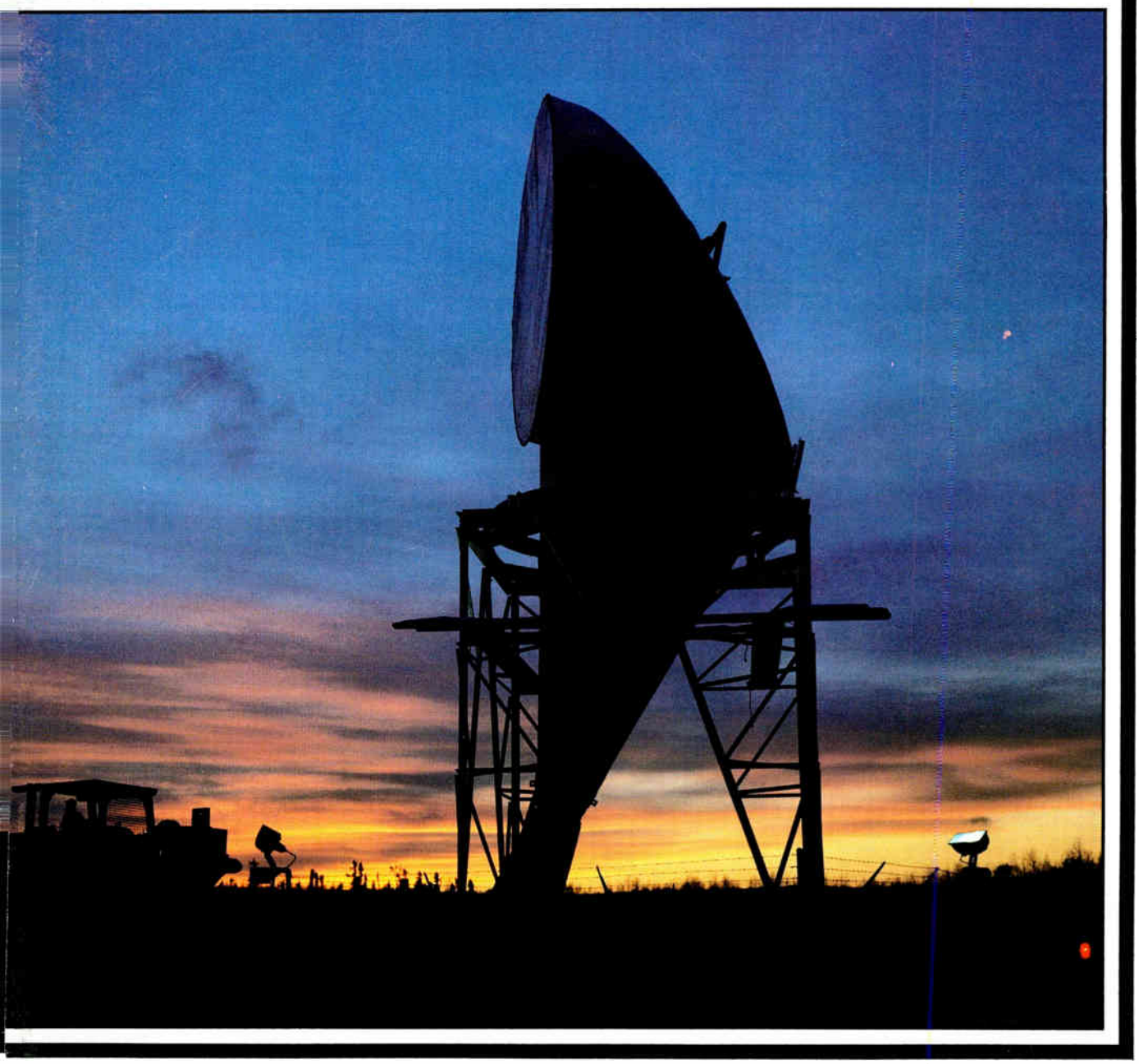
C-ED

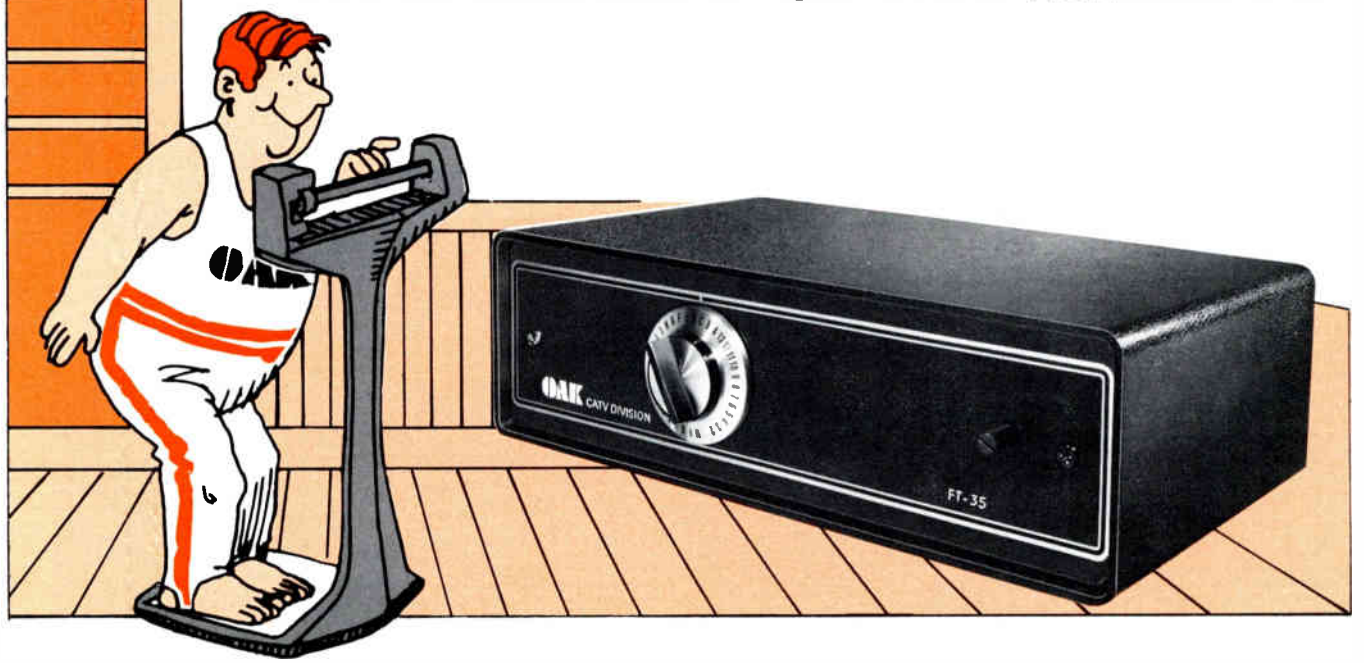
MDS and Microwave Techniques
CATV/Broadcast Subscription TV



Communications-Engineering Digest
Reporting the Technologies of Broadband Engineering

November 1978
Volume 4, No. 11

New Oak Trimline FT Reduces Overhead ...Builds Performance



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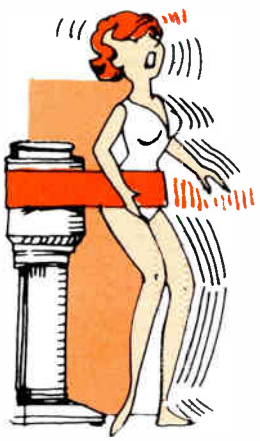

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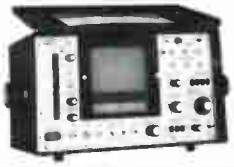

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C-ED News at a Glance

WASHINGTON, D.C.—The **Federal Communications Commission has finally eliminated the certificate of compliance process** for cable television systems.

Under the new operation, a cable system will be allowed to begin service to its customers simultaneously with the filing of limited identifying information with the FCC.

The certification process will be replaced with a simple registration procedure similar to the one used for smaller cable systems. Operators of cable systems beginning operation or adding signals will be required to file certain basic information with the FCC including system identification, location, equal employment statement and signal carriage, with a separate filing required for each community to be served.

Immediately upon filing this information, cable service may be initiated or new signals added. However, commencement of operation will be entirely at the risk of the system operator.

Cable systems with certificates of compliance now pending would be considered to be registered and are free to initiate its new operations if consistent with the new rules. The commission also stated that systems previously certified will be considered registered. No further filings, other than required annual reports, will be necessary until new services are added to its operations.

WASHINGTON, D.C.—The National Cable Television Association has issued a **call for papers for the NCTA convention** to be held **May 20-23, 1979, in Las Vegas.** Papers are welcome from all aspects of the industry on any subject of CATV interest.

Of special interest are Small Earth Stations, Protection of Service and Privacy, Training and Continuing Education and more.

NCTA is also requesting comments on the desirability of establishing a Technican's Day with a separate program, and a no-frills registration fee. See *C-ED* page 16.

WASHINGTON, D.C.—The **FCC has issued a notice of proposed rulemaking to allow the transmission of a digital source identification signal on line 20 of the vertical blanking interval (VBI).**

The rules currently allow test signals, cue and control signals to be transmitted on lines 17 through 20 of the VBI. Three of these four lines are reserved for the transmission of the vertical interval reference signal.

The rules also require that television broadcast stations authorized to operate by remote control shall utilize specified test signals inserted in the VBI on lines 17 and 18 of both fields. Line 20 of the VBI is not currently reserved for any specific use and is thus available for the transmission of any other test, cue and control signal that is in compliance with the rules.

WASHINGTON, D.C.—The **FCC has extended until May 1, 1979, the authority of the chief of its Field Operations Bureau to waive the November 1, 1977 deadline for repainting antenna towers** to conform to the new obstruction painting standards in individual cases, where warranted. See *C-ED* page 21.

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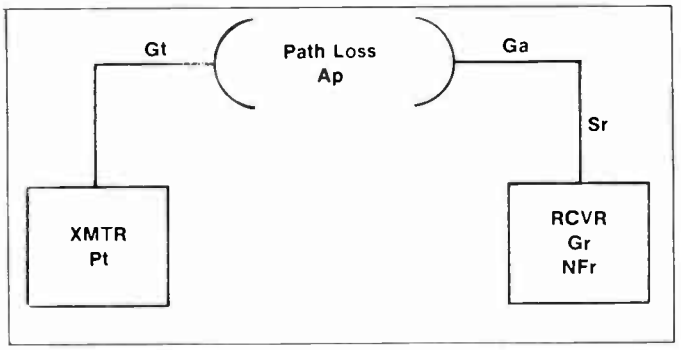

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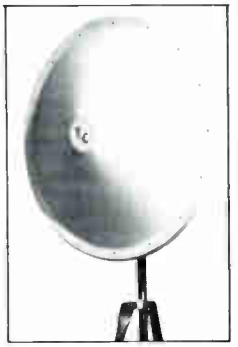

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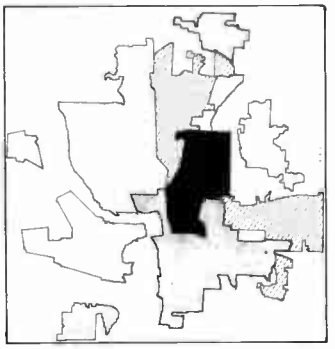

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FEATURES

DEPARTMENTS

OPINION

Cover: The November cover of *C-ED* features a conical horn, cryogenic low noise amplifier that is located directly behind Visions' office in Anchorage, Alaska. Photograph provided courtesy of Visions.

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Editor's Letter

One of the latest state-of-the-art technologies cable television is employing is the use of microwave and Multiple Distribution System equipment. Due to several breakthroughs in this field, the thrust of the November issue of *C-ED* deals with various aspects of MDS and microwave applications.

The first MDS article presented is "Using C/N to Select MDS Receiving Systems." This piece provides insight into how to choose the right receiver and antenna based on a desired carrier-to-noise ratio and output signal level. You'll find this article on page 22. The second feature article, "A Transmitter Scrambled MDS System," deals with scrambled transmissions, origination, scrambling, transmitting and receiving equipment. We believe you'll find this feature extremely useful. And that's on page 29.

An added attraction on MDS is a special two-page wrap-up of the MDS seminar recently held in Washington, D.C. That story is on page 36. And if that isn't enough MDS information for you, the Technology section on page 39 features equipment solely on microwave and MDS.

In addition to the above articles, we are presenting the first in a series by Early Monroe of the FCC entitled, "Interfacing CATV with Broadcast Subscription Television." And that starts on page 11.

Paul A. FitzPatrick

50 Channels?

By Robert Bilodeau, President
Suburban Cablevision

The FCC has under consideration Docket 21472 addressing "Saturated Systems." However, the issue of this docket relates to 12 channel systems. Would you believe there are now systems in the major markets that are confronted with the near term possibility of fully-loaded 35 channel systems!

It was just a few years ago that 300 MHz was more than anyone would need (or pay for) and the industry settled in on that "upper frequency" limit. But what about 400 MHz 50 channel systems—practical or not practical? Surely not, you say quickly! However, when you ponder the improvements in system design, improvements in cable attenuation, passive hardware bandwidth additions, and the capability to tune active devices beyond 300 MHz, it gives you pause. In fact, some recent municipal applications have offered 50 channel systems (see Agra Industries application - Fort Lauderdale, Florida). In Suburban's North Jersey area we currently are carrying information on 29 positions with six channels set aside (per hub) for access use. We have available only non-prime portions of four or five channels for future growth. We would like to consider new program services by satellite, alarm and security services, the addition of a regional program network feed, etc. Where will we find the space? We have reached the happy circumstance in three years of having to establish priorities on channel use.

Let's consider the hardware requirements. Certain kinds of cable will have return loss characteristics disfavoring the region above 300 MHz. That will have to be a careful consideration. Converters are currently being manufactured by at least one company for 40 channel use—but not 50! Active devices can be extended with resultant sacrifices in spacing. This latter may be offset when compared to the cable attenuations of five years ago. Headend equipment should present no lasting difficulty except for that of availability. With Docket 21505 re: the expansion of CARS to 13,200 MHz, LDS broadband microwave can become 50 channel capable—and so forth and so on.

One question remains—I cannot answer it—Is the timing of this stretch of existing technology poor (or fatal) with respect to the introduction of fiberoptics to CATV transportation requirements? If the optimists are right, then considerations along these lines are somewhat specious. If they're wrong and fiberoptics on a total system capability basis is still some distance away, then the industry ought to look hard at 400 MHz coax systems. As further protection, why not study this model in any event to determine the cost effectiveness of same and be protected on both counts.

This discussion seems to separate even further the concept of the classic CATV situation from that of the broadband multifaceted service type business.

New Director of Membership Services and Publications For SCTE

WASHINGTON, D.C.—The Society of Cable Television Engineers has added Mila Albertson as its Director of Membership Services and Publications. Albertson is a familiar name to the cable industry. She has been with Television Digest, Inc. since 1970 in the capacity of assistant editor for the cable section of the *Television Factbook* and for the *CATV Addendum*.

