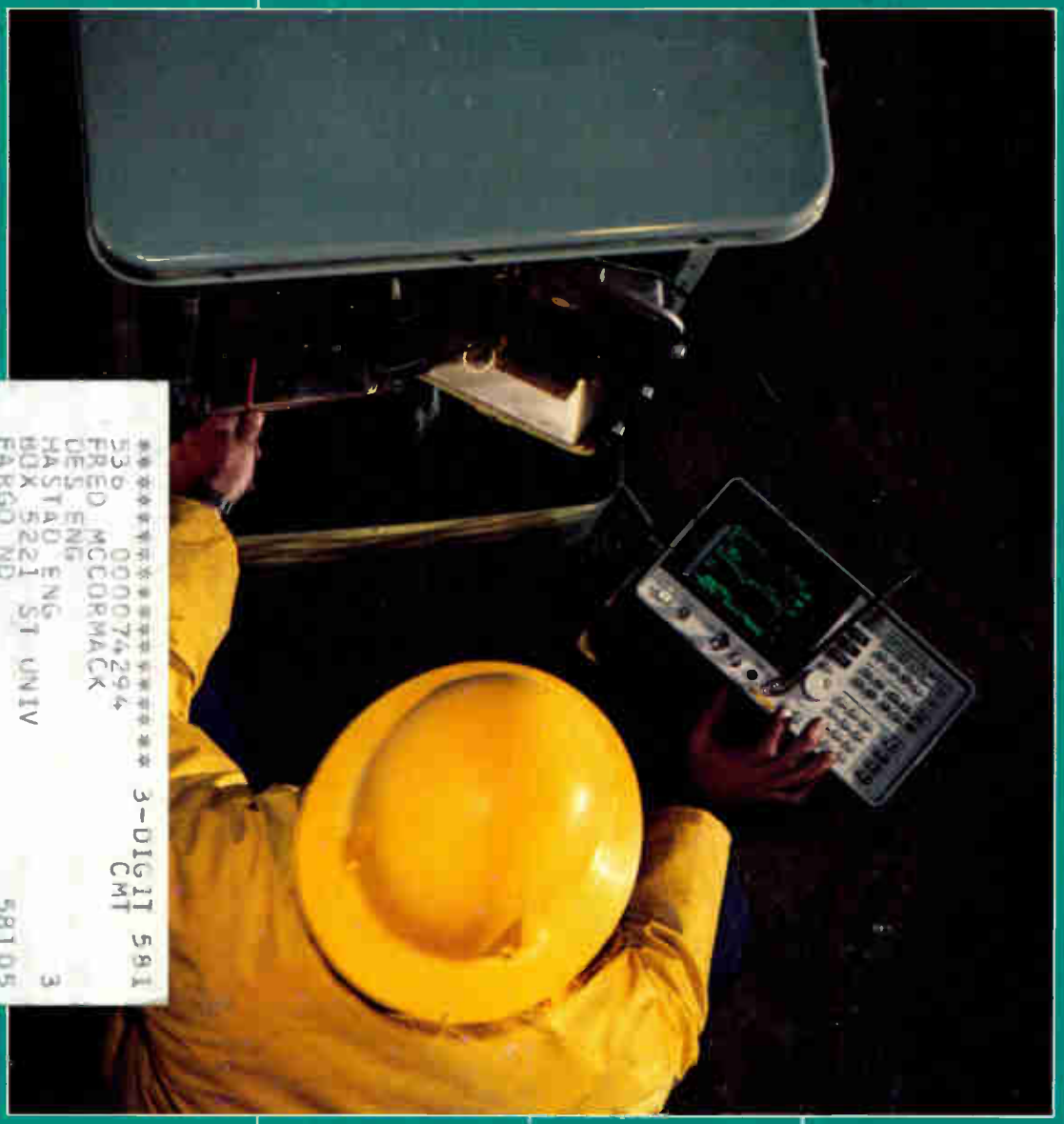
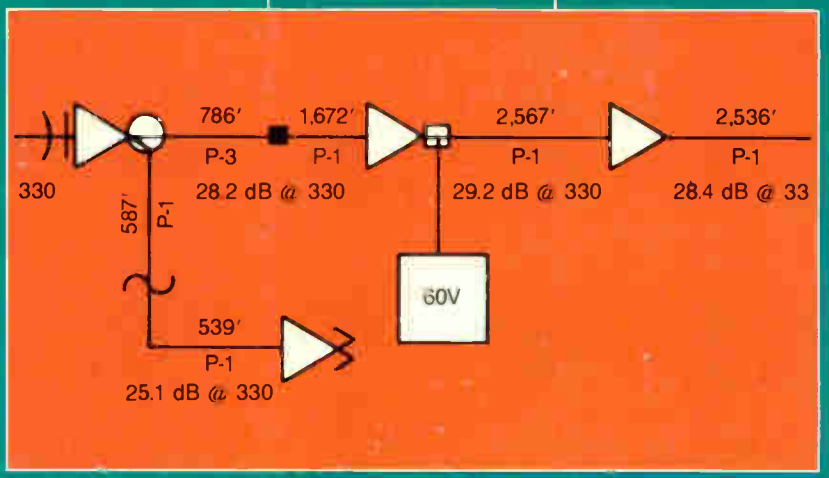
# COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers




**Performance analysis: An ongoing need**

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July 1987

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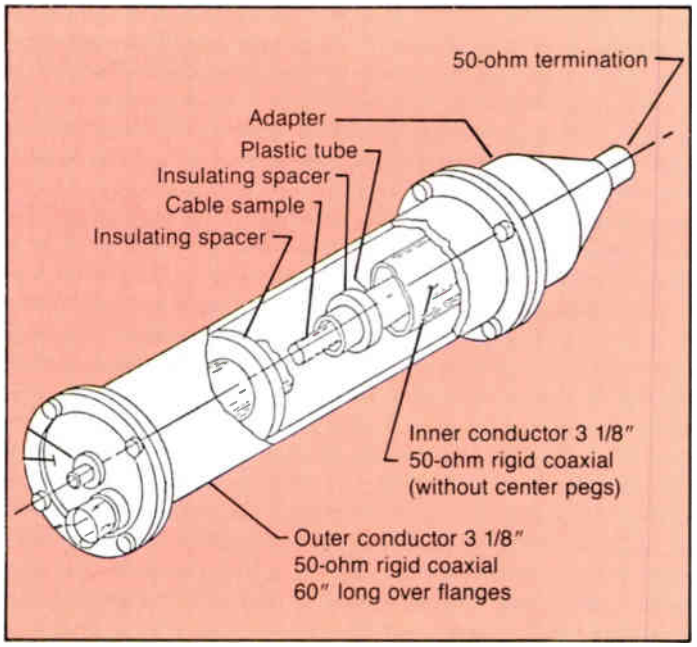




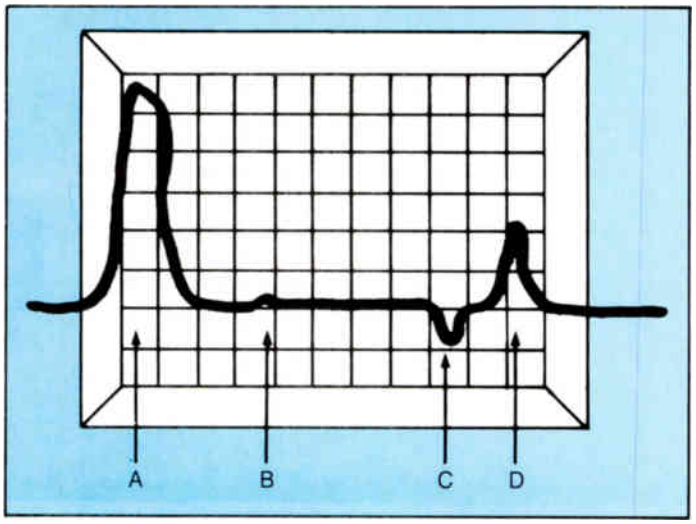






## Features





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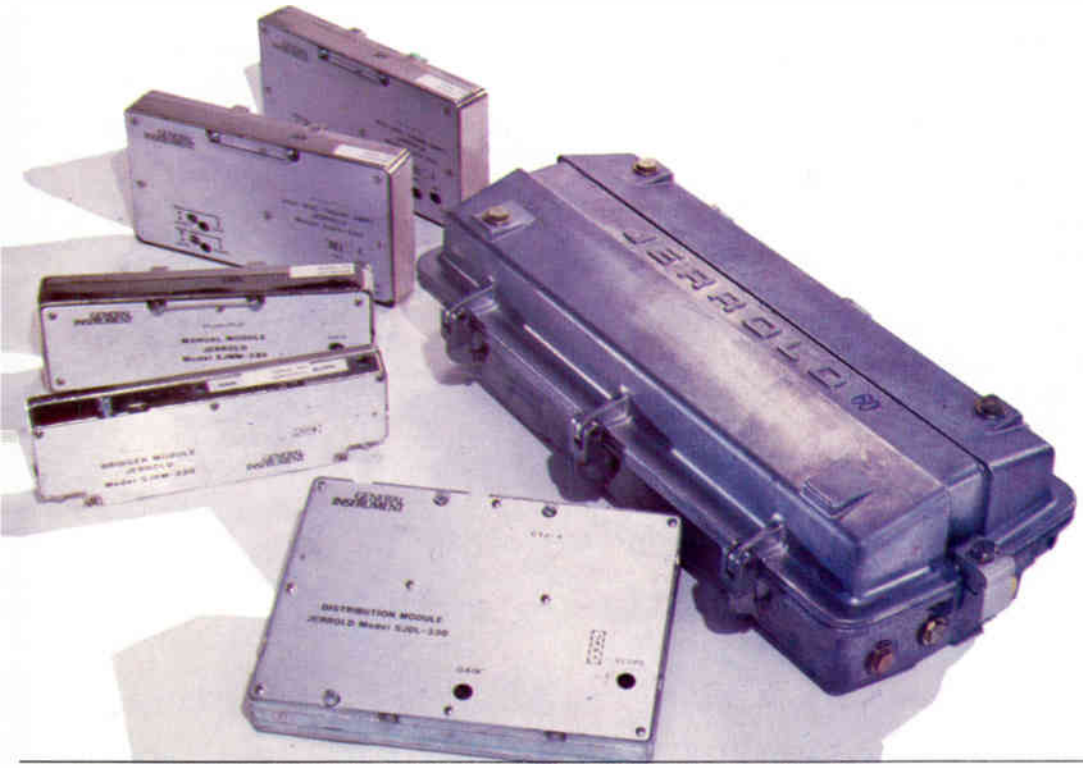
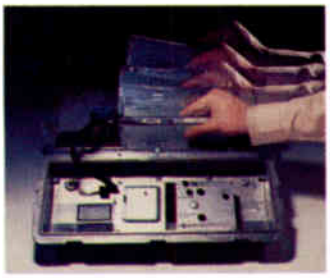


**GENERAL INSTRUMENT**

# Reflections

Summer is the time we usually take our vacations. It's a time to relax and forget our worries for awhile. And what better time than summer to reflect on what we've been doing the first half of 1987.

I see a lot of good things: the increasing interest in fiber optics, stereo sound, pay-per-view and interactive technologies. I also see the challenges of reducing leakage, improving signal quality and interfacing consumer electronics. Not to mention the latest FCC A/B switch and must-carry requirements.

But there is one other topic that needs some reflection. So far there have been three major shows in the first five months of 1987: the Texas Show, which is one of the best regional conventions; the SCTE Cable-Tec Expo, which was phenomenal this year; and the NCTA Show, which is the show you *have* to attend. Still to come: the New England Show, Eastern Show, Great Lakes Show, Atlantic Show, Mid-America Show and Western Show.

Some questions arise from all of this, activity that we seem to take for granted. But think:

1) Are there too many shows every year? (Or too few?)

2) Are these shows tuned into the needs of the industry? (Where does the emphasis belong—on products? Issues?)

3) Is anybody on the convention staffs really listening to the attendees and exhibitors in their reaction to how the shows are set up? (Is anyone making suggestions?)

4) Who benefits from the way these conventions are coordinated?

5) Specifically: Is there enough floor time? Does it conflict with seminars? Are convention hours too long or too short?

6) Are the various organizations talking to one another when scheduling these conventions as far as location and time?

7) Are we as an industry located in only one part of the country (i.e., West coast) or are we spread out?

8) Are so many press conferences really necessary? (Can't we just read the press kits?)

9) As far as the NCTA Show is concerned, did the preconvention announcement of the Vanguard Awards detract from the ceremony? (Is the press given too much or too little information beforehand?)

Perhaps you have other questions. We as an industry need to hear them for our own improvement.

**In memoriam**

We recently lost another industry leader. Carl Pehlke, the founder of Texscan Corp., died of cancer May 27. He was 59. Under his leadership, Texscan became one of the largest independent suppliers of proprietary products to the CATV marketplace. Among his many accomplishments, he engineered the purchase of Hughes Aircraft's Theta-Com Division in 1976.

His business efforts do not reveal everything. Carl possessed a vitality and charisma that made him a natural and effective leader. He had three passions: for family, for business and for the quality of life. Rest in peace. You may be gone, but not forgotten.

**Number 36**

With the introduction of three new meeting groups, the SCTE now has 36 chapters and meeting groups to assist in the further education of technicians and engineers. The new groups are the North Country Meeting Group from Minneapolis, the Tennessee Meeting Group from Nashville and the Southeast Texas Meeting Group from Houston.

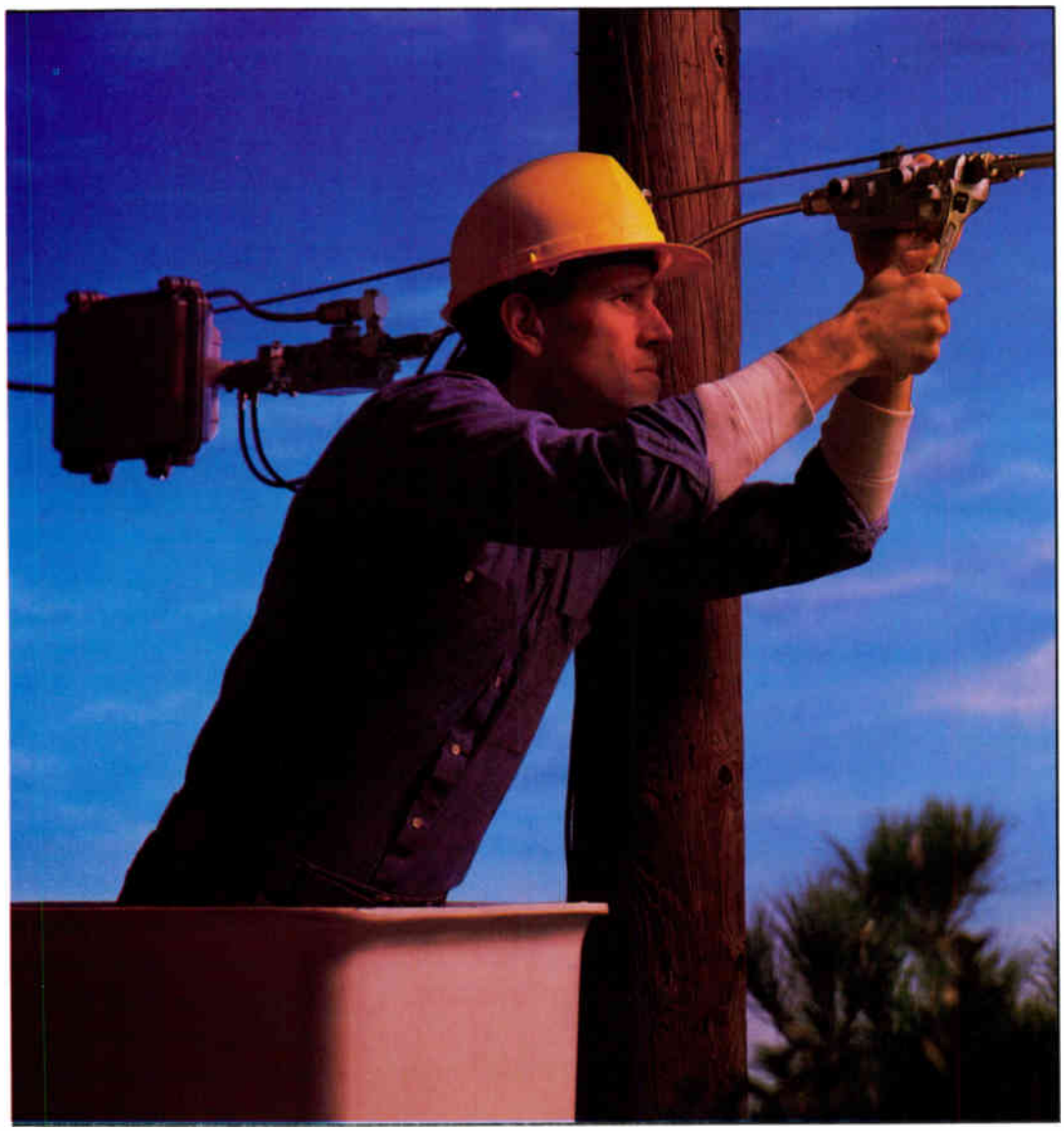
In this month's *Interval* you'll find the complete category outlines and bibliographies for the BCT/E Certification Program. Everyone in the industry should take advantage of the opportunities that the program—and the SCTE—offers.

Be on the lookout for *CT*'s card pack this month, a full deck of 52 cards from manufacturers, sent out to over 30,000 in the industry. Watch for it.

Speaking of *IT*, our new publication *Installer/Technician* will premiere in September. The first month's editorial focus is on antennas, earth stations and site selection. We'll also feature some important articles specifically aimed at CATV installers.

Paul R. Levine

# HOW TO AVOID SPLITTING HEADACHES.



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**Scientific Atlanta**

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COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

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*Reader Service Number 8.*

## NCTA urges action on switch quality

WASHINGTON, D.C.—The National Cable Television Association recently urged the FCC to require higher standards for A/B switches. In comments filed June 10, the NCTA stated that the commission should require an A/B switch isolation standard of 90 dB instead of the proposed 60 dB standard.

According to the NCTA, 90 dB is a de facto standard in the cable industry, but many subscribers might obtain switches from sources other the the cable operator. If 60 dB switches are installed, unacceptable video signal degradation will occur and increase customer complaints to the cable system.

Also, the NCTA urged a delay in the FCC's phased program of reducing the spacing between satellites used for video transmissions from the current 3° to 2°. The commission had adopted a plan in 1983 to reduce orbital spacing from 4° to 2°, due to an expected increase in demand for transponder space (which the NCTA claims has not occurred).

As well, the association suggested modifications to the FCC's proposed satellite interference rules with respect to applications and licenses for space stations and earth stations and technical standards for transmissions and operations of transmitting and receiving earth stations.

## National Amusements completes Viacom buy

NEW YORK—On June 9, Viacom Inc., formerly Arsenal Holdings Inc. and a holding company subsidiary of National Amusements Inc., completed its merger acquisition of Viacom International Inc. Viacom International shareholders, who approved the acquisition earlier in June, will receive for each share of common stock $42.75 in cash, plus interest; three-tenths of a share of 15.5 percent cumulative exchangeable redeemable preferred stock of the new company; and one-fifth of a share of common stock of the new company.

A special committee of the board of directors of Viacom International had announced on March 4 that it had entered into a definitive merger agreement with the National Amusements subsidiary. The FCC approved the transfer of control on May 13.

National Amusements owns and operates 396 movie screens in 14 states and is headquartered in Dedham, Mass.; Viacom International is headquartered in New York.

## Wavetek announces technical seminars

BEECH GROVE, Ind.—Wavetek Indiana has begun a new field seminar program for CATV technicians with a modular approach. Using a menu provided by the company, a cable system can choose topics appropriate for its needs. Then, Wavetek designs an instruction program and holds it on the system's premises or at a site nearby. Previously, the company had been regularly scheduling system sweep seminars at its facility.

Topics listed on the menu include system frequency response (method, application, problems and troubleshooting), signal level measurements (method, application, problems and troubleshooting), intermodulation tests (cross modulation, second- and third-order distortions and composite triple beat), and leakage and ingress.

For futher information, contact Wavetek Field Training at (317) 788-5980.

## GTE improves purity of fiber-optic glass

WALTHAM, Mass.—Scientists at GTE Laboratories have developed a new process to improve the purity of compounds used in fluoride glass, the basic material for a new generation of optical fiber. According to GTE, information can be transmitted 20 times farther than possible with silica-based fiber currently in use. The GTE process, which can be performed in a single cycle, involves a reaction of chemical vapors that separate desirable elements from contaminants.

When fully developed, fluoride glass is expected to make fiber optics cheaper to install and maintain.

*Ciciora*

## Ciciora wins award at Cable '87 Show

LAS VEGAS, Nev.—On May 20, Dr. Walter Ciciora, vice president of strategy and planning at American Television and Communications Corp., received the Vanguard Award for Science and Technology at the National Cable Television Association's annual convention. Ciciora was recognized for his efforts to assure that consumer electronics and cable system design are compatible.

Ciciora joined ATC in 1982 as vice president of research and development. Prior to that, he was with Zenith Electronics Corp. as director of sales and marketing of cable products. He is currently chairman of the NCTA's Engineering Committee, has been active in the IEEE Consumer Electronics Group and has served on several industry standards-setting committees.

Other Vanguard Award winners were: Distinguished Leadership (Male)—Daniel Aaron, Comcast Corp.; Distinguished Leadership (Female)—Beverly Harms, Communications Equity Associates Managed Investments Division; Young Leadership—C. Ronald Dorchester, Prime Cable Corp.; Associates Award—Robert Mathews, CableData; State/Regional Association Leadership—Anthony Accamando Jr., Adelphia Communications; Marketing—Doug Wenger, Storer Cable Communications.

