SEPTEMBER 1986

COMMUNICATIONS ENGINEERING AND DESIGN
THE MAGAZINE OF BROADBAND TECHNOLOGY

CED

CLI versus flyovers: which is better?

Action heating up on the IS-15 front

LAN companies working harder than ever

ADDRESSABILITY: WHO WILL DRAW FIRST?

Presenting ISIS: Magnavox's 600 MHz Integrated Subscriber/Institutional System. It carries both subscriber signals *and* institutional services—all on one line.

Let's talk business.

It makes good sense to operate two services on one coaxial cable. ISIS lets you serve your subscribers while opening new markets: all local businesses interested in data communications and local area networks.

And if businesses in your area haven't been asking about LANs for their data traffic, they may be soon.

It'll be a pleasure.

Your subscribers will be pleased with a full range of video services. Your business customers will enjoy access to new services, wherever they're located within your franchise area. And you'll reap the benefits of operating two systems while maintaining only one.

If you're building or rebuilding, ISIS makes sense. For today and tomorrow. Call your Magnavox sales representative for more information. It'll be a pleasure doing business with you.

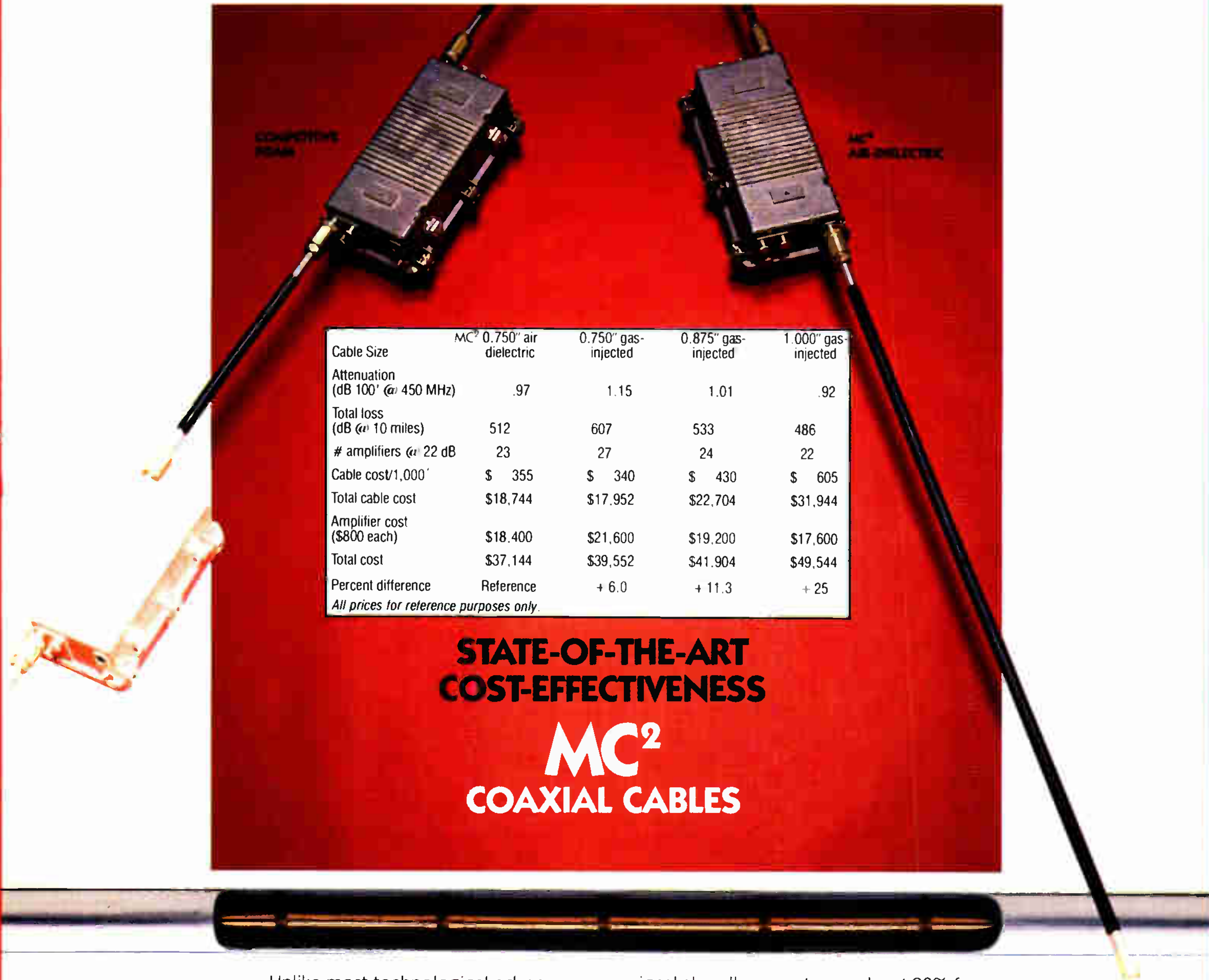
Magnavox CATV SYSTEMS, INC

A NORTH AMERICAN PHILIPS COMPANY
100 FAIRGROUNDS DR., MANLIUS, N.Y. 13104
TOLL-FREE 800-448-5171 (IN NY, 800-522-7464)

Reader Service Number 1

Magnavox's new 600 MHz System combines business with pleasure.

TRILOGY LEADS IN TECHNOLOGY:



Cable Size	MC² 0.750" air dielectric	0.750" gas-injected	0.875" gas-injected	1.000" gas-injected
Attenuation (dB 100' @ 450 MHz)	.97	1.15	1.01	.92
Total loss (dB @ 10 miles)	512	607	533	486
# amplifiers @ 22 dB	23	27	24	22
Cable cost/1,000'	$ 355	$ 340	$ 430	$ 605
Total cable cost	$18,744	$17,952	$22,704	$31,944
Amplifier cost ($800 each)	$18,400	$21,600	$19,200	$17,600
Total cost	$37,144	$39,552	$41,904	$49,544
Percent difference	Reference	+ 6.0	+ 11.3	+ 25

All prices for reference purposes only.

STATE-OF-THE-ART COST-EFFECTIVENESS

MC²

COAXIAL CABLES

Unlike most technological advances, MC² reduces costs significantly, in a variety of ways.

The unique air dielectric—with 93% velocity of propagation—makes it possible to use MC² in one size smaller than you normally would with foamed cables. The advantage, is the accommodation of more cables per duct in an urban system.

The lower attenuation and stronger signal also allow you to use about 20% fewer amplifiers.

MC² also provides relief from "suck out"—the air dielectric and the 100% bonded construction permits the inner and outer conductors to expand and contract at virtually the same rate. This provides you with quicker and simpler installations and maintenance.

Trilogy

COMMUNICATIONS INC.

Call or write for a free sample and brochure:

TRILOGY COMMUNICATIONS INC., 2910 Highway 80 East, Pearl, Mississippi 39208

601-932-4461

800-874-5649

Reader Service Number 2

CED

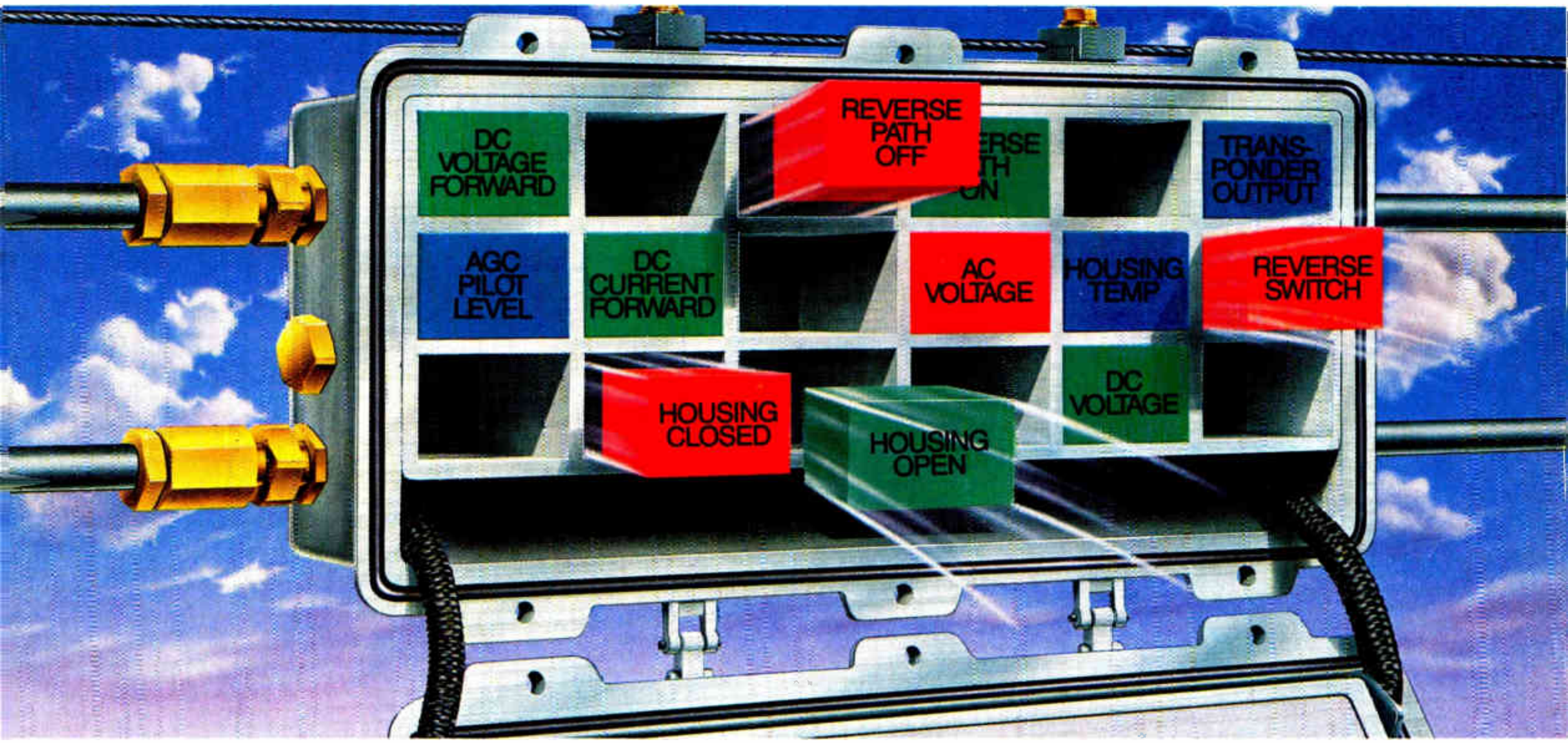
September 1986 Volume 12, Number 9

OFFICE
Denver 600 Grant Street, Suite 600, Denver, CO 80203 -or- P.O. Box 5208 T.A., Denver, CO 80217, (303) 860-0111.

ITCI
INTERNATIONAL THOMSON COMMUNICATIONS INC.

 CED (USPS 300-510) (ISSN 0191-5428) is published monthly by International Thomson Communications Inc., 600 Grant St., Denver, CO 80203. © September 1986, Volume 13, Number 9. Subscriptions free to qualified industry readers. All other one-year subscriptions are $26, prepaid in U.S. funds only. Second-class postage paid at Denver, CO. *CED* is published on behalf of the cable television and broadband communications industries. POSTMASTER: Please send address changes to P.O. Box 5208 T.A., Denver, Colorado 80217. MEMBERS OF THE BPA.

About the cover
The shoot-out over addressability is fast approaching. TCI is pulling out—for now—but other MSOs say they're in to stay.



MULTIPLE CHOICE MONITORING.

INTRODUCING THE FIRST FLEXIBLE STATUS MONITORING SYSTEM.

At Scientific-Atlanta, we think you should be able to monitor the functions of your distribution system that are important to you. That's why our new 6585 Status Monitoring System lets you monitor or control up to 21 functions of your choice and define the operating parameters of each one. No more pre-determined, pre-set functions.

CHOOSE FLEXIBILITY.

The 6585 Status Monitoring System is easy to use because you only buy the features you need. And you can always upgrade later. Begin with the basic system: an IBM® PC/XT, color monitor, printer and software; an RF subsystem to interface the computer with the cable system; and 2-way transponder modules, circuit boards and switches which snap in and out of the trunk station housing for quick installation, changes or upgrades.

CHOOSE SERVICEABILITY.

The 6585 System helps you manage your maintenance and repair resources for maximum efficiency. Complete, real-time system monitoring and reporting give you the power to perform trend analyses on key operating parameters such as power supply voltages, swings in AGC range, and internal housing temperatures. Right in your office. And if you already have a Scientific-Atlanta distribution system, installing our status monitoring is usually as easy as snapping in our status monitoring modules.

CHOOSE PROFITABILITY.

Greater control means greater profits. The 6585 continuously polls up to 2048 Scientific-Atlanta distribution trunk stations and automatically identifies potential trouble spots before they become expensive problems. That reduces fault-finding time and troubleshooting costs dramatically.

CHOOSE ALL OF THE ABOVE.

How did we manage to offer so much in a status monitoring system? Simple: we asked people like you what they wanted to monitor and control. Then we built a system that gives them a choice. We can give you a choice, too. For more information on our status monitoring equipment, other distribution products, or any of our full line of cable products, call us at **1-800-722-2009** or write to: Scientific-Atlanta, Dept. AR, P.O. Box 105027, Atlanta, GA 30348.

Scientific Atlanta

Reader Service Number 3

T&D. THE

Strip the jackets off a piece of new jacketed P III and the other guy and take a very close look. What you'll discover is startling.

P III's new medium density jacket compound has a lower drag coefficient than ever before.

It has 52% greater cut-through resistance, 125% higher abrasion resistance and 67% higher tensile strength. Which means it does a lot of things better than it ever did before. Or the other guy still does.

Colquitt's goals: return to basics, improve tech

After 20 years in the cable industry, Walt Colquitt has doubtless seen many changes. And as ATC's director of new technologies, he actively searches for ways to enhance revenues through the use of new devices and strategies. It's interesting then, that he articulates to his colleagues the need for a return to the basics in order to improve cable's product and stay ahead of competing technologies.

"We've gotten away from the premise that we are, first and foremost, a service business," says Colquitt. He compares the industry's present status with that of a newly-built system approaching the end of its construction stage—the era of tremendous growth and activity is over and the focus becomes the implementation of sound business acumen.

"We need to look at the technology that has emerged recently and ask ourselves, 'What can we do to improve the signal quality and achieve closer to 100 percent reliability?' Wherever the competition is going to come from, the areas that offer the biggest threat to us would be in those areas," he says.

His own suggestions for improving signal quality include the use of fiber for long-haul delivery spliced with coaxial cable for local distribution. And for increased reliability, why not incorporate a system of redundant trunking that would allow a signal to be routed around a break in the cable, as is the case when a pole is knocked down by accident?

"We need to sit back and make some decisions as to how we're going to run this business for the next several years," he adds.

Colquitt got his start in the industry in 1966 with TPT Communications in Long Island City, N.Y., a company involved in master antenna work. Shortly after his arrival, TPT began doing turnkey work at government military installations.

From there, Colquitt held various supervisory positions with other systems around New York and New England before jumping on board the PTL Satellite Network in Charlotte, N.C., in 1979. Colquitt says his tenure as a satellite engineer "actually helped me because it gave me an insight into the broadcasting side of the business. It gave me a lot of appreciation for the baseband side."

In late 1980, Colquitt came to ATC as a project engineer working on franchising before directing the company's SSAVI engineering (the scrambling technology used in ATC's subscription television service). After the company left STV in 1983, the towering father of four children became director of the research and development group, a title which has since changed to director, new technologies.

Despite his seemingly paradoxical call for a move back to basics, Colquitt is firmly committed to using technology to find ways to overcome obstacles to cable's growth. He has been and continues to be an active player in getting EIA's IS-15 Baseband Decoder Interface accepted in the marketplace.

"We consider consumer electronic incompatibility to be one of the major problems in our industry today," he says. "So we've given a great deal of attention to supporting the development of both IS-15 and IS-23."

Although IS-23 is "kind of on hold," the IS-15 specification was successfully met by several television and decoder manufacturers during tests hosted by Colquitt's research labs in Denver last year. And, though he concedes the interface is at best a long-term solution to the home electronics tangle, he remains excited about its prospects for restoring full use of cable-compatible receivers back to the subscriber.

"I am very enthusiastic about IS-15 and I would like to see many of the MSOs get behind it because I think they are ultimately its key to success," he adds.

Although Colquitt puts the burden on MSOs to assure the success of the decoder interface in the marketplace, he gives credit to the television manufacturers for agreeing to install the necessary hardware as early as next year.

"It would be very easy for the decoder manufacturers to sit back and say, 'Why should we make decoders, there's no TV sets to plug them into.' It would be equally easy for the TV manufacturers to say, 'Why should we make the TVs, there are no decoders to work with them.' It looks like the consumer industry is going to solve that dilemma for us in that we've heard from several manufacturers that their next sets will come out with the interface. We feel that once these sets get into the marketplace we can put pressure on the decoder manufacturers to come up with product."

Even now that the technology for the interface has been settled upon, Colquitt and ATC have remained supportive to suppliers who want to test interfacing circuits or decoder prototypes. The ATC research labs are open to those manufacturers who want a "neutral ground" test site to see if their product will work.

Colquitt has also done extensive work with BTSC stereo, which the IS-15 interface will pass without degradation, unlike some other approaches taken by manufacturers, which include external decoders or a broadband audio bypass through the decoder.

"I would not call most of those latter solutions a good solution for the industry," says Colquitt. "They're workable solutions, that's about it."

If there's a better way, you can bet Colquitt is trying to find it.

—Roger Brown

Trilogy Communications Inc.

AN OPEN LETTER OF GRATITUDE

Dear Customers,

On August 15, 1986, Trilogy Communications, Inc. celebrated the anniversary of our first year in business. It was far more successful than our initial forecasts. In fact Trilogy was 27% above our crystal ball predictions. We were successful as a new company which acquired and markets MC_2, the technological leader in the coaxial cable market.

You, our customers recognized this up front and trusted Trilogy with these all-important first orders. As any new kid on the block, we had to prove ourselves—and we did. We busted our backsides to make it work for you—and us.

Now, we feel compelled to thank you publicly and privately, and frankly we would be proud to list your names. This would serve no purpose for you, and it certainly would appear self-serving for Trilogy.

However, the key personnel who sign this letter truly appreciate your trust in Trilogy and we promise to continue or even improve, where possible, our quality, delivery and service, resulting in an even more cost-efficient Customer/Trilogy relationship.

Many, many thanks.

Sincerely,

Stephen L. Hallock

S. Shinn Lee

John Kaye

William P. Kloss

Kevin J. Dunckel

Gene Faulkner

Gene Gough

Bill Herrin

Bruce Lane

Danny Roberson

2910 Highway 80 East
Pearl, Mississippi 39208
601-932-4461

CLI Revisited

On July 1, 1990, the provisions of Sec. 76.611 of FCC Rules will become effective, requiring that:

"No cable television system shall commence or provide service in the frequency bands 108-137 and 225-400 MHz unless such system is in compliance with one of the following cable television basic signal leakage performance criteria:"

Criterion number one is the Cumulative Leakage Index (CLI), based on ground level measurements. Criterion number two is the measurement of maximum leakage signal in the airspace, at 450 meters (1,500 feet) above the average terrain.

Of the two alternative procedures, the flyover raises the fewest questions. One may wonder at the wisdom of flying over Manhattan, N.Y., at 1,500 feet with the World Trade Center towers at 1,700 feet above ground; or over San Francisco with the Mt. Sutro antennas at nearly 1,600 feet above ground. Some may wonder how to set up the specified calibration procedure.

These questions are not difficult to answer properly, and a number of qualified service agents will surely offer to conduct flyover surveys on a reasonable fee basis. In fact, if you have access to an airplane and a licensed pilot, most qualified CATV technicians could probably work out the necessary calibration procedures.

The flyover can probably be accomplished within a few hours of flying time, including the calibration. During that time, it is rather unlikely that any leaks would be repaired. Thus, the flyover provides essentially an instantaneous measure of the cumulative airspace leakage signal at a particular time.

The ground-based CLI procedure, on the other hand, raises a number of unanswered questions. Ground based coverage of 75 percent of most systems will require from several days to several weeks, or even months, depending on the size of the system.

The critical question is: should *all* leaks detected in the ground-based CLI survey be included in calculating the index; or, only the *unrepaired* leaks? There can be no doubt that FCC prefers that leaks be repaired as quickly as possible after detection; even when detected during the CLI survey. It seems to me that, if the CLI is to be comparable to the flyover measurement, it should include only the *unrepaired* leaks existing at any particular time.

Another difficult question is how to include high-rise apartments and hotels in the ground-based CLI survey. The rule requires that the survey include "any portions of the cable system which are known to have or can reasonably be expected to have less leakage integrity than the average of the system. . . ." MDU wiring may fall in that category.

In the case of a leaky system (one with unsleeved connectors, pressure taps, old-fashioned low coverage drop cable and short ferrule F-connectors) these may be critically important questions.

