COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

Stereo TV: Giving the ear its due

Honoring the first BCT/E grad

December 1987

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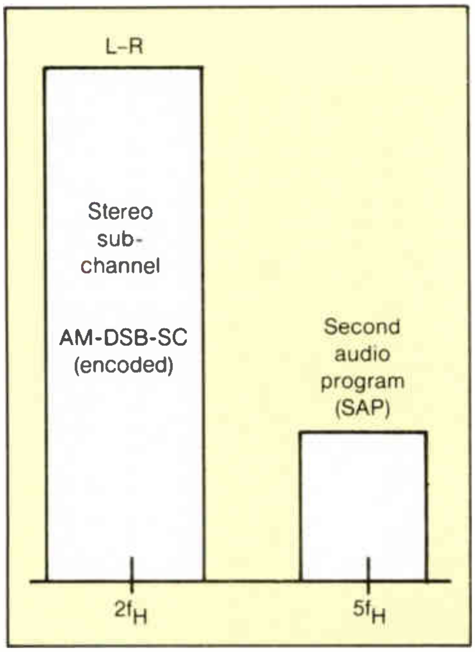

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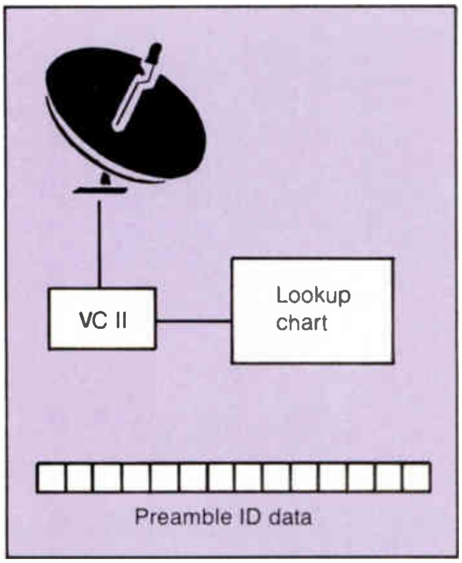

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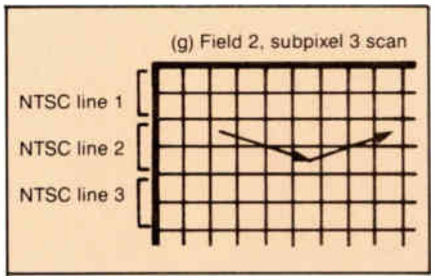

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Features

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GENERAL INSTRUMENT

There's no business like show business

Welcome to Anaheim, Calif., site of the 19th annual Western Show, one of the largest conventions for the cable TV industry each year. There's always something interesting happening, either on the exhibit floor or in the classrooms. This year will be no exception, with nearly 200 companies represented in the exhibit hall and plenty of seminars coordinated by the Society of Cable Television Engineers and the California Cable TV Association. Here's just a sampling:

- "Signal leakage and other deregulatory issues," with moderator Steve Ross (FCC).
- "Cable consumer interface issues," moderated by Viacom Cable's Joe Van Loan.
- "Antenna technology," with moderator Norman Woods of Hughes Microwave.
- "Fiber optics," with moderator Jim Chiddix of ATC.

In response to an accelerating pace of developments in the field of high-definition television, there will be a special session on the topic for cable operators on Thursday, Dec. 3. The first half will be technical and will deal with the problem of transmitting the HDTV signal through broadcast and cable facilities. The second half will consist of a presentation by Rupert Stow of CBS with a selection of the works of virtually all the HDTV producers in the world, as well as reports on HDTV viewer perception tests, a demonstration of Super-VHS and a report on how to transmit increased resolution pictures.

While you're on the exhibit floor, don't forget to stop by the SCTE booth and register for the BCT/E Certification Program exams, to be held Friday morning, Dec. 4. The BCT/E Program is a topic we've brought up before and is one that can't be overemphasized. Check this month's *Interval* for Bill Riker's "The Evolution of BCT/E."

IT is here

Don't forget to pick up a copy of the preview issue of our latest publication, *Installer/Technician*. As shown from our recent acquisitions of *CATJ* and *Cable Tech* magazines, we felt that the cable TV installer and technician needed a forum of their own. *IT* intends to reach the largest audience in CATV technology—the rank and file —consisting of installers, line technicians, field technicians, etc.

Most of all, *IT* will be an educational tool. Through *IT*'s features, departments and "advertorials," readers will be encouraged to learn more about their jobs, to better their current position in the cable industry and to assist in the furthering of the knowledge of their fellow workers. As we see it, *IT* will be read, reread and referred to each month by all people in the cable technical field from the entry-level installer on up. *IT* will be on the desks of many chief techs and engineers (after all, they're the ones responsible for the training of their employees).

We'd love to hear your comments and suggestions about our preview issue.

A profitable event

While "there's no place like home for the holidays," many in our industry have and will be traveling away from home as the seasonal festivities approach—much like you, if you're away from home in Anaheim. *CT*'s Assistant Editor Karen Naiman is another example: She recently flew to Valley Forge, Pa., shortly before Thanksgiving to attend the General Instrument/Jerrold Division seminar "Cable Insights '87."

According to Karen, the seminar was extremely profitable for its attendees and sponsor. For the attendees, it meant learning from qualified cable leaders and seasoned professionals. For Jerrold, it meant a seminar filled to capacity, as well as taking it on the road to the West Coast in early 1988. Anyone interested in attending this traveling show, contact Jennifer Lambert at (215) 674-4800.

I'd like to close with a flashback of my December 1986 letter. I wrote, "Take a look back to where you were at the beginning of the year, where the industry was. All things considered, we've made a lot of progress. And next year..."

Happy holidays from all of us at CT Publications. We sincerely hope your new year brings you success and promise.

Paul R. Levine

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Western Show to feature SCTE seminars

ANAHEIM, Calif.—"See It Here" is the theme of the 1987 Western Show to be held at the Anaheim Convention Center Dec. 2-4. In cooperation with the California Cable TV Association, the Society of Cable Television Engineers will present three days of technical seminars. The agenda for the show follows. (See accompanying breakdown for technical sessions.)

Wednesday, Dec. 2
8 a.m.—Registration opens
8:30 a.m.-5 p.m.—Technical sessions
10 a.m.-6 p.m.—Exhibits open
1-2:30 p.m.—Welcome and keynote panel
4-6 p.m.—Cocktail party in Exhibit Hall

Thursday, Dec. 3
8 a.m.—Registration opens
8:30 a.m.-5 p.m.—Technical sessions
10 a.m.-6 p.m.—Exhibits open
11:15 a.m.-12:45 p.m.—Exclusive exhibit hours
12:45-2:15 p.m.—Luncheon
4-6 p.m.—Exclusive exhibit hours and cocktail party

Friday, Dec. 4
8 a.m.—Registration opens
8:30-10 a.m.—Technical sessions
10 a.m.-3 p.m.—Exhibits open
11:15 a.m.-12:15 p.m.—Exclusive exhibit hours
10:30 a.m.-1 p.m.—BCT/E testing
12:15-1:30 p.m.—Luncheon
1:45-3 p.m.—General session
3-4:15 p.m.—Roundtable sessions

Technical sessions

Wedneday, Dec. 2

- 1:30-3 p.m.—"Building fiber-optic supertrunks today." *Moderator:* Jim Chiddix, ATC. *Speakers:* Al Johnson, Synchronous Communications, "Economics"; John Holobinko, American Lightwave Systems, "Path design"; Douglas Truckenmiller, Heritage Cablevision, "Construction"; Tom Jokerst, Continental Cablevision, "Testing and operations."
- 3:30-5 p.m.—"Fiber optics in CATV tomorrow." *Moderator:* Jim Chiddix, ATC. *Speakers:* Dave Pangrac, ATC, "Fiber backbone"; Dr. Lawrence Stark, Ortel, "Analog lasers and detectors today and tomorrow"; Jack Koscinski, General Optronics, "AM video on fiber."

Thursday, Dec. 3

- 8:30-10 a.m.—"FCC update: Signal leakage and other regulatory issues." *Moderator:* Steve Ross, FCC. *Speakers:* Robert V.C. Dickinson, Dovetail Systems, "Signal leakage"; Wendell Bailey, NCTA, "Industry update"; William Riker, SCTE, "SCTE update"; John Wong, FCC, "A/B switches."
- 10:30 a.m.-noon—"Cable consumer interface issues." *Moderator:* Joe Van Loan, Viacom Cable. *Speakers:* Dave Large, Gill Industries, "Baseband and stereo interconnection"; Walter Ciciora, ATC, "EIA multiport"; Vito Brugliera, Zenith Electronics Corp., "Pay-per-view"; Alex Best, Cox Cable, "BTSC: A progress report."
- 1:45-3:45 p.m.—"HDTV production and transmission." *Moderator:* Dave Large, Gill Industries. *Speakers:* Terrence Smith, David Sarnoff Research Center, "ACTV"; Masao Sugimoto, NHK, "MUSE System"; Bill Guerinot, North American Philips, "North American Philips HDMAC-60/HDNTSC compatible system"; Ben Crutchfield, National Association of Broadcasters, "A status report on the Advanced Television Systems Committee and experiments in over-air broadcasting of HDTV."
- 4-5:45 p.m.—"HDTV, EDTV, and cable: Demonstration and discussion." *Moderator:*

Dave Large, Gill Industries. *Speakers:* Rupert Stow, CBS, "HDTV presentation"; Paul Heimbach, HBO, "HBO viewer perception tests"; Sam Sonenszajn, JVC, "ED-BETA and Super-VHS"; Nick Hamilton-Piercy, Cablesystems Engineering, "Transmission via cable."

Friday, Dec. 4

- 8:30-10 a.m.—"Antenna technology." *Moderator:* Norman Woods, Hughes Microwave. *Speakers:* Gerald Robinson, Scientific-Atlanta, "Ku- on C-band antennae"; Claude Baggett, ATC, "Ku flat panel antennae"; Pete Petrovich, Viacom Cable, "Frequency reuse microwave CARS band"; Helmut Schwarz, Vertex Communications Corp., "Ku-band TVRO installation considerations"; Don Garlick, Scala Electronics, "VHF/UHF multipath resolution."
- 10:30 a.m.-1 p.m.—BCT/E Certification examinations: Examinations in all seven categories. Preregistration in SCTE booth on floor or test site.

Two more years of fiber progress

ENGLEWOOD, Colo.—Recently, a faithful *CT* reader cited that the first fiber-optic use in the United States occurred two years earlier than the first date given in an outline accompanying an article from the October '87 issue of the magazine. ("Fiber optics in CATV: 10 years of progress," page 28).

Teleprompter made history in July 1976 when it replaced a segment of coaxial cable in its Manhattan cable TV system with an 800-foot fiber-optic cable.

ATC to use fiber in cable systems

ENGLEWOOD, Colo.—American Television and Communications Corp. is working with a number of manufacturers to introduce fiber backbone technology that will allow the use of optical fibers to bring cable signals into each of its systems. The existing coaxial cables will then be used for the delivery of service over the last mile to the cable household.

The electronics required in each neighborhood to convert optical signals back to radio frequency signals is a critical element in this application. Practical approaches to the electronics are expected to be demonstrated in ATC's laboratory within the next six months, followed by field tests, probably in the Kansas City, Mo., system.

The expected cost of fiber backbone installation is $20 to $30 per customer, or $100 million if applied to all of ATC's systems. However, this is a gradual process that will be driven in part by test results in selected systems, and ATC expects reduced operating costs and improved signal quality as a result.

- Pioneer Communications of America announced the sale of its BA-5000N addressable converter to St. Croix Cable TV for the system in St. Maarten, Netherlands Antilles, and to Warner Cable Communications for systems in Parker, Ariz.; Clearfield, Pa.; and Marshfield, Wis.
- American Television and Communications Corp. recently honored Austin Coryell, corporate director of vendor support, with a special engineering award in recognition of his career achievements in 16 years with ATC. His accomplishments include patents for concepts and technical design of cable hardware, implementation of addressability in selected locations and assistance in the development of installer training at the ATC National Training Center.
- The R.L. Drake Co. recently received an award from the Electronics Technicians Association (ETA) for outstanding performance in the service department. The ETA's awards go to firms or individuals whose actions benefit technicians, dealers and other professionals in the home satellite/video industry.
- Paragon Communications purchased $1.3 million worth of subscriber cable TV equipment from the Jerrold Division of General Instrument to be used as part of an addressable upgrade of Paragon's Newburgh, N.Y., system.
- The National Cable Television Cooperative named James Lysaker of Scientific-Atlanta as the winner of its first Vendor of the Year Award in the manufacturer's category.

China—April 1987

By Isaac S. Blonder
Chairman, Blonder-Tongue Laboratories Inc.

At the invitation of the Chinese Mechanical Engineering Society, the Citizen Ambassador Program of People to People selected a team of professionals in engineering from the American Society of Mechnical Engineers to visit China and exchange ideas about the current practices in engineering management. A friend suggested I join this group and see China at the factory and university level. My wife and I were accepted, the trip lived up to its promises and the following are some of my observations (hopefully accurate).

China is a Communist society with all the ills implicit in its philosophy. During the cultural revolution some 20 million citizens were eliminated simply because they were intellectuals or landlords. Schools were closed or restructured, resulting in the severe retardation of education and industry.

However, with Mao gone since 1980, China is now marching down the road to socialism with a dash of capitalism in the mix. Individuals may now sell goods, employ a few workers and build their own homes on very limited parcels of property. We, however, encountered none of this except in the street "free" markets. We did hear that tea farming had gone private with a gratifying increase in quality and quantity. All of the factories, professors, managers and engineers we visited were controlled and paid by the government. When we asked how soon private companies could be formed to compete with the government entities, no one could answer with a date, but said it would "happen someday."

Wages averaged 100 yuan monthly—about $30. Top managers might earn double this amount, with fringe benefits limited to food and company vehicles. Bicycles and buses were the principal form of transportation to and from work. Automobiles, which were largely Japanese and new, were confined to business and government uses.

Housing was mostly government and averaged about $1 per month per family. In every city, construction of new apartment buildings lined the major streets right behind the old hovels being razed. Cranes criss-crossed the skies. Here and there one saw glimpses of brighter clothing, mostly on the children, but the universal costume was a dull colored hat, shirt, jacket and pants of the same cotton cloth.

Children were uniformly good natured, charming and attended with love by their parents. The child was always in physical contact with the parent or grandparent, either being carried or walking hand-in-hand. It was extremely rare to see a child running about without an adult hovering nearby. One child per couple is the official government decree and this restriction is almost always obeyed!

Our hosts were unceasingly polite, attentive and complimentary of our presentations. An interpreter was always present and language was not a barrier to communication.

The visit to a heavy machine manufacturing plant went like this: We were bused to a very large plant site employing at least 2,000 employees spread out among a dozen buildings of indeterminate origin. The grounds were minimally landscaped and marginally maintained, but generally clean. Gathered in a large second-story room, the management cordially greeted us. We sat down, about 30 all told, in a variety of chairs facing each other in a rectangle of tables on which hot tea in large, covered cups were set, ready for each of us. Then followed an hour of welcoming talks by the managers and local dignitaries; all, of course, were translated. Next, one of our group gave a prepared talk on a subject of possible interest to the particular industry we were visiting. A discussion period then followed.

I was never able to deliver my paper on our company's experience with quality circles—it seems they were sick of hearing about the subject from the Japanese, and besides, labor was so abundant they didn't concern themselves with its cost but rather the output! Then came a tour of the plant and a banquet lunch. Some of the enthusiasm in our presence may have been due to the resulting large budget for food!

Shipbuilding, turbine manufacturing, massive electrical transformers, giant castings, boilermaking, etc., were novel experiences for most of us. There was a universal desire to possess the latest machinery. Apparently, money was available to buy what was needed. I visited a modern color TV plant obtained from Toshiba that I, as an old TV engineer, found admirable in every aspect, with a superb TV signal center and mechanized conveyors. All of the workers were native Chinese who operated the most complex machinery with surety and lack of anxiety. There seemed to be no quality personnel and supervisors visible in the production areas. Indeed, I seldom saw a blueprint or a clipboard laden with papers.

Three weeks are hard to condense in a single page. Perhaps the best glimpse into the Communist world is this exchange I had with the manager of an electronics complex:

"How many workers do you have?"

"2,000."

"Do you have the right to interview and select the workers you want?"

"No, we were sent 2,000 and told to find work for them."

"Do you pay them according to their skills?"

"No, they are paid the standard wages by the government."

"What do you pay for?"

"Electricity, water and 50 percent of the profits."

"Who pays for the buildings and machinery?"

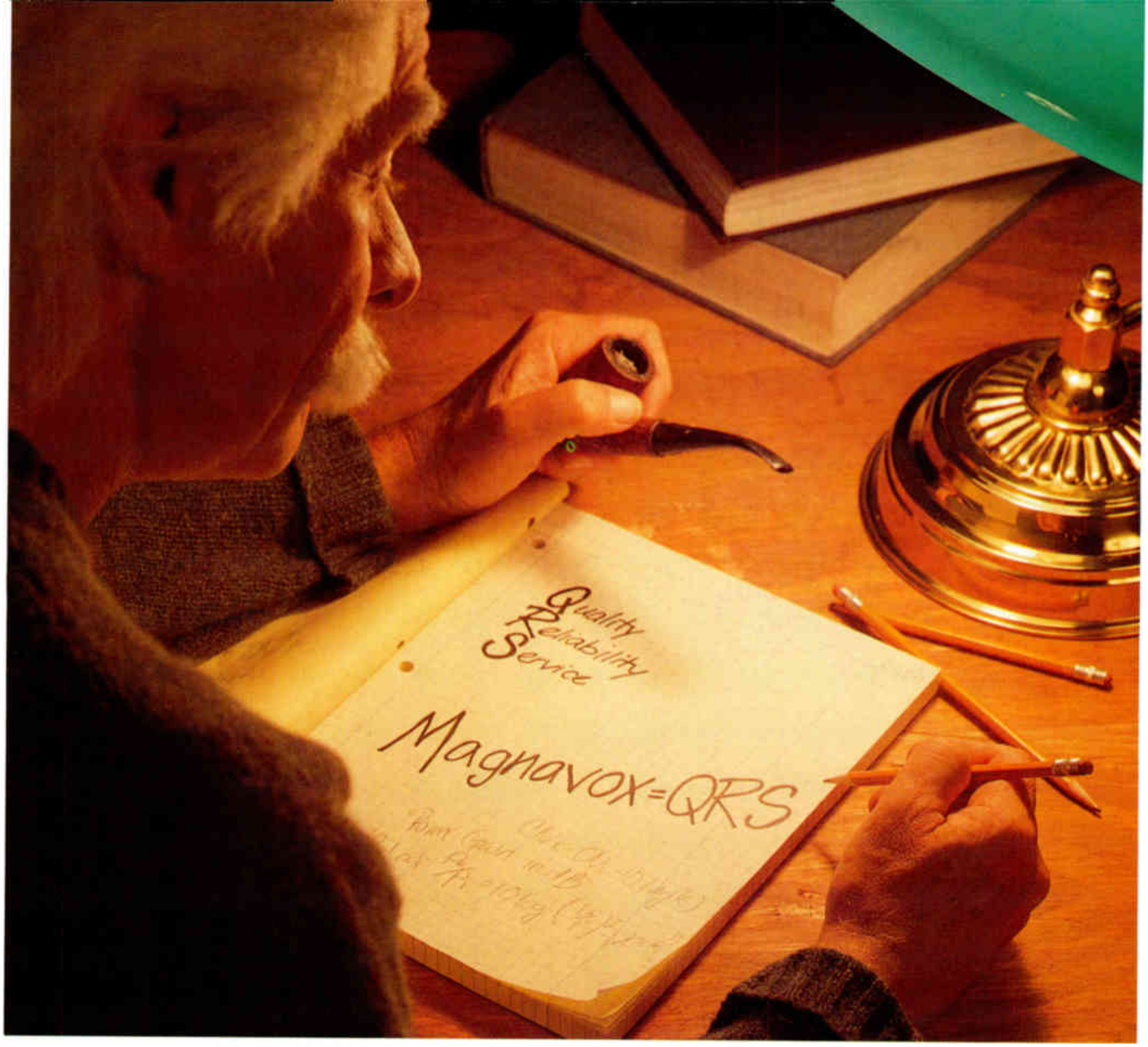
"The government."

"How much do you pay for the materials used in manufacturing your transformers and television transmitters?"

"They are given to us by the government."

"How much will you charge me for one of your products?"

"I'm not sure; what are you willing to pay?" ■



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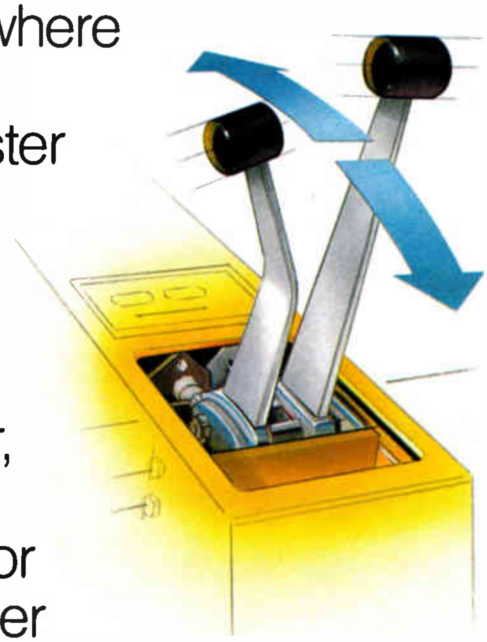

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Reader Service Number 12.

Mutual effects of RF scrambling and BTSC stereo in the headend

By Steve Fox
Manager, Customer Applications, Wegener Communications

As you think about adding BTSC stereo to your cable system, several questions might come to mind: how BTSC works, what kind of signal quality can be expected and how to integrate the new equipment into your headend. Talking to technicians and engineers throughout the country, I found a major concern in adding BTSC is the effect on stereo quality and headend scramblers. In other words, when BTSC encoders are installed on a locally scrambled channel, will either the encoder or the scrambler "crash and burn?"

Earlier this year, Wegener conducted a series of tests. The purpose of the testing was to find the pitfalls that might be encountered and to find solutions that would ensure acceptable stereo generation over cable, assuming, of course, that BTSC would operate over a scrambled channel at all. We found that very acceptable stereo could be derived, but that some problems did exist and needed to be addressed when installing the equipment.

The encoding process

Before discussing the tests, let's first look at the BTSC encoding process. Figure 1 is a drawing of the BTSC signal. The L+R, or monaural portion of the signal, is identical to the mono signal you are presently generating. Frequency range is 50 Hz to 15 kHz, the audio signal includes 75 μsec pre-emphasis, and peak deviation is 25 kHz.

At this point, the similarity between mono and BTSC stereo ends, however. A pilot is located at 15.734 kHz (note that this is the same frequency as horizontal sync) and is peak-deviated at 5 kHz. The L-R, or stereo, subchannel is centered at twice the horizontal sync frequency and is deviated at 50 kHz peak. This is an AM double-sideband suppressed signal and includes a non-linear dbx compressor. These three components together make up the BTSC stereo signal. Total audio bandwidth is 53 kHz and total peak deviation is 55 kHz. (These numbers will take on greater significance when we discuss interfacing the BTSC encoder to the TV modulator.)

An additional component that may be added to the BTSC stereo signal is the SAP, or second audio program, channel. Although it will probably not be used in most cable applica-

Figure 1: Multichannel sound baseband signal

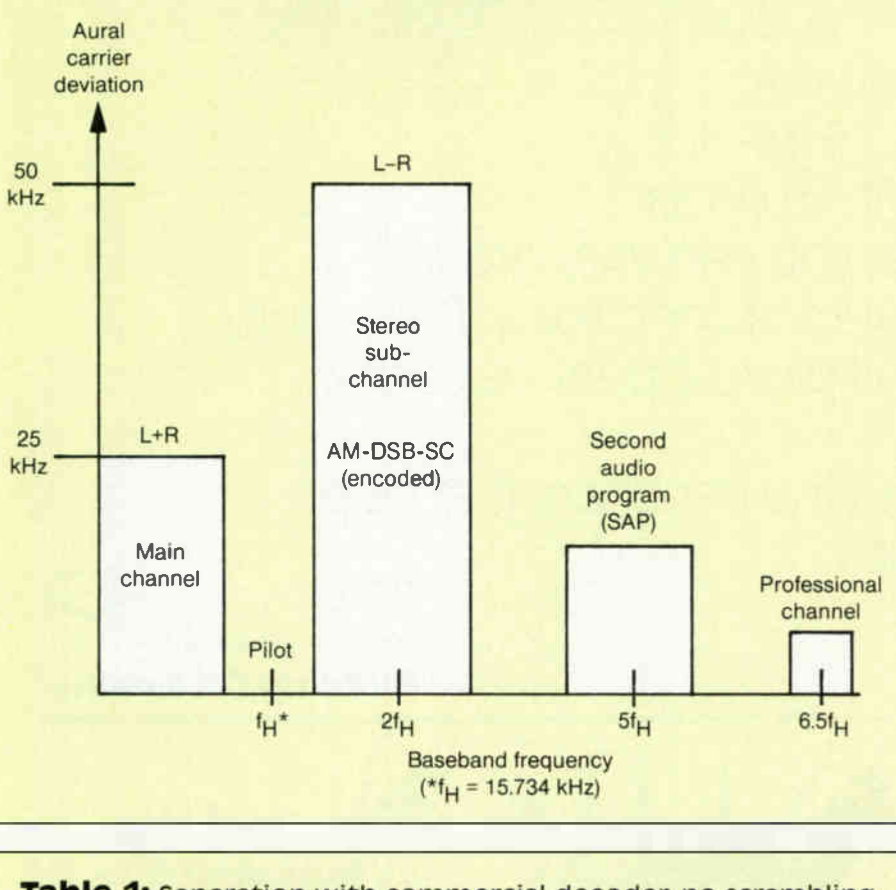
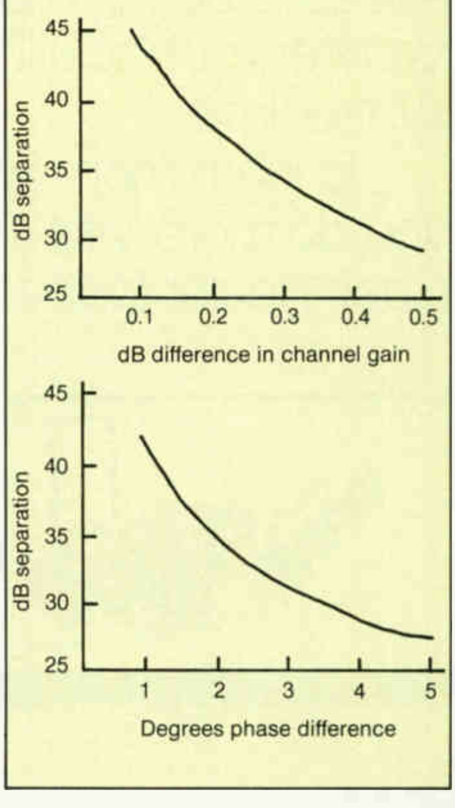
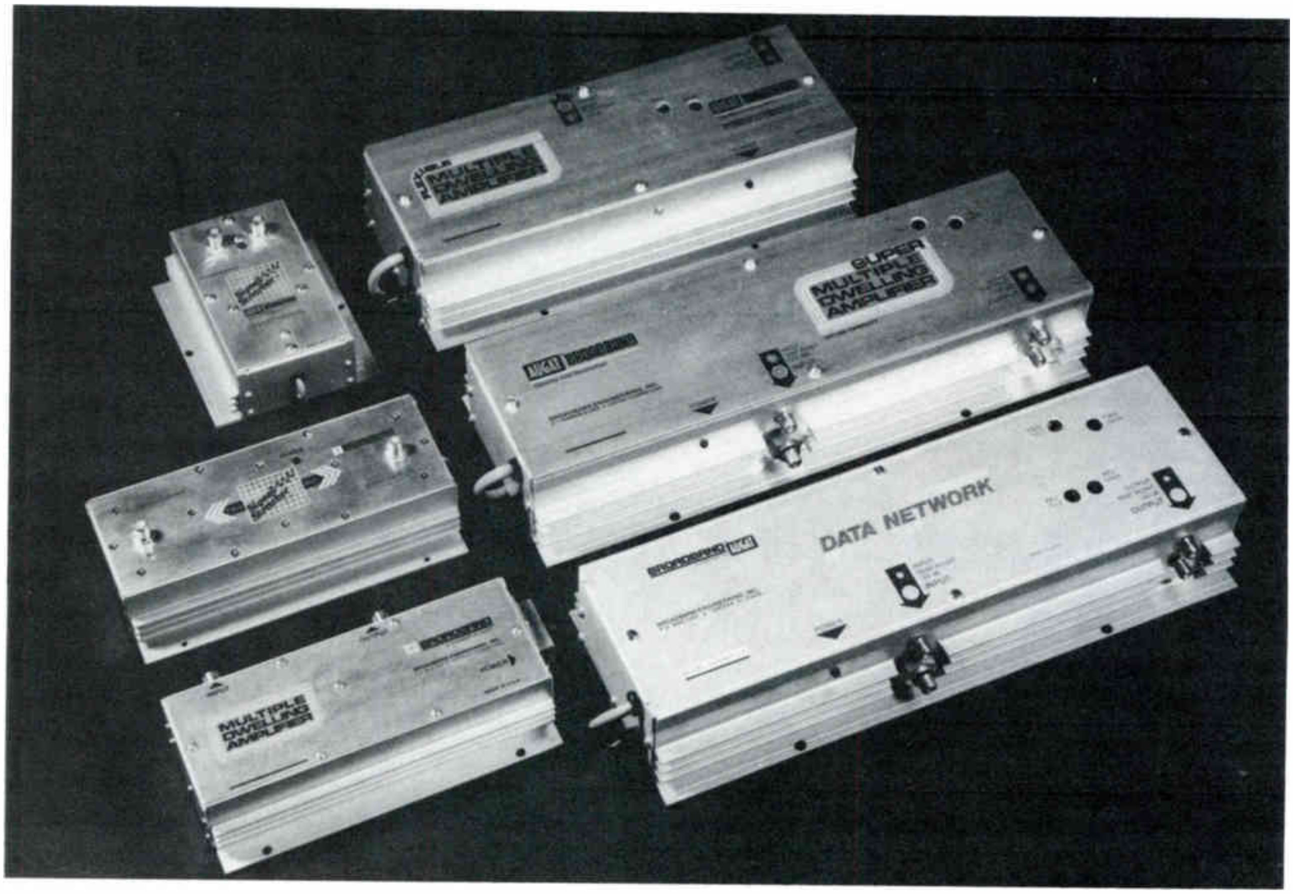


Table 1: Separation with commercial decoder, no scrambling

Separation	Composite	4.5 MHz	Full system
Low	32 dB @ 12 kHz	29 dB @ 12 kHz	31 dB @ 50 Hz, 2 kHz
High	49 dB @ 3 kHz	38 dB @ 2 kHz	36 dB @ 3, 9, 10 kHz
Average	38 dB	33 dB	33 dB

Figure 2: Effect of gain and phase errors on matrix transmission system stereo separation





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Reader Service Number 13.

tions, SAP is useful as a second language mono channel and will find other uses as well. The SAP channel provides a 50 Hz to 10 kHz audio bandwidth and is also dbx compressed. Use of SAP or additional BTSC components will add to the total audio bandwidth and deviation of the BTSC signal and add a

Table 2: Separation with commercial decoder, sine wave sync suppression method

Separation	Scrambled	Non-scrambled
Low	18 dB @ 1 kHz	20 dB @ 1 kHz
High	31 dB @ 50 Hz, 4 kHz	33 dB @ 50 Hz
Average	25 dB	25 dB

Table 3: Separation with consumer decoder, sine wave sync suppression method

Separation	Scrambled	Non-scrambled
Low	16.5 dB @ 12 kHz	16 dB @ 12 kHz
High	32 dB @ 2 kHz	31.5 dB @ 400 Hz
Average	23 dB	23 dB

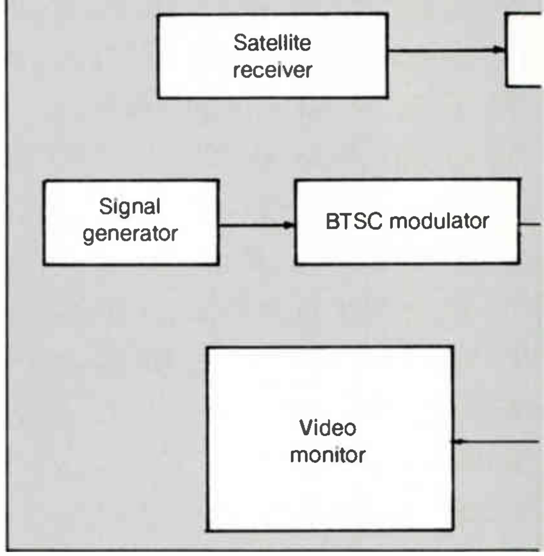
Table 4: Separation with commercial decoder, gated sync suppression method

Separation	Scrambled	Non-scrambled
Low	13 dB @ 2 kHz	25 dB @ 2 kHz
High	26 dB @ 50 Hz	37 dB @ 4 kHz
Average	22 dB	33 dB

Table 5: Separation with consumer decoder, gated sync supression method

Separation	Scrambled	Non-scrambled
Low	15 dB @ 1 kHz	13 dB @ 12 kHz
High	22 dB @ 4, 5, 6 kHz	24 dB @ 1 kHz
Average	20 dB	19 dB

Figure 3: System block diagram wi

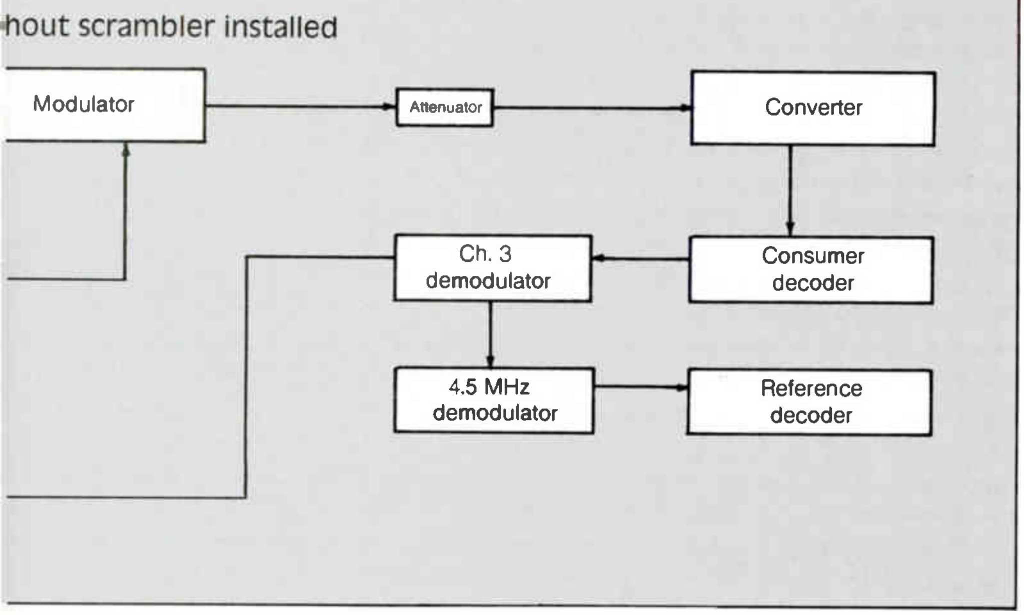


potential degrading factor to overall signal quality. Therefore, SAP should only be used in headends where an additional alternate audio channel is desired.

