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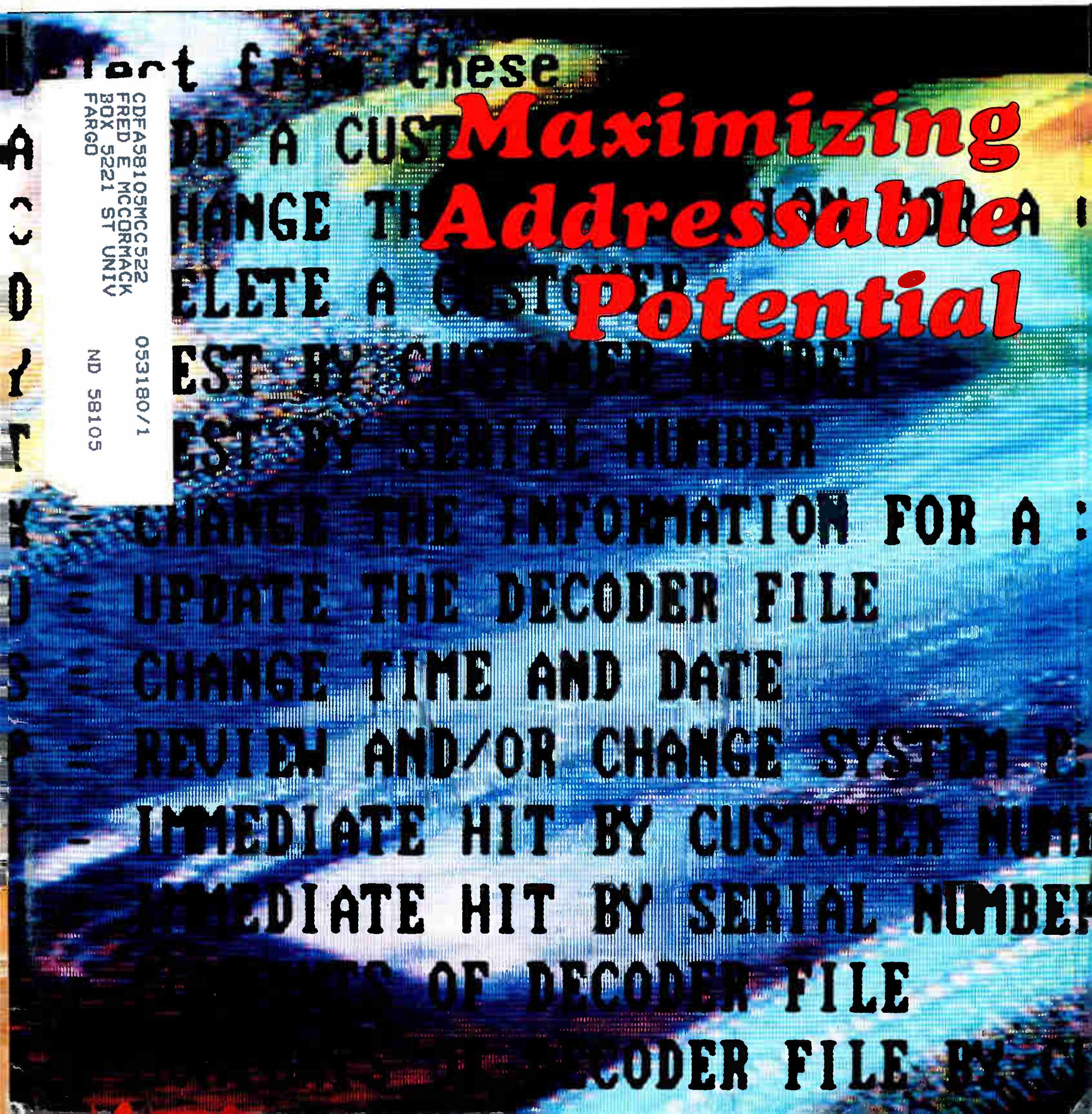
Communications Engineering Digest/The Magazine of Broadband Technology

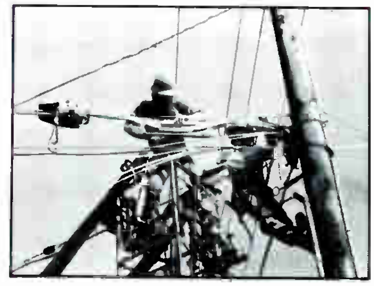
October 1982

Product Profile: Directional Couplers

Maximizing Addressable Potential



Jackson tools 2 year warranty



The name **Jackson** has always meant quality in cable construction tools. We stand behind this claim. Every tool shipped from Jackson Enterprises is backed by a **Two Year** limited warranty against factory defects in material and workmanship.

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Shown above: #1010 Trailer, #1078 Reel Brake, #1019 90° Corner Block, #1084-0 Double Bender.

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See us at the Atlantic Cable Show Booth #79

CED

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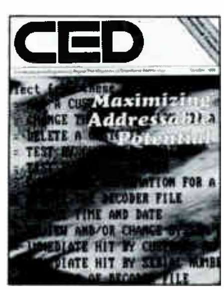
About The Cover:

The many faces of addressability; a scrambled video signal obscures an addressable menu in this composite design. Photos courtesy of Oak Communications.



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Oak Red Phone

Oak Communications Systems has a 24-hour hot line. Staffed by Oak field service personnel in Crystal Lake, Ill., the phone line gives system managers using Oak equipment instant access to service personnel in an emergency. Norm Zachrel, Oak's director of field services, points out, "We know that down time costs money. The sooner we can get an Oak engineer on the scene, the sooner a system can get back to normal." System managers using Oak equipment have been supplied the hot line number, Zachrel says, and shouldn't hesitate to use it if the situation warrants it. He adds, "Problems don't operate on a time clock, and neither do we."

Record Start-up

Catawba Valley Cable TV, as part of a service upgrade, ordered, received, installed and turned on a Jerrold addressable system in 28 days. Involved was a Jerrold AH-1 headend computer package, digital remote-controlled 58-channel converters and addressable STARBASE descramblers along with miscellaneous distribution hardware. Wayne Wright, the system manager for the Hickory, N.C., system, added Cinemax and a seven-channel tier to his existing 12-channel basic service plus HBO. The remaining channel total will be reserved for pay-per-view events. The order was received at Jerrold on May 17 and the start-up was announced on June 14.

One Scoop With Jimmies

The chain of 2,500 ice cream franchises of the Baskin-Robbins Co. was linked via Westar IV for an eight-hour teleconference broadcast live from Dallas. The training conference was transmitted to 25 cities, the first time the "31 Flavors" company updated its training electronically. Previously, the company has conducted all of its corporate training conferences at the Glendale, Calif., headquarters or at individual local sites.

Tanner Goes Chapter 11

Tanner Electric Systems Technology filed for protection under Chapter 11 of the Federal Bankruptcy Code on Sept. 1, 1982. Under Chapter 11, TEST will continue to be funded by its lender, Barclays American Business Credit, and will make on-time deliveries of its products to customers.

In spite of the general industry slowdown, TEST's active order backlog is growing in all product categories, according to the company. TEST is expanding production of its new pay-per-view decoder and field testing its MDS multi-channel downconverter.

SlushNet

Alaska may be colder than a popsicle in January, but the 49th state has warmed to Anixter-Mark. The State of Alaska has awarded Anixter-Mark a contract to supply 50 earth station antennas for the Satellite Relay Center in Anchorage. The 5-meter transmit/receive antennas will be installed by the State's Division of Telecommunications to support communications projects in the outlying Alaskan communities. Some of the communities designated for the antenna network are: White Mountain and Pitkas Point in the Yukon River area; Cordova; Girdwood; Moose Pass; Battles; McKinley; Eak and Kasigluk (and that's not a typo). Clinching the deal were Anixter-Mark's engineers. They met the state's requirement by designing a platform for permanent mounting of the antennas in the quicksand-like slush and ice of the Alaskan tundra.

NPR Pilot Service

A National Public Radio study takes an optimistic view on the potential of cable audio services. The 69-page report predicts the market for such services will reach eight million subscribers by 1985, with subscriber-supported services profitable by 1988. As a result of its findings, NPR is encouraging its member stations to develop local services for the cable market and is readying its own one-year pilot cable service for the print handicapped, expected to start in mid-January.

Atari R&D

Atari, whose most famous product is the Pac-Man video game, is establishing research and development labs around the country. Their mission: to expand products and transactional services involving microprocessor applications. The first lab, with 30 people, has been set up in New York City with others scheduled for Boston and one somewhere in the Midwest. What's in the offing may be home banking and shopping, and possibly electronic publishing. But with the Atari-Warner Communications marriage and the Warner Amex connection, Atari may find a role in CATV ancillary services.

EPIC Fight

During the Cooney-Holmes fight, a pay-per-view event, pirate receiving devices failed to operate due to an "electronic program intrusion control (EPIC)" system developed by the Jerrold Division of General Instrument. Viewers using pirate decoders purchased on the open market found them to be useless. The illegal boxes could not defeat the intermittent random scrambling of the Jerrold EPIC system. For now, the signal thief has been boxed to a technical knock out.

St. Louis Security

St. Louis now has 24-hour security service including fire, burglary and medical alert emergency services. The security service is provided by Warner Amex Cable Communications to both cable and non-cable TV families and businesses in the metropolitan St. Louis area. The area served includes 26 communities, passing some 75,000 homes with a potential for 90,000 subscribers. St. Louis is the sixth major city where around-the-clock emergency services protection is offered by Warner Amex.

Cable-Tec Update

The Society for Cable Television Engineers is anticipating some 1,200 technicians and engineers for its Cable-Tec Expo '83, May 6-8, at the Dallas Convention Center. Judy Baer, executive vice president of SCTE, reports that 100 booths are already committed, surpassing the Society's projections. She expects about another 100 booths by convention time. The three-day expo will include many "back to basics" workshops, all of a technical nature, Baer said. "It's stuff that the participants will be able to go back and use on Monday."

Seminars

October

1: A conference on cable television interconnect in Massachusetts sponsored by the **Boston Health Care Cable Consortium, Boston University, The Communications Consortium, Emerson College, Northeastern University, the Massachusetts Cable Television Commission, University of Massachusetts** and **WGBH Educational Foundation** will be held at the Boston University Law Auditorium. Contact Barbara Cuggino, (617) 727-6925.

1-3: The **National Institute for Low Power Television** will sponsor the second annual **LPTV EAST Conference and Exhibition** at the Shoreham Hotel in Washington, D.C. For more information contact Joann Coviello, Conference Management Corporation, 17 Washington Street, P.O. Box 4990, Norwalk, Conn. 06856, (203) 852-0500.

4-8: An advanced technical training seminar sponsored by the **Community Antenna Television Association** will be held in Indianapolis. Contact the CATA Engineering Office, (305) 562-7847.

5-7: 1982 Western Design Engineering Conference, sponsored by the Design Engineering Division of the **American Society of Mechanical Engineers**, will be held at the Anaheim Convention Center, Anaheim, Calif. For more information contact (212) 370-1100.

6, 7, 8: A **Blonder-Tongue** MATV/CATV/Earth Station Technical Seminar will be held in Miami, Fla. in conjunction with **Singer Products Co.**, Export Sales Representative. Contact Steve Schiffman (516) 683-3000 or Glenn Stawicki (201) 679-4000.

10-12: UCLA, in cooperation with the **Society of Cable Television Engineers**, will present a program on "Modern Telecommunications Networking" during the SCTE 1982 Fall Engineering Conference at the Don Cesar Beach Resort in St. Petersburg, Fla. Contact the SCTE, (202) 293-7841.

10-12: The **University of Wisconsin-Extension Communication Programs** and **Cable Television Information Center** are sponsoring a conference on "Upgrading Cable Systems: Renegotiation, Renewal, Rebuilding & Refranchising" at the Sheraton Inn, Madison, Wis. Contact Dr. Barry Orton, (608) 262-2394.

10-12: The 1982 **SCTE Fall Engineering Conference** will be held at the Don Caesar Beach Resort Hotel in St. Petersburg, Florida. The conference will focus on Business and Data Communications on CATV Networks. For more information call the SCTE at (202) 293-7841.

13: The **Iowa Cable Television Association** annual fall convention will be held at the Hilton Hotel in Des Moines. Contact Neil Webster, (319) 252-1343.

13-15: Magnavox CATV Systems will be conducting a field training seminar with its Mobile Training Center in Atlanta. Contact Larry Richards, (315) 682-9105.

13-14:A **Blonder-Tongue** "MATV/CATV/TVRO" technical seminar will be held in Denver in conjunction with Systems in Marketing Service Inc. Contact Chuck Fitzer, (415) 449-0547.

16: Kable Information Services is presenting a hands-on technical training and career seminar for the cable and satellite industries at the Holiday Inn, Jersey City, N.J. Contact Norman Adleman, (201) 353-1031.

18-20: Magnavox CATV Systems will be conducting a field training seminar with its Mobile Training Center in Atlanta. Contact Larry Richards, (315) 682-9105.

19-20: The annual convention of the **Ontario Cable Telecommunications Association** will be held at the Sheraton Triumph Hotel in Toronto. Contact the OCTA, (416) 481-4446.

19-21: The fall meeting of the **Alabama Cable Television Association** will be held at the Ramada Inn, Fort Walton Beach, Fla. Contact Otto Miller, (205) 758-2157.

19-21: The Mid-America Cable TV Association's 25th annual meeting and show will be held at the Tulsa Excelsior Hotel and Tulsa Assembly Center Arena in Tulsa, Oklahoma. For more information contact Rob Marshall (913) 887-6119.

19-21: A **Blonder-Tongue** "MATV/CATV/TVRO" technical seminar will be held in Houston in Spivey-LeBoeuf Associates. Contact Tom Spivey, (713) 649-1221; or Gloria Rothfuss, (201) 679-4000.

21-23: Magnavox CATV Systems will be conducting a field training seminar with its Mobile Training Center in Atlanta. Contact Larry Richards, (315) 682-9105.

22-24: The second annual convention of the **National Association of MDS Service Companies** will be held at the Sheraton Hotel in Washington, D.C. Contact Diane Hinte, (213) 532-5300; or Mark Edeman, (509) 328-0833.

26-28: The **Atlantic Cable Show** will be held at the Bally Park Place, Del Webb's Claridge and Brighton hotels in Atlantic City, New Jersey. Contact Nancy Becker, (609) 394-7477.

27-28: A **Blonder-Tongue** "MATV/CATV/Earth Station" technical seminar will be held at the Hilton Airport Inn, Romulus Township, Mich., in conjunction with Robert Milsk Company Inc. Contact Ed Curreri, (513) 729-4392; or Robert Milsk, (313) 354-3310.

November

1-3: The **Community Antenna Television Association** will be holding a basic technical training seminar in Hot Springs, Arkansas. Contact the CATA Engineering Office, (305) 562-7847.

1-3: The 1982 Satellite Communications Symposium sponsored by **Scientific-Atlanta** will be held at the Marriott Hotel in Atlanta. Contact Betsy Crawley, (404) 449-2274; or John Feight, (404) 441-4800.

2, 3, 4: A **Blonder-Tongue** MATV/CATV/Earth Station Technical Seminar will be held in Palm Beach, Fla. in conjunction with Enjay Associates, Inc. Contact Glenn Stawicki or Floria Rothfuss (201) 679-4000.

8-9: A seminar on "Ku-Band Satellite Communications in the '80s" sponsored by **Phillips Publishing Inc.** will be held at the Hyatt Regency in Washington. Contact Stacey Schalton, (301) 986-0666.

8-10: A concentrated short course, "Digital Television-Bandwidth Reduction and Communication Aspects," will be presented by the **University of California, Berkeley**. Contact (415) 642-4151.

10-12: Magnavox CATV Systems will be conducting a field training seminar with its Mobile Training Center in St. Louis, Mo. Contact Larry Richards, (315) 682-9105.

15-17: Magnavox CATV Systems will be conducting a field training seminar with its Mobile Training Center in St. Louis, Mo. Contact Larry Richards, (315) 682-9105.

17-19: The annual convention of the **California Cable Television Association**, the Western Show, will be held at the Anaheim Convention Center, Anaheim, Calif. Contact CCTA, (415) 881-0211.

18-20: Magnavox CATV Systems will be conducting a field training seminar with its Mobile Training Center in St. Louis, Mo. Contact Larry Richards, (315) 682-9105.

30-Dec.1: Frost and Sullivan Inc. is presenting a seminar on "Understanding and Using CAD/CAM" in New York City. Contact Carol Sapchin, (212) 233-1080.

Editorial

Multichannel Audio: Is Cable Ready For It?

Cable television system operators not already carrying one or more program services that offer an audio subcarrier scheme for stereo sound soon will be faced with the decision as to whether to distribute those services through second hook-ups. Not only are there several programming services offering multichannel audio with others planning to offer it, but there are many other subcarrier audio services available via satellite that will appeal to the subscriber who is an audiophile.

