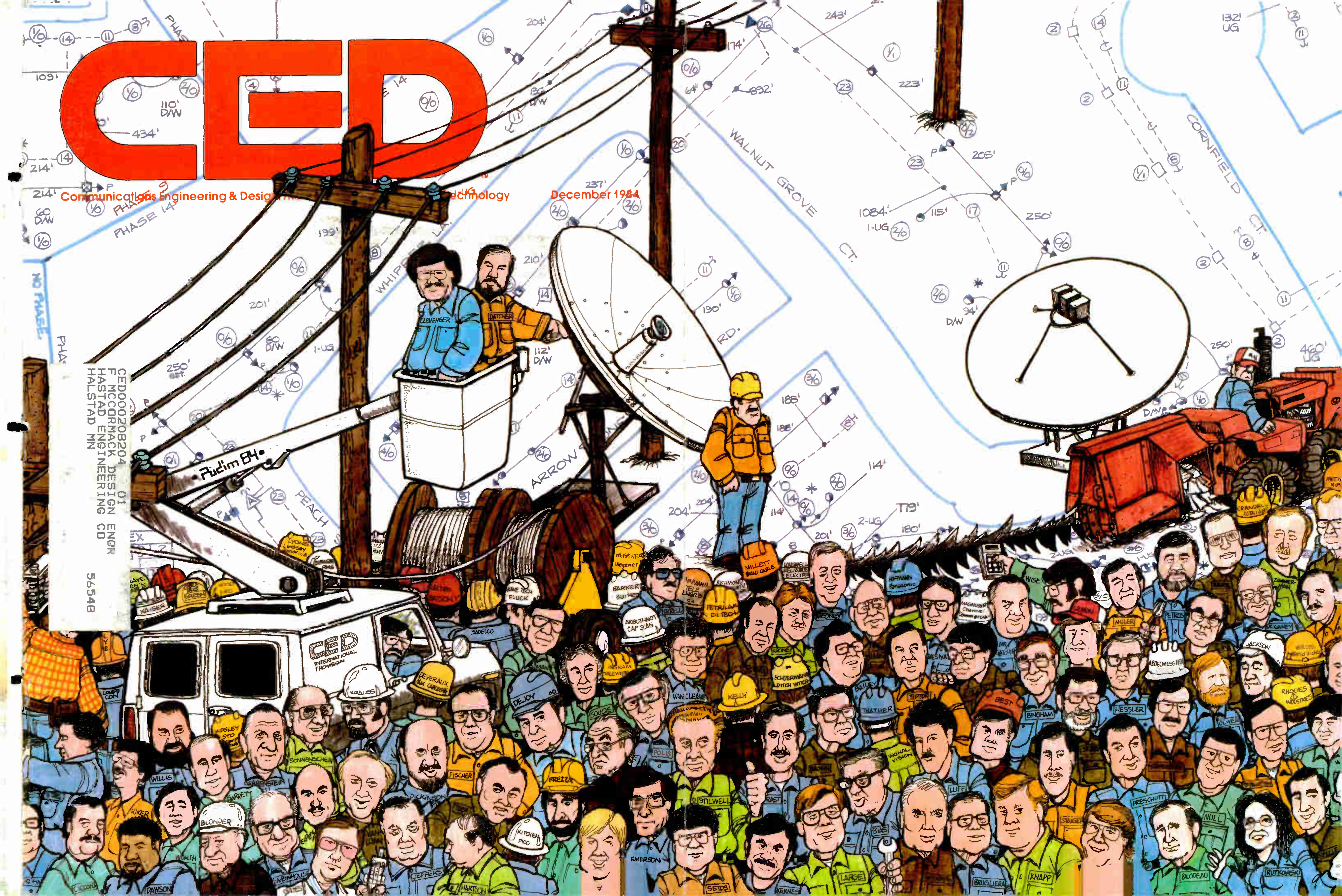
CED

Communications Engineering & Desig

echnology

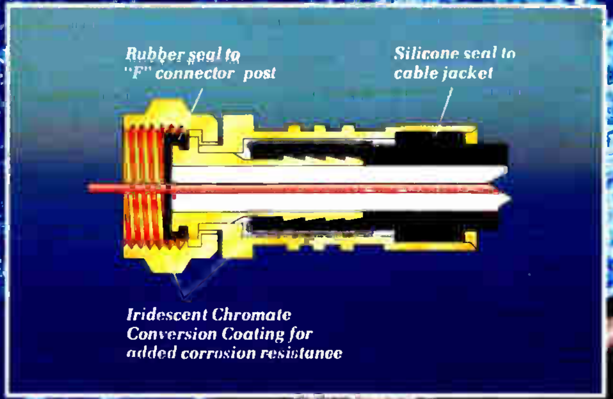
December 1984



LRC Connectors keep working in all weather…
So you won't have to.

LRC Electronics introduces the DUAL SEAL "F" CONNECTOR, a premium style "F" fitting. These connectors seal to both the female post by tightening, and to the cable jacket by crimping. With the use of both rubber and silicone seals at the front and back of the connector, moisture is prevented from migrating down the braid of the cable. Keeping moisture out insures longer life to subscriber drops.

These connectors require standard cable preparation and are available in all RG59U and RG6U cable sizes. Consult LRC for specific recommendations.



AUGAT® LRC

Quality and Innovation

LRC Electronics, Inc. 901 South Avenue Box 111, Horseheads, NY 14845 (607) 739-3844

Reader Service Number 1

Mr. customer we hear you.

Our friends told us "Sure Vitek makes the best traps. But even you aren't perfect." So we listened.

And we built a better trap.

Introducing Thermalok®

Thermalok is the new Vitek Trap that incorporates the most advanced technology in the world. It addresses the two major concerns of our customers… frequency drift and weathering.

We solved the first concern… *frequency drift with temperature variation*…by introducing Thermalok® with its unique dielectric assuring that the signal remains trapped regardless of temperature extremes (from 0°F to 100°F).

We solved the second concern …*deterioration by weathering* …with our truly revolutionary "Molded Strain Relief Connector." The weakest link in the installation "chain" was the juncture of trap and strand. From its first day aloft, this joint began to deteriorate from the inevitable motion of the winds.

Reader Service Number 2

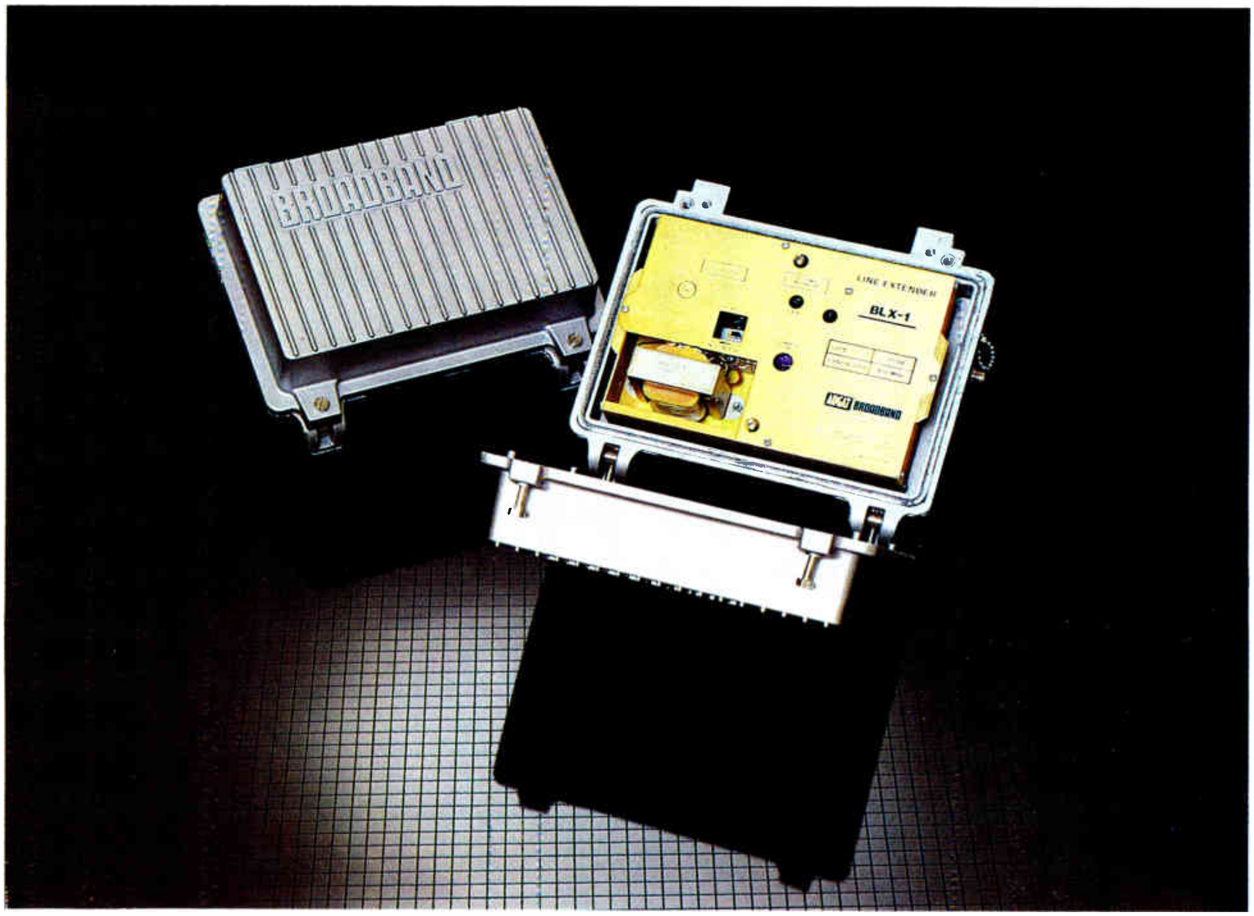
AUGAT® VITEK

Quality and Innovation

The "Molded Strain Relief" Device, applied over the back end of the Connector, now adds sufficient mechanical strength to greatly lengthen the effective life of the trap. It also provides a highly improved seal against ingress by water, humidity or salt spray.

Incidentally, the Molded Strain Relief comes in a variety of highly visible colors, so it provides added service as a color indentification tool in auditing.

Find out why it pays to add some life to your security system. Get more information on Thermalok.® Write or Call Augat/Vitek Inc., 901 South Ave., P.O. Box 111, Horseheads, N.Y. 14845, (607) 796-2611/2.



Looking for a custom-made line extender at an off-the-shelf price?

Broadband's new BLX Series line extenders come with so many options, you can end up with a unit that's virtually customized to your specs.

The BLX units use standard hybrids and are available in 330 and 450 MHz bandwidths, with gains ranging from 26 to 50 dB.

The BLX-PLUS models are equipped with Amperex power-doubler hybrids for lower distortion specs and increased output capability. They also are available in 330 and 450 MHz bandwidths, with gains of 30 & 35 dB (330 MHz version) and 28 & 33 dB (450 MHz version).

Both versions are available with one- or two-way transmission and with aerial or pedestal mounts. Cable powering is available for 30 or 60 volt systems.

For ease in installation and maintenance the amplifier module may be installed with the input on either the right or left of the housing. And the connector chassis may be replaced without removing the coaxial cable connectors in the housing.

Clean design, quality components and thorough testing combine to deliver solid, trouble-free operation for the long haul. High performance, flexibility and reliability — all Broadband hallmarks — are built into every unit.

For additional information on specifications or pricing, call us toll-free at 800-327-6690, or write Broadband Engineering, 1311 Commerce Lane, Jupiter, Florida 33458-5636.

Features:

- 330 & 450 MHz bandwidths
- 26-50 dB gains — you specify. (28 to 35 dB gains for BLX-PLUS.)
- One- or two-way transmission.
- Standard hybrid circuitry (BLX) or Amperex power-doubler hybrids (BLX-PLUS).
- Convertible 30/60 volt cable powering.
- Aerial or pedestal mounting.
- Amp module can be installed with input on right or left of housing.
- System upgradable for different gains.
- Plug-in hybrids for ease of maintenance.
- Plug-in equalizers.
- Plug-in thermal network for temperature compensation.
- Optional plug-in gas discharge tubes for surge protection.
- Connector chassis replaceable without removing coaxial cable connectors in housing.
- 30 dB test points eliminate need for probes.
- Compact, durable die-cast aluminum housing.

See us at the Western Show
Booth No. 505

AUGAT® BROADBAND
Quality and Innovation

Reader Service Number 3

CED™

December 1984

SPOTLIGHT 8

CED editorial board forms

Chaired by NCTA's Vice President of Science and Technology Wendell H. Bailey, the board includes Ron Cotten, Bob Dattner, John Dawson, Roy Ehman, Mark Elden, Steve Raimondi, Sruki Switzer, Joe Van Loan and Nick Worth.

COMMUNICATION NEWS 18

FCC closes controversial Docket No. 21006

Technical opinion is divided on the merits of final rules governing cable use of the aeronautical bands. Frequency offsets and threshold power rules are relaxed, but monitoring rules are tougher. A mandatory channelization plan is required. A challenge is expected. Meanwhile, Jerrold's Krisberg warns industry that programming window is shutting; PPV a possible solution. And SCTE plans a January multichannel sound seminar.

FEATURE 25

Signaling and control protocols set

The nagging problem of irregular cue tones prompts NCTA signaling and control subcommittee to recommend standard signaling practices. HBO's Scott Tipton reports the group's findings and urges better ad network signaling.

FEATURE 26

Low power, high risk

Even though LPTV stations are secondary services, it's the cable operator's responsibility to prove an LPTV station will interfere with its long distance signal reception. NCTA's Katherine Rutkowski advises operators to petition the FCC before the LPTV license is granted and offers some tips on where and how to find LPTV applicants.

FEATURE 32

The history of RF converters

Scientific-Atlanta's James Farmer chronicles the evolution of RF converters, emphasizing technical innovations and outlining new challenges.

FEATURE 56

NCTA/ARRL progress report

The traditional animosity between HAMs and cable operators is dying, thanks to the joint NCTA/ARRL committee. The group developed a new signal leakage calibrating device and cleaned-up a "leaky" system. But there's more to be done.

FEATURE 58

Stereo must-carry battle nears end

All baseband converters, headend processors and sync suppression descramblers will have to be replaced or modified if the FCC votes for must-carry stereo sound. The decision also will influence the commission's views on must-carry teletext.

TECH II 65

Trunk amplifiers evolve

Increased channel capacity and amplifier reach spurred the development of amplifier technology, from single-ended, vacuum tube devices to feedforward and power doubling.

FEATURE 68

European amp finds home in U.S.

Broadband Engineering develops "special" amp for European client and finds it can solve some U.S. underground construction, maintenance and installation headaches.

PRODUCT PROFILES 72,75

Trunk amplifiers and cable

This month, *CED* highlights manufacturers' "top-of-the-line" trunk amplifiers and cable—trunk, distribution and drop—in two separate charts.

About the Cover

This month, *CED* inaugurates a new tradition; special covers featuring the industry's top engineers. Look for them once or, perhaps, twice a year.

DEPARTMENTS

Seminars 12
In Perspective 17
Classifieds 78
Ad Index 83

©1984 by International Thomson Communications Inc. All rights reserved. CED. (USPS 300-510) (ISSN 0191-5428) is published monthly by International Thomson Communications Inc., 600 Grant St., Denver, CO 80203. December 1984, Volume 10, Number 12. Subscription Price: 1 year, $26.00: 2 years, $43.00: 3 years, $63.00. OUTSIDE USA 1 yr. $64.00; 2 yrs. $89.00; MUST BE PREPAID IN US FUNDS ONLY! Second-class postage paid at Denver, CO. *CED* is published on behalf of all parties, including the Society of Cable Television Engineers (SCTE). POSTMASTER: Please send address changes to P.O. Box 5208 T.A., Denver, Colorado 80217. MEMBERS OF THE BPA.

BPA

Growing bigger shouldn't make your signal grow weaker.

Upgrading seems to be the name of the game these days. But upgrading and expanding your system shouldn't mean loss of signal or extended down time, or expensive outlays of capital, either.

The answer to all of the above problems lies in Standard's unique *loop-through* feature.

Instead of replacing your present 4-way splitter with an 8-way splitter, thus attenuating your signal output by half, Standard's loop-through feature allows you to maintain full power as your system expands.

All that's required is a one-port jumper from your present splitter to our *Agile 24M* master receiver. Through the use of our active loop-through design, up to 100 Agile 24S slave units can be driven from a single Agile 24M and no external power dividers are required.

Your alternative to Standard's loop-through design is a power divider system which results in a reduced signal level when it's divided amongst each receiver. Or, you may be forced into a much more expensive 4 GHz amplifier/divider to make up for the signal loss to each receiver.

The Agile 24 eliminates both of these unsatisfactory alternatives.

System Design

The Agile 24M is a complete 24-channel dual conversion, 4 GHz input receiver that block-down converts to 760-1260 MHz. Then, through the active loop-through design, this IF is supplied to the Agile 24S.

A temperature-stabilized dielectric resonator oscillator (DRO) in the down converter, combined with a synthesized L.O. and an effective AFC circuit, ensures rock stable operation. In areas where microwave interference is a problem, optional 60 MHz and 80 MHz filters can be easily installed.

An inexpensive plug-in simultaneous second audio board is also available.

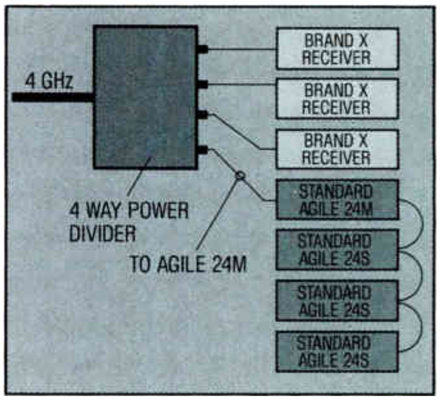
Installation, Test and Maintenance

The Agile 24 M/S series features a low-profile 1¾" chassis designed to occupy a single standard rack space. The front panel includes three-function meter displaying signal strength, C/N and center tune, convenient front test connections and all normal performance adjustments, as well.

A ONE YEAR WARRANTY

A new replacement program to our existing one-year warranty allows for a failed unit to be replaced within 48 hours.

All it takes is a simple phone call, and an immediate replacement is on its way, thus avoiding down-time.



Also, our new post-warranty for years two through five allows for speedy replacement at a total cost of only $100 plus freight.

Standard Communications is ready to help improve the quality of your system right now. And to position you to expand without losing efficiency. For full information on Standard's complete line of TVRO components, call direct, (800) 421-2916 or (213) 532-5300, or mail the coupon below.

Standard Communications®

...the TVRO Systems People

I'm interested in your full line of TVRO Components. **12/84 CED**

☐ Please send me a detailed brochure.

☐ Have a sales representative call.

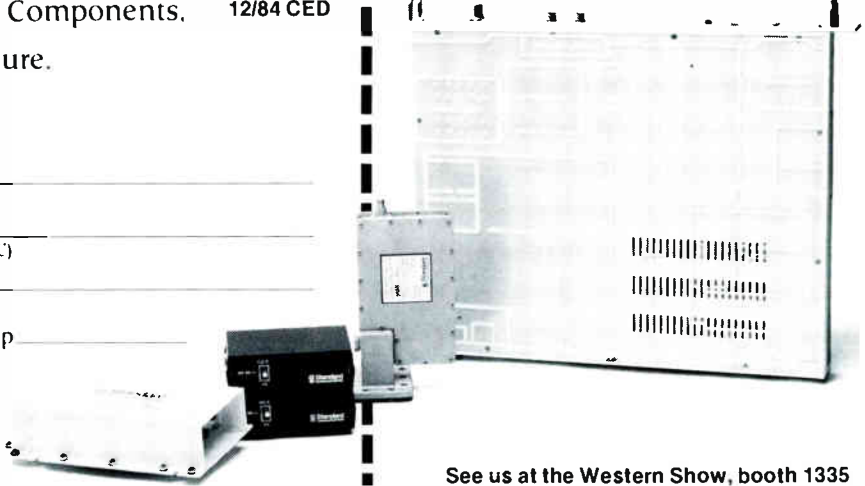
Name __________ Title __________

Company __________ Phone __________ (A C)

Street __________

City __________ State __________ Zip __________

Telecommunications Division of
Standard Communications Corp.
P.O. Box 92151, Los Angeles, CA 90009-2151



See us at the Western Show, booth 1335

Reader Service Number 4

CED's Board of Consulting Engineers

In this month's Spotlight, CED is proud to introduce the members of our newly formed Board of Consulting Engineers: Wendell Bailey, Ron Cotten, Bob Dattner, John Dawson, Roy Ehman, Mark Elden, Steve Raimondi, Sruki Switzer, Joe Van Loan and Nick Worth. Each board member brings with him a wealth of technical knowledge as well as years of hands-on experience in the cable TV industry.


Wendell Bailey


Bob Dattner


John Dawson


Roy Ehman


Mark Elden


Steve Raimondi


Sruki Switzer


Joe Van Loan


Nick Worth

Chairing *CED*'s Board of Consulting Engineers is Wendell Bailey, vice president of science and technology at the NCTA. Because of his position at the NCTA, Bailey is in the foreground of both the technical and legislative issues affecting the cable industry.

Being at the center of new technologies is not new to Bailey, who joined MCI long before its success was assured and its name a household word. "In the beginning at MCI, it was really a struggle. I wasn't even sure the company would last for six months," Bailey said. "But I am proud to have been a part of such a special time in the history of telecommunications."

In his spare time, Bailey enjoys talking on his HAM radio. "I just throw out my net and see who I catch," he said. Undoubtably his knowledge of Spanish, Swedish, Danish, Norwegian, French and German help him communicate with whomever happens to fall into that net.

Ron Cotten knows cable TV from the trenches up to the boardroom. Cotten started in cable in 1964 as an installer at Cablevision in Layfayette, Calif. Since then, he has climbed up through the ranks to become vice president of engineering at Daniels & Associates Inc. Along the way, he earned a BSEE, became the first SCTE president and formed his own cable consulting firm.

Cotten loves the cable business because of its challenges and, even, for its frustrations. "First, the challenge was in getting the plant to work," he says. "Now, it's in terminal equipment. The cable business will continue to grow and change, and I plan to be part of it all."

An outdoorsman at heart, Cotten spends his off hours backpacking, skiing, camping, fossil hunting, gardening and "swamping." "I've been to almost every major swamp in the United States," he claims. Cotten's future plans include exploring the Amazon River and visiting the Soviet Union.

Bringing an MS in Systems Engineering to *CED*'s board is Bob Dattner, vice president and director of technical operations at Media General Cable. Dattner admits that he was very theoretically oriented in his early cable days and applying his education to making things work in real world situations was initially a challenge.

Dattner loves the cable industry because "it's one of the few fields in electronics where you actually deal with the end consumer." Dattner said, "I try to make a point to live on the cable system in order to get feedback from my neighbors."

As his job became more managerial and less technical, Dattner said that he occasionally missed the earlier days. "After all," he chuckled, "it's easier to kick a piece of equipment than to fire an employee."

An expert on building cable systems from the ground up is John Dawson, who's been in charge of Mile Hi Cablevision's Denver build since February 1983. Since then, he hasn't had much free time (or much sleep), but Dawson says, "I wouldn't have missed it for the world."

Dawson, who started in TV/radio repair at age 17, claims his entrance into cable was purely accidental. He landed a job as a mechanical assembler at Jerrold in 1963 and says from then on he "just happened to be in the right place at the right time."

Dawson isn't sure exactly where he will go from here, but hopes someday to own a small cable system.

Roy Ehman, director of technical services at Storer Cable Communications, also says that he got into cable by chance. Fascinated by what he had read about cable technology, Ehman was ready to accept a position in another field when he heard of a cable system opening up nearby. He applied for the job, got it, and has been in cable ever since.

Ehman, who developed a computer program for the FCC to off-set aeronautical frequencies, enjoys being on the leading edge of technology. "Consumer interface issues, like stereo TV, pose a particular challenge that I am eager to confront," he says.

AFTER ENGINEERING FINISHED WITH OUR STANDARD CONVERTERS, ACCOUNTING SUGGESTED ONE MORE IMPROVEMENT:

Remember when Pioneer's line of standard converters were known for superior features in every area — but price?

Times have changed.

Right now, Pioneer's full line of set top and remote converters (from 26 to 67 channels) are available *at their lowest prices ever*. And Pioneer still offers superior features, like a new capristor that adds extra surge protection for even greater reliability. In fact, Pioneer converters are so reliable that we back every one with a two-year written warranty — the longest in the industry.

And because Pioneer constantly maintains a substantial inventory of its standard converters ready for *immediate delivery*, we can fill your order in days rather than weeks — or months.

This means that Pioneer's new pricing policy has been achieved *with no compromise* in capability, reliability or service.

For complete information on pricing and delivery, call Pioneer toll-free 1-800-421-6450. (In Ohio, call 614-876-0771.) And do it now.

After all, since the best standard converters in America are now more affordable than ever, why settle for anything less?

PIONEER
PIONEER COMMUNICATIONS OF AMERICA
1-800-421-6450 614-876-0771 (in Ohio)
Reader Service Number 5

Spotlight

Mark Elden was interested in video technology long before he entered the cable industry. In the early 1970s, Elden worked as a senior engineer for Jacques Cousteau Enterprises, where he designed a special camera for use in underwater construction and exploration.

Seeing cable as the next frontier in video electronics, Elden took his knowledge of communications and video technology to HBO, where he became director of affiliate engineering in 1976. From there he went to Group W Satellite Communications and, most recently, he became director of engineering at Showtime/The Movie Channel.

Confronting challenges also appeals to Steve Raimondi, director of engineering (east) at United Artists Cablesystems. Raimondi says his biggest accomplishment was supervising construction of over 4,000 miles of cable plant. "I was involved in the build from its conception to serving more than 250,000 subscribers," he said.

Raimondi likes being part of the evolution of cable as the technology changes. He is looking forward to analyzing a feedforward electronic drop-in rebuild in the near future.

Sruki Switzer is one of cables' oldtimers. In 1954, Switzer built the first CATV system in western Canada and, since then, has participated in dozens of other builds.

Switzer served several terms as director of the Canadian Cable TV Association and was principally responsible for the development of coherent carrier transmission technologies for cable TV. He holds the U.S. patent on harmonically related carrier techniques.

More than once Switzer has been called to testify as an expert witness in court cases concerning cable issues. A regular guest lecturer at the Annenberg School of Communications, the University of Pennsylvania and the University of Toronto Law School, Switzer is currently retained as senior consulting engineer at Cablecasting Ltd. in Toronto.

"I'm an innovator, not a creator," says Joe Van Loan, engineering vice president at Viacom Cablevision. Always more of a hands-on man, Van Loan prefers implementing new technologies in real-world situations to developing them in the sterility of a lab.

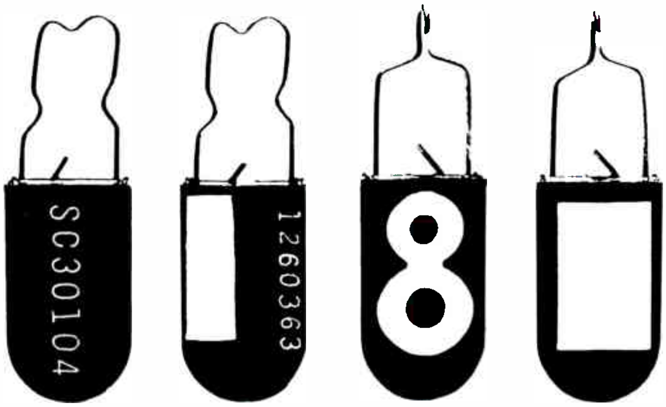
Fascinated with electronics since grade school, Van Loan worked part-time in radio/TV repair during high school and went on to study electrical engineering in college while working for a company that designed builds and TV translators. After graduation, he became chief engineer for the nine-station Nebraska Educational TV Network. Prior to joining Viacom, Van Loan was engineering vice president for Cable Dynamics, a consulting engineering firm.

Van Loan lives in the San Francisco area, where he enjoys waterskiing and debugging programs on his personal computer during off hours.

Nick Worth got into cable in 1973 on the advice of a good friend who was then engineering vice president at the NCTA. Worth finds grappling with cable's tough problems rewarding. "Satisfying the VCR customer is definitely the front burner issue today," he says. "Sixty-five percent of our subscribers have VCRs, and cable must be synergistic to these products—not antagonistic. Customer satisfaction is always our ultimate goal."

Recipient of the NCTA's Engineering Award for Outstanding Achievement in Operations, Worth holds two undergraduate degrees in electronics. Currently the vice president of engineering at TeleCable Corp., Worth enjoys sailing during his free time and even designed and built his own sailboat.

—Lesley Dyson Camino



Seminars

December

2-4: The 22nd Annual National Translator/LPTV Association Convention & Expo will be held at Caesars Palace in Las Vegas. Contact David Stone, (714) 794-4704.
4: The Network Awards for Cable Excellence, sponsored by the **NCTA,** will be held at the Wilshire Hotel in Los Angeles. Contact (202) 775-3611.
4: A **Paul Kagan Associates** seminar on "Cable TV Security" will be held at the Marriott Hotel in Anaheim, Calif. Contact Genni O'Connor, (408) 624-1536.
4: QV Publishing will sponsor a seminar on "Addressability & Pay-Per-View" at the Disneyland Hotel, Anaheim, Calif. Contact Barbara Freundlich, (914) 472-7060.
4-6: abc TeleTraining Inc. will offer a course in "CATV Management, Engineering, and Operating Principles" in Tampa, Fla. Contact (312) 879-9000.
5-7: The Western Cable Show will be held at the Anaheim Convention Center in Anaheim, Calif. Contact (415) 428-2225.
5-7: Magnavox is sponsoring a Mobile Training Seminar in Anaheim, Calif. Contact Laurie Mancini, (800) 448-5171.
11: The Southern California Chapter of Women in Cable is meeting at the Marriott Hotel in Marina del Rey, Calif. Bob Alter, president of the Cable TV Advertising Bureau, is scheduled to speak. Contact Jeanne Cardinal, (213) 410-7312.
11-13: A **Blonder-Tongue** SMATV/MATV/CATV/TVRO Technical Seminar will be held at the Hyatt Palm Beaches in Tampa, Fla. Contact Sharon Leight, (201) 679-4000 or Neville Johnson, (813) 953-9843.
11-13: Jerrold will offer a technical seminar at the Sheraton Valley Forge in King of Prussia, Penn. Contact Ann Pliscof, (215) 674-4800.
14: Microwave Filter Co. is holding a Terrestrial Interference Seminar in East Syracuse, N.Y. Contact Bill Bostick or Carol Ryan, (315) 437-3953.

January

9-11: University of Central Florida will sponsor a fiberoptics workshop at the Dutch Resort Hotel, Walt Disney World Village in Buena Vista, Fla. Contact V. Amico, (305) 275-2123.
10-14: NATPE '85, Moscone Center, San Francisco, Calif. Contact (212) 949-9890.
15-17: Jerrold will offer a technical seminar in San Francisco, Calif. Contact Ann Pliscof, (215) 674-4800.
22-23: The **SCTE** is offering a seminar on "Multichannel TV Sound" at the Sheraton Hotel in Concord, Calif. Contact David Large, (408) 988-7333.
22-24: C-COR will hold a technical seminar at the Best Western Airport Park Hotel in Inglewood, Calif. Contact Bryon Brammer, (800) 233-2267.
23-25: North Dakota State Cable Association Annual Convention at the Kirkwood Motor Inn in Bismark, N.D. Contact Elden Pfenning, (701) 223-4000.
Jan. 30-Feb. 1: Texas Cable Show, San Antonio Convention Center. Contact Bill Arnold, (512) 474-2082.

Looking ahead

Feb. 11-15: Video Expo, Civic Auditorium, San Francisco, Calif. Contact (800) 248-5474 or (914) 328-9157.
March 18-20: "Communications Satellite Systems-The Earth Station," George Washington University, Washington, D.C. Contact Darold Aldridge, (800) 424-9773 or (202) 676-8515.
April 16-18: CAST '85, National Exhibition Centre, Birmingham, England. Contact, 01-863-7726.
June 2-5: National Cable Television Association convention, Las Vegas Convention Center, Las Vegas.

Cable installs:

Expertise based on 12 years and 3,000,000 connections.

If installs have you feeling snake-bit, our Installation Services Division is the solution. We're setting the pace in both residential and multiple dwelling unit installations. All of our crews and field supervisors must prove themselves capable *and* courteous on every job—or they don't go out. We also handle special projects (like audits, rebuilds, regrounding, converter changeouts and upgrades), and we specialize in MDU construction. Cable installs? No problem!

Converter repairs:

Warranty-authorized by the industry's leading manufacturers.

RTK's Converter Services Division is the answer when converter repairs are eating your profits. We're showing the industry how repairs should be done. Our technicians check and re-check *every* component—not just those with obvious problems—so your subscriber gets back a unit that's as good as new. We stock parts and supplies for all models, and back our work with the most comprehensive guarantee in the business. Converter repairs? No problem!

Cable construction:

We build better cable systems—from the ground, up.

