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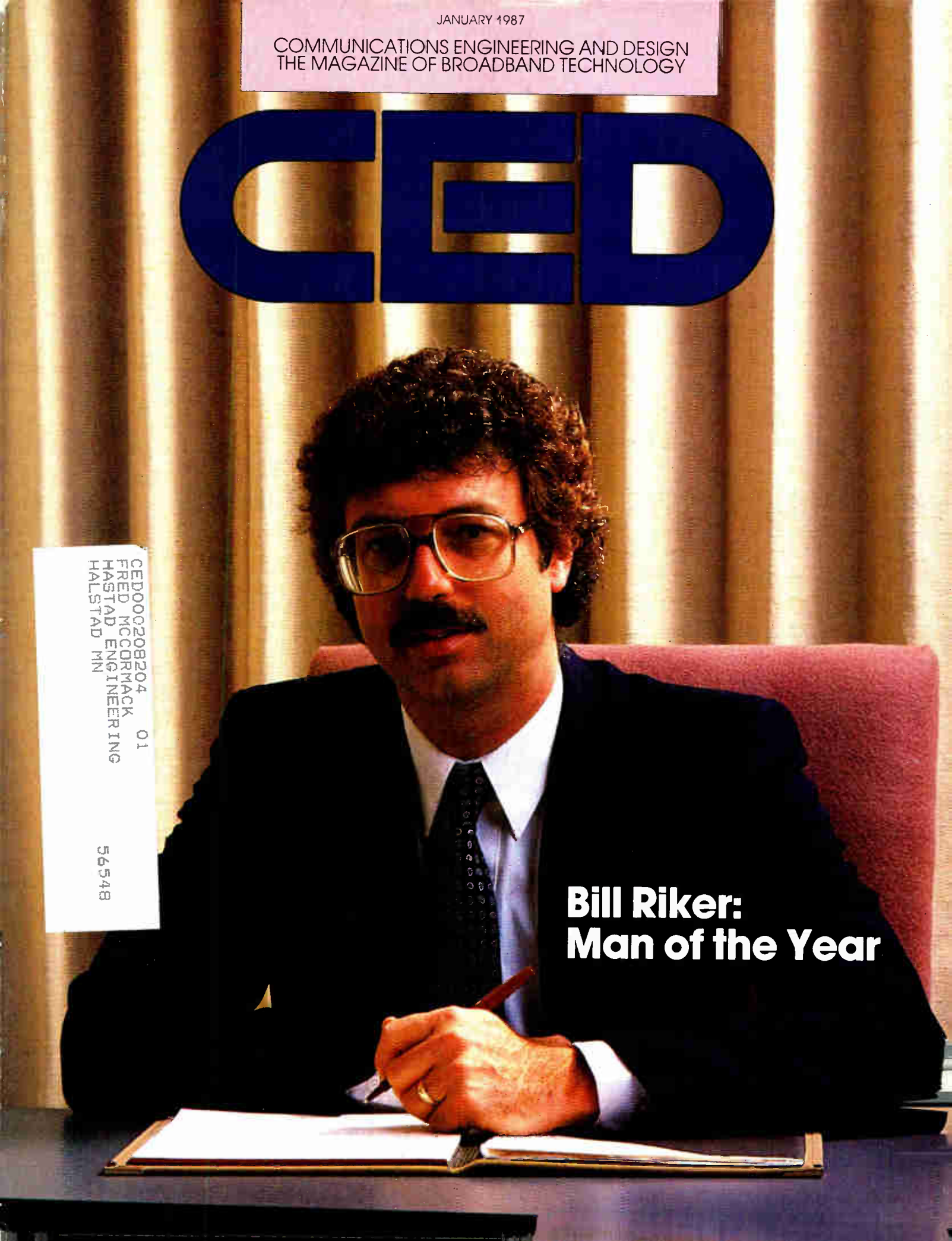
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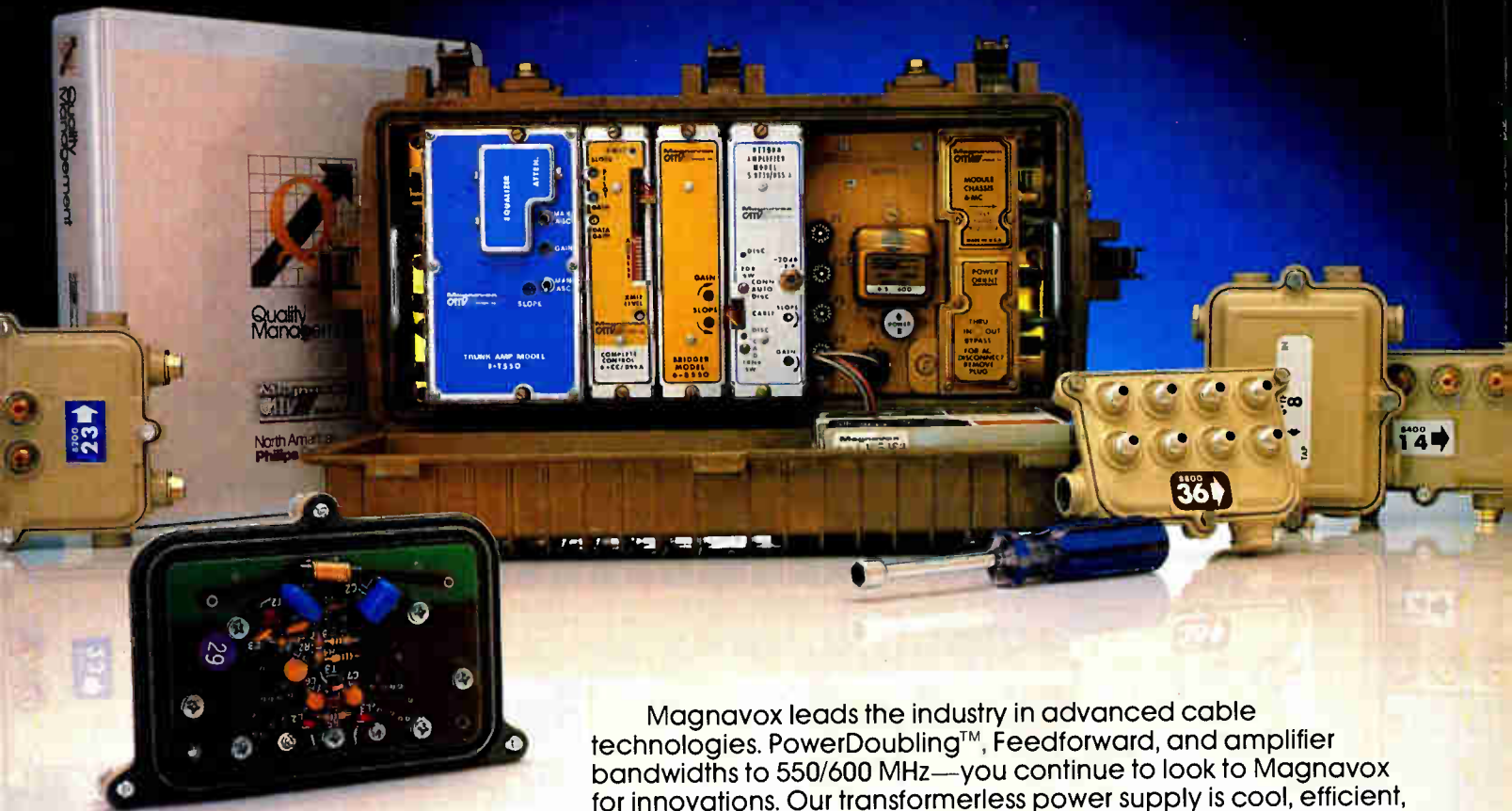
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**Bill Riker:  
Man of the Year**



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**SPOTLIGHT**

**Bill Riker: Man of the Year**

**6**

Almost single-handedly (give credit to his wife Anna), Bill Riker has quarterbacked the Society of Cable TV Engineers to newfound stature. For his achievements, a panel has named him Man of the Year.

**MY TURN**

**Is HDTV in the picture for CATV?**

**14**

Possibly, says Archer Taylor. But don't count VCRs and DBS out. And MAC or improved NTSC are contenders.

**CLASSICS**

**Phaselocked loops**

**18**

Phaselocked loops are used in almost all frequency synthesizers and converters. Jim Farmer of Scientific-Atlanta here explains how PLL technology lessens co-channel beats.

**At last, a turning point**

**22**

If current sales and Western Cable Show sentiment are any indication, 1987 will be a good year for CATV suppliers. Zenith's new two-way PM system, Scientific-Atlanta's new OUTER system and wide availability of BTSC generators were top hardware stories at the show.

**HRCorfeedforward?**

**35**

In the second of two parts, ATC's Walt Colquitt explains when to use each.

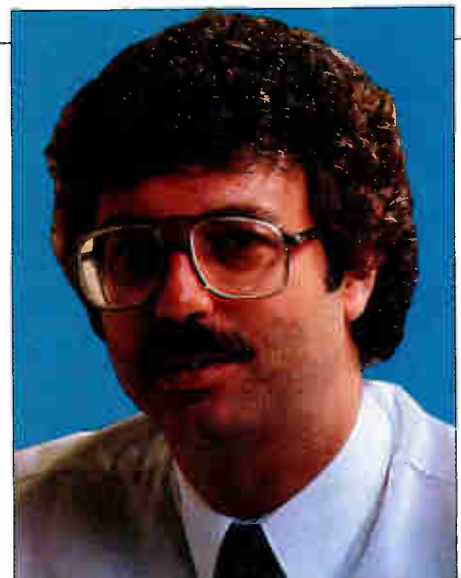
**Oh, for the good old days**

**36**

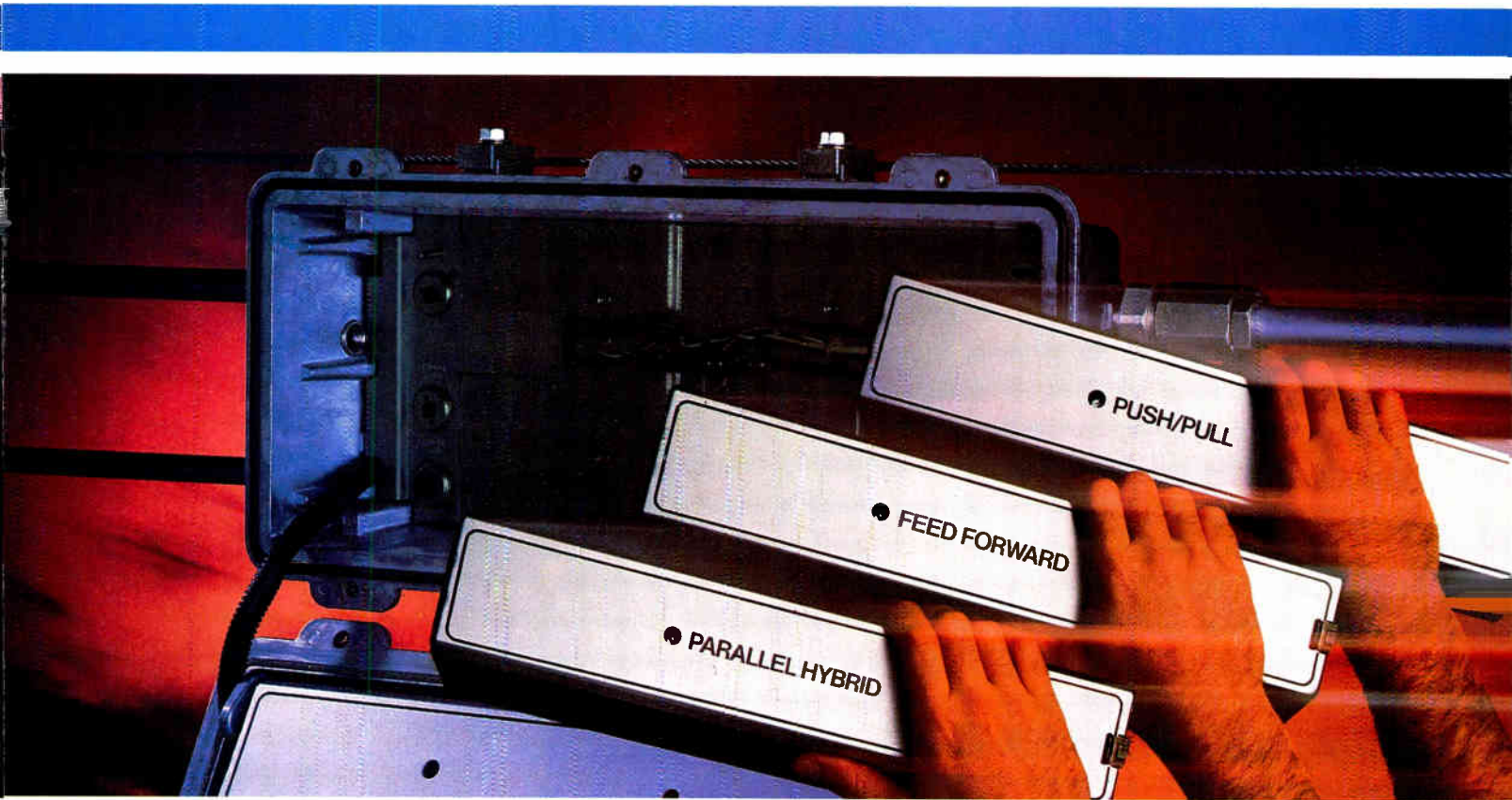
You can't just fit a matching transformer and a drop cable to the back of a TV anymore. No sir. But learning and programmable remotes, timing circuits and switcher boxes will help.

**DEPARTMENTS**

**In Perspective** 14  
**Classifieds** 42  
**Ad Index** 45  
**In the News** 46



**About the cover**  
*Bill Riker is 1986 "Man of the Year." For compelling reasons. See story page 6. Cover photo by Michael Bush.*



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# Scientific Atlanta



# Man of the year: Bill Riker

When NCTA was looking for a director of engineering a few years ago, I sent a letter to a professional society involved in the CATV industry. In that letter, I stated that I was "looking for someone who could beat me out of my job."

The executive director of that group called me and asked if I was planning to leave and if not then why did I make such a statement. I'm sure that the answer is obvious to Bill Riker and other highly motivated and talented people who are reading this. The best way to be successful is to hire the absolute best people you can find even if they could pass you up on the career ladder.

Bill Riker did not come immediately to mind when NCTA was searching. His life, as they say, was hidden under a basket. But it didn't take long to recognize his abilities or to appreciate his motivation.

Bill did then and does now possess a rare combination of intelligence with a practical sense. The glue that makes the package hold together is his personal commitment to a desire to see the industry be the best it can be. He's shown that commitment here at NCTA and he shows it at SCTE.

When Bill told me of his decision to join SCTE, I was both happy and sad. I was happy and extremely pleased that he was taking a personal risk in an effort to revitalize the SCTE. Bill's motivation was simple and eloquent at the same time. He reasoned that the SCTE was vitally important to the industry as well as to his own professional development and it needed help. He told me that he did not know if he was the best person for the job, but he at least knew that someone who cared would be at the helm.

The sadness came from losing the day to day contact with someone who I had come to respect and admire. Bill's humor and warmth are true treasures which all of the NCTA staff miss. Bill was extremely popular here with his fellow workers, and was as professional and competent as anyone I could have found.

His selection as the man of the year

Introduction by Wendell Bailey, Vice President, Science and Technology, NCTA

The committee's selection came as no surprise to anyone.

is no surprise, nor will I say that it is long overdue. To succeed and be recognized while playing in the big league requires extra talent and the right timing. This is Bill and Anna's time and they have our sincere congratulations. Editor's note: Anna Riker is Bill's wife and assistant.

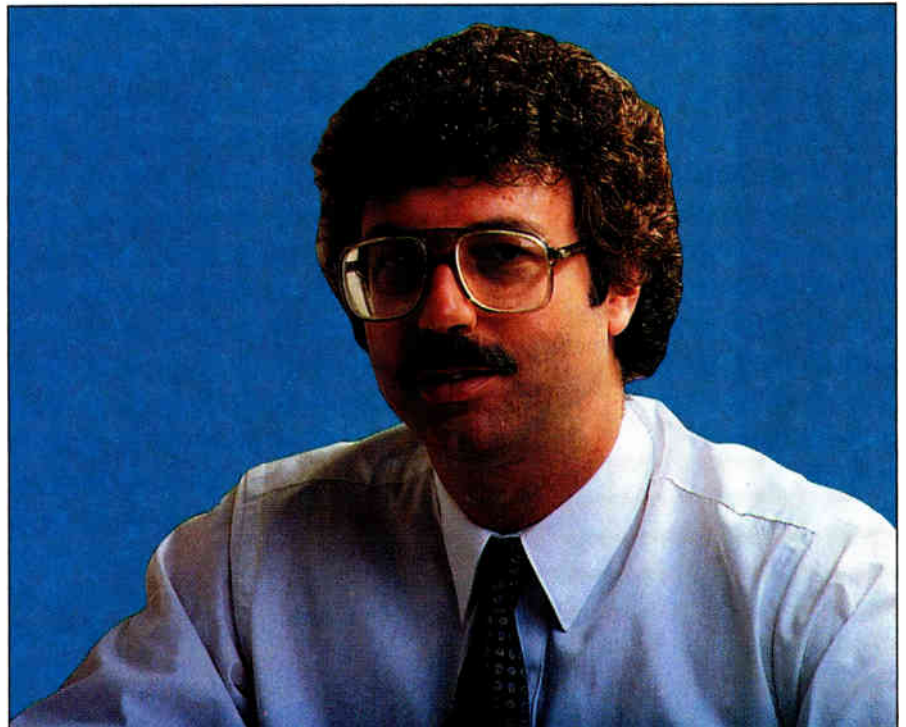
Take a man who loves to be challenged with an almost impossible task, give him the type of personality and charisma that gets others to cooperate with him, add a dose of organization and commitment—and you've got CED's first-ever Man of the Year. You've got Bill Riker.