As the results of the tests are discussed, the specification that will be emphasized will be stereo separation. This is because separation is the factor most degraded by anomalies in the stereo encoding process. The BTSC encoder requires three inputs: left channel audio, right channel audio and baseband video. The horizontal sync pulses from the video are used to generate a reference pilot for the BTSC decoder. (Again referring to Figure 1, note that all components of the BTSC signal are referenced to the pilot signal by the encoder.)

Left and right channel audio are used to generate the matrixed stereo output. Since the L+R and L-R subchannels are processed by entirely different methods, tracking the subchannels accurately during the encoding process is difficult to do. Tracking will not be linear through the audio output frequency range of 50 Hz to 12 or 14 kHz (specifications vary with manufacturers). Accurate gain and phase tracking of the subchannels is essential to maintain good stereo separation and, since this tracking is non-linear, separation will vary at various frequencies (Figure 2). As little as a 0.5 dB error in gain will limit theoretical maximum separation to about 28 dB. As little as a 5° error in phase tracking will limit theoretical separation to about 27 dB. RF scrambling also can affect the separation of the BTSC stereo signal.

Initial testing was performed without the scramblers installed to provide reference data and a basis of comparison when the scramblers were later added. Figure 3 is a basic diagram of the test system. A satellite feed was used for the video source, while the audio source was stereo audio during subjective testing and signal generated audio during objective testing. Measurements were taken using both a Belar BTSC reference decoder for commercial data and a Recoton



Fred II BTSC decoder for consumer data. It should be noted that results will vary somewhat depending upon the particular decoders used, but the variance will not be significant with quality components.

Figure 4 shows the results of initial testing. For the composite tests, the BTSC encoder was installed back-to-back with the Belar reference decoder with a baseband audio interface. Optimum results would be expected in this configuration, and the expected was attained. A second test was then made, again in a back-to-back configuration but with an interface at 4.5 MHz. As expected, separation decreased but not significantly (Table 1). A final test was then performed through a CATV modulator and converter, again interfaced at 4.5 MHz. Adding these components had very little effect on stereo performance.

Scrambling methods

The next phase of the testing program was to add the scramblers to the test configuration, as shown in Figure 5. Two types of scrambling methods were analyzed: sine wave sync suppression and gated sync suppression, and measurements were made in both the scrambled and non-scrambled modes. Sine wave sync suppression will be discussed first. An Oak Mark V scrambler and M35B converter were used for this test. To our surprise, this scrambling method had little effect on separation over the audio output frequency range with each BTSC decoder used and no effect on average separation at all.

There were some problems that became evident, however. For these tests, both the commercial and consumer decoders were used, and interfacing was at 4.5 MHz. Figure 6 and Table 2 show the separation using the Belar BTSC reference decoder. Figure 7 and Table 3 show the test results with the Recoton consumer BTSC decoder.

We concluded from these tests that as far as specifications of the resulting stereo signal, BTSC encoding is compatible with sine wave sync suppression scrambling; this scrambling method has very little detrimental effect on the BTSC signal. The same cannot be said, however, for the effect of BTSC encoding on the video. While no negative effect was found in the scrambling process itself, some audio components were observable in the resulting video output when using the consumer

Figure 4: Separation measurements prior to scrambling

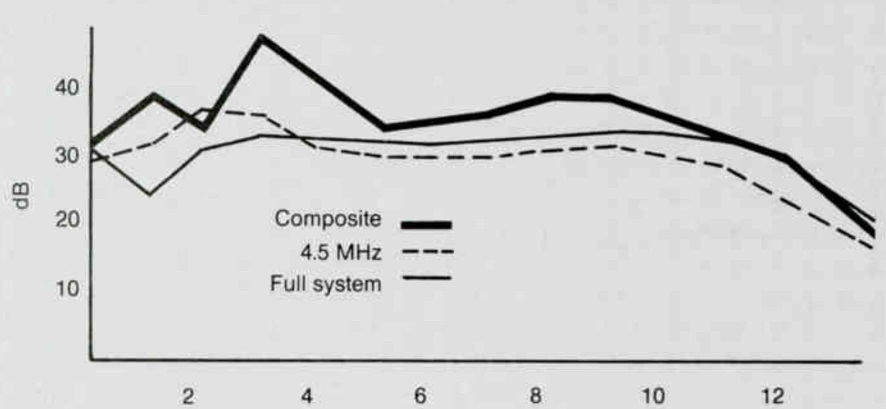


Figure 5: System block diagram with scrambler installed

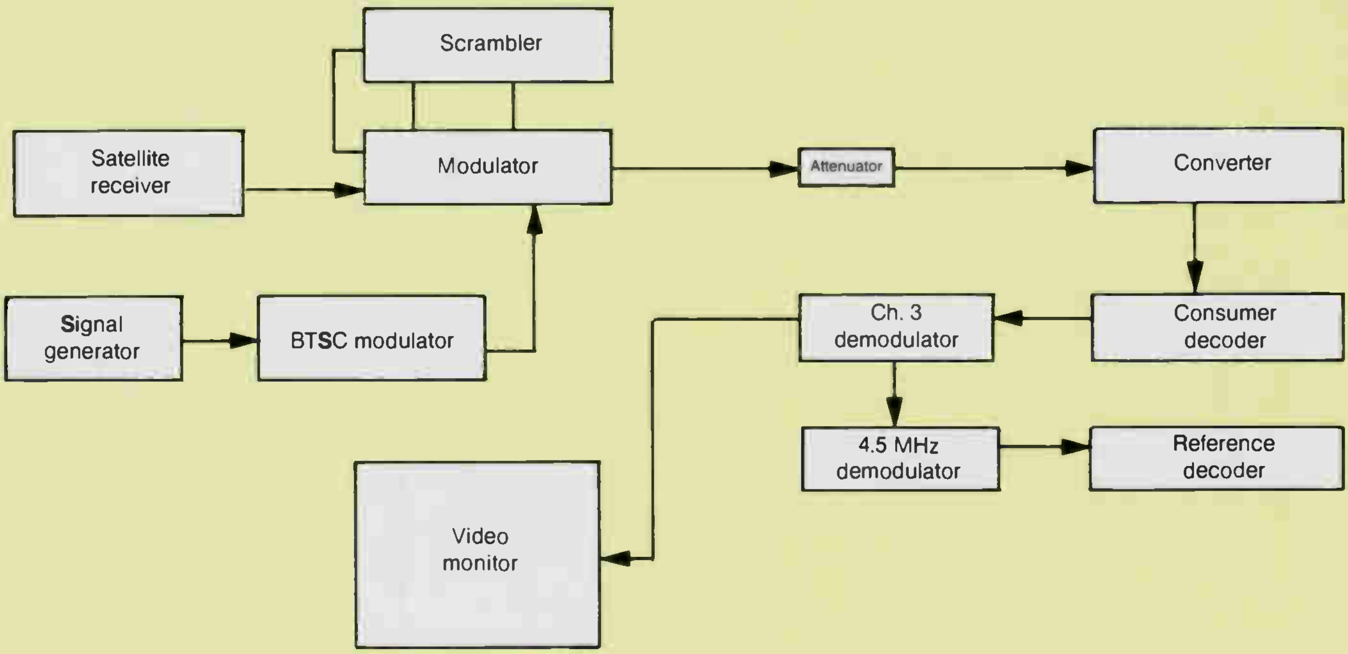


Figure 6: Comparison of sine wave sync suppression, scrambled vs. non-scrambled (commercial decoder)

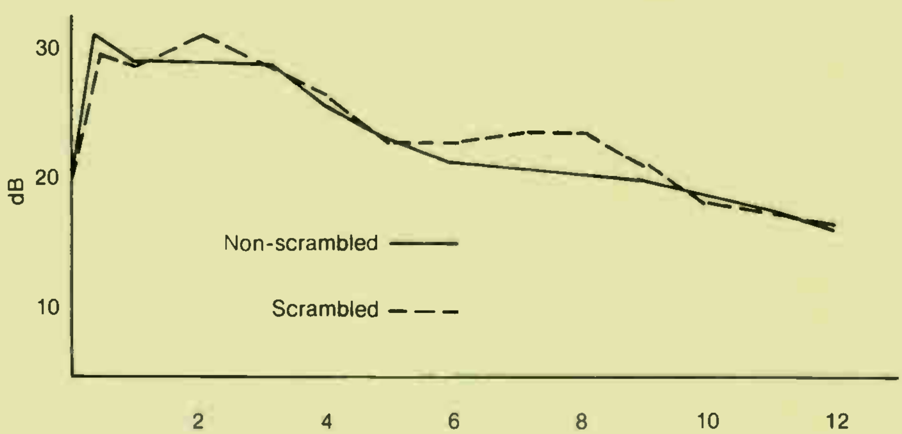
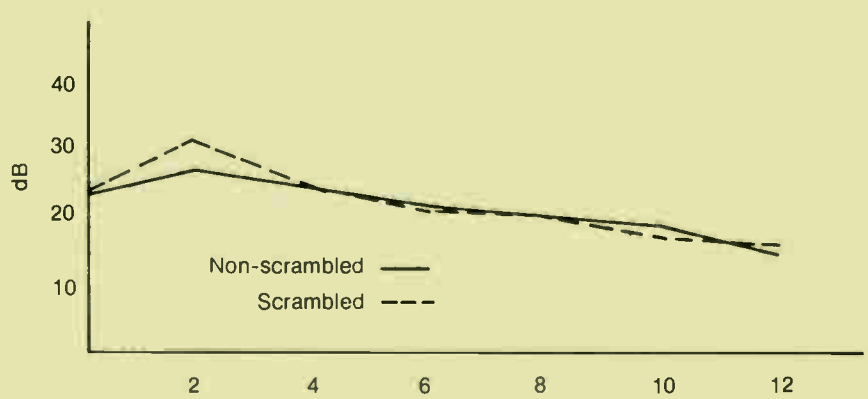


Figure 7: Comparison of sine wave sync suppression, scrambled vs. non-scrambled (consumer decoder)



decoder. This was especially significant, considering that this decoder is representative of the type of decoder used by the subscriber. This degradation was most evident when a composite BTSC interface was used; that is, when video and BTSC audio were combined and modulated as a single signal onto a 4.5 MHz carrier. When separate interfaces were used (BTSC on a 4.5 MHz carrier and baseband video as a separate signal), audio/video interaction became imperceptible.

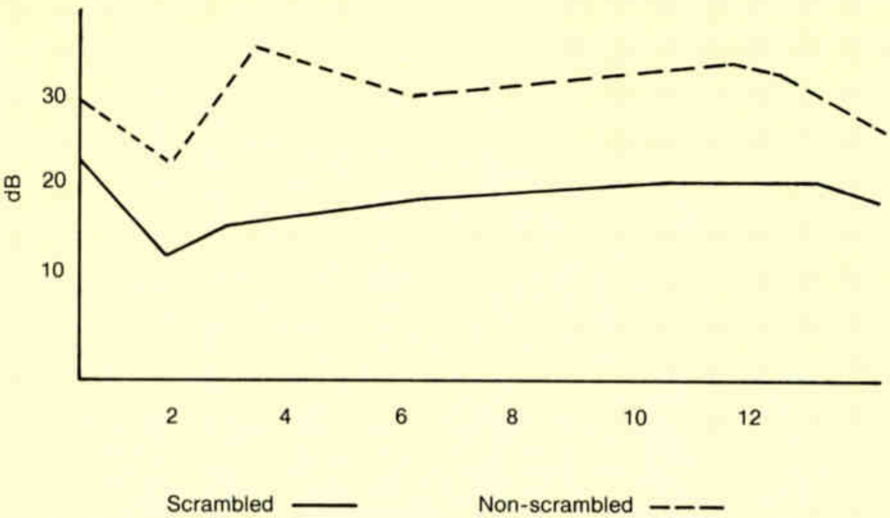
When gated sync suppression scramblers were installed in the test system, a completely different set of results were established. Systems from several manufacturers were evaluated and results varied somewhat from system to system. The results presented here are an average of the findings from systems provided by Pioneer and by Scientific-Atlanta. Again, testing was performed with commercial and consumer BTSC decoders and interfacing was at 4.5 MHz. As expected, this scrambling method caused degradation in BTSC performance, but performance remained within desired guidelines. The BTSC encoding process caused no detrimental effects on scrambler operation, however. Figure 8 and Table 4 show stereo separation with the commercial decoder; the effect on stereo separation using the consumer decoder is shown in Figure 9 and Table 5.

From the tests with gated sync suppression scramblers, it can be concluded that this scrambling method does affect BTSC stereo separation. The significant results, however, are those with the consumer decoder, again because this represents the signal quality that will be received by the subscriber. Average separation was affected adversely by only 1 dB and remained within the 18 dB average separation targeted for subscribers.

No perceptible video degradation was

evident with either BTSC decoder when the scramblers were installed, but sync buzz was evident in the audio. To pinpoint the cause of the buzz, the level was measured with the BTSC encoder installed and operating. The BTSC encoder was then removed from the test system and buzz level was again measured. The level did not change when the BTSC encoder was removed, indicating that the encoding process was not a factor to the sync buzz, but rather the buzz was produced by the scrambling process itself. Further testing verified that the buzz could be controlled and reduced to acceptable or non-evident levels by careful level setting of the headend components (a practice you should be using anyway).

Figure 8: Comparison of gated sync suppression, scrambled vs. non-scrambled (commercial decoder)



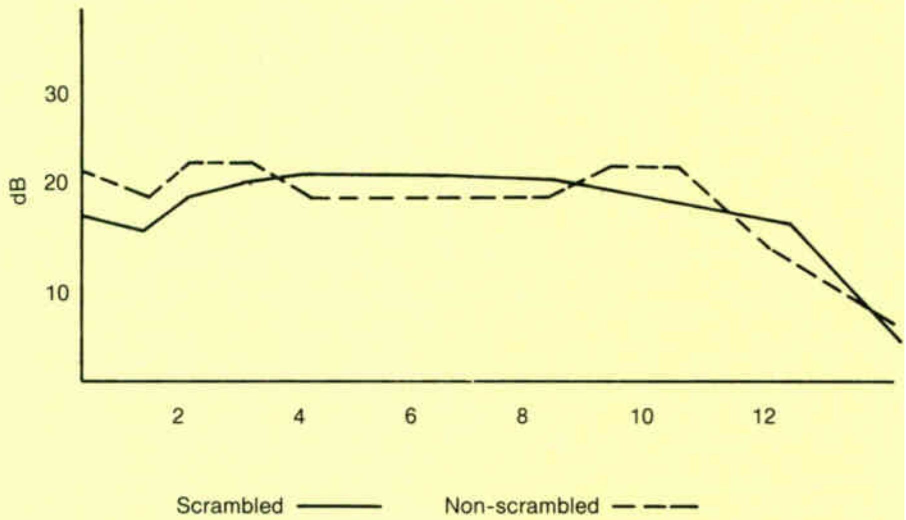
BTSC interfacing

A brief discussion of BTSC interfacing is in order. Remember in the discussion of sine wave sync suppression scrambling that some audio/video interaction was encountered with the consumer BTSC decoder, which was resolved by changing the interface used in the initial test. There are four ways to interface a BTSC encoder to a headend TV modulator, as shown in Figure 10. Keep in mind when evaluating your equipment requirements that not all interfaces (or other encoder features, for that matter) are offered as standard equipment by all manufacturers. Some may be optional, while others may not be available at all. You should look at all needed and desired features of a BTSC encoder before selecting the equipment for your particular headend requirements.

There are four ways to interface a BTSC encoder to your TV modulator, each with advantages and disadvantages over the others:

1) *Baseband audio interface*—BTSC is provided to the audio input of the TV modulator as baseband audio signal, while baseband video is provided to the video input as a separate signal. This method will provide the best performance if all TV modulator levels are optimized, but this is not always easy to do. A small error in audio deviation, for example, will severely restrict attainable stereo

Figure 9: Comparison of gated sync suppression, scrambled vs. non-scrambled (consumer decoder)



separation. To counteract this, some manufacturers provide an audio "calibration" tone to help set deviation. This is at best an approximate setting, however, and at least some loss of separation will be unavoidable. When using this interface, the audio processing section in the TV modulator must be BTSC-compatible. This means the 75 μsec pre-emphasis is disabled and the audio section can process the 53 kHz bandwidth and 55 kHz peak deviation of the BTSC signal (remember, these numbers are greater if SAP is also used). Normal mono audio requires 15 kHz bandwidth and 25 kHz deviation and if the TV modulator is not BTSC-compatible, only the monaural portion of the BTSC signal will pass through the modulator. Therefore, if the TV modulator is not set up for the BTSC and you elect to use this interface, the modulator will need to be modified or replaced. For these reasons, the baseband audio interface is not recommended for use in BTSC applications.

2) 4.5 MHz composite video interface—In this case, the BTSC signal and video are combined and modulated onto a single 4.5 MHz carrier. This is the simplest interface to make, with the combined carrier sent to the video input of the TV modulator. The other advantage is that since the audio section of the TV modulator is completely bypassed, no modifications to the modulator are required. The drawback with this interface is that with some TV modulators, audio/video interaction may occur. If it does, the modulator can probably be modified locally to accommodate the next interface to be discussed.

3) 4.5 MHz BTSC and separate baseband video interface—This is the preferred BTSC interface. BTSC audio is modulated onto a 4.5 MHz carrier and input to the TV modulator. Baseband video is looped out of the BTSC encoder and provided to the TV modulator video input as a separate signal. Interfacing in this way reduces or eliminates audio/video interaction at this point in the equipment chain and bypasses the audio section of the TV modulator, eliminating the need for modifications. Configuring the TV modulator for dual inputs, if not already available, is easily done on most quality TV modulators.

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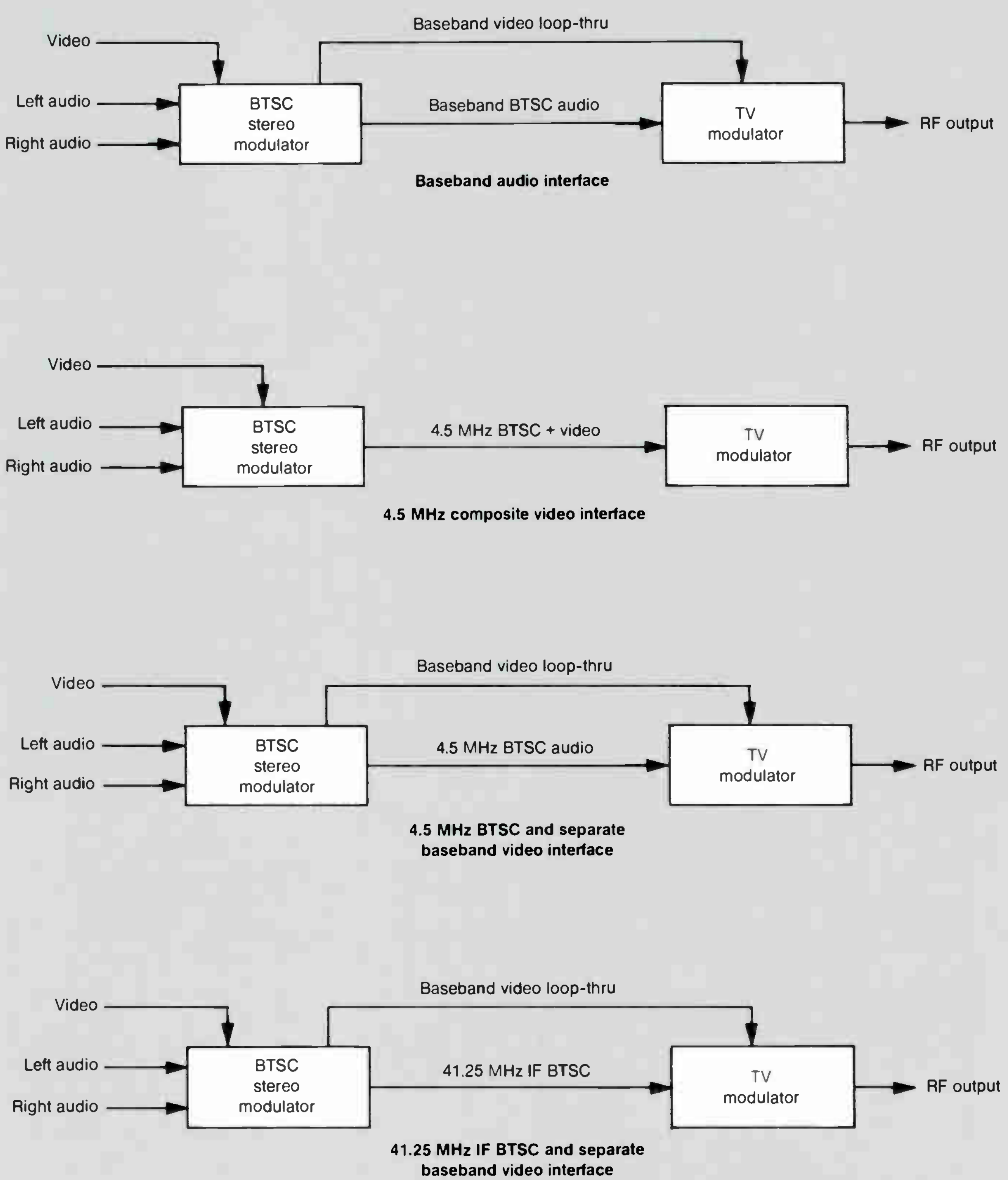
4) 41.25 MHz IF interface—Rather than using 4.5 MHz, a 41.25 MHz modulated carrier is used to interface with the TV modulator at intermediate frequency (IF). High stability of the 41.25 MHz carrier is required over time, with the possibility of audio/video interaction if the carrier drifts too far off frequency. Due to this possibility most manufacturers do not offer a 41.25 MHz interface and, although preferred over the baseband audio interface method, it is not generally recommended.

In summary, the results of these tests demonstrate that BTSC stereo encoding and RF scrambling are mutually compatible systems. Although some problems may be encountered when implementing the stereo system, they can be controlled and good quality audio signals will be the result. The key is simply proper equipment installation and good headend maintenance to deliver an exciting new sound to your subscriber.

Figure 10: BTSC interface methods



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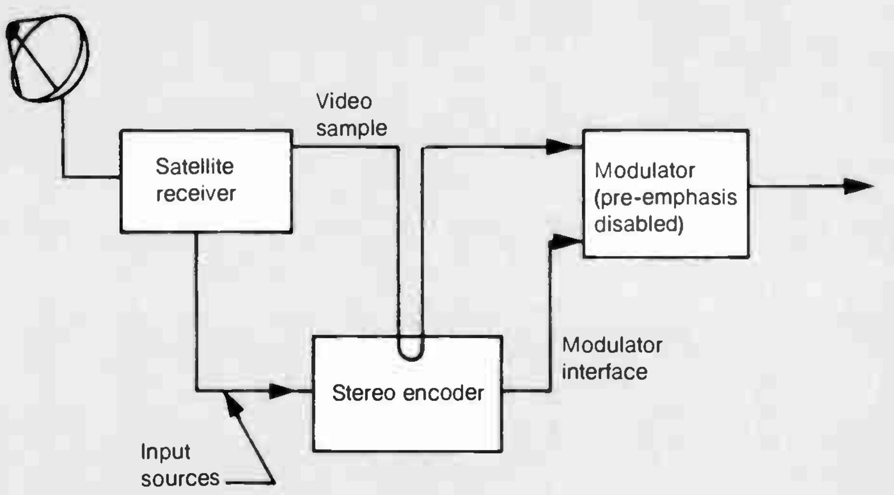


Figure 1: BTSC stereo interfaces

Figure 2

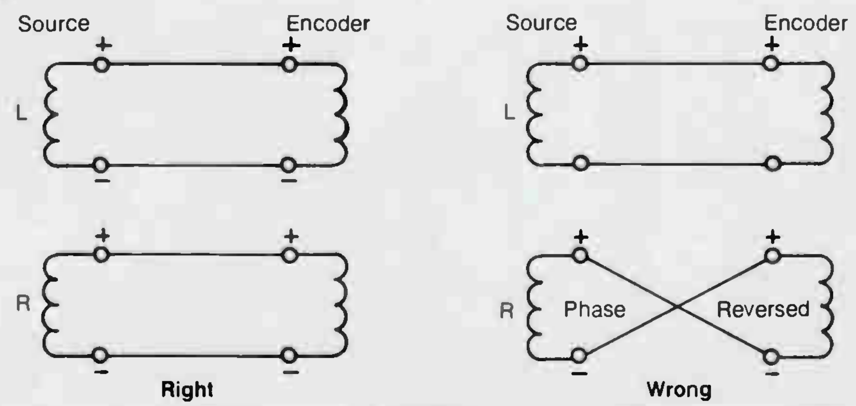


Figure 3

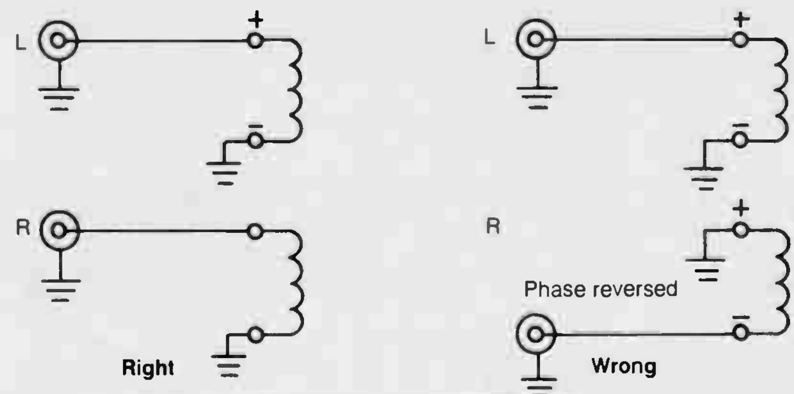
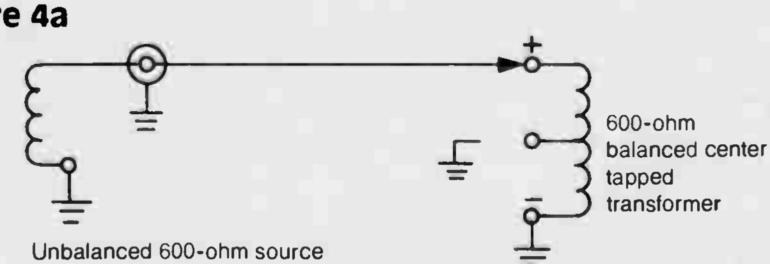


Figure 4a



Unbalanced 600-ohm source

Center must be ungrounded for unbalanced operation.

A guide to installing your BTSC encoders

By Karl Poirier
Vice President, Corporate Development
Triple Crown Electronics

You have just received your first BTSC encoder, and what do you do now? While it may seem complex at first, the installation and fire-up of a stereo TV encoder is not as difficult as it seems. The following guidelines apply to most well-designed stereo encoders from reputable manufacturers.

The installation of a BTSC encoder is comprised of three interface requirements. These are: input sources, video sample and modulator drive (see Figure 1). Each of these areas has its own particular set of potential interface difficulties, depending primarily on the available technical information about the headend system, and the degree of built-in flexibility in the encoder.

Input sources

The first step in installation is the provision and identification of input sources, with particular attention to type (balanced, unbalanced), impedance (high, 600 ohm) and content (discrete, matrix).

For most stereo applications, the source program will be obtained from one of the following: low-level subcarrier (via Wegener or Learning demodulator), high-level subcarrier (via satellite receiver or auxiliary demodulator), digital audio (via VideoCipher or digital B-Mac decoder) or local baseband sources (such as VCR, studio, compact disc, etc.). The sources may be balanced, unbalanced, high or low impedance. The primary areas of potential problems with source connection will be level and phase reversal.

Balanced/unbalanced connections: Most stereo encoders, as well as source devices that employ balanced inputs or outputs, will have terminals labeled + and –. This marking is to allow the maintenance of proper phase when interconnecting and has no DC relevance. When interconnecting the outputs of a balanced source to balanced inputs, attention to + and – signs as well as employing color-coded wire will prevent accidental phase reversal (Figure 2). The same caution applies when connecting an unbalanced source to a balanced input (Figure 3).

Note that active balanced inputs (transformerless) may have a specific input terminal

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Figure 4b

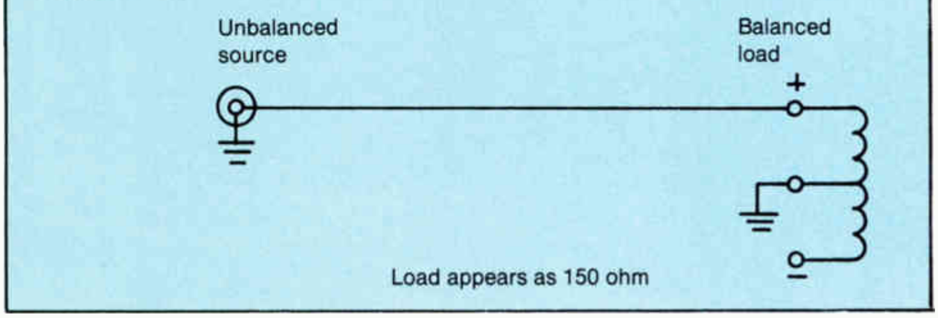
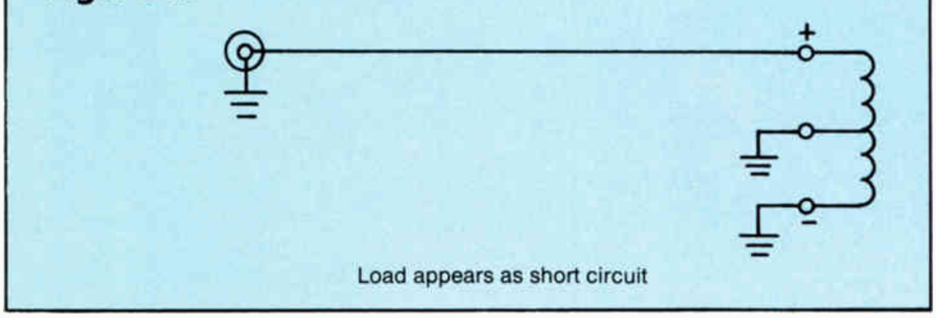


Figure 4c



to be employed for unbalanced operation. In these cases, an unbalanced connection may be required to be made to the + terminal while grounding the − terminal, reversing these terminals may not work. Check the manufacturer's wiring information if doubt exists.

Some equipment may incorporate balanced center-tapped transformer inputs. In these situations, driving from an unbalanced source presents several other potential problems. In situations where the center tap of the input transformer is permanently grounded, the second winding must be left open (no connection, Figure 4b). This results in a load impedance reduction, which reduces the audio signal level. The alternative is to modify the input to remove the center tap ground (Figure 4a), and ground the second winding. Grounding both the center and one winding of the input will cause the other winding to appear as a short circuit (Figure 4c).

Source load impedance: While most stereo encoders will be equipped with 600-ohm balanced inputs, some source programs may be delivered as high impedance unbalanced outputs. Connecting these sources to a 600-ohm input will result in significant reduction in level, and may also result in distortion at the source due to having to overdrive the output amplifier in order to make up lost level. This will most likely occur if the source is recovered from VCRs or consumer-type decoders. While some stereo encoders incorporate high impedance input facilities, those that do not will probably require the use of a buffer amplifier between the source and load (Figure 5).

Matrixed inputs—In certain cases, the inputs to the stereo encoder may be delivered as matrixed (L+R, L−R) signals. Matrixed signals can tolerate very little phase or level imbalance without severely affecting the stereo recon-

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Figure 5

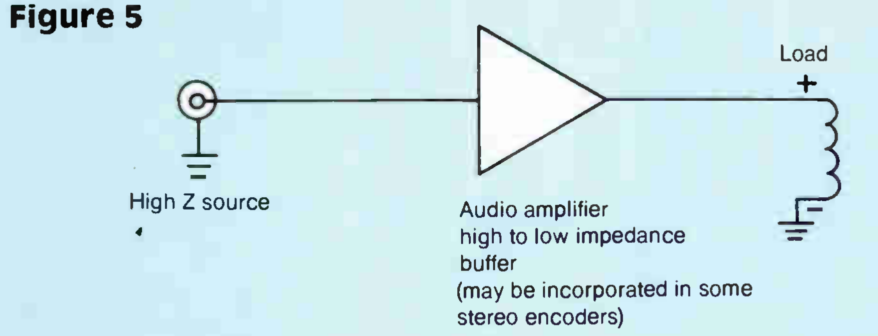
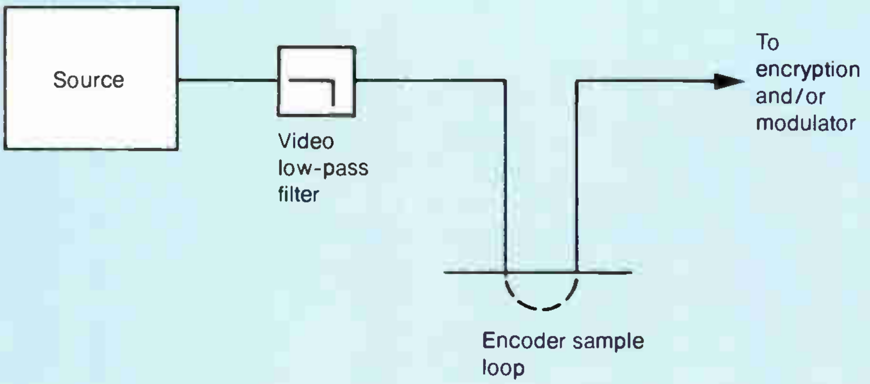


Figure 6



struction. Should it be necessary to operate in this manner, particular attention should be paid to interconnect wiring. Interconnects should be made with short, identical wiring from source to encoder. Any buffer amplifiers required should have identical gain and frequency responses.