Soon, the Federal Communications Commission will be authorizing multichannel sound use for the broadcast networks. Given the must-carry rules, cable television system operators will be faced with several additional technical problems in rebroadcasting network audio. If subscribers can receive broadcast signals with stereo sound over-the-air, certainly they will expect to receive the same over cable even if stereo sound is not required by "must-carry" rules.

Leaving aside the technical difficulties for the moment, let's take a brief look at the possible pay-off from multichannel stereo sound for cable systems. National Public Radio recently received the results of a nine-month study it commissioned, titled "Listening To The Future: Cable Audio In The '80s." The authors (marketing and financial analysis was performed by Audience Research Analysis and Kalba Bowen Associates) predict that the market for multichannel sound on cable will develop by mid-decade. The number of cable audio subscribers will more than double over the next two years from less than 1 million to 2.3 million, with 8 million subscribers expected by 1985. The study predicts by 1990, 60 percent of all cable subscribers, or 28 million, will have some form of cable audio with some 42 million people having access to audio services.

NPR estimates each operator will need to hook up 284 audio subscribers or about 6 percent of cable subscribers in a medium-sized system to be profitable. The study points out, "It's significant that the majority of franchise proposals for new systems submitted during the last two years specifically mention the availability of audio services."

For audio programmers, the study predicts profitability could come as early as 1988 for a subscriber-supported service started next year. An ad-supported service could be profitable by 1989. A service paid for by system operators could become profitable in 1987 for a three-program offering and in 1988 for a five-program service.

Two manufacturers supply the necessary headend equipment for processing of satellite audio transmissions in stereo: Learning Industries Corp. and Wegener Communications Inc. Equipment also exists for stereo synthesis of audio received at the headend in monaural. Therefore, all the audio a cable system transmits can be made available to subscribers in stereo.

But technical problems exist and some technical standards may need to be established. The Electronics Industry Association's Broadcast Television Systems Committee has a Multichannel Sound Subcommittee that has been working on standards for the broadcast industry. The National Cable Television Association's Engineering Committee has formed an *ad hoc* subcommittee to examine the potential impact on a typical cable system of a stereo TV signal. Their initial findings point to the following areas of concern: "There are several subsystems in a typical cable plant which will degrade the stereo sound to a point where it is objectionable; if the stereo signal somehow makes it through a cable system 'undegraded,' it will probably cause audio interference to adjoining channels severe enough to make them unusable; in certain cable system equipment configurations, the standard channel audio could be degraded to the point of unusability; and there is a strong potential for stereo sound to disrupt certain scrambling devices and render them unworkable."

We know that with the demonstrated technical ingenuity of the cable television engineering community, these potential difficulties will be overcome. **CED** Magazine supports the work of the EIA and NCTA subcommittees in this area and urges them to work together toward technical solutions and standards. To that end, we suggest that anyone with substantive suggestions and recommendations regarding multichannel sound contact the NCTA Engineering Committee. Letters should be addressed to Engineering Committee, National Cable Television Association, 1724 Massachusetts Avenue., N.W., Washington, D.C. 20036. Phone, (202) 775-3550.

CED

Volume 8, No. 10

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United Video Studies Louisiana Cable Link

TULSA, Oklahoma—United Video Inc. is conducting a study to determine the feasibility of linking cable systems throughout south-central Louisiana via microwave.

The project, initiated by the Louisiana French Mass Media Foundation and the state's public broadcasting system, which awarded the contract to United Video, wants to link a microwave system from Baton Rouge to the New Orleans area, Lafayette, Lake Charles, and other cities throughout the state. The network would provide French-speaking and educational programming to cable systems throughout the community where the language is prevalent.

The engineering study is to be completed by mid-November and projections for implementation of the project, if accepted, will be in late 1983.

FCC Overhaul

WASHINGTON—The Federal Communications Commission finally has completed the task of consolidating its media bureaus into one—the new Mass Media Bureau.

The new bureau, under the jurisdiction of former Broadcast Bureau Chief Larry Harris, will provide a single, integrated organizational structure for administering FCC policies regarding traditional broadcasting, cable and what the commission has termed "the emerging television systems." The action is subject to congressional approval. FCC officials have said they do not expect any problems in Congress and are hopeful for a quick approval prior to the fall adjourment.

In a closed session last week, the FCC appointed Broadcast Bureau Deputy Chief Jeff Baumann and former Cable TV Bureau Chief Bill Johnson deputy chiefs. Offices at both bureaus were closed Sept. 15 for approximately an hour to inform staff of the realignment.

Harris said that no jobs will be eliminated nor will any staff be reduced in grade. However, the FCC should be able to process applications better and authorize new services faster through the reallocation of personnel.

Under the action, the Mass Media Bureau will consist of four divisions: Audio Services, Enforcement, Policy and Rules and Video Services.

The Video Services Division will consist of the AM and FM branches, the Auxiliary Services Branch and Data Management staff. This division will process applications for new AM and FM services, assess modifications of existing stations and act on renewal and transfer requests, plus applications for FM translators.

The Enforcement Division will consist of a Complaints Branch, an Equal Employment Opportunity Branch, a Fairness/Political Branch and Hearing and Investigations Branches. The division will combine all existing enforcement functions under a single unit and the EEO section will combine broadcast and cable EEO review functions.

The Policy and Rules Division will consist of an Allocations Branch, Legal Branch, Policy Analysis Branch and a Technical and International Branch. This division will provide legal, technical and economic input into the bureau's policy and rulemaking activities.

The Video Services Division will assume the responsibilites of the former Cable Bureau, now assigned to a branch within the division, plus oversee a Distribution Services Branch, a Low Power Television Branch and a TV Branch. The ownership staff, which examines ownership and other documents filed with the commission for all services under the bureau's authority, will also be incorporated under the Video Services Division.

Further duties of this latter division will include the processing of applications for new TV services, studying modifications of existing stations, handling renewal and transfer requests and acting on applications for various video services such as Instructional Television Fixed Service, DBS, low power and cable antenna relay systems (CARS).

TOCOM And Transcience Show Wireless Security

ATLANTA—TOCOM Inc. demonstrated wireless cable security technology at the Eastern Show here, Sept. 9-11, in conjunction with Transcience Inc. The Transcience supervised wireless system, when used in conjunction with the new TOCOM 3000 home alarm terminal, provides a complete cable security system compatible with all of the TOCOM III central data systems.

According to the company, wireless technology allows intrusion sensors and smoke detectors to be located throughout the subscriber's home without the necessity of wiring the units to a central alarm control panel. This increases the ease of installation and can cut labor costs for installation to a minimum.

The battery-powered wireless transmitters report alarms, low battery levels and tamper signals back to the TOCOM 3000 home alarm terminal, which then communicates the reports to the CDS via the cable television network. The system is supervised, meaning that the failure of a transmitter is automatically detected and reported to provide a failsafe operational system.

Both TOCOM and Transcience plan to cooperate in the development of compatible products for the cable security industry.

For more information, contact TOCOM, (214) 438-7691.

Phasecom Will Produce And Market Hughes TVRO Hardware

TORRANCE, California—Phasecom Corp. will manufacture and market Hughes Aircraft Company's satellite video receiving (TVRO) equipment under terms of an agreement signed recently.

Hughes will continue to provide TVRO systems and products to the national and international cable industry. Phasecom will become an alternative supplier of Hughes systems.

The TVRO line includes the SVR463 satellite video receiver, capable of receiving either C-band or Ku-band signals with the appropriate external down-converter, as well as a line of expandable TVRO antennas.

Phasecom Chairman Arnie Zimmerman noted that the addition of the Hughes equipment will complement the company's current line of headend equipment, enabling the company to market complete headend packages to operators.

Ma Bell On The Make For Cable Ancillary Services

ATLANTA, Georgia—Speaking at a seminar on "Competitive Services" at the Eastern Cable Show, AT&T electronic interactive services district manager Andrew Bulfer restated earlier claims that AT&T will not compete with cable systems in "traditional cable markets," but later conceded that AT&T will strongly pursue two-way transactional and various text services. The only area that Ma Bell seems unwilling to move into is one-way transmission of entertainment programming. Bulfer predicted that the information

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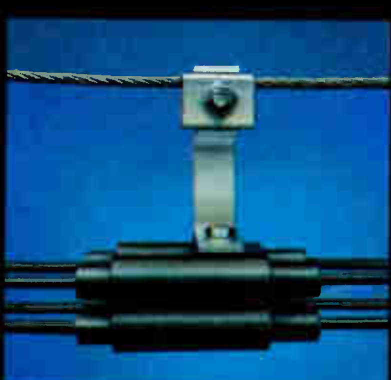

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MFE-4

market will grow to a $5-$10 billion range; plenty of room for everyone.

AT&T is reportedly testing an enhancement for its recently introduced frame creation terminal. The unit, soon to emerge from Bell Labs, permits the capture, transmission and display of color pictures along with videotex graphics on a full-frame basis. The system uses a video camera for both the translation of artwork and videotape images into "instant" videotex frames.

This new capability is compatible with the North American Presentation Level Protocol Syntax (NAPLPS) recently endorsed by the American National Standards Institute's subcommittee on character sets and coding. The NAPLPS has been endorsed by the U.S. committee to the CCITT which will convene at the CCITT's international meeting in Geneva in November.

CableBus Systems Bought By Pacific Telecom

BEAVERTON, Oregon—CableBus Systems Corp., the Beaverton, Ore., manufacturer of two-way interactive, computer-based residential security systems, has been bought by Pacific Telecom, a subsidiary of Pacific Power and Light.

According to CableBus officials, Pacific Telecom now owns an 80 percent share of the company while Cliff Schrock, CableBus System's chairman, retains 20 percent. CableBus Systems also has a new president, Karl Hoffmann, formerly an executive with PPL, replacing the former president, Peter Cass. Cass will be moving over to Pacific Telecom.

Last February, PPL invested $1.5 million in CableBus after purchasing a 40 percent interest in Multivisions, the cable operator headquartered in Anchorage, Alaska. This recent move increases PPL's investment in the cable industry. PPL bought out Howard Vollum and John Gray, two of the original shareholders of CableBus.

CableBus Systems Corp. will change its name to CableBus Laboratories and will increase its activity in research and development, according to company officials.

Business Notes

★ **Scientific-Atlanta Inc.** reported sales of $337.2 million in its fiscal year ended June 30, 1982, an increase of 22 percent over $277.3 million in the prior year. Net earnings of $14.2 million were 26 percent below the prior fiscal year earnings of $19 million. Earnings were $0.63 per share in the year, down from $0.90 per share a year earlier. The fourth fiscal quarter ended June 30, 1982, showed sales of $81 million, down 3 percent from $83.4 million in the fourth quarter last year.

CORRECTION: The article entitled "CATV As The Local Loop In Business Data Transmission" in the September issue of **CED** contained some errors. In figure 7, page 36, the price for Scientific-Atlanta's model 6402 data modem was incorrectly listed. The price should be listed as $3335. Also, the following Comtech Data modem models were inadvertently deleted from the listing:

Model	Speed (B/S)	Bandwidth	Price
M500	56,000-10,000,000	39.2kHz-7MHz	$5300
M500C	56,000-10,000,000	39.2kHz-7MHz	4650.
M570	Up to 3,500,000	6MHz	1500.

CED Magazine regrets these errors.

Upgrading A Cable System To Addressability

By Norman Zachrel, Oak Communications Systems

Today, many cable operators are weighing the decision to upgrade their cable systems from nonaddressable equipment to one or another form of addressability now available.

Addressable systems provide greater flexibility in instituting each subscriber's premium programming. Software controls the accessability to programming, instead of relying on hardware such as traps in the cable distribution plant.

Among the advantages of addressable systems are:

- Simpler control. Pay-per-view and premium offering authorizations can be made by a computer terminal at the headend, rather than physically installing traps near each subscriber's house.
- System responsiveness—Subscriber requests for premium service can be implemented without delay.
- Better security—The headend computer can automatically update home terminal descrambling authorizations at regular intervals, deterring tampering with the home terminal.

There's more than one way to upgrade a system, so care should be taken in deciding what kind of addressable package is selected.

The best upgrade will match system demands (in terms of size and ease of management) with the correct software package for a cost-effective installation. This way, the change will have a positive long-term effect on the system's operation and growth. Several addressable systems are available in different sizes to accomodate effective levels of service.

Headend To Home Conversion

Making the upgrade to addressability does not require a major rebuild or extensive changes to the signal distribution plant. Basic changes include installing an addressable headend with appropriate software, a computer drive and any necessary peripherals, and addressable converter/decoders.

The primary change needed for a system upgrade takes place at the headend and the home terminals. The headend choice will affect other equipment, so that decision should be made first. Addressable software has to be incorporated into the system at the headend and a computer powerful enough to drive the software has to be installed. Peripherals such as keyboard terminals and outboard memories are needed. The type and number of these units is determined by the individual characteristics—size and complexity of programming—of each proposed upgrade.

At the home terminals, converter/decoders incorporating microprocessor-based software must be installed to

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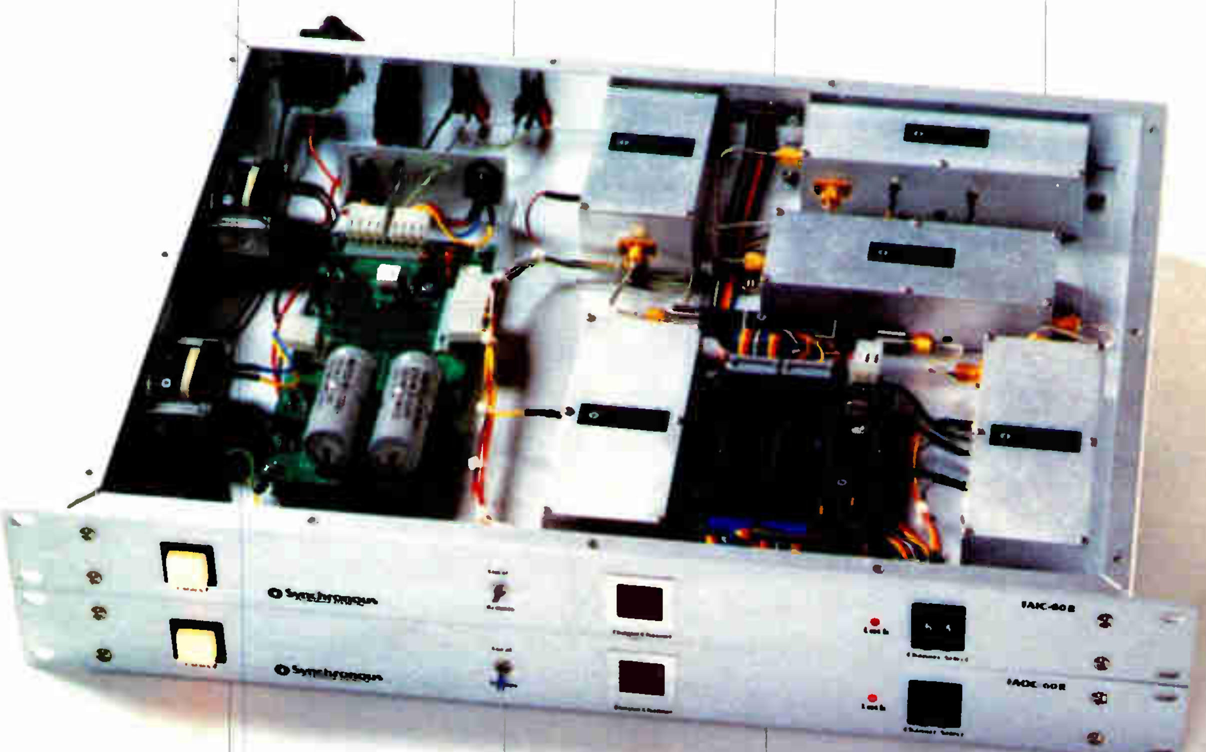

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replace nonaddressable converters. Traps in place for nonaddressable system operation simply can be bypassed. Unless two-way interactive will be instituted some day, there is essentially no difference in specification requirements for addressable converter/decoders that can be used with various headends. Oak converter/decoders must accomodate the number of channels being offered, and some extra capacity may be desirable for future expansions in number of channels offered.

Depending upon how many premium scrambled channels will be offered, a number of secure scrambling units will be needed. Any number of channels can be scrambled, and some operators may decide to even scramble basic service. Peripherals such as disk drives and keyboard terminals will be needed as well, with the number determined by the size of the system and service requirements.

Upgrade Opportunities

There are several ideal times to make an upgrade. When an operator increases the number of channels offered, when the subscriber base is being expanded, or when additions are being made to a multi-hub system, an upgrade can be easily and economically implemented.

One prime opportunity to upgrade a cable system comes when the system operator decides to extend the number of channels being offered. This is a situation that commonly occurs. An operator may decide to increase the number of channels in a system from 12 or 16, say, to 24 or 35. Addressable equipment can be installed at the same time as new headends and converter/decoders.

For a cable system that wants to expand its subscriber base, any major extension of the cable plant would present a chance to institute addressability in the new branches and incorporate addressability into the branches already operating. When increasing market penetration, the addition of subscribers using addressability is much simpler in terms of the work needed on the cable grid. As already noted, data-coded addresses, not traps, control which home terminals receive selected premium program packages.