On the other hand, leakage in modern, well constructed and maintained systems may be so low that considerable savings in time and money could be achieved by relying on the regular leakage monitor logs. If the CLI computation, including *all* leaks reported for the entire year, regardless of repairs, is less than the specified maximum, there should be no need for a special CLI survey.

In a tight system, it may even be possible to demonstrate compliance with the CLI threshold by assuming, for purposes of computation, that all leaks detected during the entire year by the monitoring program are equal in magnitude to the largest leak recorded. The CLI is then, simply, 10 log (nE^2/k), where n is the total number of leaks, E is the field strength in microvolts per meter of the largest leak detected during the year, and k is the fraction of the total system cable length actually examined for leaks at some time during the year. If the CLI calculated in this manner is less than 64 dBu, the system should be considered to be in compliance. Since all leaks detected were, by definition, of smaller magnitude, and most (if not all) detected leaks were actually corrected within a few days, there is no likelihood that a larger index could result from a separate CLI survey.

Clearly, the flyover technique is superior to the ground-based CLI method, especially where the MDU population is significant. Surely, FCC recognizes that the 450 meter flight path would not be permissible in some cases for safety reasons. It would appear reasonable to adjust readings taken at higher altitudes to 450 meters by applying the inverse distance rule. Thus, readings at 900 meters (3,000 feet) should be increased by a factor of two for comparison with the 10 microvolt per meter threshold of compliance. This actually represents over-correction for any leak that is not directly under the aircraft; and, therefore, provides a conservative estimate of the weighted average leakage signal at 450 m.

However, if the conscientious regular monitoring program, required by Sec. 76.614, covers at least 75 percent of the total strand during the year, and the magnitude of each detected leak is duly recorded, there may be no need to conduct either the flyover or a separate CLI survey of generally tight systems.

July 1, 1990, is only four years away. Plans should now be in progress to replace connectors, review service drops, remove pressure taps, rebuild, upgrade or whatever is needed to assure that any system that carries, or may carry, TV programs in the 108 MHz to 136 MHz and 225 MHz to 400 MHz bands, will be tight enough to comply with the criteria without a special, time-consuming CLI survey.

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

Fishing where the rocks are

The crews are aboard and the fleet's ready to sail. But when the nets are cast, will they come up empty? Nobody knows yet. But one thing's for certain, the fishing won't be easy as NCTA seeks to snare support for the proposed IS-15 baseband interface. Luring the boats to sea: a long-term solution to cable/consumer electronics interface problems; dramatically lower costs for addressability; and, an end to converter capital investment.

But even if the fish are running, the nets could tear wide open, because VCRs still must be dealt with; traps seem to many MSOs a better solution; TV set and converter manufacturers must introduce the plug simultaneously; and somehow, conformance testing has to occur in a neutral setting not injurious to any single vendor's proprietary methods. And there's always the cost issue: retooling production lines, development work and testing will cost money. Exactly how much isn't clear yet. Also, full implementation could take 10 years. After which, operators couldn't charge for remote rentals anymore. And converter vendors would be selling a product that could be 40 percent cheaper than today's boxes: great for buyers, but for sellers?

Casting a wide net

Nope, it won't be easy, especially given the industry's current interest in trapping as a preferred method of pay security—at least where three or fewer pays are involved. But the stakes are enormous. Viacom, for example, probably will spend about $100 million in the next five years on descramblers. It's a major cost of doing business, and widespread IS-15 compatibility would mean 40 percent cheaper converters, and also the chance to sell the converters to subscribers.

But the industry has scant experience in the real world with any analogous type of technology. Fortunately, there is at least one real world precedent for IS-15: Zenith's Redi-Plug and the matching Base-Tac converter.

In essence, Redi-Plug is an IS-15 plug: it uses different and simpler protocols. And the Base-Tac unit corresponds perfectly to an addressable converter that is adapted to the new interface. So who's got practical experience to talk about? Douglas Fuller, for one. He's general manager of the St. Joseph, Mo., Cablevision system. He was, in fact, the first customer for Base-Tac, a move he made because Zenith is the biggest mover of TVs in his franchise area. One of the first items of business, he points out, is to make sure you've got very good rapport with TV set distributors. You can have all the Base-Tacs you want, but the dealer still has to install the Redi-Plug.

Here's another pointer: the Base-Tacs won't move themselves. Fuller says he probably hasn't been aggressive enough about letting his customers know what he's got for them. And VCR compatibility still is a problem.

Base-Tac

Another operator with Base-Tac experience is Rogers. Base-Tacs were introduced to several hundred customers in Rogers' Vancouver system last year, partly because the local Zenith distributor had always worked closely with Rogers, because there was relatively high penetration of cable-compatible TVs, and because more pay channels were being added to the program lineup out there.

"One thing we can say is that pay TV spin and churn were substantially lower among Base-Tac customers," says Nick Hamilton-Piercy, Rogers engineering vice president.

Zenith has since produced a more rugged version of the Base-Tac, and those new boxes are going in now. They may also be tried out in Toronto households as well, where 15 percent of new sets sold are Zeniths.

Shoals ahead

The plans Rogers has, however, also point out a major obstacle to IS-15 adoption on a widespread basis. Although still interested in addressability for large systems with three or more pays, Rogers also has made a big commitment recently to trap technology. In some cases, Rogers will go addressable, but with HBO on a trap. Why? "Because it's consumer friendly; because customers can use their cable-compatible TVs," Hamilton-Piercy says.

And it isn't just Rogers. TCI, ATC, Wometco, Warner, American, Storer, Continental—virtually every major MSO—is using traps for pay security. And probably using traps more than they used to in the recent past. And many addressable systems use traps as low-pass filters to prevent ingress. Pico's trap sales this year, for example, will be bigger than last year's, and bigger still next year, president George Knapp predicts.

So it may be tough fishing, at least initially, for IS-15 proponents. Because to the extent that trap technology is favored, the support for the new interface decreases. Still, there are some very compelling reasons for the industry to move ahead aggressively. Dramatically lower costs for converters and addressability, for one. The potential for freeing capital currently tied up in descrambler inventories. More customer satisfaction. A more consumer-friendly posture. And maybe, just maybe, better relations with the rest of the consumer electronics industry.

Whether you agree with IS-15 or not, it's critical that the technical community takes a good, hard look at it. The sooner, the better.

Remember...it was only yesterday when offering a PPV event in one-way cable systems usually meant mass confusion. Too many telephone operators to pay, but not enough to handle the last minute phone calls. In solving this problem, Jerrold drew on experience that dates back to 1956. That year, a two-channel device was developed and demonstrated at the Jerrold plant in Philadelphia. Known as the PBPB "program-by-program billing," it attracted much interest—and visitors—from all over the world. Although the PBPB was too far ahead of its time to be a financial success, it was one of cable's earliest demonstrations that pay-per-view technology was quite feasible.

Remember when PPV required a large phone staff? Or two-way cable plant? Now...

The Pay-Per-View Solution JERROLD STARFONE™

Get ready to cash in on the coming PPV explosion. Add impulse pay-per-view capability with Jerrold STARFONE, the economical add-on unit.

- ELIMINATES NEED FOR TWO-WAY PLANT. The STARFONE system uses your existing one-way cable plant for downstream communications and a telephone return path for upstream communications. *No new construction needed.*
- ELIMINATES PHONE INTERFACE PROBLEMS. Your subscribers self-authorized purchases are recorded in the converter memory. When you want to gather this data for billing, the converters are prompted to make that single phone call to your billing computer.
- MINIMIZES IPPV BILLING LOGISTICS. Your billing computer automatically receives IPPV detail usage for normal monthly billing statement. *No* incremental billing support costs.
- EXCLUSIVE AVAILABILITY. Jerrold is the only converter supplier offering this advanced cost-effective store and forward telephone return capability.

Simply by pressing a few buttons to indicate an authorized purchase, your subscriber can order a PPV event for immediate viewing. No phone calls to make. No busy signals to cope with. No need to plan in advance.

Jerrold STARFONE, an inexpensive add-on module, makes all this possible. For detailed information, call or write today. Jerrold Division, General Instrument Corporation, 2200 Byberry Road, Hatboro, PA 19040. (215) 674-4800.

JERROLD
You know we'll be there.

GENERAL INSTRUMENT

Reader Service Number 5

looking ahead

Ready or not, competition's coming

I appreciate the opportunity to undertake this column for *CED*. New technologies, and the problems and opportunities they create, have both short and long term effects. I'll be speculating on a quarterly basis on the technical side of the future of CATV.

I'm keenly aware of the risks of actually committing my speculations to paper. I occasionally amuse myself by thumbing through magazines like *Scientific American* and *Railway Age* and reading their summaries of material which appeared 50 or 100 years ago. The most fascinating items are the pronouncements of prominent scientific, engineering and business figures of the day regarding the direction of future developments. All too often these are embarrassingly, and sometimes hilariously, wrong.

There is no hint in *Railway Age* in 1886 that the future of transportation in the United States would move in any direction other than in a reasonably straight line of growth and discovery extending from the experience of the day. Indeed, the railroads' golden age did not begin to dim for 40 or 50 more years. By the time that revolutionary changes were brought about by cheap, efficient gasoline engines, railroads had settled into the complacency that ultimately lead to their undoing.

Any successful business acquires a good deal of inertia, and inertia has both good and bad aspects. For the CATV industry, the inertia of our enormous capital investment, thousands of employees and millions of subscribers, allows us to weather minor disturbances in the market, as well as occassional strategic, managerial and technical mistakes.

Nevertheless, CATV has, in the midst of many technical, business, and political forces, evolved into an intensely pragmatic and vigorous industry, employing many exceptionally talented people. This, and our currently strong market position, give us the happy kind of inertia which football coaches call momentum.

Another kind of cable industry inertia is in the cable plant itself. Cable systems embody the technology current the year they begin construction, yet need to have useful lives of 15 or 20 years or more. Many of us today operate systems with channel capacities which seemed absurdly large when construction began, but which now seem quite limited.

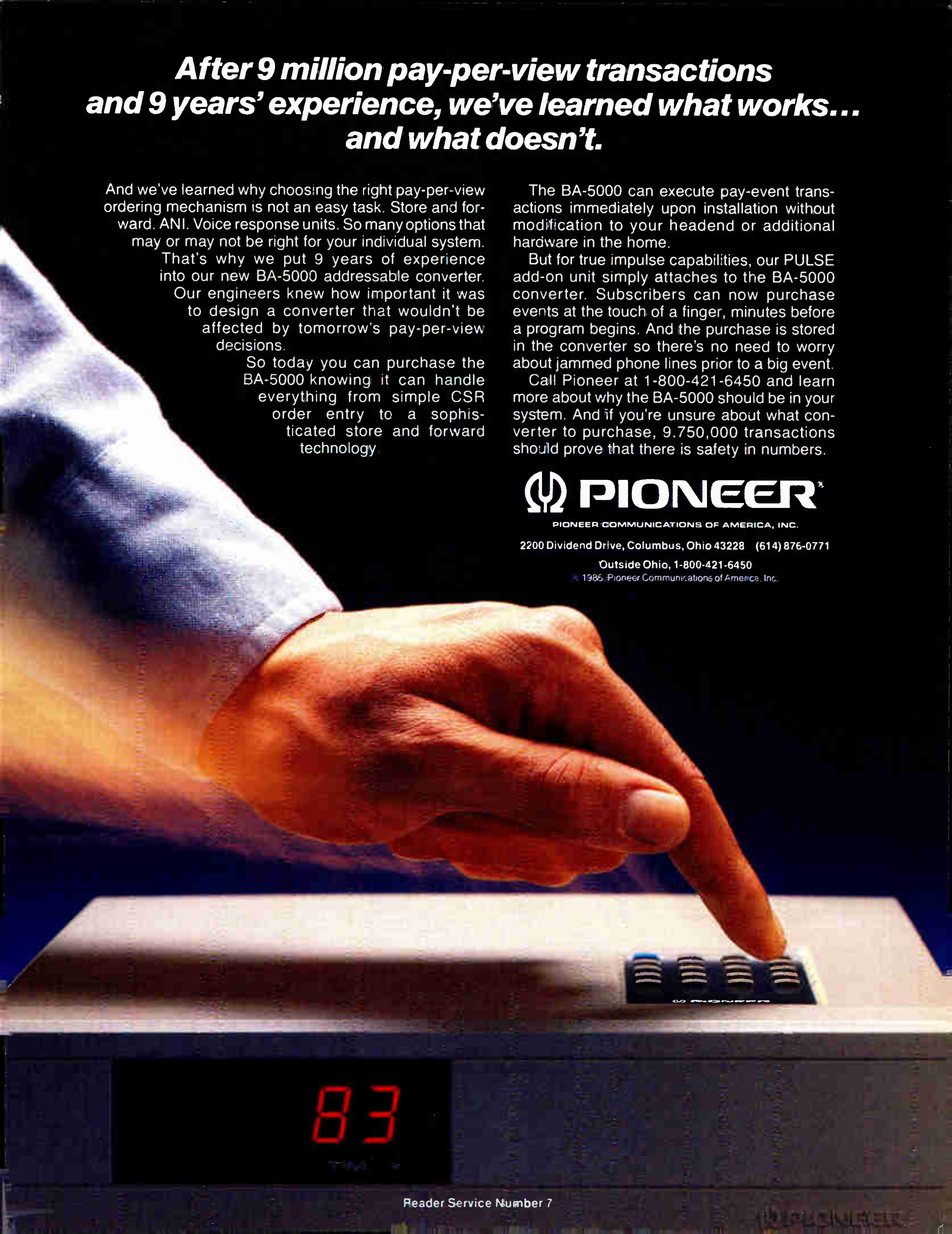
The most dangerous kind of inertia is business complacence. Unlike the railroads, we almost certainly do not have 50 comfortable years ahead if we ignore the implications of change. Part of our role as engineers is to keep our management apprised of the directions technology is taking. Not only will these changes affect our cable television plant, but they also produce opportunities for our companies (and our competitors) to deliver information and entertainment services in new ways.

The challenge we face as CATV engineers is clear. We must provide thoughtful answers to current issues such as the consumer equipment interface (VCR's, cable-ready TV sets, remote control, broadcast stereo, etc.). We must also give thought to the future of our delivery systems, and the disruptions and opportunities posed by the business consolidation which is moving deliberately through CATV.

We must be mindful of the various forms competition may take in coming years. The most immediate of these may be a flurry of system overbuilds following the resolution of the "Preferred" case in the courts and the partial dismantling of the franchising system. DBS, with its attractive signal delivery efficiencies, is not many years from a form which may provide a serious alternative to coaxial systems, and the telephone companies clearly have not lost their fascination with the delivery of video and other services over a single wire or fiber.

High definition television, perhaps delivered by fiber or satellite, could offer television manufacturers an enormous new market. We cannot say which of these kinds of competition will develop, or precisely how they will do so. We can be sure competition *will* come and we will have the choice of being either its victims or beneficiaries.

By Jim Chiddix, Senior Vice President, Oceanic Cablevision


After 9 million pay-per-view transactions and 9 years' experience, we've learned what works... and what doesn't.
And we've learned why choosing the right pay-per-view ordering mechanism is not an easy task. Store and forward. ANI. Voice response units. So many options that may or may not be right for your individual system.
That's why we put 9 years of experience into our new BA-5000 addressable converter. Our engineers knew how important it was to design a converter that wouldn't be affected by tomorrow's pay-per-view decisions.
So today you can purchase the BA-5000 knowing it can handle everything from simple CSR order entry to a sophisticated store and forward technology.
The BA-5000 can execute pay-event transactions immediately upon installation without modification to your headend or additional hardware in the home.
But for true impulse capabilities, our PULSE add-on unit simply attaches to the BA-5000 converter. Subscribers can now purchase events at the touch of a finger, minutes before a program begins. And the purchase is stored in the converter so there's no need to worry about jammed phone lines prior to a big event.
Call Pioneer at 1-800-421-6450 and learn more about why the BA-5000 should be in your system. And if you're unsure about what converter to purchase, 9,750,000 transactions should prove that there is safety in numbers.
PIONEER
PIONEER COMMUNICATIONS OF AMERICA, INC.
2200 Dividend Drive, Columbus, Ohio 43228 (614) 876-0771
Outside Ohio, 1-800-421-6450
© 1986 Pioneer Communications of America, Inc.
83
Reader Service Number 7

Is addressability dead?

There's still some who are trying to sustain addressability, but the plug may be pulled sooner than we think.

For manufacturers of addressable cable equipment, the feeling has to be like a race car driver who runs out of gas on the last lap of the big race just as he was about to catch the leader—he can still coast across the finish line, but how many places will he lose to the competition?

Fueled by industry demands for better signal security, simplified control of churn and spin, and lower service call expenditures, addressability got a fast start and showed early promise as a de facto standard way of doing business. But now, operators concerned about the high capital costs associated with rolling out addressability and the resulting consumer electronics interface problems are waving the yellow flag, signaling their cautious approach to launching new addressable systems.

Operators as diverse as ATC, Rogers, Heritage and Storer have in many cases halted plans to add addressability, preferring to use inexpensive traps to control a subscriber's programming.

ATC, for example, plans no new launches of addressability, with the possible exception of its Queens and Manhattan, N.Y., systems, according to Bonnie Blecha, vice president, financial planning and analysis. With addressability available to about 1.8 million homes and about 700,000 addressable units presently in the field, ATC put on the brakes mainly for cost considerations.

"We haven't yet found the cost savings" that were promised by the manufacturers of equipment, Blecha said. Although fewer truck rolls were needed to service upgrades and downgrades, ATC discovered they were receiving more calls relating to the in-home equipment.

Al Kernes, vice president of engineering at Jones Intercable, agrees. "Addressability is supposed to allow you to have fewer technicians for the churn issue, yet I'm not convinced that that really happens because now rather than having technicians to handle churn, you add more CSRs because the telephone calls are longer," Kernes said. "So your overall overhead remains about the same." Jones is making addressability decisions on a system-by-system basis, looking at demographics, the likelihood of pay-per-view offerings and pay penetration before making a decision whether to use traps or set-tops, Kernes said.

The consumer electronics interface problem resulting from addressable descrambler converters has also caused Heritage officials to remain trapped in several of its smaller systems, said Doug Truckenmiller, vice president of engineering. "We're holding off converting some of those systems to addressability until we do feel we've solved this customer interface problem," he said. A notable exception is in Dallas, where the company plans to offer PPV events.

"We're hearing more and more about the interface problems from our consumers but just exactly what we're going to do about it we're not sure," said Truckenmiller. "The industry is starting to address it, but the real good solutions are not real simple."

Addressability's high capital cost initially has resulted in some operators moving into it slowly while others are backing off in already-launched systems.

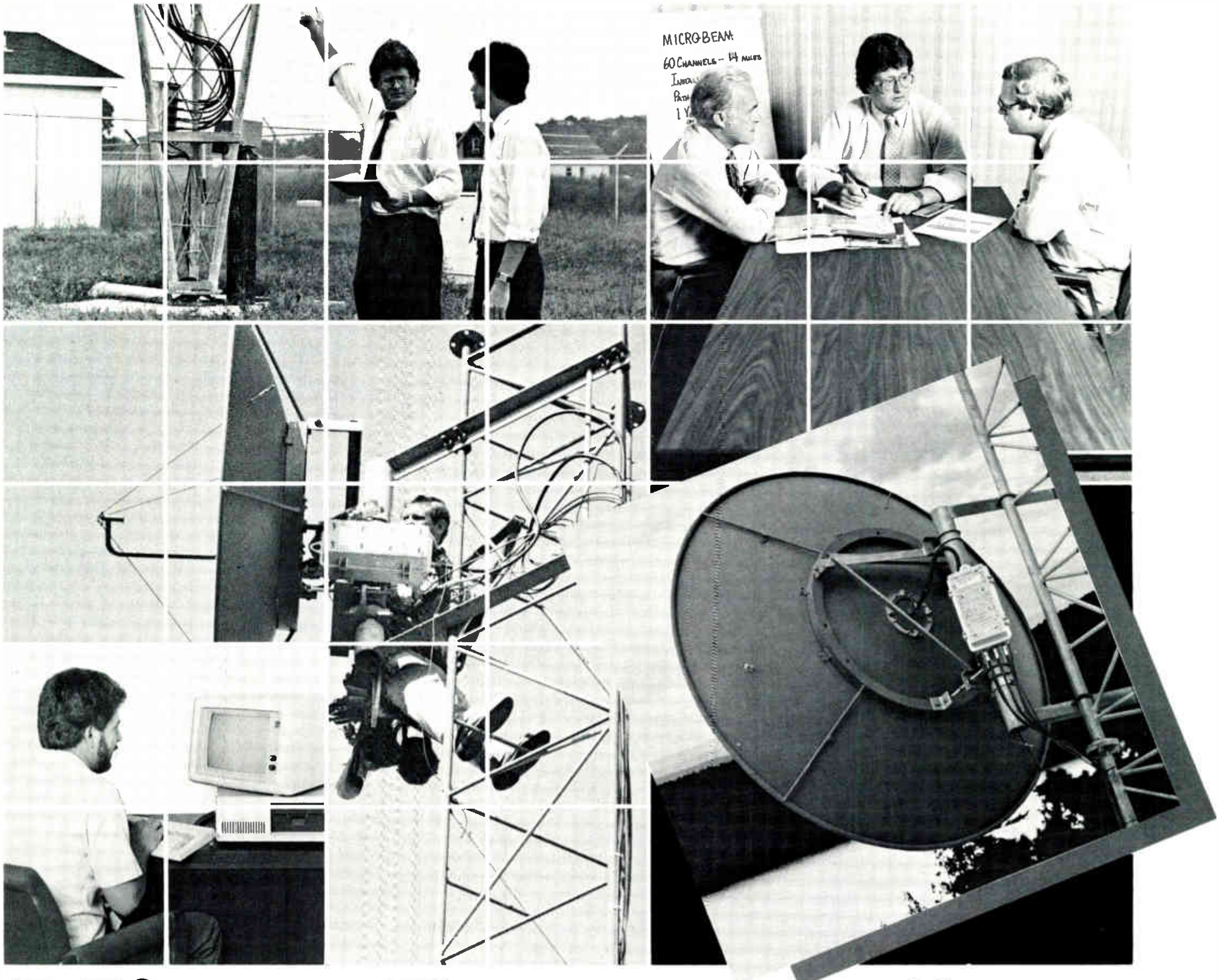
Storer plans "no tremendous advances in addressability," according to Walt Ader, technical manager of Storer's Florida region. Although a small PPV test is planned in the Miami area, addressability often impacts a system's profit and loss statement to the point where traps are used instead, he said.

