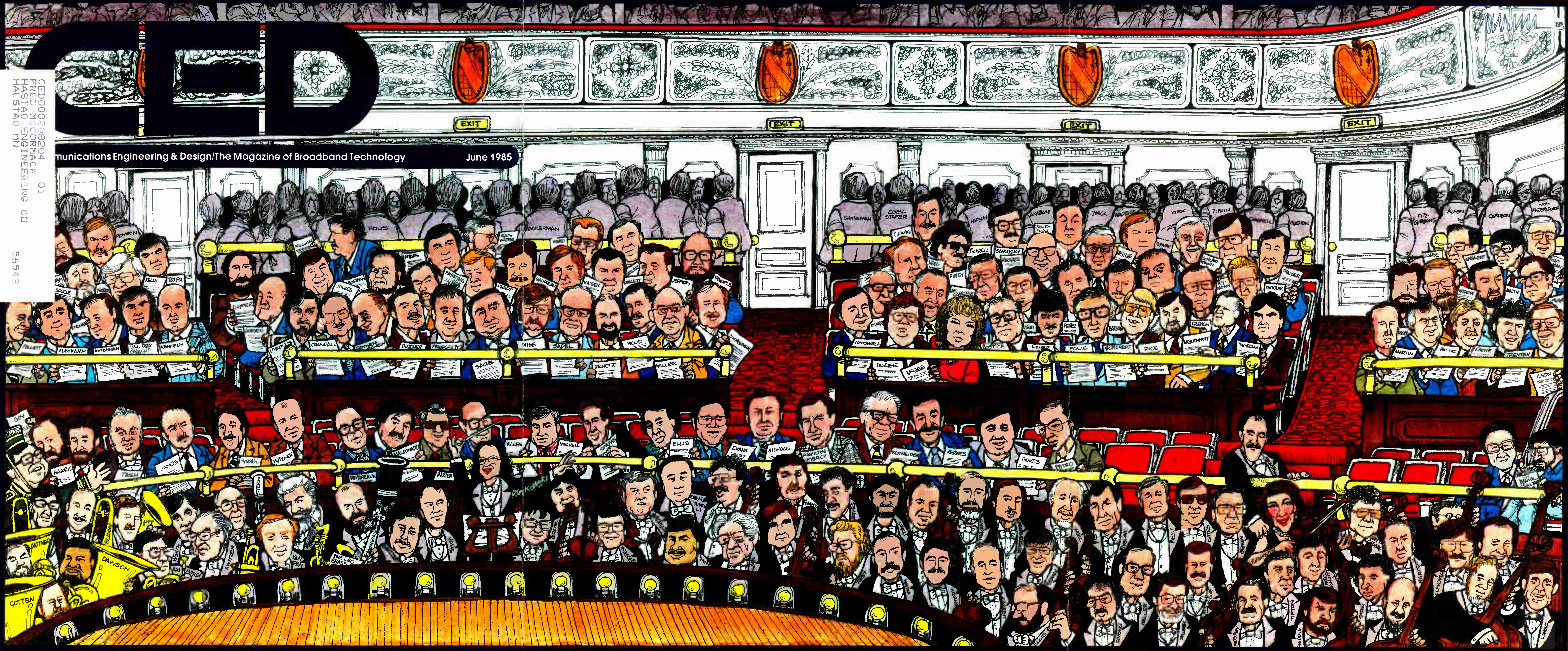
CED

Communications Engineering & Design/The Magazine of Broadband Technology
June 1985



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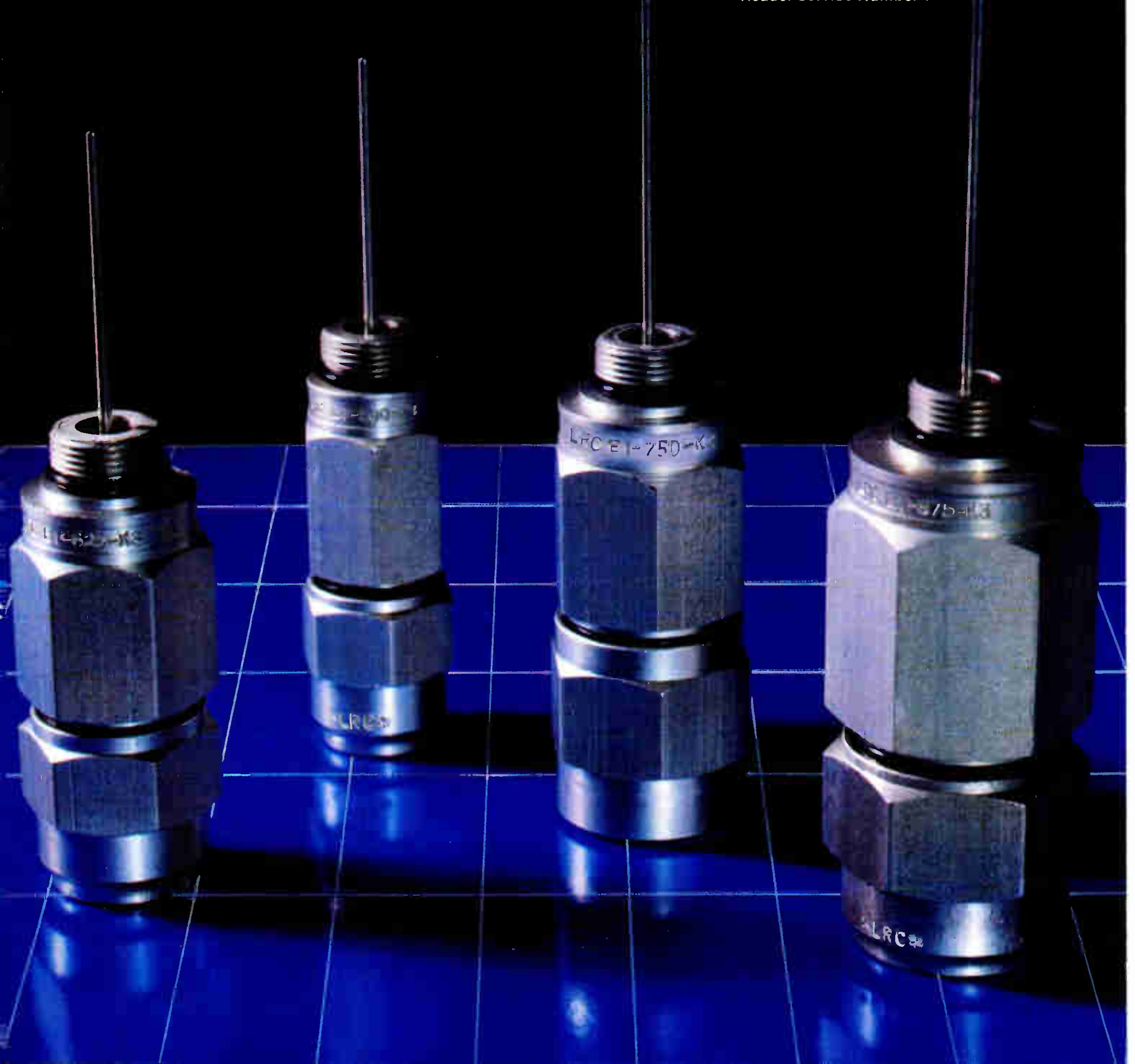

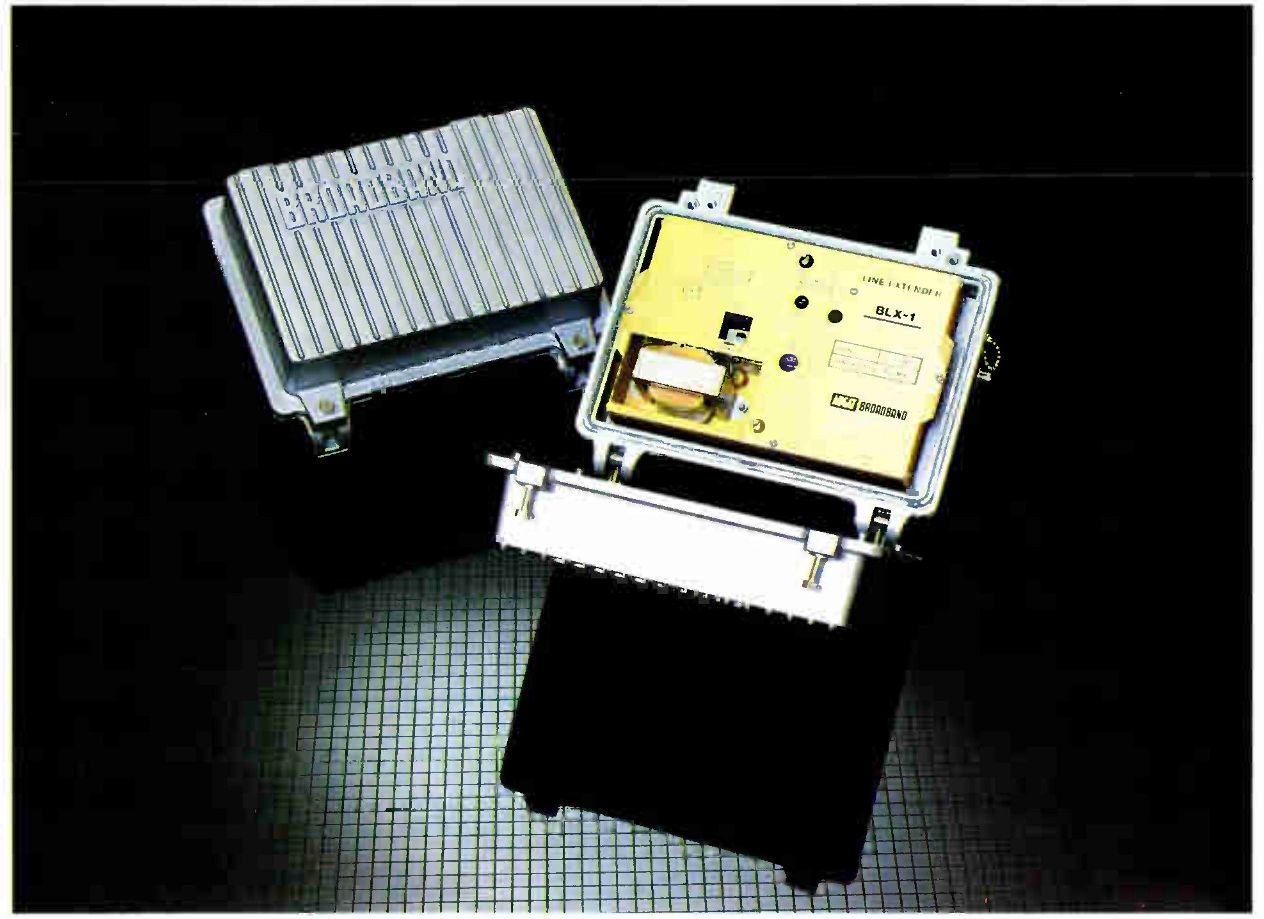

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Reader Service Number 3

CED

June 1985

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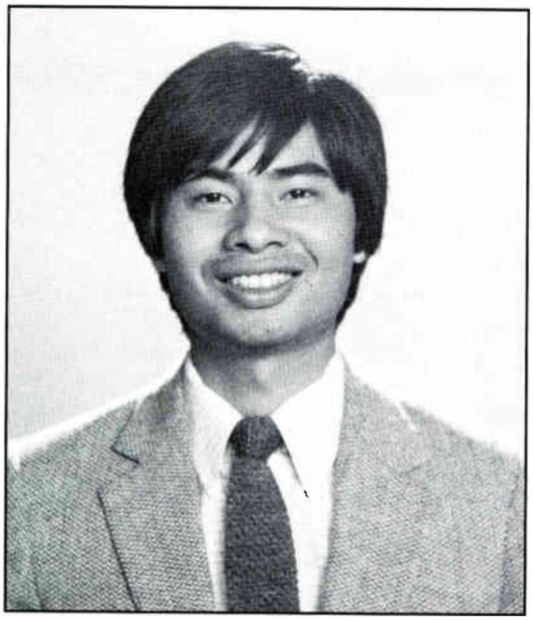

John Wong

John Wong may be on the other side of the table, be he is on *our* side of the fence. And his "side" keeps expanding. As newly appointed chief of the engineering branch, mass media bureau, at the FCC, Wong will oversee broadcast as well as cable interests.

"I feel that I am as necessary a part of the cable industry as the MSOs, system operators, manufacturers and the NCTA," Wong says. "Even though we are technically on 'different sides,' our goal should be the same: to promote the cable industry while encouraging the advancement of technology within the industry."

Wong has proven his commitment to the cable industry by learning as much as possible about what the technicians actually have to contend with out in the field. In 1980, when he was promoted from the broadcast bureau to the FCC's CATV bureau, Wong enrolled in a two-year home course in cable engineering. "It's easy for me to sit at my desk and impose rulings, but the first-line technicians have to contend with those decisions," Wong says. "I could be putting burdens on them without even knowing it, so I took the NCTI course to gain an understanding of the actual hands-on level of the cable industry.

Wong's thirst for knowledge about CATV didn't stop there. Cliff Paul, former CARS microwave branch chief at the FCC, affirms," John goes much further than the boundaries of his job description to learn as much as he can. Every chance he had, he was out in the field with a cable operator to learn more about actual system operations."

Ted Hartson, director of engineering services at Capital Cities Cable, couldn't agree more. "John has an incredibly thorough understanding of the cable industry. He really takes his job seriously—a welcome change from some of the government bureaucrats we have to deal with."

Does Wong ever see himself going to work for a manufacturer or service provider? "Not at this time. The challenges at the regulatory level fascinate me," Wong claims. "There are so many different aspects of every situation to deal with and so many facets to telecommunications as a whole that I could explore here within the Commission." Wong also takes pride in working for the FCC, which he believes is one of the most respected regulatory agencies in the world.

What's coming up on the agenda at the FCC that might affect the cable industry? "Instead of imposing additional regulations, we will be looking at trying to eliminate unnecessary burdens on the various industries, including cable, so they will have less to contend with," Wong says. "We also have received quite a few petitions for reconsideration of Docket 21006, which we are reviewing now in hopes of an early response."

Wong is adamant in urging cable system operators, engineers and technicians to really get involved with the FCC's functions. "Write to the FCC. If you have a gripe or a comment, let us know," he urges. "The FCC wants to hear from you if you have a complaint or a problem. We are here to work with you—not against you. Together, we can do magic!"

Magic seems to be a specialty of Wong's. According to Bob Luff, senior vice president of engineering at United Artists Cablesystems, "John is always fair to the public interest and the needs of the CATV technical community. He gives unselfishly of his own personal time a great deal and always seems to come through with what is needed in the end."

You can't ask for much more than that. But even if you did, John Wong would probably find a way to deliver.

—Lesley Dyson Camino

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Reader Service Number 6

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Engineered to a new standard

TV Signal Quality

By Archer Taylor
Malarkey-Taylor Associates

Are you aware that there are no FCC standards regulating broadcast TV signal quality? FCC rules for TV broadcasting are concerned only with interference to other spectrum users and compatibility with consumer products.

Carrier-to-noise ratio, for example, is not specified at all. As in the cable TV rules, the peak-to-peak variation in transmitter output due to all causes (including hum, noise and low-frequency response) shall not exceed 5 percent. Enforcement of even that low standard was suspended more than 30 years ago, "pending a further determination."[1] No frequency response tolerances are stated for high power TV; for low power UHF (less than 1 kw), the response can droop as much as 6 dB at 3 MHz; 12 dB at 3.5 MHz.[2] There is no FCC tolerance for differential phase or gain, chrominance-aural intermodulation (920 kHz beat), chrominance-luminance cross talk or luminance linearity. No wonder Europeans refer to NTSC as "never twice the same color."

To their credit, however, broadcasters have done an excellent job of establishing their own standards. The Electronic Industries Association (EIA), with the participation of the National Association of Broadcasters, Association of Maximum Service Telecasters (MST) and various equipment manufacturers, has developed a substantial body of Recommended Standards of Performance for broadcasting transmitters, microwave relay systems, monochrome and color TV cameras. Tape recorders and film projection standards also have been established by the Society of Motion Picture and Television Engineers (SMPTE).

For many years, broadcast network and station engineers have worked with the Bell System to develop guidelines for video interconnecting facilities. The latest report of this Network Transmission Committee, known as NTC-7, was issued in June 1975, and revised in January 1976. (Copy of the 1975 version is included as Part IV of the *NCTA Recommended Practices*).

Franchise administrators, as well as cable operators, should be advised, however, that the performance objectives set forth in NTC-7 are specifically applicable only "to video facilities provided by the Bell System." *They are not meant to apply to the signals delivered to the ultimate consumer—the viewer.*

Philosophically, broadcasters and receiver manufacturers long ago agreed that most of the tolerance allowable in signal quality degradation should be allocated to the high-power broadcast transmitter with its vestigial sideband and diplexing filters, the transmitting and receiving antennas and the home receiver itself. Cameras, VTRs, studio electronics, network facilities and STL should be as nearly transparent as technologically possible.

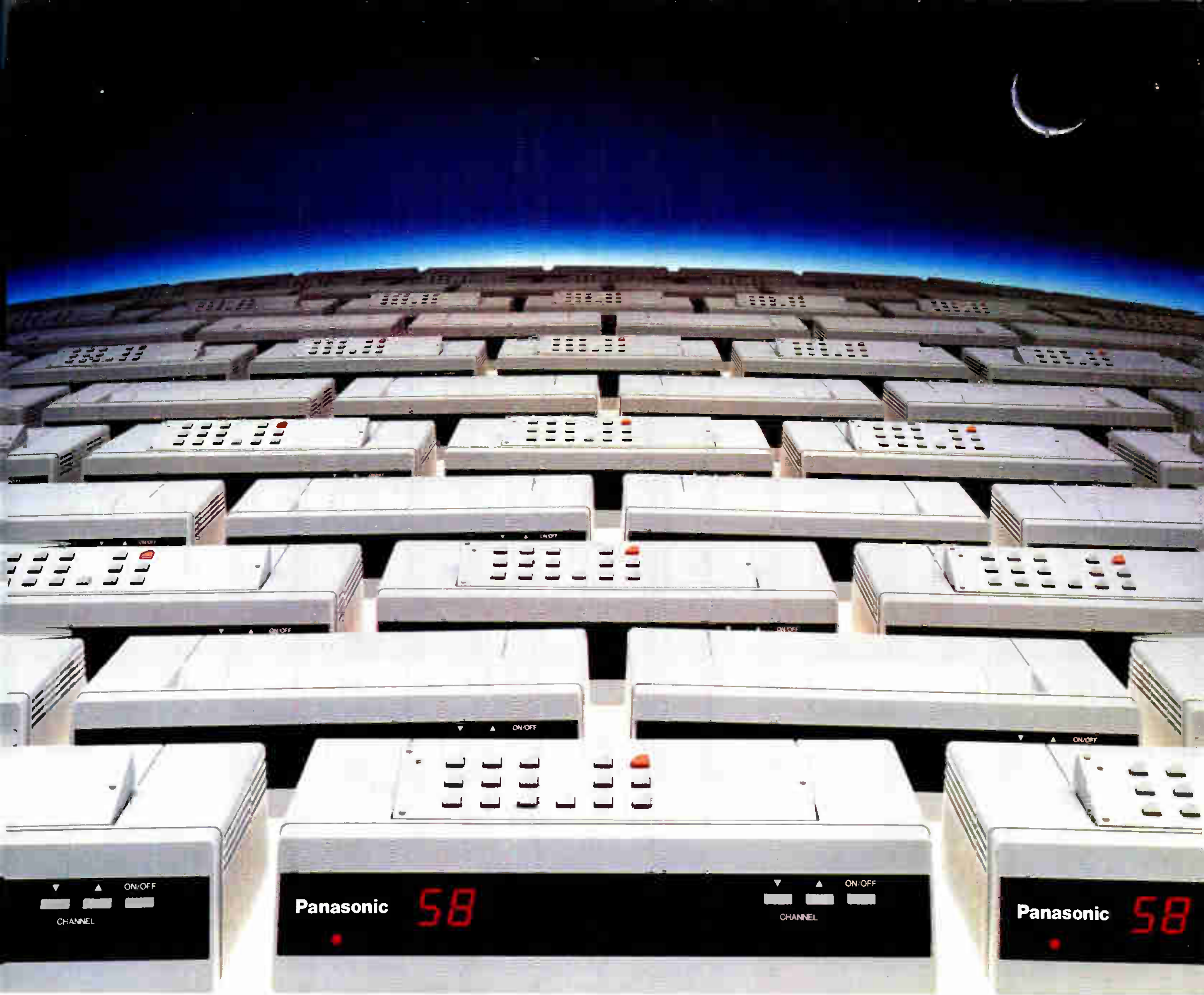
For this reason, broadcast engineers and technicians tend to become accustomed to tight technical standards of performance for everything up to the transmitter input port. Beyond that point, things begin to fall apart rather fast, a fact that not many broadcast engineers realize. Unless the studio and network facilities are held to tight standards, they might add an intolerable burden to the distortions inherent in the transmission and receiving facilities.

The fact of the matter is that, using conventional home TV sets, it is virtually impossible to deliver to viewers off-air TV signals meeting the standards set by NTC-7. Fortunately, it is not necessary to do so because picture quality observed on the screen of the TV set will be rated "excellent" in spite of signal degradation much greater than specified in NTC-7.

Since cable TV systems are interposed between the transmission (either broadcast or satellite) and the home receiver, they should be as nearly transparent as is technically feasible. The most likely sources of waveform degradation are at the headend. I have observed tests on modern headend modulators and processors (yes—and even demodulators) that are in full compliance with most of NTC-7, and only slightly out of compliance in a few instances.

If noise, intermodulation, return loss and ingress are maintained below the levels recommended by NCTA, they will be nearly imperceptible to the typical viewer at a normal viewing distance from the screen.[3] The broadband portion of a cable TV system then will be seen as nearly transparent. The remaining impairments are probably caused by some form of "quadrature distortion" that is an inherent consequence of vestigial sideband amplitude modulation and to an insidious and infinitessimal, but cummulative, phase error, possibly in the coaxial cable itself that tends to

Continued on page 65.



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58

Volume 11, No. 6

CED

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In Perspective

Technology transfer

I made an amusing discovery a couple of months ago as I was poking around in the grass outside my home: about 55 yards of RG-59, casually draped over shrubs and lazily winding its way back to a pedestal. It's connected to an MDU closure that feeds my TV and about six others.

I'm waiting for the next lawn cutting, since most of the 55 yards of cable is lying on the ground. It can't be spec.

So far, there's been no apparent move to bury or suspend it. And it's not clear to me whether the ad hoc arrangement has something to do with the incredible tear, jitter and roll I've gotten on a number of frequencies. I hope the situation is temporary.

Repeated often enough, such episodes could cause even the most open-minded corporate communications manager to cringe at the very suggestion that any network using CATV components could possibly be reliable enough to install.

That's too bad because it puts our industry's vendors in a much-weakened position when it comes to getting orders for broadband communication systems.

Fortunately, our occasional foot-shooting hasn't killed broadband's reputation. Despite the gaffes, serious network users continue to view broadband technology as suitable for a variety of applications.

I spent some time at the International Communications Association's annual meeting last month. ICA is a giant user group, representing companies that buy a million dollars worth of communications gear a year.

Big, complex, expensive stuff. Now, don't get me wrong, the show was still heavily Ethernet and twisted-pair dominated. The big issue is more voice and data integration than video and voice and data. But the old debate about local area network technology has died down.

The issue isn't baseband (twisted pair) versus broadband (coaxial) any more. The issue is PBX versus LAN.

The choice to be made, it seems, is between a local network driven off a private branch exchange or a stand-alone LAN. Broadband now is an accepted technology for getting certain jobs done. Meanwhile, Ku-band satellite and fiber optic technologies continue their march into the marketplace.

And software defined networks, the much-heralded integrated services digital network and all manner of other private network technologies continue to grow.

Bypass, in short, is a reality. Business and governmental users are determined to lower their communications costs, and private networks, whether hardwired or software defined, are the rage.

It would seem to me that there's a window of opportunity for broadband private networks based on CATV technology. Fiber's going to get here soon enough, but 75-ohm RF is here now with MTBF figures of 12 years.

Somebody "accused" me of being "blue sky" the other day. I don't think so. It's just that people outside our industry take our technology seriously—perhaps more seriously than we do at times.

I'd be interested in our readers' thoughts about this. I'd like to do what I can to give broadband LAN technology a boost. Any ideas?

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Reader Service Number 8

BTSC
The future of stereo?

By Ned Mountain,
Sales Manager,
Wegener Communications

During the past 12 months, there has been much discussion about stereo television in the United States. Now that the technical standards "war" is over, all parties can get on with the task of implementing the various technologies that will ultimately result in multichannel sound for consumers.

The technology is young. Only a handful of stations actually broadcast BTSC stereo and hands-on experience is extremely limited. As with any young technology, the speculation, rumors and half-truths must be carefully sifted from the little factual information that does exist.

The delivery of stereo audio to cable subscribers is not something new. The industry has been doing it for years but not in the BTSC format. In this article, I will concentrate on delivery of satellite stereo TV signals to subscribers. In order to do this properly, it is necessary to look at the delivery system from satellite uplink to TV set as three separate problems: 1) the satellite link, 2) the cable link and 3) the total system.