Video sample

The second interface required for a BTSC encoder installation is a video sample for pilot timing. This normally involves merely looping the program video through the encoder on its way from the source to the modulator. There are, however, several potential problems, particularly with satellite video and encryption systems.

Satellite video—The video output of many satellite receivers may not be properly bandpass filtered. The lack of filtering may allow auxiliary subcarrier information to appear at the video sample detector of the stereo encoder. Depending on the number and level of subcarriers, the sync pulses may be masked and make phase-locking of the pilot erratic. This can result in intermittent pilot lock loss and buss or breakup of the sound. The normal cure for this effect is the installation of a video bandpass filter ahead of the encoder (Figure 6).

Encryption systems—The video sample must have sync pulses intact, and must therefore be derived before any baseband sync suppression encryption. While this is

normally no problem, it can be difficult if the final stereo encoder output is required as video/4.5 combined. In most encoders the same loop is employed for pilot sample and video/4.5 combining. These applications may require the use of external video/4.5 combiners (An example of this is shown in Figure 10.)

Modulator interface

There are two basic interface methods between stereo encoder and modulator, although there are many minor variations on these methods. The interface will be either baseband or modulated carrier.

Baseband interface—In cable TV applications, the baseband interface will rarely be employed, as very few existing CATV modulators have the ability to handle 48 kHz baseband signals. The baseband interface also presents calibration problems that most manufacturers have addressed through precision internal modulators (Figure 7).

The most common interface will involve modulated subcarrier, either at 4.5 or intermediate frequency (IF). This allows the manufacturer to provide a signal that has a proper preset deviation, as well as the necessary bandwidth to deliver the BTSC signal. This interface avoids most of the inherent BTSC problems of modulator capability and precision setup. The modulated subcarrier will interface in one of the following three methods (Figure 8). Each of these methods has its own advantages and disadvantages, of which a few are:

a) The video/4.5 combined input is the most commonly available 4.5 interface. The majority of these were, however, designed with the original 25 kHz deviation in mind and occasionally suffer bandwidth restrictions, as well as other limitations that can cause distortions in the wide deviation BTSC signal. Several unique problems also arise when baseband video encryption is employed (Figure 8a).
b) The separate video and 4.5 is probably the least difficult method, and presents less potential for signal degradation. Unfortunately, very few modulators have a separate 4.5 input facility. It is, however, a very simple modification to implement and most manufacturers have modification information available (Figure 8b).
c) The IF interface is very simple to implement provided the modulator employs dual IF loops. One major difficulty is that when IF interface is employed, the intercarrier frequency stability becomes a function of both the video oscillator in the modulator and the audio oscillator in the encoder. With a 4.5 interface, the intercarrier stability is solely a function of the encoder 4.5 MHz oscillator performance (Figure 8c).

Figure 7

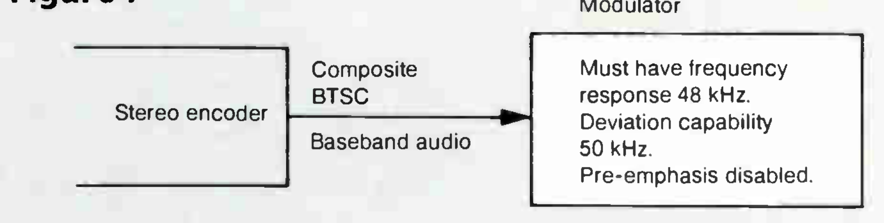


Figure 8a: Video/4.5 combined

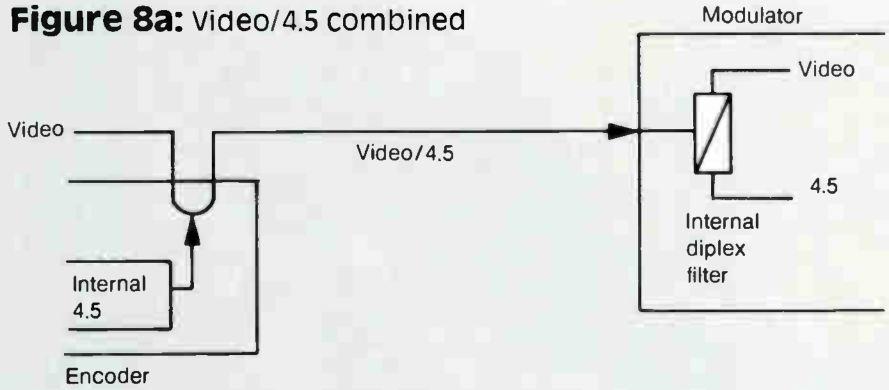


Figure 8b: Video and separate 4.5

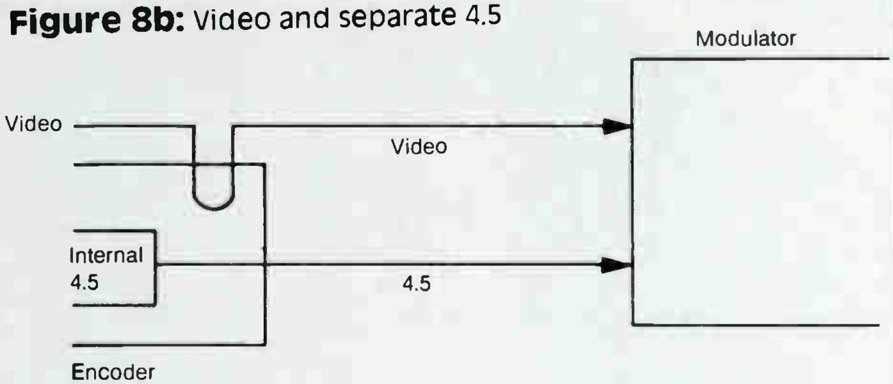
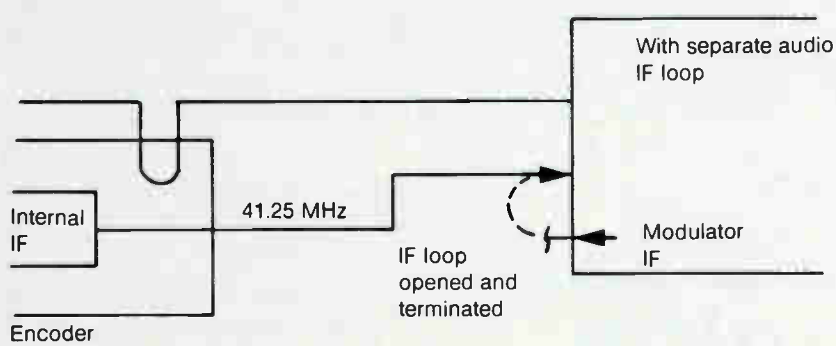


Figure 8c: Video and audio IF



Some trickier interfaces

The foregoing has outlined the interface requirements for most applications. Many systems, and in particular larger systems, may present more complex requirements. Among those that have come to light so far are commercial insertion, baseband encryption, slave headends, microwave links and combinations of these items. While not all of these problems can be addressed here, we can examine a few particular cases and offer certain suggestions.

Commercial insertion must occur prior to the encoder video pilot sample loop so that the relationship between video and stereo pilot phase be maintained. The commercial inserter also should have facility to switch the encoder to mono mode should the insertion source not

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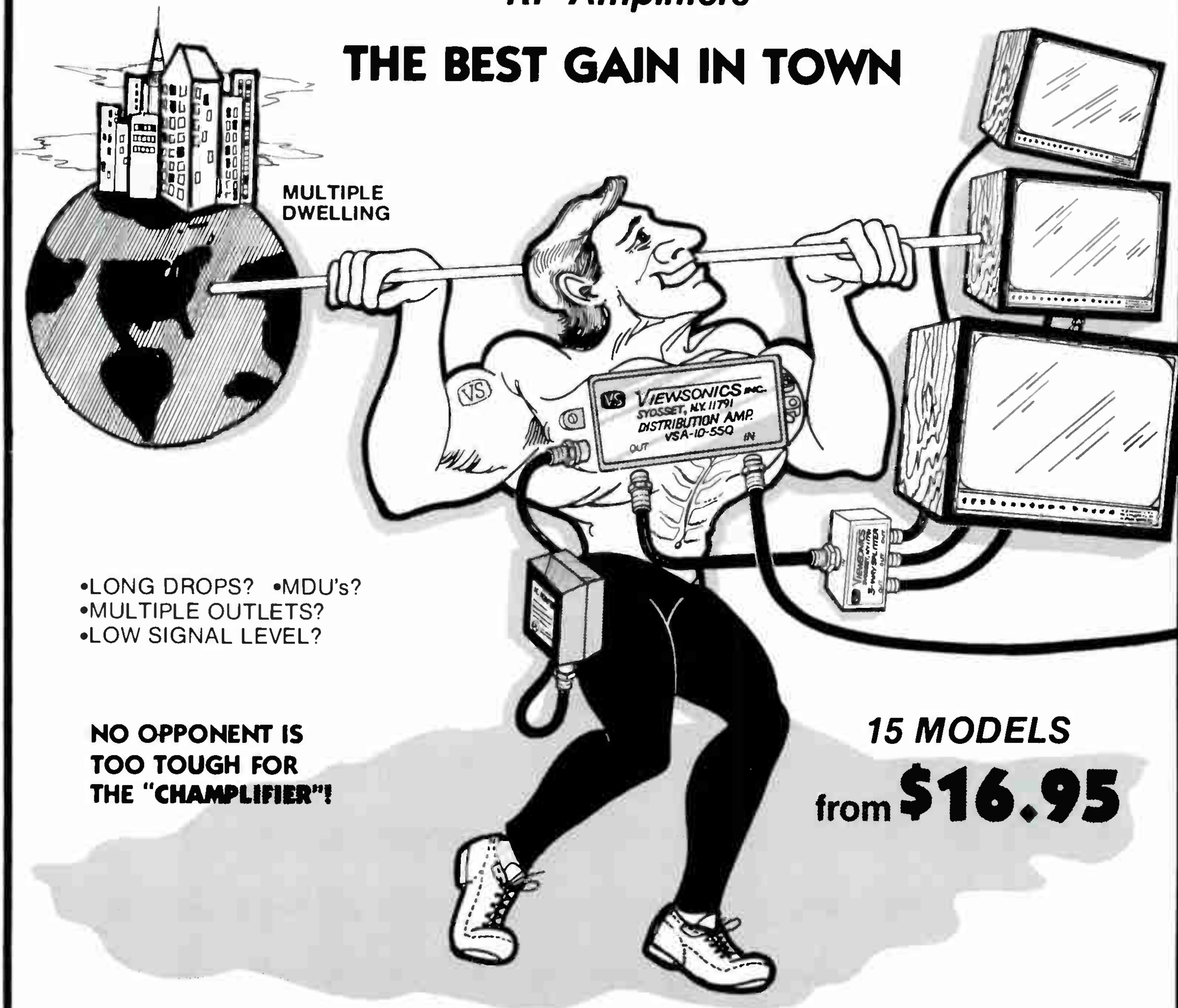

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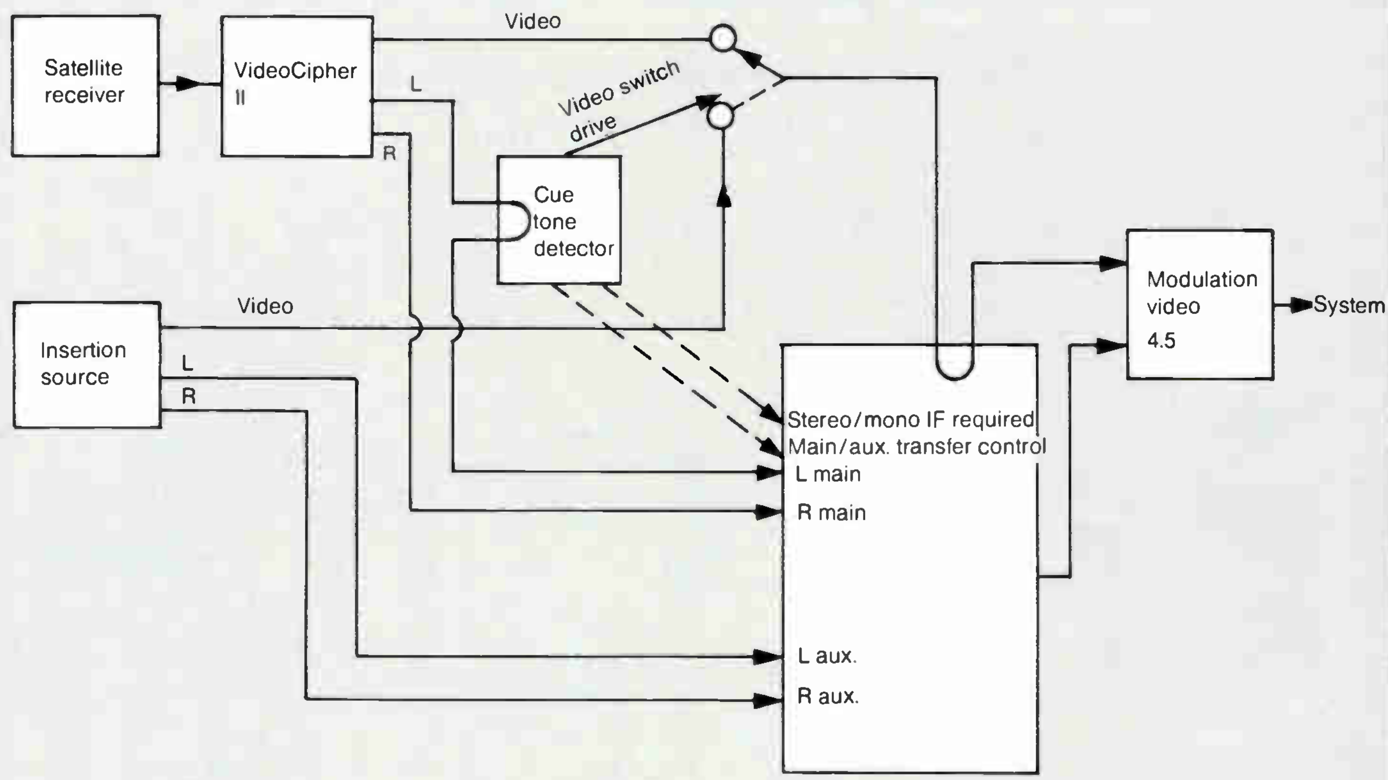
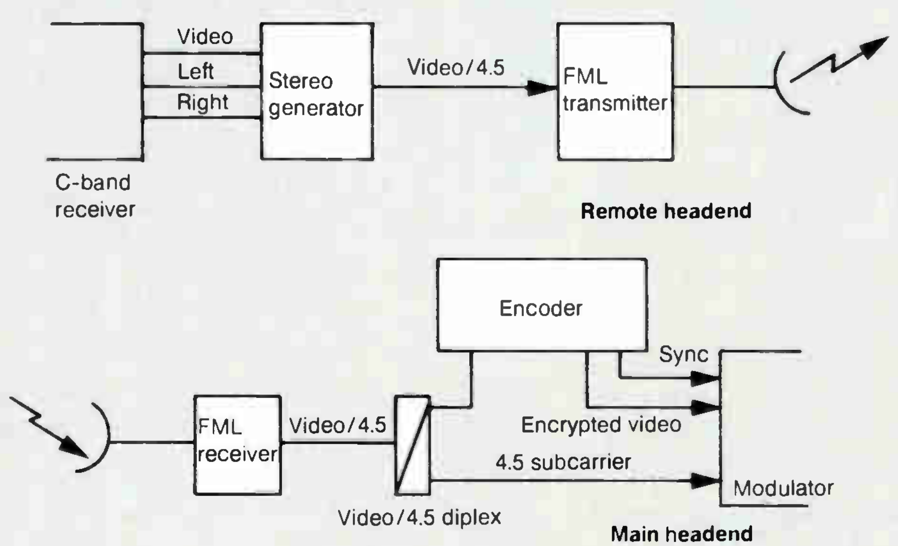
Figure 9: Typical commercial insertion wiring



be stereo (Figure 9).

Remote headends that provide signals intended to be processed into stereo should have the encoding performed at the remote site. The BTSC can then be transported over microwave links or supertrunks as modulated subcarrier. Discrete left and right should not be transported as separate signals due to the potential for phase and level imbalance (Figure 10).

Figure 10: Transmission of stereo from remote headend



Some of the most commonly encountered problems with stereo encoder installation and some probable causes are:

Lack of separation

a) Improper deviation setup
b) Poor modulator audio frequency response
c) Narrow or imbalanced 4.5 or audio IF filters
d) Severe left vs. right input level or phase imbalance

Buzz

a) Video overmodulation
b) Poor modulator video spectrum filtering
c) Video overshoot from alphanumeric generators
d) Pilot lock errors due to interference on video sample
e) Poor video sample clamping or stability
f) Gated sync suppression encryption

Poor quality sound

a) Phase reversal on left or right input
b) Frequency response problems on left or right input
c) Overdriving left or right inputs
d) Modulator baseband frequency response problems

While it is not possible to cover all potential problems, the adherence to several basic recommendations will alleviate the majority of difficulties:

- Employ short, identical input connections, particularly with matrixed signals.
- Observe + and – phase markings.
- Ensure a clean, stable video sample.
- Employ video and separate 4.5 modulator interface if possible.
- Maintain modulation depth of all components including character generator over- and undershoots at 87.5 percent maximum. Reduce modulation depth slightly if required for buzz performance.
- Do not undertake arbitrary control adjustments unless proper measurement equipment is available.

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Return loss:	20 db minimum all ports	**RFI:**	−100 db
	18 db 5 MHz tap port	**Input/Output ports:**	5/8 female
Power passing:	6 Amp AC/DC	**Subscriber ports:**	F-Type female (brass)

Reader Service Number 27.

The Brad Cable Story

Brad Cable Electronics has been serving the cable television industry since 1977. What started as a pick-up and delivery service for converter repairs has evolved into the premier cable television support company in the industry.

Brad Cable's growth and success has been directly dependent on meeting the needs of a rapidly expanding market and providing quality, timely products and services at a competitive price.

Today, BRAD continues to closely monitor and evaluate the changing trends in the cable industry. Further expansion throughout the Midwest and West Coast will provide the cable operators of those regions the service and support other BRAD customers have grown to trust and expect.

The Converter Marketplace™ BRAD

The Brad Cable Network

When time is important, it is vital to have access to a nationwide network of parts, and service. The array of products and services, coupled with strategic and ever expanding locations, makes BRAD the premier support company in the cable industry today.

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Schenectady, NY 12301
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in NY (518) 382-8000

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Cherokee, NC 28719
(704) 493-5314

1255 Boston Avenue
West Columbia, SC 29169
(803) 794-3910

5906 Breckenridge Pkwy. Suite I
Tampa, FL 33610
(813) 623-1721

2010 Pine Terrace
Sarasota, FL 33581
(813) 921-1551

112 E. Ellen Street
Fenton, MI 48430
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Brad Cable Electronics, Inc.

Where the
Cable Industry turns for
Equipment, Service, and Parts.

The Converter Marketplace™ BRAD

Brad Cable is a central source for converters, parts, service, manufacturing, and testing needs of the cable television industry.

BRAD provides more than a decade of experience in buying, selling, and servicing converters and distribution equipment to cable operators of all sizes—from the smallest independents to the largest MSOs.

When you are looking for parts and/or service in the cable industry, turn to Brad Cable. Join our nationwide network of innovation.

BRAD's Product Line-Up

The cable television market is rapidly growing. Each year, new converters are added to the cable industry. Because of this and other developments in hardware, cable companies are faced with technical decisions to make.

BRAD has kept pace with these changes and offers the cable operator a wide selection of hardware and related services.

BRAD's product line-up includes purchasing used converters, reconditioning them, and selling them to cable operators. We also sell new converters, offer service contracts for converters and CATV equipment, and also sell a full line of new and reconditioned parts. To round out our product offering, BRAD markets state-of-the-art, computer testing equipment. Our current product, the CAT System, allows you to monitor your head-end right at your desk.

Converter Sales

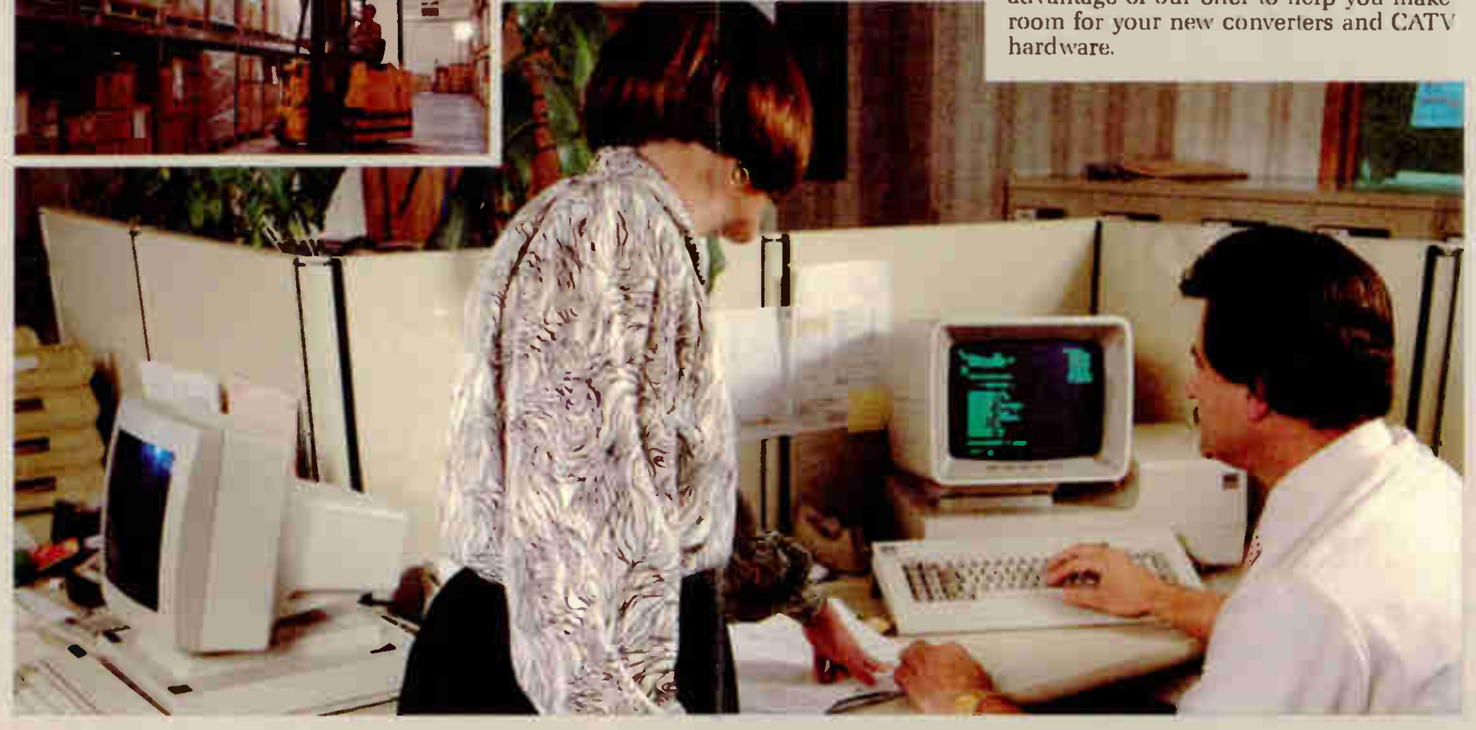
Brad Cable pioneered a unique niche in the cable industry. We were the first to buy and sell used and refurbished converters. Today, our vast inventory includes everything from new, state-of-the-art converters and test equipment to the much sought after but hard to find equipment. Call BRAD when you are ready to make your next purchase.

Converter Purchases

Whether you are looking to up-grade your current supply of converters and hardware, or sell off surplus units, BRAD can help. We purchase new and/or used equipment you might have for sale, including converters, line gear, and head-end equipment.

This equipment becomes an important source for BRAD's reconditioned converter and parts department, where more than 100,000 converters are stocked at all times.

To sell your surplus, call our Schenectady office for more details, and take advantage of our offer to help you make room for your new converters and CATV hardware.



Converter Service

Brad Cable is the largest independent service facility in the industry. BRAD services customers in all 50 states and several foreign countries. By keeping in close contact with major manufacturers, BRAD is able to service and test converters according to latest manufacturers specifications for safety and top performance.

One of the key components to our service turnaround is the vast in-house supply of parts. Our on-line computer allows our Customer Service Representatives to access the parts information necessary to process your job for the best turnaround available.

Parts Sales

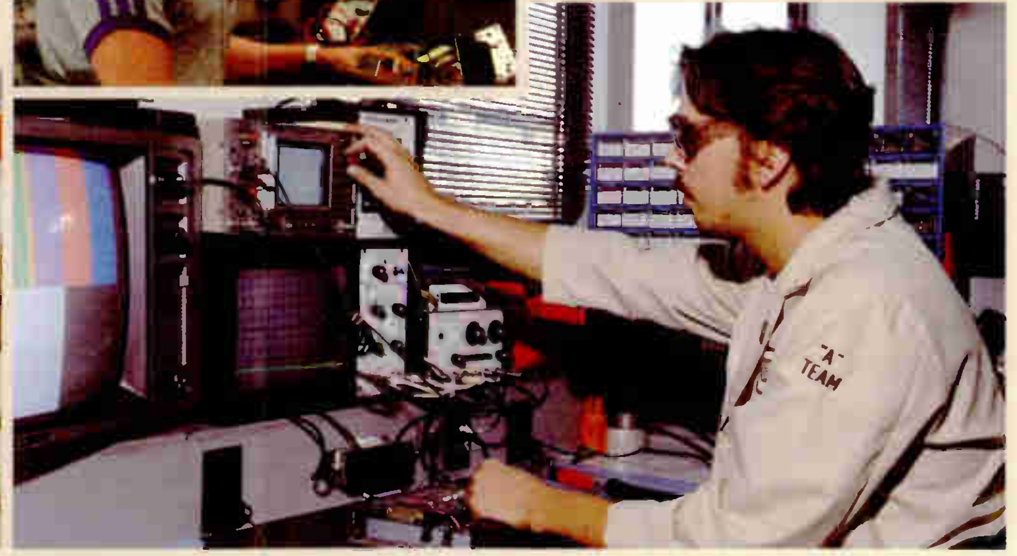
To round out our CATV product line-up, BRAD also offers a wide variety of converter components. With a multi-million dollar parts inventory, most orders can be filled and quickly expedited the same day they are placed.

Not all converter parts are still available from the OEMs. Many converters that are not being manufactured are also not being supported by the OEMs. Thus, the parts needed for repairs are no longer in inventory. In these cases, Brad Cable is able to create state-of-the-art replacement parts, thereby providing our customers with a much desired service.

The CAT System And Other Proprietary Test Equipment

RF Superior, a Brad Company, has developed a very sophisticated package of test equipment and software which is used to monitor head-ends and signal levels at the pole. Each year, our engineers create new testing methods and equipment for cable operators.

These new software and equipment developments have evolved from our direct contact with our customers, who have problems unique to their systems. Through creative problem solving and the advanced knowledge of electronics, BRAD has remained in the forefront of technology and innovation within the cable industry. We are proud of these accomplishments and continue to maintain a strong emphasis in this area in order to better serve you.



Customer Service – The Key Ingredient

The service offered at Brad Cable is second to none in the cable industry and equally important to our product line-up. Over the years, BRAD has taken a leadership role in developing a "Total Service" philosophy. With a network of more than 20 CSRs and salespeople, BRAD stands ready to service your needs.

Our rigid quality control procedures assure high quality, and our on-line computer system provides information vital to processing and tracking your order. BRAD's Research and Development Department continually finds new and better ways to test components and converters, and our convenient pick-up and delivery services save you valuable time and money.

All are key ingredients in the formula to guarantee the utmost in customer satisfaction.

We Deliver

And pick-up, too. From converters to CATV equipment — BRAD brings our service to you — door-to-door. Brad Cable has the largest truck fleet of any service company in the country — and the BRAD network is still growing.

Committed To Excellence

In order to maintain a competitive edge, Brad Cable continues to push for "zero-defect" products. Our well-equipped quality control labs are staffed by skilled technicians, who inspect and test each and every unit before it returns to the customer. Random testing, a standard procedure with most shops of our kind, is a chance BRAD has never wanted to take.

Our confidence in assuring top quality units is extended through our warranty program. All parts, converters, and other CATV components, whether new, reconditioned, or repaired, carry a limited warranty of up to six months.

Innovative Engineering At Work

Brad Cable employs a Research and Development Department, whose primary responsibility is serving our customers' specific needs. Often, a customer will call with a unique set of circumstances. Our highly-trained engineers will creatively address challenges in the CATV industry and arrive at innovative and helpful solutions, whether through a piece of test equipment or a software modification.

Quality Employees

The secret of success in any business is its employees. At Brad Cable, our employees work hard to stay in the forefront of the cable and electronics industry. We treat our employees with respect and dignity and they treat our customers the same. Company pride is further fostered by our policy to train and promote from within.

Never A Rush

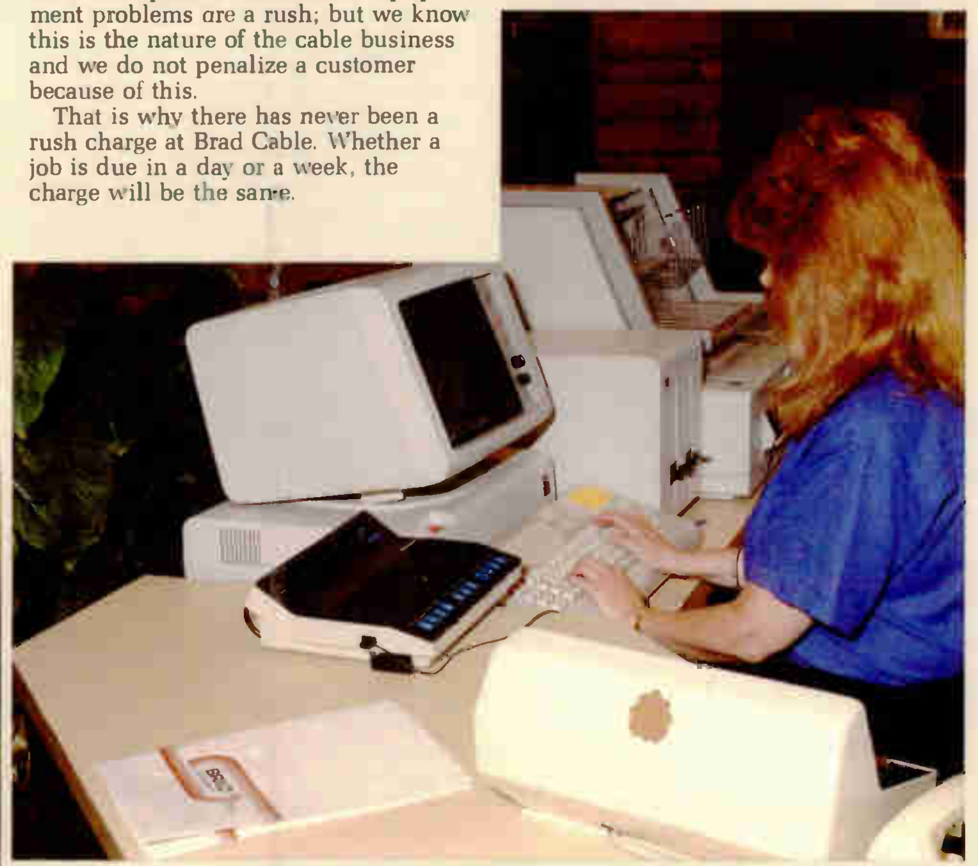
Brad Cable understands the pressures of the cable operator. Most often, equipment problems are a rush; but we know this is the nature of the cable business and we do not penalize a customer because of this.

That is why there has never been a rush charge at Brad Cable. Whether a job is due in a day or a week, the charge will be the same.

On-Line Computer System

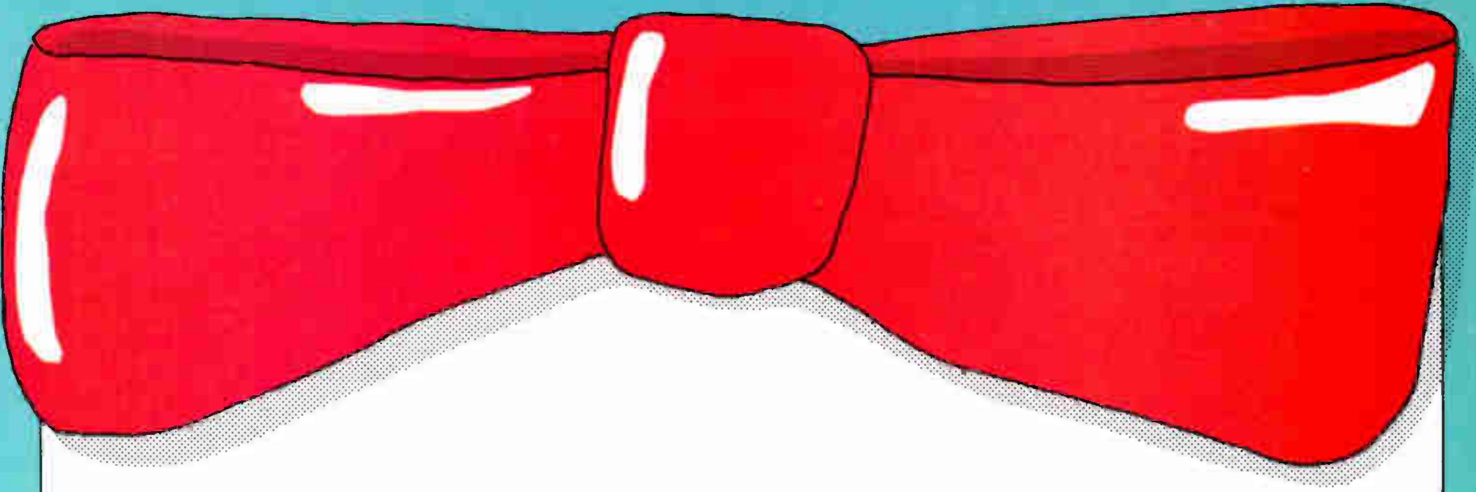
Order processing, parts inventory, shipping, receiving, invoicing, and order tracking are all computerized. These functions are linked from our branch offices to our main computer at the corporate headquarters in Schenectady.

With this information on-line, our Customer Service Representatives are even more effective in answering ordering and processing queries. Minute-by-minute updates mean that the latest information is available to you, when you need it.



The Converter Marketplace

BRAD



"A CABLE CHRISTMAS TALE"

Adapted from: "'Twas The Night Before Christmas"

'Twas the night before Christmas and all through the house
Not a creature was stirring, except for the mouse,
It was chewing the cable, (strung with such care),
In through the window, to right over there.