Winners of the President's Awards were William Bresnan (Bresnan Communications) and Arthur Sando (Turner Broadcasting System).

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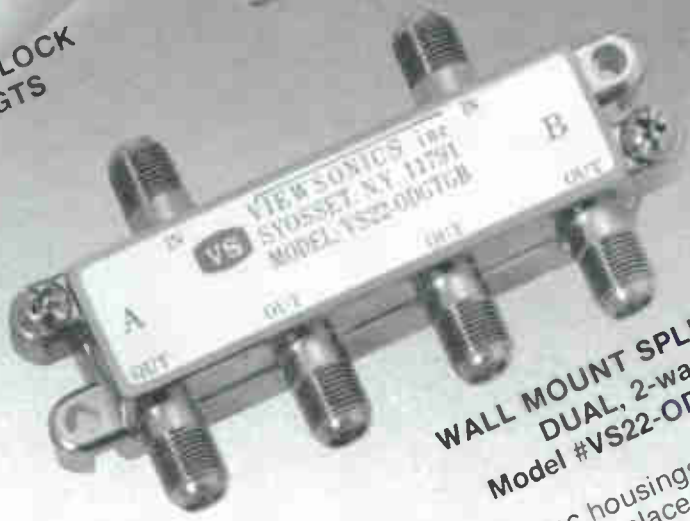

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*Reader Service Number 11.*

● General Instrument's VideoCipher Division recently announced that it plans to invest $4 million to expand production capacity for VideoCipher II decoders and decoder modules. Also, it agreed in principle with Channel Master to begin direct sales to manufacturers of home TVRO integrated receiver/descramblers who have license agreements with the VideoCipher Division. Finally, it announced a new electronic countermeasure (ECM) campaign to shut down a targeted 6,000 illegal home satellite TV decoders.

● Pioneer Communications recently held a ribbon-cutting ceremony for its new corporate headquarters in Upper Saddle River, N.J. The company's cable and LaserDisc divisions will be housed in the facility. Also, Pioneer announced a $10 million renovation to its LaserDisc replication plant in Southern California.

● Oak Communications announced an agreement with Cox Cable Communications to purchase 15,000 Oak Sigma 3 addressable decoders for the upgrade of Cox's 35,000-subscriber Macon, Ga., system. The order will extend over the next three years, with deliveries scheduled to begin in September.

● Data Transmission Devices of Peabody, Mass., announced the addition of two sales rep organizations. Com-Tek—with offices in Hayward, Calif., and Tualatin, Ore.—will handle promotion and sales in California, Idaho, Montana, Oregon, western Nevada and Washington. Comse Sales—located in Lawrenceville, Ga.—will cover Mississippi, Alabama, Tennessee, Georgia, North Carolina, South Carolina and Florida.

● M/A-COM MAC and Digital Equipment Corp. recently signed a joint agreement to sell communications systems capable of reconnecting remote local area networks (LANs) via microwave radios operating at 23 GHz. LANs up to 4.5 miles apart can be linked with M/A-COM's MA-23LAN microwave radio and Digital's Metrowave bridge.

● The New York State Cable Commission recently purchased a CAT computerized testing system, manufactured by the RF Superior Division of Brad Cable. The commission plans on including the system in its mobile test van to check headends and plant operations throughout the state.

● American Cablesystems announced that it expects to spend $38 million to $40 million over the next three years for Zenith's addressable Phase Modulation (PM) decoders for the MSO's Los Angeles-area subscribers. American recently installed the decoders in its Wilmette, Ill., system. Also, Times Mirror will purchase over 9,000 PM decoders for the premium customers of its Lafayette, Ind., system; 24,000 basic subs will be offered discounts to upgrade to premium service.

● Anixter recently received an order from Tele-Communications Inc. for on-premises security products manufactured by Pico Products. Also, Anixter announced the opening of six new service locations: Nashville, Tenn.; Charlotte, N.C.; Providence, R.I.; Louisville, Ky.; Carson, Calif.; and Des Moines, Iowa.

● Scientific-Atlanta has agreed in principle with Viacom Networks Group to provide 3.2- and 2.8-meter C-band antenna systems to affiliates of Viacom's program services as they shift to the Galaxy III satellite. Also, S-A received an $8.3 million contract from Continental Cablevision of Sierra Valley, for addressable set-top terminals and other subscriber products for use in the MSO's Fresno, Tulare and Yuba City, Calif., systems.

● Greater Media Inc. has selected General Instrument's TOCOM Division as its addressable equipment supplier for the MSO's Philadelphia cable system and has purchased approximately $4.2 million of TOCOM equipment. TOCOM recently changed its mailing address to P.O. Box 569240, Dallas, Texas 75356-9240.

● Phoenix Cable has announced a $250,000 lease financing agreement with Telecable Broadcasting of America to upgrade Phoenix's East Cleveland, Ohio, system to addressability. The leased equipment includes Pioneer converters and encoders.

**Correction, clarification**

In last month's issue of *CT*, the article entitled "Technical training: Meeting your needs" referred to a number of training videotapes available from the Society of Cable Television Engineers. The SCTE member prices for the videotapes are as follows: *Confident Climbing II*—$75, *dBs and dBmVs*—$120, *Confident Climbing I*—$75, *Coaxial Cable Basics*—$75, *Cable Handling and Installation*—$75, *SLM Basics*—$75, *SLM: Errors and Accuracy*—$75. For non-member prices or more information, contact the SCTE, (215) 363-6888.

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***Reader Service Number 14.***

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# Testing with the spectrum analyzer

**By Allan Armstrong**
Marcom Manager

**And John Cecil**
Product Marketing Engineer, Hewlett-Packard Co.

The swept-tuned spectrum analyzer is gaining wide acceptance as a tool for testing and maintaining cable TV systems. It can sweep over a wide frequency range and display the individual frequency components of a signal on its CRT. This allows a cable technician to examine individually the video carrier, modulation sidebands and audio carrier in a TV channel, or to look at all the carriers in the system at one time. With this capability, the technician can perform proof-of-performance tests and also troubleshoot a system to pinpoint problems.

Sophisticated digital functions such as trace markers and the fast Fourier transform (FFT) are available in the latest generation of spectrum analyzers. These functions simplify the measurement of standard parameters such as carrier-to-noise ratio, cross modulation, and power line hum (see "Third-generation spectrum analyzers and CATV testing," *CT*, 4/87).

The next logical step in analyzer evolution was to add specialized CATV functions to a latest generation spectrum analyzer so that tests requiring many measurement steps and calculations could be done at the push of a button. This was done for the HP8590A portable RF spectrum analyzer by creating a special CATV tester version with Option H50.

The HP8590A Option H50 is both a general purpose spectrum analyzer and a CATV tester in one portable package. The CATV system operator can now do headend testing, proof-of-performance measurements and trunk maintenance with a single instrument. The analyzer's built-in automatic tests are designed to save the cable technician time and reduce the possibility of error. However, most cable measurements also can be made using standard analyzer functions if the technician wishes to have manual control of the analyzer.

**Figure 1:** Display of one channel

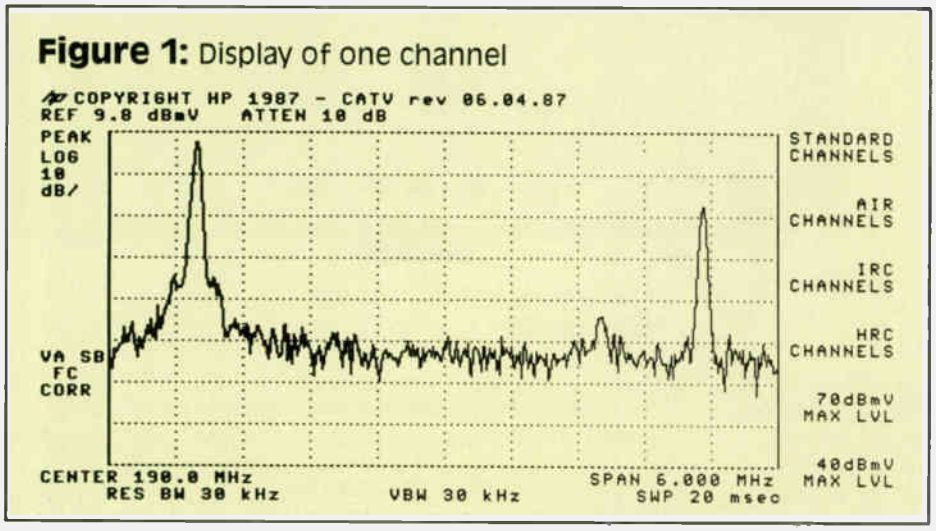



**Figure 2:** Carrier level measurement

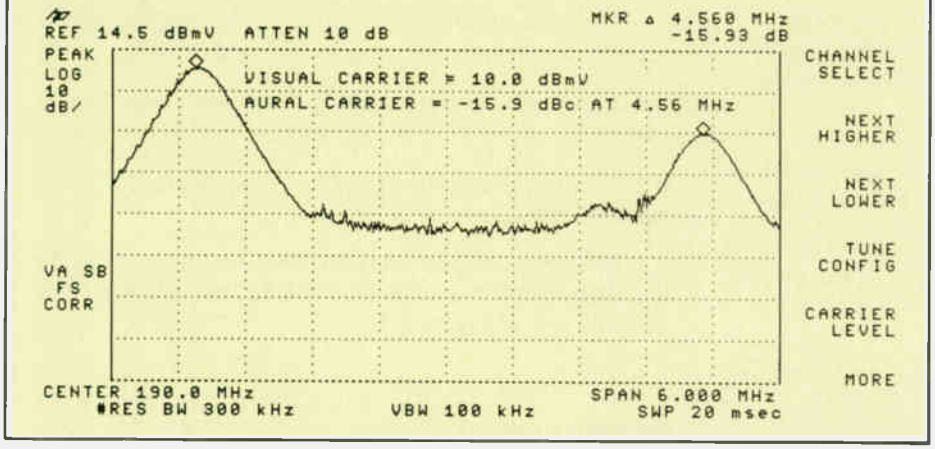
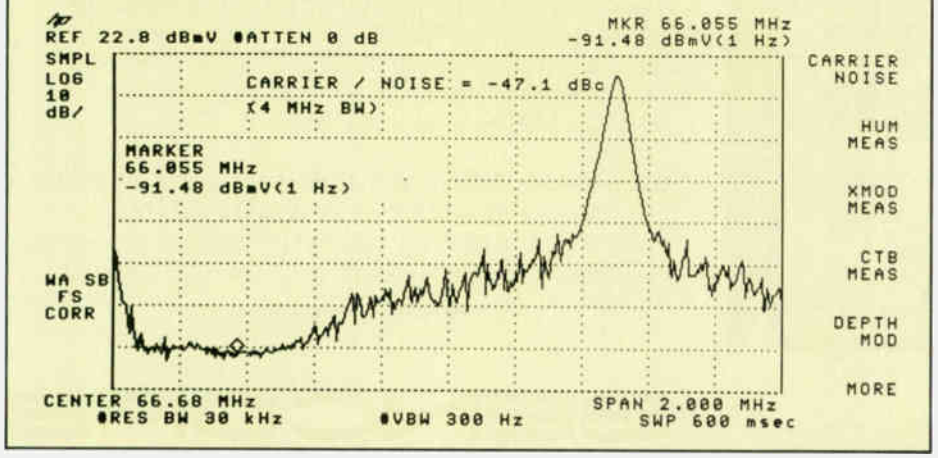



**Figure 3:** Carrier-to-noise measurement




### Nine functions

The CATV tester option adds nine special functions to the standard HP8590A spectrum analyzer. Of these, six are commonly used tests for CATV channels and can be run once a carrier is selected and displayed by the channel selection function. Other functions let the operator perform a frequency response test on the entire CATV band and store CRT traces in non-volatile memory.

When the user chooses one of the tests available through the CATV menu (softkeys on the right side of the CRT), the analyzer performs the test and displays a numeric answer on the CRT. The test results and all trace and display information can then be recorded with a portable printer via the optional digital interface (the HP Thinkjet printer made Figures 2 to 9 in this article).

1) *Channel selection:* The user first enters the type of frequency assignment for TV channels by pressing one of the tuning configuration keys—STD (standard), AIR (off-the-air), HRC or IRC. The selected configuration is stored in non-volatile memory until a new configuration is chosen. The user then selects a channel by entering a number from 1 to 99. The analyzer tunes to the channel and displays both the visual and aural carriers (Figure 1). "Next higher" and "next lower" keys will tune the analyzer to adjacent numbered channels. Or the analyzer's step-up and step-down keys can be used to change the analyzer tuning in 6 MHz steps so that adjacent frequency channels can be viewed. These tuning features save the technician a great deal

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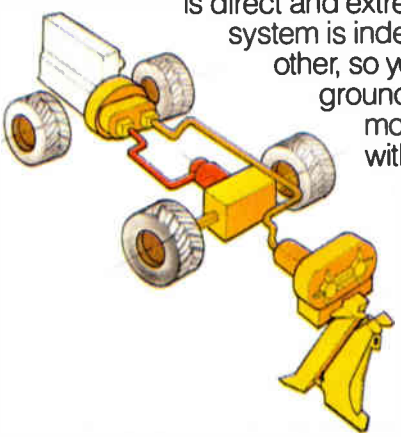

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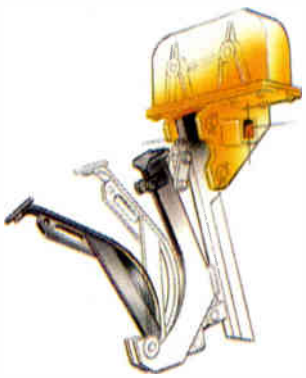

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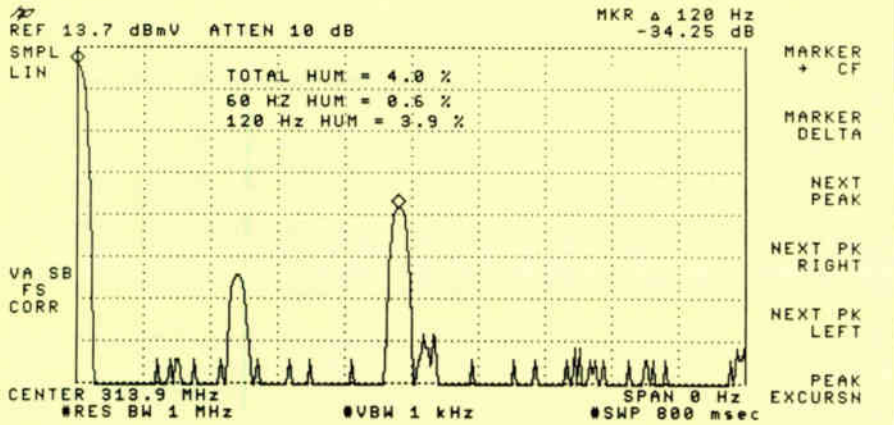
**Figure 4:** Power line hum measurement




of time, especially when measurements must be made across the entire CATV band.

2) *Carrier level:* This function captures the peak power of a modulated or unmodulated carrier. The absolute power of the visual carrier is measured in dBmV even if the horizontal sync pulse is suppressed, as is often the case for a scrambled channel. The aural carrier level is then measured relative to the visual carrier in dBc (dB relative to carrier) with an accuracy of ±0.75 dB.

The test takes only a few seconds and the results are displayed for data recording (see Figure 2). Carrier levels from −24 to +70 dBmV can be measured with a relative accuracy across the CATV band of ±1.5 dB. Using the channel selection functions with the carrier level function greatly simplifies the 24-hour variation measurement done on all system carriers.

3) *Carrier-to-noise:* This function measures the peak value of the visual carrier (modulated or unmodulated), finds the minimum noise level between channels and calculates the equivalent noise level in a 4 MHz noise bandwidth. A numeric answer for the carrier-to-noise ratio (C/N) is then displayed in dBc (Figure 3). The measurement accuracy is ±1.25 dB when system noise is greater than analyzer noise by 10 dB or more. A C/N greater than 60 dB can be measured, but a preselector filter and preamplifier may be required. The measurement can be done without system interruption on a modulated carrier. Or this test can be modified to accommodate other methods of measuring noise, such as tuning to an unoccupied channel, turning off the carrier or turning off the modulation.

4) *Power line hum:* The fast Fourier transform (FFT) computer algorithm built into the HP8590A is utilized by this function to measure power line interference on an unmodulated CATV channel. The spectrum analyzer cannot resolve the 60 Hz and 120 Hz components with its narrowest resolution bandwidth, which is 1 kHz. However, the FFT enables the analyzer to measure low-frequency amplitude modulation (AM) on the visual carrier. The hum function measures the percent hum for each component, calculates the total percent hum (root of the sum of the squares of each component) and displays the results. The CRT also shows the hum spectrum relative to the carrier (Figure 4).

Knowledge of the relative amounts of 60 Hz and 120 Hz modulation is useful for troubleshooting hum interference. An excess amount of 60 Hz hum points to a shielding problem, while a high 120 Hz component may indicate a faulty power supply. The CATV analyzer can measure from 0.5 to 5 percent hum with ±1.1 percent accuracy and up to 10 percent hum with ±2.1 percent accuracy.

5) *Cross modulation:* This measures the 15.7 kHz AM sidebands on an unmodulated visual

carrier by using the FFT function mentioned previously. The measurement is done much faster than can be done with a standard spectrum analyzer. Normally, an analyzer would be tuned to a very narrow span in order to see the sidebands. Then, the sideband level would be interpreted from the display-graticule calibration. In contrast, the cross modulation function performs the sequence of measurement steps automatically in just a few seconds and displays a numeric answer (Figure 5). Sidebands down to −65 dBc can be measured.

6) *Composite triple beat:* When this function is activated, the analyzer first finds the peak carrier level (the carrier may be modulated or unmodulated) and then displays a message asking the operator to turn off the carrier. When the test is continued, the third-order products are measured automatically and the results are displayed on the CRT (see Figure 6). If an external preselector filter is used, the analyzer can measure intermodulation products 74 dB below the carrier (a preamplifier may be needed). Along with the test results, the analyzer displays a message that reminds the operator to turn the carrier back on. This test with its user messages is designed to minimize channel interruption.

7) *Modulation depth:* This function uses a new measurement technique that does not require the interpretation of the horizontal line waveform or calibration of the CRT display in percent AM. The analyzer captures both the sync pulse and white line levels and calculates the modulation from 50 percent to 93 percent. The results are displayed with one-tenth percent resolution and ±2 percent accuracy (Figure 7). This test runs continuously while activated, and results are updated fast enough to allow modulator adjustments during the measurement.

8) *System frequency response:* This measures the cable TV system flatness without using a sweep generator and without disrupting picture reception or digital data transmission. The analyzer does this by comparing a reference spectrum taken at some point in the system (e.g., the headend) with the spectrum measured at another part of the system (e.g., the trunk amplifier). The difference between the two spectrums is displayed to show the actual system response (see Figure 8).

Once the response is displayed, the operator can use the spectrum analyzer's display markers to measure "suckouts" and ripple in the response. For example, a peak-to-peak measure function places markers at the highest and lowest amplitude points of the response and displays the frequency and amplitude differences between these points. Also, delta marker functions allow measurements of suckout width, depth and slope.

The system response is updated every one to five seconds (selectable by the user). The technician can make amplifier gain and slope adjustments while observing the response changes on the analyzer CRT. Display resolution for the response is 1 to 20 dB per division, selectable in 1 dB steps, and marker resolution is 0.05 dB.