The satellite link

Satellite audio performance can be evaluated quickly by looking at three key parameters—frequency response, distortion and signal-to-noise. Frequency response and distortion generally are limited by the system electronics, while S/N generally is limited by the satellite link. Since all existing satellite audio transmission systems are capable of providing excellent frequency response and low distortion, I will concentrate on S/N for the more common transmission systems.

Just about all satellite audio transmission systems rely on FM subcarriers to provide stereo audio. There are several simple equations that make the analysis rather easy. Purists may argue over the simplification, but the results will be valid within 1 dB. The first thing to determine is the actual C/N of the subcarrier. Generally, by normalizing the bandwidth to 1 Hz, all equations can be simplified—thus, the term C/N_0 or carrier to noise measured in a 1 Hz bandwidth. Here we go!

1) $(C/N_0)_{subcarrier} = (C/N_0)_{link} + 10 \log (m^2/2)$

Where: m = modulation index of the FM subcarrier (Don't panic yet. We'll go through an example in a few minutes!)

Once the (C/N_0) subcarrier has been determined, the actual audio performance can be predicted.

2) $(S/N)_{audio} = (C/N_0)_{SC} + 10 \log [3 (dev)^2/2(bn)^3]$

Where: Deviation = peak deviation of the subcarrier by audio
bn = noise bandwidth of baseband audio filter
bn = 5822 Hz for a 15 kHz audio channel with 75u second de-emphasis.

Another very useful equation is the audio signal to noise of a double sideband suppressed subcarrier on top of an FM subcarrier, such as FM stereo multiplex or BTSC stereo.

3) $(S/N)_{audio} = (C/N_0)_{SC} + 10 \log [1/4 (Dev)^2/Fsc^2 bn]$

Where: Dev = peak deviation of main subcarrier by DSBSC subcarrier
fsc = center frequency of DSBSC subcarrier
bn = noise bandwidth of baseband audio filter

Now, for that example I promised, let's look at a typical satellite signal with a 6.8 MHz mono audio subcarrier and go through the numbers.

Assume: Center frequency of subcarrier is 6.8 MHz.
Deviation of main carrier by subcarrier is 2.0 MHz peak.
Deviation of subcarrier by audio is 237 kHz peak.

Assume that the TVRO is providing a basic C/N of 12 dB measured in a 30 MHz bandwidth.

$$(C/N_0)\ link = (C/N)\ 30\ MHz + 10 \log bandwidth$$
$$= 12.0 + 10 \log (30 \times 10^6)$$
$$= 86.8\ dB\text{-}Hz$$

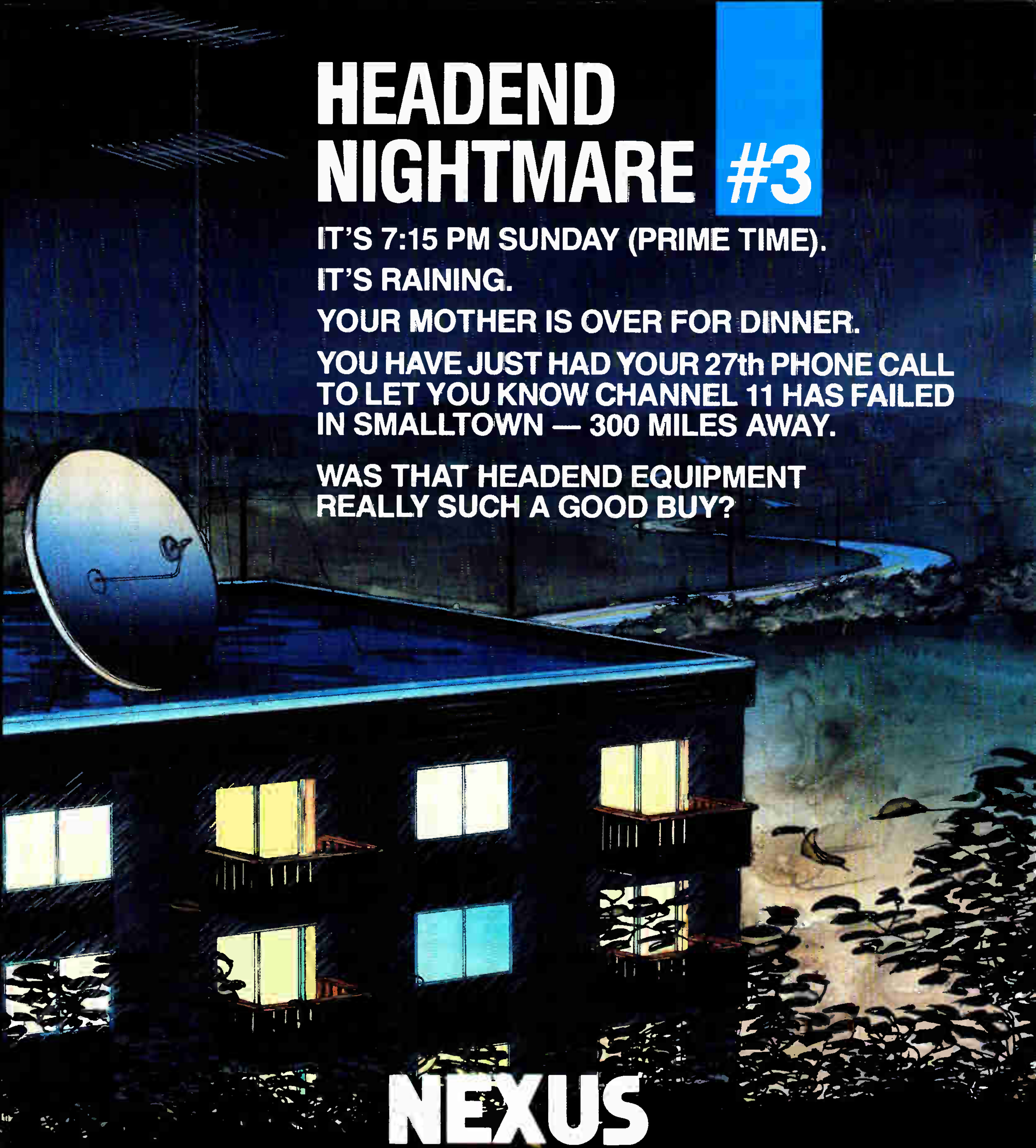
Now that we have the $(C/N_0)_{link}$, we can work through equations 1 and 2 to determine audio performance.

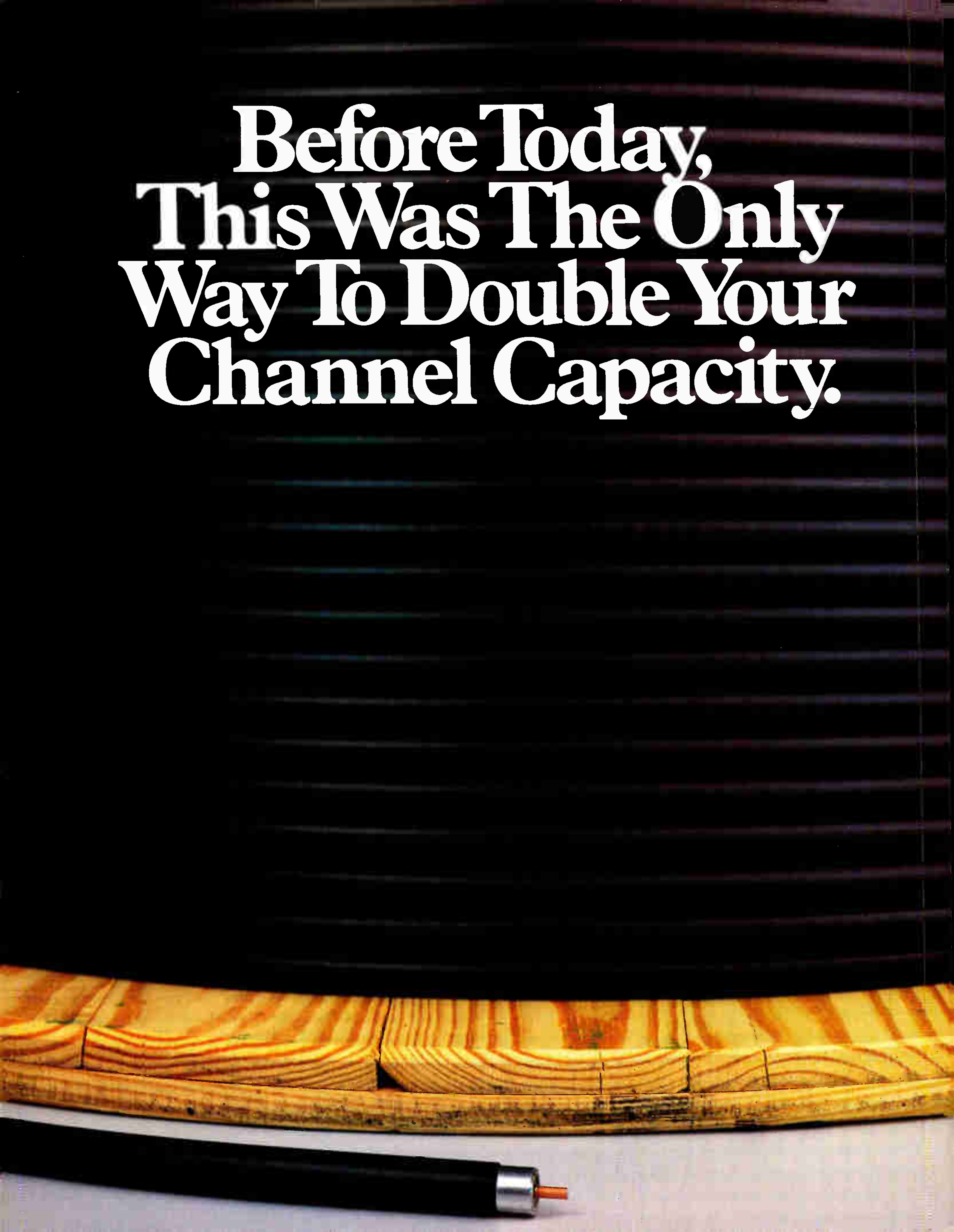
$$(m = 2/6.8 + 0.294)$$
$$1)\ (C/N_0)_{subcarrier} = (C/N_0)_{link} + 10 \log[m^2/2]$$

$$(C/N_0)_{subcarrier} = 86.8 + 10 \log[0.294^2/2]$$
$$= 73.2\ dB\text{-}Hz$$

$$2)\ (S/N)_{audio} = 73.2 + 10 \log[3(237{,}000)^2/2(5{,}822)^3]$$
$$= 73.2 + (-3.7)$$
$$= 69.5\ dB$$

This number (69.5 dB S/N) compares favorably with actual measured performance.


HEADEND
NIGHTMARE #3
IT'S 7:15 PM SUNDAY (PRIME TIME).
IT'S RAINING.
YOUR MOTHER IS OVER FOR DINNER.
YOU HAVE JUST HAD YOUR 27th PHONE CALL TO LET YOU KNOW CHANNEL 11 HAS FAILED IN SMALLTOWN — 300 MILES AWAY.
WAS THAT HEADEND EQUIPMENT REALLY SUCH A GOOD BUY?
NEXUS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The converter itself contains a one-way addressable baseband system that's competitive with any product on the market. Add the Comband decoder and you can double part, or all, of your existing channel capacity in a matter of weeks.

The design of the Comband system allows you to control when, and to what extent, you upgrade your operation. You satisfy yourself, your subscribers and the franchising authorities without major construction expense or disruption. So you increase your revenues, lower your operating costs and get a much faster return on your investment, all in one step.

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For a Comband Express demonstration, call Ron Polomsky at 1-800-GE-CABLE. Because, for the ultimate in flexibility and control, there is no alternative to the General Electric Comband system.

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See us at booth 2519 at the Las Vegas NCTA Show.

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Reader Service Number 10

Satellite stereo audio

There are three common methods in widespread use today to transmit stereo audio from programmer to affiliates. They are:

- Dual Subcarrier Matrix—used by MTV, TMC and Disney
- Wegener 1600 (Panda I) System—used by TNN, CMTV, USA, ESPN, ARTS and PTL
- Wegener Digital with Dolby ADM—used by VH-1 and MTV

Figure 1 illustrates the MTV baseband with two subcarriers. L + R is transmitted at 6.62 MHz and L—R is transmitted at 5.8 MHz. Digital stereo is transmitted at 7.4 MHz with a digital subcarrier.

If we go through equations 1 and 2 for the individual analog subcarriers and assume a basic receive C/N of 12 dB, we get the following results:

$(S/N)_{L-R} = 70.8$ dB
$(S/N)_{L+R} = 69.7$ dB
$(S/N)_{L \text{ or } R} = 67.2$ dB

Figure 2 illustrates a baseband that utilizes the Wegener narrowband audio transmission system. Each subcarrier is deviated 50 kHz peak by the audio and operates at a constant modulation index—typically 0.18. A very key element of the Wegener system is companding, which is necessary to extract broadcast quality audio from narrowband subcarriers. All of the cable programmers using narrowband subcarriers are using the Wegener Panda I (1600) system which provides a companding advantage of approximately 20 dB. The same subcarrier parameters couple with an advanced compander, the Wegener Panda II, which provides a companding advantage of approximately 40 dB. Panda II is a professional companding system used by several radio networks, the BBC and several companies involved in international satellite audio transmisson. Let's walk through the S/N number for a narrowband companded subcarrier.

Assume: Basic C/N of downlink is 12 dB
Modulation index of subcarrier is 0.18

$$\text{Thus: } (C/N_0)_{SC} = C/N_0 + 10\log[m^2/2]$$

$$= 86.8 + 10\log[0.18^2/2]$$
$$= 86.8 + (-17.9) = 68.9 \text{ dB-Hz}$$

$$(S/N)_{audio} = 68.9 + 10\log[3(50{,}000)^2/2(5{,}822)^3] + Ac$$
$$= 68.9 + (-17.2) + Ac$$
$$= 51.7 + Ac$$

The term Ac is the companding average. If Ac = 20 dB (Panda I), then the final audio S/N = 71.7 dB. If Ac = 40 dB (Panda II), then the final audio S/N = 91.7 dB. These numbers compare favorably with actual field data taken over the years.

The Wegener digital system in use by VH-1 and MTV is an example of efficient digital audio transmission. This is made possible by an advanced Adaptive Delta Modulation system developed by Dolby Laboratories. Wegener has licensed the Dolby technology (In fact, VH-1 is the first commercial application of Dolby Digital Technology to be implemented.) and coupled it with direct FSK transmission and multiplexing to form a complete system. Typical performance of this system is:

Frequency Response: 50 Hz - 15 kHz
Distortion: <0.5 percent
S/N: >75 dB

Figure 1 MTV baseband with L + R and L-R subcarriers (not illustrated is a Wegener digital subcarrier at 7.4 MHz)

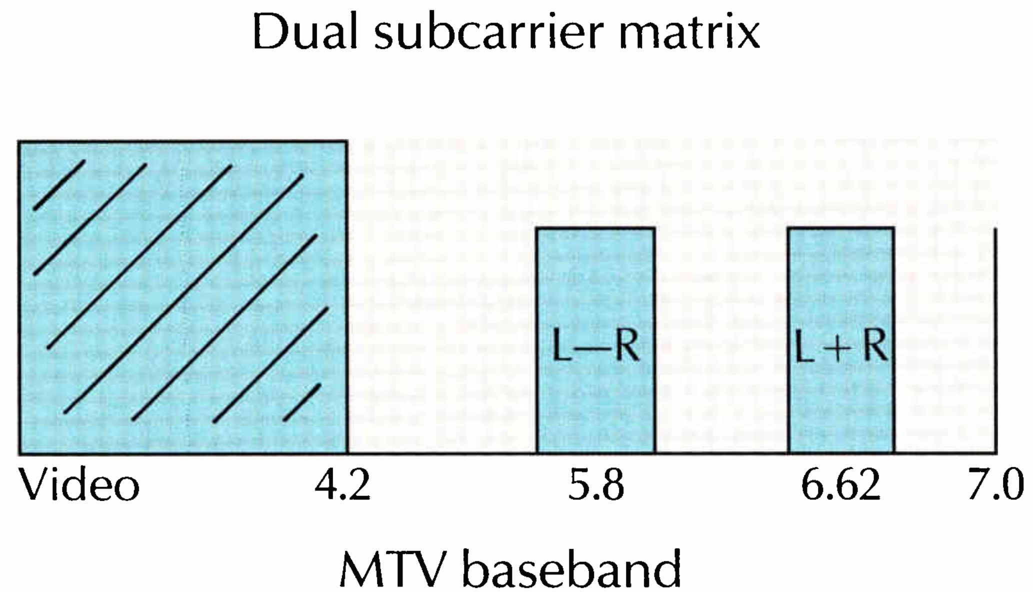


Figure 2
Wegener narrowband subcarrier transmission system typical baseband

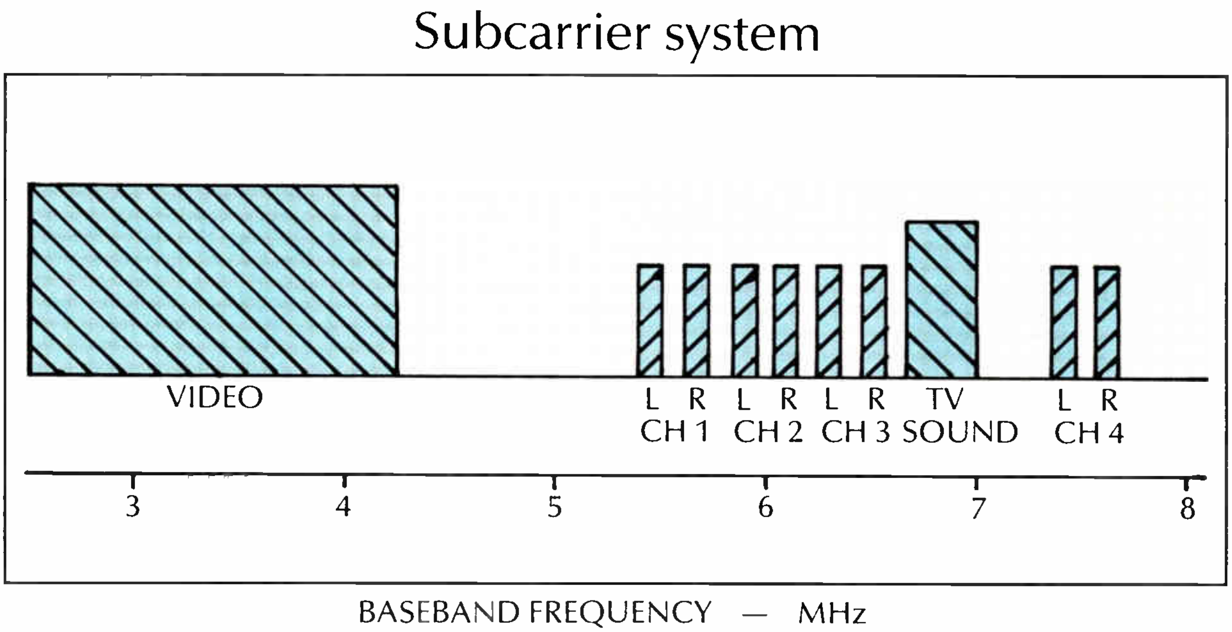
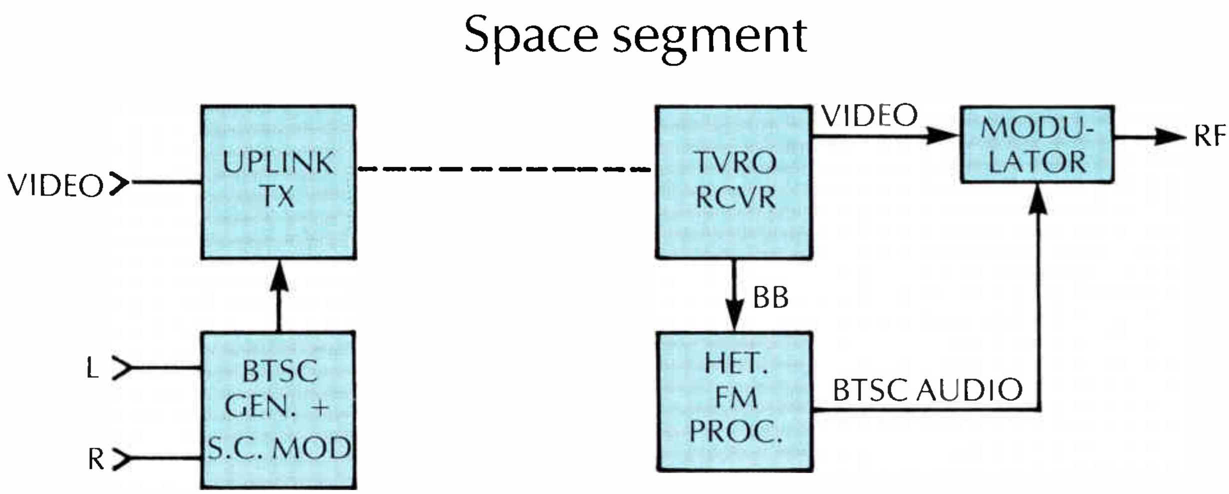


Figure 3
BTS transmission on satellite



As more of the Dolby circuits are committed to full integration, the end performance will improve even more.

BTSC on the bird

We have been through several examples and some discussion to show that the industry is now providing excellent quality audio to affiliates. Figure 3 illustrates an idea that is bound to surface sooner or later: transmitting BTSC directly on the satellite. This method of transmission will yield marginal performance at best. To illustrate:

BTSC Parameters: Dev (L + R) = 25 kHz peak
Dev (L—R) = 50 kHz peak

Assume same mod index as a conventional 6.8 MHz subcarrier.

$$(S/N)_{L+R} = 73.2 + (-23.2) = 50 \text{ dB} \quad (2)$$

$$(S/N)_{L-R} = 73.2 + (-37.6) = 35.6 \text{ dB} \quad (3)$$

$$(S/N)_{L \text{ or } R} = 35.4 + Ac = 35.4 + 14 = 49.4 \text{ dB}$$

This says that if BTSC were transmitted on the satellite directly, the audio S/N at the headend would be only about 50 dB. Increasing the deviations substantially still would yield marginal performance. For example, increasing L + R to 237 kHz peak deviation and L—R to 474 kHz peak deviation would only provide an S/N at the headend of approximately 67 dB, while requiring a subcarrier with an occupied bandwidth of well over 1 MHz.

Figure 4 Video C/N at drop

Predicted audio S/N ratios vs. C/N

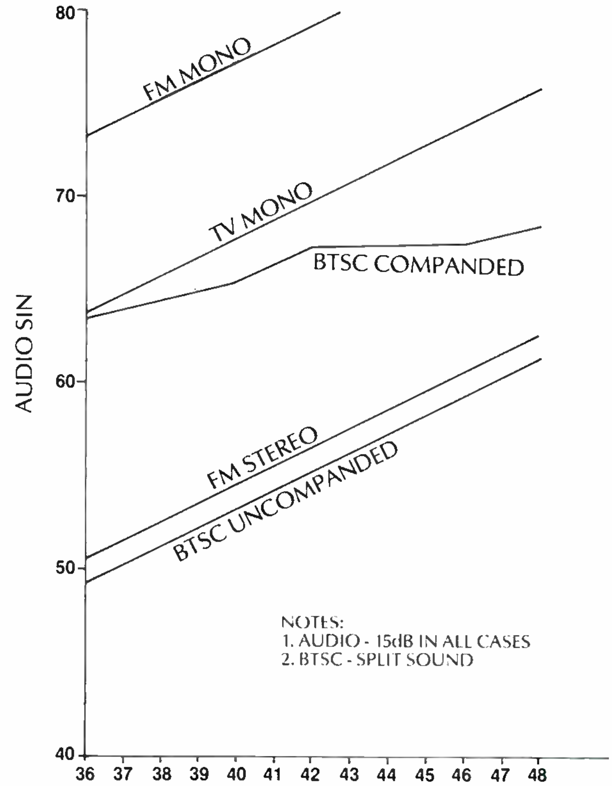
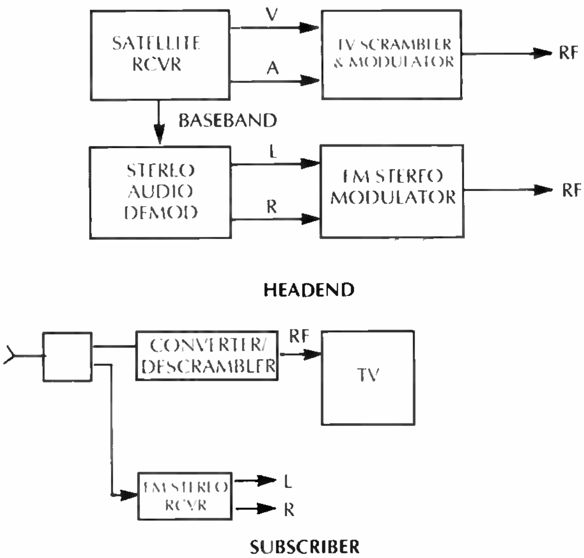


Figure 5
FM stereo simulcast



In summary, BTSC is just not the way to go on satellite systems. There are better ways to provide high quality audio to the headend.

