# COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

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## Back to Basics: Build your own dipole

April 1990

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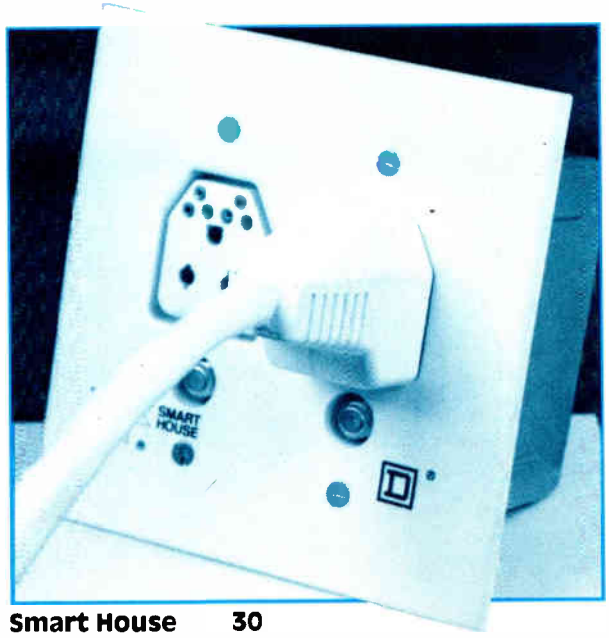


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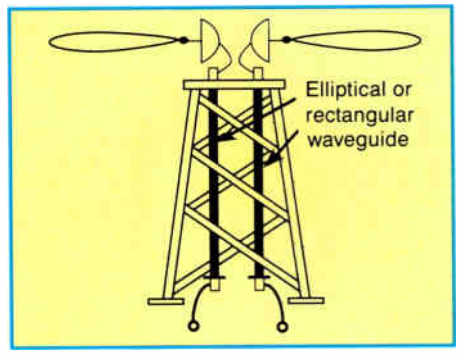





Geri Saye



## Features





*Communications Technology*™ (ISSN 0884-2272) is published monthly by Communications Technology Publications Corp., 50 S. Steele St., Suite 700, Denver, Colo. 80209, (303) 355-2101. April 1990, Volume 7, Number 2. Office of publication is 50 S. Steele St., Suite 700, Denver, Colo. 80209. Second-class postage paid at Denver, Colo. POSTMASTER: Please send address changes to Communications Technology, 50 S. Steele St., Suite 700, Denver, Colo. 80209.

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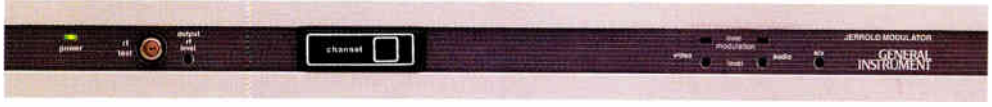


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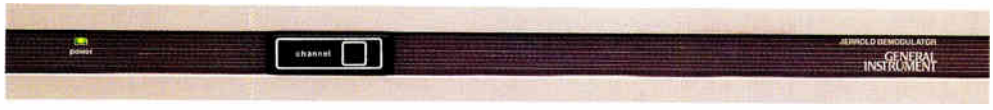


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***Reader Service Number 4.***

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# The technologist's instruction manual

In the March "Editor's Letter" I introduced *Communications Technology*'s new mission statement—"helping the industry apply and integrate technology." The three major areas of information that make up our new editorial focus also were identified: how-to, technical management and engineering. As well, I hinted that a few new features could be expected. This issue of *CT* concentrates on our expansion into those three new areas, all of which effectively make *CT* the cable technologist's instruction manual.

**How-to**

The kinds of articles and features that fall into this category are intended to help you do your job better from a hands-on perspective. Here you'll find out how it works and how to do it. To give you an idea of what to expect more of from now on, check out this month's "Back to Basics" section.

You'll find new uses for your signal level meter that go beyond just measuring levels, and some great outage troubleshooting tips. Did you ever want to build a simple dipole antenna for signal leakage measurements? We show you how to construct one from parts of an old TV antenna. And in the continuing quest to help you understand the fundamentals of our business, Richard Covell introduces the first of a series on the basics of cable.

**Technical management**

Even though technical management makes up such a large part of our daily jobs, this area hasn't been covered in depth in the past. Following our theme of helping you to do a better job (in this case from a management standpoint), we include in this month's repertoire articles on project management, productivity of outside plant personnel and a companion piece to go along with SCTE's April satellite tele-seminar program.

On Tuesday, April 24 from 11 a.m. to 1 p.m. ET (Galaxy III, Transponder 2), SCTE will uplink a special presentation by the FCC's John Wong on how to fill out Form 320. The accompanying article is a transcript of that presentation.