Riker's accomplishments in making the Society of Cable Television Engineers a high-profile, high-quality organization during 1986 made him stand out in the minds of three industry giants charged with the goal of

naming a single individual who has made the most significant contribution to the cable industry. The consensus opinion was made by a hand-picked, nonpartisan committee of former NCTA Engineering Award winners chosen by Wendell Bailey: Alex Best, vice president technical operations at Cox Cable; Joe Van Loan, vice president engineering, Viacom; and Abe Sonnenschein, AML manager, Hughes Microwave Products. After looking at the industry as a whole, each felt Riker did the most over the past 12 months to impact more people than anyone else.

"A lot of different people who have spent tireless hours on some specific (technical) category or another came to mind, but I think in Bill's case here was a situation where the SCTE was really on the ropes and needed a major influx of new talent to get it back off the ground," said Best. "Bill stepped in—he wanted the job—and said, 'I can do it and I want it.'"

"As we picked the Man of the Year, I looked at the criteria used for *Time's* Man of the Year," said Van Loan. It looked to me like the individual who had the greatest positive impact on the



Man of the year: Bill Riker

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OF  
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Reader Service Number 4

## With just himself and one secretary counted as total staff, the SCTE began its climb under Riker.

technical side of our business—people or technology—was Bill Riker. He had an affect on more people maybe than anyone else who comes to mind. "He did that by making the SCTE what it was intended to be—something for the technicians to go to and be enriched; to get together with people of similar interests on a regular basis and talk about those interests," Van Loan added.

### Milestones

Although Riker took over the helm at the SCTE in late 1984 and instituted several new programs during 1985, it all seemed to come together during 1986. The Cable-Tec Expo in Phoenix established new attendance figures, society membership reached all-time highs and a new, permanent office building was purchased, giving SCTE its first real home.

Those kinds of milestones cannot be taken lightly when the near history of SCTE is put into perspective. Financially, the SCTE was way behind, several executive vice presidents had come and gone in succession, industry leaders had been tapped too many times to offer assistance and membership waned as the value of being a member was difficult to perceive. On top of that, the national office was sharing space with another company and had to borrow the use of office essentials like telephones and copy machines.

"He's helped enhance the status of engineers, which has been sorely needed," said Abe Sonnenchein. "This industry was founded on technology but technical people have not always had the status they deserve. You won't find any controversy about this selection (of Riker as Man of the Year). He's a good choice—and he has the kind of background that keeps him intimately plugged in to what's going on."

In 1984, the SCTE board was considering bringing in a professional association manager to take the reins. Riker, who at that time was NCTA's director of engineering and its liaison to the SCTE, told the board that the position should be filled by someone from the cable industry.

Riker brought good credentials with him. He started his career in New York

radio and built one of the nation's first quadrophonic broadcast studios. A tight market led him into cable with Am-video Corp. as a chief technician for a New Jersey system.

After a stint with McLean-Hunter in New Jersey, he moved to the West Coast to become Showtime's regional engineer based in San Francisco. With the pay service busy rolling out satellite-delivered programming, Riker traveled much of the country installing earth stations. Two promotions later, as director of engineering, he created a nationwide network of regional engineers, a concept he later successfully brought to the SCTE.

Involvement in research led to his attendance at the NCTA Engineering Committee meetings where he and Wendell Bailey, NCTA's vice president of science and technology, became fast friends. In 1983, Bailey created the position of director of engineering and asked Riker to fill the slot. Soon, he became active in the SCTE at the committee level and attended several board meetings. Given his outspoken attitude about the type of person who should lead the SCTE, it was natural he would be asked to take over. The challenge was too enticing to pass up, Riker said.

"I knew that taking the job was the largest challenge I ever took on and I was also aware that I would either be a 'hero' or be unemployed in six



Joe Van Loan

months," Riker said. It's probably safe to say that put in water, Riker would swim, not sink.

In fact, that's already been proven. Anyone who knows Riker well is aware of his skill as a boatsman. One of the most repeated stories concerns the time he and Wendell borrowed a friend's boat to cruise down the Potomac River. As twilight approached, Riker, who was feeling uncomfortable steering the 26-foot Chris Craft so close to shore, turned the helm over to Wendell. As the boat moved closer to its destination, seagulls and ducks that had lined up on the water began to fly away—except for a few directly in front. As the craft moved closer, Riker shouted, "Those aren't ducks!" while Bailey shut the engine off. It was too late, however. The boat's wake lifted it up and placed it on top of several pilings left over from an old ferry boat dock. After a call was placed to the Coast Guard for assistance, it was determined the tide would eventually float the boat. The boat suffered nary a scratch and the incident serves as testimony to Riker's ability to face daunting circumstances and survive unscathed.

With himself and just one secretary counted as total staff, the SCTE began its climb under Riker. When he took over in October 1984, there were 2,500 active members with two local chapters already established and seven meeting groups (defined essentially as probationary chapters) assigned. Today there are nine chapters, 22 meeting groups and 3,200 active members. What happened?

### Strong regional ties

Borrowing a page out of his Showtime management stylebook, Riker redefined the SCTE's focus to include a loose national organization with strong regional and local chapters. By bringing high-quality training seminars and meetings to the guys in the field, and doing it inexpensively, the SCTE gained importance in the minds of its members. The word spread and, fueled by a new sense of morale, more members were recruited.

"Bill decided to take the SCTE from a national, consolidated thing out to



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## Despite all the optimism, efforts have to be made to acquire more members.

the field, where it belongs," said Bob Luff, current SCTE president. "The ultimate goal is to make it so that no one has to drive more than an hour or so to a quality SCTE chapter meeting."

For those in the industry who have no local chapter to attend, the SCTE instituted its Satellite Teleseminar Program. As a service to the industry, training tapes are created and uplinked via satellite across the country. Local system technical staffs are encouraged to tape and save the program for their own use.

The benefits of this approach became obvious early on. Individual chapters could offer low-cost training without forcing its members to lose more than one day of work.

"Many people are able to grow and expand beyond their normal dBs training," said Luff. "People found you don't have to be a vice president of engineering at a major MSO to be a board member or give a program."

Along with the shift in focus came a need to bolster the society's finances. To do this, it was important that members be able to see the benefits being offered. In addition to a variety of publications, the SCTE offers printed and videotaped training seminars, the BCTE certification program for technicians and engineers and organizes the



Abe Sonnenschein

annual Cable-Tec Expo, the industry's only 100 percent technically-oriented show. Bucking the trend that saw many shows decline in attendance, the Expo has grown each of the last two years.

Revenue from the Expo and increased membership rolls has been funnelled back into the organization. Administrative assistants were hired, giving the SCTE a total of four full-time and two part-time staffers. And, late in '86, the society purchased its own building. Riker and Luff can't overemphasize the importance of that purchase, which doubles the amount of working space for about the same cost, noting the psychological lift each member will get from seeing a permanent, brick and mortar headquarters. (The SCTE's will host a grand opening ceremony on Jan. 14.)

As a way of recognizing local system employees who perform their jobs in an outstanding manner, the SCTE offers the Outstanding Achievement Award. "The concept here was to recognize technical people who are outstanding at their jobs," said Riker. Past awards have gone to installers, system designers, technicians and others.

"We hope to give out as many as possible next year. There are hundreds of people who deserve the recognition," Riker added. (Contact the SCTE for nomination information.)

Goals for 1987 are heady. As a vehicle to help lower-level technical staffers rise through the ranks, the SCTE will soon begin awarding one NCTI scholarship per month, about a \$500 value, to its membership. Funded by the SCTE and Rex Porter of Times Fiber, each winner will be able to choose the course he wants. Also, through the BCTE certification program, installers will be able to become certified in their job category. And a national speakers bureau is being developed to help chapters locate and schedule top-flight speakers for their local programs.

Despite all the optimism, Riker said efforts have to be made to acquire more members. With an estimated 35,000 technical personnel in the industry, present membership rolls only show 10 percent of that figure. A major



Alex Best

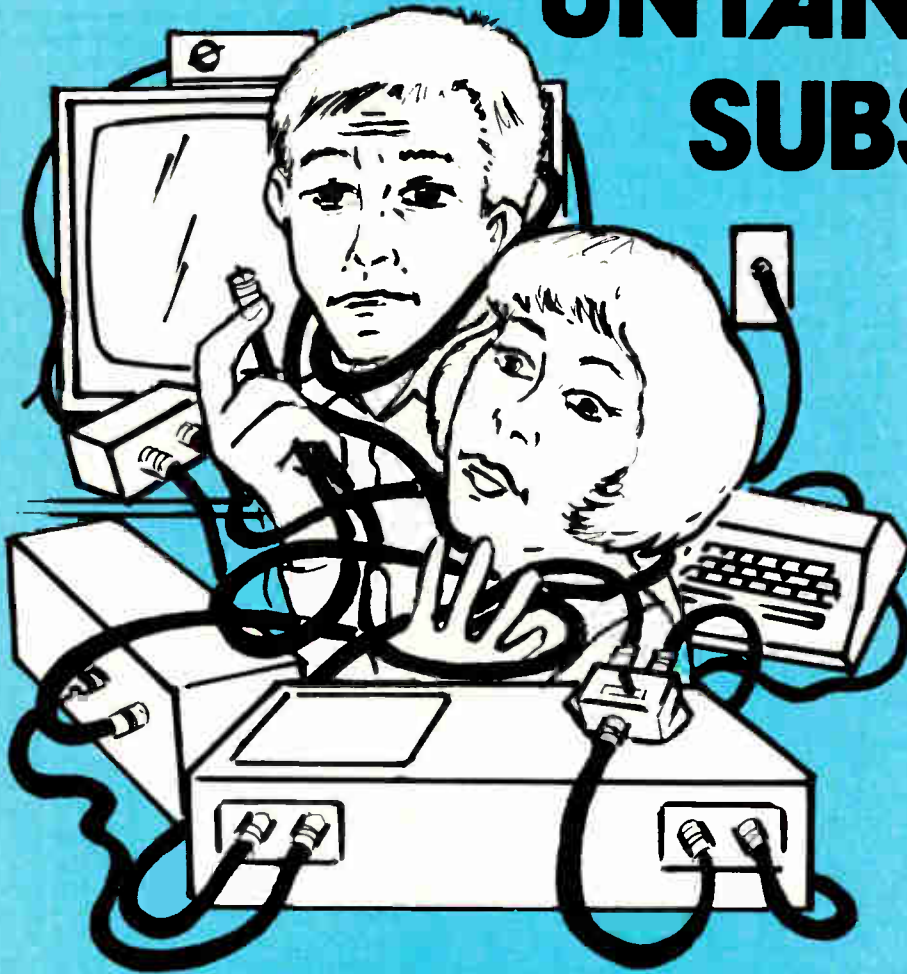
hurdle to overcome is reticence by local and regional management to give technical staff the time needed to attend local meetings. "The time lost is returned two-fold with better performance and knowledge gained," Riker said.

Lest the impression be given that Bill is a one-man show, he does benefit from his partner in life, his wife Anna. Also a dedicated, hard worker, Anna is often seen with Bill and, in the early days where staff was counted on two fingers, her efforts were paramount toward Bill's success. "The fact that they (Bill and Anna) can do that much work all day together, live together at night and still stay married says something about the guy," noted Alex Best.

Despite his ability to recruit help, Riker leads by example, said Bob Luff. "Bill is a multi-talented, diverse person. It's rare to find someone who has a technical background and really understands the training and professional development needs of the industry who can express himself and motivate others toward what needs to be done. And he's in there with his shirt sleeves rolled up doing it," he added.

—Roger Brown

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## HDTV—boon or bane?

High definition television—will it be a boon to cable TV, or the bane of the industry?

What is it? Literally, "definition" means: "The fidelity with which the detail of an image is reproduced" (*IEEE Standard Dictionary of Electrical and Electronic Terms*); or, "the absence of fuzziness" (*Webster's New World Dictionary*).

The term "definition" is misleading, however. The absence of fuzziness, or sharpness of detail, is only one of many factors affecting our subjective perception of the fidelity with which a television picture represents the real-life scene. Some other important factors are:

- Aspect ratio
  - Flicker (entire scene, or only portions)
  - Interlace vs. progressive scan
  - Depth (3-D)
  - Color fidelity
  - Interaction between chrominance and luminance
  - Geometric error
  - Spurious information, or artifacts
  - Interference from external sources
- Although the activity in the develop-

*By Archer S. Taylor, Senior Vice President, Engineering, Malarkey-Taylor Associates Inc.*

ment of improved TV pictures is motivated, at least partly, by the "public interest," it is surely being driven also by strong commercial and sociopolitical considerations. Would not obsoleting 200 million TV sets in the U.S. alone create an enormous new consumer market? Would Japan again dominate the manufacture and sale of the new television in North America and Europe? Could there be a uniform standard all over the world, at least the so-called western portion, avoiding another NTSC/PAL/SECAM situation? Will Europe accept the 60 Hz frame rate, in conflict with its own historic power source frequency?

These were some of the issues which the 16th Plenary Session of the International Radio Consultative Committee (CCIR) struggled last May at Dubrovnik, Yugoslavia. Unwilling to accept the U.S. supported NHK (Japanese) standard, the delegates punted: Study Group 11 was directed to hold an extraordinary meeting in 1988 to come up with a draft recommendation for the next Plenary Session in 1990.

Meanwhile, the Advanced Television Systems Committee (ATSC), comprising mainly U.S. TV broadcasting and cable interests, continues its three-pronged investigations:

- 1) HDTV
- 2) Enhanced 525-line
- 3) Improved NTSC

HDTV, as presently defined, would not be compatible with present TV receivers or VCRs, and could not be broadcast within the present 6 MHz channels. Recognizing this problem, the Japanese came up with a partial solution called MUSE (multiple sub-Nyquist sampling encoding) intended to compress the nominal 30 MHz band width required for the NHK system down to about 8.1 MHz. MUSE could be carried on cable TV, or UHF TV broadcast, by combining part or all of two adjacent channels. NTSC compatible converters have been demonstrated, but many engineers consider them too sophisticated and costly to be practical.

The *Enhanced 525 Line Systems Technology Group* is considering the submission of a MAC standard (multiplexed analog components) to the American National Standards Institute (ANSI) as a voluntary standard for

direct satellite transmission. The system under consideration was developed primarily at Scientific-Atlanta and is now in official use in Australia.

The *Improved NTSC Technology Group* is studying means to improve the quality of studio production and transmission involving certain modifications in the original NTSC standards to provide a fully NTSC-compatible "extended definition" system. This technology would improve the image quality on existing TV sets, and would be capable of terrestrial broadcasting within existing 6 MHz channels, but with the present 4 to 3 aspect ratio.

Mainly because of the incompatibility of the NHK system with present television technology, a further search is under way for a truly compatible, high performance system. In Europe, a 19-country association has announced a four-year, \$186 million project, as part of the program called Eureka, to do just that.

Where does cable TV come into the picture? It is obvious that, while over-the-air NTSC broadcasts can and will be improved, truly high performance technology, no matter which standards are ultimately adopted, will require more spectrum than is presently available for terrestrial broadcasting.

It just so happens that cable TV networks, presently in place, pass within service drop distances of some 70 million TV households (80 percent of the U.S. total), with an average of nine unused TV channels (Nielson CODE, July, 1986). Cable TV has what HDTV needs: spectrum availability for distribution to the public. But, so with DBS, including *de facto* DBS using backyard dishes. Moreover, video cassettes can also be produced in format suitable for HDTV VCRs and wide-screen TV sets, and may be the first to hit the streets.

The message is clear. Cable TV could play a major role in the distribution of high performance TV to the public. NCTA has participated effectively in ATSC meetings on a regular basis. RCA, Zenith, Philips, ATC, General Instrument (Jerrold), M/A-COM, Scientific-Atlanta, and other cable TV entities also have participated extensively in the activities of ATSC.