Similarly, any cable operator with multiple hubs can install addressability one branch at a time, spreading the cost over a longer period to minimize the financial impact. In both cases, the increased cash flow from premium-program merchandising, combined with savings from fewer installer-hours, can pay for the upgrade in a reasonable time.

For cable systems that are offering more complex premium-program packages, such as pay-per-view, installing addressability can be justified if only to streamline the record keeping and billing functions. The addition of some interfacing system to combine billing and headend functions into a single accessible unit can be justified for any system offering complex programming schedules for premium tiering. Such a system provides an efficient and safely redundant multi-hub system especially where separate multiple antennas must be used to optimize signal quality or where MSOs are expanding into many broad markets. Using telecommunications modems, a cable system could be installed in one region and billing could be conducted from a separate central location at the MSO's headquarters.

How A Multi-Hub System Works

For MSOs with a diverse network of hubs, utilizing the variety of addressable packages available today can be a big advantage. Just because an MSO has a large total subscriber base does not mean that even the smallest of headend addressable packages would not be appropriate for one of the hubs.

For example, Oak has recently installed three addressable headends at hubs operated by an MSO in Wisconsin. Each hub had already been operating as a nonaddressable system, and the operator decided to upgrade all three simultaneously. The installation illustrates the versatility of matching different types of addressable systems to various subscriber base requirements.

Two of the hubs were upgraded using Oak's TotalControl Cities 2™ headend. To drive the software, IBM Series 1 computers were installed. Each of these hubs had large subscriber bases, requiring capacities for handling 10,000 to 20,000 converter/decoder bases.

The third hub required a smaller capacity. For that hub, Oak supplied a MiniCon™, with the potential to handle 8,000 home terminals. A personal computer was sufficient to drive the MiniCon software. Should the subscriber base in that hub grow beyond the capability of the MiniCon system, the headend could be upgraded using a more powerful computer, while the same converter/decoders could still be used.

For any system operator wishing to simplify pay-per-view merchandising, or inaugurate any of the subscriber access features of addressability, a two-way interactive addressable headend should be installed.

The same addressable headend computing hardware is required, but microprocessor-based converter/decoders must be installed in the home to allow user entry by the subscriber. With two-way interactive, a viewer at the home terminal can plug in a request for a pay-per-view offering, and immediately have the program delivered. After the program is through, the converter/decoder automatically scrambles the channel to end the special offering.

Making The Move

After determining what a cable system operator needs from an addressable headend, the first step in a systems upgrade is conducting a feasibility study to determine the relative benefits of switching to an addressable system. Oak salesmen use a computer-run "Internal Rate of Return" study to help with this kind of estimation (see related story below). Following this, a proposal is generated based on which software package an operator wants and what ancillary equipment will be needed for the upgrade.

Some flexibility exists in an upgrade timetable. Of course, enough time must be allowed for installation and hookup, instruction of system personnel, and actual system turn-on. Total changeout time from placement of the order to startup is usually 90 days, with field service engineers spending four or five days at the system site. If necessary overall time can be shortened considerably.

Regardless of system size, a cable operator can benefit from an upgrade to addressability. Obviously, the most advantageous time to implement addressability is at the initial cable system turn-on. But for those cable systems already in business, or those operators preferring to approach addressability one step at a time, addressable technology is available in cost-effective packages. CED

Norman Zachrel is director, field technical services for Oak Communications Systems. He is responsible for customer installation and maintenance of hardware and systems. He joined Oak in January 1980 as a field service engineer. Zachrel holds a first class FCC telephone license.

Internal Rate Of Return Calculations

Cable operators often wonder if "going addressable" is worth the higher initial investment that's required.

In weighing the decision, it is clear that the merits of addressability include increased revenue opportunities and reduced operating costs that the technology brings. Yes, the cash outlay up front is higher; but close anlaysis shows that it really is a profitable investment in the long-term performance of a system.

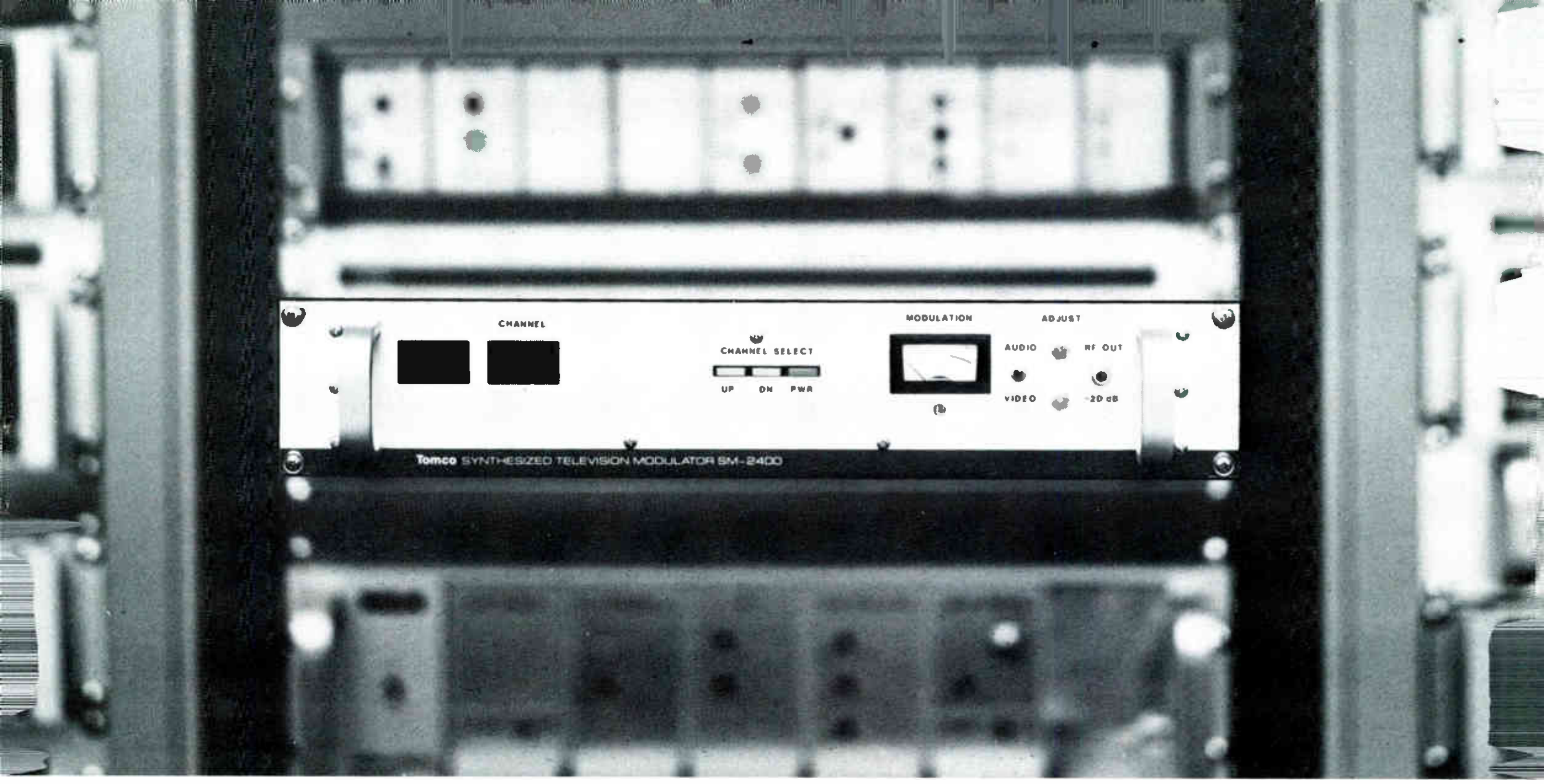
Oak has developed a method of calculating the internal rate of return (IRR) and payback period for the increased initial investment for an addressable system. The formula compares initial investment with yearly cash inflow over a given period of time, and is a present value calculation, taking into consideration the time value of money—what is a dollar received seven years from now worth today.

A typical seven-year cable cycle is shown in the accompanying chart. The model is based on a mature system upgrading 30,000 subscribers to addressability.

Some key points in the example:

- The increased investment for an addressable upgrade, over and above a non-addressable upgrade, is $882,000
- A 30 percent pay-per-view (PPV) penetration, and a $2.75 per subscriber profit per event
- A reduction in box theft rate from ten to one percent, non-addressable vs. addressable

The IRR chart details the increases in system revenues due to additional special offering (PPV) income and increased system penetration. The reduced operating costs comprise savings in subscriber



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disconnects, tiering changes and box theft.

The annual IRR for the operator in the example is quite attractive—58.05 percent. Yearly cash flows are multiplied by a present value factor at 58.05 percent to equate them with the initial investment.

The increased cash flow which results from an addressable upgrade, which is the sum of net income and the depreciation add-back, also translates into a quick payback of the higher initial investment. The operator in this example would recoup his additional investment in about 21 months.

But what do these figures mean? Not only does the operator in question get his additional cash back in less than two years; he also gets a much more attractive return on the investment over the long term than he could get in the money markets—or almost any investment, for that matter.

It's important to remember that the IRR figure and the payback period are based on the difference between the addressable and non-addressable system costs, and vary according to system assumptions. But the significance of the numbers is obvious—what initially appears as a large cash difference is quickly paid back, while the benefits of addressability keep paying off throughout the life of the system. CED

Assumptions

Maximum Number of Subscribers:	3,000
Number of Scrambled Channels:	5
Terminal Cost For Total Control System:	140.00
Non-Addressable System:	110.00
Headend Cost For Total Control System:	90,000
Non-Addressable System:	10,000
% of Subscribers Who Take Special Off:	30.00
Profit (in dollar and cent) per Special Off:	2.75
% of Increased Penetration:	10.00
Service Call Cost:	25.00
% of Subscribers Changing Tiers:	20.00
Nonaddressable Theft %:	10.00
Total Control Theft %:	1.00

	1983	1984	1985	1986	1987	1988	1989
No. of Subscribers	15000	30000	30000	30000	30000	30000	30000
No. Spec. Offer/Yr.	2	4	6	6	6	6	6
Base Rate Per Mo.	10.00	10.00	10.00	12.00	12.00	12.00	12.00
% Churn	20.00	20.00	20.00	20.00	20.00	20.00	20.00

Incremental Investment	**System TC**	**System Non Add**
Headend System	90000	10000
Home Terminals	4200000	3300000
■ Total Equip Costs	4290000	3310000
■ Invest Tax Credit	-429000	-331000
■ Cash Outlay	3861000	2979000
■ Incr. Investment	882000	0

	1983	1984	1985	1986	1987	1988	1989
A. Increase in Revenue							
1. Special Offering	24750	99000	148500	148500	148500	148500	148500
2. Increased Penetration	180000	360000	360000	432000	432000	432000	432000
Subtotal	204750	459000	508500	580500	580500	580500	580500
B. Reduction in Operating Cost							
1. Disconnects	75000	150000	150000	150000	150000	150000	150000
2. Tiering Changes	75000	150000	150000	150000	150000	150000	150000
3. Box Theft	144000	288000	288000	288000	288000	288000	288000
Subtotal	294000	588000	588000	588000	588000	588000	588000
Total	498750	1047000	1096500	1168500	1168500	1168500	1168500
C. Increase in Depm	147000	183260	136446	107791	85156	0	0
D. Profit before tax	351750	863740	960054	1060709	1083344	1168500	1168500
E. Income tax	161805	397320	441625	487296	498338	537510	537510
F. Net income	189945	466420	518429	572783	585006	630990	630990
G. Depm & back	147000	183260	136446	107791	85156	0	0
H. Inc. in cash flow	337000	650000	650000	681000	670000	631000	631000

For H., Inc. in cash flow line: 2460
Discrete rate of return = 58.08%

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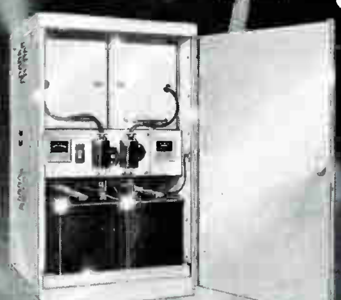

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No Loose Ends Part III

Techniques For Tests And Measurements Using The Spectrum Analyzer

By Linley Gumm, principal engineer, Communications Division, Tektronix Inc.

This is the third installment of our continuing series of *No Loose Ends*. The first and second parts were presented in the June and August issues of *CED* respectively. This four-part series deals with the best and most thorough use of the spectrum analyzer for laboratory quality CATV tests and measurements, proof of performance and system maintenance. This series is a state-of-the-art update of the widely used original *No Loose Ends* published by Tektronix in 1973 and written by Clifford Schrock. The first part of this installment deals with distribution system frequency response measurement.

Frequency response measurements can be performed directly from the antenna input to the subscriber terminals. However, separating the headend measurements from the distribution system measurements is recommended. Separate measurements are more convenient and help to isolate response problems. The results of the two measurements are then combined algebraically to verify that total system response is as specified by the FCC.

The following procedures use a sweep generator to provide input signals over a specific frequency range. When carefully performed, these procedures constitute one of the most accurate methods of measuring the frequency response of CATV system components. Resolution of ± 0.25 dB and accuracy of about ± 0.5 dB are possible.

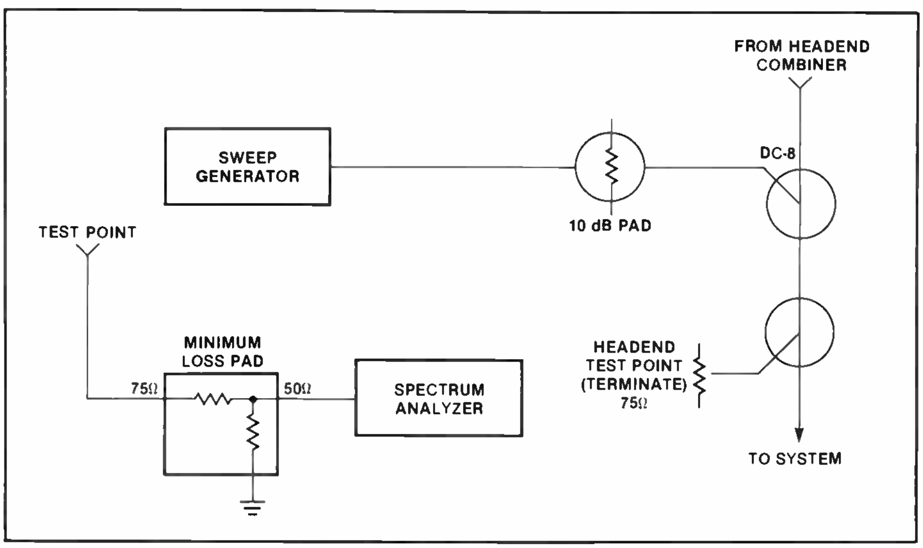

Figure 8-1 Equipment connection for distribution system frequency response measurement

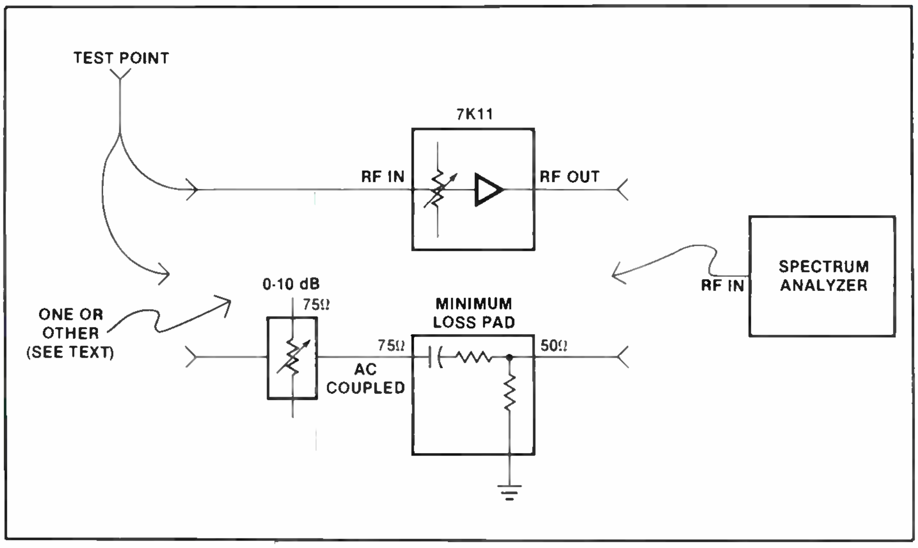

Figure 9-1 Equipment connection for carrier-to-noise measurement

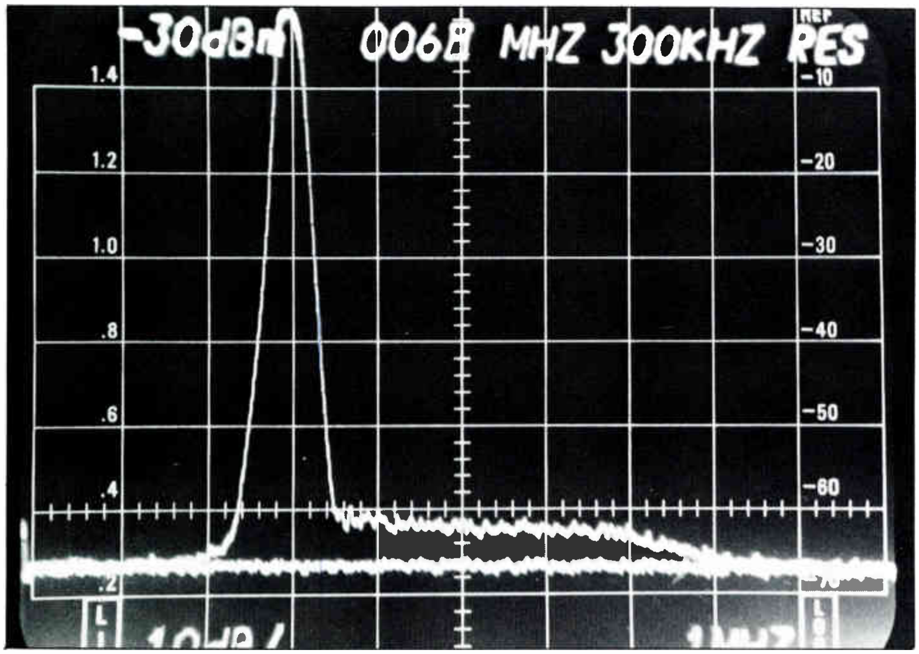

Figure 9-2 Measuring noise levels (multiple exposure photo)