Stereo audio on cable

Since BTSC transmissions will be broadcast to consumer TV sets, cable transmission of BTSC must be considered when looking at the various ways of transmitting stereo to subscribers. This phenomenon will be market driven and become more serious as the new TV sets get into the hands of subscribers.

The cable industry has been providing TV stereo for many years using a closed loop FM simulcast system. Although not totally ideal, it *does* work; and it is in widespread use. Since the big issue for stereo on cable is still signal to noise ratio, I think it is interesting to compare the S/N ratios of four systems: TV monaural, FM monaural, FM stereo and BTSC stereo. Figure 4 is a plot of the predicted audio S/N as a function of the video C/N available at a subscriber drop.

FM broadcast in mono can provide excellent performance, while FM stereo drops approximately 23 dB. Note that FM stereo typically is providing S/N ratios in the high 50 dB range —not excellent but definitely listenable.

Note that the difference between FM stereo and FM mono is 23 dB, while the difference between BTSC stereo and TV mono is considerably less (about 14 dB). Also note that the difference is not constant. This is because early implementation of the BTSC technology tends to flatten out the ultimate stereo S/N carriers at the high end. This is one area where I expect future hardware enhancements will make BTSC perform even better. I base the logic on the analogy between FM mono and FM stereo. Early FM stereo receivers provided very marginal performance that seldom approached theoretical limits. With today's implementation of FM stereo, it *is* possi-

B.S.

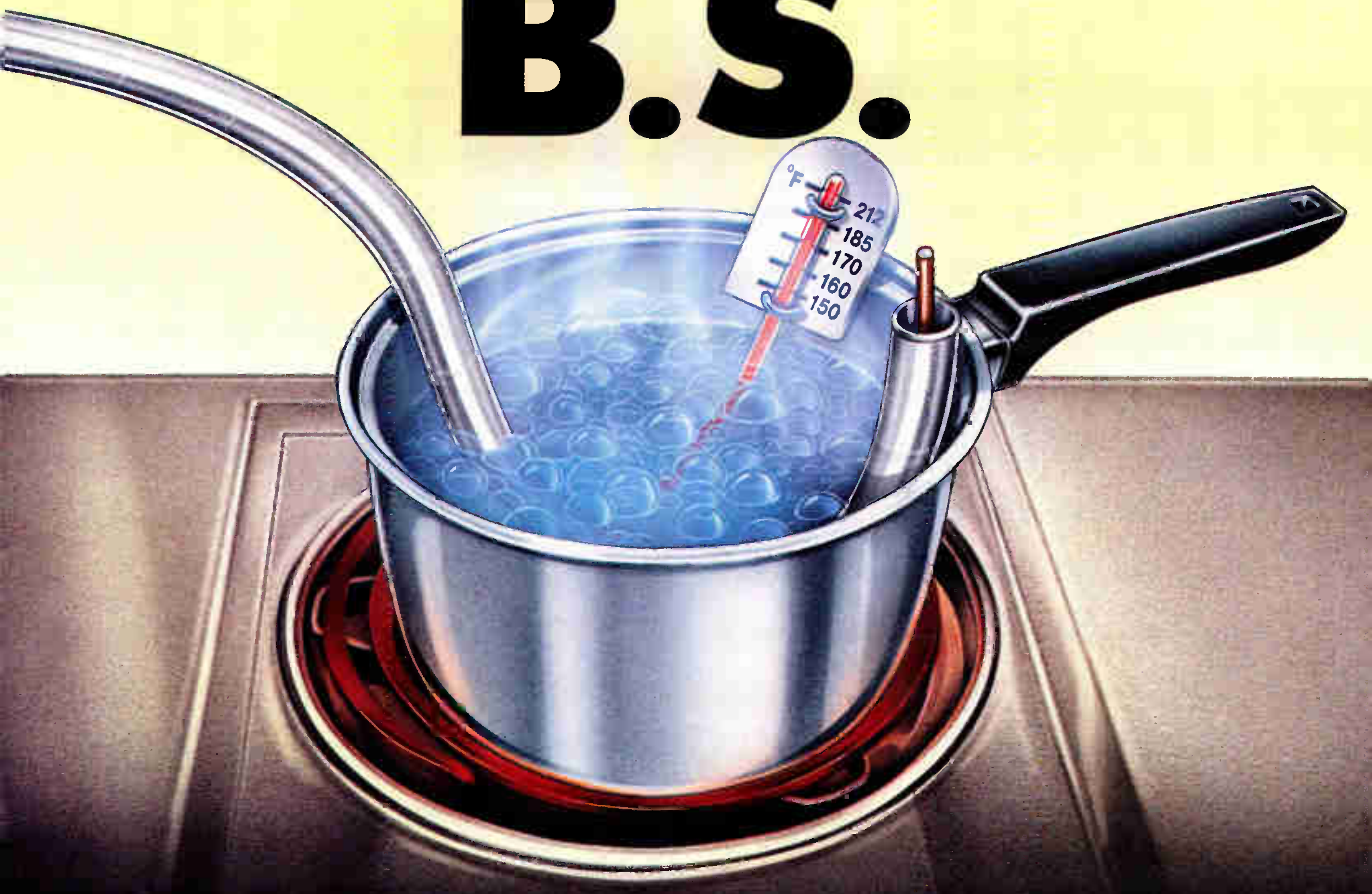


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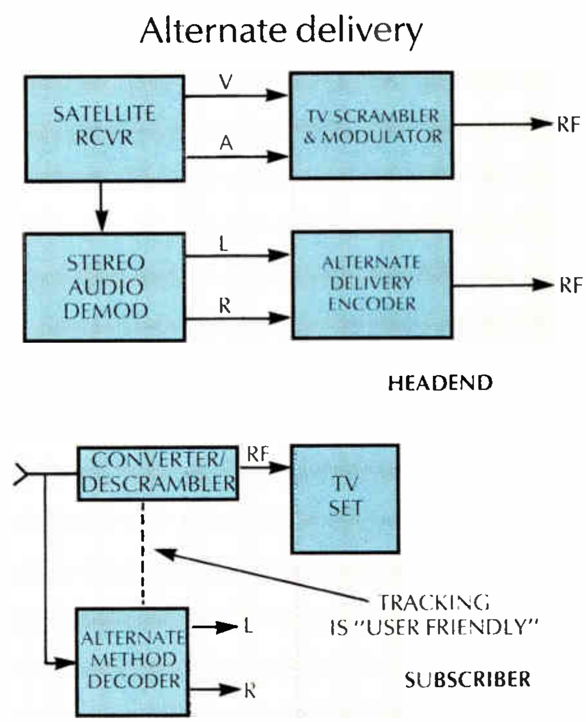
Figure 6
Out-of-band system



ble to provide 80+ dB S/N *in stereo* to listeners in direct off-air broadcast with city-grade RF contours.

Wegener Communication's early experiments with BTSC verify that the signal is quieter than FM stereo and probably will be very acceptable to subscribers.

Cable stereo configurations

It is appropriate to look at three methods of delivering stereo to subscribers: FM stereo simulcast, alternative delivery and BTSC compatible.

Figure 5 illustrates the FM stereo simulcast system in widespread use today. It delivers usable signals and requires no cable operator capital outlay in the home. Its major disadvantage is the dual tuning problem—definitely an inconvenience in many cases.

Figure 6 is a "generic" block diagram of an "alternative delivery" system. Such a system delivers stereo TV signals out of band. Several different technologies have been proposed or are being commercially marketed. Such systems are more complex and require additional cable spectrum to carry stereo. I think you will see several different system concepts emerge using both analog and digital techniques. Bandwidth efficiency, power requirements and capital investment considerations must be weighed carefully.

An interesting variation of alternative delivery would be to use FM monaural transmission for discrete Left and Right channel audio. Recalling Figure 4, it is possible to provide 80+ dB S/N per channel with FM mono without the use of companding.

Figure 7 illustrates a BTSC compatible system. At the headend, the audio is encoded into BTSC and integrated into the TV channel. To a subscriber with a new stereo TV set, the cable-generated BTSC channel would be no different than broadcast BTSC. Contrary to recent reports, BTSC generators

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- Automatic video and audio tracking of monaural and stereo channels
- Second Audio Program (SAP)
- VCR audio stereo outputs

Channel mapping capability provides the cable operator with greater flexibility in TV and FM channel selection and programming. Use of an EEPROM gives the SM 2001 its impressive compatibility characteristics. The unit can be reprogrammed to tailor the system's mapped channels, and matching the converter output channel.

Among the outstanding functional features of the SM 2001 are:

- Separate right and left audio outputs
- Option of 2, 3 or 4 selection at the input of the unit from the converter
- Last channel memory
- FM/TV automatic audio level
- 1ST and 2ND TV audio channel

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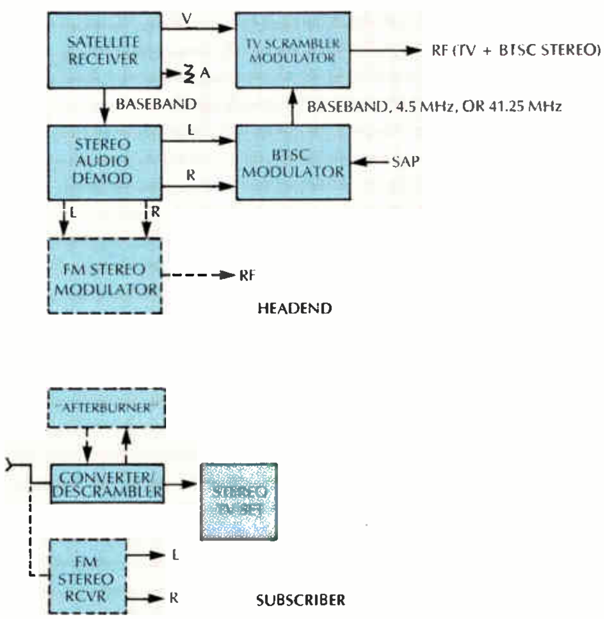
Figure 7
FM stereo

BTSC compatible stereo



at the headend will be available at reasonable prices. The Wegner BTSC modulator, for example, costs approximately $2,400 and the price is expected to drop in late 1985.

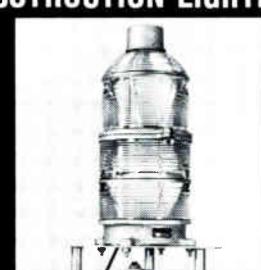
BTSC signals represent the ultimate "user friendliness" to cable subscribers. While several combinations of converter/descramblers represent a challenge, the major vendors are hard at work solving the BTSC compatibility problems. The most flexible arrangement to keep everyone happy is to simultaneously transmit BTSC and FM stereo. This allows the new stereo TV sets to come on-stream and be fully usable while still providing stereo to those choosing not to purchase a stereo TV—all without requiring the cable operator to invest in additional set-top devices.

Conclusions

This article has covered a lot of ground. The stereo TV issue is beginning to heat up and will ultimately be driven by marketplace demand. I expect the *real* demand to start in late 1985 or early 1986. By keeping all issues in perspective, we can make rational judgments and decisions now to prepare for the future.

With regard to satellite audio delivery, excellent audio quality is being delivered today to cable headends; and satellite audio systems are evolving totally independent of BTSC. With regard to cable delivery, the major vendors are busy adapting products to take advantage of BTSC stereo. The major problems are being solved.

Ultimately, there will be a strong marketplace demand for BTSC stereo on all channels. This demand will be driven by the desire of our subscribers for user-friendly systems that integrate easily with all aspects of consumer electronics. We must pay attention to these subscriber wishes in order to remain competitive in the face of alternative delivery technologies. CED



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Reader Service Number 21

Rebuilding with feedforward

By Bert Henscheid,
Vice President, Engineering,
Texscan Corp.

The decision to upgrade the performance of an existing system by rebuilding ultimately brings one around to comparing the advantages of various technologies available. Conventional, power addition and feedforward amplifiers all have pros and cons. There are too many variations in spacing and levels and existing systems to formulate any kind of single solution for all rebuilds. Generally, however, rebuilds that preserve trunk locations and existing coaxial cable may be accomplished by employing feedforward technology. Rebuilds that preserve distribution amplifier locations may be accomplished by employing power addition and parallel power addition technologies. But each system is different. This article will describe some of the rebuild considerations and show some specific examples of the decision-making process.

Trunk

The major objective of the upgrade or rebuild of trunk electronics should be to preserve the original trunk locations and preserve the cable which is in place. The following describes an analysis process that should achieve this objective and optimize the cost of equipment required.

The first step in comparing these performances is to define the requirements of the new system by doing a gain/spacing analysis of each span. Start with the trunk and compute the new gain requirement at the new bandwidth. Next, compute the dynamic range by calculating the carrier to noise ratio and carrier to composite triple beat ratio (cross-modulation, if it is the limiting factor). Adjust the operating levels until both noise and overload reach their limit at the same point in the cascade. Do this first for conventional amplifiers, then power addition, then feedforward. Maximum system length and best overall performance undoubtedly will point to feedforward. Now, compare the costs versus performance with your budget and choose the best one.

Figure 1 shows relative cable loss relationships of commonly encountered old and new system bandwidths. Note that large jumps in rebuild bandwidth require very high-gain amplifiers to preserve the same trunk station locations. High-gain amplifiers decrease the dynamic range drastically because of the lower input levels and higher output level requirements.

For trunk analysis, the old "V" charts still are a handy device for optimizing trunk levels for a given cascade length. (An example is provided in Figure 2.) Modern computer programs give the same information in tabular form and are a bit more elegant.

Distribution

A second major objective should be to preserve the existing distribution cables and the locations and type of line extenders.

Bridger, line extender and tap levels are the real "gotcha" in this process. Many old 220 MHz systems were designed for bridger levels as high as +50 dBmV. Levels to accommodate a direct drop-in bridger module at 300 MHz will approach +54 dBmV. It is well documented in published literature that 60-channel feedforward technology falls apart above +45 dBmV average level (40/49 dBmV linear tilt) because of the compression point of the hybrid used for the main and error amplifiers. In cases where higher distribution levels are required, power addition modules will be a better choice since they follow the 2:1 distortion curve to approximately +52 dBmV for 60 channels and +57 dBmV for 35 channels. Parallel power addition modules can extend these levels another 3 dB.

The Texscan bridger architecture pro-

Figure 1
Required spacing of new systems vs. old systems

		New BW (MHz)			
Old BW	Spacing	300	400	450	MHz
216 MHz	24	29	33	36	dB
	22	26	30	33	dB
	20	24	28	30	dB
270 MHz	24	25	29	31	dB
	22	23	27	29	dB
	20	21	25	26	dB
300 MHz	24	—	28	30	dB
	22	—	26	28	dB
	20	—	23	25	dB

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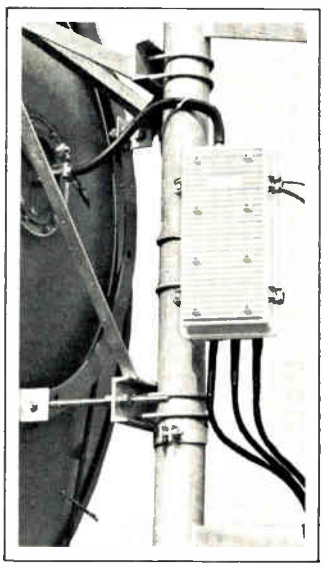

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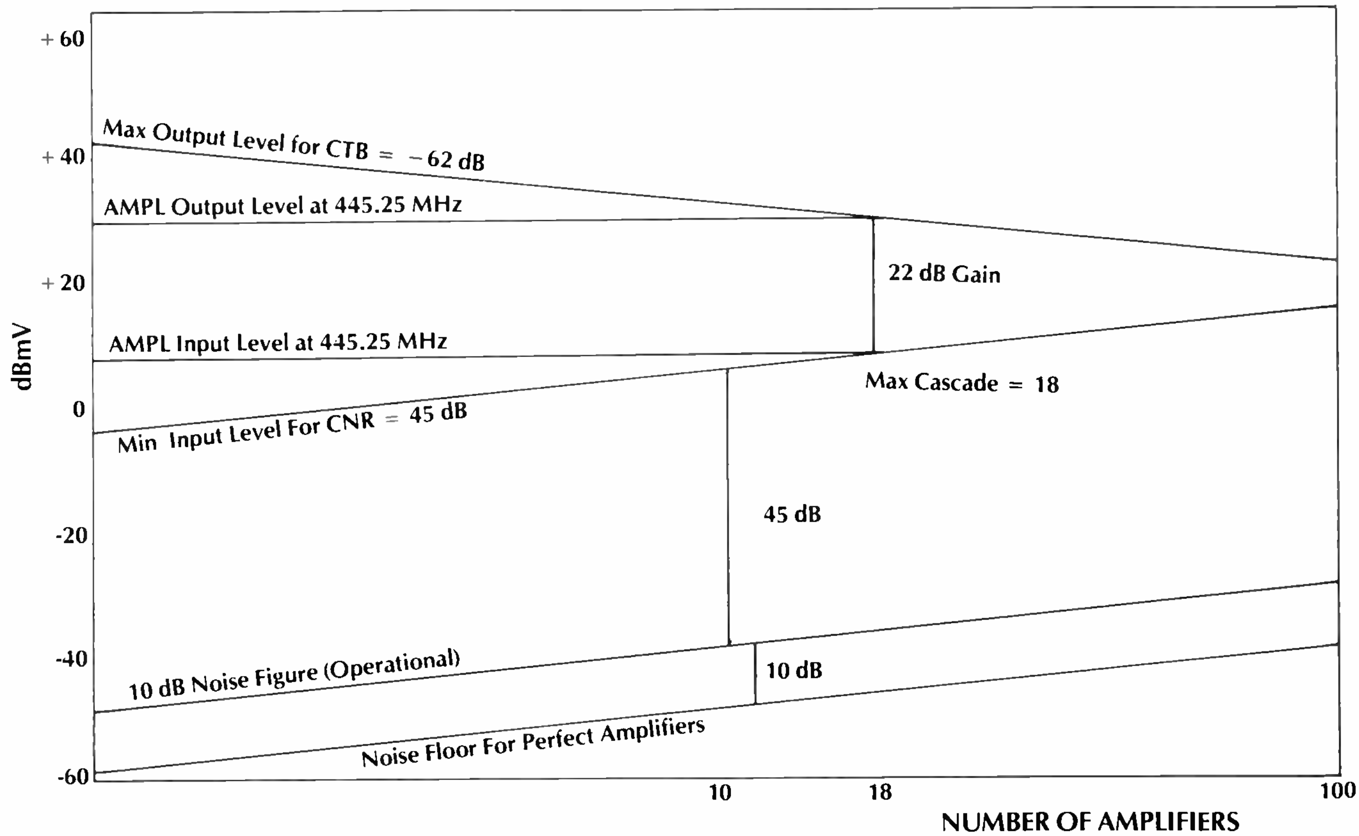
Figure 2
V-curve for typical 450 MHz trunk



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vides a 4 dB better chance of preserving line extender locations. Two independent parallel bridger output hybrids each serve two bridger distribution ports via a two-way splitter (4 dB loss). The standard approach is that of one bridger output hybrid amplifier serving all four bridger distribution ports via a 4-way splitter (8 dB loss). This architectural advantage can mean the difference between being able to preserve tap and line extender locations and being forced to move them.

In a recent analysis made by the System Design Group at Texscan on a 270 MHz upgrade to 400 MHz, it was determined that the trunk easily could be replaced by 28 dB gain feedforward amplifiers. An analysis was made of the distribution lines in an attempt to preserve the tap and line extender locations. To accomplish this scenario, 50 percent of the bridgers would have outputs of +50.5 dBmV; 38 percent would have +55 dBmV output; and 12 percent would have outputs of +60 dBmV. Seventy-three percent of the line extenders would have outputs of +57 dBmV. Obviously, a significant amount of redesign and rebuilding would be required on this system even with feedforward and power addition units in the distribution.

If feedforward is chosen for the trunk, and the trunk levels are higher than normal, check the bridger tap levels to be sure they are compatible with the bridger. In one system rebuild, the feedforward trunk levels were set for +42 dBmV, and the bridger levels were set at +48 dBmV. The bridger had to be padded down to be compatible. Check with the equipment manufacturer to be sure of this compatibility. Texscan has implemented a "plug-in" bridger tap directional coupler approach so that any combination of trunk amplifier levels may be appropriately matched to the necessary bridger levels required to meet the rebuild requirements.

Feedforward and power addition amplifiers offer a powerful means of upgrading performance without total rebuilds. . .

Design examples

Three examples are given that show the trade-offs involved. First, assume an upgrade from 270 MHz to 400 MHz on a 20 amplifier casade. Conventional equipment could not be used past five trunk amplifiers because of the high distribution levels. However, as shown in Figure 3, a feedforward trunk, power addition bridger and conventional line extenders would yield acceptable performance.

The second example illustrates an upgrade from 216 MHz to 300 MHz. Acceptable performance can be achieved with conventional equipment if the tap

Figure 3
Cascade performance analysis of three examples

Example #1 270-400 MHz

Type	Trunk FF	Bridger PA	1 LE Conv.	2 LE Conv.	
Old Levels	32.0	42.0	40.0	40.0	dBmV
New Levels	38.0	46.0	44.0	44.0	dBmV
CNR	45.0	45.0	44.9	44.8	dB
CTB	61.0	58.4	57.2	56.1	dB
Cascade	20				
Spacing	27				dB

Example #2 216-300 MHz

Type	FF	PA	CO	CO	
Old Levels	32.0	44.0	42.0	42.0	dBmV
New Levels	33.0	48.0	46.0	46.0	dBmV
CNR	46.0	46.0	45.9	45.9	dB
CTB	79.0	65.1	59.0	55.5	dB
Cascade	20				
Spacing	26				dB

Example #3 300-450 MHz

Type	FF	PA	FF	FF	
Old Levels	32.0	46.0	42.0	42.0	dBmV
New Levels	38.0	50.0	47.0	47.0	dBmV
CNR	44.8	44.7	44.7	44.6	dB
CTB	62.5	54.6	53.8	53.2	dB
Cascade	15				
Spacing	26				dB

levels are reasonably low. If higher tap levels are required, as shown, feedforward trunk and power addition bridgers must be used. Note in Figure 3 that the bridger level is +48 dBmV before split, and the line extender level is +46 dBmV. This analysis is based on original bridger levels of +44 dBmV before split. If the original bridger level is higher, then other trade-offs will have to be investigated.

The third example illustrates an upgrade from 300 MHz to 450 MHz. Satisfactory performance in this system cannot be achieved with conventional equipment. Feedforward trunk and line extenders and power addition bridgers are required to meet reasonable performance levels, even at the fifteenth trunk station.

There still are a number of 220 MHz systems on 30 VAC power. The increased current consumption of feedforward, power addition and even modern conventional equipment will almost certainly force a redesign of the power system. If so, plan on 60 VAC powering.

Feedforward and power addition amplifiers offer a powerful means of upgrading performance without total rebuilds, but each system must be analyzed *individually* to determine the best combination of equipment. CED

Preventing secondary decoder theft via master/slave configuration

By Tony Chen-tung Li
Manager, Product Design Engineering
Oak Communications Inc.

In the operation of cable television systems, a subscriber may have more than one TV receiver which he wants to connect to the cable system. Each of those receivers will require an individual cable TV decoder unit if it is to have full access to the programming on the cable system. Frequently, cable operators provide pay services to a secondary decoder at a significantly lower subscription rate than that charged for the use of the primary decoder.

Many CATV system operators are concerned that subscribers will pay the lower rate for one or more secondary TV decoders and then rent those decoders to other subscribers, thereby circumventing the normal premium service fee. The result is less revenue for the system operator.

The Oak master/slave concept provides a system of control for addressable cable systems using out-of-band data carrier whereby slave (secondary) decoders must be operated in the presence of an in-resident master (primary) decoder. Otherwise, they will be disabled by the system headend.

The master/slave concept

The master/slave configuration consists of at least two decoders. The master is the primary unit in the premise, and the slave is the secondary unit. The slave unit does not function unless its address control data from the headend transmitter is protected by a master decoder. Thus, if the slave unit is used in a neighbor's home without its master, it will not function.

Both the master and the slave can individually respond to all addressable features from the headend because the uniqueness of the scheme lies in the selective blocking, by the *master* unit, of deauthorize commands directed to all slave decoders from the headend. A high level of security can be achieved without requiring complex handshaking duplex data communications between the two decoders.

