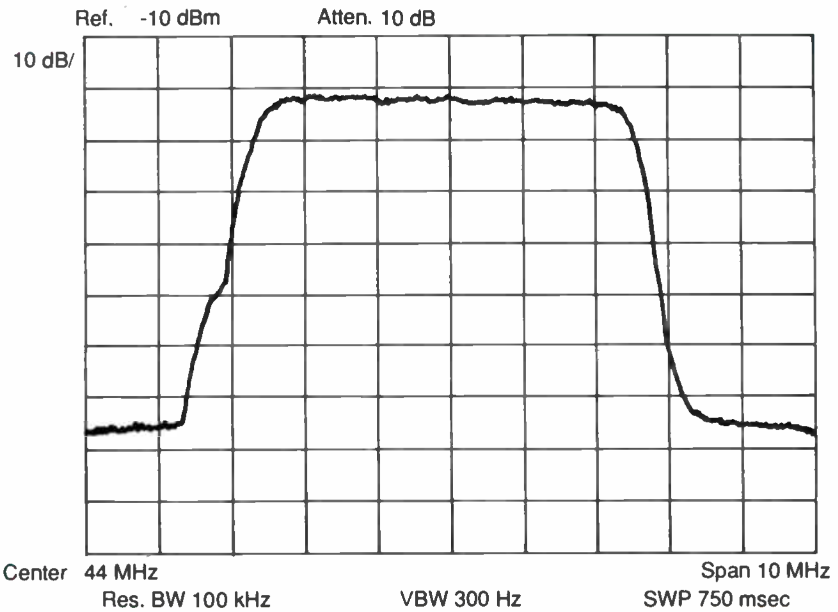


Figure 12: IF output spectrum

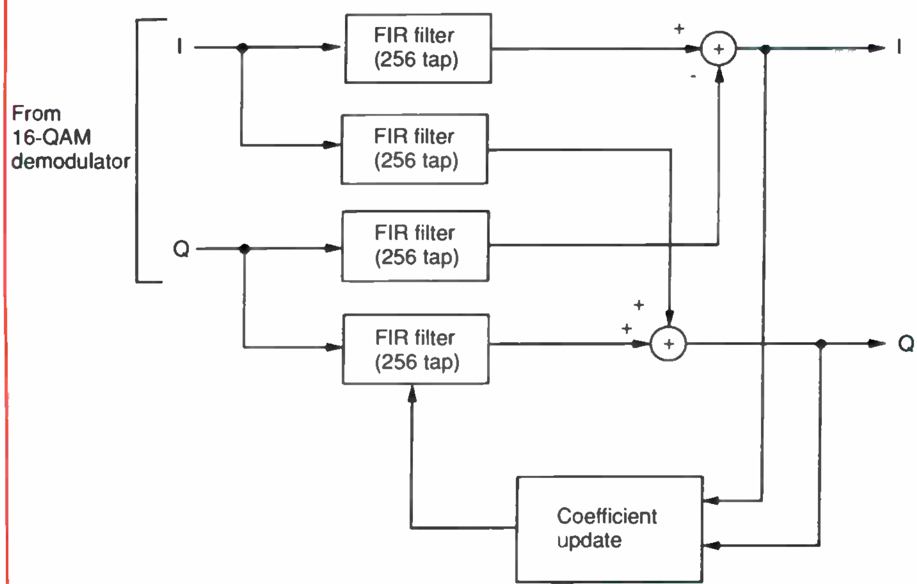


Figure 13: Adaptive equalizer block diagram

of the year, three other systems had switched to all-digital. But, naysayers worried that digital transmission was not going to be rugged enough for TV signals.

As it prepares for testing of its DigiCipher HDTV system, General Instrument has released more detailed information that provides more insight into its design and performance. Assuming that performance is verified in the lab and in field testing, it now seems very likely that the HDTV standard will, indeed, be digital.

Endnote

[1]The American TeleVision Alliance is a joint venture between General Instrument (GI) and the Massachusetts Institute of Technology (MIT) to produce TV systems for consideration by the FCC as the U.S. HDTV broadcast standard. The DigiCipher system discussed in this article utilizes interlace scanning and is based on technology developed at GI's VideoCipher Division. There is a second ATVA system, Channel Compatible DigiCipher, which utilizes progressive scanning. **CT**

SuperNTSC

(Continued from page 28)

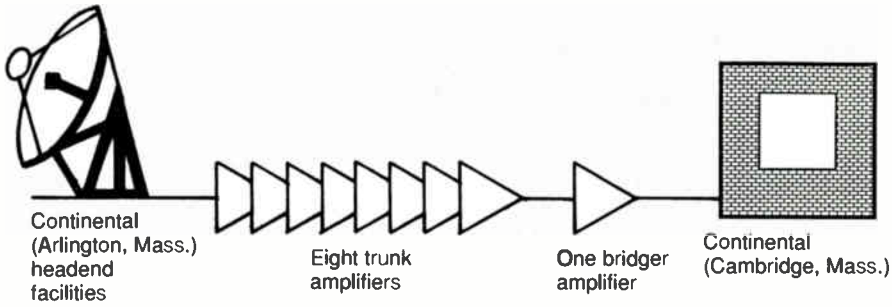
SuperNTSC — particularly on larger-screen receivers.
3) To demonstrate the commitment of a broad range of major TV industry organizations to supporting the technology through the direct participation of the Faroudja Research sponsors. These include:
- Capital Cities/ABC
- Comcast Corp.
- Continental Cablevision
- General Instrument Corp.
- Newhouse Corp.
- Scientific-Atlanta
- Tele-Communications Inc.
- Viacom International
- Westinghouse Broadcasting

The demonstrations

The Faroudja sponsors enlisted Bruce Jones of Alderbrook Consultants to help manage the demonstrations for a fully coordinated "road show." To assure the demonstrations were credible, the group needed to present live broadcast and cablecast signals over all combinations of delivery paths.

Cable programmers and local broadcasters were extremely cooperative in providing portions of their programming encoded with Faroudja NTSC encoders. One reason for their enthusiasm was the simplicity of equipping their studios for the process. This requires either replacing the conventional NTSC encoders in a production facility with Faroudja NTSC encoders, or working with material produced and edited in component form, and using the special encoding at the time of transmission. Although the use of the encoder is not required when a SuperNTSC receiver is used (as the receiver delivers very high quality images with any NTSC sources), its effect is very obvious on conventional receivers: artifacts such as cross-luminance and cross-color practically disappear.

Figure 3: Cambridge, Mass., transmission setup



Each demonstration consisted of a 10-minute tape that explained, element by element, the improvements provided by the technology. The accompanying table details SuperNTSC's features at the receiver. The explanation was followed by live programming whenever possible, or by programming taped when scheduling did not permit showing of live programming. Next followed a question-and-answer period. The demonstrations ended with taped material chosen to demonstrate the technology to its full potential.

Satellite-delivered cable programming was provided by C-SPAN, ESPN, Request TV, Showtime, The Discovery Channel and The Movie Channel. Live satellite programming was provided by ESPN (its *SportsCenter* studio had been outfitted with Faroudja encoders) and by C-SPAN (its field hearings received the enhanced NTSC processing). Local broadcasters, KPIX and KGO in San Francisco, WBZ in Boston and WETA in Washington, D.C., provided Faroudja-encoded live material from their studios including local news, local magazine shows and portions of *The MacNeil/Lehrer News Hour.* Black Entertainment Television provided "control" programming for comparison using standard NTSC encoding from its quality-controlled studios in Washington, D.C. Finally, in a special cooperative effort to be implemented this year, Boston's PBS station WGBH will encode three nationally distributed programs using the Faroudja encoding process.

Video material was displayed using a Sony 1270Q data projector using SuperNTSC processing circuitry, projected onto a 12-foot diagonal screen. Attendees were seated in a theater-like arrangement, starting at two "diagonals" from the screen. A 37-inch Mitsubishi data display also was used to provide an example of what SuperNTSC improvements look like on a more common sized TV receiver. Two standard TV sets were used to show side-by-side comparison of the improvement level in real-time.

Demonstration sites were required to be on the local cable system with the ability to receive the local broadcast participant directly by antenna. Depending on the city, various combinations of transmission paths were used involving over-the-air, coax, fiber, microwave and satellite. Figures 1, 2 and 3 show examples of some of the setups of the transmission paths.

Audiences were primarily press and professionals in video and entertainment technology. Interested local and national political figures were invited in each market. Importantly, several TV set manufacturers were able to hold special viewings to see the technology out of the laboratory and under the rigor of the normal TV transmission environment.

Reactions

Reaction to picture quality was, as expected, very positive. In San Francisco, 100 self-invited attendees were surveyed — mostly independent producers and editors, as well as consumers who had purchased projection TV sets and had been disappointed with the picture quality they got. Their reaction was that SuperNTSC was a significant improvement over the equipment they were now using. The fact that the receivers improve all signals they receive was a particularly important feature.

While it was impossible to schedule all the sessions when live programming

"It is now possible to reduce the prototype electronics to a mere chip or chip set that goes into the TV set at the point of manufacture."

"SuperNTSC is not intended to compete with HDTV. Rather, it is intended to maximize the picture quality of any NTSC transmission and is friendly with any aspect ratio."

SuperNTSC features at the receiver

- Removal of chroma and luminance mutual crosstalk
- Patented augmentation of small picture details
- Comb filter chroma separation
- Dot crawl elimination logic
- Chroma transition sharpening
- Precision chroma decoding
- Patented chroma luminance enhancement
- Noise reduction without recursion artifacts
- Line-doubling with patented motion artifact removal
- Spectrum expansion, multiplicative bandwidth improvement

was available, the use of live programming in real-time made a very convincing demonstration. When real-time programming did not coincide with a demonstration time, our cooperating live programs would be recorded and replayed from that day's schedule.

That the real-time programs were so well received may well be a comment on the current status of advanced TV technologies. These advanced systems are seldom displayed without a litany of disclaimers. Being able to watch a live show, coming over-the-air or down from the satellite and through the cable system showed attendees that the technology works with a high degree of credibility.

Questions were often fielded principally from professional audiences regarding aspect ratios. How could SuperNTSC compete with "true" HDTV if it uses a 4:3 aspect ratio?

SuperNTSC is not intended to compete with HDTV. Rather, it is intended to maximize the picture quality of any NTSC transmission and is friendly with any aspect ratio. SuperNTSC also enhances a 16:9 aspect ratio NTSC regardless of the approach used such as "pan and scan" side panels or "bop and crop" reduction of upper and lower panels. Since the intent of these demonstrations was to show SuperNTSC within the current cable and broadcast infrastructure, everything presented was in the 4:3 ratio.

"Videocare" medical imaging demonstrated

In Washington, a special medical imaging demonstration was added using SuperNTSC to meet the demanding requirements of a doctor's eye. The SuperNTSC system was transmitted over a combined satellite feed and cable plant. In this demonstration, several medical procedures including open heart surgery were performed at The George Washington University Medical Center and transmitted to doctors in Sunnyvale, who viewed the full-motion video after reception and transmission through TCI's Sunnyvale cable system.

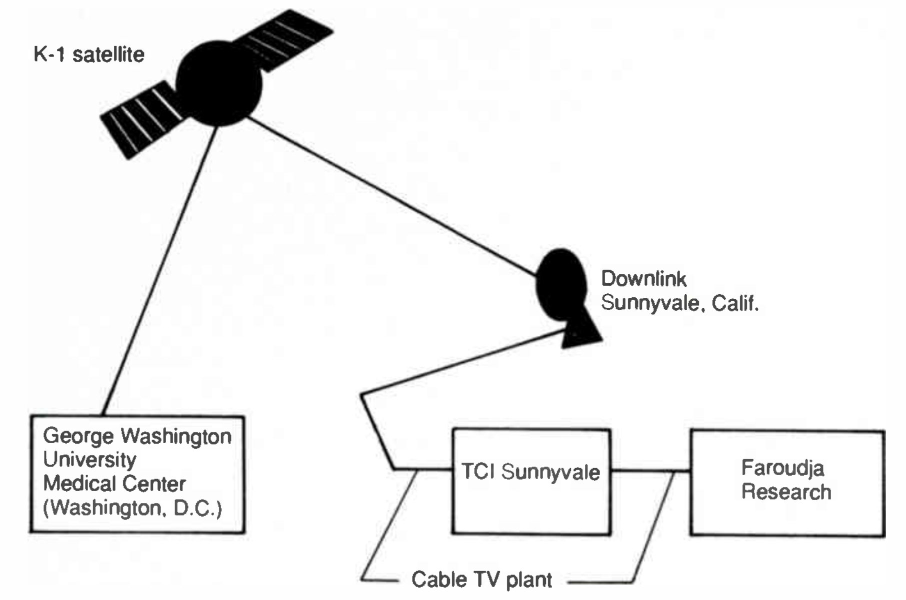
Their reaction was extremely positive. Figure 4 shows the setup.

Dr. Gordon Campbell of the Palo Alto Medical Foundation commented that such a system could save valuable time by allowing specialists to determine the extent of a medical problem from a distance. Alternatively, these images could be available in the doctors' home allowing accurate visual examination to remotely determine the extent of problem. William Jenkins, a video specialist at Stanford University Teaching Hospital, suggested that such a system is vital to tomorrow's medical teaching methods.

Results

These technology demonstrations showed that despite the need for special encoding at the station and special decoding at the receiver, the process was robust and worked under real-world circumstances. No special treatment was given to the video in the way it was mixed, distributed or transmitted. Even after passing through miles of

Figure 4: Medical "Videocare" transmission path

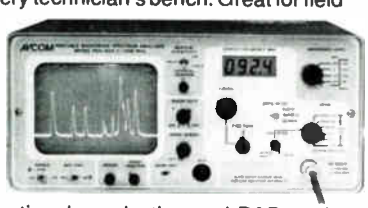


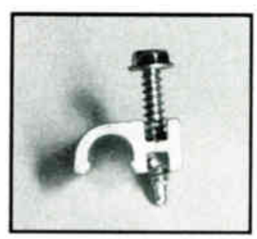
wire and several microwave paths, the broadcast and satellite-fed pictures in all markets were good on standard TV sets and great on SuperNTSC TV sets.

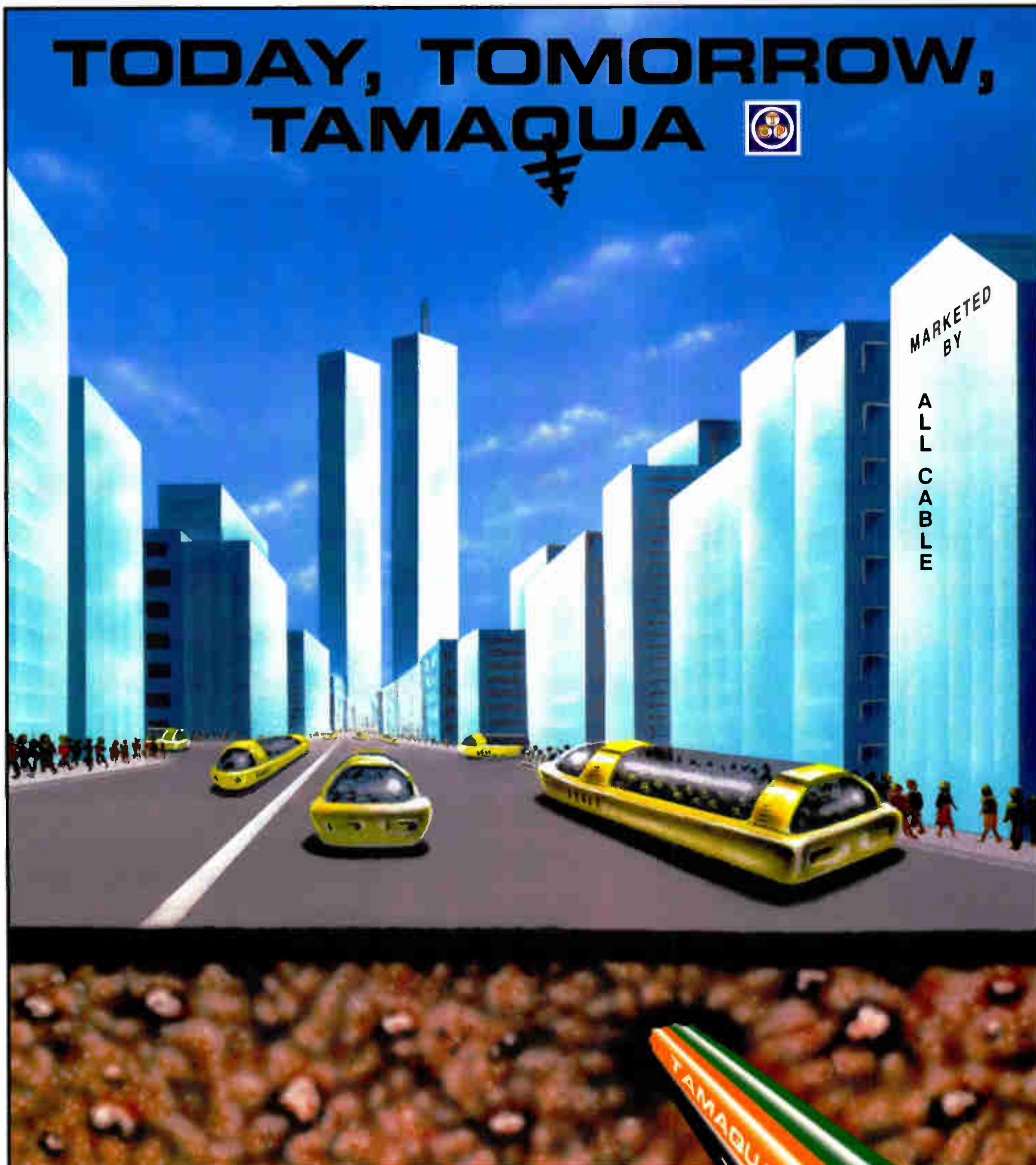
A major appeal of the technology is that once the signal is encoded, no further modifications of the transmission path — broadcast, cable or combination — are required. However, one of the realities of enhanced picture quality — regardless of technology — is the demands it puts on both source material and transmission. If source material is of poor quality or production techniques careless, enhanced picture quality will, in fact, display those defects. What's more, it redefines what is poor quality. Practices that are routinely acceptable with conventional displays become objectionable with an enhanced display. Care in the creation transmission and re-transmission of images is still and always will be important, no matter how they are received.