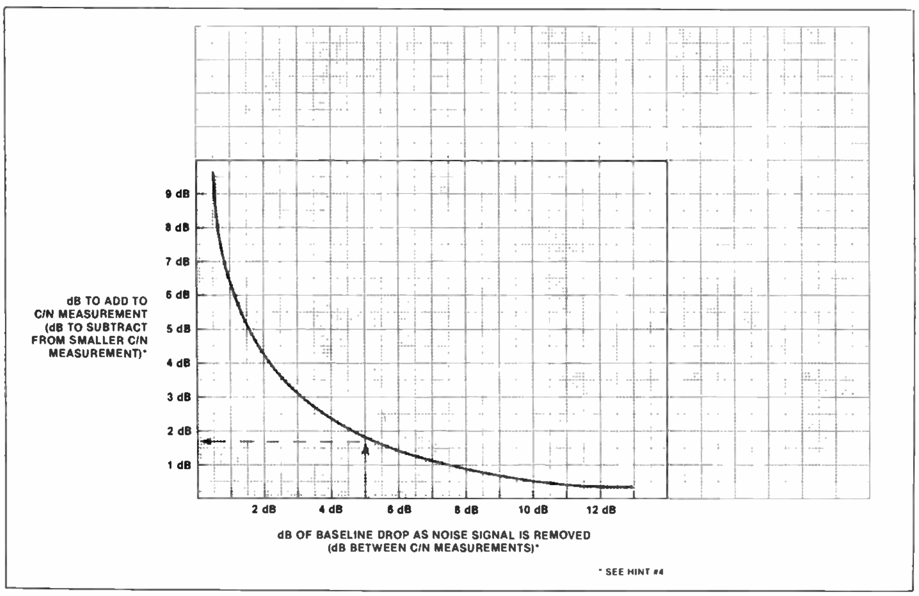

Figure 9-3 Analyzer noise floor correction chart

While this measurement technique interferes with normal CATV signals, the ease and speed with which it can be accomplished (only one or two sweeps at each test point) cause an interference interval of about one to two seconds per test point.

Equipment Required

1. Spectrum Analyzer: Tek 7L12 or 7L14.
2. Mainframe Oscilloscope: Tek 7613.
3. Sweep Generator: Slow sweep and single sweep capability very helpful. Frequency coverage to include all CATV channels.
4. Fixed Attenuator: 75 ohm, 10 dB.
5. Minimum Loss Pad: Tek 011-0112-00 or 011-0118-00.
6. F to BNC Adapter: Tek 013-0126-00.
7. Directional Couplers (2): 8 or 10 dB.

Procedure

1. Set up the equipment as illustrated in figure 8-1.
2. The sweep generator should be connected to a 10 dB pad mounted directly on the directional coupler.
3. Connect the spectrum analyzer to the test point on the second directional coupler.
4. Set the sweep generator for a CW output signal and tune it to about 50 MHz. Adjust the analyzer's FREQUENCY SPAN for 5 MHz/DIV, RESOLUTION to 300 kHz, and FREQUENCY controls to center the low band channels in the display (refer to number 1 in Hints and Procedures). Adjust the sweep generator output amplitude so that it is about equal to the channel 2 picture carrier amplitude.
5. Set the sweep generator for a wideband sweep (0 to top system frequency) with a slow sweep speed. The sweep frequency should change at about a 2 MHz per second rate.
6. Adjust the analyzer's REFERENCE LEVEL control to bring the sweeper signal to within the top division of the screen. Set the analyzer to 2 dB/DIV.
7. Start the sweep generator's sweep. Increase the scope persistence or use storage mode to hold the display.
8. As the low band is completed, rapidly photograph the resultant display. Adjust the analyzer's controls to the mid-band channels and then the high-band channels and repeat the measurement (steps 4-7). One or more sweeps may be necessary to photograph the entire spectrum.

Hints And Procedures

1. Adopt a consistent spectrum analyzer tuning method for the various photographs. For instance, for the low band, tune channel 2 to the second graticule line from the left; for the high band, tune channel 7 to the first line from the left.

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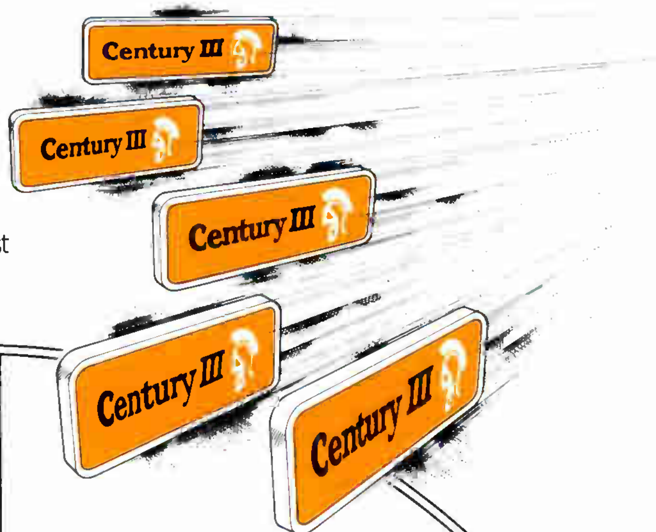

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RCA Converters: Addressability, Compatibility, Security Featured

RCA Cablevision Systems has introduced a modular system for its KS and M series converters offering cable operators configuration flexibility—(one way) addressability is added by attaching a base to the converter. RCA's addressable system adds a high level of security. In pay-per-view use, only a pulse on a particular enable line at a certain time will permit viewing. Cable operators can buy RCA converters now and upgrade later, or partially equip systems for addressability as needed. RCA's KS and M, addressable and non-addressable converters can all coexist on a system in a totally compatible fashion.

RCA's KS series is a 58 channel or 116 channel (dual cable) unit utilizing the latest digital technology, and featuring a microprocessor design.

KS converters accommodate wireless remote control, and duplicate controls on the set top unit to cut service calls if the remote is damaged. The wireless remote can switch between A and B cables and stores 15 favorite channels in its memory. A parental key lock is also available.

RCA's economical M series rotary dial converters are 36 or 58 channel units with wired remote available.

RCA's KS and M series converters are field switchable for standard, HRC and IRC channel assignments.

By adding addressable base units to KS or M converters subscribers can be offered up to 127 pay program levels, controlled from the headend computer.

Signalled from the headend, an LED on the converter base indicates pay service authorization.

Computer software in RCA's system is user friendly and interfaces with popular computer billing services. For more information call or use the attached coupon.

CED 10/82

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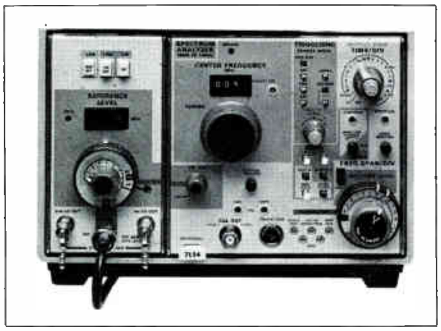
Puzzled About Headend Type?

RCA Cablevision Systems has the capability to custom design and build the headend type of your choice. Pre-assembled, tested, packed and shipped by RCA, all that remains is to unpack, plug-in and turn-on.

Here are some recent custom headends designed and built by RCA:

Type	Facility
HRC	United Cable TV Corp. Cupertino, CA
IRC	American Cable Systems, Inc. Arlington, MA
Standard	Camden Communications Carson, CA



Tektronix 7L14 spectrum analyzer

This makes it easy to compare the photographs taken at different points in the system.

2. When a Tektronix 7L14 is used, the same procedure is followed except that the MAX HOLD control is used to store the sweep information. Turn MAX HOLD off before retuning the analyzer and turn it on to make the measurement.
3. System AGC frequencies will be shown on the response photos as a notch. The slow sweep speed avoids the need for special filters.
4. Multiple serrations are caused by reflections in the interconnecting cables. If similar serrations appear in the display, or when in doubt, exchange the cables and insert 10 dB attenuators at the cable extremities to damp reflections.
5. If a generator with slow sweep is not available, tuning a generator manually will often suffice.

9. Carrier-To-Noise Measurement

Capability

The flexibility of the spectrum analyzer makes it a good instrument to measure carrier-to-noise (C/N) ratios. However, as in all measurements concerning noise, the process is complicated by various correction factors and bandwidth changes. A pair of charts is included to simplify the measurement procedure. These charts also compensate for the fact that a logarithmic display will show noise 2.5 dB lower in amplitude than it actually is.

If a tap level greater than 20 dBmV is available, the spectrum analyzer can make 55 dB C/N measurements directly (omitting a Minimum Loss Pad since the measurement is over a narrow frequency range). The following procedure describes how to make the C/N ratio tests required by the FCC on all local signals. A method of measuring first the headend and then the distribution trunk is described in the Hints and Precautions section.

A Tektronix 7K11 CATV preamplifier can be used for situations where a high tap level is not available. Using this preamp, 52 dB C/N ratios can be made with a tap level of 0 dBmV.

The flexibility of the spectrum analyzer makes it a good instrument to measure carrier-to-noise (C/N) ratios. However, as in all noise measurements, the process is complicated by various correction factors and bandwidth changes.

Equipment Required

1. Spectrum Analyzer: Tek 7L12 or 7L14.
2. CATV Preamplifier: Tek 7K11 (if required. Not usable with 7L14).
3. Mainframe: Tek 7613 or any 7000 series mainframe.
4. Bandpass Filter: 6 MHz to 10 MHz bandwidth; centered to pass the channel under test.
5. Attenuator: 75 ohm, 1 dB steps, 0 to 10 dB range (useful to maximize the measurement range if the 7K11 is not used).

Procedure

1. Set up the equipment as illustrated in figure 9-1.
2. Carefully calibrate the 7L12 and (if used) the 7K11. Refer to the instruction manual(s).
3. Select the 1 MHz/DIV FREQUENCY SPAN and the 300 kHz RESOLUTION BANDWIDTH. Make sure all video filters are off.
4. Center the channel carrier to be measured on the display. Use the REFERENCE LEVEL controls on the 7K11 and the analyzer (or the 0 dB to 10 dB attenuator) to bring the sync tips of the carrier signal to the top graticule line of the display.
5. Switch the processor AGC to manual. Adjust the processor's GAIN control to bring the sync back to the same level. Disconnect the antenna from the processor and terminate the processor's input. (If preamplifiers and/or bandpass filters are used, they must be left in the system. In general, disconnect the antenna lead from the first device it connects to and terminate that device.)
6. Turn on a 300 Hz video filter and slow the sweep speed.
7. Determine the number of dB between the top of the screen and the noise level (figure 9-2).
8. Remove the signal from the analyzer. Note how many dB the noise level falls as the noise signal is removed from the analyzer. (figure 9-2).
9. Refer to figure 9-3. Using the number of dB the noise fell as the signal was removed, determine how many dB to add to the C/N measurement in step 7. This correction compensates for the

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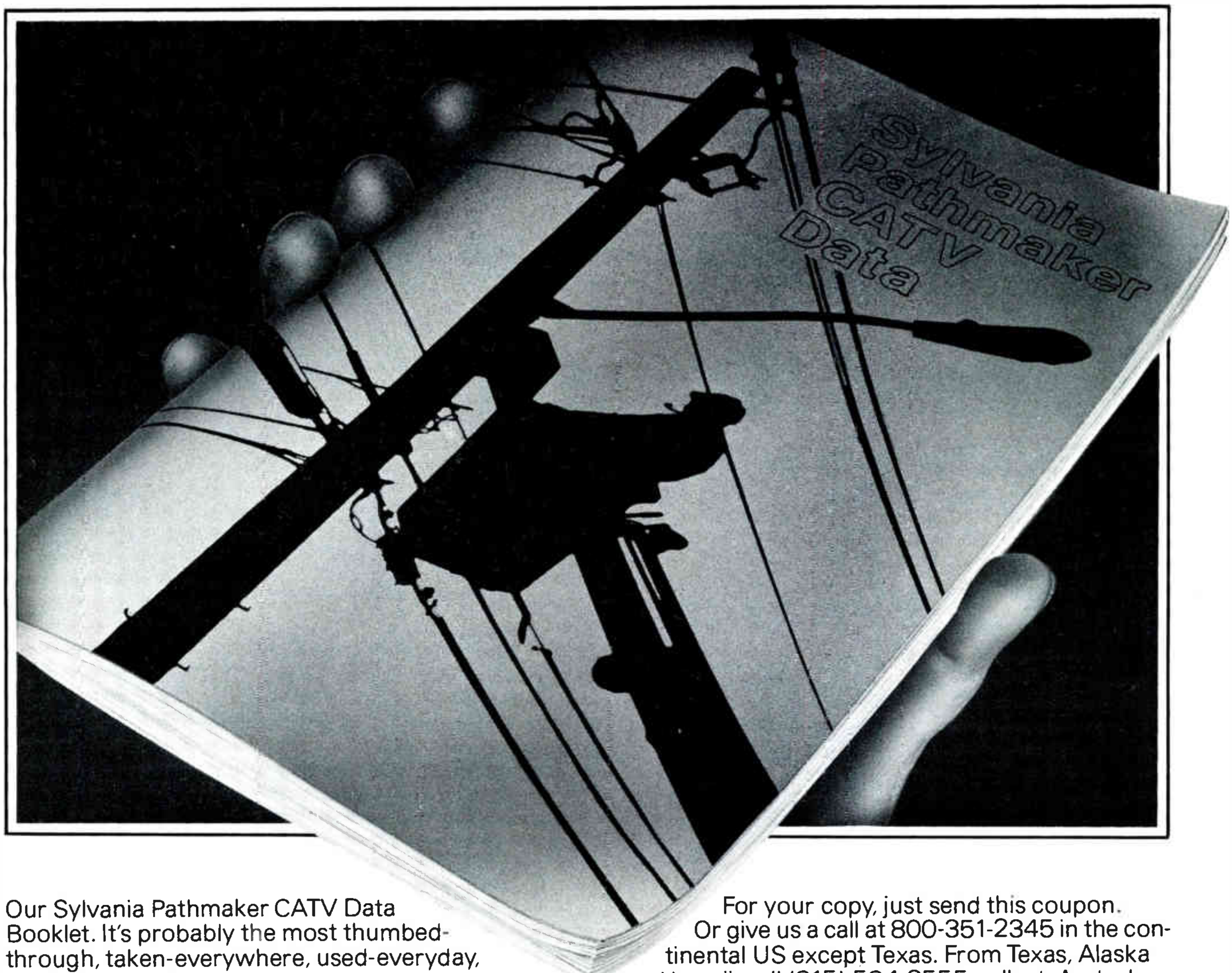

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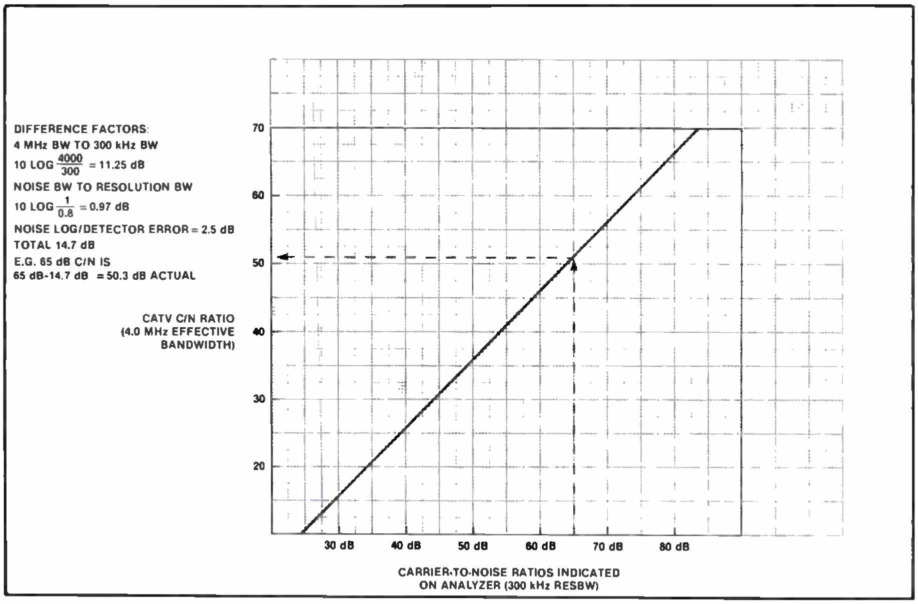

Figure 9-4 Analyzer bandwidth and log error conversion chart

analyzer's own noise when the difference between the measured noise and the analyzer's noise is less than 10 dB.