The frequency response function works even on systems with scrambled channels if the scrambling is adjusted for constant amplitude (i.e., no time-varying scrambling). Systems with



**Figure 5:** Cross modulation test

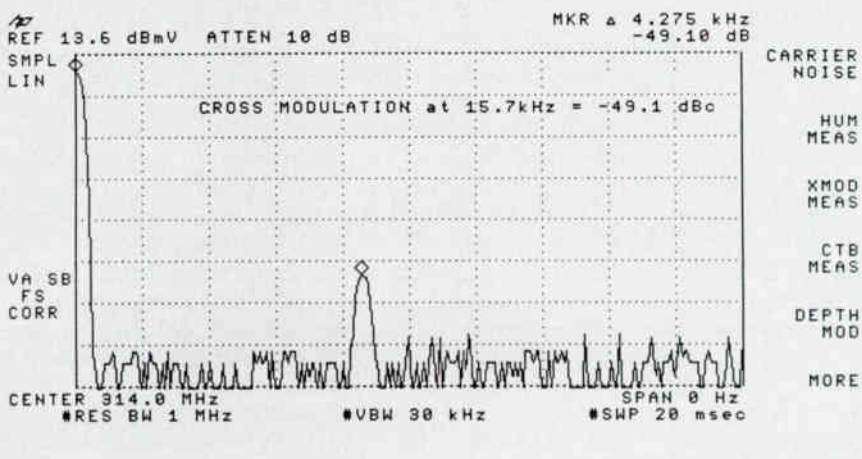


**Figure 6:** Composite triple beat measurement

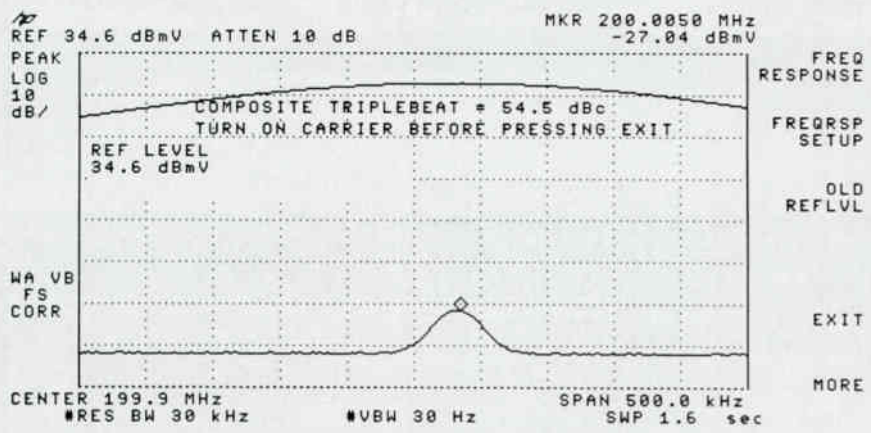



**Figure 7:** Modulation depth measurement

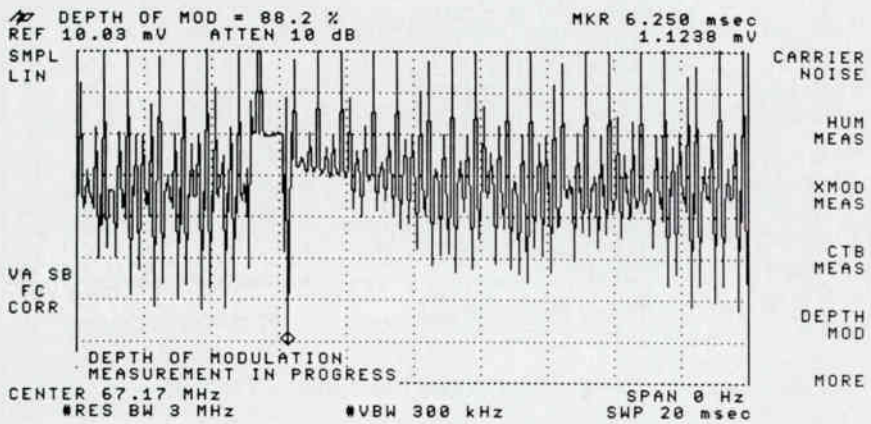
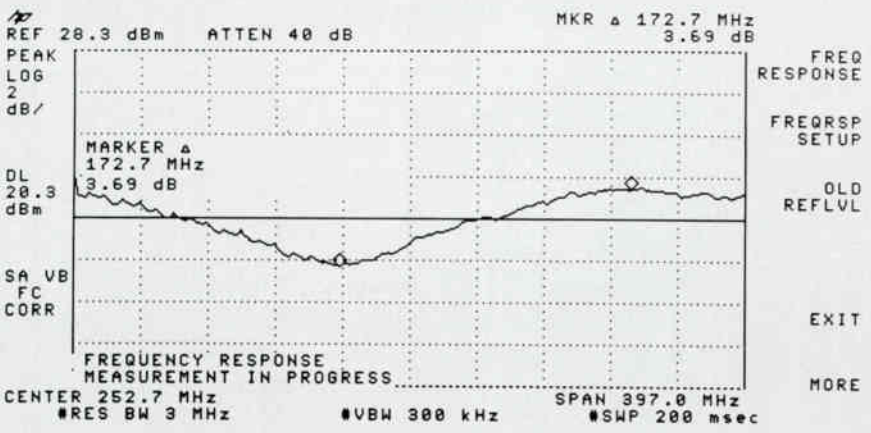



**Figure 8:** System frequency response measurement




missing bands of channels also can be tested by installing a band-limited noise source at the headend. The analyzer will measure the frequency response of the noise source where the channels are missing in the cable system.

9) *Save/recall traces:* This allows the storage of three traces with analyzer control settings in non-volatile memory. This feature is needed for the system frequency response test, but it is also useful for troubleshooting system problems. For example, it allows the technician to compare hum measurements taken at different locations in the system or taken at different times or on different days. The stored information can be recalled at any time, even months later. Recalling a trace with a single key stroke also sets up the analyzer with the same control settings that were stored with the trace. This allows the technician to duplicate the original test conditions so that new measurement data can be compared with the old data.

**Spectrum analysis capabilities**

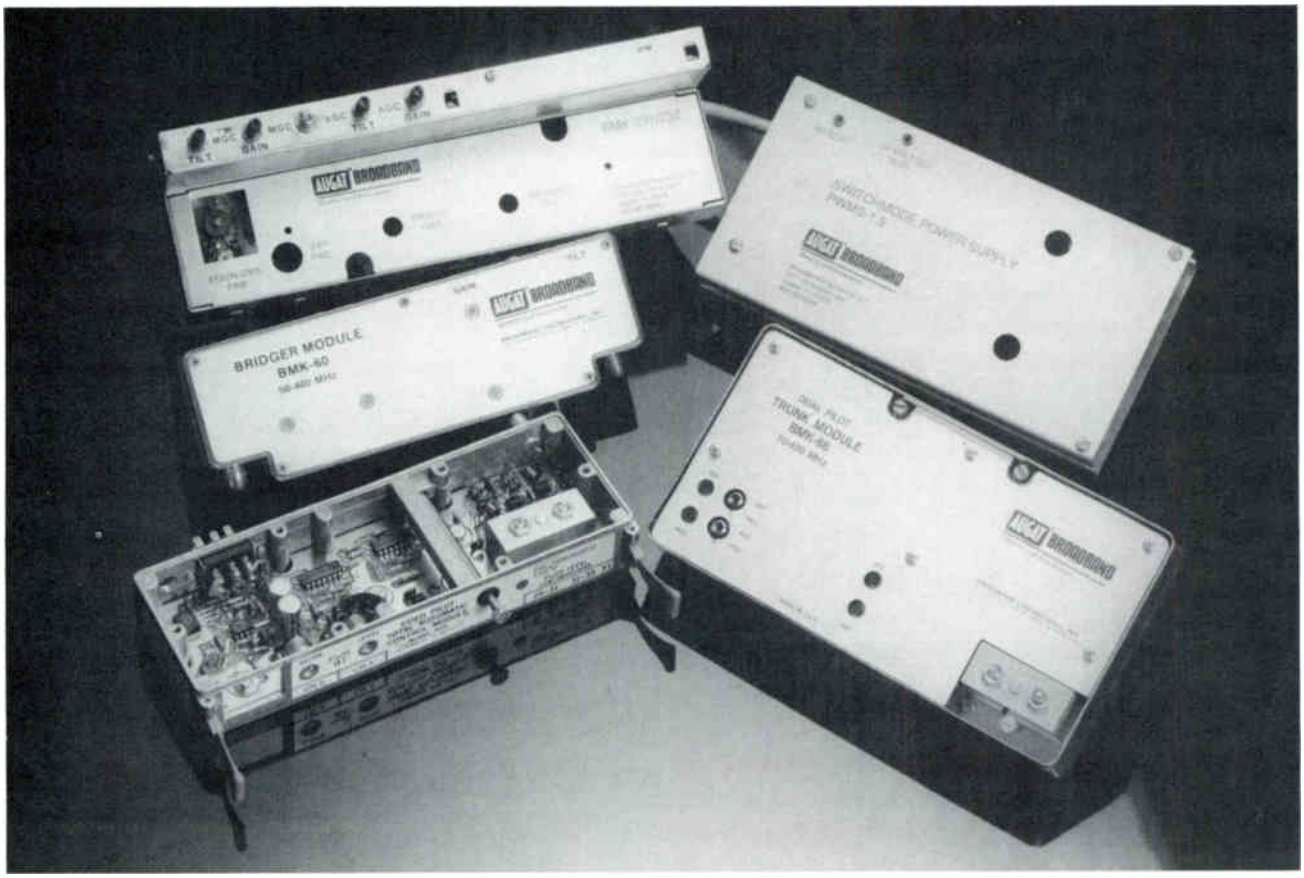
Special CATV test functions such as those described make both routine testing and proof-of-performance testing faster and simpler. However, as mentioned earlier, the general purpose signal measurement capabilities of the spectrum analyzer are very useful for general maintenance and troubleshooting, too. The HP8590A, for example, has a 1 MHz to 1,500 MHz range, which allows spectrum analysis of all cable bands and the satellite downconverted band of 950 to 1,450 MHz. Signal levels can be measured over a −60 dBmV to +77 dBmV range, and sensitivity may be increased to better than −80 dBmV with an external preamplifier. The frequency response is ±1 dB over the entire frequency range, and the relative amplitude accuracy is ±1 dB over a 70 dB range. A 75-ohm input impedance minimizes mismatch loss in cable testing, and a 50-ohm impedance is also available.

Microprocessor control, in addition to permitting sophisticated CATV functions, also provides other convenient features for spectrum analysis. A digital storage display gives the operator a flicker-free CRT picture and enables storage and recall of traces. Trace arithmetic allows traces to be compared to each other or normalized to a reference trace. Marker functions simplify trace interpretation by displaying both amplitude and frequency for any signal selected. With single key strokes the technician can place a marker on the highest signal displayed, move the marker to adjacent signals, or measure amplitude and frequency differences between signals.

The addition of an optional digital interface lets the user program all standard analyzer functions even from a handheld computer. Any one of three interface types can be used: HP-IB (IEEE 488), HP-IL (HP serial interface loop) or RS232C. The interface also lets the analyzer's plot and print keys be used to make instant hard copies of the CRT display. These digital features aid the cable technician in proof-of-performance data recording. The user can record measurement results in the field with a portable printer or a handheld computer (a program for the HP 71B handheld computer is available for storing up to 30 display traces along with analyzer control settings).

Basic spectrum analysis can be expanded with a tracking generator accessory for bench testing amplifiers and filters. This type of generator provides a signal that tracks the frequency tuning of the analyzer as it sweeps. If a filter is connected between the tracking generator output and the spectrum analyzer input, the filter's frequency response can be measured over greater than 100 dB dynamic range.

When a new generation spectrum analyzer is enhanced with digital functions for standard CATV tests, the result is a single instrument capable of performing tests in all parts of a cable TV system. The benefit to the user is faster, more accurate testing with less test equipment. ■

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# The present state of EMI measurements

**By Donald Dworkin**
Special Projects Engineer
United Artists Cablesystems Corp

With the great attention that the FCC and other governmental agencies have focused on signal leakage from CATV systems and the adoption of the cumulative leakage index, it would appear to be important to have our electron magnetic interference (EMI) measurement act together. However, this does not appear to be the case, at least as a recent article[1] in the trade press and a paper[2] given at an NCTA technical session indicate. Both cast doubt on the device called an RFI chamber (Figure 1), which is a much larger version of the Seed (Figure 2). Since the RFI chamber is the only instrument large enough to measure anything other than cable, these doubts would leave antenna testing as the only means presently available for the measurement of passive or active device radiation.

Yet, articles have been published[3,4] showing very good agreement between measurements in the RFI chamber and an open air site, as well as between the Seed and an open air site measurement. For example, in the first of these papers, the author measured a length of RG-59 in the Seed, then put it in the system. Using standard CATV dipole measurements, he achieved correlation from 3 dB to 1 dB in the VHF high band, but less in the low band due to near field effects.

In the second paper, the author tested a pair of two-way splitters in the RFI chamber and then measured the leakage levels at three different frequencies using a tuned dipole antenna at known distances from the splitter in an open field. These measured levels were then compared to predicted levels calculated by using the RFI chamber shielding factor in the standard formula for antenna path loss. The correlation obtained ranged from 1 dB at 89 MHz to 9 dB at 355 MHz.

**Figure 1:** RFI chamber

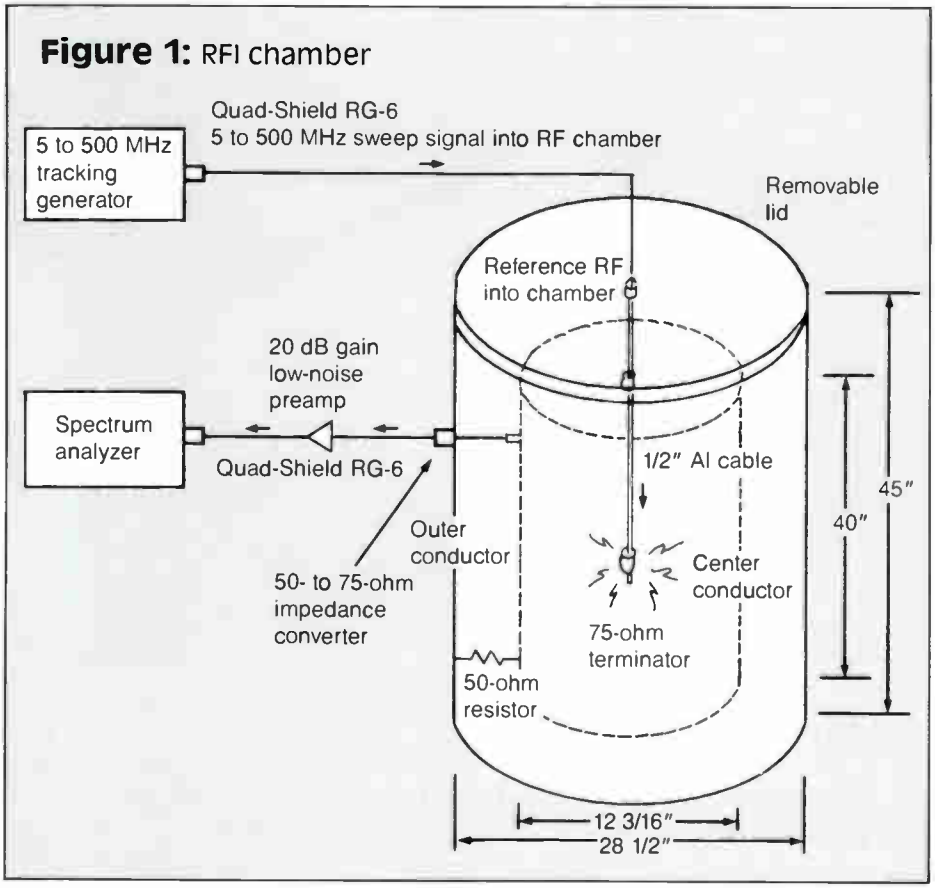
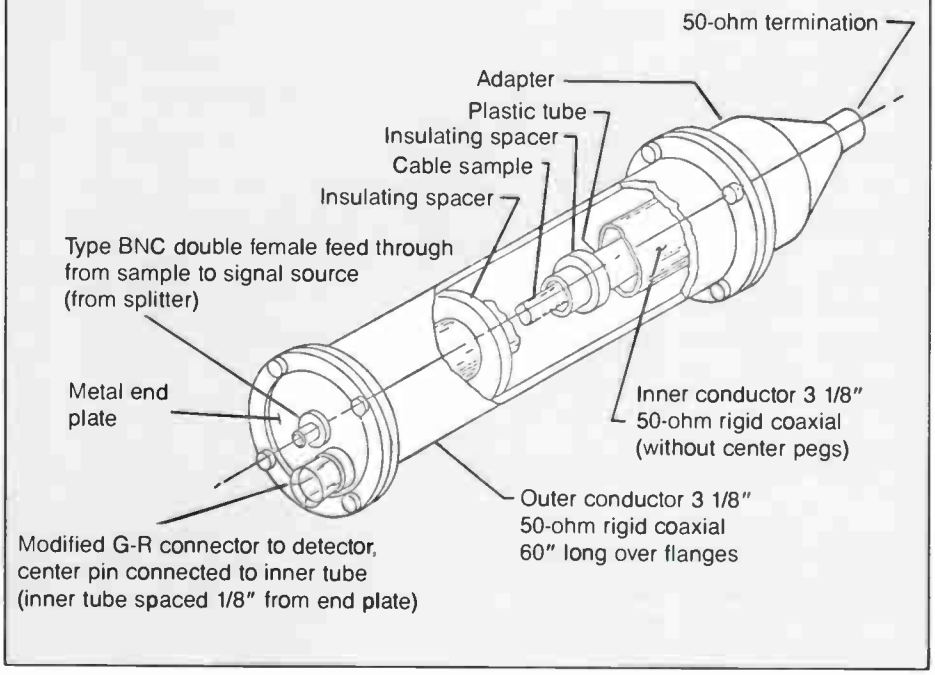



**Figure 2:** Seed chamber




### Standard radiator

It occurred that devising a "standard radiator," which could be used in both the RFI chamber and the Seed, would serve several different purposes. These would be:

- Since independent measurements by both the RFI chamber and the Seed had achieved correlation to open air site tests, they should correlate with each other in accordance with the theorem that two things equal to a third must be equal to each other.
- The test would show the correlation between the peaks of the two curves and validate the use of a smooth curve drawn from peak to peak.
- The test would prove that any RFI chamber, at any location, could be checked and calibrated with any other.

The standard radiator was assembled from a special slotted cable called Radiax and manufactured by Andrew Corp. Slots in the shield permit uniform radiation along the cable in a broadband fashion with radiation being both horizontally and vertically polarized.

The results (Figure 3) confirm each of the previous points. The agreement between the devices is within ±8 dB from 90 MHz to 500 MHz. If we accept the Radiax curve in the Seed as the most accurate, then correction factors can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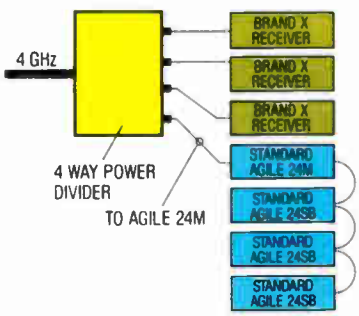


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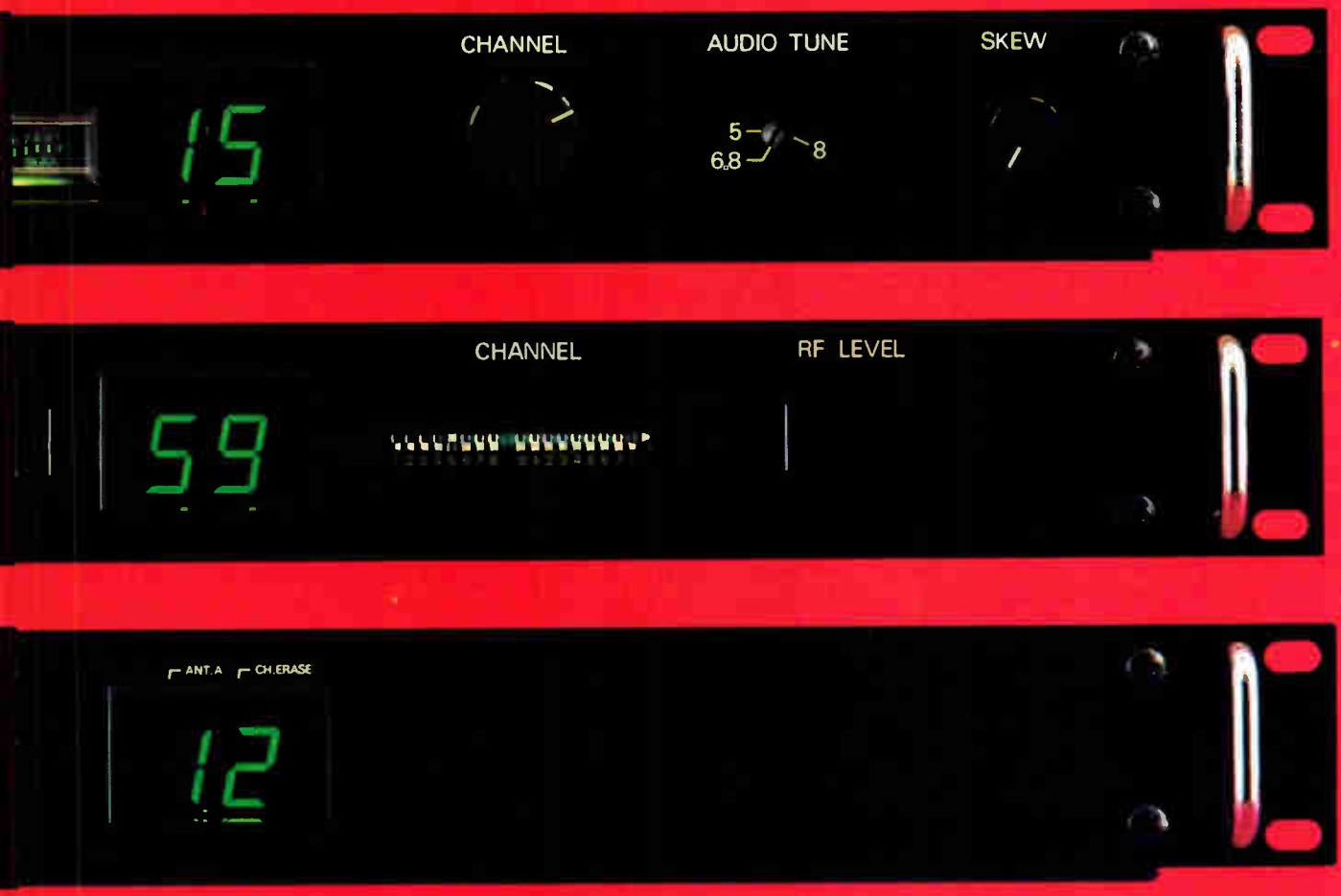


channel selection format from the front panel. This eliminates confusing "Code" setting for a simple channel selection. The Non-Volatile Memory will always come up on the last channel selected in the event of a power failure. The extensive use of this Non-Volatile Memory is throughout the entire ISS family of products. All adjustments are strictly "Front Panel." The addition of BTSC Stereo is no problem and can be ordered for added band width from the factory, or added by a simple field change.