RTK's Communications Construction Division takes the hardhat pains out of the *entire* project. We handle site planning, electronics design, surveys and strand-mapping, make-ready, cable and materials purchasing, aerial and underground construction, debugging, and maintenance for the life of the system. We can design a system and provide full or modified turnkey construction to the most exacting specifications. Cable construction? No problem!

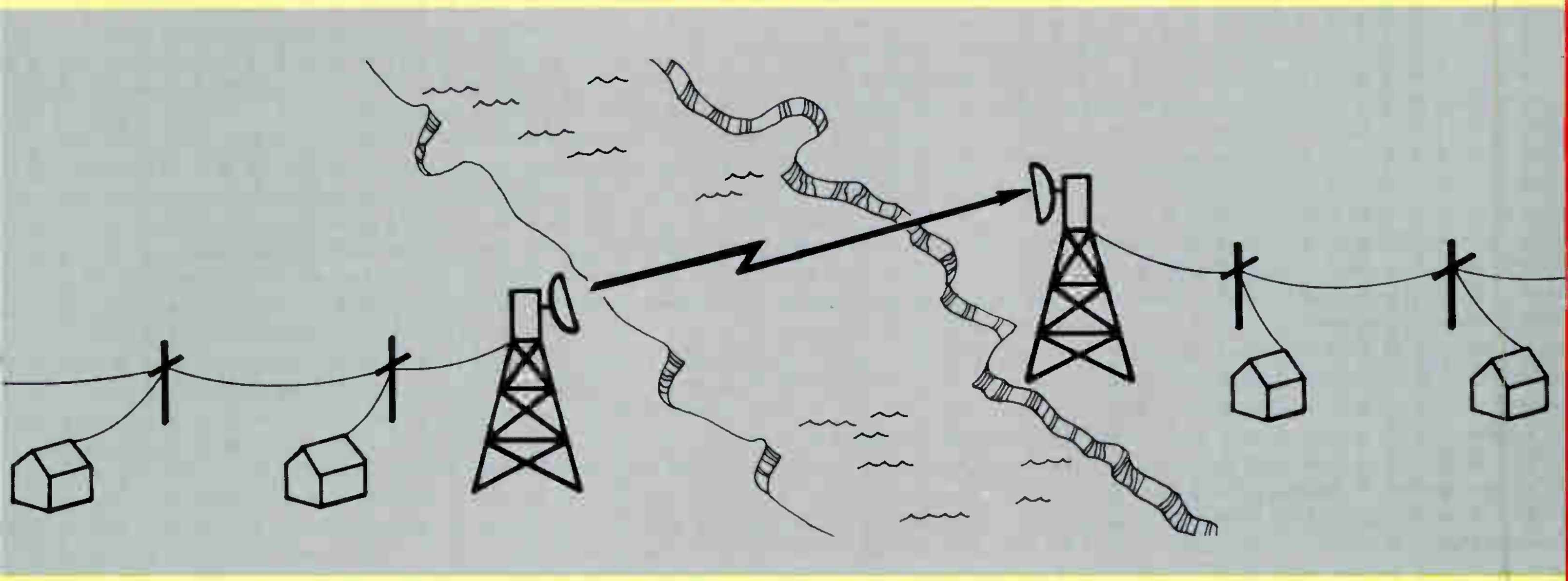
RTK™ The cable industry's problem solvers.™

RT/KATEK COMMUNICATIONS GROUP

Installation Services Division □ Converter Services Division □ Communications Construction Division
201/678-2083
800/441-1334 Toll Free
(In PA, 717/534-1161)
215/269-1946

Reader Service Number 9

Our new low cost microwave line extender can extend your service and your profits



The new Hughes AML® line extender can solve a lot of problems which may be costing you money. Problems with natural barriers. Problems with long amplifier cascades. Problems serving small pockets of potential subscribers. Our microwave line extender can make it easy and economically attractive to offer cable services where cable can't go.

These new line extenders are multichannel transmitters which block upconvert one to 60 channels. They accept combined VHF input in the 54 to 440 MHz range directly from your cable. They allow you to reach new subscribers that have previously been uneconomical to serve.

Not only can they offer new services, they can protect your existing services during planned and unplanned interruptions. Our microwave line extender makes an excellent, frequency-agile hot standby. The Hughes AML line extender is cable powered, can be mounted indoors or out, and has a temperature regulated enclosure for extra stability and reliability. It shares spares and service techniques with all AML transmitters and is compatible with all Hughes AML receivers.

For more information on the new Hughes AML microwave line extender, contact **Hughes Microwave Products Division,** P.O. Box 2940, Torrance, CA 90509-2940 (213) 517-6233.

Hughes AML® Microwave Systems

AML—ANY MODULATION LINK

HUGHES
AIRCRAFT COMPANY

Reader Service Number 10

Volume 10, No. 12

CED

EDITORIAL OFFICES

Gary Y. Kim
Publisher/Editor

Constance Warren
Production Editor

Lesley Dyson Camino
Administrative Assistant

Gary Arlen
Contributing Editor

BOARD OF CONSULTING ENGINEERS

Chairman

Wendell H. Bailey, NCTA Vice President, Science and Technology

Members

Ron Cotten, Vice President of Engineering, Daniels & Associates Inc.
Bob Dattner, Vice President/Director of Technical Services, Media General Cable
John Dawson, Director of Engineering, Mile Hi Cablevision
Roy Ehman, Director of Technical Services, Storer Cable Communications
Mark Elden, Director of Engineering, Showtime/The Movie Channel
Steve Raimondi, Director of Engineering (East), United Artists Cablesystems
Sruki Switzer, Consulting Engineer
Joe Van Loan, Engineering Vice President, Viacom Cablevision
Nick Worth, Vice President of Engineering, TeleCable Corp.

PRODUCTION

Kathy Berlin, Production Director
Brad Hamilton, Corporate Art Director
Diane Krensky, CED Art Director
Tim Sherman, Earl V. DeWald, Artists
Judith Ferland, Circulation Director
Madeleine Lyle, Circulation Manager

ADVERTISING

Cathy Wilson, National Sales Manager
Suzanne Sparrow, Classified Sales
Pam Berke, Marketing Manager
Heather Stephens, Marketing Assistant
Maureen Scance, Marketing Artist
Kevon Storie, Traffic Manager

International Thomson Communications Inc.

Thomas J. Corcoran, President/Chief Executive Officer
Michael McCready, Publishing Vice President
David Carlton, Chief Financial Officer

OFFICES

Denver International Thomson Communications Inc., 600 Grant St. Suite 600, Denver, CO 80203 -or- P.O. Box 5208 T.A., Denver, CO 80217, (303) 860-0111.
Washington Bureau 1701 K Street, N.W., Suite 505, Washington, D.C. 20006, (202) 835-0900.
New York Bureau 101 Park Avenue, Fourth Floor, New York, N.Y. 10178, (212) 661-7410.
West Coast Bureau, 101 North Robertson Boulevard, Suite 206, Beverly Hills, CA 90211, (213) 659-3965.

In Perspective

Playing for the roses

The nice thing about this industry, in fact, about life, is that occasionally walk-ons make the team. Sometimes they even get to start. More rarely, perhaps, they are lucky enough to quarterback. True, they're going to get sacked every once in a while, but maybe, just maybe, they can make a difference in the won-lost column.

Just over a year ago, I suited up and said I wanted to play. Didn't know a whole lot about the cable industry. Hadn't worked more than a few months as a reporter. But I wanted to play and they gave me a chance. A little over six months later, I was filling in for the starting quarterback, but the coach was still calling the plays from the sidelines.

A few months later even that would change. But at the time, I was still untested. Didn't have a win-lose record to show. But I did have a promise.

"Watch us blossom" I said in my first *CED* editorial. It expressed my confident determination to give you a magazine worthy of your own efforts and, since then, little has been spared as our team has striven to do so.

It's been tough. Six-day weeks and night owl hours have been required. And it's taken some time because no matter how skillful or devoted a team may be, it still takes a while before solid basics are translated into a winning streak.

So we've been very busy. Scarcely an issue has gone by without some modification. We've gone through the scenarios over and over again, reworked the game plan and tested ourselves on the practice fields. We've had our ups and downs and still don't win them all.

But with each game we've gained additional confidence. We know we're in a tough league and won't have much of a chance to relax—at least not if we want the roses. Our work is cut out for us, and nobody's putting away the practice pads.

Still, there comes a point when momentum is gained, when the execution is near-flawless and the big plays are made. We've got it. Which isn't to say we can afford to play "flat." Emotion, intensity, concentration and desire are critical—no, make that decisive—in close contests.

So, while you'll be seeing more evidence of how hard this team has worked, execution doesn't tell the whole story. Emotion fuels this team, and I can tell you the team is up. We're playing for the roses and I hope you've noticed the early results.

But we've only just begun. And to help us, I'm proud to announce, we've gotten a top-notch new editorial board.

Chaired by Wendell H. Bailey, NTCA Vice President, Science and Technology, the group includes:

- ■ Ron Cotten, Vice President of Engineering, Daniels & Associates,
- ■ Bob Dattner, Vice President of Technical Services, Media General,
- ■ John Dawson, Director of Engineering, Mile Hi Cablevision,
- ■ Mark Elden, Director of Engineering, Showtime/The Movie Channel,
- ■ Joe Van Loan, Vice President of Engineering, Viacom,
- ■ Nick Worth, Vice President of Engineering, Telecable,
- ■ Roy Ehman, Director of Technical Services, Storer Communications,
- ■ Sruki Switzer, Consulting Engineer, and
- ■ Steve Raimondi, Director of Engineering (East), United Artists Cablesystems.

Together, they'll provide top-level editorial guidance for *CED*'s staff, supplying the informed direction we need to serve you better. We welcome them with gratitude and deep respect for the collective knowledge and wisdom they bring to their new posts.

Watch us blossom. We've only just begun.

FCC changes aeronautical band rules

Action closes Docket 21006

WASHINGTON—The FCC has changed the rules governing cable industry use of the aeronautical frequencies, and while some leading engineers greeted the long-awaited decision with relief, others fear the industry may have been blind-sided. The Oct. 29 decision modified interim rules in effect since 1978. Involved are frequency offsets, threshold power level guidelines and signal leakage tests.

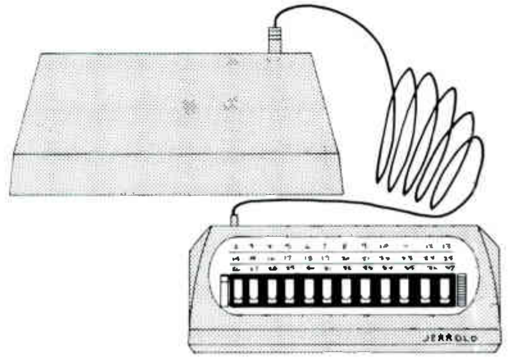
While the new rules relax the frequency offset and threshold power rules, they also tighten the monitoring guidelines. Although the full text of the decision hasn't been released, initial industry response has ranged from delight and cautious optimism to near-outrage.

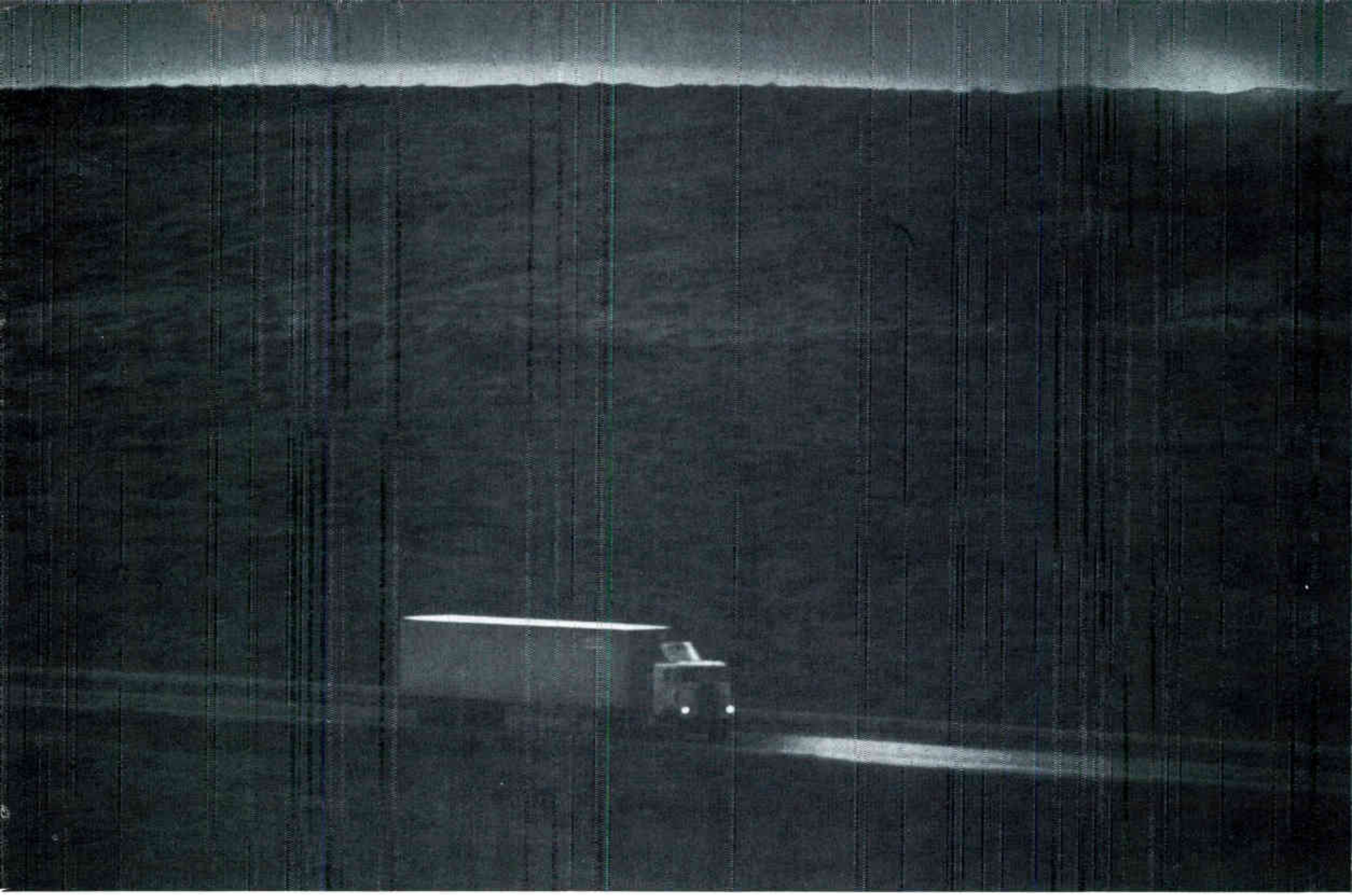
Nick Worth (right) says new channelization plan is unwarranted. Joe Van Loan (left) fears the industry got trounced.

The pluses? Relaxation of the offset and power rules, no loss of five channels on systems using Harmonically Related Carriers and an end to the FCC's clearance of aural and data carriers. And while some observers weren't thrilled with all provisions, at least the decision wasn't harsher. There was some concern that cable might be barred from use of certain frequencies. That didn't happen.

But the new rules are, in essence, a mandatory channelization plan. The worries? The cost of sweeping systems four times a year instead of just once, the possible effect on data carriers and FM transmission of deluxe audio services. There is also some concern over the availability of equipment that meets the new specifications.

Considered by some observers the





It takes a cable company you can count on to deliver on time, everytime.

It takes Capscan.

You might find a cable supplier that's bigger than Capscan Cable, but you'll never find one more reliable.

That's because we're part of the Burnup & Sims Cable Products Group. A company with over 40 years experience in the telecommunications business.

We know from experience, when cable doesn't arrive on time it can bring your entire construction project to a screeching halt. And we're not about to let that happen.

We're dedicated to the idea of providing you with the highest quality trunk, feeder and drop cable, at the most competitive prices, in the shortest possible delivery time.

We know getting cable fast is one thing. Getting it to meet your system specs is often another.

That's why when we deliver, we do it right the first time—with thoroughly tested cable that eliminates the need for time-consuming changeouts.

For more information on how you can get fast, reliable, competitively priced cable, give the Capscan sales office a call at (800) 222-5388. We're the cable company you can count on the first time—everytime.

CAPSCAN
CABLE COMPANY
HALLS MILL ROAD
ADELPHIA, NJ 07710

A BURNUP & SIMS
CABLE PRODUCTS
GROUP COMPANY

Reader Service Number 13

most technical item the FCC has looked at in years, the plan mirrors in essential respects earlier plans drawn up by commission rule-makers and advocated by some industry engineers.

In the 118-136, 225-328.6 and 335.4-400 MHz bands, cable carriers must be offset from aeronautical channel center frequencies by 12.5 kHz ±5 kHz. The old rules required 100 kHz offsets. Frequency spacing is set at 25 kHz.

In the 108-118 and 328.6-335.4 bands, carriers have to be offset 25 kHz ± 5 kHz. The previous rule was 50 kHz spacing.

Harmonically Related Carrier systems are permitted if the master oscillator frequency is set at 6.0003 MHz with a stability of 1 Hz.

The threshold power levels for carriers were changed from 10^{-5} watts to 10^{-4} watts.

Systems will, generally speaking, need to sweep their plant at least once every three months, however.

Existing systems will have five years to comply with the new rules, which also require air-space or ground measurements as a prerequisite for operation in the aeronautical bands.

"Personally, I think it's a good deal," said NCTA Vice President for Science and Technology Wendell Bailey. "If we hadn't gotten this, things would have been worse."

Nick Worth, vice president of engineering at Telecable Corp., says, "The industry may have gained some ground through the reduction of offsets and elimination of frequency conflicts, but the FCC's imposition of a channelization plan is unwarranted in view of the minute number of cases of cable interference with aeronautical communications."

Viacom's Joe Van Loan, vice president of engineering, is worried that the industry got trounced. "This is basically the same plan the FCC offered us before, and we were going to sue them over it then. Is the world different enough now that we can say we won?"

More worrisome is the effect this decision might have on other frequency allocation decisions in the future. "I've heard rumors about a removal from the mid-band," Van Loan said. "If the Federal Aviation Agency decided to go to 12.5 kHz, we could get hit."

Ted Hartson, manager of engineering services at Capital Cities Cable, is most unhappy because the decision hands the industry a complete channelization plan at a time when off-the-shelf equipment doesn't have the stability to meet the new specifications. "Everything has to be within a 5 kHz stability margin and no equipment out there now does that. Our heterodyne processors are between 5 and 8 kHz now. Our modulators only get within 12-14 kHz in some cases."

What the decision means is that a typical 35-channel system might have to do something about 17 of its channels, he adds. "If the bill's as ominous as it sounds, we could be in trouble."

FCC Docket No. 21006 was first opened in 1976, after the first documented case of cable interference with aircraft navigation occurred over Harrisburgh, Pa. The interim rules were adopted in 1977 and became effective in 1978. All along, cable signal interference with aircraft navigation has been an emotional and hotly contested issue pitting the cable industry against the FAA.

Particularly irksome for many cable technical managers is the rarity of actual interference as well as its minor nature.

Despite the heat generated by the leakage controversy, surprisingly few cases have occurred, and "there are no documented cases of an air hazard created because of cable leakage; no endangering of life or property," said Ralph Haller, chief of the FCC's technical and international branch.

Indeed, while there have been five documented cases of cable interference with aircraft navigation, there are hundreds of reported cases each year from non-cable sources, "many of them millions and billions of orders of magnitude bigger than that caused by cable," Hartson said.

FM radio tuners, heavy machinery, computers and pilots who don't use their squelch buttons cause far more problems, observers agree.

Docket No. 21006 is closed. But whether the decision is boon or bane remains to be seen.

—Gary Kim

Jerrold: program window shutting

PPV can open it

ATLANTIC CITY, N.J.—Cable's in trouble because a structural change in video distribution methods is underway. The problem? Not VCRs, said Jerrold Vice President Hal Krisbergh at a QVP seminar held here Oct. 29. VCRs are just a symptom.

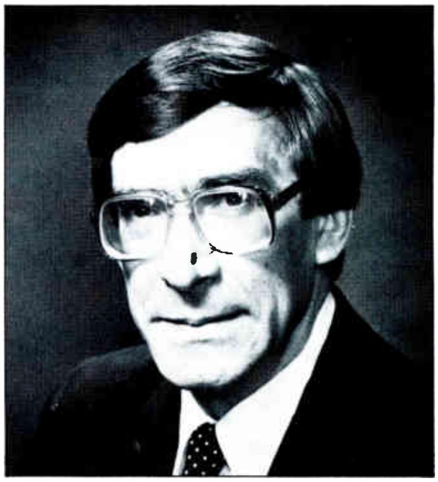
What's driven cable since 1975 isn't movies, he argued. Instead, an earlier programming window—ahead of broadcast TV—has been the single most important consumer value offered by the industry. But "blockbusters going to VCR distribution seriously undermine the foundation of the industry," Krisbergh said. "An attack of 10 to 20 percent on basic cable revenues may not sound life-threatening, but it represents the profit margin the industry needs to survive."

The solution? Pay-per-view. But only if the major program suppliers get behind it. Only if they stop focusing on the "big events" offered once or twice a month; unbundle programs; lower cost thresholds; move to narrowcasting and let subscribers cherry-pick what they want, Krisbergh said.

"I see a lethargy in the industry about VCRs. Some major aggressiveness and rethinking is needed and I'm making a plea to the industry to respond to new needs," he said. "Once subscribers get used to using a TV like a phone, on a per-use basis, many additional revenue streams are possible."

What the industry needs to avoid five to ten years down the road is a situation where one or two major programmers provide most of the software. "And that's the way things are going now," Krisbergh warned.

Which isn't to say vendors and operators didn't have ideas about more immediate problems. "RF is our bread-and-butter and will be for years," said Colony Communications Executive Director of Technology Doug Truckenmiller. "We do need baseband at some point, but only as a premium box."

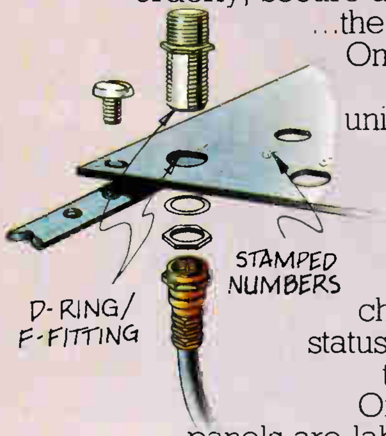


Dedicating electronics as subscribers are signed keeps Tier Guard cost per port in the $35-$95 range, Emerson says.

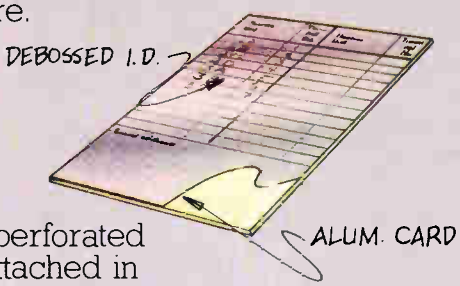
His equipment shopping list places reliability at the top. "We can't have converters fail at rates greater than 1 percent a year." Also important: favorite channel programming, parental control, unlimited tiering, remote disable of the IR receiver, two-way upgrades

Messed Up. Dressed Up.

CWY created a way to make tangled, inefficient multiple dwelling enclosures orderly, secure and easy to service ...the revolutionary new Omni-Rack™ system*. The Omni-Rack's unique panel and rail design means quick and easy auditing, connecting, disconnecting and changing subscriber status. Leads connected to the underside of Omni-Rack punched panels are labeled permanently by stamped numbers on the tops of the panels. Once leads are connected, they need never be touched again—checking or changing status means handling only jumper cables. Plus, for additional security, the Omni-Rack comes with exclusive aluminum-coated log cards which may be kept away from the enclosure.



No dangling leads...no missing labels... no searching for the right lead. Any combination of punched and perforated panels may be attached in any of five rail positions...the Omni-Rack's inherent design flexibility means you've finally got a secure, easy to service system. Service personnel save time...and that saves you money.



To find out more about Omni-Rack and CWY's complete line of CATV solutions, call or write today.

*Patent pending

Not just supplies. Solutions.

CWY
electronics

P.O. Box 4519 — Lafayette, IN 47903 — Call Toll Free: 1-800-428-7596 — Indiana: 1-800-382-7526

Reader Service Number 14

and channel mapping.

His qualms about off-premises addressability? Cost and compatibility with existing scrambling methods. "We need a per-sub cost no higher than $100."

Volume control and compatibility with "cable-ready" TVs and VCRs were at the top of George Douglas' list. The American Cablesystems vice president said cable-ready sets already represent 25 to 30 percent of TVs hooked to his systems. VCR numbers are comparable and range as high as 49 percent in some areas, he said.

Asked what incremental value volume control might represent as a revenue stream, Douglas guessed three dollars or so; Truckenmiller, about two dollars a month. Converters allowing relatively full VCR features might add an extra $1 to $1.50, Douglas said. Truckenmiller couldn't see such terminals costing anything less than twice as much as existing boxes. "We'd have to charge $5 a month more for them," he said.

Although several vendors argued for reducing the cost of in-home electronics, both Truckenmiller and Douglas expressed a clear preference for retaining ownership of the terminals.

Because no two cable systems or headend computer configurations are alike, both General Electric's Ron Polomsky and Pioneer's Ed Kopakowski emphasized design flexibility. "The boxes need to be transparent to signals coming through," Kopakowski said. "We can't compete with the consumer electronics market and have to let it call the tune on features."

Asked whether intermodulation is a problem when multiple signals are multiplexed on a single drop to feed second TV sets, Polomsky explained why not. "We don't send the color burst or sync information down the drop. It's added at the converter."

Placement of active electronics was an issue off-premises systems vendors were asked to address. Mini-Hub II subscriber module clusters should be 80 to 90 percent dedicated, said Times Fiber Vice President Allen Kushner. The older Alameda, Calif., system was designed for 70 percent penetration with 24-unit switches. The new configuration is multiples of eight, he said. "You wait until you've got the ninth subscriber before you drop in the next set of switches."

AM Cable's Jim Emerson agreed. "You dedicate the electronics as subscribers are signed, not during the first pass. With Tier Guard, that keeps the cost per port in the $35 or $95 range."

Unlike some other systems, Tier Guard doesn't scramble its signals. It jams them at the subscriber module, disrupting both video and audio. Signals are transmitted in the clear and the full authorized band is passed to the home. This allows use of cable-ready sets and provides stereo sound compatibility.

—*Gary Kim*

SCTE plans seminar

DENVER—Multichannel sound will be the topic of a special SCTE seminar to be held Jan. 22-23, 1985, in Concord, Calif. Subjects on the agenda include potential technical problems, results from field tests and operator experience; review of FCC must-carry rulings; scrambling, headend and microwave equipment compatibility questions; and alternate technologies for providing stereo sound.

Sheraton Hotel will host the event, which will cost SCTE members $150 and non-members, $195. All inquiries should be addressed to Pete Petrovich, (415) 828-8510; Dave Large, (408) 998-7333; or the SCTE, P.O. Box 455, Pleasanton, Calif. 94566.

Satisfaction guaranteed.

We stand solidly behind every piece of cable equipment we sell.

Head-end through drop materials, it performs the way we say, or we'll correct it — immediately.

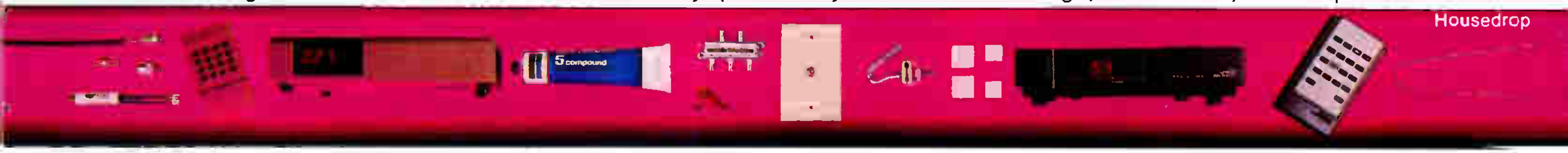
All items carry the manufacturer's full warranty.

We'll also compete with any distributor on price, selection, delivery, and service.

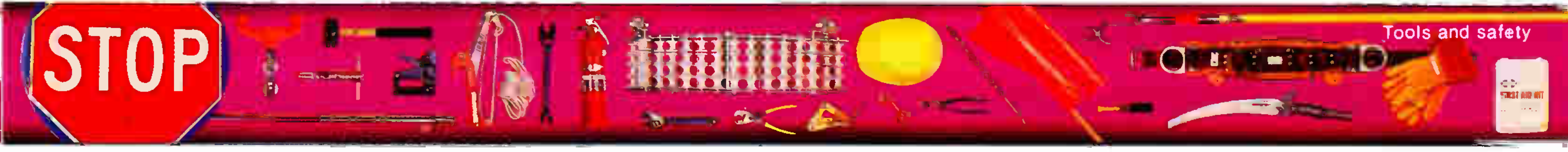
We stock all major brands, and can tailor packages to your needs.

Items arrive when you need them, not sooner or later.

And our engineers and technicians can answer any questions you have about design, installation, or field performance.



Call Cable Services with your next order, or for a free catalog: **1-800-233-8452.** (In PA, call 1-800-332-8545)



Cable Services Company/Inc.

Reader Service Number 16

2113 Marydale Avenue, Williamsport, PA 17701

Eliminate the weak link... with Alpha Standby Power.

- Alpha is the FIRST and ONLY UL/CSA approved Standby Power Supply in the industry — proof of our commitment to product safety and reliability.
- Alpha has Remote Status Monitoring systems in operation with many M.S.O.'s. Simple plug-in upgrading and compatible with any CATV amplifier maker. Two configurations to choose from.
- Alpha has the fastest battery recharge time in the business. Nearly twice as fast as our nearest competitor.
- Alpha has authorized service centres located throughout the nation. Just in case you need them. Fast turn around by qualified technicians.
- Contact us and find out about the many other IMPORTANT features.

SO DON'T MAKE STANDBY POWER THE WEAK LINK OF YOUR SYSTEM. SPECIFY ALPHA... YOUR BEST BUY IN THE LONG RUN.

ALPHA TECHNOLOGIES

1305 Fraser St., D-6
Bellingham, WA 98226
TEL: 206-671-7703

7305 East Evans Rd.
Scottsdale, Arizona 85260
TEL: 602-948-4484

7033 Antrim Ave.
Burnaby, B.C. V5J 4M5
TEL: 604-430-1476
TELEX: 04-356760

For Sales and Service
in Your Area:

Westec Communications, Inc.
Scottsdale, Arizona
TEL: 602-948-4484

Westec Communications, Inc.
Napa, California
TEL: 707-255-2010

NCS Industries, Inc.
Willow Grove, Pennsylvania
TEL: 215-657-4690

Micro-Sat s/e inc.
Marietta, Georgia
TEL: 404-971-1021

R. Alan Communications
Indianapolis, Indiana
TEL: 317-849-7572

A & M Communications
Minneapolis, Minnesota
TEL: 612-881-1311

Cable TV Services
Garland, Texas
TEL: 214-494-3348

In Canada:

Anixter-Micro-Sat
Pickering, Ontario
TEL: 416-839-5182
1-800-263-4655
TELEX: 06-981256

Reader Service Number 17

Standardizing ad insertion

Without cue tones, there would be no commercial insertion. But with inconsistent tones, there is havoc. HBO's Scott Tipton recommends standard cue tone practices that will coordinate operators' ad insertions and calls for more controlled network signaling.

By Scott Tipton,
Director of RF Systems,
HBO studio production

The NCTA signaling and control subcommittee was formed to investigate present satellite signaling practices and to recommend future procedures for signaling and controlling various devices in the cable system headend. The subcommittee was particularly concerned by the lack of a recommended practice for originating Dual Tone Multifrequency tones (DTMF) used for various switching functions in the cable system. Explanations of the group's recommended practices follow.

Duration

The committee proposed that the tone and space duration be equal and nominally 40 msec. Any group of tones sent for a specified function should be preceded by 750 ms/pretone silence.

Any sequence or repetition rate may be used. The intent of the "duration" statement is to make the pretone silence and intertone spacing of current DTMF tone equipment similar.

Example: Sequence 1, 2, 3, *, sent three (3) times.

750 ms

1		2		3		*
40 ms	40 ms	40 ms	40 ms	40 ms	40 ms	40 ms

750 ms

1		2		3		*
40 ms	40 ms	40 ms	40 ms	40 ms	40 ms	40 ms

750 ms

1		2		3		*
40 ms	40 ms	40 ms	40 ms	40 ms	40 ms	40 ms

* 35 ms-Minimum
40 ms - Nominal
45 ms - Maximum

Tone and space duration standards

Amplitude

During DTMF tone transmission, subcarrier deviation should be 13 dB below peak deviation for that subcarrier. The generally accepted audio subcarrier peak deviation is ±237 kHz. (See NCTA Tutorial on subcarrier practices, September 1983.) The general operating level during a test tone is 1 kHz at 0 dBm, equal to 10 dB below peak deviation. Given the 75 microsecond preemphasis curve and the fact that the highest DTMF tone is 1477 kHz, an additional 3 dB reduction in amplitude is recommended during DTMF transmission.