Next month we'll introduce a new monthly department by contributing columnist (and former *CT* editor) Rikki Lee that will help you become a better communicator, both written and spoken.

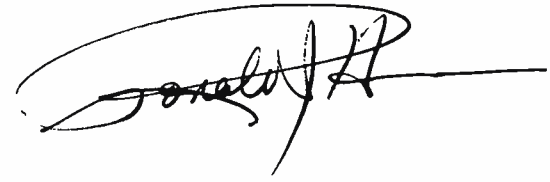
**Engineering**

The staple of our industry is engineering, so we'll continue to provide you with the best features that highlight the state of the art in cable. An example of that part of our editorial can be found in a cutting-edge feature on MMDS technology by Microwave Filter's Glyn Bostick and Andrew Olney.

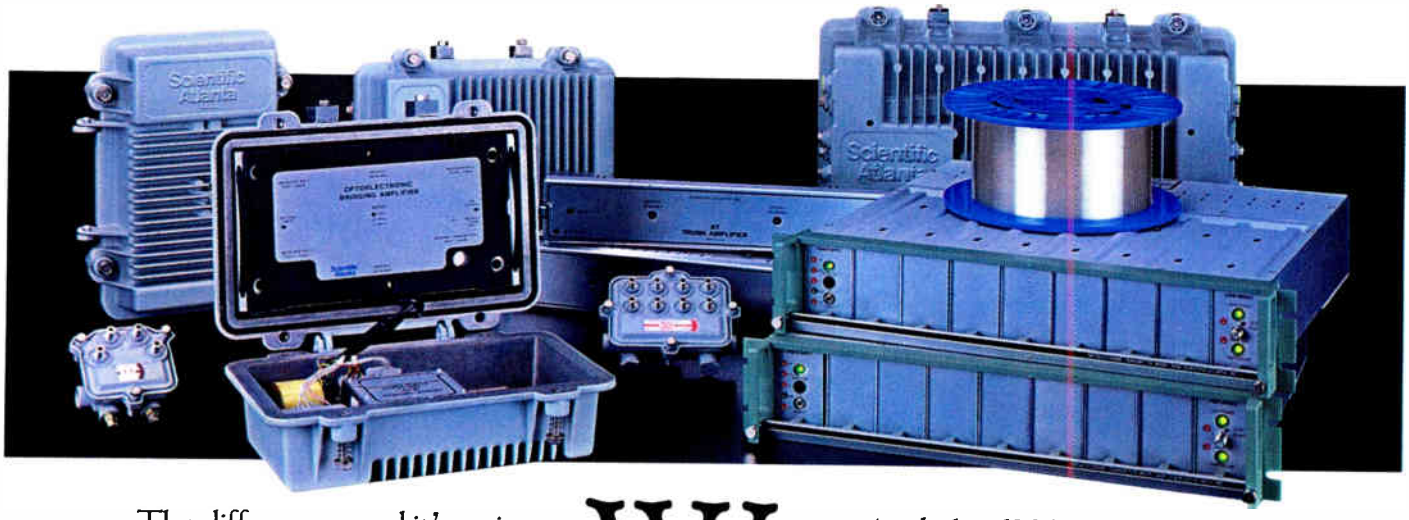
But the newest part of our engineering thrust—and one that crosses over a bit into technical management and how-to—is something you may be more accustomed to seeing in consumer publications like *Stereo Review* or even *Car and Driver.* Allow me to introduce our newest department: "CT's Lab Report." It's exactly what the name suggests—lab testing of industry products. Beginning with this issue, we'll be conducting lab evaluations of CATV equipment and reporting the results each month. Our first lab report is on a low-cost video/audio signal generator from Tektronix.

SCTE's Cable-Tec Expo is just around the corner. If you're not a member of the Society, you probably didn't receive a registration package in the mail. Not to worry. We've included a convenient pull-out registration package in this issue of *CT.* And speaking of SCTE, its BCT/E Certification Program is without question the best in the business. This month's *Interval* contains the latest information on that exciting program.

One final comment: Ike Blonder will be taking a break from his monthly department, "Blonder's View." He's been a regular on the pages of *CT* since day one, and many thanks go to Ike for all he's done. He won't be a complete stranger, though; look for occasional contributions in coming months. That said, welcome to a new *CT*—the cable technologist's instruction manual.



# Do You Know The Difference Between Telephone And CATV Fiber?

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Reader Service Number 9.

## Switched star vs. tree and branch

We would appreciate the opportunity to respond to some of the points raised by Archer Taylor's October 1989 contribution to your journal titled "Is Europe taking another look?" especially insofar as it concerns the United Kingdom.

There is no denying that American capital is coming into the U.K. cable industry. However we see this as vindication of the decision taken by our licensing authority to encourage state of the art switched star topology by the granting of longer licenses.