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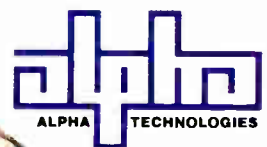
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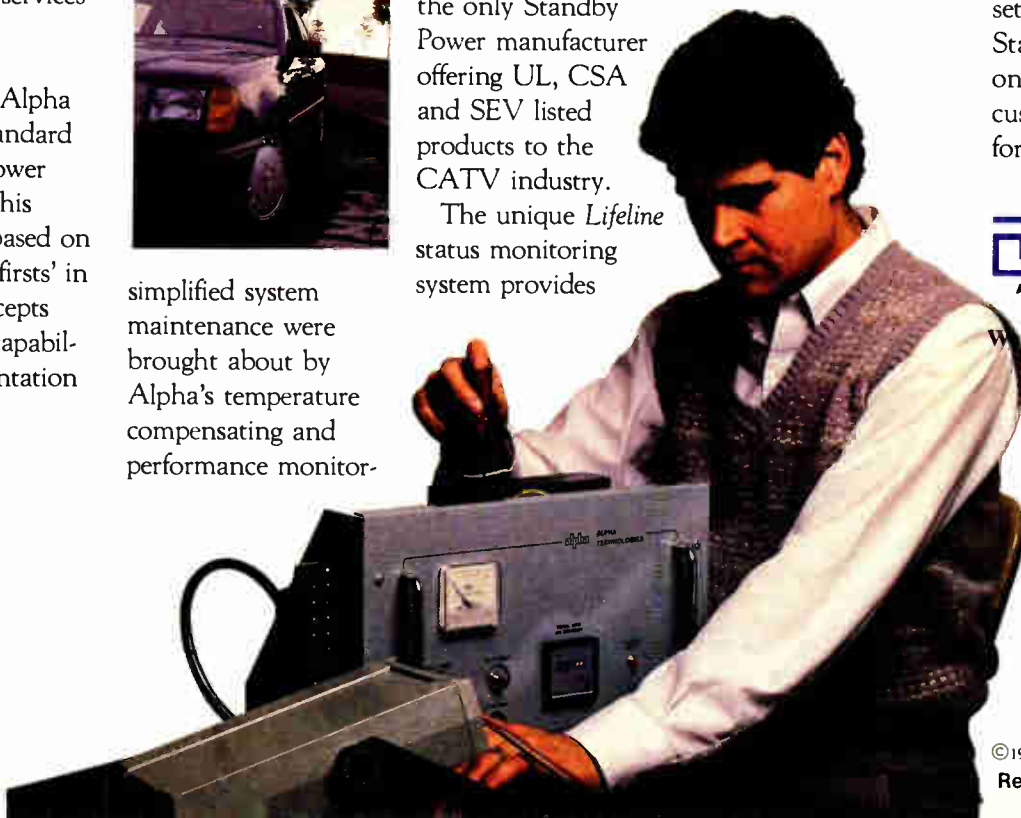
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## What the government gives it can also take away

In February 1985 the Federal Communications Commission deleted from its Part 76 Rules and Regulations those sections requiring that CATV systems meet certain technical performance criteria. These rules included frequency boundaries of channels; frequency tolerance of visual and aural carriers; minimum visual carrier levels at subscriber terminals; visual carrier fluctuation levels; maximum and minimum specs for aural carriers compared to visual carriers; maximum low frequency distortion; frequency response of each channel; allowable signal to noise level; maximum intermodulation; signal leakage limits and minimum terminal isolation.

In a March 1985 address to the Society of Cable Television Engineers, Jim McKinney, chief of the FCC's Mass Media Bureau, said that "the premise of technical deregulation...is to delete those rules that go to the 'quality' of communications services and concentrate, instead, on matters concerning interference."

So although the technical rules in Part 76 were dropped, an amended section 76.601 was added, setting leakage limits for frequencies below 54 MHz at 150 micovolts per meter at

three meters; 50 microvolts per meter at three meters for signals in the 54 to 516 MHz band; and 150 microvolts per meter at three meters for frequencies above 216 MHz. It's no mistake that the limits are tighter for the over-the-air broadcast and aircraft navigation bands. As a purely political matter, the FCC is going to look silly if it deregulates CATV too much and interference with broadcasters or the Federal Aviation Agency's aircraft navigation and communication bands occurs.

And it's fair to say that given it's druthers, the FAA would bar the use of the aeronautical frequencies by CATV in at least the 108 to 136 MHz bands, used by instrument landing systems and commercial aircraft voice navigation.

Perhaps interference with aircraft communications shouldn't be a problem. When the FCC finally settled Docket No. 21006—concerning CATV interference with aircraft navigation—in early 1985, a system of frequency offsets was mandated: 12.5 kHz in the 118-136, 225-328.6 and 335.4-400 MHz bands; 25 kHz in the 108-118 and 328.6-335.4 bands; any CATV system operating in those bands at an average power level equal to or greater than 38.75 dBmV.

Theoretically, at least, even a severe leak shouldn't interfere with aircraft, since there's an offset. Systems also are required to monitor the entire plant for leakage, note and repair within a reasonable time all leaks of 20 microvolts per meter at a distance of three meters, and keep a log for two years showing the sources of leaks, the date identified, the date repaired and the probable source of the leak.

Of course, the new rules apply only to new users of the bands. Systems that had applied for use of the aeronautical bands prior to Nov. 30, 1984, or who had applied by that date and gotten approval, are grandfathered until July 1, 1990. So that means there are still systems out there running signals in the aeronautical bands without offsets, and may be until 1990. Annual monitoring rules apply to grandfathered systems.

And beginning in 1990, all CATV systems using the aeronautical bands must perform annual CLI tests. But in

the meantime, there's still the issue of keeping the plant tight. And it's a tough issue in at least one respect. It would be very expensive to rebuild certain U.S. cable systems to bring them into compliance with the leakage rules. And as operations-oriented as many CATV system owners are these days, technical budgets are tight as a drumhead. Construction, test equipment and PM budgets probably aren't lavish, even at the biggest, most sophisticated MSOs.

At his March 1985 address to the SCTE, McKinney said "I would suggest you reflect on how many dollars are spent on transmission system improvements vs. how much your corporate parents spend on maintenance and test equipment. The balance, while improving, is still not right."

Somehow, that balance has to be restored. Somewhere between the FAA's legitimate concerns about navigation interference and the MSOs' operating budgets, there has to be a meeting point. Maybe the possible FCC fine for interference isn't a big corporate concern. But it's safe to say that complete loss of the aeronautical bands would cause heads in high places to sit up and take notice. Let's hope those heads in high places inside the CATV industry sit up before something catastrophic happens.

Speaking of catastrophic, we'd like to extend our apologies to *CED's* readers regarding a few production problems that occurred in the last issue of the magazine.

We are converting to a new state-of-the-art production system and like every new technology, we found a few bugs in the system. Dropped rule lines and font changes were some of the strange artifacts.

A special apology goes to Mike Holland whose A/B switch story (see page 74) was printed without some of the charts belonging to the story. Those charts can be found in the Western Show wrap up in this issue beginning on page 22.

Again, we apologize for the bugs.

—Gary Kim  
Publisher/Editor



# Agile Omni, the industry's most advanced receiver designed by the most relied upon name in the business... Standard.

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*Format control enable selections of desired satellite system. Direct-reading channel selector displays transponder-assigned channel. Second selectable subcarrier and space for optional third subcarrier or descrambler modules.*



# Application of phase locked modulators and processors

**R**ecently much has been said about the advantages phase locking techniques offer the CATV operator. This paper is intended to further acquaint the reader with the phaselock technique, so he can better utilize the available phase locked equipment.

Phaselock is not new to the electronic industry. The first practical applications were coherent detectors in homodyne radio receivers built in the 1930's. However, the circuit complexity of a phase locked loop is so great that until recently the technique was restricted to a few specialized applications. Now, thanks to progress in components and circuit techniques, phaselock is becoming economical for a wide range of applications.

CATV application of phaselock includes precision demodulation, minimizing the subjective effects of strong local TV signals, and various phase locked headend schemes. This paper is concerned with only one of these applications of phaselock; minimizing the subjective effects of a strong local signal leaking into a subscriber's television set. This leakage problem has required the cable system to distribute strong signals on channels which are not locally used for TV broadcast. This off-channel conversion for cable distribution eliminates the leakage problem at the expense of available cable channels.

New FCC rules and increasing program availability to cable systems have created pressure to use these fallow channels for some type of locally originated program. If the cable channel carrier is not exactly at the frequency of the interfering carrier, a co-channel beat will be seen on the subscriber's set.

Figure 1 illustrates the situation where two video carriers close together in frequency are present simultaneously. The signal on the left is the desired carrier, perhaps carrying a weather-scan picture. To the right is an interfering carrier which has leaked into the

## Phaselock is not new to the electronics industry.

subscriber's TV set. When the two signals are detected, their frequency difference will create a component  $f_b$  in the video. This shows up as black and white co-channel lines in the picture. The severity of the co-channel beat is dependent upon the separation,  $f_b$ . Phaselock can be used here to force the desired carrier to the frequency of the interfering carrier, reducing  $f_b$  to zero and eliminating the co-channel beat.

How do we accomplish this? Figure 2 is a simplest block diagram of a phase locked modulator. A sample of the interfering signal is picked off the air and applied to a fairly narrow bandpass filter. This filter removes all energy except the picture carrier and some of the luminance sidebands. The remaining signal is the reference, which is applied to a phase detector. The output of a voltage controlled oscillator is also applied to the phase detector. The output of the phase detector is a d.c. potential proportional to the cosine (in this case) of the phase difference between the reference signal and the voltage controlled oscillator (VCO) output.

This phase error is applied to a loop amplifier (normally configured as an integrator for low frequencies), whose output is the VCO control voltage. Since the amplifier has very high gain at low frequencies, it will act on the VCO in whatever manner is necessary to reduce the phase error to nearly zero. Thus, the VCO output is required to maintain a strict phase relationship to the reference signal, and hence must operate at the same frequency. The VCO output is then applied to the modulator, and the remaining modulator operation is identical to that of a non phaselocked unit.

In the case of Scientific-Atlanta's Model 6300 PL Modulator, the modulation is performed at the 45.75 MHz intermediate frequency, which is then upconverted to the desired channel. A common local oscillator is used for up conversion and for down conversion of

the reference. This assures phase coherence. For stability the VCO used is a voltage controlled crystal oscillator (VCXO).

## Tracking filter

Use of the reference signal directly instead of locking another oscillator to its frequency is not practical. This is because a bandpass filter cannot be realized that will adequately strip all modulation sidebands off the reference, maintaining this characteristic over all combinations of reference drift, time, and temperature. In this respect, the phase locked loop operates as a tracking filter, since its output is at the frequency of the input, and all sidebands can be suppressed to an arbitrary degree. Even so, the output can track the input carrier over a greater range than the effective filter bandwidth.

Before a phase locked situation can exist, VCXO must be made to run at the same frequency as the reference. Figure 3 defines some terms that are appropriate to the acquisition of phase lock. This figure is a spectrogram

## Cable Classics

Phase Locked Loops (PLL's) are very widely used in cable television equipment. Almost all frequency synthesizers use a PLL; frequency synthesizers are employed in satellite and microwave receiving in headend signal processors, and in most of the converters now being sold. One of the earliest uses of the PLL was in headend modulators and signal processors to avoid (or minimize) co-channel beat problems.

Can you distinguish between lock-in (or acquisition) range, pull-in range, and hold-in range? Do you know what factors to take into account when estimating a lock-in range requirement?

In this paper, Jim Farmer describes the operation of the phase locked loop and its application to the co-channel beat problem.

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Consulting Engineer*

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*James O. Farmer,  
Scientific-Atlanta Inc.*



## The detailed process of bringing the VCXO into lock is quite complex and beyond the scope of this paper.

centered on the free running frequency of the VCXO; as this frequency changes, it will appear to stay fixed, but other features of the spectrogram will move.

The free running frequency is the frequency at which the VCXO would run if no control voltage is applied from the loop amplifier. When power is first applied, or when the reference carrier first becomes available, the loop must somehow move the VCXO frequency to the reference frequency before phase lock can be achieved. Also shown in Figure 3 is the frequency of the reference, which might appear anywhere in the spectrogram.

The detailed process of bringing the VCXO into lock is quite complex and beyond the scope of this paper. However, a brief discussion of the process involved is in order. The difference is defined as  $f_b$ . If the frequency difference is sufficiently small, the control loop is able to rapidly bring the VCXO into lock. The range over which this can be accomplished is called the

lock-in range. For all practical purposes, the lock-in range is roughly equal to the loop bandwidth, which should be small in order to improve rejection of the reference sidebands. If the initial frequency difference is within the lock-in range, the loop will rapidly acquire. If the initial frequency difference is out of the lock-in range but within the pull-in range, the loop can theoretically lock if given enough time.

However, in this range practical considerations of amplifier offset and noise are such that lock generally cannot be achieved without additional circuitry. Outside of the pull-in range, lock cannot even theoretically be achieved without additional acquisition circuitry. However, once lock is achieved, the loop is able to hold lock over a much wider range, known as the hold-in range. This is the frequency difference over which, after lock is achieved,  $f_b$  may drift and still permit the loop to remain locked. For the most useful type loop, the hold-in range is

not a function of loop dynamics, but rather is a function of saturation levels of loop amplifiers or other components in the loop. Within certain practical bounds, the hold-in range may be made arbitrarily large.

### Acquisition circuitry

Proper acquisition circuitry may be used to aide the loop in locking up at any frequency in the hold-in range. An adequate acquisition (and hold-in) range is one which permits acquisition under the worst possible initial frequency error,  $f_b$ , due to all causes. This acquisition must be without operator intervention. In order to determine the required acquisition range, we will develop a worst case error budget, taking into account all known sources of frequency error.

The major contributors to the error budget are listed below. The first source of error is the 1 kHz frequency tolerance imposed upon the broadcast



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## Recently, several types of digital phase detectors have become popular for frequency synthesis work.

station. Although not a frequency error, we will add in the 10 kHz broadcast carrier offset. If the acquisition range is insufficient to handle the carrier offset, then the offset must be specified when ordering the phase lock equipment or when transferring it to a different location. To the above tolerances must be added the drift of the VCXO, which might reach 5 kHz at the higher channels. This may be drift reduced to 0.2 kHz with a highly stable VCXO enclosed entirely in an oven. However, an oven is undesirable because the higher temperature will accelerate component failure, and will also increase power consumption. In addition, an oven stabilized oscillator must be allowed to warm up after turn-on or a power failure.

Another error which must be taken into account to insure that the operator does not have to "tweak" the phase lock after installation, is the initial frequency setting of the VCXO. A reasonable allowance for this is 0.5 kHz.

Error budgets for determination of required acquisition range are:

- 1) Broadcast carrier tolerance = 1 kHz
- 2) Broadcast carrier offset = 10 kHz
- 3) VCXO drift (Ch. 13, non oven controlled) = 5 kHz
- 4) VCXO initial setting = .5 kHz
- 5) Crystal aging = ?
- 6) Component aging = ?
- 7) Variation with power supply = ?

Error budget = 16.5 kHz (For heterodyne processors, add down-conversion error).

So far the error budget is  $\pm 16.5$  kHz and there are still several other sources of error to consider. These errors are more difficult to quantize. They include crystal aging, frequency fluctuation with power variations, etc. In the case of a phase locked heterodyne processor, we must also add the tolerances pertaining to the station whose signal we are processing. A safe acquisition range to consider is plus or minus 25 kHz. This allows for known sources of error, plus some margin for the undefined errors.

Implicit in the discussion of safe acquisition range has been the require-

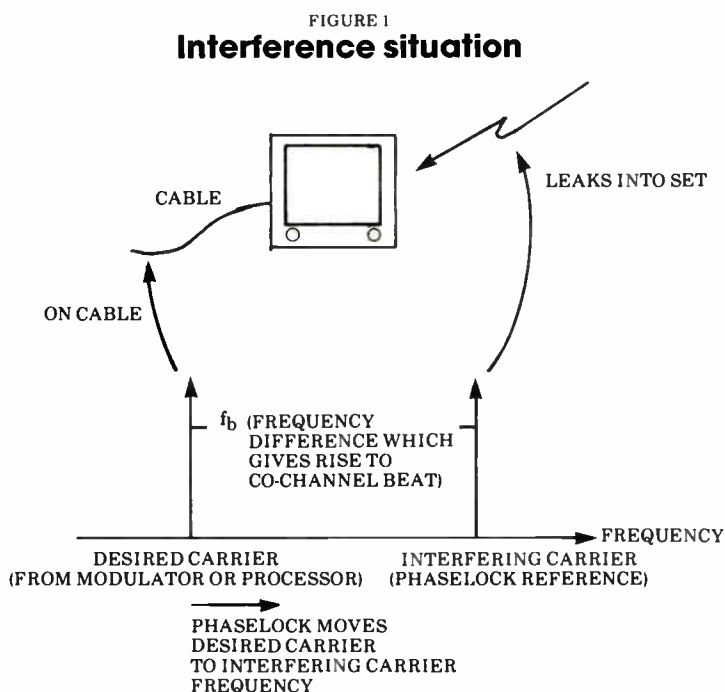
ment that the loop must also exhibit an adequate hold-in range. Considerations with respect to adequate hold-in range include the use of servo compensation that develops a vary high gain at low frequencies, so that a significant phase error does not develop at the phase detector output. Also, the VCO must be capable of being controlled over an adequate range. For good stability, the VCO should be crystal controlled but special design techniques are required to pull a VCXO over the frequency range required.

Several types of acquisition circuitry have been developed over the years. Probably the most common technique in communications applications is use of a triangular ramp which drives the VCO back and forth over the entire hold-in range, searching for a signal to lock to. When the VCO is driven to within lock-in range, the loop locks and the ramp is disabled. The technique works, but is relatively slow, because acquisition dynamics limit the maximum search rate. Also, if significant sidebands exist within the search range, the loop may attempt to lock to them rather than to the carrier.

### Digital phase detectors

Recently several types of digital phase detectors have become popular for frequency synthesis work. The most elegant is a sequential circuit, available in I.C. form, that matches the negative-going transitions of the two waveforms. This detector has the property that if one input is higher in frequency than the other, the phase detector output is maximum in the direction that drives the VCXO into lock. Thus, if this detector is used, acquisition circuitry is unnecessary. For noise free applications such as frequency synthesis, this detector is often an excellent choice.