10. Add the correction factor obtained in step 9 to the C/N measured in step 7. Referring to figure 9-4, use the corrected C/N value from the spectrum analyzer to find the C/N for a 4 MHz system.

EXAMPLE: Figure 9-2 shows an uncorrected C/N of 63 dB and a noise fall of 5 dB when the signal is removed from the analyzer.

Referring to figure 9-3, 5 dB along the x-axis crosses the correction curve at 1.7 dB. Therefore 1.7 dB must be added to the measurement:

C/N = 63 dB + 1.7 dB
= 64.7 dB or 65 dB

Referring to figure 9-4, 65 dB along the x-axis crosses the noise conversion curve at 50.3 dB. Therefore the 4 MHz C/N is actually 50.3 dB.

Hints And Precautions

1. In wideband systems, the total input power can saturate the analyzer's front end, especially if a preamplifier is used. A bandpass filter should be used to protect the analyzer's inputs.
2. Measuring high C/N ratios requires a high tap level. If the analyzer's input is protected with a bandpass filter (so only in-band noise is measured) the carrier can be moved 10 dB off the top of the screen by removing RF attenuation after step 6. Proceed as before, but at 10 dB to the C/N measured in step 7.
3. The C/N of the distribution system can be determined by performing steps 1 through 4 as given. Skip to step 6. In step 7, measure from the top of the screen to the noise floor of an unoccupied adjacent channel. For example, two divisions to the left of the picture carrier in figure 9-4.
4. If the C/N of the headend and the distribution system have been measured separately, the two measurements can be combined with the help of figure 9-3. Note the difference in dB between the two C/N measurements. Move along the x-axis to the corres-

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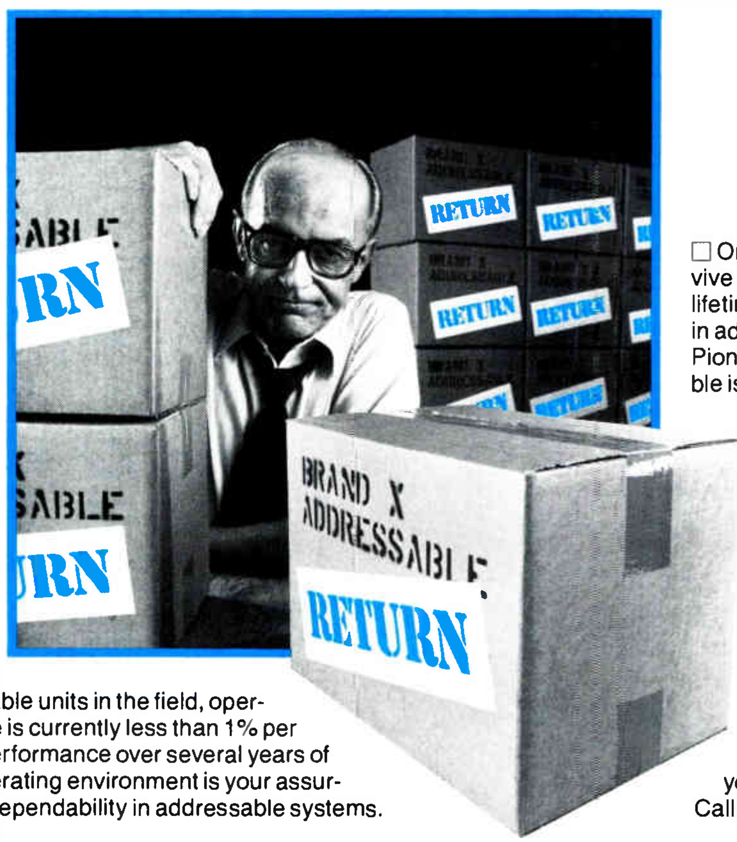

It is common knowledge in the cable industry that RELIABILITY has been a major problem in the addressable market. Profitable operation for your addressable system is directly tied to the reliability of the terminal you purchase. ☐ Too many operators have selected addressable systems without checking vendor records. They've found out the hard way what works and what doesn't. They've experienced catastrophic failure rates of 10%, 40%... in some cases, 100% failure. ☐ Since 1977, Pioneer has had addressable units in the field, operating every day. Their failure rate is currently less than 1% per month. This kind of low failure performance over several years of thorough testing in an actual operating environment is your assurance of Pioneer's strength and dependability in addressable systems.

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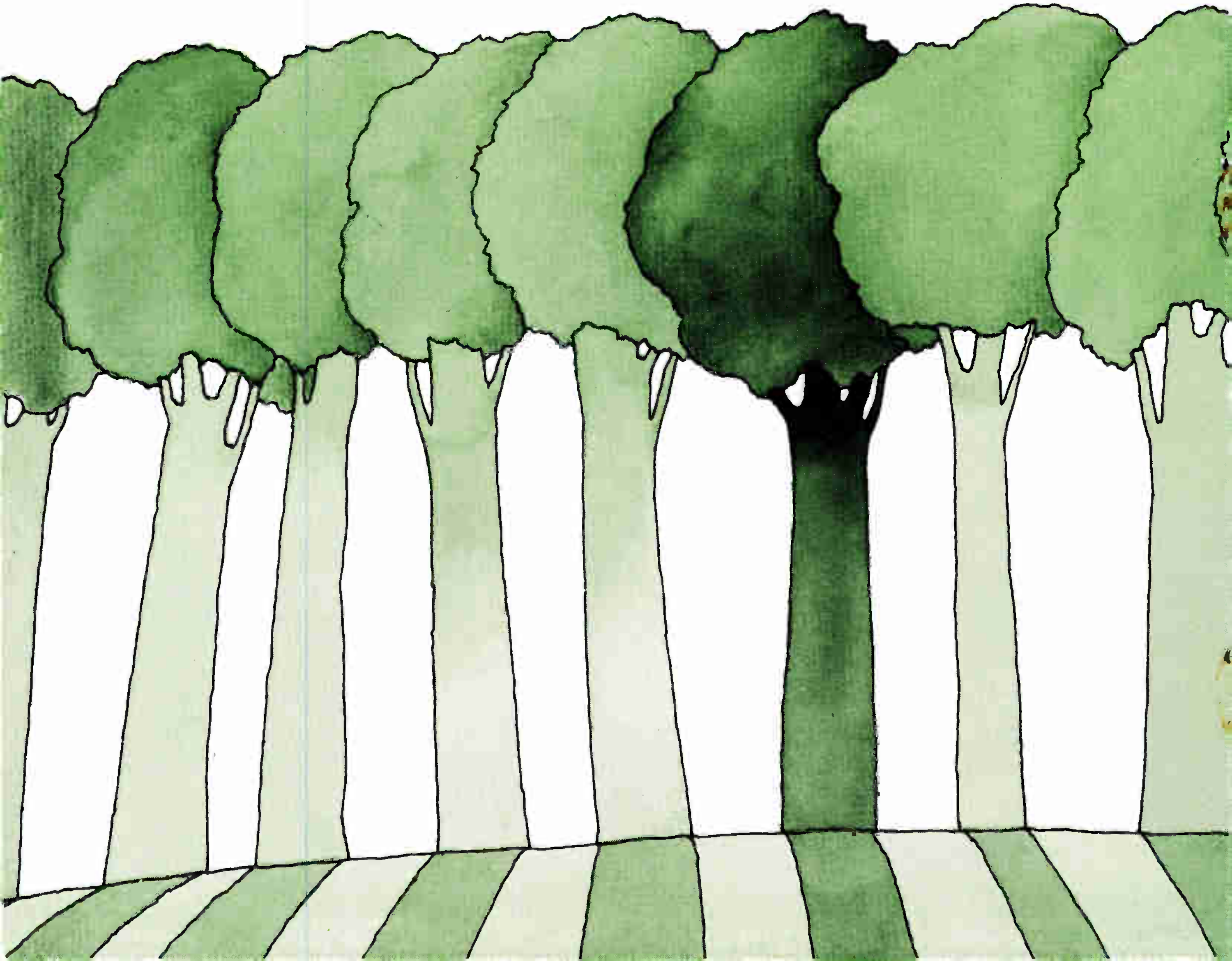

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The heart of addressable hardware is the computer. So you can't afford anything less than the best.
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In subscriber terminals, look beyond pretty cases and into performance. Look for things like a "favorite channel" memory for fast, easy tuning, parental control and durable membrane keyboard entry.

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Look at software performance.
See if it offers modular programs for you to pick and choose the kind of input and output you need.
You want a system that takes into account versatile record access, allows entry to common menus with a single keystroke and interfaces with your billing system for highly efficient and accurate operation.

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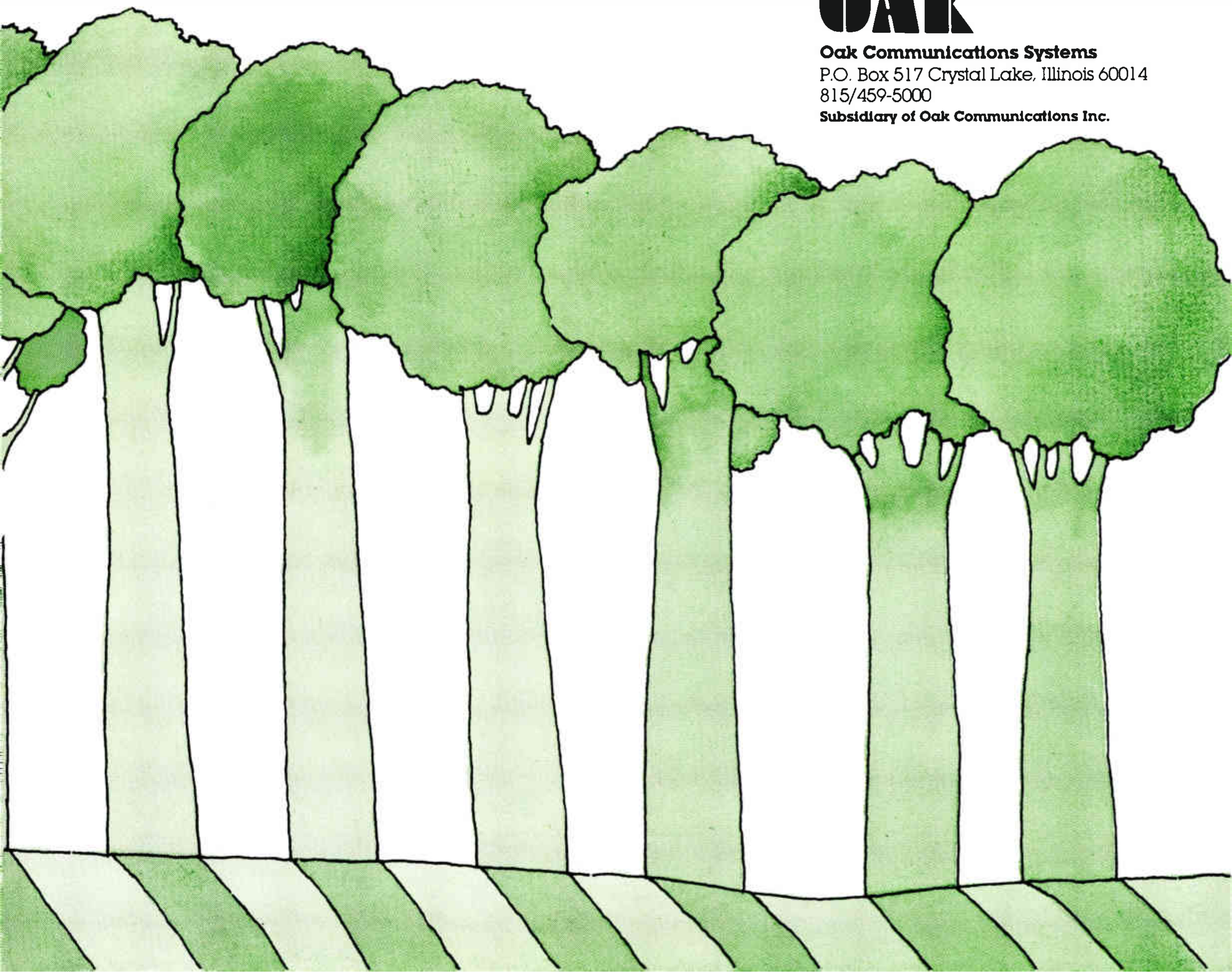

ponding (difference) value in dB. Move up to the curve and subtract this value from the smaller of the two C/N measurements.

EXAMPLE: If the headend C/N is 53 dB and the distribution system C/N is 58 dB, the difference is 5 dB. Enter figure 9-3 at 5 dB and find the correction factor at 1.7 dB. The combined C/N is then 53 dB-1.7 dB=51 dB.

If one C/N value is 10 dB or more smaller than the other, for all practical purposes the smaller value is the combined headend and distribution system C/N.

5. The 2.5 dB correction is due to differences between the RMS and AVERAGE amplitudes of CW and noise signals. If one has a noise signal and a CW signal with the same RMS amplitude, the AVERAGE amplitude at the noise signal will be 2.5 dB less than the amplitude of the noise signal. A 0.8 dB correction is included since the 300 kHz resolution bandwidth filter typically has a noise bandwidth of 240 kHz.

Alternate Signal-To-Signal Noise Measurement

Capability

The Tektronix 1430 and 147 noise test sets are capable of measuring signal-to-noise (S/N) ratios from 20 dB in 1 dB

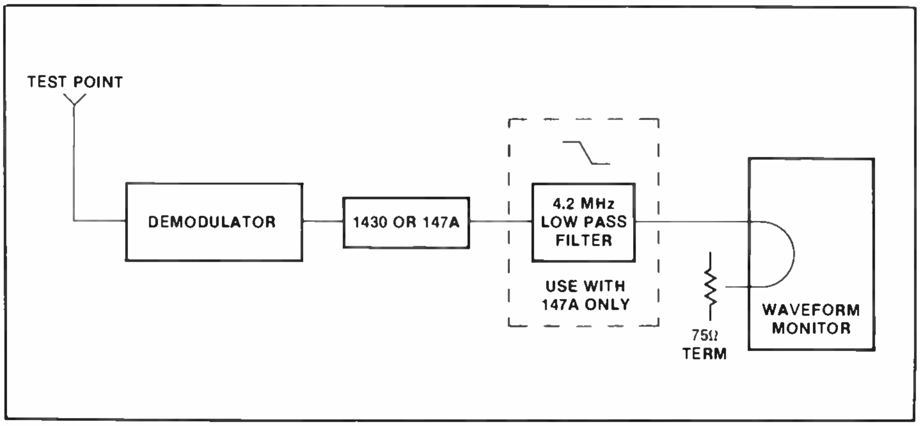

Figure 9-5 Equipment connection for alternative noise measurement

increments. The actual performance is dependent upon the performance of the demodulator and the customer tap level. The test sets are capable of easy and consistent measurements.

Equipment Required

1. Test Set: 1430 or 147A.
2. Demodulator: Tek 1450-1/TDC1/TDC2 or equivalent.
3. 1480 Waveform Monitor: or Oscilloscope with delayed sweep.
4. BNC Terminator: 75 ohm, Tek 011-0055-00.
5. Low Pass Filter: 4.2 MHz (only with 147A), Tek 015-0212-00.