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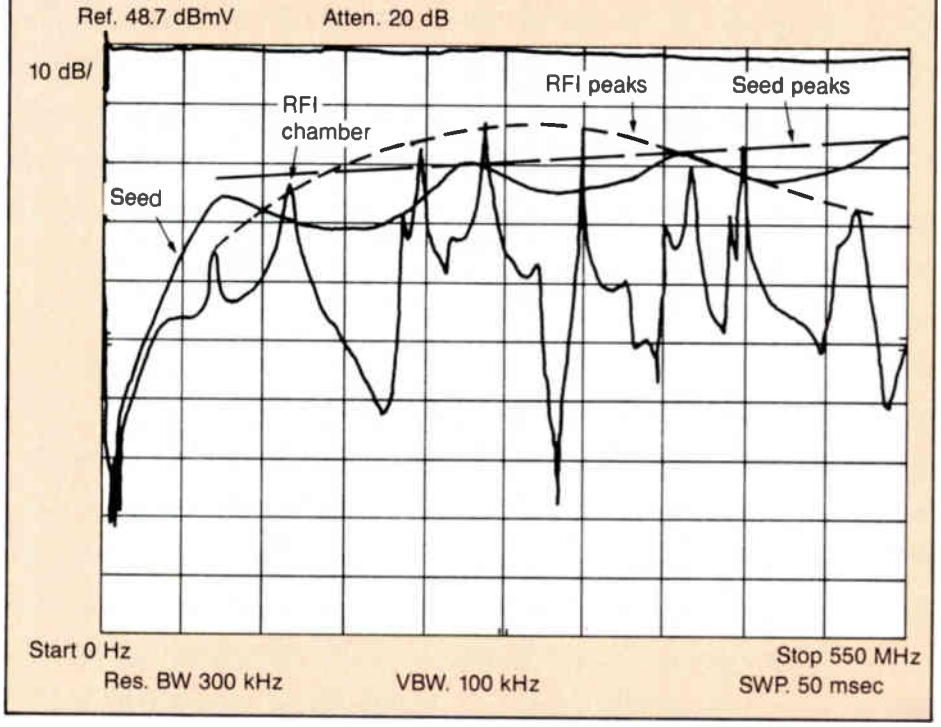
**Figure 3:** RFI chamber vs. Seed (using Andrew's Radiax)




be applied to the RFI chamber from 50 to 550 MHz. The curves also show that only their peaks give true value and that a smooth curve connecting them is the correct way to use them. Lastly, the fact that correlation was established shows that RFI chambers, just as Seeds are, can be correlated to others of the same type.

**Additional objections**

Two additional points raised against the accuracy of the RFI chamber are the following:

1) The chamber measurement is relative, not absolute.—We have just shown that practically (by open air site measurements) and experimentally (by calibrating with a standard radiator from the known accuracy of the Seed) that a shielding factor can be obtained from the RFI chamber, which, when inserted into the path loss antenna equation, will yield the correct field strength as obtained by the standard CATV 10-foot dipole measurement.

2) Resonance frequencies may be present in the chamber, making actual readings at those frequencies somewhat questionable.—As discussed, it is only at the peak frequencies that the RFI chamber and Seed appear as a 50-ohm structure and therefore the curve has meaningful values. But this makes the readings no more difficult nor ambiguous than doing a CATV dipole measurement in which the observer must rotate the antenna to obtain the correct polarization and simultaneously probe for the maximum field.

**Accuracy**

The Seed was developed by the Belden Cable Co. because at the time none of the test methods were consistently showing repeatable data. With Seed, results are typically within 1 to 2 dB between repeat tests. This compares very favorably to the variations of up to 20 dB found with antenna test methods. The RFI chamber shares the Seed's characteristic of containing and therefore absorbing all the radiated energy so that variations in sample placement and orientation have a minor effect on repeatability.

Finally, the use of the standard radiator, which has direct traceability to the Seed, enables the user to measure within 1 dB of a known standard. The shielding factor so obtained will yield correlation to open air site tests and the CATV 10-foot measurement.

Working with electron magnetic fields is not as direct and unambiguous as working with discrete circuits. It is hoped, however, that building on the work previously cited, results within engineering limits will be obtained. These should be helpful in designing radiation shields for CATV equipment, which will be directly translatable to the CLI.

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3"The Rogers/UA Approach to Setting Standards," Hugh Bramble, *CED*, July 1983.

4"RF Shielding Measurements Using the UACC RF Chamber," Jody Shields, *1984 NCTA Technical Papers.*


*Author's note: The UACC Technology Center, among other work, performs the radiation testing for United Artists Cablesystems. It possesses a Seed chamber from which it developed the RFI chamber in 1981. The plans and facilities of the center are available to applicants in testing for EMI or other electrical tests (e.g., assistance in building an RFI chamber, Radiax calibrator, etc.).*

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# Cable testing: A faultless combination

**By Duff Campbell**
Riser-Bond Instruments

Cable TV and communications in general have seen tremendous growth in the last decade. With this growth comes many more problems in keeping a system in tip-top condition. Extensions, rebuilds, upgrades, reroutes and maintenance become necessary yet time-consuming parts of operating a cable system. Efficient use of time and controlling costs are essential to reaping profits from our coaxial-based systems.

A fast and accurate way to test coaxial cable for a fault is to use a time domain reflectometer (TDR) with a built-in oscilloscope display. However, because of the high cost and complexity of these instruments their use has been limited. The introduction of *digital* TDRs with their lower cost and basic one-button operation has made them a popular choice for locating "opens," "shorts" and *major* impedance mismatches or discontinuities. However, for cable faults of less severity, the oscilloscope-type instrument is still necessary.

Newer digital TDR designs provide an output for connection to a general purpose oscilloscope, which most cable systems have on hand. By combining the simplicity of the digital TDR with the display information of an oscilloscope, the result is a time domain reflectometer that gives the operator a choice: a simple one-button digital reading in feet (or meters) to a cable fault or, with connection to an oscilloscope, a sensitive waveform measurement of the cable quality.

**Why the waveform?**

If a digital TDR can give a reading in feet or meters to a cable fault, why is it necessary to see the waveform of the cable? To answer this question consider the following test scenario using a digital TDR (with variable sensitivity control and scope output capability) coupled with a 60 MHz general purpose oscilloscope.

Figure 1 is an illustration of the scope's display showing the transmitted pulse (Point A), a reflected pulse (Point D) and two other reflections of less severity (Points B and C). When testing the cable in the TDR's least sensitive mode a reading of 250 feet and an "open" condition are indicated. By shorting the center conductor to the sheath on the far end of the cable, a reading of 250 feet and a "short" condition now appear. These readings mean that the major reflection (Point D) is the end (full length) of the cable run. By increasing the sensitivity control, the TDR indicates a "short" at 210 feet (Point C). Increasing the sensitivity control of the TDR to its maximum position the digital LCD remains on Point C. The digital TDR alone is not sensitive enough to trigger on Point B. However, because the Point B reflection can be seen on the oscilloscope, the distance can be calculated as 100 feet (Figure 2).

Referring to a plant map, it's determined there is a cable splice at approximately 100 feet (Point B), but no splice had been made at Point C. Digging a hole at Point C reveals that the cable has a cracked jacket and the sheath is deteriorated, causing enough reflection to be detected by the TDR. Now the problem can be corrected.

Although Point B was determined to be a cable splice, and was undetectable by the TDR, it still could be seen on the oscilloscope. Herein lies several important points. The digital TDR is not sensitive enough (by itself) to detect a good splice. If it were, this would prove to be counterproductive. No one wants to be digging up good splices. It is important to maintain a good set of plant maps and maintenance records. Had it not been known that there was a splice at 100 feet, time and money would have been wasted digging at this location. If, according to the plant map, there was not a known splice at Point B, the location could be investigated further. Alternately, if this slight discontinuity was not causing any major problems, keeping an eye on it for future problems or deterioration could suffice. The most important point to be made is that with an oscilloscope attached to the digital TDR even a very small discontinuity or fault in a cable system and its distance from the test point can be identified.

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**Figure 1**

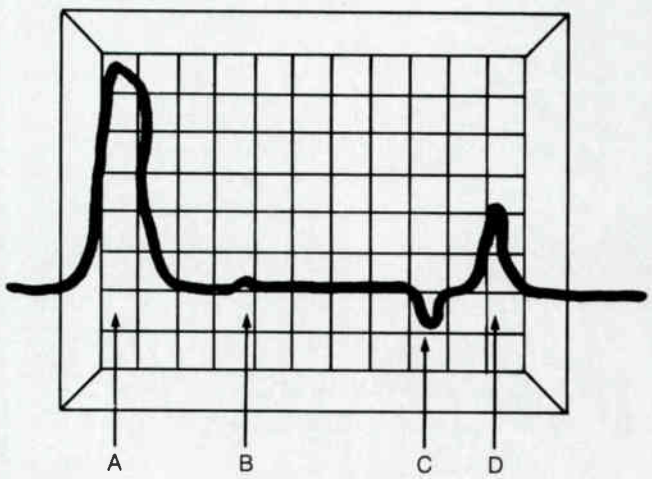
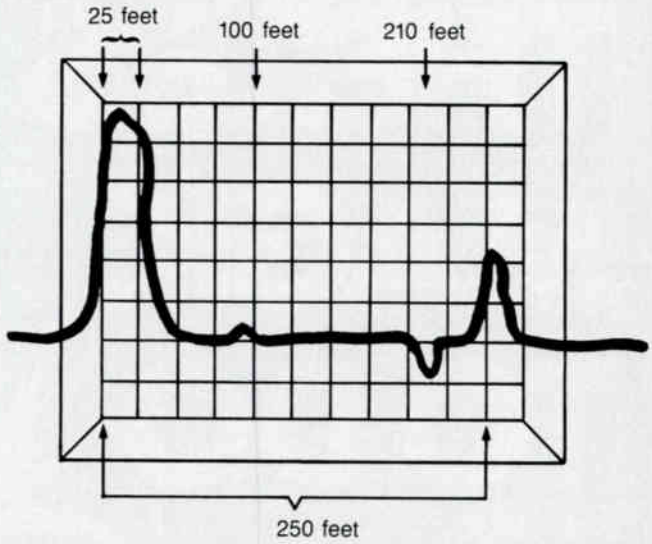



**Figure 2**




**Hints and helps**

When installing a new cable or testing an existing good one in a system, connect the digital TDR to an oscilloscope and test the cable. A photo or drawing of the resulting waveform of "good" cable sections should be kept with the plant maps or in a file for future reference. Should a problem arise with a section of cable, it can be retested and the new waveform compared with the original, which was made when the cable had no problems. Since testing all the cables in a system is generally not practical, choose those cables that are especially hard to get at and those that are especially vulnerable to damage. Tower cables that go to an off-air antenna are good candidates.

A separate function of the digital TDR is its ability to act as a tape measure. When there is no fault it will read the full length to the end of an unterminated cable. This is handy for checking the lengths of incoming new reels of cable or for verifying lengths left on partial reels. By using this same technique unmarked cables in a pedestal can be measured by length for quick and easy identification.

As with any new piece of test equipment, familiarity develops versatility. The more a piece of equipment is used the more applications will be found for it. This combination of digital TDR and oscilloscope can become an easy-to-use, time and money saving convenience for everyone from the first-level technician to the top-level engineer.

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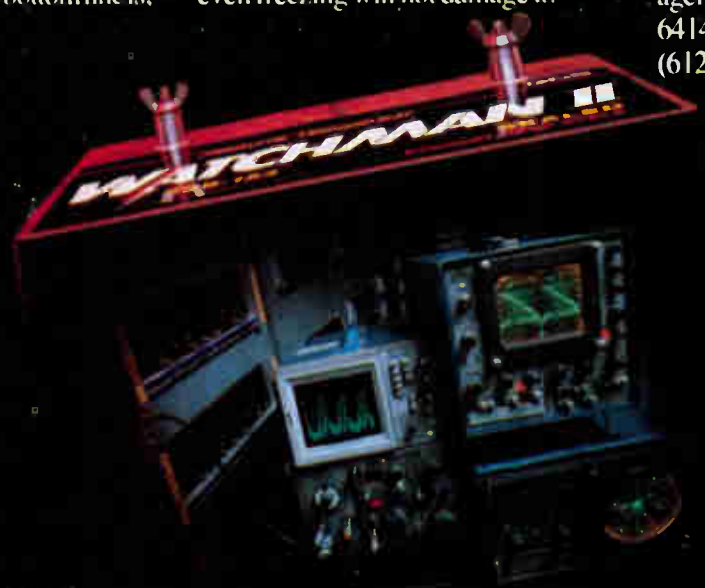

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*Sheila Yount*
*Customer Service Representative*
*15 years with Comm/Scope*


*Jim Sherrill*
*Process Engineering Manager*
*28 years with Comm/Scope*

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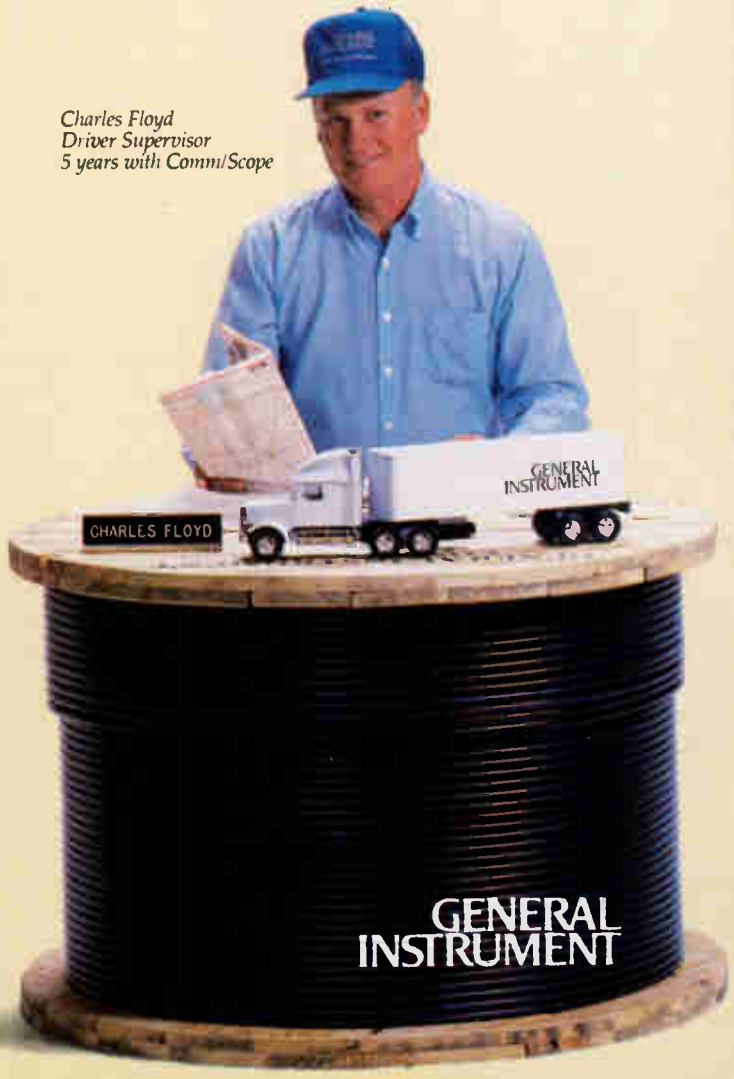


# Design considerations for rebuilds/upgrades

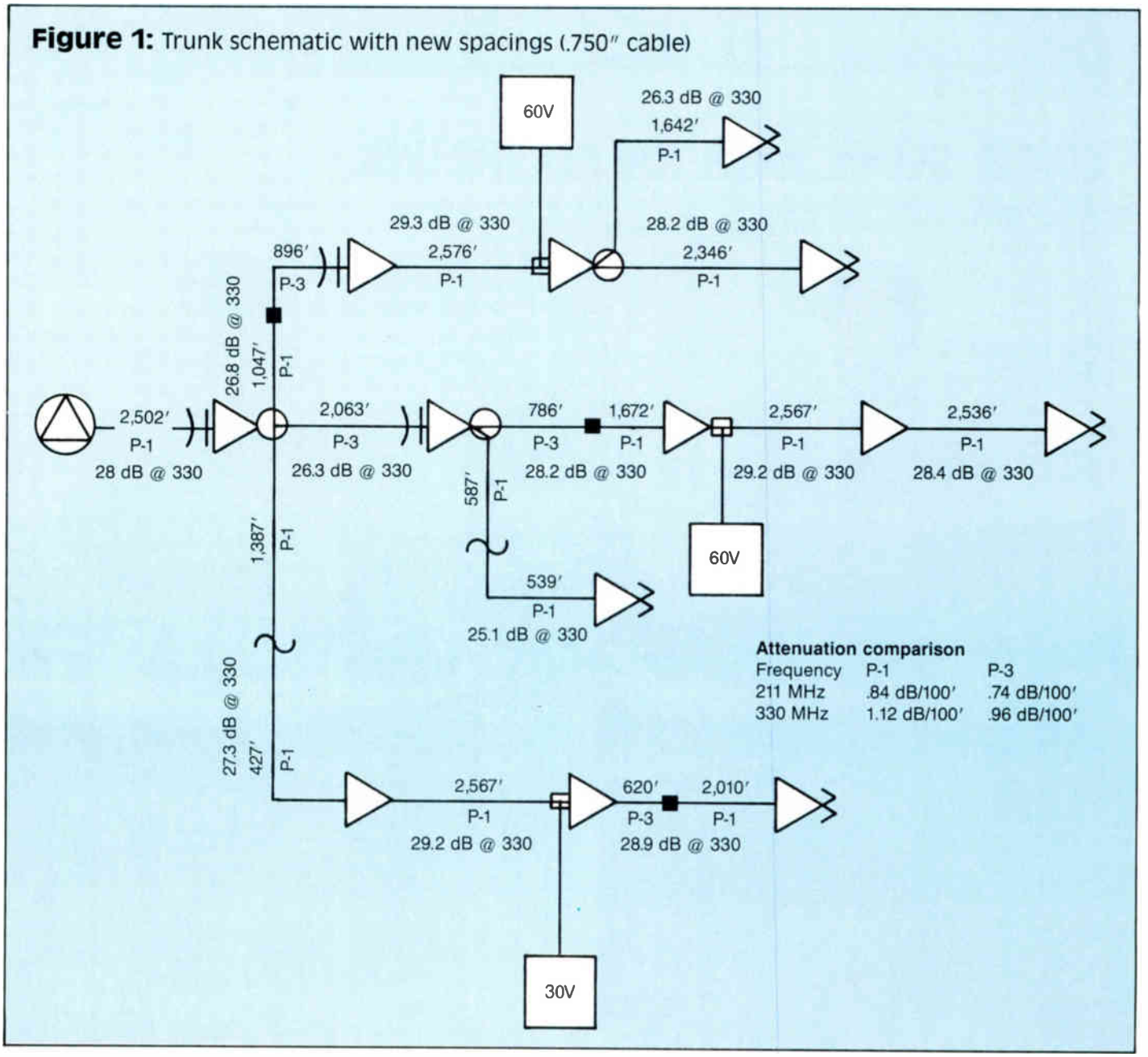
**By Dale Lutz**
Applications Engineer, Distribution Products
Scientific-Atlanta Inc

Once the decision has been made that a system is in need of additional channel capacity, all aspects of that system should be reviewed to ensure that nothing falls through the cracks (e.g., newly rebuilt or upgraded plant offers little improvement if headend considerations are overlooked). There are five major areas of concern that need strict coordination so all aspects of the rebuild and/or upgrade are completed on time. They are: 1) headend, 2) distribution, 3) drop, 4) terminal equipment and 5) construction.

### Headend

Expanded bandwidth over a cable system necessitates additional modulators, processors, antennas, etc., and, if adding hub sites for cascade considerations, possible microwave equipment. This means additional rack space. If no spare rack space is available does the possibility of

**Figure 1:** Trunk schematic with new spacings (.750" cable)



building expansion exist? Is the headend property large enough for this to occur? Is the land owned or leased? If additional TVRO antennas are planned, where will they go? What are the air-conditioning requirements for the revamped building?

If multiple hub sites are being incorporated into the system, a number of items need to be reviewed. First, land must be acquired. Next, unless the hub site is to act as a stand-alone headend, an interconnect should be implemented. There are several ways to build this interconnect. Cable, fiber optics and microwave usually top the list. Each needs careful study to determine how each helps the rebuild and how they affect long-range maintenance.

**Distribution**

Distribution has the most variables. However, regardless of whether it's a rebuild or an upgrade, accurate starting information is imperative. Design and construction of the new system will do little good if the foundation (strand maps) are inaccurate. As well, during the mapping process, remember the MDUs (multiple dwelling units).

For a complete rebuild a decision must be made on the equipment best suited for expansion requirements. All alternatives of active devices (such as push-pull, parallel hybrid or feedforward technology), cable size for best cascade results and power supplies for the most efficient system powering must be scrutinized closely against system geography. This is to assure the best possible quality-vs.-dollars ratio. From an operational standpoint, a rebuild will result in two systems. The existing one must stay active until the new system is built and all subscribers are attached. So, for a time, operating expenses will increase.

There are three goals in an upgrade: 1) use existing cable, 2) employ active devices that will "drop into" existing locations and 3) change-out as few passive devices as possible for the expanded channel capacity. This usually requires high-gain, advanced technology actives. With this approach it is easy to see that accuracy of the as-built maps is crucial. Upgrades also require close inspection of the connector/splice line in the existing system. In older systems, the use of non-mandrel type connectors is likely. The new expanded channel capacity will probably require previously unused aeronautical frequencies where potential leakage is a concern.

From an operational standpoint, office staff should be prepared for a deluge of calls from subscribers. Since the upgrade is accomplished by desplicing/resplicing equipment, service to customers will be intermittent. To combat this, trunk work should be scheduled for early morning hours (12-6 a.m.).

Both rebuilds and upgrades have their own distinct advantages that can only be weighed on a system-by-system basis. However, if viable, an upgrade is much more economical.