Rogers Cablesystems has also been forced to take a more conservative approach to addressability over the past year or so, said Don Monteith, director of telecommunications. In systems that started off as exclusively addressable, neither the pay nor subscriber penetration lived up to the financial plan laid down by the company. As a consequence, Rogers has retrenched, bringing in low-cost descramblers or traps to service low-tier customers.

"We view the step toward going back to traps as a necessary one for cash flow considerations," said Monteith. However, addressability will be maintained because Rogers is committed to providing PPV events to its subscribers. "Long-term, we view addressability as a very viable approach that will give us more opportunity to provide additional enhanced services," Monteith added.

Even Viacom, long a pro-addressability MSO, has been forced to cautiously consider all its options before increasing its addressable base. With roughly 35 percent of its customer base addressable capable, there have, however, been no new launches in more than a year. But that situation may soon change, said Doug Semon, director of engineering, new technology development.

In the past, Viacom chose addressa-


MICRO-BEAM:

The outcry over incompatibility with consumer electronics has added a new wrinkle to the MSOs thought process.

bility because it increased signal security and allowed for increased channel capacity, two important criteria for going addressable, he said. "Most of the changes (to addressability) in Viacom have been for good, sound technical reasons as opposed to operational advantages."

But the outcry over incompatibility with consumer electronics has added a new wrinkle to the MSO's thought process. "It has changed our thinking in terms of what we want long-term," Semon said. "At one point in time I would've said a good, reliable addressable technology is something we could live with for 10 or 15 years. Now our thinking is more along the lines of a standard decoder interface in the television set."

Nearly all of the equipment suppliers surveyed reported a leveling off of sales of addressable gear over the past year, but note that overall, sales are good and in most cases, meeting company forecasts.

"Although addressable sales have been fairly flat," said Steve Necessary at Scientific-Atlanta, "we have seen an increase in demand for our non-addressable products." At Tocom, Manager of Marketing John Fullingim said the market overall is soft but Tocom has seen increased sales of its full-featured addressable converter. And at Oak Communications, sales are up and the company is experiencing a successful sales rate among customers it has targeted, reports Graham Stubbs, vice president of science and technology. "We continue to be very bullish about the future of addressability," Stubbs said.

Benefiting from the industry's uncertainty are the trap vendors, who report that business is healthy. At Pico, unit sales were up 20 percent over last year and company President George Knapp predicts an increase of 25 percent to 50 percent next year. Knapp said his company does sales projections every two years and since addressability was introduced, the company each time has predicted traps to go by the wayside. "The trap market won't go away," said Knapp. "In fact, it seems to be increasing. I would have expected it to be obsolete by addressability by now."

At Eagle Comtronics, the story's the same. "Activity in the last four or five months is definitely up," said Chester Syp, national sales manager. "Everybody I've been with always says that in three years traps are going to be dead," said "Doc" D'Alfonso, vice president of marketing at Northern CATV Sales. "But I've never been with a company that did not show dramatic increases in sales while I've been associated with them."

To get back on the fast track, addressable equipment manufacturers have added features like remote volume control, self-contained timers to allow unattended VCR recording and low-cost add-on units to make unaddressable systems addressable.

"Our market research with consumers began to indicate about a year or two ago a concern over the interface with scrambling systems that limit the use of their VCRs and cable-ready televisions," said Tocom's Fullingim. "We're having to work harder for our business but our sales are actually increasing."

Not surprisingly, manufacturers of addressable equipment predict an eventual resurgence in addressable sales based on the industry's need to identify and develop new revenue streams.

Pete Morse, vice president of new business development at Jerrold, thinks the real sleeper lies in unique marketing approaches. For instance, with addressability, an operator can actually encourage subscribers to churn and spin through pay services by offering a monthly package price where the sub can get a week-long taste of each service during a 30-day period.

"It gives the consumer the feeling that he is the one who has control," he said. Morse predicts addressability to rebound mightily, reaching 30 million units by the early 1990s.

But equipment suppliers have pinned most of their predictions of renewed sales vigor on the eventual development of pay-per-view as a viable business.

When addressability was first introduced, said Vito Brugliera, vice president of marketing and product planning in Zenith's cable products division, it was touted as a way to save money through reduced service calls

Vito Brugliera

and easier control of pay services. Now, however, pay unit sales have suffered, operators are discovering there is no need for a set-top terminal for basic-only subs and the perceived value of addressability is less important than two or three years ago. However, pay-per-view is going to change that perception, predicted Brugliera.

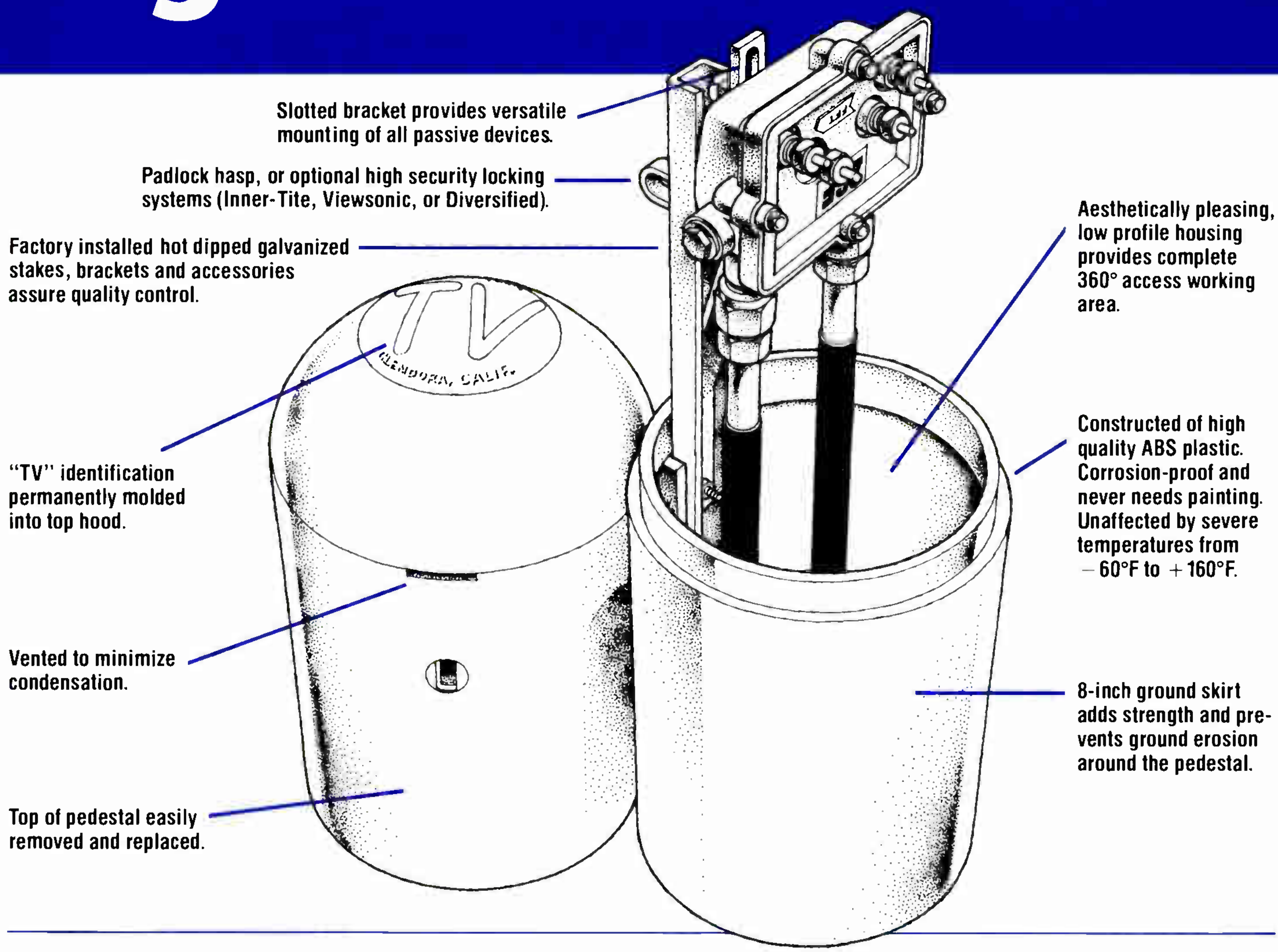
"If you (as an operator) feel pay-per-view will be an important part of your revenue stream, then pay-per-view does not make any sense at all unless you're addressable," he said. "I think the next year will demonstrate how important pay-per-view is to cable operators."

Bob Chalfant, marketing manager of CATV products at Panasonic Industrial Co., agrees. "Addressability is the only way to do impulse pay-per-view, which allows operators to compete with the video stores." He predicts PPV to take off because the studios see cable as a good delivery medium and gives them the opportunity to make a substantial amount of money overnight.

In fact, Panasonic is so convinced of addressability's future that it plans to put its first addressable box into production in October, during a time when the latest Paul Kagan Associates survey shows an 18 percent drop in addressable homes created over the same time last year.

Chalfant painted his rosy outlook of PPV on the growing VCR/home video threat. With sales of more than 14 mil-

Take a good look at Channell's above grade enclosures!



Take a good look at Channell's high quality, above grade ABS plastic enclosures and you'll discover why they're the best possible buy for your money.

Designed specifically for the CATV industry, all Channell enclosures come with stakes, accessories and locking systems factory installed. There's no need to buy separate stakes or go through the added chore of installing accessories. And, because Channell stakes and brackets are hot dipped galvanized *after* they have been manufactured, you can be sure they are *totally* protected from corrosion.

For the complete story on Channell's above and below grade plastic enclosures, Cablecon® Cable-in-Conduit and Carson Industries grade level boxes and vaults, call or write today.

CHANNELL COMMERCIAL CORPORATION
620 W. Foothill Boulevard
Glendora, CA 91740 • Telex: 670-368
(800) 423-1863
Toll Free outside California
(818) 963-1694 in California

Channell
COMMERCIAL CORPORATION
Technology you can trust!

SINGLE PLANT ABOVE GRADE ENCLOSURES

(Also available — A complete line of dual plant above grade enclosures)

CPH-508

Designed to house small diameter taps and for above ground service wire applications.

Dimensions: 5" diameter, 11" - 15" above grade.

Shipping: 12 per carton.

CPH-658

Houses all taps currently available in the CATV industry.

Dimensions: 6.5" diameter, 11" - 15" above grade.

Shipping: 8 per carton.

CPH-6512

Designed for special applications such as high water thresholds. Houses taps and filters, or one equalizer.

Dimensions: 6.5" diameter, 15" - 19" above grade.

Shipping: 8 per carton.

CPH-816

Houses tap and splitter combinations.

Dimensions: 8" diameter, 20" - 24" above grade.

Shipping: 2 per carton.

CPH-1006

Designed for special tap locations such as multiple dwelling units.

Dimensions: 10" diameter, 11" - 14" above grade.

Shipping: 2 per carton.

CPH-1016

Houses tap, splitter and line extender combinations, or small amplifiers.

Dimensions: 10" diameter, 21" - 25" above grade.

Shipping: 2 per carton.

CPH-1022

Houses tap, splitter and line extender combinations, or amplifiers.

Dimensions: 10" diameter, 27" - 32" above grade.

Shipping: 2 per carton.

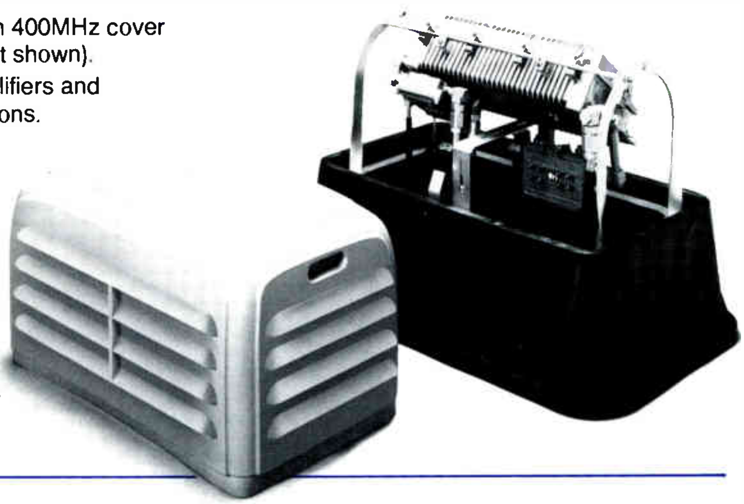
CPH-1730 with 400MHz cover (550MHz cover not shown).

Houses trunk amplifiers and passive combinations.

Dimensions: 17" wide, 30" long.

Shipping: 1 per carton.

(Low Profile CPH-1230 for line extender, tap and splitter combinations not shown.)



Channell Commercial Corporation designs and manufactures the broadest selection of free-breathing above grade pedestals, and airtight and watertight below grade enclosures available anywhere. In addition, Channell is the exclusive representative for Integral Corporation's Cablecon® Cable-in-Conduit and Carson Industries grade level boxes and vaults.

For complete information on Channell's total packaging concept, call or write today.

CHANNELL COMMERCIAL CORPORATION
620 W. Foothill Boulevard
Glendora, CA 91740 • Telex: 670-368
(800) 423-1863 Toll Free outside California
(818) 963-1694 in California

Channell COMMERCIAL CORPORATION

Technology you can trust!

Reader Service Number 53

A possible long-term solution to the friendliness issue looms on the horizon.

lion VCRs predicted for this year and a total base of 35 million units, VCRs cannot be ignored, he said.

Likewise, said Zenith's Brugliera: with home video revenues reaching nearly $4 billion and cable operators continually looking for new revenue, "cable can share a good part of that revenue" through impulse pay-per-view," he said.

While many operators bemoan the present addressable technology, most say they plan to wait and see how the technology develops before making any long-term decision. But cable's major player, TCI, isn't waiting any longer. And the company is backing away from addressability completely.

TCI's widely-publicized "on-premise" plan (consisting of a box attached to the home that will serve as a central cable connecting point) grew out of the MSO's unwillingness to spend the necessary dollars to put set-top addressable terminals in the home. TCI presently uses traps for signal security, except in those systems that offer a fourth or fifth pay channel. Those subscribers are presently given a set-top converter, said Dave Willis, director of engineering at the giant MSO.

"We frankly never really believed we were going to make the savings that were initially projected operationally with addressability," said Willis.

But what strikes fear into some addressable equipment suppliers is that TCI plans to phase out the 350,000 converters presently in its systems. Beginning as early as the first of the year, TCI plans to "move away from addressability on some of those multiple pays," Willis said.

"We think that we, as well as everybody else, made a mistake when we elected to put our security device at each TV set. Our approach will be to deliver our signals at the home, not the set. We're trying to erase the impediments that the subscriber has to using his cable-ready set, his remote control, his VCR, etc.," said Willis.

What about the potential for significant revenue from PPV? "We're not very excited about impulse pay-per-view," said Willis. "We've never been successful with pay-per-view events." Willis added that he felt the current technology cannot handle the logistics needed to offer IPPV without order logjams. "And it doesn't have a high profit margin" either, he added.

Despite TCI's opinion about present addressable gear, Willis is holding the door open for the future. The new on-premise system will start out with passive trapping, but will evolve into the use of active traps and possibly become addressable in several years, he said.

Just what the impact of the approach, if successful, will be is difficult to gauge, but other operators and manufacturers say the MSO's sheer size will make others sit up and take notice.

But it remains doubtful that a large number of operators plan to install off-premise addressable systems using present technology. "We've looked at it," said Rogers' Monteith, "both in the fiber and coaxial versions." But after recognizing the cost of implementation and a problem with second outlets, the MSO decided that the costs are significant enough to outweigh the merits in most cases, Monteith added.

Kernes said Jones is planning to install TRACS in one of its systems to determine exactly what the installation and operational costs will be.

So, while suppliers plan to introduce more consumer-friendly features to bolster sales of addressable converters and operators look to PPV to provide the revenue to justify their investment in addressability, a possible long-term solution to the friendliness issue looms on the horizon: the Electronic Industries Association's Baseband Decoder Interface standard, known as IS-15.

Walter Ciciora

The upside to IS-15 is that it will restore all the features of a cable-compatible television back to the subscriber, who would only have to use one remote control unit, and the cost of addressable boxes is likely to drop about 40 percent. The downside is that interfacing circuits must be built into every TV and electronic device to make the decoder work—that takes time and costs money and without a consensus from the cable community, manufacturers are reticent. The unknowns: Will more operators be encouraged to go addressable once the price falls? Will penetration increase to help offset the revenue lost from remote unit rentals?

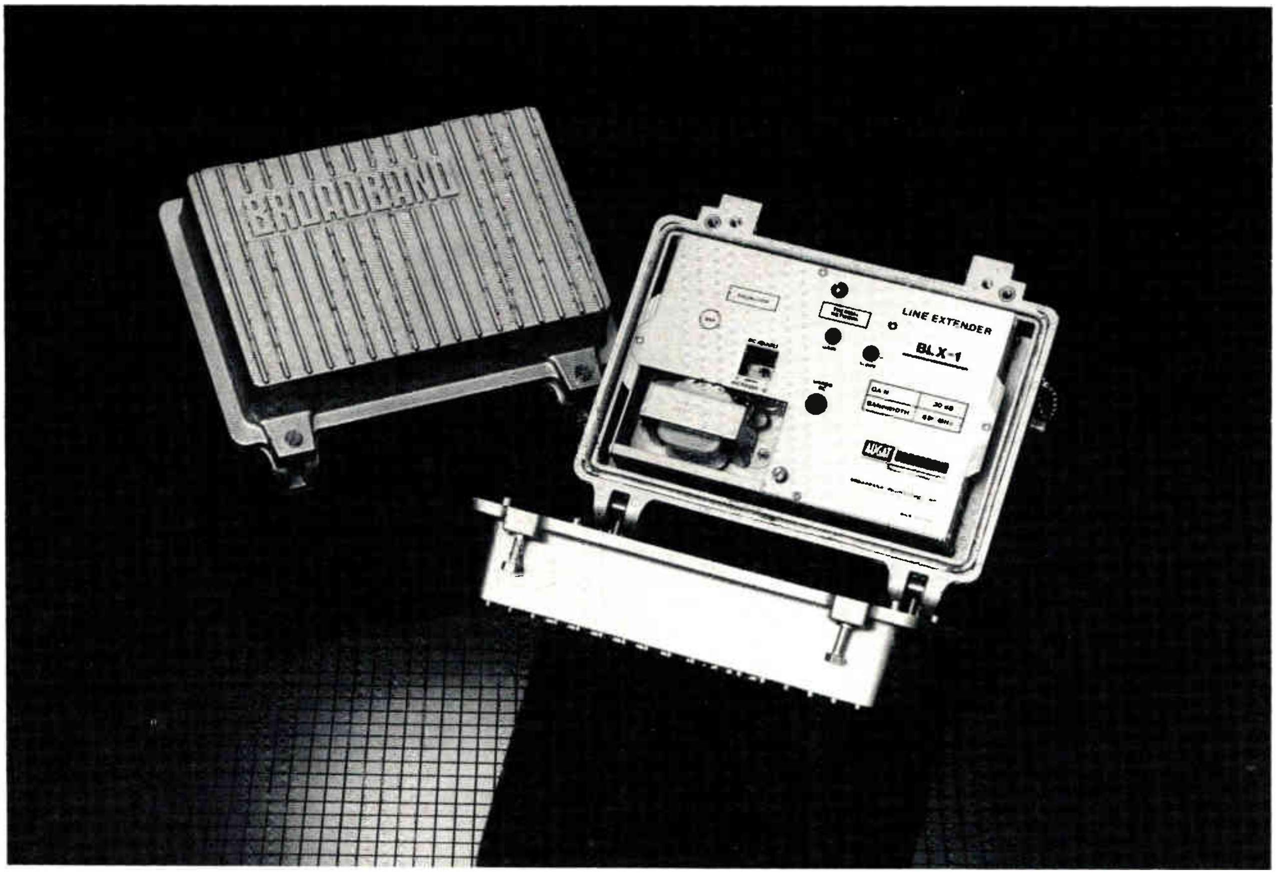
In spite of its current stance on addressable launches, ATC is firmly committed to IS-15. "We believe the decoder interface will be a major step in the direction of solving consumer electronics interface issues," said Walter Ciciora, vice president, new technologies. "ATC is a strong supporter of the standard and we are currently planning ways to support it in a visible fashion."