Procedure

1. Connect the equipment as illustrated in figure 9-5.
2. Use a 4.2 MHz low-pass filter with a 147A. The filter is built into the 1430.
3. Tune the demodulator to the desired channel and fine tune for the least 4.5 MHz intercarrier as indicated on the waveform monitor.
4. Calibrate the waveform monitor for 1 volt or 140 IRE units.
5. Set the video output level on the demodulator such that the sync of the incoming signal is exactly 40 IRE units.
6. Select the line containing the calibrated noise generator on the waveform

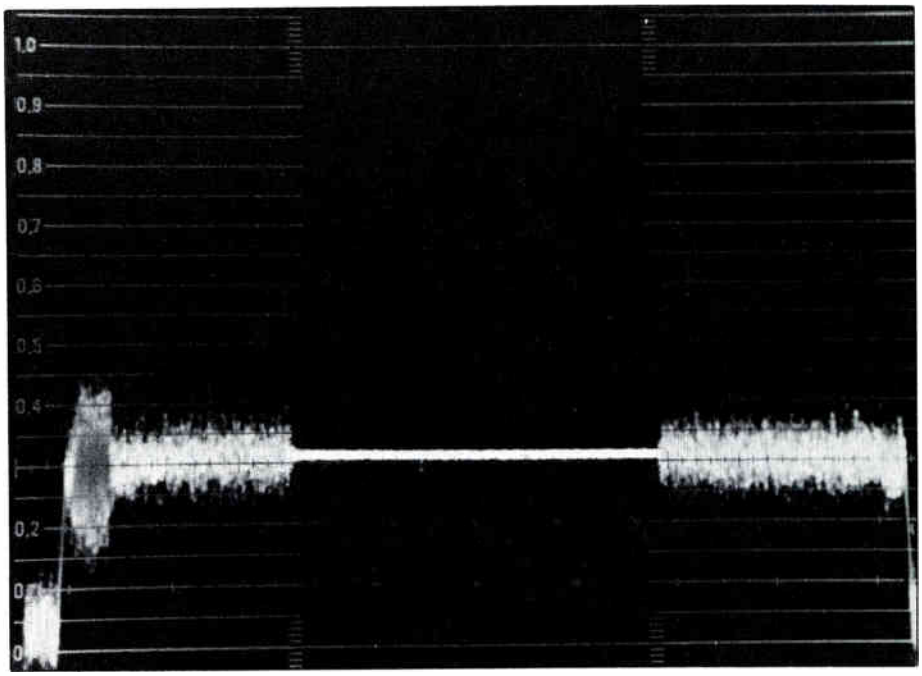

Figure 9-6 Match level with input signal

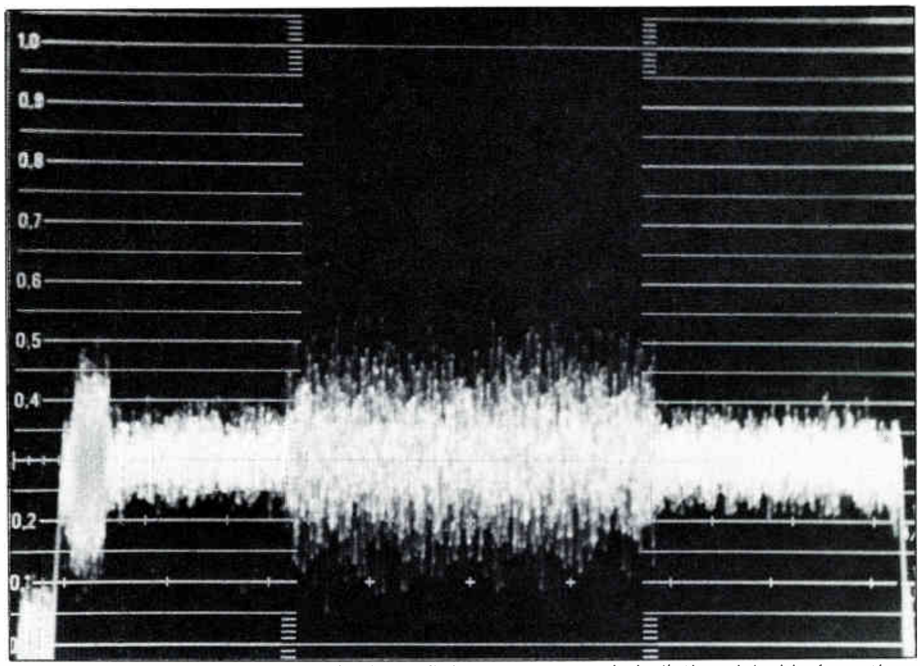

Figure 9-7 Adjust noise amplitude until the center area is indistinguishable from the rest of the line

monitor. The noise can be programmed onto an unused line such as line 17, field 1.

7. Match the calibrated noise generator level to the incoming noise and read the noise directly from the dials. This is the S/N ratio (figures 9-6 and 9-7).
8. The signal-to-noise ratio as requested by the FCC in 376 605(9) is actually the carrier-to-noise ratio which can be obtained by adding 4 dB to the reading obtained in step 7.
   EXAMPLE: For a reading of 41 dB S/N on the 147A or 1430, add 4 dB to obtain a 45 dB signal-to-noise ratio (C/N) to satisfy 376.605(9).

Linley F. Gumm was raised on an Eastern Washington wheat ranch. He hold a B.S.E.E. degree from Washington State University and a M.S.E.E. degree from the University of Washington. He began his career with Tektronix in 1964 and now holds the title of principal engineer. As a member of the engineering group within the Frequency Domain Instrumentation Business Unit, part of the Communications Division, at Tektronix, Inc., in Beaverton, Ore., Gumm has been associated with the development of spectrum analyzer instruments.

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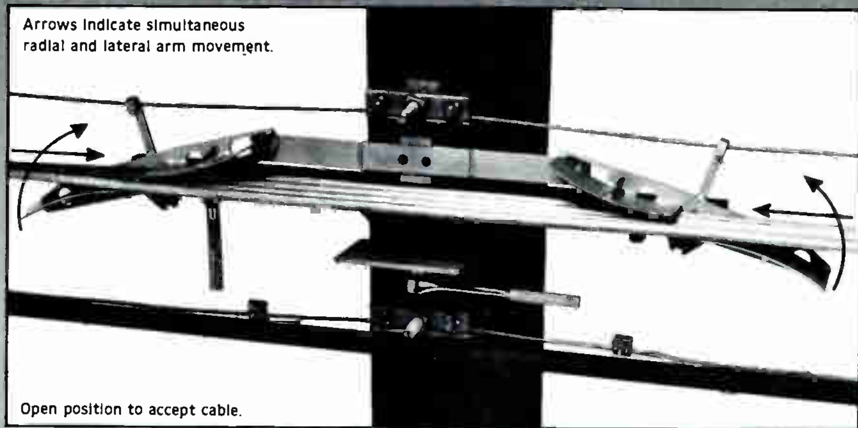

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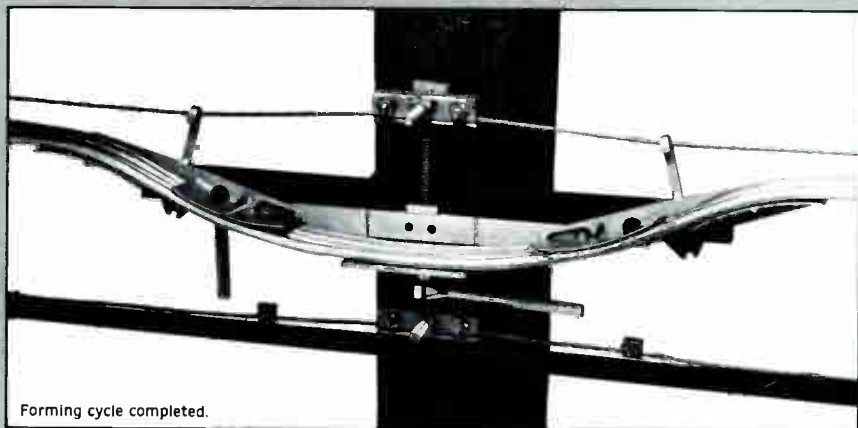
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Pioneering Design Philosophies For Addressable Service

This article, delivered at an Eastern Show technical session on addressability, discusses some of the key issues involved in the successful implementation of an addressable system based on Pioneer's past experience in developing large scale CATV addressable systems. The design philosophies for multi-pay service, pay-per-view and theft of service that developed from some rather atypical experiences of the first system are addressed, and experiences in two-way operation that influenced later two-way and one-way designs are also covered.

By Michael Hayashi, sales engineer, Pioneer Communications of America

Pioneer's venture into the CATV industry started in 1972 as one of two major corporate diversification efforts—the other being laser disc development.

In 1975, the first of 50,000 interactive terminals were delivered to Warner Cable (now Warner Amex Cable) in Columbus, on schedule, to meet the start of their well-publicized QUBE project. Pioneer's primary responsibility in this joint effort was development of the technology, mass production of addressable converters and the system control software. Warner's responsibilities were operations and development of the QUBE system. System operation began in mid-1977 with full two-way addressability to control the first multipay interactive CATV system.

Since 1977, several new models have been introduced to meet the specific needs of large metro cities such as Cincinnati, Pittsburgh, Dallas, Houston, St. Louis, Chicago, Milwaukee and others.

The BT-1000 System

Pioneer's initiation into the CATV market was not a pleasant experience. Obviously, being a first generation terminal, the BT-1000 had its technical and operational problems. As well as being addressable, Columbus QUBE was the first impulse pay-per-view capable system, providing subscribers with nine channels of 24-hour on-demand premium programming. Naturally, the perceived value of the programming was very high.

Shortly after the introduction of the first addressable terminals, subscribers developed various "cheating" methods. These methods soon spread throughout the system, even though the addressable converters in use had all the conventional theft of service protection (e.g., scrambling).

All was not lost, though, because of the upstream status reporting feature. This unique opportunity allowed us to analyze the status from individual terminals in the system. We were not only able to determine how much theft of service was occurring, but how that theft of service was taking place. We could literally "see" illegal entries into the converter, as well as "no answers" for terminals which stopped responding to the command from the control center.

We soon found that a service call on every attempt at illegal entry was not practical, but we could at least keep track of the situation. Through this costly experience in theft of service, Pioneer determined it was our corporate responsibility to design control over theft of service into the terminal and system. With this decision, the BT-1000 went through a mass modification at Pioneer's own expense.

We also learned that, as a CATV system supplier experienced in consumer products, our responsibilities must be extended to *both the cable operator and the consumer*. In other words, we had to solve the cable operator's theft of service problem *and* give the subscriber a very high grade product. If we could do that, then both parties would have a reliable system.

Here are some other things we learned about addressability from those early experiences. From the viewpoint of day to day cable operation, we quickly learned the importance of overall system integrity in order to maintain a reliable data communication path. As you know, addressability means remotely controlling certain functions of a terminal. Obviously, then, to ensure that proper services activation and correct billing take place, it is critical that all information to and from the addressable terminal is reliable.

There was also a demand for better quality on the converter side. With the start of the Columbus QUBE system back in 1977, customers were no longer 12-channel CATV subscribers, but multiple-pay subscribers. We were no longer dealing with subscribers who were receiving pictures at the mercy of the cable operator, but instead with subscribers who were buying premium merchandise. You know that in 1977 there was a lot to be desired from the quality of available converters.

Stemming from our consumer market consciousness, we felt it was our responsibility to give that new grade of subscriber a higher quality converter. That led to the employment of adjacent channel traps and an input buffer amplifier for the system to offer an interference-free picture to each subscriber.

Redesigning The BT-1000

The BT-1000 terminal, still used in the Columbus system today, is probably the only Pioneer product that ever crossed the Pacific Ocean for a major modification. But it wasn't enough to simply bandaid the

BT-1000. We had to completely redesign the unit to eliminate tampering. So again, our first experiences with tampering, coupled with a responsibility to solve the problem, provided the impetus to redesign.

Here are some of the design objectives we attempted to meet in the redesign of the two-way addressable, and some examples of how they affect the design of the one-way addressable.

Objective #1

Provide protection against theft of service. Pioneer strongly believes that "the cable operator should not give any tools to the subscriber to defeat his own system." This may sound simplistic; however, it ultimately places the problem of theft of service on the converter manufacturer as well as the cable operator.

The vast majority of bootleg converters sold on the black market today are original products that have been tampered with, rather than homemade devices. We had to make the terminal useless if broken into, and then, make the individual parts within useless as well. An example of how we accomplished this in the one-way terminal is to design the PLL circuitry right into the converter module. That converter module is nearly impossible to take out and use as a standard tuner.

Figure 1 **Cost of Unreliability**

Assuming 10,000 converter customer base, $120 per unit base

% per month failure	at 1% = 100 units	at 5% = 500 units
service call cost at $20 ea.	$ 2,000	$ 10,000
repair cost at $18 ea.	$ 1,800	$ 9,000
total cost per month recurring cost	$ 3,800/mo.	$ 19,000/mo.
total cost per year recurring cost	$45,600/yr.	$228,000/yr.
cost of service inventory first year only cost	$18,000	$ 90,000
total costs for first year (10,000 units)	$63,600	$318,000
total cost per unit first year	$6.36	$31.80
total cost per unit subsequent years	$4.56	$22.80
real per unit cost $120 base price plus failure cost		
year 1	$126.35	$151.80
year 2	$130.92	$174.60
year 3	$135.48	$197.40
year 4	$140.04	$220.20
year 5	$144.60	$243.00
year 10	$167.40	$357.00
cost of unreliability for 10 years per converter	$47.40	$237.00

Objective #2

Eliminate subscriber incentives for theft of service. The biggest incentive to beat a scrambling system comes from seeing a scrambled picture. Rather than turning a descrambler on and off, the best thing to do is off-tune the converter so your subscriber sees noise rather than scrambled video.

Another incentive to cheat can be eliminated by a sophisticated hardware configuration. We learned that the original BT-1000 was easily entered, tampered with and then reassembled. Today's

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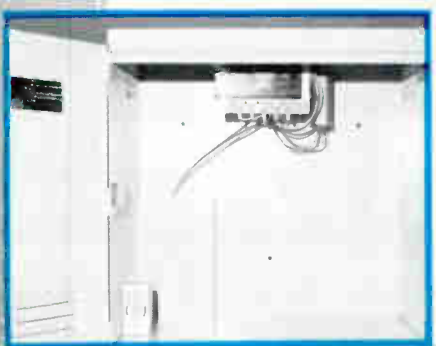

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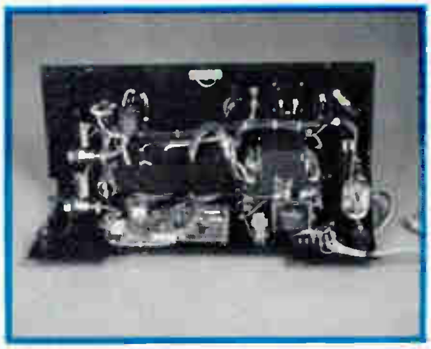

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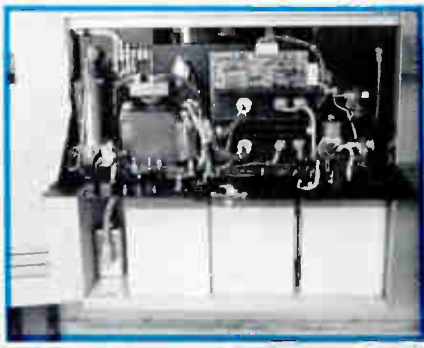

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plastic-covered terminals give the subscriber a tremendous incentive to cheat, especially when they are easily opened with conventional tools. Even if they can't figure out the circuitry, you've probably got a damaged unit on your hands.

The box must be physically protected to an extent that any attempt of illegal entry leaves some sort of physical evidence. For this reason, our addressable converters are encased in steel, and a special "access trap" is built into the design making it virtually impossible to put the box back together without returning it to the operator's service lab.

Objective #3

Prevent theft of service from within. We know that theft of service can come from within your own organization. To that end, spare parts control, inventory control and servicing methods were developed to make theft of service from within very difficult. For example, there are certain circuits within the Pioneer addressable unit designed to foil tampering attempts. Those circuits are buried deep within the three main modules and it takes a special device to reset those circuits. This design philosophy takes your converter maintenance personnel out of the circuit repair loop and out of the theft of service loop.

Objective #4

Prevent theft of service from bootleg operation. As mentioned earlier, the vast majority of the so-called black boxes available on the street today are actually tampered-with converters, rather than true bootleg devices. Effective protection against this must be a part of the design philosophy of the system as well as of the addressable converter.

A. Local disabling. If the box *is* broken into, the hardware contained in the box *must be rendered useless*. This must happen regardless of the power application. An electromechanical device to perform this function was developed during the redesign stages, and has eliminated virtually all theft of service due to tampering.

B. Detection of abnormal system status. This requirement is extremely important in the one-way addressable design since the terminal must be able to identify abnormal system status. Abnormal system status includes conditions such as loss of address, loss of clock, loss of carrier, etc., even illegal scrambling conditions.

In fact, a great burden is placed on the one-way addressable converters for identifying system problems. This is contrary to what one may think about the complexity of a one-way versus a two-way addressable unit.

For example, in a one-way system, it is left up to the addressable terminal to determine whether the data communication path disappears due to attempted theft, or actual system failure. In a two-way system, the headend contributes substantially to this function of terminal protection.