**Drop**

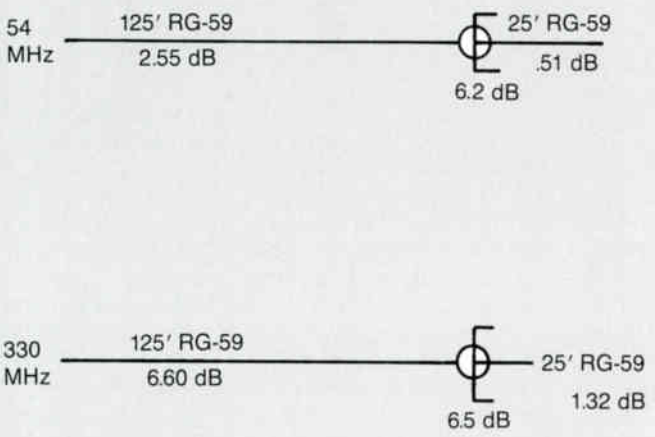
This area is mentioned for several reasons. First, manufacturer and type of cable used must be verified to assure the "passibility" of the new upper frequency. Derive attenuation at this new frequency and check the shield quality. If the shield quality is low, drop-change-outs may be required to eliminate any potential leakage problems. Second, special information pertaining to the drops in the system is required for the system design. The information required is the average drop length and average outlets per drop. This data allows minimum/maximum tap output specifications to be calculated to ensure sufficient levels for subscriber use.

During the drop verification analyze the installation and grounding techniques. Though codes change little through the years installation supervisors do. The rebuild or upgrade gives you a good reason to bring all installations to uniform standards. This also allows time to acquire an accurate drop audit to update billing data bases and convert illegals to paying customers.

**Terminal equipment**

The choice of terminal equipment or set-top terminals (STTs) is usually a direct decision with minimal variances. The new channel capacity will invariably lead to revised channel lineups, the development of tier packages for sales/marketing strategies and possibly the introduction of a new scrambling technique. Can the existing equipment be used in this new scenario? Probably not. The types of scrambling techniques, addressability

**Figure 2:** Calculating tap output levels




| Item | 54 MHz loss | 300 MHz loss |
|---|---|---|
| RG-59 | 2.04 dB/100′ | 5.28 dB/100′ |
| Split | 6.2 dB | 6.5 dB |

**Minimum tap outputs**
54 MHz = 9.26 dB (9 dB)
330 MHz = 14.4 dB (15 dB)

(on- and off-premise), parental control, etc., on the market today are numerous. Once again, close scrutiny is required to assure the best choice for the dollar.

### Construction

This is where most cost savings can be attained. A rebuild is, in effect, the construction of a completely new system. Therefore, construction costs are identical to a new-build. However, added to this are the additional costs of raising and/or lowering existing plant, "swinging" the drops from the old to new plant and the "wreck-out" of the existing system. Typically local utilities jump at the opportunity to have their maps updated and will require total make-ready work and the re-permitting of the entire aerial system. City, county and state bodies also will usually require the same for underground work.

During an upgrade, no (or very little) new cable will be added to the system. Therefore, re-permitting is not generally required. However, be prepared to raise and/or lower some aerial attachments to clean up any clearance violations, and review and update bonding/grouding and guying/anchoring techniques. Since an upgrade is generally a desplice/resplice of active/passive equipment, all other construction costs usually incurred (place strand, place cable, lash cable, etc.) are not there. Because of the demand for odd work hours (i.e., early morning) some individual item pricing may seem out of line. However, once the total picture is examined, the upgrade is still the most cost-effective way to increase a system's capacity.

### Upgrade equipment selection

The key to a successful system upgrade is to choose the active/passive equipment providing the required expanded channel capacity with 1) as little system rework as possible and 2) at the lowest possible cost. This is accomplished by a detailed study of the system layout vs. available equipment.

Initially, the system should be completely reverified (strand and plant). Having correct as-built maps is imperative for an upgrade to be properly constructed. From these as-builts a detailed trunk schematic map should be designed. It should show all cable routing, size and type. Trunk stations, plus power supply type and locations should be noted with footages for each type of cable between all active/passive devices. As well, this schematic will provide information to determine the maximum spacing at the new frequency and existing cascades. When figuring the maximum spacing be certain to calculate in all the different cable types and passive

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*Reader Service Number 32.*

**Table 1:** Output levels for feedforward trunk amps with push-pull bridgers and line extenders

330 MHZ SCIENTIFIC ATLANTA DISTORTION ANALYSIS SYSTEM: S/S
SYSTEM NAME..HYPOTHETICAL DATE...6-22-87

| EQUIPMENT: | | | | F9330T | | PP330B | | PP330L | |
|---|---|---|---|---|---|---|---|---|---|
| NOISE FIGURE | 1 | 14 | 27 | 9.0 | 40 | 7.5 | 53 | 9.0 | |
| DISTORTION REF LEVEL | 2 | 15 | 28 | 33.0 | 41 | 46.0 | 54 | 46.0 | |
| CTB RATING(-dBmv) | 3 | 16 | 29 | -107.0 | 42 | -70.0 | 55 | -70.0 | |
| XMOD RATING(-dBmv) | 4 | 17 | 30 | -106.0 | 43 | -65.0 | 56 | -66.0 | |
| 2nd RATING(-dBmv) | 5 | 18 | 31 | -104.0 | 44 | -74.0 | 57 | -74.0 | |
| HUM RATING(-dBmv) | 6 | 19 | 32 | -70.0 | 45 | -70.0 | 58 | -70.0 | |
| OPERATIONAL TILTS | 7 | 20 | 33 | 3.0 | 46 | 7.0 | 59 | 7.0 | |
| REF CH. CAPACITY | 8 | 21 | 34 | 40.0 | 47 | 40.0 | 60 | 40.0 | |
| DESIRED CH. LOADING | 9 | 22 | 35 | 40.0 | 48 | 40.0 | 61 | 40.0 | |
| AMPLIFIER INPUT | | | | 9.5 | | 16.0 | | 14.0 | |
| OPERATIONAL GAIN | 10 | 23 | 36 | 29.5 | 49 | | 62 | 32.0 | |
| BR. MIN FULL GAIN | 11 | 24 | 37 | | 50 | 33.0 | 63 | | |
| CASCADE LENGTH | 12 | 25 | 38 | 29.0 | 51 | 1.0 | 64 | 2.0 | |
| AMPLIFIER OUTPUT | 13 | 26 | 39 | 39.0 | 52 | 49.0 | 65 | 46.0 | |

| | INDIVIDUAL | | | TOTAL |
|---|---|---|---|---|
| CARRIER/NOISE . . | -45.1 | -63.7 | -57.2 | -44.8 |
| CROSSMOD . . . . . | -64.8 | -59.0 | -60.0 | -51.4 |
| CTB . . . . . | -65.8 | -64.0 | -64.0 | -55.0 |
| 2nd . . . . . | -83.4 | -71.0 | -71.0 | -67.9 |

losses. Also, allow for future growth. (See Figure 1.)

The hypothetical system shown in Figure 1 is being expanded from 211 MHz to 330 MHz. The trunk schematics indicate that the 22 dB/211 MHz existing spacings have 29.3 (30) dB maximum spacing at 330 MHz. Within the industry trunk stations are available with gain ranges from 22 to 30 dB of operating gain. In this instance 30 dB gain modules are required. To achieve this high gain, feedforward electronics are needed. This technology not only achieves higher gain but provides much improved distortion performance. This will prove instrumental in meeting end performance requirements.

The next step is to look at the various types of existing trunk amps and line extenders in the system. Ideally for the most cost-effective upgrade, all housings will be kept intact only replacing the modules. But in reality the system will most likely have quite a variety of housing types. The key is to find the largest quantity of the same type of housings and find the high-gain feedforward modules that drop into them. Generally, while expanding to the new frequency the system will be upgraded to two-way capability and possibly two-way active. Accomplishing either of these may entail more than just a module change-out. If the housings have a removable base plate the diplex filters probably are located there and may

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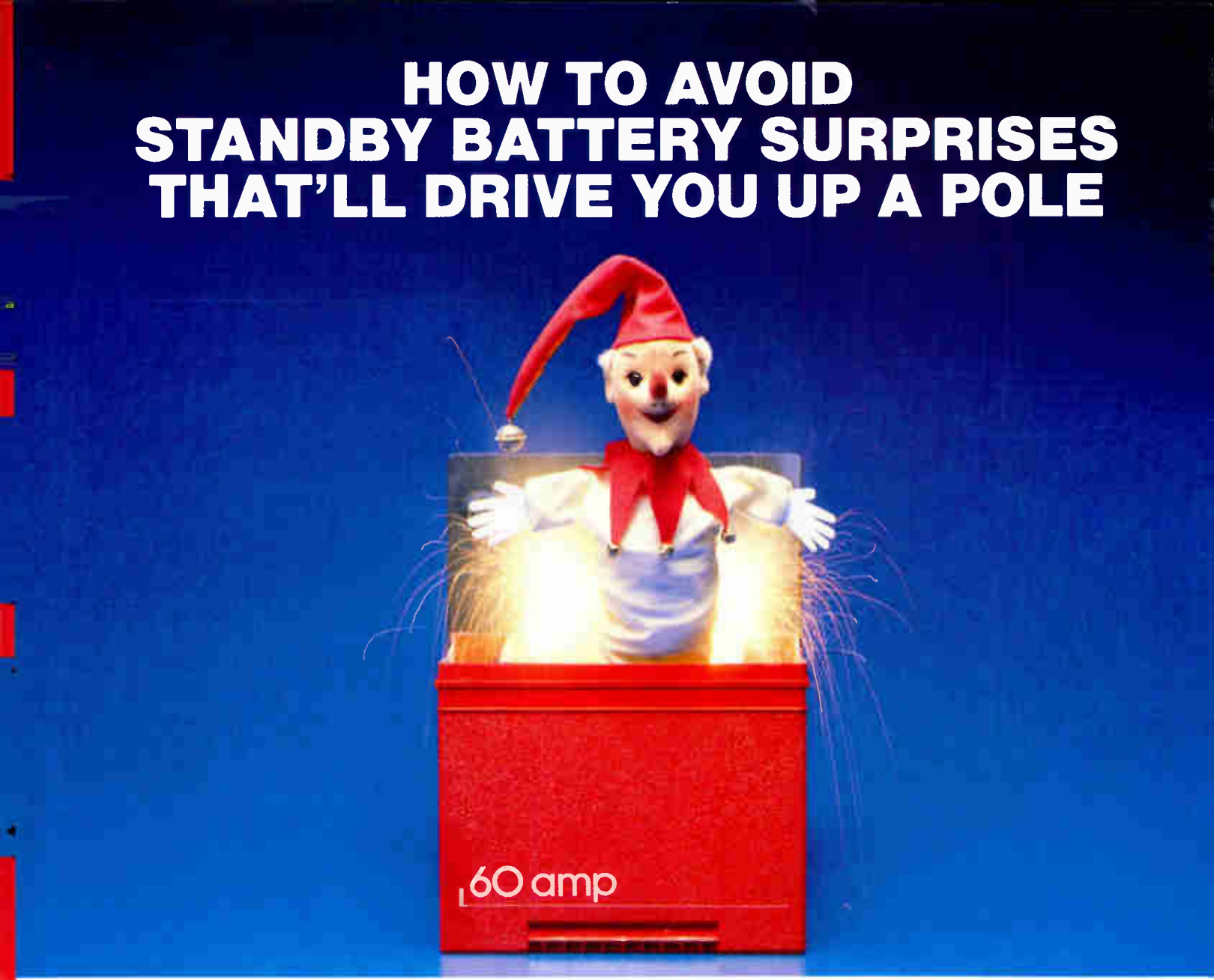


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*Reader Service Number 35.*

**Table 2:** Output levels for feedforward trunk amps, parallel hybrid bridgers and push-pull line extenders

330 MHZ SCIENTIFIC ATLANTA DISTORTION ANALYSIS SYSTEM: S/S

SYSTEM NAME..HYPOTHETICAL DATE...6-22-87

| EQUIPMENT: | | | | F9330T | | PH330B | | PP330L | |
|---|---|---|---|---|---|---|---|---|---|
| NOISE FIGURE | 1 | 14 | 27 | 9.0 | 40 | 7.5 | 53 | 9.0 | |
| DISTORTION REF LEVEL | 2 | 15 | 28 | 33.0 | 41 | 46.0 | 54 | 46.0 | |
| CTB RATING(-dBmv) | 3 | 16 | 29 | -107.0 | 42 | -74.0 | 55 | -70.0 | |
| XMOD RATING(-dBmv) | 4 | 17 | 30 | -106.0 | 43 | -70.0 | 56 | -66.0 | |
| 2nd RATING(-dBmv) | 5 | 18 | 31 | -104.0 | 44 | -70.0 | 57 | -74.0 | |
| HUM RATING(-dBmv) | 6 | 19 | 32 | -70.0 | 45 | -70.0 | 58 | -70.0 | |
| OPERATIONAL TILTS | 7 | 20 | 33 | 3.0 | 46 | 7.0 | 59 | 7.0 | |
| REF CH. CAPACITY | 8 | 21 | 34 | 40.0 | 47 | 40.0 | 60 | 40.0 | |
| DESIRED CH. LOADING | 9 | 22 | 35 | 40.0 | 48 | 40.0 | 61 | 40.0 | |
| AMPLIFIER INPUT | | | | 9.5 | | 18.0 | | 15.0 | |
| OPERATIONAL GAIN | 10 | 23 | 36 | 29.5 | 49 | | 62 | 32.0 | |
| BR. MIN FULL GAIN | 11 | 24 | 37 | | 50 | 32.0 | 63 | | |
| CASCADE LENGTH | 12 | 25 | 38 | 29.0 | 51 | 1.0 | 64 | 2.0 | |
| AMPLIFIER OUTPUT | 13 | 26 | 39 | 39.0 | 52 | 50.0 | 65 | 47.0 | |

| | INDIVIDUAL | | | TOTAL |
|---|---|---|---|---|
| CARRIER/NOISE . . | -45.1 | -65.7 | -58.2 | -44.9 |
| CROSSMOD . . . . . | -64.8 | -62.0 | -58.0 | -51.6 |
| CTB . . . . . | -65.8 | -66.0 | -62.0 | -54.8 |
| 2nd . . . . . | -83.4 | -66.0 | -70.0 | -64.5 |

be soldered in. If so, the module and base plate must be changed.

Trunk amp and line extender housings produced in the past five years were constructed with wire mesh gaskets for RFI/EMI (radio frequency interference/electron magnetic interference) integrity. This factor is vital during upgrades to combat potential RF leakage in the expanded frequencies. If the housings do not have this protection they should be replaced even if they meet the drop-in module requirement.

Housings that do not have module upgrade capability also must be replaced. This generally means cutting the cable at input and output. In doing so, if expansion loops were not built in, the space left will require a longer housing. If the product line chosen for the upgrade does not have the longer housings, either extension connectors or a splice are required at each location to extend the existing cable.

The majority of the system rework (desplice/resplice) takes place in the taps and passives of the feeder portion. Testing must be done to assure that all taps and passives will pass the new frequency; if not they, too, must

be replaced. A significant cost savings can be realized if the face plates of these devices are replaceable with newer ones. This allows a simple switch of this item rather than buying and replacing the whole piece.

Like the active housings, cable and connector leakage is a concern where taps and passives are located. Older tap/passive connections did not have RFI gasketing to deter leakage. In this case, replace the entire tap or passive to prevent potential problems.

In addition, feedforward electronics have increased current requirements over the existing equipment. It is possible that the current draw on the existing power supplies is beyond designed capacity. The upgrade is a good time to re-evaluate system powering and convert the system to all 60-volt standby power supplies. In those instances where the power supply current draw is too high, that portion of the system should be repowered or converted to a station with increased load capacity.

**Performance analysis when upgrading**

In system upgrades, or any build, there is a point where analyses must be run to customize operational levels to obtain acceptable end system performance. Once system verification is completed and equipment selection is made, this analysis can be performed and the new design started.

We will now take a hypothetical system through this process. The system is an existing 211 MHz system being upgraded to 330 MHz. Existing operational parameters are:

| | Trunk amp | Bridger amp | Line extenders |
|---|---|---|---|
| Input (dBmV) | 10 | NA | 21 |
| Gain (dB) | 22 | NA | 27 |
| Output (dBmV) | 33/28 | 48/41 | 48/41 |
| Cascade | 29 | 1 | 1* |

*Or 2 line extenders with levels derated by 3 dB

If the system is typical of older lower frequency ones, there is a variety of amplifier brands in use. To calculate end performance, even if you could gather all the station specifications, would be burdensome. Assume the system meets or exceeds the old minimum FCC requirements of: carrier-to-noise (C/N), 36 dB; cross modulation (X-MOD), 46 dB; composite triple beat (CTB), 46 dB; and second-order distortion (2nd), 46 dB.

From the trunk schematic it was found that at the required upgrade frequency of 330 MHz, maximum trunk amp spacings are 29.3 dB. To achieve this gain requirement, feedforward trunk modules are required. We can now use this information to run an analysis of this system at the expanded frequency. End performance requirements at 330 MHz are as follows: C/N, −45 dB; X-MOD, −51 dB; CTB, −53 dB; and 2nd, −60 dB. (Note: End performance requirements vary according to personal judgement. These are minimum specifications Scientific-Atlanta strives for for a one-way balanced temperature system (68°F). The effects of reverse signals, headend performance, converter performance, temperature swing and peak-to-valley results will degrade these further.)

Tables 1, 2 and 3 show maximum output levels allowed utilizing different combinations of electronics. To keep feeder system rework to a minimum, levels at 330 MHz need to be higher than the existing 211 MHz levels (48 dBmV). Generally, the levels require a minimum increase of the following amounts to keep feeder rework to a minimum:

| Frequency from – to | Feeder levels increased by |
|---|---|
| 211 – 330 MHz | 3 dB |
| 300 – 330 MHz | 2 dB |
| 300 – 400 MHz | 3 dB |
| 300 – 450 MHz | 4 dB |

Increasing feeder levels by these amounts does not assure total drop-in upgradeability. However, this amount of increase will allow the majority of the feeder systems to be upgraded with minimal rework. In this instance, the feeder levels are best suited for an upgrade using feedforward trunk amps with parallel hybrid bridgers and line extenders.

The last operational specification required is the minimum tap output levels for 54 MHz and 330 MHz. From system verification and billing files

**Table 3:** Output levels for feedforward trunk amps with parallel hybrid bridgers and line extenders

330 MHZ SCIENTIFIC ATLANTA DISTORTION ANALYSIS SYSTEM: S/S

SYSTEM NAME..HYPOTHETICAL DATE...6-22-87

| EQUIPMENT: | | | | F9330T | | PH330B | | PH330L | |
|---|---|---|---|---|---|---|---|---|---|
| NOISE FIGURE | 1 | 14 | 27 | 9.0 | 40 | 7.5 | 53 | 9.0 | |
| DISTORTION REF LEVEL | 2 | 15 | 28 | 33.0 | 41 | 46.0 | 54 | 46.0 | |
| CTB RATING(-dBmv) | 3 | 16 | 29 | -107.0 | 42 | -74.0 | 55 | -75.0 | |
| XMOD RATING(-dBmv) | 4 | 17 | 30 | -106.0 | 43 | -70.0 | 56 | -70.0 | |
| 2nd RATING(-dBmv) | 5 | 18 | 31 | -104.0 | 44 | -70.0 | 57 | -73.0 | |
| HUM RATING(-dBmv) | 6 | 19 | 32 | -70.0 | 45 | -70.0 | 58 | -70.0 | |
| OPERATIONAL TILTS | 7 | 20 | 33 | 3.0 | 46 | 7.0 | 59 | 7.0 | |
| REF CH. CAPACITY | 8 | 21 | 34 | 40.0 | 47 | 40.0 | 60 | 40.0 | |
| DESIRED CH. LOADING | 9 | 22 | 35 | 40.0 | 48 | 40.0 | 61 | 40.0 | |
| AMPLIFIER INPUT | | | | 9.5 | | 19.0 | | 20.0 | |
| OPERATIONAL GAIN | 10 | 23 | 36 | 29.5 | 49 | | 62 | 28.0 | |
| BR. MIN FULL GAIN | 11 | 24 | 37 | | 50 | 32.0 | 63 | | |
| CASCADE LENGTH | 12 | 25 | 38 | 29.0 | 51 | 1.0 | 64 | 2.0 | |
| AMPLIFIER OUTPUT | 13 | 26 | 39 | 39.0 | 52 | 51.0 | 65 | 48.0 | |

| INDIVIDUAL | | | | TOTAL |
|---|---|---|---|---|
| CARRIER/NOISE . . | -45.1 | -66.7 | -63.2 | -45.0 |
| CROSSMOD . . . . . | -64.8 | -60.0 | -60.0 | -51.8 |
| CTB . . . . . | -65.8 | -64.0 | -65.0 | -55.3 |
| 2nd . . . . . | -83.4 | -65.0 | -68.0 | -63.2 |

we find that the drop cable type is RG-59, average drop length is 125 feet and the average number of outlets per drop is 2.2. Generally, tap outputs are designed to achieve a 0 dBmV level at each TV set or converter box. Figure 2 shows the calculations to determine 54 MHz and 330 MHz minimum tap output levels.

To achieve proper levels at the TV set (0 dBmV) the minimum level required out of each tap is 9 dBmV at 54 MHz, and 15 dBmV at 330 MHz. The reason for these high tap levels is: 1) a three-way splitter was used to allow for the 2.2 outlets/drop and 2) the existing RG-59 cable is fairly lossy. These minimum level requirements can be reduced to calculating just a two-way splitter loss (and note where additional signal is required for extra outlets) and by switching to a larger drop cable (RG-6), which has less attenuation.

With this analysis now complete, trunk, feeder and tap output levels have been established to assure upgradeability with minimal rework, while obtaining quality end of system performance.

## Pulse generator

Berkeley Nucleonics is introducing its Model 6030 light pulse generator with pulsed, impulse, CW, digital and analog light output capabilities. It provides logic pulses of light with adjustable repetition rate, delay and width timing controls and adjustable high- and low-level power controls. The product is also able to modulate the light source with analog and digital signals up to a bandwidth of 800 MHz.