However, it tends to be overly sensitive to noise or modulation sidebands, because of its characteristic of responding only to a waveform transition. In addition, its maximum operating frequency is only about 10 MHz, so it is not useful for our present application. Another acquisition scheme involves use of a frequency discriminator, which must be accurately zero'd with the



## Several things may be done in order to minimize the subjective effect of ghosting.

### VCXO free running frequency.

Scientific-Atlanta has used an acquisition technique in our 6300 PL phase locked modulator and 6150 PL processor which to our knowledge is unique. Before the loop pulls into lock, a beat note exists at the phase detector output. The characteristics of the beat note are analyzed to determine the direction in which the VCXO must be driven in order to acquire lock. This technique permits lock to be achieved in a few milliseconds, with an initial frequency difference of 50 kHz. Circuit logic makes the technique insensitive to false lock on the reference sidebands as long as their amplitude is less than that of the carrier.

The visual effect of non phaselock is primarily the familiar co-channel beats, the subjective effect being dependent upon the frequency difference. When the two signals are phaselocked, a ghost of the interfering signal will still be seen on the screen. No satisfactory method exists for eliminating this ghost except to eliminate the signal leakage.

However, several things may be done in order to minimize the subjective effect of the ghosting. The subjective effect depends upon the relative magnitude of the interference, upon picture content, upon the relative phase of the two carriers, and upon the relative frame rates of the two pictures.

Some reduction of the effect of ghosting may be obtained, in the case of display of text only, by utilizing white lettering on a black background. This is possible because black will then occupy the larger area, and a ghost is less noticeable with black picture content than with white.

Phase angle between the two carriers is important because the effects of modulation of the interfering carrier on the overall instantaneous carrier amplitude may be shown to be dependent upon the manner in which the two carriers add vectorially.

The relative frame rates of the two pictures is important because sync information is transmitted at a blacker-than-black level, and if the ghost sync bars are moving through the desired picture, a more distracting situation is seen than through stationary bars.

For this reason, the operator should be careful to operate at the same frame

FIGURE 2  
Simplified block diagram, phase locked modulator

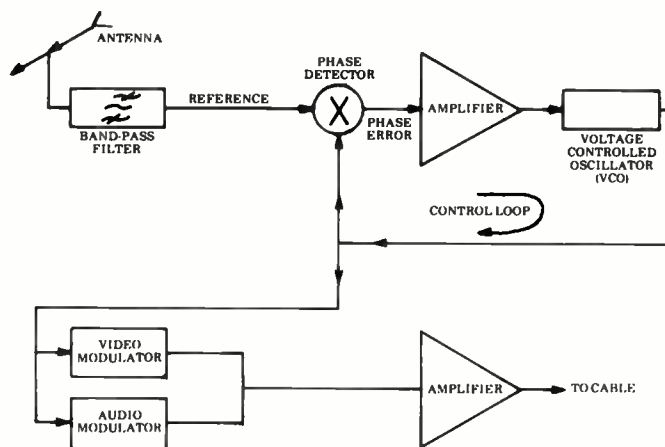
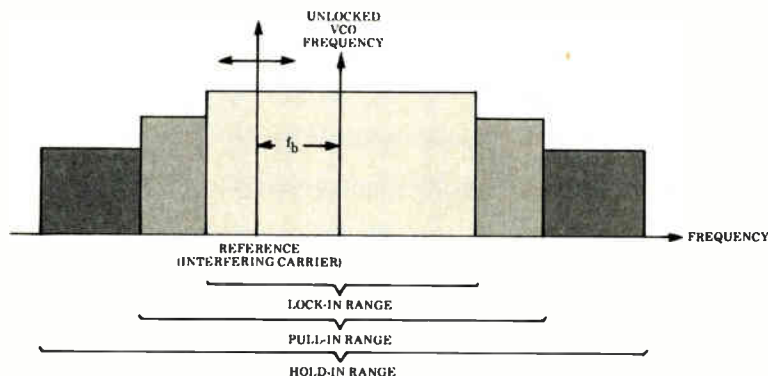


FIGURE 3  
Definition of terms



rate as that of the interfering signal, if maximum picture quality is to be maintained. This should not be a problem if both the desired cable picture and the interfering picture are synchronized to broadcast quality color sync generators: the frequency stability demanded ensures that the two frame rates will be so nearly identical that the sync bar will move more slowly if at all. Such may not be the case if the local origination picture is in black and white. This is because a 60 Hz field rate is traditionally used for black and white, while the field rate for color transmission is slightly retarded. This

can give rise to sync bars moving rapidly in the picture. This problem may be eliminated if the local origination signal is genlocked to the interfering picture. This normally required, in addition to a camera, a sync generator capable of being genlocked to external video.

To provide this video source for genlocking purposes, Scientific-Atlanta has provided a utility demodulator on its phaselocked modulator. This demodulated video output is available on the rear panel of the modulator.

*Bibliography available upon request.*

# At last, a turning point

The unmistakable air of optimism at the Western Cable Show appears warranted. The last quarter of 1986 was good for a broad range of suppliers. More important, 1987 is shaping up to be a good year as well: perhaps not the best year suppliers have ever had, but a marked improvement over anything seen in the past several years. There's no single cause. The upcoming move of Viacom-owned programming services to Telstar 303 has spurred sales of satellite receive, modulation and demodulation equipment. So has the explosion of home shopping networks. Rate deregulation seems also to be spurring upgrading. Finally, the investments made can be recouped without lengthy franchise renegotiations. Interest rates are down and look to stay down. Pay-per-view continues to grow, especially in the Northeast, and that is leading operators to look at addressability. Also, the cost of addressable two-way boxes is down dramatically. The last remaining urban builds are underway and in many cases, rebuilds simply cannot be postponed any longer. With deregulation, there's also a new economic calculus for line extensions.

Even the "back-to-basics; focus on operations" mentality so prevalent in the industry now will help. Traps not only refuse to die, they're poised for continued strong sales in 1987. Sales will be boosted by TCI's new on-premises control strategy and Scientific Atlanta's new positive trap technology, featuring an extremely narrow notch of only 70 kHz.

And the FCC, like it or not, has given the industry new A/B switch rules. All the fundamentals, in short, are positive for a broad range of industry suppliers. Will sales equal the heights of the massive newbuilding era? Of course not. But sales will be much better than we've seen for several years.

Those of you with long memories will recall that, typically, operators have made money when suppliers haven't. And suppliers have made money when operators didn't. But there's a difference this time around. Operators have large, established, positive cash flows. And for most, the big capital outlays for plant already have been made. So there's a bit more wiggle

## 1987 will be a good year for CATV suppliers.

room for expansion. Also, rate deregulation now allows a matching of investment in new plant to expected return. And, in many cases, rate increases will be easier to politically justify when channel capacities and programming line-ups are expanded.

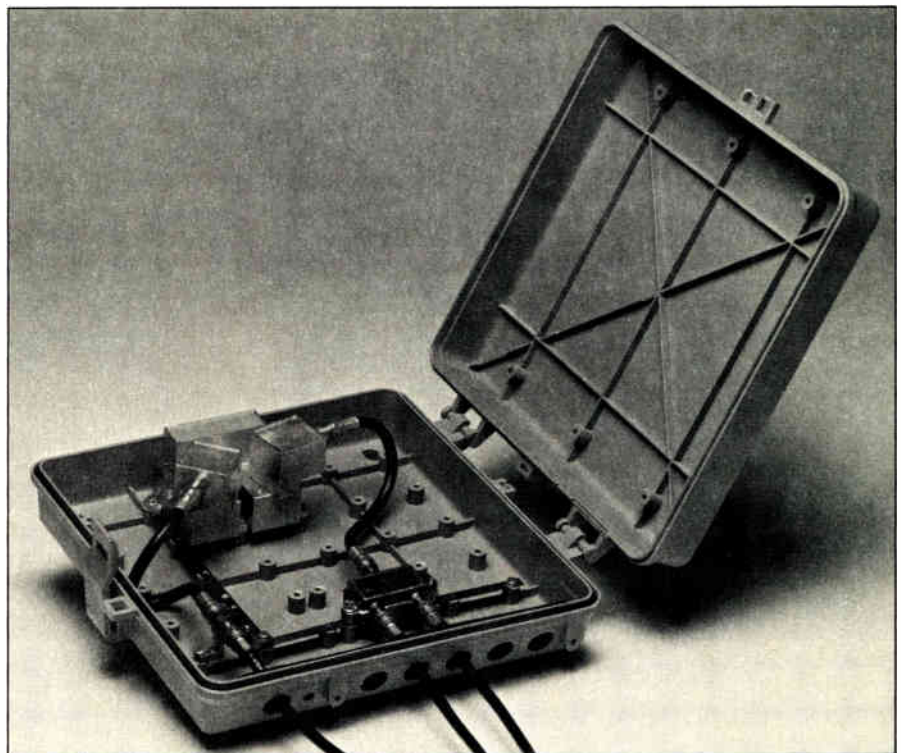
### Back to the future

Aside from the decidedly buoyant atmosphere, we'd say the more significant news at the show includes the first public showing of Scientific Atlanta's Outside Utility Type Enclosure ("OUTER"), initially designed for TCI's use. The development schedule for the key initial element of the system, a new positive trap, has been hectic. In fact, a new passive material S-A needed arrived the week of the Western Show. But it now appears that the big 'R' part of the R&D effort is finished. Computer projections for trap

performance appear to have been validated and a fairly large Beta site set to fire up in February. Remaining are small 'd' details such as specifications for the thickness of the metal housing for the trap.

Mass production of the traps, ranging from several thousand to tens of thousands of units per month, will begin in May or June, says Stephen Necessary, company marketing manager for broadband products. It will be late 1987 before a wider trap frequency selection is available. The initial price of the new traps is about \$18, dropping to probably \$15 to \$16 as volume builds, Necessary says. The plastic closure will run about \$20, the ground block and interfaces about \$20.

The company also is working on an interdiction approach for multi-port applications like MDUs, says the company's Steve Nussrallah, division engineering manager. Basically, the interdiction approach would be used in situations where there are 10 or more addressable channels. "Probably 12 to 16 controlled channels would meet everybody's needs for handling two to



Scientific Atlanta's "Outer" enclosure



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***R**emember when converters were only needed to convert TV signals? Subscribers demands were simple...all they wanted was the ability to see more than 12 television channels. But as the years went on, bandwidth increased, programming proliferated, and subscribers became more sophisticated. More and more features were demanded and, although some converters could be modified, most became obsolete and had to be replaced. They simply could not satisfy the needs of the future.*



## Oak Communications also has worked hard on the price front.

three PPV channels plus pays," Nussrallah says. There probably would be a PIN diode switch for addressable control of the traps.

The high impact plastic enclosure, which will begin shipping this month, has a sealing gasket for drops but still breathes. There's a padlock hasp for tighter security and oval-headed screws to deter tampering if the box is opened. Basically, though, the box is designed to be tamper-evident—using a seal such as power companies often use—rather than tamper-proof. So regular auditing is going to be essential. It won't take too long before customers figure out they can steal the positive traps from one box and install them in another. Tight inventory control also is going to be important. What would really breach system security is free-lance operations by installers. Contact: (404) 441-4000.

### Zenith does it again

At last year's Western Show, Zenith Electronics was way up there on the list for technical cleverness as it rolled out its PM system, an RF scrambling system that is rugged, secure and cheap. They've gone further this year by introducing a two-way PM-Pulse system using store-and-forward, with expected shipping in the first quarter of 1987. Designed from the ground up

as an impulse PPV system, the two-way PM system offers an in-home terminal with remote for about \$100 a box. The new system uses the same transmission protocol as Z-View and the boxes can self-authorize. The polling system uses biphasic shift keying, not frequency shift keying and can interrogate about 100,000 boxes an hour. What that means to an operator is that, typically, a subscriber's ordering information can be obtained while he or she is still watching the event. It may be store-and-forward but it's very close to real time.

The system also is very rugged. "It'll operate in a real world cable plant with minimum maintenance; a plant that isn't necessarily too tight," says Vito Brugliera, company vice president, marketing. "At 6 dB C/N data throughput is 50 percent; at 12 dB C/N throughput is 90 percent." Program ordering information is stored in non-volatile memory in the IC and transmissions both upstream and downstream are encrypted.

Zenith also has introduced a new line of headend controllers built around the IBM PC and IBM PC/AT. Software for the controllers includes a program called SuperSchedule that automates scheduling and maintenance of program tags by event. That's helpful since the rapid polling capability of PM-Pulse allows quick reuse of pro-

gram tags.

The company also introduced an add-on BTSC decoder for PM and Z-TAC converters. It features built-in amplification circuits and both 4.5 MHz and channel three inputs. It has two pairs of left and right outputs: powered outputs to drive speakers and low-level outputs for home stereos or external amplifiers. Contact: (312) 391-8181.

### Price, friendliness

Oak Communications also has worked hard on the price front. Its Sigma Phase Two boxes, with remote, now are priced at about \$115. Furthermore, the company has been adding consumer friendly features. The Sigma Three line features BTSC stereo decoding at an additional per-box cost of about \$6 to \$7 and should be on the market during the second quarter of 1987. The 3D version offers output at RF for stereo-compatible TVs while the 3C version has output at baseband for an audio system. This was no mean feat since Sigma encrypts audio. For customers with existing Sigma converters, the 3D and 3C units can be mixed into the system without problem.

A VCR timer in the set-top as well a timing circuit in the remote control unit will be available in the second

## IS-15, signal leakage at Western Show panels

IS-15, or "multiport," and signal leakage were hot topics debated by engineers.

Panasonic has announced it plans to market two high-end models next year with the multiport plug built-in. Additionally, at the Western Cable Show, Zenith, Quasar and Sony TVs had been adapted to accept the plug, with decoders shown by Zenith, Oak and S-A.

As stated before, the device allows incoming cable to be attached directly to a cable-compatible TV receiver or VCR. That allows all tuning functions to be performed through the TV or VCR tuner, eliminating the need for tuning functions within set-top descramblers. Therefore, the cost of descramblers will likely be reduced as

much as 40 percent.

The snag holding up its implementation is uncertainty over whether consumers will pay the extra cost. And given that TVs have a life span of more than 10 years, roll-out could take time.

However, if the device is targeted toward VCRs, the roll-out timetable is significantly reduced, said Walt Ciciora, ATC's vice president of new technology. By placing a VCR with multiport capability between the cable and TV, the subscriber can still tune channels through the VCR and use its remote control. He can also use its programming capability to record unattended.

Signal leakage is likely to be of great concern to the FCC during 1987

as cable operators struggle to show they can monitor themselves. With FCC officials promising to take a tougher line against leakage, it is important the industry develop better hardware, installation techniques and monitoring practices, said Robert Dickinson, president of Dovetail Systems.

Dickinson went on to question the wisdom of the present monitoring process and downplayed the importance of flyovers, describing them as fast, but expensive. "They're great if you pass, but useless if you fail," he said.

Dickinson added that his firm is developing test equipment that will monitor several frequencies and store the data for later analysis.

—Roger Brown



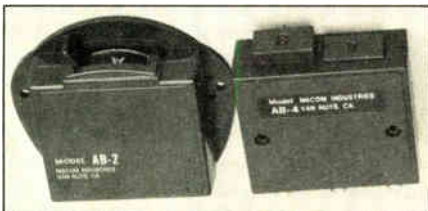
**On Nov. 28, 1986, the Federal Communications Commission released the final text of its new A/B switch rules.**

quarter, according to Tony Wechselberger, company vice president, engineering. "We also have a full-blown impulse pay-per-view program under way and expect to have a store-and-forward system available in the the third quarter in two versions: integrated into the set-top and as a sidecar unit."

Still, the company isn't relenting on the cost issue and is considering "de-featured, three-button set-tops to get the cost down further," Wechselberger says. Also, expect 500 and 550 MHz versions of Sigma late in 1987. Contact: (619) 451-1500.

#### A/B rules

Operators won't like this, but on Nov. 28, 1986, the Federal Communications Commission released the final text of its new A/B switch rules. Beginning Jan. 15, 1987, all systems, regardless of size, are required to supply A/B switches to every new subscriber at no additional cost to the subscriber. A switch must be provided for every TV set connected to your system. An exception: if a new subscriber already has an A/B switch, you're not required to provide an additional switch. If the subscriber has an antenna, the switch must be connected to the antenna and you are expressly prohibited from recommending that the antenna be taken down. If the sub has no antenna, you must explain that the switch works only when an antenna is connected to it. Also, you must leave written materials explaining the FCC's new rules and their impact. Additionally, the information must be updated every year.



High isolation switches give 90 dB isolation at 500 MHz, 70 dB isolation at 950 MHz.

Also, within the six months after Jan. 15, 1987, you must offer existing customers without A/B switches a free switch plus installation instructions

or offer the free switch and install it yourself. If you install it yourself you may charge a "reasonable" fee. The offer to existing subs must be made in writing. Furthermore, the offer must be repeated, in writing, every year

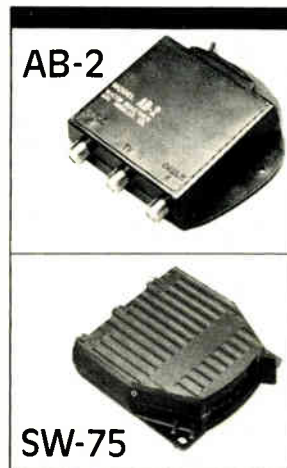
until 1992. Information on the FCC rules and the use of the switch must be included with the offer. What isn't clear yet is whether operators are responsible for post-installation maintenance or replacement.

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## Another change you couldn't help but notice was the availability of BTSC generators.

### 'Multiport' chosen as new name for IS-15 plug

Remember the word "multiport." You're going to hear a lot about it in 1987.