We believe it is very doubtful that level-headed American entrepreneurs would invest in any technology that they felt was not viable. Yet this is exactly what is happening. Some of the American companies he quotes are investing in franchises such as Winsor (100,000 homes) Birmingham (446,000 homes), Camden (80,000 homes), East London (143,000 homes), Preston and Merseyside (225,000 homes), Nottingham (160,000 homes), totalling well over 1 million homes. All these franchises are installing switched star systems. We believe they are doing so because they see the benefits of interactivity and all the other advantages of switched star systems and they have been satisfied that it is cost-effective.

Nor is this trend confined to the United Kingdom. In France, one of the major MSOs is busy installing switched star systems in all its networks, encouraged by the French government recognition that only such a topology is secure enough for datacoms.

We are constantly being told that the public is not interested in interactivity and will not pay for it.

Let there be no mistake, the American and European public does make use of interactivity and does pay for it. In many cases the return path is via the telephone with all the delays and frustration caused by "busy line" signals. Although he may not be aware of it, from looking at his telephone bill, at the end of the day the consumer always pays, directly or indirectly.

In a switched star environment near instantaneous responses are obtained via the cable network. There is no need to tie up the telephone and there is no cost involved.

We are also being reminded constantly of the impact our technology is having by the way that tree and branch systems are responding by improving, as best they can, their interactive capabilities in an attempt to cope with PPV, IPPV, home shopping, etc. These activities are with us today and are fully integrated in a modern switched star system.

We recognise we have been fortunate to enter the field late and in so doing we have benefited from the American experience. How many Americans would honestly say that, if they were starting now, they would still go with tree and branch?

Andy McGregor
Sales Manager

Dan Smart
Technical Adviser
Cabletime Ltd.

*Author's response: Andy McGregor and Dan Smart, of Cabletime, quite correctly describe the advantages of switched star topology when directly associated with two-way interactivity. After 30 years and hundreds of millions of dollars spent in experimentation in the United States, however, no truly viable residential market for interactive services has yet been proven. Until viability has been convincingly demonstrated, it would be hard to find a U.S. operator wishing for switched star facilities.*

*The franchise wars in the United States in the early 1980s forced applicants to promise extravagant interactive services. In the United Kingdom, license applicants are under similar pressures, not only to outpoint their rivals but also to seek the favor of the Cable Authority that is bound by law to prefer the switched star applicant, other factors being equal. Moreover, some U.S. operators have invested in systems that were already licensed for switched star.*

*Some U.S. readers may not be aware that, at the present state of technology, the "switch" in the U.K. switched star is, in fact, an off-premises converter, somewhat like the now defunct SCAT, TRACS and Mini-Hub.*

*The United Kingdom seems to be as hopefully optimistic today regarding the potential for interactive data services as the United States was in the 1970s, with no more concrete evidence of viability. Only time will tell whether the switched star actually becomes a profitable concept, or remains as a depressing drag on the marketability of entertainment video.*

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

# ANNOUNCING: THE STANDBY POWER SYSTEM FOR THE 1990's

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## Harris to develop RF test bed for ATV

The Advanced Television Test Center awarded the broadcast division of Harris Corp. a contract to develop the specialized radio frequency test bed to aid in the evaluation of advanced TV (ATV) transmission systems. The combination of equipment in the RF test bed permits simulation of the conditions to be encountered by broadcast ATV signals. This will ascertain the likely performance of different kinds of new, high definition TV (HDTV) systems.

The RF test bed will be a key component at ATTC's special purpose laboratory that is under construction in Alexandria, Va. It is expected that the center along with its HDTV equipment will cost $3.5 million and will be completed sometime this spring.

## Century activates largest FO link in LA

Century Cable TV completed construction and activated the largest fiber-optic cable TV link in Los Angeles. Construction on the link began in 1987.

The link stretches approximately 35 miles throughout Century's service area, from Santa Monica, Calif., to Eagle Rock, Calif. This final phase of the fiber-optic link ties all of Century's Los Angles franchises together. The link also interconnects United Cable Television, Valley Cablevision and King Video into the City Interconnect for government programming.

Century serves more than 150,000 customers in Los Angeles and is spending over $50 million to rebuild the 1,400 miles of its systems. According to the company, the rebuild will provide enhanced picture quality, more programming, increased reliability and dependable services.

## Porter revises coax shipping advice

Rex Porter says it's been a case of that old "first you say you do, then you say you don't" syndrome.

Porter, western regional vice president of Midwest CATV, suggests that if there is a culprit responsible for his contradictory, often changing directives on the shipping of coaxial cable, then technology must be to blame. He has frequently held training sessions for vendors and customers and his messages, although accurate at the time, frequently have to be revised.

"Some of them will remember me telling them, in no uncertain terms, to only accept cable on the rolling edge. Others will undoubtedly recall that they were told to accept coaxial only if it had been transported on its side," Porter said.