Figure 1
FSK receiver inhibit

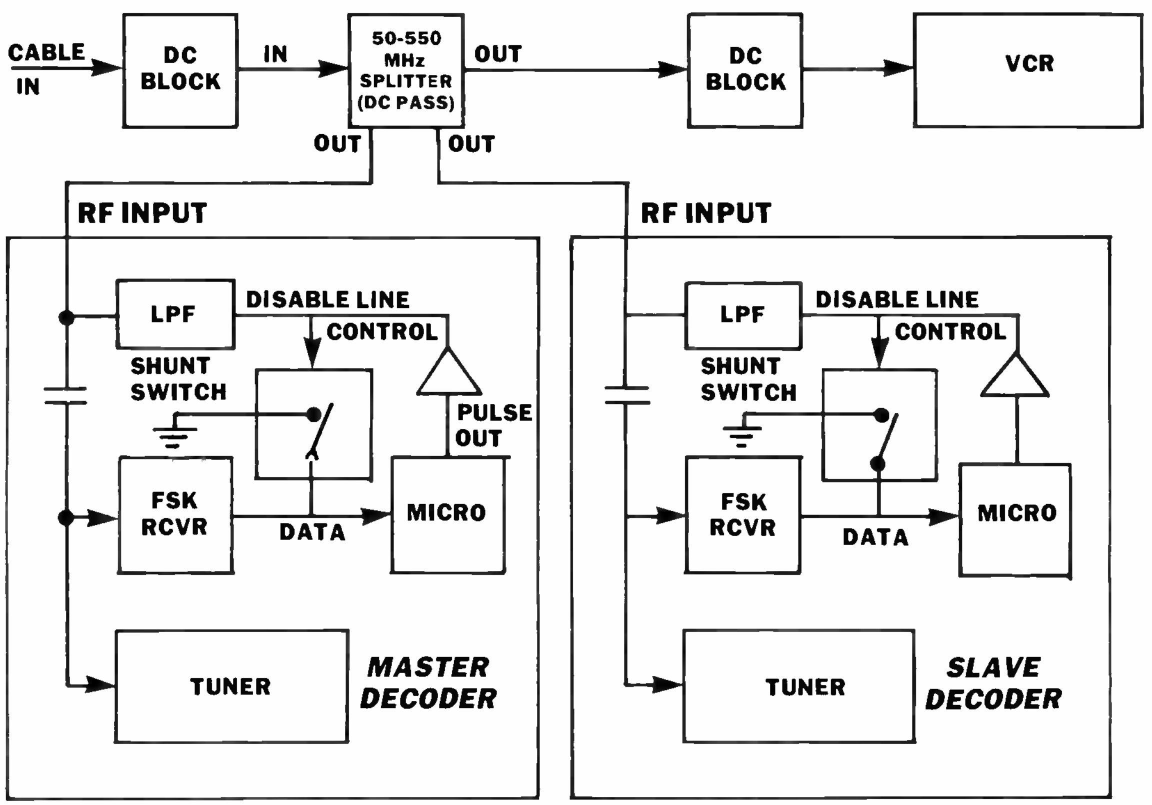


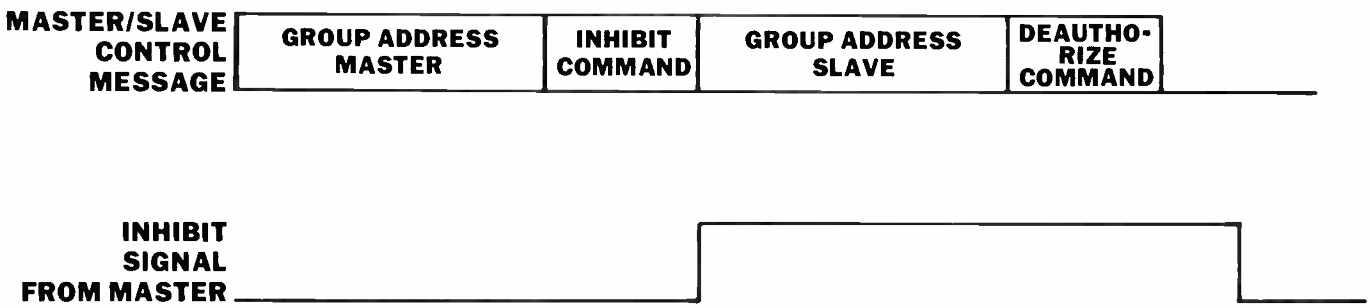
Figure 1 illustrates a functional block diagram of a master/slave configuration, the FSK inhibit approach. The master is designed to transmit a DC pulse of a certain duration to the slave that will disable the slave decoder's control data line during a deauthorize message that follows an inhibit message. (See Figure 2.) The DC pulse is put on the RF input cable of the master decoder whenever an inhibit command is received from the headend via the out-of-band standard FSK control channel.

The inhibit command is sent to all master decoders in the system as a group. The duration of the inhibit DC pulse is sufficient to disrupt the following message, which is directed to slave decoders. The inhibit function operates as long as the master decoder is powered. The frequency and period of the deauthorization command can be operator-controlled at the headend. The slave decoder is designed to respond to the DC pulse inhibit signal. When this pulse is present, the FSK control data at the output of the slave FSK receiver is deactivited and no control data messages can be received by the slave microprocessor.

Periodically, the headend sends deauthorize messages to all slave decoders as a group, preceded by a group inhibit command sent to all master decoders. If the slave decoder *is* connected to the master decoder via the splitter, it will be protected from the deauthorize command and will continue to function normally. If the slave *is not* connected to the master, it becomes deauthorized following reception of the first deauthorize message.

Both slave and master decoders can be manufactured the same and shipped as master units. At installation a message from the headend can be sent via the standard FSK control channel that will configure designated decoders as

Figure 2
Timing diagram



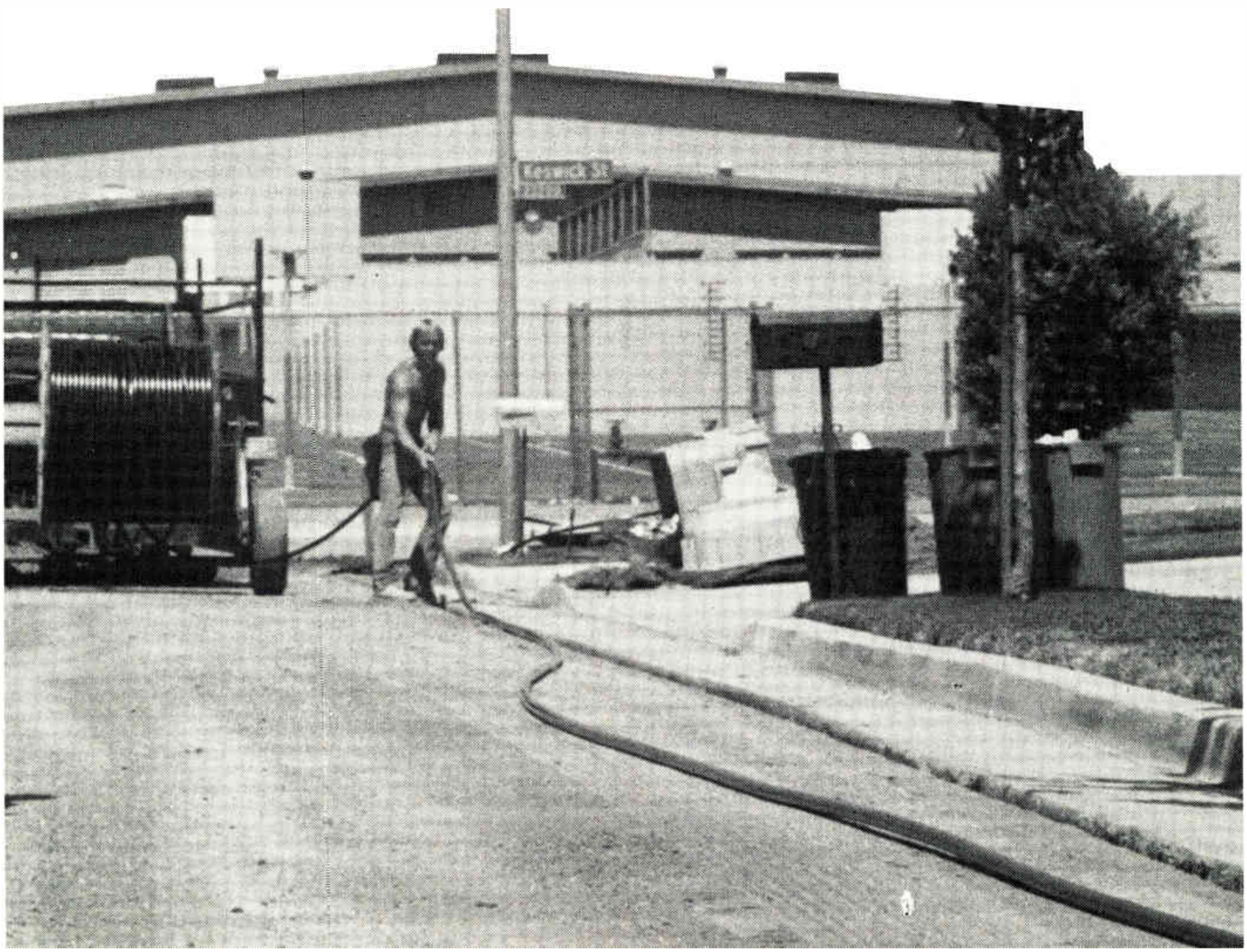
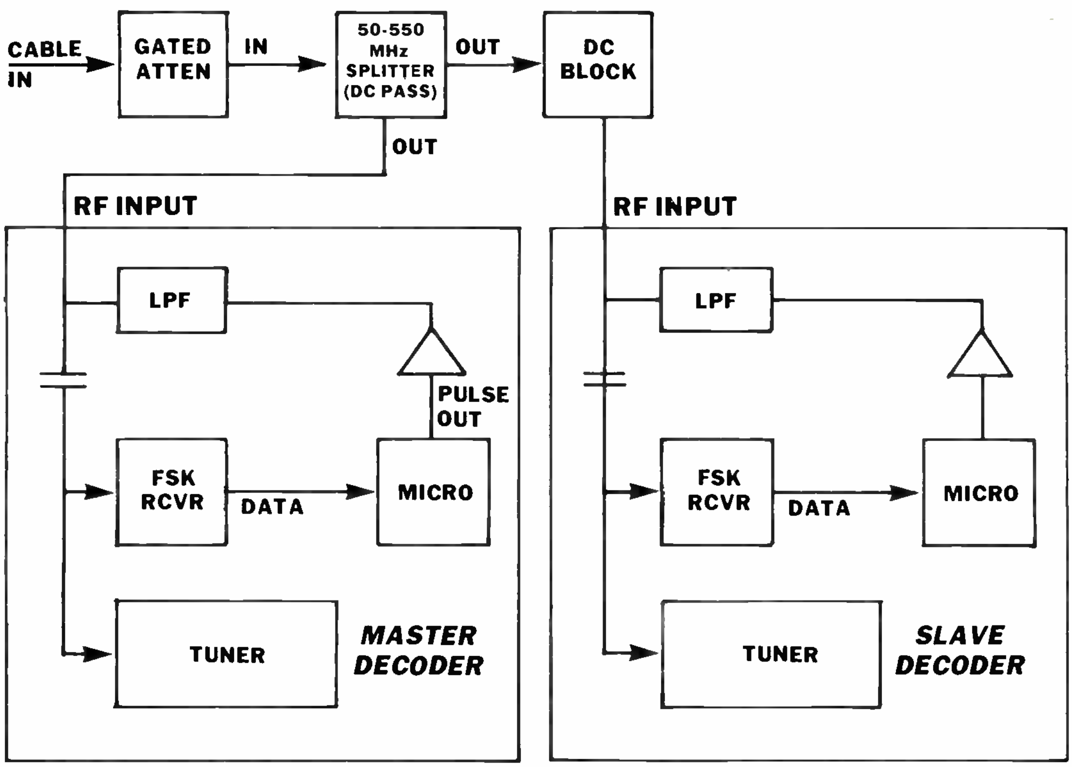


Figure 3
External gated attenuator



slaves or masters. The DC block units are required to block any DC signal from entering the system, as well as to prevent possible DC signal attenuation caused by customer equipment hook-up (such as VCRs). Most commonly available splitters can pass DC signals without significant degradation from output to output.

Central to this approach is a technique of informing the master units of an impending slave disable command. In any system employing this technique, the ability of a pirate to covertly mimic the master's message interruption process must be examined. The Oak solution to this issue, as well as other problems of control channel manipulation (or tampering), is to encrypt all control channel data messages using a time-varying process. Thus, a pirate will be unable to detect the slave disable warning message going to the master units.

Figure 3 shows a functional block diagram of the external gated attenuator approach to the master/slave configuration. The master decoder is designed to transmit a switching pulse on to the input cable. This switching pulse is transmitted by the master decoder immediately following reception of an inhibit command from the headend via the standard FSK control channel. The in-

The uniqueness of the scheme lies in the selective blocking, by the master unit, of deauthorize commands directed to all slave decoders from the headend.

hibit command is sent to all master decoders in the system as a group. The duration of the switching pulse is sufficient to prevent the reception of the following deauthorization message, which is directed to all slave decoders. The switching pulse operation is executed as long as the master decoder is powered.

The gated attenuator is designed such that the signal from the cable drop normally passes directly through to a splitter. However, when a switching pulse from a master decoder is imposed on the output port of the device, an attenuator is switched into the line to interrupt the RF signal. When the switching pulse is removed, the device returns to normal operation—passing all signals on the cable.

In the gated attenuator configuration, any addressable decoder that is system compatible can be used as a slave decoder. No special master/slave hardware is required in the slave decoder. At installation a message from the headend will be sent to the slave decoder to make it associate with the slave group. Periodically, a deauthorize message is sent to all system slave decoders as a group. If a slave is operated downstream from a master-decoder-controlled gated attenuator, it will be protected from receiving the deauthorize command. If the slave decoder operates directly on the system, it will deauthorize following reception of the first deauthorize message. Again, DC blocks are required to prevent significant degradation of the DC switching pulse.

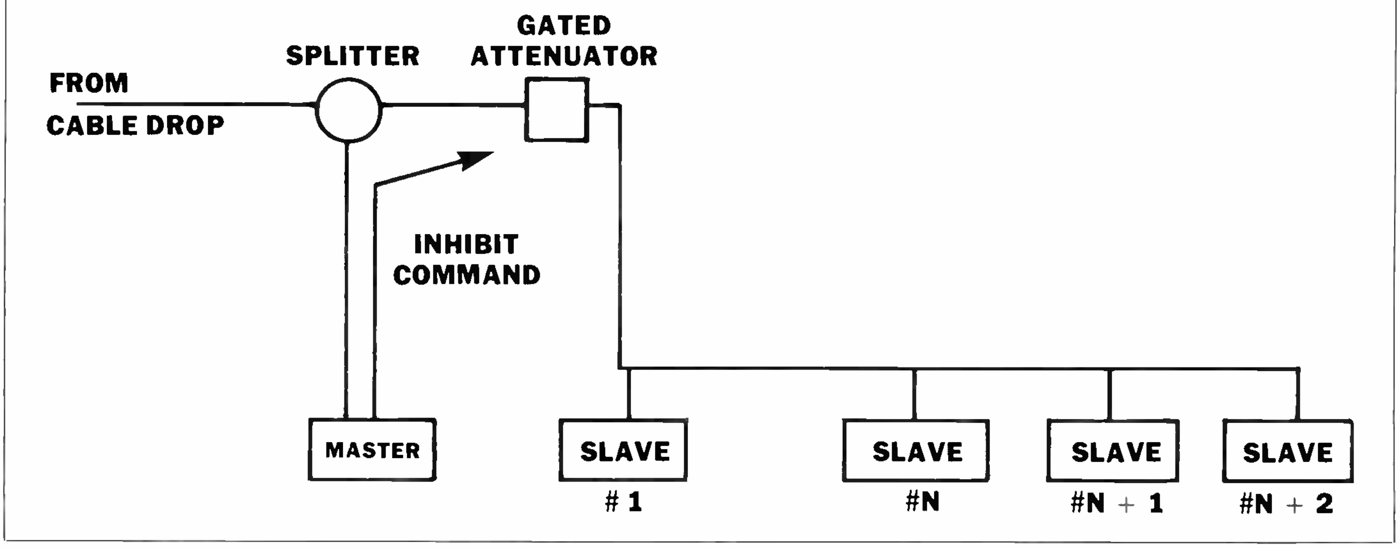
The gated attenuator method can readily be extended to multiple dwelling situations where a large number of slave decoders are required for the master decoder. (See Figure 4.) This can offer an interesting alternative to off-premises equipment in situations where unauthorized migration and use of home terminals is the principal concern.

There is no restriction to the number of slaves in one building. Each building would be treated as a separate group with its own group address. Thus, slave decoders from one building would be useless in any other building. However, interruption in the cable spectrum between the gated attenuator on/off states can create short duration disturbances visible in the TV picture.

Summary

The problem of secondary decoder theft is a major concern for cable system operators that offer lower rates for secondary decoders. The master/slave solution will eliminate that risk for ad-

Figure 4
Extension of multiple dwellings



dressable cable systems using out-of-band data carrier.

For the two approaches described, the master and slave decoders can be manufactured and shipped identically. At installation the decoders can be reprogrammed from the central control computer to function as master or slave decoders. For the gated attenuator approach, the slave decoders do not require any special master/slave circuitry to function as slaves. The control message will utilize a time-varying encryption process to ensure maximum security. These techniques are being patented and currently are under development at Oak Communications. CED

NOTE: This article is based on a paper to be included in the NCTA '85 Technical Papers.

About the author

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Amplifier $$$ and sense

By David Underwood,
Applications Engineer,
Scientific-Atlanta Inc.

Feedforward technology has opened a new sense of cascade freedom for the designer, but cascade limitation is not the only consideration when determining what types of amplifiers and cable are to be used in any given application.

Cost is one issue that must be examined on a practical scale. That is, cost from a hardware as well as a power consumption point-of-view. There are several options that must be considered in order for feedforward technology to play a positive problem solving role. The intent of this article is to define a practical application for feedforward technology with regard to system economics, technical practicality and system simplicity.

First, I will examine device comparisons of push-pull, parallel hybrid and feedforward. Next, we will look at feedforward in a supertrunking application. With at least three gain versions available, it can be difficult to pick and choose the right gain and cable diameter combination to fit optimum performance versus economics. A price/performance comparison will be presented relative to cable diameter and trunk amplifier gain. Third, we will illustrate the use of trunk amplifier technology combinations. Here we will examine a trunk cascade comprised of 60 percent push-pull and 40 percent feedforward. The point is to match 100 percent parallel hybrid trunk performance while reducing cost and system complexity. Fourth, the system upgrade gain requirements will be examined, offering feedforward as a practical solution. Finally, a series of trunk/feeder performance analyses will be presented realizing optimum usage and placement of feedforward, parallel hybrid, and push-pull amplifiers.

System limitations

Among the various characteristic limitations in cable systems, noise and distortion contribute more to system degradation than any other elements. Since noise and distortion contributions are predictable elements (as long as levels are held constant), cascade length versus acceptable levels of noise and distortion are easily calculated.

Distortion generated in CATV amplifiers is caused by the non-linearity of the hybrids and is a function of channel loading and signal level. Composite triple beat (CTB) and cross modulation products, will degrade by 2 dB for every 1 dB increase in signal level. The carrier to noise relationship (C/N) will improve by 1 dB for every 1 dB increase in signal level.

The most significant factors influencing end-of-line performance are the single station characteristics. Improvement in single station characteristics over conventional push-pull technology is accomplished with parallel hybrid and feedforward technology.

In order to understand the relationship of individual station performance relative to end-of-line performance, a brief description of push-pull, parallel hybrid and feedforward technology is in order.

Broadband transmission of video and data over coaxial cable requires the incorporation of distortion reduction techniques into the active portion of the system. The most familiar and common means of reduction techniques are found in the standard CATV hybrid amplifier.

Push-pull, rather than single-ended, amplifiers permit broadband amplification while contributing a minimal amount of distortion to the system. Utilization of a push-pull output configuration results in reduced second-order distortion when compared to single-ended

Figure 1
Device specification comparison

	Push-pull	Parallel Hybrid	Feedforward
Gain	19 dB	19 dB	24 dB
Freq. Response	±0.1 dB	±0.2 dB	±0.2 dB
Output Level	33 dBmV	33 dBmV	33 dBmV
CTB	−84 dB	−89 dB	−106 dB
NF	6 dB	6.5 dB	9 dB
DC Current	230mA @ 24V	450mA @ 24V	670mA @ 24V

Notes: 450 MHz 62cH loading

When combined to form complete amplifiers, the different devices result in performance shown in Figure 2. This chart assumes identical interstage and amplifier losses of the different devices.

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output amplifiers. This was the first use of distortion cancellation techniques in CATV applications and has proven to be effective and highly reliable.

As discussed earlier, the output levels of a push-pull device will play a major role in setting the distortion limitations of that same device. Distortion performance of an amplifier at a given level can be improved if two push-pull hybrids are placed in a parallel configuration. The output level of each active device is reduced, resulting in approximately 5.5 dB of distortion improvement over conventional push-pull amplifiers. Because of input and output coupling losses within the power-doubling device, parallel hybrid amplifiers have a slightly worse noise figure than their push-pull counterparts.

The feedforward concept can be explained as follows:

1. A signal introduced to the input of the feedforward gain block is amplified by the main amplifier.
2. The output of the main amplifier is compared to its input. The result is an error signal consisting of the distortion products generated by the main amplifier.
3. This error signal is amplified by the error amplifier.
4. The amplified error signal is subtracted from the output of the main am-

Figure 2
Typical station specifications
(450 MHz, 62 chan.)

	GAIN (dB)	CTB (dB)	NF (dB)
Trunk Amplifiers			
22 dB PP TRUNK	22	81	9.1
28 dB PP TRUNK	28	82	9.3
22 dB FF TRUNK	22	99	12.0
26 dB FF TRUNK	26	99	10.0
30 dB FF TRUNK	30	99	9.0
22 dB PH TRUNK	22	88	8.0
26 dB PH TRUNK	26	88	8.5
Bridging amplifiers			
PP BRIDGER	29	62	5.3
PH BRIDGER	29	66	8.5
FF BRIDGER	29	79	10.0
Line extender amplifiers			
PP LINE EXTENDER	32	62	7.5
PH LINE EXTENDER	33	67	8.0
FF LINE EXTENDER	32	78	8.5

Outputs
TRUNK 33 dBMV, BRIDGER 46 dBMV, LINE EXTENDER 46 dBMV

Typical specifications include losses for equalization and interstage AGC/ASC and thermal compensation, if applicable.

plifier. Consequently, the distortion products generated in the main amplifier are cancelled out.

Phase relationships are critical in order for the feedforward cancellation to take place. Consequently, highly accurate delay lines are required to maintain the proper phase relationships throughout the feedforward gain block.

In comparison to standard push-pull technology, the feedforward technique renders a minimum 18 to 20 dB improvement in distortion. A specification comparison between push-pull, parallel hybrid and feedforward devices is shown in Figure 1.

Supertrunk applications

Feedforward technology offers the greatest advantage when used in conjunction with higher amplifier gains. This is particularly helpful when implementing a supertrunk application, as less trunk amplifiers may be used to reach a given distance.

The economics of the design now must be analyzed to choose the proper cable diameter along with amplifier gain to satisfy a given end-of-line performance.

The examples below show three gain versions of feedforward trunk stations—22, 26 and 30 dB. Each gain version was used with 0.750, 0.875 and 1.0 inch cable and compared on performance and cost. Desired performance at the end of the cascade is 45 dB C/N and 57 dB CTB.

22 dB gain feedforward at 450 MHz

0.750"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $40,000
	TRUNK TOTAL	= 55 (22 dB)
	FF TRUNK COST w/AGC	= $54,000
0.875"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $53,000
	TRUNK USAGE	= 50 (22 dB)
	FF TRUNK COST w/AGC	= $48,000
1.000"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $77,000
	TRUNK USAGE	= 46 (22 dB)
	FF TRUNK COST	= $43,000

(NOTE: 110,880 FT. = 21 MILES)

System cost with 22 dB gain spacing
0.750 inch—$ 94,000
0.875 inch—$101,000
1.000 inch—$120,000

26 dB gain feedforward at 450 MHz

0.750"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $40,000
	TRUNK TOTAL	= 48 (26 dB)
	FF TRUNK COST w/AGC	= $48,000
0.875"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $53,000
	TRUNK USAGE	= 42 (26 dB)
	FF TRUNK COST w/AGC	= $42,000
1.000"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $77,000
	TRUNK USAGE	= 38
	FF TRUNK COST w/AGC	= $38,000

System cost with 26 dB gain spacing
0.750 inch—$ 88,000
0.875 inch—$ 95,000
1.000 inch—$115,000

30 dB gain feedforward at 450 MHz

0.750"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $40,000
	TRUNK TOTAL	= 42 (30 dB)
	FF TRUNK COST w/AGC	= $45,000
0.875"	PLAIN CABLE TOTAL	= 110,880
	CABLE COST	= $53,000
	TRUNK USAGE	= 36 (30 dB)
	FF TRUNK COST w/AGC	= $38,000
1.000"	PLAIN CABLE TOTAL	= 110,880 FT.
	CABLE COST	= $77,000
	TRUNK USAGE	= 33 (30 dB)
	FF TRUNK COST	= $35,000

System cost with 30 dB gain spacing
0.750 inch—$ 85,000
0.875 inch—$ 91,000
1.000 inch—$112,000

Price versus 21 mile supertrunk performance

	C/N (dB)	CTB (dB)	Supertrunk Cost
22 dB Spacing			
0.750" Cable	44.7	55.9	$ 94,000
0.875" Cable	45.2	57.0	101,000
1.000" Cable	45.7	57.6	120,000

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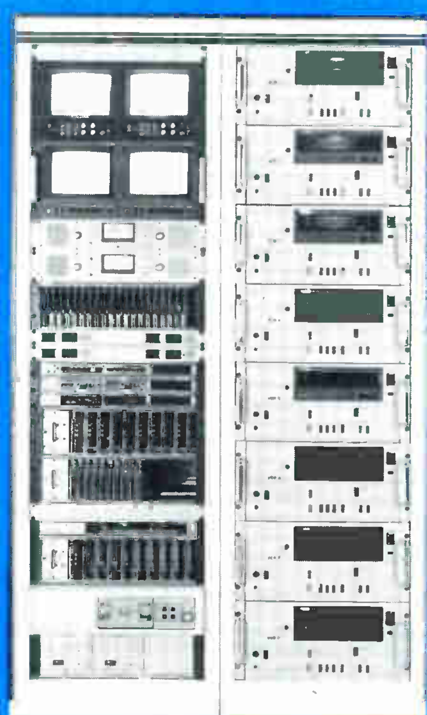

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	C/N (dB)	CTB (dB)	Supertrunk Cost
26 dB Spacing			
0.750" Cable	44.4	55.4	$ 88,000
0.875" Cable	45.0	56.5	95,000
1.000" Cable	45.4	57.4	115,000
30 dB Spacing			
0.750" Cable	43.0	54.5	$ 85,000
0.875" Cable	43.7	55.9	91,000
1.000" Cable	44.0	56.6	112,000

It may be concluded from the preceding example that the combination of 22 dB gain feedforward amplifiers and 0.875 inch GID III cable provides the best combination of lowest cost while still meeting the minimum end trunk cascade performance criteria of 45 dB C/N and 57 dB CTB.