Multiport has been chosen as the buzz word to describe the EIA's base-band decoder interface, known previously as IS-15. Now that IS-15, er, multiport, has received the blessing of the NCTA Engineering Committee, it's beginning to show up on TVs and in decoder manufacturers' labs. "Help is in the offing" for those operators who are worried about incompatibility between consumer electronics and scrambled cable signals, said Joe Van Loan, Viacom's vice president of engineering and the man charged with heading the effort to drum up support for multiport. Van Loan made the announcement concerning the new device's name at the Western Cable Show.

However, until the day comes when there is a critical mass of multiports in the field, other options exist that would make the cable/consumer electronics connection simpler, Van Loan said during a technical session at the show.

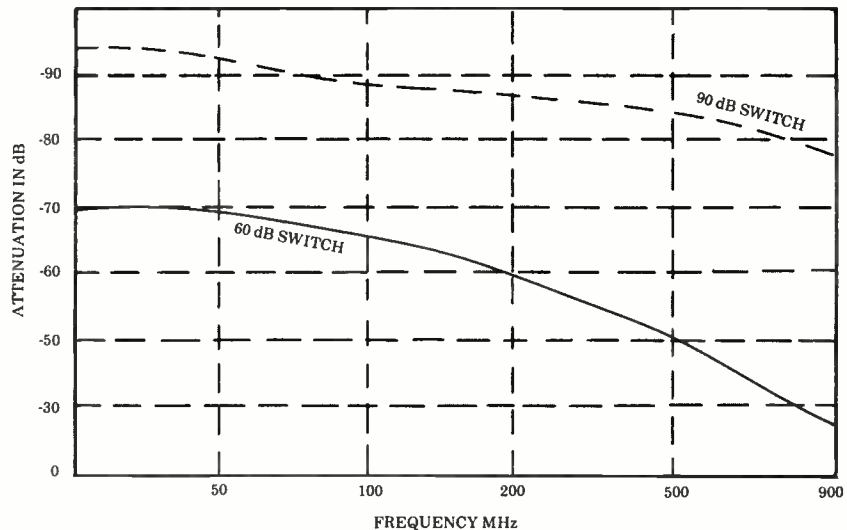
By placing the time of day and program information within the vertical blanking interval, VCRs and cable converters could identify what time and channel to tune to for trouble-free recording. This would eliminate the problem of unattended recording and make it unnecessary for converter manufacturers to install VCR timers and programmable remote controls.

Van Loan also suggested that operators offer videotapes to explain VCR connection to cable. The instruction could include programming notes and channel lineups and be broadcast over the cable at varying times.

"We're at the beginning of a great idea," Van Loan said. "It (multiport) won't be a way of life by July, but we have to start somewhere and it does ultimately represent the long-term solution to our consumer-surliness problem."

—Roger Brown

FIGURE 2  
Switches with nominal isolation ratings of 90 dB and 60 dB exhibit much lower isolation at superband and UHF frequencies.



While there's always the possibility of an industry court challenge, the FCC appears determined to keep the rule and has indicated that if the A/B switch rule dies, so does cable's relief from must-carry. As Jim McKinney, FCC mass media bureau chief said at the show, "the decision is firm and it is final."

At the show, Mike Holland of Pico Macom was making the rounds explaining that 90 dB switches, not 60 dB switches, are needed here, the reason being that a typical lower-cost 60 dB switch will not exhibit flat frequency response. The real problem occurs at the higher frequencies, he points out.

#### BTSC generators

Another change you couldn't help but notice at this year's Western Show was the availability of BTSC generators. Leaming Industries, for example, has both the newer MTS-2 as well

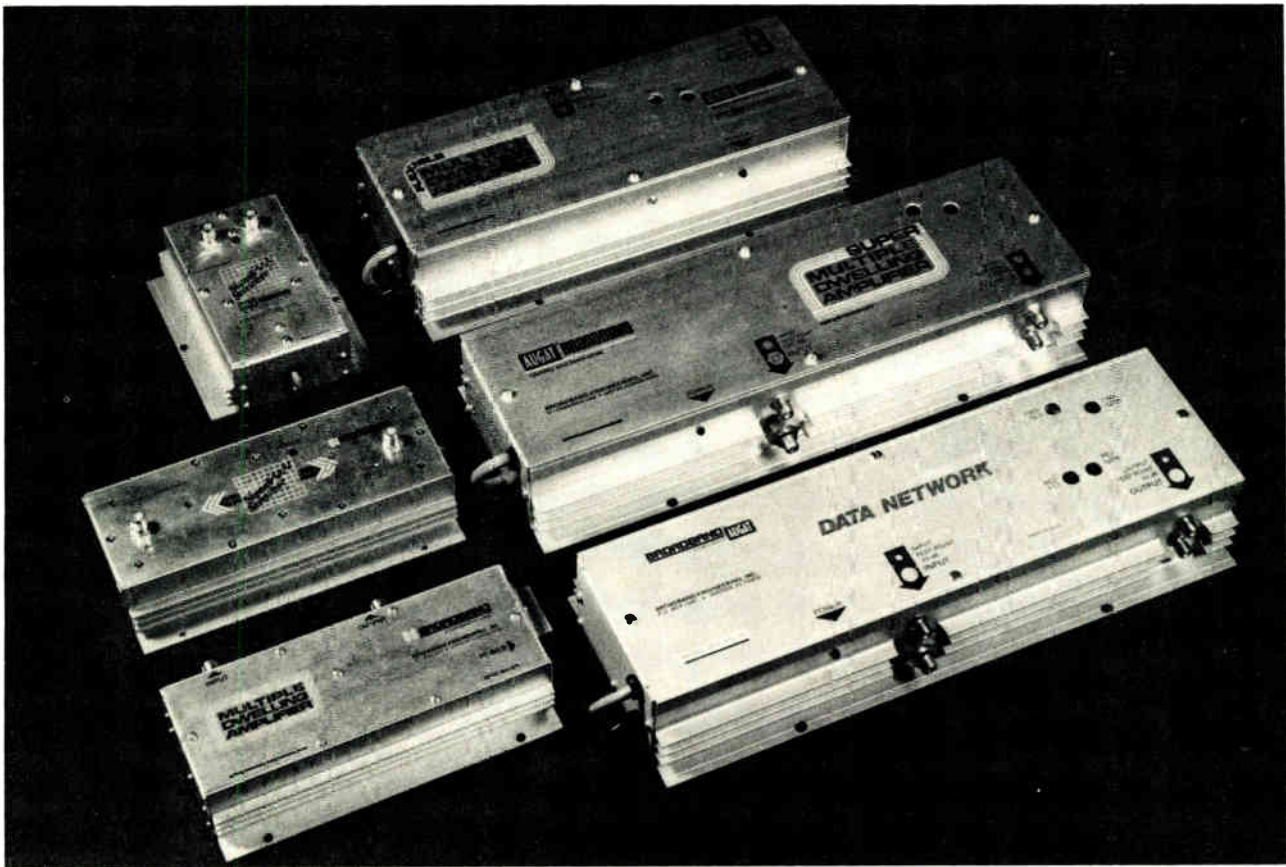


Leaming Industries' MTS-2 stereo generator

as the original MTS-1 encoders. The MTS-2 has front panel left and right level meters with peak indicators, optional program level AGC and stereo program phase auto-corrector readouts. The MTS-2 generates, in its base configuration, a sync-locked pilot and a BTSC composite signal. Both composite and 4.5 MHz subcarrier outputs with separable video and 4.5 MHz loop-throughs are produced. There's a built-in test-tone generator, switching for ad insertion, stereo level controls, a stereo synthesizer for monaural services and dbx companding. All controls are accessible from the front panel. The MTS-1 generates a BTSC composite signal as well as a modulated 4.5 MHz carrier if an add-on board is in place. The MTS-1 lists for \$1,895; the MTS-2 lists for \$1,595. Contact: (714) 979-4511.

Jerrold's encoder, the Commander, produces BTSC at both 4.5 MHz—which eliminates deviation adjustments by the operator—and 41.25 MHz for optimal separation and use with modulators that aren't stereo compatible. The company says the Commander also offers overmodulation protection without clipping and an additional 10 dB of headroom. Pilot and subcarrier phase accuracy is one degree plus/





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## Jerrold's encoder produces BTSC at both 4.5 MHz and 41.25 MHz for optimal separation.

minus. Commander uses dbx noise reduction circuitry. All controls are on the front panel and there are 12-segment LED bar graph indicators for left, right and SAP channels as well as A/B input for commercial insertion. The units are priced at \$1,800. Contact: (215) 674-4800.

Wegener Communications has a series 1791 stereo modulator accepting input from a Wegener 1600 or 1700 demodulator, VideoCipher unit or local audio source and producing modulated 4.5 MHz output as well as baseband output. The modulator consists of two cards that plug into a model 1601 mainframe, uses dbx noise reduction, and has dual five-step LED indicators for audio level. Front panel potentiometers allow left and right channel input level adjustments and monitoring without the need for test equipment. Interfaces are available for baseband audio or video. Separation ranges from 26 dB to 30 dB. The card set costs \$1,995. Contact: (404) 448-7288.

Scientific-Atlanta's model 6380 BTSC Stereo Encoder offers BTSC output, optional 4.5 MHz, SAP output and dual

subcarrier demodulation. Front panel LED bar graphs display left, right and SAP input levels. All controls for input level also are on the front panel and there are LED indicators for SAP carrier, override, video lock and overmodulation status. There's a built-in reference test tone generator and baseband audio switching of main and SAP channel inputs for emergency override applications. Isolated ground BNC connectors and balanced audio connectors are used. Contact: (404) 925-5000.

The Nexus SG-1/TV generator combines signals from any source into a composite BTSC signal. Audio level indicators are calibrated to the internal 4.5 MHz modulator to eliminate set-up errors. Input and output level controls are on the front panel, as are LED indicators for power and video lock. Dual 10-segment LEDs show audio level and there's an overmodulation indicator as well. F and barrier strip connectors are used. Contact: (604) 420-5322.

FM Systems has a model FMT633S encoder that produces a 4.5 MHz BTSC signal that can be directly hooked to a

modulator with separate 4.5 MHz input port. Modulators requiring video and audio combined will require a combining filter. FM uses the Dynamic Noise Reduction system of National Semiconductor. SAP transmission also is possible. FMT633S modulators cost \$985.00, the mainframe \$245. The combining filter costs \$85. Contact: (714) 979-3355.

The model SG48 generator from Triple Crown Electronics produces both a 4.5 MHz subcarrier or composite BTSC output with dbx noise reduction. A built-in test tone generator is standard. If sync or video lock should be lost, the modulator automatically transfers to monaural mode. The front panel includes a display selector and bar graph for right, left, processed audio, composite output and test tone generator levels. Controls for power and stereo/mono selection as well as indicators for power on, stereo on and overload also are included. Contact: (416) 629-1111.

Catel has a new TVS-2000 generator that produces either baseband composite output for direct input to a stereo compatible modulator or 4.5 MHz RF output. The front panel has LED indicators for audio levels, under modulation and overmodulation. Stereo separation is 25 dB. The unit draws 15 watts of power. Weighing four pounds, the unit takes up 1.75 inches of rack space. The TVS-2000 lists for \$1,995 and is available 30 days ARO. The FMS-3000 modulator basically offers the same circuitry as the 2000 generator but comes in a modular package, offers eight channels of BTSC output and will be available for ordering this month, 30 days ARO. Each module costs \$795, the mainframe \$1,115. Contact: (415) 659-8988.

### Multiport

There's continuing progress on the IS-15 standard, now to be called the multi-pjort. Oak, Scientific Atlanta and Zenith were showing prototypes of multi-port-equipped converters and NCTA had a multi-port-equipped Sony TV hooked up to an Oak converter as a demonstration. We also understand that at least two VCR manufacturers will be offering multi-port options on

## BTSC tech problems not insurmountable

"A BTSC signal is not so fragile that it cannot be handled," said Jim Gibson, fellow of the technical staff for RCA Laboratories. Speaking at the technical session, "Practical Considerations in Implementing BTSC Stereo Television", Gibson said the technical problems facing BTSC are not insurmountable. The panelists seemed to agree with Gibson as they discussed BTSC equipment design and operating practices during the Thursday session. David Large, moderator for the session and vice president of engineering at Gill Cable, echoed Gibson saying careful handling of the signal can make it manageable. "There are two problems with BTSC—basic signal to noise and signal to crud (buzz)," said Large.

William Hogue, consultant for Leaming Industries, spoke of the equipment requirements and signal processing associated with BTSC. According to Hogue, cable needs to use equipment similar to broadcasting. The equip-

ment must be reliable, sound good, and be able to operate near video gear. Hogue also stated that cable has an advantage over broadcasters in that cable does not have the same problem with fringe area reception since cable is shielded.

### Stereo will get better

"Stereo will get better and as a cable company, we have to deal with it," added Walter Reames, manager, special products for Gill Cable. Reames discussed different methods of transporting audio and used recent Gill Cable testing as an example to discuss what cable has been through with BTSC. Al Johnson, director of marketing with Synchronous Comm., also discussed stereo audio but through fiber optics as an alternative. According to Johnson, the bandwidth is not as critical with fiber.

—Kathy Berlin



their machines in the 1987-88 time-frame.

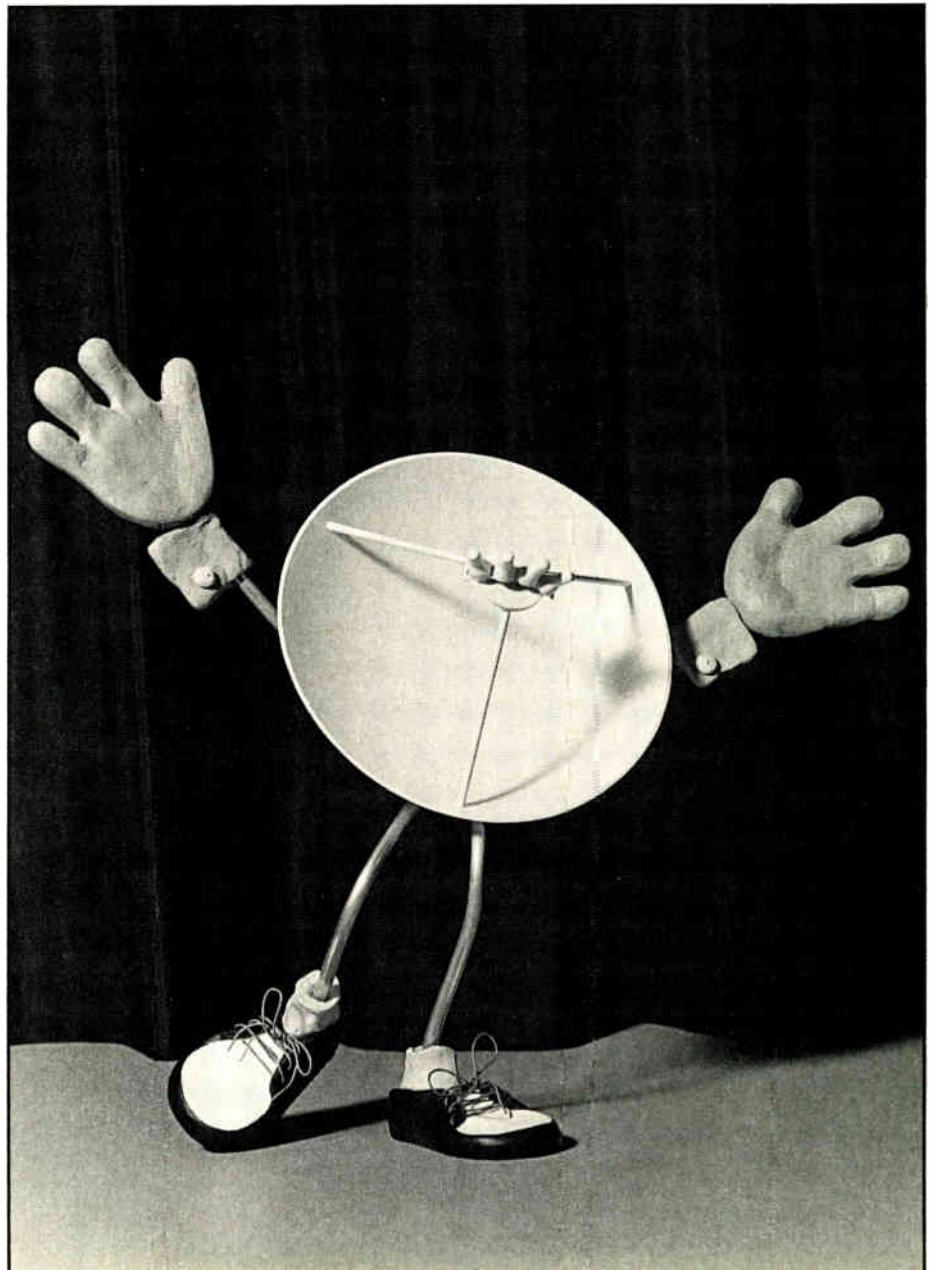
### Expo

The preliminary program for the April 3-5, 1987, Cable-Tec Expo has been set. The full-day Engineering Conference to be held on April 2 will feature a session on lightning and grounding by Dr. Rodney Bent, NASA consultant. Also featured are a session on consumer interface issues, a technical evaluation of competing technologies like DBS, SMATV, VCR and MMDS, as well as a session on how to develop a corporate training program. Expo workshops will include sessions on Ku-band technology and TVRO calculations; cable system design; antenna theory and EMI reduction; test equipment and measurement; modulator alignment and video test equipment measurements; and pay TV security. Contact: (215) 363-6888.