After demonstration in San Francisco (sponsored by Viacom Cable) and Boston (sponsored by Continental Cablevision), it became apparent that the sponsors had accomplished the first objective: demonstrating that SuperNTSC works under commercial broadcast and cablecast applications. The technology had performed using two different cable systems and three different broadcasters.

Given the success of these demonstrations, the sponsors determined to shorten the overall demonstration time frame from six to four months to permit greater focus on working with specific TV set manufacturers. A special dem-






TODAY, TOMORROW,
TAMAQUA
MARKETED BY
ALL CABLE
TAMAQUA
TAMAQUA

> ***"While Faroudja Laboratories continues to market its high-end NTSC encoders to broadcasters ... the SuperNTSC TV set will actually make many of these improvements in the home."***

onstration at the 1991 National Association of Broadcasters show in Las Vegas, Nev., was added to the list of cities, which included San Francisco and Boston. Also, the three remaining sponsors — Comcast, Newhouse and TCI — co-sponsored the final demonstration in Washington. This demonstration culminated in a day-long open house and formal reception in the U.S. House of Representatives' Rayburn Building.

Developments

A fundamental premise in the initial design of the system was to place only those improvements in the TV set that could not be accomplished "upstream" in the video path. This was based on the simple economic theory that the cost of improving signals at their source would take far less hardware implementation in a few thousand source locations vs. additional technology at the end of the path in millions of TV sets.

Now, as Faroudja Research Enterprises is implementing final design of its system for IC mass production, Faroudja determined that critical encoder enhancements could be incorporated in a single chip implementation without adding significant costs. As a result, key elements of the encoder system including chroma and luminance enhancements plus artifacts removal have now been incorporated in the all digital TV set chip design.

This means that SuperNTSC in today's TV receivers will provide consistent improvement from all source signals. While Faroudja Laboratories continues to market its high-end NTSC encoders to broadcasters and other video production users, the SuperNTSC TV set will actually make many of these improvements in the home.

This August, prototype discrete digital versions of the SuperNTSC receiver technology were successfully implemented and tested. Final tests to assure compatibility with various video game technologies, closed captioning, cable addressable equipment and signal copy protection are now completed. As efforts toward integration are continuing, Faroudja is currently in advanced negotiations with several of the world's leading TV set manufacturers. It is realistic to expect to buy a SuperNTSC-compatible TV set for Christmas 1992.

To stay competitive the broadcast and cable sponsors of Faroudja's SuperNTSC want to provide quality programming with quality pictures and sound that please viewers and make them want to watch. We can expect that these and most improvements in picture quality will provide for more satisfied customers. With these and other improvements in TV set technology, it will become increasingly important to maintain high quality control standards in our headends and to adopt ghost reduction and other processing and transmission improvements as they become available to assure that all customers enjoy the best NTSC picture possible. **CT**

Construction and subscriber hardware specialist

We stand behind our quality products

Jack Sachs
President

OUR TRAINING MEASURES UP TO OUR STANDARDS.

We assure you:

- **High grade material**
- **Excellent corrosion resistance**
- **Effective quality control**
- **U/L, CSA certified**
- **Technical training on applications**

Upon your request; test reports and samples are available on any of our products. Please call toll free
1-800-361-3685

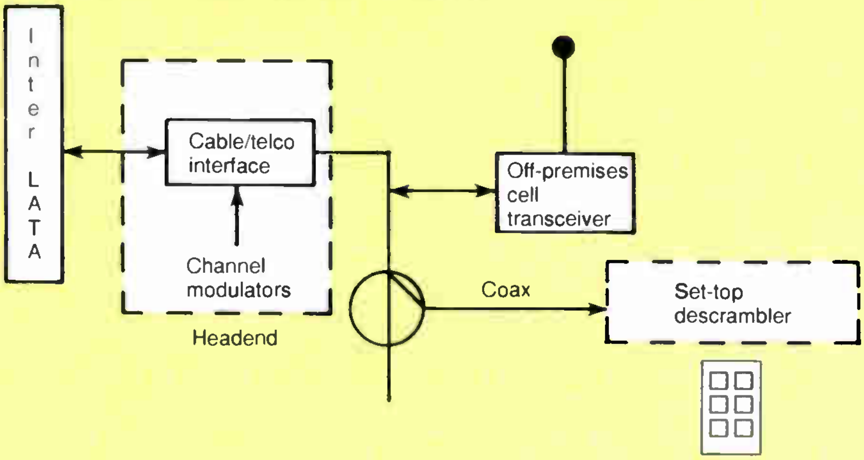
SACHS®

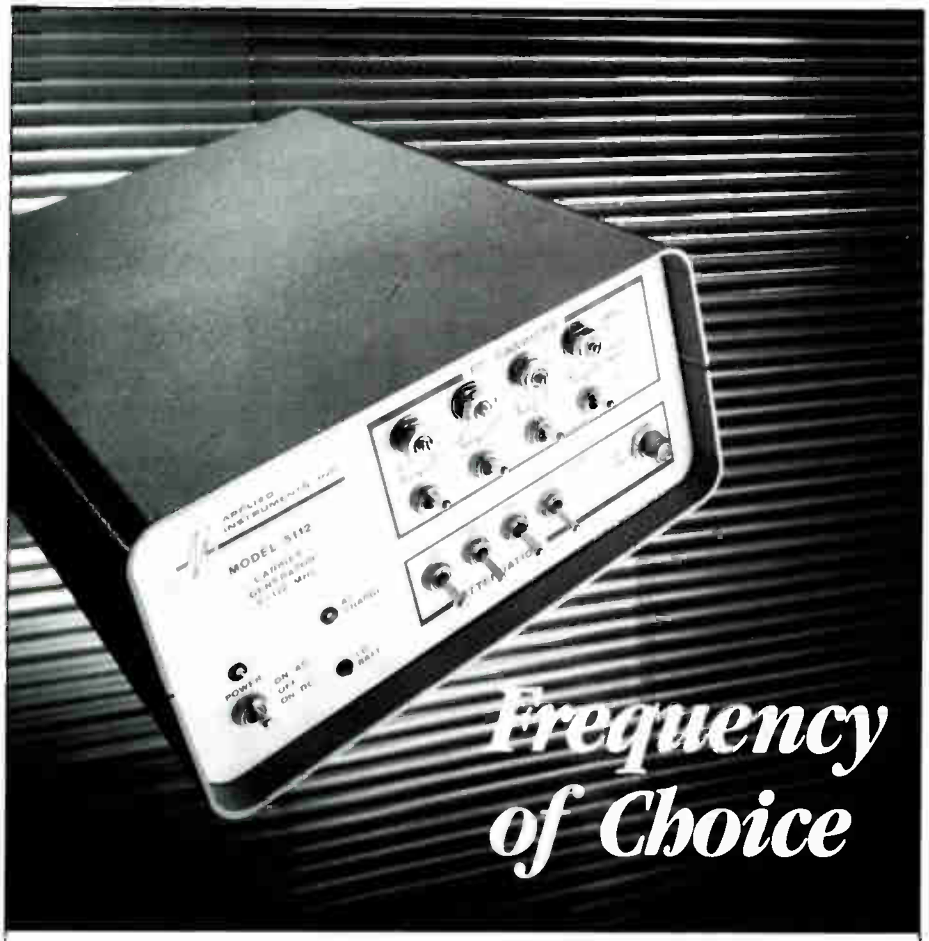
Sachs Canada Inc.
CORPORATE OFFICE
745 Avoca Avenue
Dorval (Quebec) H9P 1G4
Tel.: (514) 636-6560
Fax: (514) 636-0794

Sachs Communications Inc.
CORPORATE SALES OFFICE
9200 East Mineral Avenue
Englewood, CO 80112
Tel.: 1-800-829-SACHS
Fax: (303) 790-7343

See us at the Atlantic City Show, Booth 253. *Reader Service Number 49*

Figure 4: Personal communications





Cable/telco integration

(Continued from page 32)

Figure 1. It would allow the subscriber to make and receive calls while simultaneously watching and controlling TV programs. Phone communication is via RF, while control of the TV program is through an infrared link.

Through the phone network, both store-and-forward and automatic number identification (ANI) PPV ordering can be accommodated with the device. Business opportunities for 800/900 numbers also are easily supported, for the convenience of the consumer and the financial benefit of the cable operator.

On-screen display technology opens up some further enhancements to the approach, with convenient information display on the TV set. One approach, as illustrated in Figure 2, allows for identification, display and storage of incoming calls on the TV screen. Another feature stores and displays frequently called numbers. Both are easily adapted for automatic dialing of the numbers displayed under cursor control.

Dial-up data bases also are easily supported through the technology for a variety of applications. Directory assistance, program guides, stock information and a host of additional new services are all possible with the hardware described. Billing could be either directly from the service provider or through the cable operator.

In Europe, where cable/telco integration is encouraged, video and telephony can both enter the home via the CATV system coax. For this scenario, the interface to the phone network is no longer in the home, but rather through the cable system, as detailed in Figure 3. Fiber's deployment into CATV system architectures facilitates the performance and reliability required in support of two-way communications.

Finally, in Figure 4, the concept is extended to personal communications networks (PCNs), where the RF base station(s) may be located external to the home and interconnected through the cable system. Currently the focus of considerable interest in the United States, the Federal Communications Commission has approved numerous test licenses to investigate the feasibility of such an approach. Cable is well positioned to provide the required infrastructure to implement PCNs, once its use is approved by the FCC. **CT**

Digital videotape recording — from NTSC to HDTV (Part 2)

A recent column (see April 1991) was about film and television. This one (which appears in two installments) is about videotape recording — especially digital videotape recording. Part 1 (September 1991) provided a synopsis on the birth and growth of analog VTRs. This final installment details the various digital VTR systems, beginning with the D1 standard.

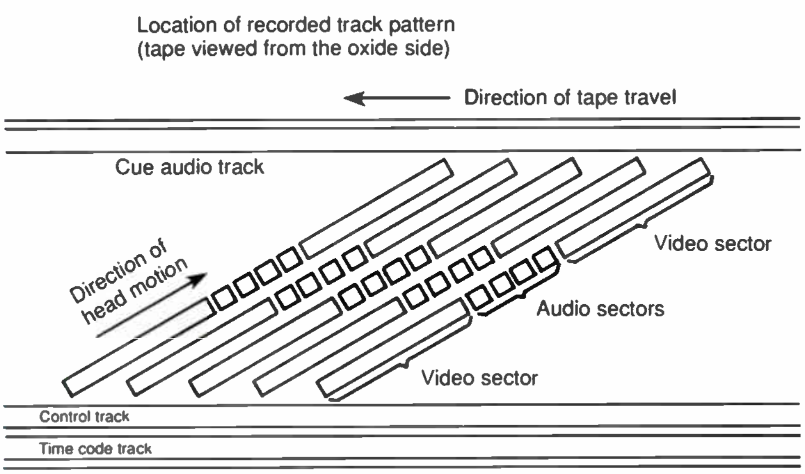
"It is important to note that no compression is used in any portion of any of the digital VTR systems."

By Lawrence W. Lockwood
President, TeleResources
East Coast Correspondent

Table 3: CCIR 601 standard values used in D1 VTRs

Parameters	525-line, 60-field/s systems	625-line, 50 field/s systems
1) Coded signals	Y, R-Y, B-Y	
2) Number of samples per total line		
• Luminance signal (Y)	858	864
• Each color-difference signal (R-Y, B-Y)	429	432
3) Sampling structure	Orthogonal, line, field and picture repetitive. R-Y and B-Y samples cosited with odd (1st, 3rd, 5th, etc.) Y samples in each line.	
4) Sampling frequency		
• Luminance signal	13.5 MHz	
• Each color-difference signal	6.75 MHz	
5) Form of coding	Uniformly quantized pcm, 8 bits per sample, for the luminance signal and each color-difference signal.	
6) Number of samples per digital active line		
• Luminance signal	720	
• Each color-difference signal	360	
7) Correspondence between video signal levels and quantization levels		
• Luminance signal	220 quantization levels with the black level corresponding to level 16 and the peak white level corresponding to level 235.	
• Each color-difference signal	224 quantization levels in the center part of the quantization scale with zero signal corresponding to level 128.	

Figure 5: SMPTE D1 component digital recording format



An advantage of digital recording was recognized early on when editing of videotape increased in complexity. Editing practices may require as many as 10 generations. With the compilation of even small losses per generation using analog recording the result, at times, becomes unacceptable, but with digital recording this can be accomplished without significant loss of quality.

Component recording (luminance Y, color difference signals R-Y and B-Y) also reduces signal quality loss in generation to generation. Since Sony was initially the only manufacturer of component digital recorders, its specifications were adopted by the SMPTE as the D1 standard. Sony used the CCIR 601 recommendation specifications for its recorder. CCIR 601 has become accepted as the international standard for digitization of all TV standards — NTSC, PAL or SECAM. (See Table 3.)→

Table 4: SMPTE D1 VTR parameters

Signal system	Digital, component video
Scanner type	Helical, six tracks per field
Scanner diameter	2.95 inches
Head-to-tape speed	1,390 ips
Media type	3/4-inch wide, cobalt-adsorbed gamma-ferric oxide, 850 Oe*
Tape speed	11.3 ips
Track length	6.7 inches
Track angle	5.4°

*Oe is the abbreviation for oresteds, a measure of magnetic intensity

Figure 6: SMPTE D2 composite digital recording format

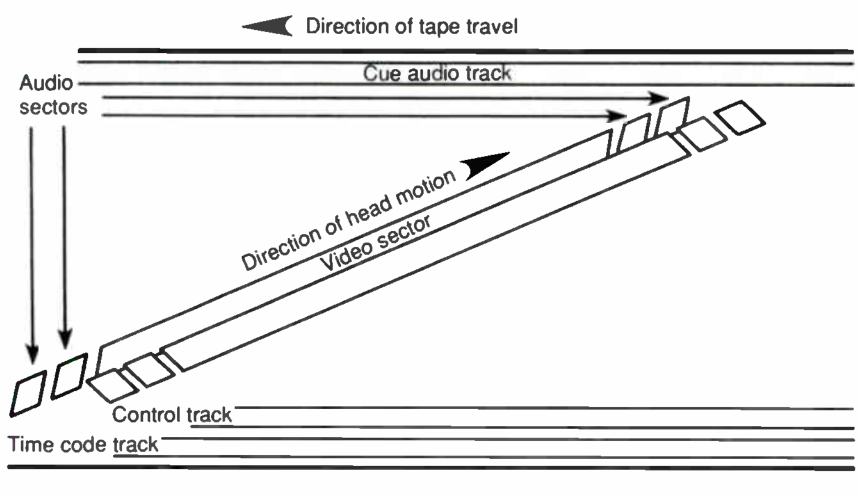
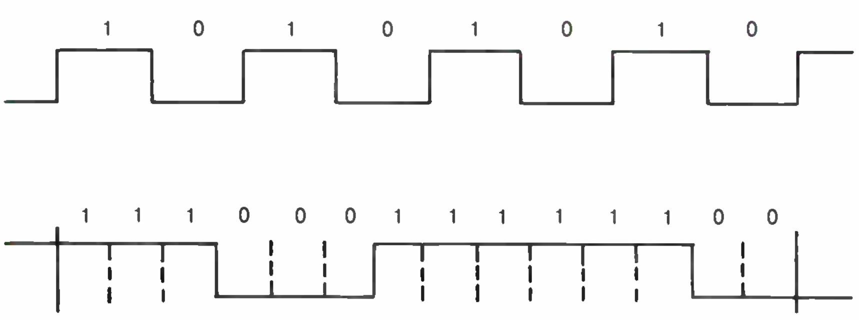


Table 5: SMPTE D2 VTR parameters

Signal system	Digital, 4 x F_{sc}
Scanner type	Helical, six tracks per field
Scanner diameter	3.8 inches
Head-to-tape speed	1,075 ips
Media type	3/4-inch wide, metal particle, 1,450 Oe
Tape speed	5.2 ips
Track length	5.9 inches
Track angle	6.12°

Figure 7: Example of 8-14 coding



In D1 only the active video in each line is recorded but with such a high data rate the D1 transport as designed by Sony has two head pairs installed on opposite sides of the scanner so that a segment becomes a *pair* of tape tracks. The layout of the recording tracks is seen in Figure 5. D1 uses 3/4-inch tape moving at 11.3 ips.

As this format shows there are no separate audio tracks. Four digitized audio channels are placed in the center of the video track segments. The tape wrap is a little more than half wrap and thus the Sony D1 VTR uses cassettes — that record up to 94 minutes. D1 VTRs list at about $160,000 and are made by Sony and BTS. The D1 VTR operating parameters are shown in Table 4.

Digital VTR — D2 standard

Although digital recording is most beneficial in postproduction systems that require complex editing, its uniformly high quality is advantageous for more routine applications. Digitizing composite video (television as sent to a transmitter) rather than component video has advantages. Since there is only one "component" (the composite signal) rather than the three components comprising color video, the data rate is less. It also allows for much easier picture manipulation (e.g., still frame, slow motion, variable speed and direction tape shuttling, etc.) than with D1.

In a typical transport, two pairs of heads are positioned at 180° apart on a scanner that uses a wrap of just over half a turn (permitting use of cassettes). The layout of the tracks is shown in Figure 6. The video digital sample rate is 4 x F_{sc} (four times the color subcarrier frequency or 14.32 megasamples/second) and the quantization is 8 bits resulting in a total data rate of 127 Mb/s (including four audio channels). It uses 3/4-inch tape moving at 5.2 ips. D2 VTRs sell for about $60,000 to $80,000 depending on configuration. The D2 VTR operating parameters are shown in Table 5.

DX — Panasonic version of D2

Panasonic has developed and just begun to sell digital VTRs to a specification it calls DX that are, input and output, identical in signal specifications to D2 but have significant advantages. They use 1/2-inch tape instead of the 3/4-inch tape of D2, thus they make a much more compact digital camcorder.