But other operators aren't so sure. At best, they see the interface as a long-term solution because of the length of time necessary for televisions equipped with the IS-15 plug to achieve a substantial market share.

"We need more time to assess what our real needs are," said Truckenmiller at Heritage. "We're just not totally committed yet one way or the other."

But it is exactly that attitude that industry leaders say must be overcome for IS-15 to quickly find a place in the market. They say the first step is for MSOs to line up in favor of the interface, then lobby the TV industry and decoder manufacturers to provide the necessary hardware.

"I personally am very enthusiastic about IS-15," said Viacom's Semon. "Long-term, it's what the industry needs. It needs the standard and it needs a driving force behind it. The IS-15 interface is not a good short-term solution to the problems but I think we need to get started on it quickly."



Broadband:
For flexibility in outdoor distribution amplifiers

Broadband has a complete line of one and two-way outdoor distribution amplifiers to meet any line extender or distribution requirement.

Flexibility is the key word. With gains of 26 to 50 dB and bandwidths up to 550 MHz, we can meet virtually any requirement that you have.

We offer reduced distortions with power doubler hybrids in many models.

For ease of maintenance, our amplifiers feature plug-in hybrids.

Excellent heat sinking, with an extruded aluminum chassis in close contact with the housing heat sink fins, assures the best possible heat transfer. That means lower operating temperatures and long life.

For information on specifications, pricing and delivery, call Broadband Engineering at 800-327-6690 (305-747-5000 in Florida) or write us at 1311 Commerce Lane, Jupiter, Florida 33458.

For quality, performance and service, call Broadband

AUGAT® BROADBAND

Quality and Innovation

Reader Service Number 9

If IS-15 gains acceptance, will the resulting lower cost of addressability bring more operators into the fold?

In fact, Joe Van Loan, engineering vice president at Viacom, has been chosen to head an NCTA subcommittee charged with the task of organizing support for the interface.

"In my view, IS-15 deserves the kind of crusading that Jim Mooney did a year ago for satellite scrambling," said Stubbs. "IS-15 ultimately is going to have at least as big an influence on the pattern of cable operations as satellites did."

The first task is to convince the consumer, who will have to spend perhaps as much as $25 more per TV to have IS-15 compatibility. "IS-15 offers our subscribers more choice in terms of how they interface with cable," said Ciciora. "If the subscriber can understand that this plug will make the use of home electronic equipment much more convenient, I think he'll see it as an excellent value."

"I have a feeling our salvation will be in technology," said Viacom's Semon. "But the only way the customer is going to buy that plug is if we do a sufficient job of telling him what life will be like for him as a viewer once he has it. That's the key: we have to get the customer to want it."

The next step is getting decoder manufacturers to begin production. But because of the huge expense involved in developing and producing another piece of hardware, suppliers are waiting for industry and marketplace support.

"We're quite willing to produce (the decoder) if the industry wants to go that way," said Jim Farmer, technical manager at Scientific-Atlanta's broadband communication division. "I think it would solve the problem if it received universal support. Right now, the standard is a long way from receiving universal support because I think cable operators don't understand it. Beyond a few people talking about it, I really haven't felt the type of support among the MSOs that I had expected at this point."

"If the MSOs can generate a perceived value (among consumers) for IS-15, it's going to move quickly. On the other hand, it could take an awful lot of marketing dollars to try to generate a perceived value that may never materialize," said Jerrold's Morse.

"Our basic strategy is to stay very familiar with the standard as it evolves and generate an experimental circuitry which is compatible," said Tocom's Tom Martin, director of research and development.

If IS-15 gains acceptance, will the resulting lower cost of addressability bring more operators into the fold? ATC's Walt Ciciora thinks so. In fact, his company may add more addressable units throughout its systems if the conditions are right.

Which way the industry will go—IS-15 or out-of-home technology—is unclear.

"It depends upon the rate at which TVs and VCRs with the plug become available. It certainly does impact the economics of addressability, it requires a considerably smaller investment on ATC's part and therefore the average price to install addressability should go down," he said.

According to Viacom's Semon, once the plug is in place, there's no reason not to go addressable. "At the point in time when the VCRs and TV sets sold have the IS-15 plug in them, then I think we're going to be in real good shape.

Under its present form, the standard primarily addresses baseband converter technology, which has been a source of consternation for some manufacturers. Although RF boxes can be made to work under the standard's specifications, it's going to cost more, says Zenith's Brugliera. And since most of today's converter sales are for RF products, there should be an RF standard as well, he argues.

"We think the marketplace is the best arbiter," he said. "We feel there should be a similar standard for RF products since three-quarters of the world is RF," he said. It should be noted that Zenith's new PM line of products will not be compatible with the interface.

Nevertheless, Mike Jeffers, vice president of engineering—advanced development at Jerrold, agrees. "We are still working with the EIA committee to establish an IF interface."

But Oak's Stubbs disagrees. "The NCTA Engineering Committee voted to endorse the baseband standard unambiguously. There's a strong sense in that committee that they'd rather not get things muddied up with work on an IF standard. The sense of both the NCTA Engineering Committee and their counterparts in the television receiver industry is that if there would be two standards, there might as well be no standard at all—the whole thing will be dead."

So where does all this leave the television manufacturers? As undecided as the cable industry, and time is moving quickly. According to Bob Burroughs, manager of cable systems at Matsushita Technology Center, Panasonic has already locked into its design for the 1987 models.

Burroughs said Panasonic supports the interface, and has already made some circuitry changes to accommodate it, "but I don't think we'll pioneer it." He cites the number of players in the game—the television manufacturers, decoder manufacturers, MSOs and consumers—as the reason why the jury is still out concerning IS-15's future. "Our preliminary analysis has shown it to be risky," he said. And "it's quite a negative sign" that TCI seems to be going in a different direction, he added.

Which way the industry will go—toward IS-15 or toward out-of-the-home technology—is unclear. What is clear is that Van Loan's subcommittee has a lot of work to do. ■

Analysis of CATV cable Return Loss

The widespread use of television and other VHF services has greatly increased the interest in the behavior of transmission lines at these high frequencies. Coaxial cables, as opposed to other types of cables, have gained acceptance for CATV systems because of economics, performance and availability. However, the complexities of CATV systems and the behavior of coaxial cables at the higher frequencies has resulted in differences of opinion on testing the cables before installation.

In some instances, misinterpretation of test data has resulted in erroneous conclusions. In other instances questionable test techniques have led to erroneous conclusions. Therefore, this paper is intended as an aid to understanding the salient points of a CATV coaxial cable transmission path and the interpretation of the data from properly performed tests.

Transmission paths

The small impedance deviations resulting from the vagaries of cable manufacture can cause signal reflections (ghosts) and a loss of picture resolution (smear). However, system degradation can be greatly reduced by properly testing and selecting for use only low reflection cables. The testing procedure and equipment used must be capable of discerning cable faults from normal cable and connector impedance behavior.

It may be helpful in some instances to review the transmission behavior of coaxial transmission lines. A short review is included in the Appendix which describes several types of reflections that occur in a terminated coaxial cable. These reflections are classified as follows:

1. Small impedance discontinuities *randomly distributed* along the cable length. These discontinuities produce incoherent reflections which resemble a noise waveform and if large enough can cause a loss of picture resolution.

2. Small but *equally spaced* impedance discontinuities. These discontinuities will combine at specific frequencies to produce large reflections and high attenuation. A double image or even loss of signal can result when these reflections occur at the TV frequencies.

3. A poorly matched cable termination and/or connector to the cable characteristic impedance will cause a reflection. A double image may occur depending on the magnitude and phase of the reflection and the cable path loss.

These reflections, as shown in the Appendix, are produced by a deviation from the cable characteristic impedance at any point in the system. Some of the reflections in the system are more significant than others since the signal is attenuated over the cable length.

Reflections originating from mismatches at the receive end are attenuated by twice the cable loss and further reduced by the degree of mismatch at the transmit end before reappearing at the receiver end. Therefore, assuming a transmit termination mismatch of less than = 16 percent and a path loss of 20 dB, these reflections can be neglected.

Reflections from the transmit end mismatches can be neglected since they are not sufficiently delayed by the short transit time between the amplifier output and the cable input. The most significant reflections are those produced by the random and periodic impedance discontinuities distributed over the cable length.

These reflections are the result of small changes in the cable structure. Since these structural reflections appear to increase the cable loss they are termed Structural Return Loss (SRL) and are measured at the cable input in dB relative to the input signal.

In attempting to measure the cable SRL, a combination of all types of reflections described above will be present at the input to the cable. Many of the reflections can combine, such as the random SRL of the cable and a test equipment mismatch to the cable which can result in a misleading measurement of SRL. It is important, therefore, to separate the SRL of the cable from the other reflections when the SRL of the cable is under examination.

The return loss of a poorly matched connector decreases exponentially with frequency and can easily be detected with a good sweep frequency

Coaxial cables have gained acceptance for CATV systems because of economics.

Distributed privately by the Essex Co., which is no longer in business.

Cable Classics

Do you know what the term "Structural Return Loss" means? Do you know how to determine, by measurement, the effect on return loss of structural irregularities along the length of a cable?

Structural Return Loss no longer receives a great deal of attention in print, but it is still an important perimeter in the specifications for every reel of cable. Cable manufacturers originally experienced much difficulty with the effects of periodic changes of minute magnitude, uniformly distributed along the length of a reel of cable.

Those small periodic discontinuities were mostly associated with the machinery used to manufacture cable. Such periodic discontinuities could lead to allowing effects such as suckouts on cable attenuation/frequency performance.

The fact that Structural Return Loss receives little attention now is really a tribute to the enormous strides made by cable manufacturers in cable construction and manufacturing methods. This paper was published by Essex International Inc. in the early 1970s, and provides a concise account of Structural Return Loss, its measurement and effects.

For a more detailed theoretical account of Structural Return Loss, the reader is referred to: *Structural Return Loss Phenomenon—Coaxial Cable* by J.A. Olszewski and Herbert Lubars, Proc. IEEE, Vol. 58 #7, July 1970, pp 1036-1050.

Graham S. Stubbs, Vice President, Science & Technology, Oak Communications

The reflections from a cable can be measured with an RL bridge.

test system. Random discontinuities in the cable produce random reflections which are similar to noise and these reflections do not necessarily increase with frequency since they generally exhibit phase incoherence. The base line of a Return Loss (RL) vs. frequency oscilloscope display is ideally flat and horizontal.

Equally spaced discontinuities can appear as one or more return loss "spikes" in the RL vs. frequency display. The "spikes" appear at the frequencies where the reflections add together but the base line of a frequency vs. SRL display is flat and horizontal.

If the cable is terminated in an impedance which is not equal to the cable Zo, then the overall RL appears to decrease and will be frequency dependent since the input impedance will change with frequency. Therefore, the RL of a cable improperly terminated will appear to decrease and the base line of the RL vs. frequency display will be neither flat nor horizontal.

The reflections from a cable can be measured with an RL bridge. As in other bridge circuits, the component being tested is compared to a standard. The difference between the standard and component under test appears as a voltage at the bridge output terminals. The output voltage is then calibrated in some convenient units.

The capability of the bridge and associated equipment must be determined before meaningful measurements can be made. If a bridge is to be used to measure RL's of 40 dB, then the bridge must have a null depth of at least 43 dB to 46 dB, excluding the bridge insertion loss, when balanced.

The null depth can be checked by terminating both the reference and test inputs in equal terminations which are known to have reflections less than the expected bridge null depth. The RL measured when the bridge is terminated as described must be at least 43 dB to 46 dB. The output voltage from the bridge is calibrated in dB of RL.

Most sweep frequency test systems use an electronic switch and a standard attenuator to provide an attenuation reference trace on an oscilloscope. Therefore, the accuracy of the test system is dependent on the tolerance and calibration of the standard attenuator regardless of the bridge and associated equipment capability.

For this reason, the attenuator must be of good quality and periodically checked and calibrated over the frequency band of interest.

Cable SRL can be measured once the test system capability has been determined. However, the problem of separating the various reflections from the cable SRL must still be resolved. One way to separate the effects of terminal mismatch reflections from the cable

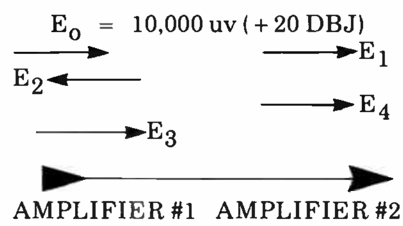
The problem of separating the various reflections from the cable SRL must still be resolved.

SRL is to terminate the standard (comparison) arm of the bridge in a variable impedance consisting of a resistance and capacitance. *The resistance is adjusted to balance with the actual Zo of the cable and the capacitance is adjusted to cancel the connector mismatches. The only component of the reflections from the cable that does not have a counterpart in the variable termination is the cable SRL which will appear on the bridge output terminals.*

The cable SRL will be displayed by the test system when the variable impedance is adjusted for the flattest and lowest RL vs. frequency. This test method depends on the ability of a simple R-C impedance to cancel the non-structural reflections. The measurement method described may not seem entirely correct to some at first thought.

However, referring back to the cause of the structural return loss, it was shown that the SRL resulted from small structural *changes* and not from small termination and connector to Zo differences.

FIGURE 1



Z out* = 54.4 to 103.5 ohms (VSWR = 1.38:1)

Z in* = 54.4 to 103.5 ohms (VSWR = 1.38:1)

Cable Zo = 75 ohms
Insertion Loss = 20 dB
SRL = 26 dB

(* Pure resistive loads are considered for simplicity.)

Therefore, a cable with a Zo which is not exactly 75 ohms will perform as well as a 75 ohm cable provided neither cable has unacceptable structural changes over its length. The following examples are given to elucidate this point.

Example 1

Two amplifiers are separated by a trunk cable. The terminating amplifiers are assumed to have a VSWR of 1.38:1 match to 75 ohms. (Typical values for SKL series 400 amplifiers and Entron ABX-64OB Amplifiers.) The equipment impedances and signal levels are shown in Figure 1.

The incident signal (E_1) received at amplifier #2 is:

$$20\ \text{dB} = 20\ \text{Log}\ \frac{10{,}000}{E_1}$$

The measurement method described may not seem entirely correct to some at first thought.

$$E_1 = 1000\text{ uv.}$$

The reflected signal (E_2) from the cable SRL received at the transmit end is:

$$26\text{ dB} = 20\text{ Log}\frac{10{,}000}{E_2}$$

$$E_2 = 500\text{ uv.}$$

The portion of E_2 reflected (E_3) by the mismatch between amplifier #1 output impedance and the cable Zo is:

$$E_3 = \frac{103.5\ -73}{103.5\ +73}\ E_2$$

$$E_3 = 86.5\text{ uv.}$$

The first reflection (E_4) received at amplifier #2 from the cable SRL is:

$$20\text{ dB} = 20\text{ Log}\frac{E_3}{E_4}$$

$$E_4 = 8.65\text{ uv.}$$

The ratio of E_1 to E_4 in dB is:

$$\text{dB} = 20\text{ Log}\frac{1000}{8.65}$$

$$\text{dB} = 41.26$$

The first reflection E_4, which is the largest reflection, is too small in magnitude to cause a ghost.

Example 2

Two amplifiers are separated by a lateral cable which has two directional couplers servicing subscribers. The amplifier impedances are the same as in Example 1 and are shown in Figure 2.

The signal received (E_1) at the input of amplifier #2 is:

$$20\text{ dB} = 20\text{ Log}\frac{E_o}{E_1}$$

$$E_1 = 1000\text{ uv.}$$

The signal received (E_2) at the output of coupler #2 is:

$$(5+1+8+10)\text{ dB} = 20\text{ Log}\frac{E_o}{E_2}$$

$$E_2 = 630\text{ uv.}$$

The signal received (E_3) at the output of coupler #1 is:

$$(5+16)\text{ dB} = 20\text{ Log}\frac{E_o}{E_3}$$

$$E_3 = 894\text{ uv.}$$

The SRL reflection (E_4) toward amplifier #1 is:

$$26\text{ dB} = 20\text{ Log}\frac{E_o}{E_4}$$

$$E_4 = 500\text{ uv.}$$

The portion of (E_4) reflected (E_5) by the mismatch between amplifier #1 output impedance and the cable Zo is:

$$E_5 = \frac{103.5\ -73}{103.5\ +73}\ E_4$$

$$E_5 = 86.5\text{ uv.}$$

The first reflection E_6 from E_5 at the first coupler output is:

$$(5+16)\text{ dB} = 20\text{ Log}\frac{E_5}{E_6}$$

$$E_6 = 7.7\text{ uv.}$$

The first reflection E_7 from E_5 at the second coupler output is:

$$(5+1+8+10)\text{ dB} = 20\text{ Log}\frac{E_5}{E_7}$$

$$E_7 = 5.46\text{ uv.}$$

The first reflection E_8 from E_5 received at amplifier #2 input is:

$$(5+1+8+1+5)\text{ DB} = 20\text{ Log}\frac{E_5}{E_8}$$

$$E_8 = 8.65\text{ uv.}$$

The portion of E_1 reflected E_9 by the mismatch between amplifier #2 input impedance and the cable Zo is:

$$E_9 = \frac{103.5\ -73}{103.5\ +73}\ E_1$$

$$E_9 = 176.5\text{ uv.}$$

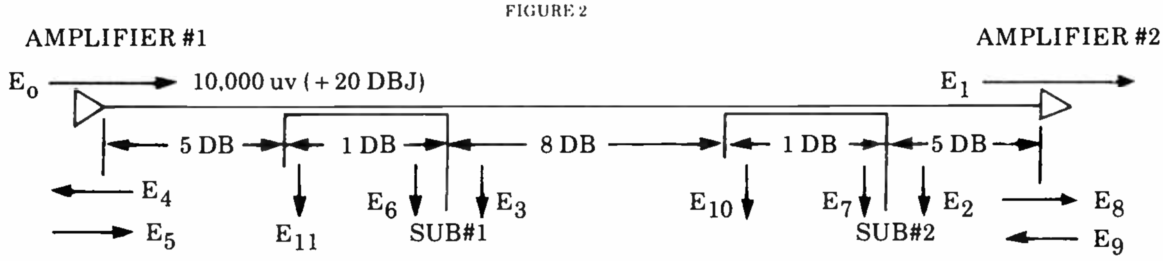
The reflection E_{10} at the output of coupler #2 from E_9 is:

$$(5+35)\text{ dB} = 20\text{ Log}\frac{E_9}{E_{10}}$$

$$E_{10} = 1.76\text{ uv.}$$

Two amplifiers are separated by a lateral cable which has two directional couplers servicing subscribers.

FIGURE 2



Z out* = 54.4 to 103.5 ohms   Z in* = 54.4 to 103.5 ohms

Cable Zo = 73 ohms
Insertion Loss = 20 dB
SRL = 26 dB

(* Pure resistive loads are considered for simplicity)

Coupler #1 (SKL Model 463 Chromatap)		Coupler #2 (SKL Model 462 Chromatap)	
Insertion loss	= 1 dB	Insertion loss	= 1 dB
Coupling	= 16 dB	Coupling	= 10 dB
Directivity	= 35 dB	Directivity	= 35 dB

Several values of SRL have been used to compute the reflections and incident signal magnitudes for examples 1 and 2.

Table I

Example #1

Cable SRL	Incident Signal Received at Amp #2	1st Reflection at Amp #2
22 dB	1,000 uv	13.70 uv
26 dB	1,000 uv	8.65 uv
30 dB	1,000 uv	5.46 uv

Example #2

	Incident Signal at			1st Reflection		
Cable SRL	Amp #2	Coupler 1	Coupler 2	Amp #2	Coupler 1	Coupler 2
22	1,000 uv	894 uv	630 uv	13.70 uv	12.20 uv	8.65 uv
26	1,000 uv	894 uv	630 uv	8.65 uv	7.70 uv	5.46 uv
30	1,000 uv	894 uv	630 uv	5.46 uv	4.88 uv	3.45 uv

HOW TO TALK THE POWER COMPANY INTO LOWERING YOUR BILL 10%.