### 550 MHz sweeping

Simpler, smarter, smaller test equipment packages are coming, says Ron Adamson of Texscan. Speaking at a panel chaired by SCTE executive vice president Bill Riker, Adamson argued that surface mount technology and newer microprocessors are leading to smaller, lighter packages. "Performance closer to milspec, 600 MHz sweeps and meters are coming," he added. "It used to be that 3-5 MHz was accurate enough. Now we're down to 500 kHz accuracy. Level accuracy to 2/10 of a dB now is possible, partly because of better LSI technology. And as the time approaches when CLI measurements are mandatory, dB/microvolt readings will be standard."

A. William LeDoux, marketing manager for CaLan, pointed out other advances. "It used to be that you had to shut the system down to test. We only used SLMs early on, then added white noise tests. The simultaneous sweep was an advance, as was the low level sweep." Then 35-channel systems started appearing. That required moving back to a modified high level sweep approach, "injecting the carriers twice as fast to get better resolution," LeDoux said. The drawback:



## Let's all do the satellite shuffle

In case you've been off on a deserted island, it's happening again. The satellite shuffle. This time it's Showtime who's moving to Telstar 303. So is the Movie Channel, MTV, Nickelodeon and VH1. Both eastern and western feeds.

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## New from Reliable Electric is a line of low profile closures made of 14 gauge steel.

the sweeps had to be higher to get away from video carriers. Addressable converters added another twist. "They don't like high level sweeps coming through them rapidly," LeDoux pointed out.

So what are the requirements for a solution? Syd Fluck, president of CaLan, said phaselocked loop technology holds part of the answer, because "it offers very fast acquisition from one frequency to another. Surface mount technology, on the other hand, allows quick peak detection circuitry." Plasma, liquid crystal and electroluminescent displays also will offer reliability five to seven times better than CRTs, he added.

### Catel

In addition to its new BTSC generator, Catel was showing a model D-850 tunable demodulator covering 140 channels (off-air or cable); programmable eight-channel memory; standard, HRC and IRC channelization. The D-850 can demodulate VHF, UHF, cable channels 2 to 64 and A minus channels. Contact: (415) 659-8988.

### Reliable

New from Reliable Electric is a line of low profile closures made of 14 gauge steel and featuring concentric knockouts for conduit of various sizes.

Ten sizes are available, ranging from 12 by 12 by 8 inches to 18 by 24 by 8 inches. Contact: (312) 455-8010.

### New modulator

Standard Communications has introduced a new BTSC-compatible model TVM60 frequency agile modulator featuring PLL synthesis, FCC offsets, visual and aural loop through, balanced as well as unbalanced audio input, BTSC 4.5 MHz input, LEDs for power, video overmodulation and audio overdeviation, a front panel RF test point and aC outlet. The TVM60 tunes channels 2 to W and A1 to A5. Contact: (213) 532-5300.

### Jerrold

New from Jerrold is the model DPPB Starcom VI addressable baseband converter. The 550 MHz box is compatible



*Jerrold's Starcom VI, model DPPB*

with all existing Jerrold systems and can be used with other Starcom VI boxes. The new converter has volume control, last channel recall, favorite channel and time-controlled programming, parental control and remote control enable/disable. Impulse PPV capability is added by Starfone or Starvue sidecars.

Small cable systems now have the model AI-O addressable interface, designed for systems with 8,000 to 16,000 subscribers. Controlled either through a billing system computer or a terminal and modem (model AI-RTM), the product is designed to bring addressability within reach of the smaller operator. The interface is compatible with all Jerrold addressable converters, including the Starcom VI line. The interface costs \$6,500 and is ready for quantity shipment now.

Also shown was the Starcom VI model DQN, a plain converter programmable for last channel recall, favorite channel, remote and parental control using the model IR-PROG converter programmer.

The Commander 5, a 550 MHz frequency agile headend modulator designed for BTSC compatibility, also was shown. It features automatic gain control, automatic signal switching, RF and baseband scrambling compatibility. In the phaselock version, it is switchable for HRC or IRC operation.

## Acquiring a system requires technical knowledge

"One thing for sure after a cable acquisition, there is going to be change," says Bob Luff, group vice president of Technology for Jones Intercable. Speaking at the Friday technical session, "After the Acquisition-A Technical Evaluation", Luff focused on what happens in the acquisition process and what affect it has on the technical end. According to Luff, there were 270 cable systems bought last year and it is expected more than 300 will be sold this year. This equaling out to roughly a system a day, Luff figures if you haven't already been involved in the acquisition process, your time could still come.

Luff went on to explain the actual process involved with acquiring a

system, what role the technical person plays in it and what should be looked for. Leaks per mile, is there an ongoing maintenance program, has there been any violations of the FCC requirements—these are a few of the items Luff said needed to be addressed. He also stressed being ready for an acquisition team to come into your system at any time. "Such things as checking and looking at your signals, keeping a leakage log, keeping your warehouse neat and clean—these are all useful items for daily upkeep, and helps in case you're ever acquired," says Luff.

Kent Jonas, an attorney with Corbett and Kane, dealt with the issue of people who are employed with the cable system. What happens to the

employees of the system that was bought? According to Jonas, the people buying the system should immediately tell the employees they are all terminated. This enables the company to hire anyone they want and set new conditions of employment.

Jonas stated this should be solved during the acquisition. There should be something within the purchase and sales agreement that provides a policy for employment. Otherwise, you could be caught in a contractual agreement between the old employer and what you want to do. Jonas advised anyone purchasing a system to look at the personnel policies to see if you're at risk for inheriting any of their policies.

—Kathy Berlin



## Small cable systems now have the model AI-O addressable interface.

An additional board will offer video switching, audio and video AGC, second level IF switching and 4.5 MHz audio input.

The company also is packaging its Starcom VI converter and Starfone or Starvue sidecar as the "Jerrold Jukebox." Contact: (215) 674-4800.

### Pioneer

Pioneer Communications introduced a 550 MHz standard converter with remote and a footprint 40 percent smaller than the previous model. The BC-4500 has an Options Selector that can modify converter functions without opening the case or using a PROM. The Selector enables or disables parental control, IR remote or barker channels, spectrum allocations (HRC, IRC and standard). The Selector also can program channel allocations so remapping is possible. The BC-4500 will be ready for shipments in the first

quarter of 1987.



*Pioneer's Options Selector*

Also new is the SmartRemote, available in April 1987, that can learn and control up to eight TV, VCR or home entertainment device functions. Smart-

Remote can be used to restore volume control, for example. We understand that acquisition time in the learning mode is very quick: about four minutes to learn eight commands. Contact: (614) 876-0771.

### Magnavox

A new line extender, the 5-MLE-H/60, was introduced by Magnavox. It operates in 50-450 MHz forward and 5-33 MHz return paths and uses 60 VAC power with operating gain of 33 dB. The company also was showing its new status monitoring software, SOFT/DSS-IBM, which uses color graphic displays, bar graphs of analog parameters, fault windows and schematic maps showing signal paths through a cascade. Analog parameters monitored include forward and return carrier levels, AGC/ASC gain and slope control voltages, power supply output voltage and temperature. Both fault

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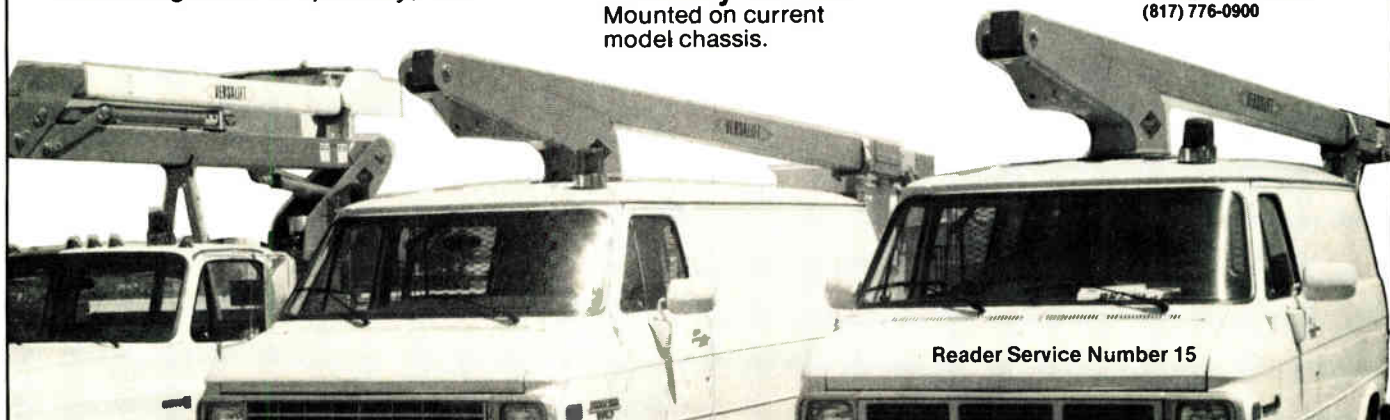


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## Also new is the SmartRemote, available in April 1987, that can learn and control up to eight functions.

locations and magnitude are displayable.

The company also announced its 1987 Mobile Training Center schedule.

Seminars will be held Jan. 7-9 and 12-14 in Torrance, Calif.; Jan. 20-22 in San Jose, Calif.; Jan. 27-29 in Portland, Ore.; Feb. 3-5 in Denver; Feb. 10-12 in Lincoln, Neb.; Feb. 18-20 in Albuquerque, N.M.; Feb. 24-26 in San Antonio, Texas; March 4-6 in New Orleans; July 20-22 in Syracuse, N.Y.; Aug. 10-12 in Buffalo, N.Y.; Aug. 18-20 in Cleveland; Aug. 25-27 in Detroit; Sept. 1-3 in St. Louis; Sept. 9-11 and 15-17 in Memphis, Tenn.;

## A satellite dish for every home?

Because Ku-Band will drastically cut costs of TVRO, Charles Ergen, president of Ecosphere Corp., said that in the future, there will be a dish in every home in the United States and Europe. Not saying when he felt this would happen, Ergen addressed the present state of satellite technology during the session on "Technology and Distribution Future of Satellite Communications" on during the Wednesday session at the Western Show. Ergen said economics is the driving force behind this change. Giving statistics that showed the cost of TVRO dishes going from 10,000 per dish in 1981 to 2,000 per dish in 1985, Ergen stated that with emerging technology and the advent of Ku-Band, it is highly unlikely that anyone would pay for cable when he could own a dish.

Taylor Howard, director of research and development for Chaparral Communications disagreed with Ergen, saying that cable provides two-way communications, whereas satellite does not. Howard said broadcast, cable and satellite all have a place in the consumer's home. He also commented on the cable industry's present campaign of "wooing" the consumer.

Andrew Hospodar, president of RCA American, spoke of RCAs continuing commitment to C-Band, but said the future tends toward high Ku-Band concentration.

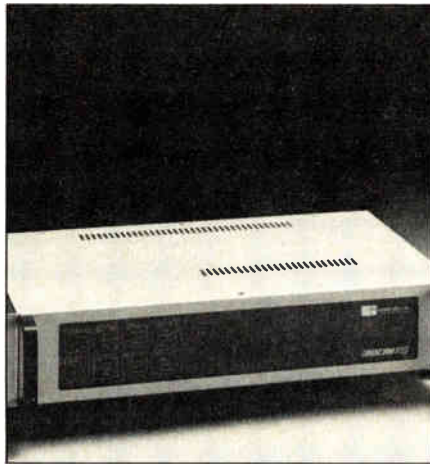
—Kathy Berlin

Sept. 22-24 and Sept. 29-Oct. 1 in Greensboro, N.C.; Oct. 6-8 in Baltimore and Oct. 14-16 and 20-22 in Boston.

Contact: (800) 448-5171j, in New York (800) 522-7464.

### Channelmatic

The Adcart 2+2 is the newest random access commercial insertion system from Channelmatic. It offers fully automatic two-channel stereo ad insertion and eliminates the need to tweak audio trim pots to adjust audio level.



Channelmatic's Adcart 2+2

A user-friendly interface, system status displays and expansion capability beyond two channels using the System Control Unit is available. Error reporting and scheduling software are included.

Also new is the NDSS-4A Network Share Switcher, which allows commercial insertion into four satellite networks from one source. The NSS-4A will interface with character or graphic generators or low-cost sequential insertion gear like the company's Li'l Moneymaker.

The device has four DTMF decoders. When a valid cue tone is detected, the other three decoders are disengaged. When the ad is finished the unit switches back to the network and resets all decoders. There are four preroll delay timers and a bypass to return to the network if power is lost.

Contact: (619) 445-2691.

### CableTALK

Business Systems Inc. introduced CableTALK, a voice recognition system integrated into the company's Cable Television Management System, allowing callers to talk to the answering computer. CableTALK can be used for PPV, home shipping, technician tracking or subscription inquiries. CableTALK overcomes the limitations of audio response systems requiring the use of a touch tone phone. BSI also has a new version 6.0 CTMS system, featuring faster display of information and decreased numbers of key strokes. Trouble call improvements and a shared message board have been added. Further reporting modifications will make it easier to track changes of service, penetration, lift, churn and spin. Contact: (803) 297-9290.

### Power conditioners

Alpha Technologies has a new ALC series of line power conditioners for power ratings from 150VA to 1,000VA. The company also has a new Alpha 3000 3KVA power source. Versions for 1.5 KVA and 2.0 KVA applications also are available. Contact: (206) 647-2360.

### Wavetek

A new SAM IIIIE signal analysis meter with tuning through 600 MHz now is available from Wavetek. Also new is the model 1882 system analyzer, a portable spectrum analyzer with a 4 MHz to 1,000 MHz frequency span. It has a sweepless sweep function allowing frequency response tests without actual subscriber interference. It places a horizontal marker across the carriers for reference. The sweep measures carrier levels which can then be compared with the stored reference. Contact: (317) 788-5965.

### Gilbert

A new weather-tight connector designed to keep moisture out of drop cable is new from Gilbert Engineering. The connector features two gaskets; a face gasket and jacket gasket to keep moisture out of the male fitting-female



**A new weather-tight connector designed to keep moisture out of drop cable is new from Gilbert Engineering.**

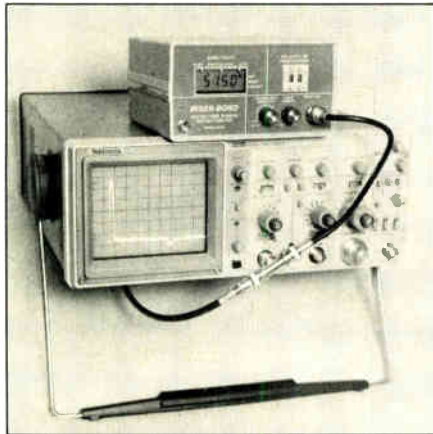
port and connector/jacket interface. Contact: 602) 245-1050.

**Riser-Bond**

A new TDR selling for \$795, the model 2901B+, is available from Riser-Bond. The new TDR allows connection of an oscilloscope to the front panel.



*Riser Bond's 525 Cable Designator*



*Riser Bond's new TDR*

The model 525 Cable Designator is a cable identification instrument for finding individual cables in a bundle. It sells for \$395. Contact: (402) 694-5201.

**Splitter**

Intercept Communication Products was showing a new 16-way 600 MHz splitter with 14 dB insertion loss, 27 dB isolation and 18 dB return loss. Also shown was a new model SGB 500 groundblock offering an easier way to ground aluminum cable before entering a building. Contact: (201) 471-

2212.

**FM Systems**

Among the products shown by FM Systems was the FMT615C frequency agile wideband modulator for 88-108 MHz stereo broadcasts and the AMR612 dual channel AM broadcast band receiver. The FMC661C weather receiver and FMT631SAP second audio program modulator for multiplexing a SAP program onto a stereo modulator also were shown. Contact: (714) 979-3355.

**Scientific-Atlanta**

Scientific-Atlanta introduced its Series 6500 Multiport Distribution Amplifier. The amp is designed to accept a variety of modules, allowing it to be configured as a terminating bridger, line extender or as an alternative to trunk station amplifiers. It has four connection ports, and splitters and directional couplers may be plugged inside the housing. The Series 6500 can be configured to use push/pull, feedforward or parallel hybrid technologies from 330 MHz to 550 MHz.



*S-A's model 8580 set-top terminal*

S-A also unveiled two new low-priced basic set-top terminals. Model 8505, for 330 MHz systems, is the most basic, with just two buttons operating channel scan and on/off functions located on the front. Model 8510, for use with systems up to 450 MHz, adds IR remote for direct channel entry and automatic fine tuning.

Thirdly, S-A is making available an

**The Inside Story Behind the PTS/Katek Acquisition.**

Bloomington, IN—Why did the two leaders in converter repair agree to an acquisition?

"Frankly, we've been chasing Katek since we entered the cable market in 1981," says Jeff Hamilton,



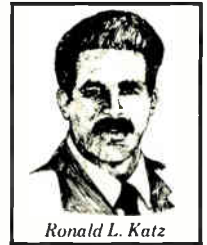
*Jeffrey A. Hamilton*

PTS Vice President of Marketing. "Katek was the first company to emerge as a national contender. More important, they have maintained a technological edge especially

in addressable repair."

Ron Katz, founder of Katek says, "PTS was unlike any competitor we had faced. On their first day of cable operation, they had hundreds of technicians in Servicenters nationwide.

They were flexing the muscle they had built as the largest independent repair company for T.V. service dealers and manufacturers."



*Ronald L. Katz*

In 1984 Katek merged with RT Construction. "It was a good move at the time. But this new alignment with PTS—a company dedicated to repair will put us in a much stronger position," explains Katz.