Feedforward and push-pull combinations

As more and more feedforward amplifiers become plug-compatible with their push-pull counterparts, the idea of mixing feedforward and push-pull amplifiers in a given trunk is becoming increasingly accepted throughout the cable industry. This method of custom tuning a cascade permits the designer to obtain desired end-of-cascade performance specifications without using feedforward in all trunk stations. This flexibility minimizes up-front costs, while permitting future system expansion.

One result of being able to mix feedforward and push-pull is the ability to come up with trunk cascades that have equal end-of-cascade performance to that of total parallel hybrid trunk cascades, while still using some amount of push-pull trunk amplifiers. This approach minimizes the number of amplifiers that are not push-pull and still meets the desired end-of-cascade performance.

The next questions to ask are: What mix of push-pull and feedforward amplifiers equals total parallel hybrid performance? Is that push-pull/feedforward mixture less expensive to build and power than the total parallel hybrid cascade?

Trunk cascade performance

100 percent parallel hybrid cascade performance
Individual station specifications

C/N = 56.7
CTB = 88.0
Trunk Output = 32 dBmV

Cascade analysis (21 trunk amplifiers):

CTB (CSC) = (-88.0) + 20 Log (21)
= **-61.5 dB**

C/N (CSC) = (-56.7) + 10 Log (21)
= **-43.5 dB**

40 percent feedforward + 60 percent push-pull cascade performance
Individual station specifications

1. Feedforward specifications:
   C/N = 60.2 dB
   CTB = 91.0 dB
   Trunk Output = 37 dBmV

2. Push-pull specifications
   C/N = 54.9 dB
   CTB = 85.9 dB
   Trunk Output = 31 dBmV

Cascade analysis (8 feedforward/13 push-pull trunk amplifiers)

1. Feedforward segment (8 amplifiers)
   CTB (CSC) = (-91.0) + 20 Log (8)
   = -72.9 dB
   C/N (CSC) = (60.2) + 10 Log (8)
   = 51.2 dB

2. Push-pull segment (13 amplifiers)
   CTB (CSC) = (-88.0) + 20 Log (13)
   = 65.7 dB
   C/N (CSC) = (-54.9) + 10 Log (13)
   = 43.8 dB

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Figure 3

Pre-upgrade Bandwidth (MHz)	Post upgrade bandwidth (MHz) 260	300	330	400	450
216	24.3	26.3	27.8	30.6	32.4
260		23.8	25.1	27.7	29.3
300			23.2	25.6	27.0
330			24.3	25.7	28.4
400				23.3	25.7
450					24.4

Post Upgrade Gain
(Assumes 22 dB pre-upgrade spacing)

3. Combination cascade (8 feedforward + 13 push-pull)

CTB (SYS) = 61.0 dB
C/N (SYS) = 43.1 dB

From the preceding analysis, it can be seen that 40 percent feedforward/60 percent push-pull cascade performance is quite near that of 100 percent parallel hybrid cascade performance in most trunk applications.

With performance equalized, the next analysis will look at equipment costs of a 40 percent feedforward/60 percent push-pull versus a 100 percent parallel hybrid cascade. For clarity, the pricing shown reflects only the trunk module pricing since all other costs (AGC, housing, power supply, etc.) are common to both examples.

100 percent parallel hybrid

$ 380/amplifier
x 21

$7,980/21 amplifier cascade

40 percent feedforward + 60 percent push-pull

$ 250/PP amplifier
x 13

$3,250

$ 500/FF amplifier
x 8

$4,000

$7,250/21 amplifier cascade

Forty percent feedforward/60 percent push-pull has approximate performance parity with 100 percent parallel hybrid, yet the electronics cost less than the parallel hybrid system.

System powering

Feedforward devices and parallel hybrid devices draw significantly more current than their push-pull equivalents. For this reason our comparison is not complete without a look at powering cost comparisons between our 40 percent feedforward/60 percent push-pull and 100 percent parallel hybrid cascades.

The following calculations reflect a conservative total power consumption for the 21 parallel hybrid trunks and the push-pull/feedforward combination trunk. For this illustration we will examine power consumption using 0.70 (70 percent) as the power supply/transformer efficiency.

100 percent parallel hybrid cascade
21 parallel hybrid cascade

Step 1 - DC(W) = DCI x DCV
DC(W) = 0.66 x 24
DC(W) = 15.84 WATTS

$$\text{Step 2 - AC(W)} = \frac{\text{DC(W)}}{\text{power supply efficiency}}$$

$$\text{AC(W)} = \frac{15.84}{0.70}$$

AC(W) = 22.62 WATTS

Total Power = 21 amplifiers x 26.62 AC (WATTS)

Parallel hybrid = 475 AC (WATTS)

40 percent feedforward/60 percent push-pull amplifier cascade
13 push-pull amplifiers segment:

Step 1 - DC(W) = 0.44 x 24
= 10.56 WATTS

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Figure 4 Amplifier types versus cascade performance

AMPLIFIER TYPE TRK	BR	L.E. (2)	MAXIMUM CASCADE (TRUNKS)	COMMENTS
PP	PP	PP	15	1. If outputs of two line extenders are not derated by 3 dB, the trunk cascade is limited to (1) in cascade.
PH	PP	PP	17	1. Use of parallel hybrid trunks extends the total push-pull cascade by (2) amplifiers (113%).
FF	PP	PP	35	1. Use of feedforward trunk amplifiers extends the total push-pull cascade by (20) amplifiers (+133%) and extends the parallel hybrid trunk/push-pull feeder by (18) amplifiers (+106%) 2. A mixture of FF/PP in the trunk could be used for shorter cascades.
PP	PH	PH	21	1. Use of parallel hybrid in all feeder amplifiers extends the total push-pull cascade by (6) amplifiers (+40%) 2. Use of parallel hybrid line extenders permits use of non-derated output levels while still maintaining good trunk cascade lengths. (18 amps) 3. Use of parallel hybrid feeder permits the use of elevated feeder levels while delaying compression by nearly 3 dB over push-pull and feedforward feeder. 4. Cost effective where 2 or less feeder legs are used off bridger.
PP	FF	PP	19	1. Use of a feedforward bridger extends the total push-pull cascade by (4) amplifiers (+27%) 2. All line extenders remain push-pull 3. Use of a feedforward bridger becomes increasingly cost effective where 2 or more feeder legs are used off of the bridger.
PH	PH	PH	25	1. A total parallel hybrid system extends the total push-pull cascade by (10) amplifiers (+66%)
FF	FF	PP	50	1. Use of feedforward trunk/bridger and push-pull line extenders extends the total push-pull cascade by (35) amplifiers (+233%) and (25) more than a total parallel hybrid system (+100%) 2. All line extenders remain push-pull. 3. Line extenders can be left at 46 dBmV (without derate) and still obtain a (35) amplifier cascade. 4. A mixture of FF/PP on trunk could be used for shorter cascades.
FF	FF	FF	57	1. Use of total feedforward system extends the total push-pull cascade by (42) amplifiers (+280%) and (32) more than a total parallel hybrid system. (+128%) 2. Use of feedforward line extender is costly, but can be effective where use of extended feeder cascades is required (>3 line extenders)

Step 2 - AC(W) $= \frac{10.56}{0.7} =$ 15.09 WATTS

Total Power = 13 Amplifiers x 15.09 AC (WATTS)

Push-Pull Segment = 196.17 AC(WATTS)

8 feedforward amplifiers segment:

Step 1 DC(W) = 0.88 x 24
= 21.12 WATTS

Step 2 AC(W) $= \frac{21.56}{0.7} =$ 30.17 WATTS

Total power = 8 amplifiers x 30.17 AC (WATTS)

Feedforward segment = 241.36 AC (WATTS)

40 percent feedforward/60 percent push-pull cascade

= 196.17 W + 241.36 W
= **437.53 AC (WATTS)**

Assuming similar power factors and transformer power supply efficiencies, it may be concluded that the cost of powering a system with 40 percent feedforward/60 percent push-pull sta-

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tions is less than the cost of powering a system with 100 percent parallel hybrid stations.

There is another factor to be considered when contemplating using total parallel hybrid versus a mixture of feedforward and push-pull stations. No matter what system is being considered, it is desirable to keep the system as *simple* as possible. This practice maximizes system reliability and minimizes service requirements—a major goal for all cable system engineers.

Use of 100 percent parallel hybrid stations increases the complexity of every trunk amplifier in the cascade. Use of 40 percent feedforward and 60 percent push-pull concentrates the higher performance amplifiers in less than half of the trunk cascade—keeping most of the trunk with simple push-pull stations.

System upgrade

By definition, a system upgrade involves using the existing trunk cable, and possibly distribution cable, but still expands the system's bandwidth. This requires higher gain trunk amplifiers since the post-upgrade attenuation per amplifier will be greater.

Figure 3 shows the trunk amplifier gains required to accomplish various frequency upgrades. As can be seen from Figure 3, most upgrades involve a 26 dB post upgrade trunk gain. For this reason, all of the following system applications will involve 26 dB trunk amplifiers.

System applications analysis

With all the potential combinations of push-pull (PP), parallel hybrid (PH) and feedforward amplifiers in trunk, bridging and line extender applications, the system engineer is faced with the task of determining which type or types are most effective in any given application. The following section outlines cascade limitations of many combinations of distribution amplifiers and comments on the advantages of each type.

The cascade analyses use the amplifier performance shown earlier in this paper and assume the following:

System Bandwidth	450 MHz
Channel Loading	62
Trunk Gain	26 dB
Bridger Output	46 dBmV
Line Extender Output	46 dBmV (1 L.E.)
	43 dBmV (2 L.E.)
Tilts	3 dB Trunk
	7 dB Feeder
Minimum End-Of-Cascade Performance (Including Bridger and 2 Line Extenders)	C/N = 43 dB
	CTB = 53 dB

Conclusions

- Parallel hybrid and feedforward technologies offer the system engineer great flexibility in designing a new build, rebuild, or upgrade cable system.

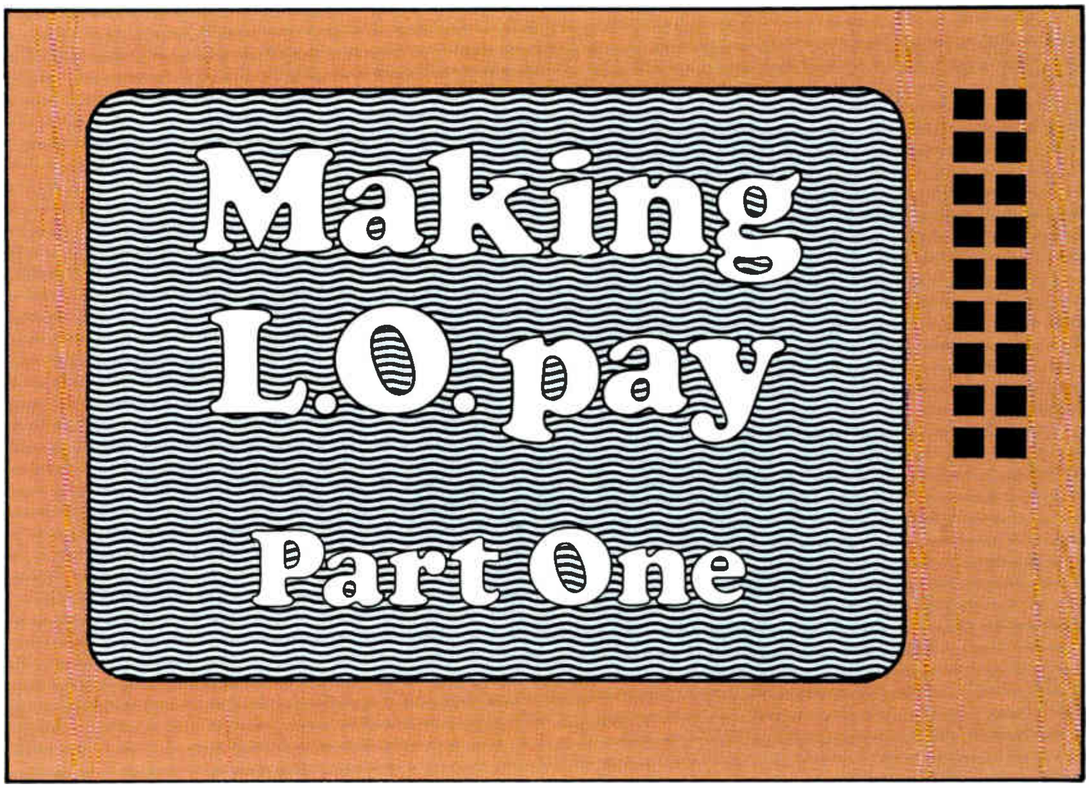
- For the reason of system simplicity and reliability, push-pull technology should be used whenever parallel hybrid or feedforward amplifiers are not needed.

- Feedforward technology is a cost-effective solution to supertrunking applications.

- Use of feedforward and push-pull technology can be a cost-effective alternative to using 100 percent parallel hybrid cascades.

- In applications where many feeder legs are being served by a bridger, feedforward bridgers/push-pull line extenders can offer economic and performance advantages over parallel hybrid bridgers and line extenders.

- In applications where there are few feeder legs coming out of bridger or where elevated feeder levels are required (>46 dBmV), parallel hybrid bridgers and line extenders can offer economic and performance advantages over feedforward bridger/push-pull line extenders. CED



By David Andis

Pay-per-view is one way cable operators hope to generate new revenue streams. Another growing area is local ad insertion. Today, almost all non-premium services, such as CNN, ESPN, USA, MTV, The Nashville Network, Lifetime and others, make local ad time available to their affiliates.

Avail times vary from a minimum of one or two minutes per hour upwards to six minutes per hour for local systems to insert their local ads. The potential for revenue from the commercial insertion endeavor is tremendous. A system in Houston, Texas, predicts it will generate over $1.5 million in local ad sales in 1985, with a subscriber base of 18,000. Translated into dollars, this projection would equal roughly $83.33 per sub—almost hard to believe. Yet it's happening across the country as rapidly as manufacturers enter the hardware market for commercial insertion equipment, which ranges from the very simple one machine per channel to the complex and elaborate random access units with computer programs that do everything from scheduling to billing.

The drawbacks to local commercial insertion are mainly production and equipment expenses. The cheapest I've seen commercial insertion done is just under $3,000 per channel. That's the actual insertion equipment cost. In addition to equipment, you have to invest in a sales force and develop a marketing scheme. Also, someone has to produce the spot, put it on tape, lay down the necessary tones for cuing and update the tapes regularly. Because the initial expense sometimes is prohibitive, specialized commercial insertion firms have moved in. They lease the rights to a system's avails for either a flat fee, a percentage or both.

Access and L.O.

There are other choices as well. Local programming has been in the shadows for a few years. After the franchising hoopla died down, the problems of wiring, theft prevention, must-carries, scrambling and adding new networks outweighed investments for local channels. Systems that invested heavily in access channels began to lose money, and many scaled down their local productions. Others pulled the plug. But when the industry pushed its federal deregulation bill through Congress last year, it also intensified the few areas of local control which remained with city council. So, the issue persists.

There are two basic types of local channels. The first and most common are access channels: public, government, leased and educational channels. An initial equipment investment averaging around $50,000 usually is necessary.

The second, and least programmed, local channel format is local origination. In essense, a local origination station is a miniature independent broadcast channel. Best of all, an L.O. station can sell air time just like its broadcast counterpart but for much less. While there is no standard *right* way to do L.O., we have learned a few things.

In the United States, 43 percent of all L.O. channels are combination access/L.O. Only 9 percent of the local channels in the country are *strictly* L.O. MSOs operate 90 percent of the local origination channels, while 9 percent are operated independently. Operating budgets vary accordingly. The average equipment investment into L.O. by an MSO is roughly $250,000, while independents average considerably less at $100,000. Most local channels own or have access to a mobile unit, and more than 41 percent have both a van and a production studio. The most popular yearly budget is under $25,000 with more than 30 percent reporting.[1] Unfortunately, there are no records as to annual income from local origination stations and, thus, no accurate way to tabulate their rate of success or failure.

Getting started

It will be very hard to set up even the most basic local station without an initial budget of at least $100,000.

The following is a general overview of equipment necessary to start a simple production operation.

Two cameras (studio/eng)	$20,000
Editing pack	10,000
Two time-base correctors	15,000
Production switcher	7,000
Video tape players	5,800
Lighting	3,000
Audio board	3,500
Test equipment	4,500
Monitors	4,300
Sync generators	3,100
Mics/batteries/chargers	2,000
Tripods/carrying cases	5,000
Distribution amps/assrt	2,000
Automation switcher	6,000
Character generators	10,000
TOTAL:	$101,200

Another area of concern is staffing. Nearly 50 percent of the companies doing local programming operate with a staff of less than five full-time employees. The remainder of the workload is done by volunteers, either from the community or neighboring schools and universities. Although often young and untrained, these volunteers more than make up in energy and enthusiasm what they lack in experience. As far as full-time employees are concerned, students fresh from college appear to have a corner on the marketplace. Cable has become an excellent entry-level industry for recent graduates trying to find a place in the TV and video world.

The average equipment investment into L.O. by an MSO is roughly $250,000, while independents average considerably less at $100,000.

After you've begun organizing the hardware and staff, programming is the issue. And the product *must* reflect the community which it serves.

A local origination station format can be profitable if done properly. Next month, I'll examine ways in which L.O. stations can increase their appeal to both viewers and advertisers, and I'll try to project the outlook for local programming channels. CED

References

[1] *The Video Register*, 1984-1985, Knowledge Industry Publications Inc. White Plains, New York 10604. Wallace Press 1984.

About the author

David Andis was production manager and chief engineer for Malloy Broadcasting in Houston, Texas. He now is a consultant to the cable industry and L.O./access centers.

Off-channel MTS

By James Wonn,
Manager Equipment Engineering, Group W Cable

A year ago, the cable industry was much concerned with BTSC and for good reason. We had a lot of questions: Would BTSC produce quality audio in a cable environment? How would cable equipment react? Would interference be a significant problem? Would BTSC lead to a customer-friendly product? Over the past year, only modest progress was made to dispel most of these concerns, but we have learned some positive things.

First, multichannel sound and BTSC are not *necessarily* synonymous. Stereo sound can be delivered to our cable customers in forms other than the BTSC format received off-air. Second, customers *want* stereo audio, and we believe they'll pay for it.

Let's touch on some regulatory issues for a moment. No one knows if the FCC will ultimately rule multichannel sound a must-deliver. But Group W Cable believes that if the FCC rules on this issue at all, it will be must-*deliver*, and not must-*carry*. No matter how the FCC rules, we're preparing to move forward to evaluate alternative, non-BTSC methods for delivering TV stereo.

Last spring, fearing the worst about BTSC, the cable industry called for some alternative means of delivering multichannel sound over cable. One alternative called for was to deliver the stereo sound in a special and separate band of frequencies, *independent* of the normal TV channel. This meant equipment had to be worked out that automatically coordinates the reception of the appropriate audio signal with whatever channel the TV set is tuned to. If successful, the customer would be able to enjoy stereo without needing to buy a stereo TV. Instead, the stereo sound would be produced in the stereo equipment already found in most homes.

Happily, a number of vendors responded with creative, user-friendly hardware solutions that feature some form of automatic channel tracking, remote volume control, some second-language capabilities, and do not require a costly stereo TV for delivery.

Also in 1984, Group W Cable did some field and lab testing. This testing has started to produce some answers on issues of quality of delivered sound and potential for interference, but our inquiries and level of understanding are far from complete. We do know, however, that the baseband delivery equipment we now own probably won't work. Most of our headend modulators and demodulators require some modification for delivery of BTSC stereo sound. Some microwave signal transport equipment needs to be modified to carry BTSC, and some so-called stereo TVs are subject to interference from scrambled signals.

One specific field test relates to determining if signals delivered to subscribers are actually stereo. In our first few systems receiving BTSC, we thought we had discovered how to deliver it over the cable because we could see the BTSC pilot carrier on a subscriber drop with a spectrum analyzer. In another case, that conclusion was reached because the stereo LED lit up on a "stereo" TV set. But of course, it takes much more than just the pilot carrier to make BTSC stereo work.

We learned that we needed some simple, non-subjective way to confirm

that stereo actually is being delivered. The solution we have found quite useful is to take the Left and Right audio signals from a BTSC decoder and put them on the X-Y display of an oscilloscope. If the received audio is monaural, then the pattern on the X-Y scope is a straight line. Stereo sound, on the other hand, runs the X-Y scope trace in a random pattern all over the screen, since the Left and Right channels are different for stereo.

While we engineers often try to ignore what the marketplace is telling us, our marketing people won't permit that. And rightly so. In fact, it was from consumer market research that we developed the confidence that we were on the right track in believing the technical and marketing considerations of off-channel delivery methods indeed work hand-in-hand. In short, what makes technological and operational sense and what will sell are virtually one and the same thing.

Here are some of the highlights from our marketing survey. First, we project an enthusiastic reception to stereo TV sound—perhaps 15 percent to 20 percent of all subscribers. Second, the interest is concentrated in the younger male pay subscribers. Income level did not appear to be a significant factor. The study also provided some insights into the high-tech habits of our customers. Cable subscribers, particularly pay subscribers, are more likely than the population as a whole to own VCRs, component TVs and computers.

Thirty percent of our subscribers owned VCRs at the midpoint of 1984. This compares to the projected 20 percent of the general population predicted to have VCRs by the end of last year. And an additional 15 percent of our subscribers intend to purchase a VCR over the next 12 months, for a projected VCR base among cable subscribers of 45 percent by the end of 1985. Obviously, we must make sure that cable, including alternative stereo sound delivery methods, is VCR-friendly because nearly half of our subscribers will have a VCR by the end of this year.

But the picture changes drastically when customers are asked about purchasing a stereo TV set. Very few people own a stereo TV today, and less than 4 percent intend to purchase a stereo TV in the next 12 months. So, we see the interesting combination of a *low* ownership and *low* interest in purchasing a stereo TV with a *high* degree of interest in receiving stereo sound.

We must keep an eye on the most important consideration—the customer. What does he want? What is he willing to pay for? We're zeroing in on those questions, developing tests and refining the feature requirements so we can proceed to test market the off-

Perhaps the most surprising fact revealed by our market research was that customers preferred to buy, rather than rent, the equipment that could bring them stereo TV sound.

channel delivery idea and equipment development can continue along an appropriate path.

These are some of the features we think customers will be looking for and their equipment implications:

■ Channel Tracking—How user-friendly does it have to be? The right equipment must at least provide automatic coordination between sound and picture without further complicating the remote control situation. What about a trapped cable plant where converters are not required? The right stereo equipment *should not* require a converter to work.

■ Sound Quality—Not everyone is looking for 90 dB of dynamic range today, but what is the appropriate level? We think the answer is close to the sound quality produced by good home entertainment turntable equipment.

■ Interface Capabilities—What about interfacing with other in-home equipment? Are there plugs for the new stereo VCRs? How do they connect to the stereo TV sets?

All of these issues need to be answered by the right equipment.

Perhaps the most surprising fact revealed by our market research was that customers preferred to buy, rather than rent, the equipment that could bring them stereo TV sound. Obviously, this lease/buy issue is very important to the cable operators. First, if our customers can buy the needed equipment, we won't have to own it ourselves, which should make our financial people very happy. Second, customers are apt to take better care of the equipment they own, which should make our operations people happy too. And we're not responsible for maintenance, which should make our technicians smile. Finally, it doesn't raise our monthly price to customers, which should please our marketing people.