The children were nestled all snug in their beds,
While reruns from Disney raced through their heads.
Mom in her nightgown, and I in my flaps,
Had just settled down to watch Cinemax.

All of a sudden, there arose such a clatter,
I ran to the set, Mom said, "What's the matter?"
No picture was there, none I could see
All the channels were out, even my MTV!

I dashed to the phone and as I was dialing,
I glanced back at Mom, why was she smiling?
"You'll never get service, it's too late at night.
"They won't come right out like they did for that fight!"

"They better," I fumed, "I pay for this service!"
Someone answered the phone, (she sounded nervous).

"Listen here," I said (in a threatening tone),
"You better send someone out here to my home!"
"He better come fast, and he better be able,
"'Cause if it's not fixed, you can cancel this cable!"

"Sir...I've taken three calls from your neighborhood."
She asked if I'd hold, I told her I would.
In just a few seconds, she came back to say,
"I called a technician and he's on his way."

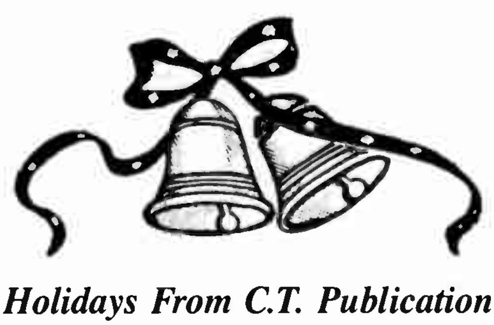
A little while later, (seemed only a minute),
A truck stopped out front, with a cable guy in it.
He opened the door and stepped into the street,
Then picked up his tool belt and a box from the seat.

All the while looking at the cable above,
He put on his hardhat, some hooks and his gloves.
Then he walked to the base of the pole and he stopped.
With a twinkle of his nose, he zoomed up to the top.

He opened the box that hung way up high,
And then checked with his meters and let out a sigh.
He quickly fixed something up there on the line,
The picture came on, and it looked just fine!

He buttoned it up and was down in a flash.
I reached for my wallet to give him some cash,
But, he got in his truck and as he drove out of sight,
"Merry Christmas," he yelled, "And to all a good night!"

Dave Shroeder ***Concord TV Cable***
Headend Technician ***Concord, Calif.***



Happy Holidays From C.T. Publications Corp.

Integrating BTSC into a cable system

By Kim Litchfield
Sales, Learning Industries

The biggest change in television transmission since color is now well under way: stereo TV audio. Decoding stereo in the home is a simple process and the addition of stereo to a cable headend should be painless.

Consumer awareness of stereo is growing. With the advent of hi-fi VCRs, compact discs and now stereo TV, the public has been subject to a major stereo campaign. "In stereo where available"—sound like a familiar phrase? It is for many. In fact, as of September, over 90 percent of TV homes were within reach of broadcast stereo stations. The Electronics Industries Association (EIA) estimates that as of September, 7 percent of U.S. TV households had MTS (multichannel television sound) TVs. This proportion does not include those households with stand-alone decoders or VCRs with built-in decoders, both of which give the consumer MTS capability. EIA projects that by the end of 1987, 37 percent of color sets sold and 22 percent of VCRs sold will have stereo decoders built in.

For the consumer, adding stereo capability is a simple process, and many alternatives are available. A popular method is purchasing a television with a stereo decoder built in. But if the consumer wishes to retain monaural television, stereo decoders are also available in newer model VCRs or as separate sidecar units. For added revenue and convenience to their subscribers, some cable systems offer such stand-alone devices to their subscribers to complement their stereo services.

In most cases, delivering stereo throughout the cable system is easily accomplished. In fact, with most applications, the only additional equipment needed is a BTSC stereo generator. One exception to this rule arises when the generator is interfaced to the channel modulator at composite baseband. In this case, a wideband audio modulator, or a few modifications to the existing channel modulator, may be necessary.

Satellite vs. off-air signals

When considering BTSC for the cable headend, the two main groups of signals that must be attended to are off-air and satellite-delivered. In most instances, off-air stereo signals will pass through the headend's signal processor and retain good stereo separation, although various techniques of signal processing are used and each affects the stereo signal differently. The most prevalent method is split-sound processing. Fortunately, stereo is virtually unaffected by this method, though slight degradation of stereo separation may occur. Another common type of signal processing used is the variable notch technique. This method is also compatible with stereo, but more degradation results when using these processors due to FM to AM conversion. A note of caution: If your processor converts the stereo signal to baseband, the signal will most likely be lost. If any difficulties are encountered when processing off-air signals, the processor manufacturer should be contacted.

Satellite-delivered services, on the other hand, require that a BTSC stereo generator be used to deliver BTSC stereo. A direct comparison is made when switching from an off-air stereo program to a pay service not delivered in stereo; subscribers not only see their stereo light extinguish, but more importantly, they also hear the separation disappear. As more and more local broadcasters go stereo, the demand for stereo on the cable channels increases. Since channel realignments and price hikes inevitably occur, many cable systems are incorporating the added value of stereo transmission to offset these changes.

Let's take a quick look at the BTSC signal. The main channel modulation consists of a L+R monaural channel, a pilot, and an L-R stereo difference channel. For the viewers who have not yet converted to stereo, the L+R sum channel is identical to the monaural baseband audio signal delivering strictly monaural programming. The pilot illuminates the stereo light on the consumer's decoding device and is phase-locked to the horizontal sync of the video. The L-R stereo difference channel is an AM double-sideband suppressed carrier using dbx companding. The BTSC signal also may include a second audio program (SAP) channel and a professional channel (PC). The SAP channel is primarily intended for second language programming, but it could be used for any supplementary audio service. The PC channel is used primarily by broadcasters for voice or low-speed data.

A BTSC stereo generator accepts a left and a right channel of audio information and

Figure 1: IF scrambling using 4.5 MHz output

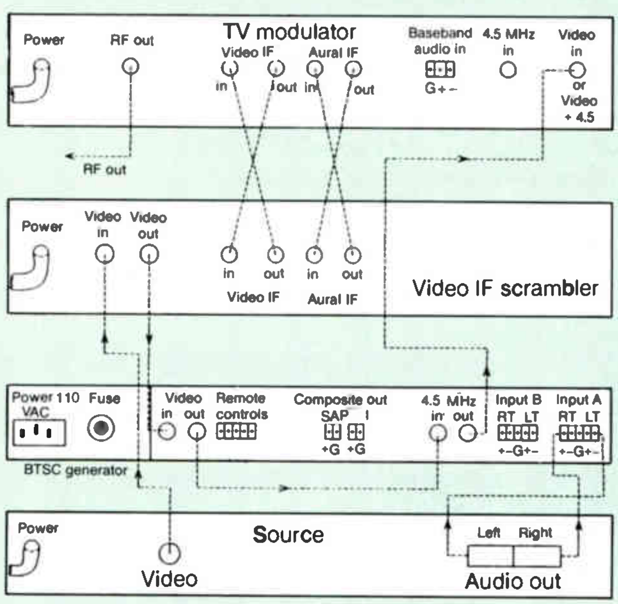
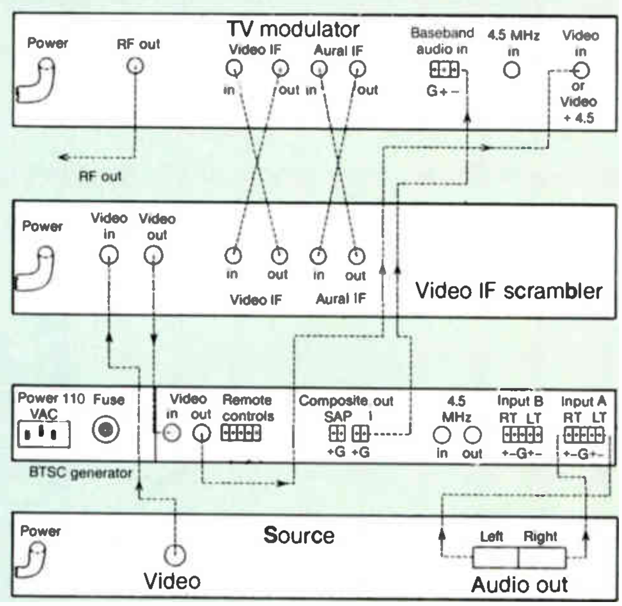


Figure 2: IF scrambling using baseband output



Make no mistake—IPPV is big business. Even systems using phone ordering schemes have pulled in pay-per-view revenues of over $1 million in a single month. Now the equipment needed to *fully* tap this potential gold mine is at last available: Oak's Automatic Self Authorized Purchasing system—*SIGMA ASAP.*

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'til you've seen *SIGMA ASAP.* It's cable's hottest new IPPV system—and a whole lot more.

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COMPLETE HOME MERCHANDISING. With *ASAP*, Subscribers can "impulse buy" from home shopping services or automatically "sign up" for additional premium channels. You can even offer merchandise for sale yourself and let your subscribers order it *automatically.*

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FORGET ABOUT OBSOLESCENCE. *SIGMA* was designed to expand to meet new opportunities as they arise. Planning for two way cable? *ASAP* can report over phone lines or upstream over two-way cable systems.

The cost of all this capability? Get ready for a surprise. Because *ASAP* builds on the flexibility and software-driven power of the Sigma baseband addressable system, no other supplier can deliver so much for so little. Check the math and you'll see why *SIGMA ASAP* is the best equipment value on the market.

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Figure 3: Video scrambling using 4.5 MHz output

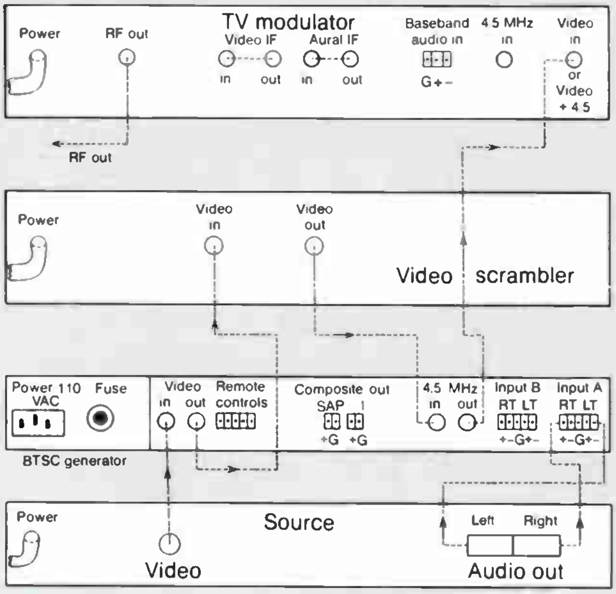
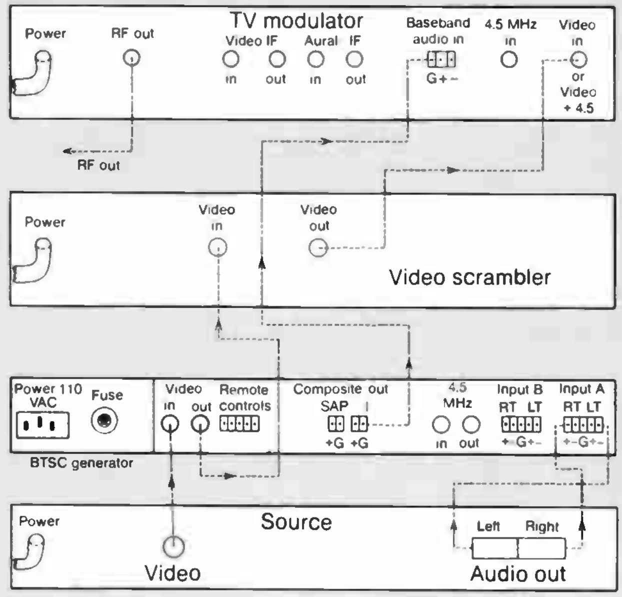


Figure 4: Video scrambling using baseband output



encodes the signal into the BTSC format, which can then be distributed throughout the cable system. A monaural program also may be used as a source. A convenience that then proves to be useful is a built-in stereo synthesizer. With this feature, the ambience is not lost when the program or local ad source is providing mono.

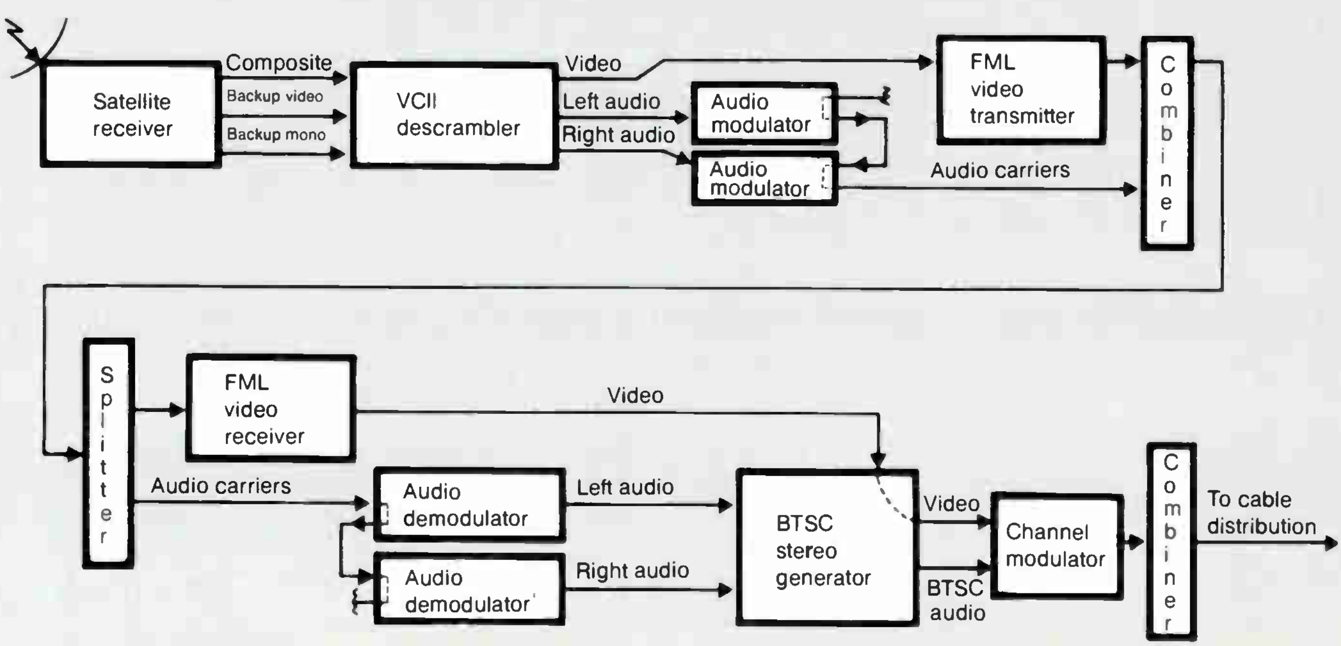
Many of today's pay TV services are scrambled (encrypted); the most prevalent method in use is the VideoCipher II (VCII). With this system, the headend descrambler provides left and right audio. With services delivered to the headend as subcarriers, a subcarrier demodulator must be used to obtain the left and right audio for the BTSC generator. Systems that now supply FM simulcast stereo signals to their subscribers will most likely have access to audio from existing subcarrier demodulators. Left and right channel information also may be obtained from a local origination source.

Many generator manufacturers provide a second input to be used as backup audio or for local ad insertion. With some generators, this second input is stereo (left and right inputs) rather than monaural. At present, most backup and local commercial audio is monaural. But, since the industry is moving toward stereo, the future should be considered when choosing a generator and its input configuration.

Modulator interface

Once the audio inputs are connected, the BTSC generator must be interfaced with the channel modulator. The generator is usually racked near the corresponding TV modulator. In fact, in many headends, the equipment for each service is grouped together (e.g., satellite receiver, VCII, BTSC stereo generator, scrambler and TV modulator). For this reason a fully self-contained compact generator is

Figure 5: Stereo audio (discrete subcarriers) and video transmission for remote headend



preferred. Or the signal may need to be transported (as explained later).

A variety of interconnections are possible. The generator may be interfaced with the TV modulator as BTSC composite baseband and video, as a video plus 4.5 MHz aural subcarrier, as a 4.5 MHz aural subcarrier separate from video or as a 41.25 MHz intermediate frequency (IF) carrier. Each application has advantages as well as disadvantages. The specific interface chosen will depend on the individual components in the headend as well as personal preferences.

A particularly important adjustment is the audio deviation. To preserve the BTSC signal, accurate deviations of the main aural carrier must be maintained; that is, ±25 kHz for the monaural (L+R) channel, ±5 kHz for the pilot and ±50 kHz for the stereo difference (L-R) channel. If there is a deviation error between the generator and the decoder, the L-R signal will not be recovered properly. This will cause degradation of the separation between the left and right channels. For example, a 3 dB error limits the separation to about 15 dB. A 10 dB error limits the separation to less than 6 dB.

One of the preferred methods of interface is composite baseband. When interfacing at BTSC composite baseband, the modulator's audio pre-emphasis network must be disabled as pre-emphasis is included in the BTSC sum channel (as standard 75 μsec pre-emphasis) and in the L-R stereo difference channel (as an integral portion of the dbx companding system). Also, the modulator's audio bandwidth and deviation capability must be compatible with BTSC (i.e., 100 kHz bandwidth and ±73 kHz deviation). Your TV modulator manufacturer should be contacted to receive the most recent information regarding how you can modify your modulator. Also, many channel modulator manufacturers now offer audio modules that contain all the required modifications, and currently available modulators should come equipped with all the needed changes.

The BTSC composite baseband method of interface requires that the headend operator set and maintain the deviation level. Since this level cannot be accurately set with program audio, worry exists as to how accurate the setup will be. But if done properly, the deviation level may be set very precisely. The recommended procedure for deviation adjustment is to apply a Bessel null test tone (10.396 kHz) at a level that is to produce 100 percent modulation, monitor the output using a spectrum analyzer and null the carrier. This procedure will yield ±25 kHz deviation for the sum (L+R) channel, and the other required deviations will correspondingly follow.

This may sound complicated, but since some manufacturers provide a Bessel null test tone built into the generator, setting and maintaining accurate deviation levels is actually a simple process. If a spectrum analyzer is not available, the channel modulator's over-deviation light or deviation meter may be used, although this method is not as accurate. Once the modulator's deviation is set, however, it must not be casually readjusted. For audio level adjustments, the level controls on the generator should be used.

When interfacing at either 4.5 MHz or 41.25 MHz, no modifications to the channel modulator are normally required. This is true because the RF bandwidth of the audio subcarrier path of most modulators (both old and new) is sufficiently wide to pass the stereo signal. When interfacing at a subcarrier or IF frequency, the generator includes its own modulator. Therefore, the generator can be shipped with the deviation accurately preset by the manufacturer.

When interfacing at 4.5 MHz, two possible interconnections exist. The modulator can be arranged to accept the 4.5 MHz aural carrier separately from the baseband video or it may accept the 4.5 MHz aural carrier combined with the baseband video. Many modulators must be modified to accept the two separately. In either case, the channel modulator's internal 4.5 MHz modulator must be disabled. If it is not, two 4.5 MHz subcarriers will be present, interfering with one another in your system.

The simplest and most convenient interface between the generator and the modulator is the 4.5 MHz aural carrier combined with video, due to the ease in its setup. With this method, however, there is a risk that the video might bleed into the audio when combined as a composite subcarrier, creating unwanted buzz. Therefore, the video source should be band-limited to 4.2 MHz. For this reason the method of interfacing with 4.5 MHz separate from video preferred. If the subcarrier and video are not combined before the channel modulator, the risk of audio contamination is reduced.

The other interface option that is available is at 41.25 MHz. This interconnection is recommended only when using a modulator that cannot accept a 4.5 MHz subcarrier.

Considering field results and the previous information, the following order of preference can be stated for the generator/TV modulator interface: 1) composite baseband provided that a Bessel null is performed to set the deviation, 2) a 4.5 MHz subcarrier separate from video, 3) video and the 4.5 MHz subcarrier combined and 4) a 41.25 MHz subcarrier combined with video.

BTSC and scrambling

At the onset of BTSC, concern existed as to whether or not the BTSC signal would survive scrambling. This concern has, in most cases, been put to rest. BTSC is up and running in headends across the country, most of which are using scrambling. The scrambling process may, however, cause slight degradation of the stereo signal or the video depending on several variables (e.g., type of scrambling, levels and transmission paths). Most scrambling systems presently being used in headends fall into one of two categories—gated sync suppresion and sine wave sync suppression. Both scrambling processes have produced acceptable (sometimes even exceptional) results when used in conjunction with BTSC stereo.

According to field feedback, gated sync suppression scrambling works well with BTSC. Video is virtually unaffected by the combination of this type of scrambling with BTSC, but degradation can be noticed in the audio. It is primarily apparent as noise on the audio (increased sync buzz). Separation may also be reduced. However, the goal of the cable system should be to deliver approximately 20 dB of separation to the home. Studies have shown that separation greater than 17 dB is difficult to discern. Since most generators available deliver greater than 30 dB of separation across the band, a few dB can be spared to the scrambler.

Sine wave sync suppression, on the other hand, has very little effect on separation. In this case, it is the video signal that is altered; some audio components may be perceptible in the video. To reduce this video degradation, best results occur when the 4.5 MHz BTSC aural carrier and the video are applied separately to the modulator.

Provided that care is taken when setting levels, BTSC and scrambling can co-exist. Typical interfaces with the scrambling systems are shown in Figures 1 through 4.

Another consideration in the world of BTSC stereo is the type of converter used in your subscribers' homes. In general, RF converters should not seriously effect the BTSC signal. Baseband converters, on the other hand, can virtually destroy the stereo signal. Unfortunately, baseband converter manufacturers could not predict the stereo revolution and the resulting requirements of stereo. Baseband converters currently on the market, however, have sufficient bandwidth and are capable of passing the stereo signal. It is the volume control that now poses a threat. When the volume control is set too low, separation will be severely reduced, if not completely cancelled, along with the pilot. Therefore, it is important for the subscriber to leave the volume at a sufficient level so as to pass the BTSC signal. Over time, many cable systems are phasing out older converter boxes with newer, more compatible boxes; that is, they are replacing or modifying the converters as the subscribers become stereo capable.

Transporting BTSC between hubs

If the satellite receiver is not in the same location as the channel modulator or the signal has to be transported to several hub sites, a variety of options are available for transportation of the signal.

The most preferred method of transportation is to ship the left and right audio signals as discrete subcarriers separate from the video as shown in Figure 5. With this method, the subcarriers are demodulated at the receive site yielding baseband left and right audio and then encoded into the BTSC format.

The video also is demodulated at this receive site and it is looped through the BTSC generator.

This method, however, actually can be rather expensive, especially when transporting the signal to multiple sites. For every service

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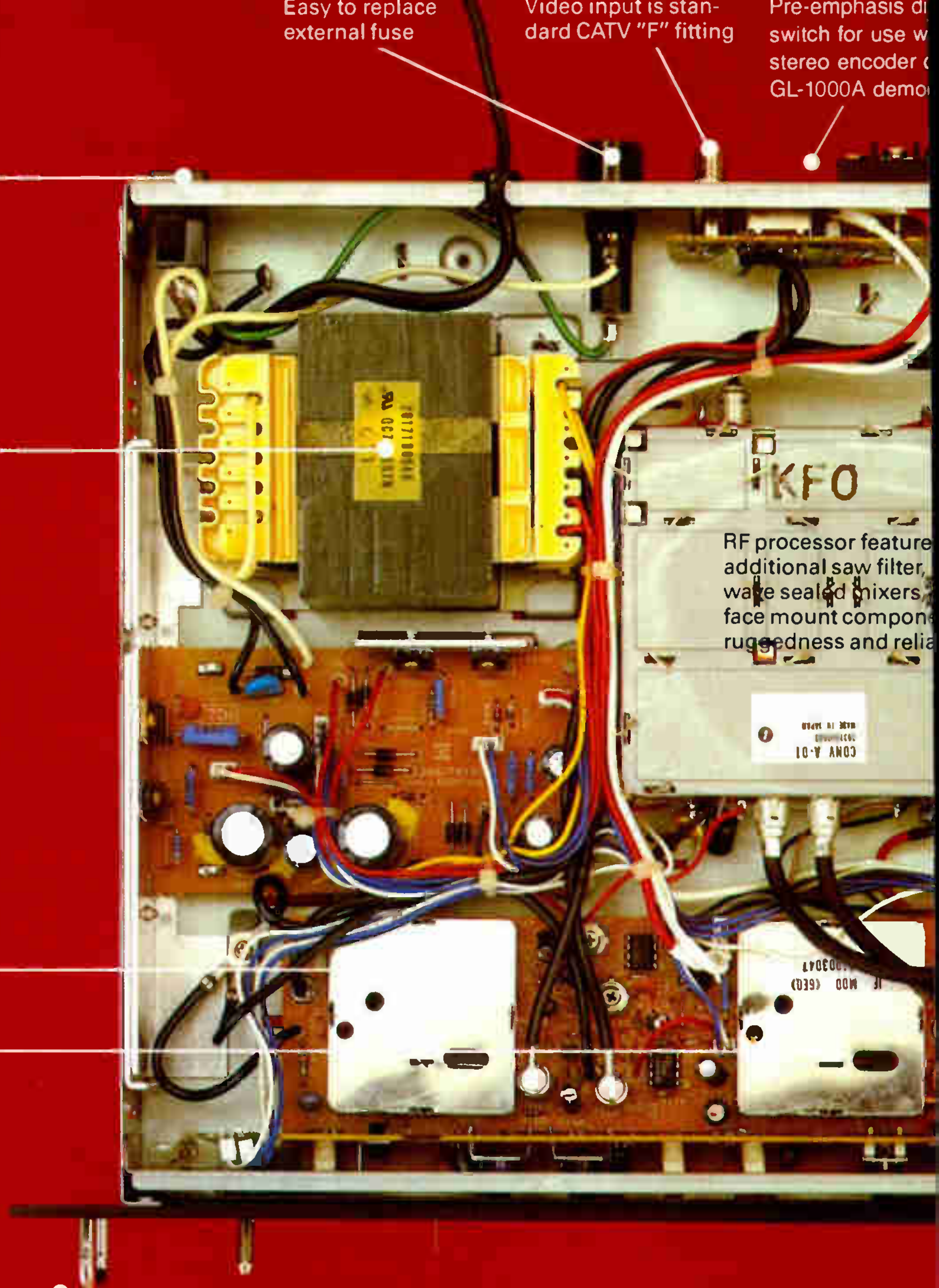

Separate audio/video modulators, instead of simple single consumer IC, assures proper operation with stereo encoders. Two saw filters provide a clean audio/video IF for use with scramblers.

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Locking power switch to prevent accidental operation.

Quality pots that are recessed to provide screwdriver adjustment of audio and video modulation.

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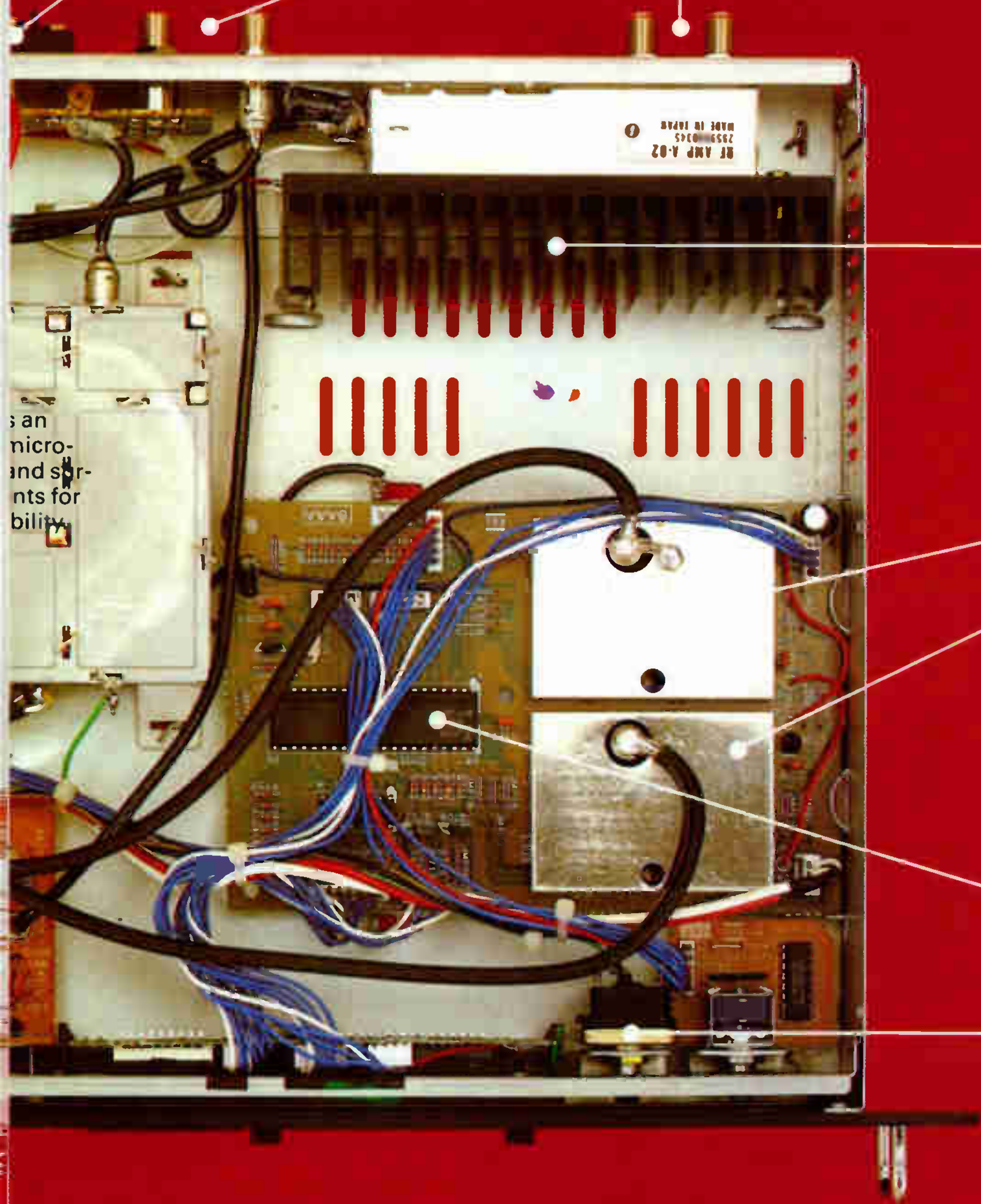

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Custom programmed microprocessor allows proper operation of frequency settings **without resorting to nonstandard IF frequencies,** unlike units using simple consumer ICs.

Final RF output level adjustment uses DC to control high quality pin diode attenuator.

Recessed control of required frequency offsets provides proper indication of required operation while preventing accidental operation. Software control assures accurate offset while maintaining a **standard 45.75 MHz IF** frequency.

Large green LEDs display accurate channel indication.

Simple two-digit switch setting allows for accurate channel selection without the use of troublesome charts or complicated codes.

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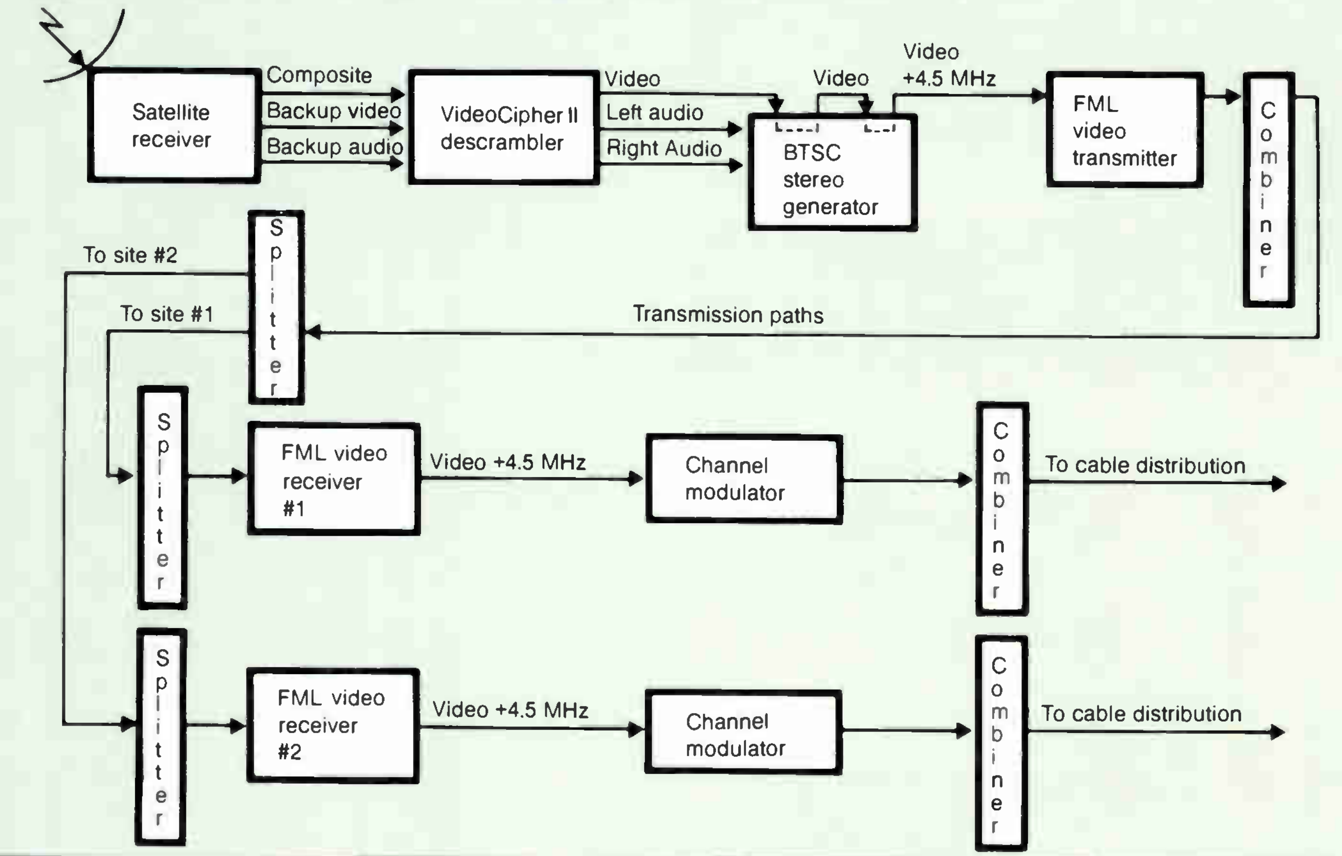
Reader Service Number 33.