This new position with the SCTE was created for Albertson after she began assisting executive director Judy Baer part-time. It soon became apparent that SCTE needed more than one person in the Washington office.

In her new capacity Albertson will be involved with handling all of the membership services, helping to organize conferences and producing publications and ads.

Roaring Success in Nashville

NASHVILLE, TENNESSEE—Over thirty table-top exhibits and special workshops on scheduling, make-ready, balancing, strand-mapping and more were featured at the Society of Cable Television Engineer's Southcentral regional conference on construction October 23-24 in Nashville, Tennessee.

Over 162 registrants attended from 33 states, including Canada, Mexico and Puerto Rico. Technical sessions were held in the mornings and workshops were conducted in the afternoons. The exhibit hall was well laid-out and exhibitors had a customer ratio of 4:1. Brian Lamb, president of C-SPAN, was the guest speaker at lunch.

On the evening of October 23, SCTE had a pumpkin carving party in honor of Halloween. The pumpkins were then donated as a group effort from SCTE to one of Nashville's local children's wards.

SCTE Membership Tops 1,500

WASHINGTON, D.C.—Tom Townsend, construction engineer for Fox Cities Communications in Appleton, Wisconsin, is SCTE's member number 1,500. Townsend's application for membership was received September 6, 1978, and opened at random. SCTE membership is growing at a phenomenal rate, with an average of 75 new members joining each month.

Townsend, 33, has been with Fox Cities for one year. Prior to that he was with Pleasanton Cable in northern California for seven years. He is a resident of Green Bay, Wisconsin.

SCTE membership is expected to rise to approximately 1,700 by December 31, 1978. Growth in 1979 is expected to bring the membership rolls well over 2,000. The recent influx of members is the result of existing SCTE member recruitment in the field and increasing exposure of SCTE at state and regional association meetings.

SCTE Health and Safety Manuals Offered in Bulk For MSOs

WASHINGTON, D.C.—Western Communications has ordered five SCTE CATV Health & Safety Manuals for delivery to its systems in California and New Mexico. Teleprompter has ordered 15 manuals to be delivered to district engineers in Worcester, Massachusetts; Ventnor, New Jersey; Clarksburg, West Virginia; Horseheads, New York; LaCross, Wisconsin; Iron Mountain, Michigan; Galveston, Texas; Florence, Alabama; Lakeland, Florida; Mobile, Alabama; Seattle, Washington; Lewiston, Idaho; Oakland and San Bernadino, California; and El Paso, Texas.

SCTE is currently supplying the 24-unit once-per-month safety program to nearly 200 CATV systems nationwide.

Members to Receive Directory As November Issue of "The Interval"

WASHINGTON, D.C.—Every SCTE member will receive one copy of the 144-page 1978 SCTE Annual Report and Membership Directory in November. The publication will supplement the yearly 11 issues of "The Interval."

Charter members have been interviewed and most answered two questions: What was the most significant technical innovation in CATV over the past 30 years?; and, What will be the most important technical advancement of the industry by the year 2000? The answers are interesting, as nearly 70 CATV engineers, technicians, managers and SCTE charter members share their thoughts.

Also included will be a number of historical articles on CATV, a view to the future, photographs, charts and special breakouts of sustaining charter and senior SCTE members.

One copy of the publication will be sent to every SCTE member on record as of October 15, 1978 free of charge as a member service. Purchase price for the 1978 SCTE Membership Directory will be $20 to members added after October 15th and $30 to non-members.

Look for SCTE Exhibit at CATV Meetings

ATLANTA, GEORGIA—SCTE introduced a table-top exhibit of its own at the Southern Cable Television Association meeting in Atlanta, Georgia, September 24-26 at the Downtown Atlanta Marriott. Since many members and potential members have visited with SCTE at nearly 25 state and regional association meetings over the last nine months, SCTE wished to create a presentation which would provide a standard backdrop for its programs.

Scientific-Atlanta and CATV System Attack Energy Costs

MONROE, GEORGIA—SCTE sustaining member company Scientific-Atlanta is involved in one of the first applications of energy management through an existing CATV system with the municipally-owned system in Monroe, Georgia. The program operates through a master control unit and over 1,000 appliance controllers provided through S-A technology. The system controls electrical utility loads.

The appliance controllers will be used to control the peak demand of electricity during hot summer days.

The S-A load control equipment utilizes a combination of cable and power line carrier. While the system at Monroe is capable of two-way communication, the load control system only requires one-way communication. Scientific-Atlanta has stated that the concept can be used in all systems in place today.

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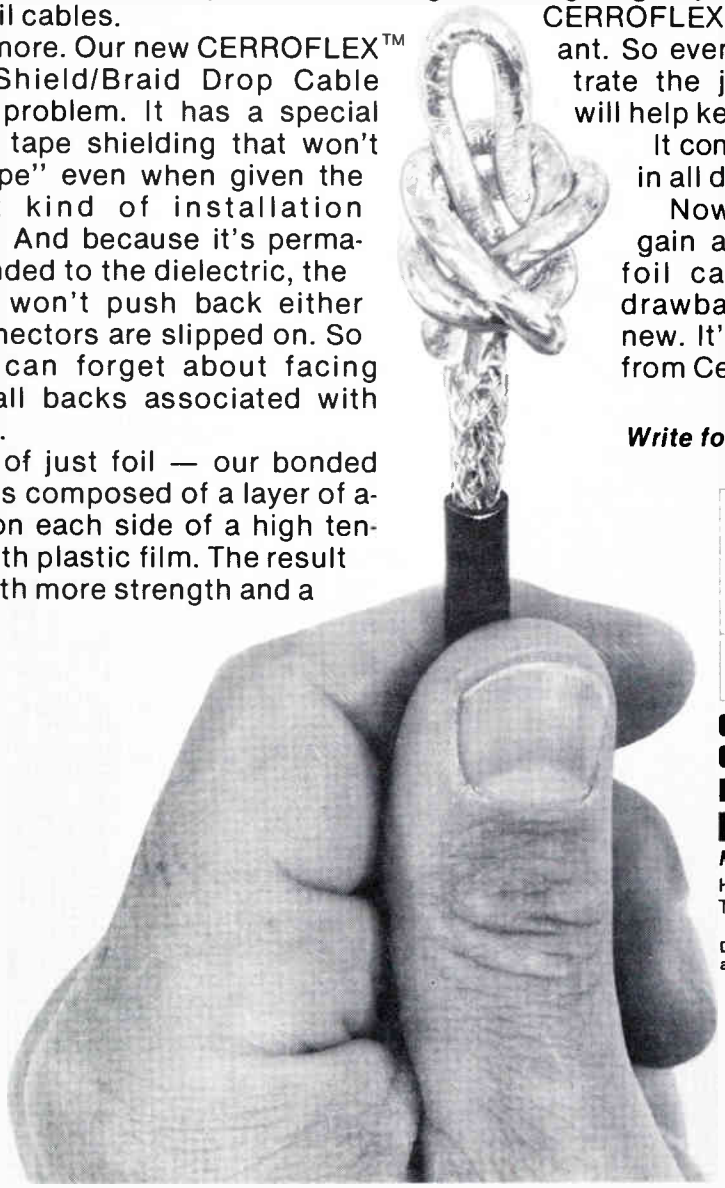

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PART I

Interfacing Cable Television and Broadcast Subscription Television

By Early D. Monroe, Jr.
Federal Communications Commission
Cable Television Bureau
Policy Review and Development

One of the primary technical advantages with coaxial cable television for telecommunication purposes is the cable system's technical compatibility with most of the newly developed communication systems.

Cable television systems may be confronted with technical compatibility problems if they are required to carry both the Broadcast Subscription Television (BSTV) station's premium and "free" programs. While there may not be a channel capacity problem in offering more than one type of premium program, there are compatibility problems involving the delivery of BSTV and cable premium programs over the same cable system.

By Public Notice dated November 15, 1977, the Federal Communications Commission identified seven BSTV systems which had received "advance system approval." These systems are not compatible. Moreover, there are applications presently pending before the commission for a waiver of "the one BSTV station to a community" rule. If this rule is waived, this would further complicate the compatibility/interfacing problem between cable and BSTV. Cable systems may choose to carry other over-the-air premium signals with little or no technical interfacing problems. This is evident from system carriage of: HBO's programs via satellite, and Multipoint Distribution Service (MDS) signals. This paper will only focus on premium BSTV program carriage on cable systems.

BSTV premium carriage on cable systems presents varying degrees of technical problems for all cable systems since all the BSTV systems involve encoding both the video and audio.

This paper will address: some of the technical, compatibility problems between various types of cable systems; specific hypothetical encoding and decoding techniques which could be proposed by BSTV stations; how interfacing can be accomplished; circumstances under which piracy can occur; and what can be done to minimize piracy.

Types of Cable Systems

For the purpose of examining specific types of cable systems in conjunction with BSTV stations, we will assume that the FCC has a rule requiring cable systems to carry BSTV stations coded programming if the cable system serves a community located within the BSTV station's Grade B contour.

Technically, there are three basic types of cable television systems. They are: 1) the Single-Cable-Non-Converter cable system; 2) the Multi-Cable-Switcher-System; and 3) the Converter-Cable-System. The Single-Cable-Non-Converter system attaches directly to a matching transformer for connection to the back of the subscriber's receiver at the 300 ohm input antenna terminal. This system has a maximum TV channel capacity of the standard 12 VHF television channels. Moreover, the cable operators normally remove the off-air-antenna when a cable connection is made (see Figure 1).

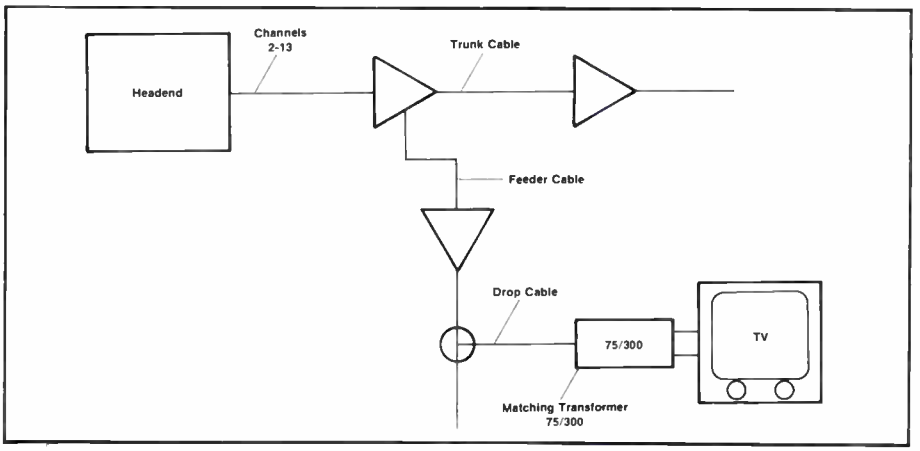

Figure 1
Single-Cable Non-Converter-System

The Multi-Cable-Switcher-System utilizes two or more cables on the distribution plant up to the subscriber's terminal, where a switch is then installed containing a single 75 ohm cable output which is attached to a matching transformer containing a 300 ohm twin lead that connects to the back of the subscriber's receiver at the 300 ohm input antenna terminal. This system's channel capacity depends on the number of distribution cables, with a maximum of 12 TV channels per cable. The majority of Multi-Cable-Switcher-Systems are dual cable systems with a capacity of 24 TV channels selected from "A" and "B" cables using a switch at the back of the subscriber's receiver (see Figure 2).

The Converter-Cable-System is a system utilizing a converter at the subscriber's terminal which attaches to the receiver preempting the television set tuner. This system's TV channel capacity is normally in excess of 30 depending on the type of converter and/or the number of distribution cables utilized (see Figure 3).

These three types of cable systems and the combination of the Multi-Cable-Switcher and Converter-Cable-System constitute the vast majority of cable systems in operation throughout the country. Therefore, interfacing of of BSTV premium programming over cable systems will be limited to a discussion of these three systems.

Types of BSTV Premium Systems

By Public Notice dated November 15, 1977, FCC-91486, the commission identified seven BSTV systems which had received "advance system approval." [The systems are: 1) Zenith Radio Corp.-Phonevision; 2) Blonder-Tongue-

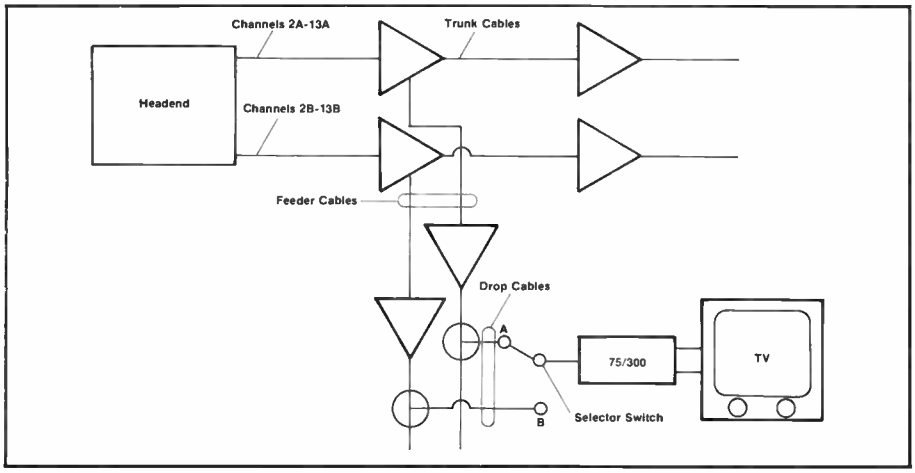

Figure 2
Multi-Cable-Switcher-System

Number 4745; 3) Feature Film Service, Inc.-Model FFS-2000; 4) Oak Industries, Inc.-Model I; 5) Pay Television Corp. - PTV System 3; 6) Teleglobe, Inc. - Number 410; and 7) System Development Corp. - SCD Pay TV System. One other system is pending from MELCO which proposes to only scramble the audio, and the commission has denied one system filed by Tanner Electronics.] As indicated earlier, these systems are not compatible. Using three imaginary, hypothetical premium systems, the non-compatibility characteristic of premium systems can be demonstrated. These hypothetical systems were constructed by extracting technical data from available data submitted to the commission. The propriety of the material would not allow the author to specifically discuss any of the type approved systems.

These premium systems are not intended to describe any of the BSTV systems which are pending or which have secured system approval from the FCC. These are imaginary, hypothetical systems described to focus on the problems confronting cable systems if the commission were to require carriage of BSTV station's premium programming. The premium systems are described in a manner to include a close replica of a premium system which may be utilized by a BSTV station, MDS station and/or a premium satellite signal (e.g. HBO). These imaginary systems will be identified as STV-Model-1, 2, and 3 premium systems.