Introducing the first superferroresonant power supply–the new Lectro **Super Ferro.**

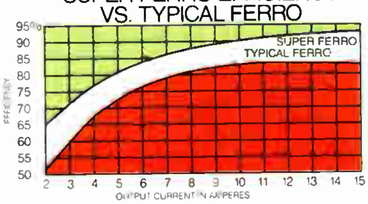
It's a radical improvement in power supply technology. It operates 10% more efficiently than most power supplies available until now.

For example, the **Super Ferro** is 93% efficient at normal load factor (see graph at right). Take that news to your power company, and you've got a powerful argument for a 10% saving in your power bill.

We've put together test results to help you prove the increased efficiency of the **Super Ferro** to even the most skeptical utility company.

Call **1-800-551-3790** or write today for complete details and test results. Because that 10% would look better on your bottom line than on your power line.

SUPER FERRO EFFICIENCY
VS. TYPICAL FERRO



Super Ferro Outperforms The Average Power Supply At Every Load Factor.

THE NEW SUPER FERRO BY LECTRO

A Burnup & Sims Cable Products Group Company

Reader Service Number 22

Reflection magnitudes and phase relationships are indicative of the cable performance for CATV transmission path.

The reflection E_{11} at the output of coupler #1 from E_9 is:

$$(5+1+8+35)\,\text{dB} = 20\,\text{Log}\,\frac{E_9}{E_{11}}$$

$$E_{11} = 0.63\,\text{uv}.$$

Several values of SRL have been used to compute the reflections and incident signal magnitudes for Examples 1 and 2. The results of these computations are summarized in Table I.

The magnitudes of the reflections received are dependent on the match of the terminating equipment to the cable Zo. A reflection coefficient of 16 percent, which is the largest reflection for a VSWR of 1.38:1, has been assumed in order to demonstrate the effects of cable SRL on ghosting. Some ghosting will probably occur for the 22 dB cable SRL values in Table 1 since the reflected to incident signal ratios are 37 dB. A general criterion for ghosting is that ghosts will not occur if the incident to reflected signal ratio is greater than 40 dB and the incident signal is greater than 500 uv. Therefore, ghosts would not occur for the 26 dB and 30 dB cable SRL values in Table I. (W.A. Rheinfelder, Chasing Ghosts, *TV and Communications*, December 1964, p. 30.)

Conclusions

The reflection magnitudes and phase relationships in a coaxial cable are indicative of the cable performance for a CATV transmission path. The significant reflections, which degrade system performance, are those occurring from small structural changes along the cable length. Examples have been presented to clarify the significance of structural reflections as opposed to reflections from termination and connector mismatches.

It is, therefore, necessary to separate the structural and non-structural reflections, since both are present, during the cable acceptance test to determine the acceptability of the cable.

Most cables, although of the same type, have slightly different characteristic impedances. For this reason, the changes in non-structural reflections from different terminations require the complex impedance to be adjustable. It can then be adjusted to both the exact cable Zo and to cancel the non-structural reflections. Once adjusted the cable SRL can be measured.

Appendix

The behavior of coaxial cable transmission lines can be reviewed by considering first an infinitely long length of cable whose cross-sectional dimensions and constituent materials are constant and equal along the cable length. Some impedance is exhibited at the input of the cable which is termed the characteristic impedance (Zo). The characteristic impedance is determined by the ratio of the concentric conductor diameters and the permittivity of the dielectric material between them.

If a signal is transmitted into the cable, no reflection will occur within the cable since the cable has a constant cross-section and a homogeneity of material over its length. However, the signal is attenuated as it travels along the length and is eventually dissipated since the cable is infinitely long. If the cable were made a finite length and terminated in exactly Zo then no reflections will occur since the termination appears as more cable to the signal and dissipates the signal incident upon it.

Consider next a cable as before with a finite length but having a slight impedance discontinuity—a change in the conductor diameter ratio or dielectric permittivity—at a point between the cable ends. As a signal propagates along the cable a small amount of the energy in the incident signal is reflected back to the transmit end. Two signals are now traveling in the cable, one in the incident direction and one in the reflected direction. The incident signal is proportionately reduced by the amount of energy reflected since the reflected signal originated at the impedance discontinuity from the incident signal.

It is important to note at this point that the impedance of the signal source has not been considered and has not caused reflections. However, the source impedance now serves as the reflected signal termination and if equal to the cable Zo will completely dissipate the reflection. The source impedance should also be equal to Zo for a maximum transfer of energy into the cable.

Two Reliable Systems

Nothing is more reliable than the predictable path of the solar system.

And nothing is more reliable than your LAN system using these GENERAL INSTRUMENT components.

X-Series LAN Amplifier—the only mainstation that offers fully redundant two-way communication, as well as plug-in status monitoring in one amplifier. Redundant power packs assure continuous operation.

Status Monitoring System—continually tests every active LAN component from the headend. It provides instant reports on how the system is functioning and offers the capability to make changes in the system remotely.

Transverter Redundancy Switch—continuously tests the primary and back-up transverters. It instantly switches to the back-up, when needed, allowing continued data flow at all times.

Standby Power—the SPS-RS redundancy switch offers automatic switchover to a back-up system power supply.

Whether upgrading or developing a new LAN system, trust these General Instrument products to maximize your system's reliability.

For complete information on our expanding line of modem, distribution, and headend products for broadband local area networks, ask for our new LAN catalog.

GENERAL INSTRUMENT

Local Area Networks
2200 Byberry Road
Hatboro, Pa 19040
(215) 674-4800

Reader Service Number 25

Off into the wild blue yonder. . .

. . .with the help of the nation's biggest LAN

When the 1,261 members of the Air Force Academy's class of 1990 were formally inducted into the cadet wing on Aug. 9 in Colorado Springs, Colo., they found more than uniforms and books waiting for them. RS-232C cables were waiting as well, because all the dorm rooms are equipped with ports allowing access to a dual cable, broadband LAN linking classrooms, living areas, laboratories, the gym and field house. Befitting the grandeur of the showpiece campus—it's on an 18,000 acre reserve—the LAN itself is awesome.

The system, designed by Contel Information Systems and installed by Kelly Western Corp. of Denver, contains 70 miles of hard cable; 2,600 network interfaces; 6,300 installed outlets and a total of 10,000 potential user locations. Altogether, the system uses 1.056 million feet of quad drop wire; contains 167 line extenders; 10 trunk amplifiers and 12 headend amps. Everything is fully redundant.

The academy's using the LAN to provide cadets with 21 video channels; micro-to-mainframe communications; scheduling and appointment calendars; electronic mail and bulletin board services. Three VAX 865s and one Venus 248 host are wired into the net. The academy wanted a system that is totally hidden from view, and got it. All trunks are carried under the campus in tunnels. Except for the laboratory training building, cable entry occurs entirely from the tunnels. Similar care was taken to hide drops and feeders, amplifiers and passives in closets, false ceilings, false floors or between walls.

It was a demanding job—"mil spec"—all the way. And note: the subcontract for installation and system proofing went to a company that cut its teeth in CATV back in 1980 and continues to work for Jones Intercable, Mile High Cablevision and United Cable. But Kelly Western is no run-of-the-mill contractor. Its list of clients also includes AT&T, Mountain Bell, TRW and Sytek. With annual revenues of about $7.6 million and 250 employees, Kelly Western has in the past handled turnkey cable and fiber optic systems, pre-wiring, alarm systems, mapping, temporary manpower, facilities management, system design and surveys. Not bad for a company that remains family owned.

Principals Martin and Richard Block and Jack Kelly originally headed three separate businesses that handled installation, construction and engineering services. They merged to form Kelly Western in 1984.

The company got interested in LANs about a year ago, when it began talks with the academy. Takeoff was in March 1985 when the company got a subcontract from Sytek to install a LAN for Mountain Bell. Jobs for an IBM facility and the University of Colorado, both in Boulder, Colo., followed. Recently, the company was awarded a contract for installation of three large LANs for TRW.

Without question, the academy job "has been a springboard for us all over the country," says Kelly, executive vice president for the firm. "The academy job represents our very best work, and as a result, we're heavily into the military sector." Although the company is focusing on broadband installations, it has done baseband coaxial, twisted-pair and fiber optic jobs as well. And ultimately, the company wants to be a prime contractor in its own right, says Jeff Reetz, who handles most of the communications side of the business. But the firm is wisely taking its time about doing so. "Blow it just once and you're in trouble," Reetz emphasizes.

Well said. TRW is prime contractor for the Wright Patterson and four other jobs for the Air Force, and according to company Director of Marketing and Sales Bronson "Bob" Purdy, "we've gotten burned a couple of times" by subcontractors whose work just didn't measure up.

Every company has a founding culture, a way of doing things or set of beliefs that form the core of its approach to business. EDS under Ross Perot was big on hiring ex-Marines. You didn't dare wear anything but white shirts, white socks, dark suits. You never wore loafers; you never even thought about it.

At Kelly Western, an explicit part of the company culture is a deeply-rooted commitment to professionalism and quality work. It's reflected in the training employees get, the symmetrical bend radii and disciplined cable paths the company leaves behind when it finishes a job. At the academy, for example, even evidence of construction activity had to be hidden. The company literally had to pick everything up and put it away whenever the day's work

Kelly Western leaders include: standing, from left to right, Roger Hays, Jeff Reetz and Richard Block; sitting are Jack Kelly, left, and Martin Block.

was finished. And those "days" often were nights: no work when cadets are in the dorms or classrooms.

A word often used by company leaders to describe the firm is "family." "People are the finite resource," Kelly says. "It's the people that make the company go." In return, there's a high level of trust and confidence in the company management. "Everybody gets to see the numbers," Richard Block says.

"It isn't the bids you don't get that can bury you—it's the bids you do get," Reetz emphasizes. "It all goes back to the employees. You've got to be good to them if you want them to do good work for you."

The company also believes in crawling before it walks. Although it wants to grow to be a prime contractor, Kelly Western also believes in controlled growth. "As we evolve, we'll be prime for small jobs at first," Kelly says. "Right now we need to keep the right company, need good relationships with the people who've got high technology expertise, and can't overstep our bounds. We're not anxious to prime before we're ready."

And the firm knows where it wants to go. Total communication packages for "intelligent buildings" are the company's strategic direction, says Roger Hays, marketing director. That includes phone, alarm, telemetry and data services. Interestingly, the company sees a certain maturation on the buyer side of the business. "It's like the PC business," Hays points out. "At first, clients asked about the hardware. Then they got more sophisticated and asked about software. Now, finally, people are thinking about what their needs are and how PCs can help."

To date, the company's business has been heavily, though not exclusively, in the Rocky Mountain region, although it has done jobs nationwide as well, notably Baltimore, Los Angeles and Alameda County.

The lesson here: if you want to be a player in the LAN business, as a sub- or prime contractor, you've got to be sure of the quality of your work, your people, your project management capabilities. Word gets around pretty quick, and your reputation is your ticket to walk in the door.

—Gary Kim

Sometimes you need a full plate

When does a good host serve caviar and beer? When that's what the client wants to eat. And like a good host, TRW Information Networks Division has graciously conceded to its guests' wishes. For 10 years or more, TRW has been installing highly classified military and government networks for clients like the White House. And they were big: some jobs TRW has gotten were the result of proposals that cost a million dollars to prepare. And today, its slice of the civilian market is the large account local area network: Fortune 500s, for example. Why then would the company announce a 40-PC network?

"Because our research of the Fortune 500 market indicates you need a full plate to compete effectively," says Bronson "Bob" Purdy, director of marketing and sales. "To many MIS directors, PCs are a real problem. And now those directors are facing whole clusters of departmental PCs that aren't necessarily integrated with the rest of the company's information systems," Purdy explains. But those PCs aren't going away.

So while a LAN server that can handle 40 PCs might not at first glance appear to be a strategic product, you've got to consider the possibilities. The PC server handles the 80 percent of communications that are specific to that particular work group or department. But it also bridges to a broadband backbone LAN. Ethernet for the locals, access to the backbone for real serious file sharing; preservation of the PC investment companies already have made; but expansion potential for company-wide networks when that makes sense. That's the strategic vision the company has in mind with its new TRW PC Connection.

Likewise, the company's new line of E-Modems and E-Modem Repeaters, designed to run Ethernet over broadband, are an answer for campus settings where building networks need to be linked over a larger backbone LAN. The idea: "Have a suite of products that are embellishments around our core broadband LAN," Purdy says.

The Information Networks Division already has gotten several major contracts since its founding in January 1985. Among them, a 27-building LAN for the Cleveland Clinic Foundation using 50 miles of cable and supporting 3,000 drops. IND also has gotten a five-base contract for the U.S. Air Force valued at about $15 million over five years. Perhaps its biggest completed job to date was a 17,000 connection network covering a facility a million square feet in size.

The IND also competes with outside vendors for in-house TRW business. And while the company has experienced some delays in its marketing plan and some glitches with network interfaces, it has stood behind its products and offered customers upgraded versions at no charge. "When the rubber meets the road, we'll be there," Purdy promises. "We'll always meet our commitments."

The IND product line is based on the Concept 2000 family of broadband and baseband LAN products, supporting gear from a variety of vendors. Synchronous and asynchronous devices, IBM 3270 terminals, PCs and video applications are supported.

At the heart of the system is the Intelligent Connector Unit, or ICU, a two- or four-port modem supporting RS232C ports. RS422, RS423 or MIL-STD-188/144 interfaces are available as options.

For network management of small LANs, TRW uses a DEC PDP-11/23 running UNIX, which can monitor up to 500 nodes.

The company's baseband products include communications, gateway, host and network control servers supporting Ethernet for lower level protocols and TCP/IP or XNS at the upper levels. TRW's communications servers support async, bisync, bit-sync, X.25, TCP/IP and UNIX machines. In addition, the CS/1-SNA server performs protocol conversion to IBM SNA devices, allowing ASCII terminals and PCs to emulate IBM 3278 terminals at any point on the LAN. Gateway servers support protocol conversion for XNS, X.25 or HDLC.

And, take heart, even the big guys sometimes draw blank nods when the subject of broadband comes up. "I almost feel like an evangelist for broadband," Purdy says. Let's hope the full plate turns into a healthy slice of the market. Because if it does, lots of suppliers reading this also will get to eat.

—Gary Kim

Development of baseband decoder. . .

. . .with EIA Interface Standard for cable receivers and decoders.

The EIA Television Receiver Committee has been developing an interface standard for improving the compatibility of TV receivers and decoders operating on cable TV systems. This paper reviews pertinent specifications of the standard and efforts involved in developing a compatible decoder. Specific problems encountered, such as the generation of AGC control signals (derived from received scrambled signals) with the required response time, are described. Overall characteristics of the decoder and its performance during field tests are reviewed.

Introduction

Separate developments in the cable television and television receiver industries have resulted in equipment with several incompatibilities and duplicate functions, frustrating to the subscriber and cause for non-essential in-home equipment costs. This situation is apparent even with the introduction of "cable ready" television receivers. Subscribers have been finding that after paying additional money to obtain a "cable ready" receiver they still cannot receive channels which have been scrambled.

A committee formed under the EIA (Electronics Industries Association), called the Television Receiver Committee (R-4) Interface Working Group, has been working with cable operators and equipment suppliers to alleviate some of these incompatibilities. The result has been the development of the NTSC Television Receiver Baseband (Audio/Video) Interface Standard IS-15 (reference 1).

This paper illustrates some of the duplicate functions which are eliminated by the use of equipment compatible with the Interface Standard. It also describes some of the steps involved and the problems encountered in developing a cable decoder compatible with the IS-15 Standard.

The utilization and assignment of carrier frequencies different than those assigned for standard broadcast television transmission occurred early in the development of cable television. This provided several advantages, among them the use of frequency bands not available for transmission over the air. This in turn permitted transmission of up to 54 channels without having to use carrier frequencies above 408 MHz, a definite advantage when considering the increased attenuation of coaxial cables at higher frequencies.

However, until just the last few years, television receivers were unable to tune most of the cable channels available, and required a separate cable converter in order to receive the cable channels. Even today, most television receivers on cable systems are tuned to one channel (3 or 4) and selection of the cable channels is performed with a set-top converter or converter/decoder.

Television receivers advertised as "cable ready" are now available which can tune the cable channels. But the use of scrambling techniques on some channels means that those channels remain unavailable to these receivers. Furthermore, the use of a converter/decoder to view the programs on the scrambled channels relegates these receivers to fixed tuning on one channel and as a result most of this tuning capability ends up wasted (along with the TV remote control function).

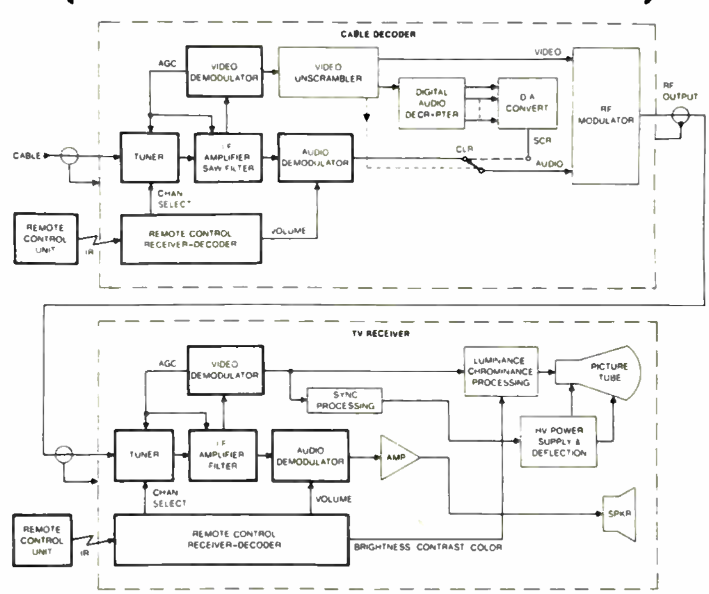
Figure 1 is a block diagram illustrating typical functions performed by a cable decoder and television receiver when interconnected for reception from a cable TV system. In the case of the decoder, the functions illustrated are for an Oak Sigma unit, as this was the unit later modified for compatibility with the EIA standard. The Sigma system's implementation of digital audio transmissions has been described in a previous NCTA paper (reference 2).

The functions of the decoder can be summarized as follows:

a) A remote control unit (or local keyboard) is used to select the channel to be received from the cable by the

FIGURE 1

Cable Decoder and TV Receiver Functions (Redundant Functions shown in bold)



Arthur E. Vigil, Staff Scientist, Oak Communications Inc.

Reprinted with permission, 1986 NCTA Technical Papers.

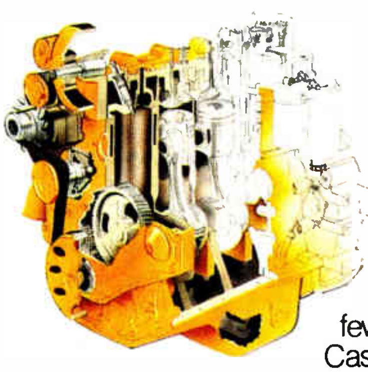
Your next loader/backhoe.

If it's not a Case,

here's what you'll miss.

Case loader/backhoes offer you a unique combination of features that deliver a proven edge in productivity and the greatest return on your investment.

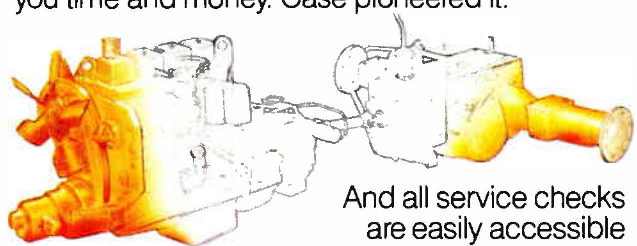
The Case diesel: reliable power on less fuel with lower maintenance cost.



Our engineering expertise brings you an engine that works for you *and* your bottom line. Computer-designed from the ground up to provide maximum performance with fewer moving parts, the Case engine gives you high torque rise with lower fuel consumption and much longer service intervals than conventional diesels. It gives the Case 580E a hard-working edge and is available in *all* Case loader/backhoes.

Componentized power train.

Our engine, torque converter or transmission can be removed easily and individually to save you time and money. Case pioneered it.



And all service checks are easily accessible for simplified maintenance.

Investment performance.

The excellent 25-year reputation of Case loader/backhoes is something you can bank on when it's time to trade or sell. No loader/backhoe holds its value as well as our 580.

Reliable power. Maximum serviceability. High resale value. Those are just three of the reasons you can't afford to pass up a Case.

See your Case dealer today, and give yourself the competitive edge that comes only with a Case.

J I Case
A Tenneco Company
TENNECO
700 State Street Racine, WI 53404 U.S.A.