Figure 6: BTSC stereo multiplex and video transmission to multiple hubs



that is transported, each receive location needs to be equipped with a video demodulator, two audio demodulators, a BTSC stereo generator and a channel modulator.

Another method that should result in a quality stereo signal is transporting the BTSC signal as a 4.5 MHz subcarrier, as illustrated in Figure 6. In this case, the composite subcarrier signal from the BTSC stereo generator is first applied to the microwave modulator and transported. At the receive site, the demodulated video plus 4.5 MHz BTSC subcarrier signal can then be applied directly to the TV channel modulator. This method offers the cost-effective advantage of requiring only one BTSC stereo generator per service for multiple locations. It is also useful for systems that are near or at capacity and wish to avoid adding extra channels. However, this method is more susceptible to added buzz and reduced separation than the discrete subcarrier method. Also, it should not be used if a demod/remod (to baseband audio) process is involved.

With any of these methods, FMLs, FM fiber optics and AMLs can all be used successfully for transportation of the BTSC signal.

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3) Rauch, K., technical guidance.

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Reader Service Number 35.

BTSC stereo in a digital audio system

By Bob Reiner
Supervisor of Technical Publications, Oak Communications

The Sigma baseband addressable system was designed to provide high security largely based upon the use of digitized and encrypted audio. Although stereo TVs were not yet on the market when it was developed, this digital technology readily lent itself to secure transmission of baseband stereo. With this system, two channels of baseband audio are first processed at the headend (digitized, encrypted and transmitted as part of the scrambled video signal). When the decoder receives the scrambled signal, it extracts and decrypts the signals, then restores them to analog form to produce right- and left-channel baseband audio for application directly to the subscriber's stereo amplifier.

With the adoption of the BTSC stereo format of multichannel television sound (MTS) as the industry standard, over-the-air transmission of stereo programming was begun and stereo TV receivers soon became widely available. For basic channels without scrambling, the Sigma decoder was already transparent to the BTSC audio. For premium channels, however, it became obvious that the system would have to be modified to deliver the BTSC format to subscribers with new stereo TVs. The challenge was to be able to output a BTSC signal on scrambled channels and remain compatible with existing Sigma products without compromising the system's high security or adding substantially to its cost.

Ultimately, the decision was made to provide two stereo decoder models. One decoder, the 3C, would continue to provide baseband audio. This box, based on the original Sigma stereo decoder, would be suitable for stereo enthusiasts who might prefer to hear stereo TV programming through their hi-fi systems or for subscribers who don't have an MTS receiver but still want stereo TV. The second stereo decoder, the 3D, would provide BTSC stereo for subscribers who have a stereo TV.

Baseband stereo operation

Before explaining how BTSC stereo was added to Sigma, it may help to describe how we initially provided baseband stereo signals. At the headend, the left and right audio signals

Figure 1: Encoder before upgrade

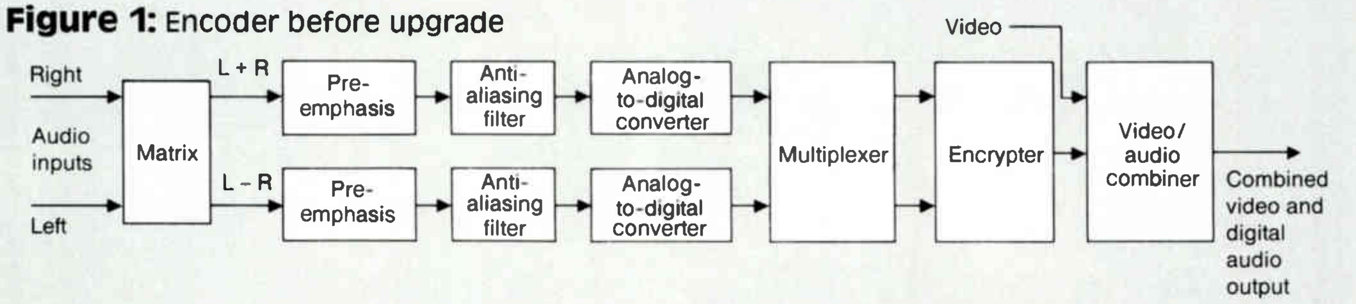
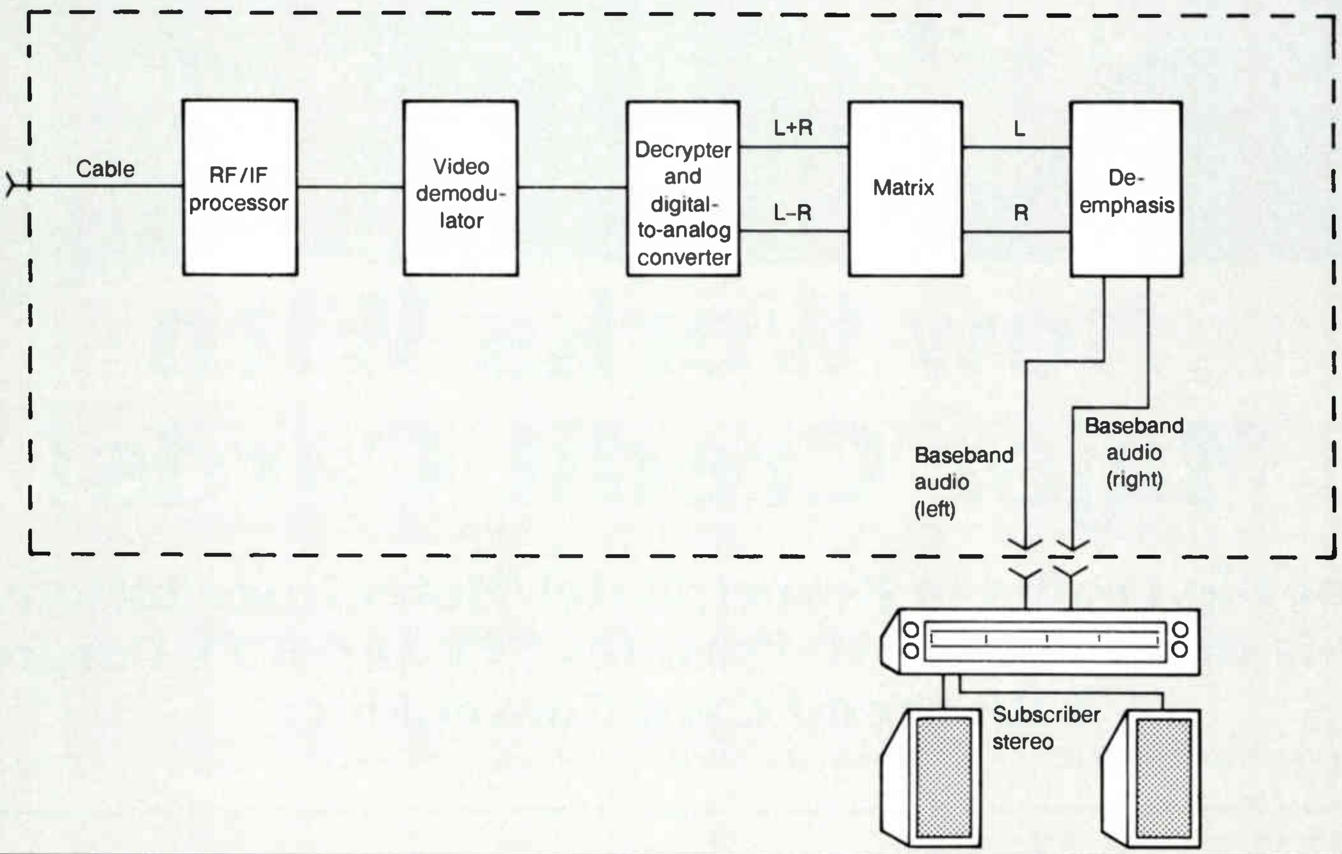


Figure 2: Preliminary stereo decoder



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were applied to the encoder (Figure 1). The left and right audio signals were matrixed into separate sum (L+R) and difference (L-R) signals. The encoder added pre-emphasis to both signals, filtered and digitized them, then encrypted them using a time-varying key. The resulting signal was then combined with Sigma's scrambled video for upconversion and transmission.

When the decoder (Figure 2) received a scrambled signal, it first extracted the digitized audio from the video. The digitized audio was decrypted and converted from digital back to analog. The resulting sum and difference signals were dematrixed into left and right audio signals and de-emphasized.

All Sigma decoders are designed to be virtually transparent to unscrambled BTSC stereo. Incorporation of BTSC stereo into the scrambling format of digitized audio presented more of a challenge. The BTSC signal could not be directly digitized and delivered to the decoder because of its wide bandwidth and precise phase accuracy requirements. Providing circuitry to deal with these in every decoder would have been enormously expensive and would not have been compatible with existing products. Instead, it was determined that premium channel audio could be modified to accommodate the BTSC format, and remain compatibly within Sigma's digitized encrypted format.

The most expensive signal processing necessitated by BTSC is dbx compression. This circuitry was designed into the encoder. The resulting encoder signal flow, shown in Figure 3, provides pre-emphasis of the audio sum and dbx compression of the audio difference signal. The remaining signal processing is unchanged from the original encoder design.

In the 3D decoder, two methods of audio processing are used, depending on whether the received signal is scrambled or transmitted "in the clear" (Figure 4). When BTSC stereo (without scrambling) is processed, the aural signal is simply demodulated so it can be passed through the decoder's volume control. The audio is then remodulated onto the output channel aural carrier for transmission to the stereo TV.

To handle scrambled stereo, a DSB (double sideband) modulator and circuitry to generate a pilot tone from the horizontal sync pulse were added to the 3D. The digitized audio is extracted from the video and decrypted, and the decrypted digital audio is restored to analog sum and difference signals. The resulting pre-emphasized sum signal and dbx compressed difference signal are applied to BTSC modulator where they are added to each other and to the decoder-generated pilot tone. The

(Continued on page 69)

Figure 3: Encoder upgraded for BTSC compatibility

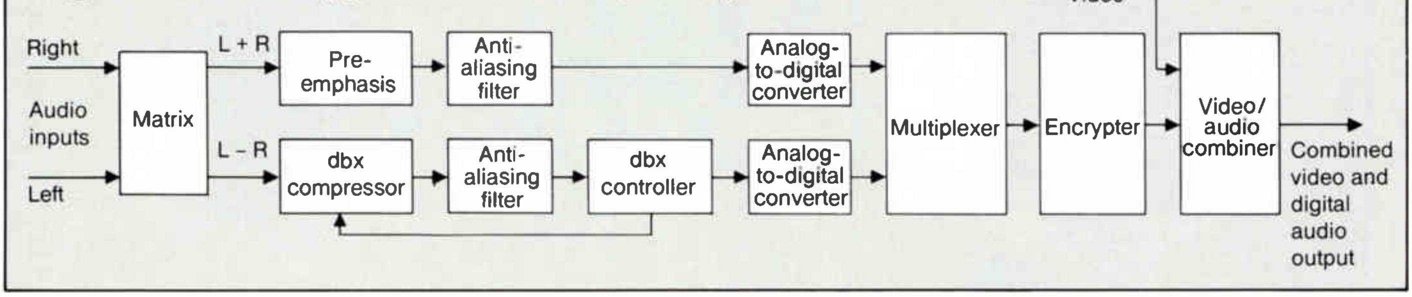
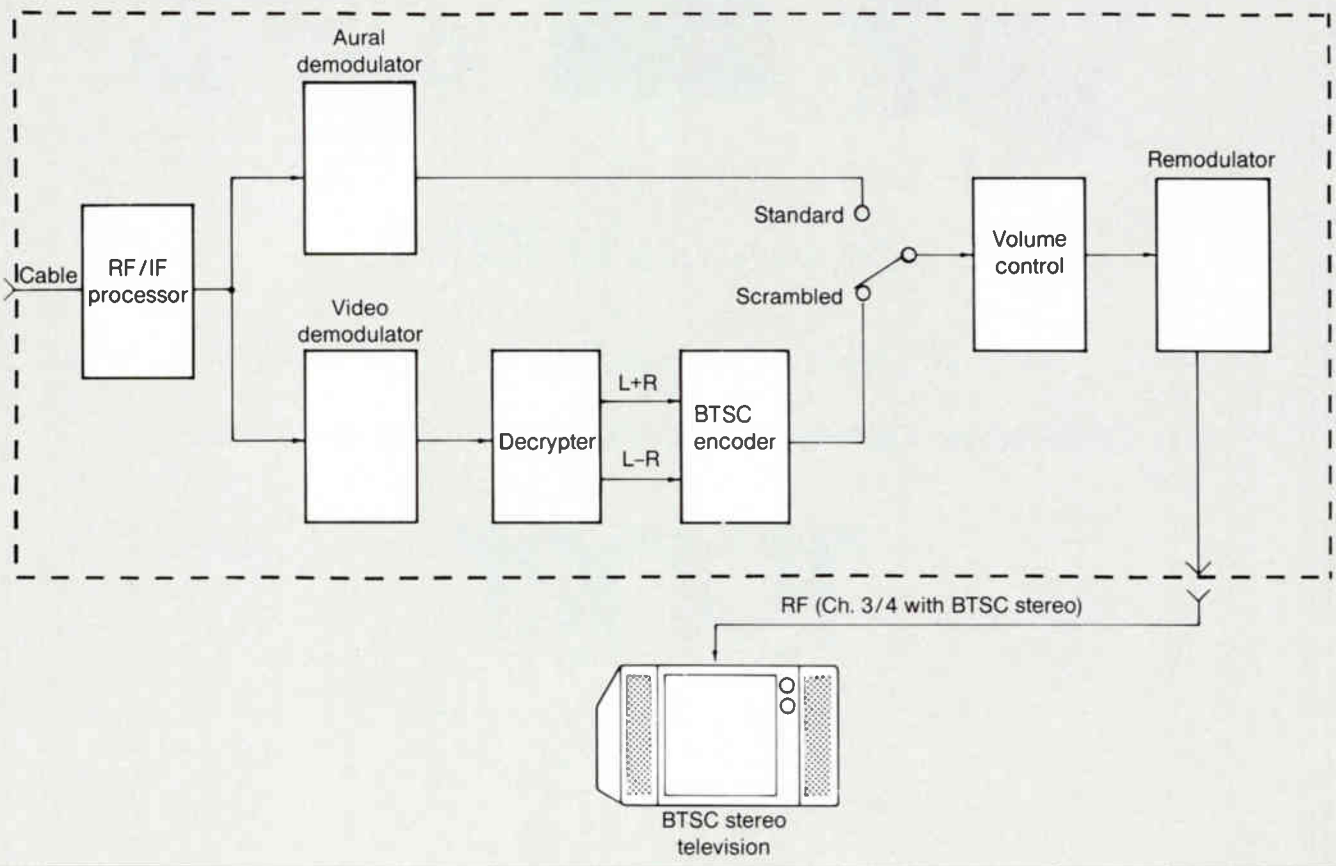


Figure 4: Sigma 3D audio path

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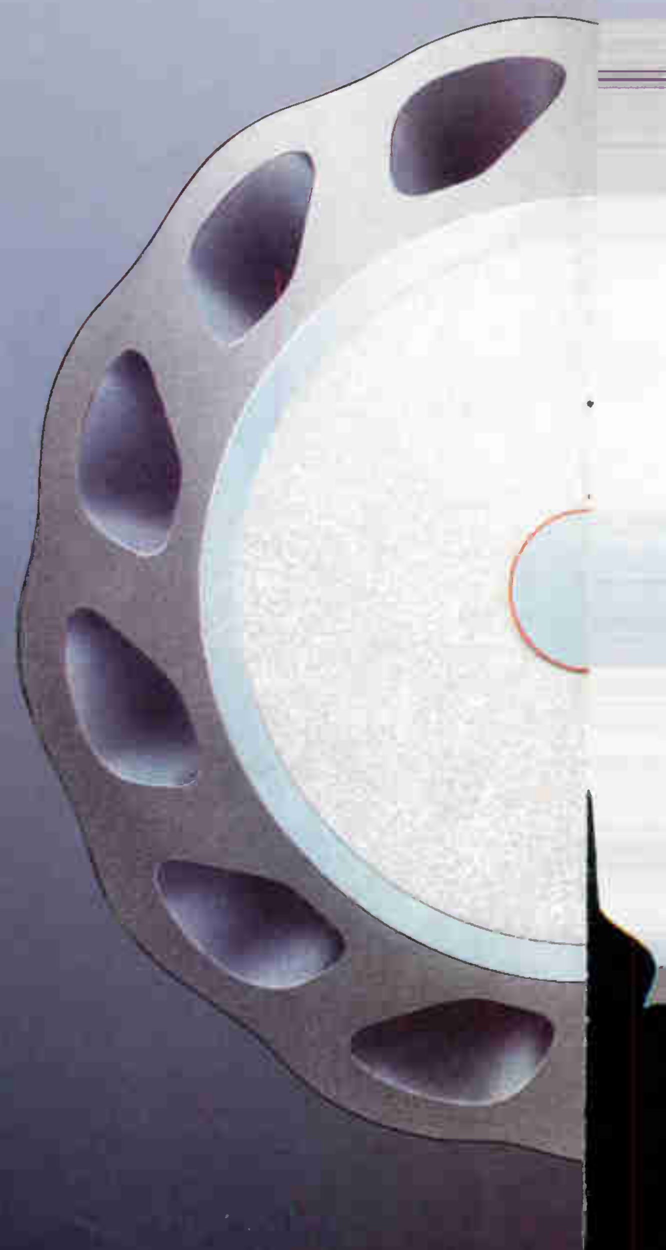

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Figure 5: Sigma 3C audio path

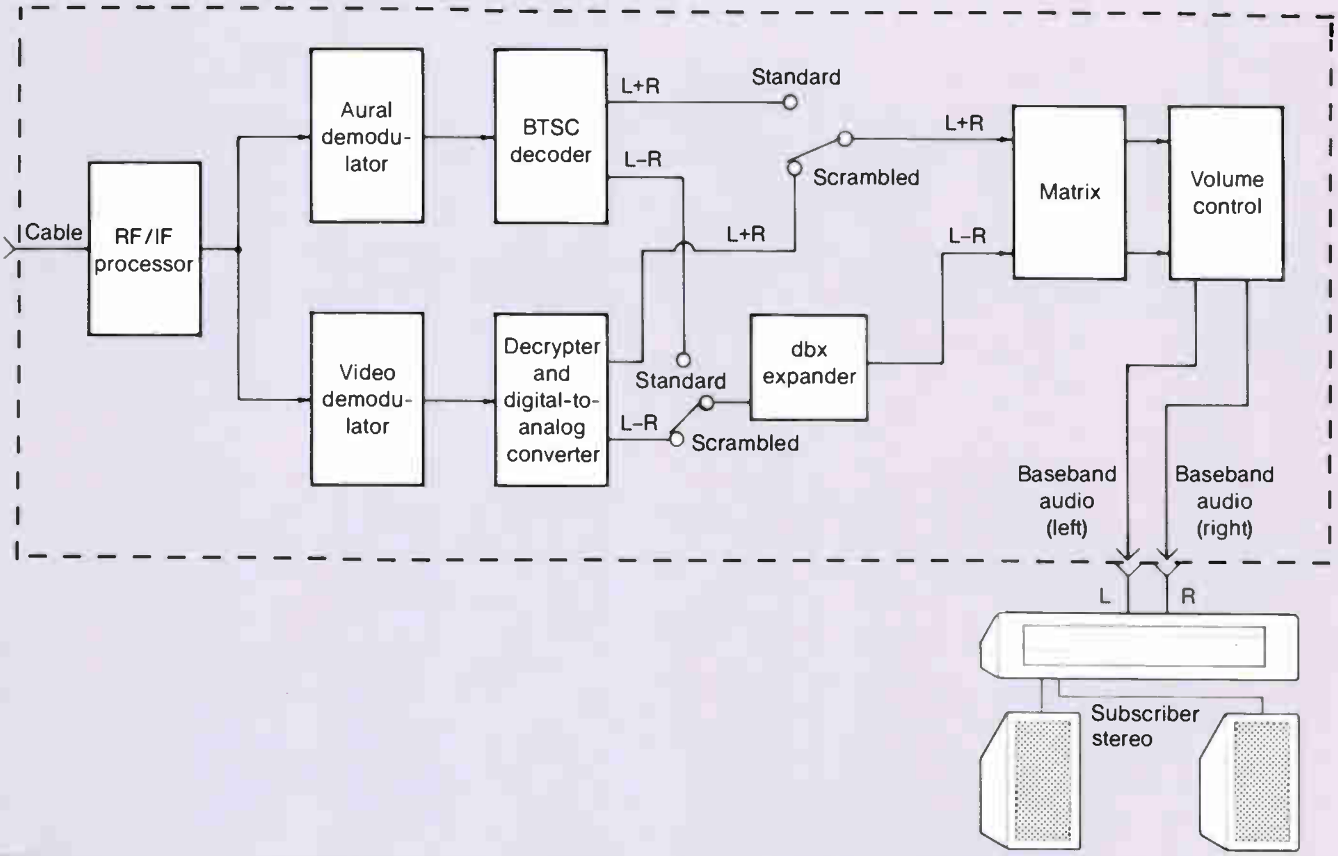
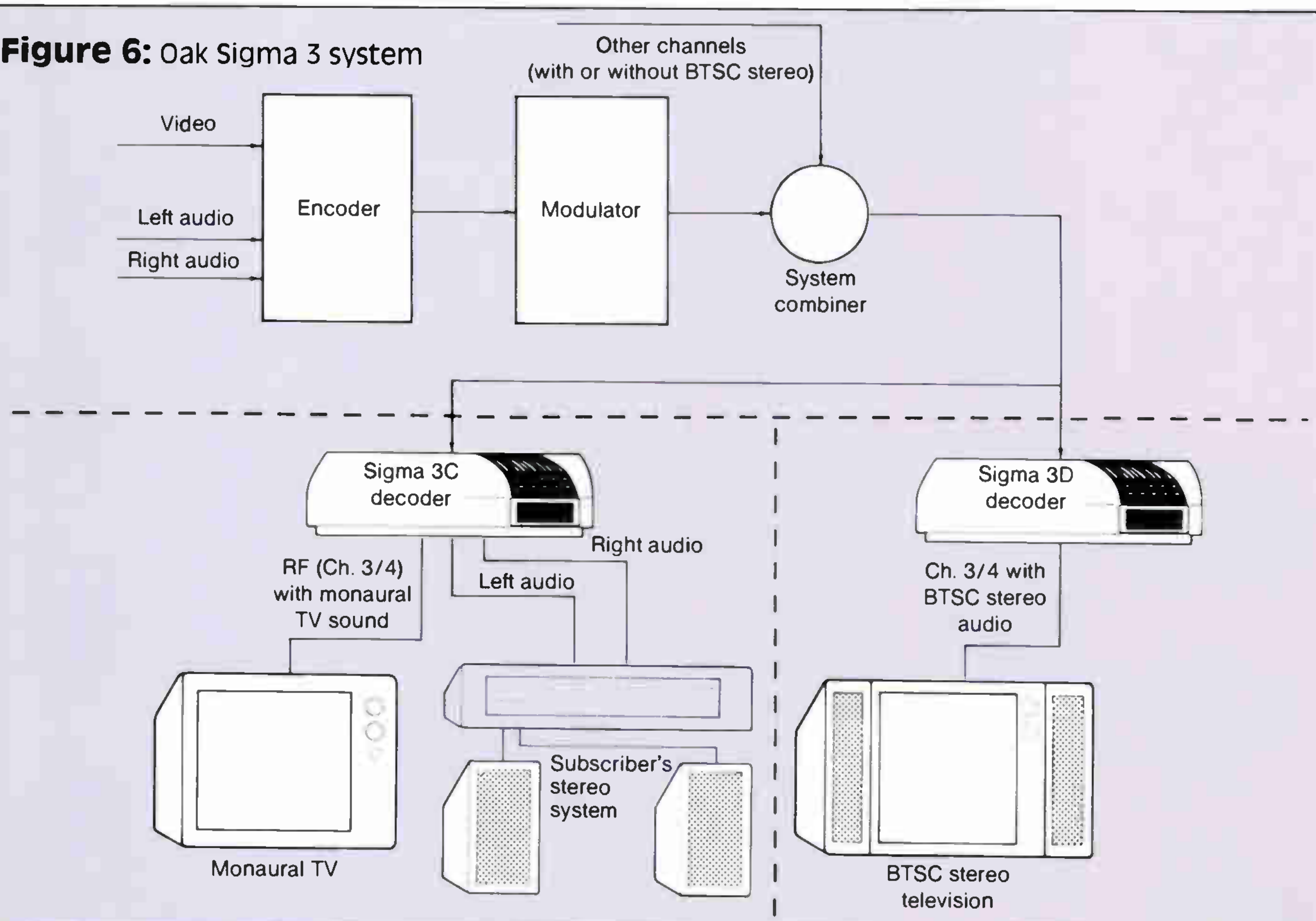


Figure 6: Oak Sigma 3 system



(Continued from page 52)
resulting BTSC output signal is fed through the decoder's volume control circuitry and applied to the remodulator where it is modulated onto the video signal for output to the stereo TV on Channel 3 or 4.

The use of this configuration allowed another possibility. With the addition of a BTSC decoder to the 3C (Figure 5), BTSC stereo could be converted into baseband left and right audio signals. This allows subscribers to enjoy stereo programming as it should be heard—in stereo, even without a stereo TV.

When presented with a non-scrambled MTS stereo channel, the 3C demodulates it and applies it to the MTS decoder. The output of the decoder is a sum and difference signal. The difference signal is applied to a dbx expander. The L+R signal and the dbx-expanded L-R signal are dematrixed into baseband left and right audio signals. These signals are fed through the decoder volume control and passed through the decoder RCA phone-type output jacks to the subscribers stereo amplifier.

When a Sigma-scrambled channel is received, the 3C passes it through a video demodulator where the digitized audio is recovered. The data is then decrypted and the resultant digital audio is restored to analog sum and difference signals. The difference signal, previously compressed at the encoder, is passed through the dbx expander. The L+R signal and the dbx-expanded L-R signal are dematrixed into baseband left and right audio signals and passed through the volume control to the output jacks.

With this design, using one encoder per channel at the headend, subscribers need only specify which decoder they want according to their home equipment. The 3C provides baseband stereo audio, and the 3D provides BTSC stereo. With either decoder, the subscriber enjoys volume-controlled stereo audio in a consistent format on both clear and scrambled channels, received in-band, and with no add-on hardware cluttering up the living room.

EIA multiport

The recently adopted EIA standard IS-15 provides a baseband interface between the TV receiver and the descrambler. This interface feeds demodulated, baseband-scrambled video to the decoder's descrambling circuitry, and accepts the baseband, descrambled video for reinsertion into the TV circuitry. The process minimizes the existing redundancy of RF circuitry: all descramblers must now contain a complete TV tuner that also is present and operating in the television itself.

The Sigma decoder supplied for multiport-compatible stereo TVs operates similarly to the 3C described previously. The decrypted sum channel is simply de-emphasized, and the difference channel dbx-expanded. The recovered sum and difference signals are then dematrixed to form the desired left and right channels and fed back to the TV via the multiport interface.

Satellite-delivered tag change system

By Andrew Ferraro
Request Television

Since the launch of regularly scheduled satellite pay-per-view (PPV) on Nov. 27, 1985, many cable systems have discovered that their in-place hardware presents obstacles to full participation in this potentially profitable revenue stream. Specifically, their addressable hardware does not allow them to show multiple events in a 24-hour period.

The problem is this: Billing systems rely on a tag or address to identify a program service so the customer can be billed properly. With a monthly pay service, this is not a problem. In fact, tag levels were initially designed to work with monthly pay services.

It's not so simple with PPV where each event must be considered a different service, and the tag or address must be changed for each. Otherwise, the customer would only be billed for one view but actually able to see the complete day's programming. The challenge was clear: Simply change the tags before each event. The solution, however, was a little more difficult.

Changing tags manually

Before the satellite-delivered tag switching system was developed, some eager operators positioned an employee in the headend to manually change their tags for each event. But it was costly keeping employees on, day and night, to manually switch the tag levels. Showing less than a full schedule of movies was not the solution either because that resulted in few movies sold to subscribers.

Other operators preset different encoders to different tag levels and then switched them in line with a clock-controlled video switcher for each event. But that wasn't cost-efficient either; each encoder cost up to $2,000. There was the cost of the video switcher as well; and in the end, this approach too was limited to only a few events.

A third route a system could take was to update to a new controller. However, it is hard to justify a $40,000 price tag just to bring PPV into the market when the older controller is already doing every other aspect of its job.

The answer was a separate system to do the switching, one that would be completely transparent to the cable operation. What components were needed? The first requirement was an intelligent device in each cable headend. The device needed the ability to accept a serial data string and convert it to a parallel output. It also needed a non-volatile memory and be inexpensive and reliable.

A logical solution was the Commodore 64 computer. With the aid of the game cartridge port on the computer, a prom could be programmed with all the information and lookup charts needed as well as a self-boot program for outage problems, all without fear of accidental erasure.

A means of communicating with each site was needed. Telephone lines are too costly and a subcarrier on the satellite feed is not only an additional expense but takes time to implement, since each receive site needs a demodulator.

The VideoCipher II (VC II) scrambling system (Figure 1) equipped with its data channel provided an inexpensive path to each and every headend. After testing, the data channel proved to be transparent under many adverse conditions, such as a high noise ratio and terrestrial interference. A simple RS422-to-TTL converter was built and communication with the receive site was established.

The satellite-delivered tag change system was being designed to be compatible with encoders of different manufacturers (Figure 2), and a simple means of communication was needed. Since each encoder uses a different means of changing tags, it was impossible to send the individual setup codes to each headend with 100 percent reliability. Instead, all of the setup information was stored within the receive site program. In this way, only a generic signal (Figure 3) needed to be sent. The generic signal would first identify a receive site and then instruct it to execute one stored tag.

The setup information stored represents the binary code for each tag and is arranged as a lookup table (Figure 4). The lookup table is arranged in order of use, with the first code being assigned to the first event, regardless of time of day.

Four sets of data

With this arrangement the host computer need only send four sets of data: first, a preamble so the receive site recognizes this as incoming data; second, ID codes so that each system recognizes particular commands; third, a setup command; and the fourth and final step has all systems execute the setup commands simultaneously. This final execution command, being separate of the setup procedure, allows the universe of sites to grow and still have them execute each command simultaneously. This also allows for expansion into other controlling areas.

Figure 1

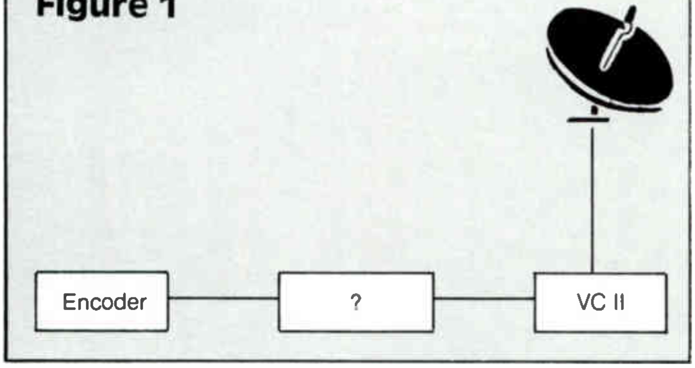


Figure 2

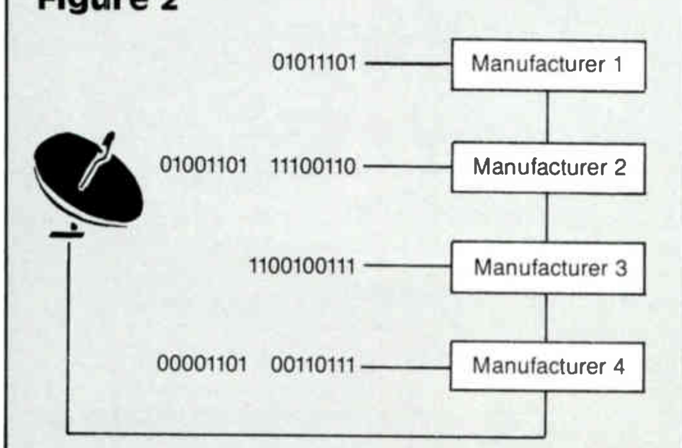


Figure 3

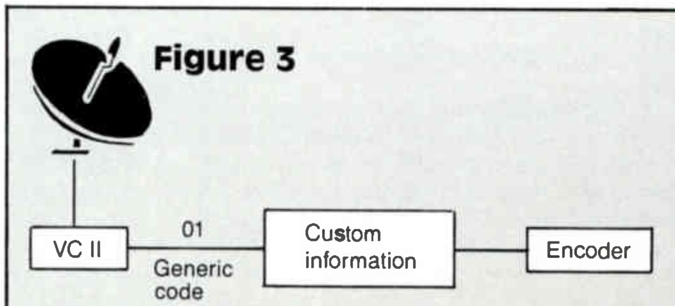
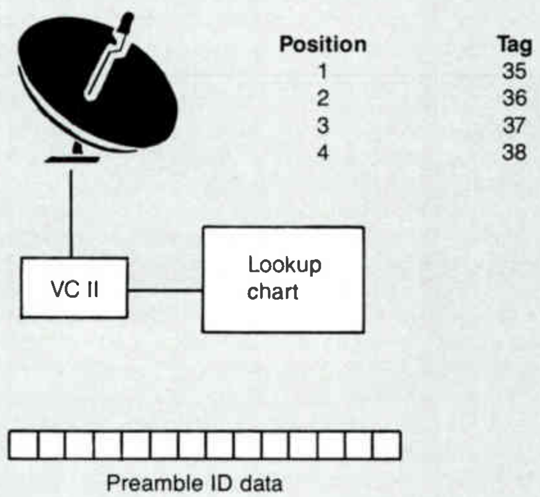


Figure 4



The functional procedure is to send the setup code two minutes prior to the top of the hour, and to send the execution code at the top of the hour prior to the start of an event.

With this all firmly in place, a beta test was conducted. A Torrance, Calif., system was chosen as the test site. On Dec. 15, 1986, the equipment was installed and placed on-line. Some shortcomings in the program were discovered that would not allow it to send the commands on time. The program was revised and a retransmission of the last data option was added.

Another problem that appeared at the receive site was the accumulation of noise. The computer collected noise as though it were data and stored it until the buffer was full—and then bombed out. The receive site program was revised so it would ignore all but recognizable data.

With these revisions in place, the satellite-delivered tag change system was complete. The second generation of the tag switcher, which will be available in the first quarter of 1988, will operate primarily in the same fashion as the first.