If a standard VU meter and its associated matching network is used to measure the DTMF tones, care should be taken to assure the VU-meter is operating on the lower extremities of the meter scale—i.e. approximately -13 or 25 percent. If a buffered meter is used (with buffer amp ahead of the meter to recover 4 dB loss of matching network), the meter reading still should be quite low, i.e. approximately -9 dB. If a buffer amp is used, an additional 10 dB of gain should be applied (for a total of 14 dB), to achieve more suitable meter indication of +1 dB.

If an oscilloscope is used to measure the peak-to-peak amplitude of the tones, care should be taken to ensure that the instrument (usually an unbalanced input) ground does not short one side of the (usually balanced) tone circuit to ground, giving erroneous results. A balanced to unbalanced transformer or an oscilloscope with an isolated ground should be used.

Frequency

It is proposed that DTMF tones follow the standards for DTMF dialing used in telephone signaling:

Digit	Low tone	High tone
1	697	1209
2	697	1336
3	697	1477
4	770	1209
5	770	1336
6	770	1477
7	852	1209
8	852	1336
9	852	1477
0	941	1336
*	941	1209
#	941	1477

Note: °0.5 percent frequency tolerance

Audio signal-to-noise and distortion

It is recommended that the transmission medium carrying DTMF tones have an audio signal-to-noise characteristic of at least 50 dB unweighted, with no greater than 1 percent harmonic distortion.

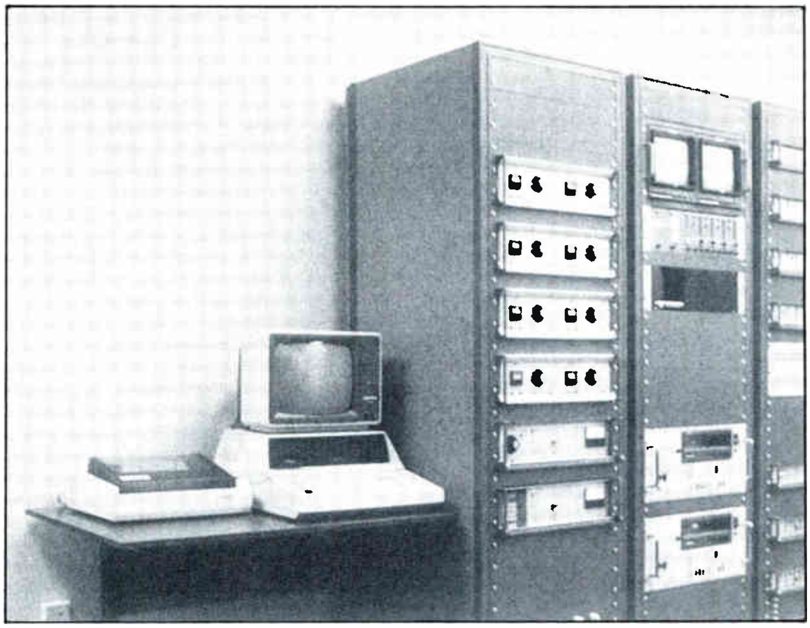
These recommendations are intended to be used as a guide whenever DTMF tones are used, whether by program audio or separate subcarrier. It is granted that this signaling method is slow, cumbersome and, to some, annoying, but there is no widespread equipment obsolescence; and a good number of users using this method have had fewer switch failures.

When satellite programmers began using DTMF tones, the functions were generally simple—such as enable or disable encoders, leave net, return to net. The burning issue now is not simple closures, but commercial insertions. Good reliable insertion that ad agencies and advertisers now enjoy through broadcast methods, for example.

A look at the 50-150 top television markets perhaps would provide good insight into what happens at commercial time. (The first fifty television markets generally have more equipment, personnel and capital.) The station log is substantially generated at least

RAMS 5000

COMMERCIAL INSERTION SYSTEM



Commercial insertion equipment is installed between your satellite receiver and modulator, and FALCONE fits in with the best of them.

- Fully digital machine control logic
- Fully electronic switching on both audio and video
- Adjustable stop delay and gain control
- Automatic bypass
- Operational with all network formats
- Glass epoxy double sided gold contact circuit board
- Digital decoder, programmable tone sequence
- User friendly, easy to operate

Falcone International, Inc.

Distributed by
Scientific-Atlanta
Western Cable Show Booth 1420

P.O. Box 3067 • Marietta, GA 30060 • (404) 427-9496

Reader Service Number 18

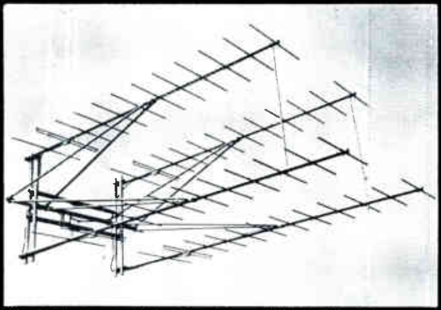
twenty-four hours ahead of time and shows the contents of each minute of the day. An operator "builds the spot reel" and loads it or gives it to a switcher or a switcher director who then enters the network, leaves the network at a predetermined time, runs the commercial and returns to the network, or local program segment. Mentioned here was a key item in the chain—operators. Not many headends have operators. Another key item is network. The CATV community has a reported 25 networks providing commercial availabilities to each headend. (Some broadcast stations program more than one network, too, but not at the same time.)

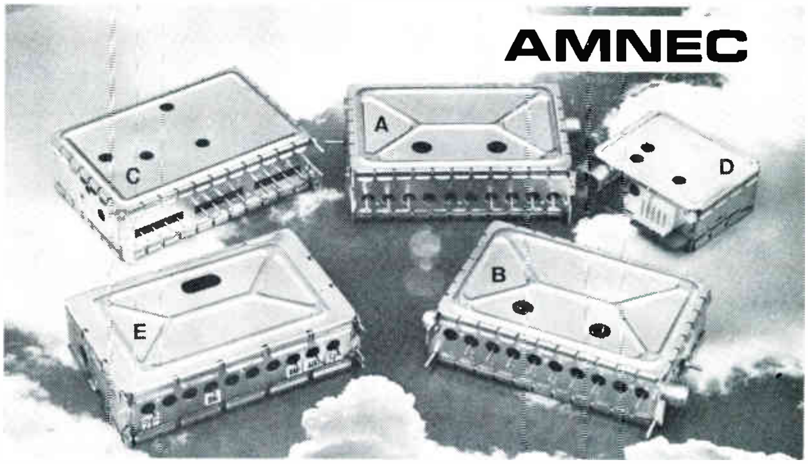
Clearly, more sophisticated high-speed signaling and control methods must be devised, and there must be communication between the various program sources issuing the commands as to where the commands are placed, the speed at which they are sent, and even, perhaps, which coding schemes are being used.

Examples of possible command paths are the vertical blanking interval (VBI), the program audio channel (either audible, subaudible, or super audible) or a separate subcarrier channel.

Equipment designed for the vertical interval is usually more expensive and complex. Any command path in the program audio is somewhat limited by objectionable audible tones or by a smaller number of switch functions. A command path on a separate subcarrier is generally not overly expensive, has enough bandwidth for very high data rates or switch functions and is inherently reliable. It does use up a potentially lucrative communications channel unless frequency is considered carefully. Perhaps more important than where the command path is located is that enough bandwidth be allocated for sufficient data rates for device control.

Device control was really the crux of the subcommittee investigation. The device should be a television tape recorder and in many cases its operation can be unattended to moderately attended. As pointed out earlier, there will probably be more than one program source with commercial availabilities and, as always, each source will have different spot length and position formats. There will be some form of logging required and, perhaps, a method for alerting systems to last minute schedule changes. In other words, each programmer and each system operator has certain minimum and similar tasks. It also is prudent to identify and coordinate minimum technical issues faced by manufacturers, programmers and system operators through participation in available trade groups. ■





Low power, high risk

By Katherine Rutkowski,
Director, Technical Services,
National Cable Television Association

Can you "crystal-ball" when your cable system will suffer from a signal interference problem? Chances are in 1985 it will be when a member of the quickly growing class of low-cost, low power TV stations transmits a VHF broadcast signal in your system's delivery area. Initially caught in an applications logjam, the Federal Communications Commission has solved its administrative nightmare and is processing LPTV licenses with increasing speed. The FCC eventually plans to license over 4,000 UHF and VHF LPTV stations —500 should be in operation by the end of 1985.

Although low power stations are secondary services and thus not permitted to interfere with full-service stations, existing cable systems are responsible for correcting LPTV-caused interference in the cable distribution system and at subscribers' TV sets. Cable systems are vulnerable to signal interference when a LPTV station:

- broadcasts on a converter output channel,
- transmits too near the headend,
- uses a distant signal's frequency while located between the headend and a non-microwaved imported distant signal,
- operates on a cable-transmitted channel near vulnerable (ingress permitting) portions of the system's distribution plant.

While the FCC grants the first user of a frequency priority (when interference precludes joint use), it is still vital that operators become aware of any interference potential from planned LPTV broadcast services and settle matters *prior* to the granting of the LPTV operating license. Petitions to Deny are reviewed on a case-by-case basis and are not issued lightly. Petitioners must offer "substantive supporting engineering documentation or a well-founded procedural objection" and offer it within brief filing "windows."

Since it's unlikely that future LPTV neighbors will knock on the door and ask where it would be convenient for them to raise a tower, the onus is on cable operators to look for signs of pending intent to broadcast and to arrive at an informal settlement prior to start-up. In a practical sense, once a low power station starts to cause interference, a system's cable service will be disrupted until the problem can be remedied, a lengthy and sometimes impossible task.

Roy Ehman of Storer Cable will present detailed technical ramifications of LPTV signal interference to CATV systems along with suggestions for preventative measures in part two of this two-part series to be printed in *CED*'s January issue. This paper addresses LPTV license procedures and points out important filing "windows" in which cable operators may file a Petition to Deny at the Commission. A resources list is included to help operators set up an LPTV awareness and monitoring program.

Information on potential LPTV stations can be found in the local newspapers in a cable system's vicinity and by reviewing FCC license applications lists and public notices. Easier said than done. You have to check back files *and* keep up with current material—and quickly[1].

The FCC publicizes applications for new broadcast services. LPTV applicants also must publish a notice of their license application and some details of the planned service (including output channel and proposed power) in local newspapers. At various points and in more than one place there are, or will be, printed statements with details on planned LPTV stations, including planned channel number.

Look for LPTV notices of intent to transmit:

- in local newspapers

LPTV applicants are obliged to publish details of their planned service in local newspapers at the time of their application filing, at least once during a two-week period. Check the papers' or local library's collections for back issues.

- in FCC lists and public notices

As the flow chart on page 29 indicates, in LPTV's three-year history, the FCC has adjusted its licensing process more than once. Since this chart was prepared, even speedier licensing procedures have been adopted. LPTV applicants will no longer be placed on a cutoff list. As soon as current applications are completed—probably late 1985—the Commission will give 30 days public notice and then open a five-day "window" for competing applications. Lotteries will continue to be held to choose LPTV licensees in areas where competing applications have been filed.

Review relevant back-issues of FCC Public Notices (the cut-off lists may list data on thousands of applications) at the Commission's headquarters in the Public Reference Room (room 239), 1919 M Street, N.W., Washington, D.C. 20554. Telephone: (202)632-7566.

To order back issues of FCC Public Notices, phone International Transcription Services (703)352-2400 in Fairfax, Va. For a fee, this firm will also flag and forward current notices pertaining to LPTV on a subscription basis.

FCC "cut-off" lists

Prior to processing, most applications are (until late 1985, after pending applications are removed and the shorter filing window procedures become effective) placed on an "A" or "B" cut-off list. For a 30-day period after the list is issued, competing applicants can apply for a license in the same service area.

FCC "proposed grant lists"

Formal title: Low power/television translators: proposed construction permits.

Pay particular attention to release dates. If all efforts to effect an informal compromise with an LPTV applicant have failed, there is an important notice of a 30-day "window" in which to file a petition to deny at the FCC.

FCC "announcement of lottery date" notices

Formal heading: Low power television and television translator applications accepted for filing and notification of lottery date to award construction permit.

These pubic notices are issued 15-days prior to a lottery. No petitions to deny will be entertained until after the lottery takes place.

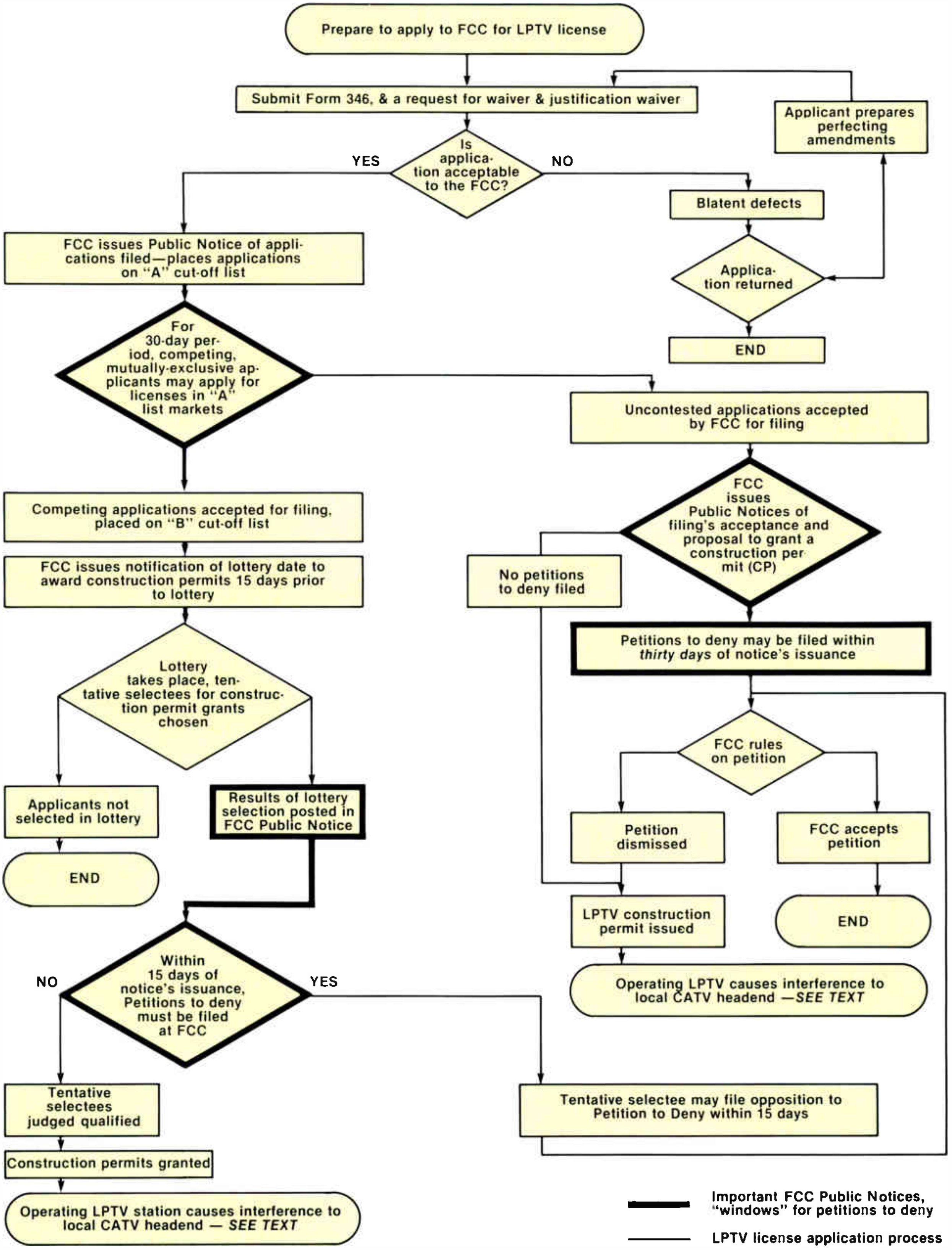
FCC "notice of selection"

Formal title: Notice of selection by lottery; mutually exclusive cases involving low power television and television translator applications.

This notice cites results of the lottery and lists tentative selectees for construction permit grants. If all efforts to effect an informal compromise with an LPTV applicant have failed, this gives notice of a 15-day "window" in which to file a petition to deny at the FCC.

As in mine-sweeping, thoroughness and timing count when tracking a potentially troublesome LPTV license application. It's important to know the

LPTV License Application Process



LPTV's technical plans as early and as completely as possible.

If an applicant needs to be found and can't be found in the local telephone directory or through information offered in the ad the applicant placed in the local newspaper, check with the Low Power Television Branch at the FCC for more help. It may be able to provide details on single applications. LPTV Branch telephone numbers in Washington, D.C.: (202)632-3894 or 7426.

- other background information

In 1982, the Commission issued a Report and Order that detailed types of protection from LPTV interference offered to cable systems. (Generally, the first user of the frequency is given priority when interference precludes joint use—especially in converter output channel or existing headend situations. LPTV operators violating technical operating standards are responsible for correcting those conditions. CATV operators must correct interference to the cable distribution system at subscribers' sets.)

The Report and Order was printed in the Federal Register/vol. 47, no. 96/ Tuesday May 18, 1982. The docket number is 78-253; "An Inquiry into the Future Role of Low Power Television Broadcasting and Television Translators in the National Telecommunications System."

Copies of the Federal Register are available in most public libraries or may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. You may also call the NCTA Science & Technology Office for reprints of the December 1982 issue of the newsletter *TECHLINE*.

Though time-consuming and complex, it's important for cable operators to protect their systems from the threat of signal interference by instituting an "ounce of prevention" plan to keep track of low power and translator license applications.

[1] Resources permitting, attorneys, frequency consultant firms or engineering consultants may be contracted to safeguard your system(s) from potential LPTV interference. ■

LPTV update

LPTV service has been called local origination for broadcasters and "superstations without cable." LPTV is a new class of local television service created by the FCC in 1982 to open up new opportunities—particulary for non-commercial ventures and minority entrepreneurs—for increased programming diversity in both rural and urban areas. LPTV utilizes translator technology to transmit (at limited watts and over unused VHF and UHF channels) broadcast signals over a 10- to 15-mile radius. Unlike translators, low power stations are allowed to originate programming (including subscription programming) as well as retransmit the programs of other stations as long as they don't interfere with full-service broadcasts.

How many are operating now?

About 155 low-power stations are on the air now in the continental United States. Over 200 have been issued construction permits. The FCC handles 250 to 350 applications a month and has instituted smoother processing methods that allow 30 to 50 new licenses to be issued each month. Many use a UHF channel, but a significant minority have been granted use of channels two or three.

Simplified application procedures, relaxed technical rules and lower-than-network operating costs have lured thousands of would-be William Paleys to file low power applications with the Commission. The latest filing "window" reaped 25,000 entries. Recent reports indicate that the low-cost promise that was part of LPTV's early appeal was overly optimistic. ■

STANDARD COMPONENTS PRESENTS IMAGICON 78 Channel Converter

With Digital Touch Button Tuning

Standard Components is pleased to announce their new trim quality-crafted mini set-top converter for the CATV market, and to insure its unmatched performance and reliability throughout the industry. Our goal in producing the Imagicon is to achieve product excellence while remaining price competitive. Forty years of professional RF tuner engineering design and manufacturing experience contributed to the realization of our goal.

To meet a variety of current systems' needs we offer the Imagicon model in 37, 54, 60, 70, and 78 forward channel versions. In addition all model versions are offered as basic converters - this allows every type of system to select only the features that are needed. The options that are available include 3-button and 17-button infra-red remote controls both with off/on relay for TV. The 17-button also has random access and program memory for 6 favorite channels. Other options include; SAW resonator, A-B switch, HRC frequencies or inverted carriers. Call or write us today for more information.

Standard Components, Inc 2201 Landmeier Rd., Elk Grove Village, IL 60007 ● 312/593-3080

Reader Service Number 7

The history of RF converters

Reprinted with permission of the National Cable Television Association's Science and Technology Dept. This article originally appeared in the NCTA's 1984 technical paper series.

By James O. Farmer
Scientific-Atlanta Inc.

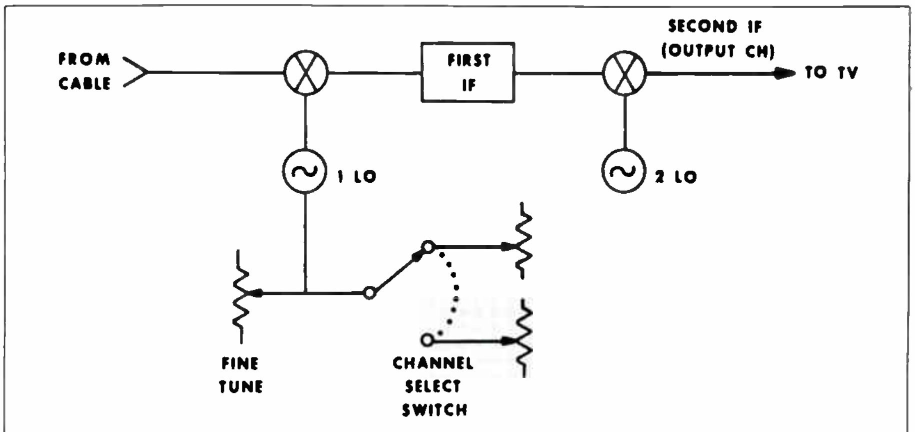


Figure 1 Early set-top converter

The first set-top converters used an architecture shown in Figure 1. Signals from the cable were sent through a low pass filter (not shown) to a balanced mixer. Here, they were mixed with signals from a local oscillator with a frequency higher than that of the incoming signal. The resultant first IF was at some conveniently high frequency, usually in the lower portion of the UHF spectrum. This high IF frequency was chosen over the much lower IF used in TV receivers because it simplified the input filter and prevented LO radiation in-band.

The first IF signal, after amplification and filtering, was mixed with a fixed tuned second local oscillator to produce a second IF frequency, which was the same frequency as channel 2, 3 or 4. Recently, many people have stopped using channel 2 as an output because it is the second harmonic of the citizens band.

The first local oscillator was frequency-controlled by a varactor diode. The varactor received its bias from one of a number of potentiometers, one for each channel. Because of the instability of the two local oscillators and the potentiometer voltages, a fine tuning control also had to be provided. This fine tuning voltage was added to the control voltage selected by the channel select switch.

Even today, this architecture is utilized in economy lines of set-top converters. However, there are several shortcomings. For example, the voltage to the varactor must be controlled very carefully. In the case of a wired remote control unit, the variability of contact resistance precludes use of plug-in cords. Adjusting the fine tuning also can be difficult for some subscribers. Security is marginal, because descrambler authorization must be mechanically coupled with the channel select switch.

These drawbacks have prompted manufacturers to develop new architectures for set-top converters, leading to renaming the box the set-top terminal.

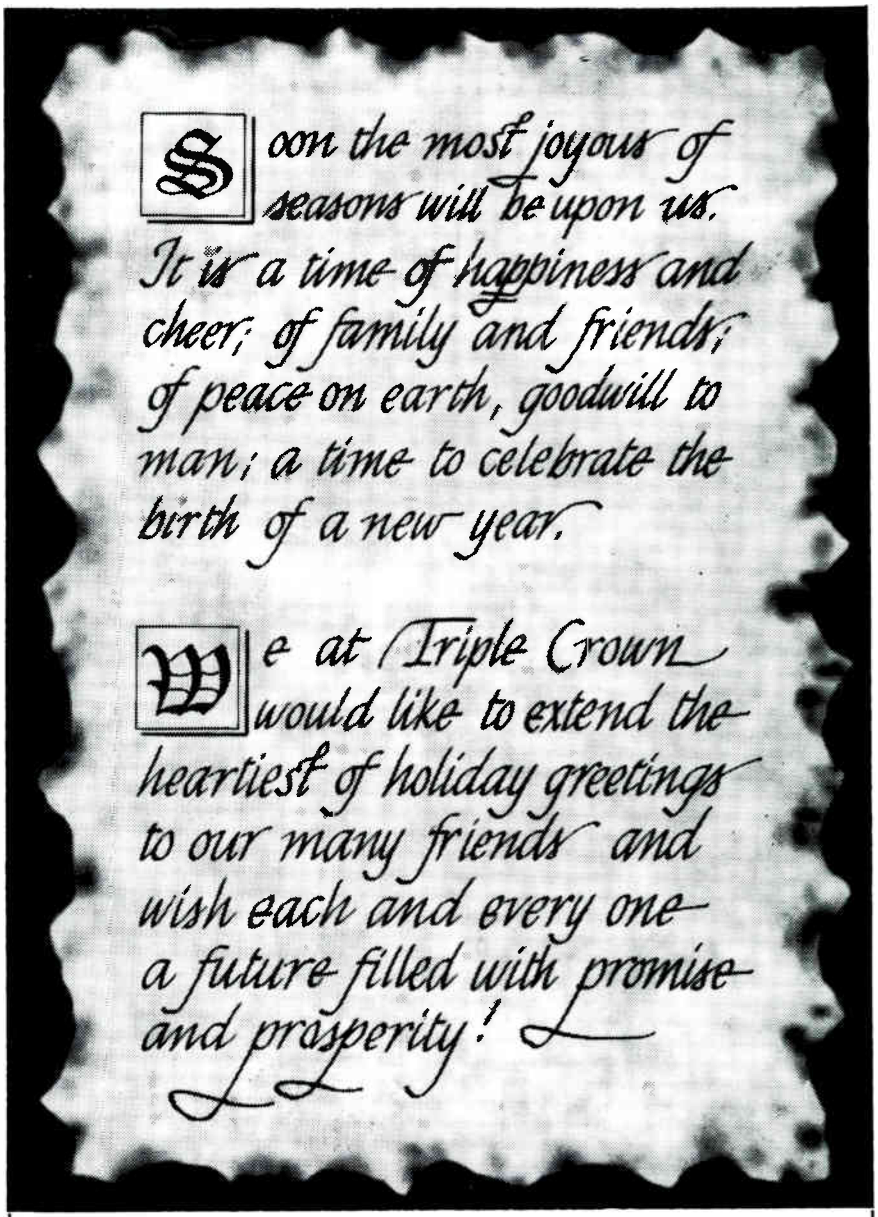
Figure 2 shows the basic architecture of the new terminals, which are microprocessor-controlled. The RF path is similar to the set-top converter, with the exception of the first IF frequencies. Better set-top terminals have replaced manual fine tuning with automatic fine tuning, and some set-tops have added adjacent carrier traps.

When the number of channels went from 35 to 54 and more, many manufacturers abandoned potentiometer tuning of the first local oscillator. Phase-locked loop (PLL) tuning is now almost universal in terminals. In a phaselocked system, the local oscillator frequency is divided to a low frequency and then compared to a reference frequency. If the two differ, even in phase (the integral of frequency), a correction voltage is sent to the local oscillator, forcing it to the correct frequency. By changing the division ratio ("modulus" of the counter), the local oscillator is forced to tune to the desired frequency. Long-term stability is as good as that of the crystal-controlled reference frequency.

Thus, each time the tuned channel is changed, a new tuning word must be supplied to the PLL. This is usually supplied from a single chip microcomputer. Lighted channel displays (usually LEDs) are utilized and controlled by the microcomputer. The keypad used for channel entry and other functions also is scanned by the microcomputer. Wireless remote controls using infrared signaling are another option. The microprocessor accepts the modulated signal from the remote control receiver and interprets it.

Figure 3 shows the same set-top terminal except that now we have added descrambling and addressability functions. No additional RF connections are necessary, since virtually all current scrambling systems utilize in-band timing to permit an unlimited number of scrambled channels at no incremental cost per channel. The descrambler must be authorized from the microcomputer in such a way as to preclude tampering that forces the descrambler to turn on. We are finding that some scrambling systems appear to coexist reasonably well with stereo, but this should be discussed with your system supplier.

A data carrier on the cable is frequency shift-keyed (FSK) with data representing a box address and information intended for that box, or with information intended for all boxes (a global command). The data receiver is lightly coupled to the incoming cable. This receiver is constructed similarly to a single channel FM radio through the receiver discriminator, except that a crystal oscillator is used for long-term stability. Special techniques help to re-



duce local oscillator emission. After the discriminator, a low pass filter and comparator are used to convert the demodulated signal to logic levels. The logic level encoded signal from the receiver is supplied to the address decoding logic. This circuit, under microcomputer control, determines whether or not the incoming information is intended for the terminal. If so, the updated transmitted information is stored in non-volatile memory, an electrically alterable read-only memory that retains stored data under power-off conditions. This is important because neither the subscriber nor the cable operator should be bothered with having to initiate the memory update after every power loss.

The digital architecture of an addressable terminal is shown in Figure 4. At the headend the data for all terminals is formated into a modified Manchester code, in which information is carried as a logic transition for each clock pulse. If a 1 is to be transmitted, an extra transition is inserted between clock pulses. A longer period with no transition indicates a "start of message" pulse. This format is inherently "self-clocking" and exhibits high tolerance for both noise and timing errors.

The Manchester encoded data is frequency shift keyed onto a carrier. At the terminal, this carrier is demodulated in a receiver not too unlike an FM radio. The output is applied to a custom IC in the address decoding logic. This chip translates the Manchester encoded information into parallel bytes, which are shifted into a microcomputer for interpretation.

Error detection techniques are utilized to prevent erroneous data reception. When the decoding logic interprets that it has received valid information, the information is loaded into the non-volatile memory. If the new information affects the current status of the terminal (e.g., channel tuned to), then the terminal immediately changes its status.

Pay-per-view functions also are

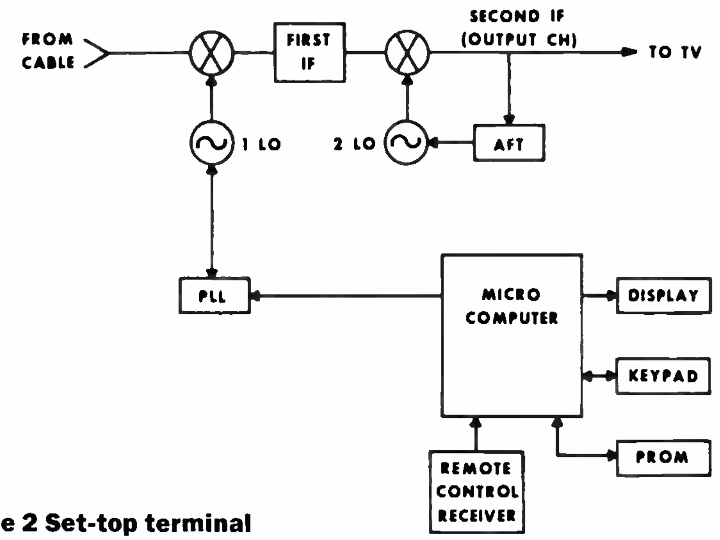


Figure 2 Set-top terminal

Comm/Scope's Plenumax™ Plenum Cable.

Now you can do it without conduit–and still have money to burn!

The Cable TV Industry now has a new channel to go through that can eliminate costly conduit cable applications – forever!

If you're still protecting your cable with conduit in low power commercial applications, your time and money could be going up in smoke. Because the installed cost of new Plenumax Plenum is lower than that of traditional cable and conduit systems. Which is important when you consider that more and more cities are incorporating safer, more stringent rules to their fire codes.

Comm/Scope's Plenumax Plenum cable saves installation time and labor, requires less installation space plus no special tools or training are required. It eliminates conduit costs forever, simply because there's no need for it! UL-approved Plenumax cable has a tough, Teflon® jacket to protect the cable from fire and smoke damage. It's strong, durable, corrosion resistant, abrasion resistant and flexible enough to take the toughest bumps, curves and corners. And the high dielectric performance of Plenumax Plenum is not affected by time and temperature. Comm/Scope's Plenumax Plenum cable is also available in a variety of cable types: RG-59 (shown in illustration) and RG-6, RG-11, Dual RG-59, and Dual RG-6.

So give us a call today. And take the heat off your next installation budget with Comm/Scope's Plenumax Plenum cable.

®Du Pont's registered trademark for its fluorocarbon resin

M/A-COM

Comm/Scope Marketing, Inc.

Box 199-A
Catawba, N.C. 28609
Contact Specialty Cable Sales at
1-800-438-3335
Reader Service Number 28

stored in non-volatile memory in the form of a table containing pre-authorized channel and program numbers. Each pay-per-view program is pre-assigned a channel number, and within that channel, a program number. When a subscriber requests a certain program, it is entered into the table in the terminal's non-volatile memory via the headend computer. This entry is made at the time of the request, which may be hours, weeks or even months before the event. When the event begins, a global command is sent with the channel and program numbers contained within it. Upon receipt of this command, each terminal searches its non-volatile memory. If a match is found, the program is authorized. At the end of the program, another command cancels the authorization. A comprehensive set of commands generated at the headend makes sure the non-volatile memory in each terminal contains current requests only, meanwhile purging the old and cancelled requests.

