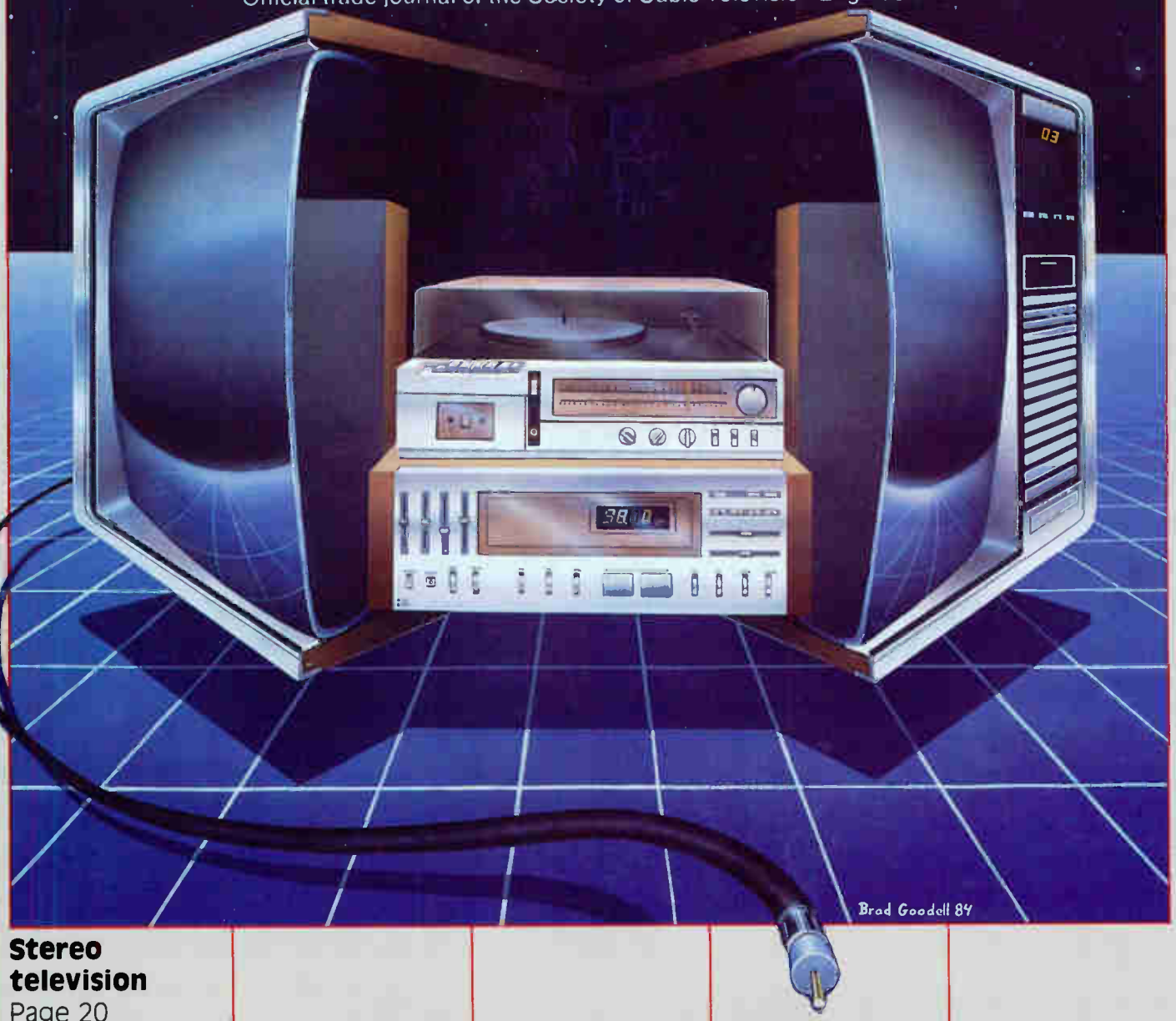
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers



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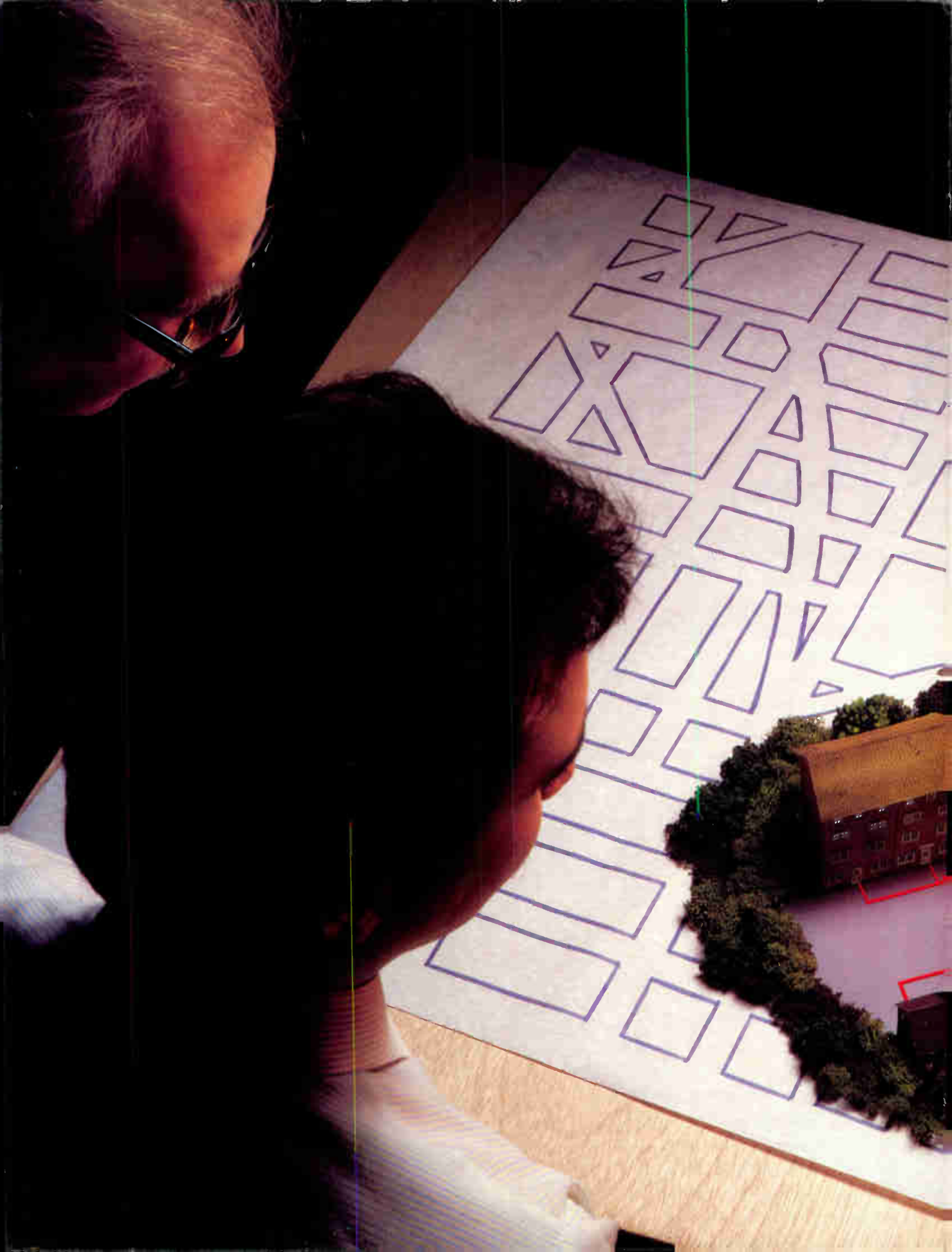

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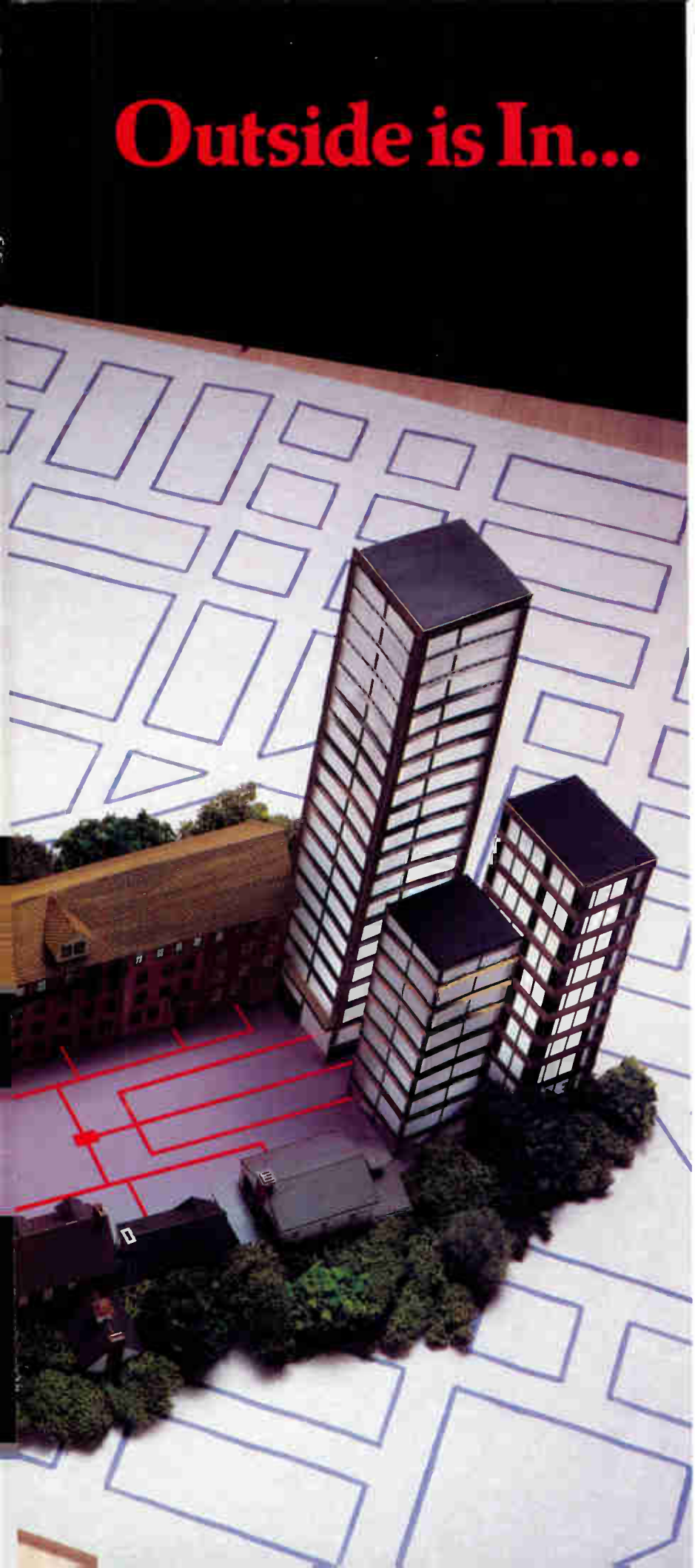

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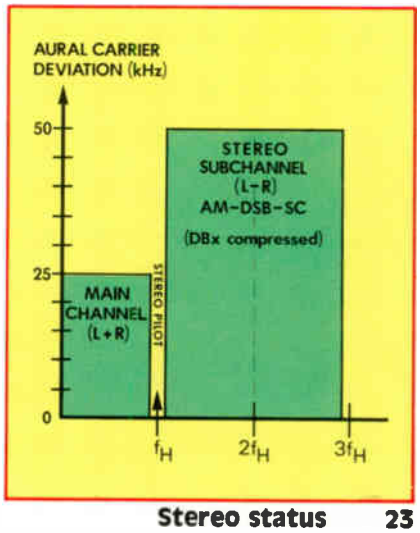

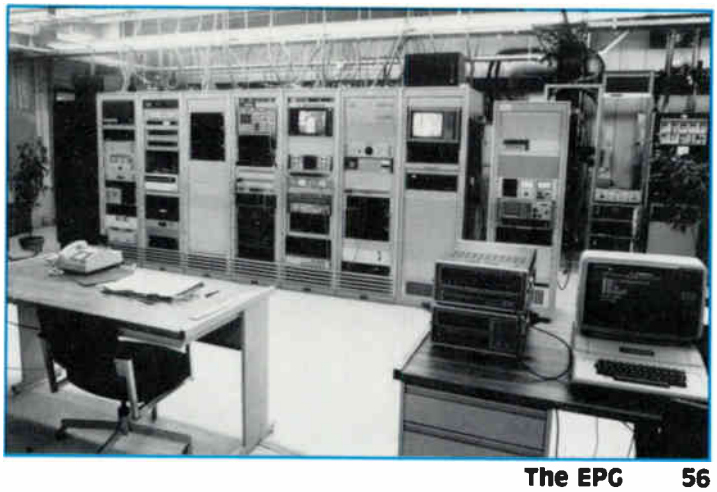

Features

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Seminars support learning

I was pleasantly surprised recently when I attended the first meeting of the Society of Cable Television Engineers Rocky Mountain Meeting Group. The seminar, under the direction of Sally Kinsman, Kinsman Design Associates, was executed brilliantly. (Congratulations also to Kinsman's staff: Denise Finnie, Jeanine Cowan and Tad Larsen for producing a well-coordinated meeting.)

The seminar featured basic information regarding data communications. Cliff Schrock, president of C-COR Labs and one of *Communications Technology*'s advisors, was one of the guest speakers. Schrock is a 15-year veteran of the cable industry and an expert in the data field. He discussed the multitude of options available utilizing video, data, audio and telemetry that are not being implemented now.

Schrock also provided a clear overview of the developments leading up to data communications (computers, single chip microprocessors and mind expansion). According to Schrock, "Broadband is the best choice of the mediums we have available."

Ron Hranac, corporate engineer for Jones Intercable, focused on the importance of data communications in a cable system. Hranac stressed the basics involved in data, explained the terminology and how data interfaces with cable systems. The seminar attendees (about 53) seemed to appreciate the basic data information as evidenced by the number of questions asked.

Untapped resources

Considering that Denver is known as the cable capital of the world, I was extremely disappointed at how few MSO technicians attended this fine seminar. Considering the fact that Denver boasts ATC, TCI, United, Jones, Daniels, Mile Hi, etc., only a handful of representatives from some of these companies were in attendance.

The lack of attendance certainly was not due to high fees to attend the seminar (it was free!), air fare, hotels, etc. (at least from our local MSOs). It's up to management to realize how critical good training and informational seminars are. It's difficult to fault the technician or engineer when his superior has "more important" tasks for him to do. To be sure, engineers and technicians have important responsibilities to attend to. However, just as critical as day-to-day responsibilities is the importance of training and re-training.

Many MSOs may believe their technicians have had enough training through their own in-house programs. I strongly disagree.

A few years ago I did a two-year franchising

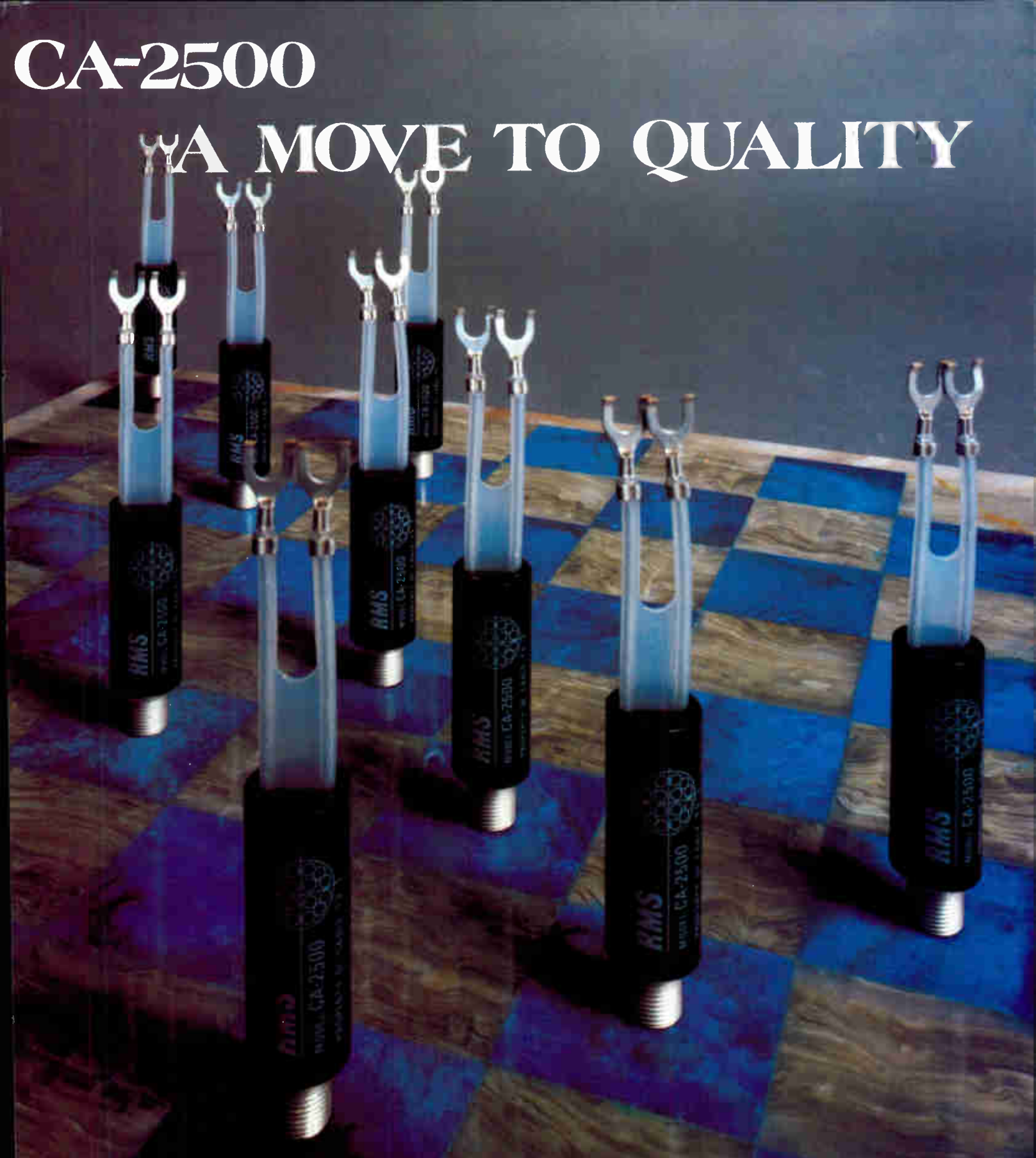
stint with one of the top 15 MSOs. While the technicians at headquarters were relatively competent, it was obvious that reinforced training would have been a positive influence.

The next meeting of the SCTE's Rocky Mountain Meeting Group will be about Oct. 15. Let's not overlook the obvious and assume all of our technicians are top-of-the-line and don't need improvement. Besides, at meetings like this one, a lot of problem-solving is accomplished because technicians from different systems have a chance to talk to each other face-to-face. Let's wake up and take advantage of these opportunities when we can.

Toni J. Barnett

CA-2500

A MOVE TO QUALITY



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Eastern Show boasts top tech lineup

ATLANTA—According to the Southern Cable Television Association, sponsor of the Eastern Show, this year's lineup of technical sessions "is designed to yield information . . . information that will produce immediate results for your system."

Produced under the guidance of Harold Null, vice president of engineering for Storer and a 30-year industry veteran, the technical seminars will look at new technologies, new products, improved methods, upgrades and applications.

In addition, every cable system that has registered at least one person for the full Eastern Show, can register technical staff at a special Saturday rate of only $10. The special fee covers the Saturday session and access to the exhibit hall.

Show agenda

Wednesday, Sept. 5

Pre-convention activities, including the annual Wometco Golf Tournament, entertainment and hospitality suites. Pre-registrants may pick up their registration packets from 1-5 p.m. at the World Congress Center.

Thursday, Sept. 6

7:30 a.m.—Registration opens
9-10:15 a.m.—Opening session: concurrent management/technical seminars
10:20-10:35 a.m.—Opening ceremonies for the exhibit hall
10:35 a.m.-6 p.m.—Exhibits open
10:45 a.m.-noon—Concurrent management/technical seminars
12:15-2 p.m.—Free deli lunch in the exhibit hall
2:15-3:15 p.m.—Session on current political issues—"Cable: Past, Present Future"
4-5 p.m.—"Cable Image Campaign"
5-6 p.m.—Social hour in the exhibit hall (open bar)
Evening—Hospitality suites

Friday, Sept. 7

8 a.m.—Registration opens
9-10:15 a.m.—Concurrent management/technical seminars
10 a.m.—Annual SCTA associates meeting
10:30 a.m.-6 p.m.—Exhibits open
10:30 a.m.-noon—Concurrent management/technical seminars
12:15 p.m.—Annual SCTA luncheon (at World Congress Center)
2 p.m.—Annual SCTA membership meeting
6:30 p.m.—Annual SCTA reception
7:30 p.m.—Annual Southern Cable TV Association banquet at Westin Peachtree Plaza Hotel—featuring Neil Sedaka

Saturday, Sept. 8

8 a.m.—Registration opens
9 a.m.-noon—Exhibits open
9-10:30 a.m.—Free Bloody Mary's in the exhibit hall
10-11:30 a.m.—Technical seminar

Technical break out

Thursday, Sept. 6

9 a.m.—"Data Transmission Via Cable, Microwave and Satellite." *Speaker:* W.C. Margiotta, product marketing manager, special programs, Hughes Aircraft
10:45-noon—"Addressability–On and Off Premises." *Speaker:* Allan Kushner, vice president, Times Fiber
2-3:15 p.m.—"Signal Security." *Speaker:* Michael Hayashi, sales engineer manager, Pioneer

Friday, Sept. 7

9-10:30 a.m.—"Cable: Utilizing Existing Cable in Rebuilds and Upgrades." *Speaker:* Richard Thayer, vice president, cable television engineering, Times Fiber
10:45 a.m.-Noon—"Connectors and Repair Kits For Cable." *Speakers:* Rex Porter, vice president, sales and marketing, Gilbert Engineering; John Carlsen, manager strategic marketing, CATV, Raychem Corp.
2-3:15 p.m.—"RF Amplifiers-Feedforward and Power Doubling." *Speaker:* Jay Staiger, product manager, amplifiers, Magnavox

Saturday, Sept. 8

9-10:30 a.m.—"Proper Testing of System Components, Before and After Installation." *Speaker:* Larry Richards, manager of technical services, Magnavox

SCTE launches Rocky Mtn. group

DENVER—On Aug. 15, the Society of Cable Television Engineers hosted its first get-together of the Rocky Mountain Meeting Group. The meeting, not limited to SCTE members, served a dual purpose: a technical seminar on data communications and a brief business meeting on what's happening with the SCTE.

Sally Kinsman, of Kinsman Design Associates and an SCTE director, reported that the Society will be coordinating all technical seminars at the upcoming Eastern, Western and Cable-Tec Expo shows.

Ron Hranac, corporate engineer for Jones Intercable, and Cliff Schrock, president of C-COR Labs, were the guest speakers at this meeting.

Hranac described the importance of data communications on cable systems and included definitions and basics of this technology. Schrock discussed what could be utilized on a data communications system. Specifically, he explained applications in video, data transmission, audio and telemetry. Schrock also explained plant considerations in a cable system. "A little bit of foresight," he stressed, "can save a lot (of time, money, headaches) in the end."

About 53 representatives from Jones Intercable, Group W, Cadco, Winegard R&D, Mile

'Channeling Into Cable'

OAKLAND, Calif.—The Society of Cable Television Engineers Golden Gate Meeting Group, the Bay Area Chapter of Women In Cable and the Bay Area Cable Club are sponsoring a seminar series entitled "Channeling Into Cable."

The purpose of the series will be to provide an overall picture of the cable industry through five practical seminars that will get the participants working and learning, according to the sponsors. Each of the seminars will focus on a different aspect of the cable industry: "Overview of Cable Television in the Bay Area," "Technical Session," "Programming and Services," "Hands-On Marketing Session," and "Challenges Facing the Cable Industry."

The seminars will be held every other Tuesday, beginning Sept. 11 and running through Nov. 6, at Gallaghers Restaurant in Jack London Square, Oakland. For more information, contact Sharon Kellogg at Viacom, (415) 828-8510.

Hi Cablevision, ATC, Kinsman Design, Toshiba, TCI, ITS and Great Lakes Telephone Supply attended the seminar.

According to Kinsman, "We considered this first meeting a real success. We're planning the next meeting about October 15. That meeting," she emphasized, "is going to be a much more basic course. We're going to start from the ground level and work up."

The Rocky Mountain Meeting Group is geared for local technicians in various size systems. The October meeting will be directed towards what's involved in system basics. In November, the group plans to meet at a location with actual test equipment set-ups, and let the attendees gain hands-on experience.

Olympic winners

LOS ANGELES—The medal winners weren't the only newsmakers to come out of the Summer Olympics; Jerrold, Zenith and Wegener also helped bring new dimensions to the games.

The Jerrold Division of General Instrument Corp. supplied ABC-TV with a 52-channel Commander IV prepack headend to process incoming signals from Olympic event sites and distribute the coverage from each venue to ABC-TV personnel throughout the network's West Coast television headquarters. The 52-channel headend system also incorporated a 25-channel system used during the 1984 Winter Olympics in Sarajevo, Yugoslavia.

ABC allocated 12 channels to process incoming feeds from the various event sites and 10 channels for editors to review and/or edit sporting events and other segments. The headend system also provided capacity for in-house studio output channels, local Los Angeles off-air channels, several utility and screening channels. These channels were then distributed to ABC-TV's three main control rooms and approximately 2,000 television sets in 10 buildings and 20 trailers located on the ABC lot.

In addition to the headend equipment, ABC-TV used other Jerrold distribution and subscriber equipment including JLE line extenders and Starcom converters with infrared remote control units.

John Wilson, ABC-TV's manager of the system maintenance and assembly group, said: "Quite simply, CATV equipment such as Jerrold's lets us bring in more signals and get them efficiently and economically to more places."

Stereo coverage

The nation's first commercial television broadcast with stereo sound occurred during coverage of the opening ceremonies of the 1984 Summer Olympics. ABC-owned Los Angeles TV station KABC broadcast the ceremonies live using the specifications of a patented multichannel TV sound transmission technology developed by Zenith Electronics Corp.

In addition to developing the transmission technology, Zenith also supplied KABC-TV with color television sets and new TV-stereo adaptors for stereo television demonstrations at a number of locations.

(For more on stereo television, see this month's cover features beginning on page 20.)

Overseas audio

A double hop Wegener multiple subcarrier transmission system was successfully implemented during the recent Olympic games. In what was perhaps the most challenging environment encountered, the Wegener Panda® II System provided "some of the best audio ever to come out of the States," stated Norman Taylor of the British Broadcasting Corp. (BBC). In addition to video plus a conventional audio carrier, four 15 kHz channels were accommodated with the primary BBC video.

"The BBC job is the result of over six months extensive planning, testing and cooperation among several key players," according to Ned Mountain of Wegener.

AM Cable receives first Tier Guard order

QUAKERTOWN, Pa.—AM Cable TV Industries announced that the firm has received its first purchase order for its Tier Guard System from Comm Management Inc. of Topeka, Kan., an operator of CATV systems in five states. This initial order, valued at $335,000 for the supply of off-premises, two-way addressable equipment, will be installed in the areas of North and East Topeka in Shawnee County, Kan. Delivery of the equipment will begin this fall.

The tamper-proof Tier Guard System is designed to integrate with any type of cable system an operator has in place. It is currently being evaluated by a number of cable operators and MSOs for use in their cable systems.

AM Cable also announced that its Field Services Division was selected by Booth American Co. to construct a turnkey cable telecommunications system for Appalachian State University, Boone, N.C.

Under the agreement, AM Cable TV will wire dormitory units in the university's 17 residential buildings. In addition, the company will presurvey, design, construct and turn on the cable system as well as tie it in to the university's Appalnet local area network. The new contract is valued at about $280,000.