Porter has modified his advice because today's dielectric has been dramatically improved and provides strong support within the tube and when laid flat ensures damage-free delivery.

"If the truck is fully loaded, pack reels on their edges or laid flat; if however, there is anything less than a full truck load, the reels should be laid on their sides to prevent free rolling," Porter suggests.

## Electronics, CATV see symbiotic future

Statements of expanded efforts of cooperation at all levels of the cable TV and consumer electronics industries were made recently at a seminar sponsored by Cable Television Laboratories in Boulder, Colo. The two industries plan to work closely together in the future to improve the consumer electronics interface for cable subscribers.

The seminar was the first in a series of initiatives that CableLabs has planned to reaffirm the commitment between the two industries at the technical level and to expand alliances in marketing and strategic issues. Members of both industries suggest that such work is in the best interest of both.

While problems still exist at the consumer interface (the point where customers connect their TV set or VCR to cable) much progress has been made, said Richard Roberts, president and CEO of TeleCable.

"The door appears to be open for cooperation between the cable and consumer electronic industries. The time is now for us to improve and upgrade the quality of the product we deliver to our subscribers through our networks," he added.

## Operators offer EPS

A group of nine cable operators (American Television and Communications Corp., Comcast, Continental Cablevision, Cox Cable, Newhouse Broadcasting, Tele-Communications Inc., United Artists Entertainment, Viacom and Warner Cable) and GE Communications will offer extended program service (EPS) to the rural United States and some cable subscribers. Ten transponders on GEA's K-1 Ku-band satellite will be used.

The joint venture believes its services could spur growth in the Ku-band satellite industry and could provide a transition to high-power direct broadcast satellite (DBS) in the United States even though EPS will use only 10 of more than 100 Ku-band transponders in orbit today. EPS is the first major Ku-band project to use the authorities of and serve the policies of the Congress' 1988 Satellite Home Viewer Act as it provides superstation programming.

## Comm/Scope's Ed Foust dies

The cable industry has lost a good friend. Ed Foust, an account executive in the market development group for Comm/Scope recently died after an illness.

In lieu of flowers, his family asks that donations be made to Shriner's Hospital, Genesis Lodge #305 or Scottish Rite Hearing and Speech Fund. Shriner's Hospital will use the funds toward leukemia research.

Send donations to Shriner's Hospital, Nile Temple, 500 N.E. 205th St., Edmonds, Wash.; Genesis Lodge #305, Building Fund, c/o Harry Sherman, 2203 54th Ave. W., Mont Lake Terrace, Wash. 98043; Scottish Rite Hearing and Speech Fund, 1155 Broadway East, Seattle, Wash. 98102.

## HSN presents HDTV broadcast

LOS ANGELES—Hospital Satellite Network presented the first-ever high definition TV (HDTV) live medical program on March 3. The program also marked the first time HDTV was used for an interactive broadcast in which viewers were able to communicate with guests appearing live on the program.

The two HDTV viewing sites were in Sunderland Auditorium at St. Lukes-Roosevelt Hospital Center in New York City and Factor Auditorium on the campus of the University of California at Los Angeles. The teleconference also was fed to 1,700 hospitals nationwide, using standard TV technology. →

## Attention ham radio operators

A group of Denver area ham radio operators in the cable TV industry is updating a list of other amateur radio operators in CATV. This list allows ham operators to get in touch with one another and also provides contacts for clearing up signal leakage complaints. If you are not yet on the list, send your name, call sign, company, address and communications modes to Steve Johnson, N0AYE, ATC, 160 Inverness Dr. West, Englewood, Colo. 80112.

This updated list is scheduled for publication in the June 1990 issue of *CT*, so responses will be needed no later than April 27.

The videoconference was produced in cooperation with the NHK Enterprises USA Inc. and Hughes Communications Inc. NHK supplied the HDTV equipment, Hughes coordinated and provided the HDTV satellite distribution and HSN developed the program.

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● Tele-Communication Inc.'s Boulder, Colo., system received its Jerrold Starport on-premises addressability devices that use any standard positive or negative traps. The modules are mounted on the side of subscriber's houses or on a fence post near the house with brackets. Pay services can be authorized or deauthorized from the subscriber's phone without the need for a service call to the home. Jerrold and TCI tested the device using 47 Starport test units in the 20,000-sub system earlier this year. The test units have been replaced with the actual product.

● Graycor Laser Systems announced it began taking orders for its pay-per-view event controller. Product information is available from the company at 5021 N. 55th Ave., Suite #2, Glendale, Ariz. 85301, (602) 842-2873.

● Paragon Cable bought Pioneer's BA-6000 series addressable converters and M1B/M1D addressable controllers for its Keene, N.H., and Mt. Vernon, N.Y., cable systems. Paragon also ordered additional Pioneer BA-6000 adressable converters for its Watertown, N.Y., system.