STV-Model-1

The Model-1 system encodes by cutting the conventional 525 line television picture into many horizontal segments of a specific number of lines each. Alternate number of line segments are continuously shifted back and forth horizontally, while the divisions between these specific number of line segments randomly shift their position, producing a visual effect of picture segments moving up and down vertically. The combination results in a satisfactory breakup of the picture with little intelligibility. In addition, the video signals are transmitted with the black and white inverted similar to a photographic negative.

Video segments not shifted in the coding process are shifted in the decoding process, while segments that are shifted in coding are not in decoding. This makes the video coding process at the transmitter complementary to the video decoding at the receiver.

The audio accompanying the encoded video is scrambled by shifting the audio in frequency. The decoding of the audio is accomplished by shifting the audio back to its original frequency.

The video coding is varied from program to program. Therefore, the coding pattern information needed by the decoder will change from program to program. The coded broadcast signals cannot be decoded without the combined use by each subscriber of the following combined steps:

A "Pressure" signal is transmitted over the air as part of the Model-1 broadcast and both subscribers and non-subscribers can receive this "Pressure" signal. However, decoding does not occur until a ticket, which is mailed to all subscribers, is inserted into the decoder (see Figure 4).

STV-Model-2

The Model-2 system multiplexes discrete spectrum bandwidth for transmission of visual, chrominance, barker aural, digital control and digital aural signals. The visual, chrominance, and barker aural information are transmitted together on a single channel as is standard for NTSC color transmission. However, a second grouping of signals is utilized for transmission of a digital, frequency-shift-keyed signal containing a stream of specified bit serial binary data and a digital frequency-shift-keyed signal containing a stream of specific bit serial binary data.

The Model-2 system frequency-division multiplexes the frequency-shift-keyed signals with the visual portion of the television signal in a single broadcast TV channel. The carrier frequency of the amplitude modulated visual signal, frequency modulated control signal, frequency modulated aural signal, and phase modulated chrominance signal all

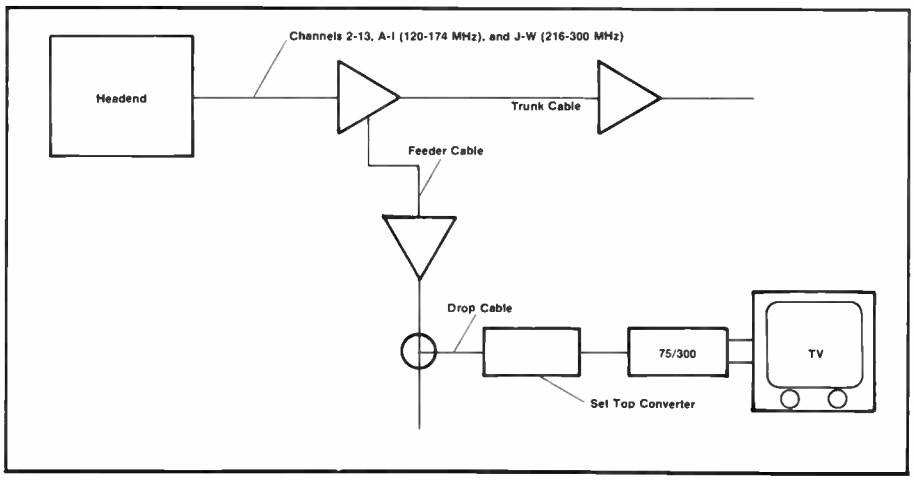

Figure 3
Converter-Cable-System

occupy the same bandwidth, but at different center frequencies.

Separate discriminator and synchronous detector circuits in the receiver's intermediate frequency amplifier and detector circuit boards sort out the four signal components. This method of overlapping AM and FM signals is identical in principle to recently proposed methods for broadcast of stereo on the AM standard broadcast band channel.

The STV-Model-2 decoder attaches to the subscriber's receiver's 300 ohm antenna lead and to a standard four-prong telephone socket. When a subscriber requests service he depresses a button on his decoder. Automatically his decoder places a telephone call to the broadcaster's facility and sends data over the telephone network containing the subscriber's account number and requested code.

picture can be viewed.

STV-Model-3

The Model-3 system employs a method which uses an interference signal impressed on the normal composite video signal, including the intercarrier audio signal, in a phase relationship to the horizontal sync pulses. This reduces the amplitude of the sync pulses and simultaneously increases the video content between pulses.

A receiver seeing this encoded signal will attempt to achieve horizontal lock on the highest instantaneous signal level detected which is now in a new position from a normal television broadcast signal transmitted in the United States. The randomness inherent in video information will add to the receiver's difficulty in achieving horizontal lock and the resulting picture is unwatchable because of improper lock

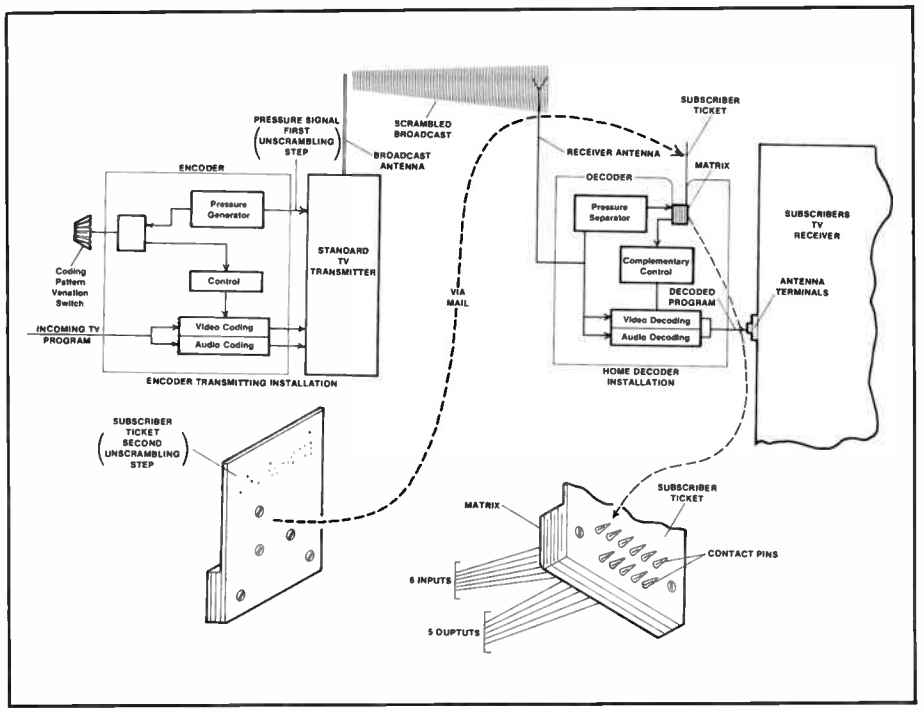

Figure 4

BASIC ELEMENTS OF THE STV MODEL-1 SYSTEM

A computer at the broadcaster's site stores this data and the telephone call is terminated. At the appropriate time, the broadcaster sends the control signals to unlock the subscriber's decoder box and the otherwise scrambled audio and video on the television receiver is restored. When the broadcaster no longer sends the account code of a particular decoder box in his control signal, the decoder automatically locks up and only a coded and horizontal tearing.

The decoder, which attaches to the subscriber's receiver's 300 ohm antenna terminal, is activated by simply turning a switch to the premium mode.

Interfacing

If the commission were to require cable systems to carry the BSTV station's premium program, the commission should also require that the BSTV station premium system comply with the technical transmission standards codified in Section 73.682 of the Rules for conventional television broadcast stations. Moreover, a premium system receiving "system approval" from the commission does not necessarily mean that when the system is installed and operated by the BSTV station, the station will comply with the transmission standards codified under Section 73.682 or 73.644. Section 73.644 of the Rules contains technical standards applicable to BSTV stations' equipment and system performance.

Existing cable systems have been designed and built to carry television station signals meeting the requirement of Section 73.682 of the Rules. Cable systems carrying stations meeting the standards under Section 73.682 require that the cable system be designed and built in accordance with certain specifications, utilizing specific types of active and/or passive equipment in order to comply with the cable television technical standards codified under Section 76.605 of the Rules.

While it appears relatively easy for the premium signal out of the BSTV station subscriber's decoder to violate Section 73.682, especially in reference to overmodulating the audio, an assumption will be made that the three hypothetical premium systems transmit signals in compliance with Sections 73.682 and 73.644 of the Rules. However, it must be emphasized that if the commission decides to create separate technical standards for BSTV premium signals out of the decoder, no requirement pertaining to cable system carriage of BSTV premium signals should be instituted without ascertaining the impact on cable systems.

Assuming that the STV-Models-1, 2 and 3 premium systems meet the standards under Sections 73.682 and 73.644, one can then examine how these imaginary premium systems can be carried on the three types of cable systems identified above.

The operator of the Single-Cable-Non-Converter (S-C-N-C) system can carry any one of the three types of hypothetical premium systems with little or no technical difficulty. BSTV premium signals can be carried and unscrambled on a cable system in two ways: 1) unscrambling the signal at the headend; or 2) unscrambling at the subscriber's terminal.

Part II will appear in the December issue of CED.

If we didn't foil the horrors of crack 'n crunch, someone else might be number one.

When interference invades drop cable through tigerstripe cracks or through crunched foil at the connectors, you can't blame subscribers for being a little upset. But Crack 'n Crunch doesn't happen with Times' new 'Lumiseal.

Times' drop cable is designed with aluminum foil laminated to each side of high strength polypropolene tape in order to tame tigerstriping. In 'Lumiseal this composite foil is sealed directly to the dielectric. So it can't crunch up when you put on the connector. Rather, the connector slips on quickly and smoothly assuring maximum RFI integrity. Furthermore, by heat sealing the foil to the dielectric the possibility of moisture migration is practically eliminated.

'Lumiseal is available in RG-59 and RG-6 sizes; with either heavy or extra-heavy braid coverage. Try it. We think you'll agree it's the number one drop cable from the number one cable company.

For more information, just contact Times Wire & Cable, Wallingford, CT (800) 243-6904. Or call your nearest Man From Times.

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800-243-6904
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Merits of CS² Technology Debated in Telco Cross-Ownership Docket

WASHINGTON, D.C.—Research conducted by the NCTA for its filing in the FCC's rural telephone cross-ownership proceeding appears to be at odds with findings submitted by the Rural Electrification Association over the economy and applicability of providing rural communications services using the CS² integrated technology developed by the 3M Company.

In its filing, NCTA proposed a three-tiered approach to providing service to "underserved, low-density rural areas:

- In areas where density is below six homes per mile, telephone companies should be permitted to offer cable television service with a simplified FCC waiver process including FCC approval and telco notification to potential independent cable operators who might serve the area.
- In areas 6-20 homes per mile density, telephone companies seeking cross-ownership waiver should bear the burden of proving that cable television service would be otherwise unavailable. A simplified filing should be required consisting primarily of information developed as part of the telephone company's own consideration of broadband investment. Again, notice to potential independent cable operators should be required.
- In areas with over 20 homes per mile, telephone company broadband service should be strictly limited, with telephone companies assuming considerable burden of proving that monopoly service is the only alternative. Telephone companies should be required to submit cost analyses and demonstrate efforts to obtain independent broadband services.

The Community Antenna Television Association suggested in its filing that further inquiry into the entire matter was necessary, but also offered a homes per mile threshold of ten for its rule of thumb.

Although the original petition for waiver of the rules was filed by the National Telephone Cooperative Association, the REA, which through its low-cost loans, funds a majority of the Associations membership, has taken an active interest in the proceeding. Based on its own as well as independent research it commissioned, REA suggested that a 26 percent cost savings could be realized through the construction and operation of an integrated telephone/CATV system utilizing CS². A Department of Commerce study shows virtually no cost differentiation.

Meanwhile, NCTA's preliminary research indicates that CS² is "a technology of rather limited application, with cost savings possible only in low density areas with a very small and stable population. Cost savings," NCTA said, "are only obtainable if the telephone system in the given community is ready for total rebuild."

"The CS² interface units, at $200 per home, are complex electronic circuits needed to bridge the telephone industry's main switcher and the CATV-fashioned, broadband distribution system. The other new cost associated

with the CS² model is the subscriber terminal unit, required at each subscriber location to interface the integrated CS² distribution system with the subscriber's TV and telephone. These units are estimated to be approximately $300 each," said NCTA.

Other findings:

—Reliability could be a problem due to the added complexity of CS² over separate telephone, CATV and cable systems. Further, with the CS² system, all information/telephone and broadband services would be interrupted by a single system outage.

—CS² uses a plant construction technique known as 'pressure tap distribution system.' The technology was developed and abandoned many years ago by the cable industry because it was found to be unreliable, prone to interference and not capable of maintaining consistent quality signals.

—Privacy of telephone conversations could be more difficult to protect in a CS² system. All conversations are available to each home through the STU, which selects the desired signal according to internal circuits. Internal modification of STVs to permit easy access to other conversations appear to be possible.

—There is a 300 volt current through the entire length of the CS² system, significantly higher than in traditional telephone or CATV distribution systems. Even though the cable and STU's can be designed to handle such high voltage, there is an additional shock hazard to both maintenance personnel and subscribers.

NCTA's Call for Papers For Las Vagas

WASHINGTON, D.C.—The National Cable Television Association is now developing the technical program for its 28th annual convention May 20-23, 1979, at Las Vegas, Nevada.

Papers are welcome from all aspects of the industry on any subject of cable television interest. Of special interest are the following categories:

- Small Earth Stations
- Protection of Service and Privacy
- Testing and Maintenance
- Rural Distribution of CATV Signals
- Training and Continuing Education
- Interference
- Two-Way
- Small System Problems
- Pay Cable
- Fiberoptics
- Low Cost Microwave
- Signal Leakage
- Advanced Techniques
- Foreign Developments

Papers should be prepared for 15-minute presentation time and additional time will be provided for discussion. Slide and transparancy projectors will be available, and other audio-video aids can be arranged upon request.

Persons interested in preparing a paper for the technical sessions are requested to express their interest by submission of a one-page, 150-word abstract and candid photo no later than November 30, 1978. (Abstracts and photos will be used for publicity purposes.)

If your paper is selected, you will be notified by December 15, 1978. Your complete paper will then be due March 30, 1979 for publication in the NCTA Official Convention Transcript.

Also, NCTA requests industry comments on the desirability of establishing a Technician's Day with its own separate program and an attractive no frills, special registration fee.

Submit your abstracts, comments and suggestions to: Robert A. Luff, NCTA, 918-16th Street, NW, Washington, D.C. 20006, (202) 457-6700.

FCC Moves Toward Zero-Based Regulation of Cable

WASHINGTON, D.C.—The Federal Communications Commission's Cable Bureau met recently in a special session with an agenda tailored to deregulating the cable industry. Inspired by FCC Chairman Charles D. Ferris' statement in August that the industry has been overregulated at the federal level, the FCC is now trying to implement what it terms "zero-based regulation."

Results of the special agenda include the announcement that service requirements on the broadcasters have been eliminated—the cable certification process will be done away with.