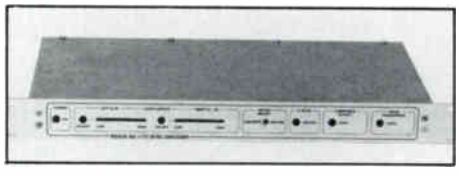
The Model 6030 comes in both 1,300 nm and 1,550 nm versions and allows for wavelength interchangeability. It uses single-mode fiber with biconic, FC or Diamond output connector options. Other operating modes include square wave, double pulse, zero baseline, single cycle, and external trigger and drive.

For more information, contact Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, Calif. 94710, (415) 527-1121; or circle #94 on the reader service card.

## Amplifiers

C-COR Electronics is introducing its PT-500 Series PHD (power hybrid doubling) trunk amplifiers to its CATV product line. The new amps are designed to be a cost-effective intermediate range alternative to conventional and feedforward amps. According to C-COR, the parallel hybrid circuitry provides 6 dB improved output performance.

For more details, contact C-COR, 60 Decibel Rd., State College, Pa. 16801, (814) 238-2461; or circle #138 on the reader service card.



## Stereo encoder

The Model SG-1/TV BTSC encoder from Nexus Engineering utilizes the dbx noise reduction system and can encode any stereo audio source into a BTSC composite or 4.5 MHz subcarrier stereo signal. The audio level indicators are calibrated to the internal 4.5 MHz modulator, said to eliminate field setup errors and measuring equipment.

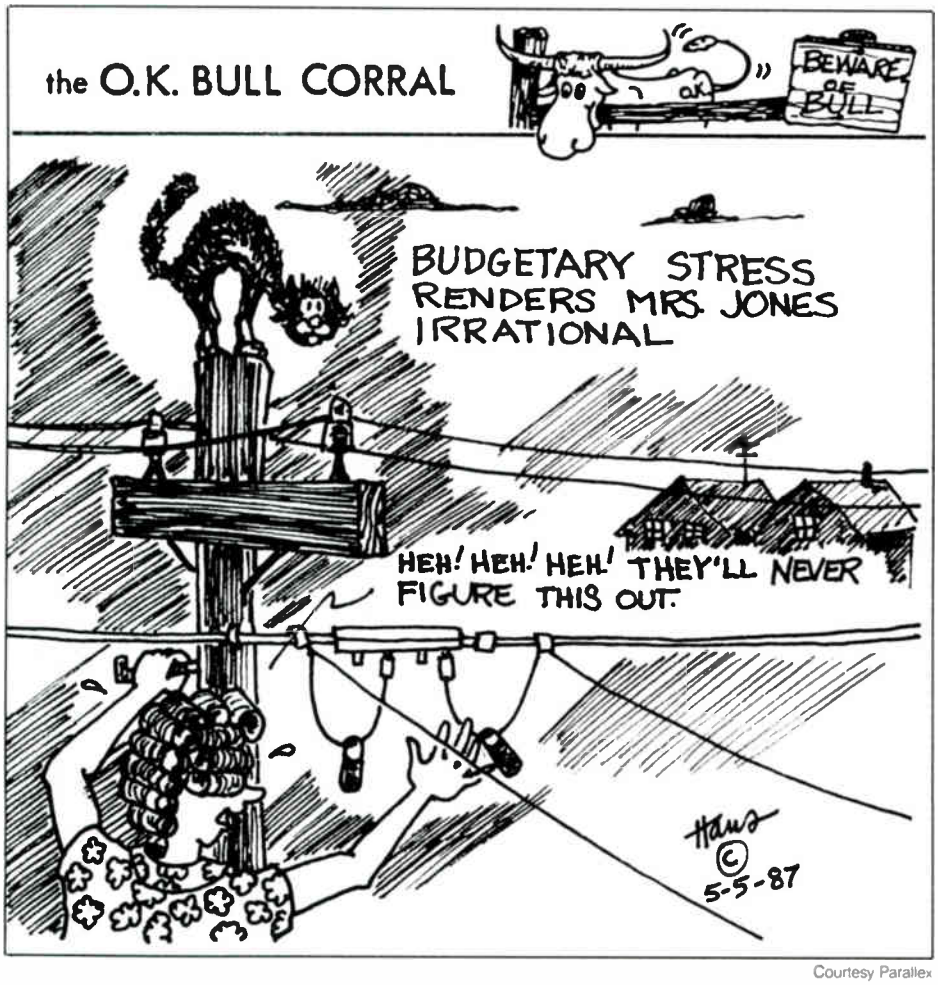
For further information, contact Nexus, 7000 Lougheed Hwy., Burnaby, B.C. V5A 4K4 Canada, (604) 420-5322; or circle #135 on the reader service card.

## 600 MHz taps

Texscan Corp.'s Communication Products Division is offering its new line of taps that span the 5-600 MHz frequency range. The products feature aerial or pedestal mounting with rotating seizure mechanisms, weather sealing with molded neoprene gaskets and radiation sealing with RFI gasket sealing.

The products contain corrosion-resistant brass F connectors with electro tin plating. The tap housing is alloy 360 aluminum with acrylic permacote for maximum corrosion protection. Port spacing allows up to the maximum number of channel traps required per tap. Also, shrink sleeving collars allow direct application of shrink sleeving for weather protection.

For more details, contact Texscan Corp., Communication Products Division, 10841 Pellicano Dr., El Paso, Texas 79935, (915) 594-3555; or circle #134 on the reader service card.




Courtesy Parallex


## Remote control

Zenith announced its new Personal Control Center (PCC) remote control device, able to operate at least 18 brands of color TV sets, 19 brands of VCRs and eight brands of cable converters. According to the company, the PCC does not have to learn infrared command codes, but has more than 35 codes built in.

After a one-time setup of a series of internal switches, the customer can control the television, VCR or converter. For customers with a remote

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control set, the PCC operates volume control through the TV, not the converter. This is said to provide optimal performance for MTS reception.

For more information, contact Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, Ill. 60025, (312) 391-8181; or circle #128 on the reader service card.

## Technical software

Image Processing Systems is offering its Turbofonts word processing software. The product is designed for users who need to incorporate scientific, foreign language or specialized business characters within word processing documents using an IBM or compatible computer. The new software allows the user to see on the screen, as well as to print, all the characters from over 30 different sets (Greek and other languages, math, statistics, engineering, business, etc.).

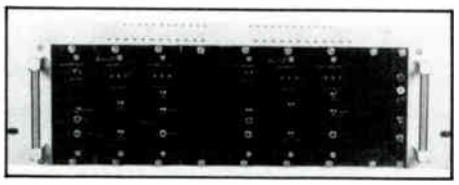
For more information, contact Image Processing Systems, 6409 Appalachian Way, Madison, Wis. 53705, (608) 233-5033; or circle #100 on the reader service card.


## Microwave radio

M/A-COM MAC has introduced its MA-18CC microwave radio operating in the 17.7 to 19.7 GHz band. The product is a solid-state FM microwave communication system designed for broadcast and high-definition TV applications. It meets EIA standard RS-250B for short-haul transmission and can carry one video and up to three audio subcarriers over 15 miles.

The system features field-tunable RF frequencies, built-in diagnostic alarms, and options such as LNA, narrow-band IF, multiplexing and hot-standby protection. The weather-resistant RF transceiver assembly is designed for outdoor use and is field tunable over the full 470 MHz segment of the band. The transmitter features an RF source phase-locked to a stable crystal reference, plus high-power output and a built-in RF monitor test port.

For more information, contact M/A-COM MAC, 5 Omni Way, Chelmsford, Mass. 01824, (617) 272-3100; or circle #93 on the reader service card.



## FM equipment

A new line of FM equipment, the 800 Series, is being offered by Pirelli Optronic Systems. The broadband units meet or exceed RS-250B requirements for TV signal transmission. All 800 Series plug-in modules use large-scale integrated hybrid circuits that are said to eliminate most discrete components and reduce circuit noise.

Audio and video modules feature front panel switches for user-controlled frequency agile operation. Video frequencies are selectable in 1 MHz steps from 40 to 540 MHz; audio, in 0.5 MHz steps from 5 to 7.5 MHz. The system is available in carrier deviations of 4, 8, 10.75 or 13.5 MHz peak.

For more information, contact Pirelli Optronic Systems Corp., 300 Research Pkwy., Meriden, Conn. 06450, (203) 238-9665; or circle #92 on the reader service card.

## BTSC generator

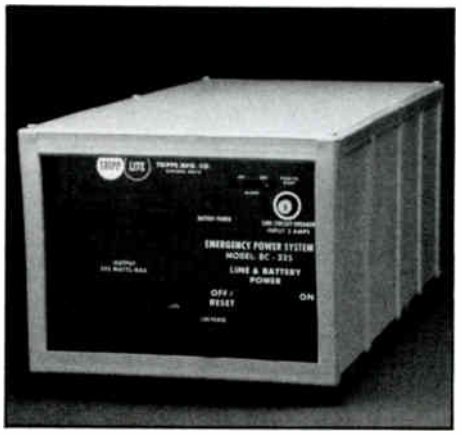
Catel Telecommunications is offering its Model TVS-2000 BTSC television stereo generator. This product uses the dbx companding system and is said to provide high quality BTSC stereo signals. It will provide either a baseband composite stereo signal or a 4.5 MHz subcarrier signal. All operating controls are front panel mounted and the unit has dual LED modulation meters for audio level indication.

For more details, contact Catel, 4050 Technology Pl., Fremont, Calif. 94537-5122, (415) 659-8988; or circle #139 on the reader service card.

## Satellite receiver

Microdyne announced its Model 1100-CKR satellite video receiver that provides commercial quality reception for both C- and Ku-band applications. The product is designed for long-term continuous use. According to the company, it allows precise selection of any C- or Ku-band transponder via its front panel 1 MHz step tuner. The model also features a 30 MHz IF filter as standard with filter options from 18 to 40 MHz available.

For more details, contact Microdyne Corp., P.O. Box 7213, Ocala, Fla. 32672-0213. (904) 687-4633; or circle #124 on the reader service card.



## Battery backup

Tripp Lite has announced its Model BC-325, a 325-watt battery backup system. In addition to offering protection against power failures, the product is said to feature full brownout protection. It also has a built-in filtering network that guards against transient spikes and line noise when operating on AC power.

The BC-325 includes a maintenance-free gel cell battery, regulated battery charger and alarm with reset. It supplies 60 minutes of emergency power at half load and 25 minutes at full load.

For more information, contact Tripp Lite, 500 N. Orleans, Chicago, Ill. 60610, (312) 329-1777; or circle #91 on the reader service card.

## Spectrum analyzer

The new HP8590A Option H50 from Hewlett-Packard's Signal Analysis Division is a CATV tester version of its portable RF spectrum analyzer. It has all the capabilities of the standard

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**1. Are you a member of the SCTE (Society of Cable Television Engineers)?**
Yes ☐ No ☐

**2. In the performance of my job, I authorize, specify or purchase products and/or services.**
Yes ☐ No ☐

**3. Please check the category that best describes your firm's primary business (please check only one).**

1. Cable TV Systems Operations
- ☐ a. Independent Cable TV Systems
- ☐ b. MSO (two or more Cable TV Systems)
- ☐ 2. Cable TV Contractor
- ☐ 3. Cable TV Program Network
- ☐ 4. SMATV or DBS Operator
- ☐ 5. MDS, STV or LPTV Operator
- ☐ 6. Microwave or Telephone Company
- ☐ 7. Commercial Television Broadcaster
- ☐ 8. Cable TV Component Manufacturer
- ☐ 9. Cable TV Investor
- ☐ 10. Financial Institution, Broker, Consultant
- ☐ 11. Law Firm or Government Agency
- ☐ 12. Program Producer or Distributor
- ☐ 13. Advertising Agency
- ☐ 14. Educational TV Station, School or Library
- ☐ 15. Other _____ (please describe)

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Title _____

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| 3 | 17 | 31 | 45 | 59 | 73 | 87 | 101 | 115 | 129 |
| 4 | 18 | 32 | 46 | 60 | 74 | 88 | 102 | 116 | 130 |
| 5 | 19 | 33 | 47 | 61 | 75 | 89 | 103 | 117 | 131 |
| 6 | 20 | 34 | 48 | 62 | 76 | 90 | 104 | 118 | 132 |
| 7 | 21 | 35 | 49 | 63 | 77 | 91 | 105 | 119 | 133 |
| 8 | 22 | 36 | 50 | 64 | 78 | 92 | 106 | 120 | 134 |
| 9 | 23 | 37 | 51 | 65 | 79 | 93 | 107 | 121 | 135 |
| 10 | 24 | 38 | 52 | 66 | 80 | 94 | 108 | 122 | 136 |
| 11 | 25 | 39 | 53 | 87 | 81 | 95 | 109 | 123 | 137 |
| 12 | 26 | 40 | 54 | 68 | 82 | 96 | 110 | 124 | 138 |
| 13 | 27 | 41 | 55 | 89 | 83 | 97 | 111 | 125 | 139 |
| 14 | 28 | 42 | 56 | 70 | 84 | 98 | 112 | 126 | 140 |
| 15 | 29 | 43 | 57 | 71 | 85 | 99 | 113 | 127 | 141 |

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model plus a set of dedicated cable TV test functions for commonly needed tests.

Included are softkey functions for carrier-to-noise, carrier level, power line hum, cross modulation, composite triple beat, modulation depth and system frequency response. There is also a "channel select" function that allows the user to tune to a channel just by entering a number from 1 to 99.

For more information, contact Hewlett-Packard Signal Analysis Division, 1212 Valley House Dr., Rohnert Park, Calif. 94928, (707) 794-1212; or circle #137 on the reader service card.

## Fault locator

Hipotronics has introduced its Model T-50 cable fault locator using time domain reflectometry. The product is a microprocessor-based, battery-operated TDR with LCD display and printout capabilities. It also features a memory capability whereby previously tested cable pairs can be compared to cables under test.

The Model T-50 can locate load coils, splice points and sheath damage, as well as both close faults (from 0 to 820 feet) and those at distances up to 2.5 miles.

For more details, contact Hipotronics Inc., P.O. Drawer A, Brewster, N.Y. 10509, (914) 279-8091; or circle #98 on the reader service card.



## Impulse equipment

TV Answer announced its impulse equipment capable of enabling total interaction between the viewer and the television without the need for telephones or two-way cable. Using standard video insertion technology, a PC and a master "black box," a message is encoded into the main portion of a TV signal.

The message is inserted on a portion of the horizontal blanking interval of the signal overscanned by the television. The home unit attaches to a television, VCR or cable decoder; this unit decodes the message and displays it on the screen. To respond, the viewer presses the appropriate button on a standard wireless remote control. The home box then reads the response and transmits it to the cable headend or other designated collection point. Using a small receive antenna, viewer responses are collected and automatically processed by the PC.

For more details, contact TV Answer, 1229 19th St., N.W., Washington, D.C. 20036, (202) 659-2480; or circle #130 on the reader service card.

## Ku-band LNBs

Sony Satellite Communications Group announced its Models FSL-1800 and FSL-2000 Ku-band low noise block downconverters (LNBs). These AlGaAs/GaAs microwave HEMTs (high electron mobility transistors) are said to feature extremely low noise performance, high reliability and excellent local oscillator frequency stability.

The new products decrease noise to 1.8 dB maximum (1.6 dB typical) for the FSL-1800 and 2 dB maximum (1.8 dB typical) for the FSL-2000. Input and output VSWR is reduced to 2.2 maximum (1.7 typical) with both products; local oscillator frequency stability is improved to ±1 MHz maximum.

For more details, contact Sony Corp. of America, 9 W. 57th St., New York, N.Y. 10019., (212) 418-9470; or circle #129 on the reader service card.

## Deviation meter

FM Systems has announced its Model ADS-75 audio deviation standard; it operates in the FM broadcast band at 100.1 MHz and is said to produce a precision ±75 kHz calibration standard. When used with the Model ADM-1 audio deviation monitor and an FM tuner, the product can calibrate and measure the deviation of live program FM signals. It can operate in a stand-alone mode with power supplied by DC adaptors or may derive power from the remote accessory power plug on the ADM-1.

The product also expands the capability of the ADM-1 to include measuring program audio deviation of FM channels in the 88-108 MHz FM broadcast band in CATV systems.

For further details, contact FM Systems Inc., 3877 S. Main St., Santa Ana, Calif. 92707, (714) 979-3355; or circle #97 on the reader service card.

## Converters

Pioneer Communications of America is offering its Model BA-5000N, the enhanced version of its BA-5000 series addressable converter. The new model is said to offer enhanced BTSC transparency, improved pay-per-view and impulse PPV features, and expanded tag capability.

The new model incorporates a PPV confirmation feature, giving subscribers the ability to verify that a purchase has been authorized. It can store six confirmed purchases and identify 256 different PPV event codes. It also offers 550 MHz capacity as a standard feature.

For further details, contact Pioneer, Sherbrooke Office Centre, 600 E. Crescent Ave., Upper Saddle River, N.J. 07458-1827, (201) 327-6400; or circle #95 on the reader service card.

## TVRO system

Channel Master has announced its Model 6441 integrated C/Ku-band satellite receiver/positioner/descrambler. The VideoCipher II satellite receiver features a 30-function soft-touch infrared remote control, said to provide complete command of all receiver, dish positioner and descrambler functions of satellite reception.

Fully operational at the Ku-band, the product increases the video format to 32 channels, initiates video inversion and features a C/Ku switch output and Ku LED display. A microprocessor provides direct satellite entry, automatic format sensing and skew optimization. An audio seek feature automatically tunes in the precise audio frequency, according to the company.

For further information, contact Channel Master, P.O. Box 1416, Industrial Park Dr., Smithfield, N.C. 27577, (919) 934-9711; or circle #96 on the reader service card.

## Modulator

Standard Communications is introducing its model TVM60 frequency agile modulator. The product features PLL synthesis, FCC offsets, visual and aural loop-through, balanced/unbalanced audio input and BTSC 4.5 MHz stereo input. No modifications are required for the product to pass BTSC correctly. Front panel readouts include video over modulation, audio over deviation and channel illumination.

For more information, contact Standard Communications, P.O. Box 92151, Los Angeles, Calif. 90009-2151, (213) 532-5300; or circle #127 on the reader service card.

## Ad insertion

Grumman Electronics Systems is offering its AIS 5000 automatic ad insertion system for cable operators. It offers computerized control of spot commercial insertions, random access to recorded commercial material and the ability to com-

pletely automate the control of broadcast equipment as well as sales, billing and traffic operations.

For further details, contact Grumman, Sunrise Highway, A38-043, Great River, N.Y. 11739, (516) 435-6089; or circle #126 on the reader service card.

## Status monitor

The Jerrold Division of General Instrument has announced its advanced status monitoring system, designed to reduce maintenance costs. The system allows for monitoring forward and return levels, amplifier currents and powering status as well as controlling return feeder and bypass switches in trunk amps.

The headend computer polls the entire distribution system every 30 seconds, spotting any problems that might exist. In the field, the status monitoring modules can be dropped into JN and X Series amps and are compatible with power supplies and stand-alone stations.

For more information, contact Jerrold, 2200 Byberry Rd., Hatboro, Pa. 19040, (215) 674-4800; or circle #131 on the reader service card.

## Power monitor

Scientific-Atlanta announced a new stand-alone power supply status monitoring system compatible with its Model 6585 status monitoring/reverse switching system. The new product allows direct interface with the wiring harness of power supply products from Alpha Technologies, Lectro Power Supply and Data Transmission Devices.

The system provides an overview of the power supply status for the entire system or for critical locations. The system's tamper switch alerts the operator when unauthorized entry interferes with power distribution. The user can define up to 16 functions for monitoring.

For more details, contact Scientific-Atlanta, Box 105600, Atlanta, Ga. 30348, (404) 441-4000; or circle #133 on the reader service card.

## DSS software

Magnavox CATV Systems is offering three new software features for its digital system sentry (DSS) status monitoring: remote monitoring, automatic feedforward polling and automatic power supply polling. Remote montoring makes it possible to monitor a cable system from any location. The system operator with a personal computer can view the same status information previously available only at the system's main office or headend.

Also, feedforward amps and standby power supplies can be polled at a fixed time each day, as well as at any time with a single key stroke at the controlling computer.

For more details, contact Magnavox CATV, 100 Fairgrounds Dr., Manlius, N.Y. 13104, (315) 682-9105; or circle #132 on the reader service card.

## System analyzer

Wavetek Indiana announced its Model 1882 "Sweepless Sweep" system analyzer. At one location, a reference spectrum is stored in non-volatile memory. At yet another location, the stored reference is compared with the system spectrum and a normalized display is presented to the user. According to Wavetek, alignments of frequency response are made with no subscriber interference.

Measurements on a broadband system can be made over the range of 4 MHz to 1 GHz, and the unit is compatible with both horizontal and vertical sync suppression scrambling systems. The product also performs automated measurements of signal level, second- and third-order distortion, FM deviation, system leakage and so on.

For more details, contact Wavetek, 5808 Churchman, P.O. Box 190, Beech Grove, Ind. 46107, (317) 788-9351; or circle #136 on the reader service card.

## Processors

Precise Manufacturing is introducing its new heterodyne processor, Model CAP-600. The product is frequency synthesized; other features include dual heterodyne conversion, SAW filter, sync tip AGC, double balanced mixer, stereo signal pass-through, low heat generation, front panel controls, and test point and grounded AC convenience outlet.

For further information, contact Precise Manufacturing Co., 2143 E. Fifth St., Tempe, Ariz., 85281, (602) 967-0030; or circle #99 on the reader service card.

## BTSC encoder

Wegener Communications announced its Model 1602-95 single channel BTSC stereo encoder. The product is a 1¾-inch high unit and features dbx noise reduction, 14 kHz audio bandwidth, 4.5 MHz audio subcarrier and composite video output. It also includes balance audio inputs and a barrier strip interconnect.

For more information, contact Wegener, Technology Park/Johns Creek, 11350 Technology Circle, Duluth, Ga. 30136, (404) 623-0096; or circle #125 on the reader service card.