Times Fiber restructures, appoints new execs

WALLINGFORD, Conn.—Times Fiber Communications Inc. announced that Kenneth Coleman and William Tuxbury have been elected senior vice presidents of the company. The new titles are in recognition of the increased responsibilities these general managers have in the operation of their divisions. At the same time it was announced that each of the company's three divisions—Cable Television, R.F. Cable Products and Communication Systems—will function as autonomous units.

Describing the new organizational structure, Colin O'Brien, Times Fiber president and CEO, said, "I have concluded that we should restructure our company into complete divisional units with full profit and loss responsibility. This move will properly balance responsibility and authority and position us to better service our customers and expand our present business. This organizational and financial foundation will enable us to seek out additional opportunities for growth in the future."

Central corporate staff departments will provide legal, treasury, controller and human resources services for all three divisions. Coleman is now senior vice president and general manager of the Cable TV Division; Tuxbury holds the same position for the R.F. Cable Products Division.

Consulting, search firm opens for business

STAMFORD, Conn.—Bruce M. Brown Associates announced the opening of the new consulting firm's headquarters office here. In announcing the opening, Bruce Brown, founder and principal consultant, stated that the firm will specialize in executive search and organization planning services for clients in fast growth and high technology industries.

Brown formerly held executive and general management positions with General Electric Co., The Telex Corp., The Singer Co., Harvey Hubbell, Irvin Industries, and most recently served as vice president and general manager of Times Fiber Communications' Cable Television Division.

Brown is a charter member of the National Association of Corporate and Professional Recruiters and has served as a search consultant for a number of major corporations as executive vice president of E.A. Butler Associates Inc. He also is a member of the Institute of Electrical and Electronic Engineers, the Society of Cable Television Engineers, the Financial Executives Institute, the Association of Old Crows, and the Navy League.

The company's new address is: 6 Landmark Square, Suite 400, Stamford, Conn. 06901; phone: (203) 359-5720.

Rogers uses Zenith for two-way addressability

SAN ANTONIO, Texas—Rogers Cablesystems Inc. launched what could be the world's largest two-way interactive cable television system, according to Zenith Electronics Corp. The cable system, which currently has more than 190,000 subscribers, is being upgraded with Zenith's Z-TAC addressable cable TV decoders and two-way interactive equipment called "Z-View."

Rogers' San Antonio cable subscribers who subscribe to new pay TV services now have all the benefits of state-of-the-art baseband addressable technology, including full-function wireless remote control, according to Vito Brugliera, vice president of marketing and product planning for Zenith's Cable Product Division.

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The headend reviewed

By Harry Linden
Vice President and Managing Director, Phasecom Corp

All cable television systems built in this country are broadband, tree-structured systems using coaxial cable and frequency-division multiplex technology. Broadband, in this context, means that the communication conduit (coaxial cable) has a bandwidth greater than the bandwidth required for a single communications channel. Tree-structured means that the network of cables fans out from a common "root"—the system headend or hub—through "trunks" and "feeders" to individual households connected to the feeders, much as stems connect leaves to the boughs of a tree.

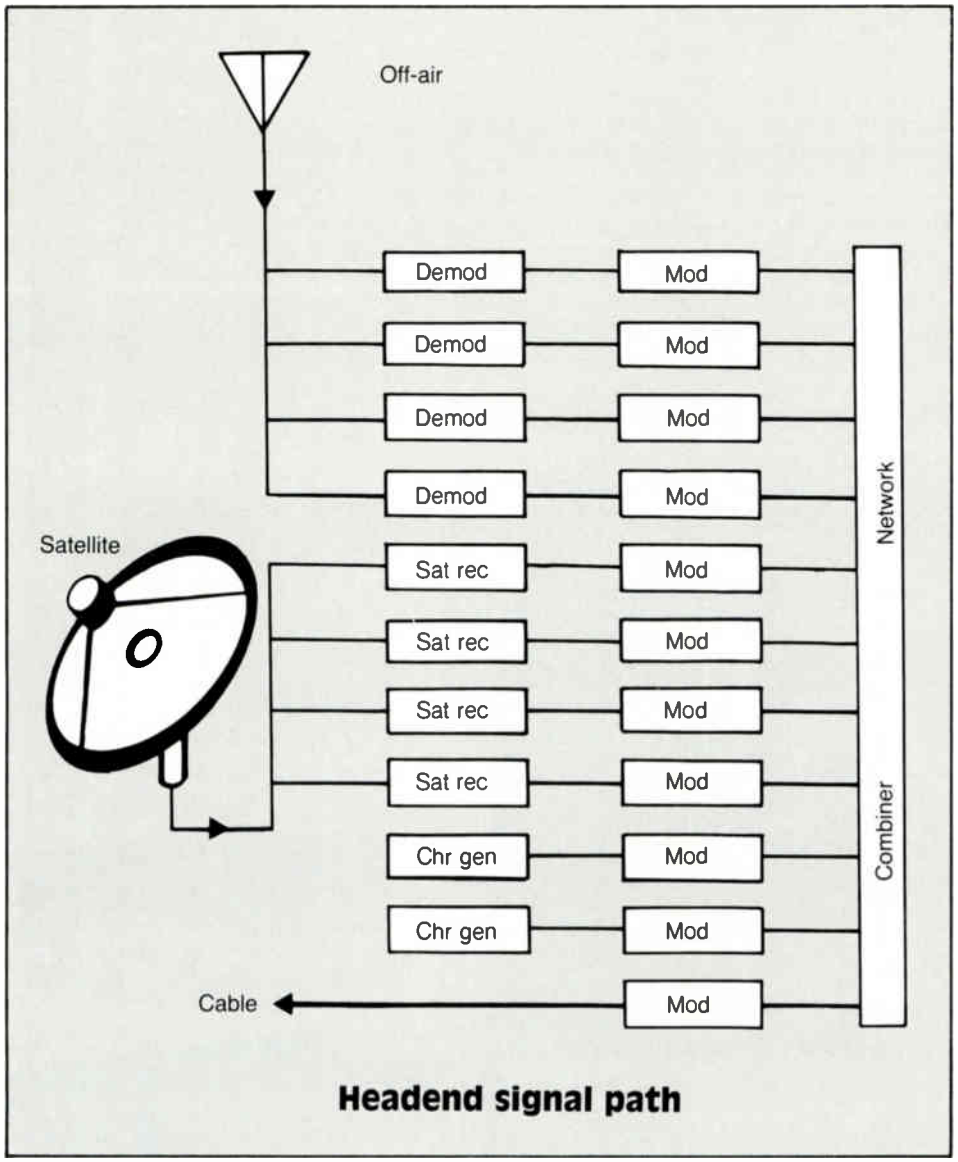
It is the intent of this article to take a basic look at what must happen to the signal during its momentary capture by the headend.

Signal source

There are several basic signal sources for the headend: satellite, microwave, "off-air" transmission and local video sources such as a VCR, character generator, etc. These sources require different treatment at the headend, since they may be received at different frequencies on different formats.

Signals that are received from a satellite are at about 4,000 MHz. Because these signals come in at such an extremely high frequency, they must be downcoverted in two basic steps. The group of signals is block downconverted by a low-noise converter (LNC) from 4 GHz to 950-1,450 MHz. This group of signals (20 MHz apart, 24 channels) then proceeds to a satellite receiver, where the desired signal is selected and then downconverted to video (baseband). Most satellite receivers are frequency agile, that is they can select any signal transmitted from the satellite. One receiver for each channel is required.

Signals that come in from off-air sources or broadcast television are assigned frequencies from 54-890 MHz. These signals proceed from the antenna to a demodulator, which delivers the signals at baseband, or to a heterodyne processor, which may change the channel assignment and equalize the level.



Headend signal path

Demodulators

It is the function of a demodulator to select the channel, convert it to baseband, filter and equalize it—thereby providing a video signal before sending it down the line. A few of the basic performance features to look for in a demodulator include: a superior filter at IF (intermediate frequency), which rejects adjacent channels; a self-synchronizing detector to eliminate quadrature distortion; a low-noise input; sync-tipped and delayed AGC circuits that equalize signal level; and minimum uncompensated group delay, which keeps the color portion of the signal aligned with the black-and-white portion.

Baseband

Before the baseband signal gets to the modulator, several "detours" can be set up. It can either be a straight connection, or it can go through a video patch panel, frame synchronizer, baseband scrambler, video production title inserter, or etc.

Scrambling

Since most cable operators wish to get paid for their services, scrambling plays an ever increasing role in their operation. Currently, the most popular method of scrambling is to "confuse" the synchronization circuit of the television receiver. There are a wide variety of these scrambling devices available from a number of major manufacturers. The critical thing to examine with regard to the headend equipment is compatibility with the modulator.

Modulators

It is the basic job of the modulator to reconvert the signal at baseband to the desired RF (radio frequency) channel. It is also at this point that the output signal level is made consistent (at about 1 volt) and therefore compatible in level with the other signals being sent by the headend. The scrambling function may be performed at baseband or at IF and therefore the modulator must be capable of working with these "confused sync" signals.

A few of the basic performance features one might look for in selecting a modulator are: an advanced SAW (surface acoustic wave) filter at IF, sync-tip output AGC (automatic gain control) for long-term constant output, a hybrid broadband amplifier for higher distortion-free outputs, an internal bandpass filter for low spurious outputs and minimal video differential phase and gain.

The larger system operators usually have a frequency agile modulator to act as a back-up. By having frequency agility, that is the capability to tune to any output channel, they have "spare" channels without the expense of buying another complete set of dedicated modulators.

Combiners

After the RF signal leaves the modulator, it is sent to the combiner. It is the job of the combiner to provide the individual channels with isolation padding (which keeps one device from affecting another, normally 16 to 32 dB) and then to take all the channels and put it on the cable. At this point, the signal leaves the domain of the headend.

Our present state of the art allows us to carry as many as 70 television channels in a system utilizing 50-550 MHz bandwidth (downstream) over a distribution network distance of about seven miles from the headend. Greater channel capacities are presently being achieved by the use of dual-cable networks.

In a system employing dual cables, the network is completely duplicated—duplicate headends (which may be in the same building), duplicate trunks, feeders, service drops, repeater amplifiers, everything—right up to the back of the subscriber's TV set where a switch selects which cable network will be connected to the TV set.

HRC headend

For larger headend operation a distortion reducing method utilizing harmonically related carriers (HRC) offers the maximum benefit. Not only are the visual carriers coherent, but the frequencies of the channels are harmonics of a master 6 MHz oscillator. All the visual carriers are harmonically related and the distortion caused by intermodulation between them also will be harmonics of the master oscillator, therefore, undesired signals will fall "zero beat" on carriers. Thus, the visual effect of all second and third order intermodulation products are eliminated.

Operational experience with HRC carriers has shown that the effective distortion "reduction" affects all active system components. In addition, the phase optimization capability has been shown to provide a 6 dB improvement in distortion levels.

An HRC system requires a set-top converter for every subscriber, as the new set of system carrier frequencies differs from the broadcast frequencies by 1.25 MHz (except for channels 5 and 6 which move up .75 MHz). In addition, it is important that the system be RF leakproof to prevent off-air interference from entering the cable.

ICC headend

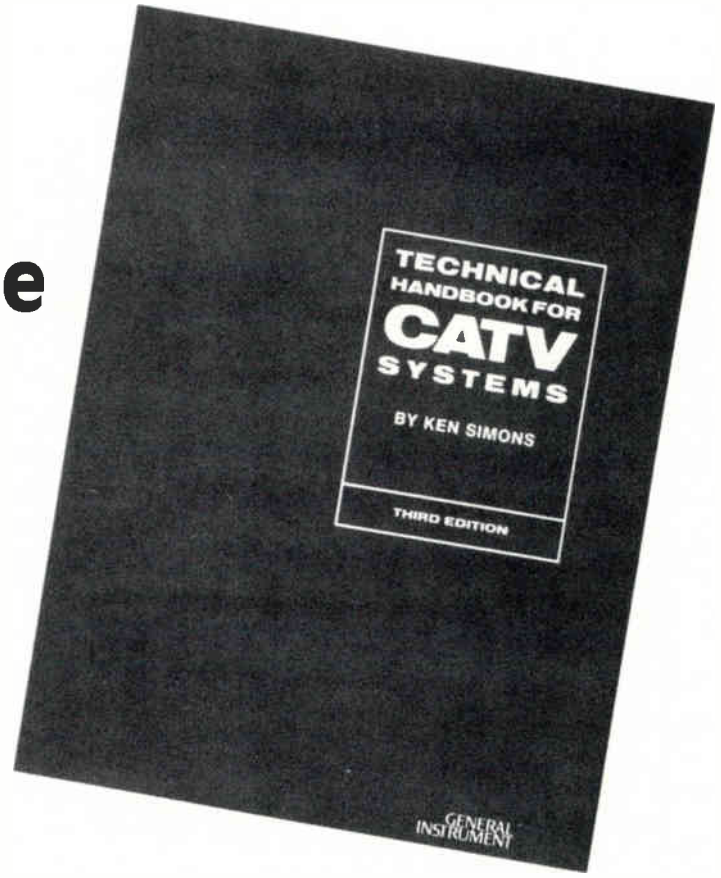
An incrementally coherent carrier (ICC) headend (also referred to as IRC, incrementally related coherence) offers a reasonable compromise to those systems that wish to expand without full set-top converter penetration. The ICC system has nearly all channels at nominal broadcast frequencies, making it possible for subscribers to tune to basic channels without a converter (except for channels 4 and 5).

The ICC system has all visual carriers spaced by a uniform 6 MHz, but not at multiples of a fundamental 6 MHz. This results in somewhat more than half of all third order intermodulation products falling "zero beat" on carriers. It has no effect on second order distortion and is recommended for those systems with 20 or more channels. The ICC reference "comb" of frequencies can be generated in a manner such that it is coherent with one off-air channel, in order to minimize the possibility of a co-channel beat with that channel. Once the HRC or ICC system is implemented, additional coherent channels can be added as needed.

The future

The headend has come a long way since its roots some 30 years ago. The successful operator must stay cost-effective yet remain poised to capture new markets as they arise. Two-way systems already are here, and significant penetration of the data market is not far behind. The push is on for more channels and fiberoptics will probably soon come of age. The challenges are formidable, so is the competition. Only greater than the risks are the rewards for the informed and aggressive operator.

The arithmetic of cascaded trunk-line amplifier systems



This is Chapter VII of the "Technical Handbook for CATV Systems." Chapter VI, which covers cross-modulation, has been skipped over because recent developments have caused portions of the material to be outdated; Chapter VI will appear at a later date once it is updated. (Author's note: A more recent effort entitled "Identifying Picture Problems" is available from the Society of Cable Television Engineers, who published it as a technical monograph, TM-7.)

By Ken Simons
Consultant to Wavetek CATV Division

The noise and the cross-modulation relations worked out previously can be combined to show the factors that determine the maximum length of a cascaded trunk-line system. The system is idealized by assuming that all amplifiers are identical, that they are all "well-behaved," and that they are separated by identical cable lengths each having a loss equalling one amplifier's gain. The use of decibels reduces the mathematics to simple addition and subtraction.

Definitions

Two qualities describe the noise and distortion performance of the system; they determine the quality of the picture at the end of the system, and are, in effect, the ground rules for system design:

R_{min} = the lowest signal-to-noise ratio (smallest number of + dB) that will be allowed.

XM_{max} = the highest cross-modulation level (smallest number of – dB) that will be allowed.

Three more quantities describe the performance of each amplifier:

G_1 = the operating gain (dB) of one amplifier (taken from manufacturer's specifications or worked out for best cascading).

F_1 = measured (or rated) noise figure (dB) of one amplifier at this gain.

$S_{max(1)}$ = measured (or rated) output (dBmV) from one amplifier at which cross-modulation = XM_{max} on the worst channel, with the channels to be used on the system measured at the operating gain.

Starting with these five quantities, a great deal of information about the system can be calculated, including the maximum number of amplifiers that can be cascaded. From this, knowing the cable loss, the maximum system length is easily found.

Noise relationship

(Refer to Chapter III for derivation, *CT*, June 1984.) Starting with a single amplifier, its noise output (input terminated) is $N_1 = -59 + G_1 + F_1$ (dBmV). The lowest permissible signal output (S_{min}) is found by adding the minimum signal-to-noise ratio R_{min}:

$$S_{min(1)} = N_1 + R_{min} \quad -59 + G_1 + F_1 + R_{min} \text{ (dBmV)}$$

When many amplifiers are cascaded, the system noise characteristics are found by using the cascade factor (C), which is related to the number of amplifiers in cascade (m) by: $C = 10 \log_{10} m$ (see Table H, Chapter III).

System noise figure $F_m = F_1 + C$ (dB)
$= F_1 + 10 \log_{10} m$ (dB)

Noise output of last amplifier $N_m = N_1 + C$
$= -59 + G_1 + F_1 + C$ (dBmV)

Lowest permissible signal output from last amp. is:
S_{min} (m) $= N_m + R_{min}$
$= -59 + G_1 + F_1 + C + R_{min} = S_{min(1)} + C$

Cross-modulation relationships

At a given output level, cross-modulation (expressed in percent) increases directly with the number of cascaded amplifiers. For a given system output level S_m, this is expressed (in decibel terms):

system cross-mod (in dB rel. to 100%)
= (single amp cross-mod) + $20 \log_{10}$ m;
thus $XM_m = XM_1 + 2C$

When "well-behaved" amplifiers are used, the system cross-mod is reduced 6 dB by lowering system output level 3 dB. This says that system cross-mod can be held at the maximum permissible level (XM_{max}) by reducing system output 3 dB each time the number of amplifiers is doubled:

for system cross-mod = XM_{max}:
system maximum output $S_{max(m)} =$
$S_{max(1)} - 10 \log_{10} m = S_{max(1)} - C$

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How noise and cross-mod limit system length

To relate noise and cross-mod, the ideal of "tolerance" is used. The tolerance of a system expresses the variation in level that can be allowed without objectionable picture degradation.

Tolerance is defined as the difference, in dB, between the lowest permissible output level (determined by noise) and the highest (determined by cross-mod).

For a single amplifier:

$$\text{Tolerance } T_{(1)} = S_{max(1)} - S_{min(1)}$$
$$T_{(1)} = S_{max(1)} + 59 - G_1 - F_1 - R_{min}$$

This says that the tolerance of a single amplifier is increased by increasing its maximum output, and by reducing its gain, its noise figure, or the minimum permissible signal-to-noise ratio.

For a cascaded system:

System *maximum* output: $S_{max} = S_{max(1)} - C$
System *minimum* output: $S_{min} = -59 + G_1 + F_1 + C + R_{min}$

So system tolerance is:

$T_s = S_{max(m)} - S_{min(m)}$;
$T_s = S_{max(1)} - C - (-59 + G_1 + F_1 + C + R_{min})$; then
$T_s = S_{max(1)} + 59 - G_1 - F_1 - R_{min} - 2C$, and
$T_s = T_{(1)} - 2C$

This says that the tolerance of a system is increased by increasing the maximum output of the individual amplifier, and by reducing its gain, its noise figure or the minimum signal-to-noise ratio. It is decreased as more amplifiers are cascaded (C increases).

Maximum number of amplifiers

As the number of cascaded amplifiers is increased, a point is reached where the tolerance reaches zero. For this number of amplifiers there is a single critical operating level which alone allows satisfactory pictures. Any increase in level produces cross-modulation; any decrease produces snow. Obviously this is not a practical condition since levels in an actual system inevitably vary from channel to channel (due to frequency response variation) and with temperature as the cable heats and cools. Some tolerance is required to allow for these variations, but the condition of zero tolerance (neglecting these variations) still gives a workable approximation to maximum system length.

Thus, for zero tolerance of a maximum number of cascaded amplifiers the system tolerance

$T_s = 0$ and, from the foregoing:
$T_{(1)} - 2C = 0$; hence $T_{(1)} = 2C$.

This means that zero tolerance for a maximum number of cascaded amplifiers is reached when 2C becomes equal to the tolerance of a single amplifier.

The number of amplifiers that can be cascaded without excessive degradation is increased by all factors that increase the tolerance of a single amplifier.

Optimum system operating level

The optimum system operating level is defined as the operating level midway between the maximum output at which cross-mod becomes intolerable and the minimum at which noise becomes intolerable.

When the number of amplifiers is increased to the point of zero tolerance, only one operating level is possible. This is the same as the optimum operating level for *any* number of amplifiers and is found as shown:

System maximum output $S_{max(m)} = S_{max(1)} - C$;

At zero tolerance $2C = T_{(1)}$;

so $S_{max(m)} = S_{max(1)} - \frac{T_{(1)}}{2}$; that is:

The optimum operating output level for each amplifier in a cascaded system is found by subtracting half the single-amplifier tolerance from the single-amplifier maximum output.

At zero tolerance the maximum and minimum system outputs are equal, so,

since $S_{min(m)} = S_{min(1)} + C$, and
at zero tolerance $2C = T_{(1)}$ then:

$$S_{min(m)} = S_{min(1)} + \frac{T_{(1)}}{2}$$

This seems like a long way round to show that the optimum operating point for an amplifier is half-way between the maximum set by cross-mod and the minimum set by noise; but it illustrates some of the reasons why this is so, and the calculations that can be made.

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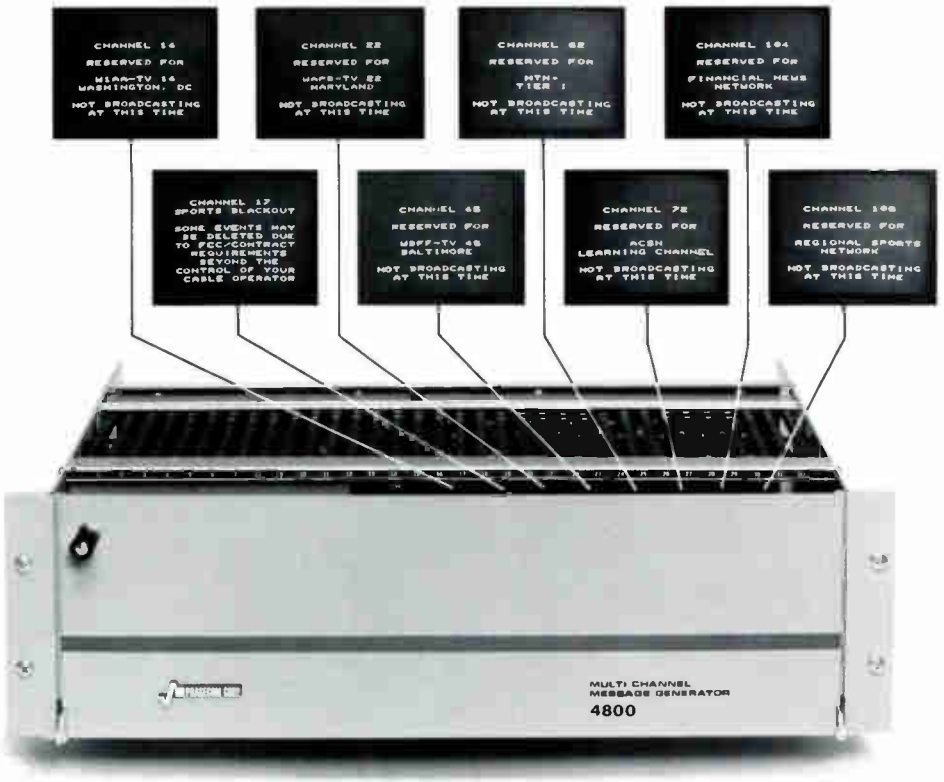

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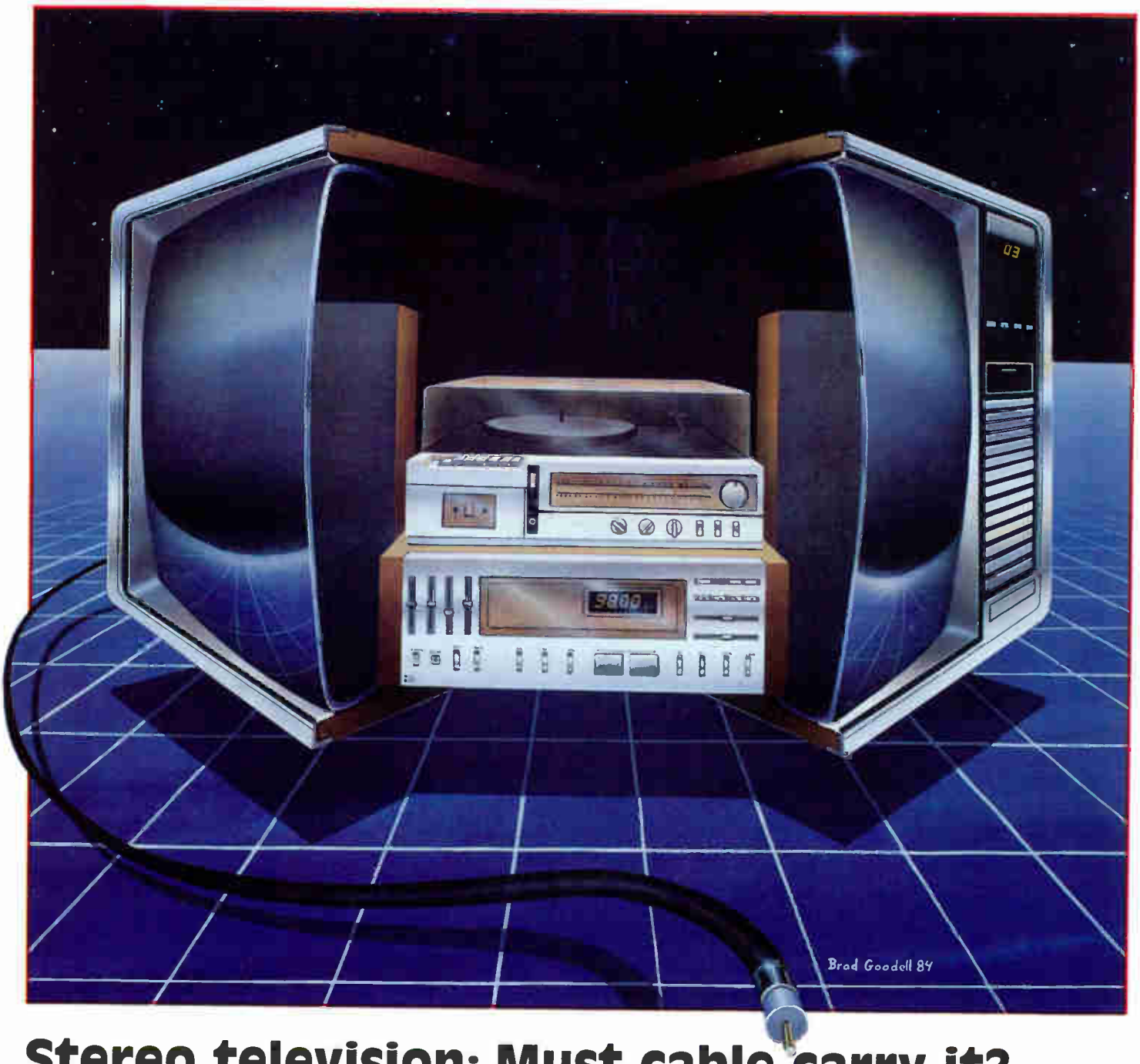

Stereo television: Must cable carry it?

By William W. Riker
Director of Engineering, National Cable Television Association

On July 26, 1984, the Federal Communications Commission reminded the cable industry that it has yet to decide whether cable systems will be forced to carry stereo audio signals from broadcast TV stations to cable subscribers. By a 5-0 vote, the commission approved the issuance of what is known as a Further Notice of Proposed Rulemaking. This document invites comments from the public as to whether the stereo portion of a television signal should be included in the FCC's "must-carry rules." These rules were originally created to protect local television stations and state that cable systems must carry designated signals *without modification* and offer them to all subscribers. Legislative process dictates that the commission consider all information supplied to it during the filing period when making its decision. Therefore, *now* is the time for the cable industry to let the FCC know of its feelings.

The course of events

In order to place the FCC's recent action in the proper perspective, we should review some of the events that led to this point. In 1978, the Electronic Industries Association (EIA) charged its Broadcast Television Systems Committee (BTSC) with evaluating a number of stereo transmission systems and recommending one for use in this country. The EIA hoped that, in recommending a system, the FCC would make it a standard and in doing so avoid the confusion caused by "marketplace decisions" as happened with teletext and AM stereo.