Customer ownership also leads to other questions and requirements:

■ Compatibility—Equipment must be compatible, at least within our own systems.

■ Expandability—We must be able to add channels as they become stereo.

■ Reliability—Stereo TV must be as reliable as cable TV itself.

Group W Cable plans to proceed with an operational evaluation of the off-channel method for delivering multichannel sound. Our primary focus will be to test customer acceptance of the idea of off-channel delivery, where so-called stereo TVs are not a requirement. By this time next year, we plan to be much farther down the pathway, and we look forward to having more information to share with you then. CED

Continued from page 12.

slightly soften otherwise high-quality pictures.

The moral of this tale is: Be wary of NTC-7 as a guide to signal waveform standards at cable subscriber terminals. It is a good tight standard, based on the *technological* capabilities of the Bell System network. It bears no relation, however, to the *viewer's perception of picture quality*. NTC-7 should not be used as a standard for cable TV system technical performance.

The recent FCC Proposed Rule Making in MM Docket No. 85-38 is most timely. By proposing to delete all technical performance standards and the FCC performance testing, FCC recognizes that its rules had little to do with customer satisfaction. The rules were so relaxed that poorly run systems could comply, and well-run systems might be out-of-spec in some relatively insignificant way. This is a good move. CED

References

[1] FCC Rules and Regulations; Section 73.682 (a)(16).
[2] Ibid; Section 73.687 (a)(1).
[3] Normal viewing distance generally is greater than 6 times the height of the viewing screen. This translates to about 6 to 8 feet from screens with 19 to 27 inch viewable diagonal.

Composite second-order distortions

By Norman Slater and Douglas McEwen, Cablesystems Engineering

Many cable television systems now are rebuilding or upgrading their networks in order to carry extra channels. These channels may have to be carried in order to meet franchise commitments or to generate greater revenue for the system.

Carrying more channels on a system causes two basic technical problems: an increase in intermodulation distortion and greater cable loss because the added channels usually are carried at higher frequencies. Because of the large economic advantages obtained by reusing existing cable, amplifiers with high gain and high output capability are desirable. To meet these two requirements, new amplifier technologies such as feedforward and parallel-hybrid amplifiers have been developed. In addition, various new headend technologies sometimes are used to improve system performance. Two commonly used examples are incrementally related carrier (IRC) frequency assignments and scrambling systems which also reduce distortion levels in the system.

These technologies all are designed to reduce the level or the effects of composite triple beat (CTB), the generally accepted limiting distortion in a CATV system.[1] Feedforward and parallel-hybrid technologies typically are used in post-amplifiers and provide some 18 dB and 5 dB improvement respectively in post-amplifier CTB. In an IRC system, CTB falls precisely on the video carrier frequency. The subjective degradation of picture quality is reduced, although the CTB level is unchanged. It generally is considered that IRC technology permits a 3 to 5 dB increase in amplifier output levels.[1] Scrambling systems used to provide security for pay channels or for tiered channels often use techniques such as suppression of synchronization pulses or alteration of video levels. One such technique, called sync suppression and active video inversion (SSAVI), reduces the CTB level by at least 10 dB if all channels are scrambled, and by a lesser amount if only some channels are scrambled.[2]

Cablesystems Engineering has performed subjective and objective tests on cascades of amplifiers fed by an operating system which uses IRC and has 30 out of 52 channels SSAVI scrambled. Cascades of 16 feedforward trunk amplifiers, 16 conventional trunk amplifiers and a combination of both cascades all were tested. The limiting distortion with various system configurations is shown in Figure 1, where it can be seen that CTB was not always the limiting distortion and that composite second order beats (CSB) tended to be the limiting distortion in many cases. This article examines why the technologies which give a significant improvement in CTB give a somewhat disappointing improvement in CSB, and will propose possible solutions to CSB problems.

CTB improvements

Improvements in CTB achieved with new technologies have been well researched and documented. This section will briefly summarize previous work in this area in order to highlight the differences between improvements in CTB and CSB.

Figure 1 Limiting non-linear distortion using 52 channel (400 MHz) loading

Amplifier Technology	IRC Comb	Modulation	Limiting Distortion
Feedforward (6 dB O/P slope)	off	NTSC	CSB
	off	NTSC/SSAVI	CSB
	on	NTSC	CSB
	on	NTSC/SSAVI	CSB
Conventional (flat O/P)	off	NTSC	CTB
	off	NTSC/SSAVI	CTB
	on	NTSC	CTB
	on	NTSC/SSAVI	CTB
Feedforward and Conventional	off	NTSC	CSB
	off	NTSC/SSAVI	CTB
	on	NTSC	CSB
	on	NTSC/SSAVI	CSB

Feedforward and parallel-hybrid technology is analyzed first. A conventional station with a single hybrid post-amplifier is used to determine reference distortion levels. Stations which have the same gain as the conventional station but which have parallel-hybrid or feedforward post-amplifiers then can be analyzed to determine CTB improvements by comparing their CTB performance with the reference conventional station performance. Block diagram models of these three amplifier types are shown in Figure 2. Output levels of preamplifier and post-amplifier hybrids are shown in Figure 3.

If a standard hybrid amplifier CTB spec of -86 dBc at a flat output level of +34 dBmV for 52 channels is assumed, then the performance of the three stations can be compared by calculating CTB levels generated by the input and output amplifiers as shown in Figure 4. It should be noted that the CTB level for the output hybrid amplifier has been improved to take into account its sloped output level. The CTB contribution of the input hybrid amplifier has been calculated twice, at the two extremes of a 4 dB range in station input level.

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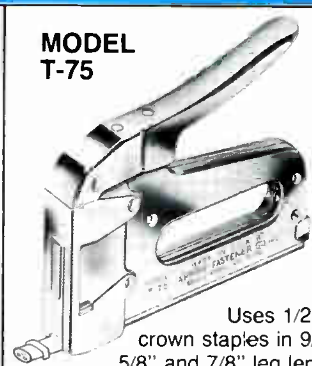

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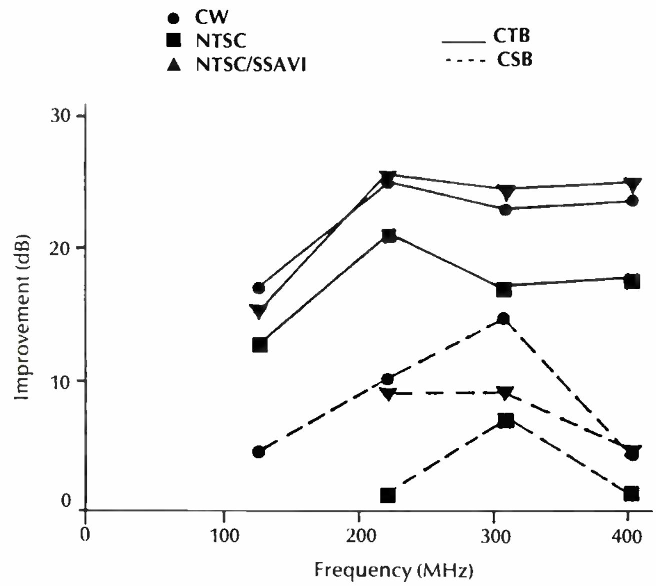
In a rebuild situation, the great appeal of parallel-hybrid and feedforward stations is that they can be configured with higher gains and higher output levels than can conventional stations, while still delivering the same CTB performance.

Figure 5 Improvement in CTB and CSB of a feedforward station over a conventional station



cally related carriers (HRC). With HRC, all in-band beats formed by video carriers fall precisely on the video carrier frequency of a channel. An HRC system, however, usually cannot be used in a rebuild as HRC frequency assignments are non-standard and incompatible with many TV sets and converters.

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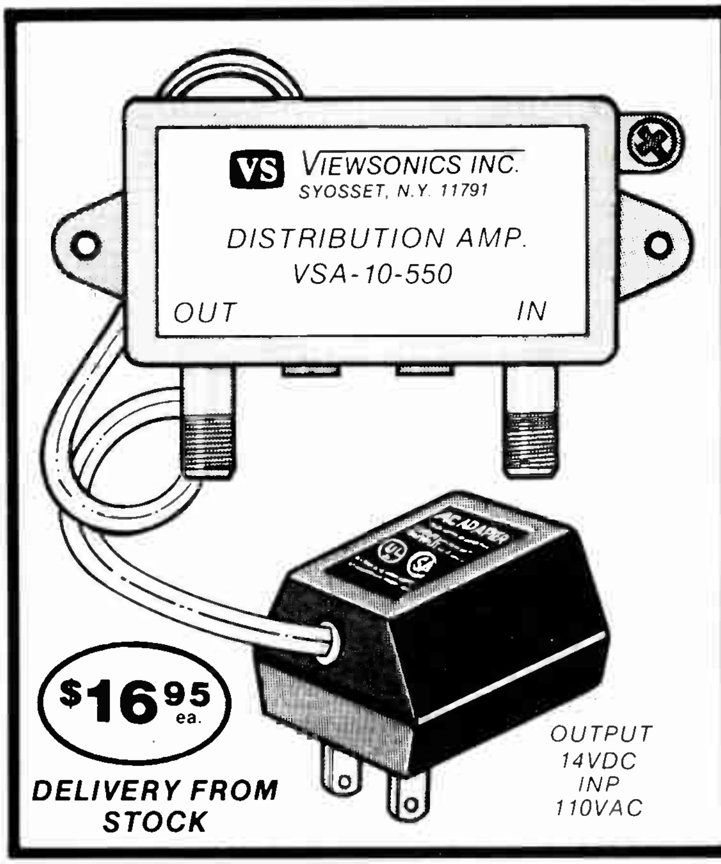

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2nd Order Distortion @ +20 DBMV .... -70db

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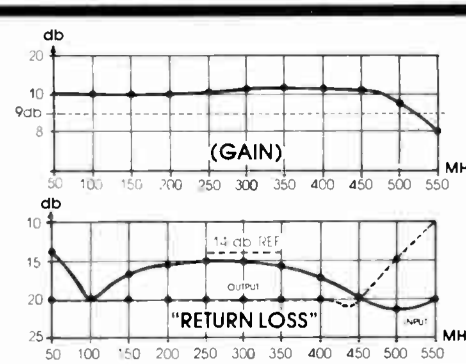

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An improvement in post-amplifier technology can achieve excellent improvement in CTB levels because the post-amplifier in a conventional amplifier is the major contributor to CTB.

First, the horizontal synchronization pulses are suppressed; second, the video information is inverted when its average level is less than 50 IRE units. Both of these elements reduce the average RF level in a channel and, thus, reduce the average level of a beat created by one or more scrambled channels.

In a system that is rebuilding to increase its channel capacity, there likely are already a large number of non-scrambled channels. These unscrambled channels form part of a basic service offering. In a rebuild it may be unwise from a marketing viewpoint to scramble these channels, but there is no reason why extra channels could not be scrambled as they would likely form part of a pay service or at least part of a more expensive tier of service.

If all channels on the system were SSAVI scrambled, approximately a 10 dB reduction in CTB level should be expected. Significant reductions in CTB level also should be expected, even if fewer channels are scrambled. For example, if all channels from 54 MHz to 260 MHz are *unscrambled* and all channels from 260 MHz to 400 MHz are *scrambled*, greater than 5 dB reduction in CTB can be expected.

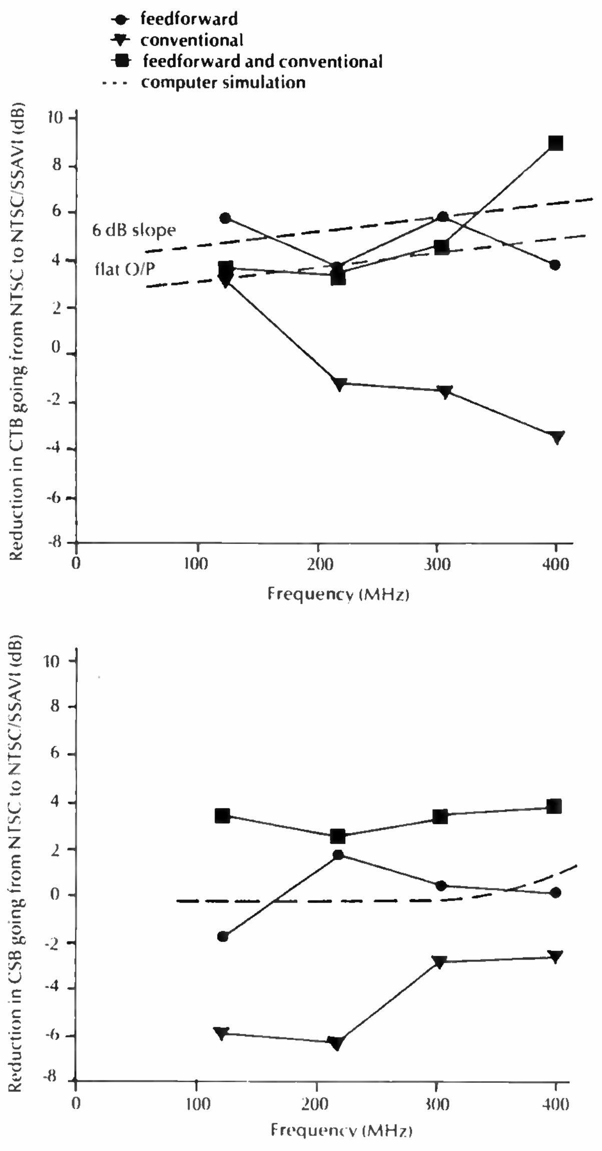
System test results

As briefly described in the introduction, a test was conducted to determine the effects of low distortion post-amplifiers, IRC and SSAVI.

The conventional, feedforward and combined cascades were tested with the four combinations of IRC on and off and SSAVI scrambling on and off. Selected victim channels were viewed as amplifier output levels were adjusted until it was determined that barely perceptible distortion was visible on the victim channel. Objective tests then were made at that level. CSB was the distortion which limited output levels in the cascade under several conditions.

The test results have been examined in an attempt to determine why CSB was predominant. First, the reduction in beat level achieved with a feedforward post-amplifier was examined. The reduction in CTB and CSB achieved by using a feed-

Figure 6 Improvements in CTB and CSB when 30 of 52 channels are SSAVI scrambled



forward post-amplifier is shown in Figure 5, where it can be noted that for any signal format, significantly less feedforward improvement is obtained for CSB than for CTB.

The effect of an IRC frequency assignment as compared to a standard assignment where output frequencies are not locked to a comb was subjectively analyzed. The addition or removal of IRC from the system did change the pictures when distortion, particularly CTB, was present. However, no significant improvement in picture quality was evident when IRC was added to the system. This result conflicts with previously published work and may be caused by some peculiarity in the operating system, such as the large number of character generator channels.

The effect of signal format on CTB and CSB was analyzed by comparing the difference in beat levels on a system with NTSC signals and on the system with 30 of the signals SSAVI scrambled. Differences in CTB and CSB levels are shown in Figure 6, where it is clear that less improvement because of SSAVI scrambling was measured for CSB than for CTB. The reason for anomalous test results in the conventional cascade is unknown.

CSB improvements with new technologies

The tests results in the previous section indicate that new technologies give a disappointing improvement in CSB compared with the improvement in CTB. It is interesting to examine why.

Using the station models employed to compare the effect of different post-amplifier technologies on CTB (see Figure 2), an analysis of the effect of these technologies on CSB was conducted. Because of a lack of CSB specifications for hybrids, an assumed specification must be used. A CSB specification of -66 dBc at a flat output level of +34 dBmV for 52 chanels was considered reasonable. CSB levels for preamplifiers and post-amplifiers are calculated and shown in Figure 7, where it is clear that the preamplifier is a major contributor of CSB, especially with a feedforward post-amplifier.

Improvements in both CSB and CTB achieved by using feedforward and parallel-hybrid post-amplifiers compared to conventional post-amplifiers are shown in Figure 8. It is clear that improvement in CSB is much less than in CTB because of the significant contribution of the preamplifier hybrid.

As mentioned earlier, in a system with an IRC frequency assignment, most third order video carrier beats fall precisely on the victim channel video carrier frequency. However, no change should be expected in CSB if IRC is added to a system.

If all channels in a system have the same signal format, the effect of a change in signal format on the levels of CTB and CSB can be analyzed fairly simply. Since three channels combine to form a third order beat and only two channels combine to form a second order beat, the change in CSB level would be expected to be two-thirds of the change in CTB level.

In most systems, however, only certain bands of channels would be scrambled. An analysis of CTB and CSB levels under these conditions was conducted. Television channels modulated with an average video level of 30 IRE units were modeled. The levels of individual third order and second order beats were predicted as the relative phases of the video information were varied randomly. Time average discrete beat levels then were established. All individual third order and second order beats falling on selected victim channels were classified according to offending channel signal format and level. Expected CTB

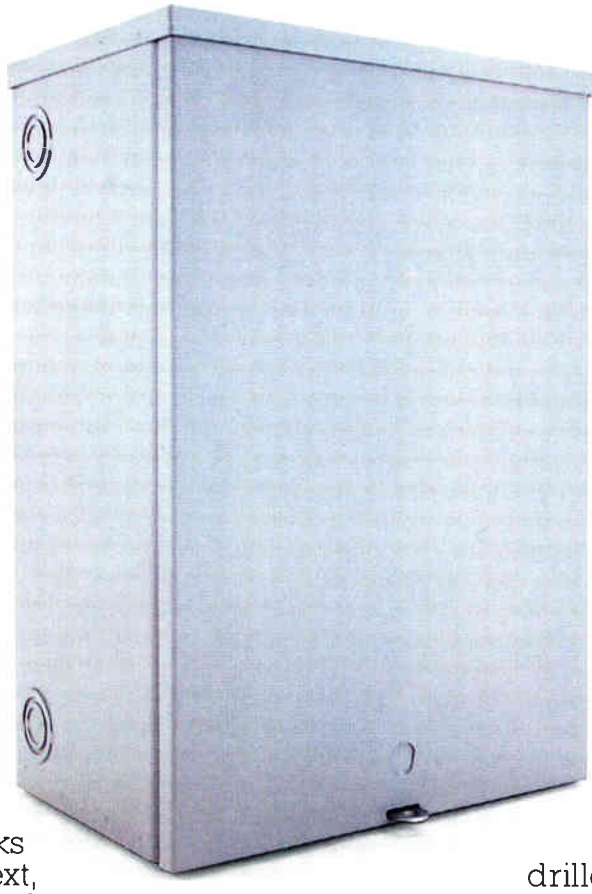
Figure 7 CSB ratios for the stations in Figure 2

Amplifier Type	AGC gain	CSB (dBc) I/P	O/P	Station
Feedforward	max	-80	-92	-79.7
	min	-76	-92	-75.9
Conventional	max	-74	-71	-69.2
	min	-70	-71	-67.5
Parallel-hybrid	max	-74	-73.5	-70.7
	min	-70	-73.5	-68.4

Figure 8 Expected CTB and CSB improvements with feedforward or parallel-hybrid instead of conventional

Amplifier Type	AGC Gain	CTB	CSB
Feedforward	max	16.9	10.5
	min	16.0	8.4
Parallel-hybrid	max	4.2	1.5
	min	3.4	0.9

Details Enclosed



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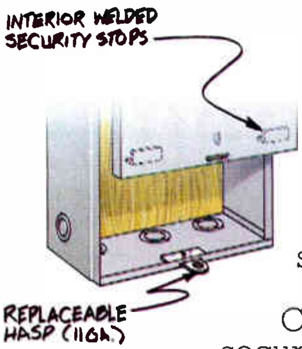

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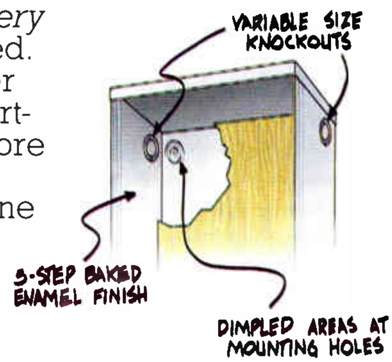

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When considering CSB, the preamplifier can be a major contributor, especially when low distortion post-amplifiers are used.

and CSB levels then were determined by adding individual beats on a power basis. Using this method, improvements in CTB and CSB levels were predicted for the channel line-up described earlier, where all channels from 260 MHz to 400 MHz were SSAVI scrambled. Predicted reductions in CTB and CSB are shown in Figure 6, where it is clear that significant CTB improvements can be expected with SSAVI scrambling, while very little CSB improvement can be expected. It should be noted that this analysis assumed that the relative phase of the video information on offering channels was random. If many, but not all, channels have common sync pulse sources, then the effects on beat levels and picture quality may be detrimental.

Possible solutions to CSB problems

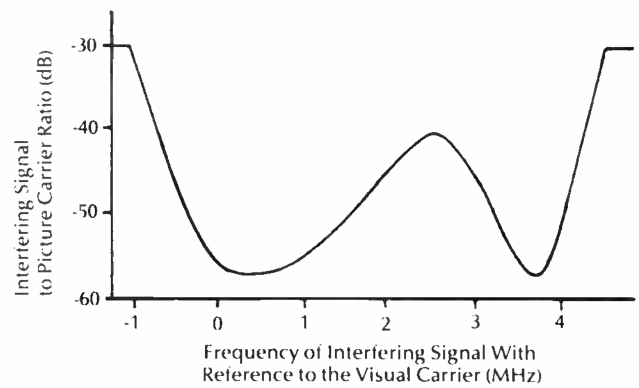
An improvement in post-amplifier technology can achieve excellent improvement in CTB levels because the post-amplifier in a conventional amplifier is the major contributor to CTB. However, when considering CSB, the preamplifier can be a major contributor, especially when low distortion post-amplifiers are used.

In order to reduce the CSB level from the preamplifier, three approaches could be taken. First, hybrid amplifiers with better CSB performance could be used as preamplifiers. Second, preamplifier hybrids could be arranged in a parallel-hybrid or feedforward configuration to reduce their CSB contribution. Third, hybrids could be tested for critical parameters such as noise figures, CSB and CTB levels and selected for various uses. For example, in feedforward amplifiers, preamplifier hybrids with good noise figure and CSB characteristics, post-amplifier hybrids with good CTB characteristics and other hybrids could be used as error amplifiers.

Amplifier output slope has a significant effect on CSB levels. The CSB high frequency levels of an amplifier operating with 6 dB output slope will be approximately 7 dB lower than the CSB levels of a similar amplifier with flat output levels.[4] At the low end of the frequency band, CSB levels will be higher with sloped outputs than with flat outputs. However, this may not be a problem because hybrid amplifiers have better second order distortion performance at lower frequencies.

The IRC frequency assignment was designed to mask the effect of CTB by making it fall precisely at a video carrier frequency. Using this frequency assignment or even a standard unlocked frequency assignment, second order beats formed by the summation of offending carrier frequencies fall 1.25 MHz above a victim video carrier frequency. As can be seen from Figure 9, this is a critical area of a video channel.

Figure 9 Relative sensitivity of a victim channel to an interfering signal as a function of frequency



It would be more desirable to have these beats fall 2 to 3 MHz above the video carrier frequency. In order to accomplish this, a non-standard frequency assignment could be used. For example, channels above 300 MHz could be lowered by 1 MHz from their standard frequency assignment, while all channels below 300 MHz would remain on their standard frequencies. This would sacrifice one channel which could have 5 MHz of spectrum from 300 MHz to 305 MHz. This spectrum could be used for other purposes such as modified video transmission or data transmission.

The frequencies of various second and third order beats generated using this non-standard frequency assignment have been analyzed and compared to the frequencies of beats generated using a standard frequency assignment. The resulst of this analysis are shown in Figure 10.

Note that on the highest channel, 16 second order beats fall 1.25 MHz above the video carrier frequency with a standard assignment; while with a non-standard assignment, only 3 beats fall on the same frequency. The other 13 beats fall at a less critical frequency 2.25 MHz above the video carrier frequency. Assuming power addition of beats and neglecting the beats falling 2.25 MHz above the video carrier frequency, a 7.3 dB improvement in CSB level can be achieved using this non-standard frequency assignment. This was accomplished at the cost of one lost video channel and possible tuning problems with existing converters. In a rebuild situation these tuning problems may be minor, as existing converters may not tune beyond 300 MHz in any case.

It also should be noted in Figure 10 that the non-standard frequency assignment will give a minor improvement in CTB level. If all third order beats not falling on the video carrier frequency are neglected, a 1.5 dB improvement on the highest channel could be expected using this non-standard frequency assignment.

The frequency offset of channels between 300 MHz and 400

Figure 10 Number of second and third order beats falling on sample victim channels with and w/o frequency offsets (400 MHz system)

Frequency Assignment	Carrier Frequency	CTB 0 MHz*	CSB 1.25 MHz*	CSB 2.25 MHz*
Standard	397.25	565	16	-
	301.25	806	8	-
	217.25	827	3	-
Offset	396.25	401	3	13
	306.25	401	0	9
	217.25	567	3	0

* These frequencies refer to the beat frequency relative to the victim channel frequency.