● Garden State Cable TV announced a multimillion dollar, four-year project to upgrade service throughout its 3,200-mile franchise. The rebuild will include installation of fiber optics. Jerrold's Impulse 7000 converters and SX amplifier line will also be used in the system.

● The Society of Cable Television Engineers recently announced the technical program for Cable-Tec Expo '90 to be held June 21-24 at the Convention Center in Nashville, Tenn. For further information, see the pull-out Cable-Tec Expo registration package included in this issue in the "Back to Basics" section.

● Orchard Communications, a manufacturer specializing in CATV lightwave transmission systems and interactive video networks, moved to a new corporate location. The address is 101 N. Plains Industrial Rd., P.O. Box 5031, Wallingford, Conn. 06492. The new phone is (203) 284-1680, and the new facsimile number is (203) 269-2964.

● TeleCom Satellite Systems, a New Jersey-based private cable operator bought six private cable TV systems in Dallas and adjacent suburbs from Satellite Country Inc. of Texarkana, Ark. National Satellite Equity Associates represented Satellite Country in the sale. Terms of the sale were not disclosed.

● The first Sumitomo fiber and electronics links for cable TV will be installed in two, 8½-mile new-builds in Florida. One is located in Osceola County where the fiber will connect the system currently serving Indian Lakes Estates with new subscribers in River Ranch Resorts. The second link will run from Sunny Hills and connect a new system in Wausau.

● Syrcuits International's Matrix on-premises addressability system, which is marketed exclusively by Midwest CATV, is being installed in a 21-building apartment complex in Thorton, Colo. This is the first installation in an already existing commercial structure although it is already operating in several new apartment complexes in the East.

● Cencom Cable Television is investing $5 million in a three-phase fiber-optic and service upgrade project in St. Louis County. When completed, Cencom's fiber network will serve over 100,000 customers in St. Louis County, making it one of the largest metropolitan fiber systems.

● Telestar Satellite TV Ltd. of St. Albans, England, was appointed as U.K. distributor for Channel Master. Channel Master recently started to manufacture a range of European Astra packages.

● Comcast Cable Corp. and Anixter Cable TV announced the activation of the first fiber-optic link in Mississippi. The AM Laser Link system eliminates two headends in Lake Serene and serves 6,000 subscribers who previously received cable signals over a 44-amplifier cascade. A second AM Laser Link system will be activated this spring to serve Purvis, Miss.

● C-COR Electronics acquired Acunet Data Systems, the Canadian-based distributor of C-COR products. Acunet has been renamed C-COR Electronics Canada Inc. and will have sales responsibility for the parent firm's cable and data products throughout Canada.

● Laser Precision Corp. announced the award of U.S. patent No. 4,875,772, Remotely Controlled Optical Time Domain Reflectometer Serving a Plurality of Fiber Optic Cables. The patent covers a method for testing a number of fiber-optic cables with a single OTDR through the use of wavelength division multiplexers and wavelength independent couplers.

● Scientific-Atlanta has been chosen to supply its System Manager V, scramblers and Model 8591 addressable set-top terminals to Cable Television of Yokkaichi City Co. Ltd., Japan. This is a new-build that is to serve 40,000 subs. Shipments have already begun and will continue through the spring.

● Adelphia Cable Communications awarded its Falmouth, Mass., contract to Preferred Services Corp. This project includes installation, MDU wiring and drop burial.

● The Ohio Cable Television Association board of directors recently unanimously voted to endorse the voluntary standards for customer service adopted by the National Cable Television Association in February. Companies represented by the OCTA serve the overwhelmingly majority of Ohio's cable subs.

● Multicom Inc. announced an agreement to stock and distribute the Pyramid product line. The pedestal line includes all sizes of pedestals and the connector line consists of the new two-piece integral sleeve connector.

● Suburban Cablevision of East Orange, N.J., announced an extensive marketing and promotion campaign to coincide with the completion of its $25 million rebuild and launch of new channels in its lineup. In addition to the rebuild and upgrade, the system now uses fiber-optic technology to deliver signals.

● TVC Inc., parent company of TV Cable Supply, Co. and Horizon Cable Supply, reached an agreement in principle to acquire certain assets of Donley International, a Texas company doing business as Donley Cablevision Supply. Terms were not disclosed.

● CaLan and Long Associates have agreed to develop a CATV test communications standard and Snap Shot CATV test management software, which will

allow trend analysis, archiving, automated report generation performed on the downloaded data and is capable of displaying up to six sweep response traces on screen at a time. This software will be available exclusively through CaLan representatives.