Table 6: Panasonic DX parameters

Drum diameter	3 inches
Effective wrap angle	178.2°
Scanner rotation	90 r/s
Helical tracks per field	Six tracks/field
Tape speed	3 ips
Comparison of tape area efficiencies	236% (D2: 100%)

Because of its unique technique internal to the VTR, a much greater signal packing density on the tape than D2 is achieved (D2 uses 2.5 times more tape than DX). This also increases the advantages of a DX camcorder.

As stated, the video is still sampled at 4 x F_{sc} and quantized at 8 bits — the same as in D2. The greatly increased tape packing density is achieved by a technique developed by NHK (Japan Broadcasting Corp.) that Panasonic calls "8-14 channel coding." In understanding the 8-14 action it must first be emphasized that it is not a mathematical operation. The 8 bits of any given word (or pixel) may have a sequence of bits that when applied to the recording head would require many flux reversals. If a word could be substituted for each 8-bit word that had fewer magnetic flux reversals, the substitute words could be placed closer together — hence saving tape. The method for finding such words sounds intuitively wrong but it works. Internal to the VTR, Panasonic uses a "look up table" of 14-bit words. The total number of words using 8 bits is 256 and using 14 bits is 16,384. Therefore out of the 16,384 words available, 256 are found that have fewer reversals than the original 8-bit word. There is no math involved — the 14-bit words have no mathematical relation to their corresponding 8-bit words — the 14-bit words merely have fewer flux reversals than the corresponding 8-bit word. An example is shown in Figure 7.

The configuration of the heads in the scanner is shown in Figure 8a and the track records are in Figure 8b (all quite similar to D2). As in D2 the DX uses cassettes and can record up to 64 minutes in a camcorder and up to 245 minutes in a studio recorder. The DX operating parameters that are different from D2 are shown in Table 6. At the time of writing Panasonic had not announced prices but they probably will be competitive to D2 VTRs (i.e., approximately $60,000). NBC will use

Figure 8: The Panasonic DX digital VTR

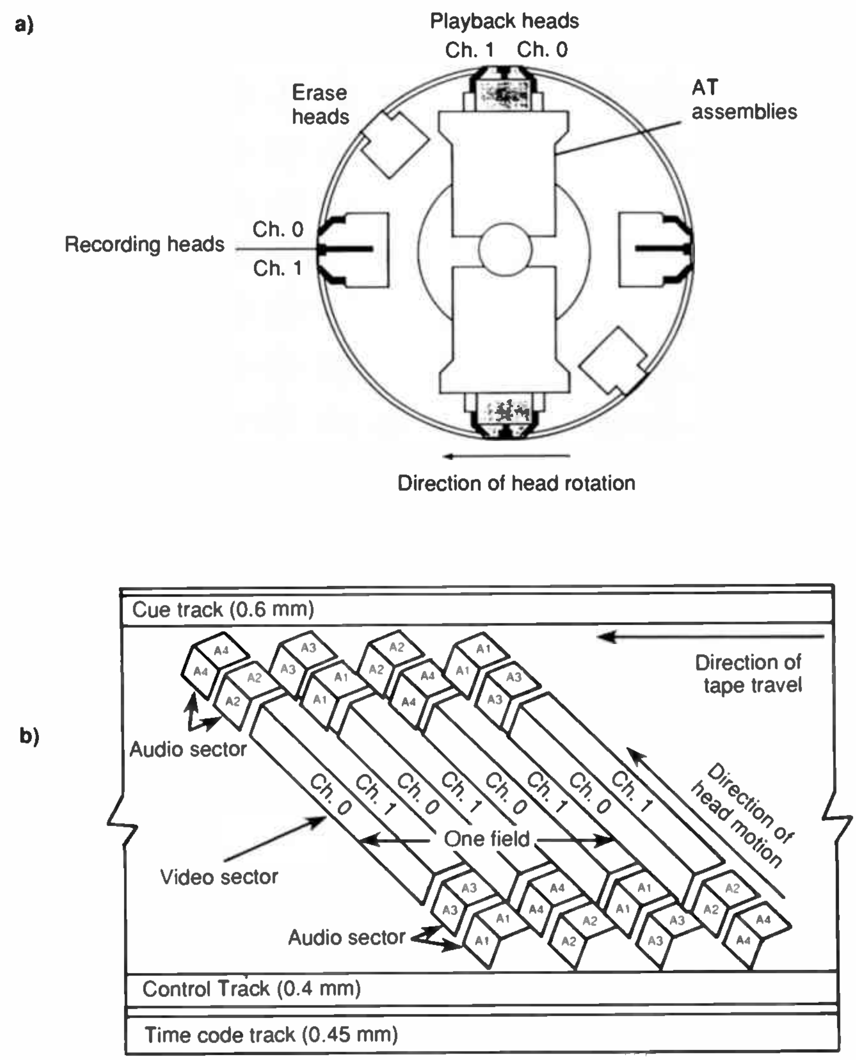


Table 7: Analog and digital parameters of SMPTE 240 M 1,125/60

Parameter	Analog bandwidth (MHz)	Digital sampling (MHz)
Luminance (Y)	30	74.25
Color (R-Y)	15	37.125
Color (B-Y)	15	37.125

Table 8: Sony HDTV digital VTR parameters

Signal system	Digital, component
Scanner type	Helical, eight tracks per field
Scanner diameter	5.3 inches
Head-to-tape speed	2,028 ips
Media type	1-inch wide, metal particle, 1,450 Oe
Tape speed	31.7 ips
Track length	16.14 inches
Track angle	2° 34 min.

Figure 9: Recording, playback and erase heads of the 1.188 Gb/s digital HDTV tape recorder

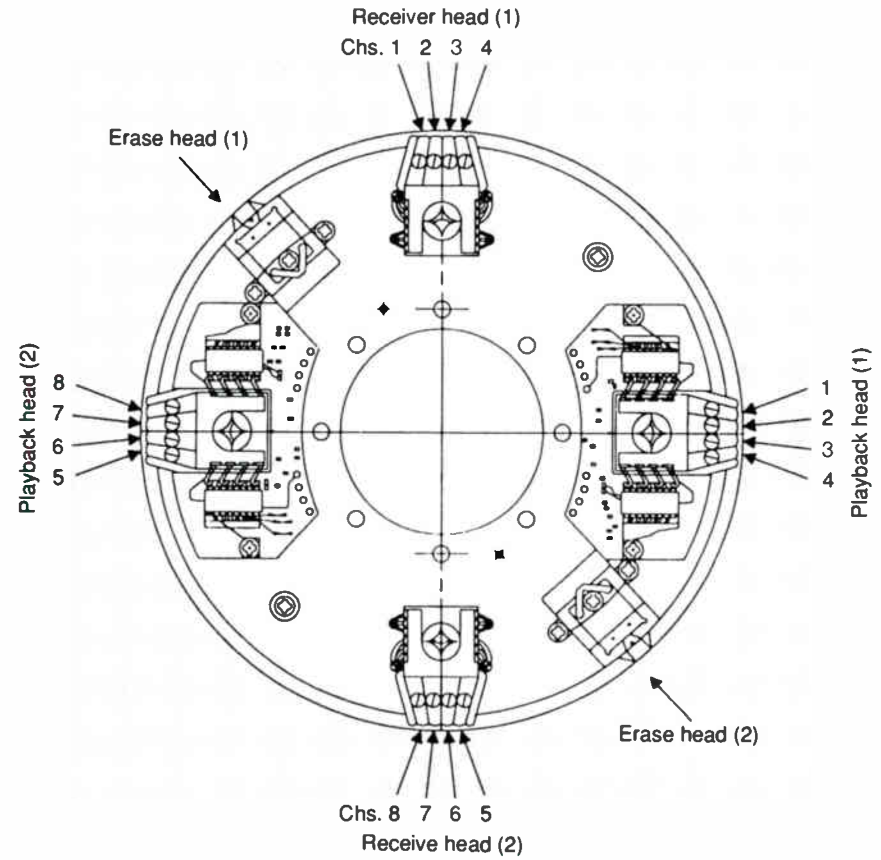
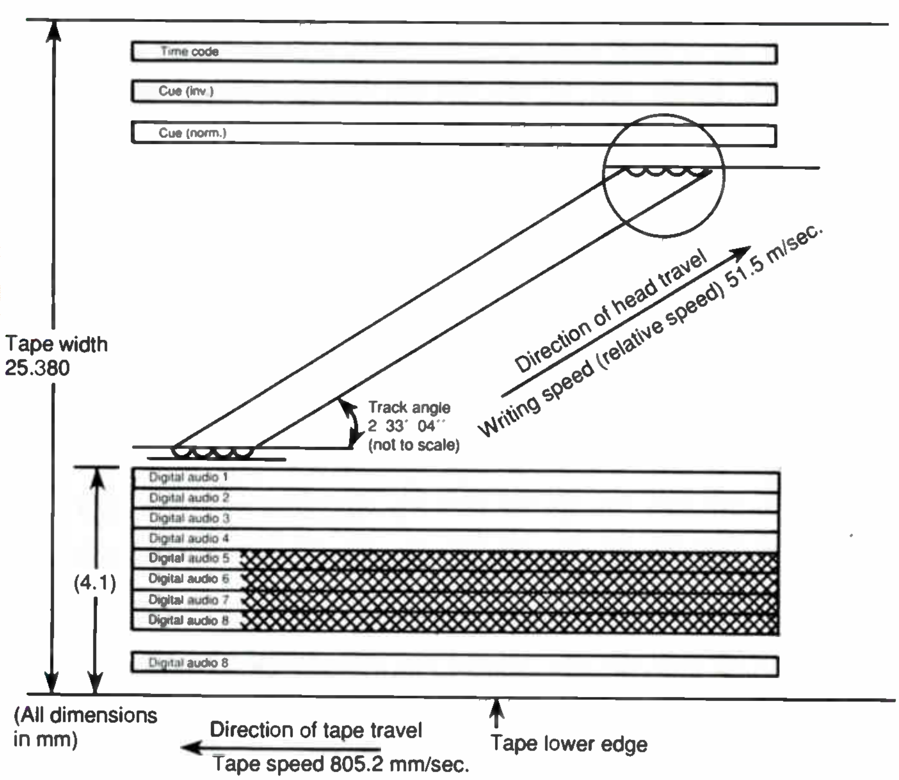


Figure 10: Sony HDTV digital VTR track format



these 1/2-inch digital VTRs in its coverage of the 1992 Summer Olympic Games in Barcelona, Spain.

Sony HDTV digital VTR

The SMPTE 240 M standard defines the analog and digital parameters of the Japanese 1125/60 HDTV system and Sony uses this standard in its HDTV digital VTR. The basic parameters are listed in Table 7. Quantization is at 8 bits resulting in a total date rate of 8(74.24 + [2 x 37.125]) = 1.188 Gb/s. The sampling frequencies are 5.5 times those selected in the CCIR 601 recommendation, which makes for a straightforward conversion between 1,125/60 and current standards. The very high data rate of 1.188 Gb/s required multiple heads on the scanner as seen in Figure 9, which lay down eight video tracks per field.

The record/playback amplifiers are mounted on the head drum with eight channels of 148.5 Mb/s each. Connection to the record and playback circuits is accomplished by means of a wide band 18-channel rotary transformer. The layout of the recorded tracks is shown in Figure 10. The multiple track recording is based on the Type C 1-inch tape format and uses open reels — an 11.75-inch reel can record up to 63 minutes. The operating parameters of the Sony HDTV digital VTR are shown in Table 8. The list price of this digital VTR is $325,000. Considering inflation this price is comparable to the 1956 price of $50,000 for the first VTR — the Quadraplex.

Conclusions

The advances in the technologies involved in magnetic tape recording are astounding. Comparing the audiotape recording capabilities of 1956 — 15,000 Hz at 15 ips on 1/4-inch tape — to the 1991 capabilities of digital HDTV tape recording — 1.188 Gb/s at 31.7 ips on 1-inch tape — shows an increase of 10,000 in the utilization of tape area. The two major factors responsible for this amazing progress are much better recording heads (and their clever scanning techniques) and much better tape materials (e.g., metal particle tape).

A brief list of operating parameters of the various digital video recording schemes outlined previously provides comparisons of all the *standardized*

(Continued on page 79)

October 1991

Cable construction

BACK TO BASICS

The training and educational supplement to Communications Technology magazine.

Gen Saye

Table of Contents

Aerial fiber construction

By Jeffery S. Weech
General Foreman, ATC Construction

With the new design of the fiber-to-the-feeder (FTF) systems there is more of a need for aerial fiber construction. There are many different ways to construct fiber but the most productive is the drive-off technique. The more productive your fiber installation is the less it costs, which will help keep the cost of fiber vs. coax down.

When ready to start construction, the first step that should be taken is a preconstruction ride-out of the plant in which the fiber is going to be constructed on. With fiber this could consist of miles of plant. The best way to approach this is to take it one reel at a time.

You can start the ride from either end of the spacing. It doesn't matter at this point. With maps in hand, look at each pole as a different job. Can you drive your fiber off by a certain pole with no obstructions stopping you? If the fiber can be driven off by this pole, put a check by this pole on your map. If there is an obstruction that prevents a drive-off, make a note on your map. Example of some obstructions might be:

- Poles that are framed field side that cannot be driven around
- Underground dips
- Power down guys
- Laterals from other CATV or phone companies
- Trees

Look at each obstruction from different angles to make sure there is no possible means of getting the fiber by the pole. Some possible solutions might include:

- Can you take the reel off the trailer and roll it around the pole?
- Can the power company meet your fiber crew to move a down guy?
- Can a lateral be hoisted out of the way?
- Can some of the trees be cut?

I can go on for pages about obstructions and how to go around them, but for now I think you have the idea.

As you are doing your ride-out, check to see if you might have problems with traffic. If so, make a note of where you will need extra "men working" signs or safety cones. Also, look for places where figure eights can be placed if necessary. Making this note now will keep you from going back the next day looking for a place to figure eight.

Now go back to the office, sit down and open your maps so you can see the whole picture. The maps will show you where to set up, where a back-pull is needed, if you need to figure eight, and most of all it will tell what part can be done with a drive-off.

The basic steps

The following are three basic steps to aerial fiber construction:

- *Drive-offs.* This is accomplished by lashing the fiber directly off the reel. The reel is loaded on the trailer so that the fiber is feeding off the top of the reel and away from the truck as shown in Figure 1. There is never any pres-

Figure 2: Fiber figure eight setup

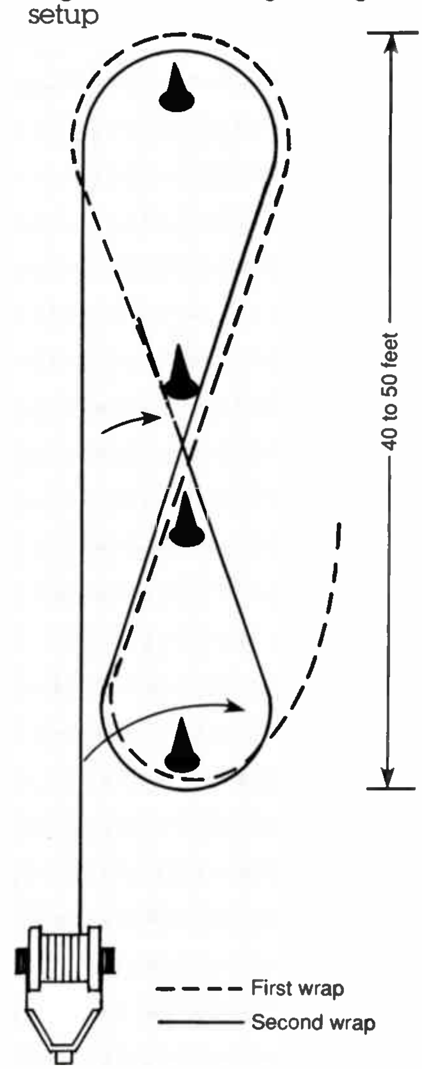
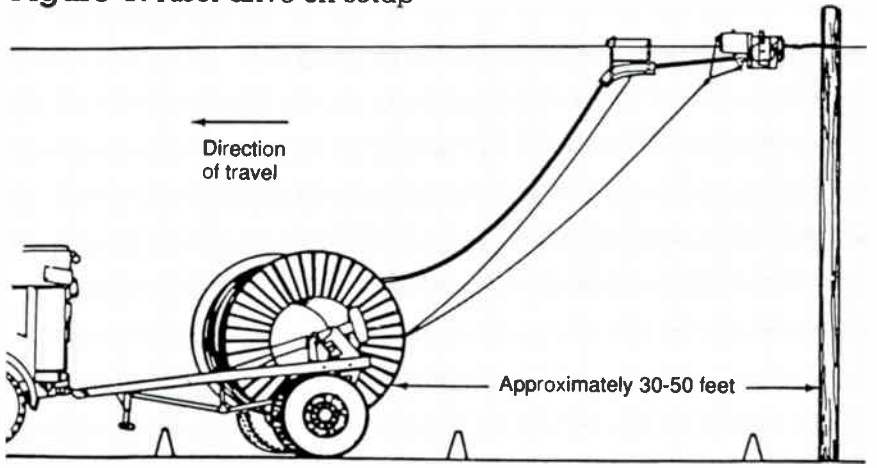


Figure 1: Fiber drive-off setup



"The key to a productive and safe day of fiber construction is a good ride-out of the job site before beginning."

sure put on the fiber when doing a drive-off so there is no need for a tension release device. The way to do this is for someone to spin the reel as you go, keeping slack between the trailer and the lasher. The trailer should lead the lasher by at least 30 feet.

• *Back-pulls*. These are used when a drive-off isn't possible. Back-pulling a whole spacing is possible, but most often you will exceed the fiber pulling tension set by the manufacturer. Load the fiber reel on the trailer the same as in a drive-off, then build the same way as you would coax cable. A tension release device will be needed.

• *Figure eights*. This is a means of taking the fiber off the reel to get to the end, so you can back-pull over or under an obstacle. Keep the figure eight neat so there will be no problems when feeding fiber back. Figure 2 shows a figure eight setup.