# Microwave systems

**By Terry Snyder**
Area Engineer, Tele-Communications Inc

For the cable operator who utilizes microwave for signal delivery the term *preventive maintenance* might attach an additional system responsibility. The overall concept is to maintain quantity and quality with as few outages to the subscriber as possible. Depending on how extensive the microwave system, this could affect just one channel or all channels delivered to the customer. Most systems using FM (frequency modulation) microwave carry only a few channels over a few hops. However, some systems utilizing AML (amplitude-modulated links) have a headend that feeds only the AML; all channel delivery is by microwave.

Both types of microwave do have certain things in common, usually considered peripheral to the microwave equipment itself. Yet they all directly affect the operation of the equipment. Let's begin with these.

*Waveguide*—The recommended waveguide support for EW 127A, for example, is every four feet. The weight of EW 127A is .29 pounds per foot. Needless to say, 150 feet of waveguide falling off the tower definitely could ruin your day. Waveguide runs occasionally get out of hand when attempting to negotiate corners. The minimum bending radii for EW 127A are 6 inches in the E plane and 15 inches in the H plane. Too sharp a bend results in an increased standing wave ratio (SWR) and a high probability exists of physically damaging the waveguide.

The pressurization and mechanical integrity of the waveguide connectors are of paramount importance. If you find pressure leaks in the waveguide, fix them as soon as practical, especially in coastal environments. Salt-laden air will corrode the interior walls of the waveguide, resulting in a power loss. If nitrogen is used for purging or for constant pressurization, use caution, as nitrogen is a dehydrating agent and in a confined building can cause suffocation. When pressurizing the waveguide be careful not to exceed the manufacturer's specification for pressure windows, both in the waveguide or the feedhorn of the antenna.

*Microwave antennas*—Most microwave antennas have a series of guy wires to keep the feedhorn at its focal point. Check to see if all the wires are in place. If one is missing, the feedhorn will be pulled off its focal point resulting in low receive carrier level, severely reducing the fade margin of the path.

Most microwave antennas have radomes to reduce tower windloading and protect the feedhorn from being damaged. There are two types of microwave antennas used in the CARS-band service: a standard and a high-performance. A standard antenna usually has a fiberglass radome that should be checked occasionally for holes and mechanical mounting. The high-performance antenna looks somewhat like a drum and has a fabric-like covering over the front. Sometimes a seam will open, creating a large wind scoop that increases tower stress during storm conditions. It's also an ideal location for some animals to take up residence.

Now let's consider the microwave equipment. At first glance it may seem as if there is not a lot you can do about preventive maintenance for the microwave, but by close monitoring some outages can be prevented. As you go through the checks, note that none of the front panel meter readings are used.

*AML microwave*

DC voltage checks—Primarily the driver amp DC voltage should be verified with a digital voltmeter and recorded; then you know if the front panel meter is correct. The klystron filament voltage should be checked periodically; this requires shutting down the klystron supply. The voltage should be set using the manufacturer's alignment procedures.

RF inputs—All channels should be maintained as close to the manufacturer's specs as possible. Don't forget that the pilot tone is included as a RF input. The pilot tone is used to drive a solid-state source or sources at the transmitter and also is used for AGC and VCXO (voltage-controlled crystal oscillator) control at the receiver. Both level and frequency of the pilot tone must be correct for the transmitter and receiver to operate correctly.

The VHF recovery test point tends to be a true indication of the combined transmitted signal. A lot of useful information can be found at this test point. Primarily, look for two things. First, see if all the levels are within 1 or 2 dB of each other when referenced to the pilot tone. The second is the intermodulation content created by each channel. The intermod test will require the removal of programming from the desired channel and complete removal of the two adjacent channels. If the intermod products are out of specs, it could result from the improper separation of visual and sound carriers. But it also can be an indication of an improperly aligned up-converter or a mixer diode about ready to fail. When all levels are properly set and intermod is still present on only one bay of channels, check the pump level on the klystron output. Remove the diode detector from the cross-guide coupler and measure the 12 GHz with a power meter.

For AML a good preventive maintenance program also should include a close monitoring of ambient room temperature and incoming line voltage.

*FM microwave*

Frequency—The frequency will affect the power output of the transmitter. Of course the frequency has to be maintained within the tolerance specified by the FCC. Most transmitters have a means of measuring the output frequency at a lower intermediate frequency (usually 50 or 70 MHz). Consult the manufacturer's manual for frequency alignment and multiplication factor to determine the final output frequency.

Power—Most transmitters have a cross-guide directional waveguide coupler for measuring the power output. However, the coupler must be calibrated in order to obtain a true reading. If the coupler is not calibrated then measure the power output of the transmitter prior to the filter. Then measure the power at the coupler. The difference between the two is the calibration factor for that coupler at that frequency.

Deviation—The deviation normally is checked annually or semi-annually. However, if a 2 GHz modulated oscillator or video baseband amp is replaced in the transmitter, the deviation should be set again. Not all manufacturers use the frequency or level for setting the deviation, so you have to follow the manufacturer's alignment procedure.

Baseband input level—The input level of the video should be maintained at 1 volt peak-to-peak. This will keep the transmitter fully deviated and the baseband noise minimized. The output of the receiver also should be maintained at 1 volt peak-to-peak for the modulator input.

When measuring the frequency and power out the frequency should be measured first as it affects the power output.

## Time intervals

Now the main question arises: How often should I perform these checks? Time intervals for the preventive maintenance program only can be determined by the local system. But a few suggestions are:

*AML*

- RF inputs: weekly.
- 12 GHz pump level: quarterly unless klystron is replaced.
- DC drivers: quarterly.
- Klystron supply: semi-annually; out of service measurement.
- Pilot tone frequency: every headend check.
- Overall transmit power out: annually; out of service adjustments.
- Intermod changes: semi-annual; out of service three channels at a time.

*FML*

- Baseband input: monthly.
- Frequency and power: monthly; these two measurements will give the most advanced indications of a pending failure.
- Deviation: annually unless an integral module failure has occurred.

The common peripherals (grounds, tower plumb, path alignments waveguide and antenna systems) should be checked at least on an annual basis. (These are only recommendations and not set time intervals for making these checks.)

The overall microwave preventive maintenance program should be designed to track declining system performance and allow you time to make the corrections or create the outage for repair at a time when *you* choose, not when the system fails.

*Jennings*

**Microwave Networks** named **Bruce Jennings** as vice president of sales. He will be responsible for all sales efforts toward the government, telco and international markets, as well as overseeing the company's direct-sales force. Prior to this, Jennings was vice president and general manager of the MAC Division of M/A-COM. Contact: 10795 Rockley Rd., Houston, Texas 77099, (713) 495-7123.

*Hynes*

**Mycro-Tek** named **Donna Hynes** its new vice president of engineering. She will be responsible for the successful development of all hardware and software undertaken by the company, as well as recommending new product directions. Prior to this, she was manager of software development for NCR. Contact: P.O. Box 47068, Wichita, Kan. 67201, (800) 835-2055.

**Scientific-Atlanta** appointed **J. Larry Bradner** to the position of president of its Broadband Communications Division. He was previously vice president and general manager for the division. Contact: 1 Technology Pkwy., Box 105600, Atlanta, Ga. 30348, (404) 441-4000.

**Oak Communications** announced the appointment of **Carl Brown** as vice president of marketing and sales. Prior to this, he was acting national sales manager for American Satellite Co. Contact: 16935 W. Bernardo Dr., Rancho Bernardo, Calif. 92127, (619) 451-1500.

**James Cownie**, president of the telecommunications Group of Heritage Communications, Des Moines, Iowa, was elected chairman of the board of directors of the **National Cable Television Association**. **John Goddard**, president and CEO of Viacom Cable, Pleasanton, Calif., was elected vice chairman.

Also, **Steven Dodge**, chairman and CEO of American Cablesystems Corp., Beverly, Mass., was elected secretary of the board; **Robert Miron**, executive vice president of Newhouse Broadcasting Corp., North Syracuse, N.Y., was elected treasurer. Contact: 1724 Massachusetts Ave., N.W., Washington, D.C. 20036, (202) 775-3629.

**Allied Steel and Tractor Products** announced the appointment of **Allen Springer** as vice president of sales and marketing. Prior to this, he was Allied's general sales manager.

**Stan Boyce** has been appointed technical service representative for Allied. Previously, he was distributor service manager.

Also, **Thomas Munch** has been appointed field product specialist of Allied's underground tools. He will be responsible for the training in the use of and demonstrations of piercing tools and pipe splitters. Contact: 5800 Harper Rd., Solon, Ohio 44139, (216) 248-2600.

**Wilbur Gantz** has been elected to a three-year term on **Zenith Electronics**' board of directors, replacing retiring director Thomas Ayers. Gantz is currently executive vice president and chief operating officer of Baxter Travenol Laboratories. Contact: 1000 Milwaukee Ave., Glenview, Ill. 60025, (312) 391-8181.

*Kenyon*

*Morgan*

**Barry Kenyon** has been named national CATV sales manager for **Texscan MSI**. Prior to this, he was product manager for headend systems and standby power supplies for the company.

Also, **Robert Morgan** has rejoined the company as marketing services manager. His previous position at Texscan was Western regional sales manager. Contact: 124 Charles Lindbergh Dr., Salt Lake City, Utah 84115, (801) 359-0077.

**C-COR Electronics** announced **Robert Beaury** as manager of data market. He will be responsible for developing and implementing a marketing plan for the company's broadband LAN products. Prior to this, Beaury was marketing manager of semiconductor assembly systems for Kulicke & Soffa Industries Inc.

**George Butts Jr.** has been named sales engineer of data and will provide technical sales support of LAN products in Eastern United States. Prior to this, Butts was a sales engineer for AM Communications.

Also at C-COR, **William Margiotta** has been named regional account executive for the Southwest. Prior to this, he was Western regional sales manager for Hughes Aircraft. Contact: 60 Decibel Rd., State College, Pa. 16801, (814) 238-2461.

**Ronald Denham** has been named product sales manager of premises wiring products at **Anixter Bros**. Prior to this, he was fiber-optic product manager for TRW's Connector Division. Contact: 4711 Golf Rd., 1 Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

*Chawla*

**Sudsy Chawla** has been appointed sales manager for the Western region at the **Video-Cipher Division** of General Instrument. He joined the company in 1969. Contact: 6262 Lusk Blvd., San Diego, Calif. 92121, (619) 535-2436.

**Scientific-Atlanta** announced the appointment of **Russell Paul** as manager of corporate communications. Prior to this, he was director of public relations for Lanier Business Products. Contact: 1 Technology Pkwy., Box 105600, Atlanta, Ga. 30348, (404) 441-4000.

**NYT Cable TV** appointed **Robert Breed** as its director of

engineering. Prior to this, he was a senior staff engineer with CBS Engineering and Development. Contact: 1250 Haddonfield-Berlin Rd., Cherry Hill, N.J. 08003, (609) 354-1880.

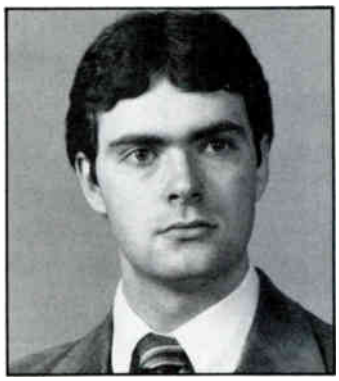
*Jenkins*

**Bob Jenkins** has been named engineering manager for **Cable-Bus Systems**. He will oversee all product development activities and contribute to corporate planning. Prior to this, Jenkins was design engineer and product manager at Tektronix. Contact: 7869 S.W. Nimbus Ave., Beaverton, Ore. 97005, (503) 643-3329.

*Hineson*

*Wells*

**Sachs Communications** named **Peter Hineson** and **Sam Wells** as technical managers for its training program on aerial construction and subscriber drop installation using Sachs hardware. Hineson, technical manager west, has 16 years of experience in CATV; Wells, technical manager east, has worked 18 years in the industry. Contact: 30 W. Service Rd., Champlain, N.Y. 12919-9703, (800) 361-3685.



*LaBarge*

**Microwave Filter** appointed **Jay LaBarge** as manager of field sales. Prior to this, he was managing editor of the company's Microfilco Press division. Contact: 6743 Kinne St., East Syracuse, N.Y. 13057, (315) 437-3953.

# Business Directory

# Installing the VideoCipher

**By Joseph F. Girard**
Director of Engineering, Cooke Cablevision Inc.

During a conversation with system technical personnel, I found the most common questions currently being asked concern scrambling. The VideoCipher can be one of the easiest pieces of equipment to install and maintain—or one of the most challenging. With the onset of encryption the industry became involved with the problems that the cable operators were having with the installation and setup of their VideoCiphers. Previously, satellite receivers providing a qualitatively acceptable picture were now found, in some instances, to be supplying video with measurable anomalies.

The first step in installing VideoCiphers is to confirm that the receivers to be used fully comply with the specifications listed by General Instrument in Appendix B of the VideoCipher instruction manual. Complying with the specs for chrominance-to-luminance (C-L) delay and frequency vs. gain distortion is the biggest challenge, and it may be necessary to modify the receiver's video performance via internal or external devices to acheive the desired performance.

Additionally, the receiver must be capable of providing a nominal 1 volt peak-to-peak of unclamped, unfiltered and de-emphasized video. If the video level is significantly below this 1 volt specification, a video distribution amplifier must be installed such that the total C-L delay and frequency vs. gain distortion contributed by the receiver and the distribution amp does not exceed the specs in the manual. (Measurement of the specified video level and performance criteria can be done while viewing an unscrambled video signal.)

While these steps might seem time-consuming and overly cautious, the term "gigo" (garbage in, garbage out) applies.

If the sync light is not on, see that you are tuned to a service using VideoCipher and check your connections. If possible, try using a different receiver and/or a spare VideoCipher unit. If you are unable to obtain an AGC (automatic gain control) voltage of +4 VDC, turn the unit off for 10 minutes. During that time, turn the adjustment control counterclockwise (approximately 24 turns) until you hear a click. Now turn the unit back on and retry the adjustment.

### Authorization procedure

Assuming that all of the previous adjustments are correct, contact the scrambled service's hot line and give your system ID number and your unit's address code to authorize that VideoCipher unit. (The ID number is not commonly available to the technician or engineer, but should be obtainable from the responsible party at your cable system. In any case, it's a good idea to tape this number to some portion of the VideoCipher unit used for each service.) If you call the hot line before you have completed all of the preceding steps, it may be possible that your "instant trip" authorization signal will be missed and your unit will not turn on until the next pass. This may be up to six or seven hours later.

If you run into technical problems, go back over your checklist to be sure:

1) That the sync light is on.
2) The authorization light is on.
3) The composite video is 1 volt peak-to-peak and compliant to specification.
4) The AGC is set to +4 VDC ±.2 volts and a 75-ohm terminator is on J.2.

If you still have problems check for:

5) Terrestrial interference in the area.
6) Problems on other services on same satellite or polarity.

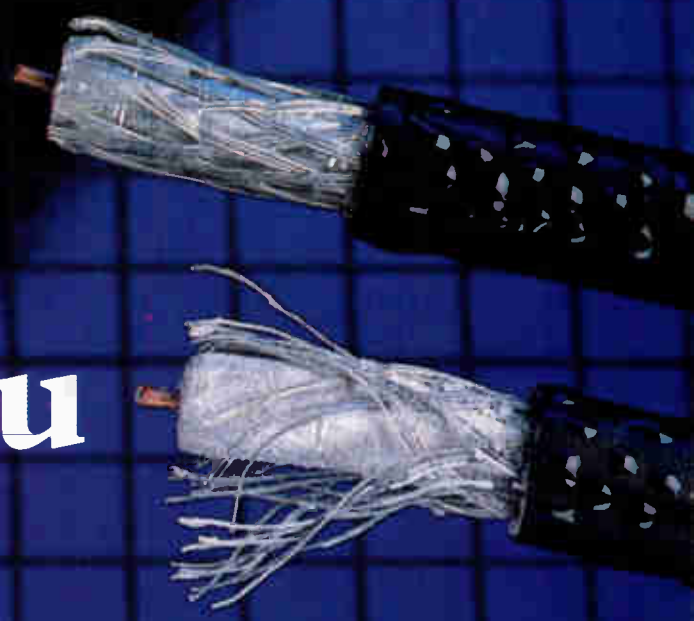
If after checking these items, you are still unable to correct the problem, then contact the hot line for the service affected and give their engineer the information you have found; together you may discover a solution.

It is also wise to keep a spare generic (white label) VideoCipher unit available to use as a backup in case of a failure and to assist in troubleshooting. This is good insurance and a small price to pay when compared to having a channel out of service while waiting for a VideoCipher unit to be repaired.

After the descrambler is on-line, it might be the appropriate time to start a weekly log of video performance measurements on each receiver.

With a properly terminated waveform monitor or an oscilloscope with greater than 5 MHz bandwidth, look at the vertical blanking interval (VBI) and record the C-L delay and frequency vs. gain distortion on each receiver. (The exact procedures for the previous two performance measurements can be found in the *NTC-7, NAB Handbook* (Seventh Edition) or the *NCTA Recommended Practices Handbook*.) In this way you can detect a slow and gradual decline in video performance that may cause your VideoCipher to go into "bypass," providing your subscribers with a scrambled picture instead of one they can watch.

# Buy the Solution.



# Before You Have the Problem.

**The Problem**

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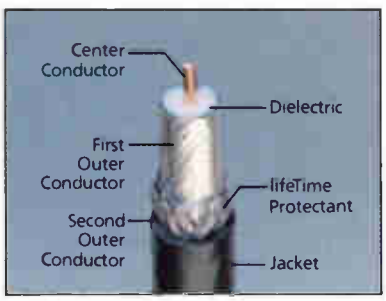


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*Reader Service Number 45.*

# Labor-saving devices

**By Carlton Alspaugh**
Triad Designs Inc.

Success, to the small business, is often measured by how well it spends time and money. Over the years, three products have saved time and increased efficiency in our company. These are: a distance measuring device, a personal computer and an automated lettering machine.

One practical device widely used by almost anyone working in the field is a DMI (distance measuring instrument). DMIs are designed to eliminate time-consuming walking when measuring for strand mapping.

The brand we chose was a Nu-Metrics. The principle is simple: The instrument is installed in-line with a truck's odometer, and the vehicle actually tracks the distance. The vehicle is simply aligned with a given point and allowed to roll. By calibrating the DMI with the known point, this method can be extremely accurate in measuring the footage for strand mapping straight-line areas. Circular areas, such as cul-de-sacs, most off-road areas and heavily traveled highways still require walking.

We currently use two DMIs, both of them over six years old. Each has been switched to different vehicles numerous times, yet have proven to be extremely reliable and have never needed any adjustments or repairs beyond routine recalibrations.

A major addition to our office equipment that has saved a tremendous amount of time was an IBM-AT personal computer, purchased nearly two years ago. The IBM features a 20-megabyte hard disk and a 512K memory.

By using an Innovative software package, we have greatly increased our efficiency in distribution design and line powering by designing a spreadsheet program for each. (The Innovative spreadsheet works very similarly to the Lotus package.) Along with the program, Innovative offers graphics capabilities to produce charts for distribution high- and low-level graphs and system specification graphs.

By changing one value (such as an insertion loss) in the spreadsheet, the entire file can be altered accordingly. This iterative design allows greater fine tunings without the headache of re-entering all calculations with traditional calculator design.

Specific entries for design specifications can be inserted to enhance the specialized needs of any given project. Once the entries are made it is a simple matter to enter line footages to quickly produce a bidirectional design that is efficient, practical and accurate, thereby freeing more time to pursue other things, like soliciting more business.

With the use of our IBM-AT specialized distribution design software, a 20-hour design by hand calculator can be produced in eight hours, even with a greater number of design iterations investigated.

### Lettering machine

Although the IBM has been an incredible time-saver to our designers, our drafting department has recently realized a 50 percent reduction in time because of a computer-aided lettering machine, the Linex Scriber. The Scriber is an automated lettering machine that is considered to be a step between manual drafting and a CAD (computer-aided design) system.

Like many cable design firms, we were faced with an overwhelming amount of time-consuming, wearisome lettering and symbol drawing in both strand mapping and design drafting production. Traditionally, all our mapping was done in freehand unless specified by the customer. Those jobs requiring Leroy lettering generally reflected an extra charge due to the increased time and cost incurred.

The biggest disadvantage to freehand lettering is very simple—not everyone has acceptable freehand, and excellent freehand lettering usually comes with higher labor costs. As the workloads increased, it became more and more difficult to find personnel as well as the time to meet the lettering deadlines.

Computer automation seemed to be a logical choice to alleviate this problem, but we had no real need for the sophistication of a CAD system. Our usual procedure is to draft a map, then pass the map on to the customers for their permanent control, releasing us of any requirement to retain a computer-stored record. Good drafters can manually draw maps quicker than digitizing them into a computer. As well, CAD entry-trained personnel labor costs again reflect increased overhead to pass on to the customer. As a result, we decided upon the Scriber to automate the drafting room and replace the Leroy sets and the freehand work.

Buying the lettering machine meant all of the employees (even those in the field) could produce quality lettering in a fraction of the time it takes to use the Leroy. This allowed our field personnel to revise projects without taking drafting personnel off production projects. As an added bonus, a number of the CATV national standard symbols are already on the keyboard of the device, reducing the need for templates.

Symbols not already on the keyboard can be quickly programmed. For example, the headend symbol we use was programmed in less than five minutes and perfectly fit the national standard. Once a symbol is created, we store it in one of 100 registers in the 4K permanent memory of the machine so it can be recalled at any time.

Callouts, where a number is centered within any shape (i.e., circle, square, hexagon, etc.), are simple—the device automatically centers the desired number within the designated shape.