Building On Quality™

480E 580E 680K 780C

case

Reader Service Number 26

An audio demodulator recovers the baseband audio signal from the audio carrier.

tuner on the decoder.

b) The output of the tuner passes through the IF amplifier section where filters are used to separate the audio (in unscrambled mode) and video carriers.

c) An audio demodulator recovers the baseband audio signal from the audio carrier (in the unscrambled mode).

d) The video demodulator recovers the baseband video signal from the video carrier. In the scrambled mode, digital signals carrying the audio information are also recovered by this demodulator.

e) If the baseband video signal is scrambled a video unscrambler section provides unscrambling. This section is transparent to nonscrambled signals.

f) In the scrambled mode the baseband audio signals are recovered by the digital audio decrypter and D/A (digital to analog) converter from the encrypted digital signals carrying the audio.

g) An RF modulator section generates modulated carriers on one channel for transmission of the recovered video and audio signals to an external receiver.

The functions of the television receiver are summarized as follows:

a) The remote control unit or front panel controls are used to select the channel to be received from the cable decoder. Note: In most installations, once this selection is performed, the receiver remains on that channel indefinitely.

b) The output of the tuner passes through the IF amplifier section where filters are used to separate the audio and video carriers.

c) An audio demodulator recovers the baseband audio signals from the audio carrier. These signals are then amplified by a power amplifier and used to drive a loudspeaker.

d) A video demodulator recovers the baseband video signal from the video carrier.

e) Sync processing circuits separate the horizontal and vertical sync from the composite video signals. The sync signals are used to drive a high voltage power supply and deflection system which ultimately cause the display of an illuminated raster on the picture tube.

f) Luminance and chrominance processing circuits provide three video signals (one for each primary color) for driving the picture tube thereby displaying a composite color (or black and white) picture.

Figure 1 and the description of receiver and decoder functions above, clearly illustrate that the remote control unit, associated infra-red receiver, tuner, IF amplifier, audio and video demodulator functions are repeated in

MORE FOR LE$$

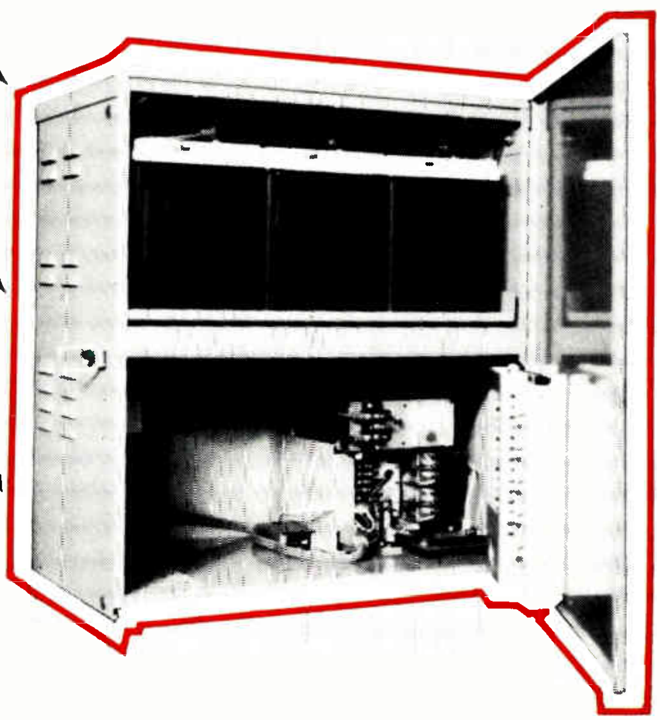
(When WE say PROFIT BUILDER - WE mean YOUR PROFIT!)

CABLE POWER CL 737

- ENGINEERING EXCELLENCE
- FIELD PROVEN RELIABILITY
- REALISTIC PRICE

- Hinged lid
- Easy access battery location
- Spill-guard battery trays (available)
- Insulated shelf for battery protection
- Modular construction
- Lightning arrestor
- Bottom indicator lights and entries

15 OPTIONS including
- Remote Status Monitor
- Automatic Performance Monitor
- Vandal and corrosion resistant galvanized steel pedestal enclosure



STANDBY POWER SUPPLY
Model CL 737XL

UL LISTED

Factory and Customer Service:
14860 N.E. 95th
Redmond, WA 98052
(206) 882-2304

Service:
Redmond, WA
(206) 882-2304
Deerfield Beach, FL
(305) 429-0870
Ontario, CANADA
(416) 629-1111

Reader Service Number 28

A Triple Crown Corporation

The desirability of avoiding repetition of RF and baseband processing is well established.

each unit. These functions impose penalties in complexity, cost and functionality.

In addition, the desirability of avoiding repetition of RF and baseband processing, especially demodulation and remodulation, is well established. These processes can introduce distortions into the original signals so that the quality of the displayed picture and audio signals may degrade from repeated processing. It should be noted that decoder manufacturers, being aware of this problem, use considerable care and optimize equipment design to assure that the degradation will be minimum and usually imperceptible compared to direct viewing and listening with just a receiver.

TV monitor approach

Figure 2 illustrates one approach towards reducing the redundant functions previously described for the decoder and receiver. The approach utilizes a decoder wherein the RF modulator has been replaced by baseband audio and video driver amplifiers. These amplifiers deliver baseband signals directly to a television monitor instead of a receiver.

There are several technical reasons favoring this approach. The interface between the decoder and monitor is very straightforward. Furthermore, a television monitor can display a better picture than an equivalent quality receiver, again because of reduced signal processing. This improved display capability is often exploited in monitors used for computer graphic displays. A monitor can also improve the playback from a video tape recoder or other video source which features baseband video output.

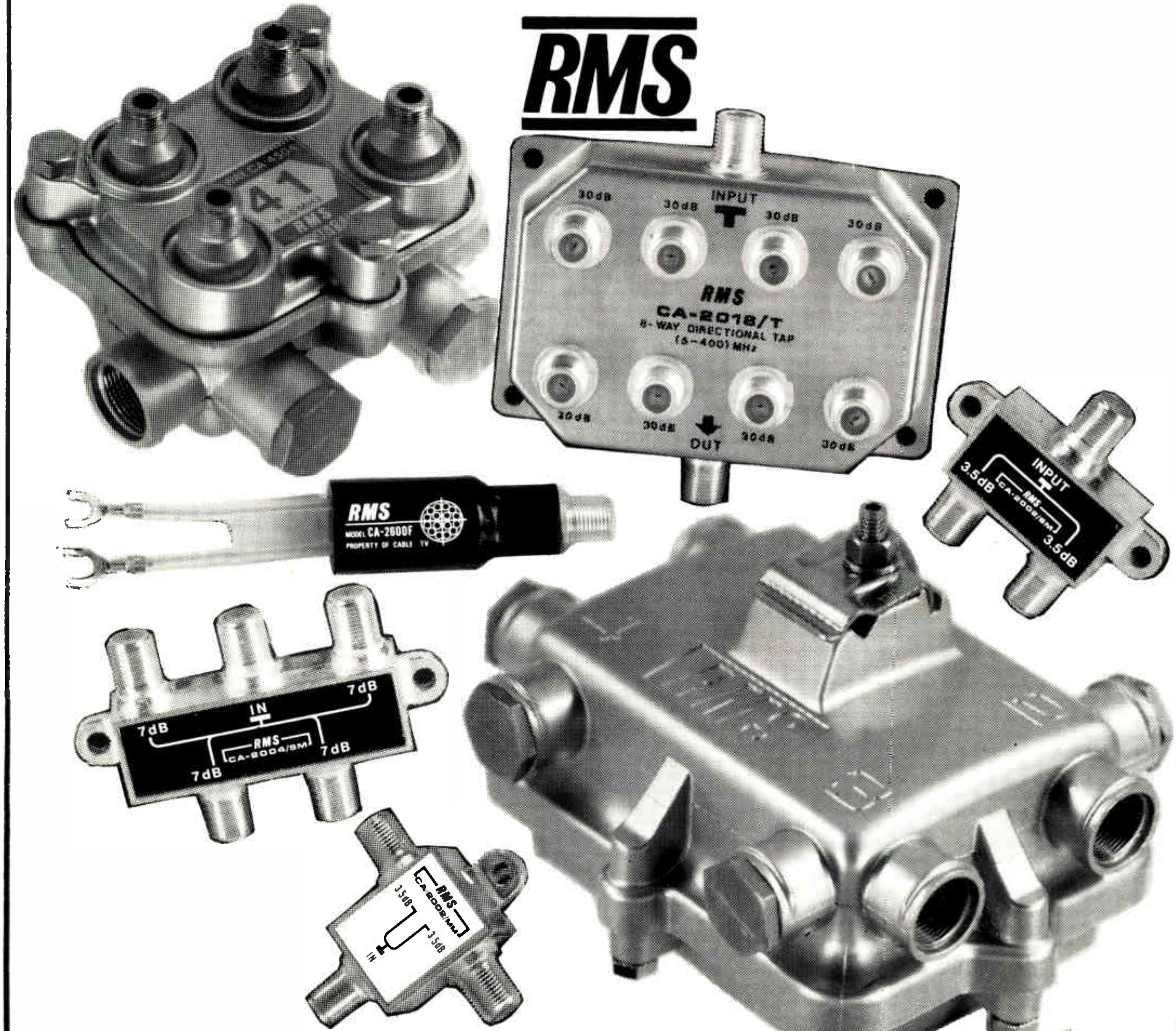
However, this approach was not seriously considered by the EIA committee since most cable television subscribers already own receivers, not television monitors.

Figure 3 illustrates the basics of the approach adopted by the EIA committee in order to achieve improved compatibility between the decoder and receiver. As shown, this approach maintains most of the receiver functions while reducing the decoder functions. However, it requires modification of both the decoder and receiver to include internal interface circuits. These circuits normalize the baseband audio and video signals as well as generate control signals which are exchanged between the receiver and decoder.

In operation, channel selection is performed by the tuner in the receiver. Baseband video signals from the video demodulator pass through the receiver interface circuits and are sent to the decoder. These signals may be scrambled or unscrambled.

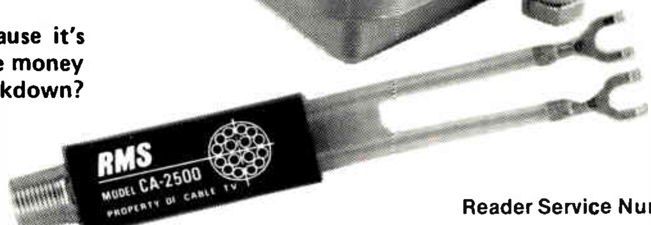
QUALITY, SERVICE AND RELIABILITY...

RMS



Have you ordered equipment from other suppliers because it's almost as good as RMS, and cheaper? Only to spend more money replacing that product due to trouble calls and breakdown?

Why settle for less than RMS?



Reader Service Number 29

RMS

- Offers highest quality products at affordable prices.
- Maintains a revolving inventory to fill any size order.
- Assures factory tested products that meet printed specifications.
- Has account executives to inform you of availability and delivery of your order.

RMS — *"Built with the technician in mind"*

RMS ELECTRONICS, INC.
50 ANTIN PLACE, BRONX, N.Y., 10462
CALL COLLECT: (212) 892-1000 (New York State)
TOLL FREE: (800) 223-8312 (Continental U.S.A., Puerto Rico, U.S. Virgin Islands)

The decoder receives the video signals through its interface circuits and sends them to the video unscrambler.

The decoder receives the video signals through its interface circuits and sends them to the video unscrambler. The video output from the video unscrambler is then sent back to the receiver through a similar path. Nonscrambled video signals pass through the decoder without modification (transparently). Thus video signals transmitted to the receiver are in standard NTSC format for both clear or scrambled signals (from authorized channels).

The decoder generates control signals which the receiver uses for determining selections to be made for scrambled or unscrambled modes of operation. In the nonscrambled mode, internal receiver AGC control is selected along with audio from the receiver's internal demodulator. In the scrambled mode, receiver gain is controlled by the output of a video level measuring circuit in the decoder and, for Oak Sigma descrambling, audio is selected from the D/A converter in the decoder.

Summary of EIA standard

The following list summarizes some of the items which have been specified by the NTSC Television Receiver Baseband (Audio/Video) Interface Standard (IS-15) developed by the EIA Television Receiver Committee (R-4).

a) Specifies a 20 pin (plus shield) connector of a type used widely in Europe for interconnections with RGB operation, called a Cenelec connector. The connector is to be installed on the rear of the receivers and decoders (optional) designed for this standard.

b) Defines the functions of 18 of the pins and associated conductors of an interconnecting cable expected to be less than 2 meters in length.

c) Standard allows for four possible interfaces to the receiver from a decoder or other audio/video device. Four interfaces are: monaural, stereo, monaural + RGB, and stereo + RGB.

d) The main baseband video connections between a decoder and receiver are:

Pin 19, video signals from receiver to decoder.

Pin 20, video signals from decoder to receiver. These signals are nonscrambled when pin 19 receives scrambled signals from selected (authorized) channels.

Pin 18, video or control signals from decoder to receiver; same signal as pin 19 during acquisition mode, a DRS (Decoder Restored Sync) for AGC control when operating with a scrambled channel and a high level when receiving a clear signal on pin 19.

e) Audio connections between a decoder and receiver include:

The committee's apprehension over AGC performance was justified during the first field tests.

Pin 2, left channel audio signals from decoder to receiver.

Pin 6, right channel audio signals from decoder to receiver. Note: In monaural reception both pins carry same signal.

f) Control signals between a decoder and receiver (other than pin 18) include:

Pin 1, signal from decoder to receiver to select receiver internal (receiver) or external (decoder) audio source.

Pin 3, signal from decoder to receiver used with signal on pin 18 for selecting slow, fast or normal receiver time constant.

Pin 14, signal from receiver to decoder indicating a channel change or power interruption.

Television receiver manufacturers vary in their philosophy and methods of achieving AGC. Some use very short time constants in attempting to overcome effects of rapid carrier level changes such as airplane flutter. Others use various longer time constants. For level detectors, peak, gated and other types are employed. Expertise in the design of AGC circuits is apparently scarce; it has been stated (reference 3) that it is limited to "probably less than 20 experts in the entire world."

AGC problems

Knowing some of the above variations, the EIA committee anticipated that one of the most severe problems faced in developing the interface standard would be defining the AGC functions with the receiver interconnected to a decoder, especially in the scrambled mode. The overall AGC functions must be shared between the decoder and receiver. Furthermore, the receiver has to provide some degree of AGC control during the acquisition phase in order to deliver usable video signals to the decoder. Achieving this degree of AGC control when dealing with scrambled signals with suppressed or non-existent sync was a major concern of receiver manufacturers.

The committee's apprehension over AGC performance was justified during the first field tests, conducted in January 1985. At those field tests almost every decoder and receiver interconnected for the first time, exhibited various types of AGC instability. A common symptom was a mode where acquisition by the decoder was followed by a change in receiver gain, which in turn affected the video to the decoder sufficiently to cause loss of acquisition, followed by re-acquisition, etc. The visual result was a televised dis-

The unscrambler circuits in the decoder provide an unscrambled video output which is then sent back to the receiver.

FIGURE 2

Cable Decoder and TV Monitor Functions

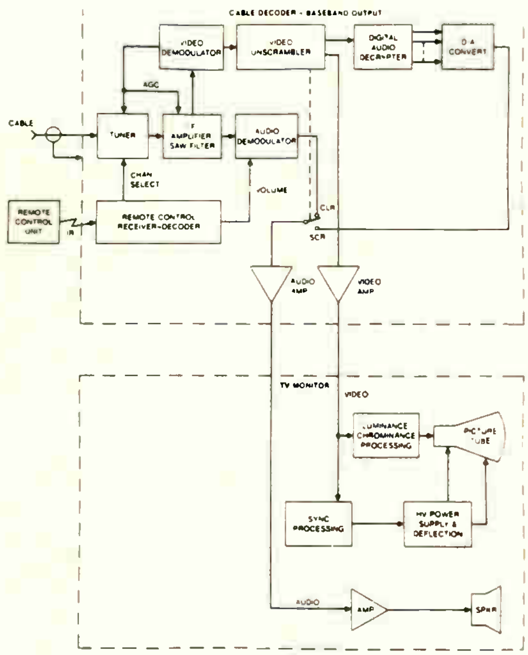
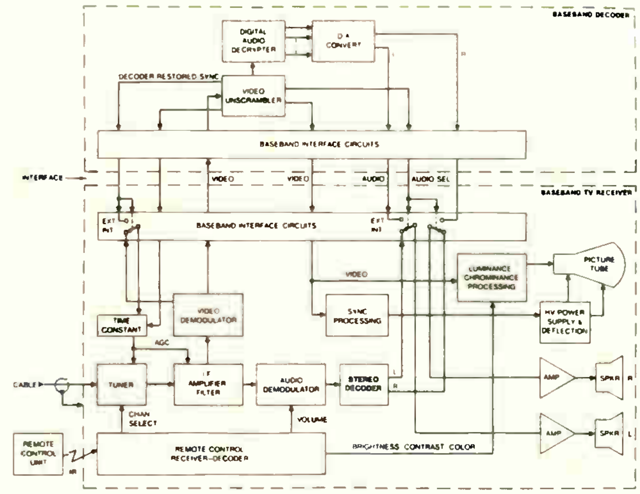


FIGURE 3

Basic Baseband Cable Decoder and TV Receiver Functions



play flashing wildly between a blank screen and a picture.

Figure 4 illustrates the main functional elements of a typical television receiver AGC control loop. The main function of the overall circuit is the maintenance of a constant video output level while receiving RF carrier levels varying from one channel to the next and possibly varying with respect to time, especially during over-the-air reception.

Video processing involves obtaining a measure of a fixed, repetitive portion of the video level, often the sync pulse, through peak detection, gated sampling or other technique. The processor output is filtered by passage through a low-pass filter, then compared with some fixed reference in order to generate an error control signal. This error signal is then used to control the gain of the IF amplifier and sometimes the tuner of the receiver.

Figure 5 is a simplified block diagram showing the combined receiver and decoder functions involved in control of AGC, with equipment modified for the baseband interface standard.

As shown on the diagram, baseband video signals from the receiver's detector are sent to the decoder through buffer stages in the respective interface circuits. The unscrambler circuits in the decoder provide an unscrambled video output which is then sent back to the receiver.

The unscrambling circuits also generate a gating pulse which drives a sample and hold stage. Sampling takes place at the time a recurring reference is received with the scrambling video signals, so that the voltage generated is representative of the video amplitude. This voltage is scaled, compared with an internal reference and the resulting output is gated on and out to the receiver as a DRS (decoder restored sync) signal.

At the receiver the DRS signal is typically processed by the interface circuits, passed through a low-pass filter and the result, a slow varying DC voltage, is then used to control the gain of the receiver.

After acquisition the loop settles at a level where the output of the decoder's sample and hold circuit equals the reference on the following comparison stage. With everything operating correctly, this should correspond to an optimum video level to the encoder and DRS level to the receiver.

To achieve stability for the combined receiver and decoder the cumulative effects on the phase margin of the AGC system from the combined transfer functions of both must be carefully controlled. The specification provides for selectable receiver time constants. Through judicious selection, minimum interaction can thus be obtained between the time constants of the receiver and decoder. For scrambled signals this selection of time constants is determined by decoder generated control signals.

Note: Time constants were defined in part as the time required to reach 90 percent of steady state following a step change in the input signal level.

Before the field tests described above, the specifications provided selection between a slow time constant of 20 milliseconds or greater and a "normal" time constant for the receiver. The slow mode was to be selected by the decoder only while decoding (during the acquisitions mode).

For the decoder a time constant of 5 milliseconds maximum was specified initially. With a sampling circuit of the type shown on figure 5, a time constant of about 0.2 milliseconds was obtained.

A problem encountered which contributed to some of the instabilities during the January field tests was that the "normal" time constant differed for each receiver and was in some instants interactive with the time constant of the decoders.

To overcome this problem the committee later agreed to specify both a SLOW and FAST time constants for the receiver, still selectable by a control line from the decoder. These were:

SLOW: 20 milliseconds or greater

FAST: 1 millisecond or less for a carrier increase of 6 dB
2 milliseconds or less for a carrier decrease of 6 dB

Field tests conducted in June demonstrated a marked improvement in the AGC operation for interfaced receivers and decoders indicating a benefit from specifying the time constants as shown.

The latest specifications have incorporated the above SLOW and FAST time constants. In addition, a "normal" time constant has been made available for selection at the receiver if the decoder indicates (through signal lines) that a nonscrambled channel has been selected at the receiver.

For the decoder, the time constant specification now calls for a response time of 1.0 millisecond or less, which the decoder can readily achieve.