Briefly, the host computer, located in Stamford, Conn., sends a data stream to the tag switchers, located in the affiliates' headends, at the start of each event instructing them to switch the tag to a predetermined level. The next version also will send a command at the end of the movie to open breaks to all the systems subscribers. This will be accomplished by either sending a basic tag or closing set of contacts. The type of equipment in the headend will determine what is sent. One minute prior to the start of the event another command will allow the system to insert local how-to-order spots. It also can be used to switch in a single event from another source.

The Commodore computer will no longer be used. Instead, a CPU (central processing unit) of our own design will be housed in an enclosure that will be designed around our needs. It also will handle more than one channel. Finally, there will be an RS232 port for interfacing computers for the purpose of transferring data.

Acknowledgements: Many people have contributed to this project since its inception. The author wishes to acknowledge the contributions of James Schmeiser, David Rodriguez, Paul Swedberg and the cable operators who have worked with us with a spirit of cooperation.

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ANI as a PPV ordering tool

By Jeff Corbett
Software Engineering Manager, Business Systems Inc

One aspect of pay-per-view (PPV) that gets a large amount of attention is the ordering method. The traditional methods that cable TV has used successfully for many years—door-to-door solicitation and the office visit—are not useful in the spur of the moment or impulsive order that puts the gleam in the marketing manager's eye. However, in the past four years many technologies were put to the task of taking a PPV order.

The most obvious method for subscribers is where they press a button on the converter (or remote) and an event is ordered. However, this requires special converter hardware, which is an additional expense for each converter. Also required is either two-way cable plant or connecting the converter to the subscriber's phone outlet if using telephone return path technology. Two-way plant is expensive and almost doubles the cost of plant maintenance. Some subscribers, with visions of CIA wiretaps in their heads, are wary about having things connected to their phone.

Several methods allowing subscribers to use the phone have been experimented with over the years: a person-to-person telephone call to a customer service representative (CSR), who places the order; a person-to-machine telephone call to an audio response unit (ARU), which accepts information by reading the touch-tone signals of an account number or similar identification and possibly the choice of event; and automatic number identification (ANI), where the telephone company's switching equipment intercepts and completes the call without completing a station-to-station telephone call.

As shown in Table 1, ANI has two advantages: speed and ease of use. An entire call takes less than 16 seconds from the moment the subscriber finishes dialing the number to the point the call is disconnected after completion of the message.

Order placement

When the subscriber calls the order number, the local switching device recognizes the dialed number as being one of a set of special numbers that require the caller's number to be transmitted along with the call. The switch then routes that call, including the caller's automatically identified number, to the central office (CO) containing the modular services node (MSN). The nearest CO to the cable office houses the MSN for this project. A leased communication line is connected from the CO to the cable office for communications between the MSN and the billing computer. The MSN takes the signal that a call has been placed to number X from number Y and sends this information across the leased line to the billing computer. The fact that the calling phone number is automatically captured by the phone company provides the billing computer with positive identification of the calling party. False identification of the account is not possible as long as the data base of subscriber phone numbers is kept accurate.

The billing computer checks the called number to ensure that it corresponds to a scheduled event and that the event is not almost over. It then verifies the phone number as belonging to a valid subscriber whose account is current and who has an addressable converter. In order to be accepted, the order must successfully complete each of these checks. To avoid unnecessary processing time, the call is rejected after the first failed check.

When these tests are complete, the billing computer replies to the MSN via the same leased-line circuit, indicating whether the call passed or failed these checks. All of this takes place in a fraction of a second, usually before the caller hears the very first ring. If everything was in order, the subscriber will be informed that the call was received and is thanked for calling; if not, the caller will be told that the call could not be completed and to contact a service representative for assistance. This ability to deliver differing messages is a relatively new

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Table 1: Comparison of order methods involving subscriber-placed telephone calls

Ordering Method	Call Duration	Notes
CSR	3 to 5 minutes	Subscriber asks for schedule, opinions on events, discusses subjects unrelated to PPV order.
ARU	45 to 90 seconds	"Unfriendly" push-button interface; most require that the subscriber have a touch-tone phone.
ANI	16 seconds	As easy as dialing a (correct) phone number.

development for ANI and an important one as well. It immediately tells the subscriber whether or not to expect to receive the event.

If the call was rejected, it is filed away for later printing on a report, allowing the cable office to follow up with the caller. In this way, errors in the phone number data base or in the subscriber's interpretation of the instructions may be corrected so that the subscriber may place a successful order in the future.

If the call was accepted, however, the remaining steps are identical (or nearly so) to those required by either of the other two methods shown in Table 1. The system charges the subscriber's account for the event and sends commands (via the addressable transmitter, headend equipment and cable plant) to the converter located in the subscriber's home. These commands will activate the event associated with the phone number dialed at the appropriate time. They are repeatedly sent to the converter at varying intervals. This is done in order to avoid failure of the box to perform these functions due to temporary interruption of signal to the converter, whether incidental or deliberate.

One of the reasons some subscribers prefer the more automated ordering methods is the anonymity seemingly provided when ordering from a machine rather than a person. It is less embarrassing to order an R-rated movie by punching buttons than giving the order to a CSR. This sense of privacy has provided some unexpected benefits. Subscribers who are no longer active, yet were never physically disconnected, would never dream of calling a CSR to order. However, after they read the instructions on the barker channel, they dial an order number. When these calls appear on the reject report and the accounts are checked, a technician can be sent to physically disconnect these subscribers. It is hoped that lack of free service will encourage these subscribers to reconnect and become paying subscribers who also will order events.

Another, more expected benefit is the increase in sales, due partially to the anonymity factor, but also to the increase in availability. Not only is this system available to take orders nearly 24 hours a day, it can take as many simultaneous calls as there are phone companies providing trunk lines to the MSN. This can be particularly important near the start of an event when many of the orders are placed. With a limited number of phone lines and CSRs, each taking three or more orders per minute, a busy signal is a real possibility during these peak calling times for a CSR system. An ARU system is better, but still is limited by the number of phone lines dedicated to the function of receiving PPV orders. Additionally, more than half of the orders are placed when there is no one in the office to manually take the call. Although manual orders must still be taken for those few subscribers who do not have home phones or insist on having a person take their order, these account for less than 6 percent of the total orders.

Now that ANI can provide immediate feedback to the subscriber, its speed, ease of use and positive identification of the caller make it a natural to ease the burden of overworked CSRs. A fast, efficient ordering service to sometimes impatient subscribers can furnish the cable system increased sales for PPV events.

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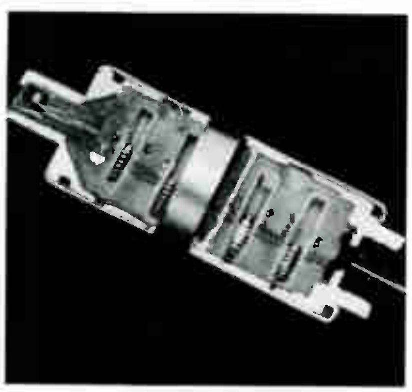

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- Smaller size allows **extra units** to be installed in pedestals or lock boxes.
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Reader Service Number 47.

RF vs. telephone for an impulse system

By Jeremy Rosenberg
Director of Operations

And Mei Yang
Financial Services
Cable Video Store, Jerrold Division/General Instrument Corp.

Historically, the biggest objection to two-way technology has been the cost of maintaining return path plant. In a real-time two-way system, this can be expensive because of the need to resolve trouble calls at night and on weekends on a real-time basis. Store-and-forward impulse systems allow return path maintenance to be performed as part of standard maintenance; therefore, a fault in the return path is not an emergency situation and can be handled during regular working hours.

Various two-way plant managers have indicated that return path maintenance should be looked upon as part of regular plant maintenance, providing an early warning system for possible one-way signal distribution problems. However, some managers allocate no additional funds for return path maintenance over and above maintenance for the one-way system. Given that there is additional equipment involved with a return path, the model for determining the tradeoff between telephone and RF return incorporates a maintenance cost at 10 percent of equipment cost.

Differences in investment per subscriber are broken down into two categories: equipment and installation. For this model, the difference in equipment cost of $5 per subscriber between the $20 cost of Jerrold's Starfone phone return path and the $15 cost of its Starvue RF return path is used. Additional equipment also is required to install a phone return. This is budgeted at $6 per subscriber (based on Cable Video Store's installation experience) and an additional time of 20 minutes per subscriber installation at $12 hourly rate. The difference in installation cost is $10 between a phone and RF return path. Totalling these differences yields a $15 greater investment in phone return path households.

The primary difference in headend costs between a telephone return path and an RF return path is the additional number of phone modems needed for cable systems with more than 5,000 impulse subscribers. Each increment of 5,000 subs is budgeted to add one additional $850 modem.

Part of the beauty of a two-way RF impulse system is that the cable operator has complete control of the system and incurs no additional operating cost. On the other hand, a telephone return path is budgeted to have a basic $6 monthly line charge to the telephone company.

Industry estimates run from approximately $200 to $400 per mile for return path equipment. This model uses a figure of $300 per mile as an average.

Examining the tradeoffs

Given an understanding of the differences between maintenance cost, incremental investment in subscriber homes, headend cost and additional return path equipment required, we can now develop a model to examine the tradeoffs between phone and RF return for an impulse store-and-forward system. The critical variable in determining tradeoffs is the density of impulse subscribers in a cable system. Impulse sub density is referenced on a per-mile basis and can be articulated as a system's sub density per mile times the percentage of impulse subscribers in a system.

The model has been run for cable systems with 750 or more impulse subscribers. There is very little sensitivity to the size of the cable system. This should not be surprising, since the only variable that changes with the size of a system is the number of telephone modems and lines needed at the cable system's headend.

The figure of 22 impulse subscribers per mile will strike some as surprisingly low to justify a decision on an RF return path. There is, however, no mistake in the calculation; it rests upon a critical assumption that there is very little cost for return path maintenance. This is a reasonable assumption in a store-and-forward system that has been well maintained.

Some may argue that their own physical plant is not tight enough to upgrade to an RF return path without considerable maintenance expense. While this may be true, such systems can benefit from such a cleanup regardless of whether there is consideration for an RF return path.

Base model of 40,000 subs operating for two years

Phone return:
- P = Equipment cost
- Q = Telephone connection
- R = Telephone operating
- W = Headend cost

RF return
- T = Equipment cost
- U = RF connection
- V = Return path equipment
- X = Return path maintenance
- Y = Headend cost

- D = sub density per mile
- S = basic sub
- I = percent of impulse

Break-even formula:

Cost per impulse sub = P+Q+[(R+W) / (S×I)]
= T+U+[(V+X) / (D×I)]+[Y / (S×I)]

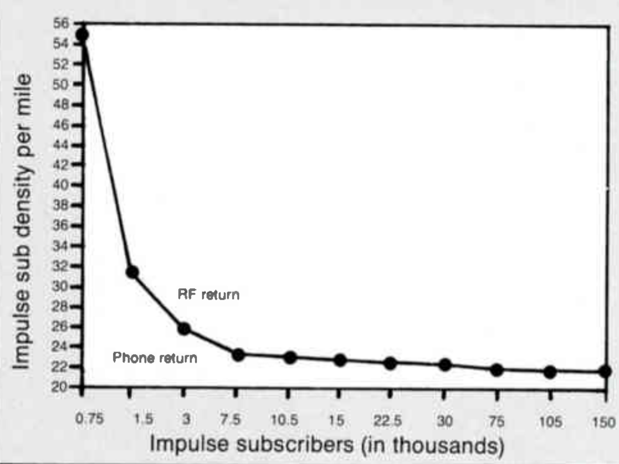
Variables are assigned the following values:

P	= 20	
Q	= 20	
R	= 432	$6/line/month to telephone company for period of two years
W	= 2,550	Basic cost under 5,000 subs is two modems at $850 per modem; each additional 5,000 subs needs an additional modem.
T	= 15	
U	= 10	
V	= 300	Two-way capability cost low-end $200, high-end $400 per mile assuming 10 percent equipment cost
X	= 30	
Y	= 3,000	$3,000 for RF modem

Assuming:
I = 0.15
Cable system with basic sub count of 40,000

Solution:
This system would need a density of sub per mile of 147 with impulse sub density per mile of 22.

Break-even points (phone return vs. RF return)



Minding the store-and-forward

By John Donahue
Director of Operations, Comcast Philadelphia

I can see you sitting there now. You've either already started or plan to begin installing addressable converters. All along the planning process you were thinking, "This is a perfect opening to launch pay-per-view, but is now the right time?" With all the talk in the recent past about the growing number of successful PPV projects and the refinement of the technology to support them, you've finally done it. You've made the decision to launch pay-per-view! Now what?

The decision you just made may very well be the easiest one of the whole project. Now you are faced with selecting technology that best serves your situation. Your overall goal is to generate incremental gross revenue that, in this project, is simply a function of buy rates, net product costs and operational expenses. The one area in that equation that you have the most control over is operational expenses.

So now you are confronted with the task of selecting the system that is not only easy to operate from a consumer standpoint and proven to be reliable, but also is as minimally disruptive to your existing operations as possible during and after implementation. Herein lies the first and most important caution: If you start this project thinking that all you need to do is plug it in, walk away and collect the money, you are on a definite course of failure. Success can only be realized through a commitment of resources, planning, training and monitoring.

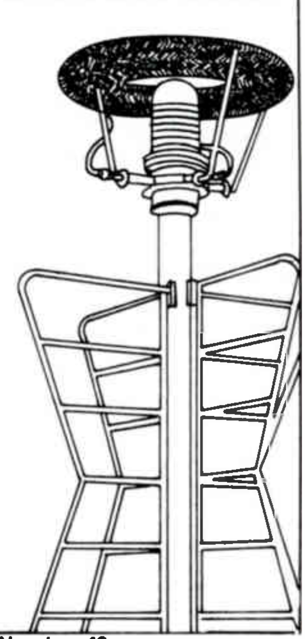
Preprocessing vs. store-and-forward

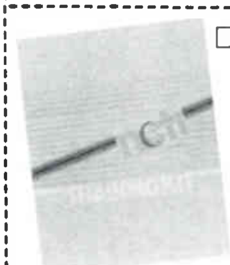
The technologies involved in the operation of PPV events are numerous but can generally be grouped into two classes. The first is preprocessing of all transactions and the second is store-and-forward. While it is true that both methods require processing of the customer request for the event, the distinction is *when* the processing takes place and the consumer interaction. In preprocessing, subscribers must communicate their requests to the cable company before an event is delivered. The methods for this communication can be a phone call to a customer service rep or an automated machine, or a signal sent upstream on the cable system.

Regardless of the communications, a central computer must process the transaction and deliver a message down to an addressable converter to descramble the event. Even though different systems yield different processing times, the limitation is still, as it always will be, the ability to handle the last-minute ordering that is the true impulse market. Data indicates that if impulsive buyers encounter difficulty in ordering (like jammed phone lines or long waits on hold), they are not going to purchase. The obvious result in this situation is reduced buy rates from what you potentially could have had. The other major problem with preprocessing transactions is the potential for error. If you develop computer or phone problems, or if phone operators don't show up, the result can be anything from a few lost orders up to cancellation of the entire event. This not only means lost revenue but it can ruin your credibility with your subscribers.

On the other hand, store-and-forward technology removes many of these obstacles. Consumers only have to communicate with their individual addressable converters. Because of this simple fact there is absolutely no limitation on the last-minute ordering surge, ensuring you the entirety of the impulse market. Data collection for billing purposes follows the event at the operator's leisure. The potential for error also is reduced because the communications and processing for the delivery of the event are contained within the subscriber's residence. Even with store-and-forward, you have a choice of the return path methods. You can either choose the upstream capacity of your cable system or the phone system.

As in the introduction of all new projects, there are unique considerations that must be made. The one we are probably least familiar with is in the connection to the existing phone system. Even though the facilities





on the customer side of the demarcation line (Demarc) were detariffed by the Federal Communications Commission on Jan. 1, 1987, rules remain governing the connection of third-party equipment.

Knowledge of the FCC's rules and regulations, specifically Sections 68.104 and 68.213 (b), is a must before you attempt a connection to the phone system. The rules require all connections to be made through standard plugs and jacks on the customer's side of the Demarc. In many cases, connection is made via a T connector to an existing active jack in close proximity to the converter location or to a clearly identified network interface installed by the phone company. The installation and connection are very straightforward. You will, however, run into situations where neither of these examples exist and the installer is confronted with a decision that, if made wrong, could have serious consequences. The answer, as it is in so much of our operations, is training and then more training.

Another important point to remember is that each state can add further clarifications to the rules you must know before you begin. As in the case of all aspects of a professional install the customer should be consulted before the install actually begins. The customer's input is valuable in this area to gain knowledge of any security systems or business lines, which involves additional considerations to be made.

As should be the case in all the work functions we perform, the objective should be installs with "zero defects." Obviously, training is the first requirement to meet this goal. In addition, installers need an efficient test by which they can quickly verify the proper working of the system they've just installed. We'll divide this final test into two parts, each with its own objective. The first part is a simple phone call placed on the line just installed. All installers carry inexpensive portable phones perfectly suited for this purpose. The phone call is placed to our dispatch operations, which is a part of standard installation practices. A successful phone call obviously confirms the ability of the newly installed line to pass signal. An additional check should be made on an existing customer station to ensure that service had not been interrupted.

The second part of the test occurs after the successful phone call. Initiated by the dispatch office, the PPV-equipped converter is commanded to contact the addressable computer. Once connected, data is exchanged and verified. The successful test indicates that the entire chain is working properly and is ready for operation. If it fails, it can be corrected before the installer leaves the home.

Once installed, ongoing maintenance of the system must be considered. This alone is one of the leading reasons to choose the phone system as the return path. That fact aside, you will still encounter incremental service calls solely due to the PPV system. As you might have expected, many of the calls are for the "traditional" things such as lack of education, VCR wiring and compatibility, etc. The balance of the calls, however, are genuinely due to PPV operations.

There are many other operational considerations that must be made for the successful launch of a PPV project. Just to mention a few:

1) interfacing between the billing and addressable computer including uploads and downloads;
2) the frequency and time of data collections;
3) the responsibility of event scheduling;
4) allocating time and developing computer maintenance routines; and
5) The development and maintenance of credit policies including limits, attempts at illegal tampering or viewing and collection.

Only after these considerations are made can you begin to project the resources necessary to support a successful operation.

Ongoing commitment

The benefits of pay-per-view that have been reported are real and indications are that it will continue to grow. It won't happen on its own, however. Success requires your ongoing commitment to resources, planning, training and monitoring. If you are not willing to make these commitments, the results could be worse than just an unsuccessful PPV project. You could place an extreme burden on your entire operation that will be extremely difficult to control. A successful launch, however, will enable you to receive the immense benefits of pay-per-view now, as well as place the foundation for exciting future services using interactive technology. The choice now is yours.

Is amateur radio an asset to the cable industry?

By Dave Pangrac
Director, Engineering and Technology
American Television and Communications Corp.

Amateur radio—is it an asset to the cable industry? Yes, I strongly believe so. There are tensions between the two groups, but they can be corrected and the potential benefits outweigh the problems.

I have been an amateur radio operator for about as many years as I have been a cable TV engineer. Over the years, I have seen a wall built between amateur radio enthusiasts and cable operators because of signal leakage from the cable systems into amateur radio bands. The main culprit is Channel E with its video carrier at 145.25 MHz, which is in the amateur radio two-meter band. With the rapid increase in two-meter FM amateur radio operations, and with the very sensitive receivers now available for this band at a relatively low cost, the problem has grown nationally by leaps and bounds.

In my travels to cable systems and attendance at numerous industry shows, I have had the opportunity to talk to a lot of people in cable, from service technicians to chief engineers. I am continually surprised to find that many people do not know about (or do not have the proper perspective on) the problem with Channel E. Some know it causes a problem with amateur radio, but feel it is not a cable problem because cable can carry all channels that are licensed by the FCC. They reason that since CATV is an operating business and amateur radio is a hobby, why, then, cable has priority over the hams. Right?

Wrong! A self-righteous attitude is a poor attitude. It does not help cable's image in the community, nor is it the way to conduct a highly service-oriented business, which is what cable is all about. It is unfortunate that so many in the cable industry ignore amateur radio enthusiasts and, to put it mildly, tell them to "get lost."

Two sides of the issue

On the other hand, there are two sides to every story. There are also uncooperative ham operators. A while back, as an engineer at one of our cable systems, I had to deal with an amateur radio operator who was causing a problem to our system's operation. He was running a full kilowatt on six meters and a six-element beam not more than 60 feet from a main distribution trunk spliced near our system. The results were devastating. His six-meter rig was not very clean and when his beam pointed at our cable (in our 300 MHz system), to say the least, we were alarmed. Further, the ham had the same opinion about his rights as did some of our cable people about theirs—he told me to "get lost." With territorial attitudes on both sides, a lot of walls have been built and a lot of problems nurtured.

One day, an idea occurred to me. There is a lot of traffic between 0 to 300 MHz, and with cable operations up to 550 MHz, there are a lot of potential problems. Amateur radio operations alone include over 430,000 ham enthusiasts throughout the United States. It would be nice if the technicians who worked for me in the system had a better understanding of amateur radio and were more sensitive to interference issues in general. If I could get people involved in radio as a hobby, they would become more sensitive to plant leakage issues because they would experience the challenges and think about problems that could be caused by a cable system. I decided to set up an amateur radio club for the system we operated.

I was able to convince our general manager that spending the money to set up a station was a good investment for the system. He approved the funds (after a lot of discussion) and I purchased a used KWM 2-A and a three-element tri-band beam. (He didn't approve a lot of money!)

For security reasons, I installed the ham radio station in my office. Hoping to spark people's interest, I used the radio during working hours to talk to as many far away places as possible. It worked. Several of my staff became interested and after about a week we set up one of the first code classes. Learning Morse Code, which is not difficult, is one of the basic requirements to becoming a ham operator.

The results were great. Two years later, we had 38 hams in the company. There were many benefits. Besides the natural employee/management communications that were established (people had something in common to discuss that was not work related), we found that ham radio was the start of getting more people involved in overall radio training. The need to know more about electronics was driven by the desire to upgrade the "ham ticket." Employees that had rejected any type of classroom training were now requesting classes that would assist them in upgrading their licenses. To encourage this, I set up a program that provided a two-meter transceiver to each employee who obtained a technician's class ticket. The transceiver was used after work for fun and during work hours for locating system leakage.

The local ham clubs were happy to learn that cable system people were actively involved in amateur radio. Nowadays, if they have a problem with our cable system's operations, they call one of our many hams (and not the FCC) to get the problem resolved. Also, members of our club have been popular during amateur radio field day events. Popularity and goodwill have increased with the 15 bucket trucks we use to help amateur radio enthusiasts set up their antennas.

Good citizens

Our cable people have become good citizens of the amateur radio community—understanding and participating, helping fellow hams solve system leakage problems and interference problems not related to the cable system, helping with antenna installations, providing speakers for club meetings, conducting frequency checks of mobile radio equipment, etc. Our newest contribution we are particularly proud of is offering code practice on the cable system at speeds from five to 35 words per minute. The code will be available to those hooked up to the cable system by tuning to a channel on FM radio. The text will be from *Time* magazine (Time Inc. is the major shareholder in ATC.).

It should be clear by now that amateur radio can be an asset to cable TV, if you want it to be. Perhaps above all, it can be fun. Our system currently has five active high-frequency radio stations that have been supplied by the company and a host of two-meter radios used by employees. As a result of the tremendous success of the project and the extensive activities that developed, I had to move the first amateur radio setup out of my office, so I could get some of my other work done.

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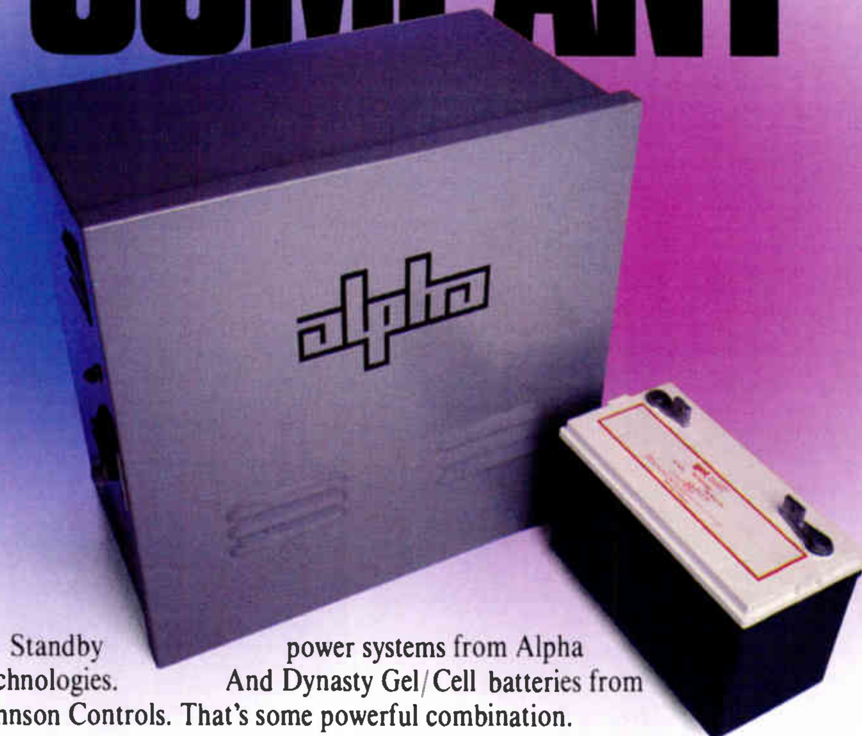

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Reader Service Number 54.

Anchoring utility poles

This is the first of two parts. Part II will discuss drive anchors.

By David Chandler
President, Foresight Products Inc.

Soil classifications

Soil class #	Description of soil
1	Bedrock
2	Hardpan: dense-very dense sand; compact gravel laminated rock; slate schist; sandstone
3	Hardclay; dense sand; shale; broken bedrock; compact clay gravel mixtures
4	Very stiff-hard clay; clay pan; medium-dense sand, gravel; compact gravel and sand
5	Very stiff clay; medium sand; loose sand and gravel
6	Stiff-very stiff clay; medium sand; clayey silt
7	Medium-stiff clay; loose sand; fill; silt
8	Very soft-soft clay; very loose sand; swamp; marsh; saturated silt; humus

The important factors to be considered in the anchoring of utility poles and communications towers are the types of anchors to be used, the types of soils in which the anchors are installed, the equipment required for the installation, the labor force required to make the installation, the amount of time required to install each anchor and the location of anchor installation—backyard, busy street, alley, open country, etc.

There are three types of anchors in general use: auger or screw, expandable or plate, and drive. Auger or screw type anchors are screwed into the ground by digger derricks usually mounted on trucks. The cost of equipment can range from $50,000 to $150,000. The average amount of time spent installing this type of anchor is 20 to 30 minutes per anchor.

Expandable type anchors are placed in a pre-drilled or pre-dug hole in the ground. The blades of the anchor are then expanded by an expanding bar. The hole is refilled with dirt and tamped. The pre-drilling of the hole is done by a large power auger usually mounted on a truck or by hand, taking several hours of dig time. The cost of this equipment is the same as the cost of equipment needed to install auger type anchors, and two or more people are usually involved. Most utilities and contractors report that no more than two expandable type anchors can be installed per day, especially when holes are hand dug.

Drive type anchors are driven into the ground by one person using a hydraulic or pneumatic jackhammer at ground level. Once in the ground they are rotated into a perpendicular load lock position by means of an anchor setting device that pulls up on the anchor rod, rotating the anchor into position underground. A gauge on the anchor setting device tells the installer how many pounds of holding capacity have been locked in. No large trucks or expensive augering equipment is needed. Since all utilities and all contractors have jackhammers and power sources

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Reader Service Number 56.

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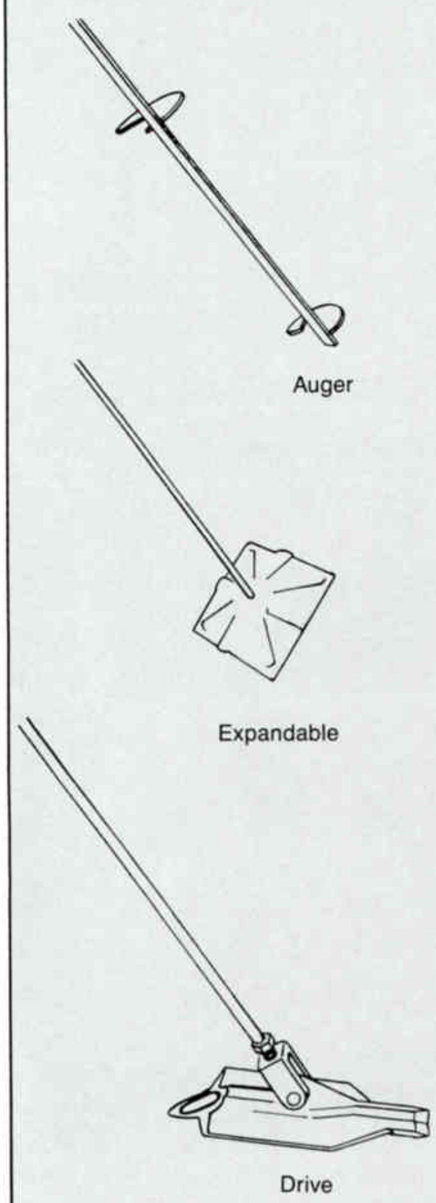
Reader Service Number 57

"Although various soil testing methods are available, there often is not enough time for soil testing in the field."

Anchor types



for them, the only equipment to be purchased are drive gads (to drive the anchor into the ground) and the anchor setting device. The cost for this equipment is under $1,000. The time required for the driving and setting of a drive type anchor is 20 minutes or less in normal soils.

Soil types

Engineering students are taught that soil mechanics is not an exact science, and all engineers must face the reality that there is a limited dependability of results of soil investigations. They also learn that few soil analyses provide highly accurate results; most provide rough estimates at best. For example, in the case of analysis of seepage quantities, it is normal procedure to use a number of laboratory tests on samples of soil from the site. But often a few strata are more coarse than other strata in the area, and the coarser may cause much more seepage than the rest of the soil strata in that same area. In many cases these conditions are discovered only in the field during installation of anchors.

Soils can be classified into two broad categories: cohesive and non-cohesive. Fine grained soils such as clay are cohesive, and sand and coarse-grained soils are non-cohesive. Unfortunately for anchor installers, there are often different layers of soil types underground of different thicknesses. Difficulties occur when a soft soil layer is encountered between two hard soil layers, or vice versa, because anchors obviously achieve greater holding capacity in hard soils.

Although various soil testing methods are available, there often is not enough time for soil testing in the field. With auger and expandable type anchors the holding capacity achieved is often a matter of guesswork based on studies of soils conducted in the past in various regions of the country. An advantage of the drive type anchors is that the gauge on the anchor setting device tells exactly how many pounds of holding capacity have been locked in, regardless of the type of soil in which the anchor has been installed.

All anchor holding capacities vary with the moisture content of the soil. Frozen soil provides a greater holding capacity than soil that is not frozen, and soil that has been subjected to spring thaws provides less holding capacity than dry soil. Anchor holding capacity decreases as moisture content of the soil increases. It must be noted that there are a number of types of anchor pull test rigs in existence to test the holding capacity of installed anchors, but these are not always convenient to use or available in the field.

Soil classifications

The various types of soil are given soil class numbers to identify soil hardness. Soil class numbers are determined in the following ways: from the soil description and standard penetrometer values (ASTM D-1586) if soil boring logs are available, continuous monitoring of installing torque during an anchor installation, pull testing anchors and visual inspection of augered holes.

In the soil class numbers on the accompanying table, soil class number 1 is solid rock. No anchor can penetrate solid rock unless a hole is first drilled through the rock. If there is no way to do this, a different anchoring site must be sought. Soil class numbers 2 through 7 are suitable for the power installation of all three types of anchors, although class 2 is very tough. All anchors will have greater holding capacity in the lower soil class numbers and less holding capacity in higher soil class numbers. In soil class number 8, it is usually necessary to install the anchor to a greater depth, hoping to reach a class 7 soil or better.

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For more information on the loss test set, or Laser Precision's state-of-the-art OTDR's, contact: LASER PRECISION CORPORATION, 1231 Hart St., Utica, NY 13502, or call (315) 797-4449, or telex 646803.

Reader Service Number 58.

Cutting costs using your existing plant

By Norm Canfield
Regional Engineer, Cooke Cablevision

Do you have reverse capability in your cable system? Are you presently using telephone lines to transfer internal data? Perhaps you ought to look at using the reverse capability of your cable system to transfer data or voice communications from one point to another point on your cable system.

The cost of data or voice transfer using telephone lines can be quite expensive. If you have reverse capability it would be worthwhile to look at using your existing cable plant for data or voice transfer. For example, if you have hub sites you would like to link together or put on your central computer system, you could do so with your existing cable system. One of the methods used in this system is shown in the accompanying figure.

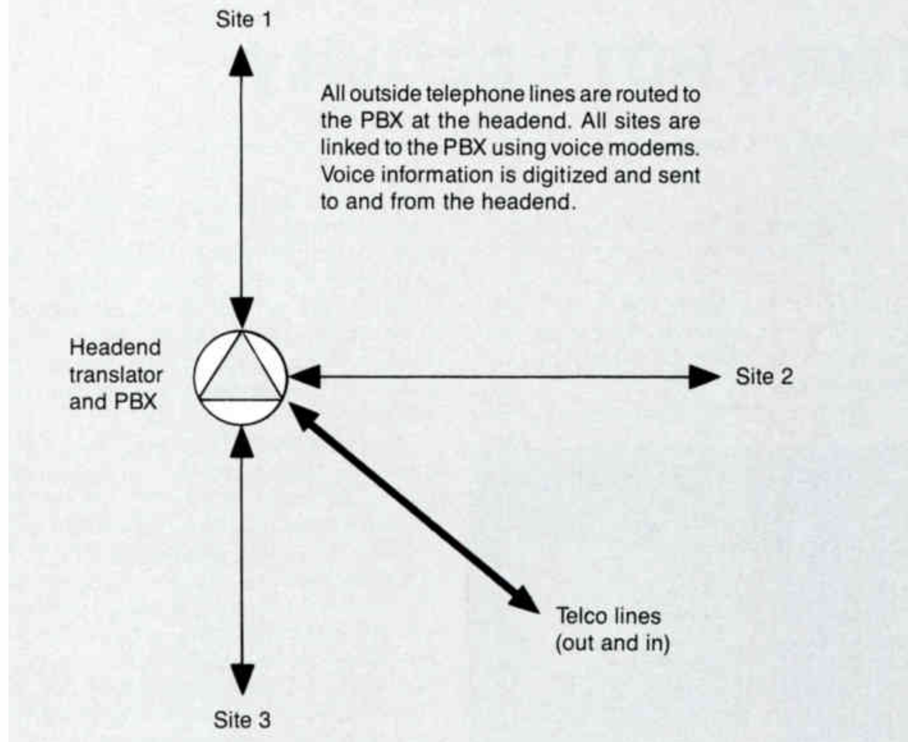
As shown in the figure all outside telephone lines enter the system at the headend, where they are routed to a PBX for switching and routing. All sites are connected to the headend via the cable system using voice modems. All upstream signals from the various sites may or may not be translated (upconverted in frequency) depending on the type of modem you use. Some modems have the capability to use a translator, but in order to achieve full duplex operation you will have to set the transmit frequency to a downstream frequency and the receive frequency to an upstream frequency for the modems at the headend and the opposite for the modems at the various sites.