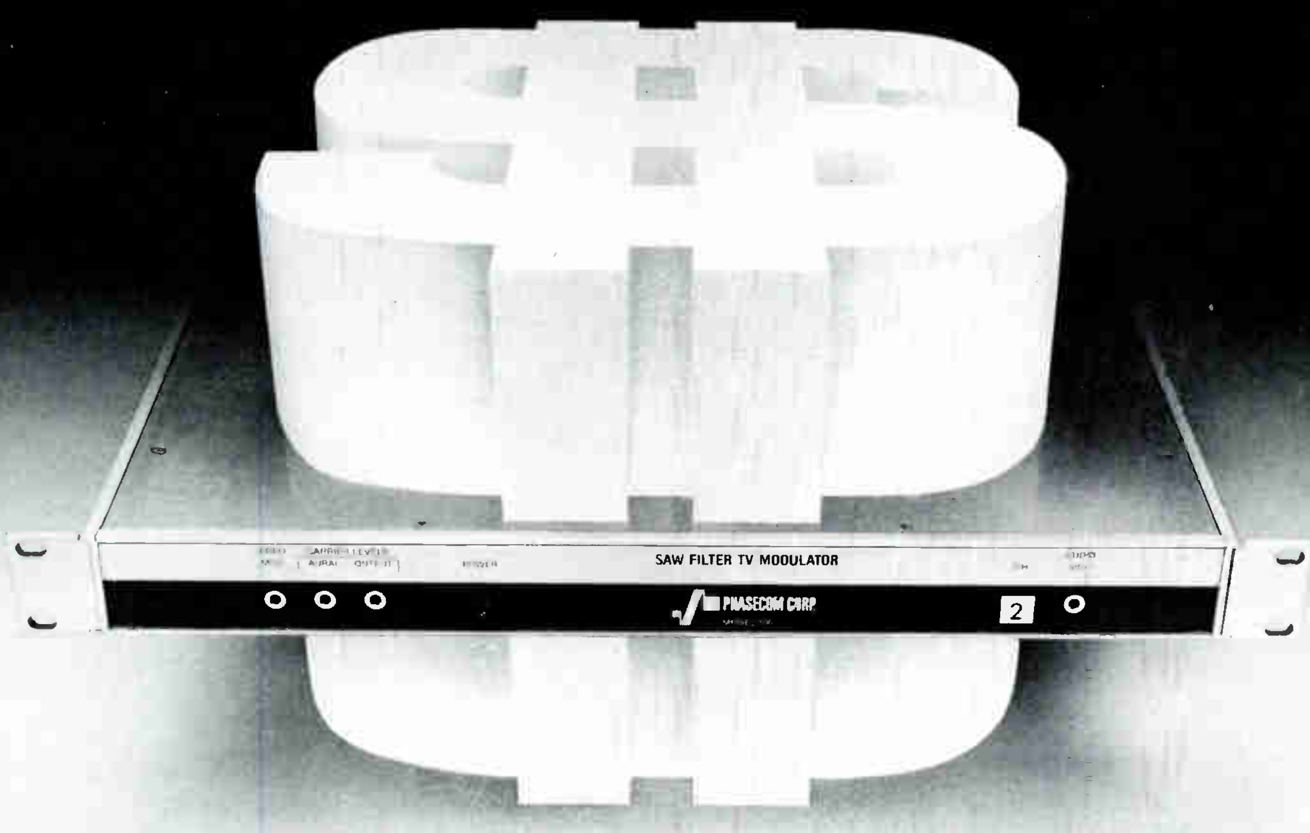
The vendor's criteria to meet all of the theft of service variables could place a considerable amount of operational restrictions on the cable operator. It's not easy designing the addressable converter so that it has this protection yet allows for normal operation such as installation and disconnects. Not only that, the unit has to be easily maintained to keep those operational costs down.

Addressable Converter Maintainability

Let's assume that we have done the job of eliminating the big problem of theft of service through tampering and other means. The next important thing we learned came not just from cable television, but from selling consumer products for years... and that is product reliability and maintainability. We can't think of anything more important to the success of addressability than reliability.

If you agree that one of the main reasons for addressability is to decrease

continued on page 57



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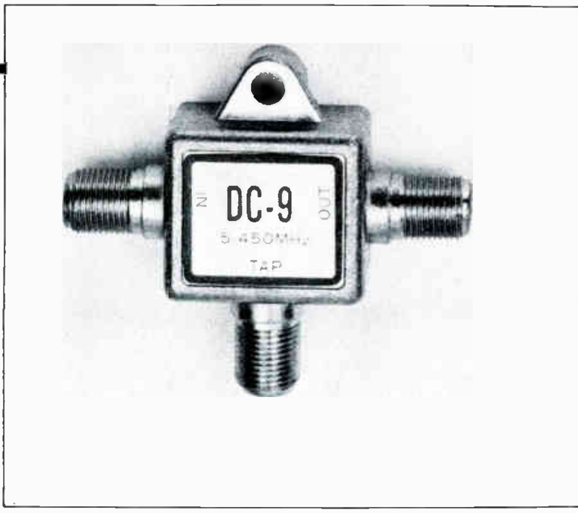
Telex: 181899

Product Profile



Directional Couplers

The directional couplers listed on the following pages are either main line passives, pedestal or wall mount couplers used for signal distribution. In most cases the manufacturer has designed the product for a specific application, but that application may be flexible depending upon the needs of the operator.

Directional couplers ease the splicing and installation of drop cable in the home and, in most cases, secure directional splices on the strand. Typically, a directional coupler is used where a cable connection would result in the bending or kinking of the cable and degrade that cable's performance. For multi-unit dwelling installations the "T" type coupler or the right angle coupler (for wall plate mounts) are convenient ways of distributing the CATV signal without having to bend or loop distribution lines.

The directional coupler is differentiated from the directional tap in that the coupler is used downstream, in or outside of the subscriber's home, totally non-power passing. The directional tap is completely power passed. Directional couplers can pass the UHF band alone or they can pass both the UHF and VHF bands.

All of the manufacturers listed stock directional couplers in varying isolation values. As always, **CED** suggests that the individual manufacturers be contacted for complete information.

The prices listed are single unit prices unless otherwise indicated.

Model	Freq. Range	Mount	Return Loss	Isolation	Insertion Loss	Hum Modulation	Special Features	Availability	Cost
Blonder-Tongue, Old Bridge, New Jersey									
4888	5-300 MHz	Pedestal or wall plate	8 dB at 5 MHz, 20 dB at 40 MHz	28 dB min.	3 dB max.	N.A.	High isolation prevents interference from other subscribers in the system. Miniature size provides flexibility for use in wall outlet boxes; anodized aluminum enclosure prevents damage to internal circuitry; available in six isolation values, non-power passing with F-type fittings.	Immediate	$6.48
C-COR Electronics Inc., State College, Pennsylvania									
S400 Series	5-450 MHz	Strand or pedestal	22 dB min.	28 dB min.	1.4 dB max.	-70 dB max.	Excellent return loss down to 5 MHz; housing tapped ⅝ inch; 24 TPI for standard entry port connectors. Center seizures accommodate up to 0.172-inch diameter center conductor; Three isolation values.	6 weeks ARO	$32 ($25.60 in lots of 50)
Century III Electronics, Anaheim, California									
3416-20	5-400 MHz	Strand	18 dB min.	N/A	2 dB max.	-60 dB max	All models use hybrid circuits; modules are retained by hex head mounting screws; power passing chokes carry up to 15 amperes; die cast aluminum alloy housing and lid; integrated silicon rubber/monel mesh gasket; stainless steel shoulders on all ports; five isolation values.	N.A.	N.A.
Gamco Industries Inc., Roselle, New Jersey									
GTO/F	5-450 MHz	Pedestal or wall plate	20 dB min.	30 dB min.	1.5 dB max.	N.A.-	Designed to allow one distribution line of low loss and one line of a pre-selected loss; for use in apartment buildings in place of cascade splitters; tap port on the face of the unit for use with wall plate; painted terneplated steel housing, "F" type fittings, five isolation values.	N.A.	N.A.
5546		Strand	18 dB min.	25 dB min.	2.2 dB max.	-70 dB max.	Designed and manufactured for mainline applications; plated die cast aluminum housing; can be used with feed-thru or pin type connectors of any size.		
General Instrument, Jerrold Division, Hatboro, Pennsylvania									
STC Series	5-450 MHz	Strand or pedestal	18 dB min.	22 dB min.	2.4 dB max.	N.A.	Cast aluminum housing adaptable for pole or pedestal mounting; developed for STARLINE series of equipment, center conductor seizure mechanism; 10 amps carrying capacity	Immediate	$34

N.A.- Not Available

Model	Freq. Range	Mount	Return Loss	Isolation	Insertion Loss	Hum Modulation	Special Features	Availability	Cost
Intercept Corporation, Clifton, New Jersey									
UVDC	5-890 MHz	Pedestal or wall plate	15 dB min.	18 dB min.	.5 dB max.	N.A.	Irridite plating; die cast housing, precision machined threads; compact size; right angle for wall mount; eight isolation values	Immediate	$1.50
Macom Industries, Los Angeles, California									
DC-DCW	5-450 MHz	Pedestal or wall plate	16 dB min.	30 dB min.	2.2 dB max.	N.A.	Zinc die cast case with machined threads; right-ange for wall plate mounting, mounting tab on DC model, AC/DC isolated on output port.	N.A.	N.A.
Magnavox CATV Systems Inc., Manlius, New York									
MX-5TFC	5-440 MHz	Strand or pedestal	18 dB min.	24 dB min.	4.3 dB max.	-70 dB max.	Model MX-5ITFC contains same electronics as model listed above but has an Irridite/Profilm finish, wire mesh gaskets and sealed F ports. 5TFC series includes 2- and 3-way splitters and 8, 12 and 16 dB isolation values; aluminum alloy body; sealed shoulders on connector bosses; 14 amp power passing and secure center conductor seizure.	Immediate	$23 (avg)
RMS Electronics Inc., Bronx, New York									
CA-1090/M	5-400 MHz	Pedestal or wall plate	15 dB min.	25 dB min.	2 dB max.	N.A.	Zinc die cast silver-plated housing, eight insertion values available.	Immediate	N.A.
CA-2090/M			16 dB min.	25 dB min.	2.1 dB max.		Right angle coupler suitable for indoor or outdoor use; totally shielded and weather-proof housing—die cast with "chromate" plating; all terminals machine threaded. Extra long tap terminal permits mounting to a wall plate. Eliminates bending of coaxial cable through direct downward and upward installation of cable.		
CA-2012/S			17 dB min.	20 dB min.	3.7 dB max.		Zinc die cast silver plated housing; non-power passing two-tap port; seven insertion values available.		
Sylvania, CATV Division, El Paso, Texas									
3600B Series	5-450 MHz	Strand or pedestal	18 dB min.	20 dB min.	2.4 dB max.	-65 dB max.	Weatherproof housings, seized center conductors; 1⅜-inches between port center lines; four isolation values.	Immediate	$17.50
Texscan/Theta-Com, Phoenix, Arizona									
XR2DC Series	5-440 MHz	Strand or pedestal	18 dB min.	20 dB min.	2.4 dB max.	N.A.	Die cast painted housing; stainless steel inserts and heat shrink collars; 100 percent pressure tested; center conductor seizure assemblies; heavy duty chokes for ten amp capacity with low hum modulation.	Immediate	$31-$43

N.A.-Not Available

ANYWAY YOU LOOK AT IT...

ADM HAS YOUR ANTENNA!

AND YOUR TVRO SYSTEM. Rapid delivery on ADM's super-efficient 11-foot polar-mount antenna (includes remote controlled polarization rotation system as well!), plus, packages are available for complete systems including LNA, 24-channel tuneable receiver and cabling. Why wait in a long line when you can get the best, today!

A SUPER TVRO ANTENNA SYSTEM. High-quality panelized aluminum 11-foot dish and steel polar mount. Dish weighs approximately 200 pounds, mount 265 pounds. Precision designed, easy installation, zinc chromate base primed and heavy-duty white top finish. The rotating feed is standard! Easily shipped and installed. Choice openings for dealers and distributors.

Antenna
Development &
Manufacturing, Inc.

P.O. Box 1178, Poplar Bluff, MO 63901 (1-314-785-5988)

Figure 2

The Case for Maintainability
30,000 terminals

non-modular design

subscriber base	at 1% failure per month	1 unit in repair =1.5 units replacement	cost per terminal	total mo. terminal inventory
30,000	400	450 units	120	54,000

modular design

subscriber base	at 1% failure per month	1 unit in repair =1.5 units replacement	replacement modules	avg. cost per module	total mo. module inventory
30,000	400	450 units	600	$20	$12,000

dollar equivalency in terminals
100 units

continued from page 49
trips to the home, then you'll understand how trips to the home to replace unreliable converters can defeat the purpose of the technology. From the vendor's point of view, it only makes sense to limit the warranty exposure as much as possible. And the way to minimize this exposure is to tightly control the quality before it leaves the factory.

Without raising the flag too high, Pioneer's mass-produced two-way addressable terminal is currently experiencing a 99 percent factory through-put rate, and that includes cosmetics. What that gives us is a very low failure rate in the field... usually less than 1 percent per month. If you've never run the numbers to see what the real cost of unreliability is, figure 1 tells the story.

Looking at a comparison on a 1 percent and 5 percent per month failure rate in a 10,000 subscriber system, your total service and repair costs, on line three, show a substantial difference. Inventory costs for repair assumes a requirement of 1.5 replacement converters for every one that fails. Line five shows those costs divided out among the 10,000 terminals in service, and line six runs it out for 10 years. You can get a pretty good idea from this chart how important reliability is to the success of your addressable system.

Even with a failure rate of less than 1 percent per month, we're still going to have terminals to repair. That needs to be done in the most cost-effective way possible. We learned the best way to do this is to go with a modular design.

The next chart (figure 2) compares the inventory costs associated with modular vs. non-modular design using a 30,000-subscriber system. A non-modular unit that fails requires 1.5 units to back it up, and the per month inventory would be $54,000. On the other hand, a modular design allows the failure rate to be spread out among the modules, and lets you stock modules at $20 each, rather than converters at $120 each. There is also a ripple effect in shipping and handling costs, not to mention the after-warranty expenses.

The last item of major importance is what we have learned by the comparison of component vs. LSI design and manufacture.

The addressable converter in demand today calls for very high technology—400 MHz technology, data communications, etc. Inevitably, circuit design becomes more complicated. The use of conventional component manufacturing techniques may result in a very complicated and difficult manufacturing procedure, as well as servicing level, thus making the product more susceptible to field failures.

Pioneer was the first to use microprocessor LSI technology for CATV application in 1975. It worked so well that we continued by introducing the first frequency synthesized PLL for the converter, custom high speed data communications LSI, one chip upstream transmitter, one chip downstream receiver and finally in the one-way addressable, the first all-in-one packaging of the converter with a built in PLL and AB switch.

At Pioneer, our goal is to continue using our experience in two-way addressability to increase the reliability features of the one-way addressable system. Targeted also are technical innovations to increase the cost performance and flexibility features of all our products. CED

Michael Hayashi is a sales engineer at Pioneer Communications of America Inc. Hayashi formerly served Pioneer as corporate engineering liaison to Warner Amex Cable Communciations, as advisor to the repair and service laboratory and as liaison to Pioneer's International Service section. He was also responsible for research and development of next-generation product lines. A graduate of St. Joseph's College in Yokohama, Japan, Hayashi received his BS degree in engineering from Harvey Mudd College in Claremont, Calif.

People News

★ **Ben Forrester** has been appointed a vice president of **Anixter Communications**. Forrester comes to Anixter from Scientific-Atlanta where he was most recently national sales manager.

In his new position at Anixter, Forrester will assume a number of responsibilities including national MSO sales, development of electronic product line sales, and sales training.

Ben Forrester

★ **Thomas Christy** has been promoted to product manager, TVRO products by **Blonder-Tongue Laboratories Inc**. Christy will be responsible for supporting B-T's TVRO market activities by assisting customers and field sales representatives in the sales, applications and installation of TVRO and related equipment.

Christy joined Blonder-Tongue in 1979 and prior to his present position was TVRO Systems Engineer.

Fred Canzano was also promoted at Blonder-Tongue to manager, technical services. In his new position, Canzano will be responsible for the operations of the company's customer service and systems engineering departments.

Canzano joined Blonder-Tongue in 1962 and has held several supervisory positions in the company's manufacturing, customer service and industrial engineering departments.

★ **James Griffin** has been appointed chief engineer for the Broadcast Video Systems function of **RCA**'s Commercial Communications Systems Division. Griffin will be responsible for all engineering activities in the design and manufacturing of RCA television cameras and videotape recorders.

Prior to this appointment, Griffin had been program manager for the digital optical disc system being developed by RCA's Government Communications Systems business unit.

Griffin joined RCA in 1960 and has held numerous positions in engineering and engineering management.

★ **John Fannetti** has been named senior technical consultant of **Microwave Filter Co. Inc.** In his new position, Fannetti will have many responsibilities including assisting with a new DBS (Direct Broadcast Satellite) R&D program. Fannetti will conduct field research, advise customers, advise and assist R&D in new product development and assist in the training of applications engineers.

Fannetti was previously president of JDF Communications, a CATV consulting firm and earth station installation and maintenance service in Canastota, N.Y. He has also been employed as director for MSOs with Ohio Cable Systems in Kentucky, as a research engineer with Syracuse University Research Corp. and as a technical specialist with General Electric in Syracuse, N.Y.

Vince Fannetti

★ **Miles Reinhart** has been named product manager, MATV, for the RF Systems Division of **General Instrument**. In this position Reinhart will be responsible for the overall marketing program for MATV products, including the division's general line of terminal and electronic products, MATV systems, antennas and towers.