- Midwest CATV of Charleston, W.V., signed an agreement with Noyes Fiber Systems to be the exclusive distributor of Noyes fiber-optic test equipment to the CATV market.
- LeBlanc and Royle Telcom in Oakville, Ontario, was appointed a distributor in Canada and the United States for the full line of static dissipation lightning protection products manufactured by Lightning Master Corp.
- Three MSOs purchased Pioneer non-addressable converters. ATC purchased Model BC-4500 converters for its Charlotte, N.C., division and Models BC-4600 converters for its Jackson, Miss., system Continental Cablevision purchased BC-4500 and BC-4600 converters for its Williamsburg, Va., system. The Storer Communications' Richmond, Va., system purchased BC-4500 converters.
- General Instrument Corp.'s VideoCipher division detailed the upgrade program planned for the VideoCipher II Plus scrambling system. The program is slated to begin early next month. A distributor, dealer, consumer or licensee may trade in an untampered, undamaged VideoCipher II module for $129 plus shipping, handling and applicable dealer service charges for a VideoCipher II Plus descrambler or integrated receiver/descrambler.
- The U.S. Navy contracted Communications Engineering Inc. to design and install a new digital video post-production system at the David Taylor Research Center in Bethesda, Md. The system will be used to develop documentaries, technical reports and visual data analysis for the Navy.
- Cable Link is realigning its corporate position by not only purchasing surplus CATV equipment, but concentrating most of its efforts on providing equipment that is no longer manufactured. It also will provide new and remanufactured equipment.
- Wegener Communications recently announced that its Model 1694-02 audio automatic gain control received approval by Jones Intercable for use in its systems. The unit is a 600 ohm audio device that is totally independent of other equipment and its selectable parameters include output level, AGC time constants and stereo or dual monaural operation.
- General Instrument Corp.'s VideoCipher Division announced the addition of Earth Terminal TV Ltd. of New England to its network of authorized full-line distributors. Earth Terminal TV is a TVRO distributor specializing in direct broadcast and commercial satellite products.
- Effective immediately, Dynair Electronics Inc. has changed its mailing address to 5275 Market St., San Diego, Calif. 92114.
- Englewood, Colo.-based Mega Hertz was appointed by Wavetek as its authorized stocking distributor. The company will distribute on a national basis Wavetek's Microsams, Sam 1000 and 2000 signal level meters, the RD-1 dipole antenna and CLR-4 leakage detectors.
- Blonder-Tongue Laboratories announced that the SatCom Technologies Division of Radiation Systems Inc. awarded it a contract to provide modulators and distribution amplifiers for use in the Whittle Education Channel. A reported 6,000 installations will be made during the first phase of the contract to run through August 1990.
- Effective immediately, the new address for GWG Associates is RR 1, Box 367D, Schoharie, N.Y. 12157, (518) 295-7954.

**Figure 2:** Weekly/monthly stats sheet

| Month: | | | Month | Prev. month |
|---|---|---|---|---|
| Customer service total calls answered | | | | |
| % calls answered | | | | |
| Avg. speed answering | | | | |
| Office | | | | |
| Repair | | | | |
| Avg. number calls/CSR | | | | |
| % calls service | | | | |
| % calls billing | | | | |
| % calls sales | | | | |
| Disconnects: % moved | | | | |
| % customer service | | | | |
| % non-pay | | | | |
| Total number non-pay disc. | | | | |
| % paid | | | | |
| Money collected | | | | |
| Absenteeism % | | | | |
| Plant number of installs | | | | |
| Number installs outside contr. | | | | |
| Installation comp. % | | | | |
| Install backlog (days) | | | | |
| Days out Sat. connects | | | | |
| Number disconnects | | | | |
| Disconnect comp. % | | | | |
| Number service calls | | | | |
| % service calls | | | | |
| Serv. call comp. % | | | | |
| Serv. call backlog (hours) | | | | |
| Total number outages | | | | |
| Number calls/tech | | | | |
| Absenteeism % | | | | |
| Sales (total basics sold) | | | | |
| Total pays sold | | | | |
| Avg. number sales per rep | | | | |
| Total basic sold (T) | | | | |
| Total pay sold (T) | | | | |
| Avg. number sales per telemarketer | | | | |
| Penetration % | | | | |
| Net gain | | | | |

In measuring these weekly numbers, sales is aiming for the highest percentage of calls. Both billing and repair are aiming for the lower percentage. Repair should always be the lower

The percentage of total incoming phone calls received at the system generated by the bills sent to customers

The percentage of total incoming phone calls received at the system generated by the marketing and sales activity

This is a time-consuming field activity and the chief technician and the office manager need to work together to ensure as much is done by office personnel prior to sending a truck out

This shows percentage of the total disconnects sent into the field that paid

Understanding the amount of dollars the entire field crew collects could be crucial in high crime areas

This number must be measured in relation to the service call backlog and the activity in the system. (How many calls can a technician complete according to the needs of the system and the sensitivity of the equipment used?)