A drive-off isn't always possible for an entire spacing of fiber. Any combination of the three different techniques is effective to accomplish a finished product. For example, back-pull over or under an obstacle to another trailer, then reel up footage needed and then drive-off in both directions. Back-pull to a figure eight, lash up, then drive-off. With the use of the preconstruction ride-out maps you can set up the project for the most productive way possible to build aerial fiber.

Another use of ride-out maps is to determine how many people will be needed on a fiber crew. The maps show wood or cement poles and rights-of-way or easements. Therefore, you will know if bucket trucks are needed. An average bucket crew consists of at least seven people: one foreman, two lineman, two drivers and two or three ground hands. Our fiber crews can build 2 to 3 miles of fiber in an eight-hour day.

In conclusion, let me sum up by saying that the key to a productive and safe day of fiber construction is a good ride-out of the job site before beginning. **CT**

Going underground: A trenchless installation

By Richard Brinton, P.E.
Vice President, Marketing & Business Development
UTILX Corp.

The residents of Huning Castle & Country Club are very protective of the majestic old oak trees that line the fairways and streets of one of Albuquerque, N.M.'s most exclusive neighborhoods. The towering trees, witness to over a hundred years of Old West history, had survived drought, floods and an occasional stray bullet, and residents were determined to ensure the trees' future.

While the aesthetic nature of the trees was valued by homeowners, the trees presented continual problems to Public Service of New Mexico (PSNM) when falling branches caused frequent power outages during storms. Since residents always have been reluctant to have any of the branches trimmed, PSNM had to re-route many of its cables either above or below the limbs during original installation.

The problem with digging

The trees also presented a problem for Jones Intercable. Because of its charter with the city, Jones was under pressure to extend service to the Country Club area, yet the irregular spacing of PSNM's aerial cables made it difficult for Jones to install coax that would meet the National Electrical Safety Code standards. With some residents complaining about lack of cable TV, and others saying "you can't dig up my yard to install underground cable," Jones was in a no-win position from the very beginning.

"During our initial meetings with the homeowners association, the members made it very clear to us that if we damaged any of the trees, we'd be run out of town," mused Terry Arnold, plant manager for Jones in Albuquerque. (*Editor's note*: Since this was written, Arnold has transferred to the Jones system in Hilo, Hawaii.) "We knew the plant had to go underground, but if we open-trenched we faced a possible liability of $1.6 million in trees alone, not to mention the ire of all the local residents. We value our customer relations very highly, so open-trenching was obviously not a solution."

New boring technology

Officials at PSNM recommended a new guided boring technology developed by UTILX Corp. in Kent, Wash., that permits installation of underground cable with minimal surface disruption. The proprietary drilling system, known as GuideDril, uses fluidjet technology to drill tunnels from 2 to 14 inches in diameter and up to 450 feet long. PSNM uses the system to install distribution cable in developed areas and gave it an excellent recommendation.

Jones contracted with UTILX in April 1990 to install 10,000 feet of cable-in-conduit for main trunk lines and feeder cables to the residences. "When we announced we were installing the cable underground, I immediately had five complaints from the residents concerned with potential damage from open-trenching," said Arnold, "and that was before we even started the job!"

How it works

When the two-man crew showed up for the first day's work and began to set up the mobile GuideDril, the supervisor went door-to-door explaining the unique process to residents. Unlike other drilling devices, the GuideDril's drill head can be inserted directly into the ground via a small access hole, eliminating the need to dig large access pits. In addition, the self-propelled unit can maneuver through gates as narrow as 32 inches and has low-pressure tires that won't damage lawns or landscaped areas.

"We needed to stay within a narrow utility corridor that was 11 feet from the curb," said Walt Donovan, operations manager for UTILX's southwest region. "In that tight a space, you'd normally hand trench since you're right in with the water, gas, telco and sewer lines, plus the tangle of roots from the surrounding trees." With the GuideDril system, the drill head can be precisely steered around these obstacles avoiding the restrictions of working near live electrical or delicate telco lines.

The soft, sandy soil allowed the crew to drill two to three runs a day, averaging 150 feet per run. The proprietary fluidjet technology, called the SoftBor process, uses a very small volume of liquefied clay at high pressure to cut a tunnel through the soil. The drilling fluid, a mixture of bentonite clay and water, impregnates the sandy soil forming a stable tunnel wall and providing a slippery surface for pulling conduit back through the tunnel. The small-diameter jets have a limited effective cutting distance in their submerged state, eliminating the problem of overcutting (common with other technologies such as "jetting" and "water-boring"). The minimal amount of spoils produced are pumped back to a storage tank on the truck. Since the fluidjets lose their cutting power quickly, the drill head can be operated in close proximity to other utilities with no danger of cutting cables or damaging pipes.

Other advantages

The main advantage of the GuideDril is its ability to be accurately steered within ±3 inches at depths to 34 feet. Once the initial tunnel is drilled, crews attach the conduit to a swivel on a back reamer and pull the conduit back through the tunnel. The fluidjet reamer enlarges the tunnel to the required diameter. "At one junction point, we needed to pull three separate 1-inch conduits back through the tunnel," stated Arnold.

The ability to install underground cable in developed areas with minimal surface disruption cannot be overstated. "The residents are very influential and protective of the area's natural environment," said Arnold. "Considering all the concern when we proposed this project, I was amazed that we had no customer complaints, either during the project or several months later. One especially vocal resident — ready to do battle — ran out asking us when we were going to start the job," said Arnold. "I had to keep a straight face when I told her we finished her section several days before. The only visible difference was a small service pedestal installed in the right-of-way."

The 10,000-foot installation, including drilling under sidewalks, lawns and innumerable tree roots, was completed in just under six weeks. "If we had attempted to open-trench, it would have taken us a minimum of eight weeks with numerous callbacks for the inevitable restoration," said Arnold. "And God only knows how many trees we would have had to replace at $30,000 to $50,000 apiece." **CT**

Getting the most from your antenna system — Part 1

By Rick Murphy
President, Wade Antenna Ltd.

Many CATV operators today are not getting the most out of their antenna system. One reason for this is the general lack of information about how reception problems occur and what can be done to resolve them. Another reason is the practice of adding antennas one or two at a time without a thorough understanding of the overall effect on the entire antenna system. An improperly placed antenna will not perform as well as it should and may adversely affect the performance of other nearby antennas.

We spend millions of dollars rebuilding our cable systems to increase channel capacity and improve the carrier-to-noise ratio (C/N) at the subscriber's TV set. While C/N in the cable system must be considered separately from the received signal-to-noise ratio (S/N) at the headend, we know from experience with satellite and microwave reception that choosing a properly designed, high quality antenna system with a suitable tower layout can provide significant improvement in S/N and signal-to-interference ratios (S/I). The cost of upgrading an antenna system is normally small compared to the cost of rebuilding your cable plant. This is not to suggest that new antennas are an alternative to rebuilding your cable system. However, a system rebuild should include a thorough review of the antenna system as well. The combined effect can be significant. And, after all, if signal quality at the headend is not as good as it can be, no amount of system rebuild will make it better.

"A system rebuild should include a thorough review of the antenna system as well. The combined effect can be significant."

What is an antenna?

An antenna is a device that can be used either to transmit or receive RF energy in the form of electromagnetic waves. It can be further defined as an electrical conductor of specific design that acts to couple radio frequency energy from a transmission line to the atmosphere, or from the atmosphere to a transmission line. The greater the coupling an antenna has, the greater is its efficiency in transferring energy.

An antenna can be excited in two ways. A signal can be applied to the terminals of the antenna causing the elements to resonant. Standing waves of voltage and current are produced and the resulting electromagnetic field is radiated into the atmosphere. In this case, energy will be coupled to the atmosphere and the antenna is said to be transmitting. An antenna also can be excited from an electromagnetic wave in the atmosphere passing over the elements at the resonant frequency. Standing waves of voltage and current are induced in the elements and

Figure 1: Single dipole radiation pattern

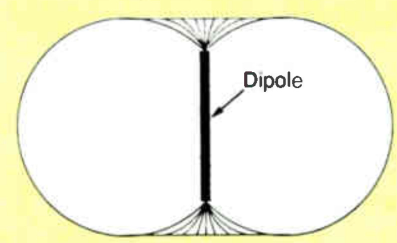


Figure 2: Reflector antenna pattern

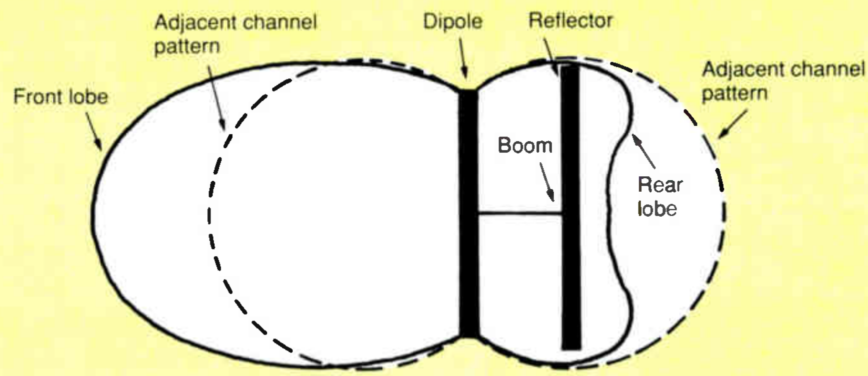
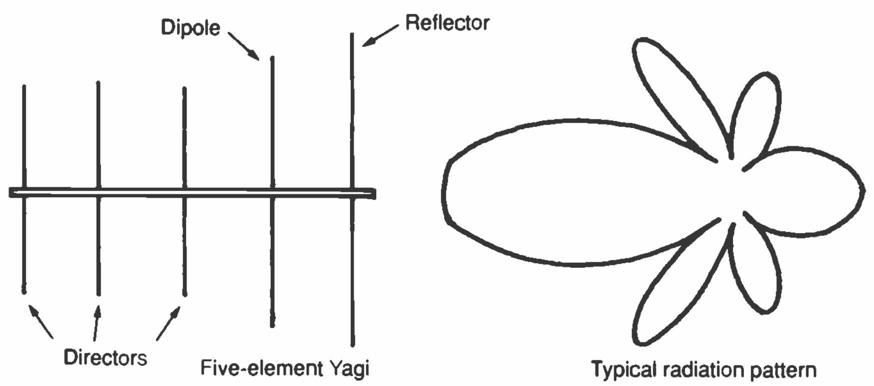


Figure 3: Yagi antenna



are coupled to the transmission line. Since energy has been coupled from the atmosphere to the transmission line, the antenna is said to be receiving.

The receiving function of an antenna is the reciprocal of the transmitting function. This simply means that an efficient antenna is as good for transmitting as it is for receiving, while a poor antenna is inefficient in both respects. When considering antennas, it is often easier to understand them if we talk in terms of transmitting rather than receiving. This should not create confusion since one is the reciprocal of the other.

Antenna types and uses

• *Dipole antenna*. The simplest antenna consists of a single dipole, the electrical length of which is normally equal to one-half wavelength at the desired frequency. This type of antenna radiates energy equally in all directions perpendicular to its length. When vertically polarized, it has an omnidirectional pattern as shown in Figure 1. The vertically polarized dipole antenna is used for portable radios, mobile communications and automobile antennas, where size is more of a concern than gain and where the direction of the received signal is constantly changing. If the antenna is placed in a horizontal position (horizontally polarized) it will have a bidirectional pattern. A horizontally polarized dipole is used more in combination with other types of elements where directivity is more of a concern.

At AM broadcast band frequencies the length of a half-wave antenna would be a few hundred feet. Consequently a shorter wire is often used for AM reception. Even the shortest length of wire will act as an antenna to some extent. The efficiency is reduced and is dependant on the length of the antenna relative to one-half wavelength of the signal. The poor efficiency of an antenna is often masked by the higher sensitivity of modern radio and TV receivers. For this reason a poorly performing antenna often goes unnoticed. The price that is paid for an inefficient antenna is not only lack of signal but also poor S/N and S/I.

• *Reflector antenna*. A dipole antenna will radiate or receive signals equally in all directions perpendicular to its length. If we shield the dipole on one side we can reduce the radiation that occurs in that direction. This is done by adding an element near the rear of the dipole, spaced 0.15 to just over 0.25 wavelength away. The length of this element, called the reflector, is just over one-half wavelength and is made from the same size material as the dipole. Some of the signal transmitted from the dipole is picked up by the reflector element, which re-radiates the signal back toward the dipole. The re-radiated signal is in phase with and reinforces the signal that is radiated in the forward direction from the dipole, while it is out of phase with and cancels the signal that is radiated to the rear beyond the reflector. The ratio of the level of signal transmitted to the rear as opposed to the level transmitted to the front is called the front-to-back ratio (F/B) of the antenna. Figure 2 shows a typical reflector antenna pattern.

Clearly, the length of the reflector and the spacing from the dipole is a function of the wavelength of the desired signal. The efficiency of both the reflector and the dipole is reduced as the frequency (wavelength) is varied from resonance. The 3 dB (half-power) bandwidth is about 10 percent of the center frequency at resonance. Thus, the gain and the F/B of the antenna varies significantly with changes in frequency, and the radiation pattern on adjacent frequencies may be quite different from the pattern of the same antenna at the tuned frequency. A typical adjacent channel pattern is shown in dotted lines in Figure 2.

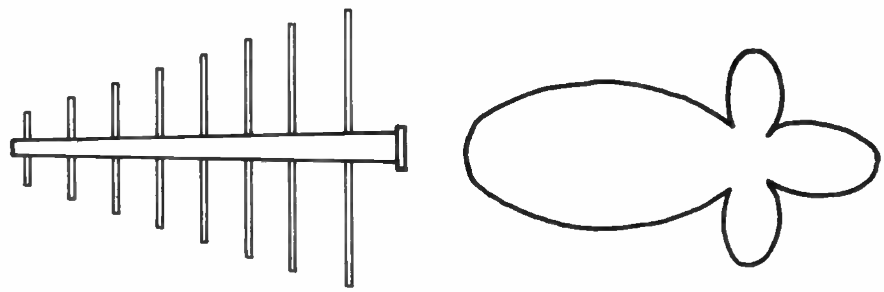
A change in the length or diameter of the dipole or reflector elements will alter the resonant frequency of the antenna. This reduces the gain and F/B at the desired frequency. Hence the high degree of fading or complete loss of signal that may occur with icing.

• *Parabolic reflector*. If the reflector is of sufficient size with respect to one wavelength and is in the shape of a parabola, a dipole placed at the focal point of this parabolic reflector will receive far more reflected than direct signal. This kind of antenna is called a parabolic reflector and has a relatively high gain depending on the size of the reflecting surface with respect to one wavelength. Due to the longer wavelength at VHF frequencies, the size and cost of such a reflector antenna makes it impractical in most situations.

• *Yagi antenna*. This antenna was invented in 1926 when transmitters had relatively low power and were used primarily for narrowband transmissions. It consists of a one-half wave dipole, a reflector element and one or more director elements. (See Figure 3.) The purpose of the reflector element has already been explained and its operation is identical on the Yagi antenna. The addition of director elements in front of the dipole increases the forward gain and directivity of the antenna. The length of the directors, their relative spacing from the dipole and from each other are chosen to ensure that the re-radiated energy from each director adds in phase with the direct signal from the dipole as it passes over each director along the boom. Each time the length of the boom and the number of elements is doubled the gain will increase about 3 dB. A relatively high gain can be achieved in this manner. There is a limit to the number of elements that can be added. This is typically at about 15 to 18 dBi of gain. However, high gain alone is not always advantageous, as we shall see.

The Yagi antenna is a frequency-dependent device; that is, the operation of the antenna is based on the use of director and reflector elements that are tuned to resonate at a specific frequency. Any conducting material near the antenna will act as a reflector or

Figure 4: Typical log periodic antenna



director to a greater or lesser extent. The center mount of the Yagi antenna often places the elements in close proximity to the tower or the mount itself. This will alter the antenna pattern and the performance of the antenna will not be as expected.

Like the reflector antenna, the performance of the Yagi drops off at other than the tuned frequency. As a result, Yagi antennas have a poor F/B on adjacent channels and often do not perform well on distant signals when strong local adjacent channels are present. The light weight construction and center mount makes the Yagi less expensive and relatively simple to install. However, this also makes it less rugged and more susceptible to damage from wind and ice. Ice build up on the elements will increase the element size, lowering the tuned frequency of the antenna. This results in a gain reduction, often as much as 10 to 15 dB, at the desired frequency until the ice melts or is removed.

• *Log periodic antenna.* A frequency-independent antenna, the log periodic (Figure 4) was invented in the mid-1950s. It was developed for the U.S. military, specifically to overcome many of the shortcomings and limitations of the Yagi antenna.

Due to the complexity of the design of the log periodic antenna, a detailed description will not be undertaken here. The operation of the antenna is based on the fact that there are no parasitic elements as such. All the elements on the antenna are tuned half-wave dipoles. Each dipole is tuned to a slightly different frequency within the bandpass of the antenna. At the desired channel there may be one or more active dipoles. Elements in front of the active dipole(s) will act as directors and those to the rear will act as reflectors. Thus the log periodic antenna will perform over a much wider band with equal gain at all frequencies. If the size of the elements changes due to icing, the active region shifts to shorter elements and the gain of the antenna does not change.

The number of elements is determined by the bandpass of the antenna. Therefore, the gain of the log periodic antenna is relatively fixed. Some antenna designs include additional passive elements in the form of reflectors or directors to increase the gain of the antenna. Other changes such as increasing the size of the elements also will increase the gain. However, these changes either cause the antenna to perform like the Yagi with its inherent disadvantages, or compromise the performance in other ways. A pure log periodic antenna will have a gain of 8 to 12 dBi. Any changes to the antenna to increase the gain will alter the performance and it may no longer operate as a pure log periodic antenna.

The design of the log periodic antenna usually requires that it be mounted from the rear and extend out from the tower in the direction of the desired signal (cantilever mount). This is an advantage rather than a disadvantage, since the mount is not complicated and reduces wind and ice loading on the tower. This also reduces the problem of interaction between the antenna and the mounting structure or the tower itself.