New cable systems wishing to carry a consistent signal may now commence carriage of signals as soon as they have filed a registration statement. Previously, there was a 30-day waiting period after the application went on public notice. Cable systems usually were required to wait at least four weeks after filing to begin carriage. In many cases, that waiting

period spanned several months.

Cable systems wishing to carry an inconsistent signal, on the other hand, now have new, less stringent requirements. They must still file a waiver request with the FCC, but if they meet certain criteria, they can receive a waiver from usual FCC rules. Systems carrying inconsistent signals could actually begin signal carriage as soon as they file a registration statement, but the FCC strongly discourages them from doing so. Instead, they can begin signal carriage as soon as they receive FCC approval.

One offshoot of zero-based regulation of cable by the FCC will be the elimination of approximately 20 positions in the Cable Bureau. Some of the personnel being reassigned may take over cable monitoring functions. Overall, FCC spokesmen seem to feel the commission is moving in the right direction toward the fulfillment of its own goals and those of cable operators.

Antenna Repainting Waiver Authority Extended

WASHINGTON, D.C.—The Federal Communications Commission has extended until May 1, 1979, the authority of the chief of its Field Operations Bureau to waive the November 1, 1977 deadline for repainting antenna towers to conform to the new obstruction painting standards in individual cases, where warranted.

On July 28, 1977, the FCC authorized the bureau to waive the requirements of Sections 17.23 and 17.43(b) of the rules requiring antenna structures up to 700 feet high to be painted with seven alternate aviation orange and white bands by November 1, 1977. It later extended that authority to October 31, 1978.

The FCC pointed out that in some cases, due to pending moves of transmitter sites or changes in antenna height involving replacement or dismantlement of towers, further extension of the repainting deadline may be warranted.

The commission said waiver would be at the discretion of the bureau when it was determined that the existing obstruction painting was in satisfactory condition and the issuance of the waiver would not adversely affect air navigation safety. (See the September issue of *C-ED*).

Using C/N To Select MDS Receiving Systems

By Bert L. Henscheid, Director of Engineering
Theta-Com CATV
Phoenix, Arizona

The MDS receiver and antenna system should be chosen for each site based on a desired carrier-to-noise ratio and output signal level. Knowledge of the transmitter power, antenna gain and pattern, path loss, obstructions, climatic environment, and receiver and receiving antenna specifications is essential. Initial site survey during daylight is necessary to determine if a line of sight path is possible. Buildings are an obvious obstruction but fully leafed trees cause an extremely high attenuation of signal.

The first step in choosing the right receiver for a given site is to select the desired carrier-to-noise ratio. The prevailing market may largely determine how good the performance has to be. The TASO Report of 1959 may also be used as a guide. Once the carrier-to-noise ratio is known, the desired input signal level to the receiver can be calculated as follows:

$$Sr = NFr - 108 + C/N \text{ dBm} \quad (1)$$

where the carrier-to-noise ratio, C/N, is a positive number and NFr is the noise figure of the receiver. This noise figure can be obtained from the receiver manufacturer's data sheets.

Path Loss Calculation

The signal level into the antenna is a function only of the transmitted power and the path loss. If the receive site is in direct line of sight with the transmit antenna and there are no obstacles such as trees or buildings, the path loss will consist of free space attenuation only. To calculate free space attenuation, use the following equation:

$$Ap = 36.6 + 20 \log f + 20 \log D \quad (2)$$

where f is the frequency in MHz and D is the distance in miles. For the MDS frequency of 2154.75 MHz, the path loss is:

$$Ap = 103.26 + 20 \log D \quad (3)$$

The signal level at the receive antenna is the radiated power minus the path loss. The radiated power, Po, is determined by adding the rated power of the transmitter, Pt, to the gain of the antenna, Gt.

$$Po = Pt + Gt \quad (4)$$

The signal level, Sa, at the input of the receive antenna is then:

$$Sa = Po + Ap \quad (5)$$
$$= Pt + Gt - Ap \quad (6)$$
$$= Pt + Gt - 103.26 - 20 \log D \quad (7)$$

Receive Antenna Gain

To calculate the signal level at the receiver, Sr, i.e., out of the antenna, add the gain of the receive antenna. Ga, to Sa:

$$Sr = Sa + Ga \quad (8)$$
$$= Pt + Gt + Ga - 103.26 - 20 \log D \quad (9)$$

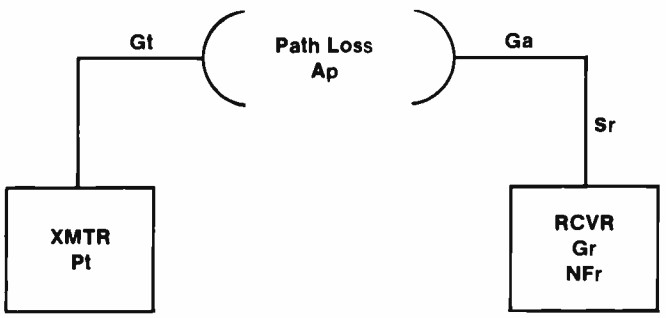

Figure 1: MDS system diagram

Substituting equation (1) into equation (9),

$$NFr - 108 + C/N = Pt + Gt + Ga - 103.26 - 20 \log D \quad (10)$$
$$C/N = Po + Ga + 4.74 - NFr - 20 \log D \quad (11)$$
or
$$Ga = C/N - Po - 4.74 + NFr + 20 \log D \quad (12)$$

Transmitter power currently authorized by the FCC is 10 watts (40 dBm) standard and 100 watts (50 dBm) by special request. Two types of antennas currently in use are the omni-directional with a gain of 13 dBi and the cardiod with a gain of 16 dBi. The effective radiated power, Po, can be determined from the chart in Figure 2.

PT / GT	10 Watts	10 Watts
13 dBi	53 dBm	63 dBm
16 dBi	56 dBm	66 dBm

Figure 2: radiated power, Po

Equation (12) and Figure 2 can now be used to determine the required receiving antenna gain for a specific receiver and distance. For example, assume that:

Pt = 10 watts or +40 dBm
Gt = 16 dBi
NFr = 5 dB (Mfr. spec sheet)
Distance = 20 miles
C/N = 45 dB

then Ga = C/N - Po - 4.74 + NFr + 20 log D
Ga = 45 - 56 - 4.74 + 5 + 20 log 20
Ga = 15.28 dBi

This is the minimum gain necessary to insure the desired C/N. An antenna should be chosen that has at least the calculated gain or more. If the antenna chosen has more gain use equation (11) to determine the actual C/N.

Receive Gain

Once the antenna is chosen, use equation (9) to compute the actual signal level to the receiver. The level will be needed to determine the receiver gain required for compatible level matching to the local TV antenna system.

Most MDS receivers available today are designed for a 50 ohm input and a 75 ohm VHF output. A conversion factor of 48.75 dB will be needed to convert the levels from the 50 ohm system reference, dBm, to the 75 ohm system reference, dBmV. The receiver output level is the given in equation (13):

Sro = Sr + Gr + 48.75 dBmV

where Sro = receiver output level in dBmV
Sr = receiver input level in dBmV
Gr = receiver gain

In the example above, assume a receiver output level, Sro, of +15 dBmV is desired to combine with the TV antenna signal. Using equations (9) and (13):

Sr = 56 + 20 - 103 - 26
Sr = - 53 dBm
Sro = - 53 + Gr + 48.75
= + 15 dBmV
Gr = 15 - 48.75 + 53
Gr = 19.25 dB

The receiver must have at least 19 dB of gain.

Using a Preamp

If an antenna preamp is used and the cable loss connecting the preamp to the receiver is much less than the gain of the preamp, equations (11), (12), (13) can still be used. Substitute the noise figure of the preamp for the receiver noise figure. The receiver gain, Gr, in equation (13) will include the preamp gain.

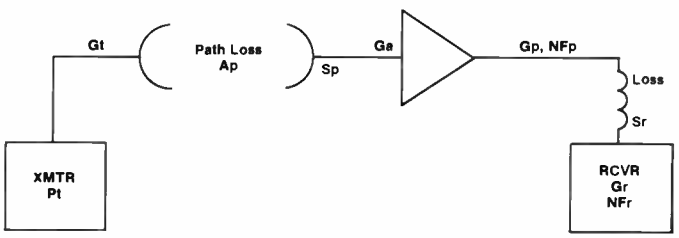

Figure 3: MDS system diagram using preamp

If the cable loss between the preamp and the receiver exceeds several dB, the following procedure must be used: convert the preamp gain, preamp noise figure, receiver noise figure and cable loss from dB to power factor by using the chart in Table 1. (See Appendix).

dB	Factor
3	2.0
4	2.5
5	3.6
6	4.0
7	5.0
8	6.3
9	7.9
10	10.0
12	15.8
14	25.1
16	39.8
18	63.1
20	100.0

Table 1: dB to factor conversion

Substitute the appropriate factors into equation (14):

$$F\ (equiv) = Fp + \frac{Fr - 1}{G^1p\ L} \qquad (14)$$

where F (equiv) = equivalent noise factor
Fp = noise factor of preamp
g^1p = gain factor of preamp
L = loss factor of cable

Convert F (equiv) back to NF (equiv) dB by using Table 1.

Somewhere in this picture there's a trouble shooter aimed straight at you.

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They understand your home territory because it's their home territory too.

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Determine the desired C/N and calculate the preamp input level, Sp, from equation (15).

$$Sp = NFp - 108 + C/N \quad (15)$$

Next, calculate the antenna input level, Sa, from equation (7). Calculate the antenna gain, Ga, from equation (16).

$$Ga = 5a - Sp \quad (16)$$

Compute the receiver input level by adding the preamp gain to and subtracting the cable loss from the antenna output, Sr, in equation (9).

$$Sr = Po + Ga + Gp - L - 103.26 - 20 \log D \quad (17)$$

The receiver gain can now be calculated from equation (13) as before.

If the gain of the chosen antenna exceeds the calculated gain, Ga, use equation (11) to compute the actual C/N. Substitute NFp for NFr in equation (11).

To summarize, the calculation should be made in the following sequence:

Step	Determine	Calculate	Equation	Comment
Without Preamp				
1	D, C/N, NFr	Sr	1	Rcvr. input
2	Pt, Gt	Sa	7	Ant. input
3		Ga	12	Ant. gain
4	Sro	Gr	13	Rcvr. gain
5		C/N	11	Actual C/N
With Preamp				
1	NFp, Gp, Cable loss	Fp, G^1p, L	Table 1	
2		F (equiv)	14	
3		NF (equiv)	Table 1	Equiv. noise figure
4	C/N	Sp	15	Preamp input
5	Pt, Gt, D	Sa	7	Ant. input
6		Ga	16	Ant. gain
7		Sr	17	Rcvr. input
8	Sro	Gr	13	Rcvr. gain
9		C/N	11	Actual C/N

Appendix

$$X = 10 \log Y$$

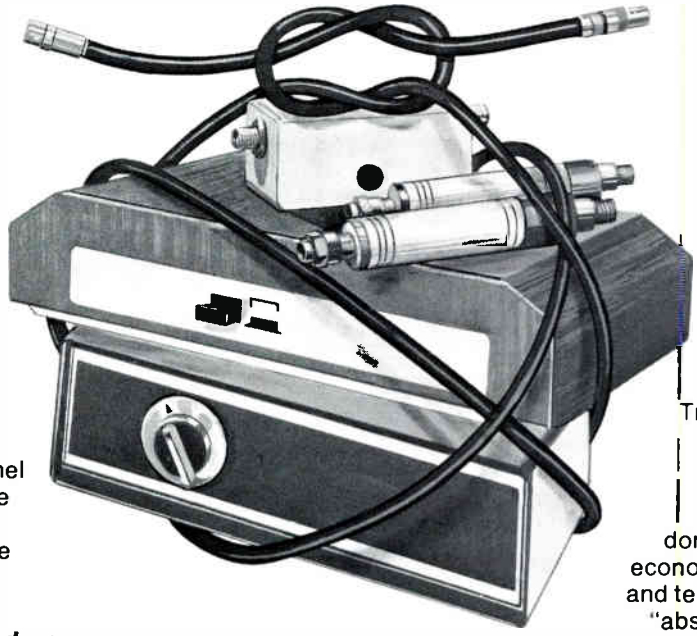
$$Y = 10^{\frac{X}{10}}$$

$$Y = \exp\frac{X}{(10)}$$

$$dB = 10 \log (\text{factor})$$

$$\text{Factor} = \exp\frac{dB}{(10)}$$

Negative vs Positive Systems
Audited vs Unaudited Systems
Cable Traps vs Descramblers
Lowest Overall Costs vs
Lowest Front End Costs
Single Channel or Multi-channel



Negative vs Positive System

There's no doubt about it . . . the Negs have it over the Pos. The greatest deterrent against theft of service is to not allow the premium channel into the home where it can be reconstituted . . . to trap the signal of all non-payers at the pole where it is least subject to tampering.

VITEK Cable Traps ***look like drop cable***, provide deep-notch depth (typically greater than 70dB), superior environmental stability and durability, are maintenance-free — and are ***on the pole!***

Audited vs Unaudited Systems

Auditing is easy with VITEK Cable Traps. Simply count your traps and compare with your current subscriber list. No contact with the subscriber is necessary. Since (Pos) descramblers are located in the home, installation records are your only clue as to who your "customers" really are. Gaining access to the residence can be difficult and may require numerous visits.

Cable Traps vs Descramblers

If "they" don't pay . . . reconnect the cable trap . . . on the pole! Recovery and replacement of descramblers is time consuming, costly and may require legal action.

Any way you look at it... VITEK is the answer for PAY TV Security!

VITEK

Descramblers can also be "loaned out" depriving you of additional income . . . but VITEK Cable Traps stay put . . . ***on the pole!***

Lowest Overall Cost vs Lowest Front End Costs

You get what you pay for, so don't be misled by the apparent economies of (POS) descramblers and terms like "self-amortize" and "absorbed costs". The larger the installation, the more economical VITEK Cable Traps become. You save on maintenance and service calls, recovery or replacement of equipment and in the end, there is nothing more foolproof and reliable than a VITEK Cable Trap to prevent theft of service . . . and that's what PAY TV Security is all about.

If you're successful, you'll outgrow the short-term economics and inadequacies of descramblers as others have and change over to VITEK's Cable Traps.

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- **Requires only one cable for operation**
- **Individual control on loop system without access problems**
- **Fits any single gang electrical box**
- **Stainless steel plate**
- **Tamper detection circuitry**
- **Compatible with pay services**
- **3 remote control options to suit any operational requirement**
- **Standby memory power maintains system conditions during AC power outages**

Pay only systems choose IT-1G

These tap offs provide switching of one pay channel within a wall plate. Basic service is passed uninterrupted. The IT-1G is ideal for MDS, hotels and motels, where basic service is optional. Other features are identical to those of the IT-1.