Before coming to RF Systems, Reinhart was with the Siemens Corp. as product manager of discrete semiconductors.

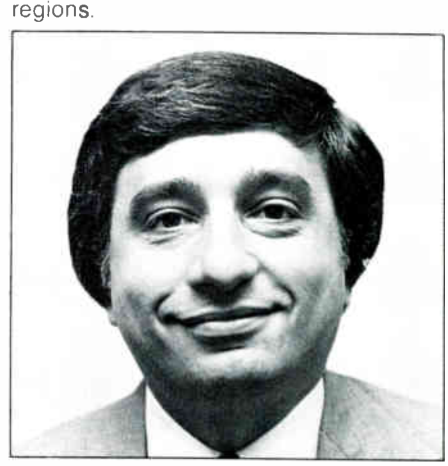
★ **Scientific-Atlanta Inc.** has appointed **Charles Rhodes** a principal engineer assigned to the company's corporate research and development unit. His primary responsibilities will be the conception and design of products to support the company's growth in communications and instrumentation.

Rhodes comes to Scientific-Atlanta from Tektronix Inc., where he was engaged for 26 years in engineering positions, principally in the design of television products. During the last four years at Tektronix he was chief engineer with staff responsibility for long-range product planning.

Additionally, Scientific-Atlanta has appointed **Dr. Michael Teichmann** as general manager of its German subsidiary, Scientific-Atlanta GMbH. Teichmann assumed his position on Sept. 1. Teichmann previously was with Micro Control Products, a U.S. firm of which he was president and chairman of the board. Prior to joining Micro Control Products, Dr. Teichman held several managerial positions with companies in the electronics field in Germany. He received his undergraduate and post-graduate degrees from the University of Aachen in West Germany. Dr. Teichmann will be located at the company's office in Munich.

★ **Joseph Checola** has been appointed sales manager for **Eagle Comtronics.** In his new position, Checola will be responsible for the management and supervision of Eagle's sales force.

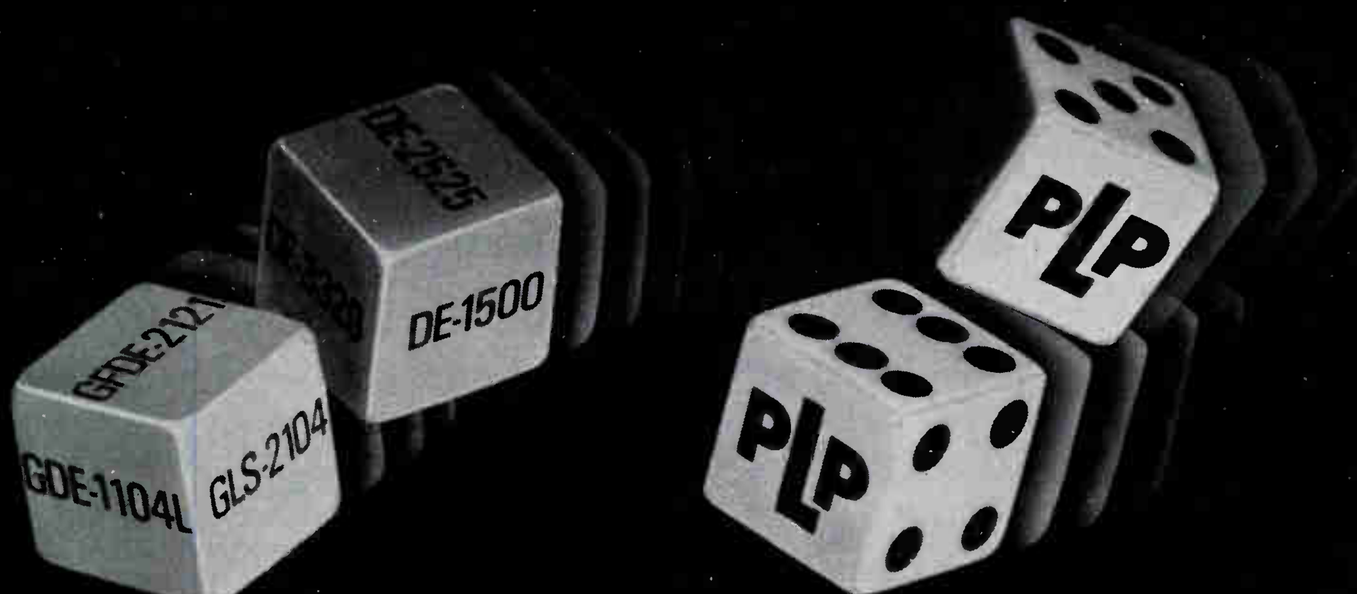
Prior to his appointment at Eagle, Checola was district sales manager at Tektronix Inc. for several east coast regions.



Joseph Checola

★ **Jack Sutton**, formerly a cable system executive, has joined Jerrold Division, **General Instrument Corp.**, to handle equipment sales in Southern California and parts of Nevada.

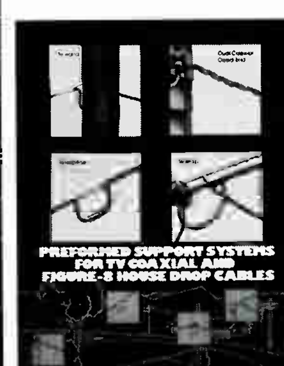
PREFORMED goes by the numbers and takes the gamble out of ordering cable construction hardware.



Get the best in CATV cable construction hardware. Order only Preformed Line Products Company parts from your supplier. And, make sure you get what you ask for by ordering "Preformed" hardware by its catalog numbers. Preformed's hardware has been the leader in the CATV industry for over 20 years.

Specify the numbers below or send for our free CATV cable construction hardware catalog. It's the difference between choice and chance. Write to Preformed Line Products Co., P. O. Box 91129, Cleveland, Ohio 44101. Phone: 216/461-5200.

For 1/4" Galvanized Steel Strand specify:	
GDE-1104L	Galvanized Guy-Grip Dead-End for 1/4" Galvanized Steel Strand
GLS-2104	Galvanized Strand Splice for 1/4" Galvanized Steel Strand
GFDE-2121	Galvanized False Dead-End for 1/4" Galvanized Steel Strand
For House Drop Coaxial Cables specify:	
DE-1500	Galvanized Telegrip for RG-59/U Coaxial Cable
DE-3329	Stainless Steel Custom Dead-End for RG-59/U Coaxial Cable
DE-2525	Galvanized Dead-End for .051 Galv. messenger of Figure 8 RG-59/U Coaxial Cable
DE-2505	Galvanized Dead-End for .063- .072 Galv. messenger of Figure 8 RG-59/U Coaxial Cable
For protection of Strand and Cables, specify:	
Plastic Guy Guards, Plastic Tree Guards, Ground Wire Molding	



PREFORMED LINE PRODUCTS

73-1-42

TRW hybrids offer something the competition can't: a real choice!

(a way to keep amplifier costs in line)

Only TRW gives you a complete line of hybrids specifically designed to produce optimum performance for systems from 30 channels to 60+. With TRW, you can be assured you're only paying for the performance you need.

TRW introduced its first hybrids in 1971 and ever since we've been the recognized leader in CATV amplifier modules. Each time the industry stepped up the channel numbers, TRW stepped in with a new transistor and a new hybrid with increased channel capacity and characteristics to fit.

The latest is our new CA5000 series "super chip" with lower distortion and a better noise figure than any other available (ask us for comparison data). And with CA5000 deliveries on schedule at any volume, TRW can deliver the best-performing hybrid on the market at a competitive price.

New CA 5000 Series "super chip."

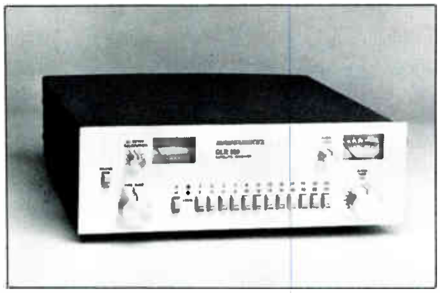
But for many new and rebuilt systems, our top-of-the-line CA5000 hybrid is more than you need for optimum performance. So TRW matches performance to price and gives you a real choice. TRW CA2000, 3000 or 4000 series are specifically designed to make fewer-than-52 channel systems play longer and stronger for less. With TRW, you don't pay for more than you need.

There's no need to channel your production requirements anywhere else. TRW has it all: performance, price. And a super choice.

Contact TRW Semiconductor Division, TRW Electronics Group, 14520 Aviation Blvd., Lawndale, California 90260, (213) 679-4561.

TRW

Semiconductor Division
TRW Electronic Components Group



Automation Techniques GLR 520

and a relative RF signal meter for constant quality check on dish orientation.

The GLR-520 also has a separate weatherized tuning module (downconverter) which can be located at the dish or at the receiver. In addition, the GLR-520 has unfiltered video output for external audio demodulators with an optional modulator with vestigial sideband filter also available. The GLR-520 is available in stand-alone configuration and has a 70 MHz output that may be run through standard coax.

For more information, contact Automation Techniques, (918) 836-2584, or see them at booths 421-423.

Portac Message Generator For SMATV, Cable Systems

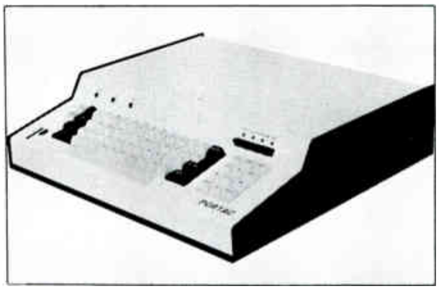
Portac has introduced a two-way telephone-coupled message generator for SMATV and cable systems. Many new SMATV installations require the use of a character generator for an information channel to display daily program schedules. This can also be used for home-owner's newsletter or local advertising, but there is always a problem of getting someone to accept responsibility for entering the information.

The new KBD-4 system from Portac eliminates this problem by enabling the cable operator to remote-load all SMATV installations from the main office over standard telephone lines.

The two-way "handshake" system permits error-free data transmission by a self-checking talk-back system that also includes automatic dialing to any remote message system within reach of the standard telephone system. The dialer will handle any area code, up to 16 digits total.

In operation, the display is first entered on the keyboard at the main office and previewed on a color monitor. Using Portac's "-P" option, it is possible to set up a complete schedule for a week in advance with different messages at varying times of each day. Then the data may be transmitted totally automatically to any number of remote locations over standard telephone lines.

Each page will then be displayed on one of six background colors in one of four display modes, vertical roll, horizontal crawl, flow (letter by letter) or static display. Twelve-page memory is standard, 24- or 56-page memory optional.



Portac message generator

Pricing for the master transmitter is $2,950 and $3,500 for the slave receiver/message generators.

For more information, contact Portac, (805) 685-2960.

New Portable Spectrum Analyzer

New from Hewlett-Packard is the model 853A spectrum-analyzer display, a ruggedized, portable mainframe incorporating a digital display system for use with HP's economically priced series of spectrum analyzer plug-ins, covering from 10 kHz to 21 GHz.

The company feels that the attributes of the new display unit, combined with the performance of the analyzer plug-ins, will make the overall instrument attractive for

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In Orbit

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
ACSN	Weekdays Weekends	6 a.m./4 p.m. 6 a.m./1 p.m.	192*/#	Satcom III-R #16
The American Network	Daily	5 p.m./5 a.m.		Satcom IV #19
ARTS		9 p.m./12 a.m.		Satcom III-R #1
BET	Daily	8 p.m./2 a.m.	406*/#	Westar V #12X
BizNet		O/V until 10/4/82		Satcom IV #15
Bravo		8 p.m./6 a.m.		Satcom IV #6
Cable Health Network		24 hrs.	None	Satcom-III R #17
CBN		24 hrs	None	Satcom III-R #8
CBS Cable	Weekends	4 30 p.m./4 30 a.m 5 p.m./5 a.m.	524*/#	Westar V # 4D
Cinemax		24 hrs	None	Satcom III-R #20 (E.C) Satcom III-R #23 (M.P)
CNN		24 hrs	None	Satcom III-R #14
CNN Headline News		24 hrs.	None	Satcom III-R #15
C-SPAN		24 hrs.	None	Satcom III-R #19
Daytime	Weekdays	1 p.m /5 p.m		Satcom III-R #22
The Entertainment Channel		24 hrs.	None	Satcom IV #8
ESPN		24 hrs	None	Satcom III-R #7
Eros	Thurs.-Sat.	11 p.m./2 a.m.		Westar IV #10D
Escapade/Playboy		8 p.m./6 a.m.		Satcom IV #7
Eternal World Television Network		8 p.m./12 p.m.		Satcom III-R #18

Major Communications Satellites Serving North America

Location: Degrees West Longitude	Satellite: Present	Satellite: Future
70		Southern Pacific-2 (Oct. 84)**
74		Galaxy-2 (Mid 84)
79		Advanced Westar-2**
83	Satcom-4	
87	Comstar-D3	Telstar-2
91	Westar-3	Advanced Westar-1**
94		SBS-3**
95	Comstar-D2 & D1	Telstar-1
97	SBS-2*	
99	Westar-4	
100	SBS-1*	
103		GTE-1*
104		Anik-C (Mid 82)
106		GTE-2*
109	Anik-B**	
114	Anik-2 & 3	
119	Satcom-2	Southern Pacific-1 (Feb. 84)**
123	Westar-2	
123.5	Westar-5	
127		Comstar-D4 (Mid 82); Telstar-3 (1986)
131	Satcom-3R	
135	Satcom-1	Galaxy-1 (Mid 82)
139		Satcom-1R (Mid 83)
143		Satcom-2R (1984)

*Ku Band
**Dual Ku/C Band

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
Financial News Network	Weekdays	10 a.m.-5 p.m.		Westar IV #9X
GalaVision	Weekdays Weekends	4 p.m.-4 a.m. 24 hrs		Westar IV #12X
HBO		24 hrs	Program 729*/# Scramble 835*/# Duplication 940*/#	Satcom III-R #24 (E.C) Satcom III-R #13, #22 (M.P)
HTN Plus	Daily	4 p.m./4 a.m		Satcom III-R #16
The Movie Channel		24 hrs	None	Satcom III-R #5
Modern Satellite Network	Weekdays	10 a.m./1 p.m.	421*/#	Satcom III-R #22
MTV: Music Television		24 hrs	None	Satcom III-R #11
National Christian Network		6 a.m./8 p.m.	073*/#	Satcom IV #7
National Jewish Television	Sundays	1 p.m /4 p.m		Satcom III-R #16
Nickelodeon		8 a.m./9 p.m.	311*/# (E.C.M) 519*/# (P)	Satcom III-R #1
PTL		24 hrs	None	Satcom III-R #2
Reuters	Weekdays	4 a.m./8 p.m.	None	Satcom III-R #18
Satellite News Channel		24 hrs.	None	Westar V #4X
SelecTV	Weekdays Weekends	8 p.m.-4 a.m. 2 p.m.-4 a.m.		Westar IV #9X
SIN		24 hrs	None	Westar IV #8X
SPN		24 hrs	None	Westar IV #11x
Showtime		24 hrs	None	Satcom III-R #12 (E.C) Satcom III-R #10 (M.P)
Spotlight		24 hrs	None	Satcom III-R #4
Trinity (KTBN)		24 hrs	None	Satcom 4 #17
USA Blackout Network		O/V after 5 p.m.		Satcom III-R #22
USA Cable Network	Daily Weekends	3 a.m./10 p.m. 10 a.m./2 a.m.	438*/#	Satcom III-R #9
WFMT		24 hrs	None	Satcom III-R #3 Subcarrier
WGN		24 hrs	None	Satcom III-R #3
WOR	Daily	24 hrs 10 a.m /5 p.m.	None	Westar V #2D
WTBS		24 hrs	None	Satcom III-R #6
The Weather Channel		24 hrs.	None	Satcom III-R #21

E=eastern M=mountain
C=central P=pacific

Alert tones listed are for sign-on, sign-off.

All program times are listed for the eastern time zone, unless otherwise noted.

THE GREAT TAP TEST.

COMPARE THESE FEATURES

FEATURE	MANUFACTURER EAGLE	R	M	J
500 MHz +	✓			
Available With Brass F Ports	✓			
Made in USA	✓		✓	
All Ports Numbered For System Audit	✓			
Lowest Insertion Loss	✓			
Epoxy Base Protective Coating	✓			
All Ports Can Utilize Traps	✓	✓	✓	
Fits in 4″ pedestal (2 & 4 way taps)	✓	✓	✓	
Sand Bond Finish On Hardware	✓		✓	
*Published Cost 4-Way Taps (Lot of 2,000)	$7.00	$9.99	$8.00	$8.25

*CE-D Product Profile November 1981

Manufacturing quality products that perform beyond the competition is tradition at Eagle.

The proof is in the comparison. Spec by spec, feature by feature, our 500 MHz taps far exceed the competition.

Compare our 500 MHz taps for yourself. You'll find there's no compromise when it comes to quality at Eagle.

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