The F/B of a log periodic antenna is 6 to 7 dB greater than a typical Yagi antenna and does not change across the entire bandwidth of the antenna. This is a particularly significant advantage when there is a strong adjacent channel to the rear. The rugged design and superior, predictable performance of a pure log periodic antenna over a wide band of frequencies makes it ideally suited for use as a single antenna or in a phased array designed to reduce the level of interference caused by co-channel and adjacent channel carriers. **CT**

Troubleshooting feedforward amplifiers

By Jud Williams
Owner, Performance Cable TV Products

Feedforward amplifiers were specifically designed to provide improved performance in 450 MHz CATV applications by reducing distortion components more than 20 dB compared to conventional CATV hybrid amplifiers.

This article will discuss troubleshooting techniques for the Motorola FF124B used in Scientific-Atlanta Series 6800 feedforward sub-split trunk stations.

Feedforward modules are made up of two loops: one containing a 34 dB main amplifier and delay line, and the other with a 34 dB error amplifier and delay line. Since all amplifiers have a certain delay characteristic caused by propagation time, delay lines are used to compensate. (See Figure 1.)

The input signal is split into two paths by a 10 dB directional coupler. A portion of the signal enters the low noise main amplifier. Part of the amplified signal and the distortions generated in the main amplifier is sampled by a 24 dB directional coupler at the amplifier's output. Unamplified signal that went through the first delay line is combined out of phase with the sampled amplified signal, cancelling the signal and leaving only distortions to be routed through the error amplifier. The amplified distortions from the error amplifier are then combined out of phase with the main signals and its distortions leaving only the desired signal at the output of the feedforward module.

Feedforward modules are used in trunk and bridger amplifiers and are preceded in both cases by a conventional hybrid having a gain of 18 to 22 dB, depending upon the overall gain of the complete amplifier. Trunk amplifiers come in 22, 26 and 29 dB versions, while the bridger comes in a 21 dB version.

The condition of the conventional input hybrid may be checked by sweeping and observing the response. A hybrid exhibiting a rapid drop off of gain as the frequency increases indicates that it is defective.

Figure 1: Feedforward module

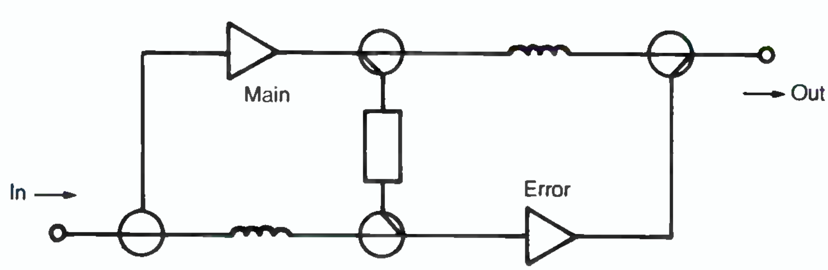
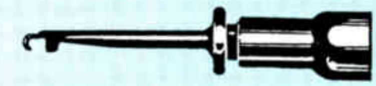


Figure 2: Plunger-type test clip



The feedforward module is initially tested while mounted in the amplifier. In addition to a sweep setup, a DC bench supply and digital voltmeter are needed. The positive lead coming from the power supply should have a plunger-type test clip (Figure 2) and the negative lead, an alligator clip. The DC bench supply needs an output of at least 24 volts and should have an ammeter able to resolve current levels of between 150 mA and 2 amps. The digital meter requires a low range of 200 mV.

Testing the trunk amp

Our first procedure will involve the trunk amplifier. Sweep the amplifier in the usual way, powering it with the bench supply. Attach the positive lead of the bench supply to the 24 volt (B+) line on the PC board, then attach the negative lead to the chassis. When disconnecting the power supply later, remove the minus lead first and then the plus lead to prevent touching the B+ to another part of the circuit accidentally.

It is important to note the amount of current being drawn by the amplifier. The 26 dB amplifiers typically draw a total of 800 to 900 mA (0.8 to 0.9 A), while 29 dB amplifiers, between 1.0 and 1.1 amps. Anything outside these ranges should alert you to a problem.

The next test is what may be called a field check. The trunk amplifier has what are called "DC bypass jumpers." These jumpers are located as indicated in Figure 3. While sweeping the amplifier, either one may be removed. This will cause a slight change in the swept response. If the change exceeds 1 dB, then the feedforward module may be faulty.

Bridger testing

The bridger does not have this feature so another method must be used to check out the feedforward module. By the way, the following technique may be used with both the trunk and bridger. It involves the measurement of a very small voltage drop across the inductors in the DC paths leading to the feedforward module. As noted earlier, there are two individual amplifiers within the feedforward module. Each of these has separate B+ pins in order to supply the needed 24 volts.

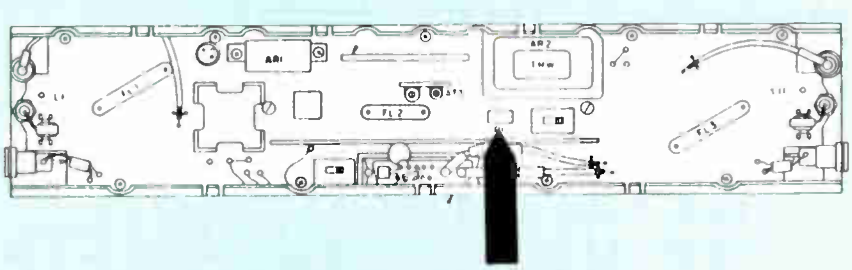
The inductors, which look very much like small resistors with color code bands around them, are designated in the trunk amplifier as L6 and L7 (1.2 µH), and in the bridger as L1 and L2 (1.8 µH). We are looking for two nearly equal voltage readings across the pairs of inductors. With B+ applied using the bench supply set at 24 volts, measure the millivolt drop across each inductor with the digital voltmeter.

When both amplifiers within the feedforward module are functioning properly they should draw equal amounts of current, so the voltage drops will be the same. Typical readings will be in the range 50 to 75 mV depending on the exact setting of the bench supply and the values of the inductors.

As a further test, the feedforward modules may be removed from the amplifier chassis and checked on the bench. Again, we are concerned with the current drawn by each of the internal amplifiers, thus we may attach our bench supply first to one B+, then the other. Since the module is spec'd out at 660 mA total, 330 mA per amplifier would be ideal.

The preceding is a simple method of troubleshooting these very sophisticated modules. It is intended to benefit facilities with limited equipment. A test set is available from Scientific-Atlanta that allows technicians to verify proper operation of their feedforward modules. It is specified as a Feedforward Test Set Series 6800, (part no. 344696) with optional test cables (344777 and 344778). **CT**

Figure 3



DC bypass jumper

Are you ready for a break?

By Tom Szumny, Gene Bray and Greg Miller
Test, Measures and Restoration Group
Optical Networks International

It's four o'clock on Tuesday afternoon when calls start coming into the cable system — the cable's out and prime time is a few short hours away. After determining the outage was caused by a fiber break, the dispatcher sends out a technician. Unfortunately, as the technician stops to gather a few tools, he finds there are no splices to be found, equipment needed is being used elsewhere and the replacement fiber has not been tested.

This scenario can be extremely frustrating. Not only does the system initially have very little time to do an emergency restoration, it will probably take the technician most of prime time just to gather materials needed for the job. A fiber break is not the time to be gathering tools, thoughts and equipment — instead, it's the time to have a restoration plan implemented, with tools, thoughts and equipment already in order and ready to go.

To think that a fiber break will never happen to your system is a bit like saying "I don't need home theft insurance. It will never happen to me." Breaks do occur and the causes are many: pellet shots from rifles; a dump truck with the dump up pulling down lines as it drives by; an afternoon squall knocking down trees; or simply a backhoe operator cutting the cable during road construction.

No matter what the cause, an operator needs to locate the problem, determine the cause and fix the break quickly. And in order to do that, an operator must have a game plan, along with the materials needed to do an emergency restoration.

Establishing a game plan

At the heart of any emergency restoration plan is a restoration kit itself. A kit should contain all the necessary items for an emergency restoration, along with additional fiber. There are two options operators have when choosing a restoration kit — either purchasing one off-the-shelf or building one from scratch with existing materials.

An initial problem with building a kit is materials. Often, a technician will raid existing equipment to assemble a kit, leaving gaping holes in equipment inventory reserved for a permanent restoration. Keep this in mind if you build your own kit, and remember to replenish your reserve. Perhaps one of the biggest obstacles in creating a restoration kit in-house is procrastination. You should put the kit together as soon possible — you never know when you'll need it. Perhaps purchasing a ready-made kit will suit your needs better. Regardless of how you obtain a kit, there are certain items that should be included: cables, splices, tools, enclosures and written documentation.

Features to consider when purchasing or building a restoration kit are active fiber count, expansion capabilities and speed of repair. Kits can be purchased with various fiber counts, tools, cleavers and work stations for either one or two technicians splicing simultaneously. Other options can expand the capability up to 96 active fibers with four technicians working simultaneously. Options are system-dependent — balancing how fast a system wants to restore a signal and how much money management wants to spend. The idea is to have the most efficient restoration kit possible for an individual system.

Once a kit is assembled or purchased, it should be placed where it can be quickly accessed and used for *emergency purposes only*. Taking items out of the kit for everyday use defeats the purpose of the "insurance" and leaves the system in the same unprepared situation — a technician will end up at a job site without the necessary equipment.

The kit is now the focus of the restoration plan. A key item contained within the kit is written documentation concerning an emergency break. With actual written plans, the cable operator can put the responsibility on an individual to develop and finalize procedures to follow during an emergency. This can be done by one or several employees who actually will be a part of the restoration team.

These documents, customized for each cable system and stored within the restoration kit, should contain:

- Procedure for the restoration process — to include several different restoration scenarios such as repairing a backhoe cut or an aerial fix. Again, this forces personnel to think and document how an emergency situation would be handled.
- Drawings and/or maps of the system.
- A list of trained technicians, addresses, telephone numbers and other related materials (e.g., keys and/or combinations for locks).
- A contact list of construction vendors with telephone and beeper numbers.
- Any other information that may be applicable to a specific system.

Once the problem has been identified as a break or damage to the fiber by normal troubleshooting procedures, the technician can proceed to the site with the knowledge that he is prepared to handle the emergency.

An emergency fix

One of the first things to consider when documenting a restoration plan, and later fixing an emergency break, is the different physical attributes of fiber from traditional coax. When fiber breaks, the glass could shatter away from the break point in both directions. Actual splicing needs to be done approximately 50 feet on either side of the break point. But also keep in mind that stored slack could pre-empt this decision.

Often, emergency vehicles, traffic, an intersection, water, trees and so forth might prevent the splice from being performed at the break site. Telephone technicians or electrical personnel at the scene also may necessitate pulling the cable away from traffic in order to avoid being trampled.

With 400 feet of cable (the typical length of cable usually contained in a restoration kit), a technician is assured to have enough cable to perform the splice on prepared cable, away from non-cable activity. The main objective at this point is to get the fiber back up and the signal restored to subscribers. Once the objective has been met, the cable system needs to look at a permanent repair.

Completing the job

With the completion of the emergency fix, the system is up and running and everyone can return to normal operations — except the construction crew. Part of the game plan is to have a documented permanent restoration procedure. The plan should keep in mind the materials needed, location of splices and method of procedure for the permanent fix — this needs to be accomplished before another signal interruption might possibly occur. While awaiting materials ordered by engineering, technicians can rebuild the damaged area and position the replacement cable at the selected repair splice points.

The replacement cable needs to be prepped into the new splice points and the "dark" fibers spliced. Once this is complete, test and record the fiber and splice point losses for future maintenance needs. Because of the need for minimum signal interruption, select a non-prime time for transition, usually in the early morning hours. (Remember that the system is up and you have time to be selective.)

Establish good communications among personnel in order to minimize down time. Now is the time to transition the system to the newly established "dark" fibers. This will allow you to return to the splice location,

"Waiting until a break occurs is not the time to wish materials and plans were in place."

complete the splices and make them permanent. Test and record the fiber and splice losses for future maintenance records. At this point, the system can be changed back to the original assignment, making system records correct. Or, records can be corrected according to system needs, noting the additional materials with the fiber and splice loss characteristics.

A permanent fix is important. Despite that we are in a time when cable system needs are demanding, a lethargic attitude often is taken once signal continuity is restored. However, more than resumed programming is at stake here. There are three important reasons a permanent fix should be completed as soon as possible:

1) As a cable operator, there is the responsibility of maintaining a reliable, efficient system. Part of this is doing a fast emergency fix. The other part is going back and fixing it correctly and permanently.

2) An emergency repair is vulnerable to more damage and the fiber loss is high.

3) A second break will leave you without equipment. Since technicians have already used restoration equipment for the first break, keeping that equipment in the field will leave the system defenseless against another untimely break. And remember, whenever a kit has been opened for an emergency restoration, items used must be replaced immediately in order to be fully prepared for another possible break.

A positive image

Regardless of new technological advancements, cable operators today are faced with increasing demand for reliable systems. A major factor in customers' perceived image of a system's reliability is the duration of an outage. Being prepared for a fiber break can reduce a 20-hour signal discontinuity to a matter of a few hours.

The key word here is "prepared." Waiting until a break occurs is not the time to wish materials and plans were in place. Today is the best time to begin a restoration plan. It will not only eliminate a chaotic knee-jerk reaction to a break, it will solidify the professional image cable operators want to maintain. **CT**

Correspondent's Report

(Continued from page 68)

(and one not yet standardized — DX) NTSC and HDTV digital VTR systems. (See Table 9.)

Table 9: Comparisons of D1, D2, DX and HDTV

	D1	D2	DX	HDTV
Tape	Oxide tape	Metal particle	Metal particle	Metal particle
Width	3/4-inch	3/4-inch	1/2-inch	1-inch
Coercivity	850 Oe	1,500 Oe	1,500+ Oe	1,500 Oe
Track length	6.7 inches	5.9 inches	4.6 inches	16.14 inches
Drum diameter	2.95 inches	3.8 inches	3 inches	5.3 inches
Data rate	227 Mb/s	127 Mb/s	125 Mb/s	1.188 Gb/s
Tape speed	11.25 ips	5.2 ips	3.3 ips	31.7 ips
Tape area efficiency (using DX as the norm)	20%	42%	100%	5.2%

The future multichannel TV satellite schemes proposed for current NTSC and the proposed HDTV transmission schemes, although all are digital, all require compression to fit the information in the available spectrum. It is important to note that *no compression* is used in any portion of any of the digital VTR systems. Therefore, there need be no concern about artifacts in the pictures (which is going to be a major consideration in the subjective evaluation of these transmission systems).

As has often been noted, television (and the electronic entertainment world in general) has been rapidly progressing into an all-digital domain, so it seems that the future of digital videotape recording looks increasingly bright. **CT**

References

1) *Behind the Tube,* A. Inglies, Focal Press, 1990.

2) *The Art of Digital Video,* J. Watkinson, Focal Press, 1990.

3) *Television and Audio Handbook,* K. Benson, J. Whitaker, McGraw-Hill, 1990.

4) *HDTV, Advance Television for the 1990s,* K. Benson, D. Fink, McGraw-Hill, 1990.

5) *Television Engineering Handbook,* K. Benson, McGraw-Hill, 1982.

6) *Electronic Engineers Handbook,* D. Fink, D. Christiansen, McGraw-Hill, 1986.

7) *Reference Data for Engineers: Radio, Electronic, Computer and Communications,* E. Jordan, Sams & Co., 1985.

8) Information supplied by various VTR manufacturers; e.g., Ampex, Panasonic, Sony, etc.

Industrial Technology's FiberFone fiber-optic talk set

By Ron Hranac
Senior Technical Editor

As fiber optics becomes more common in today's cable architectures, it's not unusual for system operators to build future capabilities into the networks. In a typical AM fiber system, this often means that each node has extra fibers run to it for bandwidth expansion, return capability and signal redundancy. These extra fibers also could lend themselves well to use for maintenance purposes.

The non-CATV telecommunications industry has for years made use of service channels in point-to-point links. These service channels are useful for communicating between repeater sites without the need for two-way radios or the disruption of the primary link's signals. As fiber optics became more popular in telecommunications, manufacturers responded with fiber-optic talk sets that provided the same maintenance communications capabilities over fiber that have for years been used on copper and microwave links.

Only recently have these products been introduced to CATV. Industrial Technology Inc. is one manufacturer that has been providing fiber talk sets to the telephone industry, and now has entered the cable marketplace. A fiber talk set consists of a pair of telephone-like devices that are connected to the ends of an unused fiber. A basic talk set allows voice communications between the two locations.

While field personnel in cable commonly use two-way radios or cellular telephones for communications between a headend and a fiber node, these aren't always possible or practical in all situations. Using a two-way radio ties up the frequency, and in most cities many users are licensed on the same frequency. If a node just happens to be in a radio "dead zone," then the radios won't be too effective.

With cellular phones (which are nothing more than two-way radios themselves) it may be difficult to get an open line in some cities at a particularly critical moment (like when you're doing maintenance), or you may be out of range of a cell site. When you combine that with the cost of each phone call, even cellular phones begin to lose their appeal.

Model 120 FiberFone specifications

Dimensions: 10.8 x 5 x 5.7 inches (140 x 278 x 120 mm)
Weight (with batteries): 5.5 pounds (2.5 kg)
Operating temperature range: 0 to 120°F (-18 to 48°C)
Battery life: 75 hours typical
Operating wavelength: 1,300 nm
Optical range: 15 dB single-mode, 18 dB multimode
Optical connector: FC-PC
ID signal: 2 kHz squarewave at -26 dBm minimum
CW source: unmodulated 1,300 nm signal at -23 dBm minimum for single-mode fiber, -20 dBm for multimode fiber

"Considering the availability of extra fibers at most nodes ... talk sets have the ability to become a regular part of the CATV fiber maintenance toolbox."

Enter the fiber talk set. Considering the availability of extra fibers at most nodes (or the possibility of dedicating a fiber during system design to each node for service channel use), talk sets have the ability to become a regular part of the CATV fiber maintenance toolbox. With this in mind, I obtained one of Industrial Technology's Model 124 FiberFone talk set kits to evaluate for this month's "Lab Report."