- **Requires only one cable for operation**
- **Designed for hotel and motel loop through systems**
- **Basic service uninterrupted**
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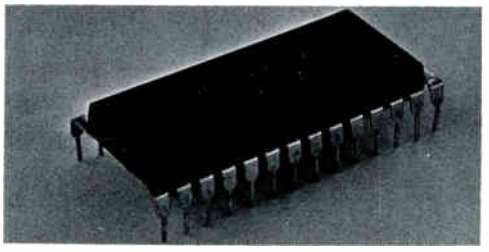
The IT-6 provides six indepentdently switchable outputs from one common input. Multi-input options are available. Designed for home run apartment distribution and pay systems. Each port has a unique address. Combine IT-6s to provide an unlimited number of pay channels or multi-tier services. Control existing home run systems by installing our IT6-6 in series with existing wiring. Contol two services to one customer with our IT6-3.

- **Remote or local control of multi-tier systems**
- **Each output fully addressable**
- **Pay service options**
- **Lowpower consumption**
- **Combine units to provide unlimited pay or multi-tier service**
- **Standby memory power maintains system condition during AC power outages**



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A Transmitter Scrambled MDS System

By Art Johnson,
Manager of Field Engineering
Oak Industries Inc.
Communications Group
CATV Equipment Division
Crystal Lake, Illinois

The Oak scramble system may be used with an MDS transmitter although this system would ordinarily be used when pay-TV programming was being transmitted. The Oak system scrambles the video, but not the audio portion of a TV signal. There are two main reasons for scrambling: off-air pirating and selective subscriptions.

Anyone within the coverage area of an MDS transmitter with suitable antenna and down converter may receive MDS transmissions—off-air pirating if not paid for. However, when the signal is scrambled, the picture viewed on a TV set will be largely unintelligible.

At a typical MDS receive site, the received signal is down converted to the TV band and distributed throughout the MATV system of an apartment building. With a scrambled system descramblers are provided only to building residents that have subscribed to the pay-TV service. Alternatively, a "Master Descrambler" may be inserted, following the down converter, and all building residents will receive a normal picture.

Oak System Components

The signal is scrambled by re-modulating the channel with a sine wave that is phase locked to the horizontal sync.

The video and audio signals are converted to IF (41.25 MHz audio and 45.75 MHz video) in the modulator before being re-modulated by the scrambling sine wave in the scrambler. The signal is then returned to the MDS transmitter for upconversion to the transmitted microwave frequency.

The sync separator circuits in a TV set identify the peak video level as sync signals. After being scrambled, as above, the sync signals will no longer be the peak video level. As a result, a TV set not driven by a descrambler will not be correctly synchronized.

The Mini-Code Descrambler has a "standard/premium" switch. In the "standard" position, signals at the input terminal are bypassed directly to the output terminal for normal TV viewing.

With the switch in the "premium" position, the premium channel (optionally channel 2, 3 or 4) is automatically descrambled. Obvious-

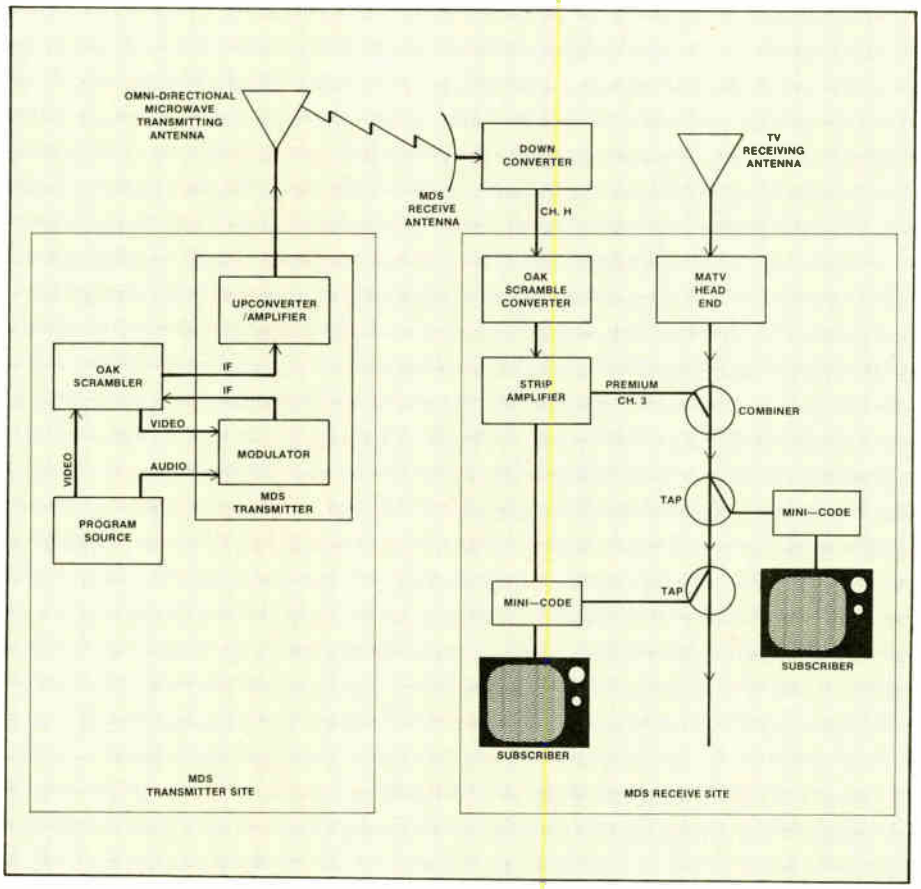

Figure 1.1: Scrambled MDS system

ly, the associated TV set must be tuned to the premium channel. The Mini-Code uses the amplitude modulation (scrambling signal) on the audio carrier to automatically control the gain of a stage which passes the entire TV channel. If the audio carrier is leveled in this stage, the video carrier will also be leveled and thus descrambled.

The signal to noise ratio of the premium channel may be degraded by an MATV system. In the Mini-Code, noise present at the audio carrier frequency may be impressed on the video carrier by the AGC circuit. For the best signal to noise ratio on the audio carrier, this carrier should be operated at a relatively high level. Video to audio carrier ratios of 10 to 15 dB are suitable.

Scramble Converter

The output signal of an MDS receive site down converter can vary in level and frequency. If the MDS signal is scrambled an amplifier with normal sync tip operated AGC will not function normally.

A down converter that outputs on midband channel H is normally used with the Oak system. A "scramble converter" is used to convert channel H down to the Mini-Code premium channel used. The scramble converter has AFC and an AGC circuit operated by the audio carrier. Thus, the output of the scramble converter is stable in both frequency and level.

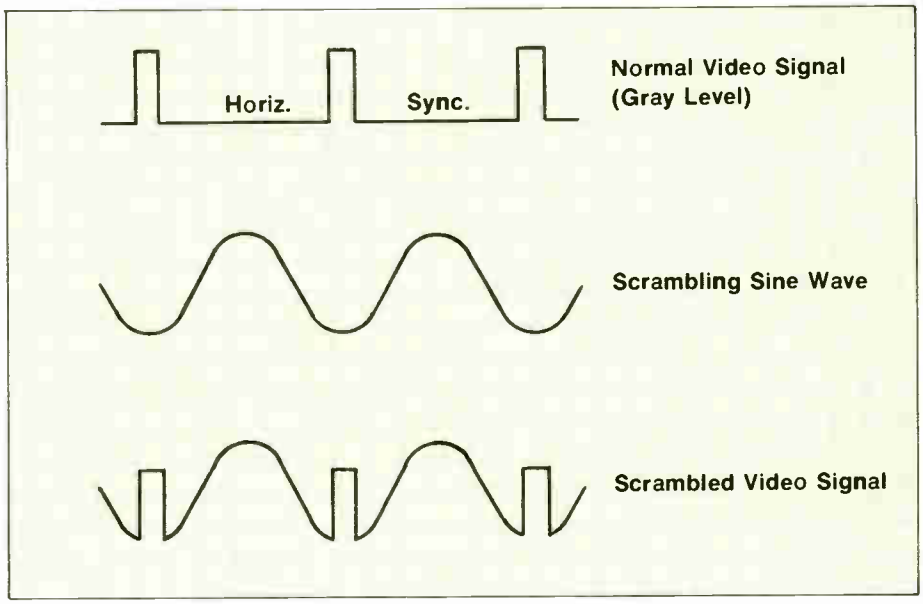

Figure 1.2: Scrambling waveforms

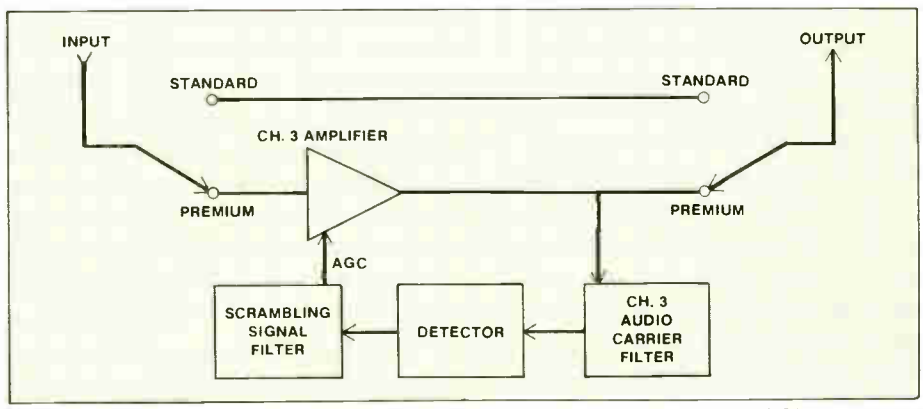

Figure 1.3: Mini-code block diagram (premium Channel 3)

Master Descrambler

If it is desired to carry the premium channel descrambled, at a receive site, a "master descrambler" is substituted for the "scramble converter". An Oak "Econo-Code" (CATV system converter/descrambler) is used as a master descrambler. This unit combines the functions of the scramble converter and a descramble circuit.

Origination, Scrambling and Transmitting Equipment

The program source may be a TV camera, film chain, VTR, character generator, microwave feed or satellite earth station. The system will accept separate baseband video and audio feeds or a composite feed with baseband video combined with 4.5 MHz audio.

An Oak-supplied video filter is inserted between the video source and the video input on the modulator. Many video sources have frequency components extending to 4.5 MHz and above. The video filter prevents these components from being transmitted as extraneous noise on the audio carrier and interfering with descrambler operation. The video filter is incorporated in the scrambler chassis.

The video filter also contains an audio demodulator that is intended for use when a composite video/audio source is used. A front panel audio level control is provided.

The preferred origination site interconnection is shown in Figure 2.2. The video set-up procedure is as follows:

- The NTSC generator is selected as a video source. The video output used is a flat white field of 100 IRE units at a level of 1 volt peak to peak and the waveform monitor display is calibrated at 100 IRE units. The video level control on the modulator is adjusted for an indication of 80 percent video modulation on the meter, and the video level controls on the waveform monitor and the modulator are left set in this position.
- The video out of the program source is then selected and adjusted so that the white level corresponds to 100 IRE units on the waveform monitor. This adjustment may have to be monitored, depending on the stability of the video source used.

If a waveform monitor and NTSC generator are not available, the following method may be used, but with less accuracy:

- The program video is connected directly to the video filter. The video level control on the modulator is initially set for a 65 percent reading. When a white scene appears the video level is set for a 75 percent reading on the meter. This adjustment may have to be monitored, depending on the stability of the video source used.

If the program source includes a baseband audio output, the audio is connected directly to the audio input on the modulator. The audio level control on the modulator is set so that

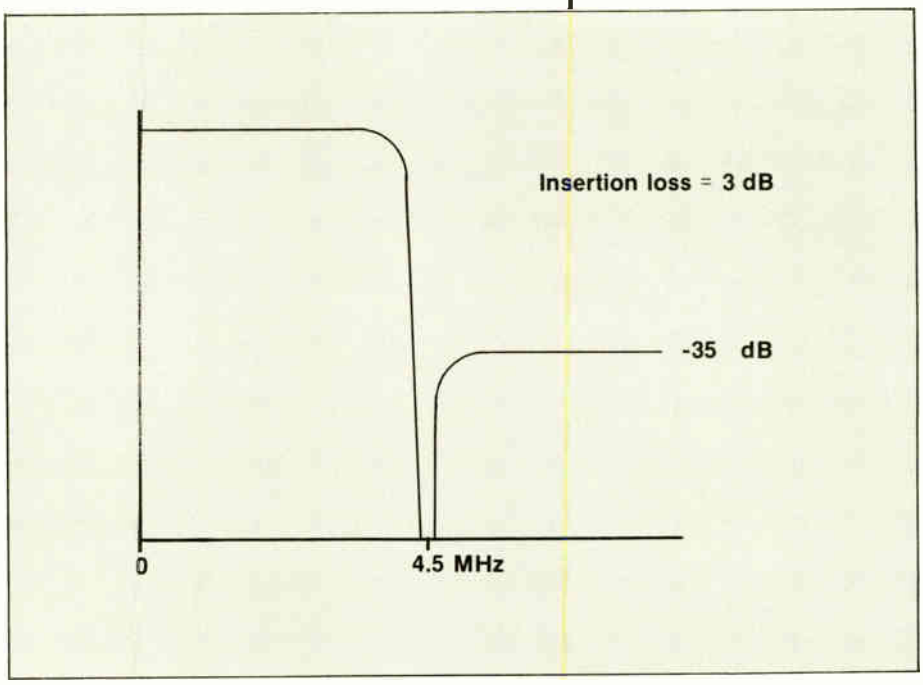

Figure 2.1: Video filter bandpass

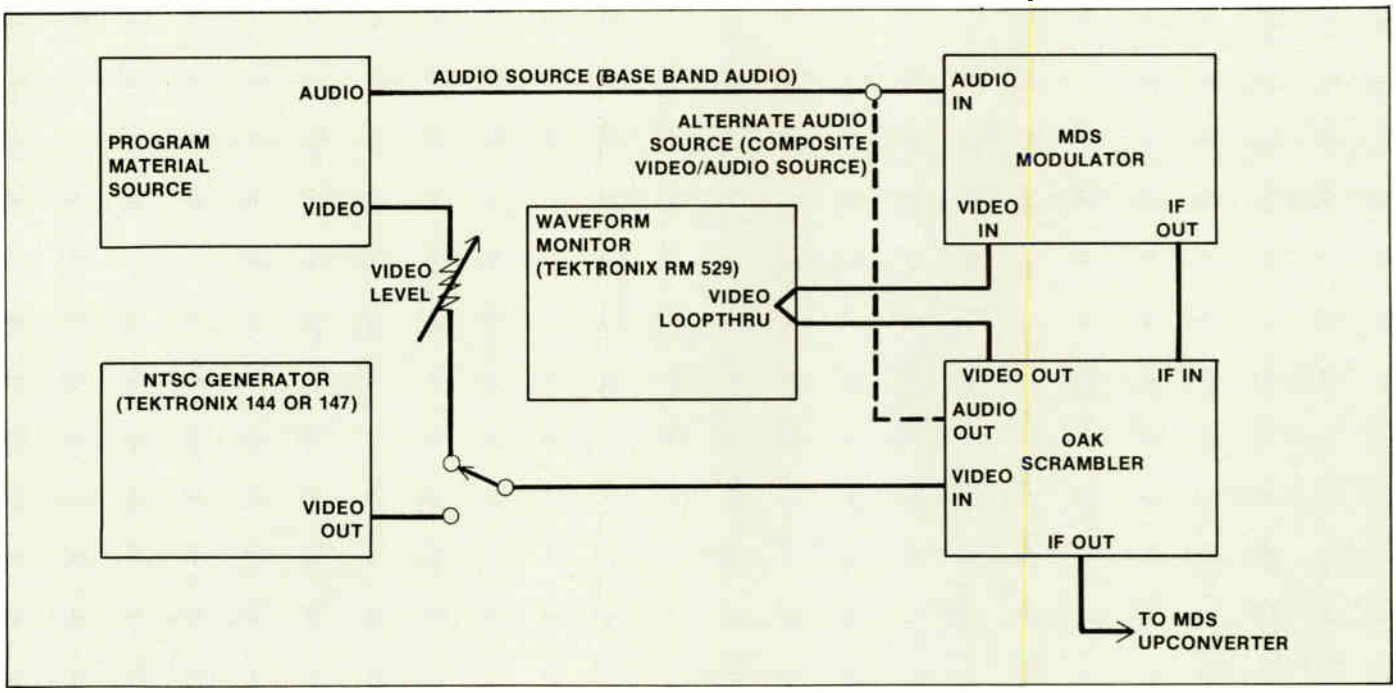

Figure 2.2: Preferred origination site interconnection

audio peaks produce about ± 12 KHz deviation on the meter. This adjustment may have to be monitored, depending on the stability of the audio source used.