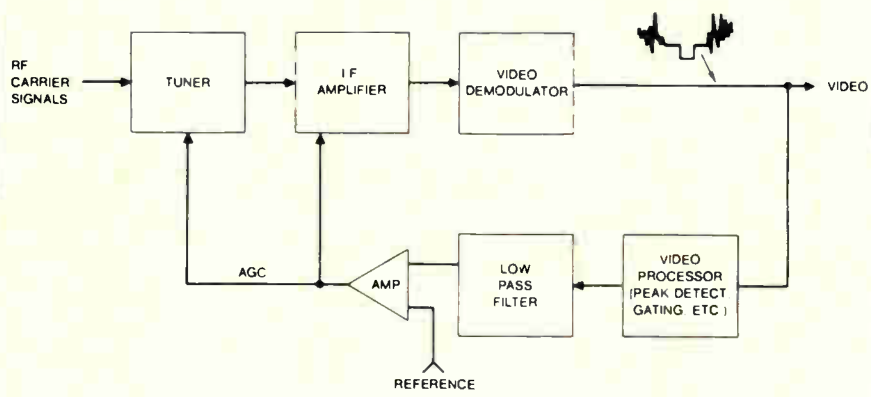
Video level variations

Variations encountered in the absolute level of the video signals delivered to the decoder by different receivers was a severe problem for the original Oak decoders. These variations were

The net effect was a variation in the contrast of the receiver displays.

FIGURE 4

Typical AGC Control Loop



verified during the June tests. Using five step linearity test video signals, the DC level delivered for each step was different from each receiver. However, the receivers were well within the specifications as written at the time.

In the committee meetings during the development of the specifications, reference was often made to an ideal receiver with a video output as shown in figure 6 (a). Specifically, the ideal voltage output for 0 carrier level was 2.143 volts, for 100 IRE (corresponding to 12.5 percent modulation) it was 2.000 volts and for sync tip (100 percent modulation) the output was 1.000 volt. However, the specifications as published in May 1985, allowed video amplitude of 1.0 +/− 0.25 peak to peak and the DC level for sync tip of 1.0 +/− 0.25 volts.

A brief analysis of the operation of the original decoder as illustrated in figure 5 identifies the reason for its sensitivity to absolute levels. The sampler circuit was designed with the expectation of a specific DC level during the arrival of the recurring reference signal present in the scrambled mode. In standard Sigma decoders, this is assured by a factory adjustment in a circuit following the video demodulator, which normalizes the output of the internal receiver in every decoder.

With the receivers used at the field tests any variations in the receiver reference level was translated into an error in the DRS signal. This in turn caused an incorrect receiver gain setting. The net effect was observable as a variation in the contrast of the receiver displays, especially when changing between clear and scrambled channels.

In discussions of recommendations, after the field tests of June 1985, the receiver manufacturers generally agreed that the installation and setting of a video normalizing adjustment (as used in Sigma decoders) was too severe a requirement for mass produced receivers. However, the committee agreed to improve the specifications on receiver video output. As published in the latest specifications they are as follows:

Blanking to
Peak White 0.71 +/− 0.1 Volt P-P
Sync
to Blanking 0.29 +/−0.06 Volt P-P
DC Level

at 100 IRE 2.00 +/− 0.1 Volts

These changes now limit the variations to those shown on figures 6 (b) and (c). But, noting the variations of DC levels which are possible for the 80 IRE steps (near the reference level used in a Sigma scrambled signal) a variation of +/− 15 IRE units relative to the optimum level can still occur.

On the basis of the above specifications, previous experience with the Oak Orion satellite scrambling system and also recommendations made by committee members, a decision was made to incorporate two reference levels into the overall scrambling system, for the EIA baseband equipment.

With two reference levels a measurement of the difference between the two levels provides a good measure of the amplitude of received video signals. And more importantly, with a properly designed differential circuit, the measurement can be obtained while largely ignoring the absolute DC levels common to both of the received references.

The encoders used with the system were modified to provide a second reference level (0 IRE) for a few lines during each vertical blanking interval of the scrambled video signal. The normal reference level, presently 75 IRE, which is transmitted once every line, was left unchanged.

Decoder Modification

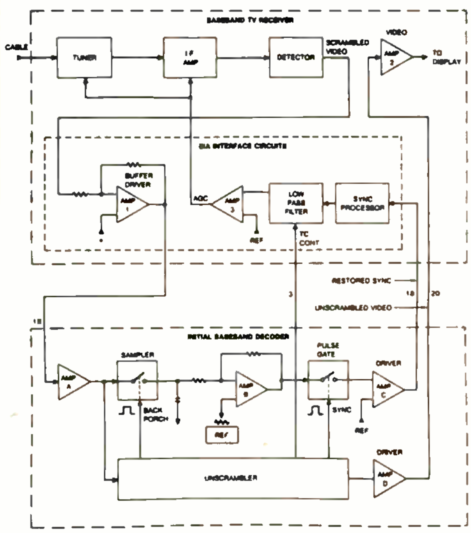
Initial laboratory tests with a decoder modified to receive and process two reference levels demonstrated very good performance, with one exception. The response to step changes in the video input was slowed down due to the fact that sampling of the video signal for the new reference was restricted to only one sampler per field (i.e. 16.6 milliseconds). Initial considerations towards sending both references once per line had to be rejected since this would have required a major system re-design.

Consultation with one of our colleagues (reference acknowledgement) resulted in the design of a unique circuit capable of achieving the fast decoder response required in spite of the slow sampling of one of the references. The basic circuit configuration is shown on figure 7 along with a diagram of a portion of the scrambled sig-

One reference signal is transmitted during the back porch interval also used for sending the color burst.

FIGURE 5

Typical AGC Functions
Initial Baseband Decoder and Receiver



nal applied to its input. A summary of its operation is as follows:

One reference signal is transmitted during the back porch interval also used for sending the color burst. This occurs on every line thus allowing a fast response time. The second reference is only transmitted as a video signal for a few lines during the vertical blanking interval.

Switch S1 closes during the arrival of the second reference signal and this level is stored in C1. Switch S2 closes for the same lines but during the arrival of the first reference signal, which occurs on the back porch of every line and this level is stored in C2. Switch S3 also closes during the arrival of the first reference but on every line and this level is stored in C3.

Operational amplifiers U1 and U2 are used to compute a constant based on the difference between the levels stored in C1 and C2. The output of U2 is thus a constant which may change from one receiver to the next but will not change even with video level changes or after selections of different channels.

Amplifier U3 is used to compute the sync tip level, based on the nearly static input level from U2 and the fast changing input from C3. The result is a sync tip level signal which also responds rapidly, well within the 1.0 millisecond maximum specified for the decoder.

As shown in figure 7, the actual restored sync output is generated by sending out the sync tip level through a switch (actuated during sync time) and an output buffer stage. The rest of the time when the switch is open, 0 IRE level is sent out. This composite output is the DRS (decoder restored sync) used by the receiver for AGC control, as described earlier.

Figure 8 is a block diagram illustrating the overall functions provided within the decoder in order to achieve the baseband interface requirements. A brief description of these functions is as follows:

Video input signals from the receiver are received through input buffer amplifier A. For unscrambled signals these pass through switch S4 and the output driver B and back to the receiver in a transparent mode.

After receiving a channel change signal from the receiver a one-shot multivibrator is actuated for a few seconds. During this time transistor Q1 is turned off which allows the sending of video signals from S4 through output driver C, providing transparency for the input video out of the restored sync port (18). If the received video is unscrambled the one-shot will time out, driving Q1 to interrupt the video, while sending a high level out through output driver C indicating a clear channel to the receiver.

When a scrambled channel is received and acquired, the unscrambling circuits will:

a) Open switch S4 interrupting the incoming video signals path to the output.

b) Close switch S5 allowing the unscrambled video signals to pass through output driver B and on out to the receiver.

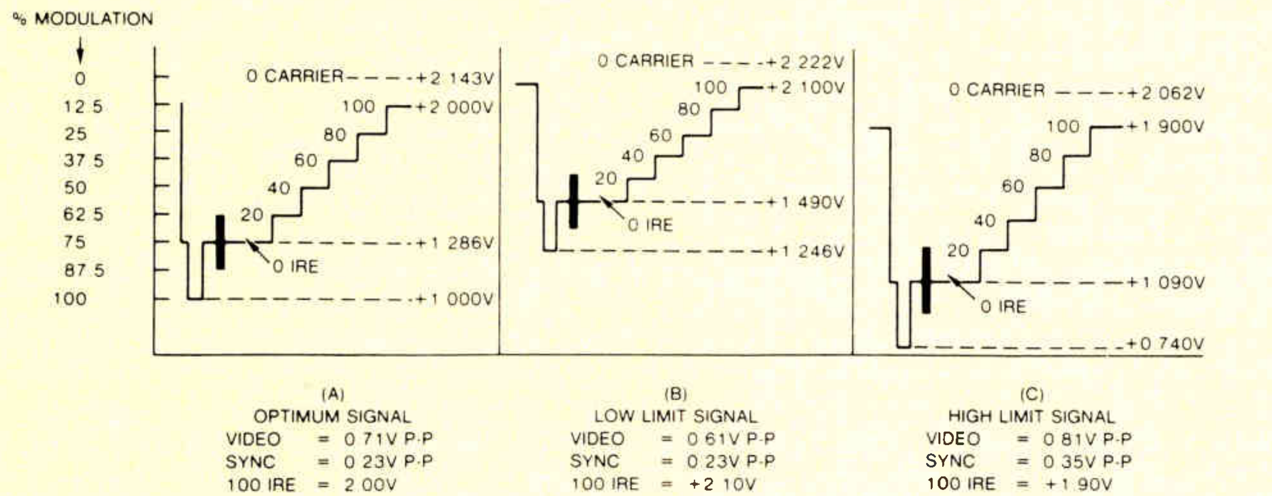
c) Reset the one-shot multivibrator.

d) Close switches S6 and S7 to send

The worst thing observed, with some receivers, was a barely perceptible flicker in the picture displayed.

FIGURE 6

Video Tolerance Range
Latest Specifications



the restored sync signal to output driver C and on out to the receiver.

The operation of S1-S3 and U1-U3 has been described in the previous section. The rest of the functions are self evident.

Final performance

The decoder, upgraded to the configuration described in the last two sections was used during the field tests conducted in November 1985.

Overall the performance was quite satisfactory. The previously experienced sensitivity to variations in different receiver's outputs was no longer a problem. The worst thing observed, with some receivers, was a barely perceptible flicker in the picture displayed. This was considered a prototype phenomena to be resolved in producing equipment for operating with this interface.

The first public demonstration was the operation with a modified Sony receiver, during the Western Cable Show, in Anaheim, Calif., Dec. 4-6, 1985.

Summary and conclusions

The specifications of the EIA developed interface standard relative to decoder design and a review of the development of a compatible decoder have been presented.

The specification has other applications not covered by this paper.

The process of developing a standard of this type through a committee effort is sometimes a tedious experience. There were the expected conflicting interests among the participants. But necessities often imposed by the marketplace do provide a positive drive towards achieving the benefits of standardization.

The final standard developed has many good attributes and with further communication among future users, it should be effective and acceptable. Actions and conditions necessary for successful adoption of the interim standard have been discussed elsewhere (reference 4). Because of this and the pleasant relationship established with other participants, the overall participation was a rewarding experience.

Note: Any opinions stated in this paper are those of the author and are not intended to represent those of other participants or of the EIA.

See figures page 74.

References

1. *NTSC Television Receiver Baseband (Audio/Video) Interface Standard*, EIA document IS-15.
2. A. Vigil, *Digital Audio Applications in Cost-Effective Cable TV Systems*, 1985 NCTA Technical Papers, pp 123-129.
3. W. Ciciora, *Cable Interface and Decoder Interface Working Group Progress Report*, 1985 NCTA Technical Papers, pp 189-192.
4. G. Stubbs, *IS-15 And The Cable Ready Set*, Communications Technology, February 1986.

Acknowledgement

Thanks are extended to Jim Holzgrafe whose assistance in this project, especially in the unique circuit solution described herein, was extremely helpful.

The final standard developed has many good attitudes and with further communication, it should be effective.

FIGURE 7

Scrambled Signal—Two Level Processing

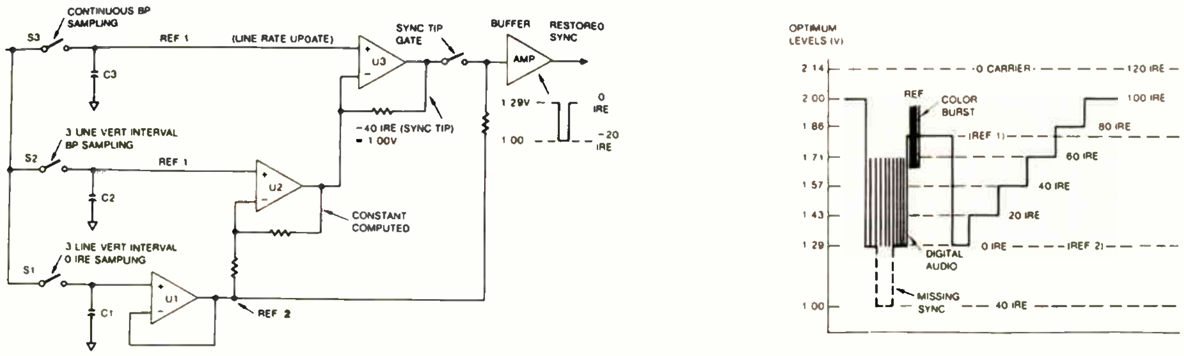
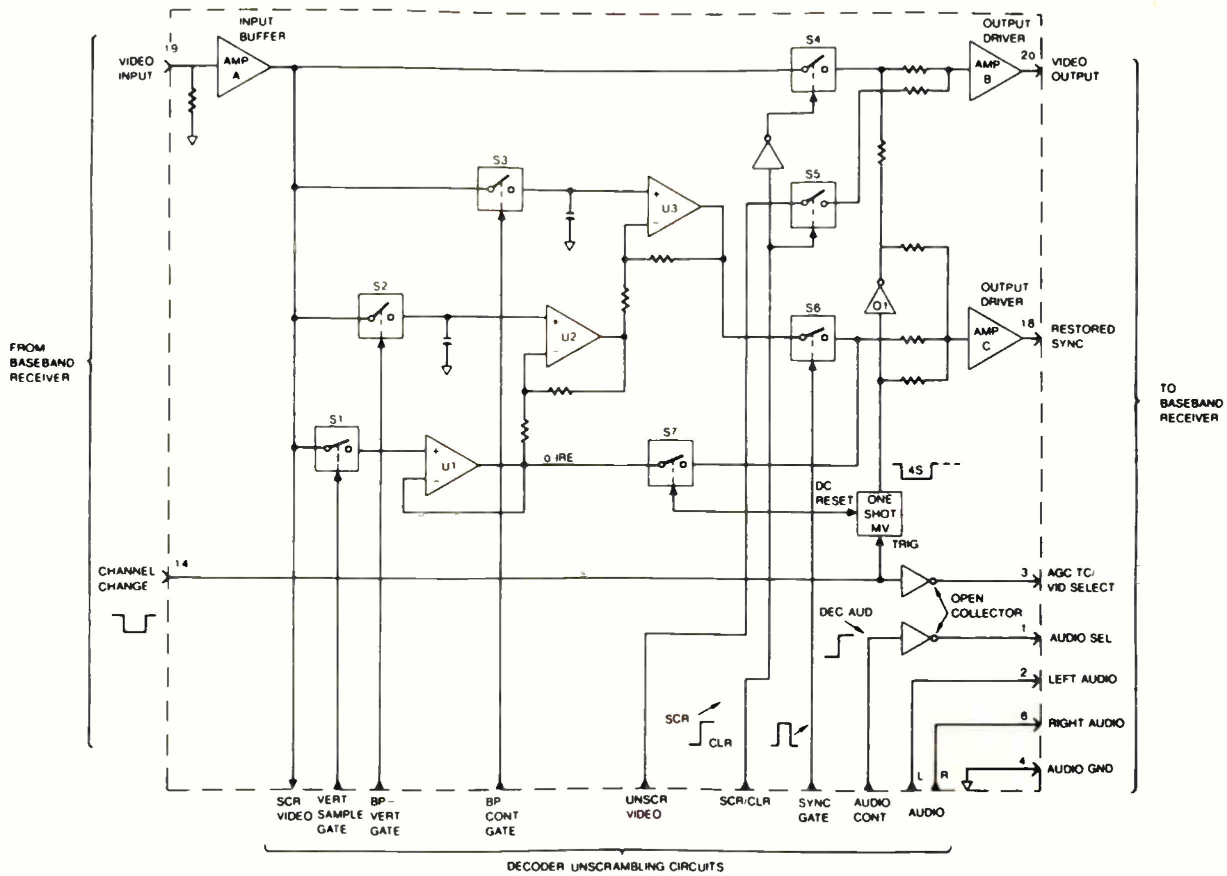


FIGURE 8

Block Diagram
Final Baseband Decoder Interface



in the news

FCC strikes; so does Jerrold

Trick or treat. Although the final rules won't take effect until October of this year or so, the Federal Communications Commission has given CATV operators new A/B switch rules. To wit: all systems, regardless of size, are required to install A/B switches for all new subscribers at no additional cost. Existing subs must be offered the option of getting one. If the sub installs the switch, there's no labor charge. If the op puts it in, a fee can be levied. Repeat: all new subs must get the switches; and existing subs must be offered the switch each year for the next five years.

There's more. Operators may not recommend that their subs dismantle their off-air antennas, and must provide consumer education materials on how the switches work and what off-airs are not carried on the system. This has to be done at least once a year for the next five years.

The new requirement is part of interim must-carry rules the commission has adopted.

And it's official. The rumored acquisition of M/A-COM's Cable Home Group by General Instrument has taken place. Jerrold's parent will pay $220 million for M/A-COM's cable business, VideoCipher, home TVRO and converter lines. Frank Drendel, executive vice president and vice chairman of the board of M/A-COM, will be joining Jerrold as part of the deal.

Departures

Hewlett-Packard, responding to serious competitive pressure from Japanese vendors, is about to release a portable, lower-cost spectrum analyzer containing most of the processing and measurement power of the expensive HP 8568B, but at a fraction of the cost. The move is a real departure for the company, which has for years emphasized higher-end equipment. The HP 8590A weighs a bit under 30 pounds and is designed for R&D lab benches and on-site measurements. The self-calibrating general purpose analyzer can do CATV proof of performance tests, for example. It'll probably be priced at $10,000 or so, (707) 794-2528.

There's a significant departure at Oak Communications as well. Graham Stubbs, vice president, engineering, will be leaving the company Oct. 1. He wants to stay in the CATV industry, and is open to both the operating and supplier side of the business. Graham will keep his spot on *CED*'s board of consulting engineers, to be sure. We wish him much luck with his job hunt. Anybody out there got ideas for him? He can be contacted at (619) 451-1500.

Company moves

Scientific-Atlanta has set up a service division to handle installation and service of communications products for non-technical customers, initially for S-A products, ultimately for other vendors' gear as well.

New in the test equipment area is Cable Communications Scientific, (317) 326-2601, headed up by John Shaw, formerly of Wavetek and Regency. Com-Tek Inc. will handle the company's western business; R. Alan Communications the Great Lakes region and O.W. Lindberg for the Southeast. W. Emery is distributor for the North Central United States; Winfield Scott Associates will handle the South Central region and R.F. Technology will represent the East.

Merit Communications Supply will be distributing the Power Guard line of power supplies nationwide. Meanwhile, Beta Tech Engineering of Phoenix has finalized its purchase of the CATV division of Merrill Cable Equipment, also of Phoenix, (602) 266-9389.

Comsearch's System Engineering Division, which does microwave route design, path surveys and site acquisition, is moving to 11720 Sunrise Valley Drive, Reston, Va. 22091, (703) 620-6300.

New in LANs

It's escaped nobody's notice that GM has been slowing down on its MAP project ordering. This year, in fact, the cell controller market might be off as much as 40 percent. It's also no secret that full MAP implementations are expensive, or that buyers are somewhat confused about what MAP means. So what do you do when business slows down? Allen-Bradley may have an answer. Instead of pushing fully networked automation solutions, it is packaging a stand-alone cell controller. The idea: get the customer involved in automation on a cheaper, smaller scale now. Worry about bigger applications and more networking later.

"For $25,000, a customer can get experience with automation without making a full investment in computer-aided manufacturing," says the company's Ralph Waite. It's a cheaper, easier way to go to broadband without waiting for MAP. "This way, you focus on cell control first, then get factory floor control later," Waite says. The Vista Base Cell 1 offers independent cell control, the Base Cell 2 adds ability to interface with a Vista 2000 LAN (216) 449-6700.

Also, Ungermann-Bass broadband products will be used to support Hewlett-Packard 1000 and 3000 computer systems, the two companies have announced (408) 496-0111.

Codenoll Technology Corp. and Sytek, meanwhile, have teamed to jointly develop fiber optic products, the first being an IBM PC network fiber optic adapter card, which converts IBM PC broadband or IBM token ring twisted pair nets to a 10 Mbps fiber optic LAN. Codenoll also has developed a fiber optic version of the 3Com Ethernet PC connection card. (914) 965-6300.

Sytek, for its part, has introduced a Model 2555 translator switch, which automatically switches to a backup translator. Fault detection and switching occur in about 100 milliseconds (415) 966-7300. The company also announced that Joseph Seidler is new vice president of product marketing, with a mission to develop a more com-

LanTel was the first broadband manufacturer to market voice products for telephones with RJ 11 connectors.

plete line of network products.