The BTSC selected three transmission systems for further evaluation. The proponents chosen were Zenith, Telesonics and the EIA-J (EIA of Japan). A laboratory was set up in Matsushita's Chicago plant and the systems were subjected to a multiplicity of tests. The resulting 860-page report had only 1½ pages that addressed compatibility with cable television systems. It was then that the NCTA decided to perform its own series of tests. An *ad hoc* multichannel sound (MCS) subcommittee was formed under the chairmanship of Alex Best of Scientific-Atlanta. A professional test engineer was hired and with the EIA's permission, the NCTA conducted its own tests in the same Chicago lab. Some six

months and $100,000 later, a 225-page report dealing exclusively with compatibility between stereo broadcast television and cable was produced.

NCTA's testing indicated that many cable systems will encounter problems with the reliable delivery of MCS signals into the home. First, older generation headend processing equipment may degrade the wider deviation stereo subcarrier as it passes through the filtering systems and will need either preparatory modification or replacement. Baseband headend equipment, by virtue of its built-in monophonic remodulator, will tend to strip off the wider deviation stereo information and pass only mono audio to its output. The cable distribution system itself was found to degrade the MCS signals somewhat (severity being a function of system age and maintenance), but still pass a usable signal. Standard heterodyne converters also were shown to degrade MCS signals slightly. However, when this slight degradation is added to the slight degradation of the distribution electronics and the slight degradation of headend equipment, the sum may well be enough to cause complaints from subscribers with newly purchased stereo TV sets or adapters.

Million dollar problem

The major problem turns out to be with set-top converters. Baseband converters, like baseband headend equipment, will strip MCS information and pass only mono audio to the TV set. In the converter/descrambler arena, we find even more dramatic problems. Sync-suppression type descramblers that detect the descrambling "key" as information on the FM audio subcarrier also will begin seeing the AM modulated portion of MCS signals. The results may be the attempted descrambling of a stereo broadcast channel transmitted in the clear—and an obliterated picture. Conversely, stereo TV sets may be false triggered into the stereo mode when receiving only a mono signal by artifacts generated in the descrambler, which appear at the MCS decoder pilot frequency (15.734 kHz), resulting in a large amount of noise being introduced into the audio. In terms of cost, NCTA has calculated that to replace all such problem converters and descramblers plus modify a percentage of headend processors would represent a financial burden to the cable industry of many millions of dollars.

On Dec. 22, 1983, the BTSC voted to recommend the Zenith transmission system along with the dbx noise reduction system as its proposed standard. NCTA went on record during that meeting stating that all three proponent stereo systems pose an equal level of problems to the cable industry and therefore cable operators should not be forced to carry them. The NCTA also filed comments with the FCC stating that, while the cable industry favors the introduction of stereo television broadcasting, the high cost associated with becoming compatible with these new signals should preempt cable operators from being immediately forced to replace and modify existing equipment in order to carry them (the must-carry rules would prohibit moving the stereo audio to the FM band or another area for cable distribution). The NCTA further observed that marketplace pressure to provide over cable what consumers can receive over the air should be sufficient incentive for cable operators to find an economically viable method for them to get these signals to their subscribers. Also introduced were legal arguments concerning the intent of the original must-carry rules and that they should not pertain to "ancillary" signals that are not governed by any content rules and which broadcasters can use for non-program-related, revenue-generating uses (such as paging, data transmission, etc.).

'Many cable systems will encounter problems with the reliable delivery of (multichannel sound) signals'

Mere days before the FCC was to consider the stereo television issue, the National Association of Broadcasters and the Association of Maximum Services Telecasters submitted what they called a "middleground proposal." They suggested that these ancillary audio channels should only become must-carries over cable when they contain program-related information. Cable operators also could obtain a waiver from the must-carry rule if they could document interference problems or extreme financial detriment in becoming compatible with the transmissions. Further, systems employing baseband converters could obtain a waiver if and only if the units were purchased before March 29, 1984.

NCTA argued against the proposal on the grounds that the financial impact to the cable industry would be the same whether it was forced to become compatible for one hour per day of program-related material or 24 hours a day. In addition, it would be next to impossible for cable operators to monitor these ancillary signals on each broadcast channel, determine whether or not they were program-related, and then either insert or remove a filtering network. NCTA also pointed out that baseband technology has been found to be highly desirable due to its efficient ability to provide addressability and highly secure scrambling methods to protect against signal theft. NAB's middleground proposal would, in effect, dictate to the cable industry that baseband technology would have to be immediately modified to become compatible or such equipment could no longer be employed.

On March 29, 1984, the authorization of multichannel sound for broadcast television finally came before the five FCC commissioners. They voted to adopt a rule that, while not naming the BTSC's recommended system as a standard, protected the Zenith/dbx system from interference by other MCS systems. That is, a pilot carrier at 15.734 kHz can only be present when the BTSC system is being transmitted, so that stereo TV receivers designed for that system will not be false triggered by other non-compatible formats. Broadcasters are free, however, to transmit any multichannel sound system available today or in the future as long as the BTSC pilot frequency is not used.

However, because of the confusion generated by the late submission of the so-called middleground proposal, the commission felt they did not have enough information to decide on the cable must-carry issue at that time. Therefore, they delayed their ruling on must-carry pending the issuance of a call for additional comments. The Further Notice, approved July 26, asks parties to comment on an extensive list of questions, including:

1) What is the current status of cable carriage of stereo sound in relation to pay services and other special programming?

2) What would be the net effect on local TV service if local stations provided stereo service and cable systems carried none, carried all programming in stereo except that of local stations, or carried some programming in stereo but not that of local stations?

3) What kinds of communications services could cable systems offer independently on the aural subcarrier facilities that would be used by broadcasters for program-related signals?

4) Would the market served by the independent services offered by cable systems be different from that of the broadcast services and, if so, what would be its size and composition?

The commission specifically asked for information about the technical problems that arise in cable carriage of TV aural subcarrier signals, particularly the modifications to plant and equipment that will be necessary to overcome particular problems and the attendant costs. Finally, the FCC asked for comments on the "middleground proposal."

The must-carry beachhead

Although an official deadline for filing comments with the FCC is yet to be set, the NCTA anticipates that all information must be submitted by mid-September. NCTA is vigorously continuing its research on the effects of MCS transmissions over cable systems in order to support its stance of no must-carry. The broadcasters clearly view this issue as an important beachhead on the whole question of must-carry. A victory here could possibly work to their favor in the commission's reconsideration of also applying the must-carry rules to broadcast teletext. It is therefore critical for the cable industry to respond strongly and effectively if we are to defeat the brodcasters' efforts to expand their must-carry protection. Cable operators are urged to file comments in the proceeding or provide information to NCTA on any technical problems that you anticipate or the costs that mandatory carriage would impose on your system.

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Television stereo sound: A status report

By David Large
Vice President Engineering Gill Cable

On April 23 of this year, the Federal Communications Commission approved the expanded use of the aural subcarrier of the television broadcast signal. In preparation for this ruling, a study committee of the Electronic Industries Association (with some last-minute participation by the National Cable Television Association) evaluated several proposed methods and finally recommended an expanded subcarrier structure that would allow simultaneous transmission of stereo television sound, an independent audio channel (second audio program or SAP) and a telemetry channel.

In its ruling, the FCC allowed, but did not grant exclusivity, to the EIA recommended system. While cable operators are not required to carry the expanded format at this time, the commission has agreed to consider that question in a separate rulemaking. Regardless of the FCC's eventual ruling, there is a question of whether or not must-carry status may be indirectly guaranteed by the laws governing modification of copyrighted works. Presumedly, the latter question will be decided in the courts.

Cable industry participants and observers of the EIA's selection process concluded that there were a number of serious problems related to cable carriage of all the proposed formats. Since no satisfactory solutions were reached at the EIA committee level, the NCTA and several operators recommended against must-carry status in their comments filed with the FCC. Gill Cable, among others, also recommended against selection of a single standard from among the candidate systems studied. While recognizing the many disadvantages of a lack of standardization, Gill felt that all of the systems contained unacceptable compromises, even for over-air transmission and that the attainable signal-to-noise and signal-to-"crud" levels were not consistent with modern audio equipment standards. Furthermore, several recently published technical papers suggest that high-quality digital audio can be carried time-multiplexed with the video signal without any of the undesirable side effects of the proposed systems.

We will first review briefly the EIA's proposed standard, then the difficulties of cable carriage and, finally, some possible solutions.

The EIA multichannel sound system

Figure 1 is a diagram of the EIA aural subcarrier format. The main channel carries the arithmetic sum of left and right channel signals, undergoes no special processing, and deviates the aural subcarrier 25 kHz. It is thus identical to the current monaural system and compatable with non-stereo equipped television sets. This compatibility, however, puts an upper limit on stereo system performance of approximately that which is now achieved in the monaural system since the majority of information in most stereo signals is in the L + R channel.

An AM modulated, double sideband suppressed carrier subchannel carries the difference (L-R) information. Using a system somewhat similar to FM broadcasting, a separate pilot signal at 15,734 Hz provides a reference to allow the decoder to demodulate this subchannel.

Demodulating such a multiplexed signal, however, takes a heavy toll in terms of the signal-to-noise (S/N) ratio (15-20 dB in the case of FM broadcast). In an attempt to compensate for this loss, the L-R information is subjected to a companding process to reduce the apparent noise level.

The third element in the EIA scheme is the SAP channel. This is a monaural FM subcarrier whose audio bandwidth is limited to 10 kHz and aural carrier deviation to 15 kHz. Companding also is applied to this channel to compensate for inherently limited S/N ratio. The obvious use for this channel is for second language tracks related to video, however, it also could be used for independent audio purposes whose fidelity requirements are limited.

Finally, the telemetry channel is a relatively noisy, low-fidelity (3.4 kHz audio bandwidth) channel suitable for transmitter control and monitoring, paging services, low-speed data transmission or similar uses typically unrelated to video programming.

Difficulties of cable carriage

An examination of the limitations of the EIA format as an over-air transmission method is beyond the scope of this paper. Each of the three modulation and two companding schemes considered by the committee contains compromises affecting eventual sound quality, however. In the case of the Zenith format eventually selected, the principal problems are related to the use of the horizontal scan frequency for the stereo pilot and to a television transmitter phenomenon known as incidental carrier phase modulation (ICPM). Interested readers are encouraged to review the EIA's *Report on Multichannel Television Sound* (several volumes) available from the association in Washington, D.C.

Difficulties associated with cable carriage of multichannel sound (MCS) were dealt with only lightly by the EIA, however. The principal ones are as follows:

1) Compatibility with existing scrambling systems

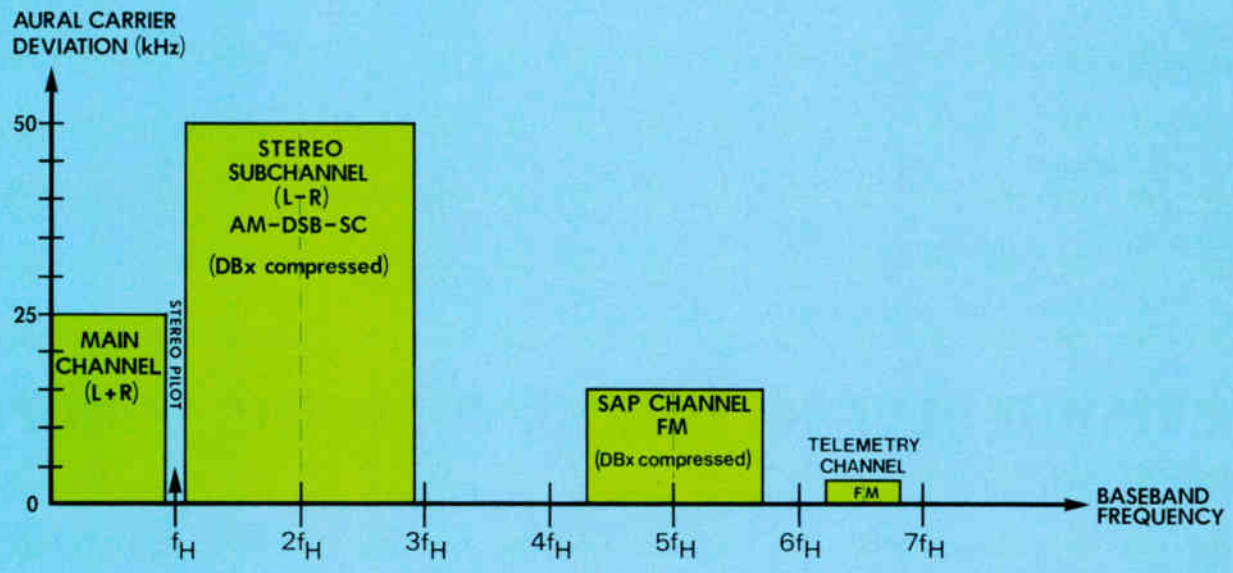
The majority of existing scrambling systems use either suppression of the horizontal synchronizing pulses (done at RF without demodulating) or baseband scrambling schemes, involving both sync suppression and some form of modification of active video lines. Most have severe problems with the MCS format.

In the case of simple RF sync suppression schemes where the encoded sync pulses are amplitude modulated on the aural carrier, this AM modulation degrades the quality of the stereo signal considerably.

In the case of sine wave sync suppression where the aural carrier is amplitude detected to recover the descrambling waveform, the greater aural deviation will result in sound modulation of the demodulated picture.

Finally, in the case of baseband devices, only the monaural sound will be demodulated and fed to the TV set. This will be true even if the signal was not scrambled, but merely fed through the descrambler.

Figure 1: EIA aural carrier modulation scheme



(f_H = 15734Hz = horizontal television scanning frequency)

Note: Total deviation due to main and stereo subchannel modulation is limited to 50 kHz so the maximum aural deviation is 73 kHz.

2) Problems related to adjacent channel usage

In order to minimize interference with upper adjacent video luminance carriers, the FCC requires cable systems to lower the aural carrier level to 13-17 dB below the level of video. This results, of course, in an equivalent reduction in recovered audio S/N ratio. If the upper adjacent signal has any video sidebands extending below the lower band edge, the reduction can be even greater. In existing monaural systems, the degradation has usually been tolerable due to the limited sound systems in most TV sets.

The MCS aural subcarrier, however, is three times as wide as the old monaural carrier and very well may cause increased interference to the upper adjacent video, particularly as the lower sound traps in existing TV sets are typically quite narrow. For that reason, raising the aural carrier level is certainly out of the question for cable operators, even though it has been suggested by broadcasters as a means of improving MCS quality in over-air transmission.

3) Modifications necessary to headend processing equipment

Existing processors, demodulators, modulators and microwave transmission equipment were not designed to handle the wider aural carrier contemplated. As a result, modification or realignment will be required to avoid distorting the MCS formatted signal.

4) Independent sound detection

A side effect of MCS may be the reintroduction of TV sets using separate sound detection as opposed to intercarrier detection, which has been almost universal for many years. Separate detection of the sound carrier provides a S/N advantage and also overcomes the problems of ICPM in transmitters. The problem is that many quality CATV converters use frequency synthesized local oscillators that have considerable phase noise. In an intercarrier TV set, this noise is cancelled when the luminance and aural carriers are mixed to produce the 4.5 MHz sound IF. In an independent sound detection scheme, the phase noise adds directly to carrier deviation thus adding noise to the recovered audio.

Possible scenarios for MCS development

1) Minimal accommodation of as-transmitted multichannel sound

Our first alternative, as an industry, is to do essentially nothing: let the MCS rollout be governed by the manufacturers and broadcasters, hope for FCC relief on must-carry and accommodate the new format as best we can. Our minimal response, assuming we are not required to carry the new format, will be to realign headend equipment for the wider aural carrier. In that case systems with no converters, those using converters or descramblers that do not modulate the aural carrier, and those using off-premises control systems will be able to deliver the new format. The MCS carrier, however, will be degraded with respect to off-air reception due to the lower aural carrier levels, adjacent channel interference and possibly phase noise in converters.

Operators using scrambling systems that involve amplitude modulation of the aural carrier would not be able to deliver stereo sound on scrambled channels. This would mean that broadcast signals could not be scrambled, but more importantly, that if any non-broadcast signals were to be carried with stereo sound, they also could not be scrambled. Any unified approach to delivering the benefits of stereo and SAP to cable customers would thus be impossible.

Finally, a rapidly growing minority of operators are using baseband converters and descramblers as the industry moves towards greater security and more subscriber features on terminals. These operators would be unable to delivery MCS at all, as those devices will only demodulate the monaural sound. A must-carry ruling in this case will require a major modification or replacement of these units to do one of the following:

- Pass the aural carrier through the box without modification. This will allow delivery of MCS, but will defeat all the audio controls that are one of the main advantages of baseband processing in the first place.
- Bring the aural carrier out of the box for connection to an external MCS decoder that will deliver baseband left and right audio channels to external sound equipment or speakers. This is a possibility for modification of current boxes, but is a confusing and messy solution for the customer.
- Build a full MCS decoder/modulator into the descrambler. This would allow full set compatibility, but would be very expensive if any reasonable sound quality were to be delivered.

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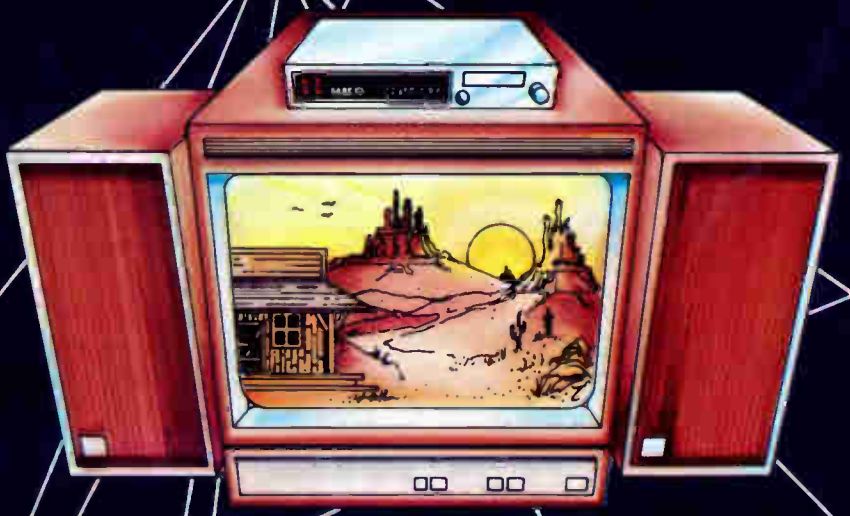

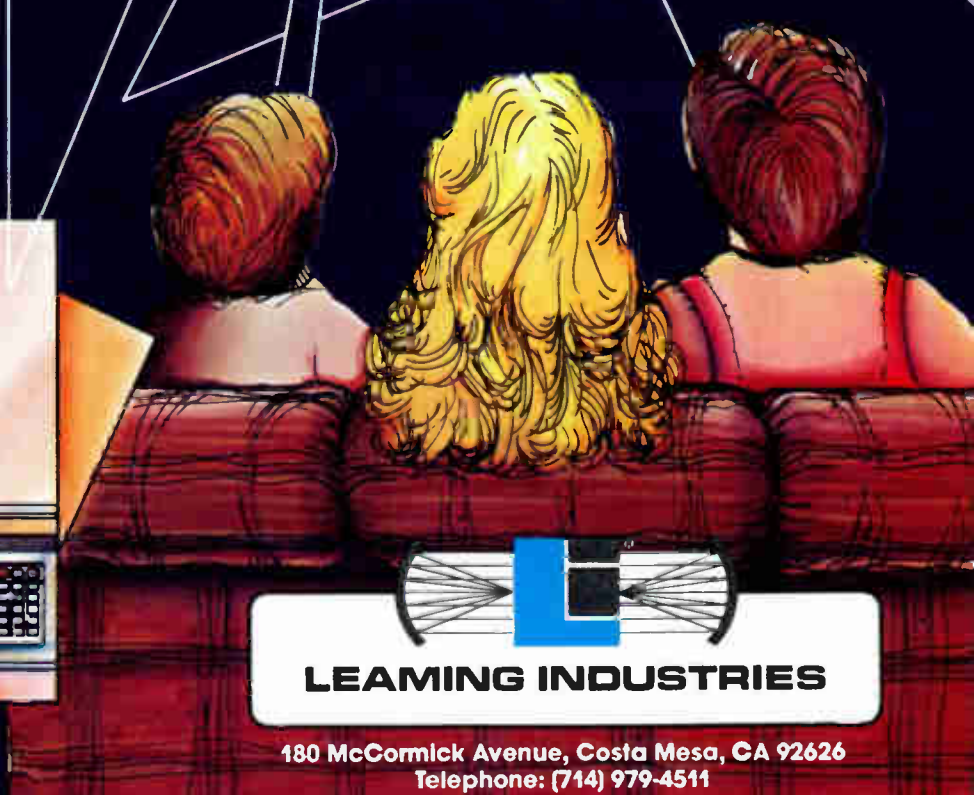

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The marketing implications of minimal accommodation are very serious. Cable's increased penetration in the last few years is directly related to being able to deliver *everything available off-air* plus significant unique product. If we have to tell the potential customer that in order to get the cable-exclusive product he must live with reduced quality or no stereo sound, that sale will be much more difficult.

2) Alternate broadcast technology

A significant feature of the FCC's MCS ruling was that the EIA format wasn't given exclusive rights for over-air MCS transmission. Nothing prevents an alternate transmission scheme from being considered. If, for instance, stereo sound of superior quality could be encoded into the luminance signal leaving monaural sound in the existing format, we might have a signal that could be transmitted with little or no modification through our present equipment. Using this scheme, we could also transmit stereo sound for those many cable services that have it available and thus have a unified answer to quality stereo sound.

The key to such a solution, of course, is timing. If a significant base of EIA equipped TV sets is installed before such a system is ready to go into production, it may be economically unfeasible to implement it.

3) Channel frequency reallocation

Since the greatest cable carriage problem, aside from scrambling and converter technology, is related to the adjacent channel situation, one possible course of action is to simply move the channels farther apart. If a guard band of, say 500 kHz, were placed between channels then the aural carrier could be raised to broadcast levels without interfering with the upper adjacent video (and vice versa).

The cost, in terms of the distribution system, would be twofold: first, a decrease of roughly 10 percent in the number of channels that could be carried due to the greater bandwidth occupancy; and second, an increase in the loading of distribution amplifiers due to the increased aural power level. The latter could force a further decrease in channels carried in order to keep system distortions within limits.

More seriously, it would force all systems to use converters as channels could no longer be tuned by many standard TV sets and would require modification of all existing converters and headend equipment. The cost of such a program would be tremendous.

4) Out-of-band carriage of MCS on cable

The proposed MCS transmission system will deliver rather limited quality sound, even under off-air conditions. This is a result of the compromises necessary for monaural compatibility and to stay within the 6 MHz bandwidth limitation. As cable operators, however, we have no such limitations. Several vendors have demonstrated equipment capable of transmitting very high-quality multichannel sound, even through cable plants operating at minimal specified performance levels for video.

Assuming cable operators are given some regulatory freedom, we could carry monaural sound in-band in the current format and high-quality stereo and SAP channels on separate carriers. Most cable systems have unused spectrum that could be used for these carriers since the power levels are typically below those requiring FCC approval and below those that would add significantly to amplifier loading. The advantages to such a solution are:

- No rework is required to existing headend equipment.
- It presents cable operators with a unified solution to broadcast MCS, stereo on cable-exclusive product, and potential stand-alone audio services.
- The deliverable quality is consistent with modern standards.
- The cost will be less than that of stereo equipped television sets and thus will hasten the availability of MCS to the consumer.

The principal technical challenge is to present a simple way for the consumer to tune the MCS sound to match his video. A separate device with its own channel selector is likely to meet with limited market acceptance, especially in these days of wireless remote controls. Two-handed tuning went out when the superheterodyne receiver was invented!

An obvious solution is a wireline connection between a converter or descrambler and premium audio tuner so that the latter will track. One outfit (Studioline) has implemented that

solution with the Zenith Z-TAC descrambler. Unfortunately, there are many manufacturers of descramblers and converters and will be an equally large number of makers of audio equipment so that the number of permutations necessary to design all possible versions of interface protocol is unreasonable.

James Wonn of Group W Cable has suggested[1] that a solution to the interface problem is to add a simple channel tag to each channel's video at the headend. The premium MCS receiver, then, would sample the output of the converter or descrambler at RF, detect the tag and tune to the appropriate frequency to recover the audio. This is obviously a higher cost solution than a wireline link, but would be compatible with all converters. One serious limitation to this technique as an add-on to a baseband descrambler, however, is that remote control of audio volume and mute functions would be lost.

This solution also would work with TV sets that contain adapter plugs for post-tuner descramblers since video could be sampled at that point for channel information. The only segment of the subscriber base not addressed in some way by this proposal is the basic subscriber who needs no converter and who has a television set not equipped with such an adapter plug (unfortunately most non-urban subscribers fall into this category).

The marketing potential of out-of-band multichannel sound of premium quality is very high if implemented quickly. A cable operator who can offer prospective customers not only stereo television at a lower cost than a new set but several cable exclusive channels *also in full stereo* should find sales easy to make, particularly if the demonstrable sound quality is much better. At some point, the installed base of EIA equipped stereo television sets may become a large enough percentage of installed sets that marketing reality may force some carriage of in-channel EIA format to reduce the cost of entry for a new basic subscriber. A strong alternate technology from cable operators may considerably delay that time.

The near future

Much of the cable industry is now facing a crisis because of the unresolved legal situation. The FCC has given a green light for broadcasters to transmit in the new EIA format and one network has announced its intention to do so by this fall. Several television set manufacturers have stated an intention to have stereo-equipped sets on the market in time for the Christmas season.

If cable had been granted a clear mandate to use our technical capabilities to the best advantage, then we could be offering our customers superior stereophonic sound at prices significantly lower than the cost of these new sets. This would result in a more rapid deployment of enhanced sound at lower consumer cost—certainly consistent with commission policy—while allowing the cable operator to pass along some of the costs of adapting to the stereo environment. As a major side benefit, operators could offer immediately the already available stereo sound for such services as MTV, CMTV, Disney, Nashville and The Movie Channel.

On the other hand, a must-carry ruling would have required us to somehow deliver the as-transmitted EIA format. It would have meant headend modifications, possible converter problems and major modifications or outright replacement of scrambling systems. Even at that, adjacent channel and system loading limits would limit the quality of the resultant sound. Under such an environment there still may be a market for equipment to deliver significantly better broadcast and premium channel audio and perhaps audio-only services as well, though the financial incentives are not as certain.

The current unresolved situation is the most serious, however. Descrambler manufacturers and potential vendors of premium audio equipment are understandably reluctant to design, manufacture and market equipment to deliver multiband sound until we have a clear definition of the legal situation. Meanwhile, an ever-increasing installed base of stereo-equipped sets will force us into a market-driven must-carry situation as it will be difficult to sell cable to a customer with such a set if subscribing means either losing stereo or buying more equipment to keep stereo.

When the FCC opens for public comments its proposed rulemaking on the must-carry issue for MCS, operators and manufacturers are urged to respond.

[1]Wonn James W. "An Equipment Scenario for Delivering Stereo Sound on CATV Systems." Technical Paper presented at 1984 NCTA convention

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Stereo TV: What it means to you and your subs

By Ned Mountain
Wegener Communications

Cable television has always been associated with bringing subscribers something different—something extra—something they *couldn't* get over the air. Today this *includes* stereo sound, even before the first commercial TV broadcaster employs the new Electronic Industries Association (EIA) recommended transmission format. We do, however, find ourselves in the uncomfortable position of maintaining that edge—that something extra with regard to broadcast multichannel sound.

Cable marketing—and stereo

If you haven't seen it yet—be prepared for the fall and winter marketing campaigns by TV set manufacturers promoting the glorious new stereo audio available from their new models. How did you handle the service calls about remote control? "Cable ready"? Well, start planning *now* for the "My new stereo TV set doesn't sound very good on your cable" phone calls.

If you plan, your subscriber can be properly educated on how their existing cable service will be affected by the *new* addition of stereo by the broadcasters. Many of your subscribers are already accustomed to receiving stereo audio on your cable channels (MTV, The Movie Channel, The Nashville Network, etc.), which brings me to a key point—the cable industry has been providing true stereo TV for at least four years and synthesized stereo for several years before that.