The product

The talk set kit we tested is a pretty comprehensive collection of equipment that includes two Model 120 FiberFone talk sets, two Model 319 headsets, a pair of 10-meter fiber jumper cables, two wall-transformer DC power supplies, a Model 320 conferencing adapter, instruction manual, pouches for the fiber jumpers and headsets, and a rugged foam-lined carrying case that all of this fits into. The heart of this kit is the pair of FiberFone talk sets. Each one is a battery-operated unit that includes a telephone-style handset. (The Model 319 headsets are normally optional unless the whole talk set kit is purchased.)

The Model 120 talk set is good for full duplex communications — just like a normal telephone — through up to 15 dB of single-mode fiber at 1,300 nm. Optical signals are generated with an LED source, and communications are digital for good quality over the full specified range. Industrial Technology has another model that can be used on longer links up to 30 dB (it has a laser source), although we didn't look at that one. The accompanying table summarizes the specifications of the 120.

Each FiberFone operates off of six D-size alkaline batteries (included), or the DC power supply. As well, any external DC source from 7 to 18 volts at 300 ma will power the unit, so even a vehicle's 12 volt electrical system could be used. There is no provision for using rechargeable NiCd batteries, unless the user physically removes them from the talk set for charging.

The FiberFone's case is bright orange molded nylon plastic, and includes an adjustable shoulder strap. The case design includes features that allow the FiberFone to be used in the rain.

An external power jack is provided on the outside left end of the case. It will accept a standard 2 mm plug, which can be used even with batteries installed. Wiring of the external power source isn't critical, since the Model 120 will accept either polarity over its DC operating range. The unit is automatically powered up as soon as the small cover on the optical interface is opened. The FiberFone emits an audible beep to indicate that it is operating, and the battery LED illuminates for a few seconds if everything is normal.

Under the FiberFone's lid you'll find the telephone handset and cord, the optical interface, four control buttons (*CALL*, *ID*, *SOURCE* and *VOL*) and five LED status indicators (*ON LINE*, *CALL*, *ID-2 KHZ*, *SOURCE-CW* and *BATTERY*). The underside of the lid also has operating instructions printed on it. The telephone handset can be replaced with a headset for hands-free use.

During typical operation, each end of the fiber would be connected to a FiberFone using an FC-PC connector or a bare fiber adapter. The calling party then picks up the handset and presses the *CALL* button. The talk set at the other end of the fiber will ring (the *CALL* LED at the originating end blinks to indicate that the other phone is ringing), and when it's answered (handset picked up) the *ON LINE* LED on both units will illuminate. If either user wants to increase the volume in his respective receiver, pushing the *VOL* button once will raise the audio level in the earpiece 6 dB. Pressing it again returns it to normal.

The FiberFone contains a fiber identification mode that will generate a 2 kHz optical ID tone that is compatible with most fiber identifiers. To activate this function after a fiber is connected, the user lifts the handset, then presses the *ID* button (the *ID-2 KHZ* LED will illuminate). Another useful feature is the CW source function. A talk set can be used as a stable optical source for fiber attenuation measurements. First the user connects a calibrated optical power meter to the FiberFone's optical interface. After lifting the handset, pressing the *SOURCE* button will activate this mode (the *SOURCE-CW* LED will illuminate). The optical power can then be measured at the talk set output. After this measurement, the power meter is taken to the other end and connected to the fiber being tested. The CW source is then turned on again and the power at the other end measured. The difference between the two readings is the loss of the fiber.

Conferencing also can be done with the talk sets using the conferencing adapter. As an example, a pair of FiberFones connected to one fiber could be linked to another pair of FiberFones on another fiber, allowing three people to communicate. The pair of talk sets in the middle (with the conferencing adapter connecting them) acts as a repeater, and this process has no limit as to the number of fiber links that can be conferenced together, so long as each individual fiber does not exceed the maximum 15 dB. (Given enough FiberFones and adapters, a link could be established from one coast to the other.)

At the time of the evaluation, the complete Model 124 talk set kit with two FiberFones and the accompanying accessories was selling for $4,025. If you don't purchase the kit, each Model 120 FiberFone talk set is $1,875.

Lab test

The CW output optical power of the kit's two FiberFones in source mode was measured on a Hewlett-Packard HP 8152A optical average power meter. Both easily met the manufacturer's minimum specification of -23 dBm; the first unit's output was -18.35 dBm, and the second was -16.80 dBm. The 2 kHz ID source was a bit more difficult to measure because of the modulation, but it averaged about -22 dBm (-26 dBm spec) on both talk sets. All of the functions and modes performed as indicated.

Whether the voice communications were through one of the 10-meter jumpers or through several kilometers of fiber, the sound quality, comparable to the quality of a local telephone call, was the same because of the digital transmission that is used. We checked the subjective quality of the audio at 15.7 dB of fiber loss (more than 40 km of single-mode fiber) plus a bare fiber adapter whose loss was unknown, and there was no noticeable difference compared to the short jumper. At 18.1 dB of fiber plus the loss of the bare fiber adapter, the audio was intermittent but still usable. The intermittent nature of the audio at this point was due to the bit errors occurring in the data stream because of the additional loss above spec.

When we began the initial CW power measurements, one of the talk sets was more than 10 dB worse than spec. A quick spray of clean air into the optical interface connector on the talk set cleared up the problem. The instruction manual that accompanies the kit cautions that this connector must be kept clean. It would be a good idea to carry a small can of dry air for this purpose.

We did not test the performance of the FiberFones over multimode fiber, but considering their performance with single-mode fiber there is no reason to expect any problems with multimode.

Comments

The FiberFones performed quite well and exceeded the manufacturer's specifications on measured output power as well as the maximum usable link distance. Considering that AM fiber links used in CATV applications seldom exceed 10 or 12 dB, these talk sets will be more than adequate. For longer FM links with higher loss, Industrial Technology's 30 dB talk sets would have to be used instead.

The instruction manual that accompanies the kit is well written and easy to understand. It doesn't include schematic diagrams or operational theory, but does a good job of explaining how to use the equipment.

If you want to operate a talk set from an automobile's 12 volt electrical system, you'll have to fabricate a power cable with a 2 mm plug on one end and appropriate clips (or a cigarette lighter adapter) on the other. In the event you accidentally reverse the positive and negative leads, the design of the FiberFone is very accommodating since it isn't sensitive to reversed polarity. The batteries do have to be installed correctly, however.

About the only downside — if you can even call it that — is the tight quarters when unplugging the handset jack and plugging in a headset. Someone with large fingers also might have a little trouble tightening a fiber's FC-PC connector into the optical interface connector, although this is easily overcome by temporarily lifting the handset out of the way. And based on our experience in the lab with the bare fiber adapters, I would recommend that you install FC-PC connectors on the service channel fibers in the headend and at each node site to simplify interfacing to the talk sets. An alternative might be to carry a jumper cable with an FC-PC connector on one end and a mechanical splice on the other end (mating mechanical splice connectors would have to be installed at the nodes and the headend). The bare fiber adapter could be kept for use only when needed.

For more information, contact Industrial Technology, Inc., 2001 FM 1821 South, Mineral Wells, Texas 76067-0190; (817) 325-9461. **CT**

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 535 RIVERTON, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

COMMUNICATIONS TECHNOLOGY

A Transmedia Publication
P.O. Box 1843
Riverton NJ 08077-9443

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 535 RIVERTON, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

COMMUNICATIONS TECHNOLOGY

A Transmedia Publication
P.O. Box 1843
Riverton NJ 08077-9443

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 535 RIVERTON, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

COMMUNICATIONS TECHNOLOGY

A Transmedia Publication
P.O. Box 1843
Riverton NJ 08077-9443

COMMUNICATIONS TECHNOLOGY

Name ____________________
Title(Please specify) ____________________
Company Name ____________________
Address ____________________
City ____________________ State ____________ ZIP ________
Phone ____________________ Date ____________

FREE INFORMATION

Reader Service Card

October 1991 (Valid until December 1991)

CT 10/91 - 1

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

1	19	38	57	76	95	114	133	152	171	190
SCTE	20	39	58	77	96	115	134	153	172	191
2	21	40	59	78	97	116	135	154	173	192
3	22	41	60	79	98	117	136	155	174	193
4	23	42	61	80	99	118	137	156	175	194
5	24	43	62	81	100	119	138	157	176	195
6	25	44	63	82	101	120	139	158	177	196
7	26	45	64	83	102	121	140	159	178	197
8	27	46	65	84	103	122	141	160	179	198
9	28	47	66	85	104	123	142	161	180	199
10	29	48	67	86	105	124	143	162	181	200
11	30	49	68	87	106	125	144	163	182	201
12	31	50	69	88	107	126	145	164	183	202
13	32	51	70	89	108	127	146	165	184	203
14	33	52	71	90	109	128	147	166	185	204
15	34	53	72	91	110	129	148	167	186	205
16	35	54	73	92	111	130	149	168	187	206
17	36	55	74	93	112	131	150	169	188	207
18	37	56	75	94	113	132	151	170	189	208

COMMUNICATIONS TECHNOLOGY

Name ____________________
Title(Please specify) ____________________
Company Name ____________________
Address ____________________
City ____________________ State ____________ ZIP ________
Phone ____________________ Date ____________

FREE INFORMATION

Reader Service Card

October 1991 (Valid until December 1991)

CT 10/91 - 2

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

1	19	38	57	76	95	114	133	152	171	190
SCTE	20	39	58	77	96	115	134	153	172	191
2	21	40	59	78	97	116	135	154	173	192
3	22	41	60	79	98	117	136	155	174	193
4	23	42	61	80	99	118	137	156	175	194
5	24	43	62	81	100	119	138	157	176	195
6	25	44	63	82	101	120	139	158	177	196
7	26	45	64	83	102	121	140	159	178	197
8	27	46	65	84	103	122	141	160	179	198
9	28	47	66	85	104	123	142	161	180	199
10	29	48	67	86	105	124	143	162	181	200
11	30	49	68	87	106	125	144	163	182	201
12	31	50	69	88	107	126	145	164	183	202
13	32	51	70	89	108	127	146	165	184	203
14	33	52	71	90	109	128	147	166	185	204
15	34	53	72	91	110	129	148	167	186	205
16	35	54	73	92	111	130	149	168	187	206
17	36	55	74	93	112	131	150	169	188	207
18	37	56	75	94	113	132	151	170	189	208

COMMUNICATIONS TECHNOLOGY

Name ____________________
Title(Please specify) ____________________
Company Name ____________________
Address ____________________
City ____________________ State ____________ ZIP ________
Phone ____________________ Date ____________

FREE INFORMATION

Reader Service Card

October 1991 (Valid until December 1991)

CT 10/91 - 3

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

1	19	38	57	76	95	114	133	152	171	190
SCTE	20	39	58	77	96	115	134	153	172	191
2	21	40	59	78	97	116	135	154	173	192
3	22	41	60	79	98	117	136	155	174	193
4	23	42	61	80	99	118	137	156	175	194
5	24	43	62	81	100	119	138	157	176	195
6	25	44	63	82	101	120	139	158	177	196
7	26	45	64	83	102	121	140	159	178	197
8	27	46	65	84	103	122	141	160	179	198
9	28	47	66	85	104	123	142	161	180	199
10	29	48	67	86	105	124	143	162	181	200
11	30	49	68	87	106	125	144	163	182	201
12	31	50	69	88	107	126	145	164	183	202
13	32	51	70	89	108	127	146	165	184	203
14	33	52	71	90	109	128	147	166	185	204
15	34	53	72	91	110	129	148	167	186	205
16	35	54	73	92	111	130	149	168	187	206
17	36	55	74	93	112	131	150	169	188	207
18	37	56	75	94	113	132	151	170	189	208

AD INDEX

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

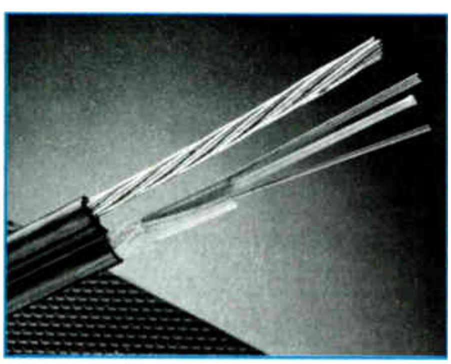
Back to Basics

Bandpass filter

CaLan announced its Model FF-xx preselector fixed bandpass filter that provides high attenuation in the stopband and low insertion loss in the passband. Universal design enables it to be used with any signal or spectrum analyzer, including the company's Model 1776 spectrum analyzer as well as competitive sweep systems.

A line technician places the product on-line to the sweep or analyzer input when making low-level distortion measurements in the presence of other high-level carriers. The product acts to extend the dynamic range of distortion measurement functions and attenuates unwanted adjacent carriers from 30 to 60 dB below the desired carrier's level. This prevents the creation of distortion products within the sweep system or spectrum analyzer. Five-section filters are available with appropriate center frequencies for Chs. 5, 14, 13 and 36, and a seven-section filter is available for Ch. 61.

Reader service #124



Aerial fiber

Siecor extended its Mini Bundle fiber-optic cable product line to include a new self-supporting aerial design that is said to have easy and economical one-step installation. The Figure-8 Mini Bundle cable integrates the company's loose tube optical cable design with an asphaltic-filled, extra high strength steel messenger. The assembly is jacketed with polyethylene into a figure-eight shape. The design allows standard, copper figure-eight cable installation practices and off-the-shelf figure-eight pole attachment hardware to be used during cable placement.

Because the cable and its supporting messenger are integrated into one functional unit and are installed simultaneously, installation steps are reduced from three to one. The integrated steel messenger carries installation forces and also bears the long-term, environmental loads sustained in aerial installations.

Reader service #123

Receiver interface

R.L. Drake's ESR1250 commercial earth station receiver now comes with a built-in RS232 serial interface, which allows the ESR1250 user to have full remote control on all front-panel tuning functions. The serial interface can be hooked up to a full-fledged personal computer or a simple terminal to provide remote operation.

To optimize the interface capability, the company offers an IBM-compatible software program that communicates with the ESR1250 at a rate of 1,200 baud and generates a single-screen, menu-driven readout of all receiver parameters, allowing easy cursor selection of any parameter to be altered. Multiple channel setups may be stored for later recall and use.

Reader service #120

dB/dBm training

Scott Training Associates is offering its *Understand dB and dBm* audiotape training course free to engineers and managers for training their staff. It is 60 minutes long and includes accompanying charts and exercises. It teaches where the dB notation comes from, how to convert numbers to dB with and without a calculator, how to specify power in dBm, and how to use dB to specify return loss, insertion loss and gain.

It is intended for technicians, testers, mechanical and industrial engineers, sales and marketing persons, and non-technical managers. According to the company, the course will improve the productivity of staff by at least 2.8 dB.

Reader service #119

Optical fault finder

The Tektronix FiberScout optical fault finder is now available with a new 1,550 nm single-mode long range port. The port allows testing of fiber links up to 64 km (40 miles). Since 1,550 wavelength systems are vulnerable to macro and micro bending (which can cause system degradation or even failure) the new port is designed so it can easily identify bends and faults, their distance and related dB loss, according to the company.

Reader service #140

Optical amplifier

Jerrold Communications' Cableoptics unit announced its Starpower field-deployable optical amplifier product for AM cable TV. It offers output power (15 dBm) that is four to five times higher than today's best DFB lasers with little measurable distortion and a noise figure as low as 4 dB over a -40° to +60°C typical strand-mount temperature range, according to the company. As well, the company reports that initial Starburst system designs using 1,550 nm transmitters and Starpower optical amplifiers produced transmitter cost savings of 35 percent, which on a total system basis represents savings exceeding $200 per mile.

The product is said to give very high performance for long distance applications, like AM supertrunking, without having to use multiple fiber configurations. The optical amplifier is ideal for higher power, high splitting ratio Starburst FTF rebuilds and new-builds, according to the company.

Reader service #141

Fiber bulletins

Orionics/Aurora fiber-optic fusion splicers and accessories manufactured by Aurora Instruments are described in a new series of technical product bulletins. Five bulletins are available.

Descriptions of the company's

Model FW-305 semi-automatic fusion splicer, Model FW-305 semi-automatic fusion splicer, Model FW-303 manual fusion splicer, Model LAS-410 local alignment system and Models FCD and FCR diamond- and carbide-tip optical fiber cleavers are available. The fifth bulletin describes the company's fiber-optic splice protection accessories. Both the FW-303 and FW-305 have integral 60X displays that show details of fiber alignment and completed splices. The FW-303 can handle fibers from 100 to 400 μm glass clad outside diameters. The FW-305 is designed for 80 to 200 μm glass clad outside diameter fibers. The LAS-410 provides precise and immediate indication for optimum fiber core alignment in the field to help assure splice quality, according to the company.
Reader service #139

Design software

ComNet announced its BSE-Pro software for CATV design has been updated to Rel. 1.04. According to the company, the software is the only commercial CATV design software that calculates carrier-to-noise ratio, non-linear distortions and AC powering in real-time while in the design mode.

The update includes a find device fault command that searches user-specified parameters such as low AC powering or low level RF outputs or inputs to amplifiers or taps. This is said to assure the integrity of the design, particularly for upgrades. Any design flaw is immediately highlighted when the software finds the affected device.
Reader service #138

Enclosure locks

The Access Control locks were introduced by Telecrafter Products. The products are said to eliminate the problems associated with frozen and rusted locks, lost keys and the use of specialty tools to gain access to enclosures. The color-coded sealing links must be broken to gain access to the enclosure equipment. Unauthorized access is easily identified and auditing procedures can be performed efficiently, according to the company.

Links are easily replaceable. The "last forever" lock body accepts new sealing links to signify access or changes in the status of the drop. The company's Tele-Theft and Access Control bodies and seals are not interchangeable.
Reader service #137

Cabinet sealants

Vinyl foam gasketing to seal out dust and moisture from its heavy duty vertical racks and sloped front consoles is now offered by Equipto Electronics. Built to EIA standards, catalog options include dust filters and blowers that pressurize the inside of the cabinet. Many accessories are offered and custom modifications are available.
Reader service #136

OTDR

Anritsu's new MW9040A optical time domain reflectometer has an ultra-wide dynamic measurement range of up to 250 km with a resolution of 10 cm. It also has 25,000 point waveform memory and high-speed full-range aggregate data averaging, enabling the user to zoom in on any arbitrary position without re-averaging. It features one-touch selection of a variety of functions, including auto-splice measurement, auto attenuation, waveform comparison and file handling.