If the program source is composite video and 4.5 MHz audio, the audio output is taken from the video filter (audio output jack on rear of scrambler). The audio level control on the modulator is first set to mid-scale. The audio level control on the scrambler is then set so that audio peaks produce about ± 12 KHz deviation on the meter. All further audio deviation adjustments will then be made using the audio level control on the modulator. This adjustment may have to be monitored, depending on the stability of the audio source used.

The basic scrambling waveforms are shown in Figure 1.2. In addition, the scrambling waveform is suppressed during a portion of the vertical interval.

The vertical interval suppression of scrambling prevents "supermodulation" of portions of the equalizing and serrated vertical sync pulses. The scrambler has unity gain at IF and may be replaced by a piece of coax if the transmitter is to be operated non-scrambled. The level of scrambling shall be set at 6 dB. A front panel meter provides a direct readout of the scrambling level. A front panel scrambling level control and a scramble on-off switch are provided. With the scramble switch off, the signal out of the transmitter is normal and may be received by a TV set.

MDS Transmitter

The transmitter can be separated into a modulator section and an upconverter/amplifier section. In the transmitter illustrated in this paper, an IF (41.25 MHz audio and 45.75 MHz video) output from the modulator is used to drive the upconverter. Other MDS transmitters may use a different TV channel to drive the upconverter. The transmitter used with the Oak system should have good amplitude linearity, minimal video to audio carrier cross-modulation and minimal incidental amplitude modulation on the audio carrier.

Modulator

If the audio section is not properly aligned, the modulator may generate incidental amplitude modulation (due to FM) on the audio carrier. If incidental AM is present, a descrambled picture may contain some audio on video interference.

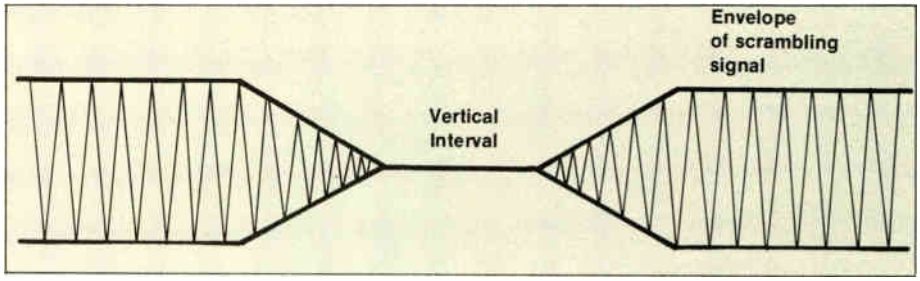

Figure 2.3: Vertical interval suppression of scrambling

As explained previously, the audio to video carrier ratio should ideally be set at either 10 or 13 dB. This ratio is set by modulator controls. The ratio may be set by monitoring carrier levels at the modulator IF output. At any other point in the transmitter, or at a receive site, a measurement of carrier ratio will only be accurate with the scrambling switched off.

Receive Site Equipment

A receive site block diagram is shown on Figure 1.1 The Mini-Code descramble channel options are channels 2, 3 and 4. The premium channel chosen should not be the same as a local off-air channel to avoid co-channel interference. Some MATV systems, especially those with a broadband amplifier headend, may occasionally pick up a distant station on the premium channel. In this case, it will be necessary to install a TV channel trap, in series with the MATV system, at a point before the premium channel is injected.

The downconverter, used with the Oak system, should output on midband channel H (163.25 MHz video and 167.75 MHz audio). The output frequency should be accurate within ± 250 KHz under all conditions. The system will operate with video carrier output levels of -6 to +20 dBmV. The nominal level is +10 dBmV.

Oak's scramble converter converts channel H down to the desired premium channel with AFC and AGC control. The nominal video carrier output level is +10 dBmV (not adjustable). This unit will operate over an ambient temperature range of +15 degrees C to +45 degrees C.

A strip amplifier has a bandpass filter tuned to the desired channel. When used with a scrambled signal, the AGC circuits of the strip amplifier may not be used. Manual gain control must be used. The strip amplifier, with an input of about +10 dBmV, must be capable of delivering an output signal of about +40 dBmV to +70 dBmV in order to drive an MATV system.

An ideal MATV system would have all channel levels constant at all taps. This ideal is seldom realized in practice. However, with the Oak system, it is impotant to have the low band channels (2 thru 6) relatively constant in amplitude (within 6 dB spread). The premium channel should be injected at a level so that it is equal to, or up to, 3 dB greater than the closest upper and lower channels.

In many cases, the premium channel will fall adjacent to an MATV system channel. To minimize the possibility of audio carrier interference to an upper adjacent channel, a premium channel audio to video carrier ratio of 13 dB should be maintained. However, if channel 4 is used as the premium channel throughout the MDS system, there will be no immediate upper adjacent channel. This is due to the extra 4 MHz spacing between channels 4 and 5. In this case, the MDS transmitter may be set for an audio to video carrier ratio of 10 dB. This smaller ratio will provide a better margin of signal to noise ratio in worst case conditions.

The premium channel input signal to the Mini-Code should lie in the range of -6 dBmV to + 20 dBmV. If it's outside this range, it may be necessary to change the tap or add an attenuator in series with the Mini-Code input.

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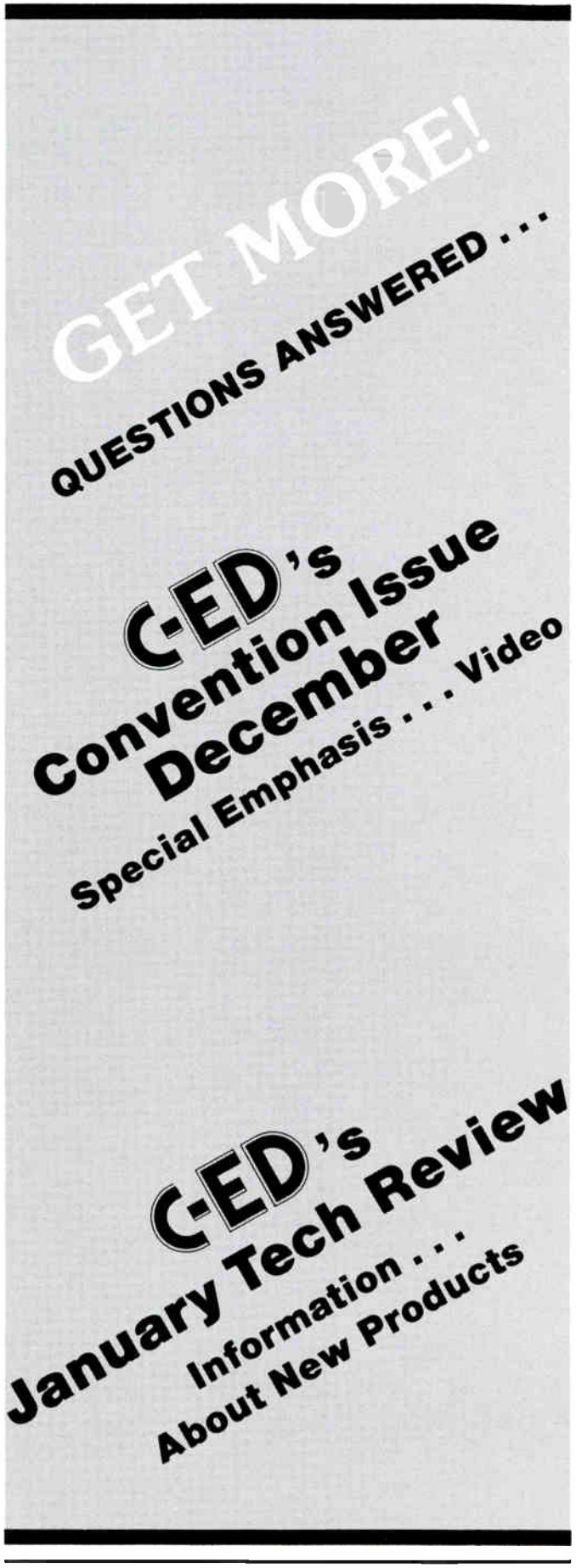


MDS Seminar Wrap-Up

A Staff Report

Buoyed by the FCC's decision last month that blocked an attempt by the New York State Commission on Cable Television to regulate and restrict the distribution of pay-TV programming to MATV systems via MDS, the 2nd Annual meeting of the Common Carrier Association for Telecommunications was termed "upbeat" but in some ways "sobering" as MDS operators and their customers continued to grapple with marketing and technical problems which have faced the once fledgling business since its beginnings.

Meeting near Washington, D.C., Sept. 22-23, the MDS group explored pay, satellites and regulation for two days, but never strayed very far from the overriding question of what direction it's all heading toward: "specialized common carriers," mini-broadcast stations," "business/data networks," and "STV stations." And, for now, the answer still seems to be "all of the above."

The "historic" Orth-O-Vision decision, although focusing specifically on the New York Commission's interest in protecting the development of cable television from MDS distribution of pay-TV, touches upon all of the varying identities of MDS. Consumers receive programming from HBO, marketed by Orth-O-Vision, distributed by Microband's MDS omni-directional transmitter which also "interconnects" STVs, microwave and satellite links with other cable systems.

The New York Commission had previously viewed MATV systems as serving the traditional rooftop function and exempted it from its state regulation until last year. At that time the commission declared that "MATV systems offering multiple-unit dwellings a non-broadcast service such as pay programming would lose their exempt status and be considered cable television systems." As a result, all MATV systems were required to apply for a municipal cable television franchise or eliminate its pay programming.

The New York Commission said it was concerned that MDS-MATV pay programming services would inhibit the development of regular cable television systems. "We anticipate that most MATV systems will choose to reduce services to gain the MATV system exemption and we encourage them to do so." Orth-O-Vision, for one, sought a franchise but was turned down. It then sought relief from the FCC prompting the commission to issue a memorandum and declaratory ruling in the matter.

The FCC found that the "MATV system to which MDS reception equipment is attached is an integral part of the transmission of HBO's programming by WQQ-79's signals to Orth-O-Vision's customers.

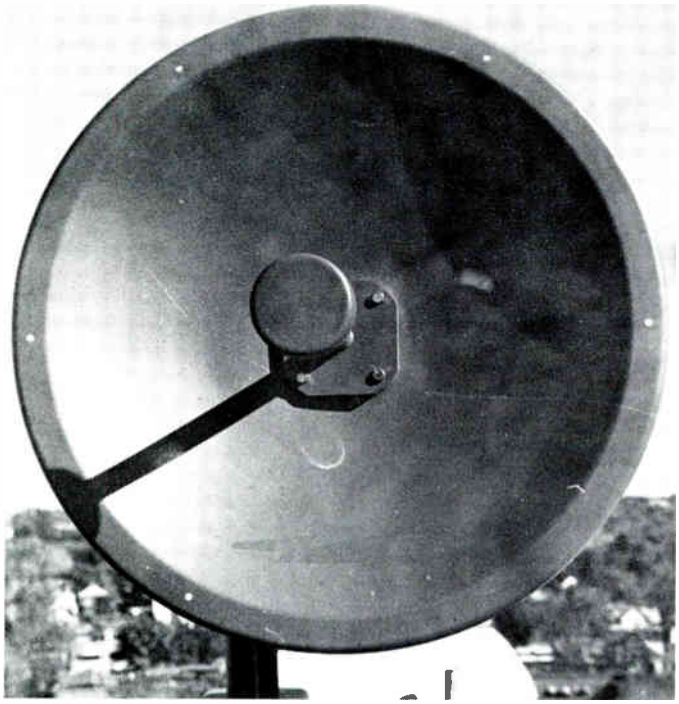
"The state's attempt to regulate these MATV systems to restrain MDS service as a competitor of conventional cable systems," the FCC stated, "deprives customers of the programming transmitted by WQQ-79 and thereby limits the maximum service that may be provided by radio frequencies assigned to MDS. The state's regulations therefore conflict

with the commission's determination as to the best use of radio frequencies."

A number of MDS subscribers are currently experimenting in developing educational, data, facsimile and other specialized types of programming for MDS transmission. The commission staff is aware of MDS stations which during the daytime hours have transmitted medical programs produced by *Emergency Medical* Magazine to doctors in hospitals, and legal education programs produced by the American Law Institute to practicing attorneys in their law offices.

It is the potential for this type of service which has made the regulators indulgent of strictly pay-TV operators which has led the way for MDS. Now, joining the cable and apartment customers of MDS transmitted pay-TV signals will be individual homes as costs for the somewhat "odd-looking" home antennas are becoming more palatable.

So although some of the more ominous regulatory blankets were lifted there are still some big concerns which can be temporarily put aside when talking of down converter receiver packages priced at less than $100 (in sufficient quantities). Among those remaining problems is the



MDS receiving antenna.

releasing of channel 2's in the hundreds of markets where applications are pending. The Common Carrier Bureau, however, is not yet convinced that the more expensive hardware meets technical requirements necessary to protect users of the spectrum. It has some concerns about some of the gear. It is expected that some new technical specifications for the service will be proposed soon.

Manufacturers, however, still promised good things to come at the convention while manning the "exhibit floor" and the association has formed a committee which will explore the possibilities for eliminating the potential for interference which will be heightened if and when channel 2's go into use. The establishment of a "guardband" is one possible remedy.