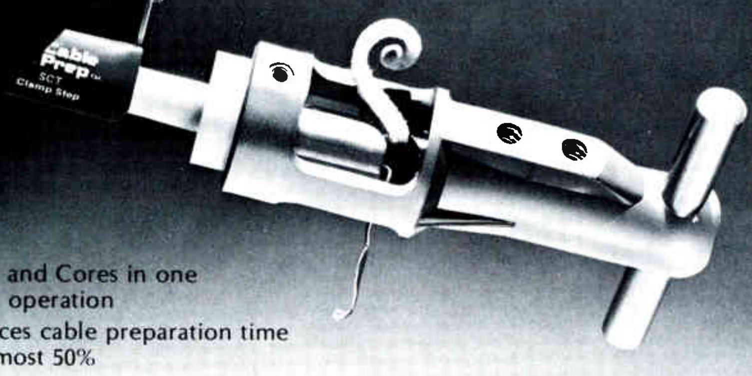
A series of commands and responses makes it extremely difficult for a subscriber or third party to use an unauthorized terminal, while also ensuring that an authorized terminal stays active.

Serial communications are utilized between different elements within the terminal. The microcomputer shown interfaces with the address decoding logic through a non-standard three wire serial interface with security check. The logic is such that no line can be tied high or low to "trick" the system. Interfacing between the address decoding logic and the non-volatile memory is done via a very complex serial format that would be difficult for a pirate to duplicate. Again, both logic 1 and 0 levels are required for a successful transaction.

Other features of the digital architecture are shown in Figure 4. The microcomputer reads commands inserted via the keypad or remote control receiver. A programmable read-only memory (PROM) stores channel tuning data that permits "customization" of channel lineups and parental discretion information. All communication between integrated circuits is done through serial ports, and valid communication requires a series of 1s and 0s. This eliminates the possibility of tying a line high or low to force unauthorized operation.

Remote control

An important option today is wireless remote control. Earlier generations of TVs remote control and a few set-top units utilized ultrasonic remote control. However, ultrasonic remote control suffered from blockage and false triggering due to high frequency noises



Introducing the 350sx Earth Saw:

Now you can trench asphalt and concrete with a machine less than 36-inches wide.

1 **The 350sx Earth Saw cuts asphalt, concrete or rock in confined areas larger equipment can't reach.** The entire unit is less than 36-inches wide. A hydraulic swing cylinder enables the saw to track directly in the path of the machine, as well as helping make tight turns.

2 **The 350sx Earth Saw cuts 2½, 3⅛, or 5-inches wide and 18-inches deep.** The cutting wheel is segmented to increase or decrease the width of the cut by changing segments with simple hand tools.

3 **It's powered by a hydraulic motor which is mounted directly to the cutting wheel.** This eliminates the need for chains, sprockets and support bearings, helping to improve efficiency and reduce maintenance.

4 **The all-new 350sx Earth Saw cuts a neat and clean trench.** Two chutes discharge spoils to one side; the front chute handles most of the spoils and the rear chute discharges the rest. This means a cleaner trench, and less clean-up time.

5 **The 350sx Earth Saw is easy to operate and easy to maintain.** The A341 Earth Saw mounts without modification to the 350sx vibratory plow; two pins, one bolt and seven existing hoses are all it takes to disconnect the plow and connect the saw. It operates with the 350sx's existing controls. And there are only four grease zerks on the Earth Saw module, so routine maintenance is kept to a minimum.

Reader Service Number 36

6 **It's backed by the Ditch Witch dealer organization.** The largest specialized parts and service organization of its kind in the world. Which means you get service when you need it, with trained mechanics who are ready to serve you in the shop or in the field.

Increased jobsite versatility, effective spoils removal, dependable performance and easy maintenance are all good reasons why the A341 Earth Saw is the perfect machine for trenching through paved surfaces.

®
The Charles Machine Works, Inc.
P.O. Box 66, Perry, Oklahoma 73077
Phone: (405) 336-4402

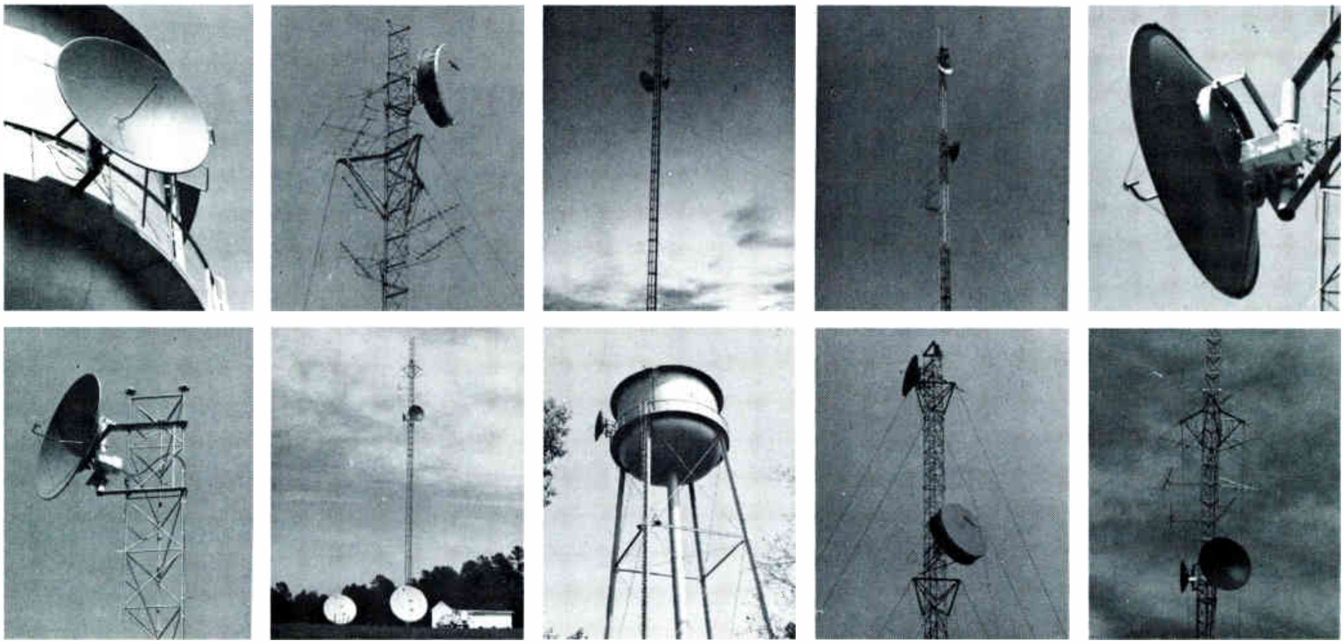
For more information contact:

See us at the Western Show, booth 1615

Ditch Witch®

Worth more, every day.

If you thought microwaves were too rich for your system...look again!



Micro-Beam™—Performance proven in over a year of trouble-free, revenue producing operation at 9 different sites.

Look at MICRO-BEAM™

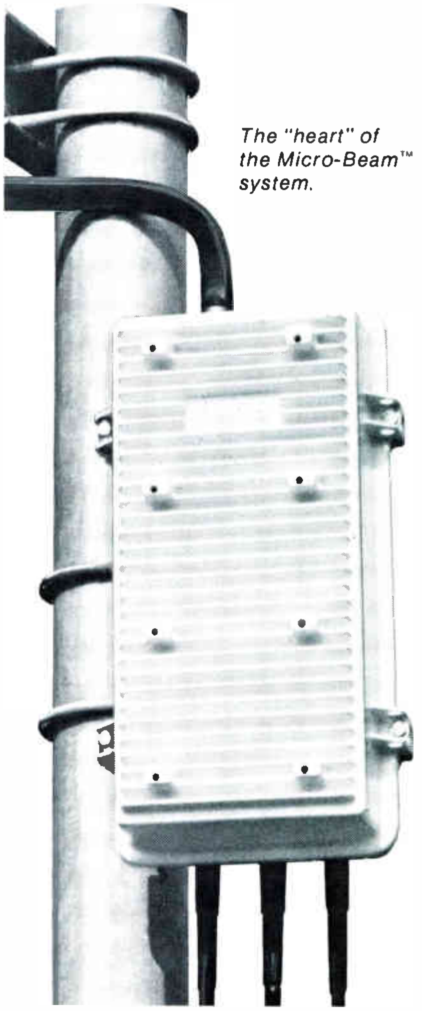
Micro-Beam™ (patent pending) is a new flexible and cost-efficient CARS Band signal delivery system ideally suited for CATV plant expansion.

Micro-Beam™ transmission allows the cable operator to skip on by long cascades. Start with a fresh signal anywhere in the system. Go beyond the limits of subscriber density, geographic, or man-made barriers—without expensive heated/air-conditioned transmitter buildings.

Using just one Micro-Beam™ transmitter (mounted behind the antenna) you can send as many as 52 channels up to 14.5 miles away! And now, with our new Micro-Beam Plus™ systems, you can transmit a full 52 channels up to 10.5 miles, in two different directions. All for less than half the cost of conventional microwave systems.

Micro-Beam™ gives you multi-channel microwave transmission of your entire service from a single outdoor unit which can be located practically anywhere in your plant.

How many new runs are you planning? Take a look at how much it's going to cost you. Then take a look at Micro-Beam™. For more details call, or write:



The "heart" of the Micro-Beam™ system.

channel master satellite systems

Subsidiary of Avnet, Inc., P.O. Box 1416
Smithfield, North Carolina 27577 (919) 934-9711

See us at the Western Show, booth 1870

Reader Service Number 32

such as keys jingling. Also, ultrasonic waves tended to be very non-discriminating about where they went, sometimes activating a TV in the wrong room. Consequently, most modern remote control systems utilize infrared remote control.

Figure 5 shows a block diagram of the transmitter and receiver system. A circuit in the transmitter IC scans the remote transmitter keypad. When a key is depressed, a code representing the key is generated. This code is pulse-width modulated (PWM), meaning that a series of pulses is generated—a long pulse representing a logic 0 and short pulse representing a logic 1. This train of pulses then frequency modulates a 39 kHz carrier, which on/off (AM) modulates an infrared light-emitting diode.

In the receiver, a photo transistor converts the light pulses back to the frequency modulated carrier. This carrier then is demodulated by a discriminator, and the resultant PWM pulses are shaped by a level detector. The pulses are supplied to the microcomputer on an interrupt input. The microprocessor decodes the pulses to determine which key was depressed.

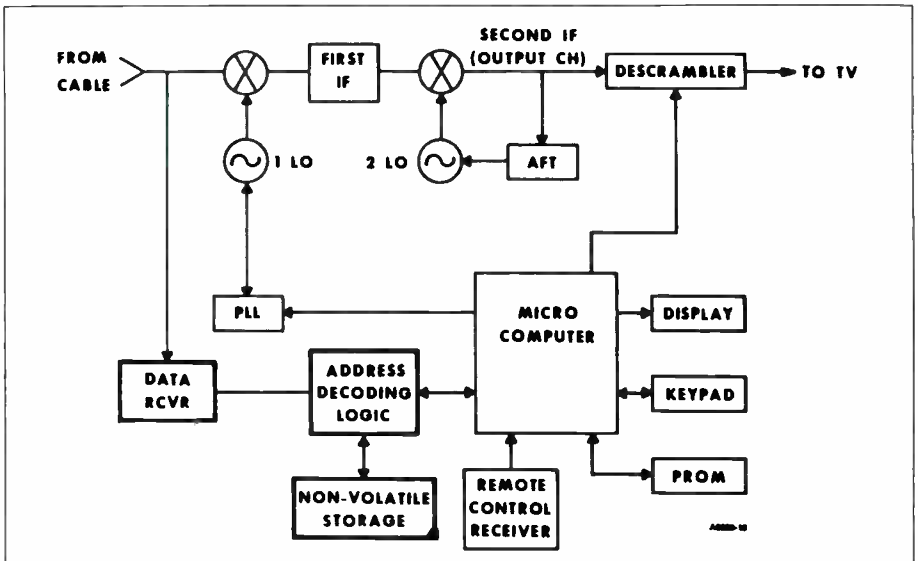


Figure 3 Addressable terminal

Since many TV receivers today utilize infrared remote control, a danger exists that interference will develop between the terminal and TV remote controls. Unfortunately, no clearinghouse has existed where one can obtain technical parameters of all present and planned remote control systems so there is a chance that a conflict will arise sooner. However, many TV remote control systems exhibit some common elements. A device which is reasonably safe from overlap with a TV system also was developed in cooperation with a large remote control manufacturer.

Referring again to Figure 5, many remote control systems utilize an FSK carrier at about 39 kHz. By changing the carrier frequency, some discrimination is obtained. Further security is obtained by transmitting both true and comple-

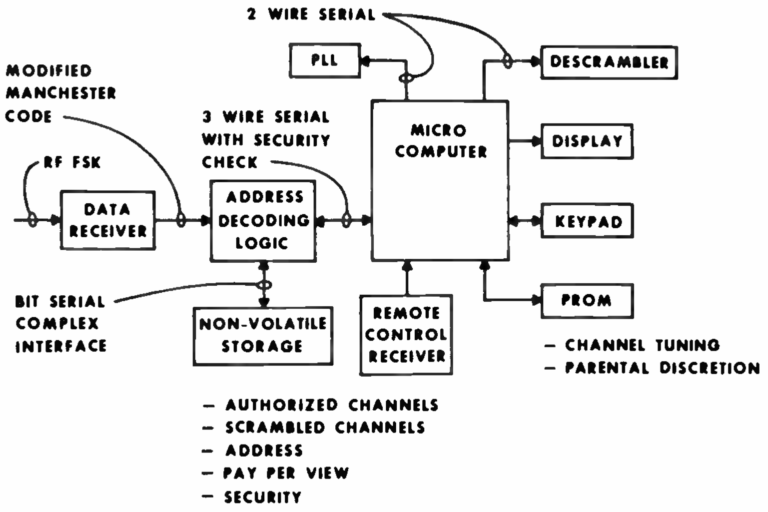


Figure 4 Addressable digital architecture

ment representation of the button pressed, with the order of the bits different from that known to be used in TV receivers. None of these counter measures guarantee that interference will never occur, but they do move the odds in our favor.

Tuning techniques

An almost universal attribute of today's set-top terminals is control of the first local oscillator frequency by a phaselocked loop (PLL). A typical terminal that tunes from 54 to 450 MHz has its first local oscillator frequency range from 668 to 1058 MHz. (An IF of 608-614 MHz is used, as this band is reserved for radio astronomy, precluding licensing of UHF transmitters at channel 37.) One way to control the oscillator within an accuracy of 10 kHz is to divide its frequency by 256 and then compare it to a reference in a CMOS phaselocked loop. In some cases, the phaselocked loop is integral to the microcomputer. Tuning is accomplished by changing the modulus of the counter fed by the prescaler. The tuning word required often is stored in PROM, permitting "customization" of the channel lineup for every cable system. The PLL reference is generated by a crystal oscillator, which also serves as the clock for the microcomputer.

The PLL technique is excellent for providing high stability on multiple frequencies. On the other hand, PLLs have some drawbacks. As one attempts to tune in successively smaller steps, two undesirable things happen. First, more information about each tuned frequency must be stored (i.e., the number of bits in the variable modulus counter increases), which raises costs. Secondly, the loop bandwidth must be set lower, resulting in a longer acquisition time (e.g., from one channel to another) and potential problems with uncorrected low frequency noise.

Thus, the loop designer is forced to trade off tuning increment for storage requirement and acquisition time. We have found that a good trade-off exists for a 1 MHz tuning increment, but this leaves the problem of accommodating HRC systems, in which the frequency of each picture carrier is 0.25 MHz deviant from the nearest 1 MHz increment of a normally configured system. (A fixed 0.25 MHz offset, e.g., 55.25 MHz, is taken care of in selection of the IF frequency. But then what do we do in HRC where this 0.25 MHz offset goes away?)

Also, how should a system which has offset a few tens or hundreds of kHz on one or more channels to avoid a troublesome aviation frequency be handled? In the days of pot-tuned set-tops, a few pots were readjusted, or the poor subscriber had to fine tune his set every time he came to an offset channel. With PLLs and demand for no fine tuning, this problem must be solved another way. One answer is to enclose the second local oscillator within an automatic fine tuning (AFT) loop. This technique applies the output picture carrier to a discriminator with an output that is a voltage proportional to frequency error. This voltage is amplified and applied to the second local oscillator to control its frequency.

Thus, the PLL tunes the first local oscillator to the nearest MHz, ensuring that the signal at the first IF is within ±0.5 MHz of nominal. The AFC is designed with adequate acquisition range to ensure that it will take out the remaining frequency error. Figure 6 helps illustrate this concept. This is a portion of a spectrum plot of two cable systems —one having standard carriers (on the right), and the other having HRC carriers, spaced 1.25 MHz lower in frequency. Shown below these two frequencies are the equivalent STT tuning frequencies. For the standard case, the "exact" frequency can be tuned. How-

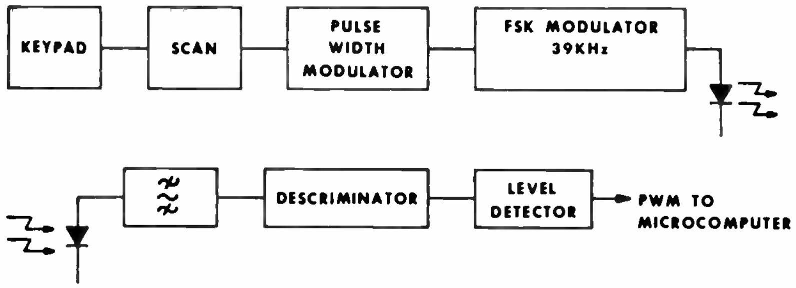


Figure 5 Remote control system

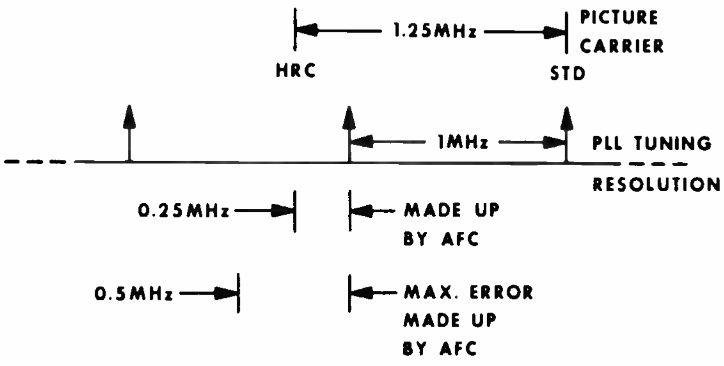
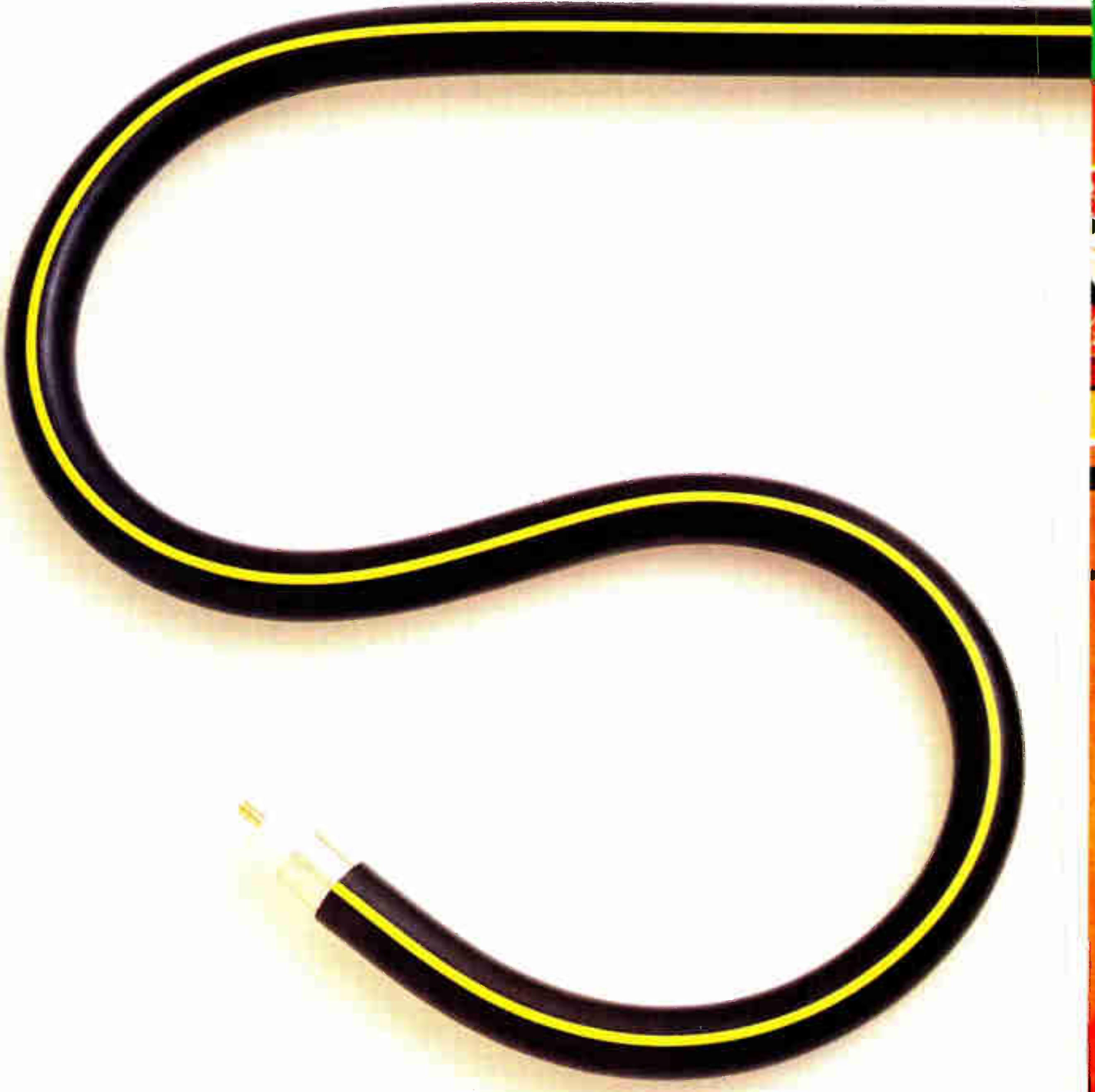
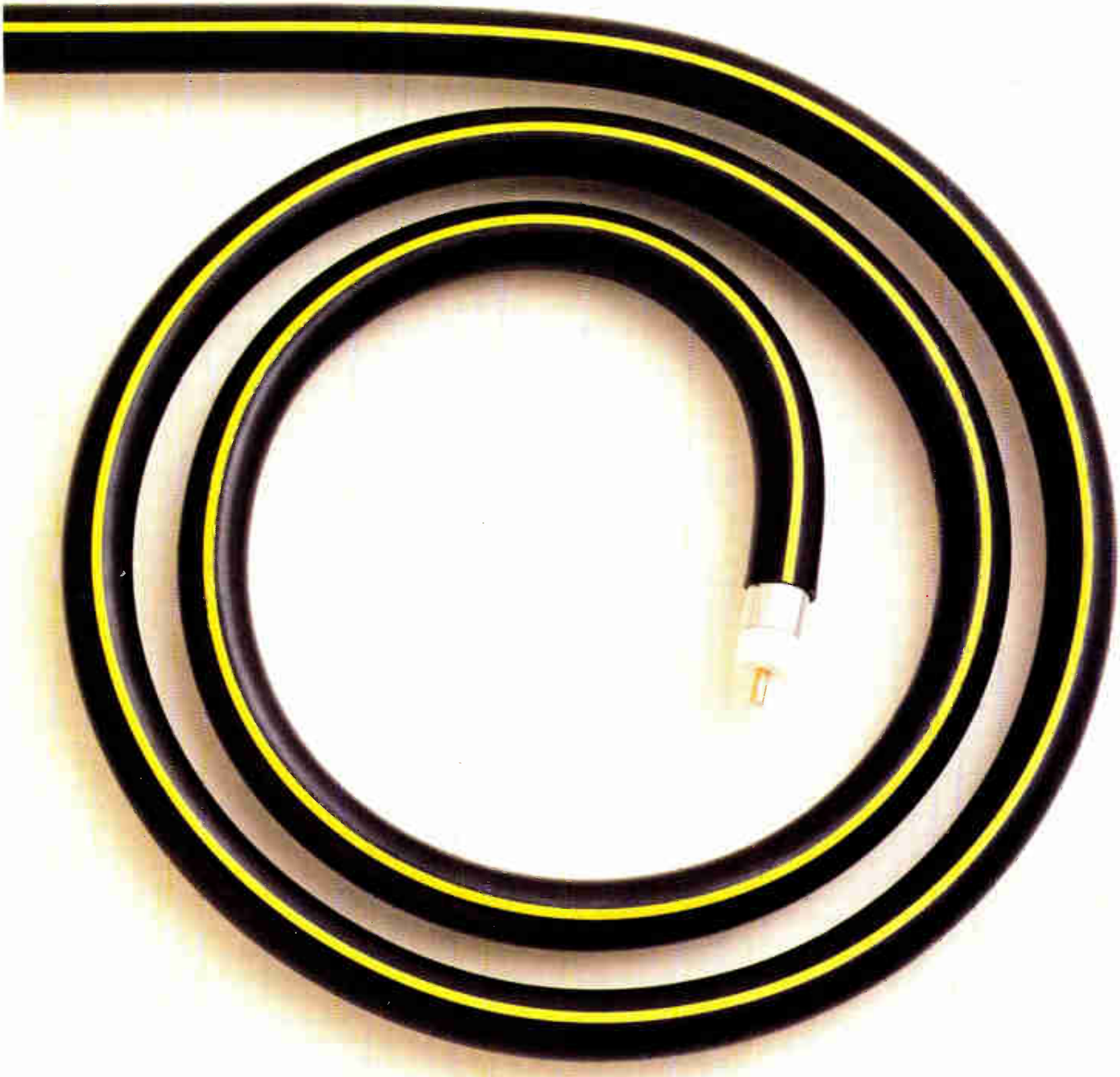


Figure 6 Accommodating HRC


Panasonic
58
CHANNEL
ON/OFF



HE COAX TO CHOOSE WS YOU A CURVE.



It's great for those rotten jobs installation crews hate. And, since it doesn't cost a whole lot more than standard cable, it can even pay for itself in labor savings and splicing hardware alone.

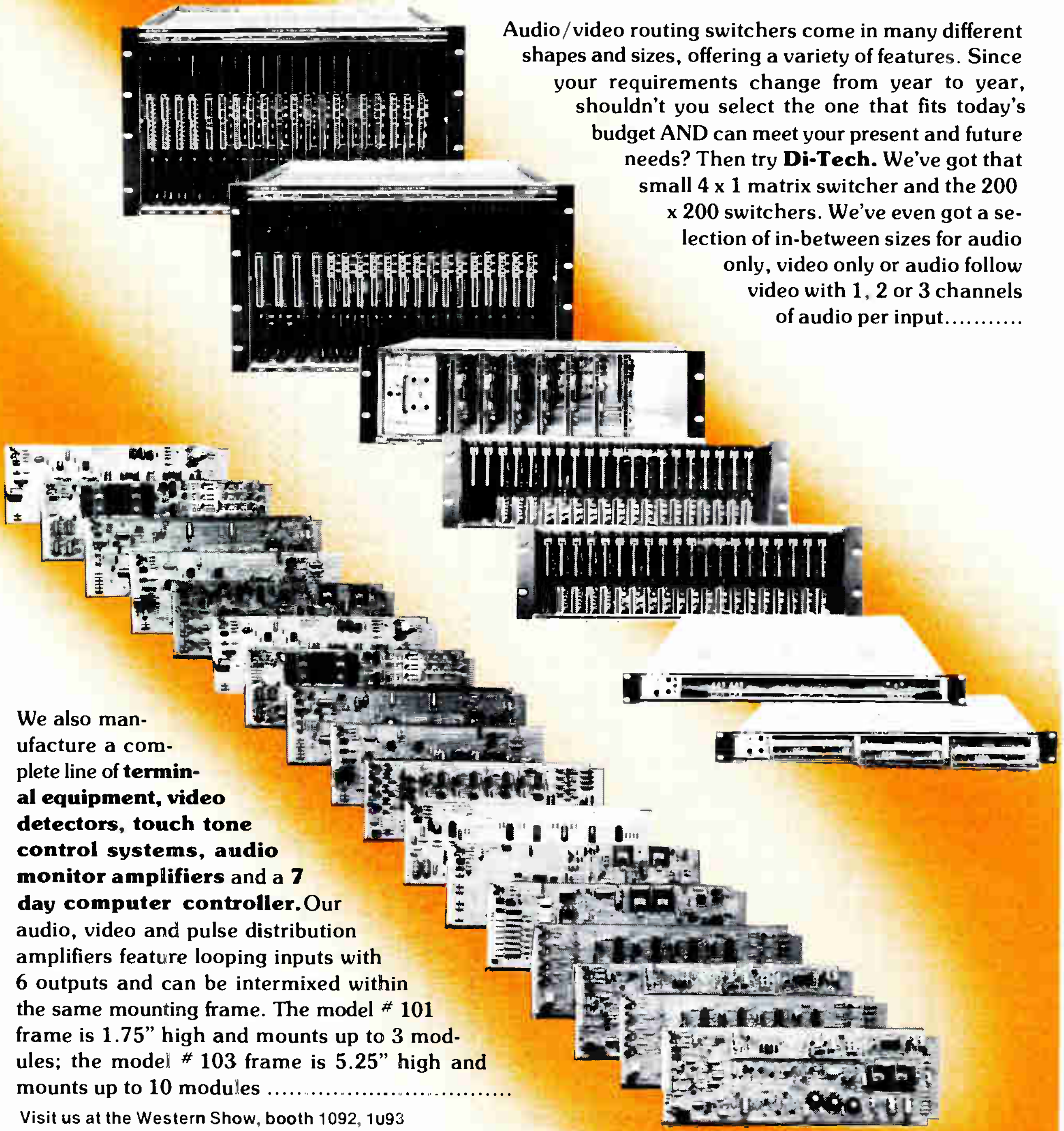
If you'd like to bend a piece for yourself call 1-800-438-3331 and ask for QR. It makes straight work out of life's curves.

M/A-COM

M/A-COM Cable Home Group, PO Box 1729, Hickory, NC 28603, 800-438-3331, in NC 800-222-6808, telex: 802-166

Reader Service Number 35

Imagine The Features That Will Answer Your Present And Future Needs ... Then Call **Di-Tech**



Audio/video routing switchers come in many different shapes and sizes, offering a variety of features. Since your requirements change from year to year, shouldn't you select the one that fits today's budget AND can meet your present and future needs? Then try **Di-Tech.** We've got that small 4 x 1 matrix switcher and the 200 x 200 switchers. We've even got a selection of in-between sizes for audio only, video only or audio follow video with 1, 2 or 3 channels of audio per input..........

We also manufacture a complete line of **terminal equipment, video detectors, touch tone control systems, audio monitor amplifiers** and a **7 day computer controller.** Our audio, video and pulse distribution amplifiers feature looping inputs with 6 outputs and can be intermixed within the same mounting frame. The model # 101 frame is 1.75" high and mounts up to 3 modules; the model # 103 frame is 5.25" high and mounts up to 10 modules ....

Visit us at the Western Show, booth 1092, 1093

Whatever your present or future needs are, call **Di-Tech** for the high quality, reliable, easy-to-operate answer.

di-tech

*our **NEW,** bigger location:*
48 JEFRYN BOULEVARD
DEER PARK, N.Y. 11729
TEL. # (516) 667-6300

Reader Service Number 31

ever, in the HRC case, there is a 0.25 MHz error caused by the 1 MHz tuning resolution. Turning to the AFC circuit is more than able to make up for this error in the conversion to output channel.

Implementation of such an AFT loop is not a job for the faint of heart. Should the second local oscillator drift or be pulled too far, the AFT may lock to the on-channel or lower adjacent sound carriers. Should the frequency pull-in range become too low, the unit could drift to the point of not locking on frequency. And, of course, AFT discriminators have calibration errors associated with them. All of these conditions must be controlled in design and production if the AFT technique is to be successful.

Key RF characteristics

No discussion of set-top terminals would be complete without considering RF specifications and their relationship to system performance. Rather than plod through the long list of specifications normally a part of any converter discussion, I will concentrate on a few things that either have developed as issues or that continue to confound many systems engineers as to their effect on system performance.

Frequency response

We all know that a terminal should exhibit flat frequency response across the channel in question. But what about on adjacent channels? Ideally, the terminal should have zero response at the adjacent channel, but this would yield a more expensive terminal without offsetting technical merit. Most older generation converters relied on the passband response of the first IF to provide the entire converter response. This yields little attenuation to the adjacent channels. Many modern TV sets are designed with adequate adjacent channel rejection, so that this response is acceptable. However, some sets have insufficient adjacent channel rejection, resulting in complaints of poor picture quality when CATV service is installed.

To ease the adjacent channel problem, some manufacturers of modern set-top terminals have added adjacent carrier traps to the output circuitry of the set-top. A typical response is shown in Figure 7, which shows 12 dB trap depth. A trap depth of 8 to 12 dB has been found adequate to improve the performance of marginal TV receivers, without adding excessive complexity.