Taken from the number of individuals to have worked and the number of days reported sick. (Above 3 percent may indicate morale problems)

A simple measurement on the number of connects minus the disconnects

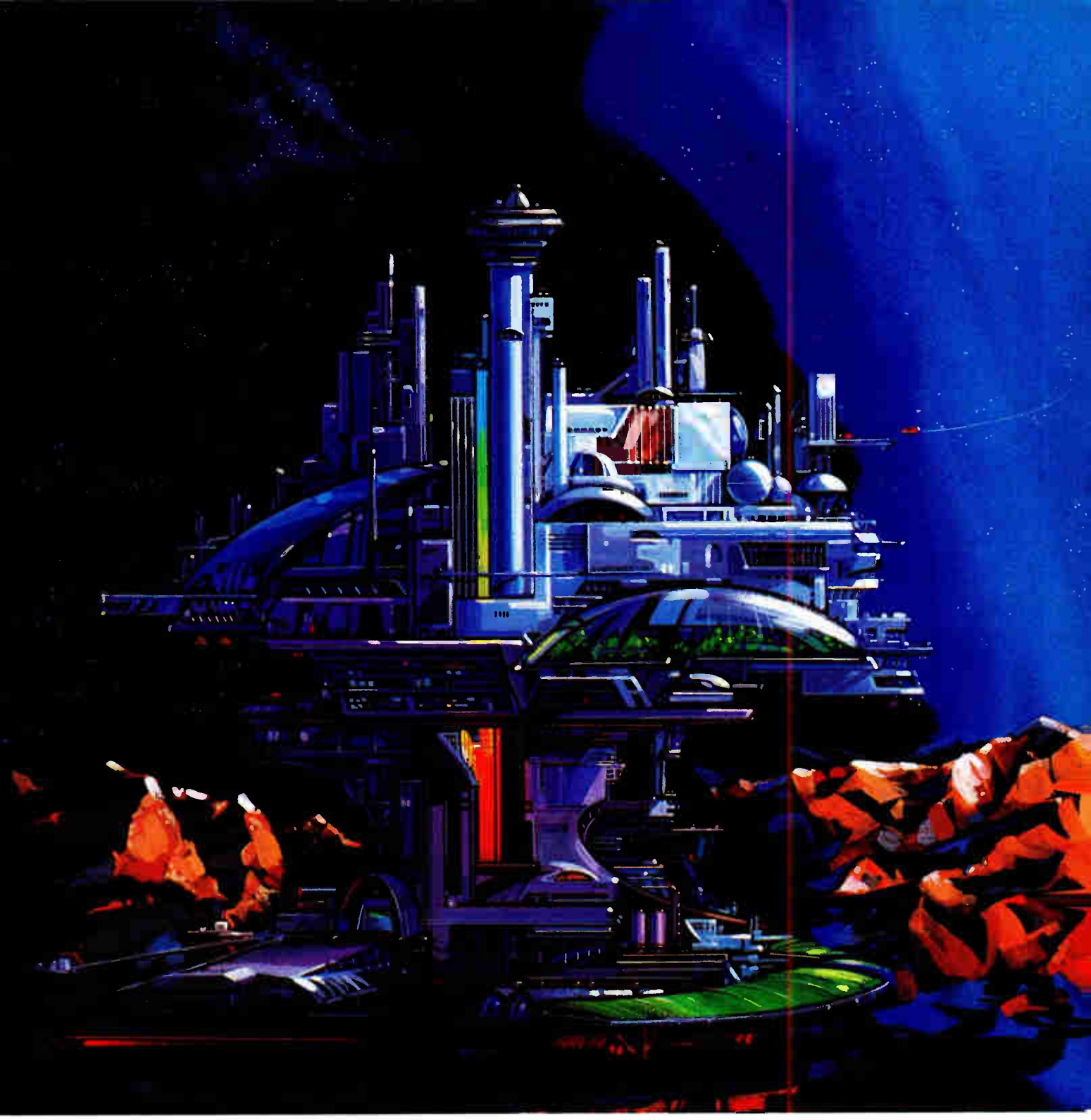
lished program listings or checking the technical needs on the upcoming pay-per-view event. And on top of these 1990 job descriptions, these same managers and supervisors still need to know what their crews are doing each day. It is not fair (in many ways it is not right) but it is true.

### The challenge

The challenge of chief technicians in the '90s is to stay in touch with their crew's productivity each day and make a personal commitment to audit what the crew has accomplished in quantity and quality. At TCI Cablevision in Tacoma, Wash., a daily stats sheet provides the entire management staff from foreman to general manager a capsule-sized view of what happened in the field. This franchise services over 35,000 customers in a 540-mile plant. Thirty field employees maintain, install and service the customer base in this market. During specials, additional installation contractors are often needed to meet the onslaught of installation orders. So, at any one time in the plant there may be 30 to 40 field employees servicing the cable system. Included in this count are the following four managerial staff that assist the running of the operation: installation foreman, field supervisor, plant manager and general manager.