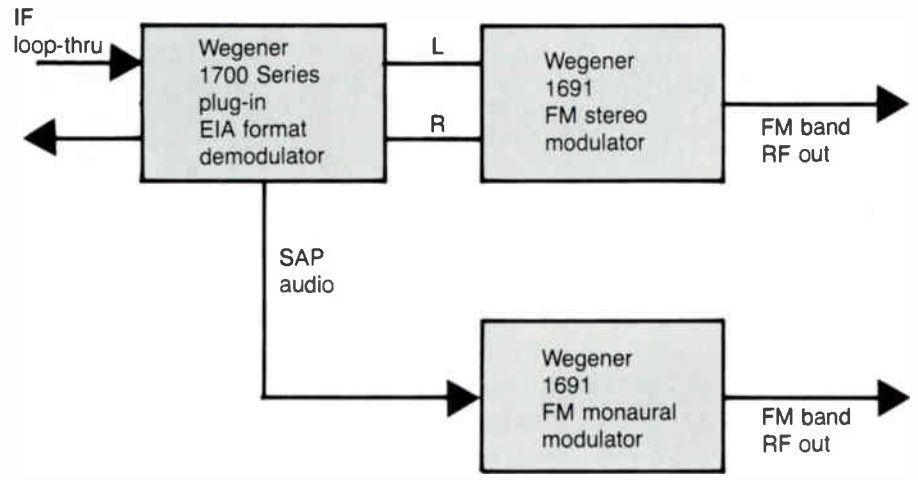
Signal quality is good and cable is providing this key service *today* without the necessity of a "new" stereo TV set. Carrying this line of thinking to its logical conclusion implies that a cable system could decode the new over-the-air stereo broadcasts in the headend and carry them in the FM band with the existing cable stereo TV services. This is probably a wise move with both short- and long-term implications in that it allows the cable operator to provide broadcast stereo now but does not lock one into any long-term commitment to new unproven cable stereo delivery technologies. Figure 1 illustrates how FM band carriage of multichannel sound can be implemented.

It also should be pointed out that the new broadcast stereo standard includes a secondary audio program commonly abbreviated as SAP. In many markets SAP audio will be as important, perhaps even more important, than stereo. In fact if SAP is carrying second language audio for popular programming, it may be advantageous to devote a second video channel with foreign language audio to that program. (As an example, subscribers could then receive NBC English, NBC Spanish, ABC English, ABC Spanish, etc.) All of this *without* the need to purchase a new TV set. If this is not possible due to channel loading, the SAP audio can be carried in the FM band. Either way, it gives the cable operator the opportunity to take the offensive and market a value added service for *all* subscribers, not just those with the new stereo TV sets.

Issues surrounding the EIA standard

Stereo has been slow to come to the world of broadcast TV because it is simply a difficult task to squeeze the multichannel sound information into the already tight spectrum of a 6 MHz TV channel. Many years have been consumed in developing the present EIA standard, which is about to see full commercial use in the United States. It should be pointed out that other countries have adopted other standards and many countries are holding out for new technologies to develop. Both Germany and Australia, for example, have adopted a TV stereo standard that is totally different from ours.

Figure 1: Providing multichannel sound in FM band



Assuming that you are receiving good *direct* off-air signals now, it should be possible to receive acceptable stereo and SAP audio at the headend and demodulate them for further processing. Should they be demodulated and processed in a different format? *That* is the $64,000 question!

The answer depends on many factors—some technical and some legal. On the legal side, should the FCC rule that multichannel sound is a "must-carry" without alteration, then the off-air signal must be passed through as received. If the ruling is a "must-carry" but leaves the *method* of "must-carry" open, then the choices are many. Regardless of the ruling, many cable operators are going to have a hard time providing satisfactory stereo and SAP performance to subscribers on a direct pass through.

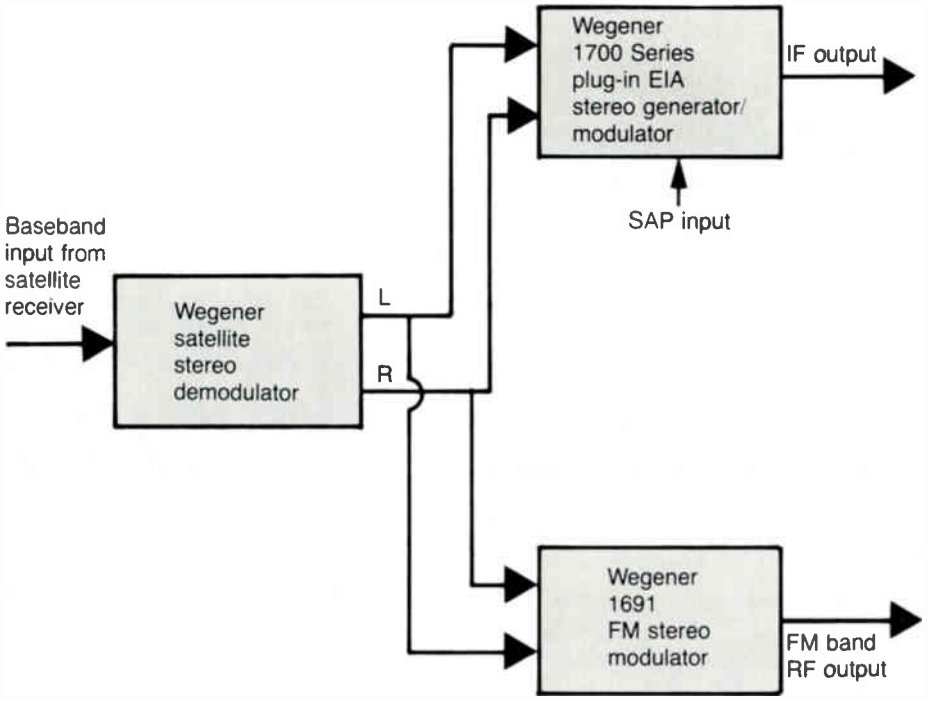
The degree of difficulty will vary as a function of headend configuration and set-top converter design. If direct pass through is a viable option on your system, then the headend processors (off-air) will probably require some attention to ensure proper performance. It also would make sense to provide a compatible stereo service on the satellite-delivered channels as well. This will require a device to take the left and right channel satellite-delivered audio and process it into the EIA format. Figure 2 illustrates how such systems can be implemented. Note that satellite delivery of the EIA format will be highly unlikely if not impossible due to the inherent inefficiencies in the multiplex format in the noise limited environment. Satellite programmers simply will not waste valuable subcarrier spectrum and power to carry the EIA signal in its final form.

Delivering stereo and SAP

Two ways of getting stereo and SAP to the home already have been discussed: 1) direct pass through of the EIA standard; and 2) processing to another portion of the cable spectrum. As the stereo TV story unfolds, the cable industry will be faced with a new platter—full of innovations designed to "solve the EIA sound problem." Manufacturers of set-top converters are no doubt hard at work on their own solutions and their products will probably start being announced by the end of the year. The systems we are likely to see will fall into two broad "spectrum" categories (in-band vs. out-of-band) and two broad "modulation types" (analog vs. digital).

In-band vs. out-of-band simply means where the stereo and SAP information is carried on the cable spectrum. It is possible, though difficult, to squeeze this information into the 6 MHz TV channel in formats other than those chosen by the EIA. On the surface, it seems a good idea to place the information here, but decoder cost and reliability issues must be carefully examined. Out-of-band simply means placing the stereo and SAP audio in unused cable spectrum and somehow having the set-top device correlate the proper audio with the proper video. The advantage of such designs will be the technical simplicity of carrying audio signals in a "clean" RF environment, while the disadvantage is set-top

Figure 2: Conversion of satellite stereo sound to EIA format showing a 'dual carry' of the EIA signal plus FM band TV stereo



integration and complexity.

You will also see solutions using conventional analog FM, "companded" FM, and various forms of digital modulation. Again, each of these will need to be evaluated on their own merits with regard to performance, complexity and reliability.

Food for thought

If this article appears to offer only suggestions, promote thinking and stir controversy, its goal has been accomplished. At this time, the legal and technical issues surrounding multichannel sound do not allow selection of clear and obvious paths that meet the needs of the industry in general. The best advice to offer is:

1) Keep abreast of legal issues surrounding multichannel sound and do not be afraid to voice your concerns and offer input to the National Cable Television Association.

2) The minute the first broadcaster in your area begins transmitting either stereo or SAP, be prepared!

3) If you are in a market where second language audio could be a significant benefit, consider carrying the video services with second language on a totally different TV channel.

4) Be extremely cautious as new hardware and systems evolve to handle the multichannel sound/cable dilemma. Make no moves until you are satisfied that the system will work on *your* system and benefit *your* subscribers.

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'It will take considerable investigation... as to which (stereo audio) system is best for the cable operator—and the anxious subscriber'

Stereo television: Tiers for the ears

By Stan Serafin
Learning Industries

Marshall McLuhan, the electronic philosopher of the 1960s, communicated the message that the medium of television was the greatest single cause in our society for every unsettling aspect of the time—the anti-war movement, hippies, divorce rate, crime rate, drug use. Based on the mirror-reflective theory, television was the ultimate culprit for the unrest. That a TV is turned on and tuned in almost ⅓ of the day in the average household is more concrete than McLuhan's theory on linear vs. nonlinear perception. Yet, this perspective might be even more acceptable than his belief that TV is a "tactile" medium. Everyone *knows* television is a visual medium that creates a state of hypnotic bliss via vibrant colors and/or trick photography. Screens of different size and shapes, brilliant color techniques, visual effects of every imaginable (and unimaginable) kind have been exploited, have been saturated, have now become commonplace.

So where do TV set manufacturers, the Electronic Industries Association (EIA), broadcasters, programmers, et al, go from here to further capture the attention of the consumer? And how does the "new kid on the block," the CATV industry, fit in? Perhaps the answers lie in observing that the television industry is moving into the era of stereo audio at such a rate that the likes of MTV or compact discs (CDs) can barely clear the path. Now that the CATV franchising smoke has cleared, it is time for the cable industry to direct its collective attention to the concerns and potential of high-quality stereo system distribution.

Its time for stereo

Several factors and conflicting forces have already merged that make this attention of primary importance:

- The FCC has opened the doors to television broadcasters to begin transmitting stereo and second language audio. Cable operators will face strong marketplace pressure to provide stereo service to their subscribers. Will they be able to get the sound into the subscriber's home?
- Compact discs have hit the market, and it is predicted that the CD will be as popular and available as the vinyl LP before 1990. "Digital" is the buzzword that is loaded with controversy and unkept promises. There are those who believe digital encryption is the method for the cable business to protect itself against piracy. But information theory proves that the digital transmission method will take up too much valuable and scarce bandwidth.
- Pay audio tiers are emerging in different package forms. Not long ago, there were seven audio satellite programs. Today, there are about that many pay audio services (among them, Studioline, Star Ship Stereo, Satellite Concerts Network, S.C.A.N.) offering from 10 to 50 channels of service. Many MSOs (for example, the Cable Audio Research group) plan to begin serious market tests.
- Standardization in the cable industry in general has not been established fully. This is even more the case in the area of stereo audio transmission. Several methods are being used or considered: FM multiplex, video-dependent analog, video-dependent digital, integrated digital. It will take considerable investigation to arrive at the proper conclusion as to which system is best for the cable operator—and the anxious subscriber.

Add to this the fact that the various and multi-faceted channels that cable systems provide has created an enormous need for new programming. This void must be filled if subscribers are to continue to pay for a service that has technological substitutes—notably, the video tape recorder. An interesting, related concept concerns the influencing perceptions from the sense of sight in that an individual gets bored after two viewings of the same production (take as proof the customer complaints about so many repeats on the pay channels). Meanwhile, the ear actually finds pleasure in hearing a piece of music again and again. This may ironically cause the downfall of MTV, which has greatly perked up the record industry and has spawned competing video music shows of every variety, but has run its gamut on the techniques and images that have been created as visual expression of the audio companion. The more sophisticated the audience becomes, the more it demands. Thus, while the ear is pleased with repetition of sound (paving the way for the success of stereo audio services), the ear/eye also is ready for the new concept of stereo TV audio. A recent *Wall Street Journal* front page bulletin reported the mass arrival of stereo-equipped TVs. Again, the cable industry must prepare for the marketplace.

Meanwhile, the EIA, under the auspices of its Broadcast Television Systems Committee (BTSC), formed a multichannel sound (MCS) subcommittee to ascertain the practicality of various program-related uses of the TV aural baseband and to develop appropriate technical standards for consideration by the FCC. Ergo, FCC Docket #21323 RM-2836, "The Use of Subcarrier Frequencies in the Aural Baseband of Television Transmitters," which will decide on five pertinent issues:

1) Multichannel sound technical standards
2) Public broadcasters' use of subcarriers
3) Mandatory carriage in cable television
4) Preemption of common carrier regulations
5) Content regulation of TV aural subchannels.

Final rulings will affect the cable industry. Preparation for the decisions is once more of utmost importance.

Stereo transmission systems

Decision-making comes with being informed about stereo transmission systems and with knowledge of what the results are when distribution is attempted. With this in mind, analysis of the true stereo transmission systems currently in use and the results of testing of an integrated analog system presently launching are in order.

There are four true stereo transmission systems currently in use. A processor intended for use on one system cannot be used for another type of system without modification. Principal manufacturers of cable stereo equipment—Learning Industries, Wegener, Catel and Modulation Associates—have basically made modifications to comply with all systems; so qualities such as user-friendliness, flexibility, reliability and necessary rack space are the main considerations to apply when deciding which equipment to purchase.

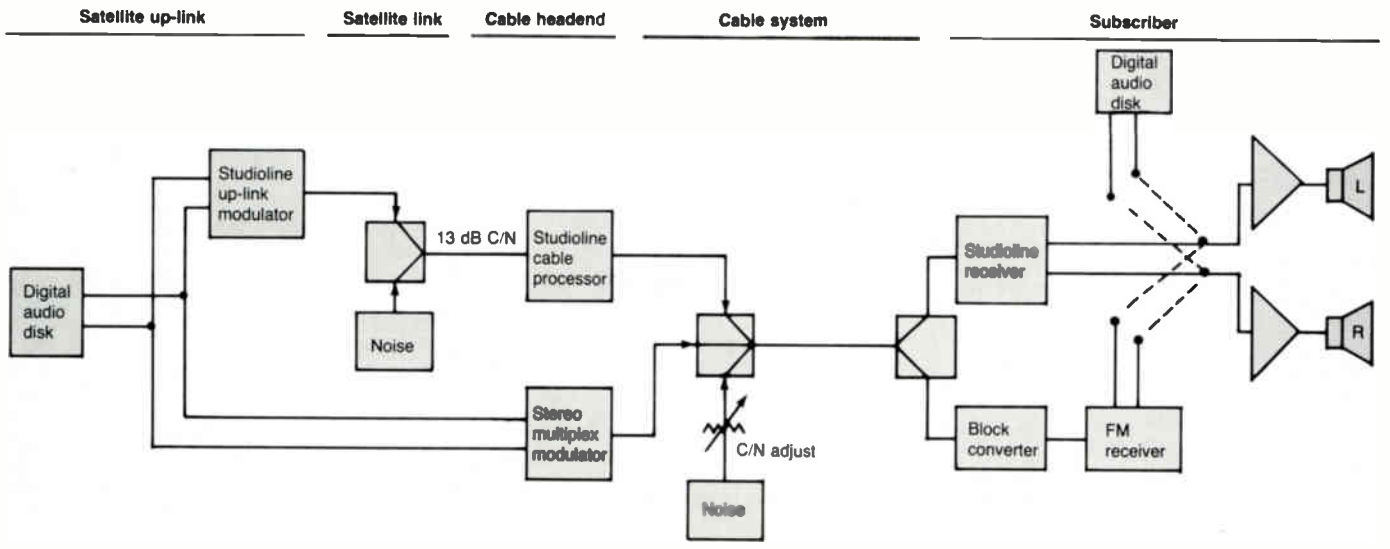
The Learning stereo transmission system: This system tramsmits the left and right stereo channels on a single subcarrier. The L + R is at audio baseband, and the L – R is double sideband suppressed carrier modulated at 38 kHz, with a 19 kHz pilot added. The modulation process is similar to the standard FM stereo process, but differs in that the total deviation is much greater and is also a function of the degree of stereo separation, called adaptive deviation. The stereo processor decodes the received signal and generates a standard FM broadcast signal. This system has the longest history of successful application, having been used for 16 years in microwave distribution and six years in satellite distribution systems.

The Warner Amex stereo transmission system: This system requires two subcarriers to

Table 1: Current satellite audio services

Name of service	Type of programming	Satellite/Tr. #	Format	Transmission form
Arts & Entertainment	Entertainment/cultural	Satcom F3/01	Stereo	5.58/5.76 MHz
Bravo	Cultural	Satcom F4/02	Stereo	5.8 MHz
CNN Radio Network	News	Satcom F3/14	Mono	6.3 MHz
Cable Jazz Network	Jazz music	Satcom F3/08	Stereo	5.94/6.12 MHz
Commodity Communications	Stock quotations	Satcom F3/16	Mono	6.2 MHz
Country Coast-to-Coast	Western music	Satcom F3/03	Stereo	5.94/6.12 MHz
Country Music Television	Country/Western	Comstar D4/18	Stereo	5.58/5.76 MHz
ESPN	Sports	Satcom F3/07	Stereo	5.58/5.76 MHz
Electronic Program Guide	Program schedule	Satcom F3/03	Text	7.237 MHz
Family Radio Network (E)	Religious	Satcom F4/07	Stereo	5.58/5.76 MHz
Family Radio Network (W)	Religious	Satcom F4/07	Stereo	5.94/6.12 MHz
Genesis Cable Storytime	Children	Satcom F3/08	Text	7.237 MHz
Georgia Radio News	News	Westar 4/03	Mono	7.695 MHz
Home Theater Network	Entertainment	Satcom F3/16	Stereo	6.8 MHz
In Touch	Special Reading Service	Satcom 4/03	Mono	7.875 MHz
Love Sounds	Spiritual	Satcom F3/08	Stereo	6.30/6.48 MHz
MTV	Popular music	Satcom F3/11	Stereo	5.8/6.62 MHz
Moody Broadcasting	Religious	Satcom F3/03	Stereo	5.4/7.92 MHz
S.C.A.N.	50s, 60s, 70s hits	Satcom F3/06	Stereo	6.435 MHz
S.C.A.N.	Big bands	Satcom F3/06	Mono	7.785 MHz
S.C.A.N.	Adult contemporary	Satcom F3/06	Stereo	5.58/5.76 MHz
S.C.A.N.	Comedy	Satcom F3/06	Mono	7.695 MHz
S.C.A.N.	Country/Western	Satcom F3/06	Stereo	5.40/5.94 MHz
Nationality Broadcasting	Multilingual services	Satcom F4/03	Mono	6.435 MHz
Nice & Easy	Easy listening	Satcom F3/08	Stereo	5.58/5.76 MHz
Rhythm & Blues	Variety artists	Satcom F4/03	Stereo	5.4/6.3 MHz
Rock America	Top 40 hits	Satcom F3/03	Stereo	SCPC circuit
Satellite Program Network	Music entertainment	Satcom F4/03	Stereo	5.58/5.76 MHz
Satellite Jazz Network	Contemporary/traditional jazz	Satcom F4/17	Stereo	5.58/5.76 MHz
Satellite Radio Network	Religious (PTL)	Satcom F3/02	Mono	6.2 MHz
Seeburg/Lifestyle	Upbeat music	Satcom F3/03	Mono	7.695 MHz
Sheridan Broadcasting	Mellow jazz	Satcom F4/07	Stereo	7.38/7.56 MHz
Star Ship Stereo	Adult contemporary	Satcom F3/03	Stereo	5.58/5.76 MHz
Studioline	Music/nine formats	Satcom F3/4,19	Stereo	To be determined
The Disney Channel	Family entertainment	Westar 5/10,12	Stereo	5.8/6.8 MHz
The Movie Channel	Movies	Satcom F3/05	Stereo	5.8/6.8 MHz
The Nashville Network	Country/Western	Westar 5/17	Stereo	5.58/5.76 MHz
The Rock Channel	Upbeat sounds	Satcom F4/03	Stereo	7.37/7.56 MHz
UPI Data Cable	News	Satcom F3/03	Individual customization	
WFMT	Fine arts/classical	Satcom F3/03	Stereo	6.3/6.48 MHz

Figure 1: Studioline transmission system compared with block conversion system



transmit stereo. The L – R signal is transmitted at 5.8 MHz, and the L + R is transmitted at 6.62 MHz (for MTV) or 6.8 MHz (for TMC). This system also uses high deviation but does not use adaptive deviation. The processor must contain two subcarrier demodulators and a stereo multiplexer in addition to the RF modulator. Supersonic control tones are transmitted on this system to control local advertising insertion. It should be noted that the nonstandard 6.62 MHz frequency was chosen for MTV to deliberately encourage the cable industry to provide full stereo to subscribers. This decision has resulted in exceptional marketing success.

The Wegener stereo transmission system: The 1600 System and the Panda II System both use very narrow deviation. Discrete left and right audio is transmitted as individual low level subcarriers. Subcarrier levels, deviation and spacing have been optimized for spectrum efficiency. An adaptive pre- and de-emphasis system (compander) is used to optimize the recovered signal-to-noise ratio. As an example of its use, United Video is transmitting such subcarriers on its transponder for various satellite audio services.

The Times Mirror stereo transmission system: This system uses two subcarriers. One transmits the left channel, while the other transmits the right channel. A third channel is required to transmit monaural TV audio. As in the Warner Amex system, two subcarrier modulators and a stereo multiplexer are required, but this system also requires a stereo matrix in addition to the FM modulator. This system was used on the now discontinued Spotlight pay service. It is mentioned here because of its many applications in Canada, now that the Canadian Radio-television and Telecommunications Commission (CRTC) has revised its regulations in related areas.

These stereo systems now bring a variety of stereo programs to cable systems by satellite (see Table 1). The cable operator can bring these programs to his customers in stereo by installing the suitable stereo processors between the TVRO composite output connector and the cable headend combiner. Some of these programs also enable local advertising insertion, which requires connecting a VCR into the circuit.

Beyond this, there are many satellite channels that can be converted into stereo by installing a synthesized stereo processor. These devices create the ambience of stereo by processing the monaural audio into two channels that differ from one another in such a way as to produce a special effect, so that the sound "surrounds" the listener and creates a feeling of being present at the movie, sporting event or concert. This process can be used for HBO, Showtime, WTBS, C-SPAN and the like, and can add an enormous level of excitement to satellite sports network viewing. Thus with a combination of true stereo and synthesized stereo processors, the cable operator can deliver stereo TV audio on all programs received from satellite.

The operator who wants to provide "total TV audio" can convert his existing off-the-air TV stations, AM radio stations, local origination leased FM stations and even short wave broadcast into stereo. The possibilities are endless for the creative operator; the results are customer satisfaction and reduced churn in any system. The added dimension of stereo makes a cable system's service state-of-the-art; but as stereo TV models permeate the market, stereo transmission may be a necessity.

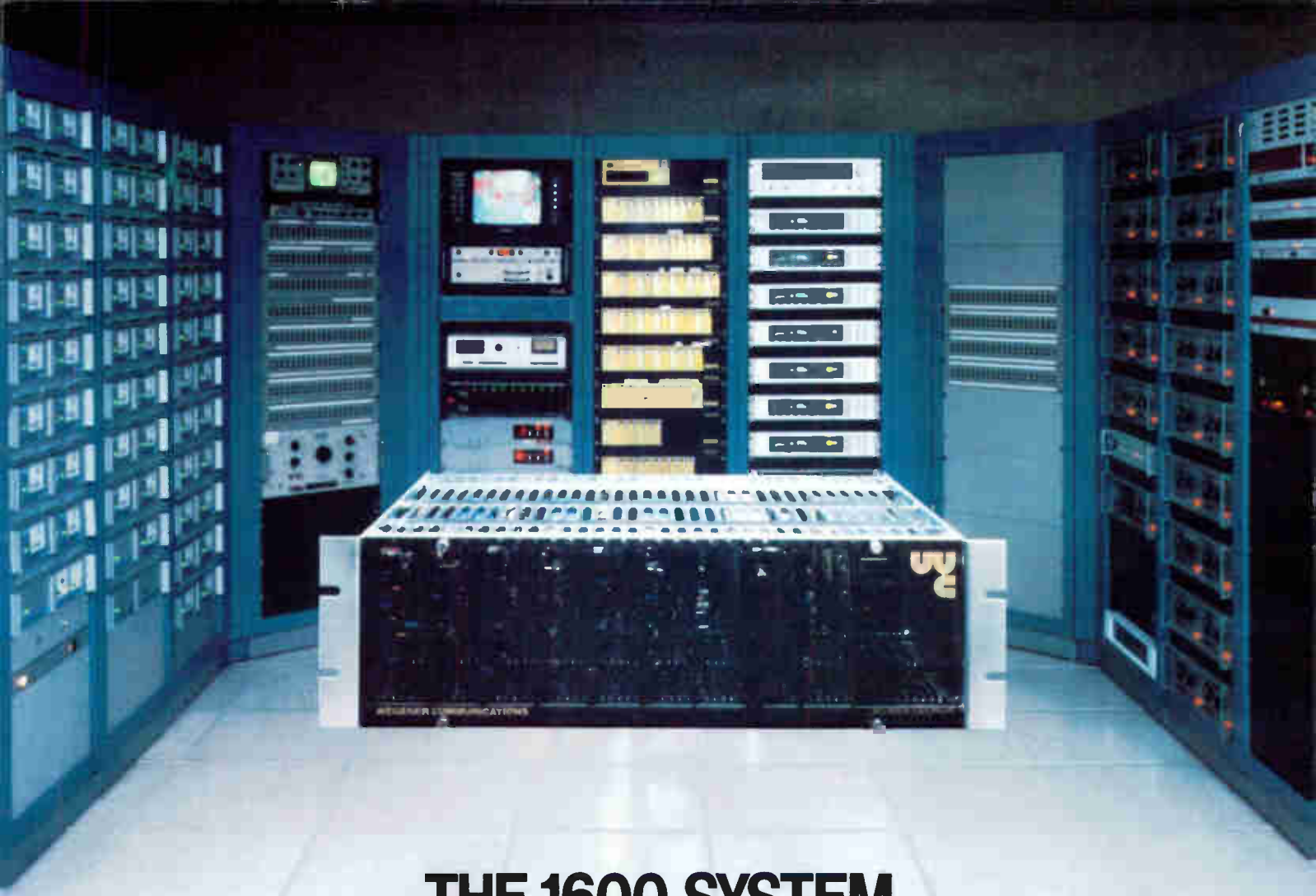
The controversy surrounding FCC/EIA rulings, the various pay audio services, the ability to make the best purchasing decision—all will be the concern of the serious cable operator. The general factual information presented herein will conclude with a more specific analysis of one of the current pay audio services, Studioline, describing what is provided as well as results of tests conducted.

The Studioline stereo service

Studioline consists of nine channels of commercial-free stereo music, plus 60 more channels that the cable operator may assign to any stereo TV audio or stereo music service. The system is addressable and tierable, with the nine channels occupying 15 kHz each. Two transponders on RCA Satcom IIIR are used: 10 subcarriers are on Transponder 19 and eight subcarriers are on Transponder 4.

Leaming-developed stereo processors at the cable headend convert the Studioline signals, and the other stereo programs selected by the cable system. Studioline is transmitted on the cable system in the 72-76 MHz band. Of the 60 remaining channels, the first 40 selected by the cable operator for additional stereo services are transmitted in the 108-120 MHz (A-1 and A-2) band; 20 more channels can be added in Channel A in 450 MHz systems to accommodate the additional video services with stereo TV audio. The audio carriers are transmitted 25 dB below video carrier level, thus all 69 channels can be added to an existing cable system without increasing the system load factor. The Studioline signal-to-noise advantage over standard FM stereo is 44 dB, so that even at the very end of a system the service will be completely noise-free to the customer.