These two multimillion dollar companies have joined to form the largest cable equipment repair company: PTS/Katek. Ron Katz directs operations as Executive Vice President, "We're in a strong position to serve cable companies. MSO's and independent operators can expect faster service, consistent quality and continued technological leadership."

"The inside story is that Katek did not fit in with RT/Katek's direction," explains Katz. "PTS/Katek creates a synergy that will set the standard in the repair industry."

**DTS Katek**  
Cable Services Division

Corporate Headquarters  
P.O. Box 272 Bloomington, IN 47402  
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(800) 441-2371

Reader Service Number 16



## Kanematsu-Gosho premiered its new Sprucer 310 two-way interactive addressable converter.

addressable terminals. The module contains circuitry to store programming credits and much more.

Call: (404) 441-4000.

### Kanematsu-Gosho

Kanematsu-Gosho premiered its new Sprucer 310 two-way interactive addressable converter that will allow the purchase of PPV events via a major credit card. Designed specifically for hotel/motel and resort area applications, the Sprucer allows viewers to key in their credit card numbers prior to an event. Once the transaction is authorized, the event can be watched.

Susan Talbot, (609) 778-0380.

### CableTEK

CableTEK showed off prototypes of its new portable terminal for field use by installers, technicians and sales personnel. The handheld device sports

a full alphanumeric keypad and accompanying light wand to scan bar codes. By entering the appropriate data after prompts are displayed and downloading the information by phone to a CableTEK on-line system, management can generate reports on task completion time, amount of material used per install, number of sales calls per employee, reasons prospects don't buy and a lot more.

Robert Noren, (606) 259-1366.

### Video Data Systems

Video Data Systems' new Commander 2000 character generator system made its Western Show debut. A standalone display channel providing full color displays of alphanumeric information and limited graphics, the Commander 2000 allows for an externally supplied video signal to replace the internal color background in selected regions of the screen. With up

to eight fonts of 128 characters each, diskette memory, Genlock and off line edit channel features, the unit can be interfaced to a variety of external devices providing bidirectional information and control capabilities.

Call: (516) 231-4400.

### Calan

Calan introduced the Model 1776/1777, a non-interfering system sweep compatible with data and addressable converters. Also, the unit offers a micro-processor controlled spectrum analyzer that operates from 5 MHz to 600 MHz and offers 50 dB dynamic range and 10 KHz stability.

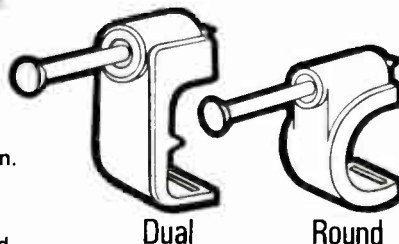
Call: (717) 828-2356.

*By Gary Kim Editor, and Roger Brown, Technical Writer*



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## HRC provides new choices for system designers



Walter Colquitt

*Continued from December 1986 issue.*

HRC channels cannot be tuned by a non-cable ready receiver; this requires the use of a set-top converter for even basic cable services. While most cable-ready receivers can directly tune the HRC channels, the tuner may not track when its input is switched to a standard frequency assignment; this could present a problem when switching from cable to an off-air antenna or to the output of a VCR or cable decoder.

Another major problem with HRC frequency assignments is the potential for interference with FAA frequencies. Individual HRC channels cannot be offset to avoid conflicts.

The advent of feed forward amplifiers offers the design engineer a new, and perhaps better, tool for reducing third-order distortion products. Instead of masking triple beats, feed forward amplifiers reduce third-order products by employing phase cancellation techniques.

The desired signals are applied to the input of the feed forward amplifier, producing an intermediate output containing both the desired signals and the undesired second and third order products. Phase cancellation techniques are then used to combine samples of the input and output signals; the desired signals are eliminated, leaving

only the undesired signals. These undesired signals are then applied to the input of a second amplifier.

Phase cancellation techniques are again used to combine the outputs of the two amplifiers, significantly reducing the levels of all second and third order products at the amplifier's final output.

While feed forward amplifiers have encountered many mechanical and design difficulties in the field, these problems are in the process of being solved. The use of feed forward equipment in the distribution system permits the operator to use standard frequency assignments, to phase-lock to strong off-air signals, and to make the necessary frequency off-sets to avoid FAA conflicts.

Feed forward also reduces cross-modulation, thus permitting even greater channel capacities and longer amplifier cascades. Using HRC channel assignments in a feed forward distribution system is redundant; there is no need to mask triple beats that have already been reduced to acceptable levels.

Another popular design approach is to use hybrid systems which employ feed forward amplifiers in the bridger/line extender system. Systems using this hybrid approach may require the use of HRC channelization in order to reduce third-order levels in the feeder cable.

In this era of seeking broadband solutions to the consumer electronic interface problems, feed forward technology may well be one of the answers.

With thanks to Austin Coryell of American Television and Communications for his assistance and suggestions.

*By Walter Colquitt, Director, New Technologies American Television and Communications Corp.*

*Colquitt has been in the cable industry for the past 20 years, after getting his start in 1966 with TPT Communications in New York. Since then, he has worked for other systems in New York and New England before moving to North Carolina to work for PTL Satellite Network.*

*Colquitt came to ATC in 1980 as a project engineer.*



# VCRs pose compatibility problems for CATV

**H**ooking up CATV subscribers no longer is so simple as fitting a matching transformer and a drop cable to the back of a TV set. Neither is CATV as consumer friendly as it used to be.

Picture artifacts like ghosts, remote control clutter and redundancy, tuner redundancy, inability to watch one pay program and record another on a VCR and problems with channel tuning are some of the glitches that make CATV less friendly than it should be. Direct pick up (DPU), for example, causes ghosting, and results when a strong off-air signal is directly picked up by a TV receiver's circuits.

It's a bigger problem today because of VCR penetration levels: VCRs typically have tuners that are more susceptible to DPU. Differences between CATV channelization and TV receiver channelization also can cause problems for customers with cable "compatible" TVs, especially when the CATV system is running programming in the FM bands (98-108 MHz), which many TV receivers can't tune because they use in-set traps in that band. In-home converters and signal scrambling cause loss of remote control capability and time-shifted taping problems as well.

Electronics Industry Association technical standards like IS-6, which assigns common channel numbers to frequencies; IS-15, the proposed decoder interface standard that would allow descramblers to use the TV

## Traps are one approach to dealing with CATV/VCR compatibility problems.

tuning circuits; and IS-23, which covers standards for converter-to-TV connectors, signal levels and backfeed into the cable plant as well as DPU, are some of the medium- to longer-term remedies being discussed and worked on by industry leaders. TCI's new on-premises signal control strategy is a medium-term approach to the same problems.

For the short term, traps are one approach some operators are taking in some cases to deal with the problem. While they aren't necessarily elegant, negative and positive traps do provide a friendlier interface to subscriber TVs, especially where a system might only be running three pays.

But shorter-term solutions that can make CATV more friendly are available today. Unified remotes that operate TVs and VCRs from the same vendor are on the market. Universal or "smart" remotes—also called "learning" remotes—also are out. Timing circuits—in the remote, in the converter or in add-on boxes—also can help. A/B switches, both the older stand-alones as well as newer switching boxes or video control centers that eliminate the cables or add amplification circuits, make subscriber taping tasks easier. Here's a run-down on what's available.

### Learning remotes

"Smart" or learning remotes, which can read and store the commands used by various infrared-controlled components, are one way to reduce coffee table clutter. According to some estimates, 3 million U.S. households have at least three remote-controlled video or audio products and over 10 million have at least two. Additionally, possibly 50 percent of the CATV converters now on the market use remotes.

New from Pioneer Communications is the SmartRemote, which can control up to eight TV, VCR or other appliance

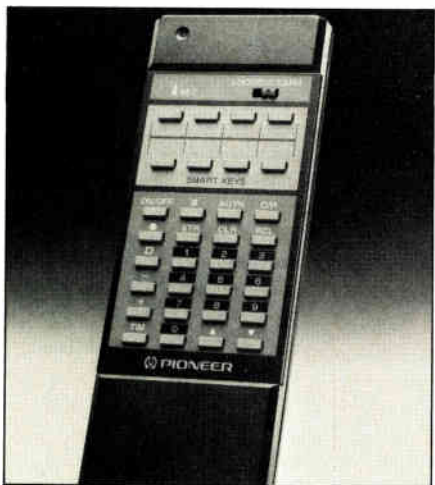
functions. The RCU retains all functions of the BA-5000 and BC-4000N converter remotes and learns volume; VCR functions like fast forward, stop, rewind and play; stereo TV left and right balance; power on/off and FM tuner control for stereo simulcasts. Contact Pioneer, (614) 876-0771.

In 1985, General Electric introduced the model RRC600 Control Central remote, which can operate as many as four devices. This year, it's released the model RRC500 Control Central 3, a cheaper remote that controls up to three devices. Each operates at a range of 32 to 64 feet and both use infrared frequencies from 20 kHz to 70 kHz. Retail price of the RRC600 is \$149.95. The RC500 carries a \$99.99 suggested retail price. Contact GE, (804) 483-5037.

And this month, CL9, Steve Wozniak's new company, is slated to begin production of CORE, a multiple processor unit with 32K of memory. Featuring macro commands to reduce keystrokes and a clock, CORE allows unattended control of multiple devices and events that can be programmed months ahead. The device also can be programmed to switch between daylight saving and standard time. CORE has a three-line LCD, 14 operating and 12 programming keys and uses one lithium and four AAA alkaline batteries. Four alarm tones signal completion of programming operations or timed events. The unit weighs eight ounces. Contact CL9, (408) 996-9999.

Scientific Atlanta's model 8550-375 Learning Remote Control, compatible with the 8500 series converters, can learn TV and VCR functions like volume control, mute, on/off, record, fast forward, rewind and play. A three-LED display prompts the user during the learning mode for "repeat action", "press keys" and "data stream learned" confirmation. The six-volt unit requires four AAA batteries and measures 2-1/2 by 6-3/4 by 1/2 inch in size. The unit is compatible with most TVs and VCRs on the market today. Contact Scientific-Atlanta, (404) 441-4100.

In May, North American Philips introduced two universal remotes, the Magnavox Universal Remote and the Sylvania SuperRemote 44. Each comes in two versions. The 33-button versions



Pioneer's SmartRemote



## Oak has a programmable remote used with the Sigma line of converters.

are designed to acquire and store infrared data streams from most cable converters, VCRs and TVs. The 24-button versions will control VCRs but not converters. The 33-button version has three clusters of keys. The top array includes channel scan, volume, mute and alternated channel functions. The bottom array includes power, channel recall, programming and TV/VCR keys. The middle array includes TV controls—audio balance, stereo, bass and treble up and down, antenna accessory, audio/video input-output jacks, sleep timer, SAP—and VCR controls: rewind, stop, fast forward, record, play, pause, reverse play, double speed, frame advance, search and slow functions. The company claims all learning functions require less than a minute.

### Programmable Remotes

Unattended VCR taping on systems

with programmable converters is made easier with programmable remotes. Scientific-Atlanta's model 8550-275, for example, works with 8500 series converters and allows taping of up to eight events over a 14-day period. It also can be instructed to operate at the same time every day, every week or every day except weekends. A clock/timing circuit in the remote allows unattended power-off or power-on. Used in conjunction with the AC jack at the back of the converter, subscribers can turn lamps or the TV on and off at programmed times. The 24-key remote has a transmission range of nine to 12 meters and uses two AAA batteries. Contact Scientific-Atlanta, (404) 441-4000.

Oak Communications has a programmable remote used with the Sigma line of converters. It has a 15-event, 31 day capacity and allows recording of a single program at the same time

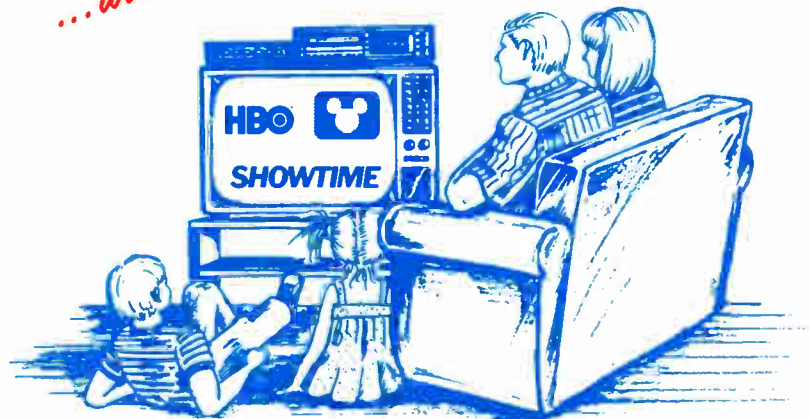
every day. The RCU uses a four-digit LCD and has dual infrared LEDs to increase transmission range beyond 30 feet. Contact Oak, (619) 485-9880.

Zenith has the Tac-Timer, a programmable remote working with Z-TAC converters that can program eight events over a 14-day period, record an event at the same time every day or turn the TV on or off at any time. The Tac-Timer's LCD shows day and week, clock, channel and program. It has buttons for clock and timer set, timer mode on/off and program clear and retains the regular remote functions as well. Contact Zenith, (312) 699-2110.

JNEL Corp. takes a slightly different approach. The CableMaster, a stand-alone base unit and remote that takes "personality modules" to control over 32 different converters, adds eight event, 14 day remote programming

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Reader Service Number 21

**GENERAL  
INSTRUMENT**



## Zenith was one of the first converter manufacturers to offer a switcher product.

figure is below -7 dB. Second order composite and cross mod should be below -60 dB. The model 4004B sells for \$16 in single quantities with a drop to \$22.20 in quantities of 300 to 999. The amplified 4005A costs \$36 in single quantities and \$32.20 in quantities between 300 and 999 pieces. Contact Qintar, (818) 706-1940.

Among converter manufacturers, Zenith was among the earliest to offer a switcher product. The VCR Interface, designed to attach to the back of the TV and be customer installed, also has two extra ports for a second TV and an FM stereo hookup. Contact Zenith, (312) 391-8181.

Jerrold's product, the VCR Control Unit, is an amplified box with a four-button, two LED front panel. Minimum signal isolation is 60 dB; gain is 1 dB. The four operating choices available are: watch any channel and record it; watch any channel while recording any non-scrambled channel; watch a pre-recorded tape or watch what's being recorded. A "best picture" button located on the rear panel of the VCU engages and disengages the internal amplifier. Contact Jerrold, (215) 674-4800.

Scientific-Atlanta has a passive signal splitter, the model 8554-100 VCR Interface Switch, that allows viewing of a descrambled service while recording it; viewing a descrambled service while recording a non-scrambled service; viewing one non-scrambled program while watching it or viewing a non-scrambled program while recording another non-scrambled program. Port-to-port isolation of the box is 20 dB, loss is 4 dB and RF switch isolation is 70 dB minimum. Contact Scientific-Atlanta, (404) 441-4100.

Pico Macom has both an amplified, Tru-Spec model HVC-1A and a non-amplified, model HVC-1, video control center. Isolation in the 50 to 300 MHz range is 60 dB for the HVC-1 and 55 dB for the HVC-1A. Isolation at 300 to 550 MHz is 55 dB for the the HVC-1 and 50 dB for the HVC-1A. The HVC-1 has -7 dB insertion loss. The HVC-1A has 2 dB insertion loss. The HVC-1 is priced at \$24 and the HVC-1A costs \$29.70. Contact Pico Macom, (818) 897-0028.

RMS Electronics has a new model VCC-1 Video Control Center with iso-

lation of 65 dB at channel three and 60 dB isolation (typically) up to 450 MHz. Also new is the model VCC-11A also has 65 dB isolation at channel three and 60 dB to 450 MHz. Gain is 4.5 dB; noise figure is 8 dB; cross modulation is -60 dB. Contact RMS, (212) 892-1000.

Also marketing a video switcher product is Panasonic, whose VCS-1 contains four RF viewing and two RF recording sources. The VCS-1 also allows hookup of an external TV antenna and is amplified to compensate for splitter losses. A non-switched AC outlet is on the back of the box. Contact Panasonic, (201) 348-7000.

Tocom offers the VCR Mate for the 5503A converter and another model for the 5503-VIP converter. Both have an A/B switch activated by the converter remote. Both switchers come complete with splitter, all RF cables and a baseband audio/video cable. Contact Tocom, (214) 438-7691.

Video accessory manufacturer Recoton has two video control center products. The model V612A Master Control Center has a 10 dB signal amplifier built in. The company says both it and the model V614 have VHF band isolation of 75 dB and UHF band isolation of 65 dB. The footprint of the V614 model is pretty small: six inches by four inches by an inch and a half. Contact Recoton, (718) 223-6009.

A new product from SEAM Electronics is the "Solution One" VCR switcher, which the company says provides 70 dB isolation up to 100 MHz and 60 dB isolation up to 450 MHz. It's got a two-button front panel and measures 6.8 by 3.5 by 1.5 inches in size. Contact SEAM, (416) 292-6640.

Of course, even if a video switcher is used, there's still the possibility of grief if the subscriber doesn't have a cable-ssscompatible TV or VCR. Mid-band and super-band channels are the problem.