Since nothing is free, however, specified frequency response may suffer slightly. The FCC specifies frequency response at from 0.75 MHz to 5 MHz above the lower channel boundary

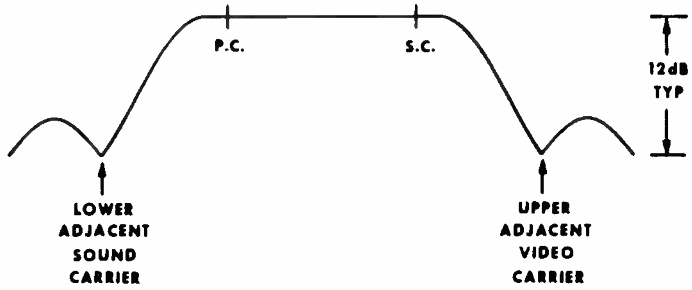


Figure 7 Bandpass characteristic

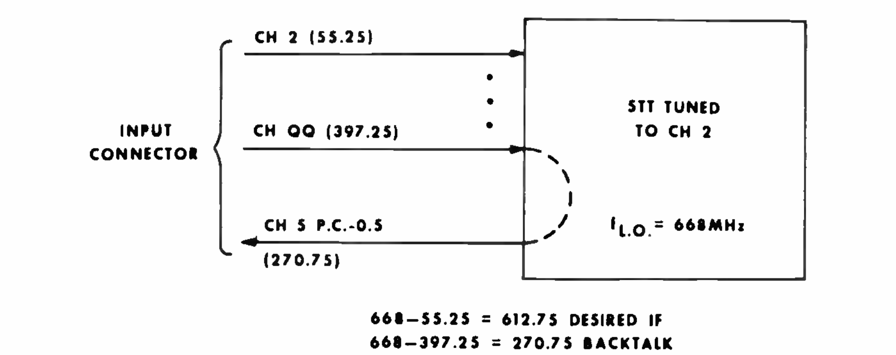


Figure 8 Backtalk source

(P.C. -0.5 to P.C. + 3.75 MHz). Most manufacturers have specified frequency over a broader range, to cover the sound carrier. One can see from Figure 7 that the lower adjacent trap, which is 1 MHz from the FCC minimum frequency, has the potential to pull down the response in the specified region. However, the FCC frequency response can still be met or exceeded by the adjacent traps. Experience has shown that having the traps is much more important than getting the last tenth of a decibel in response flatness.

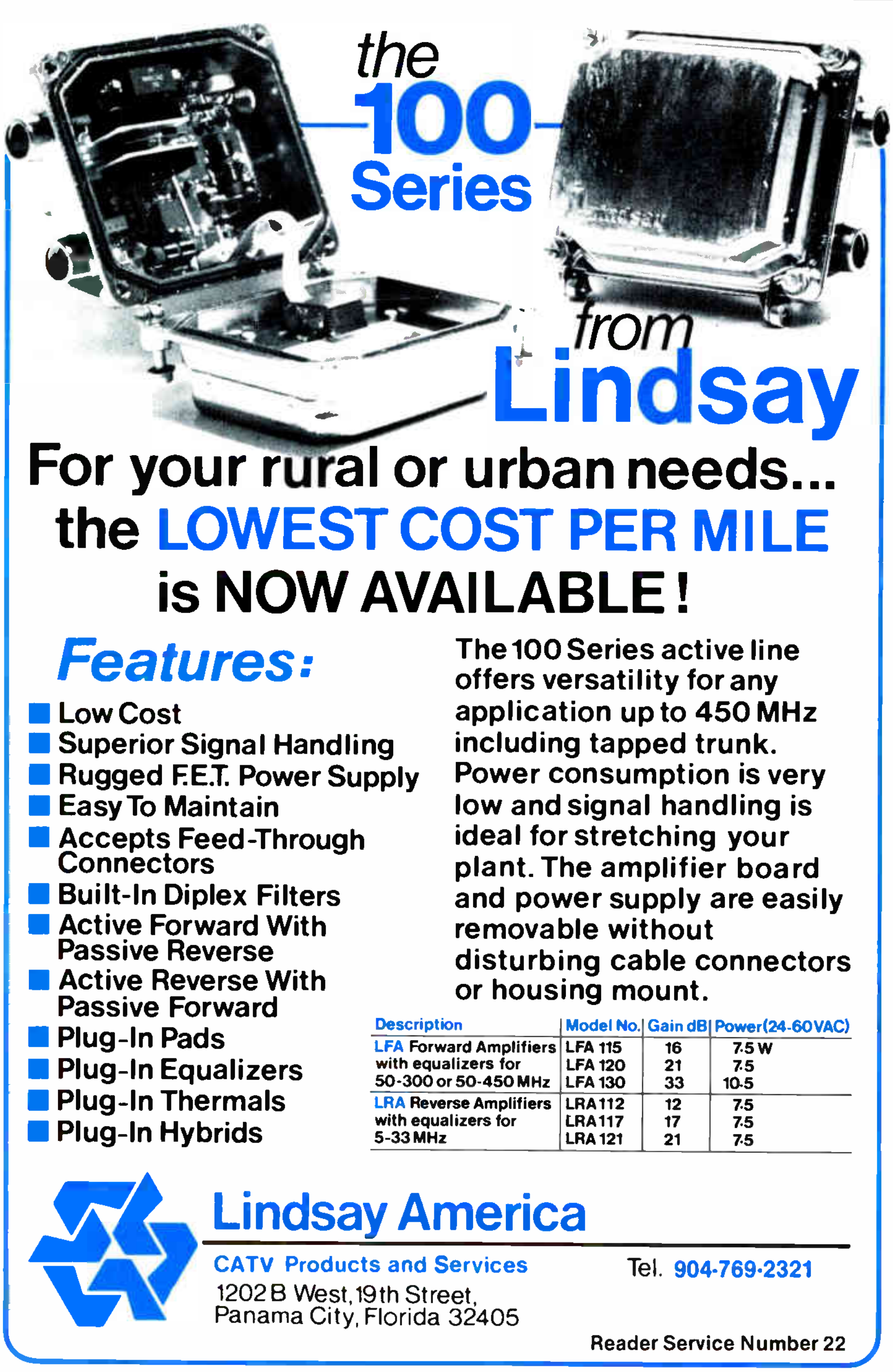
Backtalk

Here is an interesting specification that is relatively unknown within the industry. Under certain conditions a signal may be developed on the terminal input due to the presence of untuned signals. This spurious signal may appear on the input of another terminal, producing a beat. Until CATV systems went to extended bandwidths, this problem could be eliminated by proper choice of IF frequency. However, when frequencies above 330 MHz came into use, selection of an IF frequency to avoid this problem became impractical.

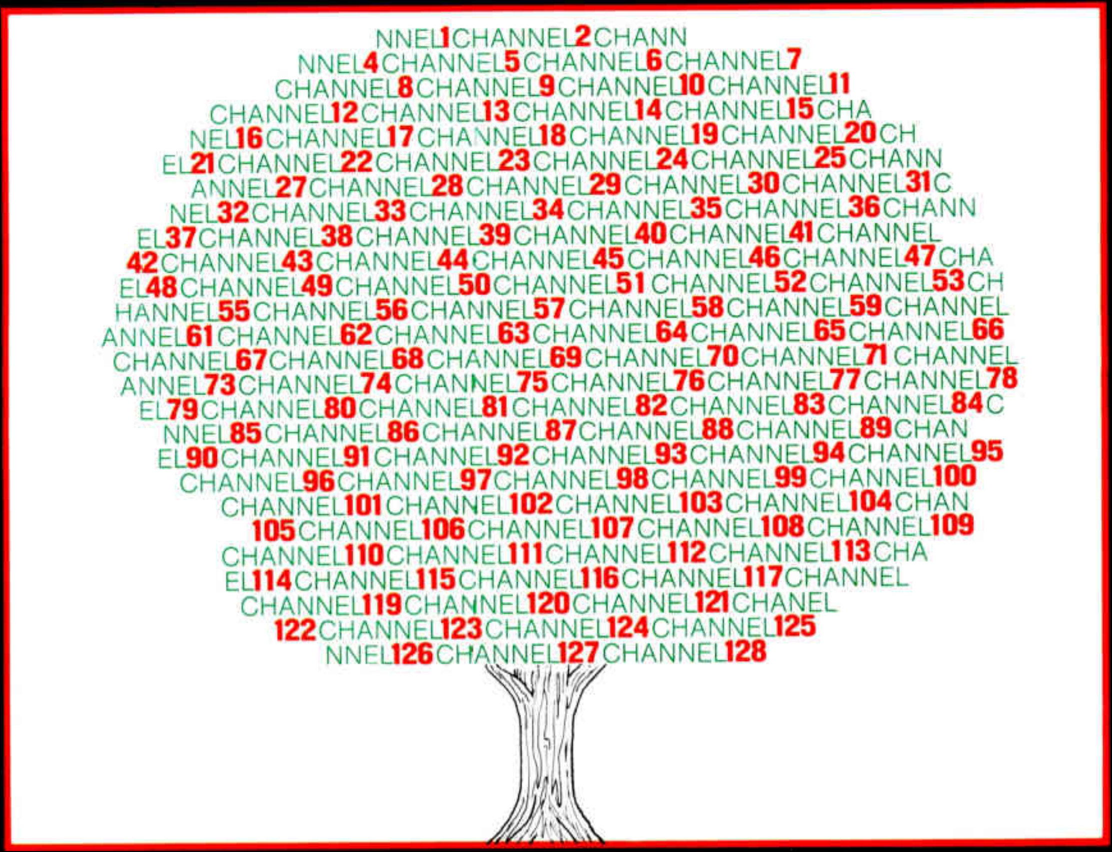
Figure 8 illustrates backtalk. We have a terminal tuned to channel 2, 55.25 MHz. Among other incoming signals is channel QQ at 397.25 MHz. Because the terminal is tuned to channel 2, the first local oscillator is oscillating at 668 MHz (668-55.25 = 612.75). Channel QQ energy also is converted by the local oscillator, to 270.75 MHz. Now this energy is ideally dissipated in losses in the mixer and IF filter, but because of incomplete balance in the mixer, some of the energy appears at the input connector. This signal is 0.5 MHz below channel S picture carrier.

To see how the backtalk signal can affect another TV set, see Figure 9. Backtalk is generated in the terminal tuned to Channel 2 and propagates back toward a splitter. Because of imperfect isolation in the splitter, a portion of the backtalk arrives at the second set, tuned to Channel 32 (S). Here the backtalk signal shows up as a 0.5 MHz beat. We assume that a backtalk signal should be -57 dB from a viewed signal to be invisible. We further make the conservative assumption of 20 dB isolation at the tap to arrive at a backtalk specification of -37 dB from an incident carrier. We don't make allowance for frequency offset improvement, so we don't get trapped with an offset channel that doesn't work.

Backtalk can be measured by connecting a 10 dB directional coupler to a set-top in a direction that transfers backtalk energy to a spectrum analyzer.



128 ways to Cherry-Pick



PPV Profits.

Only Sprucer offers total flexibility to meet the challenging marketing needs of cable service. There are no technical limitations with Sprucer as to the number of channels you can tier, address, scramble, or dedicate to Pay-Per-View.

With Sprucer you can:

- Offer impulse pay-per-view on any of our 128 channels.
- Offer different impulse pay-per-view events, simultaneously, on different channels.
- Initialize 50,000 subscribers within 1 minute of the start of a pay-per-view event.
- Fully utilize existing CableData billing and initialization systems for all down stream and pay-per-view services.
- Provide real security from theft of service with 31 randomly-selected scrambling modes.
- Provide bridger gate control for older systems to reduce maintenance costs, and also provide full system status monitoring.
- Guarantee high reliability: "Made by Matsushita, one of the world's largest consumer electronics manufacturers." Need we say more?
- Offer proven performance. Sprucer is not a "drawing board" concept. It is an existing system with an extremely successful operating and financial track record.

See us at the Western Show booth 310

SPRUCER: The Leading Edge in Cable-TV Technology.

BY KG KANEMATSU-GOSHO (USA) INC.

ONE WORLD TRADE CENTER, NEW YORK, N.Y. 10048/(212) 524-8353/TWX 710-581-5713/TLX 125202/FAX (212) 524-9249

Reader Service Number 37

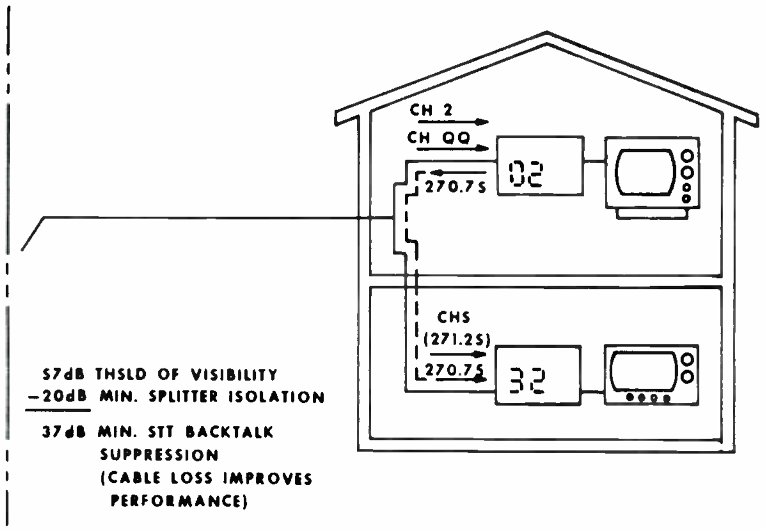
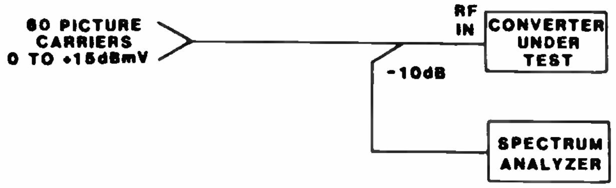
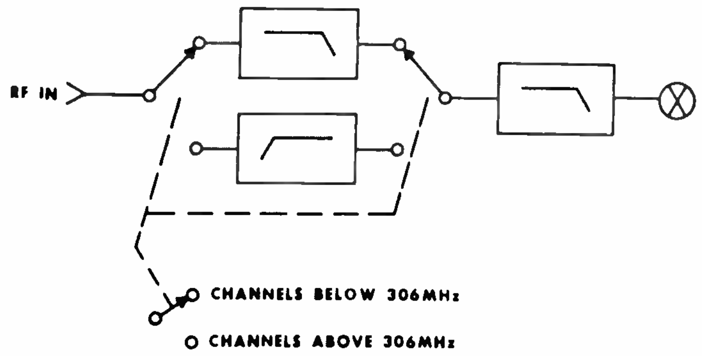


Figure 9 Backtalk interference



1. MEASURE SIGNAL LEVEL ENTERING CONVERTER.
2. MEASURE ANY SIGNALS FROM DIRECTIONAL COUPLER OTHER THAN INPUT SIGNALS.
3. SPURIOUS SIGNALS MUST BE -37dB FROM INPUT LEVEL, TAKING INTO ACCOUNT THE ACTUAL LOSS OF THE DIRECTIONAL COUPLER.

Figure 10 Backtalk measurement



A. SWITCHED FILTER

Figure 11 Backtalk countermeasures

To allow backtalk to be seen, unmodulated carriers must be used. Calibration of this set-up is a bit tedious and should not be attempted by anyone who doesn't know the technique well. (See Figure 10.)

If countermeasures are not taken against backtalk, normal circuit techniques will yield attenuation in the mid-20s. At least two viable countermeasures are available as shown in Figure 11. In A an application of switched low- and high-pass filters is shown. When tuning below 306 MHz in this case, the low pass section is switched in, attenuating the higher frequencies that cause backtalk. When the terminal is tuned above 306 MHz, backtalk doesn't occur, but it's advisable to switch in a highpass filter anyway. This reduces mixed loading and reduces intermodulation distortion.

The second countermeasure available is a preamplifier used ahead of the mixer. This works because the amplifier exhibits gain in the forward direction and loss in the reverse direction. Superficially, this seems to be the best way to go because the amplifier also can improve broadband input return loss and noise figure. Unfortunately, these benefits come at a price, as illustrated in Figure 12.

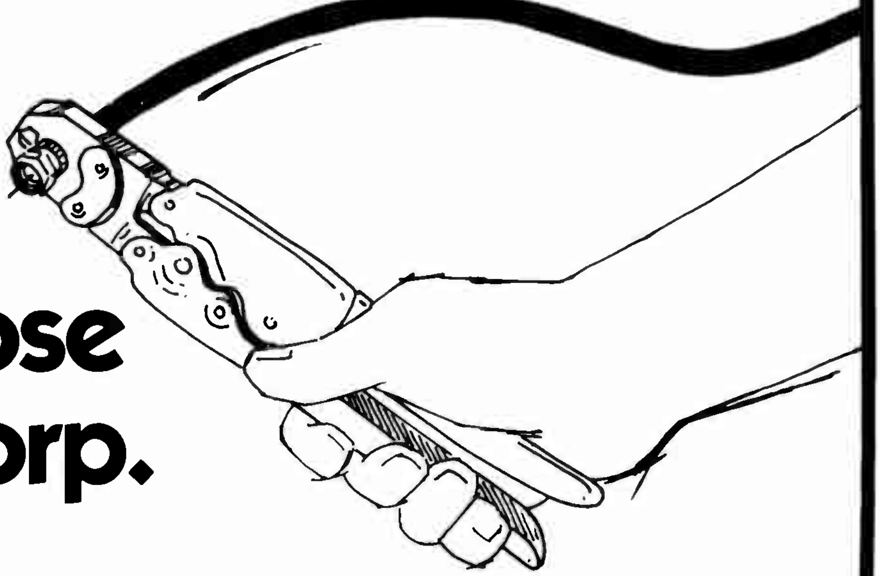
Figure 12 is divided into three parts. To the left is the dynamic range of a particular converter having neither backtalk countermeasure applied. Dynamic range is simply the window of input level that yields an acceptable picture. On the low end, it is limited by noise figure and on the high end, by distortion. For the present purpose, we won't argue about the definition of where the picture becomes unacceptable because we merely want to explore the change in dynamic range with backtalk countermeasures.

On the left, the dynamic range of a conventional converter is given. In the center, there is a switched filter having 0.75 dB of flat loss. To the right, an amplifier has been added to the basic converter. What happens to the dynamic range of our basic converter when we add either the switched filter or the amplifier (but not both)? The comparison will be based on a 440 MHz system.

When the switched filter was added, the signal hitting the mixer dropped by the filter's 0.75 dB loss, so the minimum acceptable carrier level got worse by 0.75 dB. However, we improved our situation on the high side. Empirically, we have determined that as more signals hit a mixer, the worst case composite triple beat increases by about:

24.5 log (number of signals)(1)

A fully loaded 440 MHz system has 60 carriers on it. When the backtalk filter



Reader Service Number 38

is in the lowpass position, it will allow about 38 carriers to go to the mixer, decreasing worst case CTB by about 4.86 dB. Since CTB goes about 2:1 with level, this means we can increase signal level by half this, or 2.43 dB, before we reach maximum level. To this we add 0.75 dB loss of the filter, permitting about a 3.2 dB increase in signal level. Thus, with the filter we improve high and acceptable level by 3.2 dB while giving up 0.75 dB on the low end. We now find that the terminal is 2.4 dB more forgiving on input level as a result of adding the switched backtalk filter.

Now consider what would happen if the amplifier had been added rather than the switched filter. Let's assume the gains and noise figure shown in Figure 12. We calculate an overall noise figure of 10.2 dB, an improvement of 0.8 dB over the converter alone. This means that we can reduce the level at the low end by 0.8 dB. On the other hand, the 2 dB gain means that we must drop the maximum signal level by this much to avoid overloading the mixer. (We assume that the amplifier doesn't add distortion.) Thus, after adding the amplifier, the converter is 1.2 dB less forgiving of signal level errors than it was previously. The difference in dynamic range between the switched filter and the amplifier is 3.6 dB.

Noise figure

In the above, a circumstance in which dynamic range improved at the expense of noise figure was demonstrated. Let's take a closer look at noise figure and the real effect it has on CATV system performance. The reader will recall that, by definition, noise figure is the excess noise introduced by an amplifier or other circuit element. Excess compared to what? Every real resistance, including the 75 ohm source resistance that our distribution systems look like, generates noise as a result of random electron movement. But real electronic circuits exhibit even more noise than this, and the measure of extra noise generated is noise figure. If an amplifier were perfect, it would have a NF of 0 dB. A set-top with an 11 dB NF contributes 11 dB more noise than does an ideal terminal.

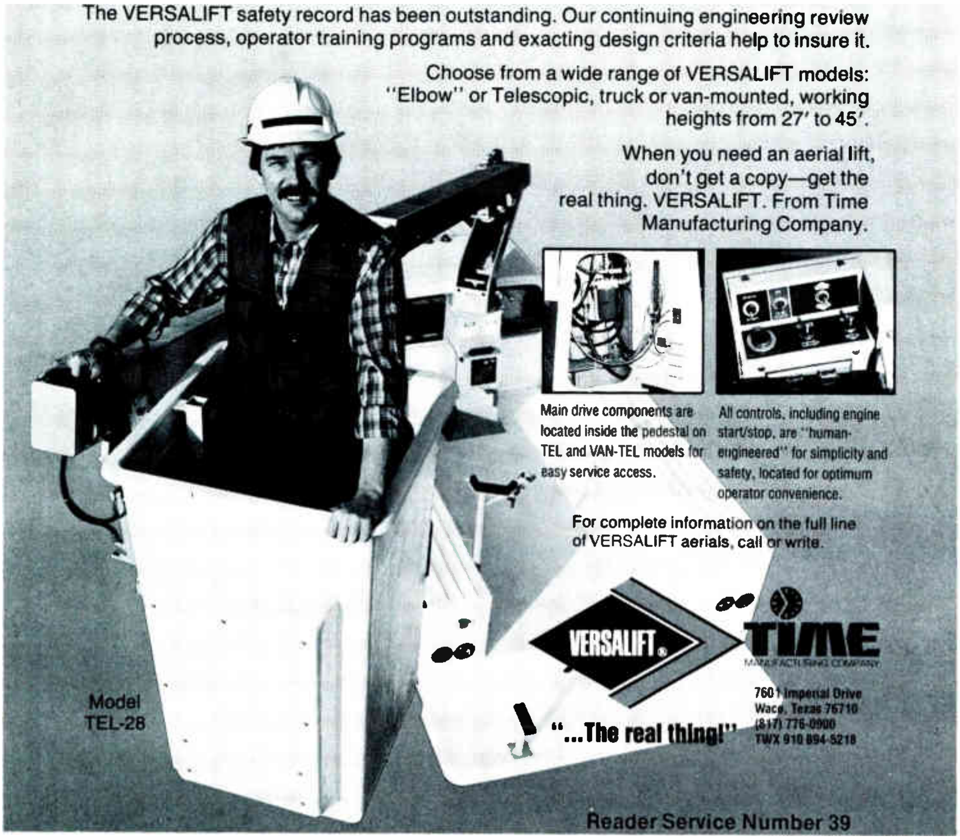
If we know the NF of a set-top and the incoming signal level, we can compute the resultant carrier to excess noise (C/N) ratio. If we know the incoming C/N, we can compute the C/N ratio out of the terminal. And if we know the TV NF, we can compute the C/N at the detector of the TV, the actual C/N seen by the subscriber.

We have done this for several conditions and the results are shown in Figure 13. Here we plot C/N seen by the subscriber vs. set-top NF for three different cable C/Ns. Other assumed conditions are shown. We now focus on cable C/N = 44 dB, representative of the end of a modern system. If the TV is directly connected to the cable, then the subscriber sees a 43.6 dB C/N. If a set-top having a 9 dB NF is inserted, the C/N becomes 43 dB, while a 12 dB NF terminal produces a 42.2 dB C/N. Thus, improving the NF by 3 dB in this case results in a C/N improvement of only 0.8 dB as seen by the subscriber.

From these curves, we see that as noise figure improves, pictures improve, but not as fast as one might hope. The reason is that we are partially limited by cable C/N and partially by TV NF.

Input return loss

Finally, let's look for a moment at the effect of input return loss. Return loss is defined as the ratio of incident signal to reflected signal. Compare waves on a pond that strike a piece of wood and bounce back. The ratio of the incoming (incident) wave to the reflected wave amplitude is the return loss. A return loss of 0 dB means all the signal is reflected (hence none is transmitted). An infinite return loss means that none of



RMS *Descramblers*
4 Packages—Custom designed for your system's requirements

[1] **#16D**—descrambles up to 16 tiers of service-unlimited channels per tiers.

[2] **#16SD**—has all the features of the #16D, plus…the advantage of sound deletion.

[3] **#8PPV**—descrambles up to 8 tiers of service-unlimited channels per tier with the provision for pay-per-view.

[4] **#8PSD**—has all the features of the #8PPV, plus…the advantage of sound deletion.

USABLE WITH EXISTING CONVERTERS
(OTHER THAN BLOCK TYPE) WITH OUTPUT ON CHANNELS 2, 3 OR 4

See us at the Western Show booth 1075.

RMS

RMS ELECTRONICS, INC./CATV DIVISION - 50 ANTIN PLACE, BRONX, N.Y., 10462 · CALL COLLECT: (212) 892-1000 (N.Y. State)
TOLL FREE: (800) 223-8312 (Continental U.S.A., Puerto Rico, U.S. Virgin Islands)
WESTERN OPERATIONS: 2901 W. GARRY AVE., SANTA ANA, CALIF., 92704 · TEL. (714) 662-1041 · TOLL FREE: (800) 247-8435 (Calif.)
TOLL FREE: (800) 624-2511 (Continental U.S.A., Puerto Rico, U.S. Virgin Islands, Alaska, Hawaii)

Reader Service Number 40

the signal is reflected, hence it must all be transmitted into the set-top.

What happens when signal is reflected from an input to a set-top? It bounces back to the other end of the drop. If everything were perfect, it either would be dissipated in the coupler resistor or by the output impedance of the last amplifier and nothing would happen. But taps and amplifiers also have finite return losses, so some of the signal is reflected again toward the set-top terminal. Or, due to limited isolation, the reflected signal may find itself on another drop, enroute to another set-top. Since the signal, wherever it arrives, will arrive later than the direct signal, it will produce that well-known phenomenon known as a ghost.

Effect of echo

To analyze the severity of the ghost, we must determine the amplitude of echo as it arrives at the set-top and its delay. We invoke the standard Mertz curve, which defines the threshold of visibility of a ghost, as a function of its amplitude and delay. Figure 14 shows a popular incarnation of the Mertz curve. To utilize this information, Mr. R. Pidgeon of our staff superimposed a curve showing round-trip attenuation and delay of an echo. The curve assumes a 20 dB return loss at the last splitter (or tap). If we are analyzing the effect on a second set-top, we take this to represent a 20 dB tap-to-tap isolaton. Thus, Pidgeon has plotted delay vs. amplitude for a particular cable with a length that is a parameter that shows only indirectly.

The curve is for an RG11 size cable having a loss of 1.62 dB per hundred feet and a velocity factor of 81 percent. The cable characteristic plot invades the "ghost visible" area of the Mertz curve for a small region around 600 ns delay. We can force the curve below the "visible" threshold by reducing the reflection by 3 dB. This may be achieved by using a terminal with a 3 dB minimum return loss. Smaller sizes of cable generally will require even lower return loss to render the ghost invisi-

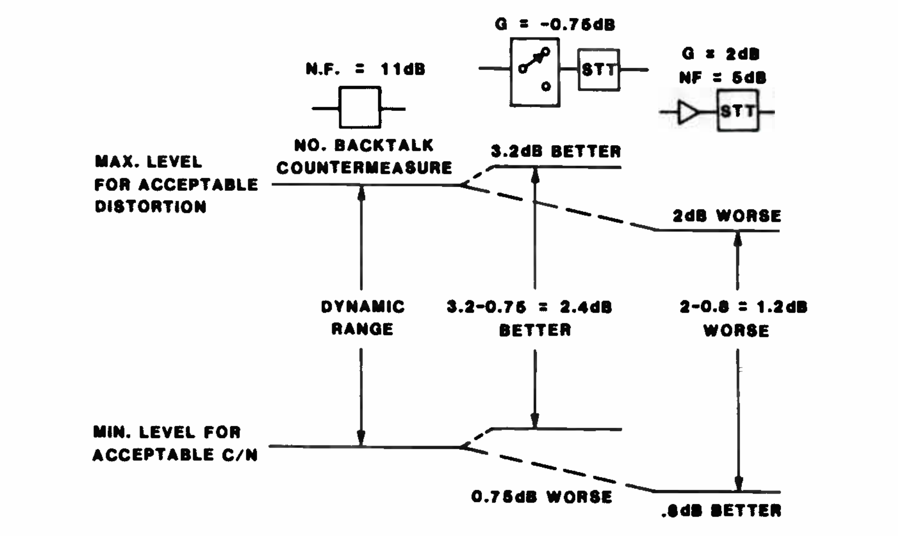


Figure 12 Effect on dynamic range

"THE WADE S.T.A.T. SYSTEM HAS GIVEN US TOTAL CONTROL OF OUR CABLE SYSTEM. AND TOTAL CONTROL MEANS BETTER PROFITS."

Ken Swift
Executive Vice-President
USA TV

USA TV provides cable television service to apartments, condominiums, and mobile home parks. Because they deal with thousands of units, in multi-family developments, control of their system, and ease of turn-on/turn-off are of utmost importance. That's why USA TV selected the WADE S.T.A.T. (Selective Trap, Addressable Tap) System for their company's installations.

Ken Swift, Vice-President of USA TV, says "The Multi-Family cable operator needs off-premise, programmable tap technology to operate efficiently and profitably. Wade's S.T.A.T. system provides us with state-of-the-art technology that is highly reliable. It works. And it gives us total control of our system.

"Using the S.T.A.T. system, we gain control of our system without the necessity to constantly enter the subscriber's home — a fact both subscribers and apartment owners greatly appreciate. The S.T.A.T. system is also very competitively priced, easy to install, and highly reliable. It's added a new dimension to our cable operations."

The Wade Communications S.T.A.T. device is available in 4 or 8 port configurations, and will control four levels of service (basic plus three pay channels).

Contact Wade Communications for more information on the S.T.A.T. system, or to arrange a personal demonstration.

Specifications:
Band Pass
10Mhz–400Mhz
Trap Notch Depth
–50db
Functions per port
All channels on/off
3 Premium Channels on/off
Control Method
Pulse Modulated FSK
Data Message
ASCII
Power Requirement
30 or 60 Volt AC
50 MA, from system.

WADE COMMUNICATIONS
The Leader in off-premise,
addressable tap technology.
3535 Briar Park, Suite 255
Houston, Tx. 77042
713-785-3143

Reader Service Number 42

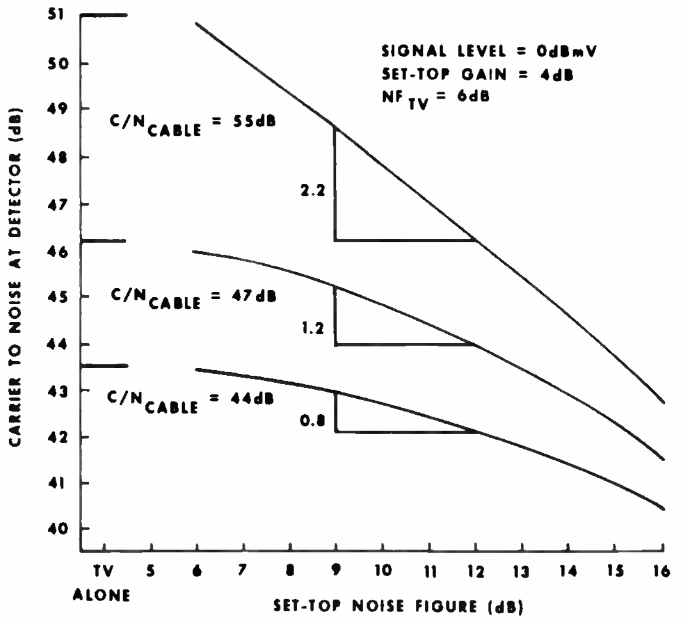


Figure 13 Carrier to noise ratio vs. set-top noise figure

ble. Thus, we can see that a minimal set-top return loss will render ghosts invisible. Typical worse case return loss for current terminals ranges from about 6 to 8 dB.

Another potential problem is that the reflection can affect frequency response, but calculations show the effect to be negligible.

Scrambling

No portion of a set-top terminal receives more attention than does the scrambling system. Virtually all of the popular scrambling systems in use today are based on rendering sync information indistinguishable from video. This is done variously by suppressing the sync pulses (horizontal and/or vertical), by attenuating the RF envelope or by shifting the baseband level prior to modulation. Descrambling is achieved by reversing the process. Synchronizing signals are inserted either within the vertical interval or as AM information on the sound carrier.

Figure 15 illustrates one such system. Shown at the top is a video waveform, which represents the bottom of a modulated RF envelope. As shown, an attenuator is switched into the video IF path, reducing the amplitude nominally by 6 dB during the horizontal and vertical blanking intervals. In this system, pulses are placed on the sound carrier for synchronization, but they are ahead of the horizontal blanking interval they will decode by a discrete length of time. Furthermore, this offset time is varied randomly from one field to the next, to make recovery by common pirate decoder boxes difficult. Extra pulses buried within a field are used to communicate timing information, which sets up a variable delay in a crystal controlled counter. For a pirate to duplicate this circuitry, he would need a rather large number of standard ICs. The manufacturer can accomplish the same more economically because he has the volume to develop a custom IC.