When used with the company's MN9607A SM/GI converter, the OTDR can be used with various large diameter fibers, including 62.5/125 μm, 80/125 μm and 100/140 μm. Other accessories include a plug-in unit for

BOOKSHELF

The following is a listing of videotapes currently available by mail order through the Society of Cable Television Engineers. The prices listed are for SCTE members only. Non-members must add 20 percent when ordering.

☛ *Broadband Cable System Spare Parts and Documentation Procedures* — Procedures to develop, document and maintain a spare parts program are outlined. Program stresses importance of proper training in a spares program. Suggestions are offered on what the CATV field technicians should carry on the job. Cannibalization of stock items is discussed. Various recommendations of stock levels for trunk-related materials, distribution equipment, passives, trunk cable and feeder are provided. (30 min.) Order #T-1017, $35.

☛ *Broadband Coaxial Cable Basics* — Addresses proper handling techniques for coax. Cable construction is detailed and special features explained. Dielectrics, adhesion and compression are covered. Hazards of improper unloading procedures are outlined. Stacking and storage of reels, wrapping, dealing the rolling edge and benefits of lagging are included. Velocity of propagation, TDR settings and testing problems are highlighted and techniques for moisture protection are covered. (30 min.) Order #T-1018, $35.

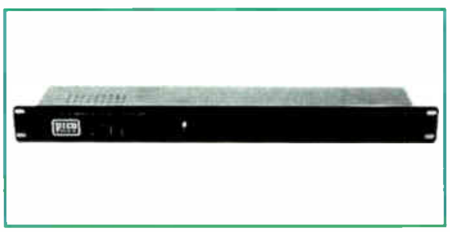
Note: All videotapes listed were produced in 1981, are in color and available in the 1/2-inch VHS format only. Videotapes are available in stock and will be delivered approximately three weeks after receipt of order with full payment.

Shipping: Videotapes are shipped UPS. No post office boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each book or videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: A $15 surcharge will be added on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required, or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 669 Exton Commons, Exton, Pa. 19341; or FAX with credit card information to (215) 363-5898.

---

long-distance and high-speed measurement and a data storage unit for outputting memory results and storing waveforms. The OTDR has GPIB input that conforms to IEEE 488.1 and 488.2 and conforms to MIL specifications MIL-T-28800D, Class 3, Style C.
Reader service #132



UHF/VHF converter

Pico Macom announced its New Look XUV-* converter. The XUV-* crystal-controlled, phase-lock loop converter converts UHF channels to any VHF channel in the low, mid or high bands. It complies with the Federal Communications Commission Docket 21006 frequency offset and frequency stability requirements for CATV systems. The frequency stability is ±5 kHz and the offsets on the aeronautical channels are factory set.

Complete alignment procedures and PLL frequency charts are provided in the manual enabling bench and field frequency agility within the output band of the converter. The converter has 20 dB gain and will accept a 0 dB input level and still perform to optimum picture quality. For additional output, filtering and AGC control, the product can be followed by a strip amplifier.
Reader service #134

Anchors

The Push Anchor fastening system from GH&S Products (of which the Cystic Fibrosis Foundation is involved in as a "for profit" venture and shares equally in the proceeds) is designed for any cable/wire fastening application using 1 to 200 PR cable/wire or multiple bundles of cable or wire. Five shapes are currently available. They are designed for interior and exterior use in concrete/masonry, sheet rock and wood and are installed by drilling a 1/4-inch hole and pushing the appropriate anchor into the hole. No screws or tools are necessary.

The CT-1 Part 10000-I tywrap receiver is for use with standard tywrap to fasten cable bundles. The C-75 Part 75200-I J-hook is for 50 to 200 pair cable. The C-25 Part 02510-I J-hook is for use with 25 pair cable. The CL-40 Part 50150-I loop is used for cable bundles with a maximum diameter of 3/4 inch. The CL-6 Part 50025-I loop is used for cable bundles with a maximum diameter of 1/4 inch. All are polypropylene, clear and for interior use and are available with UV treatment for outdoor use.
Reader service #135

ID bulletin

An updated brochure detailing Tyton's complete line of labeling, identification and bar-code products is available. The 28-page bulletin also describes the company's bar-coding software programs including the new Tag-Maker label printer and also the Tagprint II labeling software and tab tags.

The company's line of wire and cable identification and marking products are covered as well. These include the Shrink-Tag and Flex-Tag markers and the new static-free labels.
Reader service #121

CLASSIFIEDS/BUSINESS DIRECTORY

CABLE/I

COMPUTER UTILITIES OF THE OZARKS, INC.

ANNOUNCES

CABLEWORKS

The only total open system available for in-house, on-line billing. Call today for your demo.

Herb Lair, President
(800) 541–8825

P.O. Box 1062 **Harrison, Arkansas 72601**

Schenck construction

Aerial and Underground Cable Television Construction

Edward A. Schenck, President
Oliver J. Longnecker, Vice President
Imel L. Wheat, Jr., Vice President

Schenck Construction Company, Inc.
15042 N.E. 95th
Redmond, Washington 98052
(206) 867-9694

GREATER VISIONS

"Communication You Can See"

- C.A.D. Drafting Service
- Project Cost Analysis
- Engineering
- Construction

10102 Hwy. 105 W.
Montgomery, TX
77356

David Christy
409-588-2099

519 E. Center
Sikeston, MO
63801

COMMERCIAL ELECTRONICS, INC.
CATV ENGINEERING SERVICES

CATV EQUIPMENT REPAIRS

Hybrid Sales	Meter Calibrations
Equipment Upgrading	Headend Alignment
Performance Measurements	FCC Offsets

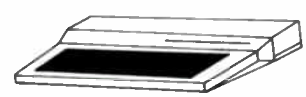
Free Pick-up Service in Certain Geographic Areas
800-247-5883 or in Virginia 800-345-6834
209 E. Jackson St. P.O. Box 484 Gate City, VA. 24251

Equipment Repair

Consistent quality at a better price. Next day emergency service at no extra charge. Call for details.

TRONITEC
Derrick Hanson
800/962-2588

AMS-1 CHARACTER GENERATOR



ATARI Computer and Software only $499.00!

OPTIONAL BATTERY BACKUP!

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

Dickel Communications Co.
517 14th Street / Des Moines, IA 50309

FAX 515-243-2563
Tel. 515-244-1526

NaCom

BUILDING COMMUNICATIONS SYSTEMS THROUGHOUT AMERICA

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

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

CABLE SYSTEM SURVEY CO.

MAPPING ■ DESIGN ■ AS-BUILTS ■ CAD & DRAFTING SERVICES

High Quality - Prompt Service - Reasonable Cost

518 N. Main St. • Tekonsha, Michigan 49092
(517) 767-4185 • FAX: (517) 767-4567

TCS CABLE, INC.

Eastern Region
2674 West Lake Rd.
Palm Harbor, FL 34684
(813) 789-6826
(800) 999-8270
Bobby J. Payne
Scott A. Stevens

Western Region
3220 West 71st Avenue
Westminster, CO 80030
(303) 430-1535

All PHASES AERIAL AND UNDERGROUND CONSTRUCTION
REBUILD • RESPLICE • FIBER • COAXIAL • ASBUILTS
CONTACT US FOR GUARANTEED PRICES AND COMPLETION DATES
Since 1976 — Over 12,000 Miles Of Completed Plant

E-CABLE, INC.

A Full Service Organization

*Aerial/Underground Construction
*Prewire/Postwire *Installations
*Drop/Converter Changeouts *LANS
*Audits *Rebuilds *SMATV

Quality Service to the Cable Industry

P.O. Box 533826 Orlando, Florida 32853
(407) 898-2387

SAVE YOUR MONEY.

Lower your costs for programming, equipment, and service through group purchasing. Join today.

NATIONAL CABLE TELEVISION COOPERATIVE, INC.

14809 West 95th St. Lenexa, KS 66215 913-599-5900

AERIAL
NEW BUILDS
EXTENSIONS
SPLICING
ACTIVATION

UNDERGROUND
REBUILDS
TRAP & AUDITS
INSTALLS
STORM DAMAGE

State Wide CABLE *Contractors, Inc.*

WALKERVILLE, MICHIGAN 49459

OFFICE (616) 873-4744
FAX (616) 873-0202

Robert Zack
William Zack

Baker Scott & Co. 1259 ROUTE 46
PARSIPPANY, NJ 07054

THE PROFESSIONAL CABLE PLACEMENT COMPANY

DAVID ALLEN , JUDY BOUER-PRINCIPALS

201-263-3355 FAX-201-263-9255

Our NATIONAL and INTERNATIONAL clients include MSO's, Networks, Regional and Independent Operators. We place ALL LEVELS OF MANAGEMENT. Fees paid.

New Construction • Installs • Balancing • Splicing

Bigham

Cable Construction, Inc.

Performance Built Our Company

Specializing In Rebuilds

Harold Bigham
(904) 932-6869

P.O. 903
Gulf Breeze, FL 32562

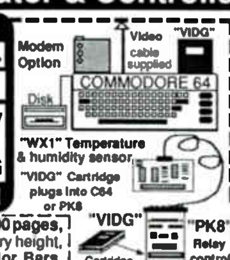
California Amplifier

U.S. manufacturer of; C-Band and Ku-Band LNBs, Feedhorns and accessories; Wireless Cable (MMDS) products including LNAs, downconverters and the Beambender™, a low cost microwave repeater; and special application products including ARABSAT LNBs and Commercial IF Amplifiers.

Contact: Dennis Schwab
California Amplifier, Inc.
460 Calle San Pablo, Camarillo, CA 93012 U.S.A,.
TEL: (805) 987-9000 FAX: (805) 987-8359

Video Page Generator & Controller $189.95

High Res NTSC or PAL
2- 240 char. crawls/ pg.
Flash, Scroll, 3 Sizes!
16 Colors, User friendly
Auto-sequence pages
Cut & Paste, WYSIWYG
12:24:30 THURSDAY 3 : 21 : 91



Color Bars
Special Effects
Special Effects
Special Effects
Weather Monitor
Temperature 20 deg C
Rel Humidity 72 %

C64 + VIDG Displays & sequences 1000 pages, Hi Res. 16 colors , scroll, flash, crawl, vary height, 24Hr. clock+ date, C64 Graphics, Color Bars, crawls! Transfer pages via modem auto-sequence at remote location. "WX1" displays temperature & humidity, "PK8" controls 8 relays. Time & date calendar: auto-loads new sequences & pages + controls relays via touchtone audio strings!

"VIDG" Inc. Cart, disk, manual, cable........$189.95
C64 Computer $159.95, 1541disk drive.....$189.95
PK8 relay control & meter input $159.95
WX1 temp. & humidity sensor (req. PK8)..$189.95
C64 Hayes modem $ 89.95;12Volt C64 Pwr. Sup.$129.95

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

Low cost remote control & video display
** Ask for free catalog **
Mastercard Visa Amex COD & P.O.

QCI Installations, Audits
CLI Drop Replacements
Pre/Post Wire MDU

Quality Cable Installation
P.O. Box 964, Eau Claire, WI 54702-0964 (715) 726-9118

Kennedy Cable
Est. 1972
For Aerial and Underground Construction Services
"Fiber Optic Specialist"
Kennedy Cable Construction, Inc. (P.O. Box 760) 30453, (912) 557-4751
Reidsville, Georgia WATTS 1-800-673-7322

CATV DESIGN ASSOCIATES, INC.

- Design
- Strand Mapping
- As-Built Mapping
- System Analysis
- AutoCad Drafting
- LinexCad Drafting
- Cad Training/Setup
- Drafting Services

5524 Bee Caves Rd., Suite C1 • Austin, Texas 78746
STEVE WILLIAMS, President (512) 328-2461 DOUG BURNS, Vice President

---

- 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

Service WITH SOLUTIONS

Hands-On Fiber Optic Training Courses

- Prepare for B/CTE certification
- Earn B/CTE recertification units
- Instructors are experienced engineers
- Atlantic Cable Show Booth#1001; Western Show Booth#146

(800) SIECOR 4 Ext. 5542
FAX: (704) 327-5533
SIECOR

CCC
Phone (708) 991-8488
Fax: (708) 991-8586

CARRETERA CONSTRUCTION CO., INC.
Specializing in underground communications, CATV, and fiber optics installation.

632 West Colfax Street
Palatine, Illinois 60067-2341
Jim Lapetina
President

Equipment Repair

MAIN LINE EQUIPMENT, INC.
National Distributor for
PATHMAKER — TEXSCAN
WE BUY: Used Converters
Used line gear
WE SELL: Refurbished Converters
Line Gear
WE REPAIR: Converters & Line Gear
Distributor of Eagle Traps
1-800-444-2288
FAX: 213-715-6695
Los Angeles • Atlanta • Spokane

Cable TV Services

- Complete Repair Facility
- Videocipher
- Headend
- Test Equipment
- Line Equipment

16 YEARS OF QUALITY SERVICE
"always, always put quality first"
4230 Rosehill Suite L-5 • Garland, TX 75043
(214) 240-5452 • 800-749-5452

Professional Services

SubTRACKER
CATV BILLING SYSTEM

Statements, Database, Reports, IBM Compatible, Low Cost, Fast. Ideal for small to medium systems.
LAN and Multi Town Capability.
Canergy Cable Software
403-354-2510 or Fax 403-354-8780

Help Wanted

National contractor looking for experienced cable TV installers on the East Coast. Must have late model truck and tools.

Call 301-426-4780.

Chief Technician

Chief Technician needed for large 450MHZ, addressable cable system in the suburbs of Minneapolis, St. Paul area. Applicants must have 3-5 years experience in a CATV technical position. A thorough knowledge of system sweep, signal leakage, preventive maintenance and outage control is a must. Strong supervisory ability is a plus. Send resume and salary history in confidence to:

Cable TV North Central
934 Woodhill Dr., Roseville, MN. 55113
Attn: Engineering Department.

Leader in the placement of Cable Television Professionals
Call Toll Free 800-433-2160: In Texas call 817-599-7623: FAX 817-599-4483

DIR ENG, E, 60K	STAFF ENG, E, 50K	SWEEP TECH, MULTI LSTGS
CIRCUIT DESIGN, SE, 45K	CHIEF TCH, S, 30K	LN TCH, W, 12/HR
TCH MGR, E, 45K	MAINT MGR, W, 15/HR	LN TCH, TX, 10/HR
TCH MGR,SE, 40K	CH TCH, W, 37K	HDEND TCH, SE, 30K
HEADEND ENG, E, 40K	MGR/TCH, TN, 26K	SVC TCH, MULTI LTGS
PL MGR, SE, 45K	SYS ENG, SE, 30K	SW TCH, NE, 12/HR
TCH TRNR, E, 35K	CH TCH, S, 26K	HDEND/MICRO,W, 15/HR
CHIEF TCH, SE, 30K	MGR/TCH, S, 26K	LN TCH, TX, 11/HR
SVC MGR, E, 35K	MGR/CH TCH, E, 28K	SW TCH, SW, 13/HR
SVC MGR,MW, 30K	CH TCH, E, 35K	SVC TECH, S, 9/HR

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

Equipment For Sale

Great Lakes Cable TV Services, Inc.
We Buy & Sell
Quality used & Surplus Line AMPS & Headend Equipment
Great Prices!
24030 Roosevelt Road, South Bend, IN 46614
TOLL FREE 1-800-383-8046, 219-234-8662, FAX 219-232-1562

Postition Wanted

Tech Manager/Field Engineer seeks position in North East. Fifteen years of well rounded experience. For resume and references call Jim Romanelli

1-508-664-0290.

TM BROKERS

WANTED: *CONNECTORS, LINEGEAR, TAPS*
FOR SALE: *CONNECTORS, LINEGEAR, TAPS*
NEW DC 8 & SPLITTERS
SPECIAL:
- *MODULATORS ....$125. & UP*
- *STRIP AMPS .... $50 & UP*
- *PROCESSORS .... $50. & UP*
- *BAND PASS FILTERS . $35. & UP*

NEW 2 & 4 PORT TAPS = $5 ea
8 PORT TAPS = $11 ea

PHONE/FAX (208) 687 • 2289
Any Quantity O.K. • Financing Available–OAC

CATV DATA LINK
(619) 757-3008
FAX: 757-4048

We Buy and Sell Converters, Line Actives and Passives 300 Mhz and Above- Magnavox, Jerrold, S/A, Pathmaker.

ANTHONY'S
MANUFACTURING SERVICE

PLOW BLADES
Irrigation/Wire/Combination
For Any Machine-For Any Application
(800) 383-PLOW
(719) 475-PLOW (7569)
P.O. Box 17701
Colorado Springs, CO 80935

— Fees Paid —
Call or Write
WICK KIRBY
(708) 369-2620
P.O. Box 2347
Naperville, IL 60567
FAX: 708-369-0126

CABLE SEARCH ASSOCIATES
Professional Search and Placement

LIQUIDATION SALE
Oak M35B Offline $5.00
Reconditioned $10.00
Hamlin MCC 3000 as is 50¢ each
Reconditioned $10.00
WANTED
Jerrold DRX-3-DIC
Oak N12 ch 2 0r 3
SA 8550 & 8580
Zenith Encoders
Pioneer Encoders
CABLE EQUIPMENT BROKERAGE CO.
818-709-3724
FAX 818-709-7565

COAST CATV SUPPLY

WANTED
USED & EXCESS

IN STOCK
SA, Jerrold, Magnavox, PathMaker
300,330,400 MHZ
Call Nick Meko
714-272-6822 Fax 714-272-3032

Test Equipment

Wavetek, HP, Tektronix and more. Sweep systems, Spectrum Analyzers, Meters, etc. Guaranteed to meet or exceed factory calibration/specs. 90 day warranty standard. Special-Wavetek 1855b/1865b sweep system $4995.00. SAM Jr.'s $425.00. ***WE BUY AND SELL***

PTL Cable Service 1-407-747-3647

---

25 Cents per db! Why pay more for isolation? Our CO-AX RELAYS kill crosstalk dead! SWITCH WITH THE SWITCHES THAT SWITCH-SWITCH-SWITCH. Matrixes & relays. Alaun Eng. PH/FAX 818-957-0618.