If you decide you need to use a translator, the standard conversions are 156.25 MHz and 192.25 MHz. Typically the 156.25 MHz translator is used for sub-split cable systems and the 192.25 MHz translators are used for most mid-split and high-split cable systems. When you use a translator, be careful when picking your upstream frequencies to make sure when that upstream is upconverted the new converted frequency doesn't fall on an existing channel you are using for video or data. Also before you order your modems, determine if you need a standard interface (such as RS232) or an optional interface.

Sweep both your forward and reverse lines before you start transmitting and receiving data, as this may uncover problems you did not know existed. Once this is done you should be able to connect your modems to the cable system and begin operation.

"Sweep both your forward and reverse lines before you start transmitting and receiving data."

Voice transfer via existing cable plant



Another use for data transfer on the cable system is to connect remote terminal units to the main computer via the cable system. This is more cost-effective when you have quite a few remote terminals. The faster the data speed needed to effectively communicate with a main computer, the more costly it is using telephone lines.

The speed, ease and reliability of using the cable system to transmit data may surprise you. You could start off by using your cable system as a back-up to telephone lines, but you may find your system is more reliable and faster. Sometimes it is difficult to convince plant management personnel of the benefits of using the cable system instead of using telephone lines, because they are confronted daily with the problems in the system and tend to feel that the cable system isn't reliable enough to do the important things. However, when you look at the big picture you will probably see that most of the time the vast majority of the plant is operating quite well and could easily be used to transfer data.

More HDTV activity

By Lawrence W. Lockwood
President, TeleResources
East Coast Correspondent

This fall there was yet another burst of activity on the HDTV front in Washington, D.C. Each fall the IEEE Broadcast Technology Society holds its annual meeting in Washington, and this year one half-day was devoted to HDTV. A few weeks later in Congress, the House Subcommittee on Telecommunications and Finance held a hearing on, accompanied by a demonstration of, HDTV in the hearing room in the Rayburn House Office Building.

"Unless some American interests...invest substantial funds— and soon—the United States may end up with the Japanese system by default."

At the IEEE conference a technical presentation of three proposed HDTV transmission systems was made. A.G. Uyttendaele from ABC, the session chairman, gave a brief review of the MUSE system of NHK (Japan Broadcasting Corp.). A. Toth of North American Philips Labs described its system and R.J. Iredale from the Del Rey Group reviewed its proposal called HD-NTSC.

The atmosphere at the congressional hearing room was much more lively. The room was packed with congressmen and their staff, the witnesses and an overflowing audience—not to mention many HDTV display monitors. In the audience, aside from many interested government workers, it seemed the entire TV industry was represented. There were leaders from broadcast (National Association of Broadcasters, NBC, CBS, ABC, PBS, etc.), from cable (National Cable Television Association, various MSOs, etc.), from various manufacturers (Sony, North American Philips Corp., RCA/GE, etc.) and innumerable independent experts. The equipment demonstrated was the same NHK/MUSE system that had been demonstrated earlier in the year at the FCC (*CT*, March 1987, page 76). Thirteen witnesses that testified for the congressional committee were split about half and half between the administrative/political areas and the technical areas. NBC (S. Bonica, vice president of engineering) presented a brief review of the new NBC-GE-Sarnoff Labs proposed HDTV transmission system called ACTV (advanced compatible TV).

There was great emphasis from all the witnesses that the current receiver base of about 140 million TV receivers in this country should not be disenfranchised by any new HDTV transmission system that might be accepted; i.e., the system should be "compatible" with NTSC. (*Compatibility* as used here is defined: Any HDTV transmission scheme must produce at least one signal that can be received by a current NTSC standard TV receiver without modification or addition—i.e., with the TV receiver "as is.")

Table 1: 1,125 / 60 / 2:1 studio system

1,125	lines per frame
60	hertz field frequency
2:1	interlace
16:9	aspect ratio
1,035	active lines

Figure 1: MUSE sampling pattern

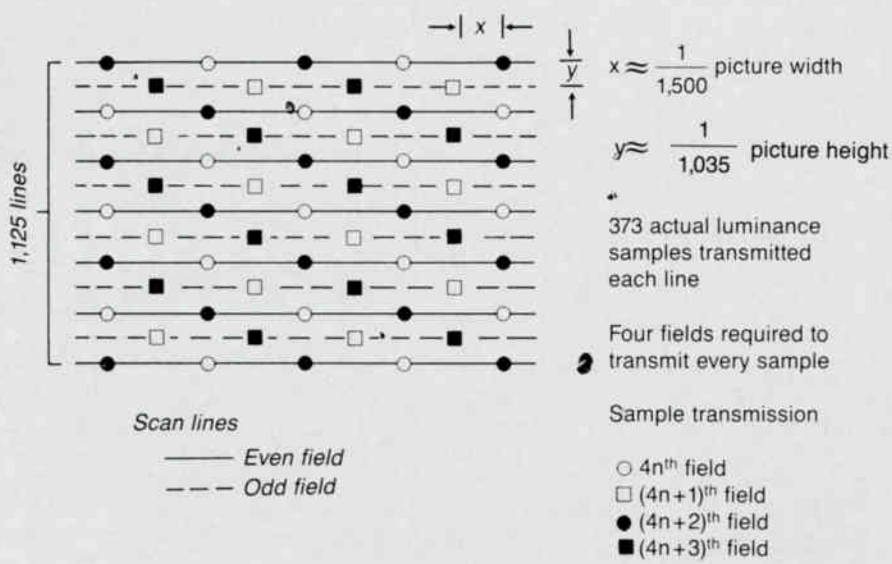


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Table 2: Comparison of NTSC and HDTV transmission methods

	Compatible?	Number of channels required	Bandwidth (MHz)	Resolution pixels/frame Vert.*	Resolution pixels/frame Horiz.**	Number of scan lines/frame	Aspect ratio	Interlace***	Approx. Kell factor
NTSC	N/A	1	6	483	440	525	4:3	2:1	0.7
MUSE	No	2	8.1	1,035	1,496	1,125	16:9	2:1	0.8
North American Philips	Yes	2	9.5	483	853	525	16:9	Transmit 2:1 Display 1:1	1.0
Del Rey Group	Yes	1	6	828	1,320	Transmit 525 Display 894	14:9	2:1	1.0
ACTV	Yes	1	6	483	747	Transmit 525 Display 1,050	16:9	2:1	0.87

*To get vertical resolution in TV lines, multiply by the Kell factor (its value varies with system claims from 0.7 to 1.0). The resultant is usually referred to as the resolution of the TV system.
**In this direction, pixel values are equivalent to TV lines.
***There has been considerable speculation that all HDTV displays will be produced with an interlace of 1:1. This will be possible, since each HDTV receiver will require a frame store.

To cap off the equipment demonstration, the first international satellite broadcast of HDTV was made from Canada (CBC) directly to the congressional hearing room.

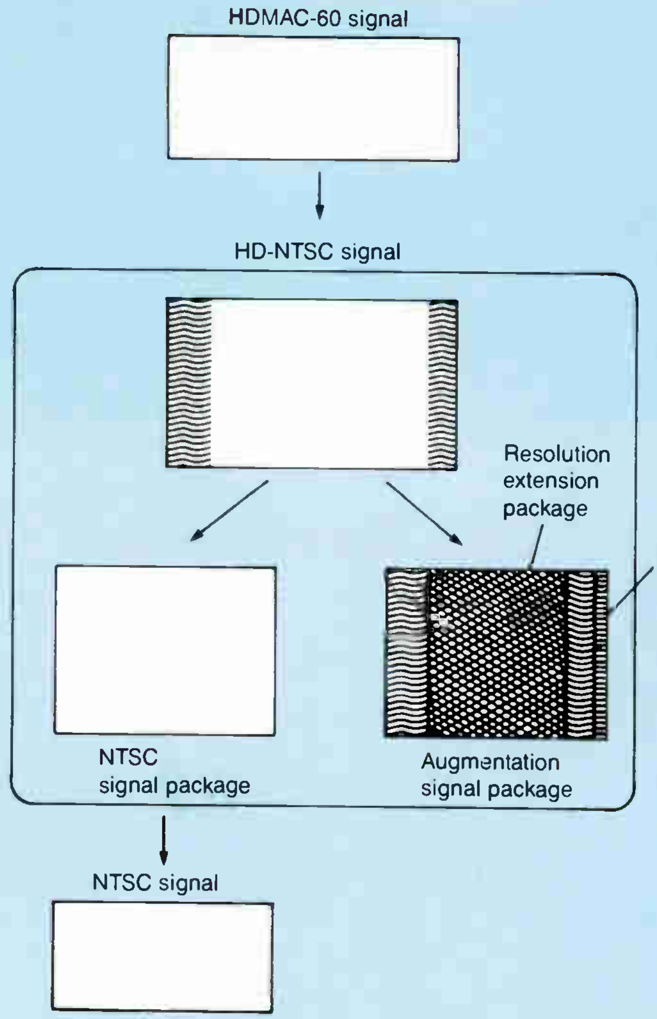
Brief outline of HDTV systems operation

These brief descriptions are *very* brief indeed and thus may be regarded as more intuitive tutorials than as complete system descriptions.

The HDTV signal source specifications, before transmission by the proposed transmission systems, are shown in Table 1.

- In the MUSE (Multiple Sub-Nyquist Encoding) system the luminance and color difference signals are band limited and then digitized. The resulting data stream is "subsampled"—one of every four samples in each succeeding line for four consecutive fields (two frames) is transmitted and, after four fields, every sample will have been transmitted. This process, depicted in Figure 1, produces high-quality still pictures, but the resolution of objects in motion is lower than the resolution of stationary objects. This system is not compatible—cannot be received on current NTSC receivers and the bandwidth required for this system is 8.1 MHz. Therefore it will require two standard TV broadcast channels.
- The North American Philips (NAP) approach[1] is considerably different. In a much simplified description, it takes the HDTV signal, processes it and transmits it in two channels (see Figure 2). One channel has become a standard NTSC channel called "NTSC signal package" (NTSC-SP) and the other channel is called the "augmentation signal package" (A-SP). In essence, one standard TV channel carries the center of the picture in a standard manner and another standard TV channel is required to carry the "side panels." Since in this technique the vertical scan rate is reduced from 1,125 to 525 the vertical resolution is decreased, but since the scan is progressive (interlace 1:1) the developers

Figure 2: Signals of North American Philips proposed system

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claim that they achieve a Kell factor of unity. However, if this proves out in production/operation, the vertical resolution will still be limited to 480 lines (acknowledged by the developers). (For a good review of the history of the Kell factor see Reference 2.)

- The Del Rey Group HDTV system[3] proposes HDTV transmission in one standard NTSC channel. It, like the MUSE system, utilizes transmission bandwidth compression by "subsampling." However, its specific subsampling methodology is different in two major ways. First, it takes six rather than four fields to complete the frame; and second, the samples of two vertical lines are combined into one line for transmission (See Figure 3).

There is one other significant factor to be accounted for if the HDTV signal is to be "fit" into the NTSC channel; i.e., the aspect ratio of HDTV = 16:9 but NTSC = 4:3. The Del Rey Group's proposal is to lop off 35 scan lines from the top of the scan and 34 lines from the bottom, leaving 414 lines for the video as opposed to the 483 scan lines available for video information in NTSC. These extra lines are then available for data or digital stereo audio at about 600 kbps. The reduced height vs. width of the picture then yields an aspect ratio of 14:9 (close to the NHK of 15:9 or the ATSC of 16:9). See Figures 4a and 4b.

- The NBC ACTV system[4] proposes the HDTV transmission in one standard NTSC channel. However, it achieves its compression by separating the baseband HDTV signal into a main center panel, two side panels and then creating four signal components, which are then combined and carried by means of subcarriers in the standard NTSC channel (Figures 5a and 5b). This proposal then would allow a standard NTSC receiver to receive this signal in the normal manner while a special HDTV receiver splits out the components remaking the HDTV picture with its wide aspect ratio.

Table 2 shows a comparison of key signal components of NTSC and the proposed HDTV transmission methods.

There are a few proposals for HDTV transmission systems other than those described here. Some who consider themselves in the race are: New York Institute of Technology (Dr. William Glenn), CBS, Bell Laboratories and others. However, none have publicly verified any of their claims.

It is apparent that all HDTV transmission systems depend heavily on quite sophisticated digital signal processing both at the transmission end and in the receivers. With all the current proposed transmission schemes (and probably in any future proposals) every receiver will require a frame store. Only a few years ago costs limited this capability to broadcasters only but the rapidly decreasing prices of all types of digital chips have brought this requirement within sight of premium consumer equipment.

Each of the proposed schemes suffers, in varying degrees, from motion in the picture. The widely demonstrated MUSE system has made efforts, quite successfully, to overcome this problem. However, each system currently proposed, or proposed in the future, will have to be subjected to close examination on this issue. In ad-

dition, any HDTV transmission system must be subjected to extensive field testing. There are some apparent possible transmission problems that will have to be tested. As an example, in a two-channel system that has the center and side panels sent on different channels, what effects can be expected if, say, the main channel, with the center of the picture, is sent on VHF and the side panels on a high UHF channel? How will different reflections, both permanent and transient, affect the picture? Will rain, passing planes, etc., cause the sides of the picture to "flutter" at the viewer? There are many conceivable factors to be tested in each method and, if life and Murphy prove true to form, more will be found during the field testing.

Conclusions

It is of significant note that all the public demonstrations of HDTV (e.g., at the FCC, before Congress, etc.) have used the Japanese MUSE system. It is the only one ready for production. North American Philips has made one private demonstration of experimental equipment. The others (Del Rey Group and even the NBC system) have, at best, only been simulated by computer (no system hardware). Bonica said that the NBC system might be at the prototype stage some time next year—perhaps midyear. However, it is important to note that NHK has been at work on its HDTV for 17 years and has invested an estimated $300 million, and it is apparent it intends to invest much more. The Japanese Government Ministry of Posts and Telecommunications has plans for a fiber-optic link of 10 "high vision cities" to network HDTV theater centers. This will help promote HDTV in Japan; the first city in the network is planned for 1989 (either Tokyo or Osaka). The government is reported to be ready to aid this promotion financially by tax incentives.

It is certainly worth observing that "bottom line" mentality has resulted in no American-owned TV laboratories (with the exception of Zenith) left in this country—the originator of color TV, video recording and other fundamentals of present-day television. RCA labs were given away, CBS labs were closed, GE TV was sold and on it went until now there are none. Unless some American interests care enough to invest substantial funds—and soon—the United States may end up with the Japanese system by default. The Japanese are already selling HDTV studio equipment to a number of U.S. production houses and it will soon be (if not already) the de facto standard there. The Europeans have resolutely refused to adopt the Japanese standards and have embarked on a program called "Eureka," to develop their own system.

This is not a polemic on the Japanese but rather the voicing of a fond hope (I trust not a hope*less* one) that the country that drove, both by development and production, the formation of TV as it is today will not give up on this new and huge area of the business. Rep. Don Ritter (R-Pa.), a member of the House committee that held the hearings, said, "We are talking about the next revolution in television and right now we are just not a player."

Looking toward the ideal HDTV transmission

Figure 3: Del Rey Group sampling pattern

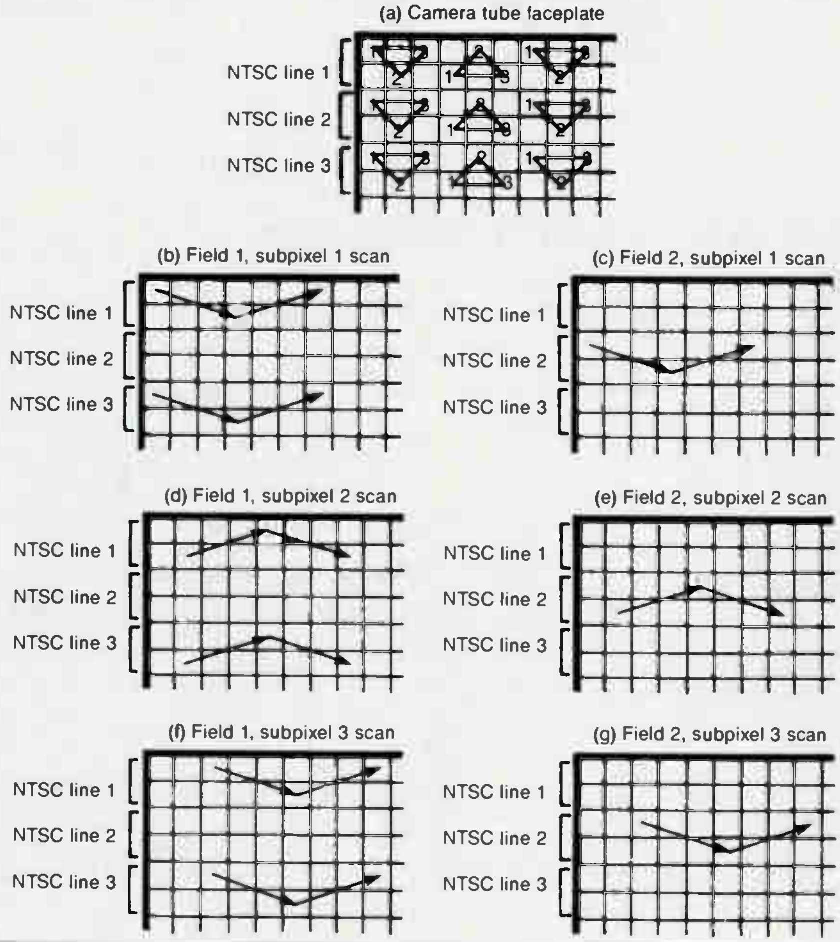


Figure 4a: Del Rey Group screen format

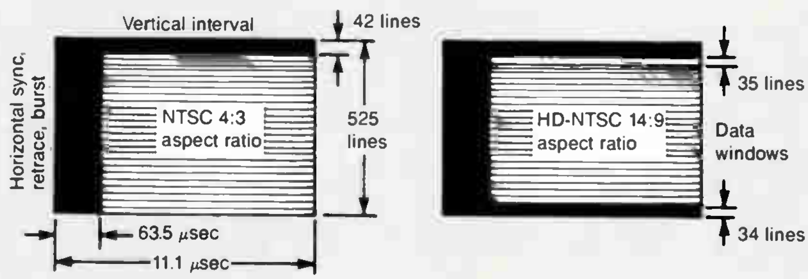


Figure 4b: 14:9 aspect ratio viewed on an NTSC receiver

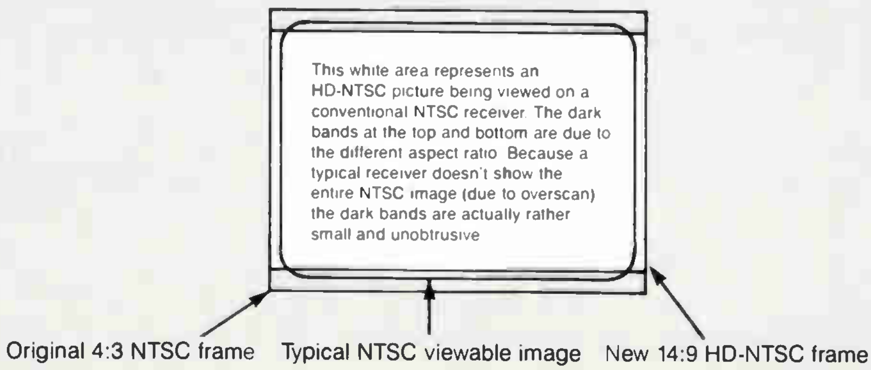
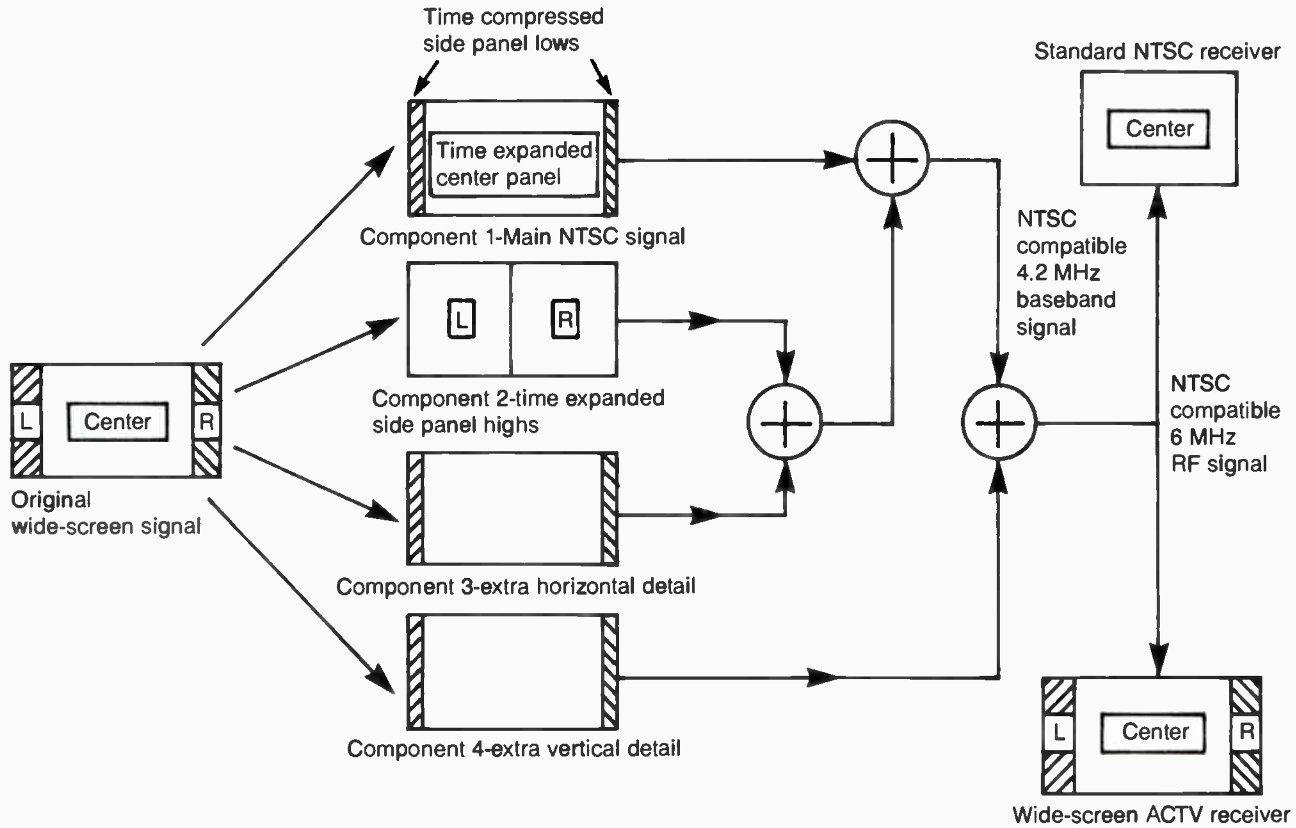


Figure 5a: Block diagram of proposed NBC ACTV system

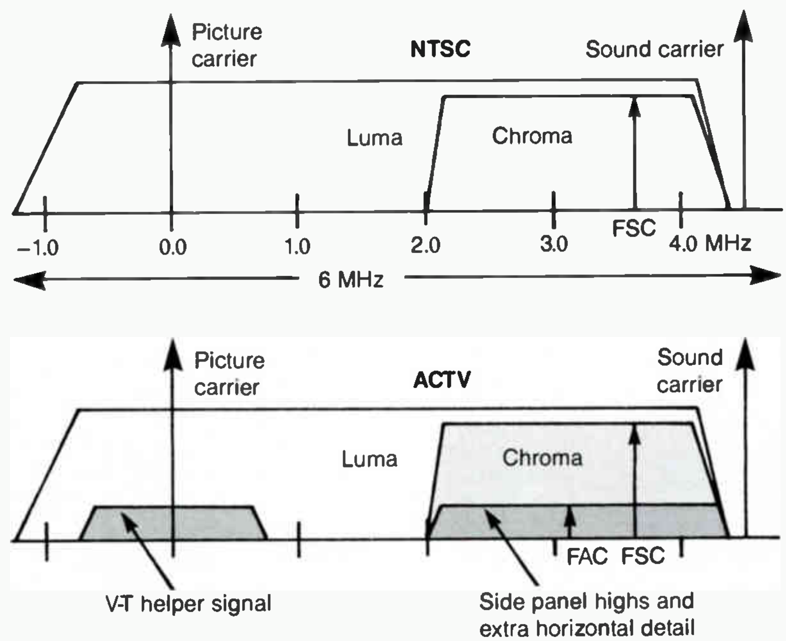


system, the robustness of the current NTSC system should be held as a model. It was established over 40 years ago and has been flexible enough to accept such major modifications as color and stereo sound. Whatever HDTV transmission standard is finally accepted, even if it initially will not produce the full definition, aspect ratio, etc., of the HDTV source, the standard should be so conceived and developed that it has the flexibility and adaptability to accept upgrades to the system as they may be developed toward providing the truest HDTV transmission but without any changes required in the then-established HDTV receiver base. With the exception of the MUSE system, all the ones reviewed here make that claim. Of course, these claims must be subjected to rigorous analysis and testing.

The path to a higher definition TV is already ordained by the new VCRs (S-VHS and Sony EDTV) that produce over 50 percent more resolution in the current NTSC format on new available matching larger screen receivers. The resultant demand for sharper, larger pictures certainly will lay the groundwork that HDTV can satisfy.

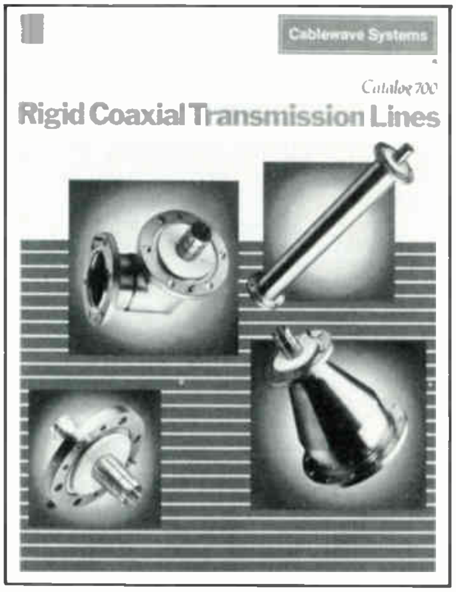
Since Japansese manufacturers are set to produce HDTV receivers, HDTV VCRs and HDTV laser discs (they were all demonstrated at the FCC and before Congress), the time frame to produce an American HDTV system shrinks.

Figure 5b: RF spectrum of NTSC and NBC ACTV signals



References

[1] "Hierarchical High-Definition Television System Compatible with the NTSC Environment," September 1987, Philips Laboratories.
[2] "The Kell Factor: Past and Present," S.C. Hsu, *SMPTE Journal*, February 1986.
[3] "A Proposal for a New High-Definition NTSC Broadcast Protocol," R.J. Iredale, *SMPTE Journal*, October 1986.
[4] Testimony of Steven Bonica, vice president of engineering, NBC, before the Subcommittee on Telecommunications and Finance, Oct. 8, 1987.



Catalog

Cablewave Systems has issued its new 48-page catalog describing its rigid coaxial transmission lines, including hardware and installation accessories, custom assemblies, FM broadcast directional couplers, low pass filters and pressurization equipment. Also, the catalog includes performance curves, an installation section and an engineering data section.

For more details, contact Cablewave Systems, 60 Dodge Ave., North Haven, Conn. 06473, (203) 239-3311; or circle #104 on the reader service card.

Satellite receiver

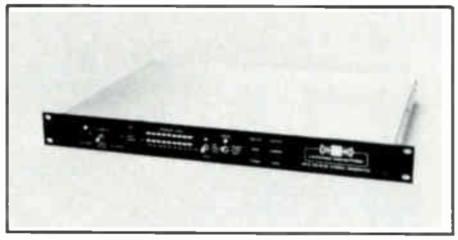
Panasonic Industrial Company has introduced the compact CRD-4400 integrated receiver/decrambler (IRD) with built-in VideoCipher II. It also has an internal programmable antenna positioner with on-screen graphics and proprietary ambience audio circuitry, an external power supply with one-touch connection and a compact remote control unit.

For further information, contact Panasonic Industrial Co., 1 Panasonic Way, Secaucus, N.J. 07094, (201) 348-7183; or circle #135 on the reader service card.

Audio modulator

FM Systems announced its Model FMT631SAP second audio program modulator, designed to provide one new audio channel for each baseband-originated TV channel in the cable system. According to the company, audio service can be received by subscribers owning a stereo TV set, stereo VCR or TV stereo adapter. The channel can be applied to the company's Model FMT633S audio modulator or connected to monaural TV modulators directly.

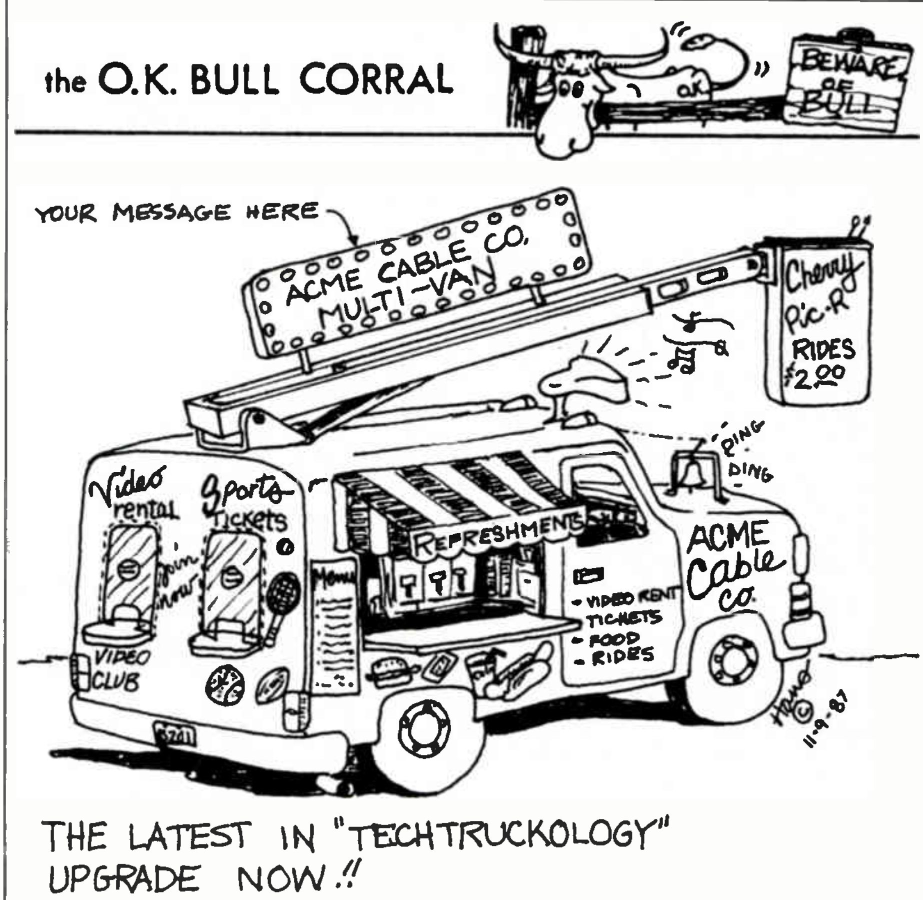
For further information, contact FM Systems, 3877 S. Main St., Santa Ana, Calif. 92707, (714) 979-3355; or circle #99 on the reader service card.



Stereo generators

Leaming announced that its MTS-2 series BTSC stereo generators now have LED bar graph metering and frequency response flat out to 15 kHz. These products encode satellite or local programming into the BTSC format using dbx companding, with a true AGC built in to reduce the need for audio level adjustment. A Bessel null test tone generator is included to set the deviation.

For more details, contact Leaming Industries, 180 McCormick Ave., Costa Mesa, Calif. 92626, (714) 979-4511; or circle #138 on the reader service card.



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Reader Service Number 67.

FINAL CALL FOR PAPERS

Synopses for planned technical papers due

by Jan. 1, 1988

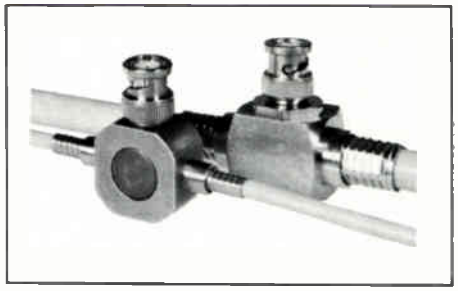
NCTA, in preparing for the Cable 88 technical program, invites readers to submit synopses of planned technical papers -- on any communications engineering topic of interest to the cable television industry -- for consideration by the Cable '88 technical program selection subcommittee. Forty to fifty paper ideas will be selected on January 6th for placement in ten convention technical sessions. Judges look for reference value and originality (although updated works are acceptable) in the context of operations or design problem solving treatments. Product pitches will not be considered.

If your paper proposal is accepted, you must complete a camera-ready manuscript within six weeks for inclusion in the 1988 NCTA Technical Papers volume -- 29th in the NCTA conference proceedings series. Oral presentations, based on the papers, within the technical sessions will be limited to 15 minutes generally, but the manuscripts may be from three to 15 pages long. To qualify for the jurying process, send a synopsis to:

Katherine Rutkowski
Director, Technical Services
National Cable Television Association
1724 Massachusetts Avenue, NW
Washington, D.C. 20036
(Telecopier: 202-775-3604)

With your synopsis include complete name, job title, work address, and telephone number for the primary author and any co-authors; the paper synopsis should be from 200 to 300 words long. Provide the judges with enough specifics about your planned [not previously published] paper to show its reference value. Call Katherine Rutkowski at 202/775-3637 if you need further details.

Topics of particular interest= cable TV and: fiber optics, high definition television, customer service, signal leakage , PPV



Tap connectors

Gilbert Engineering announced availability of its Ethernet coaxial tap connectors. Two versions are available, one for standard Ethernet cabling and another for thin Ethernet cable. Both accept PVC- or plenum-type cables and provide a BNC plug for transceiver connection. The tap system is a single unit crimping directly to the coax cable. In-line crimping eliminates accidental circuit interruption.