Use of offset timing was developed as an improved security measure, but it has been found to offer further advantages. For example, when the video sync is restored by amplifying the RF, the sound carrier is also amplified, again by 6 dB nominal. If the sound carrier has a 6 dB pulse already at this time, then the sound carrier is amplified 12 dB from its nominal level during sync times. The sound carrier is more likely to crosstalk into the picture channel, creating ringing around the leading edge of sync. This effect has been observed, but the severity with different equipment is unknown. Also, with stereo this presents a problem because AM to FM conversion can cause errors in pilot amplitude and phase.

A particularly vexing problem with early scrambling systems using sound carrier synchronization was the sound carrier had to be accurately tuned to recover pulses. Tuned radio frequency (TRF) receivers were used, and filtering was difficult due to the frequencies used.

A patented improvement makes use of the intercarrier technique to develop a 4.5 MHz sound (and sync) IF by mixing picture and sound carriers. This eliminates the critical tuning requirement of the earlier TRF approaches. By doing the filtering at 4.5 MHz, filtering can be improved dramatically.

A compromise that must be made in descrambling is the transition time of the descrambler must be controlled. Figure 16 shows this. The scrambling and descrambling processes must start and end in the order shown, without invading viewable picture area, clamp time or the leading edge of sync. When descrambling starts, the transition must complete itself before start of sync. On the other hand, if the transition is too fast, components beyond the bandwidth of the receiver are generated. In this case the receiver will generate Gibbs ringing, which can overlap the leading edge of sync and cause timing errors.

Also, the scrambler must control its transition times to prevent ringing, though this is generally not as critical.

continued on page 84

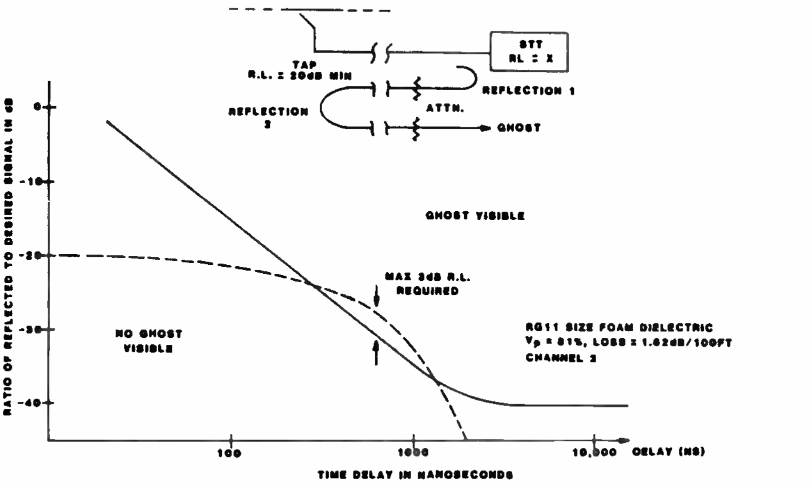
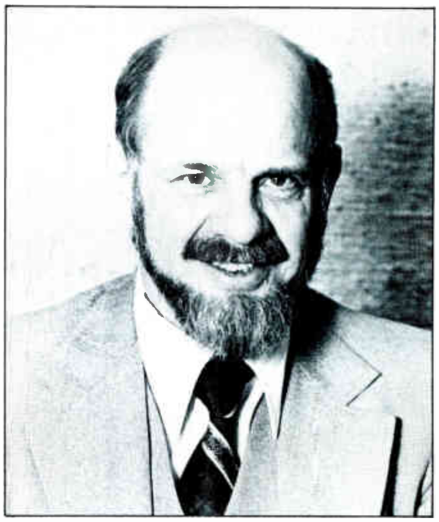


Figure 14 Effect of echo


C-2

FEATURE

Cable/HAM group reports progress



Traditionally, cable operators and HAMs have fought like cats and dogs.

But that's changing, claims Bob Dickinson, senior vice president of AM Cable TV Industries, director of E-COM Labs and chairman of the joint NCTA/American Radio Relay Committee.

The committee was formed in 1983 to seek, through cooperative means, a solution to the cable signal leakage problem that had been dividing the two groups.

In addition to a technical group comprised of four NCTA and four ARRL members plus Dickinson and a group secretary, a two-member division handles complaints.

The technical subcommittee has six goals:

- develop low cost techniques for measuring signal leakage
- gain a better understanding of leakage mechanisms
- work with cable operators and HAMs on goals one and two
- recommend electromagnetic compatibility of cable equipment and good engineering practices for EMC maintenance operations
- publish results of the committee's work
- resolve any unusual cable leakage problems.

The group's most important achievements to date have been monitoring a signal leakage clean-up in a test system and developing an inexpensive device HAMs can use to calibrate signal leakage.

The test site chosen was a Storer, Leesburg, Va., system that was being sold. The system had the usual leaks, stemming from loose F-fittings, damaged drops and a crack or two in the distribution network.

The committee first visited the system on May 8. By Sept. 11, most of the leakage had been cleaned up. "The test showed the ARRL that cable could do something about signal leakage," Dickinson notes.

The calibration device the group developed can be built by the HAM himself. It is an oscillator that, when used with a receiver, tells the HAM whether a signal is above or below the 20 microvolt threshold established by the FCC.

Previously, a HAM could only use an

> ***Operators need to make an extra effort to respond to complaints filed by HAMS.***
>
> ***—Bob Dickinson, E-COM Labs***

S meter to calibrate a leak, which didn't tell him whether the leak was within FCC specs.

However, the device is not on the shelf yet. Once the final touches have been added, Dickinson says the ARRL will publish guidelines for building it.

And there's more work to do. Guidelines for cleaning up leaky systems and statements on good engineering practices have not yet been published. And complaints keep coming in, although at a slower rate than last year.

Out of the nine complaints that were filed with the joint committee this year, only one was solved, reports Katherine Hevener, ARRL membership services assistant. And 14 out of the 15 filed last year are still outstanding, she adds.

However, some of these cases may be closed but not officially off the books yet, adds SCTE's Executive Vice President Bill Riker.

Riker, who formally headed the complaint committee with the ARRL's Rick Palm, says he left the NCTA right before he was supposed to meet with Palm. "One of the first duties the person who replaces me will have will be to meet with the ARRL and go over the cases," he adds.

And Riker says not all interference cases reported by a HAM are caused by cable. Computers, cash registers and illegal hook-ups are other culprits.

Even if interference is caused by a cable system, it's not always easy to determine where the leak occurs, he says. Leaks can travel down the cable jacket or be retransmitted by guy wires and ground wires.

Riker recommends that every system have at least one person trained in tracking down and fixing leaks. The rest of the crew should be constantly monitoring the system, looking for leaks while driving to service calls. The only equipment required is a transmitter in the headend and inexpensive FM receivers in every truck.

And although the FCC doesn't specify what "harmful" interference is, Dickinson says operators need to make an extra effort to respond to complaints filed by HAMs. This is particularly important if a leak within FCC regulations interferes with repeaters used for emergency services.

Dickinson also notes that while the FCC may have vetoed the HAM's request for cable's exclusion from the 144-150 and 222-228 MHz bands, it is doubling its field operation budgets. "Double budgets could mean double fines," he warns.

—Constance Warren

Interpreting FCC HAM band rules

Under current FCC regulations, cable operators using HAM bands cannot exceed radiation limits of 15 microvolts per meter at 100 feet for frequencies up to 54 MHz, 20 microvolts per meter at ten feet for the 54-216 MHz range and 20 microvolts per meter at 100 feet on frequencies over 216 MHz.

In addition, cable operators must keep a record of all leaks detected, the date they were discovered, their causes and the date they were fixed.

The FCC also says no violation exists if the squelch on an amateur receiver in the scanning mode is broken. But "harmful" interference does exist if cable leakage interferes with a local amatuer repeater station and its user communications.

Riker says this means that leakage causing the scanner in a HAM's car to fixate on a channel doesn't necessarily qualify as harmful interference. But leakage that causes the same thing to happen to a receiver in a fixed location is a violation.

And during severe emergencies, it's possible that the FCC could prohibit operators from using channels where leakage breaks the squelch, but is within FCC regulations.

Dickinson says that systems using HRC channelization plans are less likely to interfere with HAM repeaters because the carrier falls at 144.0 MHz, the exact edge of the 2-meter band. Since amateur repeaters typically operate at 145.25 MHz, the leak would have to be very strong to interfere with the repeaters. So strong, in fact, that the cable signals' sidebands located 15 kHz off the visual carrier would actually be the source of interference.

Because the IRC and standard visual carriers fall directly at 145.25 MHz, the potential for interference is greater.

Leakage also may become more of a problem for cable operators as more two-way systems go on-line, Dickinson says.

In the lower frequencies, HAMs use high power and large antennas; in the VHF and UHF frequencies, HAMs transmit at 20 to 30 watts. This increased power raises the potential for ingress into the upsteam cable channel. And because the signal is going upstream, it's more difficult to find where the leak is located.

"I'd like to see more work done in this area," Dickinson says.

—Constance Warren

Stereo must-carry battle nears end

By Gary Kim

Win, lose or draw, the cable industry should be getting a decision from the FCC on must-carry stereo sound by the end of the year or, perhaps, early next year. It could end up being an expensive proposition and almost certainly will influence the way the commission looks at must-carry teletext.

The problems? Legion. Especially at the headend and at the converter. The cable plant itself should pose only minor problems if well-maintained. But older channel processors may degrade the stereo subcarriers as they flow through the bandpass filters. And baseband headend processors will tend to strip off the stereo information and pass monaural sound only.

Sync suppression scrambling also can wreck havoc with MTS signals because decoding information is carried in the audio channel. NCTA tests showed decoders switching into the stereo mode when only monophonic sound was transmitted. The result? Noise-only signals coming out of one channel.

Baseband converters will be a big problem, because filtering of the baseband signal in the converter removes the Left-minus-Right and separate audio program information. Thus, only a monaural signal is passed to the TV receiver.

Sync suppression decoders, on the other hand, can generate low frequency noise as FM signals are passed through their bandpass filters. Frequency changes result in amplitude changes, a process known as FM to AM conversion. During descrambling, AGC circuits remove unwanted AM components from the aural carrier and add them to the video carrier—hence the interference.

A closer look

These initial findings and others resulted from a study commissioned last year by the NCTA and conducted by Cablesystems Engineering Ltd. Alarmed when an Electronic Industries Association report on stereo transmission systems contained scant mention of possible cable compatibility problems, the NCTA decided to have a look itself.

In addition to laboratory tests run at the same test facility used by the EIA, Cablesystems ran field tests at a Rogers system operating with 23 channels, using push-pull amps and no frequency offsets.

Test data from the six-month experiment dealt with audio bandwidth, amplitude distortion, S/N, interchannel crosstalk and subjective picture quality. To varying degrees, the tests all showed some form of signal degradation to stereo and SAP channels in all cases. One test showed deterioration of the video signal as well.

The wider bandwidth of the aural subcarrier needed for MTS causes some of the problems, especially for sync suppression systems. The Broadcast Television Systems Committee standard includes a sum audio program channel, followed by the pilot carrier, difference program audio, SAP channel and a telemetry channel. As more of these channels are carried on the audio subcarrier, the chance of interference grows.

For audio modulating frequencies between 1-3 kHz, noise in the video signals was 10-12 dB worse with MTS than with the monaural sound.

On the other hand, sync suppression systems also tend to degrade MTS signals. One NCTA test found distortion as high as 10 dB in stereo receivers using the BTSC system. Scrambling also decreased S/N of the BTSC signal by as much as 10 dB. Although SAP channel frequency response wasn't affected, noise and distortion did increase by as much as 14 dB. And the NCTA's tests also found that distortion and noise were up by 10 dB in some cases when both program MTS and the SAP channel were carried.

To test the effect MTS subcarriers have on headend processors, the NCTA ran the signals through strip amplifiers, demodulator/remodulator configurations, heterodyne processors with a notch aural carrier level control and heterodyne processors that separate the aural and visual carrier.

The results? A decrease in stereo separation of up to 20 dB; 5 dB greater stereo distortion; noise levels up 3 to 16 dB; increased stereo crosstalk by as much as 15 dB; and SAP crosstalk up to 16 dB.

The baseband converter tests indicated that stereo noise levels could be increased as much as 6 dB in the quasi-parallel mode and over 40 dB in the split sound detection mode. In laboratory tests, neither Zenith nor Tocom converters could pass the MTS signals.

In the field

Field tests of stereo decoding revealed other problems. Although both a heterodyne headend processor and a heterodyne converter reduced low frequency response and increased distortion slightly, the real problems developed with baseband converters. Half the decoders tested couldn't pass the MTS signal at all, while the other half passed enough pilot carrier to trigger the BTSC decoder but lost the L-R stereo channel. The result? Monaural sound from one speaker and noise from the other.

The field tests also uncovered interference with the video signal when fed through a sync suppression descrambler. Horizontal bands varying in time with the audio information appeared on monitors as the AM descrambling keys modulated the video signal.

There was some concern that the MTS signal, with a wider deviated carrier, wouldn't be removed totally by the adjacent channel sound trap in a TV's IF section. The tests showed that most TV sets exhibited no significant increase in lower adjacent audio problems. There was some increased difficulty with fine tuning, however.

Based on the test results, the NCTA has estimated that at a minimum, all baseband converters and headend processors as well as sync suppression descramblers will need to be replaced or modified to handle MTS. Estimates of baseband converters in use hover around 2.3 million, while perhaps 5 million sync suppression descramblers are in use.

The costs of converting

Redesigned baseband converters able to pass MTS might run about $10-$20 more than the approximately $145

Can Your System Survive The EIA TV Stereo Revolution?

It Can with the Studioline System Built by Leaming Industries

With the recent FCC decision, television stereo sound must be carried in your system. Right now you can solve your EIA signal problems and cash in on cable TV stereo with the Studioline set-top converter and head-end equipment from Leaming Industries.

Offer Up to 69 Channels

You can now offer up to 52 channels of stereo television and 17 premium audio channels on your system. All this with sound quality unaffected by cable noise and transmitted 25db below video carrier so they will not overload your system.

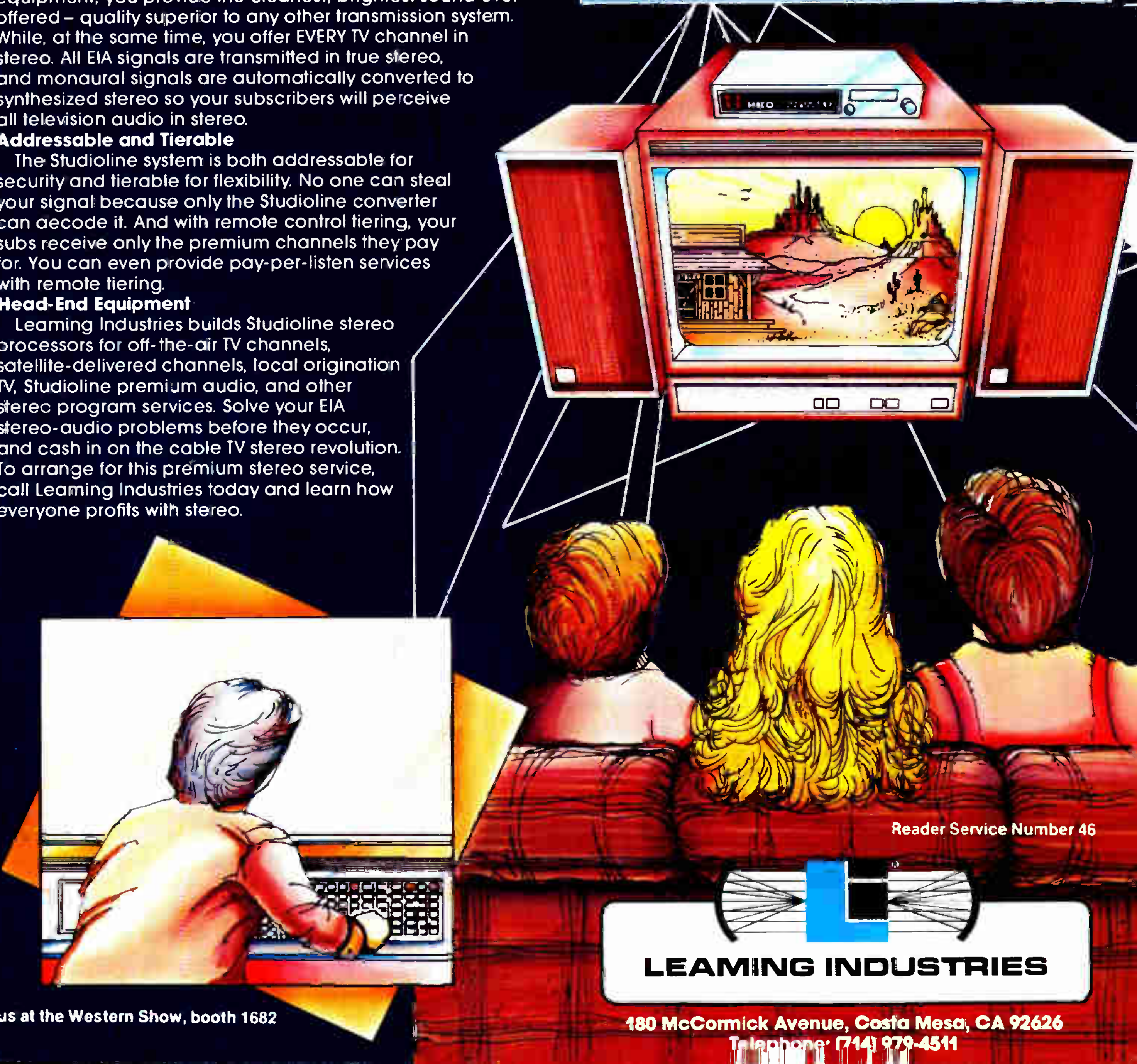
With the revolutionary set-top converter from Studioline, combined with the advanced Leaming head-end equipment, you provide the cleanest, brightest sound ever offered – quality superior to any other transmission system. While, at the same time, you offer EVERY TV channel in stereo. All EIA signals are transmitted in true stereo, and monaural signals are automatically converted to synthesized stereo so your subscribers will perceive all television audio in stereo.

Addressable and Tierable

The Studioline system is both addressable for security and tierable for flexibility. No one can steal your signal because only the Studioline converter can decode it. And with remote control tiering, your subs receive only the premium channels they pay for. You can even provide pay-per-listen services with remote tiering.

Head-End Equipment

Leaming Industries builds Studioline stereo processors for off-the-air TV channels, satellite-delivered channels, local origination TV, Studioline premium audio, and other stereo program services. Solve your EIA stereo-audio problems before they occur, and cash in on the cable TV stereo revolution. To arrange for this premium stereo service, call Leaming Industries today and learn how everyone profits with stereo.



Reader Service Number 46

See us at the Western Show, booth 1682

LEAMING INDUSTRIES

180 McCormick Avenue, Costa Mesa, CA 92626
Telephone (714) 979-4511

price of current units, vendors estimate. A retrofitted converter probably would cost just about that much.

The NCTA guesses that as many as 75 percent of all headend channel processors now in the field might need modification or replacement to carry MTS. This is based on an estimated 26,265 processors in use and a modification cost per processor of between $500 and $1,000. Replacement costs are estimated at $1,500 to $2,000. The total bill might run between $13,132,500 and $52,530,000—if the NCTA is correct.

Also, all sync suppression terminals would have to be replaced, adding another $300 million or so in costs. Baseband converter change-outs might run as high as $356 million.

The total cost to the industry, therefore, would range from $669,132,500 to $708,530,000, and that's just for equipment change-outs.

Heritage Communications, for example, estimates its headend retrofit costs would run $800,000; Viacom says $364,500; Cable Television Operators (United Cable) guesses $251,000 to $637,200; American Cablesystems figures $224,300; ATC ballparks $145,000 and Western Communications looks at $200,000.

The "Middleground Proposal"

Unfortunately, it looks like some, although not all, of these costs might have to be paid by at least some cable systems in the relatively near future. As the FCC weighs its options, it will be giving close attention to a "Middleground Proposal" submitted by the National Association of Broadcasters and Association of Maximum Services Telecasters. The document claims to address the cable industry's technical concerns about stereo must-carry, and it may be incorporated in some fashion in the FCC's final decision.

The proposal would allow stripping of enhanced audio signals if the carriage would "materially degrade" the main program video or aural signal or interfere with adjacent channels and could be fixed only by "a significant capital expenditure." The proposal also would allow stripping if the aural subcarrier was used for anything but main channel stereo or second language audio.

But certification from the FCC would be necessary before such stripping could occur. Cable systems also would be required under terms of the proposal to maintain existing equipment and adjust it as required to transmit MTS.

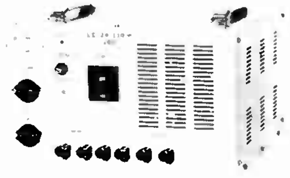
Furthermore, any interference created by equipment such as baseband converters acquired after March 29, 1984, wouldn't be grounds for an exemption from the rules.

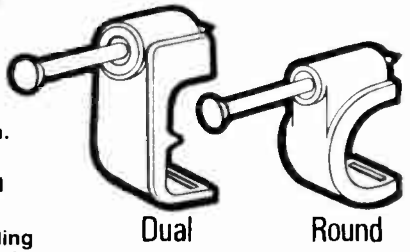
Other broadcast industry interests have proposed a "must delivery" requirement. Under its provisions, cable operators providing stereo service for non-broadcast programming would have to deliver the local broadcaster's stereo service by the same means, chewing up parts of the FM band.

The NAB/MST proposal does allow for the stripping of MTS signals on distant signals or other stations not classed as "must-carry."

It isn't clear yet how much weight these arguments by broadcast forces will carry at the FCC. But it is clear that the decision will be made as much on political grounds as on technical grounds. And as the industry has seen before, engineering data alone may not be sufficient to carry the day.

So, like it or not, many operators and vendors are gearing up for multichannel sound in some form. It shouldn't be long before the urgency of those tasks is made clear. ■





Plug-in Broadcast Stereo

Another Innovation From The People At Wegener.

Wegener Communications, the people who pioneered satellite delivered stereo technology, have done it again.

Introducing TV stereo, the technology known as "broadcast multi-channel sound," that makes true high fidelity and bi-lingual audio a reality with the new stereo equipped TV sets now entering the marketplace.

For cable services, all it takes to start offering subscribers this exciting new audio format is a broadcast stereo modulator card that plugs into your Wegener 1600 Mainframe.

Over 3,000 cable systems are already using our expandable 1600 Mainframe to provide FM delivered stereo services such as MTV and The Nashville Network. Now that plug-in broadcast TV stereo is also available, shouldn't you be talking to the stereo audio experts at Wegener, too?

Call today for more information.

See us at the Western Show, booth 2065.

WEGENER
COMMUNICATIONS
150 TECHNOLOGY PARK/ATLANTA
NORCROSS, GEORGIA 30092
(404) 448-7288 TELEX 54-3634

Reader Service Number 49

Communications Engineering & Design

TECH II

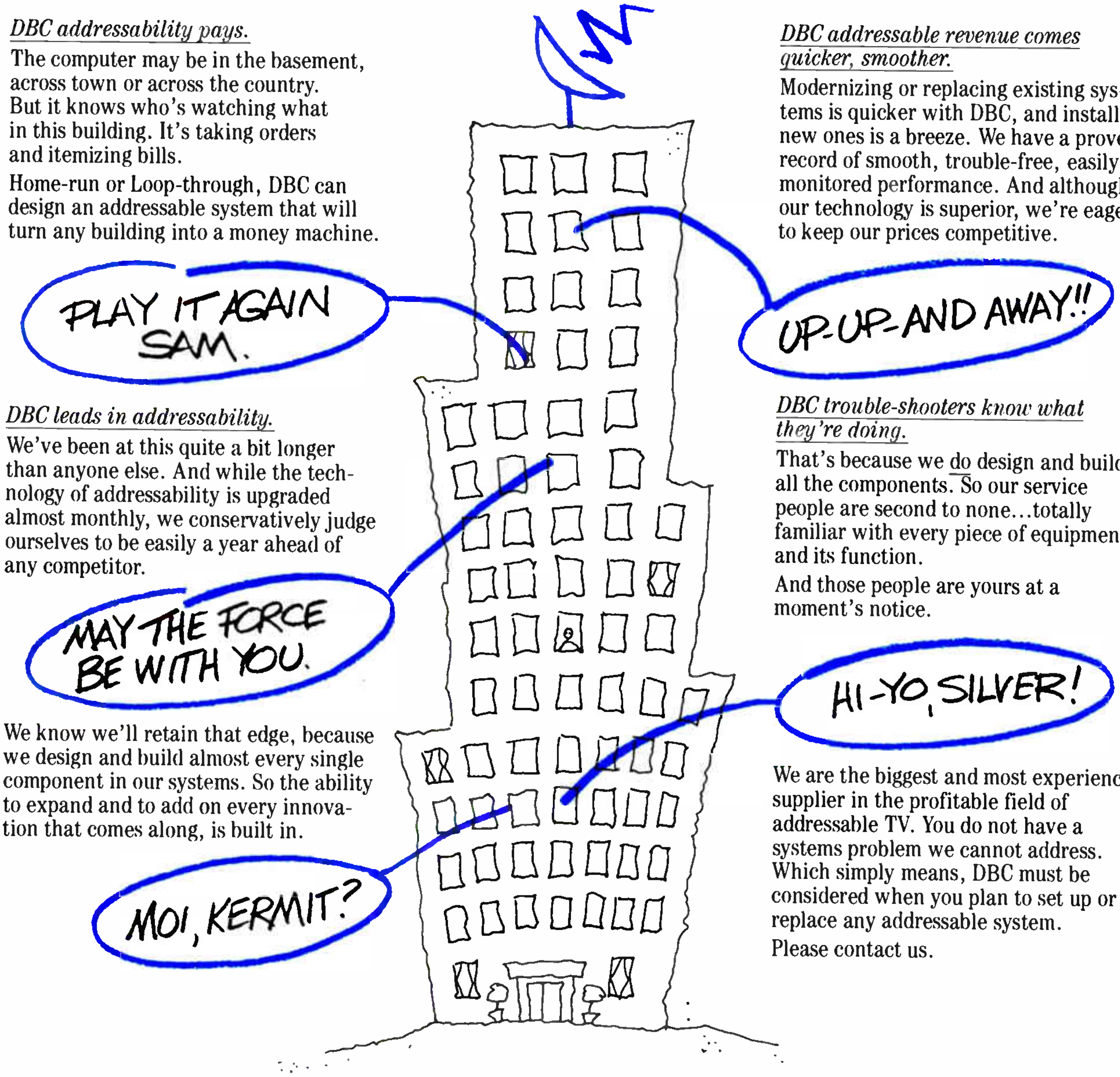
CED's feature supplement and Product Profile

December 1984

- **Amplifier technology evolves**
- **Underground amplifier problems solved**
- **Product Profiles: trunk amplifiers, coaxial cable**

Belden coax cables

AND SOMEWHERE OUT THERE THE COMPUTER'S JUST TOTTING UP PROFITS.



DBC addressability pays.

The computer may be in the basement, across town or across the country. But it knows who's watching what in this building. It's taking orders and itemizing bills.

Home-run or Loop-through, DBC can design an addressable system that will turn any building into a money machine.

DBC leads in addressability.

We've been at this quite a bit longer than anyone else. And while the technology of addressability is upgraded almost monthly, we conservatively judge ourselves to be easily a year ahead of any competitor.

We know we'll retain that edge, because we design and build almost every single component in our systems. So the ability to expand and to add on every innovation that comes along, is built in.

DBC addressable revenue comes quicker, smoother.

Modernizing or replacing existing systems is quicker with DBC, and installing new ones is a breeze. We have a proven record of smooth, trouble-free, easily monitored performance. And although our technology is superior, we're eager to keep our prices competitive.

DBC trouble-shooters know what they're doing.

That's because we do design and build all the components. So our service people are second to none…totally familiar with every piece of equipment and its function.

And those people are yours at a moment's notice.

We are the biggest and most experienced supplier in the profitable field of addressable TV. You do not have a systems problem we cannot address. Which simply means, DBC must be considered when you plan to set up or replace any addressable system. Please contact us.

DBC TURNS ALL YOUR TV'S INTO PAY TV'S.

DBC

Addressable Systems

Don Atchison
Route 3, Box 536 Lakeside Drive
Decatur, Alabama 35603 Tel: 205-355-8577

124 Belfield Road
Rexdale, Ontario Canada M9W 1G1
Tel: 416-241-2651 Telex 06-989357

Reader Service Number 52

Amplifier technology evolves

Newer techniques solve some problems, create others

By Constance Warren

The advent of push-pull technology and switch to transistors came almost simultaneously, in 1965.

Michael Jeffers, Jerrold

There was a time when intermod and CTB weren't problems. But then came broadband amplifiers. Push-pull, feedforward and power doubling followed. Now, the merits of discrete or integrated ICs are debated.

In the early days, each channel had its own amp—single-ended, vacuum tube types. Each was powered directly from the pole and had a filament that didn't last much longer than a year. Gains were high, up to 60 dB, sometimes causing amps to go into compression. But, intermod, composite triple beat and other distortion problems were practically unknown.

A few years later, in the mid-1950s, broadband amplifiers carrying five adjacent channels came into use, and operators got their first taste of intermod. Then, in the early 1960s, demand for 12-channel loads ushered in the "split-band" era, where one amp powered channels 2-6 and another, channels 7-13.

The advent of push-pull technology and the switch to transistors came almost simultaneously, in 1965, according to Jerrold's Vice President of Advanced Development Engineering Michael Jeffers. The new technology raised system channel capacity, and transistors extended amplifier life by about five years.

Push-pull used two amplification stages to cancel out second order distortion, which previously had barred operators from using the midband. The second order distortion products of one amp were placed 180 degrees out of phase with the distortion products from the second amp. When combined, the distortion was cancelled.

Improvements in transistors and push-pull circuitry raised amplifier carrying capacity from 20 channels in 1965 to 27 channels in 1970, 35 channels in 1973, 52 channels in 1980 and more than 70 channels in 1983.

But expanded bandwidth was a mixed blessing. Composite triple beat and odd order distortions posed new problems.

Sometimes, the only way an operator could carry the extra bandwidth was by boosting the signal more frequently and shortening cascades. Others went to Harmonically Related Carriers. While this equipment was more expensive, it offered a 6 dB improvement in C/CTB, adding more channels without reducing trunk reach.

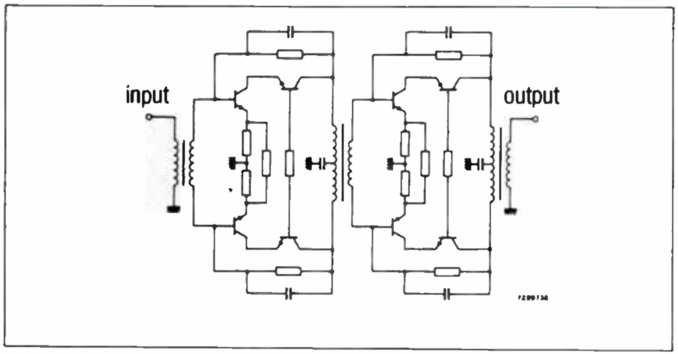
Then in 1977, Century III borrowed feedforward from the telephone industry. It was developed in 1917 and has been used in Bell Telephone's audio circuits for many years.

Century III applied this audio distortion technique to video signals. The idea is to get rid of distortion by creating it. A typical feedforward design contains two amps: a main and an error amp. As the signal enters the gain block, it is split and sent to both amps. The signal going to the main amp gets there first. Then the signal is split again, part of it going to the error amp. There, it combines out of phase with the other error signal, leaving only noise and distortion products. When combined, the noise and distortion characteristics of the signal from the main amp are cancelled by the noise and distortion from the error amp.

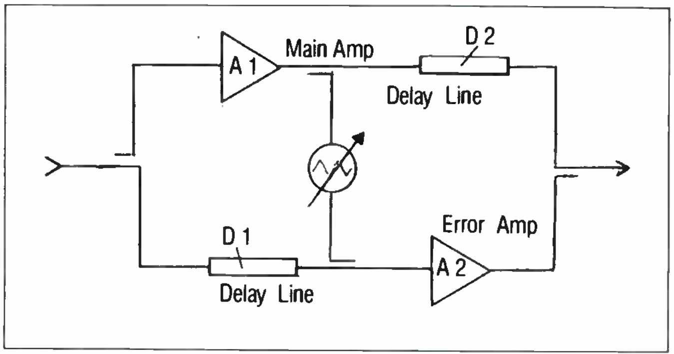
Feedforward offers better distortion specs than push-pull, higher gain and output and can be strung in longer cascades.