Will pay cash for any brand of used CARS BAND (12.7-13.2) radios, power supplies, dishes and waveguide hardware.

MICRO SUPPLY

915-685-3000

WANTED
YOUR SURPLUS LINEGEAR/ CONVERTERS

CALL TINA

(614) 222-0581

CABLE LINK, INC

LEE DENIM JEANS

Dress your technicians for success. Buy at $19.00 or lease at 50 cents per week.

MAGSON UNIFORM

279 New Britian Road
Kensington, CT 06037
1-800-877-4422

Emergency Alert Systems BY

IdEA/ONICS

69 Channels
14 day delivery
Compatible with all headends

Affordable

24 & 88 Channel units also available
(701) 786-3904
Fax: (701) 786-4294

AERIAL BUCKET TRUCKS

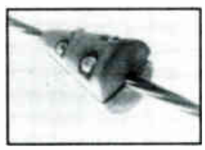
Large selection geared for CATV

STANDARD TRUCK & EQUIPMENT CO.

1155 Hill St. S.E.
Atlanta GA 30315
Phone: 1-800-241-9357

BUCKET TRUCKS

ICE KRACKERS, INC.



Inexpensive permanent protection of guy wire anchor hardware from guy wire ice slides. Average cost $400. for 400-foot tower. ICE KRACKERS sized by guy wire diameter. All sizes available.

U.S. PATENT #4435931.
273 Circle Drive, Springfield, IL 62703
(800) 747-8921 or at WSSU-FM
(21 7) 786-651 6.

LOWEST PRICED

FIBER OPTIC METERS & RF SLMs

SADEL R & D CO.
805-682-3341 Copyright © 1991

Training

On-Site
Cable Television
Training and Consulting

Nationally recognized for CATV training, Wadena Technical College will work with you to develop a training program to suit your specific needs. A one day seminar to a complete one week course can be customized and delivered on-site for your company. Training topics: Headend Concepts • Coaxial Cable Basics • Introduction to CATV • CATV Amplifiers • CATV Fundamentals • Fiber Optics

WTC offers quality training at competitive prices. Call Doug Stromberg, Technical Coordinator, for a free quote.

WADENA TECHNICAL COLLEGE

405 S.W. Colfax • P.O. Box 566
Wadena, MN 56482
(218) 631-3530, ext. 259

CALL US FIRST!

dB-tronics®

For Your Equipment Needs

- **AFFORDABLE, QUALITY REPAIRS:** Converters, Line Equipment, Headend Equipment and F.S. Meters. (Six month warranty on ALL repairs.)
- **WE BUY & SELL EQUIPMENT**

SPECIALS:

SA 8500 - 311 w/remote ..... $32.95 ea.
New Remotes SA, Jerrold ... $4.75 ea.
SA 372397 FF Trunk .... $362.00 ea.
SA 344030 PP Trunk .... $95.00 ea.
SA 344000 PP Bridger ...... $161.00 ea.

Hurry, Limited Quantity Available

FOR OTHER SPECIALS CALL:

SALES
Phone: 1-404-992-6730 • FAX: 1-404-992-6816

CUSTOMER SERVICE
Phone: 1-800-356-2730 • FAX: 1-803-439-7518

get converted!

ADDRESSABLE CONVERTERS FROM $11.95

IN STOCK

FULLY REMANUFACTURED – 90 DAY WARRANTY

List your equipment for sale with us — computerized Inventory Locater system —

CONTEC
INTERNATIONAL

NEW YORK:	FLORIDA:	MICHIGAN:
800-382-2723	800-750-2288	800-584-8007

October

3: SCTE Greater Chicago Chapter golf outing (tentative). Contact Bill Whicher, (708) 438-4423.

3-4: Telecommunications Reports Telco-Cable III Conference, Washington, D.C. Contact Kathy Lentz, (202) 842-3022.

4: The Light Brigade pacific northwest product fair, Bellvue Holiday Inn, Renton, Wash. Contact (206) 277-1240.

8: SCTE Chattahoochee Chapter seminar, HDTV/ATV, Perimeter North Inn, Atlanta. Contact Hugh McCarley, (404) 843-5517.

8-9: SCTE Desert Chapter installer certification testing (western region, Oct. 8 and eastern region, Oct. 9). Contact Chris Middleton, (619) 340-1312, x258.

8-10: Mid-America Show, Kansas City, Mo. Contact (913) 841-9241.

8-10: Magnavox mobile training seminar, CATV basic theory, practical applications and hands-on training, Boston. Contact (800) 448-5171.

9: SCTE Delaware Valley Chapter seminar, fiber theory and maintenance, Williamson's Restaurant, Willow Grove, Pa. Contact Rich Blandford, (215) 328-0977.

9-10: NCTI seminar, OSHA compliance for CATV operators, Miami. Contact Michael Wais, (303) 761-8554.

12: SCTE Cascade Range Chapter BCT/E exams in Categories I, II and VI. Contact Jim Warhurst, (503) 243-7489.

14: SCTE Satellite Tele-Seminar Program, fiber testing. To air 1 to 2 p.m. ET on Transponder 6 of Galaxy 1. Contact (215) 363-6888.

15: SCTE Greater Chicago Chapter BCT/E exams. Contact Bill Whicher, (708) 438-4423.

15-17: Magnavox mobile training seminar, CATV basic theory, practical applications and hands-on training, Boston. Contact (800) 448-5171.

15-17: International PCS Symposium, Sheraton Hotel and Conference Center, Denver. Contact (303) 843-0956.

16: SCTE Golden Gate Chapter seminar, BCT/E Category I. Contact Mark Harrigan, (415) 785-6077.

16: SCTE Great Plains Chapter BCT/E exams in Categories II, III, IV and V. Contact Jennifer Hays, (402) 333-6484.

16: SCTE Palmetto Chapter seminar, troubleshooting the drop, University of South Carolina, Columbia. Contact Melanie Burbank-Shofner, (803) 777-0281.

16: SCTE Tennessee Chapter seminar, Memphis, Tenn. Contact Don Shackleford, (901) 365-1770.

16: Fotec fiber seminar, Boston. Contact (800) 537-8254.

21-25: Optical Networks International fiber training course, Denver. Contact Rand Reynard, (800) FIBER-ME.

22: SCTE Chaparral Chapter seminar in conjunction with New Mexico Cable TV Association Show, Las Cruces, N.M. Contact Joe Roney, (505) 761-6224.

22-24: Magnavox mobile training seminar, CATV basic theory, practical applications and hands-on training, Boston. Contact (800) 448-5171.

22-24: C-COR seminar, basic theory, installation and maintenance of CATV systems, San Antonio, Texas. Contact Kelly Jo Kerstetter, (800) 233-2267.

22-25: Siecor seminar, fiber installation, splicing, maintenance and restoration for CATV applications, Keller, Texas. Contact Lynn Earle, (704) 327-5539.

23: SCTE Iowa Heartland Chapter seminar, system and headend maintenance, Amana, Iowa. Contact Mitch Carlson, (309) 797-9473.

23: SCTE Sierra Chapter seminar, installer certification program, Community Center, Roseville, Calif. Contact Eric Brownell, (916) 372-2221.

23: SCTE San Diego Meeting Group seminar, power supplies and system powering, Elks Lodge, Oceanside, Calif. Contact Frank Gates, (714) 492-4606.

29-31: Magnavox mobile training seminar, CATV basic theory, practical applications and hands-on training, Bangor, Maine. Contact (800) 448-5171.

30: National Cable Television Center and Museum lecture on cable technology, live broadcast via satellite (co-sponsored by SCTE). To air from 11 a.m. to 12 p.m. ET on Transponder 6 of Galaxy 1. Contact (215) 363-6888.

30: SCTE New Jersey Chapter seminar, future of cable, DBS and cable, PCNs, interdiction and digital technology. Contact Jim Miller, (201) 446-3612.

Planning ahead

Nov. 20-21: Western Show, Anaheim, Calif. Contact (415) 428-2225.

Jan. 8-9: SCTE Fiber Optics Plus '92, San Diego. Contact (215) 363-6888.

Feb. 26-28: Texas Show, San Antonio. Contact (512) 474-2082.

May 3-6: National Show, Dallas. Contact (202) 775-3550.

June 14-17: Cable-Tec Expo, San Antonio, Texas. Contact (215) 363-6888.

coming attractions

FIBER OPTICS PLUS '92

January 8-9, 1992
San Diego, California

SCTE Member Registration—$195

Room Rate: $130 (single or double)

LOEWS CORONADO BAY RESORT

CABLE-TEC EXPO '92

June 14-17, 1992 San Antonio, Texas

EXPO '92 REGISTRATION FEES
(UNCHANGED SINCE 1986)
Until May 8, 1992

	Member	Non-Member
Engineering Conference and Expo	$195	$350
EXPO only	$145	$250
Engineering Conference only	$120	$200
Spouse Registration	$95	$95

For further information, contact SCTE at (215) 363-6888.

Planning for 1992 events

By Wendell Woody
President, Society of Cable Television Engineers

The Society of Cable Television Engineers' national board of directors has approved two major SCTE national events for 1992. The events are the fiber-optic seminar in January, and the Cable-Tec Expo and Engineering Conference in late spring. Our SCTE national staff dedicates a great deal of planning and work toward both events to ensure their success. Every year each event is acknowledged to be bigger and better than the previous year. What supports this spiralling growth and enthusiastic success? It's a growing membership dedicated to the Society and a Society that is dedicated to its members' needs.

The old days — 1988

The annual SCTE fiber-optic seminar continues to have excellent acceptance and attendance. This series of seminars started in 1988 in Orlando, Fla. It was planned for an attendance of 150 but 250 people pre-registered and a total of 412 came to the seminar. This was one of the first CATV industry current technological meetings on fiber optics. Those times are now referred to as "back in the old days when fiber began," and that was only 1988.

HDTV bombed

Since we had completed one fiber-optic seminar, the Society chose high definition TV (HDTV) as the new leading edge technology for its 1989 technology seminar. It failed the proof of performance test. The pre-registered attendance was almost nil, and the program participants cancelled their services. The HDTV seminar was cancelled. What made the fiber-optic seminar so "magically" successful? Fiber optics is not magic. It is merely a technology that can serve an engineering need — today.

Wear out fiber optics?

For 1990, the board of directors voted the SCTE technology seminar would be titled, "Fiber Optics 1990." It was held in March in Monterey, Calif. Registered attendance was logged at 500. A proceedings manual was published containing all technical papers presented at the seminar. The sponsorship of the manual publication came from Comm/Scope of Hickory, N.C., and CT Publications of Denver. This established a "first" for SCTE to generate a proceedings manual for all future technology seminars and the annual expo workshops.

Can you wear out the subject of fiber optics? No, not when the technology advances at such a rate that the next year's seminar covers almost all new materials. Therefore, the 1991 SCTE technology seminar was titled, "Fiber Optics 1991." It was held at the Hyatt Regency Grand Cypress in Orlando. The registered attendance was near 600. The "snowbirds" (both Canadian and U.S.) loved the sun-scorching coffee breaks.

Fiber Optics Plus '92

The CATV industry is currently into a technological explosion. It is exploring digital transmissions for voice, data and video; video compression; personal communications services via PCNs; interdiction; HDTV; and the continued advancements in fiber-optic technology. The 1992 SCTE technology seminar will be titled, "Fiber Optics Plus '92." With reference to the technological explosion, the Society added the word "plus" to this year's title to give the seminar planning subcommittee the direction and power to include these other technologies in the program. It is acknowledged that fiber optics provides the transportation for these other new technologies.

The seminar will be held Jan. 8 and 9, 1992, in San Diego, at the Loews Coronado Bay Resort Hotel (a new hotel just completed). It is located on Coronado Island.

The program subcommittee is chaired by Alex Best with other members being Jim Chiddix, David Robinson, Ed Callahan, David Fellows, David Willis and Bill Riker. They are implementing a dynamic program with widespread industry appeal. Plan now to attend. Once again attendance from Canada as well as from England, Europe and other international markets is projected to be good. Budget this SCTE event as an annual seminar. In 1993 it will be held at the New Orleans Hilton Riverside and Towers Hotel.

Cable-Tec Expo '92

This SCTE Cable-Tec Expo and Engineering Conference will be held June 14-17, 1992, in San Antonio, Texas. All SCTE meetings and functions will take place at the San Antonio Convention Center. Hotels near the center are the Hilton Palacio Del Rio, Hyatt, two Marriotts, La Quinta, Plaza San Antonio and the Menger Hotel. The '92 Expo Program Subcommittee is co-chaired by Dan Pike and Bill Riker. The other members are M.J. Jackson, Rick Clevenger, Paul Levine, Bill Arnold, Roger Brown and Leslie Read. It may seem you've just returned from the '91 expo; however, this program planning group is busy working on the 1992 program.

Meeting the members

A strong core of officers from the Great Plains SCTE Chapter was responsible for all the technical sessions at the recent Nebraska state cable show in Scottsbluff. They were: Herb Dougall, Randy Parker, Chuck Thirlwall, John Page and Bill Rogers. A big thanks goes to J.D. Fallbeck for his present support and future plans for western Nebraska.

The Gateway and Heart of America SCTE chapters jointly commanded the technical sessions at the recent Missouri cable TV show in Lake Ozarks. SCTE speakers were: Steve Dyche, Terry Cordova, Richard Beard, Mike Dorman, Ron Gibson, Larry Lehman and Pierre Cubbage. Additional speakers were: Don Gall, Ken Covey, Larry Douglas, Don Henry, Bill George and Tom Gillett. **CT**

Cheetah™ Saves!

Every time you use it, you save...

TIME

Cheetah™ allows the operator to analyze system performance in seconds without ever leaving the office. With AUTO READ and AUTO ALARM the Cheetah™ System can provide unattended performance monitoring 24 hours a day.

MONEY

Cheetah™ will reduce unnecessary truck rolls, target problems and independently evaluate the performance of your equipment. Utilize Cheetah™ to cut today's expenses and manage your budget effectively for tomorrow's growth.

INFORMATION

Cheetah™ measurements are repeatable, accurate, consistent and will become the standard of your operation. Past and present data gathered from remotely accessed units is stored for printing and review. This information allows Cheetah™ to project tomorrow's developing trends today.

SUBSCRIBERS

Cheetah™ improves your Service Standards. Your subscribers will enjoy a higher level of quality with less down time. No longer will the subscriber be your status monitoring system. Cheetah™ saves subscribers.

Contact Superior Electronics Or Your Regional Representative Today!

BEYOND STATUS MONITORING™

WE MEASURE THE BEST!™

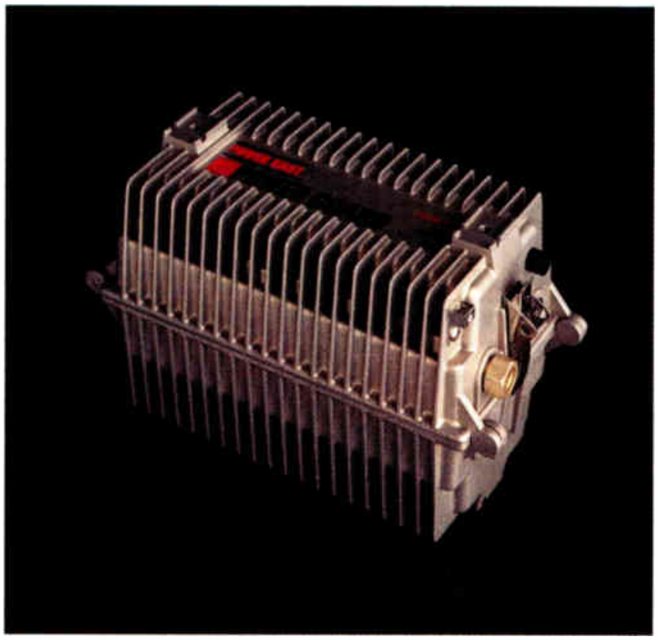
Cheetah™

SUPERIOR ELECTRONICS GROUP, INC.
2237 Industrial Boulevard, Sarasota, Florida 34234
Telephone (813) 351-6700 • Fax (813) 351-9193

See us at the Atlantic City Show, Booth 704.
Reader Service Number 57

Anixter introduces Power Cast™...

Are you designing optical networks or off-premise systems for the future?



Specify the power supply engineered for the technology demands of tomorrow.

Fiber optic systems and off-premises addressability demand a reliable, versatile power supply designed for the special applications of these systems. Power Cast is built for cool, quiet and efficient operation, with models which operate at 3, 6, 9, 12 or 15 amps.

Power Cast can be mounted virtually anywhere — on a pole, in a pedestal or on the strand. This lightweight power supply provides all the features you need along with incredible durability and performance. Backed by a five-year warranty, Power Cast is the power supply you can install today and continue using through tomorrow.

ANIXTER® CABLE TV + POWER GUARD

WEST-ANAHEIM: (714) 779-0500, (800) 854-0443; **DENVER:** (303) 740-8949, (800) 841-1531; **SEATTLE:** (206) 251-6760, (800) 426-7665; **MIDWEST-CHICAGO:** (708) 350-7788, (800) 544-5368; **CLEVELAND:** (216) 526-0919, (800) 321-8068; **DALLAS:** (214) 446-CATV, (800) 231-5006; **IRON MOUNTAIN, MI:** (906) 774-4111, (800) 624-8358; **SKOKIE, IL HDQTRS:** (708) 677-2600; **EAST-ATLANTA:** (404) 840-7901, (800) 242-1181; **NEW JERSEY:** (201) 328-0980, (800) 631-9603; **CANADA-CALGARY:** (403) 250-9646; **MONTREAL:** (514) 636-3636; **TORONTO:** (416) 568-8999; **VANCOUVER:** (604) 321-5885; **INTERNATIONAL-LONDON:** 011-44-81-848-9894.

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

See us at the Atlantic City Show, Booth 541. See us at the Mid-America Show. Reader Service Number 58