As for the channel 2 applications, they may just be

allocated by lottery. Proposed several years ago as a way of passing out the scarce spectrum allocations, the lottery advocates have long sought an opportunity to test the techniques. In addition to channel allocations, copyright also weighs heavily on the regulators and the regulated.

As the CAT convention moved into its second day, however, their were rumors of some "very big buys" in the works. Getting in on the activity for the first time this year were Winegard Company, Theta-Com/Texscan and Standard Communications.

Theta-Com brought a down converter and a parabolic antenna. Winegard pitched its own crystal-controlled down converter and power supplies. Standard brought a package from Los Angeles which included a down converter and antenna for around $90.

Among the more familiar names in MDS were Bogner, TEST, Varian, and Magic Latern TV which unveiled an array of packages ranging from $100 on up. In addition to its antenna packages, TEST's monitoring portable device designed for use by installers to test signals was well received as were Bogner's R11, Varian's MDS-402 and Emcee's TTS-20.

Inner VISIONS

One of the major attractions at the 2nd Annual meeting of the Common Carrier Association for Telecommunications was a live demonstration via MDS and satellite from VISIONS in Anchorage, Alaska. This demonstration was the first of its kind.

To videotape this production, special video equipment had to be imported from Los Angeles. The script called for dramatic aerial shots from a helicopter and moving shots in downtown Anchorage that were accomplished via use of a "Steadi-Cam," a spidery looking body brace that allows the cameraman to virtually run with the camera and still keep a perfectly steady shot. Having accumulated over fourteen hours of raw footage, it was then necessary to travel to Los Angeles in order to edit the show, add the appropriate music and sound effects and prepare it for broadcast. This took two days, and was finally finished late Friday evening preceding the scheduled Saturday morning presentation. Then the fun began.

At approximately 5:00 p.m. California time on Friday, one of the VISIONS editors was to leave Los Angeles for Seattle with its 11-minute special in hand. From there the show was scheduled to arrive in Anchorage at about 10:00 p.m. Anchorage time, so that it could be fed via satellite live to Washington, D.C. the following morning. But... the best laid plans of mice and men often go astray. For example: First, Tom Hughes, VISIONS' graphic designer, missed his connection in Los Angeles and thereby the last plane from Seattle to Anchorage. Now there was no way to get the show to Anchorage on time by regularly scheduled airline.

Next an attempt was made to rent one of two Teamster Lear jets, but one was on ambulance call on Adak Island and the other was in the States being repaired. The next option was to charter a jet out of Seattle to fly to Anchorage. This would have cost $5,000, almost the cost of the entire production itself. But while VISIONS' personnel tried to think of other alternatives, a pilot was engaged and told to stand by. Finally, it occurred to VISIONS' personnel that if the tape could be sent from Anchorage via satellite, it could just as easily be sent to Anchorage via satellite, either from Los Angeles where David Rychetnik, director of the special, had the master tapes, from Seattle where Tom Hughes had the copies, or from New York or Washington where a back-up copy of the show was enroute to the VISIONS' representatives there.

The problem was how to arrange all this at 10:00 p.m. on a Friday night in Anchorage, or 12:00 a.m. in Los Angeles, or 2:00 a.m. in Washington. The solution was to pursue all options. Seth Davis, VISIONS' chief engineer, got in touch with Cliff Scheel of RCA Alascom at his home in Wasilla. Seth relayed VISIONS' problem to Cliff, and Cliff indicated that he thought an uplink could be arranged through L.A. if they could find a way to play the tape at RCA's Los Angeles toll center. Seth then called David Rychetnik in L.A. telling him that he had to find a tape machine there (at 12:30 a.m. L.A. time). David, in turn, contacted Larry Guanada at the RCA toll center in Los Angeles who said that he would see what he could do about a video tape player. Subsequently, Cliff Scheel, Larry Guanada and Seth Davis came up with the arrangements to get a West Coast feed to Anchorage on RCA's Satcom I via transponder 18. All that was needed was to get David, the tape and a playback unit to RCA's toll center in downtown L.A.

Meanwhile, Tom Hughes and the pilot were still standing by in Seattle while in Washington, D.C., Robert Gould and Robert Uchitel were finalizing arrangements through Bob Watt and Bob Furinger at Home Box Office (at 4:00 a.m. EST) to uplink the back-up tape from HBO's studios in New York City. However, before this was necessary, David Rychetnik, after getting lost and going 30 miles out of his way, finally made it to RCA's toll center with a video tape player at about 3:00 a.m. Los Angeles time. RCA then uplinked two feeds of the 11-minute program from L.A. to its satellite, which were recorded by two of VISIONS' technicians, Gavin Reed and Gary Williams, at VISIONS' studio, and RCA Alascom's Anchorage toll center, respectively. Success at last!

At 4:30 a.m., Anchorage time, all of VISIONS' technicians congregated at VISIONS' facilities to set up cameras, lights and phones for the live feed at 6:00 a.m. Alaska time. Everything was tested and re-tested. Two dry runs were executed and, finally everything was ready.

At 6:17 a.m., Anchorage time, VISIONS put its programming on the satellite. Ten minutes later, Bob Uchitel telephoned from Washington to establish two-way communication and the show was on! VISIONS' facilities were exhibited and explained in detail. Various people in attendance in Washington asked questions and then the tape that almost didn't make it was aired. A round of enthusiastic applause from all of the viewers in Washington (and for that matter, viewers anyplace else in the world) greeted the conclusion of the presentation.

For the first time, MDS had been used to deliver programming via satellite from Alaska to the "lower 48". Instead of bringing the world to you, this time VISIONS brought Alaska to the world.

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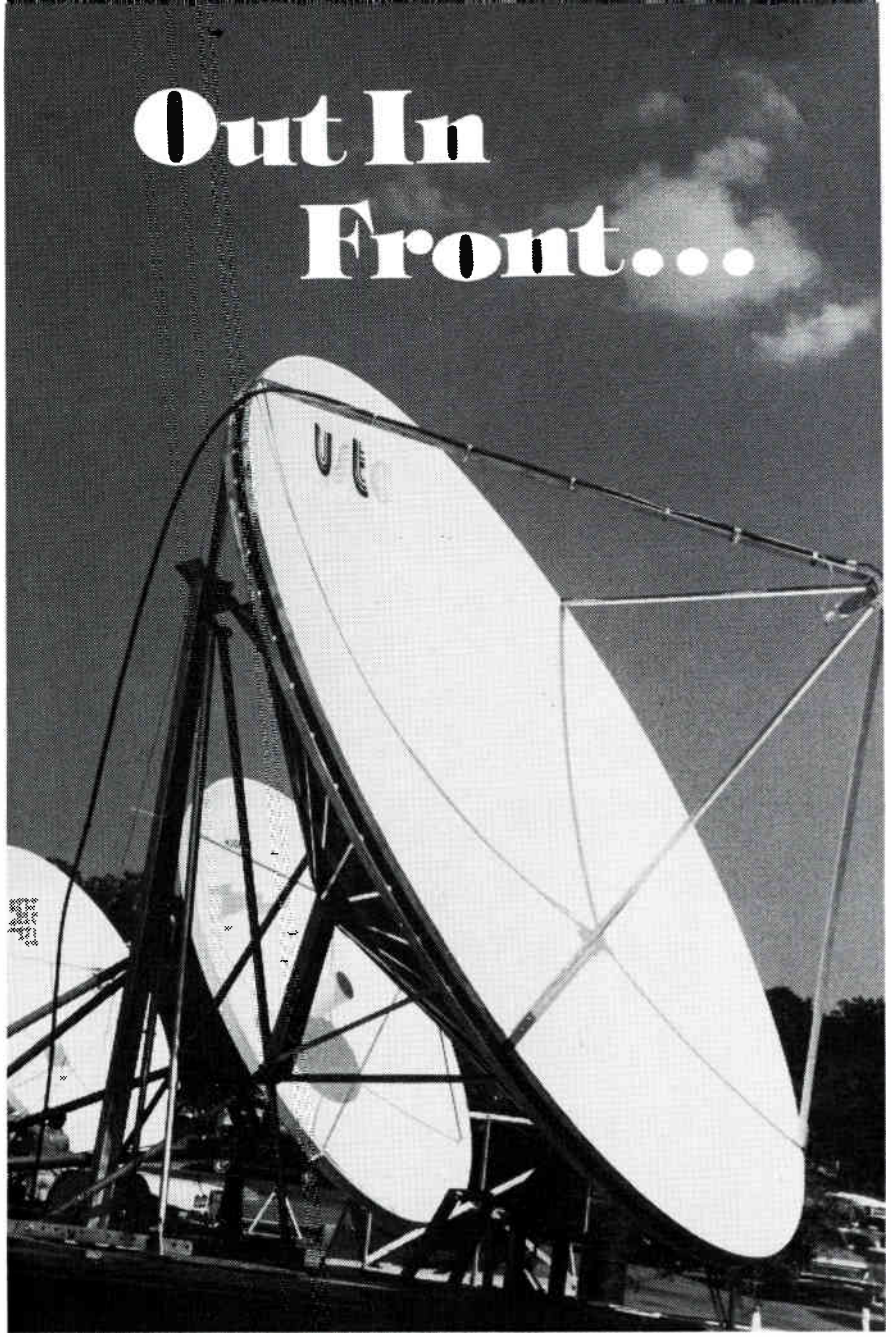

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These 15-foot MASAR antennas are supplied in two sections for ease of shipping and are easily assembled in the field with self-aligning circular rear support rings.

For more on Prodelin's product line, contact Prodelin Inc., P.O. Box 131, Hightstown, New Jersey 08520, (408) 244-4720.

Antenna Systems for MDS

Andrew Corporation offers a complete line of antenna systems for the Multipoint Distribution Service (MDS).

Equipment for the 2150-2163 MHz band includes transmitting antennas, receiving antennas, transmission lines, pressurization equipment and accessories.

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For more data, contact Andrew Corporation, 10500 West 153rd Street, Orland Park, Illinois 60462, (312) 349-3300.

Tuned Horn Antenna From Magic Lantern

Magic Lantern Television features a tuned horn antenna, model MDS-17TH, designed for multipoint applications where the antenna size, appearance and cost are determining factors. It is also designed for applications where there is adequate signal level to achieve the desired picture quality with 17 dB gain. The theoretical range of this antenna is 6-8 miles from a 10 watt transmitter and about 15 miles from a 100 watt transmitter.

A special feature of the MDS-17TH is the inclusion of an internal septum and iris which form a highly efficient lens and greatly reduce the depth of the horn by altering the E plane phase and H plane amplitude. An excellent impedance match is achieved through the use of pre-set tuning posts.

For additional information, contact Magic Lantern Television, P.O. Box 221, Carlisle, Massachusetts 01741, (617) 369-1834.

Theta-Com's MDS Antenna

The Theta-Com/Texscan model TCA-1 is a 26-inch parabolic antenna with a built-in 20 dB gain, low noise pre-amp. The total gain is 40 dB minimum, and an all-weather radome is standard.

The optional model TCA-2 contains the same dish and feed assembly but has no pre-amplification. The all-weather radome is standard, and the gain of this antenna is 20 dB.

For additional data, contact Texscan/Theta-Com CATV, 2960 Grand Avenue, Phoenix, Arizona 85017, (602) 252-5021.

TEST's MDS Down Converters

A new generation of down converters featuring controlled fundamental-frequency local oscillators is now part of the standard MDS product line offered by TEST, Inc.

The present design is based on past experience with both free-running and crystal-controlled oscillators for MDS/VHF-TV down conversion.

For further data, contact TEST Inc., 16130 Stagg Street, Van Nuys, California 91409, (213) 989-4535.

New Feature on Hughes AML Receivers Extends Coverage Capability for CATV

A wider coverage area for CATV systems using Hughes Aircraft Company's AML local distribution microwave equipment is promised by means of a 19 dB improvement in second-order intermodulation products recently made in all Hughes' current AML receiver models.

The 40-channel receivers, available in both indoor and outdoor versions, have the same performance features as the earlier models they replace, including phase-lock operation on some models and synchronous cross-modulation in excess of 90 dB.

For further information, contact Hughes Microwave Communications Products, P.O. Box 2999, Torrance, California 90509, (213) 534-2146.

Farinon's Video Earth Station Receiver

The Farinon FV4SR earth station receiver is designed to process video format satellite transmission in the 3.7 to 4.2 GHz range.

The basic equipment consists of a high-gain parabolic antenna, low noise amplifier, dual conversion IF heterodyne receiver (FV4F) and a baseband conditioning shelf (FV45).

For more details on the FV4SR, contact Farinon Electric, 1691 Bayport, San Carlos, California 94070, (415) 592-4120.

Microwave Associates' Line of npn Silicon Planar Microwave Transistors

Microwave Associates, Inc., has introduced a new line of microwave transistors. The MA-42110 series transistor is an npn silicon planar device designed to exhibit low noise figure characteristics of 1.5 dB with wide dynamic range in the UHF and L-Band ranges.

For complete information, write or call for Bulletin #5206A, Microwave Associates, Inc., 63 3rd Avenue, Bldg. 5, Burlington, Massachusetts 01803, (617) 272-3000.

MDS Down Converters from Varian

ML-4000 series MDS down converters from Varian are precision, low noise, microwave MDS receivers designed to receive 2150-2162 MHz signals and convert them to VHF or mid-band output. Utilizing state-of-the-art semiconductors and solid state circuitry enables Varian to provide low noise figures without relying on RF preamplification.

For further information, contact Varian, Beverly Division, Salem Road, Beverly, Massachusetts 01915.

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to
DECEMBER 10

1978

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FRIDAY, DECEMBER 8

THE FCC + THE REWRITE

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JANUARY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
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MAY

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JUNE

S	M	T	W	T	F	S
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

TUESDAY, DECEMBER 5

For Registration Packet Contact:

CCTA

PO Box 2719

Castro Valley, Ca. 94546

WEDNESDAY, DECEMBER 6

WESTERN SHOW STARTS

DISNEYLAND HOTEL

PANELS ON GOVERNMENT RELATIONS

PAY T.V.

RECEPTION

SATURDAY, DECEMBER 9

TAKE KIDS TO DISNEYLAND

SUNDAY, DECEMBER 10

VISIT SAN DIEGO'S BEACHES - OR GO TO SAN FRANCISCO?

See our card on page 17.

JULY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

AUGUST

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

SEPTEMBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

OCTOBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

NOVEMBER

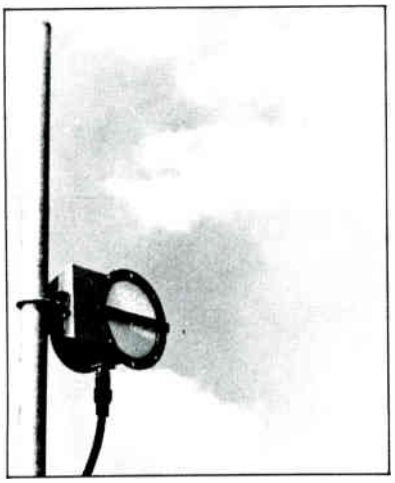
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

DECEMBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

The BOGNER MDS receiving antenna ...at just 1 dB/Dollar.