Three-fold security is provided by the system. First, the stereo is *not* in the FM band, so FM tuners cannot receive the signals. In fact, the FM band can be fully retained if desired. Secondly, the stereo modulation system cannot be received by a standard FM tuner. Thirdly, the audio terminal is both addressable and tierable. An address code sent from the cable headend activates the set-top terminal, which will automatically turn off if the address is not regularly refreshed. The audio terminal is compatible with all existing converters, providing one-dial switching for both the audio and video. There is no need to turn two dials (which customers will hardly do even for MTV)



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and there is no need for any replacement of existing converters in the home.

A series of tests were performed on the Studioline transmission system to evalute subjective audio performance and measure objective system parameters. The system was then directly compared to standard stereo multiplex transmission on a cable system using the block conversion process (see Figure 1). These tests were performed over a simulated satellite link and cable system. The carrier-to-noise ratio (C/N) for the satellite path was set to 13 dB and the C/N in the cable system segment was set to various ratios to simulate expectable performance out to the furthest end of a cable system. The subjective tests were performed using a Sony CDP-101 compact digital disc player as the music source, a Robertson EK-1 pre-amplifier, a Robertson 410 power amplifier, and two Robertson #21 speaker systems—all very high-quality audio components.

Noise performance is critical

The most noticeable difference between the two types of transmission systems was, as expected, in the noise performance. The tests were performed at several RF carrier injection levels in the cable system: one level was the normal 15 dB below Channel 6 video carrier, and the other was at the lower power level required to be used in the A-1 and the A-2 band to avoid interference with aircraft navigation and communications. Tests on the satellite portion of the transmission system revealed that the signal-to-noise (S/N) performance of all the existing satellite transmission stereo processes were satisfactory as perceived at the earth station, but that the noise introduced by the cable amplifiers was responsible for most of the noise perceived out in the cable system.

The worst case S/N test was made with both the Studioline and the block converter carriers at the reduced power level desireable in the A-1 and A-2 band; the tests were performed at a noise level equivalent to 28 line amplifiers plus one line extender in the cable system. In listening tests with no music, using the Studioline system, the speakers were perceived as "dead" with no noise heard by the listeners. Under those same conditions, the block converter system was so noisy that soft passages in the music were masked by the noise. Of course, tests made with the audio carriers 15 dB below the video caused the block converter system to sound much better, but there was still a noise level that would be very irritating to a serious listener and mildly irritating to a more casual listener. At either carrier level, the Studioline system performed with no perceptible noise at all.

The noise performance level of the Studioline system is achieved through several innovative processes. One reduces the system bandwidth while still transmitting the full 15 kHz stereo signal, thus reducing the noise intercepted in the satellite and cable system; the other reduces the noise even further by a companding process. This companding system is a special variation of the Telefunken High-Com compander specifically designed for Studioline to optimize transmission through both the satellite and cable system. The usual companding artifacts—such as noise modulation (pumping), loss of crispness, peak clipping on transients and transient intermodulation distortion—were not perceptible to the listeners in the tests.

There are many reasons for the cable operator to be in the audio business, and the CATV industry appears on the threshold of getting into high-quality stereo for the first time. Various ideas have been developed as to what stereo audio means to cable, and various systems have been designed to suit these ideas. The cable operator who seriously investigates the area will be the one to provide the stereo services that bring the results and satisfaction most desireable for distribution.

Over the last 10 years, Stan Serafin has been involved with numerous aspects of the cable industry—from franchising to public access production. He has held managerial positions with several MSOs—Tribune, TCI, Storer, and Rogers—previous to his joining Learning Industries as marketing agent for the corporation.

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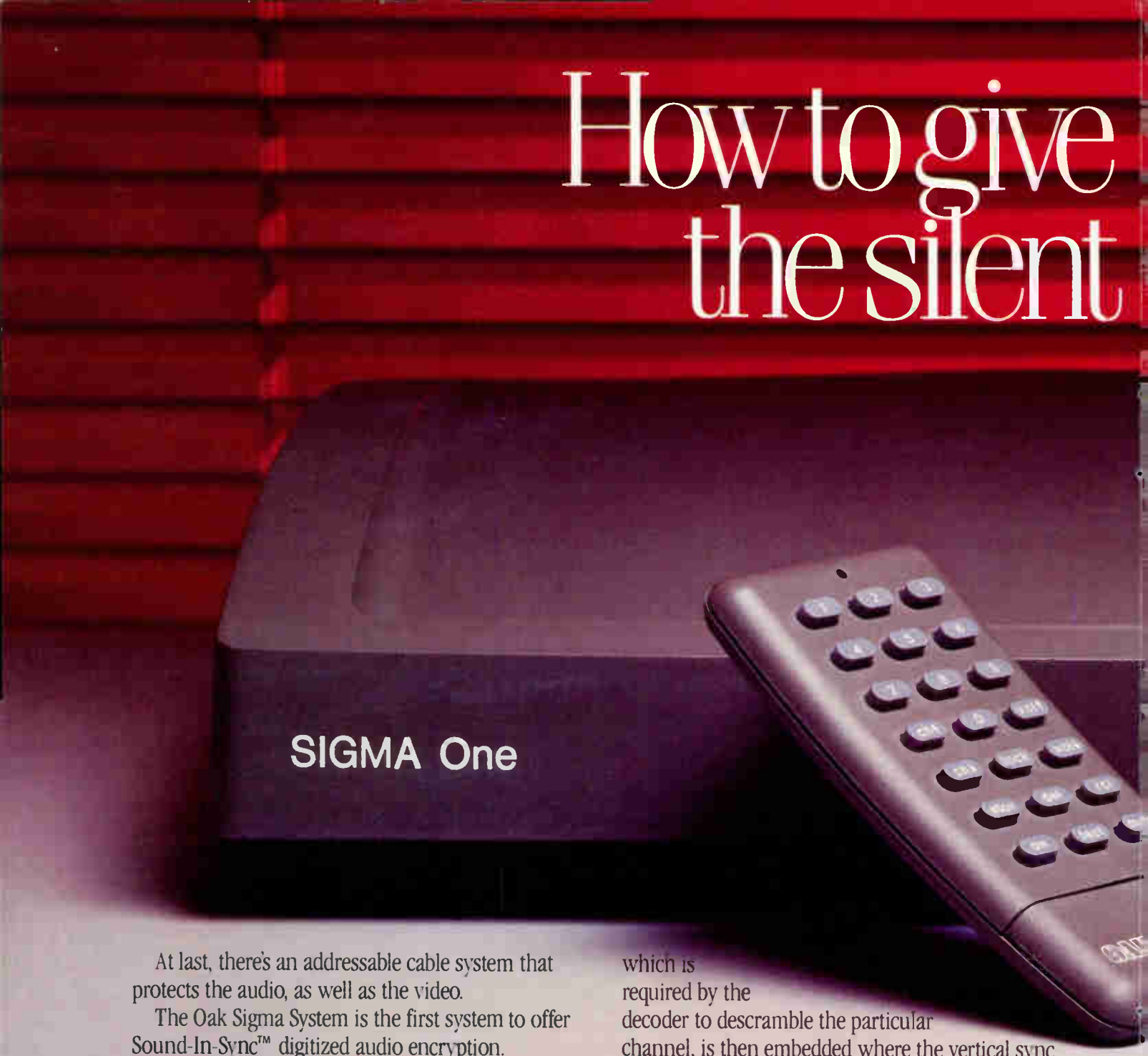

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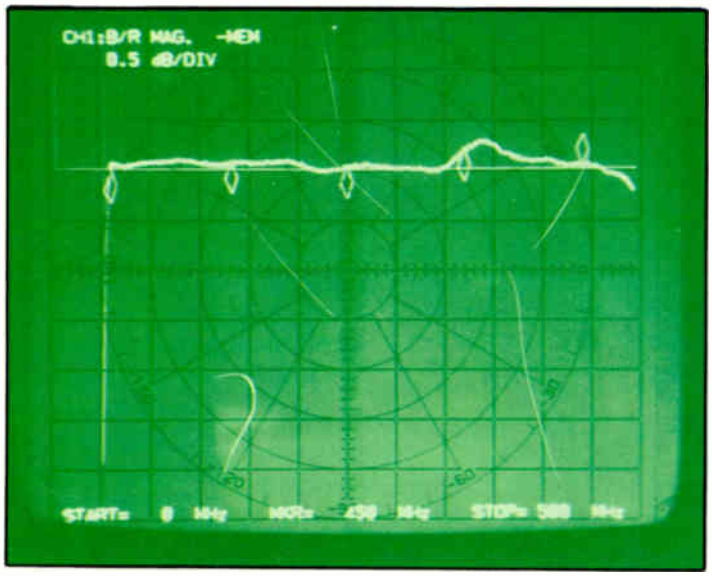

Figure 1: Normal trunk flatness—450 MHz

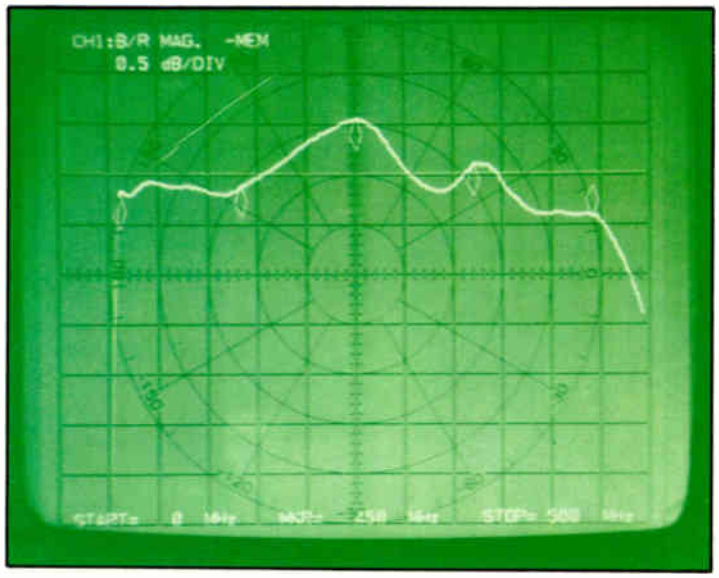

Figure 2: Trunk flatness with main amp failure

Maintenance considerations with feedforward amplifiers

This is the last in a series of three articles dealing with feedforward broadband distribution equipment. The first article described the basic concepts underlying the feedforward circuit and defined limitations and characteristics of the technology. The second article examined several systems applications of feedforward distribution amplifiers. This installment discusses system operation and maintenance procedures that are peculiar to feedforward technology. System energizing and balancing considerations, system maintenance procedures, equipment maintenance procedures and equipment repair considerations are discussed.

By Joseph P. Preschutti and Colin J. Horton
C-COR Electronics Inc

For the most part, the techniques used to balance the RF signal levels in feedforward distribution equipment are identical to those of non-feedforward types. However, there are some subtle differences that must be taken into account during the initial fire-up and turn-on phase of a feedforward system. Feedforward amplifiers consume more power than standard amplifiers, are measurably less flat in their gain versus frequency characteristic, and if feedforward bridgers and line extenders are used, the amplifiers are operated at output signal levels that create a more rapid degradation of distortion performance than with standard equipment. These will be discussed separately in the following sections.

Energizing the system

The process of energizing a cable powered system involves a sequence of events in which the first step is to turn on the power source with the succeeding steps being to energize sequentially a cascade of amplifiers, one after the next.

It is common practice to place tapped transformers on the individual power packs that are used in the distribution equipment. The transformer tap then must be adjusted according to the AC voltage present at that amplifier location. This AC voltage is a function of the current being pulled by amplifiers further on down the line, including line extenders. Naturally, when one is initially energizing a trunk station, the line extenders fed from that trunk, as well as other equipment further on down the line, may not be necessarily energized at that point in time. Therefore, the AC voltage at these initial trunk locations will be higher than they will be when the remaining equipment is energized and begins to draw current. It may be necessary to revisit equipment for a second iteration of the energizing process after a section is completely turned on to ensure that the transformer taps, if provided, are properly selected.

Although this situation is not unique with feedforward equipment, the higher power requirements amplify the effects. Because of this, trunk stations with modern switch-mode power supplies capable of operating over a wide range of input voltages without transformer taps are preferred for a feedforward trunk station.

Bridger and line extender set-up

The phenomenon known as gain compression was discussed in some detail in the first article of this series (*CT*, July 1984). It was shown that feedforward bridgers and line extenders operated with 60 channels with output levels above 48 dBmV could be expected to have distortion performance that derates on a 4-to-1 basis with an increase in output level as compared to the commonly held 2-for-1 derating factor associated with third order distortions in distribution equipment. Therefore, the performance of a bridger or line extender is extremely more sensitive to proper adjustment and maintenance of precise output signal levels. Unless the system is designed with the appropriate headroom, subscriber signal quality is dramatically dependent on the ability of the technician to accurately adjust the operational output signal levels of feedforward feeder amplifiers, and the amplifiers' output level stability over time and temperature.

Use of feedforward feeder amplifiers will require either appropriate headroom allowances in the original system design or stricter maintenance and control over line extender and bridger output levels. The additional headroom must be achieved by using output levels for the bridger and line extender that are lower than the output levels that standard performance analysis would dictate. For example, if a standard line extender is operated at +45 dBmV with 60 dB composite triple beat performance, the 3 dB headroom point could be defined as that output level which provides 6 dB worse composite triple beat or 48 dBmV out with 54 dB composite triple beat. This 54 dB composite triple beat is then the key criterion for headroom analysis. An equivalent operating headroom calculation for a feedforward extender would

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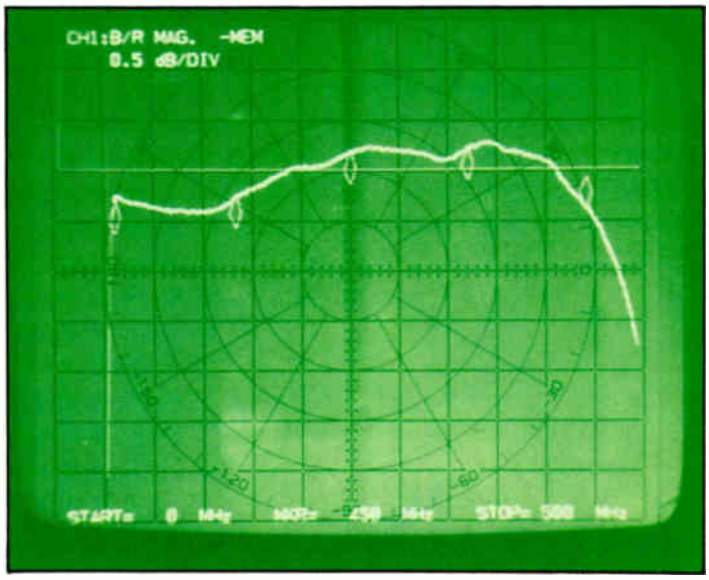

Figure 3: Trunk flatness with error amp failure

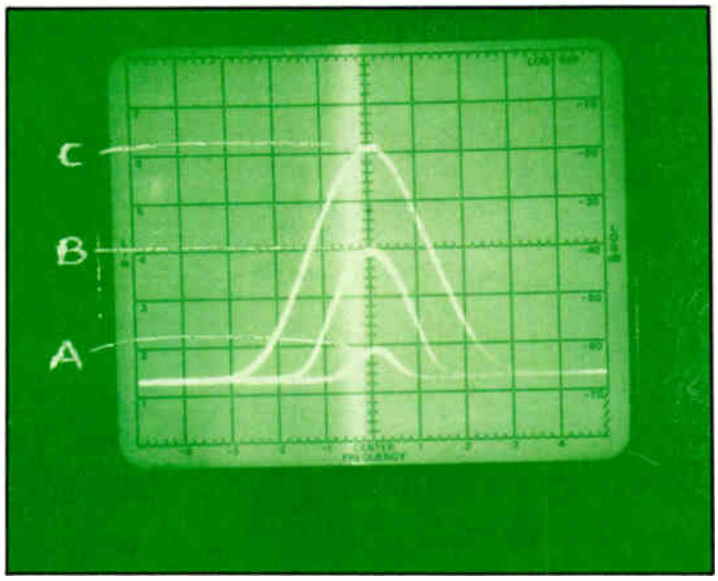

Figure 4: Composite triple beat levels
A) Normal
B) Error amp failure
C) Main amp failure

require 54 dB composite triple beat at 3 dB higher than normal operating levels. Since the line extender derates on a 4-to-1 basis at these levels, an equivalent operating point at normal levels for a feedforward line extender is one at which the composite triple beat is 12 dB better than 54 or 66 dB. In other words, a feedforward line extender with 66 dB composite triple beat is equivalent in headroom to a standard line extender with 60 dB composite triple beat, or feedforward line extenders should be operated and designed using 6 dB tighter composite triple beat specs.

Failure detection

One characteristic of the feedforward circuit that affects the need for new system maintenance procedures is the fact that failure of a feedforward circuit does not necessarily produce a reduction in gain of the feedforward circuit. Theoretically, if either the main amplifier or the error amplifier fails, there will be no change in gain whatsoever. Practically, a small flatness change is exhibited upon failure of either main or error amplifier. Figures 1 through 3 demonstrate this fact. However, there will be a considerable change in the performance of the amplifier. An error amplifier failure will cause a distortion degradation of 26 dB in the output stage or about 20 dB in the overall trunk station. A main amplifier failure can cause distortion degradation of 40 dB. This reduction in composite triple beat is shown in Figure 4.

An error amplifier failure in a trunk station will not necessarily degrade the performance of a system to the point where signal quality is significantly impaired. This causes some concern for the person responsible for system maintenance. A logical fear is the insidious long-range effect of several "soft" failures.

Failure of a main amplifier in all likelihood will result in service calls. This should be more easily detected, but could still prove elusive. If either an error or main amp fails, the system maintenance technician should identify the fault and replace the station. This identification could be a lengthy process without proper maintenance tools. This section will describe several maintenance procedures that can quickly identify the failure of a feedforward amplifier. The use of appropriate test points and momentary switches to turn off feedforward circuit hybrids produces an effective local feedforward circuit test. A more elaborate remote feedforward circuit test utilizing a status monitoring system also is useful to identify failed equipment.

Local feedforward circuit tests

The feedforward amplifier used in C-COR's trunk station has the functional block diagram shown in Figure 5. The directional coupler test points added to the basic feedforward circuit (patent pending) provide a test method for checking feedforward circuit operation in the field.

- *Testing cancellation:* The key parameter to measure that will identify proper feedforward circuit operation is the distortion cancellation of the error loop. It is possible, through use of a test point 1 (TP1) to inject a test signal in an operational trunk station, and while monitoring the signal at the trunk output test point, determine the precise amount of distortion cancellation provided at the frequency tested.
- *How does it work?:* Note that the test signal, when injected at TP1, does not appear at the input to the feedforward circuit. Instead, it is injected at the main amplifier input. Because of this, the test signal will not be cancelled by the main loop at DC3. Therefore, this test signal will be treated as if it were a distortion or error signal by the feedforward circuit. Naturally then, the error loop will cancel this error (test signal).

To check circuit operation, inject a signal at TP1 and establish a reference (see Figure 6) by momentarily turning off the error amplifier while measuring the test signal strength at the trunk output test point. Turning off the error amplifier will remove the distortion cancellation allowing the reference signal to appear at the amplifier output. (The error amp can be turned off by using the manual test switch provided on C-COR's feedforward trunk.)

To determine the amount of cancellation, reactivate the cancellation loop circuitry (by releasing the momentary switch that will turn on the error amplifier) while noting the decrease in the magnitude of the test signal. This decrease is the exact amount of cancellation provided by the cancellation circuit.

- *What equipment is required?:* A test signal generator and a field strength meter can be used to do a test at any unused frequency in the forward amplifier spectrum. This will provide a cancellation test at that frequency.
- *Is a single frequency test enough?:* A single frequency test provides significantly more information than no test. However, a thorough test would include three frequencies for a 450 MHz system. These test frequencies would be located somewhere near the following areas: 220, 350 and 450 MHz. Data accumulated by production tests at C-COR indicates that if cancellation is in spec at all three of these frequencies, it is meeting specification across the entire band.

This local circuit test provides a method for checking that the feedforward circuit is indeed producing the required distortion cancellation.

An annual check of the feedforward circuits in the system might be performed to locate soft failures. This test also can be performed during any station maintenance to identify malfunctioning equipment.

Remote feedforward circuit tests

C-COR's feedforward status monitor transponder is designed to determine the operational status of the trunk station feedforward ampli-

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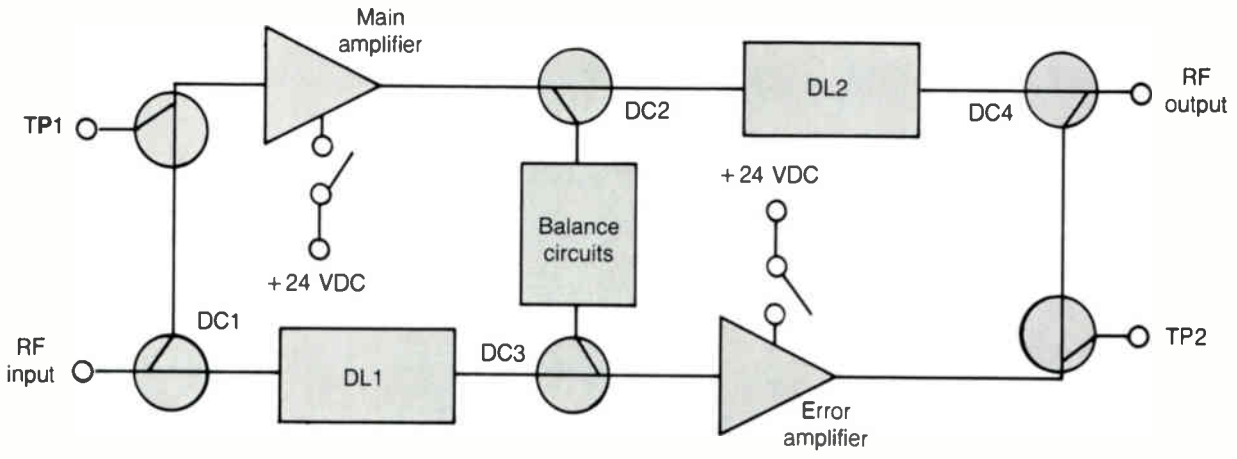
Figure 5: Feedforward circuit functional block diagram



fier. The operational test consists of measuring the RF output signal level while momentarily turning off the main amplifier and then the error amplifier in the feedforward circuit. Data is transmitted to the headend where an alarm can be generated upon detection of station malfunction.

• *Theory of operation:* Figure 6 shows a functional block diagram of a feedforward gain block. Normal circuit operation requires adequate cancellation in both the main amplifier loop and the error amplifier loop. If either the main or error amp fails, no loss of gain will occur because the gain of the main path is equal to the gain of the error path. (The signal through the error path is cancelled in normal circuit operation.)

Since hybrid failure of either the main amplifier or the error amplifier will not result in significant gain changes, the *test procedure* is to turn off consecutively the main and error amplifiers while monitoring the output signal level. Signal level changes such as those shown in Figures 1 through 3 are normal occurances in this situation. Excessive signal change indicates circuit failure due to loss of balance or hybrid failure and will generate an alarm calling for maintenance.

• *Feedforward test software:* The C-COR status monitor system software provides maintenance routings and report formats that will allow automatic monitoring of either individual trunk stations or the complete system. The system manager can command the system to perform the feedforward circuit test maintenance routine at any predetermined, preprogrammed time and receive a report that will indicate the status of each feedforward trunk circuit in the system—including measurements of RF signal levels before, with the main amp off, with error amp off and after the test. The alarm generated by excessive change in signal levels during the test has a user programmable window to define acceptable limits of signal level change. This is usually set to a ±3 dB signal change.

Equipment repair considerations

There are at present, several variations of the feedforward circuit available in the marketplace. The earliest feedforward equipment used discrete circuits with lumped-element delay lines. A more advanced form of feedforward circuit used discrete circuits with microstrip delay lines. The elimination of the costly lumped-element delay lines with a more advanced microstrip technique provided a dramatic reduction in cost and complexity of the discrete feedforward circuit. Finally, the traditional vendors of hybrid push-pull amplifiers are producing miniaturized hybrid versions of the feedforward circuit. Unfortunately, there are several varieties of packages now being developed for the hybrid versions. As with development of push-pull hybrids in the early 1970s, eventual evolution of a single packaging defacto standard will probably occur during the next few years. In any case, feedforward circuit failure will require appropriate repair measures.

In the case of the hybridized version of the feedforward circuit, equipment repair involves replacement of a single component. However, the cost of this component is now approximately three to four times the cost of the hybrid used in the discrete feedforward circuit. Since the most probable cause of failure is that of the active devices, the failure of either the main or error amplifier in the hybridized version will require replacement of the entire unit. Another serious concern is future availability of repair parts. Assuming that a defacto standard package will evolve, systems designed with non-standard packages could ultimately run out of spare parts. This facet of feedforward evolution is now in a critical stage. A good sign for development of a defacto standard is the availability of a second source. Good advice would be to identify a second source before committing to a large scale system design using hybridized feedforward packages.

Repair of a feedforward circuit that uses discrete hybrids and microstrip delay lines requires substantially lower cost components. However, replacement of a hybrid will require realignment and rebalancing of the cancellation of the feedforward circuit. On the average, the mean time to repair a feedforward trunk station, which has a failed hybrid, is approximately 30 to 45 minutes.

Cost of parts and labor needed to repair a feedforward trunk strongly favor the discrete feedforward circuit approach using microstrip delay lines. Furthermore, second source supplies abound for push-pull hybrid RF devices.

The situation may change in the future when packaging standards and further development efforts produce low-cost miniaturized hybrid feedforward circuits with reliable second sourcing. At present, repair considerations favor the discrete approach.

Feedforward circuit repair procedures

The previous section noted the requirement to realign and rebalance a failed discrete feedforward circuit on the repair bench. Naturally, equipment can be returned to the original equipment manufacturer for repair, however, the repair process is relatively simple and straightforward. Systems that have operational repair facilities for amplifiers with nominal test equipment and a reliable repair technician should have little difficulty performing on-site feedforward circuit repair.

This section details the test equipment required, necessary spare parts stock and test methods for repair of discrete feedforward circuits.

• *Test equipment required:* Aligning the feedforward circuit requires that both the error loop and main loop (see article one in this series) be adjusted to achieve adequate cancellation. Standard sweep test equipment normally used to test gain and return loss of non-feedforward amplifiers is used in production testing of feedfoward circuits and also can be used for repair. Normally, a system with even rudimentary test equipment will have a sweep test set-up.

• *Spare parts required:* Since the most likely failure mode will be that of the active devices (push-pull RF hybrids), a supply of 34 dB gain

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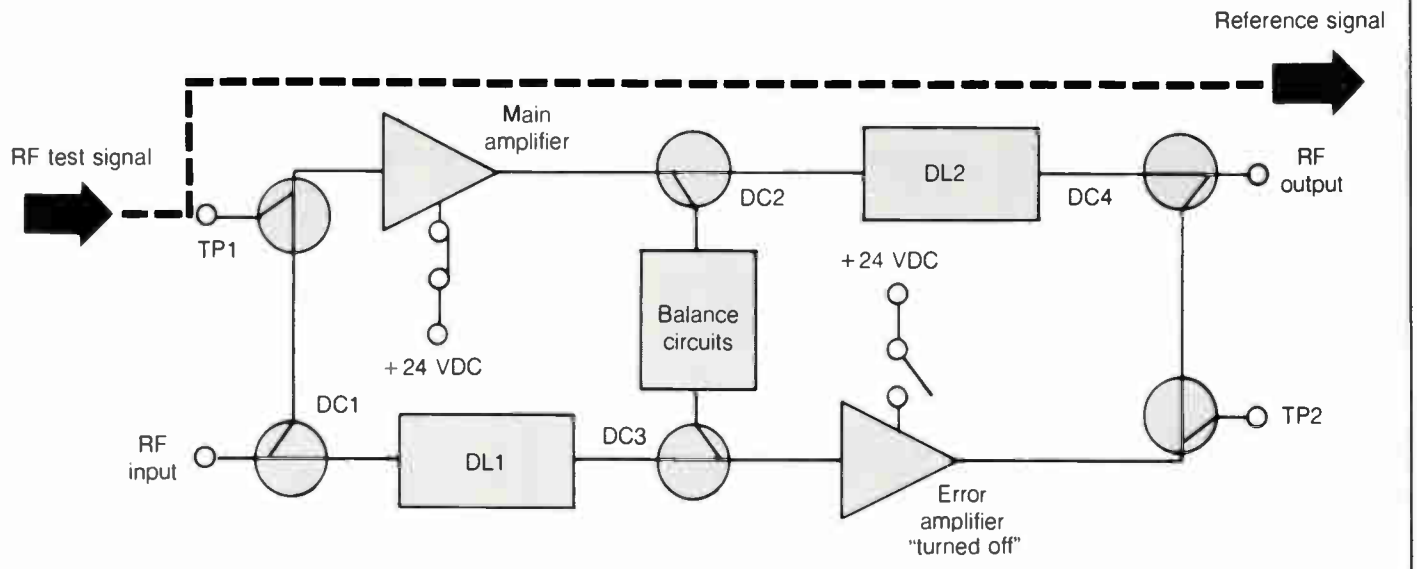
Figure 6: Establishing a reference for testing error loop cancellation



hybrids is required. For ease of alignment, the high-frequency gain of both main and error amplifiers are equal. Therefore, it is desireable to change out both hybrids upon failure of either one. However, the good device can be kept and matched with another of equal gain.