On the other hand, feedforward is more expensive. A feedforward trunk amp costs a good $200 more than a comparable push-pull operating at the same frequencies. For that reason, most manufacturers expect operators to use feedforward only in the trunk. Which explains why Patrick Miller, marketing manager, distribution products, Scientific-Atlanta, was surprised when one system ordered 600 feedforward line extenders.

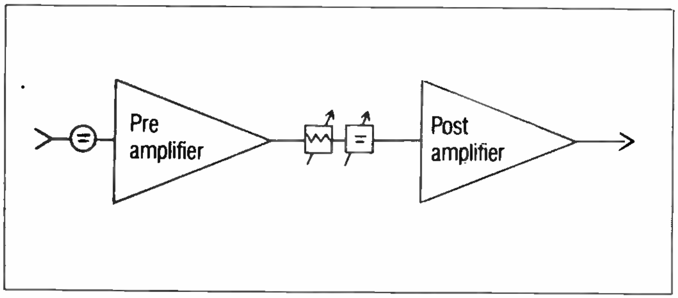
Power doubling and parallel power doubling, developed by Magnavox CATV Systems and its sister company, Amperex, in 1983, offer less costly alternatives. Parallel power doubling offers a 12 dB improvement in CTB and cross-



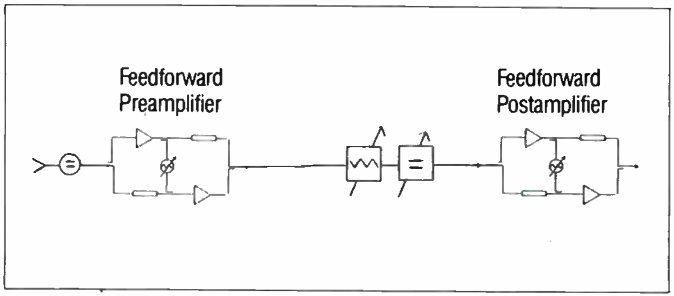
Conventional CATV push-pull configuration



Feedforward block diagram



Typical CATV amplifier block diagram



CATV amplifier with feedforward pre- and post amplifier

mod over conventional hybrid systems; power doubling, a 6 dB improvement.

Because power doubling uses a low noise preamplifier and a "distortion reduction technique" rather than a cancellation process, it has at least a 2 dB noise figure improvement over feedforward. It also has a 3-4 dB improvement in compression point, meaning it can run at higher output levels. "Power doubling is a little safer, more under control as you reach the compression point," Jeffers says. But compression really depends on system lay-out, he adds.

Broadband Engineering Vice President of Engineering Chuck Wise argues against using two power doubling hybrids unless a super high output is required. "The improvement in distortion is not that significant, but the power consumption is twice as high," he says.

Power consumption is also high with feedforward. "You're basically using twice as many amps as push-pull," Jeffers explains. However, fewer amps are required, which helps offset some of the increased power consumption.

Feedforward amps also are more sensitive to temperature and vibration and more prone to go out of balance, Jeffers says. "Because they are more complex than push-pull, there is a greater likelihood of failure," Miller adds.

But feedforward performs better at high frequencies than push-pull, which is why it is used in system upgrades.

There are three feedforward configurations: feedforward pre- and postamp, conventional preamp and feedforward postamp, and power doubling preamp and feedforward postamp. Because noise is a big factor in the preamp stage and feedforward has a worse noise figure than either push-pull or power doubling, Miller says feedforward shouldn't be used in the preliminary amplifying stage. The power doubling/feedforward combination probably has a better reach and better distortion characteristics than the conventional feedforward mix, but it consumes more power.

Without the discrete approach, there would have been no feedforward.

Vic Tarbutton,
Century III

Both discrete and package approaches are used for gain blocks. The discrete method uses two conventional IC hybrids, while the single IC hybrid package comes complete.

"Without the discrete approach, there would have been no feedforward," claims Century III Vice President of Engineering Vic Tarbutton. The IC package only goes to 450 MHz, whereas the discrete approach takes you to 550 MHz, adds John Hastings, marketing manager of distribution products for C-COR Electronics.

But not for long, says Miller. Come February, Scientific-Atlanta will begin production of 550 MHz IC hybrid feedforward units. Magnavox also has released preliminary specs on a 550 MHz feedforward product and Texscan's got feedforward in 500 MHz gear.

The discrete's performance also has been well-documented, says Lindsay Specialty Products Sales Representative and Engineer Don Stirling. Since the single hybrid package only became available recently, its field performance is relatively unknown.

The discrete approach involves a more time consuming and detailed manufacturing process. The manufacturer has to design his own loops and circuit board, put in his own splitters and combiners and do his own mounting and heat sinking. Aligning the delay lines is critical, because the cancellation process will not take place unless the delay lines match perfectly. The complexity of the design also requires more technical expertise and more quality control.

Because the manufacturer does his own alignment, Jeffers believes there's a greater chance of human error than with the hybrid approach. The discrete has long leads, which can give capacitors inductance, adds Texscan's Vice President and Director of Engineering Bert Henscheid. There also are more components, which raise the probability of failure.

Tarbutton admits that "with the discrete approach, each amp is always a little different. There may be differences in lead lengths or in the circuit board thickness. And each component has its own specific value," he adds.

But do the hybrid vendors produce a more reliable, better performing product?

Yes, contends David Chavez, national sales manager for Broadband Engineering. "The hybrid vendors' products are more dependable. They have the actual steps down pat; that's their sole and single business. For another manufacturer to do it just as well is more time consuming."

The substrate approach also uses miniaturized components, which are easier to control and more predictable, claims Henscheid.

This miniaturization results in a product that is substantially smaller than the discrete gain block. A gain block from TRW is about 2½ x 1½ inches, whereas the discrete block is about 6 x 4 inches, says Delta Benco Cascade Manager of Engineering Michael Yaw.

The discrete's larger size could translate into larger, more expensive housings and larger shipping and storing quarters. It also could require more expertise to mount on the pole, Triple Crown Electronics Vice President of Engineering Ted Shapira suggests. In an upgrade, the discrete's size could even prohibit retrofitting existing amps, asserts Herb Longwear, Magnovox's products specialist for CATV amplifiers.

While temperature is a sensitive issue for both amps, manufacturers disagree over whether both are equally tolerant of temperature changes.

In the hybrid approach, "everything is under one roof, so all the components will be affected equally by temperature," claims Longwear. Since the discrete's components are not located on one substrate, there's a greater chance the discrete delay lines will be affected unequally.

But DBC's Yaw says his company uses a proprietary sealing technique to protect its discrete components from Canada's weather, ranging from -40 to +80°F.

Hastings says C-COR's feedforward delay lines don't drift with temperature because they are cast in ceramic through a Triple S—Sealed Signal Synchronizer—technique. As a result, the delay lines are protected from temperature, moisture and heat and do not require field adjustment. But daily temperature changes are not that important, Tarbutton says. What you really have to watch for is transferring amps from aerial positions to underground pedestals where there's no ventilation, he cautions.

S-A's Miller argues that the hybrid IC has a larger heat sink, which pulls heat away from the hybrid quicker than the discrete. The hybrids also are mounted on the same heat sink, so there's no temperature difference, meaning the units age at the same rate.

Hastings and Tarbutton disagree. The key to heat protection isn't necessarily which feedforward approach is used but how the components are heat sinked and how short the heat transfer is.

"The discrete uses the same kind of heat transfer as the hybrid and the path is very short," Tarbutton says.■

R&D effort solves underground amplifier problems

By William H. Ellis, President, Broadband Engineering Inc.

During the past three years, Broadband Engineering has undertaken special R&D projects that have solved unique applications problems for specific customers and produced new products for the industry as well.

Since Broadband became a subsidiary of Augat Inc., the company's product line has grown from replacement components and upgrade electronics to more than 200 products, including indoor and outdoor amplifiers and the recent introduction of one- and two-way line extenders. Along the way, requests from customers for solutions to problems peculiar to their own systems resulted in a number of specialty amplifiers.

One such product evolved from a customer's need for a rack-mountable headend amplifier. Broadband's solution became the VFA. After introduction of the VFA, a user requested a return version for data network applications. That product is the VRA. The BIT-15 and the WP/RA (two-way intermediate trunk amplifier and return trunk amplifier, respectively) were designed in response to two customers' requirements for strand mounted expansion of trunk amplifier capabilities. Recent special R&D projects have produced the BIA-550, an isolation amplifier that eliminates off-air pick-up at the TV set from backfeeding up the subscriber drop; an apartment distribution amplifier that fits into a well-known manufacturer's lock box; and an indoor high gain amplifier for a United States government research facility.

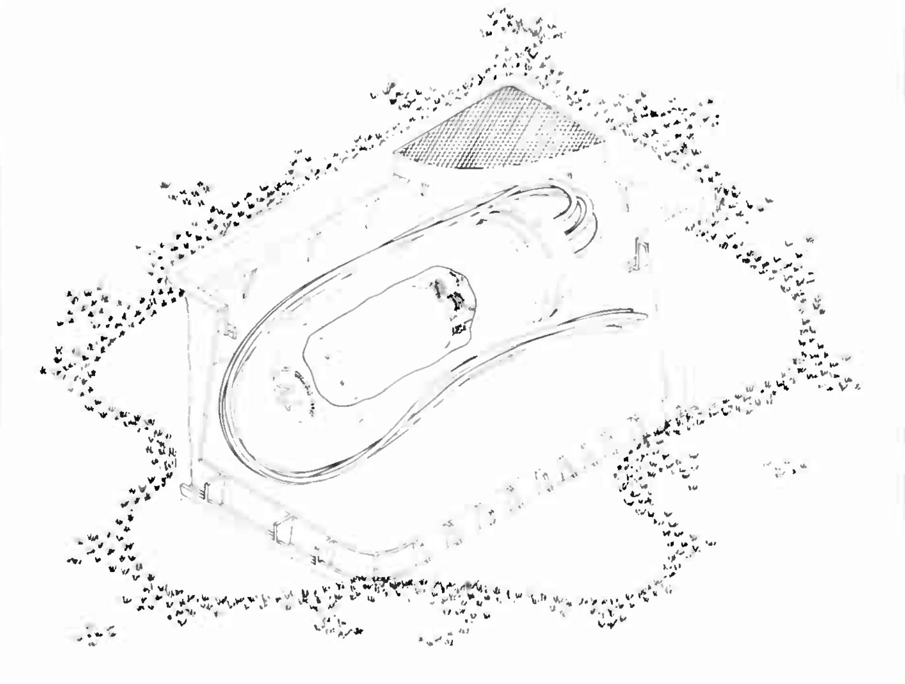
The ability to respond to special customer requests brought Broadband into contact with a European telecommunications company looking for a particular amplifier small enough to fit into an existing underground enclosure. The amplifier also had to be sophisticated enough to meet rigorous European electronic specifications.

The customer's applications included a line extender, an intermediate bridger and a two output distribution amplifier. However, the resulting amplifier also can be used as a manual trunk amplifier.

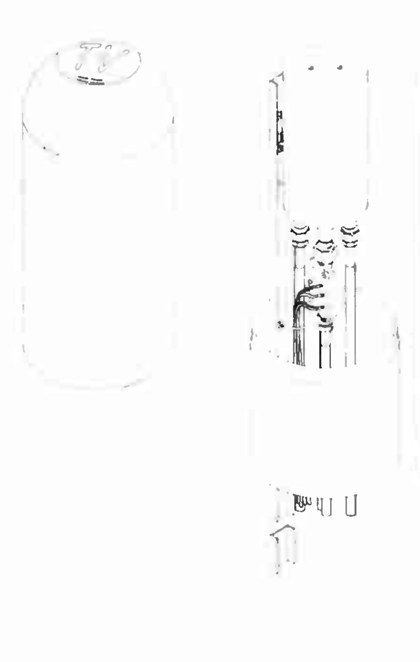
The design of the amplifier, the BUA, presented some unique mechanical and electronic problems. The mechanical problems included the requirement for all input and output connectors to be on the same end; mounting a two-way 450 MHz amplifier in a small cylindrical package; and devising a method of covering the amplifier with that configuration.

The electronic problems were a result of meeting very stringent specifications in such a unique mechanical package. To meet the return loss specifications, three new types of connectors had to be designed. The first two were mating connectors used to interface standard cable entry fittings to the amplifer base plate and to permit the amplifier itself to plug into the base plate. The third connector type was a set of mating units used to route RF signals through a heat sink plate that had pre- and post-amplifier printed circuit boards on either side.

Besides meeting stringent RF design requirements, we had to develop a very efficient switching mode power supply. The customer had established strict power consumption requirements for his systems and had limited the power to be drawn by each type of amplifier.



Broadband underground amplifier: subsurface mounting



Broadband underground amplifier: pedestal mounting

The quality goes all the way to the top.

Because, at Microflect, it starts on the drawing board.

Engineering

Quality begins with the planning. It has to be thorough. Options have to be considered. Your company's future needs have to be evaluated as well as its present ones. We want you to have a structure that will serve your requirements of today, with capabilities sufficient for those of tomorrow.

Fabrication

After all engineering details are checked, the fabrication process begins. Only the finest quality steel is used, which is then hot-dipped galvanized. All of our manufacturing is done under optimum conditions at our 56,000 square foot plant.

Installation

When all the fabrication work is done, our installation crews take over. Their professionalism and experience provide assurance that the work is done right. *We are the only major tower manufacturer with its own installation crew.*

At Microflect, the prime emphasis is quality. We have *earned* our reputation for quality and have worked hard to keep it.

Whether you need guyed or self-supporting towers, passive repeaters, or tower components, you can be confident that, if Microflect builds it, the quality is superior.

For more information about Microflect and Microflect products, call or write for our free capabilities brochure or for specific literature in your area of interest.

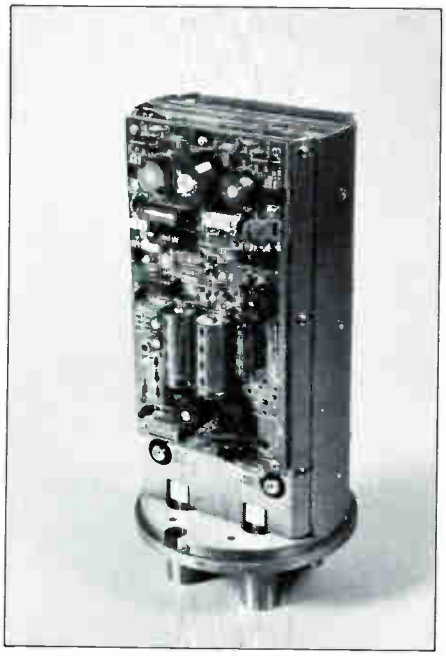
MICROFLECT

3575 25th St. SE • P.O. Box 12985
Salem, Oregon 97309-0985
(503) 363-9267 • TLX 510-599-0107

GUYED TOWERS • SELF-SUPPORTING TOWERS • PASSIVE REPEATERS
WAVEGUIDE SUPPORT SYSTEMS • TOWER ACCESSORIES • TOWER HARDWARE

See us at the Western Show, booth 592

Reader Service Number 56



The BUA's internal circuitry

Since there was no room in the amplifier for a power transformer, the supply had to operate directly from the incoming cable power. We also had to observe severe height limitations for the components mounted on the power supply printed circuit board. After evaluating a number of possible options, we decided to use a high frequency power MOSFET supply to get more power output from smaller components. The MOSFET design resulted in an efficiency of 75 to 85 percent depending upon line and load conditions.

An application has been filed with the U.S. Patent Office to patent several unique features of the amplifier.

Early in the development stages, we realized that this amplifier would solve many underground construction problems faced by U.S. cable operators. Because the amplifier can be mounted in an enclosure that can be totally waterproofed, it can be used in subsurface installations where flooding is an occasional problem. Furthermore, the amplifier is so small that it can be mounted in a tap size pedestal for above surface installation. This is less expensive than using larger amplifier type pedestals.

Installation is also less expensive because input and output connections are on the same end, eliminating the need for 90 degree connectors. The amplifier plugs into the connector base, which permits construction crews to install amplifier bases without having the amplifiers on-site. Later when the engineers activate the system, they simply plug the amplifier into the base and align it as required.

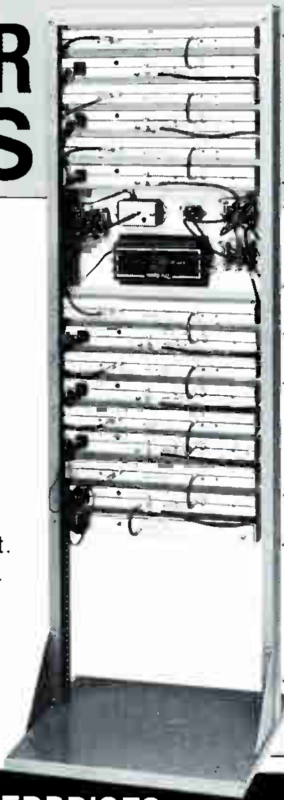
Maintenance was an important design parameter. Field maintenance is simplified since the power supply can be unplugged from the amplifier and replaced in seconds. If there are problems within the unit, the entire station can be unplugged and replaced easily by loosening two captive screws.

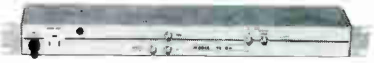
In the shop, maintenance of the printed circuit board electronics has been simplified by the use of plug-in hybrids.

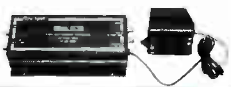
Some of the line extender version specifications include:

Bandwidth:	50-450 MHz (forward) 5-30 MHz (reverse)
Flatness:	± 5 dB
Gains:	26,28,32,36,43 dB 20 dB (reverse)
Return loss:	16 dB minimum
Signal-CTB ratio: **(60 chs. 45/40 dBmV)**	64 dB (standard hybrids) 70 dB (Power doubler hybrids)
Noise figure:	8 dB
Test points:	20 dB down ± 1 dB

By responding to the specific needs of the European customer, Broadband was able to develop an amplifier that solved some underground construction and maintenance problems.■



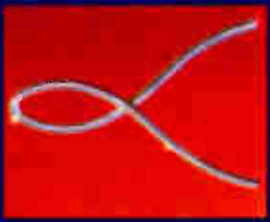




THE NEW MC^2 COAXIAL CABLE IS MORE RESISTANT

Because each cell is an hermetically sealed compartment, MC^2 is more resistant to moisture ingress and migration. No other cable can stand up to its environment better than the new MC^2.

MORE SIGNAL STRENGTH



The new MC^2 Coaxial Cable's patented design of using air instead of foam means less attenuation and more signal strength. And that's with a signal load of 77 channels.

MORE SAVINGS

Because MC^2 components are bonded together for maximum flexibility and minimum signal loss, you save more money on installation, connections, labor and on the cable itself.

MORE economical. MORE reliable. MORE flexible. MC^2 outperformed the competition hands down and we'll be happy to show you the results anytime.

General Cable Company
CATV DIVISION
A Unit of The Penn Central Corporation
Reader Service Number 58

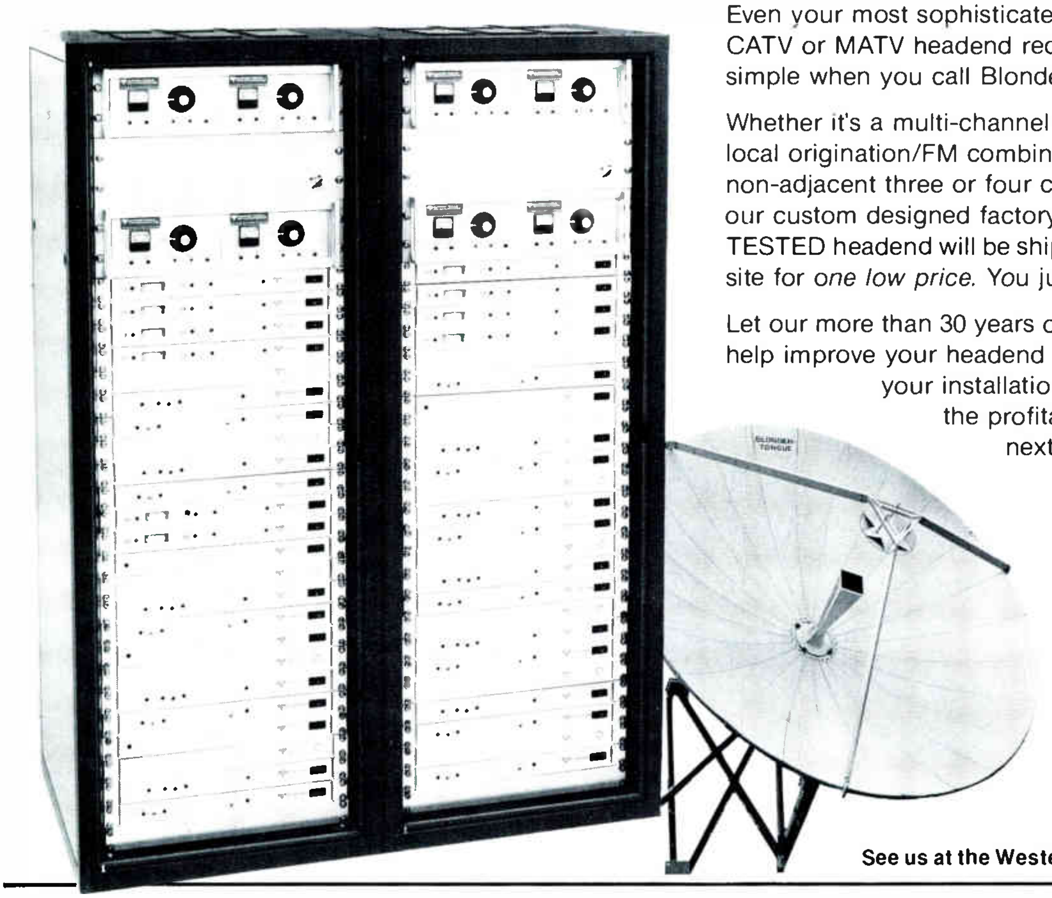
Visit us at booth 370 at the Western Show.

Trunk amplifiers

Company name, model	Bandwidth	Response flatness	Min. full gain	Return loss	Output level	Noise figure
Broadband Engineering CL-4 conventional	50-300 MHz	±.25 dB	26 dB	16 dB	29/32 dBmV recommended	7 dB
C-COR Electronics B-40 conventional	54-450 MHz @ 22 dB	±0.2 dB	26 dB	16 dB min.	31/26 dBmV	7.5 dB
FT-527 feed-forward	54-450 MHz @ 30 dB	±0.2 dB	34 dB	16 dB min.	36/29 dBmV	7.5 dB
Delta Benco Cascade Unicom conventional	50-330 MHz	±.25 dB	manual: 26 dB (slope 14-26 dB)	16 dB	33 dBmV	11.5 dB
Jerrold Starline X-1500 conventional	50-550 MHz	±.3 dB	25 dB	16 dB min.	25/31 dBmV	9 dB
40104 feed-forward	50-450 MHz @ 30 dB	±.25 dB	33 dB	16 dB min.	33/40 dBmV	9 dB
Lindsay 1010 conventional	47-450 MHz	±.25 dB	26 dB	16 dB	26/30 dBmV @ 450 MHz	9.8 dB
1020 Feed-forward series	47-450 MHz	±.25 dB	32 dB	16 dB	33/38 dBmV @ 450 MHz	10.3 dB
Magnavox conventional	50-550 MHz	±.25 dB	26 dB	16 dB @ 75 ohms	24/30 dBmV	8 dB
Power doubling	50-550 MHz	±.25 dB	26 dB	16 dB @75 ohms	24/30 dBmV	8 dB
Feed-forward	50-550 MHz	±.25 dB	35 dB	16 dB @ 75 ohms	31/37 dBmV	9 dB
Scientific-Atlanta 344070 conventional	54-550 MHz	±.25 dB	25 dB	16 dB	78 Ch + 33 dBmV	8 dB
6800 feedforward	78 channels @ 26 dB	±0.3 dB	30 dB	16 dB	+37 dBmV recommended	11 dB
Texscan T-500 conventional	50-500 MHz	±.3 dB	26 dB	16 dB	25/32 dBmV	9 dB
Superhybrid	50-500 MHz	±.3 dB	26 dB	16 dB	25/32 dBmV	10 dB
F500 feedforward	50-500 MHz	±.25 dB	30 dB	16 dB	33/40 dBmV	11 dB
Winegard 84 conventional	50-400 MHz	±.25 dB	26 dB		+30 dBmV	8 dB

Composite triple beat	Cross modulation	Second order	Hum modulation	Power requirements	Temperature
−92 dB	−92 dB	−88 dB	−60 dB	12 watts	−30 − +140° F
−87 dB	−87 dB	−85.5 dB		AC @ 60/ 30: 430/820 watts	−40 − +60° C
−91 dB	−87 dB	−80 dB	better than −70 dB @ 10 amperes	770 watts	−40 − +60° C
−89 dB		−84 dB	−60 dB one way, −75 dB two-way	39 watts @ 60 volts	−40 − +60° C
−90 dB	−92 dB	−87 dB	−70 dB	@ 60 volts: 22.4 watts, .45 amperes	−40 − +140° F
(−) −95 dB	(−) −94 dB	(−) −90 dB	−66 dB	45 watts, 10 amperes	−40 − +140° F
−87 dB@ 450 MHz	−90.5 dB @ 450 MHz	−92.2 dB (2,M6 on M15)	< −70 dB	TA/RA: 22 watts	−40 − +60° C
−91.2 dB @ 450 MHz	−88.3 dB @ 450 MHz	−91.3 dB (2,M6 on M15)	< −70 dB	TA/RA: 34 watts	−40 − +60° C
−85 dB	−87 dB	−83 dB	−65 dB	varies	−40 − +140° F
−90 dB	−92 dB	−86 dB	−65 dB	varies	−40 − +140° F
−91 dB	−92 dB	−86 dB	−65 dB	varies	−40 − +140° F
−82 dB 78 Ch	−82 dB 78 Ch	−81 dB 78 Ch	−70 dB	Max. Ac: 10 a; @ 24 V dc: .39 a	
−89 dB	−91 dB	−91 dB	−70 dB	1.9 A @ 24 V dc	
−83 dB	−86 dB	−80 dB	−65 dB	@ 60 V: 48 watts, .8 amperes	−40 − +140° F
−88 dB	−91 dB	−80 dB	−65 dB	@ 60 volts: 72 watts, 1.2 amperes	−40 − +140° F
−82 dB	−85 dB	−80 dB	−65 dB	@ 60 V:80 watts, 1.33 amperes	−40 − +140° F
−85 dB	−86 dB	−86 dB	−70 dB	(automatic) 18 watts linear	−40 − +140° F

Blonder-Tongue MAKES IT SIMPLE



Even your most sophisticated Private Cable, CATV or MATV headend requirement becomes simple when you call Blonder-Tongue.

Whether it's a multi-channel satellite/off-air/local origination/FM combination or a simple non-adjacent three or four channel VHF system, our custom designed factory assembled and TESTED headend will be shipped directly to your site for *one low price.* You just plug it in!

Let our more than 30 years of proven experience help improve your headend reliability, speed up your installation time and increase the profitability on your next installation. Let Blonder-Tongue make it simple for you!

Call or write,
Blonder-Tongue
(201) 679-4000

See us at the Western Show, booth 1230.

BLONDER-TONGUE
LABORATORIES INCORPORATED
ONE JAKE BROWN ROAD, OLD BRIDGE, N.J. 08857

Reader Service Number 59

Coaxial Cable

Model	Size	Tested for SRL to	Conductor	Dielectric	Attenuation @ 300 and 450 MHz	Capacitance	Velocity of propogation
Belden **Duobond Plus**	RG59	450 MHz	Copper covered steel	Foam polyethylene	4.6 dB/100 ft. 5.8 dB/100 ft.	17.3 pF/ft.	78%
Capscan	RG59	450 MHz	Copper covered steel	Foam polyethylene	4.27 dB/100 ft. 5.29 dB/100 ft.	n/a	81%
	1/2 inch	450 MHz	Copper covered aluminum	Foam polyethylene	1.32 dB/100 ft. 1.65 dB/100 ft.	15 pF/ft.	88%
	7/8 inch	450 MHz	Copper covered aluminum	Foam polyethylene	.80 dB/100 ft. 1.01 dB/100 ft.	15 pF/ft.	88%
Channel Master	RG59	890 MHz	Copper covered steel	Foam polyethylene	4.4 dB/100 ft. 5.7 dB/100 ft.	n/a	80%
General Cable **MC^2**	1/2 inch	550 MHz	Copper covered alum. or copper	Air	1.14 dB/100 ft. 1.40 dB/100 ft.	14.7 pF/ft.	93%
	3/4 inch	550 MHz	Copper covered alum. or copper	Air	.79 dB/100 ft. .97 dB/100 ft.	15 pF/ft.	93%
M/A-COM **Comm Scope**	F59SSV	450 MHz	Copper covered steel	Foam polyethylene	4.45 dB/100 ft. 5.40 dB/100 ft.	16.2 pF/ft.	82%
Quantum **Reach**	1/2 inch	450 MHz	Copper covered aluminum	Foam polyethylene	1.25 dB/100 ft. 1.55 dB/100 ft.	15.3 pF/ft.	88%
	7/8 inch	450 MHz	Copper covered aluminum	Foam polyethylene	.78 dB/100 ft. .97 dB/100 ft.	15.3 pF/ft.	88%
Scientific- **Atlanta**	RG59	450 MHz	Copper covered steel or copper	Foam polyethylene	4.43 dB/100 ft. 5.46 dB/100 ft.	17 pF/ft.	81%
Cableflex	1/2 inch	450 MHz	Copper covered alum. or copper	Foam polyethylene	1.30 dB/100 ft. 1.62 dB/100 ft.	15.3 pF/ft.	87%
	7/8 inch	450 MHz	Copper covered alum. or copper	Foam polyethylene	.78 dB/100 ft. .97 dB/100 ft.	15.3 pF/ft.	87%
Times Fiber **T4 Quad Shield**	RG59	550 MHz	Copper covered steel	Foam polyethylene	4.32 dB/100 ft. 5.29 dB/100 ft.	16.5 pF/ft.	83%
T4 Plus	1/2 inch	550 MHz	Copper covered aluminum	Foam polyethylene	1.32 dB/100 ft. 1.65 dB/100 ft.	15.3 pF/ft.	88%
	7/8 inch	550 MHz	Copper covered aluminum	Foam polyethylene	.80 dB/100 ft. 1.01 dB/100 ft.	15.3 pF/ft.	88%

SPECIAL OFFER

20% OFF ALL TYPES (QUANTITIES 10-999)

PARENTAL CONTROL LOCKS

INCLUDE
THIS AD WITH
YOUR ORDER
TO OBTAIN THE
20% DISCOUNT.

eeg

RX-LOCK
DUBL-LOCK
TRIPL-LOCK
TANDM-LOCK
MOVIE-LOCK
AV-LOCK

enterprises, inc.

OFFER EXPIRES DEC. 31, 1984 1 ROME STREET • FARMINGDALE, N.Y. 11735 • (516) 293-7472

Reader Service Number 60

How to Give Your Video Department the Big Budget Look

Let's face it, today's video audience demands high-quality, exciting graphic presentations. While most character/graphics generators are barely adequate, only a Chyron character/graphics generator has the features and capabilities needed to give you that "big budget" look.

And speaking of budget, our new VP-1 and stand-alone VP-2 C/G generators won't break yours.

We've taken the high-resolution, versatility and outstanding features found in our more costly models and put them in two machines that begin at $4500*. Best of all, they are Chyrons, the finest name in character/graphics generator equipment.

So, when it's time to buy, the only logical choice is the VP-1 or VP-2...a new generation from Chyron.

*VP-1 Suggested List Price. VP-2 Suggested List Price $7500.