MODEL R11

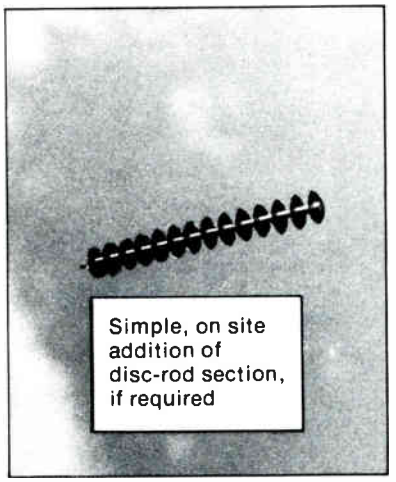


11 dBi

$11.00 *

+

MODEL R7

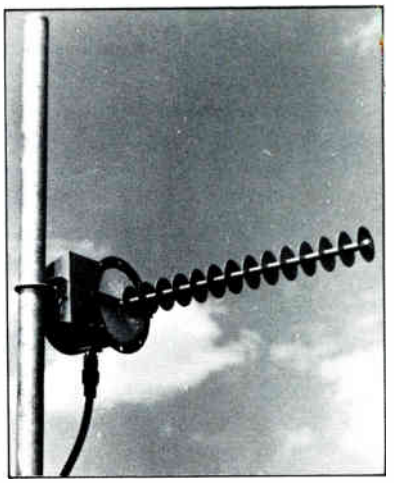


7 dBi

$7.00 *

=

MODEL R18



18 dBi

$18.00 *

THE OLDEST AND BEST MDS RECEIVING ANTENNA .....IS NOW ALSO THE LEAST EXPENSIVE !!

TECHNICAL SPECIFICATIONS

	R11	R18
GAIN:	11 dBi	18 dBi
FREQUENCY BAND:	2150 - 2163 MHz	2150 - 2163 MHz
SIZE:	5" dia. x 4"	R11 + 35" rod
MAXIMUM AREA TO WIND:	1/4 sq. ft.	3/10 sq. ft.
MAXIMUM WIND TORQUE ABOUT MAST		
IN 87 MPH WIND:	2½ ft. - lb.	7½ ft. - lb.
87 MPH WIND + ½" ICE:	3 ft. - lb.	20 ft. - lb.
WEIGHT:	2 lb.	3 lb.
HORIZONTAL ½ POWER BEAM WIDTH:	60°	20°
VERTICAL ½ POWER BEAM WIDTH:	60°	20°
MAXIMUM (1st) SIDE LOBES:	—18 dB	—12 dB
MAXIMUM LEVEL BEYOND ± 90°:	—20 dB	—20 dB
MAXIMUM VSWR:	1.5	1.2

	R 11 and R18
INPUT CONNECTOR:	N jack
MAXIMUM CROSS POLARIZATION:	—30 dB
RATED INPUT POWER:	100 Watts C.W.
SURVIVAL WIND:	120 MPH
POLARIZATION:	Can be mounted vert. or hor.
MOUNTING:	To vertical mast to 1½" dia.**
AZIMUTH CONTROL:	360°
TILT CONTROL:	± 22½°***
WATER PROTECTION:	R11 polystyrene foam filled
CONSTRUCTION:	Aluminum and plated steel
OFF CHANNEL REJECTION:	Cut off below 1730 MHz
TEMPERATURE RANGE:	—30° F to + 140° F
LIGHTNING PROTECTION:	all fully grounded

* IN 5000 LOTS; (IN 100 LOTS: R11 is $12.00, R7 is $8.00, R18 is $20.00)

** Alternate "U" bolt allows mounting to mast up to 2-3/8" dia. & ±18° elevation tilt (on special order)

BOGNER MULTITENNA CORPORATION OF AMERICA
P.O. BOX 67, VALLEY STREAM, N.Y. 11582 — (516) 997-7050

PATENTS ISSUED AND PENDING

—COMMITTED TO THE FUTURE OF MDS—

See card on page 20.

KBLE is Interactive-Ready

By Larry C. Brown, President
Cable Link Engineering
Columbus, Ohio

President Jimmy Carter and Esther Rolle, star of "Good Times" on CBS television, were among the celebrities present at the recent turn-on of the first U.S. major-market black-owned CATV system—KBLE. When complete, KBLE-Ohio, Inc. will pass about 30,000 homes with 170 miles of plant in a metropolitan portion of Columbus, Ohio.

President Carter and Ester Rolle on hand for KBLE's turn-on.

Total technical management, construction and engineering for the project, from pole applications through interactive services setup, is being handled by CLE, Inc., the Columbus-based CATV firm that performed the two-way conversion of QUBE's 800-plus mile plant. CLE also currently manages the QUBE repair facility maintaining the Pioneer-manufactured interactive data communications hardware for the system.

Thirty miles of plant are now "on." The system is supplying three imported independents plus additional cherrypicking off WTCG Atlanta via satellite/microwave. Local-origination, character generated programming, and HBO are also being provided, but that's not the whole story.

Columbus is the home of Warner Communications' interactive QUBE, Coaxial Communications' interactive Telecinema, and an enthusiastic city government anxious to make Columbus the first truly "wired city." The city now has over 40,000 subscribers actively participating in two-way CATV services. It hopes to interconnect all the CATV franchises to a City Telecommunications Center in the future. This facility would provide a multitude of services to the public, including program origination from libraries and schools, interconnection of schools, telemedicine, power load management and alarm systems. Instant opinion polling of masses of subscribers on community issues is another planned application.

KBLE systems were engineered by CLE from the outset with the provisions and flexibility necessary to efficiently accommodate planned additional programming and interactive services. A fiberoptic cable is among the links between the headend equipment room atop the Mount Vernon Plaza high-rise apartments and the KBLE studios and operations headquarters located in the adjoining business complex. RCA headend electronics and local-o modulators are split between the headend equipment room and operations area through a unique multiple-IF phase-locking scheme that gives maximum flexibility for program switching while maintaining full control of all switching functions at the studios. Non-duplication and other automatic switching takes place remotely in the headend.

The plant is RFI-secured using sleeved connectors throughout. Security sleeves have been installed on unused tap ports and pay-channel traps have been included where necessary from the outset. Theta-Com trunk stations and line extenders are all two-way ready, with built-in sub-split filters. Reverse bridger switches, identical to those used with QUBE, have been installed at each trunk station to enable selective routing of return signals while minimizing undesired off-air signal ingress problems during interactive operations. Time delay relays installed in plant power supplies protect plant electronics from transient damage characteristic of power company outages, thereby improving plant reliability. Field portable two-way test equipment will provide KBLE with the same practical and efficient two-way set-up and maintenance capability as QUBE. This equipment makes possible simultaneous setup of forward and reverse amplifier modules in one visit to any bi-directional trunk or line extender station in the system.

HIGH ABOVE THE COMPETITION

Microwave Equipment for the Multipoint Distribution Service

617-369-1834
P.O. Box 221
Carlisle, MA 01741

MLT

MLT

MAGIC LANTERN TELEVISION

Employment Oppt.

LOOKING FOR "QUALIFIED" JOB APPLICANTS OR A NEW POSITION? . . . . . LET US HELP YOU

WE ARE AN EMPLOYER-PAID PERSONNEL SERVICE ORGANIZATION WHICH MAINTAINS DATA ON POSITIONS AND PERSONNEL AVAILABLE NATIONWIDE. CALL OR WRITE FOR OUR FREE "TOP JOB CANDIDATES" OR "JOB OPPORTUNITIES" BULLETINS. CONFIDENTIAL SERVICES. LICENSED BY THE CALIFORNIA BUREAU OF EMPLOYMENT AGENCIES.

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PERSONNEL SERVICE
2326 Tampa Ave., El Cajon, Ca 92020 (714) 461-7891

Help Wanted

MATRIX ENTERPRISES, INC. CABLE PERSONNEL WANTED

Matrix Enterprises, Inc. has openings in several systems located in the Southeast for the following positions:

- **EXPERIENCED LINE TECHNICIANS**
  Growth opportunity for hard working professionals with desire for advancement.
- **CONSTRUCTION FOREMEN**
  In house construction effort, experienced in both aerial and underground.
- **SYSTEM MANAGER**
  For a new 150+ mile system to be built in Fall 1978 in Franklin, TN.
- **REGIONAL SALES MANAGER**
  To plan and implement new and re-market programs. Experienced with pay TV desired.
- **CONSTRUCTION SUPERVISORS**
  To monitor turnkey construction and system activation through proof of performance.
- **INSTALLERS**
  System personnel and contract installations needed. Consistent and well organized work.

Matrix Enterprises, Inc. is a rapidly growing MSO with growth opportunities for professional personnel willing to work hard. Excellent pay with full benefits for top personnel. Send resume and salary history to:

David Norcutt
Vice-President Operations
Matrix Enterprises, Inc.
P.O. Box 219
Lenoir City, TN 37771
or call
615-986-7062

MANAGER/CHIEF TECHNICIAN

MSO seeking someone who is willing to involve himself in all aspects of running a medium size cable system in the Mid-West. You should be familiar with AML, TVRO and be able to perform FCC proofs. Salary commensurate with ability. Excellent benefits. Send resume and salary requirements to Box CED 1178-1.

CHIEF TECHNICIAN

Excellent opportunity available for an experienced chief technician with a proven history of performance. Manage a growing system for North Carolina's largest CATV operation. Liberal benefits, company furnished car, life, health and dental insurance. Send resume in confidence to:

Regional Manager
American Cablevision of Carolina, Inc.
P.O. Box 18606
Charlotte, North Carolina 28218

CHIEF TECHNICIANS - MIDWEST & MID-ATLANTIC AREAS

Several attractive medium-sized system locations requiring experienced Chief Technicians eager to work in a progressive environment. Company sponsored training and development.

Send resumes in confidence to:

Employment Manager
Warner Cable Corp.
75 Rockefeller Plaza
New York, NY 10019

An Equal Opportunity Employer M/F

WARNER CABLE

Ad Index

INSTALLER-TECHNICIAN

Immediate opening for ambitious CATV installer-technician. Opportunity for advancement to manager-technician. Position in small town in beautiful middle Tennessee. Send resume to:

Bob Pace
Regional Manager
National TV Cable Company
P.O. Box 311
McMinnville, TN 37110

615-473-3311
or
615-473-5979

ENGINEER/TECHNICIAN

Small locally owned Colorado Rocky Mtn. ski resort system needs an experienced cable engineer/technician familiar with maintenance, headend, earth station, design and layout work. Quality of life is a big plus in this small friendly mountain town. 1st or 2nd class FCC license desirable. If you qualify and have had enough of the big city hassles, contact:

Steve Glazer
CATV of Colorado, Inc.
P.O. Box 639
Crested Butte, CO 81224

MATV/MDS TECHNICAL SUPERVISOR

Expanding Washington, D.C. MDS system needs experienced supervisor in MATV and/or Cable TV design. Minimum 5 to 7 years experience. Some knowledge of underground construction, must have administration and organizational skills to direct and update present technical staff. Formal training in electronics required. MATV headend and distribution design experience a plus. Salary commensurate with experience and ability. Send resume and salary requirements to President, Marquee Television Network, Inc., 11800 Coakley Circle, Rockville, Md. 20852.

CATV TECHNICIANS

Needed immediately for new 120 mile system. Duties include trouble-shooting and field maintenance. Send resume and salary history to:

John T. Schott
Clay County Communications Company
6317 N. Antioch Road
Gladstone, MO 64119
816-453-2022

CATV FIELD ENGINEER

A.S. OR B.S. in E.E. First Class FCC License. CATV experience desirable. Considerable travel required. Headquartered—Schenectady, NY. Salary negotiable, commensurate with experience. All replies confidential. Send resume to:

Employee Relations Office
General Electric Cablevision Corp.
1400 Balltown Road
Schenectady, NY 12309

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CHIEF ENGINEER
INSTALLATION SUPERVISOR
SYSTEM TECHNICIANS

New metropolitan system just commensing construction. Completed system will be in excess of 1000 miles of plant. Excellent company benefits. Salary commensurate with experience. Contact:

AirCapital Cablevision
P.O. Box 679
Wichita, Kansas 67201
ATTN: Ron Marnell
316-262-8455

an equal opportunity employer

MATV/MDS TECHNICIANS

MDS system in Washington, D.C. expanding. Maintenance and construction of headends and distribution systems. Experience in cable systems desirable Send resume and salary requirements to President, Marquee Television Network, 11800 Coakley Circle, Rockville, Md. 20852.

SYSTEM TECHNICIANS

Southeast Michigan system needs technicians with construction and fire-up experience. Send resume or call:

Six Star Cablevision
Jeff Dorn
9 South Adams
P.O. Box 506
Ypsilanti, MI 48197

313-481-0510

Business Directory

CATV EQUIPMENT REPAIRS

*Line & Distr. Amplifiers
*Field Strength Meters
*Headend & CCTV Gear

*Fast Turnaround
*Quality Workmanship
*Reasonable Rates

All repairs are unconditionally guaranteed. For more information call collect:

VIDEOTECH SERVICE INC.
4505-D W. Rosecrans Avenue
Hawthorne, CA 90250
(213) 675-3266

Equipment Wanted

NEED EQUIPMENT

Wanted new and used CATV construction equipment of all types. Please call or write:

David L. McBee
Lone Star Cable Company
P.O. Box 826
Round Rock, TX 78664
512-255-5779

Used CARS band microwave radios and antennas in good condition. Contact:

Bob Pace
Regional Manager
National TV Cable Company
P.O. Box 311
McMinnville, TN 37110

BRAIN BOX

We can put up to 40 channels right in the palm of your subscriber's hand.

With a simple 12-button keyboard he can select the channel of his choice and see his selection on an LED display. He can program up to 10 channels in the memory system and recall them at the touch of a button.

The sealed-touch keyboard solves the problems of mechanical contacts, and a crystal-controlled frequency synthesizer eliminates fine-tuning circuitry and converter drift.

There's an on/off remote option — and more important to you — there's a hard-security option that gives up to three channels of tiered, premium programming.

And the hand-held remote control unit is rugged. It can survive drops and jolts that could send it to the repair shop. Even the tough detachable control cord can be easily replaced by the subscriber. There's less need for service calls.

Our box is an easy way to expand your service and revenue. All you have to do is use our brains.

To find out how, contact your area salesman, or call toll free (800) 351-6010 within the continental United States except Texas. From Alaska, Hawaii or Texas, dial (915) 544-7550. Ask for Ray Pawley.

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CA-2500

A MOVE TO QUALITY

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ELECTRONICS, INC.

RMS ELECTRONICS, INC.
50 ANTIN PLACE
BRONX, NY 10462
CALL COLLECT (212) 892-1000

*Canada Representative: Deskin Sales Corp.