For further details, contact Gilbert Engineering, 5310 W. Camelback Rd., Glendale, Ariz. 85301, (602) 245-1050; or circle #141 on the reader service card.

Monitor

C-COR introduced its PSM power supply monitor hardware for single- and dual-cable broadband systems. The PSM integrates the monitoring and control of standby and redundant power supplies with its Quick Alert system. It can monitor a variety of parameters, depending upon the specific power supply such as battery voltage, battery lockout, output current, main/auxiliary status, fault status, standby status, door status and charger control. Specific units also can control features such as inverters, force to standby, main/auxiliary control and charge or float functions.

For further information, contact C-COR Electronics, 60 Decibel Rd., State College, Pa. 16801, (814) 238-2461; or circle #140 on the reader service card.

550 MHz taps

Toner Cable Equipment introduced its Royal 550 MHz multitaps, which include two-way and four-way taps in small housing and an eight-way in larger housing. Both housings are of a precision die-cast aluminum with all surfaces covered by an electrically passive, electrochemical coating to improve conductivity and provide corrosion resistance; the final corrosion coating is an electrostatically applied paint.

The tap housing is designed for aerial strand mounting and underground cable applications using pedestals or vaults and has a stainless-steel strand clamp fastened with a 3/8-inch stainless-steel hex head bolt. All electronic circuitry are protected by a plastic cover located on the removable tap mounting plate. Connection for RF and power between the housing and tap plate is made by a pin and socket.

For additional information, contact Toner, 969 Horsham Rd., Horsham, Pa. 19044, (800) 523-5947; or circle #122 on the reader service card.

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- ☐ 5. MDS, STV or LPTV Operator
- ☐ 6. Microwave or Telephone Company
- ☐ 7. Commercial Television Broadcaster
- ☐ 8. Cable TV Component Manufacturer
- ☐ 9. Cable TV Investor
- ☐ 10. Financial Institution, Broker, Consultant
- ☐ 11. Law Firm or Government Agency
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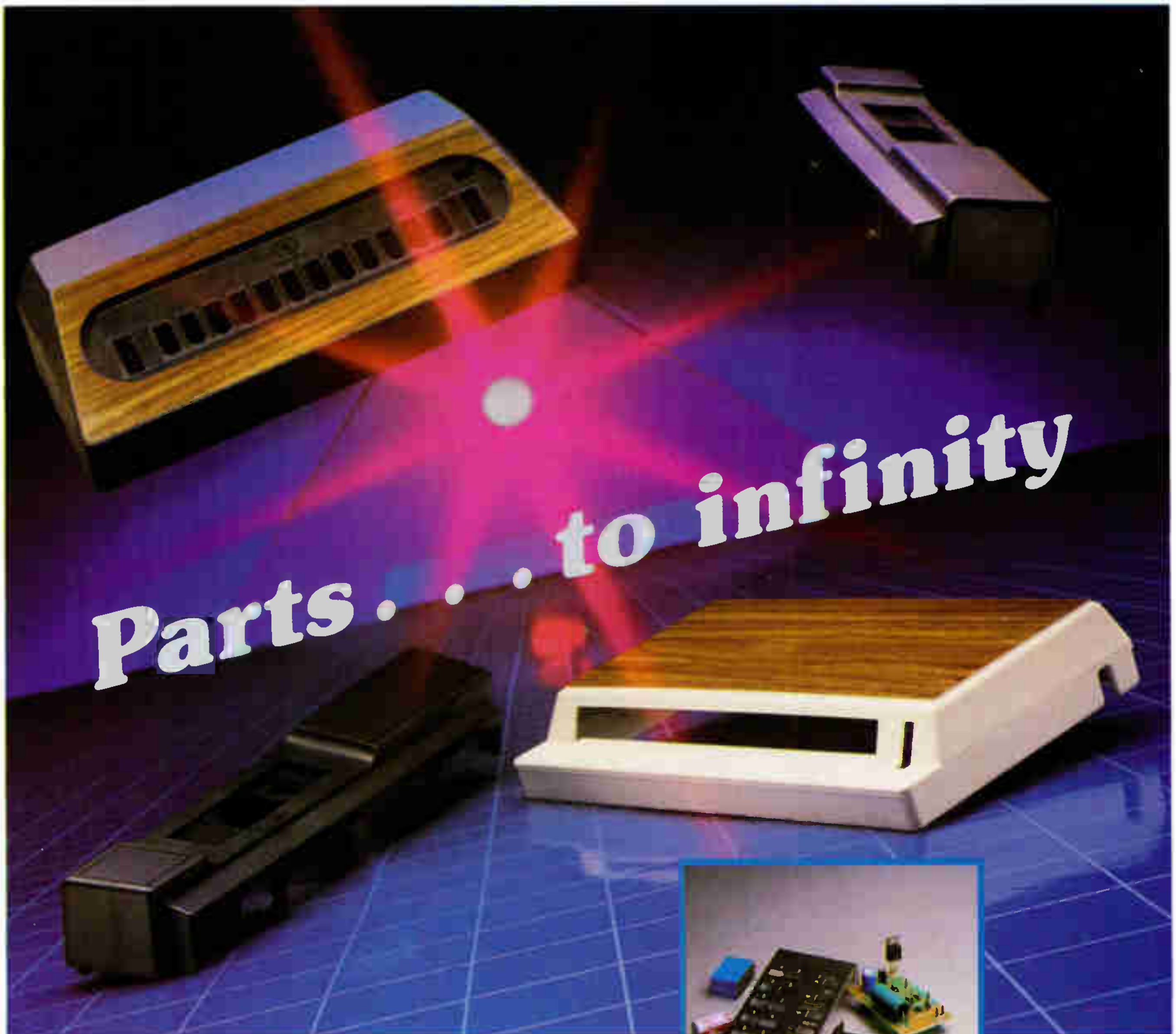

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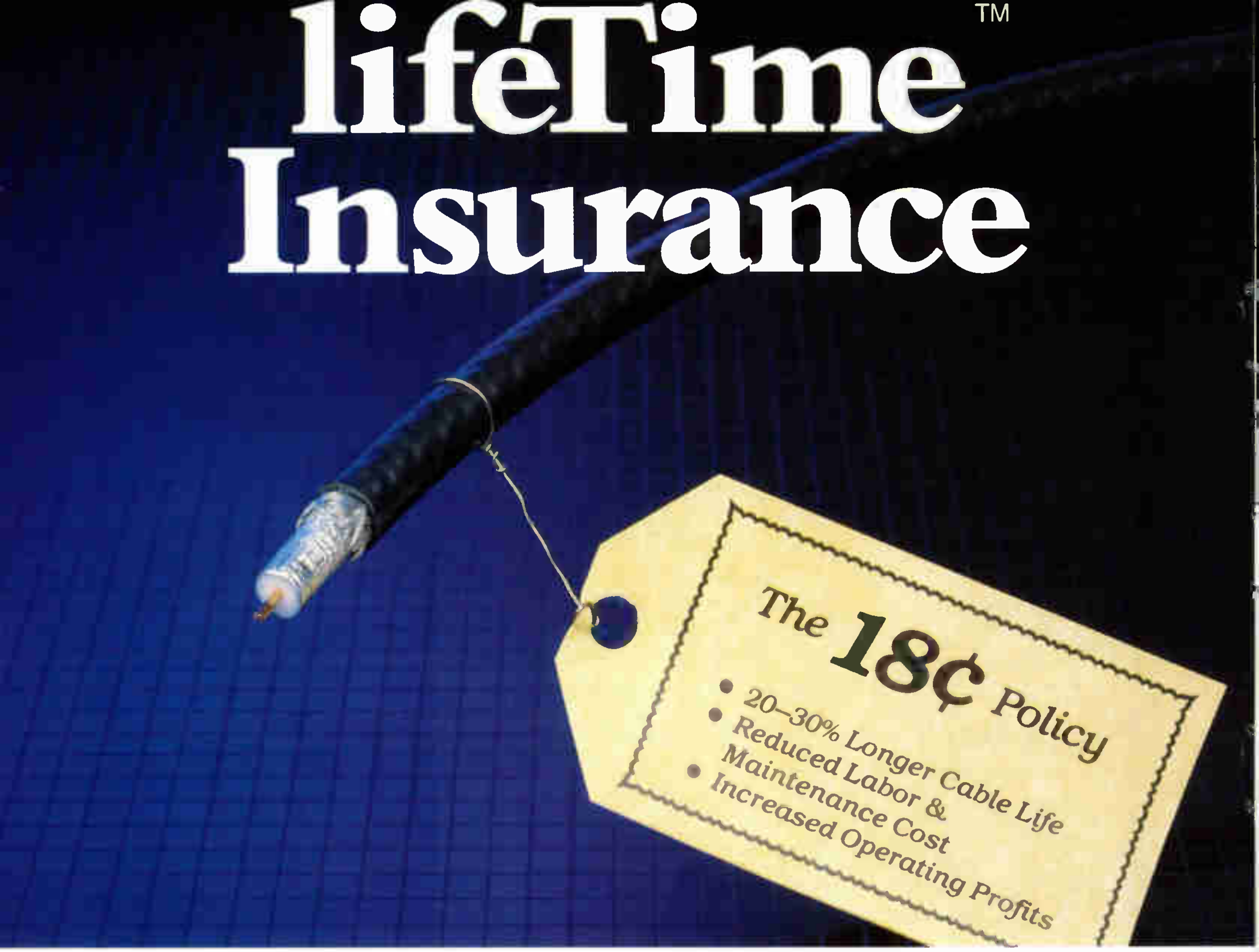

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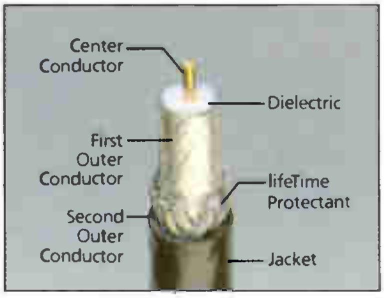

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Reader Service Number 70.

Dispatch system

The Computer-Aided Radio Service Dispatch System (C-ARDS) from the Technical Products Division of CNG Energy uses digital communications to transmit information through radios between a dispatch center and mobile data terminals such as installer vehicles. The system consists of three components: a dispatch console with accompanying computer software, a station controller and mobile data terminals. The terminals enable field personnel to communicate with the dispatcher, send information and access data stored in the microcomputer or a host computer.

According to CNG, the system replaces voice communication with speed, accuracy, privacy and immediate information access with a complete system of hardware, software and support.

For more details, contact CNG Energy Co., Technical Products Division, P.O. Box 5759, Cleveland, Ohio 44101-0759, (216) 432-6676; or circle #133 on the reader service card.

Cable identifier

AEMC Corp. introduced Fibrotest 1, a continuity tester/cable identifier designed for installation and troubleshooting of fiber-optic cable. The product connects to the fiber under test with a built-in SMA connector and uses visible light to identify the fiber and check continuity. It can be used with all optical fibers and connector types.

For additional information, contact AEMC Corp., 99 Chauncy St., Boston, Mass. 02111, (617) 451-0227; or circle #130 on the reader service card.

Cable shielding

Schlegel Corp. introduced its EMI cable shielding that attenuates up to 100 dB for cables and cable harnesses of all configurations. According to Schlegel, the product provides highly effective shielding and is flexible, durable and corrosion resistant. It seals with fingertip pressure and can be opened and resealed at any time with no loss of shielding integrity.

For further information, contact Schlegel Corp., Industrial Products Division, P.O. Box 23197, Rochester, N.Y. 14692, (716) 427-7200; or circle #136 on the reader service card.

Remote control tester

Available from Philips ECG, the RCT7501 remote control transmitter tester can be used to test both ultrasonic and infrared remote controls. It features an LED go/no-go test to detect transducer output directly without electrical connections as well as a frequency counter test jack.

For additional information, contact Philips ECG, 100 First Ave., Waltham, Mass. 02254, (617) 890-6107; or circle #137 on the reader service card.

Cable fault locator

The Biddle Instruments Model CFL510, a four-range, battery-powered, hand-held TDR (time domain reflector) cable fault locator, can provide a cable trace indicating faults up to 9,500 feet in length. The product user checks out the velocity of propagation, sets the range and moves the cursor to fault or discontinuity on the trace. The instrument then automatically shows distance to the fault.

The instrument is designed to identify and locate opens, shorts, taps, splits and resplits, and water saturation, as well as open concentric neutrals and faults on aluminum conductors in underground power cables.

For further information, contact Biddle Instruments, 510 Township Line Rd., Blue Bell, Pa. 19422, (215) 646-9200; or circle #132 on the reader service card.

Spectrum analyzer

The TR4131 Series general purpose spectrum analyzer from Advantest America is designed to cover a wide frequency range from 10 kHz to 3.5 GHz in a single sweep. It is equipped with digital memory and display functions. For example, the digital memory can produce two screen displays that permit simultaneous viewing of spectrum displays. Features include a marker function for data readout, maximum hold for measurement of frequency drift and sweep, peak hold and a market-centering function.

For more information, contact Advantest America, 300 Knightsbridge Pkwy., Lincolnshire, Ill. 60069, (312) 634-2552; or circle #131 on the reader service card.

Circuit tester

Etcon announced its RL404 circuit tester designed for AC voltages from 100 to 500V. The plastic tester features a slim metal screwdriver probe and a clip that permits it to be carried in a shirt pocket.

For more details, contact Etcon Corp., 7750 Grant St., Burr Ridge, Ill. 60521, (312) 325-6100; or circle #134 on the reader service card.

Hydraulic hammer

Allied's Model 350 X-Ram rotary hydraulic impact hammer utilizes double eccentric design for light breaking applications. Two counterbalanced eccentric weights cause the hammer's housing to oscillate and hit the chisel 1,200 times per minute. It is designed to be attached to small backhoes, skid steer loaders or mini-excavators to break concrete, pavement and rock with chisel and conical point demolition tools. Asphalt cutters and tamper tools are also available.

For more information, contact Allied, 5800 Harper Rd., Solon, Ohio 44139, (216) 248-2600; or circle #129 on the reader service card.

RF software

ComNet Engineering Co. is offering its Broadband System Engineering, a computer-aided engineering software package that designs RF broadband cable networks for both the LAN and CATV industries. The PC software features include: designs any kind of split or dual cable from 1 to 600 MHz; automatically selects taps by minimum drop level; change cable sizes anytime; delete, insert or replace designed components followed by an automatic recalculation of the RF paths; a highly interactive user screen interface; speed key commands, saves and reloads design files; help screen; and prints bill of materials used and RF design analysis to local printer or ASCII text file.

For more information, contact ComNet Engineering, 3310 Western Dr., Austin, Texas 78745, (512) 892-2085; or circle #98 on the reader service card.

Optical power meter

Philips Telecom has produced the OPM-6 optical power meter for fiber-optic cable testing. The product covers a wavelength range of 800 to 1,800 nm and is calibrated at three switch-selectable standards (850, 1,300 and 1,550 nm) with others optional. It features a large readable LCD display, automatic display function test and automatic switch-off.

For more information, contact Philips Telecom Equipment Corp., Test Equipment Division, 250 Federal Rd., Unit C22, Brookfield, Conn. 06804, (203) 755-4401; or circle #139 on the reader service card.

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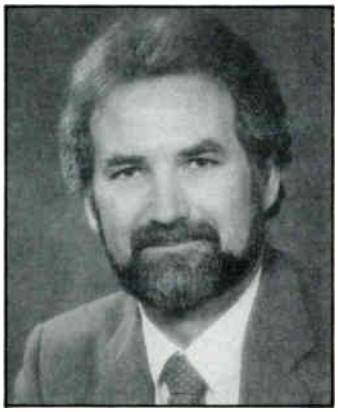

Leffingwell

Wegener Communications promoted **Ken Leffingwell** to manager of marketing services. Prior to this, he was sales engineer for the company. Contact: 11350 Technology Circle, Duluth, Ga. 30136, (404) 623-0096.

Richard Roberts, president and CEO of TeleCable Corp., was named chairman of the **National Cable Television Association**'s Blue Ribbon Committee on High Definition Television (HDTV). The committee will consider from the cable industry's perspective the policy and practical ramifications involved in the development of HDTV. Contact: 1724 Massachusetts Ave., N.W., Washington, D.C. 20036, (202) 775-3629.

James Crenca was promoted to executive vice president of **Comsearch**. He was formerly vice president of business development for Comsearch Applied Technology. Contact: 11720 Sunrise Valley Dr., Reston, Va. 22091, (703) 620-6300.

Richard Taylor was named national sales manager for **C-COR Electronics**. He was previously North Central regional account executive for the company. Contact: 60 Decibel Rd., State College, Pa. 16801, (814) 238-2461.

Robertson

Texscan MSI recently appointed **Bruce Robertson** as industrial sales manager. Previously he was with Computer Video Systems.

The company also named **Ruth Marshall** product training supervisor. Before joining MSI, she was traffic director of International Television Network. Contact: 124 N. Charles Lindbergh Dr., Salt Lake City, Utah 84116, (801) 359-0077.

James Slade was named marketing manager for CATV products at **Panasonic**. Previously, he had marketing responsibilities for the company's Matsushita Technology Center. Contact: 2 Panasonic Way, Secaucus, N.J. 07094, (201) 348-7000.

High Resolution Sciences named **Denes Ilkovics** senior vice president of technology and product development. Previously, he was chairman of ITT-Europe's Inteligent Products Steering Group and director of ITT's Information Systems Technology. Contact: 726 N. Cahuenga Blvd., Los Angeles, Calif. 90038, (213) 463-9000.

ADC Telecommunications appointed **Thomas Stanley** district manager for its Southeast district. Prior to joining ADC, he was national sales manager for Lear Siegler Sierra. Contact: 4900 W. 78th St., Minneapolis, Minn. 55435, (612) 835-6800.

Reader Service Number 77.

December

Dec. 5: SCTE Cactus Chapter BCT/E review course and testing on Category IV-Distribution Systems. Contact Chris Radicke. (602) 938-0777.

Dec. 8: SCTE Central Illinois Meeting Group technical seminar, Bloomington Normal Sheraton Inn, Bloomington, Ind. Contact Tony Lasher, (800) 252-1101; or Ralph Duff, (217) 424-8478.

Dec. 9: SCTE Greater Chicago Chapter technical seminar, Embassy Suites Hotel, Schaumburg, Ill. Contact John Grothendick, (312) 438-4200.

Dec. 9: SCTE Oklahoma Meeting Group technical seminar. Contact Herman Holland, (405) 353-2250.

Dec. 9: SCTE Chattahoochee Chapter technical seminar. Contact Guy Lee, (404) 451-4788.

Dec. 9-11: Center for Professional Development seminar on fiber-optic communications, Arizona State University, Tempe, Ariz. 85287. Contact (602) 965-1740.

Dec. 10: SCTE Central Indiana Chapter technical seminar. Contact Steve Murray, (317) 788-5968; or Joe Shanks, (317) 649-0407.

Dec. 10: SCTE North Jersey Chapter technical seminar and BCT/E testing. Contact Virgil Conanan, (212) 512-5309.

Dec. 16: SCTE Great Lakes Chapter technical seminar. Contact Vic Gates, (313) 422-2814.

Dec. 29: SCTE Satellite Tele-Seminar Program, "Performing measurements on basic test equipment," 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888.

January

Jan. 10-12: Caribbean Cable TV Association annual meeting, Frenchman's Reef Beach Resort, St. Thomas, U.S. Virgin Islands. Contact Andrea Martin, (809) 774-2080.

Jan. 12-14: Jerrold technical seminar on applying problem-solving technology, Quality Hotel, Los Angeles. Contact Jerry McGlinchey, (215) 674-4800.

Jan. 18-20: SCTE Florida Chapter seminar on fiber optics, Hyatt Orlando Hotel, Orlando, Fla. Contact Dick Kirn, (813) 924-8541; or Pat Luckett, (305) 660-5524.

Jan. 26: SCTE Satellite Tele-Seminar Program on digital TDRs and Part II of "Signal processing centers," 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888.

Jan. 26-28: C-COR Electronics technical seminar, San Francisco. Contact Shelley Parker, (814) 238-2461.

Jan. 29-30: Society of Motion Pictures and Television Engineers annual television conference, Opryland Hotel, Nashville. Contact John Varrasi, (914) 761-1100.

February

Feb. 2-3: Arizona Cable Television Association annual meeting, Hyatt Regency, Phoenix, Ariz. Contact (602) 257-9338.

Feb. 9-11: Jerrold technical seminar on problem-solving technology, Sheraton Hotel, Orlando, Fla. Contact Jerry McGlinchey, (215) 674-4800.

Planning ahead

Feb. 17-19: Texas Show, Convention Center, San Antonio, Texas.

April 30-May 2: NCTA Show, Convention Center, Los Angeles.

June 16-19: SCTE Cable-Tec Expo, Hilton Hotel, San Francisco.

Sept. 7-9: Eastern Show, Atlanta Merchandise Mart, Atlanta.

Sept. 27-29: Great Lakes Expo, Detroit.

Oct. 4-6: Atlantic Show, Convention Center, Atlantic City, N.J.

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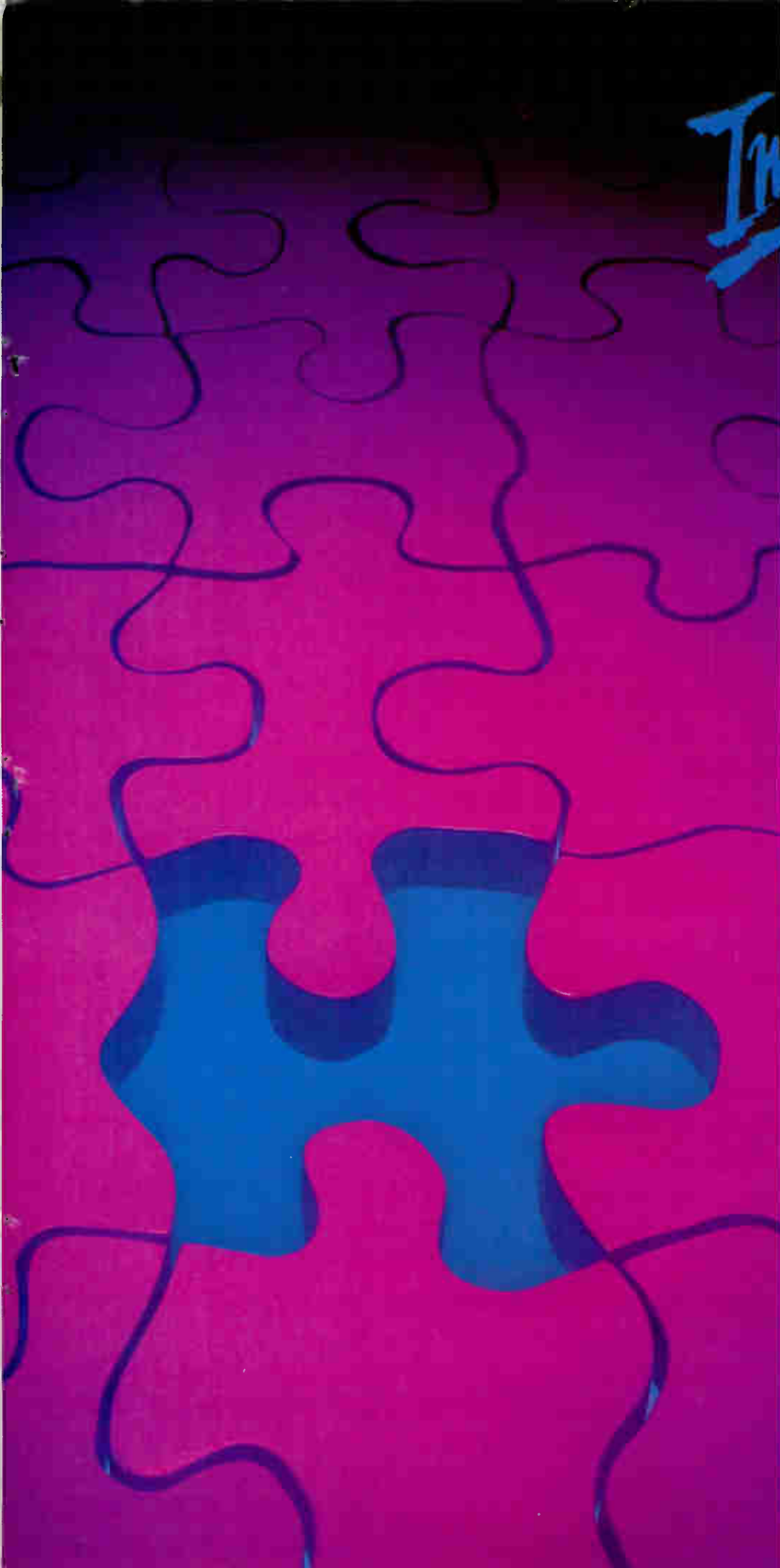

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DMV

XMOD and CTB in a cable system

By Ron Hranac and Pam King
Jones Intercable Inc.

The formula to calculate the cross modulation (XMOD) or composite triple beat (CTB) ratio at the end of a cascade of identical amplifiers is:

$$D_{CASCADE} = D_{AMPLIFIER} + 20\log_{10}(N) \quad (1)$$

where:

$D_{CASCADE}$ = CTB or XMOD (dB below video carriers) at the end of the cascade
$D_{AMPLIFIER}$ = corrected CTB or XMOD specification for a single amplifier (dB below video carrier)
N = number of identical amplifiers in cascade

The formula to calculate the corrected XMOD or CTB specification for a single amplifier is:

$$D_{AMPLIFIER} = D_{SPEC} + \Delta D_1 + \Delta D_2 \quad (2)$$

where:

$D_{AMPLIFIER}$ = corrected CTB or XMOD specifications for a single amplifier
D_{SPEC} = manufacturer's original CTB or XMOD specifications for a given output level and number of channels
ΔD_1 = correction if number of channels is different than manufacturer's CTB or XMOD specifications
ΔD_2 = correction if output level is different than manufacturer's CTB or XMOD specification

The formula to calculate how much a XMOD or CTB specification will change if the number of channels is increased or decreased is:

$$\Delta D_1 = 20\log_{10}\left(\frac{C_{NEW}-1}{C_{OLD}-1}\right) \quad (3)$$

where:

C_{OLD} = original number of channels
C_{NEW} = new number of channels

If the new number of channels is less than the original manufacturer's CTB or XMOD specification, the correction is negative. If the new number of channels is greater than the original manufacturer's CTB or XMOD specification, the correction is positive.

Output level correction (ΔD_2) **(4)**

For each 1 dB increase in output, CTB and XMOD change by +2. For each 1 dB decrease in output, CTB and XMOD change by −2.

$20\log_{10}(N)$ can be found by determining the base 10 logarithm of N then multiplying that answer by 20, or by referring to the following table:

Number of amplifiers in cascade (N)	$20\log_{10}(N)$	Number of amplifiers in cascade (N)	$20\log_{10}(N)$
1	0	21	26.4444
2	6.0206	22	26.8485
3	9.5424	23	27.2346
4	12.0412	24	27.6042
5	13.9794	25	27.9588
6	15.5630	26	28.2995
7	16.9020	27	28.6273
8	18.0618	28	28.9432
9	19.0849	29	29.2480
10	20.0000	30	29.5424
11	20.8279	31	29.8272
12	21.5836	32	30.1030
13	22.2789	33	30.3703
14	22.9226	34	30.6296
15	23.5218	35	30.8814
16	24.0824	36	31.1261
17	24.6090	37	31.3640
18	25.1055	38	31.5957
19	25.5751	39	31.8213
20	26.0206	40	32.0412

Examples

Problem

What will the CTB be at the end of a cascade of 22 identical trunk amplifiers, assuming the following?

Manufacturer's specifications (single amplifier):
Number of channels: 60
Output level: +34 dBmV (flat)
CTB: −95
XMOD: −94

Operating conditions:
Number of channels: 60
Output level: +34 dBmV (flat)

Solution

Since the operating conditions are the same as the manufacturer's specifications, corrections to $D_{AMPLIFIER}$ will not be necessary. For this situation Formula 1 is used.

$$\begin{aligned} D_{AMPLIFIER} &= D_{CASCADE} + 20\log_{10}(N) \\ &= -95 + 20\log_{10}(22) \\ &= -95 + 20\,(1.3424) \\ &= -95 + 26.8485 \\ &= -68.2 \end{aligned}$$

Problem

What will the CTB be at the end of the same cascade of 22 identical trunk amplifiers, but with the operating conditions changed to the following?
Number of channels: 52
Output level: +36 dBmV (flat)

Solution

Since the operating conditions are different than the manufacturing's specifications, Formulas 1, 2, 3 and 4 are used. First, calculate the specification correction for the new number of channels, using Formula 3.

$$\begin{aligned} \triangle D_1 &= 20\log_{10}\left(\frac{C_{NEW}-1}{C_{OLD}-1}\right) \\ \underline{1} &= 20\log_{10}\left(\frac{52-1}{60-1}\right) \\ \underline{1} &= 20\log_{10}\left(\frac{51}{59}\right) \\ &= 20\log_{10}(.8644) \\ &= 20(-0.0633) \\ &= -1.2656 \end{aligned}$$

Next, calculate the specification correction for the new output level (Reference 4). Since the output has been increased by 2 dB, the CTB specification will change by +4. You can now calculate the total corrections with Formula 2.

$$\begin{aligned} D_{AMPLIFIER} &= D_{SPEC} + \triangle D_1 + \triangle D_2 \\ &= -95 + (-1.2656) + (+4) \\ &= -92.2656 \end{aligned}$$

Finally, determine the CTB at the end of the cascade using Formula 1.

$$\begin{aligned} D_{CASCADE} &= D_{AMPLIFIER} + 20\log_{10}(N) \\ &= -92.2656 + 20\log_{10}(22) \\ &= -92.2656 + 20\,(1.3424) \\ &= -92.2656 + 26.8485 \\ &= -67.4 \end{aligned}$$

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AD INDEX

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Reader Service Number 94.

B-ISDN and cable TV

By Walter S. Ciciora, Ph.D.
Vice President of Strategy and Planning
American Television and Communications Corp

Last month we discussed the telephone industry's ISDN (integrated services digital network) and what it means for the cable TV industry. In short, ISDN is telco competition for cable's attempts at non-video services. These services include residential security, videotex, home shopping, home banking, etc. If telco's track record with these services duplicates cable's experience over the last decade or so, this form of competition will be no great loss for cable. However, if the telcos succeed at these endeavors, they will have captured business opportunities that could have been cable's.

B-ISDN is a broadband version of ISDN. As such, it is video-capable; this makes it of much higher concern to cable. B-ISDN is aimed at cable's core business—entertainment video. A mitigating factor in this concern is that B-ISDN must be delivered over fiber. The copper twisted pair will not practically support video bandwidths. This means that the B-ISDN evolution of the telco plant will require decades to carry out. This gives cable ample opportunity to develop an appropriate strategy.

Implementing B-ISDN is a two-step process. The first step is to digitize voice and develop the signaling protocols that implement the promised new features. The second step is to convert electrical signals to light impulses at one end of the fiber and convert them back again at the other end. ISDN paves the way for B-ISDN by accomplishing the first step.

There should be no mistaking the telco intent to move to B-ISDN as quickly as possible. The regular technical journals and trade magazines commonly carry papers and articles that clearly signal this intent. The *IEEE Communications Magazine* and *Lightwave* are just two examples of publications that almost monthly have related articles and occasionally special issues on the subject. In addition, special conferences focus on broadband delivery to the home.

Bellcore, the billion-dollar-a-year R&D organization of the Bell operating companies, has published a large number of quality papers outlining an evolution to video delivery. Most concentrate on technology, but some analyze the business of entertainment video. The subject of "video on demand" has received careful treatment. Bellcore's plans involve a 2.5 Gbps (gigabits per second) fiber path into the neighborhood and a 600 Mbps (megabits per second) fiber run to the home. The interface between these two types of fiber circuits occurs in a pedestal or underground vault called the RT for *remote terminal*. The RT is a mini-central office serving a neighborhood of several hundred homes. This plan is relatively conservative. The path to the home initially avoids expensive solid-state lasers. Much less expensive light-emitting diodes (LEDs) will do the job. The electronics is based on well-proven and cost-effective CMOS (complementary metal oxide semiconductor) technology commonly used in consumer electronics, computers and data communications circuits.

Years from now, when lasers become both inexpensive and reliable and solid-state electronics progresses to even higher speed capabilities, the electronics at the ends of the fiber can be upgraded to provide much higher data speeds.

But 600 Mbps is a very powerful data channel. Articles in this year's Society of Motion Picture and Television Engineers' *SMPTE Journal* by Bellcore scientists point the way. A rather straightforward video compression scheme that carries today's NTSC video in 45 Mbps is described. A time-sharing approach more than doubles the video capacity of 45 Mbps data streams. Using these methods, a 600 Mbps fiber link can carry at least 25 NTSC video channels and more likely closer to 40. The RT is intended to include digital switches. These can dynamically select the channels simultaneously carried into the home from a much larger number supplied to the RT.

The story becomes more interesting when we consider HDTV (high-definition television). It is hard to say how much capacity is required to carry HDTV, since an HDTV transmission standard has not yet been established. But it has been estimated that HDTV can be carried in 100 to 145 Mbps. It has been reported that Bellcore and NHK, the Japanese public broadcasting agency that has developed the MUSE HDTV system for use in Japan's DBS (direct broadcast satellite) industry, are about to enter into a technology joint venture to develop a digitized version for fiber delivery to the home.

As stated earlier, B-ISDN requires fiber delivery to the home. How soon will that happen? The answer depends on the application. BellSouth believes it can now cost-justify the installation of fiber to the home in new construction in affluent developments. The need for the homes to be affluent is based on their likelihood of wanting more than one phone number per residence. This can be accomplished either by multiple twisted pairs to the home or by digitizing electronics applied to a single line. If a modest percentage of homes take two phone numbers, BellSouth believes a fiber approach breaks even, when compared to the multiple copper pair alternative. Illinois Bell is seeking deals with real estate contractors to share the added cost.

AT&T has developed a method for paving the way for the fiber future, with a line of products they call the "Fiber Way." Optical fibers are bundled in the same cable as are twisted copper pairs. The idea is based on the fact that most of the cost of installing lines to the home is in the labor. The addition of the fiber is a trivial percentage addition to the total costs. The fiber is left "dark" and only the twisted pair is initially used. Later, when the electronics become affordable, the fiber is activated. An attractive side benefit is that the in-home electronics can be powered by the twisted copper pair. This retains the traditional telephone role in emergencies where even the power may fail.

So what does this mean for cable? First, there will be a great deal of fiber experimentation over the next few years. But it will be at least five years before any commercially significant amount of fiber is installed to the home. It will be at least 10 years before fiber to the home is commonplace. And it will be at least 20 to 30 years before fiber to the home is pervasive. We must use that time wisely.

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