Delay line repair stock considerations are critical to future repair capability. The purpose of the delay line is to match the delay of the RF hybrid. The delay characteristics of a particular hybrid from a particular vendor are relatively constant from unit to unit and lot to lot. Thus a single delay line value can be used in original manufacture of a feedforward circuit. However, there are striking differences in delay for a particular hybrid type supplied by different vendors. Thus, different delay lines are required for hybrids purchased from different vendors. Future hybrids will undoubtedly have more advanced transistor die technology and exhibit still different delay characteristics. Surely then, the ability to guarantee a supply of delay lines different from those values currently in production is a must to prevent system obsolescence due to a lack of spare parts.

The plug-in microstrip delay line approach to discrete feedforward circuit design has a definite advantage over the lumped-element approach. This advantage concerns ease of design, cost and availability of new value delay lines. First, the cost of a plug-in microstrip delay line is nearly an order of magnitude less than the lumped-element counterpart, requires no alignment and has essentially a 1 GHz bandwidth. Secondly, a manufacturer can easily design, develop and put into stock a series of several different value delay lines that can allow use of a wide variety of different amplifier components. This is due to the relatively simple design process of shortening the length of the delay line. A small stock of delay lines will be adequate for repair.

- *Test method:* The directional coupler test points (TP1 and TP2) shown in Figure 5 are permanently installed devices using "F" connectors for ease of signal injection. These test points were described as being used for field testing of cancellation in an operational trunk station that is on-line, carrying signals in the system. Naturally, these test points also are used for both original production test and repair test of cancellation. The directional coupler test points (patent pending) permit the use of only a sweep test set-up for alignment. Other methods and circuits using 34 dB gain blocks for main and error amplifiers require elaborate distortion test sets for optimum alignment.

Alignment of the feedforward circuit requires that the cancellation of both the error loop and main loop be properly adjusted. This adjustment involves matching the amplitude and delay response of the signal paths in each loop. Separate controls are provided for amplitude and delay characteristics.

The delay adjustments require selecting the proper delay line (DL1 and DL2) for gross adjustment and adjusting a small low-pass filter for fine delay adjustments. The amplitude adjustments are obtained with a variable resistor and capacitor in the balance circuit portion of the common leg in Figure 5. The procedure for aligning cancellation is as follows:

1) Inject a sweep test signal into TP1 while monitoring the amplifier output.
2) Turn off the error amp and establish a reference signal level. Check for adequate bandwidth (no adjustments).
3) Turn on the error amp and adjust amplitude and delay line 2 to achieve 26 dB cancellation across the band. This completes alignment of the error loop.
4) Inject a sweep test signal at the amplifier input and monitor the output at TP2.
5) Turn off the main amp and establish a reference signal level. (Check for adequate bandwidth, no adjustments.)
6) Turn on the main amp and adjust delay line 1 to achieve 26 dB cancellation across the band. Amplitude adjustments may be required. This completes alignment of the main loop.
7) The process required in steps 1 through 6 usually requires another iteration to optimize cancellation performance.

Qualitatively, the "look" and "feel" of this test is very similar in nature to standard return loss measurement and adjustments made on standard distribution equipment. This allows a quicker familiarization process for teaching repair technicians the methods for aligning feedforward circuits.

Summary and conclusions

This series of articles attempted to define the basic characteristics of the feedforward circuit, describe several applications for feedforward broadband amplifiers and identify unique system maintenance and repair considerations with feedforward circuits. If properly applied, feedforward amplifiers can provide dramatic improvements in the performance, reliability and channel handling capacity of a broadband distribution system. The feedforward amplifier will be used in the broadband distribution marketplace for quite some time in the future, and it behooves the system designers and system operators to become familiar with the technical details of this technology.

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The Electronic Program Guide: Applying research to reality

By Dave Keener
United Video Inc

A successful three-year technical development plan for the Electronic Program Guide (EPG) is now being finalized. In August, the dedicated phone line used for data transmission between United Video Inc. in Tulsa, Okla., and its satellite uplink facility near Chicago was replaced with a state-of-the-art single channel per carrier (SCPC) link. This satellite delivery has improved EPG data reliability and accuracy.

EPG at a glance

The EPG, inaugurated in December 1981, has become the largest cable television electronic program guide in the United States, serving 190 systems and 3 million cable subscribers in 35 states and the Virgin Islands. The EPG operates 24 hours a day, seven days a week providing cable subscribers with an up-to-the-minute listing service of the programming available on their system. This satellite-delivered service is customized to meet the needs of each subscribing cable system.

Programming from 1,175 sources arrives regularly at the EPG computer processing center by mail and telephone. These include: 1,100 commercial television stations, 61 satellite-delivered video sources, 16 Canadian commercial stations for the northern border states, 46 local origination channels and 13 miscellaneous sources.

After editing the program schedules, approximately 1.25 million characters are entered into a Hewlett Packard HP-3000 using a staff of 12 people, running two shifts Monday through Saturday. The software for the HP-3000 was developed by United Video's in-house staff. The EPG uses a good portion of the 1.2 gigabytes available on the HP-3000 for its data base.

The system is capable of cross referencing the program source information and generating individual customer files to be transmitted to the EPG customer without duplication. If a channel listing does not arrive at the Tulsa center by predetermined date, the HP-3000 will alert the staff, who, in turn, make sure the data base is kept current prior to transmission to the cable system. Many of the sources, usually network, can be entered far in advance of the transmission date. Advertisements, however, must be inserted at least 24 hours prior to transmission.

The signal path

Transmission begins daily from the Tulsa office at 6 p.m. and lasts until midnight (CDST), with approximately 17.5 million bits being transmitted to the uplink site near Chicago using the new SCPC data link. Backup for the SCPC is provided by a dedicated digital line, plus two dial up lines that take different routes to the UVI uplink facility. These are tested weekly for data integrity. If a failure should occur, data will travel over the dedicated digital lines after being converted to an analog signal. These are demodulated into RS-232 levels at the uplink.

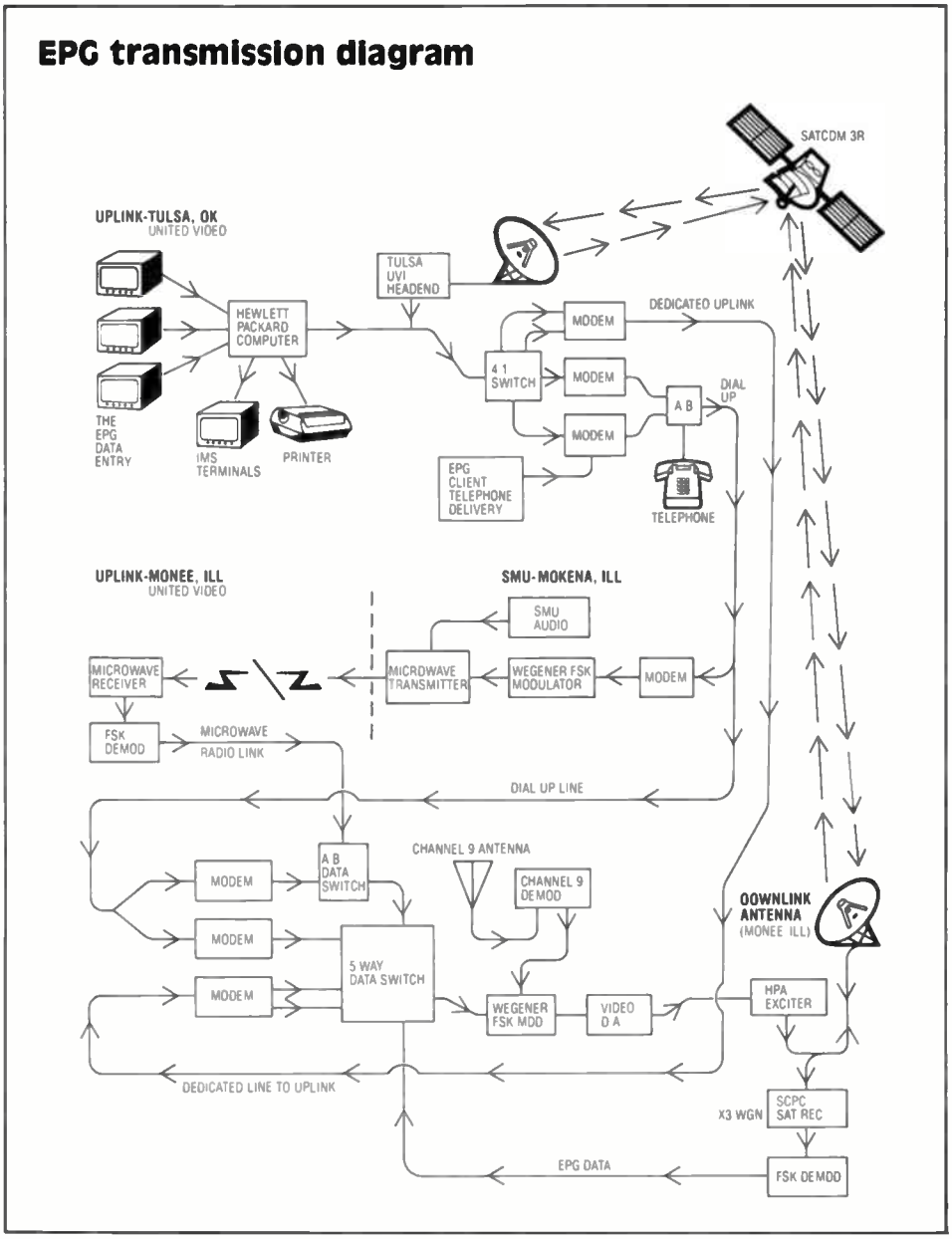
The SCPC is a 56 kilobit, one-way data link to the Chicago site. It occupies 3 kHz of Satcom IIIR's Transponder 3 (the same transponder used for WGN). The SCPC uses a Wegener Communications upconverter, a Hughes 40-watt high-power amplifier (HPA) and an Andrews 5-meter high-performance dish.

After reception at the uplink site, and demodulation, signals are error checked and a 7.2377 MHz subcarrier is generated in the uplink composite video for WGN. The EPG subcarrier is only one of the 24 provided by United Video to the cable and broadcast industries on Transponder 3. Others include WFMT, four audio channels for the Satellite Music Network, Seeburg Music, Moody Bible, and other assorted data services.

The EPG occupies 60 kHz of the 35 MHz on Transponder 3. The composite video of WGN goes through an MCL high-power amplifier then into an Andrews 10-meter dish. The effective isotropic radiated power (EIRP) leaving the dish is 100 megawatts. Transponder 3 of Satcom IIIR is a high-power transponder delivering 8.5 watts of output power. This signal is received by the EPG subscribing cable system using a satellite receiver tuned to WGN.

At each EPG customer site there is a Wegener frequency shift key (FSK) demodulator and a character generator with a unique address. (Installation time for the equipment is less than an hour.) Each customer file built by the Tulsa computer center includes the unique address of the character generator into the data stream being transmitted at a 2,400 baud rate.

EPG transmission diagram



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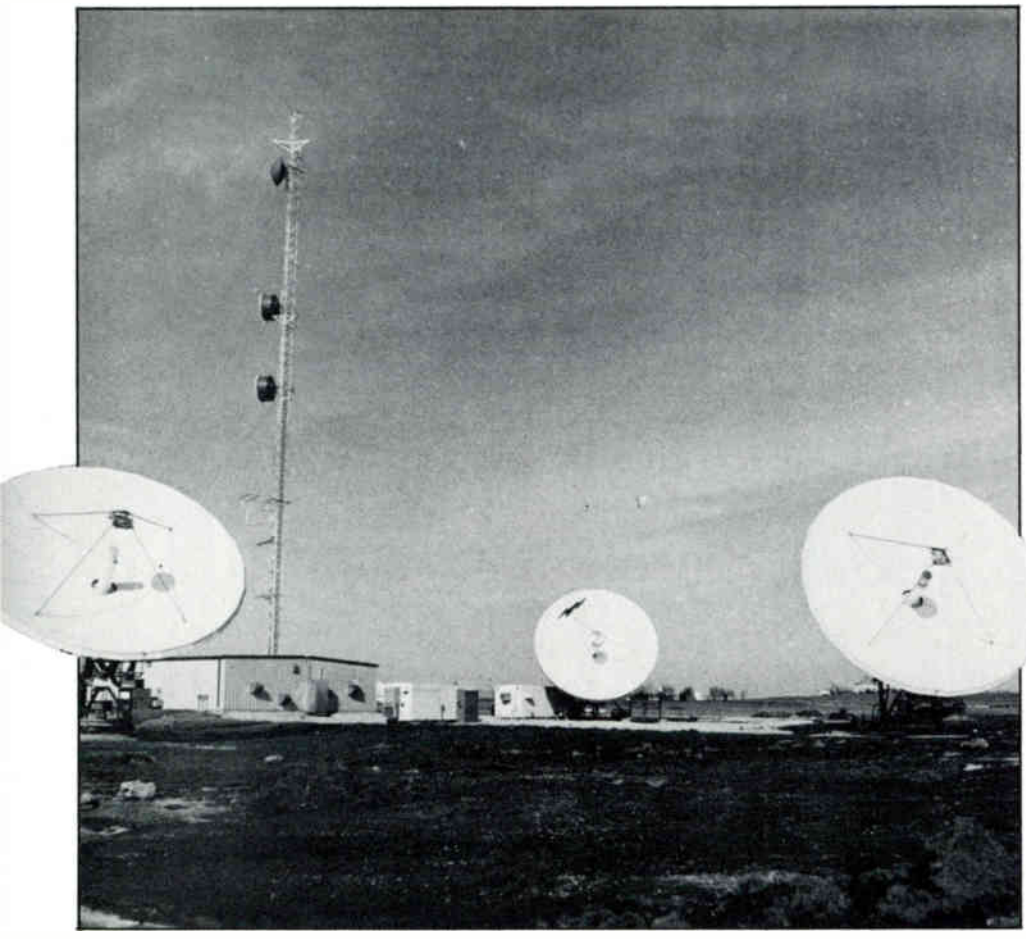

The character generators and the software for them were developed for the EPG by a special engineering staff. These units have a channel lineup display window of one-half hour behind current time and two-and-one-half hours ahead. There is a real time clock in each character generator for reference. Some units have variable scroll speeds and display windows that can be altered in each direction to meet individual cable system needs, allowing for hands-off operation.

At locations where traditional methods have failed to resolve satellite reception problems because of RFI or terrestrial carriers, the EPG signal can be delivered to the cable system via phone line. EPG provides the modems to the cable operator, who in turn supplies the phone line to the headend. There have been only four such locations that require modems.

Mike Peyton, vice president of EPG, reports that his people have improved the reception in at least 30 percent of the EPG customer locations with instructions on proper RF filter alignment, and reviewing the standards for handling video (1 volt peak to peak, into a 75 Ohm load). This assistance not only improved the EPG service, but overall satellite reception for the cable system.

The antenna farm and control room for EPG's Chicago area uplink facility.

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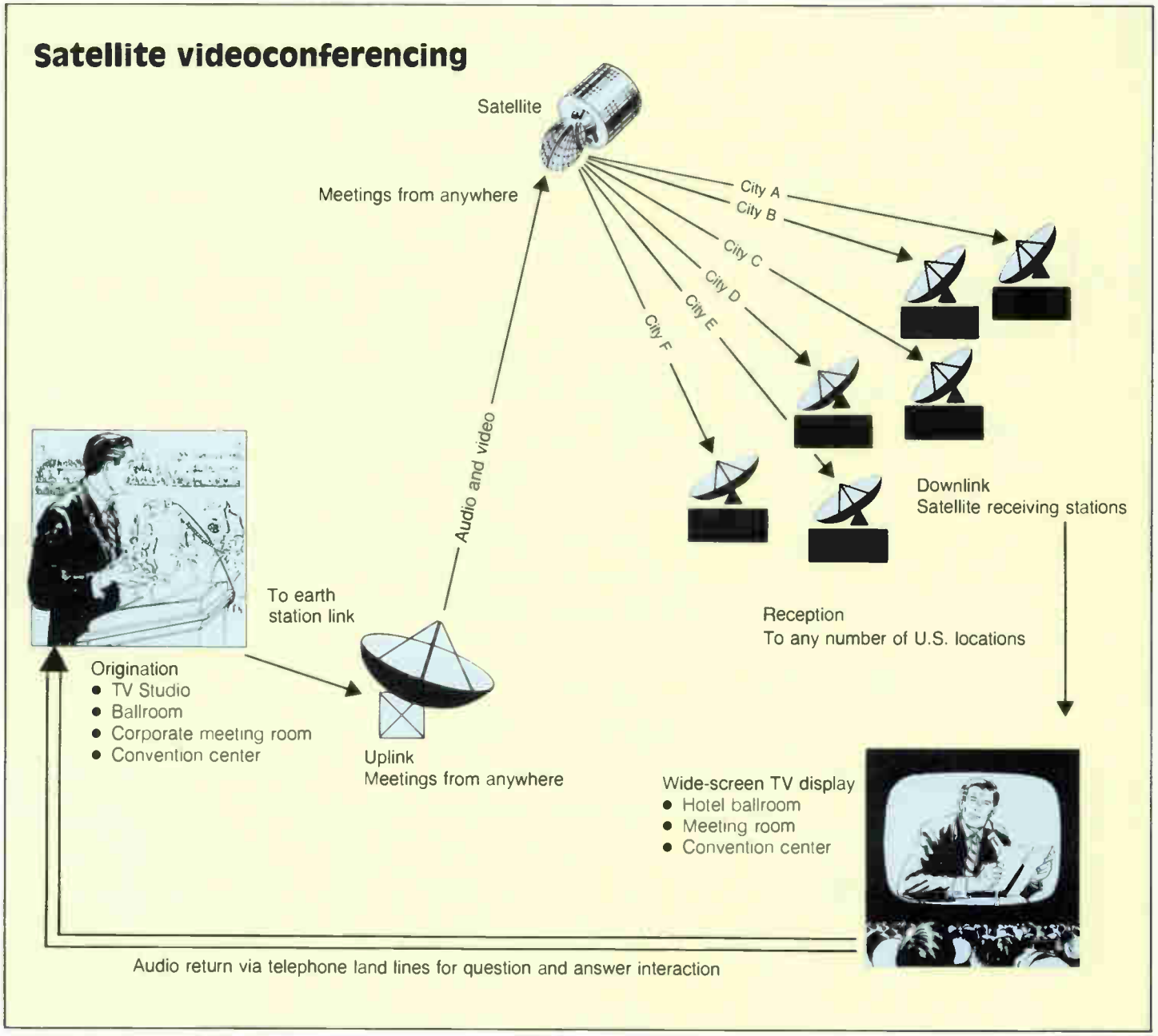

Videoconferencing: Meeting by satellite

By Beverly Johantgen
Western Region Sales Manager, VideoStar Connections

One of the most compelling developments in communications technology is the electronic meeting or videoconference. The creation of a videoconference can be broken down into two major components: the production, or software, and the transmission, or hardware. The goal of those involved in the transmission of the show is to make the medium (satellite transmission) transparent.

The basic technical components of a videoconference are: the origination site, the uplink, satellite time, networking, video projection and audio.

The origination site may be a studio, hotel or other remote site, or a company meeting room. Because television equipment is mobile, it can be brought to any origination site. Often, the most economical alternative is to a studio with a permanent loop to a nearby satellite uplink facility.

The uplink is the antenna that transmits the program to the satellite. Most major cities have permanent uplinks that can be used on an occasional basis. The alternative is a transportable uplink, which is set up specially at the origination site. The expanding number of transportable uplinks and the difficulties involved in working with a divested Bell network make transportable uplinks a more than viable alternative. This is especially the case with respect to direct transmissions in Ku-band. Because Ku-band does not share frequency spectrum with terrestrial microwave, a transportable Ku-band uplink does not require frequency coordination. It requires only a clear line of sight to the satellite arc.

The availability of satellite time or space

segment is one of the most misunderstood aspects of satellite videoconferencing. There is currently a glut of satellite capacity, particularly for occasonal uses, such as ad hoc videoconferencing. But availability and cost are not the most serious problems in selecting satellite time.

The real issues are the accessibility of the origination site and the ability of the receive stations to focus on that satellite and receive the signal free of interference. Here again, the use of Ku-band provides a higher degree of assurance for direct, interference-free reception. Many networks now are hybrid C and Ku, for that very reason.

Networking at the receive sites is the most complex area in videoconferencing and the area where you most need an experienced supplier.

Your receive sites can be located where permanent downlink equipment (such as hotel chains, PBS studios, some universities) exists. They can consist of transportable downlinks at other designated sites such as conference centers, corporate offices, other hotels, etc. Or they can consist of a combination of permanent and transportable downlinks. Permanent downlinks offer a high degree of reliability and some cost savings.

Transportable equipment offers complete flexibility and, with redundant equipment and experienced technicians, can be highly reliable.

Once the receive network has been finalized, all sites must be checked for satellite reception. This entails actual site surveys.

One of VideoStar's transportable Ku-band uplink facilities, the "VideoStar Express."

In setting up the network, remember that it is crucial to use high quality, redundant equipment and trained and experienced technicians. The network, in other words, is not the area of the budget to shave off a few dollars.

There are many choices when it comes to video projection and the ultimate selection will depend on audience size, the physical limitations of the receive site facility (such as ceiling height), the impact you want to make on the audience and budget.

Equipment ranges from standard TV monitors for small audiences to 6-foot diagonal projectors, V-Star and AquaStar projectors, usually used with 9 x 12-foot screens, IMIs for larger screens, the GE series of PJ5050 and 5055, with 20-foot screens, and the Eidophore, for very large audiences and very large budgets.

Here again, obtaining good equipment with a back-up system and selecting trained technicians are crucial. Modern, up-to-date equipment is especially important with very large projection systems.

Despite the fact that videoconference audiences are most sensitive to audio quality, the audio performance is the aspect most frequently overlooked by those planning the videoconference. A primary consideraton is whether to interface with existing house PA systems, a determination that must be made on a case-by-case basis. Some origination sites have good quality sound systems, others don't.

If audience interaction or participation is planned, telephones should be installed at each receive site, preferably a separate, dedicated, external business line. Depending on the type and extent of the audience interaction desired, standard telephone handsets can be used or microphones connected to an open phone-return line.

To guarantee a flawless audio and video performance, all facilities and equipment in the end-to-end network should be tested three to five hours before the live event. In addition, a 30-minute countdown will provide time to solve any last minute problems and will serve as an effective cue to the remote audience for the coming program.

Setting up an ad hoc videoconference is a complex activity, but the objective is simple: to make the technology transparent. With proper planning and execution, the audience will clearly see and hear the message. ➡

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Equipment needed for videoconferencing

By John Davis
Director of Engineering, VideoStar Connections

When selecting equipment for an earth station, whether it be a fixed or transportable type, it is important to purchase from a manufacturer of commercial grade equipment. Although less expensive equipment is available for consumer or home earth stations, this equipment does not have the long-term stability or performance required for commercial teleconferencing service.

Commercial grade equipment is manufactured for cable television or broadcast applications by leading suppliers.

The leading manufacturers of commercial type equipment have established reputations in the industry for equipment reliability, customer support and maintenance.

Money invested in commercial equipment will also pay off in reduced maintenance and reliable service over a long period. This article will discuss various types of equipment in each category to help you decide what is needed for your particular location.

The antenna

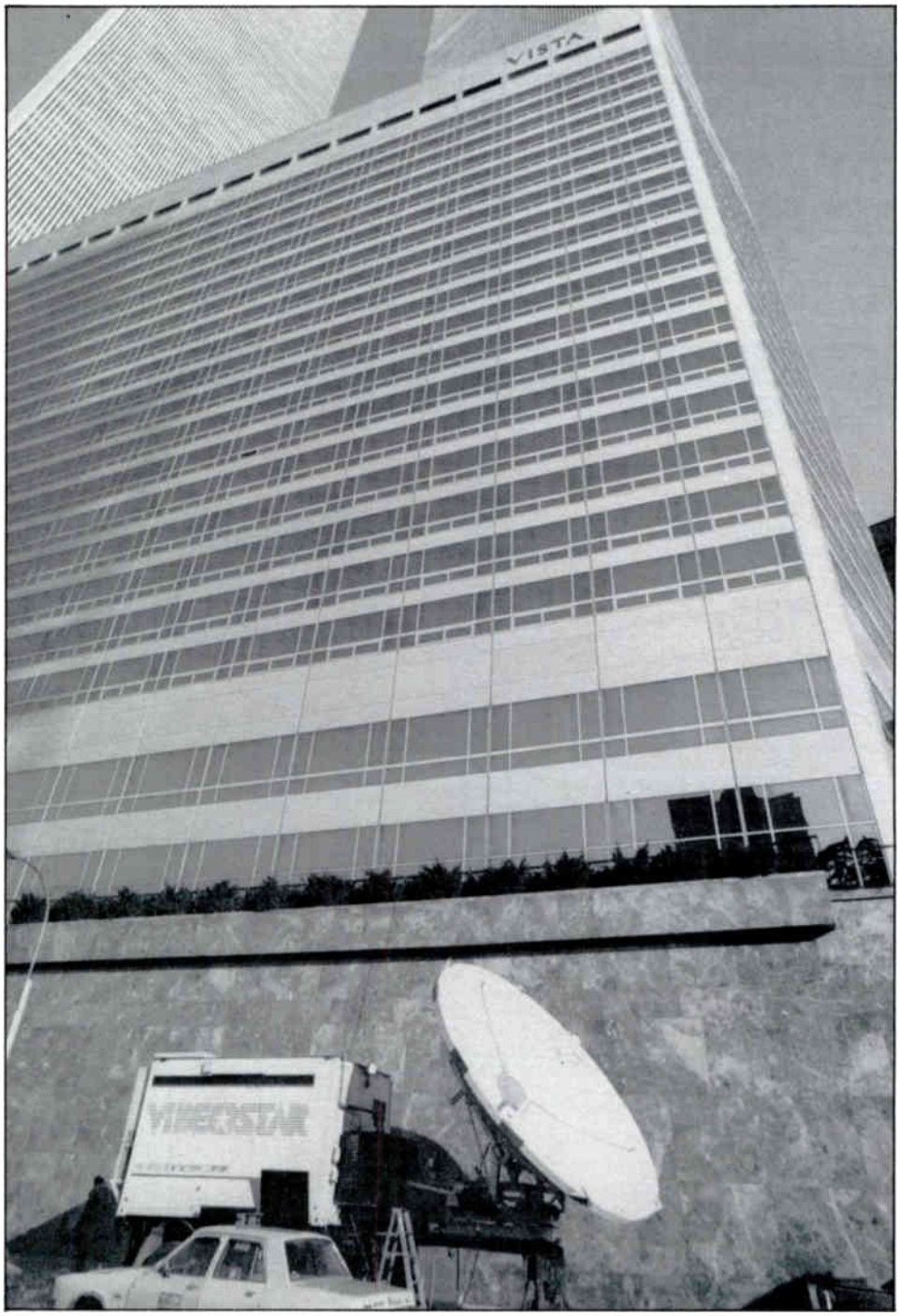
The first decision should be whether to buy a fixed or transportable antenna. To make this choice, one should carefully evaluate the proposed usage of the antenna. If your application requires reception of the satellite signal at several locations that are not served by a common television distribution system, a transportable earth station antenna will be most helpful.