MHz should be viewed only as an illustration of the potential benefits which could be realized with frequency offsets. No attempt was made to determine an optimum frequency assignment, and the effect of changing the frequencies of beats falling at the low end of the frequency spectrum may be unacceptable. However, it does appear that non-standard frequency assignments may provide a significant improvement in CSB levels and and some improvement in CTB level as well.

Conclusion

A number of new technologies have been developed in order to reduce the level or the effects of CTB. Test results have been presented which indicate that feedforward post-amplifiers, power doubling post-amplifiers and SSAVI scrambling do, in fact, reduce CTB levels as expected. The expected improvement in picture quality obtained by using IRC frequency assignments was not observed during these tests.

Test results have been presented which demonstrate that CSB can be the limiting intermodulation distortion in cable systems carrying over 50 channels. This is partly because the technologies developed to improve CTB performance provide much less CSB improvement. Further work should be done in an effort to reduce the levels or the effects of CSB.

Promising areas of development include improving preamplifier CSB performance to reduce station CSB levels and further investigating non-standard frequency assignments in an effort to reduce the impairment caused by CSB. CED

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References

[1] Jeffers, Michael, "Technical Considerations for Operating Systems Expanded to Fifty or More Television Channels," NCTA Convention Papers, 1980.

[2] Monteith, Don, and Nick Hamilton-Piercy, "Building Plant to 400 MHz and Beyond," *TVC*, December 15, 1980.

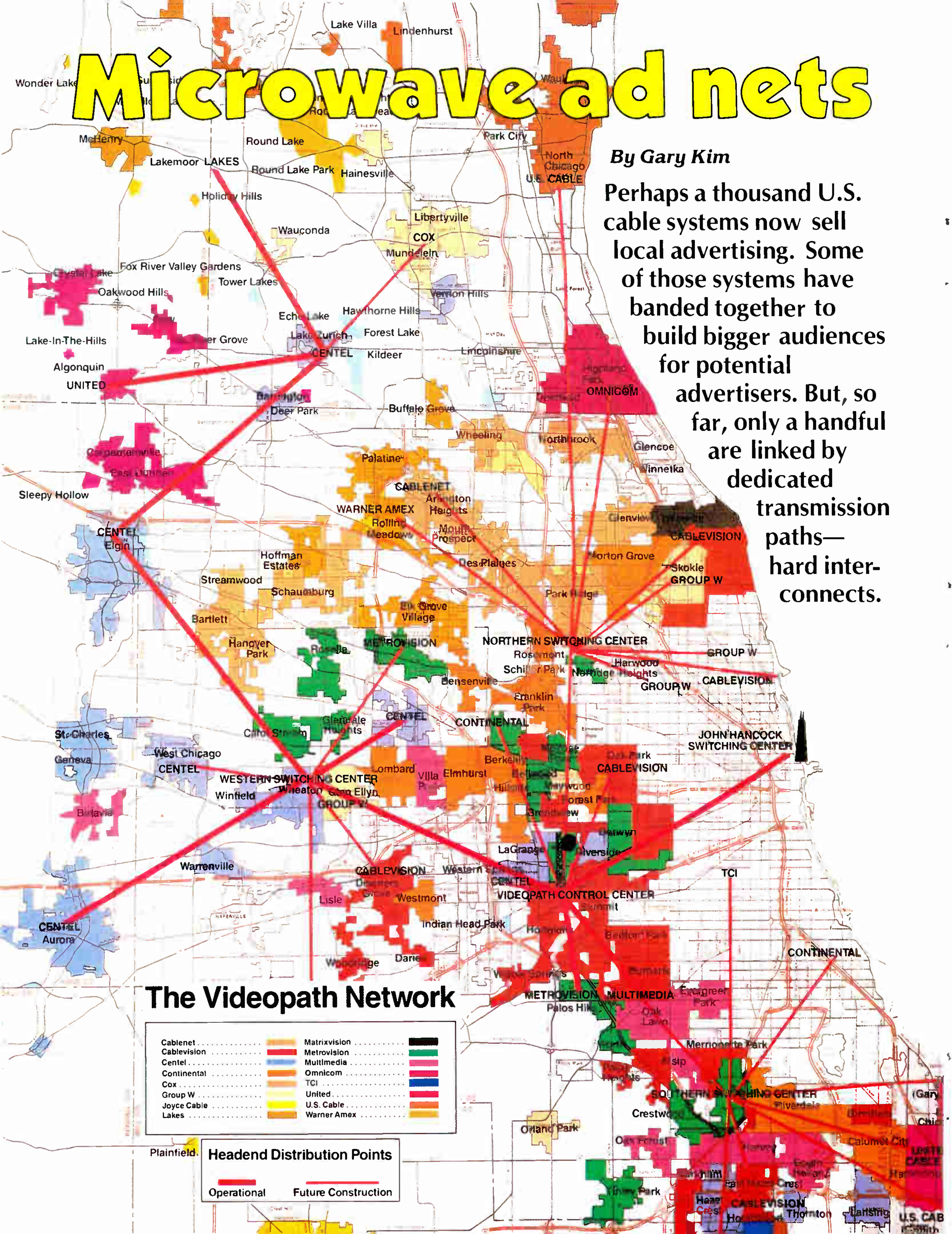
[3] Switzer, Israel et al, "Method and Apparatus for Reducing Distortion in Multicarrier Communications Systems," U.S. Patent Number 3,898,566, August 1975.

[4] Slater, Norm and Doug McEwen, "Limiting Non-Linear Distortions in 400+ MHz Systems," CCTA Convention Papers, 1984.

Microwave ad nets

By Gary Kim

Perhaps a thousand U.S. cable systems now sell local advertising. Some of those systems have banded together to build bigger audiences for potential advertisers. But, so far, only a handful are linked by dedicated transmission paths—hard interconnects.



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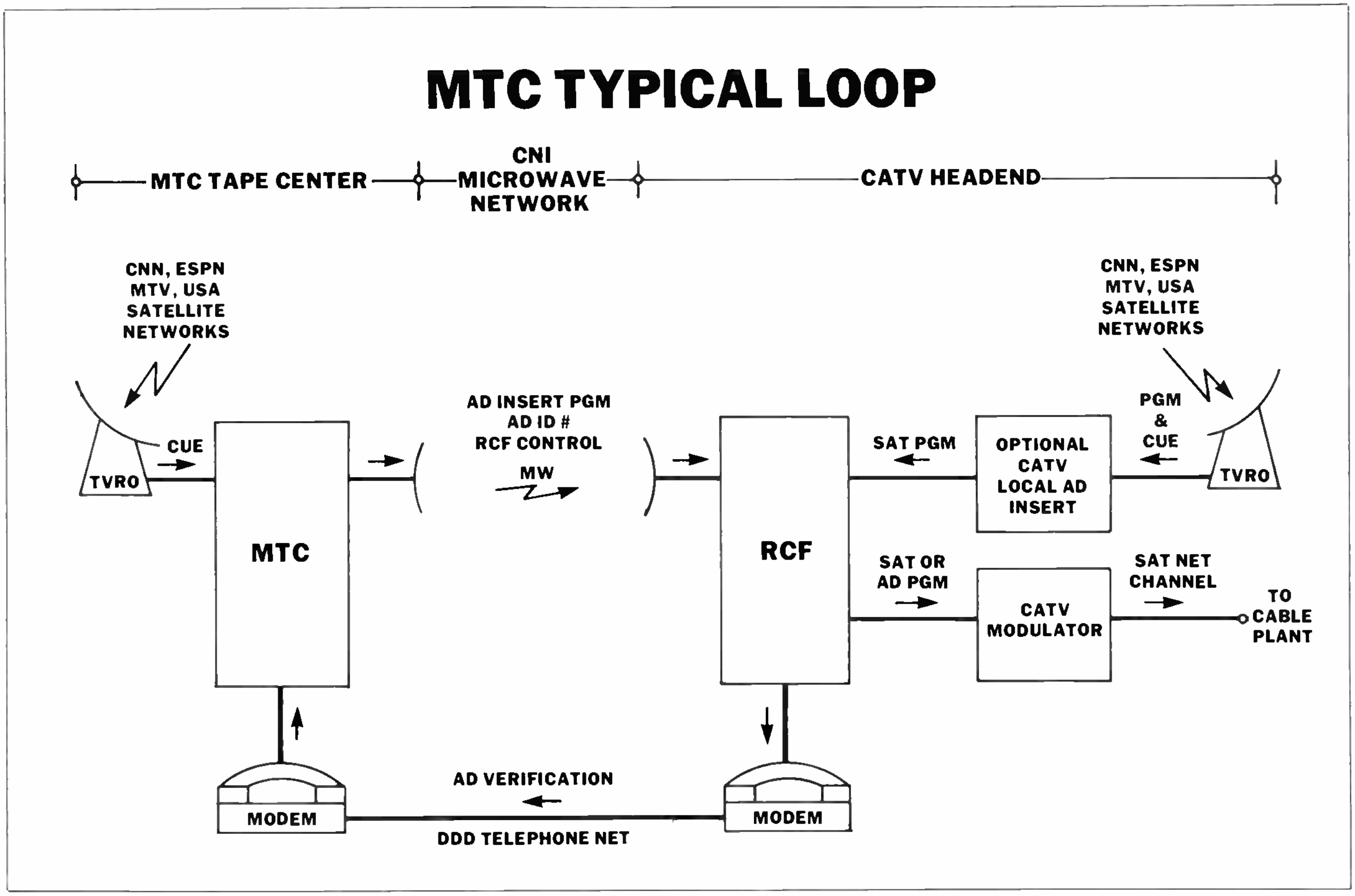

Nevertheless, interest seems likely to grow because local cable advertising revenue keeps climbing. The industry as a whole may bill $129 million in local ad sales this year, up sharply from $85.7 million last year.

In the San Francisco Bay Area alone, local broadcast TV ads are worth over $300 million a year. Working together in the Bay Area Interconnect, cable operators hope to snare 10 percent of that amount. And despite the 60 franchises and 10 MSOs in the area, the big problem isn't technical.

Sure, you need microwave frequency clearances, transmitters and receivers as well as insertion gear. And as Jack Goldie, chief engineer for the BAI, points out, expertise in cable, microwave and broadcast TV is required.

But, by and large, the equipment isn't tricky. The software and "people-ware" are another story.

The issues? Operator reluctance, for one thing. In the top 20 markets, at least, there may be a fear that one system will emerge as a dominant regional force. In some cases, the problem is reluctance to share profits or lose control over inventory. Skepticism over the quality of ads and a desire to avoid negative subscriber reaction also may be factors.

And some systems prefer to make their own deals and keep all the proceeds. Not without reason. The New York and Bay Area interconnects can sometimes sell a 30-second spot for $250 to $300. Member systems share their revenue, which can work out to something like $7.50 a sale.

If a suitably-equipped interconnect member sold that same spot in a single system for, say, $50, it wouldn't have to share the revenue with anybody.

Of course, this presupposes a capital investment in commercial insertion gear, staff training and maintenance.

And the ad sales window itself is limited. Even if a cable network makes two minutes an hour available for local ad sales, not all of it is desirable. Midnight to 8 a.m. is pretty tough to sell. The block of time from 8 a.m. to 3 p.m. isn't so hot either.

MTV is viable from 3 p.m. on and ESPN, in the afternoon and early evenings.

So the go-it-alone approach requires a capital investment that is only a revenue generator *part* of each day. The interconnect approach spreads the cost. It also may broaden the market.

"Major advertisers don't want to talk to 50 or 60 cable representatives in a single TV market," says Jack Yearwood, vice president and general manager of the Bay Area Interconnect.

Also, the same transmission path can be used to build the market for pay-per-view or regional sports/movie channels.

Opinion is divided on whether a single or multi-channel interconnect is better. Norm Weinhouse of Weinhouse and Associates argues in favor of the single-channel approach because it saves bandwidth.

The transmission path should include only control data and the actual local spots themselves, Weinhouse says.

Of course, there are sometimes reasons for supplying programming. Ease of operation, for example. Or, perhaps, no shortage of microwave frequencies. Cost savings in insertion gear at each headend also could be a factor.

On the other hand, a multi-channel approach needn't presuppose transmission of program material. It could instead mean the ability to address several different feeds to different members of the interconnect. Say, for example, a New Jersey feed and a Long Island MTV feed.

"The point is to match the technical requirements with the local markets," says Rick Rosencrans, manager of the Metropolitan Transmission Center, a New York interconnect.

Is he in favor of commercial insertion gear at each location? No. "It made our work more complicated. We had to

"Major advertisers don't want to talk to 50 or 60 cable representatives in a single TV market."

Jack Yearwood,
VP/general manager,
Bay Area Interconnect

build a switching device at each location." But in MTC's case, one of the requirements was ability to override central spots at each separate system.

His advice for anyone considering an interconnect?

1. Do extensive research *first*.
2. Know all of the electrical, space and other set-ups at each site.
3. Know the tower heights.
4. Plan, plan, plan.
5. Make sure everyone is willing to participate.
6. Build in a lot of flexibility as far as local overrides of system-wide spots. Systems may want to run some local spots on their own.
7. Make sure you can get the microwave frequencies you need.
8. Be sure you've got a sales force to sell the commercials you hope to transmit.
9. Be sure systems want those commercials.

If commercial insertion gear is going to be set up at each headend, "make sure you have a staff to troubleshoot the gear," adds Jack Goldie, chief engineer with BAI.

The BAI doesn't have insertion equipment at each headend, and "that's part of the reason we broadcast the whole channel—programming and spots."

But not the only reason. "Many of the systems don't want to mess around with their own equipment, sales force, production facilities, control room and service personnel. It's easier just to get it from us," Goldie says.

In any event, numbers are propelling the interest in interconnects. While it isn't impossible to attract advertisers with subscriber counts as small as 4,000 to 6,000—as a rule of thumb, 10,000 and up is better.

The reason? Advertisers buy numbers—the bigger the better. So, more subscribers mean larger potential revenues. How large? It's hard to say. Right now, $20 per sub in local ad revenues is on the high side. And while actual costs will vary, it's probably safe to think about $500,000 or so for a mircowave system and perhaps $200,000 in insertion gear. In the right market, with the right numbers, payback could come in about three years.

Potential problem areas? Microwave frequency congestion in large urban areas. Command and control software. Securing repeater sites.

A major advantage over soft interconnects? Verification. A big problem with local advertising so far has been housekeeping. There still isn't a standardized means of scheduling the spots, ascertaining that they've run and billing the advertiser. As a result, revenue losses of between 11 percent and 25 percent are possible.

"One of the advantages of a hard interconnect is that there's a return data link to each of the remote control facilities (headends). Once a commercial is received by the RCF, the microprocessor logs the commercial number, audio and video quality," says Geoffrey Labat, master control operations supervisor with the Metropolitan Transmission Center.

"This information comes back to the CPU here in New York City and lets us know that commercial X has been received at the designated site. The result is an immediate affadavit—and immediate billing. We used to wait 30 to 120 days with a soft system."

The MTC links about 12 cable systems and uses 30 microwave dishes to transmit six channels, most of it two-way. Where two-way wasn't possible, the return path is by modem.

The BAI links its systems in about three hops, and uses four channels. Unlike the MTC, however, there is no local system override of transmitted spots.

The Centel Videopath system uses four channels as well, and links about 10 systems at 11 and 23 GHz. Like the MTC, Videopath transmits control data and spots only. This information is mixed and cued at each headend with off-the-satellite network programming.

CED

First look at new FCC tech chief

By Wendell Bailey, Vice President, Science and Technology, NCTA

Thirty-one year old John Wong, an electrical engineering graduate of the University of New York, recently was named the chief, Engineering Policy Branch of the Policy and Rules Division of the Mass Media Bureau of the Federal Communications Commission. While in college, Wong had an interest in alternate energy sources. It wasn't long after college that he found himself involved, however, in another type of alternative—alternate media communications.

John is just beginning to dig into his new job, and in the last two weeks has found himself in endless meetings with his new bosses and people who are demanding a piece of his time and attention. Nonetheless, we were able to get Wong alone for a few moments and ask him to reflect a bit on his career at the FCC and his thoughts about the cable industry.

CED: What was your first job after graduating?

Wong: Right after college I went to work at the FCC as a staff engineer in what was then called the New and Major Changes Branch of the Broadcast Bureau. I was involved in processing AM radio applications.

After a brief period I moved into an area called AM readjustments. There, I was involved in adjustments on antenna arrays, power levels, as well as calculating interference considerations for AM stations. I liked these assignments a lot because I was able to work independently.

CED: Where did you go from there?

Wong: After about three years or so, I was getting a bit restless. I wanted to branch out, and I gave serious thought to going to work in the Field Operations Bureau. I thought it might be a way to get out and see the industry and to learn about some of the other technologies that I was aware of.

About that time (1980) I met Cliff Paul, from whom I knew I could learn a lot, and decided to go to work for him. That's how I became involved in the cable industry.

My initial assignment with Paul was CARS microwave. While in that job, I began to sense (about nine months in advance) that something was going to happen in the aeronautical band and that it might become very important. I worked out what I called processing format forms, which were designed to make the processing of aeronauticals easier. At that time we were doing everything by hand with just a little HP calculator, and it took about one week out of every month just to process the aeronauticals. By designing this new form, I managed to set up a system that would allow due process and deal with the 30 or 40 aeronauticals we received every month.

> ***"It's always been my philosophy to do all I can to break down any perceived barriers that stand between the FCC and those that it regulates."***
>
> ***John Wong, FCC***

CED: Was there a backlog in clearances at that time?

Wong: Not at first. In the beginning, the aeronauticals were something to "keep me busy" and really were not the main part of my job. Several months later, however, the number of aeronauticals increased dramatically. They went from 30 or 40 a month to something on the order of 600 a month. We developed an enormous backlog which was causing a great deal of concern and anguish in the industry from those companies trying to get clearances in a timely manner.

CED: The cable industry perceives that this backlog was finally dealt with mostly through your personal efforts. Is this true?

Wong: Yes, to a large extent, it is. The form processing system that I had developed was a great help; and we were in the process of computerizing center portions of it, which also helped. I put in an awful lot of time to try to catch up. This went on for approximately nine months, and every day I found myself staring at this huge stack of aeronauticals. It was almost, but not quite, discouraging. About this time we got a sort of computer program working, and I also was given some additional staff to help.

CED: Around this time you were getting a reputation for being one of the few FCC engineers who knew a lot about cable industry technology, not just aeronauticals. How did this come about?

Wong: I took an interest in the cable industry and went to some effort to track and understand it by talking with as many people in the industry as I could reach—in particular, the technicians and engineers who actually worked at the system level. I figured that they knew more about what was important in the day-to-day operation of the cable industry than anyone else. I

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was very interested in determining how the decisions at the FCC affected the lowest line technician's day-to-day job in the cable industry.

I've always believed that the mighty Washington bureaucracy is confusing and threatening to people in the field. I feel very strongly that there is always time to help the person who actually does the work in the field. Those are the important people to help because they will appreciate the help you give more than anyone else. It's always been my philosophy to do all I can to break down any perceived barriers that stand between the FCC and those that it regulates.

CED: Now that you've been promoted to chief of the Engineering and Policy Branch, how will you be involved with the CATV industry?
Wong: In my new position, I will primarily be responsible for dealing with engineering policy issues of all the mass media technologies—CATV, broadcasting, DBS, MMDS, etc. These also include ITFS and low-power television.
CED: With all that to consider, what do you think will be the major issues that you'll be dealing with from an engineering policy aspect in cable, broadcasting and some of the others?
Wong: Well, I think the aeronautical issue will continue to be of concern to the cable industry, as well as to the Commission. I'm hopeful, and I know the industry is hopeful, that the resolution of docket 21006 will strike a truce and a relationship between cable, the FCC and the FAA that will be a great step forward in the cooperation between these bodies. I don't think our concern will go away in the short term, however.
CED: Is there still trouble ahead on the aeronauticals?
Wong: Well, I don't know that there is trouble. I wouldn't want to put a curse on the industry concerning this matter, but the fact is that while the learning curve and the compliance curve are increasing, there still is room for improvement. We're all hopeful that the trend we've seen in improving the compliance and the techniques and engineering skills of the industry will continue and the aeronautical issue will become less important as time goes on. But for the foreseeable future, we still have concerns about it.
CED: What about broadcasting and the other technologies mentioned—what engineering policy issues will they be facing in the future?
Wong: The issues that will be facing broadcasting, MMDS and the others are mostly involved with the implementation of new technologies in those fields. Such issues as multichannel sound or teletext. They're also learning about more efficient uses of the spectrum, and that's good.

It's important for all of these services to realize that the Commission is vitally interested in seeing as many services as possible in use in the most efficient manner possible. This will ensure that a wide segment of society has access to these outlets.
CED: What about high definition TV? Do you think there's a possibility that the Engineering Policy Branch will become involved in that?
Wong: I certainly would like to see our branch involved. It sounds like exciting technology. One of the nicest things about working in the Mass Media Bureau of the FCC is that we are the bureau that's most talked about and most in the public eye. It's a very exciting set of industries.
CED: What are your future plans?
Wong: Well, it's hard to answer that since I've only been on this job for two weeks. Right now, I see no limit to the possibilities to be of service to the industries that we regulate in this position. There are many exciting issues that I am very interested in coming down the road. For now, I'll concentrate on doing the best I can.
CED: John, thanks for taking the time to talk to us, and good luck in your new position. CED

PPU: billing challenge

By Kathy Berlin

You'd probably have to look a long time to find an operator who really has problems with the basic billing functions of his management software. Generally, it works. Not surprisingly, then, attention has turned to other items on the management wish lists: automatic service call tracking, dispatching, channel selection and authorization. And as addressability spreads, handshaking between headend control and billing system computers may need more attention.

Impulse pay-per-view, in particular, may require special efforts, since the last-minute flood of telephone orders tends to overwhelm system speed.

"With addressable technology, inefficiency is no longer a big problem," said John Donahue, director of engineering with Rogers Cablesystems. "The management computer *is* the reference computer—that's the bottom line. One small entry by a dispatcher, and you've adjusted all three data entry functions."

Most MSOs now are looking for a management system that also makes service calls, dispatches and performs channel selection. And they are looking for other qualities as well. Authorization and standardization are the biggest concerns.

"Service authorization level," said Don Houde, director of support systems at Mile Hi Cablevision in Denver, "is a major area of concern. If the two systems aren't matched, a problem occurs when the subscriber is *billed* for three services but only *receiving* two."

The culprit? Incompatible phone lines. Since the computers have to handshake, anything off sync causes a glitch. According to John Dawson, Mile Hi's director of engineering, only one computer responds to the glitch, causing an operator to have to go in and manually reconcile the two computers. "Our data line is what causes the grief," Dawson said. "We've checked *both* computers, and there is no malfunction. At this point, we are looking at alternate methods for the phone line."

Power spikes and outages are real problems, especially in an area where heavy construction is being done. "We're at the mercy of the phone company's reliability, said Houde. "That's why a good back-up for communication systems is essential."

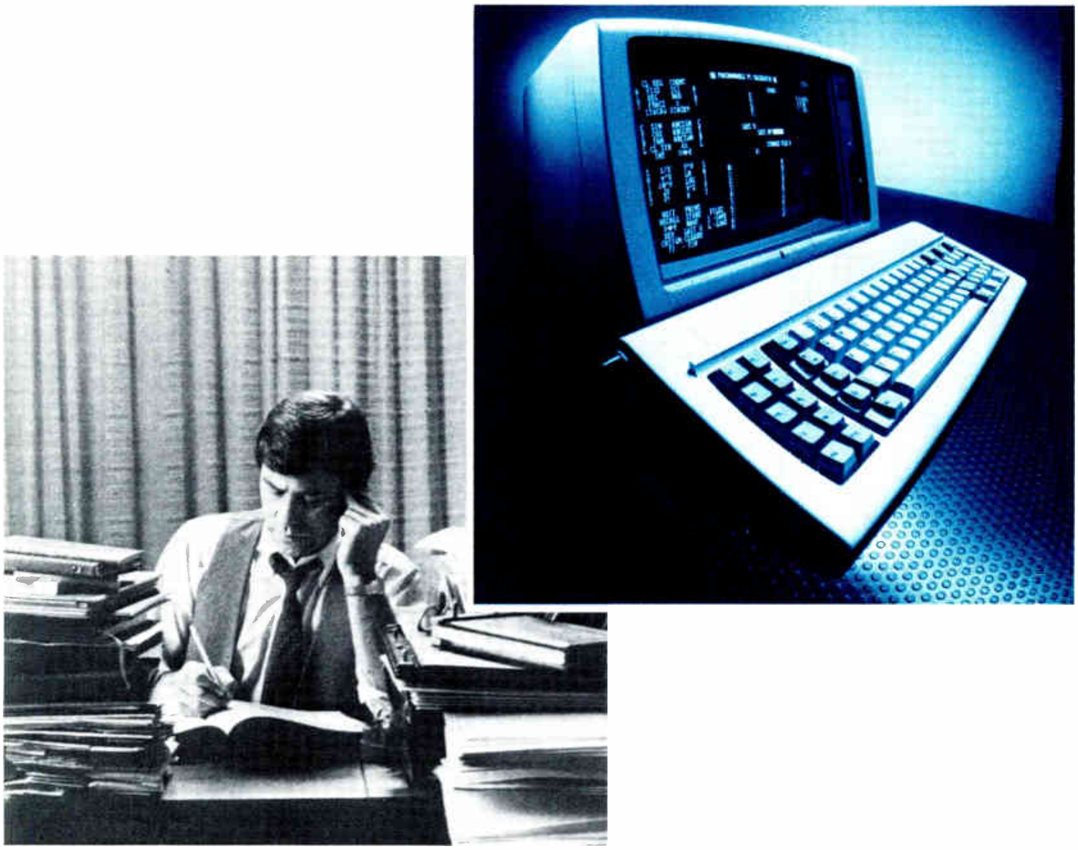
Microwave is one alternative to poor data lines. However, there are drawbacks. One, microwave is line-of-sight only. Second, you've added a maintenance requirement—whether in-house or out. The initial high expense associated with microwave also is a factor.