Also new: Artel Communications Corp. has unveiled Fiber Way, a digital broadband LAN that supports Ethernet, RS232, IBM Token Ring and other networks of wire and cable. The net runs at 200 Mbps.

Pure Data Ltd. has released an Arcnet token passing network for IBM PCs and compatibles, running on fiber optics (416) 475-3370.

And as promised last March, Bridge Communications has released a four-member family of broadband products, including two server units that allow hosts, terminals and other devices to communicate over broadband nets using TCP/IP protocols (Dept. of Defense). Also new: a bridge allowing Ethernet products access to broadband nets; a headend remodulator and a broadband modem. Joining the company as director of broadband systems is Jeffrey Blowers. And note: the company's customer base doubled between June 1985 and July 1986, (415) 969-4400.

LanTel Corp. also has introduced a new line of five products for broadband networks using 192.25 MHz as the translation frequency. The new Series 900 products include a central retransmission unit, and asynchronous modem, a synchronous/asynchronous modem and two voice modems. Basically, the 900 series products duplicate the basic function of comparable 500 series modems, which operate with a 156.25 MHz offset. They operate on mid- and high-split systems, and can operate adjacent to MAP channels on the same cable.

LanTel was the first broadband manufacturer to market voice products for standard, single-line telephones with RJ11 connectors. The company's voice modems can operate point-to-point or link a phone line to a PBX. Prices for the modems range from $780 to $880. The translator is priced at $1,490 and delivery on all items is 30 to 90 days ARO. Educational institutions get a 10 percent discount (404) 446-6000.

Motorola Semiconductor has released another MAP-in-silicon product: the MC68184 Broadband Interface Controller. It's a 10 Mbps modem for MAP networks. The dual-in-line package will be available for sampling in September, at $40 for quantities of 100 (512) 440-2140.

Communications Machinery Corp., a supplier of LAN and WAN systems and products, announces three appointments. Arnold Friedman is new vice president, sales and marketing; Tony Ulterino is Northwest district manager; Gary Berkowitz is Southwest district manager.

At Amerilink Corp., a major reorganization has occurred. Robert Powelson and Len Gibson, company founders will step into advisory and long-term planning posts. Larry Linhart is now president and CEO. Joseph Govern is now vice president, administration and controller.

—Gary Kim

classifieds

EQUIPMENT FOR SALE/WANTED

EQUIPMENT FOR SALE

FOR SALE

HRC 32 channel headend racked PHASECOM modulators, MAACOM SAT receivers, JERROLD stanpack addressable scramblers, and much more. Contact Steve Schneider, CVTV, P.O. Box 368, Palm Desert, CA., 92260. (619) 340-4556.

SMATV HEADEND EQUIPMENT FOR SALE

2 complete headends including 5.6 meter dishes, GARDINER 4500/24 modulators, GARDINER 4100/4110/4200 receivers, SCIENTIFIC-ATLANTA 6330/6600 modulator/receivers, BLONDER off-air equipment. **For information call Buford Graddy, (512) 327-7822.**

HELP WANTED

BakerScott & Co. EXECUTIVE SEARCH
1259 Route 46 Parsippany, NJ 07054 201 263-3355
Specialists in the COMMUNICATIONS INDUSTRY
CABLE TV·BROADCAST DIVISION — TELECOMMUNICATIONS DIVISION
POSITIONS AVAILABLE AT ALL LEVELS OF MANAGEMENT. COAST TO COAST
Call or write in CONFIDENCE — FEE PAID
"WE DON'T TALK CABLE. WE KNOW CABLE"
PRINCIPALS DAVID ALLEN & JUDY BOUER

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.

SERVICE TECHNICIAN

Storer Cable Communications of Miami, Florida needs a service technician. Duties will include: Organize daily schedule upon receipt of written trouble reports for supervisor. This activity involves planning optimal route & obtaining adequate equipment to replenish truck stock; Operates & maintains vehicle & test equipment, including VOM, RF radiation meter, field strength meter, ladders & pole-climbing equipment (hook & belts); Interacts with the public, receptive to customers problems descriptions. Completes necessary paperwork including material requisitions for converters, trouble reports for each service call and converter receipts for replaced converters; Ensure that each trouble report complies with FCC specifications regarding signal level; Restores system to equal or better original physical and/or electronic condition after removing connectors, splicers or other devices; Performs other related duties as required.

At least six months to one year CATV training, e.g., in installation, building, wiring or construction. Must be in good physical condition with the ability to lift and carry loads of at least 70 pounds. MUST POSSESS A VALID DRIVERS LICENSE AND SATISFACTORY DRIVING RECORD.

High school education or its equivalent, with some technical training preferred.

Please contact: Walt Ader, Technical Manager, Dade/Broward, (305) 653-5541, **Storer Cable Communications, 18601 N.W. 2nd Ave., Miami, Fla. 33169.**

TECHNICIAN

Minimum 5 yrs. experience Headend/System Maintenance. Familiar with logs and record-keeping, NCTA measurement methods and instruments, TVRO use. Large, rapidly growing MSO with systems in many parts of U.S. Send resume to: **Century Communications, Inc., 604 S. Brea Blvd., Brea, CA 92621. Attn: Mike Harris/Roger Wilson.**

SITUATION WANTED

MANAGER/ENGINEER

Seeking employment with progressive cable company. Midwest/Southwest location preferred. Experience includes: 10 years experience in construction, CATV, telephone, sweep and balance, plant turnon, franchising, headend. Has own test equipment. Respond to:

CED: 0901-01

BUSINESS DIRECTORY

CONTRACT INSTALLERS

HOUSE INSTALLERS • APT. INSTALLERS
• TAP AUDITS

P.O. Box 1564
Appleton, WI 54913
phone (414) 582-7087

Lenny Fischer — CABLE TV

Cable Television Services
120 Erbbe N.E.
Albuquerque, NM 87213
(505) 292-7766

CTS

—Converter Repairs—
Jerrold Specialists
Quality Workmanship
Fast Turnaround
Two week normal

1000's OF CONVERTERS FOR SALE

MUST MOVE IMMEDIATELY. . .

DRX 3DA	JSX 3D1	OAK B-19	MXC 64
JSM 3DIC	JSM 3/4D1	OAK G-26	RCA M014
JRX 3DIC	JRX 3A	OAK L-35	E-13
JSM 3D1	JRX 3	RL 35	E-14
JRX 3D1	OAK L-30	OAK S-13	RM 35B

NO REASONABLE OFFER REFUSED
CALL TODAY

Cablevision INDUSTRIES

Larry Smith (914) 292-7550 Liberty, N.Y.

NEMAL
ELECTRONICS INTERNATIONAL, INC.

IMMEDIATE DELIVERY ON

- TRUNK CABLE
- DROP CABLE
- CONNECTORS
- SPLITTERS
- SWITCHES
- TAPS
- SATELLITE PASSIVES
- TOOLING
- TRANSFORMERS
- AMPLIFIERS

ORDER TOLL FREE
U.S. 1-800-327-5999
FL 1-800-52-CABLE

Please call or write for your copy of our new 32-page Cable & Connector Selection Guide, and CATV Products flyer

NEMAL
ELECTRONICS INTERNATIONAL, INC.
12240 N.E. 14 Ave., N. Miami, FL 33161
(305) 893-3924 Telex: 6975377

BUSINESS DIRECTORY

Advertiser's Index

product profile

Modulators

Blonder-Tongue

The Blonder-Tongue Model FAVM-450 is a totally frequency agile heterodyne audio and video modulator. The FAVM accepts video and audio baseband inputs from any source and provides a modulated visual and aural RF carrier output on any channel in the frequency range 50 MHz to 450 MHz. The unit also offers true FCC Docket 21006 stability for compliance with aeronautical frequency offset requirements, is fully BTSC compatible and can be used in systems where the audio source provides a BTSC-encoded MTS stereo baseband.

The FAVM-450 is available for all IRC, HRC, inverted or any other offset channel assignments.

Also from B-T, the Model DSA-643A satellite receiver is designed for use with the company's DSA-541 downconverter. The unit uses a discriminator circuit for signal demodulation and features a full 30-MHz bandwidth and a threshold extension circuit.

For more information, contact (201) 679-4000.

CADCO

The Model 150 modulator from CADCO is designed for use in adjacent channel SMATV and MATV headends. The crystal-controlled 150 features FCC offsets, independent internal power supplies, SAW filtering, and front panel controls and test points. Operating at +45 dBmV output level, the 150 outputs Channels 2 through W.

For more information, contact (214) 271-3651.

Casat

The FAM 2854 modulator from Casat Technology Inc. provides NTSC TV signal frequency agility for any VHF, midband or superband channel. Output level is 45 dBmV (higher if Casat's active combiner products are used in conjunction), and the FAM 2854 also provides an IF loop-through capability before channel conversion. SAW filters are utilized to control spurious output at −60 dB or better for adjacent channels and across the 50 MHz to 300 MHz band.

The FAM 2854 is powered by its own internal power supply. All level controls are front-panel accessible and include a true −30 dB test point.

For more information, contact (603) 880-1833.

Channel Master

The Model 6133 satellite modulator from Channel Master provides a 60 dBmV output level and utilizes SAW filtering in the IF video modulator stage to ensure excellent vestigial sideband and adjacent channel perfor-

Electrohome's agile modulator features a full 30 MHz SAW filtered IF bandwidth.

mance, proper flatness and group delay. Its loop-through output allows combining of modulators for one common output. Other features include: an output monitor connection and audio/video LED output indicators.

The Model 6144 RK satellite receiver from Channel Master is VideoCipher II ready and C- and Ku-band compatible. Suitable for use in small to large SMATV or CATV systems, the 6144 RK is microprocessor controlled and features a built-in stereo demodulator, synthesized tuning for video and audio, and block conversion 950 MHz to 1450 MHz input frequency.

For more information, contact (919) 934-9711.

DX Communications

The DSM-110 frequency agile modulator from DX features front-panel channel selection of all channels from 2 through W, +45 dBmV output, adjacent channel operation with low spurious output and separate IF loop-throughs for audio and video for decoder interface.

Also from DX, the DSA-644 block downconversion satellite receiver offers detent channel tuning, a video test point, audio and video level adjust on the front panel and unclamped video and composite baseband outputs with de-emphasis on/off switch for descrambler interface. The unit also features a SAW-filtered 30 MHz bandwidth for a second IF.

For more information, contact (914) 347-4040.

R.L. Drake

The Drake VM2410 modulator provides 60 channel frequency agility at a range of 50 MHz to 400 MHz. The VM2410 also features video low pass and IF SAW filtering for operation in the most crowded systems and a full 57 dBmV output.

The ESR2240 receiver from Drake features fully synthesized front-panel pushbutton selection of transponder and subcarrier. Wide or narrow IF filtering is also front-panel selectable to optimize receiver sensitivity. Operating at an RF input level of 950 MHz to 1450 MHz, the unit's IF loop-through output allows stacking of multiple receivers per polarity without splitters. The ESR2240 also includes a SAW filter for maximum adjacent channel and interference rejection with minimum signal distortion.

For more information, contact (513) 866-2421.

Electrohome

Electrohome Ltd. has released the SRM-36F, a unique Phase Lock Look, 36-channel agile modulator and 24-channel satellite receiver combined in a standard one rack space unit. It features a full 30 MHz SAW filtered IF bandwidth.

The SM-36F, also from Electrohome, is a commercial quality standalone modulator with +60 dBmV output in any desired channel from 54 MHz to 300 MHz. It is also SAW filtered for adjacent channel operation.

Both the SRM-36F and the SM-36F feature video carrier stability of ±2.5 kHz typical. Offsets of 12.5 kHz and 25 kHz are applied automatically to all required channels while maintaining full channel selection agility, 1 through 36. Both units utilize audio and video synthesis.

In addition, the SRM-36F has been upgraded to include Ku-band software. For more information, contact (519) 744-7111.

Electrohome's SRM-36F

ECA

Electronic Consulting Associates offers the ECA Video Four microwave receiver. The Video Four features full wideband discriminator and backporch clamping. The unit accepts 950-1450 block input and features a ±0.5 stability level in the converter.

ECA also offers a modulator featuring a SAW filter for superior vestigial sideband video and a phase locked audio generator exceeding FCC specifications.

For more information, contact (918) 786-5349.

General Instrument

The Jerrold Division of General Instrument Corp. offers the FAM-300 audio/video TV modulator with frequency agility. The FAM-300 is capable of being tuned in the field to any channel within the 54 MHz to 300 MHz bandwidth. It incorporates a SAW filter for superior vestigial sideband response and is scrambling compatible through separate audio and video IF output connectors.

Front-panel controls include: audio deviation control, video depth control and output carrier level control. The FAM-300 also features an internal audio/video carrier ratio control. Separate LED bar graphs for audio deviation and video depth also are featured on the front panel.

Jerrold also released a new receiver designed specifically for SMATV applications, the Model S412R. Microcomputer-equipped, the Model S412R compensates for LNB drift by counting and compensating for any change in input frequency (950 MHz to 1450 MHz). The unit is C- or Ku-band switchable and compatible with all existing commercial descrambling technologies. Other features include: two tunable audio subcarriers with narrow/wideband selection and built-in matrix or multiplex decoding. The front panel enable button prevents accidental changes in settings.

The Model S412R is equipped with video inversion, digital channel and audio frequency displays. A polarization control signal is provided automatically with channel change and can be overridden with a format reverse switch.

For more information, contact (215) 674-4800.

ISS Engineering

The Model GL-5000 satellite receiver from ISS is VideoCipher II scrambler approved. The quartz-synthesized unit features a digital readout that displays accurate channel selection. Telco interference filters are built into the GL-

ABSOLUTELY POSITIVELY COMPATIBLE

IN STOCK AT TONER

M/A-COM CSR-T1001
COMMERCIAL SATELLITE RECEIVER

VIDEOCIPHER® II

NOW YOU CAN GET BOTH FROM TONER

Get the M/A-COM® CSR-T1001
Commercial C-Ku Band Receiver
along with the

VIDEOCIPHER® II

Commercial Decoder...
We've shipped thousands of both
to cable companies all over the country.

Toner
cable equipment, inc.
969 horsham rd.
horsham, pa. 19044
800-523-5947
in Pa. 800-492-2512

Reader Service Number 43

M/A-COM's Model UM-series frequency agile modulator is designed for the SMATV system.

5000's low profile chassis. The GL-5000 is U.L. listed. Data and international versions are available.

Also from ISS, the Model GL-2610 hyperband frequency agile modulator features switchable frequency offsets, SAW filters, dual synthesizers and adjacent channel operation. The unit offers high frequency stability and accuracy within ±5 kHz. LED indicators for video and audio warn in case of overmodulation.

For more information, contact (415) 853-0833, (800) 227-6288 or (800) 351-4477.

M/A-COM

The CSR-T1001 satellite receiver from M/A-COM features LNB block downconversion, two independently tunable audio demodulators (5-8.5 MHz), dual IF inputs, automatic polarization selection, receiver power to LNB, synthesized tuner and tunable channel assignments for non-standard satellite configurations. The unit is CSA and U.L. approved and operates at an input frequency of 950 MHz to 1450 MHz.

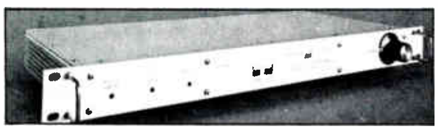
M/A-COM's Model VM-series frequency agile modulator is specially designed for the SMATV system. Typical output level of the unit is 40 dB.

For more information, contact (800) 438-3331 or (704) 324-2200.

Microdyne

The 1100-LPR from Microdyne is a compact 4 GHz satellite TV receiver offering commercial quality video. The LPR's single conversion 24-channel frequency synthesized tuner has a stability of ±0.001 percent and a threshold level of less than 8 dB. Other standard features include: dual video outputs, single knob front panel channel selector, front panel adjustment of the video and audio gain, audio subcarrier frequency of 6.8 MHz and a power consumption of 20 watts.

For more information, contact (904) 687-4633.



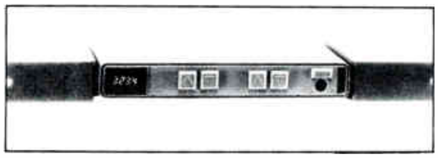
Microdyne's 1100-LPR satellite receiver

Multiplex Technology

Multiplex Technology Inc. has announced its new digital series of ChannelPlus frequency agile RF modulators that feature a carrier frequency stability of ±1 kHz.

The ChannelPlus "D" series unit is set by the installer to transmit on any channel between 14 and 60. The red LED displays on the front of the unit shows which channel number has been chosen. A ROM inside the unit's logic module contains the exact FCC specifications for video and audio carrier assignments for each UHF channel and immediately sends the appropriate commands to the synthesizer located inside.

For more information, contact (800) 423-0584 or (714) 680-5848.



Multiplex's ChannelPlus RF modulator

Nexus

The SR-5 satellite receiver from Nexus Engineering is the world's smallest commercial block downconversion receiver, according to the company. The SR-5 is designed to suit worldwide applications with 900 MHz to 1750 MHz IF signals. The audio and video controls are continuously tunable for maximum flexibility. The SR-5 is fully compatible with all current scrambling systems.

The Nexus VM-5 television modulator is designed for adjacent channel operation in SMATV and small cable TV applications. The VM-5 is crystal controlled and incorporates internal band-pass filtering to produce spurious outputs of 60 dB. The unit is compatible with NTSC-PAL color coding systems and is tunable with audio and video output controls.

For more information, contact (206) 644-2371.

Norsat

Norsat International announces its new 100C SMATV receiver. The 100C features a 19-inch rack mount with 950 MHz to 1450 MHz synthesized tuning, power fail memory, threshold less than 7 dB C/N, 30 MHz IF bandwidth, baseband outputs and a video fine tune of ±20 MHz in 1-MHz steps.

For more information, contact (800) 663-8733 or (604) 591-3334.

PICO MACOM

The Model M-45 modulator from PICO MACOM is specifically designed to provide high stability and superior picture/sound quality in adjacent channel headend use. The M-45 features SAW filtering for superior vestigial side-band shaping and harmonic reduction, thereby assuring reliable operation in crowded systems.

The M-45 is encoder compatible, using an external IF loop-through, to accommodate a pay-per-view or scrambled signal and features IF modulation, LED overmodulation indicators and a low-profile 1 and three-quarter inch rack mounting design.

Audio features of the CR-1000 include: stereo or dual audio capability, wide and narrow band width selection and Phase Lock Loop audio tuning.

For more information, contact (818) 897-0028.

Scientific-Atlanta

The Model 9630 satellite receiver from S-A offers standard C-Band 24 channel format plus 20 programmable channel frequencies for Ku-band. For security the unit offers a key lock to secure operational settings and is compatible with all present descrambling technologies.

Operating at an input frequency of 950 MHz to 1450 MHz, the 9630 block conversion receiver has frequency synthesized tuning, AFC, rear-panel IF loop and features single or dual LNB operation. The receiver features two standard audio demodulators plus discrete and matrix stereo processing.

For more information, contact (404) 925-5000.

Signal Processing

Signal Max from Signal Processing is a complete headend consisting of receivers, modulators and heterodyne

The Agile 24 PC satellite receiver from Standard Communications features a full 30 MHz video bandwidth.

processors. The combined output level of Signal Max is 54 dBmV offering SAW filter technology.

For more information, contact (214) 340-6071 or (800) 527-4361. In Texas call (800) 442-3574.

Standard

The Agile 24PC satellite receiver from Standard Communications features a full 30 MHz video bandwidth. Especially designed for SMATV and small cable operations, the 24PC features a low-profile design, coop operating temperature (−10°C to +40°C) and low power consumption. Its RF loop-through circuitry allows the addition of as many receivers as required without amplifier/dividers and splitters.

The TVM60 vestigial sideband modulator from Standard is completely frequency agile from Channels 2 through W. The unit's output level is +60 dBmV.

For more information, contact (213) 532-5300.

Triple Crown

The Channelizer Model CVR from Triple Crown is a fully frequency agile satellite receiver (3.7 GHz to 4.2 GHz). The satellite microwave signals are dual down-converted, amplified, filtered and processed to produce a baseband video and audio output as well as a composite video output. The unit features a 70 MHz IF loop and a special "AFC Slow-down" feature which ensures correct operation with video decoders.

For more information, contact (416) 629-1111.

United Satellite Systems

The SRA-500S satellite receiver from USS utilizes block down-conversion design and synthesized transponder tuning with a special memory circuit to accommodate special offset tuning requirements. This enables the SRA-500S to be utilized in Ku-band and Intelsat applications. Other features include: linear Phase Lock Loop video demodulation and frequency agility in the audio section from 5 MHz to 9 MHz. The unit is VideoCipher II and Oak Orion compatible and is backed by a two-year warranty program.

Channel Master's MDA-450 frequency agile modulator can be tuned to any channel in its frequency range by the touch of a button. Its microprocessor-controlled quartz crystal synthesizer ensures channel frequency accuracy. IF and SAW filter technology is utilized for optimum signal output.

For more information, contact (218) 681-5616.