However, a transportable antenna usually requires more skilled manpower to operate and a vehicle is required to move the antenna to each new location. If your location only requires reception of the satellite signal at a central location with signal distribution to several locations via cable or microwave, then a fixed antenna will probably serve best. With a fixed antenna, it is easy to re-aim the antenna to different satellites when necessary since satellite positions may be marked on the antenna mount or stored in the controller of a motorized system.

Another consideration in selecting an antenna is the size or diameter of the dish. Antennas for the popular C-band satellites range in size from about 3 meters in diameter (10 feet) to an average of 7 meters for receive-only sites. As a rule, the larger the antenna, the better reception one can expect. Typically, a 5-meter antenna produces excellent reception for teleconferencing or distribution purposes and is recommended for fixed installations. For transportable applications, a minimum diameter of 12 feet should be used. Transportable antennas in the 5-meter size are available and highly recommended, but may present some restrictions in towing, set-up and storage.

Potential interference from terrestrial microwave (generally from telephone company facilities) must be considered in selecting an antenna. Your site may or may not be exposed to these interfering microwave transmitters, but to be absolutely sure, a survey of the proposed site should be conducted. Frequency coordination services can either produce reports of potential interference sources at your site, or conduct on-site measurements of actual interference levels.

Probably the best way of determining if interference is a problem at your site is to compare the results of a computerized interference study with a transportable antenna and electronics set up at the site to look at actual performance on several satellites. If interference is present, it can sometimes be minimized by attaching filters to the receivers or taking advantage of natural shielding from buildings or local terrain. In many cases, relocating the site a few feet to take advantage of shielding from a nearby building may reduce interference to acceptable levels. Also, larger antennas are usually more directional and can reduce interference by rejecting signals adja-



VideoStar's portable uplink station on location in lower Manhattan.

cent to the desired angle of the antenna.

Typically, sites located in or nearby downtown areas will be affected to a greater degree by microwave interference.

A recent ruling from the FCC also affects antenna selection. Changes to reduce spacing between satellites from the present 4 degrees to 2 degrees will take place over the next several years. This means that earth station antennas must become more directional with improved performance characteristics to prevent the earth station from receiving signals from two adjacent satellites simultaneously.

Generally this requires larger diameter antennas with feeds designed to reject the signals of closely spaced adjacent satellites. Another consideration in selecting an antenna is the ability to receive Ku-band signals as well as C-band transmissions. Most of the teleconferencing signals today are received on the C-band satellites, but there is an ever increasing amount of traffic on the newer Ku-band.

Ku-band reception is not plagued by terrestrial microwave interference, because it operates on different frequency bands. Many downtown locations may only be accessible on Ku-band due to terrestrial microwave interference on the lower C-band frequencies. Purchasing an antenna now with capabilities for both bands will allow expansion at a later date for Ku-band reception.

The electronics

Earth station receiving electronics consist of two basic components. These are the low-noise amplifier (LNA), located at the antenna, and the video receiver, which is usually located at some convenient inside location.

The LNA simply amplifies the weak signal from the antenna to a usable level for the receiver. LNAs are rated in different noise temperatures (expressed in degrees Kelvin). The lower the noise temperature, the higher the carrier-to-noise ratio, producing a better picture. Typically, an LNA with a noise temperature of 100-120°K will produce an acceptable picture on a 5-meter antenna. With smaller diameter antennas, at least a 90°K LNA is required. LNAs with lower noise temperatures are often higher in price.

A variation of the LNA is called a low-noise converter (LNC) or block downconverter (BDC). An LNC or BDC amplifies the signal, as in an LNA, but also converts the high microwave frequencies down to the UHF range and allows some cost savings by utilizing a less expensive interconnecting cable to the receiver.

The LNC or BDC configuration also allows longer cable runs, which may be required in some locations. BDCs are also available for use on Ku-band, and some manufacturers have designed receivers to operate on both C- and Ku-band, depending on which BDC is used. This results in a significant cost savings for sites operating in both bands.

Receivers are usually selected on the basis of features available. If you are utilizing an LNA on the antenna, be sure that the receiver accepts a 4 GHz input. If using an LNC or BDC, be sure that the downconverted output is compatible with the receiver input. Consult the specific vendor for this information.

With today's state-of-the-art receivers, many features are usually available. Useful features to check for include 24-channel C-band tuning capability (ensure different channel format capability for Ku-band receivers), automatic polarizaton switching, signal strength display, adjustable video and audio levels and capabilities for receiving multiple audio subcarriers. Again, select receivers of commercial grade from leading manufacturers.

Finally, a very important consideration for commercial earth station electronics is equipment redundancy. All electronic components should be 100 percent backed up with standby equipment to prevent loss of the teleconference signal due to equipment failure.

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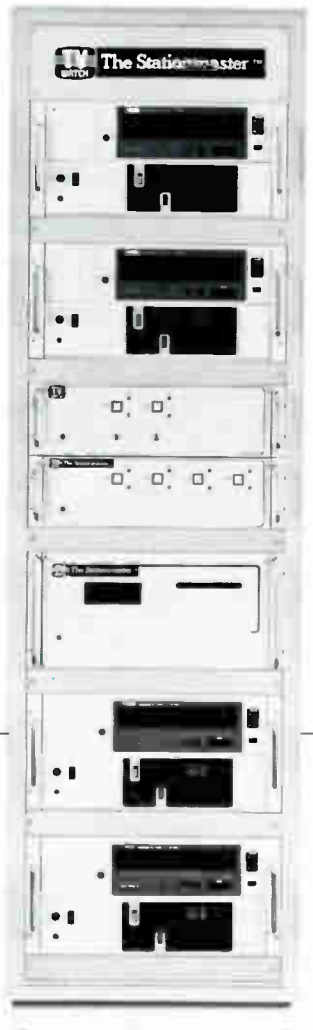

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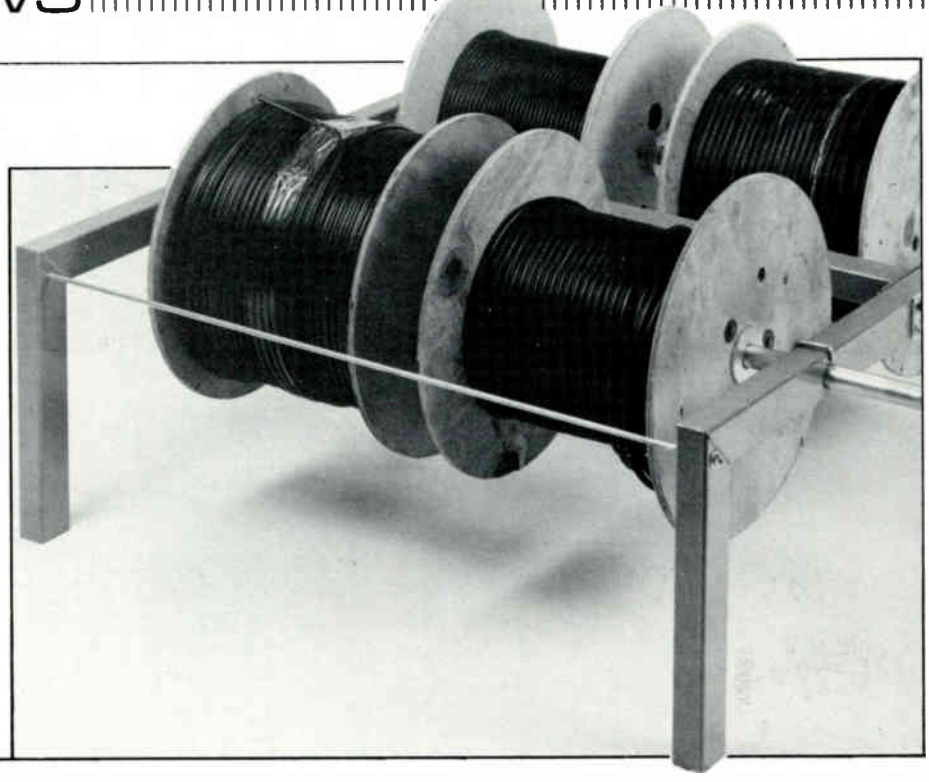
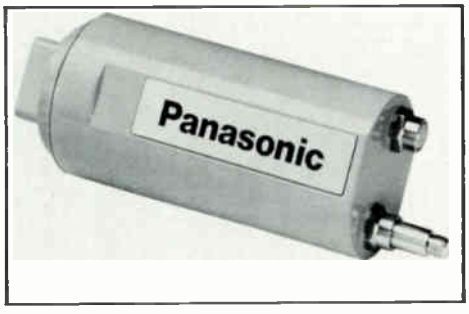
Lemco Tool Corp. introduced its Model T-256 reel jack, which supports up to four reels of drop cable and is designed for multiple wiring installations. The unit is supplied with springs that serve as a breaking device to avoid inadvertent pay-out. Fabricated of steel tubing makes the unit both durable and lightweight for transporting. Total weight of the orange painted unit is 33 lbs.

Lemco also is now offering its new 44-page "The Tools of the Trade" catalog of products used in the construction and maintenance of cable TV and telephone systems. The catalog is sectioned to include reel handling, aerial construction, underground construction, splicing and installation. Product descriptions, specifications, illustrations and prices are included for each item.

For more information and a free copy of the catalog, contact Lemco Tool Corp., R.D. #2, Box 330A, Cogan Station, Pa. 17728, (717) 494-0620 or (800) 233-8713.





Ku-band LNCs

The Panasonic Industrial Co. has introduced two Ku band low-noise block down converters designed to provide quality satellite video reception on smaller antenna sizes. Model LNB-25P uses a CR-62 antenna interface, while Model LNB-25PW uses WR-75 as its antenna interface.

The converters operate in the FSS portion (11.7-12.2 GHz) of the Ku-Band with a typical ultra low-noise specification of 2.3 dB. The converters utilize premium quality GaAs FETs in a two-stage RF amplifier configuration and an ultra stable ceramic resonator local oscillator with minimum drift for temperature variations. Wideband performance is achieved with low input and output VSWR and tightly controlled gain variation. The converters are powered by a low DC voltage, which is applied to the converter through the IF output connector and incorporates an internal IC voltage regulator. The converters are packaged in a cast aluminum case with an integral waveguide flange. The units also are waterproof.

For more information, contact Panasonic, One Panasonic Way, Secaucus, N.J. 07094, (201) 348-7183.

Editing controller

To appeal to a wider range of video editing professionals, JVC Co. of America has reconfigured its VE-93 editing system. The microprocessor-based joystick editing controller is now available without a character inserter. This allows video professionals to buy a sophisticated editor without a feature they may find unnecessary. The CI-90 character inserter is still available as an option.

For complete details, contact JVC Professional Video Division, 41 Slater Dr., Elmwood Park, N.J. 07407, (201) 794-3900.

Satellite receivers

Winegard Co. has introduced three models in its latest generation of home satellite TV receivers. Model SC-7037S, the top-of-the-line unit, features infrared remote control and a built-in antenna positioner control and power supply. Model SC-7037, in the mid-priced range, also offers infrared remote. The lowest-priced unit, SC-7073E, is a basic unit without built-in actuator or remote control.

All three receivers offer rapid scan control, polarity format switch, signal-strength LED bar graph, skew control, audio fine tuning, crystal-controlled channel ¾ modulator, and video invert switching. An IF gain control provides balancing for cable loss if needed, while a unique downconverter switch allows the installer to interchange downconverters for servicing without having to remove the entire receiver. Internal bypass circuitry on the SC-7037S and SC-7037 provides automatic switching from satellite to outdoor TV antenna, VCR, cable, etc., when the receiver is turned off.

The hand-held, infrared remote control (in models SC-7037S and SC-7037) allows armchair control of all basic functions, including on/off, channel selection, satellite selection (on SC-7037S only) and polarity switching. Range is 20 feet. All controls are located both on the remote and on the receiver faceplate for dual viewer control.

For more information, contact the sales office at Winegard Co., 3000 Kirkwood St., Burlington, Iowa 52601, (319) 753-0121.

Stripping and coring tools

Ben Hughes Communication Products Co. Inc. has introduced several new stripping and coring tools to its Cable-Prep® line.

The SCT-QR series is available for 50 and 75 Ohm Quantum Reach cables produced by M/A-COM Comm/Scope. Made for both .500 and .860 cable sizes, this tool has an added feature that removes the outside jacket to manufacturer's specifications, eliminating an additional operation in the field. The SCT-QR series tools will core the dielectric, strip back the outside conductor and strip the outside jacket, all to the proper specifications.

The SCT-MC^2 series tool for General

Cable's MC^2 cable, is specially designed to remove the extruded plastic dielectric, as well as strip back the outer conductor to the specified length. The SCT-MC^2 series tool is available for .440, .500, .650 and .750 cable sizes.

For more information, contact Ben Hughes Communication Products Co., 304 Boston Post Rd., Old Saybrook, Conn. 06475, (203) 388-3559.

PVC conduit, wiring catalog

A new line of riser guard was announced by Panduit Corp.'s Electrical Group. Designed for routing coaxial cables in outdoor applications, the one-piece construction is tamper-resistant and the exterior grips on the riser guard make handling easier, according to the company. The riser guard is made of lightweight, impact- and weather-resistant PVC and is available in three sizes: 1-inch, 1.5-inch and 2-inch. The standard length is eight feet.

Three colors are offered: beige (ivory), brown and redwood. The riser guard also can be painted with latex paint.

Panduit also is offering a newly revised and completely updated 32-page condensed catalog covering its full line of wiring products. Included is illustrated information on the firm's cable ties, specialty ties, clamps and marker ties; cable tie mounting and marking accessories; wire mounting devices; harness board accessories; tension-controlled cable tie installation tools; stainless steel ties; plastic wiring duct; spiral wrapping; the full line of terminals, splices, disconnects, wire joints and installation tools; wire and identification markers, safety signs and hazard tape; mechanical connectors, compression connectors and installation tools; heat shrink products; and foam tape.

For complete specs and free copies of catalog E-CC8, contact Manager, Inside Sales Dept., Panduit Corp., 17301 Ridgeland Ave., Tinley Park, Ill. 60477-0981, (312) 532-1800.

Engineering services brochures

Three new brochures from Compucon Inc. are now available to the telecommunications industry. The first of these brochures highlights the importance of expert and accurate engineering services when planning a terrestrial microwave system. Included in this brochure is the variety of services provided by Compucon such as frequency engineering, the prior coordination process, supplemental showings for private microwave users and a complete range of microwave planning services.

The second brochure describes the company's satellite communications services. These services include the planning and coordination of a system to ensure interference-free reception of a satellite signal. Additionally, a "frequency protection" group monitors each station to ensure continued interference-free operation of a station.

The third brochure discusses the changing communications environment and the opportunities involved. It explains Compucon's Communications Marketing Research group's role in identifying the changing markets and the opportunities that are arising and that potential problems can be profitable opportunities.

For more details and copies of the brochures, contact Compucon Inc., P.O. Box 809006, Dallas, Texas 75380-9006, (214) 680-1000.

One-inch VTR

Ampex Corp. will introduce a new 1-inch type C VTR—called the VPR-6—at the International Broadcast Convention in Brighton, England, later this month. It also will introduce a companion time base corrector, the TBC-6, which is performance matched to the VPR-6.

The microprocessor-controlled VPR-6 offers a high degree of machine intelligence. It solves a problem of broken tape due to dissimilar reel sizes by automatically sensing the size of the tape reel and if the takeup reel is working in Play mode, then adjusts the servos for optimum tape handling. It solves another problem by automatically sensing when the end of the tape is near in shuttle and slowing down the reels so that the end of the tape does not damage the heads during unthreading.

A long-life battery provides protection for setups, edit points, cue points and editor configuration including all Record Enables, audio monitor selects and the tape timer. Extensive built-in diagnostics are constantly checking various machine operations and will display a fault code to the operator to assist in trouble shooting. An expanded diagnostic routine employing a diagnostic probe can be run from the control panel.

Tape handling features include shuttle speeds approaching 500 ips and a slow motion range of –1 to 3X play speed. Single frame jog also is included.

A full range of editing capabilities include video confidence, split audio-video auto edit and auto tag (automatic transfer of edit entrance and exit points). The VPR-6 also features RS-422 serial communications capability, making it easy to integrate into state-of-the-art systems. It readily communicates with Ampex switchers, ACE editing systems and the ADO special effects system. If parallel communications capability is required, the VPR-6 remote connector is pin-compatible with the Ampex VPR-80/TBC-80, VPR-2B/TBC-2B and other equipment.

For more details, contact Ampex Corp., 401 Broadway, Redwood City, Calif. 94063, (415) 367-4161.

Apartment boxes, mounting bracket

A new line of apartment security boxes offered by CWY Electronics features aluminized steel construction, shown to outlast unpainted galvanized steel at least five-to-one, according to the company. The all-welded construction box provides additional strength and security and a hingeless, secure lid removal system with security stops welded in the front cover serving as an additional entry deterrent. CWY security boxes also feature fully replaceable 11-gauge hasps and multiple entry knockouts to suit specific installation requirements. Other standard features include full interior board backing, knockout for optional cam lock and heavy baked enamel finish.

Also from CWY is the new Model ZB accessory mounting bracket, which allows mounting of many multiple dwelling enclosure accessories, including the CWY Omni-Rack™ system. The Omni-Rack system uses a panel-and-rail design to make multiple dwelling enclosures more orderly, secure and serviceable, allowing for quick, easy audits and subscriber status changes, according to the firm. The new mounting bracket retrofits existing enclosures.

For more information, contact CWY Electronics, P.O. Box 4519, Lafayette, Ind. 47903, (800) 428-7596 or, in Indiana, (800) 382-7526.

July 1984
This notice appears as a matter of record only.

SOLD:

Northwest Cable

Serving Garibaldi, Bay City, & Rockaway, Oregon

Edward J. Thorn
represented the seller
in this transaction.

Pat Thompson Co.

14292 East Evans Avenue Aurora CO 80014 (303) 337-4707

July 1984
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SOLD:

Cablevision of Wadesboro, Inc.

Serving Wadesboro and
Anson County, North Carolina

Pamela A. Pyms
assisted in
the transaction

Pat Thompson Co.

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August 1984
This notice appears as a matter of record only

SOLD:

Kirby Cable TV

Serving Boron and
Desert Lake, California

Edward J. Thorn
assisted in
the transaction

Pat Thompson Co.

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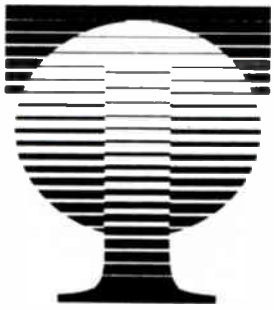
WHEN CONFIDENCE COUNTS



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CABLE TELEVISION BROKERS
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(303) 337-4707

Prototype headend provides the solution

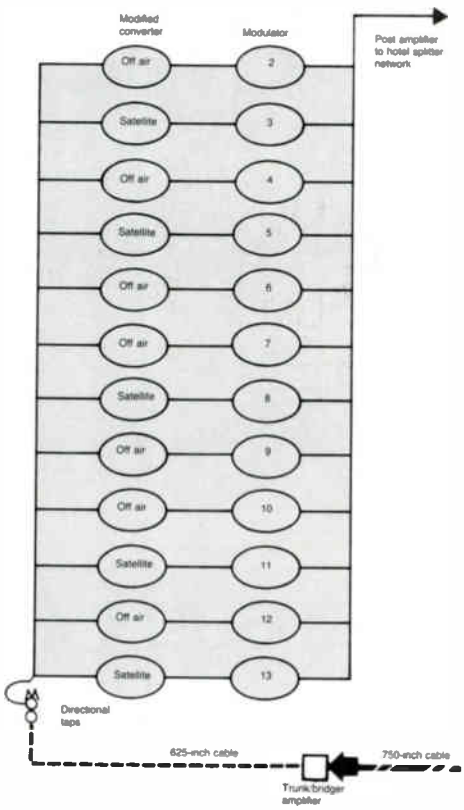
By Timothy E. Kagele
Mile Hi Cablevision

The providing of cable television service to hotels, motels and hospitals without the use of individual set-top converters in a completely addressable, scrambled system can be a major problem.

A SMATV system is one possible solution, however, it can be expensive to provide 12 channels and the headend takes a lot of room as well. Individual converter installation also brings unwanted security risks in addition to increased maintenance costs.

At Mile Hi, we decided to research another possibility, to design a prototype 12-channel headend supplied by the cable system signal with each channel decoded via a subscriber converter/decoder. To help determine cost efficiency of the project, a figure of $1,000 per channel plus $1,500 to supply a CATV input to the building was established. Once the budget of $13,500 was in place, the next step was to do an on-site survey of the property. The choice for the headend location was logical: This particular application already utilized an MATV system of which the existing headend was on the second floor, so that is where the prototype would be located.

Figure 1: Diagram of prototype 12-channel headend



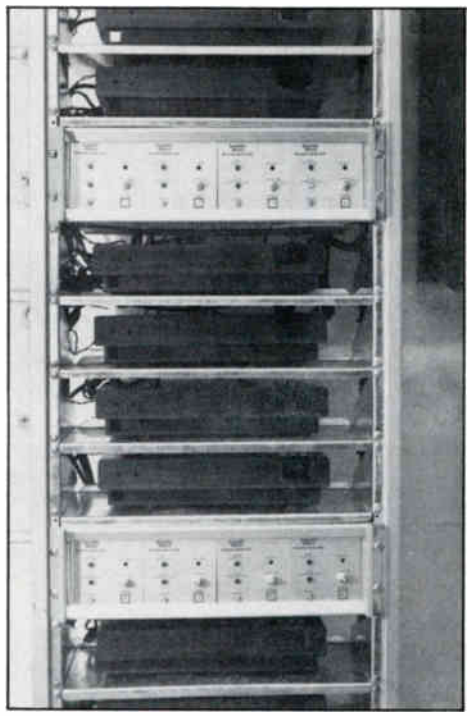
At this point, the criteria became a consideration. System parameters for signal-to-noise, cross-modulation and composite triple beat for a 20-amplifier cascade were chosen as the ground rules. Because of these specifications, the decision to use modulators instead of reprocessed decoded system signals was selected, which presented another challenge: the converter/decoder modification.

Upon studying the converter schematics, it was decided to strip the demodulated signal after it had been decoded and redesign the output circuit for baseband video and audio. Of the several modifications to the output design, a 1 volt video output was critical in order to be compatible with the modulator input. After making all changes at our test and repair facility, the redesigned converters were ready for testing. The results were exactly as anticipated. The two items remaining to be resolved were the system design necessary to supply proper input to the building's headend and the establishing of an account in the management computer for the addressing of the converters used.

The headend input design consisted of a bridger amplifier leg running to the building and up to the second floor MATV headend site. An 8-port and 4-port tap provided 0 to 5 dBmV to each converter, as well as RF termination and AC isolation on the input feed. As far as the computer was concerned, its only requirement was a single address to establish the account and all outlets over one constituted additional outlets with the level of service for each converter determined by the programing requested.

With the criteria being worked through, all equipment evaluations and selections could be achieved. Keeping in mind the per-channel cost limitation, the evaluation centered around "economy" type modulators and eventually one was chosen that would deliver. By this it is meant to be a unit that would have good adjacent channel rejection, hence no band-pass filters were required, and meet the system parameters at the cascade of the building.

Making an equipment rack selection was somewhat tricky with respect to converter/decoder installation. Because the converter/decoder enclosures were not designed to be rack mounted, trays needed to be provided for the converter/decoder to be seated on. After checking around for commercially available trays, it was determined to go with a local sheet metal shop and have them fabricated to fit a standard EIA 19-inch rack. Pricing also was much more reasonable.



MATV headend rack showing placement of converter/decoders and modulators.

Upon determining the overall height of 70 inches, a "no frills" rack was selected, complete with an adequate amount of AC outlet strips. Additionally, the non-enclosed rack offers decent ventilation and easy serviceability. A passive signal combiner was used in conjunction with an "apartment" type 300 MHz amplifier to provide the final signal output. The post amplifier did require some attenuation of the input signal as the modulators were set at 60 dBmV with a signal combiner that had a nominal loss of 20 dBmV per spigot.

The system slope was not established at the post amplifier, but rather by sloping the modulator output levels with the highest channel set at 60 dBmV and the lowest channel at 55 dBmV. This combined signal was then interfaced at precisely the same level as it was originally needed to drive the complex. Signal levels were then checked at the closest and farthest locations and found to be between 0 and 10 dBmV across the band, with picture quality being excellent.

The project from start to completion took approximately six weeks, with most of the time being spent on the test bench modifying the converters. Total cost of the project came out well under budget at $12,000 including construction cost. When this is compared to total cost of a complete SMATV headend at about $24,000, the feasibility for this type of project to succeed is increased. By investigating the alternatives, a flexible 12-channel prototype headend was developed, one that can evolve further and which programming can be easily altered.

SOCIETY OF CABLE TELEVISION ENGINEERS • SCTE

CABLE-TEC EXPO '85

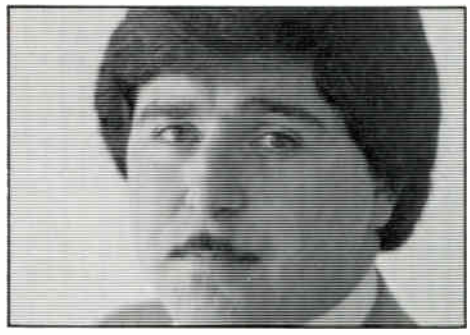
MARCH 4-6, 1985

The Society of Cable Television Engineers has concluded arrangements, and set the dates for the Cable-Tec Expo '85!

Expo '85 will be held March 4-6, in Washington, D.C. For additional information, please contact the SCTE at (215) 692-7870, or write to P.O. Box 2389, West Chester, PA 19382.

Moldings, conduits & U

By Anthony J. DeNigris
President, Nationwide CATV Services Inc



Have you ever stood with a landlord in front of his high rise apartment building contemplating how you're going to get this massive project wired to the landlord's satisfaction, especially since you are dealing with a stubborn, opinionated, unknowledgeable and unreasonable old geezer?

Why hide it?

With all the turmoil that has taken place over the past several years concerning landlord's wishes vs. cable operator's proposals for apartment wiring, it is undoubtedly not a simple task to get in and get the job done. Many, many situations exist where it seems almost impossible to get cable service into a building considering the limitations and unrealistic demands by the landlord. On the one hand, the landlord feels justified making any demand that will, in his eyes, preserve the integrity of his "pride and joy." On the other hand, the cable operator realizes that there is only a certain number of practical alternatives to providing the service that the tenants are entitled to receive.

The big problem is always the concealment of the wires. In certain situations, specifically the massive concrete, masonry and steel structures, it seems literally impossible to come up with a practical and acceptable solution other than the commonly proposed method of exposed wiring, which is definitely what the landlord does not want. How does one come out a winner? Obviously, the best approach would be to find a way to hide all the wires, but this is not always possible.

Where to put it

After convincing the landlord that it is just not practical to drill through 12 floors (inside the walls) and that wallplates cannot "magically" appear on interior walls without a way to get the wires there, a method such as enclosed raceway molding becomes very feasible at this point. There are many variations to the application of moldings. They can be used to run laterally in hallways at ceiling level to access the individual apartments through closets, which are sometimes adjacent to the hallway. They also can be used to run vertically through stacked closets from floor to floor. You can even use the appropriate molding for some applications on the exterior of certain buildings. These moldings provide ease of installation, durability, protection of wires and future access. However, it should be noted that molding will not provide the utmost in the way of security. If security is what you desire, then a form of conduit, usually PVC, is what should be used.

PVC conduit can be used in as many applications as raceway molding, but does not have the same aesthetic appeal. The primary reason for using PVC conduit is that it limits access by unauthorized persons, thus reducing the possibility of vandalism and theft of service. It should be noted that the primary difference in working with PVC conduit as compared to raceway molding is that in the case of PVC, cables must be pulled through rather than laid in. This will make installation of additional cables at a later date very difficult.