CHYRON®

VIDEO PRODUCTS DIVISION

265 Spagnoli Road Melville, New York 11747

Telephone: (516) 249-3018 Telex: 144522 CHYRON MELV

Reader Service Number 61

Cable manufacturers

Belden coax cables

Belden Electronic Wire and Cable
P.O. Box 1980
Richmond, Ind. 47375
317/983-5200

Capscan Cable Co.
Halls Mills Road
P.O. Box 36
Adelphia, N.J. 07710
800/222-5388

Channel Master Division of Avnet
Route 209
Ellenville, N.Y. 12428
914/647-5000

General Cable Co.
CATV Division
P.O. Box 700
One Woodbridge Center
Woodbridge, N.J. 07095
201/636-5500

M/A-Com
Comm Scope
P.O. Box 1729
Hickory, N.C. 28603
800/438-3331

Scientific-Atlanta Inc.
One Technology Parkway
P.O. Box 105027
Atlanta, Ga. 30348
404/441-4000

Times Fiber Communications Inc.
358 Hall Avenue
P.O. Box 384
Wallingford, Conn. 06492
203/265-8500

Correction

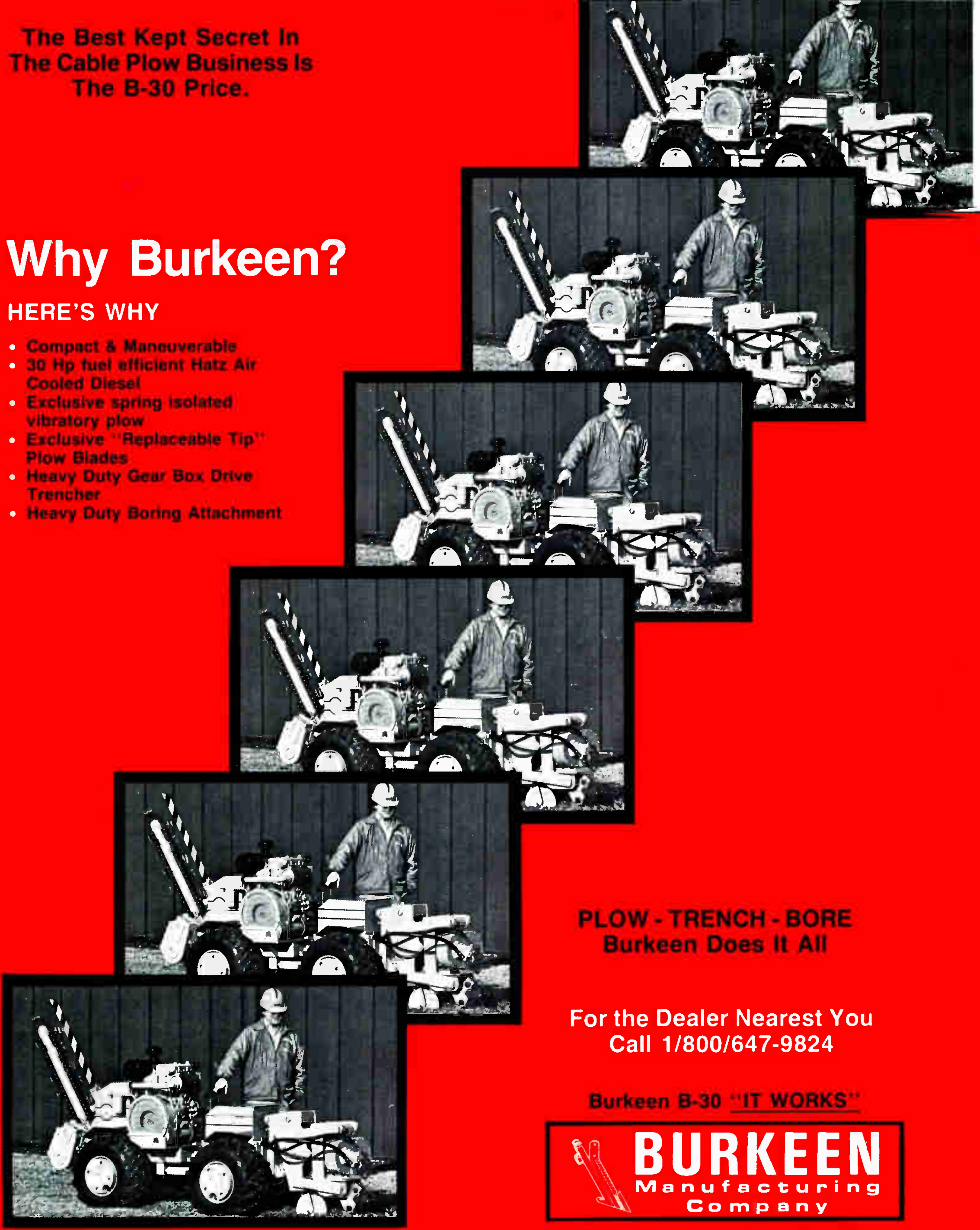
In the September issue of *CED*, we incorrectly reported that Scientific-Atlanta's 8500 System Manager III package included computerized billing. The system contains applications software designed to allow operators to take advantage of computerized billing services.

**The Best Kept Secret In
The Cable Plow Business Is
The B-30 Price.**

Why Burkeen?

HERE'S WHY

- Compact & Maneuverable
- 30 Hp fuel efficient Hatz Air Cooled Diesel
- Exclusive spring isolated vibratory plow
- Exclusive "Replaceable Tip" Plow Blades
- Heavy Duty Gear Box Drive Trencher
- Heavy Duty Boring Attachment



**PLOW - TRENCH - BORE
Burkeen Does It All**

**For the Dealer Nearest You
Call 1/800/647-9824**

Burkeen B-30 "IT WORKS"

**BURKEEN
Manufacturing
Company**

11200 HIGH POINT COVE – OLIVE BRANCH, MS 38654

Reader Service Number 62

EMPLOYMENT OPPORTUNITIES/HELP WANTED

IMMEDIATE OPENINGS: NATIONWIDE
"Leader in the placement of minority candidates"

Management: Operations Manager, General Managers, Midwest and East Coast, General Manager Trainee, Controller with cable experience, Financial Management Service Analyst, West Coast.

Marketing: Bi-lingual (Spanish) Sales Managers, Marketing Managers, Associate Marketing Manager.

Positions located West, Midwest and East Coast.

Technical: Technical Managers, Chief Technicians Midwest, East and Southwest, Director of Technical Operations, Manager of Technical Operations, Lead Technicians, Installers/Technicians, Video Engineer, Construction (Video) Engineer, Outside Plant Engineer for new voice & data network.

The above positions offer excellent salary and benefits. Send resumes in confidence to:

Note to Human Resources Directors: Call or write MCNT for references regarding successful key management placements.)

Minorities and females encouraged to apply.

Will Horton, Executive Director
Minorities in Cable & New Technologies
Telecommunications Job Development Network
624 South Michigan Avenue
Suite 602
Chicago, IL 60605
(312) 922-9043

Place a classified ad in
CABLEVISION and CED
Call or write
P.O. Box 5208 T.A.,
Denver, CO 80217
(303) 860-0111

JIM YOUNG & ASSOCIATES

"Leader in the Placement of Cable Television Professionals"

Nationwide Service

One Young Plaza
1235 Ranger Highway
Weatherford, TX 76086
(800) 433-2160
(817) 599-7623
Texas Collect

ENGINEERING • MANAGEMENT TECHNICIANS • MARKETING • SALES

(MSO or Equipment)

CAREER
MARKETING
ASSOCIATES

ROBIN SQUIRES
Cable Television Specialist
7100 East Belleview, Suite 206
Englewood, CO 80111
(303) 779-8890

BakerScott & Co.

- *General Management*
- *Operations (corp. & field)*
- *Engineers*
- *Technical*
- *Sales/Marketing*
- *Finance/Accounting*

FEE PAID

Call or write in CONFIDENCE

THE PROFESSIONAL CABLE PLACEMENT PEOPLE

Positions available with MSOs, Networks, Regional & Independent Operators, Coast to Coast.

All Levels of Management

JUDY BOUER

DAVID ALLEN
President, Cable Div.

"WE DON'T TALK CABLE, WE KNOW CABLE"

1259 Route 46
Parsippany, NJ 07054
201-263-3355

SENIOR TECHNICIAN

Minimum 5 year's experience, in plant/headend maintenance, proofchecks, etc. Good knowledge of CATV technology (NCTI Technician Course, military electronics training or trade school). Large, 615 miles urban system recently rebuilt and operating under new ownership. ThetaCom plant, S/A headends. Single cable, 35 channels at present, increasing to 50 in near future, AML hub. FCC License needed, but can be obtained after hire. Full benefits. $10.50/per hr. to start.

Send cover letter and resume (no phone calls) to:

Roger Wilson
Chief Engineer
Cable Oakland
2101 Livingston Street
Oakland, CA 94606
An equal opportunity employer.

Call Suzanne Sparrow
Today
For information on
Classified Advertising
(303) 860-0111

CABLE SEARCH ASSOCIATES

Professional Search and Placement

Engineering	Sales
Management	Marketing
Technicians	Construction

Call or Write

WICK KIRBY
(312) 369-2620
Telex: 720-462
P.O. Box 2347, Naperville, IL 6056

WANTED

EXPERIENCED UNDERGROUND FOREMAN— FOREPERSON

ESTABLISHED UNDERGROUND CATV CONTRACTOR SEEKS EXPERIENCED AND QUALIFIED FOREMAN OR FOREPERSON FOR PROJECTS IN FLORIDA, MASSACHUSETTS, NEW HAMPSHIRE AND NEW YORK. (TOP WAGES AND BENEFITS.) PLEASE SEND RESUME OR CALL:

EARLY & SONS, INC.
CONTRACTORS
BRADFORD, MASS.

Richard P. Early, Jr.
58 So. Kimball St.
Bradford, Mass. 01830
(617) 374-8033

Bill Soucy
P.O. Box 10408
Pompano Beach, Fla. 33061-6408
(305) 971-6111

CONSTRUCTION

QINTAR™
Quality Electronics for the Home

- Quantity Discounts
- In Stock Availability
- Customization Available

VIDEO CONTROL SWITCH

*Five Input Switch For CATV & VCR Use - Over 60dB Of Isolation - Low Loss

CALL TODAY — RANDY TISHKOFF (800)252-7889
Inside California (818) 706-1940

HELP WANTED

ENTREPRENEURIAL ENGINEER

Ready for more than just a paycheck? We are looking for a very special person, a technical expert in cable with an entrepreneurial personality, a self starter who would enjoy working with a dynamic small team of colleagues. You must be technically proficient in state-of-the-art cable equipment, but of equal importance, a real understanding of rebuilds, including capital budgeting. You also must be a motivator of people.

If you are interested in learning more about this opportunity and our nationally respected company, send in confidence a copy of your resume to:

President
BOX: CED 1284-1

ITCI International Thomson Communications Inc.

Suzanne Sparrow
Classified Advertising Manager

CableVision CED CABLEFILE

Office: 600 Grant St., Suite 600, Denver, CO 80203 (303) 860-0111
Mailing Address: P.O. Box 5208 T.A., Denver, CO 80217

YOUR BUSINESS CARD HERE FOR ONLY $60

HOW TO RESPOND TO A BLIND BOX AD:

Box: CED (Box Number)
c/o CED MAGAZINE
P.O. Box 5208 T.A.
Denver, CO 80217

CED

CLASSIFIED ADVERTISING MADE EASY

To place your own classified ad, simply fill out this coupon and return it to: Suzanne Sparrow, CED Magazine, P.O. Box 5208 T.A., Denver, CO 80217. Be sure to let us know how many times you want to run your ad.

Ad Copy: ______________________________

____

____

____

____

Bill to: Company ______________________________
Address ______________________________
City ______________ State __________ Zip __________
Phone ______________________________
Ordered by ______________________________
Insertions ______________________________

Rates are $50/per vertical column inch for line classifieds. Allow approx. 40 words per inch. There is a one inch minimum.

USED
AERIAL BUCKET TRUCKS

Most units completely rebuilt.
Specializing in CATV use.
Telsta SU34s and T40s Plus other makes and models.

(Call toll-free)
1-800-343-4614

Leo LeBlanc
(617) 893-3900

Colvins Inc. AERIAL TRUCKS
185 Prospect Street
Waltham, Mass. 02154
(Boston)

NEMAL STOCKS:

- SPLITTERS • SWITCHES
- TRANSFORMERS
- ADAPTERS • CONVERTERS

Immediate Delivery!!!

- TRUNK CABLE
- DROP CABLE • AMPLIFIERS
- SATELLITE CABLE

Call or write for
Cable Systems Pricing

WE EXPORT WORLDWIDE

NEMAL ELECTRONICS, INC.
12240 N.E. 14th Avenue
North Miami, FL 33161
(305) 893-3924

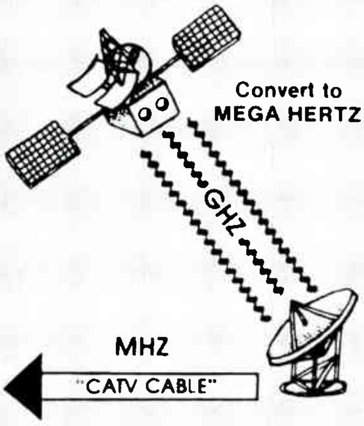
Complete Drafting Services
System Design with BOM
Over 23 years experience
E. Mark Russell
P.O. Box 1764
Bradenton, FL 33506
(813) 746-8824

TELL IT!
SELL IT!

Is your cable system for sale? Do you have used equipment in your inventory? Why not turn it into cash. A classified ad in CABLEVISION and CED is just the ticket. Call me today.

Suzanne Sparrow
(303) 860-0111

Mega Hertz Sales



Cable Television
Manufacturer's Representative
And Distributor

7061 So. University, Suite 210
Littleton, CO 80122
(800) 525-8386
(303) 797-7900

2700 Rockcreek Pkwy., Suite 304
Kansas City, MO 64117
(800) 821-6800
(816) 842-2880

4001 Airport Parkway
Bedford, TX 76021
(817) 267-2288

Better than ever—with a new company name.
INTERNATIONAL THOMSON COMMUNICATIONS INC.
(formerly Titsch Communications, Inc.)

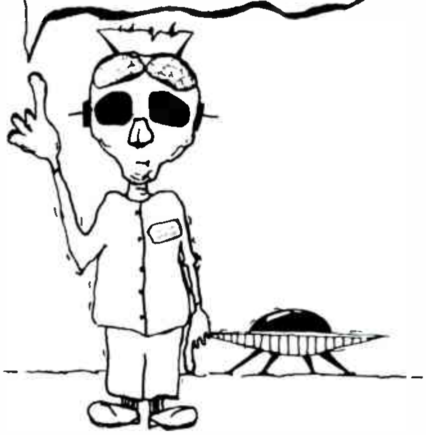
---

the only cable connection.

CableVision
CABLEFILE
CED

Take a load off your . . . inventory

Place a classified ad in CABLEVISION and CED. Call Suzanne Sparrow for details. (303) 860-0111 P.O. Box 5208 T.A., Denver, Colorado 80217



Advertisers' Index

Advertisers' Index	Reader Service Number	Page Number
Alpha Technologies	17	24
Anixter Communications	68	90
Avtek, Inc.	64	86
Barker CATV Construction	33	39
Blonder-Tongue	59	74
Broadband Engineering	3	5
Budco Inc.	8	10
Burkeen Manufacturing Company	62	77
Burnup & Sims Cable Com, Inc.	13	19
Cable Services Co. Inc.	16	23
CATV Services, Inc.	11	18
Cavision Communications Inc.	69	88
Channel Master	32	38
Chyron	61	76
Compucon, Inc.	51	63
Comsearch	23	30
C-2 Utility Contractors	43	55
CWY Electronics Inc.	14	21
CZ Labs	25	29
Delta Benco Cascade	52	64
DI Tech	31	37
Ditch Witch Equipment	36	44
Eagle Comtronics Inc.	67	89
EEG Enterprises, Inc.	60	76
EPD Electronics Inc.	20	27
Falcone International, Inc.	18	26
General Cable	58	71
Ben Hughes Communication	36	30
Hughes Microwave	10	16
ITW Linx	21	45
Kanematsu-Gosho (USA) Inc.	37	47
Kennedy Cable Construction	29	57
Larsen Electronics	47	60
Leaming Industries	46	59
Lindsay America Inc.	22	46
LRC Electronics	1	3
MACOM	57	70
M/A-Com Commscope	28	35
M/A-Com Commscope	35	42-43
Microflect	56	69
NaCom Corp.	38	49
Panasonic Industrial	34	41
Pioneer Communications of	5	9
RT Katek Communications	9	15
Rainbow Satellite	50	62
RMS Electronics	40	51
RMT Engineering	63	84
Sadelco, Inc.	27	34
Signal Vision, Inc.	53,54,55	67
Sitco Antennas	19	27
Soft Systems	12	18
Standard Communication	4	7
Standard Components	0	31
Superior Satellite Engineers	66	87
Telecrafter Products Corp.	41	52
Tele-Wire Supply Corp.	6	12
Texas CATV Association	45	57
Time Manufacturing Co.	39	50
Triple Crown Electronics Inc.	72	33
Vitek Electronics, Inc.	2	4
Wade Communications	42	53
Wavetek	44	56
Wegener Communications	49	61
Weldone Trading Co. Inc.	48	60
Westec Communications, Inc.	25	29
Westinghouse Electric Company	70	11

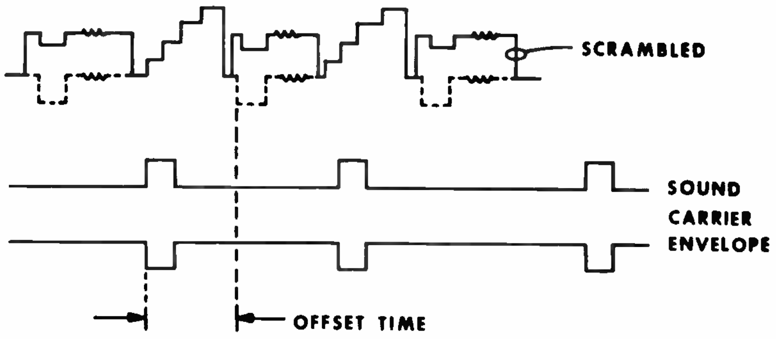


Figure 15 Offset scrambling timing

continued from page 54

The scrambler also must follow a rather onerous set of standards for the sound carrier pulses . If the pulses' transition times are too slow, then timing errors can develop. If too fast, spectrum overlap can occur.

A final requirement is the scrambler should ensure that energy content on the video doesn't fall around the sound carrier, which would result in timing errors. This is controlled by inserting a phase equalized lowpass filter in the scrambler baseband video loop. Characteristics of the filter should be checked when evaluating scramblers.

Stereo

A leading question in the industry today concerns the compatibility between various scrambling systems and the stereo TV system. The format is nearly identical to the FM stereo format that has been with us for 25 years or so. Differences between the two can be summarized briefly.

1) TV stereo transmits a pilot at 15.734 kHz (locked to the horizontal rate), rather than at 19 kHz as in FM stereo.

2) TV stereo transmits a secondary audio program (SAP), "FMd" onto a carrier at 5 times the horizontal rate (78.67 KHz). FM stereo may transmit an SCA on a 57 kHz subcarrier.

3) TV stereo also transmits a low grade "professional channel" by "FMing" a subcarrier at 6.5 times the horizontal rate. This is intended to be used by a TV station for low rate data (e.g. telemetry from transmitter to studio) or for intercom quality voice.

Multichannel sound baseband

Refer to Figure 17 for a spectrum of the proposed TV stereo baseband format (before modulation). As in FM stereo, a sum (L + R) signal is transmitted at its normal baseband frequency. Above this, the difference signal (L-R) is transmitted. To shift the difference signal's spectrum, it is double sideband suppressed carrier (DSB-SC) modulated onto a carrier at twice the horizontal rate ($2f_h$). To recover the L-R signal, the suppressed carrier must first be recovered. To do this, a pilot is transmitted at the horizontal rate. This pilot is doubled (usually in a phaselocked loop) and synchronously detects the L-R signal. The figure shows the SAP and professional channels. Phase errors in the pilot result in phase errors in the L-R signal, and this causes separation errors.

Interaction between a scrambling system and stereo breaks down into two problems: what we do to them and what they do to us.

Harold R. Null
Vice President, Engineering
Storer Communications, Inc.

"Cable technology is changing rapidly; we need up to date information at our fingertips. CED provides this input in step with the changing times."

CED

The Engineer's Most Valuable Tool

International Thomson Communications Inc.
600 Grant Street
Suite 600
Denver, CO 80203
(303) 860-0111

What they do to us

The problem is that we put amplitude modulation on signals that have been "FMd" with a deviation of ±25 kHz, and now we find ourselves facing a deviation nearly three times as great! What is bothering us? In the signal path to recover our AM for synchronization, we have placed bandpass filters. Now bandpass filters by definition are not flat outside their passband, and they may not be totally flat within their passband. Thus, as the sound carrier's frequency is changed by the imposed frequency modulation, it may ride up and down a filter response, turning FM into AM (FM/AM). Filters that worked alright with 25 kHz FM may have a problem with nearly 75 kHz deviation. This could be particularly onerous for systems that use sinewave modulation in a linear feedback loop, since the increased FM/AM component is transferred directly to the video signal. Switched systems tend to be somewhat less susceptible as a result of their use of a threshold at which a decision is made. Of course, FM/AM can distort the decision point, resulting in the eventual collapse of switched systems as a result of switching time jitter.

What we do to them

Look to Figure 17 and observe the pilot signal, which has a deviation of only 5 kHz. Remember that the pilot is used to detect the presence of a stereo telecast, switching in the stereo decoder.

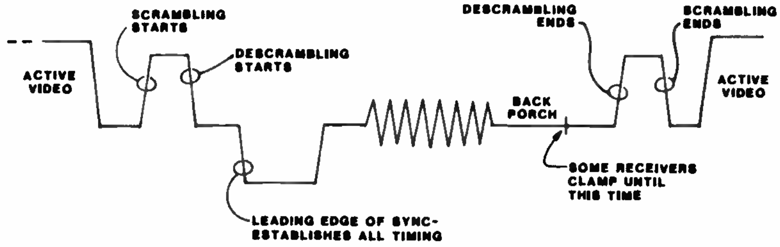
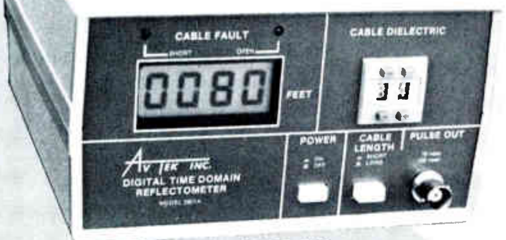


Figure 16 Descrambled video

Now, recall that many common RF scrambling schemes put AM on the sound carrier locked to the horizontal rate. Just as FM can get converted to AM, AM can get converted to FM. The mechanisms for doing this are legion, and include limiter errors and asymmetrically tuned bandpass filters. The more AM we put on the sound carrier, the more spurious FM will be generated.

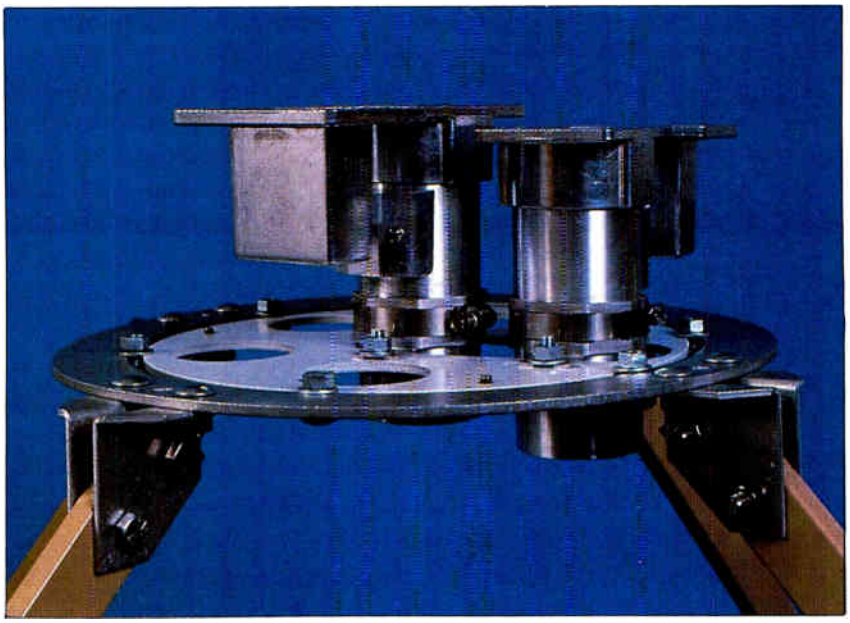
When this FM sound carrier, now contaminated with spurious FM modulation, is detected, the resultant signal has excess energy at f_h. If enough energy is present, the stereo pilot detector may falsely trigger on a monaural signal. Also, the energy generated by the scrambling process is at a random phase with respect to the pilot during a stereo broadcast. This causes a phase shift in the pilot carrier (now contaminated), which in turn results in a phase shift of the reinserted carrier. The final result is loss of separation.

In summary, it is essential that AM/FM conversion be controlled to permit good quality audio on a scrambled stereo telecast. A portion of the responsibility for controlling AM/FM resides within the TV receiver or stereo adaptor. Obviously, the more AM that exists on the sound carrier, the more severe



Superior Satellite Engineers

DUAL-BEAM PERFORMANCE KITS™ FOR 3-METER TO 4.6 METER SATELLITE ANTENNAS.

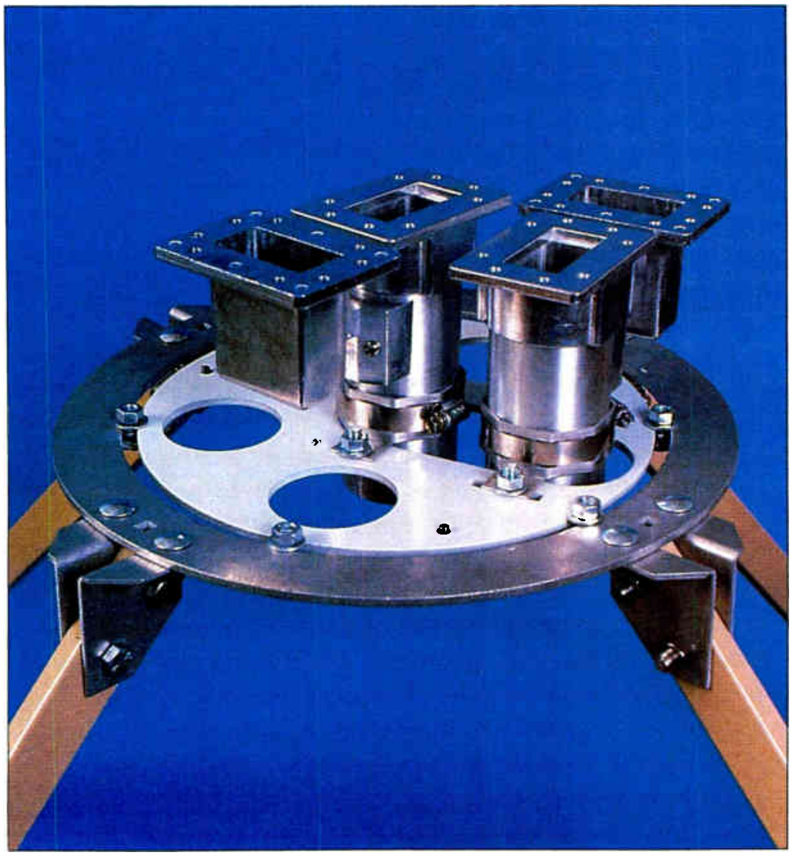


Receive simultaneous satellite programming from Satcom 3R and Galaxy I OR Comstar D4 and Westar 5

TYPICAL INSTALLATIONS

Scientific Atlanta	4.6m
Scientific Atlanta	3.65m
Scientific Atlanta	3.2m
Prodelin	3.7m
MSC	4.0m

(and many more)



SSE performance kits™ feature individual azimuth, elevation, focal length and polarity adjustments. Fibreglass cover for protection.

Performance kits™ available for 5m to 11m antennas

SUPERIOR SATELLITE ENGINEERS
P.O. BOX 1149
ROSEVILLE, CA 95661
(916) 791-3315

U.S. Patent Pend

Visit us at the Western Show, booth 010

Reader Service Number 66

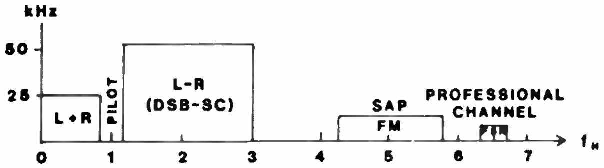


Figure 17 Multichannel sound baseband format

the problem will be. Remember, by the time the receiver gets the audio signal, the signal has been amplitude modulated not only by the scrambling but by the descrambling process as well. The greater the scrambling depth, the greater AM on the sound carrier. Also, if timing pulses are put on the sound carrier coincident with the horizontal blanking interval, then the pulse amplitude seen by the TV is the sum of the scrambling and descrambling pulse amplitudes. A particularly worrisome case is an on-time descrambling system having extra scrambling depth (e.g. 10 dB suppression). With 6 dB timing pulses, the audio carrier has pulses of 16 dB seen by the TV audio system. This could give rise to considerable AM/FM conversion.

As of this writing, the above caveats remain speculative. The quantitative severity of the effects discussed is not known. Early tests tend to support the conjectures made above, but more testing is needed before definitive statements can be made. ■

Footnote

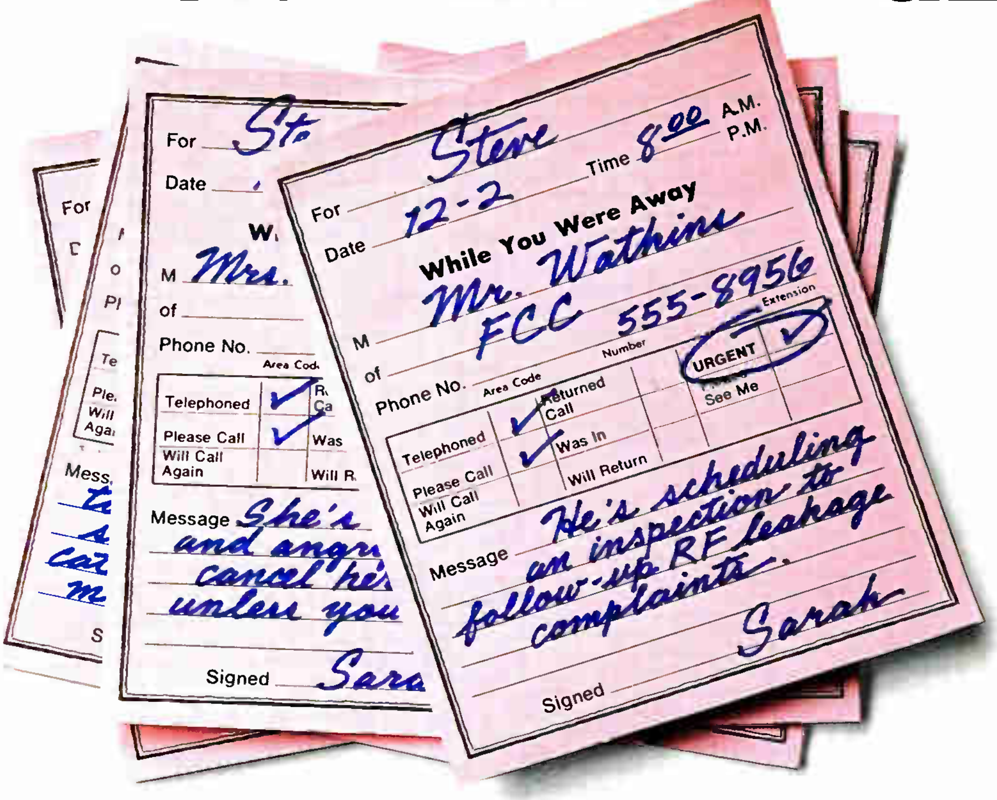
1) CTB increases with the number of channels through two mechanisms: increased mixer voltage loading which goes as 20 Log (number of channels). Additional increases are due to the larger number of CTB products on each channel. As the number of channels is increased, the channel of greatest CTB changes.

Acknowledgments

Many people have helped the author prepare this paper. R. Pidgeon, principal engineer, developed the analysis concept shown for evaluating echoes. A. Best, principal engineer, has been a prime mover for improved RF specification and stereo compatibility. G. Mobley and A. Kozushin developed many of the RF concepts. D. Foster, technician "extraordinaire," made measurements from which conclusions were drawn concerning CTB vs. channel loading. Concepts of digital architecture and scrambling were contributed by M. Roth, R. Banker, C. Plonsky, J. Lappington, among others.


EAGLE
63
EAGLE
COMTRONICS INC.
FAV
AUD

NOW YOU CAN STOP THE STATIC CAUSED BY SIGNAL LEAKAGE.



For Ste
Date
W
M Mrs.
of
Phone No. Area Cod
Telephoned ✓ R Ca
Please Call ✓ Was
Will Call Again Will R
Message She's and angr cancel he's unless you
Signed Sara

For Steve
Date 12-2 Time 8:00 A.M. P.M.
While You Were Away
M Mr. Watkins
of FCC
Phone No. Area Code 555-8956 Number Extension
Telephoned ✓ Returned Call URGENT ✓
Please Call ✓ Was In See Me
Will Call Again Will Return
Message He's scheduling an inspection to follow-up RF leakage complaints.
Signed Sarah

In the CATV business, RF leakage caused by cable damage can create all kinds of headaches. Like FCC code violations. Service complaints. Midnight repairs. And skyrocketing labor costs. Now there's a way to cut through the noise.

Introducing Raychem's new ThermoShield™ Cable Repair System, now in stock at Anixter. The system's special barrier prevents RF leakage and preserves the electrical integrity of all sizes and types of cable. Lined with hot-melt adhesive, the wraparound, heat-shrinkable sleeve reinstates mechanical strength while covering cracks and breaks with a long-lasting, waterproof seal.

And installation of the ThermoShield system is quick and simple. There's no cable cutting and splicing. So there's no service interruption. You can make repairs during prime time, at reasonable rates.

To find out how the ThermoShield system stops signal leakage, contact your local Anixter representative or call 800-323-0436. In Illinois, call 800-942-0905.

Western CATV Show Booth #625.
Reader Service Number 68

Raychem | **ANIXTER COMMUNICATIONS**