Stephen Necessary, manager for subscriber products with Scientific-Atlanta, feels they've solved these problems with their own single computer system.

"Actually, it boils down to philosophical differences," said Necessary. "We balked at the idea of having two computers. The expense was high, and the computers worked at only 30 percent capacity. The single computer system and it's capabilities have been looked at by two sides of the industry—the addressable computer manufacturers and the billing experts."

The result? A single computer system that combines addressability *and* business management functions. The billing computer sends data directly to the addressable transmitter which *then* authorizes the service.

Comprehensiveness also is an issue. Managers want within their grasp infor-



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mation that portrays what all their systems may, or may not, be doing.

JoAnne Hovanec, automation specialist with Daniels and Associates, said, "We wanted something that we could standardize into *one* system. The addressability was considered a plus, but it was the *overall* management we looked at."

Dale Moses, former regional controller for Rogers Cablesystems in Portland, Ore., agrees. "What we looked for was system wide control of the software, management reporting and number consolidation." After converting 75 percent of their existing systems to a new management system, Moses feels the systems now have these capabilities. "We looked at an overall approach," said Moses. "Although our previous system did a good job, it didn't serve all our needs."

Pay-per-view offers new challenges

Pay-per-view may be another story. Many management system interfaces for PPV work quite well, most operators say. But the problem is impulse PPV, especially with those viewers who call in ten minutes before an event to order. This has a profound effect on speed requirements—the computer must be able to process quickly that high percentage of last minute callers.

"Impulse PPV is not economically feasible," said Ron Goodrich, engineering manager for Televents in California, "because you must have your more expensive staff standing by during an event in case something goes wrong."

Normally, going into the management system, authorizing, approving and getting the information back out would take only a couple of minutes. However, with a large subscriber base, the entire process is delayed. System speed then becomes the single most important factor.

It is this increased speed that concerns MSOs in regard to the actual invoicing. The system must not only keep up with calls, it must accurately record and relay that information. "What we need," said Wendell Owen, general manager for the Cablevision of Baton Rouge, La., system. "is more reports so we can track orders. If there are four or five events in a single time period, there is no way to separate each event."

Unfortunately, the full impact of PPV on billing is still unknown. Some feel PPV takes full advantage of an addressable converter. Others feel the only way to have an accurate billing system with PPV is to go to a two-way capable system. Regardless of the final decision, billing is a factor that must be taken into consideration. CED

"We wanted something that we could standardize into one system. The addressability was considered a plus, but it was the overall management we looked at."

JoAnne Hovanec, Daniels & Associates

ONLY ONE CAMERA SHOOTS THIS WELL IN 2 FOOTCANDLES. IMAGINE HOW IT SHOOTS IN BROAD DAYLIGHT.

NiteHawk™

The Panasonic® N-3 NiteHawk.™ It's one of a kind because it's the only camera with three Newvicon® tubes. And that means you get outstanding picture quality under a wide variety of lighting conditions.

When you're shooting at night or in dimly lit locations, as in the simulated example above, the N-3's unique combination of three ½" Newvicon tubes lets you make the most of available light by providing bright, natural video images.

In sunlight and in the studio the N-3 continues to shine with 600 lines horizontal resolution. An impressive S/N ratio. As well as minimal lag, burn-in, comet tailing and geometric distortion. What's more, the N-3 has all the professional features you'd expect from the broad line of Panasonic three-tube cameras.

Still, with all the N-3 has going for it, there's another bright spot. Its price.

Audition the NiteHawk and see why from sunlight to night light no other camera can hold a candle to it.

For more information, call your nearest Panasonic regional office: Northeast: (201) 348-7620. Southeast: (404) 925-6835. Midwest: (312) 981-4826. Southwest: (214) 257-0763. West: (714) 895-7200. Northwest: (206) 251-5209.

Panasonic
Industrial Company

Product Profile

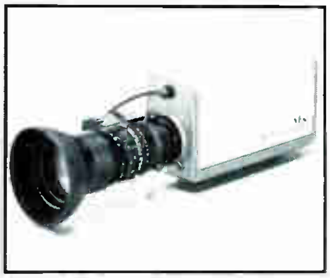
Single-tube color cameras

Manufacturer	Model	Configuration	Imaging device	Signal/ Noise ratio	Minimum illumination	View-finder	Video lock
Hitachi	FP7UD	FP-7U camera head w/2H enhancer Control-GM4U 1″ viewfinder N 10 × 10/BRM-7 10 = 1 zoom lens	⅔″ high-band Saticon	50 dB	2.3 FC	1″	No
Hitachi	IP5UD	FP-5 camera head control 1″ viewfinder 8 = 1 autofocus lens genlock	½″ Saticon tube	45 dB	1.5 FC	1″	No
JVC Company of America	GX-S700U	Single carrier, frequency-separation color system	⅔″ high-band Saticon tube	better than 48 dB	30 lux	1.5″	No
NEC America	NC-110	one piece portable	2 chip CCD	50 dB	20-150 lux.	none	Yes
Nisus	N-1821	one piece portable	⅔″ SMF Trinicon tube	48 dB	186 FC @ F4	1.5″	Yes
Panasonic	WV-6000 (S1)	ENG/studio	6 MHz high-band Saticon	50 dB	2 FC	1.5″	Yes
Panasonic	WV-F2	portable color camera	½″ CCD (w/2H line enhancer)	46 dB	1 FC	0.7″ (B/W)	No
Sharp Electronics	QC78P	one piece portable	½″ Newvicon	45 dB	100 FC	1″	No
Sharp Electronics	QC56P	one piece portable	½″ Newvicon	45 dB	80 FC	0.5″	No
Sony Broadcast	BVW-2	one piece Betacam VTR/camera	½″ SMF Trinicon	50 dB	80 lux @ F 1.2 lens (+ 12 dB gain up)	optical	No
Sony Video	DXC-1820	one piece	SMS Trinicon	53 dB	4.0 FC (40 lux) @ F1.6, (+ 18 dB gain up)	varies	genlock

Lens information	Zoom ratio	Zoom range	Maximum aperture	Weight
N 10 × 10/ BM7-7	10 = 1	10-100 mm	F 1.6	10 lbs. (w/lens UF)
F.14 8 = 1 autofocus lens	8 = 1	8.5- 68 mm	F 1.4	7 lbs (w/UF lens mic.)
F/1.8, f = 10.5- 105 mm, 10 x variable-speed power zoom lens with macro,	—	10.5- 105mm	N/A	8.7 lbs
—	15 × 9.5	15 × 9.5	F 1.8	5 lbs
any C-mount lens	any C-mount lens	any C-mount lens	any C-mount lens	15 lbs
12 × Servo Power Zoom	F 1.6	12 × 1	F 1.6	10.4 lbs
—	6:1	8.5 to 51 mm	F 1.2	2 lbs
Power Zoom with Macro	6:1	9-54 mm	F 1.2	3.5 lbs
—	3:1	11-33mm	F 1.1	2.0 lbs
6X Manual Zoom lens, F 1.2- F 1.4, macro function, filter size 52 mm	—	9-54 mm	—	7 lbs
varies	varies	varies	varies	2.9 kg

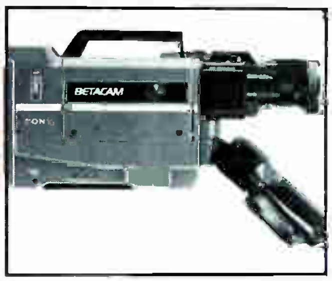
JVC GX-S700U

Panasonic WV-F2

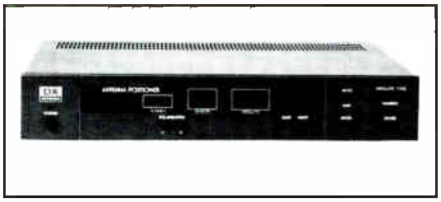


NEC NC-110

Sharp QC78P



Sony BVW-2 Newsmaker



DX Communication's DSB-400 antenna positioner.

DX intros antenna positioner

DX Communications Inc. offers a new DSB-400 antenna positioner. The positioner incorporates advanced micro-computer technology to deliver features including 24 fully programmable satellite positions.

For more information, contact DX Communications, Ten Skyline Drive, Hawthorne, N.Y. 10532, (914) 347-4040.

Cable data modem introduced

Wegener Communications introduced the Series 2060/2010 Cable Data Modem. The Series 2060/2010 system transmits FSK asynchronous data at rates to 9600 b/s over cable to the subscribers home, where the data may be downloaded through a personal computer, printer or other device. It is available with a variety of options including: synchronous data capability, multiple frequency switching, frequency synthesis, multiplexing of up to eight data channels and addressability.

For more information, contact Wegener Communications Inc., 150 Technology Park, Norcross, Ga. 30092, (404) 448-7288.

Panduit Corp.'s new line of safety tags.

Safety tags unveiled

A new line of safety tags with a wide variety of standard headers and legends was announced by Panduit Corp.

Also introduced was a new sub-miniature cross-section cable tie. The new tie has a low profile head of only 0.115 inch high and is 3.1 inches long for maximum bundle diameter of .68".

For more information, contact manager, Inside Sales Dept., Panduit Corp., 17301 Ridgeland Avenue, Tinley Park, Ill. 60477-0981, (312) 532-1800.

Scientific-Atlanta delivers new products

Scientific-Atlanta introduced the Series 8345, an advanced 4.5-meter earth station antenna designed for receive-only applications in the C- and Ku-bands.

Also announced was the development of BTSC-stereo format compatible equipment for cable operators. The equipment consists of the Model 6380 stereo headend encoder and Series 8500 set-top terminals.

For cable operators looking for an alternative to expensive dual cable sys-

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Reliable Electric/Utility Products' square-design CATV distribution closures give you more cubic inches of work area for your money.

When considering the purchase of CATV distribution closures, don't overlook the importance of design. Reliable's square-design closures provide maximum work area to install and maintain equipment. Because they feature larger housing capacities than comparable cylindrical models, they provide more mounting space for your dollar.

Another factor to consider is the solid durability built into every Reliable enclosure. While most cylindrical units are made of plastic, we construct our housings of heavy-gauge, mill-galvanized steel. We coat the pedestals with our unique nine-step finish to resist weathering and corrosion. With an engineering and manufacturing process this thorough, it's no wonder our pedestals have been known to stay on the job for a quarter century or more.

In addition to large capacity and durable design, Reliable's closures also feature the security of a padlock hasp—along with several other locking options—and the convenience of a removable upper cover. All can be stake-mounted, while some units can be wall-mounted or self-supported.

So for pedestals that offer spacious design—as well as solid construction, security and convenience—specify Reliable Electric/Utility Products' closures.

For more information, phone or write Reliable Electric/Utility Products or our nearest authorized distributor today.

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Reader Service Number 75

tems, S-A introduced a full line of 550 MHz signal distribution products. The new line consists of 26 dB feedforward trunk amplifier, 32 dB push-pull, feed-forward, parallel hybrid bridging amplifiers and a 32 dB line extender.

S-A also announced an expansion of its Series 8500 product line with the new Model 8525, an advanced programmable unit. The model features a unique method of programming service authorizations.

The Model 8555 addressable set-top terminal also was introduced. It is for operation in expanded bandwidth (550 MHz) CATV systems.

For more information, contact Soloman Webb, sales and marketing manager, Scientific-Atlanta, Broadband Communications Division, (404) 925-5536.

Cable/I-PC

Computer Utilities of the Ozarks Inc. announced the release of Cable/I-PC for the newly announced desktop versions of the IBM-SERIES/I computer.

Cable/I, a management information and billing system, can be installed on the new IBM hardware at a substantial savings over previous entry level Series/I solutions, according to the company.

For more information, contact Herb Lair, Computer Utilities of the Ozarks Inc., 103 Suite C, Industrial Park Road, Harrison, Ariz. 72601, (501) 741-1616.

G.E.'s new Comband configuration.

New Comband configuration

General Electric introduced a modular configuration of the Comband system that can reduce system upgrade costs. The new set-top components—an addressable baseband converter and a Comband bandwidth compression decoder—offer more features and better security than the earlier Comband setup, according to Ronald Polomsky, G.E.'s manager of cable products.

With the new Comband configuration, video signals can be processed to double the number of program services on each RF channel, encoded on a channel by channel basis without bandwidth compression, or both—all within the same system.

For more information, contact David Cooper or Leigh Worchester, Burson-Marsteller, (212) 752-8610.

Anixter debuts EZF

Anixter Communications will introduce Raychem's F-connector line, the EZF, at NCTA '85. The EZF line consists of two types of connectors, EZF 59, which fits all RG 59 cable, and EZF 6, which fits all RG 6 cable. A sealing ring is compressed between the cable and connector when the EZF is tightened with a wrench, resulting in a watertight electrical and mechanical connection.

For more information, contact Julie Anixter, Anixter Bros. Inc., 4711 Golf Road, One Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

WVL's "Impulser" home ordering unit.

WVL announces Impulser

World Video Library Inc. announced The Impulser, a hand-held self-contained unit for automatic subscriber impulse pay-per-view ordering and billing. The Impulser system utilizes the WVL Command Center, which acts as the interface between The Impulser's directions to the billing system and the addressable controller.

For more information, contact Rowena Andrews, (213) 826-9072.


Pioneer's BA-5000 converter.

Pioneer releases new systems

Pioneer introduced its enhanced one-way addressable system, the BA-5000. The converter is designed to solve several problems, especially the incompatibility of cable converters and equipment among vendors.

Pioneer also unveiled an add-on, two-way addressable hybrid to upgrade the BA-5000 series from one-way to two-way addressable. The two-way module, primarily for IPPV, can store and forward up to 20 purchased events to the center through a phone line. The system also can perform viewer statistics and opinion gathering.

As a part of the BA-5000 family of products, Pioneer also introduced an addressable cradle that gives operators a vehicle to move into addressability by upgrading a standard converter to an addressable converter.

For more information, contact Pioneer Communications of America Inc., 2200 Dividend Drive, Columbus, Ohio 43228, (614) 876-0771.

New receiver introduced

ICM Video has introduced a block converted commercial receiver designed for the 950-1450 MHz frequency band. The unit is compatible with M/A-Com's Videocipher system and features 55 dB S/N. The SR-4650P receiver uses a companion DC-65 block converter. The receiver sells for $590 and the converter for $180.

For more information, contact ICM Video, P.O. Box 26330, Oklahoma City, Okla. 73126, (405) 232-5808.

New report series released

Gill Management Services has released a new report series called the Manager's System Status. The series highlights the information regarding backlog, service level combinations, pay services and an expanded system analysis.

All information provided is available by entire system plant code, franchise tax area, management area/subarea, service type or service type within your system.

For more information, contact Doug Droese, GMS, 2050 Bering Drive, San Jose, Calif. 95131-2077, (408) 253-3665.

Budco Inc.'s new frangible seal.

Budco intros frangible seals

Budco Inc. introduced their line of frangible seals. The converter seal gives cable operators added security not available from a conventional lock.

For more information, contact Budco Inc., 4910 East Admiral Place, Tulsa, Okla. 74115, (800) 331-2246.

Extended warranty offered

Vitek Electronics Inc., has extended its warranty on all single, dual and multichannel traps. Effective immediately, all trap warranties will increase from one year to two years.

The warranty covers all parts and labor associated with the repair of the defective product.

For more information, contact Vitek Electronics Inc., 901 South Avenue, Horseheads, N.Y. 14845, (607) 796-2611.

Price lowered

Channel Master has lowered the price for Micro-Beam, its CARS-band microwave system. The $47,000 price for the basic system makes Micro-Beam currently the lowest cost system of its kind, according to Channel Master.

Micro-Beam permits operators to reach isolated subscriber pockets, to cross barriers such as rivers or highways and to interconnect small systems more cost effectively.

For more information, contact Steve Dozier, Channel Master, P.O. Box 1416, Smithfield, N.C. 27577, (919) 934-9711.

People


S. Ballerini


V. Swart

Samuel Ballerini has been appointed operations manager for Augat Inc.'s interconnection components division. As operations manager, Ballerini is responsible for all components manufacturing operations in Attleboro and Mashpee, Mass., and in Sanford, Maine. Prior to Augat, Ballerini was vice president of manufacturing for Sigma Instruments Inc.

Also announced was the appointment of **Vernon Swart** to Midwest regional sales manager. Swart will be responsible for handling all sales personnel and activity for Augat components.

Anixter Bros. Inc. announced the appointment of **Michael Long** to executive vice president, Anixter Canada Inc. Long will direct Anixter's Canadian operations under the supervision of George Miller, president of Anixter Canada. Long has been with Anixter since 1976. Prior to joining the company, he was with City Electrical Factors in London, England.

Anixter also announced the appointment of **David East** to deputy managing director of the company's British subsidiary, Anixter U.K. Ltd. East has served as general manager of Anixter U.K.'s communications group since 1983. In his new position, East will direct the overall operations of Anixter, U.K. Ltd., located throughout Britain and Scotland, and will oversee Anixter's European facility located in Antwerp, Belgium.


D. East

Effective April 1, **Steve Fox** was promoted from sales engineer to the position of manager, customer applications, for Wegener Communications. Fox will be responsible for the management of sales engineering which includes presale customer inquiries and order placement. He joined Wegener in October of 1982.

Joining the marketing staff is **Neil Kohrn** as sales engineer. Kohrn has been with Wegener Communications since 1982 in the customer service department.

Maggie Wilderotter, formerly director of national accounts, has been promoted to the position of vice president of sales, announced CableData. Her most recent activities included direct account responsibility for ATC, General Electric and Warner Amex Cable, plus managerial responsibility for the top 15 MSOs doing business with CableData.

Susan Grant has been appointed vice-president of sales for Magnicom Systems. Grant comes to Magnicom from Turner Broadcasting System Inc. In her new position, Grant will be responsible for developing strategies for marketing the company's MARC/10 business computer system, as well as the supervision of Magnicom's sales force.

Mohsen Manoochehri has been promoted to account manager in the Jerrold sales and service division. Manoochehri takes over responsibility for Jerrold accounts in Southern California and the Times Mirror Cable TV account. He will be based at the Jerrold/Century III facility in Brea, Calif.

Jerrold also announced the appointment of **David Del Beccaro** as controller in the subscriber systems division. In his new position, Del Beccaro will be responsible for overseeing all divisional financial functions. Prior to joining the company, Del Beccaro was a senior financial analyst on the corporate finance staff of Ford Motor Co. in Dearborn, Mich.

The board of directors of Avantek Inc. has named **James Sterrett** to the position of vice president and Fellow of Avantek. The title of Avantek Fellow was instituted by the board of directors to recognize an individual for significant and extraordinary technical contributions over an extended period of time. Sterrett is the first recipient of this award.

Sterrett was a member of the founding group of Avantek in September 1965. He holds a BSEE from Grove City College and the degrees of MSEE and Engineer, E.E. from Stanford University.

Avantek also announced the appointment of **Ron Atwater** to the position of eastern region field sales manager and acting central region field sales manager, and his assignment to the newly-opened regional field office in Columbia, Md. Atwater joined Avantek from Hewlett-Packard, where for 15 years he was involved in sales and sales management for the component products group.

Another appointment within Avantek was **Charles Bellavia** to the position of western region field sales manager, and his assignment to the newly-opened regional field office in Westlake Village, Calif.

John Battin was appointed president and chief executive officer of Wavetek Corp. He also will be a director of the company. Battin comes to Wavetek with 26 years experience at Motorola Inc.

The board of directors also announced that **Henry Reinecke**, senior vice president, operations, was appointed a director of the company.

Jones Intercable Inc. announced the appointment of **Ruth Warren** to regional vice president/operations. She will oversee various cable operations in the Southeastern area of the United States. Warren will soon relocate to the Fort Myers area, where she will supervise the establishment of a regional office for Jones Intercable Inc.

Fairchild Data Corp. recently announced the appointment of **Louis Harper** as president. Harper formerly was senior vice president and assistant general manager of Comtech Data Corp. He assumed the new role shortly after Fairchild purchased Comtech and formed Fairchild Data Corp. late last year.

RCA Americom announced the appointment of **Kurt Thoss** as vice president, video and audio services. Thoss is responsible for marketing RCA's satellite transmission services for the distribution of radio and television programming.

Also announced by RCA was the election of **Harold Rice** as vice president, business development and planning.

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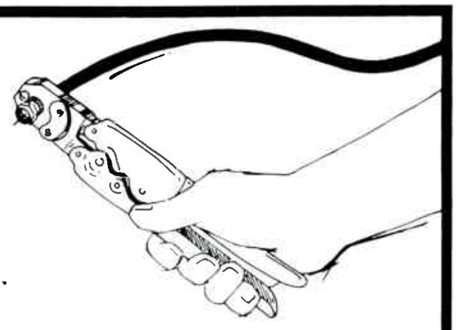

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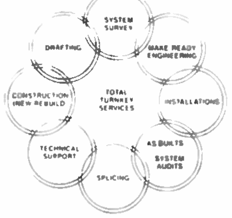

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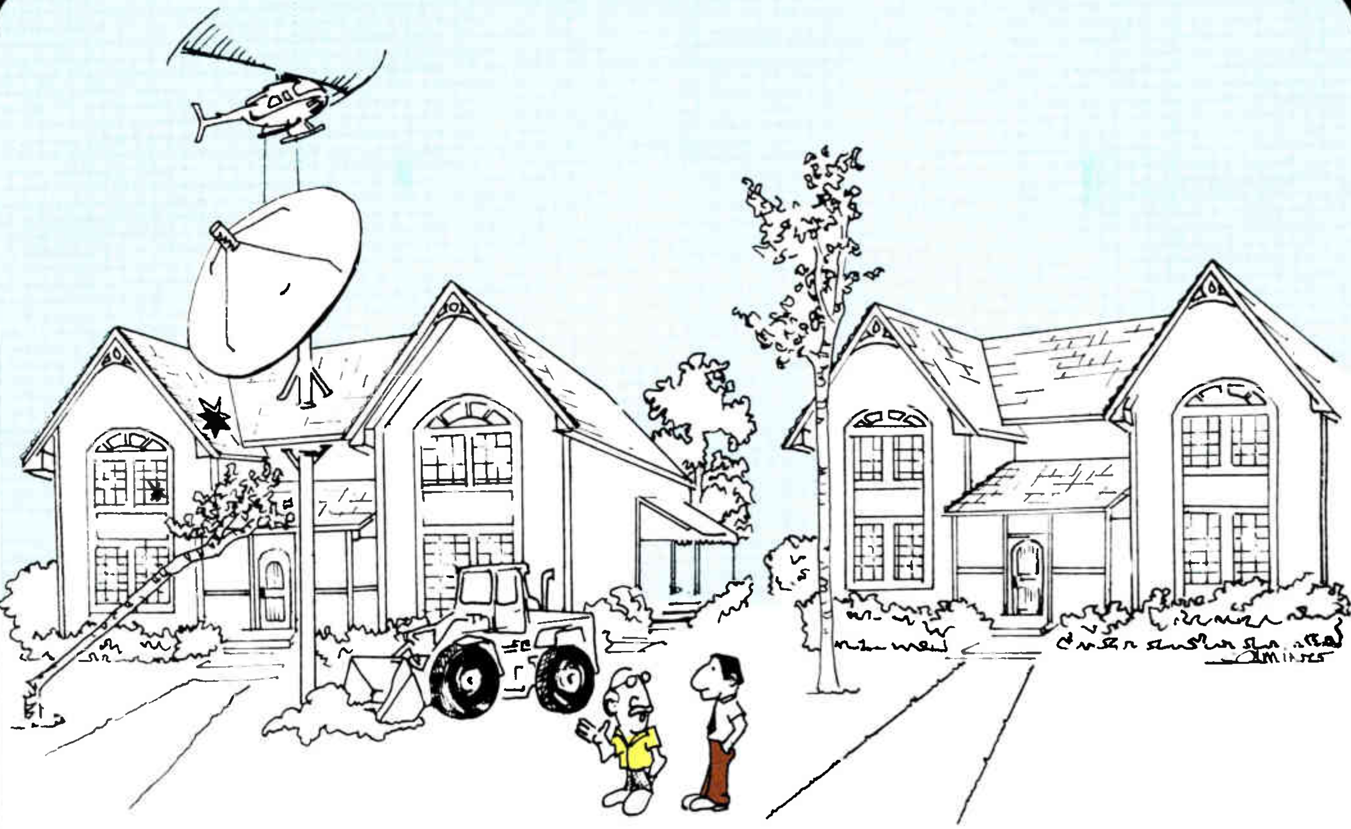

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