The best uses for PVC are for vertical runs in stairwells to connect between lockbox locations, between floors from closet to closet using outlet boxes for mounting wallplates, through basements or any location where exposed bundled wiring is not desirable, and, what is perhaps the best use of all, running vertically on the exterior of a building, with access fittings positioned at the point of entry for each apartment drop. After drilling through the back of the access fitting directly into the apartment, the drop can be fed through for mounting of a wallplate on the interior wall. It should be noted that an access fitting in PVC can be either a type C, representing a through connector, or a type E, representing a terminating connector for use at the end of a run. Access fittings differ from outlet boxes, which in PVC are called either type FSC or FSE fittings. While access fittings and outlet boxes have removeable covers, the difference between the two is that the type FSC and FSE outlet boxes are specifically designed for the direct mounting of wallplates, whereas access fittings (type C or E) are designed mainly for the pulling and feeding of cable runs from point to point.

The use of these fittings provides a unique opportunity, as previously described, to achieve a long-lasting and aesthetically perfect result. In addition to the fittings and connectors mentioned here, it also should be noted that a complete line of PVC accessories are available at most electrical supply houses that are suitable to almost any application.

Selection of materials

Although we have mentioned raceway molding and PVC conduit, there exists extreme differences in specifications and quality of each. For instance, in the area of PVC, there are three gauges available. Schedule 20, which is used only in underground situations where the conduit is to be totally encased in concrete, is thinner than what is normally acceptable for self-contained wiring applications and should not be used even though it represents the potential for reducing initial costs. Schedule 80, which is extremely thick and is made expressly for direct burial situations, can be used for standard apartment applications, but is usually too costly. Schedule 40 is the proper gauge for this type of application. It has all the strength and rigidity necessary to do an exceptional job.

Bear in mind, however, that PVC conduit and the associated fittings are not all the same. There is PVC made and designed for plumbing and there is PVC made and designed for electrical applications. The dimensions and diameters are different, so be careful to order only from an electrical supply house, and know exactly what you are ordering.

In the area of raceway molding, there are many inferior brands on the market. Be sure to examine samples of molding before making a final selection. Be aware that raceway molding is available in plastic and steel. Although steel molding represents the ultimate in strength and durability, it is extremely difficult to cut and is available only in gray and beige.

Plastic molding is much easier to work with, but you should look for the following characteristics: rigidity (the ability of the molding to withstand buckling); availability of fittings (so that the raceway molding can be adapted to various routings as desired without having to resort to mitering of the molding); the ability to hold cables in place (how well the cover is designed to lock-on and stay in place); and lastly, fastenability (the ability of the raceway molding to be drilled, cut, screwed, anchored, nailed or worked without cracking or splitting apart).

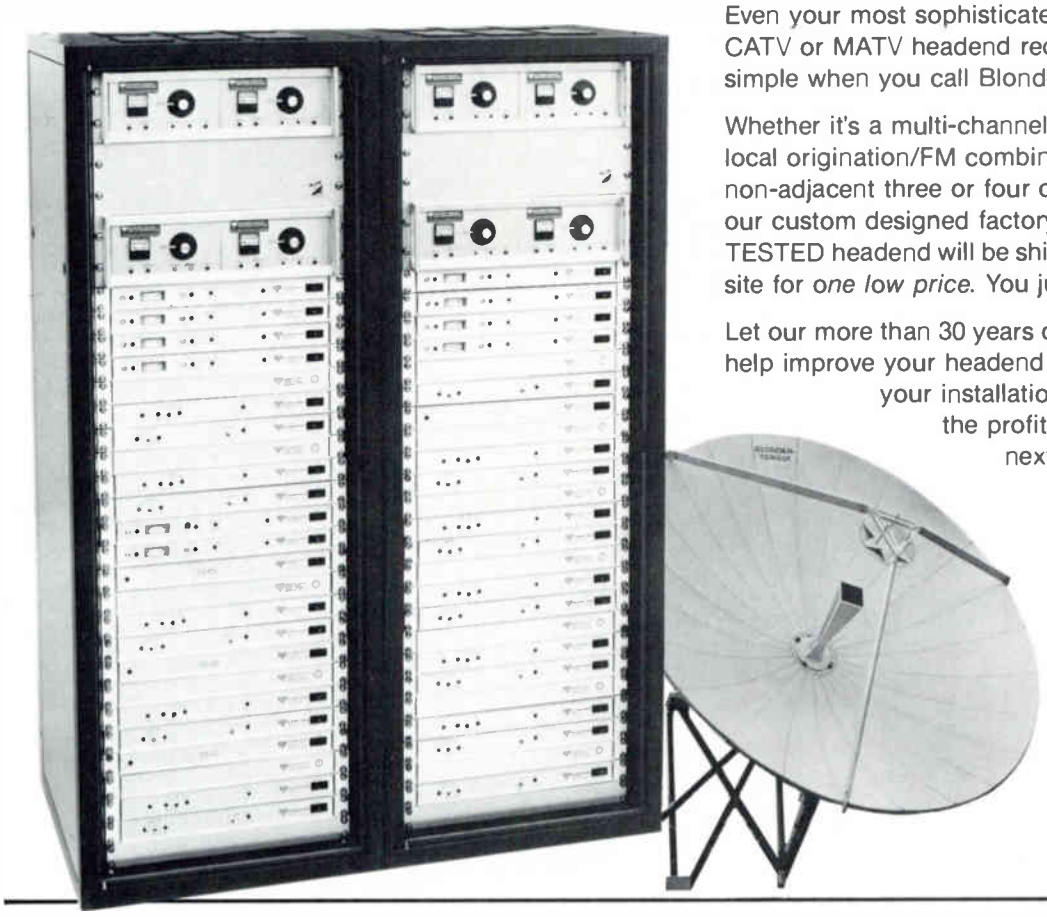
U not forgotton

One final point in discussing moldings is the utilization of plastic U-guard. This type of molding is too readily relied upon as the answer to most exterior wiring applications. While seeming to be cost effective, in reality this is the worst possible selection you can make. It tends to crack, discolor, warp and buckle with changes in temperature, and is difficult to fasten properly regardless of whether you use the flanged or non-flanged variety.

A challenging accomplishment

Many projects at first appear too difficult to attack. With a little ingenuity and knowledge of alternative methods, many apartment projects that seem difficult can prove to be a challenging accomplishment with really not too much effort at all. And the "old geezer" will be happy too.

Blonder-Tongue MAKES IT SIMPLE



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KEEPING TRACK

Hoy

General Instrument Corp. recently announced several management appointments. **Daniel Hoy** has been appointed vice president of sales for the company's Jerrold Division. Hoy, who joined the GI fold in January as director of marketing programs, previously was a branch manager for Sperry Corp., based in Richmond, Va.

Paul Morse Jr. has been promoted to vice president of marketing for the Jerrold Subscriber Systems Division. Most recently, Morse was director of planning and analysis, and will continue to direct planning until a successor is named. He joined Jerrold in 1980 as product manager for computer-based systems and was promoted to marketing manager for addressable systems in 1982.

Bernard Cory has joined the Jerrold Subscriber Systems Division as manager of manufacturing engineering. Cory comes to Jerrold from General Electric Corp., where he was program manager for the 30/20 GHz communications satellite advanced technology program. Previously, he had held a number of engineering positions with Ford Aerospace & Communications, Lew Malnak Associates and Philco Corp. Contact: 2200 Byberry Rd., Hatboro, Pa. 19040, (215) 674-4800.

Scientific-Atlanta Inc. has named **Leo Ramsauer** vice president and group executive of its Government Systems Group. Ramsauer, who spent most of his career with GTE, most recently was director of tactical systems for the Sylvania Systems Group/Western Division. Previously held positions include operations, engineering and program management, as well as system design, test and field service engineering. Contact: One Technology Pkwy., Box 105600, Atlanta, Ga. 30348, (404) 441-4000.

Lenzner

Times Fiber Communications Inc. announced the recent appointment of **David Lenzner** as vice president of human resources, a newly created corporate position. Lenzner was formerly associated with the Broadband Communications Group of General Instrument Corp. where he served as director of human resources. Contact: 358 Hall Ave., P.O. Box 384, Wallingford, Conn. 06492, (203) 265-8500.

Steven Briggs has been promoted to manager of product marketing for **Mycro-Tek**. Briggs joined Mycro-Tek in 1981 as a product marketing specialist. Most recently, he served as product manager and launch team leader for the Mycro-Vision™ Max video character generator introduced last April. Contact: P.O. Box 47068, Wichita, Kan. 67201, (800) 835-2055 or (316) 945-5087.

Philip Viener has been named vice president-marketing at **Oceanic Cablevision**. Before coming to Oceanic, he had been regional marketing director at Continental Cablevision of Virginia Inc. Contact: 2669 Kilihau St., Honolulu, Hawaii 96819, (808) 836-2888.

Ivan Riley has been named vice president for marketing of **GTE Spacenet Corp.** Prior to joining GTE Spacenet, Riley was marketing vice president for Aydin Monitor Systems in Fort Washington, Pa. He also served as director of market planning and development for COMSAT TeleSystems. Earlier, he was in charge of product development for the former Southern Pacific Communications Co. (now GTE Sprint) and technical planning for MCI Telecommunications Corp. Contact: 1700 Old Meadow Rd., McLean, Va. 22102, (703) 790-7782.

Satellite Syndicated Systems announced the addition of **Mike Stangeby** as assistant vice president of special acquisitions. Stangeby brings 15 years of communication experience to SSS. His previous positions include network manager, general manager and assistant vice president of international development for the Satellite Program Network.

John Taylor, an original director of **Southern Satellite Systems Inc.** and father of Edward Taylor, the company's chairman, passed away early Monday morning, July 23. Taylor had been influential in both the broadcasting and cable television industries. From 1930 through 1971 he served in various capacities with RCA. In 1971 he retired as division vice president, market planning, RCA Commercial Communications Equipment Division. Upon his retirement, he worked as a consultant and a free-lance feature writer for a variety of publications in the electronics and satellite communications industry. He became a director of Southern Satellite Systems when the company was founded by his son in 1976. Contact: P.O. Box 702160, Tulsa, Okla. 74170, (918) 481-0881.

Dolby Laboratories Inc. announced a new position and increased responsibilities for **Scott Schuman**. Schuman's new title is director of market development. After more than 10 years in marketing and sales in the consumer electronics field, Schuman joined Dolby Laboratories in March 1981. Since September 1982, he has held the title of manager, special projects. Contact: 731 Sansome St., San Francisco, Calif. 94111, (415) 392-0300.

Two recent appointments were announced by **Magnicom Systems**. **Gregory Casto** has been named vice president, systems and services for the company. He joins Magnicom from the Chemical Division of Borden Inc., where he spent 10 years in various information systems management positions.

Robert Hoffman was named marketing representative for four Western states—Washington, Oregon, California and Nevada. Hoffman, an 11-year veteran of the cable television industry, comes to Magnicom after spending two years as president of Creative Communications Associates, a consulting firm that provides marketing expertise to cable-related businesses. Previously, he was director of marketing at Falcon Communications in Los Angeles and director of marketing at Teleprompter's Manhattan cable system. Contact: 1177 High Ridge Rd., Stamford, Conn. 06905, (203) 968-0088.

Scott Hauter has been appointed to the newly created position of director, interactive television marketing for **Zenith**. He will be responsible for all aspects of Zenith's consumer marketing efforts in interactive TV, including videotex and teletext. As well, he will coordinate future interactive applications of various Zenith divisions—consumer electronics, cable products and computers. Hauter's previous assignments in sales and marketing include video product planning and market development. He joined Zenith in 1978. Contact: 1000 Milwaukee Ave., Glenview, Ill. 60025, (312) 391-8181.

Gill Management Services has announced the immediate appointment of **Bobby Morrison** to manager of new products/sales. Morrison occupied a similar position for GMS's Product Planning and Development Group. In his first assignment Morrison will help ensure marketing acceptance of GMS's new micro business computer products, as well as their integration into the Business Manager III online system product line. Contact: 2050 Bering Dr., San Jose, Calif. 95131-2077, (408) 998-8078.

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4630 Pacific Hwy. East
Suite B-7
Fife, Washington 98424
(206) 922-9011

CALENDAR

September

Sept. 10-12: Magnavox CATV training seminar, Buffalo, N.Y. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

Sept. 12-14: Computers and Communications International Worldcom '84 conference, Hilton Hotel, San Francisco. Contact (415) 574-3145/921-3114.

Sept. 15-19: National Satellite Cable Association annual convention, Hyatt Regency Hotel, Orlando, Fla. Contact Mickey Gorman, (202) 659-2928.

Sept. 17-18: South Dakota Cable Television Association annual convention, Sylvan Lake Resort, Custer, S.D. Contact Dale Hodgkins, (605) 343-3402.

Sept. 18: Southern California Cable Association monthly luncheon, Los Angeles Airport Hilton. Contact (213) 684-7024.

Sept. 18-20: C-COR Electronics technical seminar, Denver. Contact Deb Cree, (814) 238-2461.

Sept. 18-20: Jerrold technical seminar, Atlanta. Contact Kathy Stangl, (215) 674-4800.

Sept. 19: Southern California Cable Association/Showtime "Theft of Service Task Force" report. Contact Ellie Pynes, (213) 208-2340.

Sept. 19-21: Magnavox CATV training seminar, Ogdensburg, N.Y. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

Sept. 20: QV Publishing seminar on "Addressing Addressability and Pay-Per-View," Loews Anatole, Dallas. Contact Barbara Freundlich, (914) 472-7060.

Sept. 23: SCTE Capitol City Chapter get acquainted picnic, Fort Ward Park, Alexandria, Va. Each member will be required to fill out a questionnaire on chapter goals. Contact Randy Paschak, (703) 849-8977.

Sept. 23-25: Illinois-Indiana, Michigan and Ohio Cable Television Associations annual Great Lakes Expo, Indianapolis (Ind.) Convention Center. Contact (618) 249-6263.

Sept. 23-25: Pacific Northwest Cable TV Association annual convention, Red Lion Riverside, Boise, Idaho. Contact (406) 259-3026.

Sept. 24-26: National Cable Television Association minority business symposium, Washington, D.C. Contact (202) 775-3629.

Sept. 24-26: Magnavox CATV training seminar, Ogdensburg, N.Y. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

Sept. 26: SCTE Golden Gate Meeting Group seminar on video by Tektronix, Santa Clara, Calif. Contact Rich Adams, (707) 553-1430.

Sept. 26-28: Alabama Cable Television Association fall convention, The Grand Hotel, Point Clear, Ala. Contact (205) 288-1821.

Sept. 27: Microwave Filter Co. seminar on terrestrial interference, East Syracuse, N.Y. Contact Bill Bostick or Carol Ryan, (315) 437-3953.

Sept. 30-Oct. 2: Kentucky Cable Television Association fall convention, Galt House, Louisville. Contact Patsy Judd, (502) 864-5352.

Planning ahead

Oct. 16-18: Mid-America CATV Association annual convention, Hilton Plaza Inn, Kansas City, Mo.

Oct. 30-Nov. 1: Atlantic Show, Atlantic City (N.J.) Convention Center.

Dec. 5-7: California Cable Television Association annual convention, Western Show, Anaheim (Calif.) Convention Center.

March 4-6: Society of Cable Television Engineers annual convention, Cable-Tec Expo '85, Sheraton Washington Hotel, Washington, D.C.

October

Oct. 10-12: Magnavox CATV training seminar, Philadelphia. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

Oct. 17: SCTE Golden Gate Meeting Group seminar on converters and earth stations by M/A-COM, location to be announced. Contact Rich Adams, (707) 208-2340.

AD INDEX

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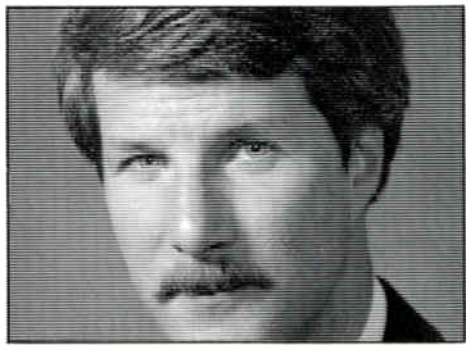
CT 9/84

The coming of 'Cartercable'



By Bob Luff
Vice President, Engineering, United Artists Cablesystems Corp

Mention the name Carterphone to the telephone industry and it will awaken anger or a period of thoughtful reconsideration of the events that led to forced competitive changes over the past decade to the onetime monopoly.

Carterphone was a small company that believed it had a better mousetrap (a home telephone answering device with more features at less price) than what the telephone company prescribed. The individual telephone companies, as you may recall, once upon a time refused to allow anyone else's equipment to be connected to their service lines. But Carterphone took the giant telephone industry to court, won, and the rest is history—the demise of the telephone industry's monopoly on subscriber equipment, the eventual break-up of AT&T, and today's fierce competition in every aspect of the telephone business. If our industry does not moderate its monopolistic attitudes toward our subscribers and "locked out" manufacturers of potentially better cable mousetraps, we soon may be awakened by "Cartercable."

While an individual system or company subscriber count may be modest, we must realize that when totaled, there are over *30 million* households today (out of an 80 million total) who choose to receive all of their TV signals via the cable medium. And particularly in the business and manufacturing world, 30 million of anything begins to attract a lot of mousetrap builders.

Cable's in-home monopoly

But while cable offers abundant quality and quantity of choice in TV programming, it offers a villainous, tight, local monopoly and technological bottleneck in the last and the most important link in delivering those signals to the home TV—the set-top converter/descrambler. The cable industry, of course, has a right to protect its signals, nonetheless, we do not have a right to monopolize converter or remote control options or adversely impact normal free marketplace purchase decisions of other electronic products in the home. There are a lot of "locked out" manufacturers who would like to have just a small competitive percentage of our monopolized 30 million household "enhanced consumer features" business. And, there are a lot of those 30 million households who would like to have a wider selection of color, style and features than their local "monopoly" has decided for them.

Actually, the problem is much more serious than simply color, style or features. The fact is—and you and I both know it—our converter/descramblers are not doing the job in today's exploding consumer electronics marketplace, and the gap is widening each year. When subscribers complain with increasing frequency—I know you are hearing them—when city councils hold hearings and delay refranchise awards—and they are with increasing frequency—and when there is an outbreak of pending cases zeroing in on cable TV monopolistic attitudes on service and features pricing issues . . . Can Cartercable be far away?

The problems can only get worse if the industry does not awaken and take corrective action. Last year, every consumer video product shattered all previous sales records. Nineteen million new TVs were sold, up 23 percent; 4 million VCRs were sold, up 100 percent; 500 million cameras were sold, up 40 percent. This year, TVs with full features, large screens and stereo audio will be sold in record numbers. Every one of these is a potential collision with the cable industry's mandated subscriber converter/descrambler and other restrictive policies.

Hindering marketplace selection

Let's review the problem, but for once, from our subscribers', local dealers' and "locked out" manufacturers' points of view. The subscriber has brought home a new VTR and has paid extra money for the enhanced features of a 14-day, seven-event programmable timer to record programs while away from home or engaged in other activities. He thought these were nice features and was willing to pay extra for them. The manufacturer saw the enhanced features as a competitive edge over the non-programmable units and was willing to take the risk of higher R&D, manufacturing and selling price to gain more sales and profit. And the local TV dealer or department store believed the extra features to be good selling items, promising more price mark-up than lower priced, vanilla models. Well, we all know the resulting situation—the programmable feature is all but worthless with the cable industry's usual set-top converter/descrambler environment. The subscriber is forced to accept the situation of a wasted feature expense or try to exchange his top-of-the-line VTR for a less featured (less usable) one. The manufacturer and your local TV dealer see the dampening influence our "monopoly" converter/descrambler interface has on their "locked out" free market success and profit.

The same situation is true for the so called top-of-the-line "cable-ready" TV sets with remote control. Ironically, cable-ready sets are more appealing when disconnected from cable. When connected to cable, the features are, almost without exception, preempted by cable's villainous set-top converter/descramblers. Even if our systems offer a remote control option, many do not, it usually only has on/off and channel selection related features—no volume control, mute, clock, or programmable auto on/off channel selection. Some even allow you to answer your phone via the remote control. As a result, cable has again, in a major way, adversely interfered with, or even blocked free consumer marketplace selection of other manufacturers' products and features.

A few years ago, the cable industry could have claimed ignorance, lack of technical standards, or that this was all an unfortunate, passing consequence of past days when converters were employed as a temporary means to expand the lagging tuning range of TV sets. But recent trends of operators boasting about developing these "necessary evil" set-tops into a lucrative (monopoly) profit center is adding salt to the wounds of our already suffering subscribers, local TV dealers and department stores as well as all of the locked out manufacturers with potentially better mousetraps at competitive or lower costs.

Do you know how many systems, after locking out other competitive sources, are planning to rent the remote feature for $3 to $5 per month? Think of it from the subscribers' point of view. The local cable company connives some mumbo-jumbo channeling and scrambling scheme that conveniently justifies the cable company into allowing only their interface device with limited features at their inflated "what-the-market-will-bear" prices and conditions.

Can any of us really justify $5 per month for the rest of the subscriber's life for a remote control feature—$60 per year; $300 for the assumed 5-year life of the box—especially when the remote control circuits probably cost less than $30 and the subscriber is locked out of any other product choice? Doesn't this smack of what a subscriber, TV dealer, or potential manufacturer would call blatant monopolistic restraint of competition and price control?

Compounding the problem

Let's look at multiple set households as a compounded example of the industry's problem with set-top converters/descramblers and resulting installation policies. As a result of our own mandated, overpriced hardware, we have backed into doing almost everything we

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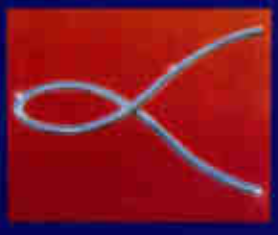

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can to make it harder for subscribers to want to connect extra sets. Because second set set-top converter/descramblers have such a poor payback for us, we charge for the extra outlet not once, but on a recurring monthly charge (even the phone company gives you one-time cost extension phone options now) and we charge in many cases full, undiscounted first set prices for secondary sets.

I think that our subscribers are beginning to see us and our subscriber set-top devices just like telephone subscribers saw the local monopoly telephone company and telephones a decade ago. The "you can have any telephone you want, so long as it is black, rotary dial, in your living room, and you pay for it for the rest of your life" attitude did not work for them and it will not work for us very much longer either.

The cable industry is definitely backing along two ridiculous and precarious paths. First, the industry is driving subscribers away from convenient and expanded features or viewing locations in the home or apartment (bedroom, children's room, kitchen, even garage or basement) and forcing, or at least heavily influencing them, to sit in one location and watch one TV with restricted features and attachments. This does not make sense at a time when we are trying to sell a slate of more and more multi-maxi pays and seek general rate increases based on expanded-channel basic tiers. Second, we are depressing the development of new video-oriented products and features. With only four hours of prime-time viewing per evening funneled into one TV, how can we expect our subscribers to justify extra channels or rates if they can use but a fraction of the signals and features they already have?

Clearly, our future lies in carrying as many signals as we can carry, to as many consumer electronic devices as the house can hold, and support, or at least be transparent to, as many convenient features as the free marketplace can develop. The cable industry needs to shuck off the monopolistic and technological bottleneck of the set-top converter/descrambler and welcome the full force of the consumer free marketplace in our subscriber homes.

Oh, I can hear the defensive outcries from our industry already. I am sure the first is, "No one is forcing them to take cable and its scrambled signals in the first place." This is true of course, but let's look at the undertones and consequences before we repeat it too widely.

First, almost without exception, each of us in our town is under a protective franchise because reason and city fathers saw the impracticality of multiple cables on already crowded poles and easements. When elected officials have to select one provider of a service (power, water, sewer, trash, school systems), they inherit a responsibility whether they like it or not, most of them like it too much, to substitute the checks and balances the otherwise free marketplace would provide against monopoly attitudes towards price, service and features.

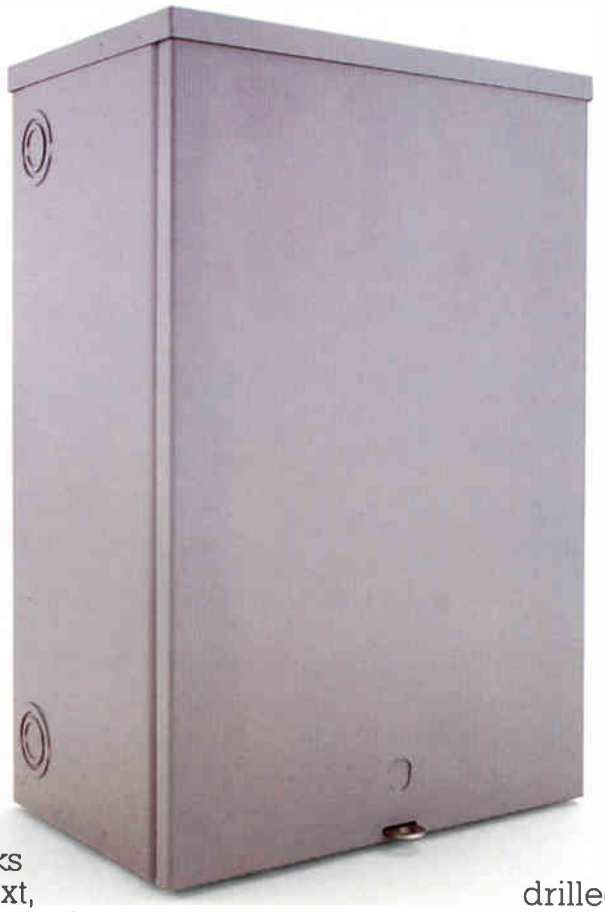
While cable and its premium signals are not "God-given rights," city councils or higher regulating bodies are charged with protecting the overall public interest, particularly in price and services, including ancillary features. Believe me, in the free marketplace, where there are alternate providers of a service, the "take it or leave it" attitude generally gets left. Our regulators, on behalf of our subscribers, local TV dealers and "locked out" manufacturers, might likely react the same way.

Unbundling the situation

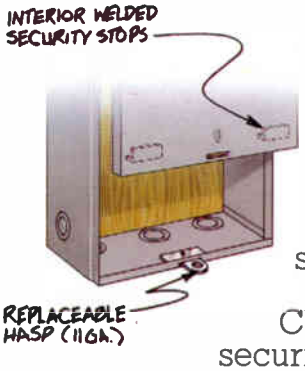
The most reasonable excuse and the heart of what needs to be changed, of course, is that today's "bundling" of justifiably preemptive signal security/addressability circuits with free marketplace consumer electronics channel tuning features inadvertently results in a single "preemptive" set-top device. These preemptive and non-preemptive circuits or functions must be "unbundled."

Cable should continue to control its preemptive signal security and addressability circuits. But it must ensure that these signal security techniques remain transparent to the free marketplace competition down the line to the home. Such a radical division is in the public's best interest and our own long-term best interests. I fear if we do not voluntarily move in this direction, sooner or later, Cartercable will force us to. As painful as such self-imposed movement would be in the short-term, we simply cannot expect to get away with what we are doing much longer.

Details Enclosed



Since one multiple dwelling enclosure looks pretty much like the next, you have to take a close look at the details. And when you do, you'll find that CWY has designed significant advantages into every apartment security box.



For example, CWY's all-welded enclosures are constructed of heavy 16-gauge aluminized steel—shown to outlast unpainted galvanized steel *at least five-to-one.* For added security, CWY enclosures feature security stops welded inside the front cover...a hingeless, secure cover removal system...knockouts for optional cam locks...and extra heavy-duty plated 11-gauge *replaceable* hasps.

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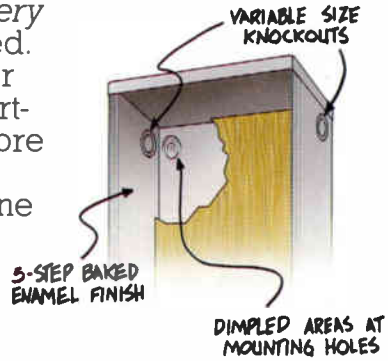

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