Some of the special functions of the machine that we use extensively include rotational writing, slope and size. The rotational function gives us the ability to turn our text 0°, 90°, 180°, or 270°, which means we can actually letter upside down. Slope controls the slant of the lettering and it can be changed from 45° to 135°. The size function allows changes in lettering height, while condensed and expanded lettering is also possible.

Within 15 minutes after working through the training manual for the Scriber, we began work on a project. On the very first job, we saved an estimated 50 percent in lettering time. Our project was a map showing an extension planned by a local cable company in a nearby county in Georgia; we finished it in two hours. Before, the job would have taken approximately four hours to complete.

### More competitive

By cutting down on the money and time involved on a job by using equipment like the Scriber, the IBM-AT and the DMI, we are able to offer a much more competitive price to our customers, both MSOs and construction contractors. Being more competitive, of course, means that the company can expand at a faster rate. And one thing I have discovered from 10 years in the cable business is that the industry will allow me to go as far as I want to go as fast as I want to go.

# Hum modulation

**by Ron Hranac and Bruce Catter**
**Jones Intercable Inc.**

System technical people generally measure hum modulation as a percentage. When one checks manufacturers' equipment specifications, hum modulation is usually expressed as a carrier-to-hum (C/H) ratio in decibels. This chart provides easy conversion between the two. The following formulas were used to derive the chart, and examples are provided on the next page.

$$\text{Percent hum modulation} = \left(10^{\frac{-C/H}{20}}\right) \times 100$$

$$C/H\ (dB) = -20\log\left(\frac{\text{percent hum modulation}}{100}\right)$$

| Carrier-to-hum ratio (dB below carrier) | Hum modulation (%) | Carrier-to-hum ratio (dB below carrier) | Hum modulation (%) |
|---|---|---|---|
| 0 | 100.00 | 36 | 1.58 |
| 1 | 89.13 | 37 | 1.41 |
| 2 | 79.43 | 38 | 1.26 |
| 3 | 70.79 | 39 | 1.12 |
| 4 | 63.10 | 40 | 1.00 |
| 5 | 56.23 | 41 | 0.89 |
| 6 | 50.12 | 42 | 0.79 |
| 7 | 44.67 | 43 | 0.71 |
| 8 | 39.81 | 44 | 0.63 |
| 9 | 35.48 | 45 | 0.56 |
| 10 | 31.62 | 46 | 0.50 |
| 11 | 28.18 | 47 | 0.45 |
| 12 | 25.12 | 48 | 0.40 |
| 13 | 22.39 | 49 | 0.35 |
| 14 | 19.95 | 50 | 0.32 |
| 15 | 17.78 | 51 | 0.28 |
| 16 | 15.85 | 52 | 0.25 |
| 17 | 14.13 | 53 | 0.22 |
| 18 | 12.59 | 54 | 0.19 |
| 19 | 11.22 | 55 | 0.18 |
| 20 | 10.00 | 56 | 0.16 |
| 21 | 8.91 | 57 | 0.14 |
| 22 | 7.94 | 58 | 0.13 |
| 23 | 7.08 | 59 | 0.11 |
| 24 | 6.31 | 60 | 0.100 |
| 25 | 5.62 | 61 | 0.089 |
| 26 | 5.01 | 62 | 0.079 |
| 27 | 4.47 | 63 | 0.071 |
| 28 | 3.98 | 64 | 0.063 |
| 29 | 3.55 | 65 | 0.056 |
| 30 | 3.16 | 66 | 0.050 |
| 31 | 2.82 | 67 | 0.045 |
| 32 | 2.51 | 68 | 0.040 |
| 33 | 2.24 | 69 | 0.035 |
| 34 | 1.99 | 70 | 0.032 |
| 35 | 1.78 | | |

**Problem:**
A manufacturer's specifications for a passive device indicate that hum modulation will be 60 dB down at the device's maximum current rating. What will the hum modulation be expressed as a percentage?

**Solution:**
Use the formula

$$\text{Percent hum modulation} = \left(10^{\frac{-C/H}{20}}\right) \times 100$$
$$= \left(10^{\frac{-60}{20}}\right) \times 100$$
$$= (10^{-3}) \times 100$$
$$= (0.001) \times 100$$
$$= 0.1\%$$

---

**Problem:**
Under the old FCC regulations, a cable operator was prohibited from exceeding 5 percent hum modulation anywhere in the system. What carrier-to-hum ratio (dB) is 5 percent hum modulation?

**Solution:**
Use the formula

$$C/H\ (dB) = -20\log\left(\frac{\text{percent hum modulation}}{100}\right)$$
$$= -20\log\left(\frac{5}{100}\right)$$
$$= -20\log(0.05)$$
$$= -20(-1.30)$$
$$= 26.02\ dB$$

---

**Problem:**
Good engineering practice recommends maintaining hum modulation below 2 percent. What carrier-to-hum ratio is 2 percent hum modulation?

**Solution:**
Use the formula

$$C/H\ (dB) = -20\log\left(\frac{\text{percent hum modulation}}{100}\right)$$
$$= -20\log\left(\frac{2}{100}\right)$$
$$= -20\log(0.02)$$
$$= -20(-1.70)$$
$$= 33.98\ dB$$

# CALENDAR

## July

**July 8-11: Colorado Cable Television Association** and **Rocky Mountain Cable Television Association** annual convention, Snowmass Resort, Aspen, Colo. Contact (303) 863-0084.

**July 9: SCTE New England Chapter** technical seminar. Contact Andy Healey, (914) 561-7880.

**July 14-17: Jerrold** technical seminar on applying problem-solving technology in hands-on sessions, Philadelphia. Contact Jerry McGlinchey, (215) 674-4800.

**July 15: SCTE Caribbean Area Meeting Group** technical seminar. Contact Phillip Glidewell, (809) 758-8408.

**July 15: SCTE Shenandoah Valley Meeting Group** seminar on consumer electronics. Contact David Lisco, (703) 248-3400.

**July 15-17: Institute for Advanced Technology** seminar on local area networks, Galleria Park, San Francisco. Contact (415) 781-3060.

**July 15-18: Mississippi Cable Television Association** annual meeting, Royal d'Iberville Hotel, Biloxi, Miss. Contact Millie Smith, (601) 582-3525.

**July 16: SCTE Ohio Valley Meeting Group** seminar on fiber-optic design, Dayton, Ohio. Contact Charles Hanchett, (614) 221-3131; or Bob Heim, (419) 627-0800.

**July 20-22: Magnavox CATV** training seminar, Syracuse, N.Y. Contact Amy Costello, (800) 448-5171.

**July 20-22: New England Cable Television Association** annual convention, Tara Hyannis Hotel, Hyannis, Mass. Contact William Durand, (617) 843-3418.

**July 21-23: Florida Cable Television Association** annual meeting, Bonaventure Hotel and Spa, Fort Lauderdale, Fla. Contact Bob Brilliante, (904) 681-1990.

**July 28: SCTE Satellite Tele-Seminar Program**, review course on BCT/E Category VII–Engineering Management and Professionalism, 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888.

**July 29-31: Wyoming CATV Association** annual convention, Holiday Inn Convention Center, Sheridan, Wyo. Contact Bob Carnahan, (307) 265-3130.

## August

**Aug. 10-12: Magnavox CATV** training seminar, Buffalo, N.Y. Contact Amy Costello, (800) 448-5171.

**Aug. 11-12: Oklahoma Cable Television Association** annual convention, Marriott Hotel, Oklahoma City. Contact Steve Lowe, (405) 943-2017.

**Aug. 17-19: NTL Institute** and **Quantum Associates** workshop on how to manage teams of engineers and technical specialists, Berkeley Marriott Marina, San Francisco. Contact Karen Parker, (703) 527-1500; or Arthur Freedman, (312) 440-0864.

**Aug. 18-20: Magnavox CATV** training seminar, Cleveland. Contact Amy Costello, (800) 448-5171.

**Aug. 18-20: Jerrold** technical seminar on applying problem-solving technology, Kansas City, Mo. Contact Jerry McGlinchey, (215) 674-4800.

**Aug. 21: SCTE Heart of America Meeting Group** BCT/E review and testing on Category II–Video and Audio Signals and Systems, Holiday Inn Sports Complex, Kansas City, Mo. Contact Wendell Woody, (816) 474-4289.

**Aug. 25: SCTE Satellite Tele-Seminar Program**, question-and-answer session with FCC engineers, 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888

**Aug. 25-27: Magnavox CATV** training seminar, Detroit. Contact Amy Costello, (800) 448-5171.

**Aug. 30-Sept. 1: Southern Cable Television Association**'s Eastern Show, Merchandise Mart, Peachtree Plaza, Atlanta. Contact Nancy Horne, (404) 252-2454.

## September

**Sept. 1-3: Magnavox CATV** training seminar, St. Louis. Contact Amy Costello, (800) 448-5171.

**Sept. 9-11: Magnavox CATV** training seminar, Memphis, Tenn. Contact Amy Costello, (800) 448-5171.

**Sept. 15-17: Jerrold** technical seminar on applying problem-solving technology, Kansas City, Mo. Contact Jerry McGlinchey, (215) 674-4800.

**Sept. 15-17: Magnavox CATV** training seminar, Memphis, Tenn. Contact Amy Costello, (800) 448-5171.

**Sept. 21-23: Great Lakes Expo**, Convention Center/Hoosier Dome, Indianapolis. Contact Daniel Helmick, (614) 461-4014.

**Sept. 22-24: Magnavox CATV** training seminar, Greensboro, N.C. Contact Amy Costello, (800) 448-5171.

**Sept. 22-24: C-COR Electronics** technical seminar, Des Moines, Iowa. Contact Tammy Kauffman, (814) 238-2461.

**Sept. 29-Oct. 1: Magnavox CATV** training seminar, Greensboro, N.C. Contact Amy Costello, (800) 448-5171.

### Planning ahead

**Aug. 30-Sept. 1:** Eastern Show, Merchandise Mart, Atlanta.

**Sept. 21-23:** Great Lakes Expo, Indianapolis Convention Center/ Hoosier Dome, Indianapolis.

**Oct. 6-8:** Atlantic Show, Convention Center, Atlantic City, N.J.

**Oct. 13-15:** Mid-America CATV Show, Hyatt Regency at Crown Center, Kansas City, Mo.

**Dec. 2-4:** Western Show, Convention Center, Anaheim, Calif.

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

# AD INDEX

# The multiport is for real

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

A lot has been written and said about the multiport, the interconnect standard developed by a joint subcommittee of the Electronic Industries Association (EIA) and the NCTA Engineering Committee. But in some quarters, this technology has not seemed quite real. The big fear has been over the "chicken and egg" problem. Would cable operators order multiport boxes when there were no TV receivers with the plug? Would TV receiver manufacturers make multiport TVs when there were no cable systems with multiport descramblers in inventory? In other groups there has been a quiet wish that it would all go away. They see a smaller added value to the products they sell.

Now, for those who have seen the EIA multiport as a contribution to the solution of the consumer electronics interface problem, there is good news. RCA announced that each of its new 27-inch TV receivers will include the EIA multiport connector on the back. These are currently in production and on their way to dealers. In addition, Panasonic announced a model with the plug available by the end of the fourth quarter 1987. This is indeed a breakthrough.

The EIA multiport is a 20-pin plug on the back of TV receivers or VCRs that accepts descrambler boxes and other consumer electronic add-ons. The "other" add-ons are of interest to the cable operator only in that they provide additional motivation to the TV receiver manufacturer to include the plug. For cable's interests, the important thing is that the descrambler can now be plugged in *after* the TV's or VCR's tuner and remote control. This improves the consumer friendliness of the cable connection.

An important side benefit is that this box costs about 40 percent to 60 percent of the price of a set-top unit because it has considerably less internal circuitry. There is no tuner, remote control, channel number indicator or remodulator. The method of connection to the television or VCR obviates the need for these circuits. Fewer circuit elements also mean less heat and greater box reliability. Since the descrambler module is behind the set rather than on top, its cabinet can be simpler and less expensive (no need for fancy wood graining or other decoration). And since the unit is out of harm's way, there should be less damage from subscriber carelessness or abuse.

The EIA multiport also has been known as the IS-15 or the baseband descrambler interface standard. These earlier names were project names. The multiport is a baseband standard because the signals that go to and come from the box are unmodulated; i.e., they're at baseband. These signals come from and return to the television or VCR after they've been demodulated. However, this does not mean that the multiport is only useful with baseband scrambling. Most so-called "RF scrambling" methods can be decoded with baseband circuits. Scientific-Atlanta demonstrated this during field trials and published several papers on the methods of accomplishing baseband decoding of RF scrambling. These appear in the *NCTA Technical Papers*.

While it is true that an IF (intermediate frequency) loop-through on the TV receiver or VCR would facilitate an even less expensive descrambler box in RF scrambled systems, there is a significant savings in the baseband implementation over set-top descramblers. The IF loop-through was not included in the multiport baseband standard for a number of reasons. The principal reason was a strong desire to expedite the standard. Many on the standards committee felt that adding the IF loop-through to the standard at this point would significantly delay the standard and further delay the implementation, which was unacceptable. After completing the standard, the committee adopted an IF loop-through recommended practice. The technology is defined for those who wish to implement it in a standard way.

While the multiport is intended primarily for addressable systems, programmable descramblers can be accommodated if an in-band tag is added to the channel signals so the box can "know" which channel is being received.

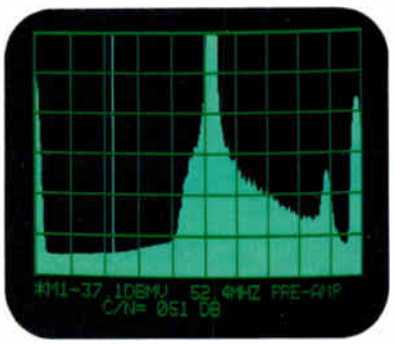
Because of the multiport, for the first time a truly cable-ready TV or VCR is possible in a scrambled environment. The subscriber can connect the television or VCR directly to the cable without an intervening set-top box. The subscriber regains the use of the remote control and, even more importantly, the VCR's timer can now change the channels being recorded.

It's important to realize that there is still one more requirement for a consumer electronics product to be cable ready: the television or VCR must not pick up off-air signals with its internal circuits. This direct pickup (DPU) problem is a real spoiler of cable-ready capability. When DPU is present, the only solution a cable operator can practically bring to bear is to put a converter ahead of the television or VCR. The cable-ready features are then lost.

One of the multiport's strong advantages is that it makes addressability more affordable. This could bring about much greater penetration of addressable products in the cable industry and facilitate pay-per-view. It is possible to provide the subscriber with a descrambler for the television and another descrambler for the VCR. The total cost of these two multiport units will be about the same as one set-top. It becomes practical for the subscriber to record one scrambled channel while watching another scrambled channel.

The EIA multiport standard is in its adolescence. There were three field tests in Colorado during 1985. The standard was endorsed by the EIA and the NCTA Engineering Committee in 1986. It has "interim standard" status with the EIA. This means that after another year or so of experience, it will be fine-tuned before being promoted to full-standard status. An industry laboratory has been established at ATC in Englewood, Colo., as a neutral test site for manufacturers of TV receivers, VCRs and scrambling systems to try their implementations of the standard. Most importantly, in 1987 manufacturers announced TV receivers with the plug on the back.

Now the ball is in the cable industry's court. To make this thing work, we need to order descrambler boxes, create procedures for dealing with subscribers who buy multiport products and inform CSRs and other cable system personnel. Cable needs to work with TV dealers to promote this advantageous technology. It is likely that some descrambler manufacturers will need extra persuasion of cable's interest in this cost-saving and consumer-friendly approach. We should be prepared to persuade.

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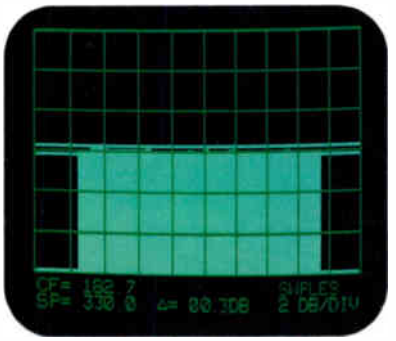


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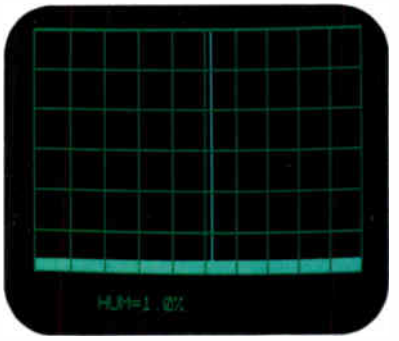
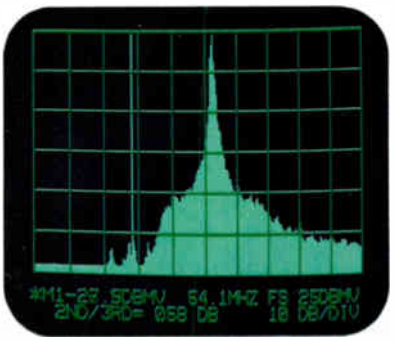
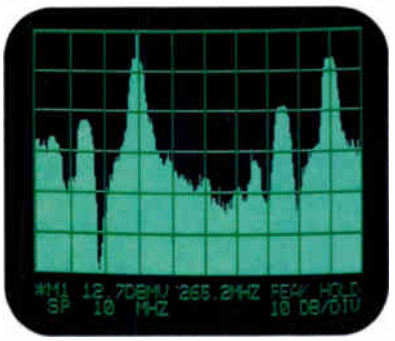


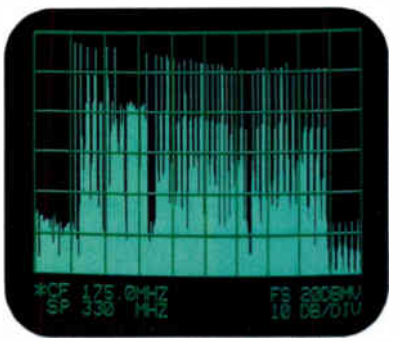

*Minimize hum.*




*Pinpoint distortion problems.*




*Peak RMS of suppressed sync.*

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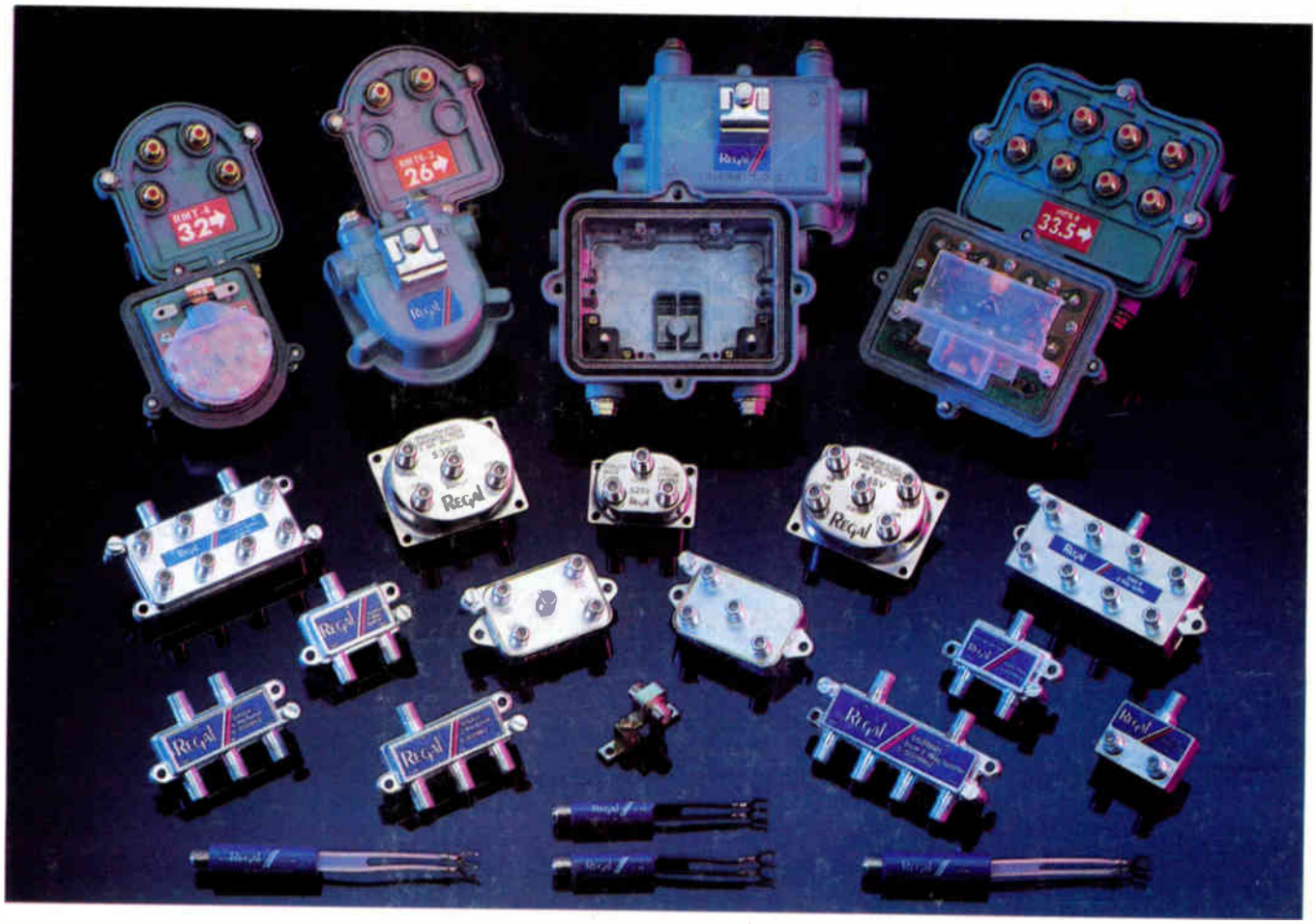


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