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	Reader Service #	Page #
Alpha Technologies.....	7	15
Anixter Communications.....	26	52
Broadband Engineering.....	6	13
C-COR Electronics .....	5	11
Cable-Link .....	22	41
General Instrument .....	4	7
Jerrold.....	11	23
Magnavox.....	1	2
Midwest Comm. Corp.....	25	51
Oak Communications.....	23	47
PTS Electronics.....	16	33
Pico/Macom .....	12	25
Pioneer Communications.....	19	28
Qintar.....	18	37
RMS Electronics .....	10	48
Sachs Communications.....	24	49
Sadelco.....	9	19
Scientific-Atlanta.....	3	5
Standard Communications.....	8	17
Telewire.....	14	29
Time Manufacturing .....	15	31
Tocom .....	21	40
Trilogy Communications .....	2	3
Vitek/LRC.....	13	27
Weldone Trading Co.....	17	34
Zenith.....	20	39

## Working with 550 MHz?

Looking at 550 MHz technology? Here are some tips offered by Steve Raimondi, US Cable Corp. director of engineering and John Donahue, regional engineering director for Comcast Corp. Both spoke at an Atlantic Cable Show panel chaired by John Kurpinski, plant manager for Wade Communications.

For starters, "power doubling and feedforward is almost a given," Raimondi says. Compression also is a problem. Because of channel loading, "output levels are limited to 50 dBmV before you start going into compression." Also, in conventional ICs, third order distortion products can change on a three or four to one ratio rather than the typical two to one common in systems with less bandwidth. "Power doubling gives a 3 to 6 dB improvement over conventional ICs," Raimondi points out. But it'll also reduce system reach. Other considerations: passives will have higher losses and cable attenuation will be higher as well. And since most 550 MHz systems are urban builds, there'll be more taps; hence more tap loss.

What's maximum reach? "Even using IRC and feedforward, you're looking at 17 to 21 amp cascades," Raimondi adds. Higher C/N also will be needed and you'll have new second order concerns, although CTB still will be the limiting distortion. AC transformer output of 90 volts also is recommended.

### Lessons learned

Donahue summarized the lessons Comcast has learned in using 550 MHz feedforward trunking and quadrapower bridging and line extenders in Philadelphia. Here's a thumbnail comparison of 450 and 550 MHz technology. A 450 MHz system using conventional ICs would use 0.7 trunks per mile, 2.8 LEs and 0.2 power supplies per mile. In Philadelphia, Comcast is using 0.4 trunks, 3.8 LEs and 0.57 power supplies a mile. The big lesson? "A 185 percent increase in power supplies," Donahue says. "You'll be confronted with power consumption increasing

from a typical 30 watts for a fully loaded conventional 450 MHz mainstation to 60 watts for a comparably loaded 550 MHz feedforward mainstation. Even a power doubling mainstation will increase to 44 watts."

You may also find an LE consumption of 40, up from 25 watts, he adds. subhead: Watch ingress

Ingress from land mobile transmissions and UHF TV is another new concern. And the problem is worse if HRC is used. "If your system used standard channeling for channel three, for example, you'd probably phase lock your channel to the off-air. C/I of -35 dB is tolerable before you get a trouble call," Donahue says. "But if you used HRC, the frequency is 60 MHz. The off-air is at 61.25 MHz. And that can give you an interfering in-band carrier at 1.25 MHz. The C/I then moves to -51 dB." What that means is that even using cable, connectors and hardware with high shielding, high ambient signal areas may cause you problems in the C/I area.

You'll also want to run the high pilot at the highest practical frequency so your AGC will have the highest degree of control over temperature variations, Donahue says. Vendors recommend 498 MHz for HRC systems and 499.25 for non-HRC systems. A selective filter detecting the pilot only is important.

Maintenance considerations also change when 550 MHz is used. Installation grade field strength meters that are 450 MHz capable and have UHF tuning are needed. Also, line and maintenance personnel need more accurate meters. And high level sweeps will be a problem. "On a 35-channel system, a sweep signal at 15 dB referenced to video wasn't too objectionable," Donahue says. "At 60 channels, it's 20 dB referenced to video. With 80 channels, it's 25 dB. That's very objectionable to subscribers and is worse if you have scrambled channels with address tags in the vertical interval."

"If the sweep signal goes through on top of the address tag, the decoder can momentarily stop descrambling." Comcast's solution: sweep only in the early morning.

### Troubleshooting

New trouble-shooting routines may also be necessary. "If one of the parallel gain blocks fails, output level should stay the same," Donahue says. "A technician might overlook that." The solution? "Monitor the output while you interrupt power to the individual hybrid. If the module's working, you won't lose signal when one IC is deactivated."

The most conclusive test for quadrapower and power doubling amps is to measure input signal, output signal and adjust for internal insertion loss caused by pads, equalizers and diplex filters.

And watch C/N parameters when designing the system. Typically, you're looking for a minimum level at the design frequency and maximum reverse slope between the lowest channel carried and the design frequency measured at all taps. "In a 450 MHz system, the average drop of 150 feet using 59/U cable would deliver 4.3 dB at 450 MHz and 13.3 dB at 50 MHz to the converter. In a 550 MHz system you're looking at 3.5 dB at 550 MHz and 13.3 dB at 50 MHz using the same cable. That's close to the margin even before additional outlets, FM or VCR connections." The fix? "Use 6/U drops. That delivers 4.9 dBmV at 550 MHz and 13.8 dBmV at the TV set. The other option is to design the system for higher tap values.

### Dates

SCTE's national seminar on technical management skills will be held Jan. 21-22 at the Holiday Inn Airport/South in Atlanta. Registration for SCTE members is \$100; \$140 for non-members. Call Mike Aloisi at (404) 633-4326 or Guy Lee at (404) 451-4788 for details.

The SCTE also will be running BCT/E (Broadband Communications Technician/Engineer) certification tests at the Texas Cable Show, Feb. 18 and 19 in San Antonio, Texas; and at the Cable-Tec Expo on April 5. The SCTE annual engineering conference and membership meeting opens on April 2. The Hyatt Orlando Hotel in Orlando, Fla. is the venue. Registration fees for



## Viacom has quietly folded personnel back into their former units.

members are \$195 for the engineering conference and expo; \$145 for the Expo alone and \$120 for the engineering conference alone. Non-members pay \$350 for the full package; \$250 for the Expo only and \$200 for the engineering conference only. These prices are guaranteed through March 2 only. For details call (215) 363-6888.

A seminar on system powering fundamentals, featuring Ray Rendoff of the National Cable Training Institute, will be uplinked on Jan. 27 from 1 to 2 p.m. EST on Satcom IIR, transponder seven. The SCTE is transmitting the training program as part of its ongoing Tele-Seminar program. You may tape and use the material for free.



*Pioneer's Options Selector*

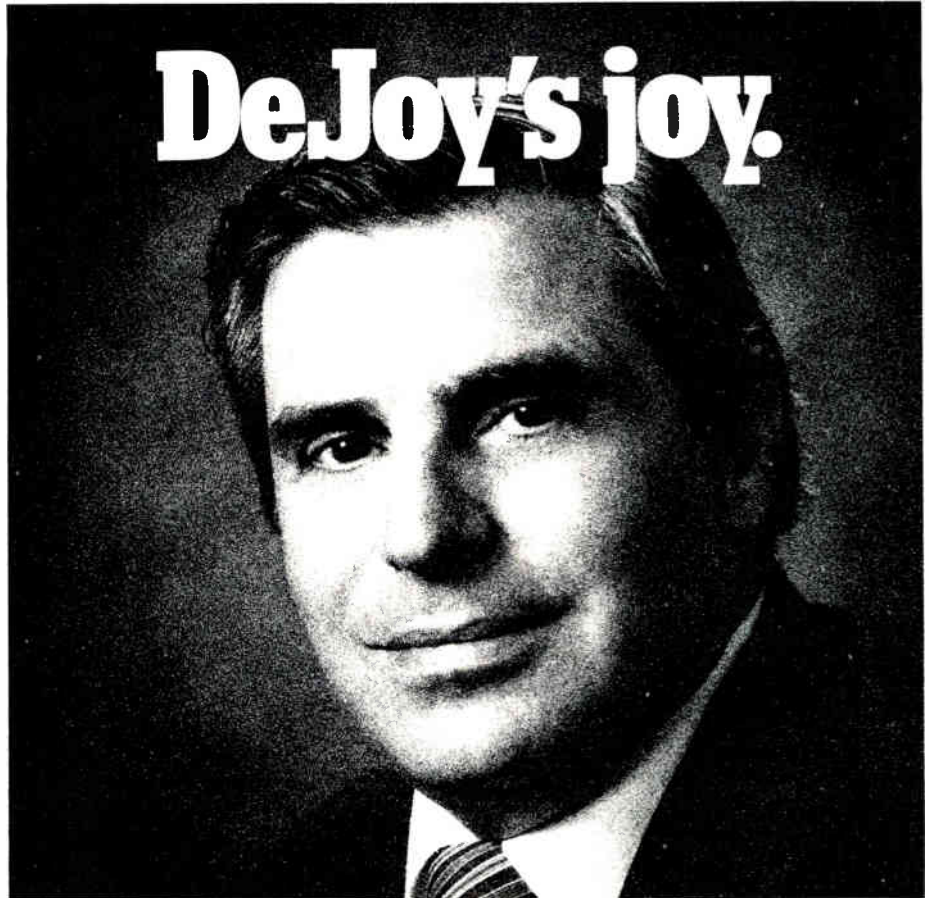
### BC-4500

Pioneer's newest converter, the BC-4500, is a 550 MHz standard converter that also is 40 percent smaller than its predecessor, the BC-4000N. The set-top also comes with an IR remote and a programming remote called the "Options Selector" that allows modification of parameters like parental control, IR remote and barker channels without opening the converter or using a PROM. The Selector also can change spectrum allocation from HRC, IRC or

standard. Channel re-mapping also can be done by the Selector. Each box also comes marked with a bar code for inventory control. Pioneer now expects shipments in the first quarter of 1987. Contact Pioneer, (614) 876-0771.

### Other priorities

Viacom, which had set up a special Telecommunications unit to bid for local area network jobs, has decided it has other fish to fry at the moment and



When they put you in charge of operations for a cable system of 185,000 subscribers, you're faced with a lot of tough decisions.

Frank DeJoy, Vice President of Operations of Suburban Cable in East Orange, New Jersey can testify to that. He and his staff took a year and a half to study all the problems and considerations of addressability for a system as large as Suburban's.

When they finally made their choice, it was Sigma. "It offers security we'll be able to rely on for the next ten years," DeJoy explains, "and technically, it is far superior to anything else we looked at."

But technology wasn't the only reason DeJoy chose Sigma. "I like the cooperation

and support of the Oak organization," and later added. "Oak engineers worked with us to develop an electronic second set relationship which allows the converter of the primary set to authorize the secondary set converter to function."

Oak solved a dilemma for Frank DeJoy and Suburban Cable. And in the process, developed a technology that is now a standard part of Oak's Sigma converter-decoder.

If you'd like more information concerning Sigma, call your nearest Oak representative or contact us directly at (619) 451-1500.

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Reader Service Number 23

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## Wegener Communications has introduced two new low cost satellite receivers.

has quietly folded personnel back into their former units. The idea had been to use existing resources: engineering staff, trucks and tools from the CATV units; the company's ability to buy 75-ohm gear in quantity; it's experience with installation and operation of microwave, fiber and broadband networks; and existing national points of presence (CATV operations, Showtime/TMC offices) to build a new LAN operation. Chilly waters or encircling sharks are our guess for the caution.

### Z-LAN additions

Zenith, which last year introduced its new Z-LAN local area network, has released a couple of new products: eight-port and sixteen-port network interface units ("Network Communication Units") and an IBM-PC/XT compatible network management system. Per-port connections run as low as \$200 for Z-LAN: very low for a broadband system. The 500MGR manager costs a bit under \$12,000 and can re-distribute network loads; remotely configure NCUs; adjust modem power levels and frequency; alter access commands; debug the system and perform data base management tasks. The eight-port NCU costs \$2,400 in single quantities; the 16-port version \$3,500.

In addition to standard CATV cabling and connectors, the NCUs and manager, Z-LAN uses a headend frequency translator and a network bridge that connects NCUs operating on frequency-divided bands. Contact Zenith Communication Products, (312) 699-2199.

### New receivers

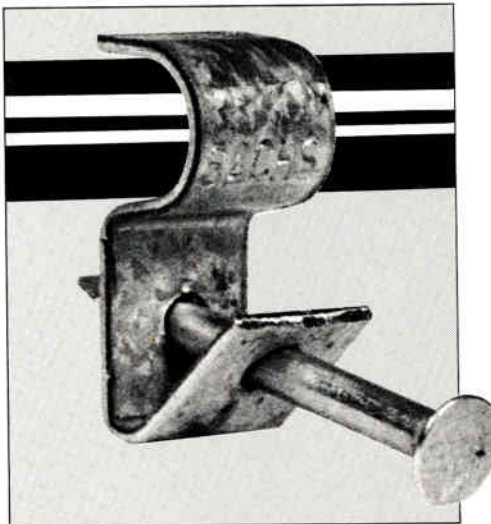
Wegener Communications has introduced two new low cost satellite receivers, the series 1606 Subcarrier Receiver and the series 1606-51 receiver. The model 1606 operates with an antenna-mounted LNB to provide composite baseband output. The 1606-51 has a 30 MHz bandwidth and is used to receive conventional subcarriers above video, has an IF loop for terrestrial traps, LNB power and IF monitoring. An optional video clamp with 6.8 MHz audio demodulator is available. Both versions are single plug-in

cards for the series 1600 mainframes. Contact Wegener, (404) 448-7288.

### New attenuator

Sadelco has a new attenuator with a

replaceable F connector for its SLM models 733B, 733C Super, FS 3D-VS, FS 3D-VU and 719D. The advantage: it can be unscrewed and replaced without the need for soldering. Contact Sadelco, (201) 569-3323.



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Reader Service Number 24

## Pete Morse has started a new company called Cable Technologies.

### SMATV receiver

R.L. Drake has a new ESR1240 SMATV receiver costing \$359 with stanard 950 to 1450 block downconversion ability. It's 19 by 1-3/4 inches in size and is ready for delivery now. It's designed to use less rack space because of the need for VideoCipher decoders and Ku-band LNBs. Contact Drake, (513) 866-2421.



Pete Morse

### People

Pete Morse, former vice president marketing/new business development for Jerrold, has started a new company called Cable Technologies. Telemarketing and market research for cable operators are initial services offered, although subscriber equipment, converter repair, billing systems, customer service and training are also company services. Contact Cable Technologies, 121 South State St., Newtown, Pa. 18940. Call (215) 968-8996.

A flurry of activity at Pioneer Communications has John Unverzagt in the position of director of engineering for the CATV division. Glenn Sigler now is field service manager in the sales support department. Jeannie Ambrosini is a new addition to the inside sales staff and Michael Callahan and Fae Kopacka are new national ac-

counts managers.



Louis Corvo

At Jerrold, Louis Corvo is now vice president, engineering for the distribution systems division and will be supervising research and development programs. Also, the company has named J. Lawrence Dunham executive vice president and general manager of the VideoCipher division.

Joining Advance Telecom, manufacturer's representative for Alpha Technologies, Hypower batteries and Autotel, are Gay Montilla, southwest sales manager and Suzan Smith, customer service manager.

### Additions

Anixter Brothers has been acquired by Itel Corp, a Chicago-based company with holdings in cargo container, rail and marine dredging. The combination offers Anixter tax advantages; Itel growth.

PTS Corp. has acquired the Katek division of RT/Katek and a new company, PTS/Katek has been formed to handle converter and amplifier repair and service.

Telstar Corp., meanwhile, has acquired World Video Library, and expects to use WVL's "Impulser" ordering device in conjunction with Telstar's pay-per-view offerings.

And Tele-Wire Supply Corp. has added Canusa heat shrinkable medium wall tubing to its line of CATV con-

struction equipment.

### Orders

Inwood Cable has added two Channel Master CARS-band microwave paths to its Inwood, West Virginia system.

Scientific Atlanta has a \$325,000 order from American Cablevision of Queens for headend and earth station products. Included are BTSC encoders, antennas, LNBs, receivers, modulators and demodulators. The company also has shipped 12 BTSC encoders to San Jose's Gill Cable. Barden Cablevision in Detroit also has placed an order with the company for \$300,000 worth of headend equipment, including receivers, demodulators and modulators.

In addition, Pacific Bell, which has the construction contract for the new Palo Alto, Calif. 550 MHz system, has agreed to buy S-A cable, headend and distribution products.

Pioneer Communications, for its part, has a 21,000 unit order for standard 36-channel converters from Heritage Communications, for distribution to systems nationwide.

Also, Riverview Cablevision Associates of Hoboken, N.J. has bought \$1.7 million worth of Jerrold subscriber gear for its upcoming conversion to addressability. The system will swap out J-series boxes for Starcom VI converters and plans to use Starfone sidecars. Jerrold also will be supplying \$3 million worth of converters to Times Mirror Cable TV of Irvine, Calif. Starcom VI addressables represent about \$2 million worth of the order while Starcom 450 boxes represent about \$1 million.

Barden Cablevision of Detroit, meanwhile, has purchased \$22 million worth of Sigma decoders.

Post-Newsweek Cable has signed a second multi-million dollar order for Z-TAC II converters for use at the company's Sherman and Denison, Texas and Gulfport, Miss. systems. Installation will be complete during the first half of the year. And Le Group Videotron Ltee has started installing 25,000 Pay-Master decoders in its Quebec system while Telesag Ltee has also ordered 4,500 Pay-Master decoders.

—Gary Kim



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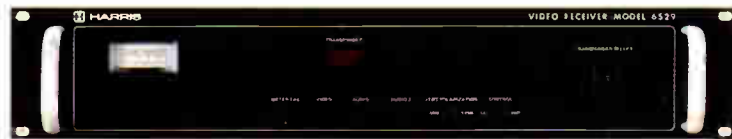
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Reader Service Number 25

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