The aforementioned daily stats sheet (DSS) shown in Figure 1 is compiled each day and reflects the activity for the previous day and what may be coming in the next few days. This report can vary from system to system depending on the age of the plant, the size of the system and the importance of the projects in that system. Nevertheless the overall composition is the same. These DSSs are compiled into a weekly summary with a month summary comparison. (See Figure 2.) This report is compiled by a customer service representative (CSR) who knows where to go for the answers—accurate answers.

One value of the DSS is in the validity of the numbers. Many of the answers can be retrieved by a computer run but an added value comes from the manual counts. CSRs, dispatchers and field employees are aware of the count and what the manager is measuring. The dispatcher who is aware of the importance of completing all work sent into the field will make sure personal evening phone calls are made and the field staff is sent back to a missed address. With this daily measurement, each individual takes pride in their own contribution to reach "100 percent."



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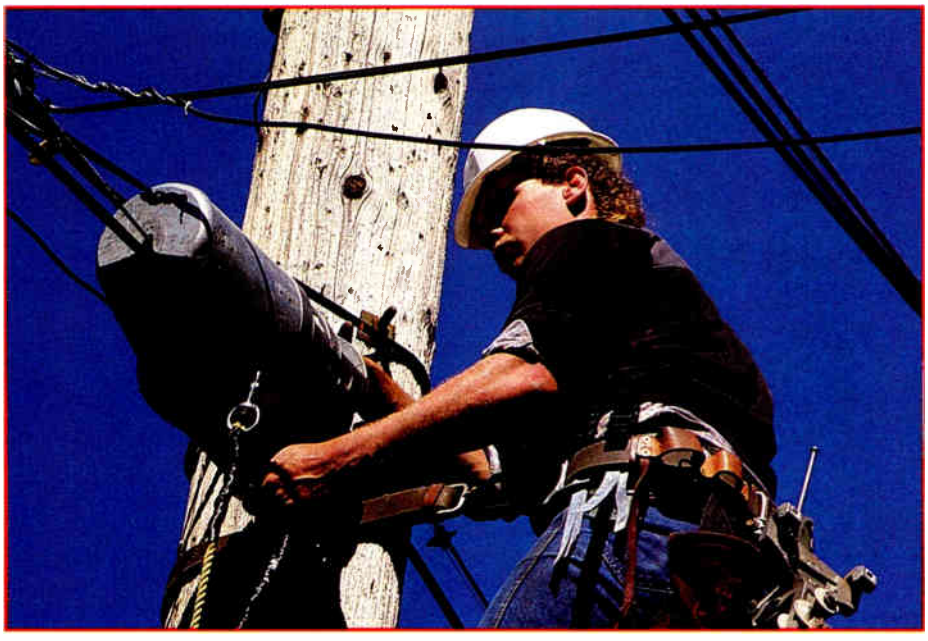


Charles Thompson

# A rebuild strategy for the 1990s

**By Bernie Czarnecki**
President, Cablemasters Corp.

As we enter the 1990s, planning your rebuild strategy is more important than ever to ensure a smooth, cost-effective program that meets operational, technical and political objectives.

## Planning

With the current rise in rebuild activity, utility companies, suppliers, and system operational and technical personnel are finding it necessary to plan well in advance to meet the objectives of rebuild projects. Material shortages and long lead times often mean that you must develop project plans as much as 12 to 18 months prior to beginning any work, depending on the size of the project, and in some cases as much as 36 months in advance. Planning, organizing, staffing, directing and controlling are the major elements of your strategy.

Management of a rebuild involves:

1) assigning a project manager who is responsible for the pre-planning,
2) organizing management monitoring and control procedures to fit the specific needs of the project,
3) establishing work and material delivery schedules to avoid delivery delays in construction and minimize inventories and
4) establishing an integrated project control system for communication, reporting, correspondence and project reviews.

**"Material shortages and long lead times often mean you must develop project plans as much as 12 to 18 months prior to beginning any work."**

## Responsibilities of key personnel

Develop a project plan in conjunction with the system *engineering, marketing and operations staffs*. The task elements will be reviewed, defined and agreed to as a project plan.

The *project manager* has total responsibility for direction of on-site personnel, plant construction and engineering turn-on. He also is responsible for overall schedules, customer liaison, planned progress and schedules, and the weekly status meeting with system personnel.

The *engineering leader* is responsible for the technical quality of the plant and reports to the project manager. He is in charge of the engineering team, which sets up the amplifier stations, activates plant, balances and proofs all work areas in accordance with the schedule.

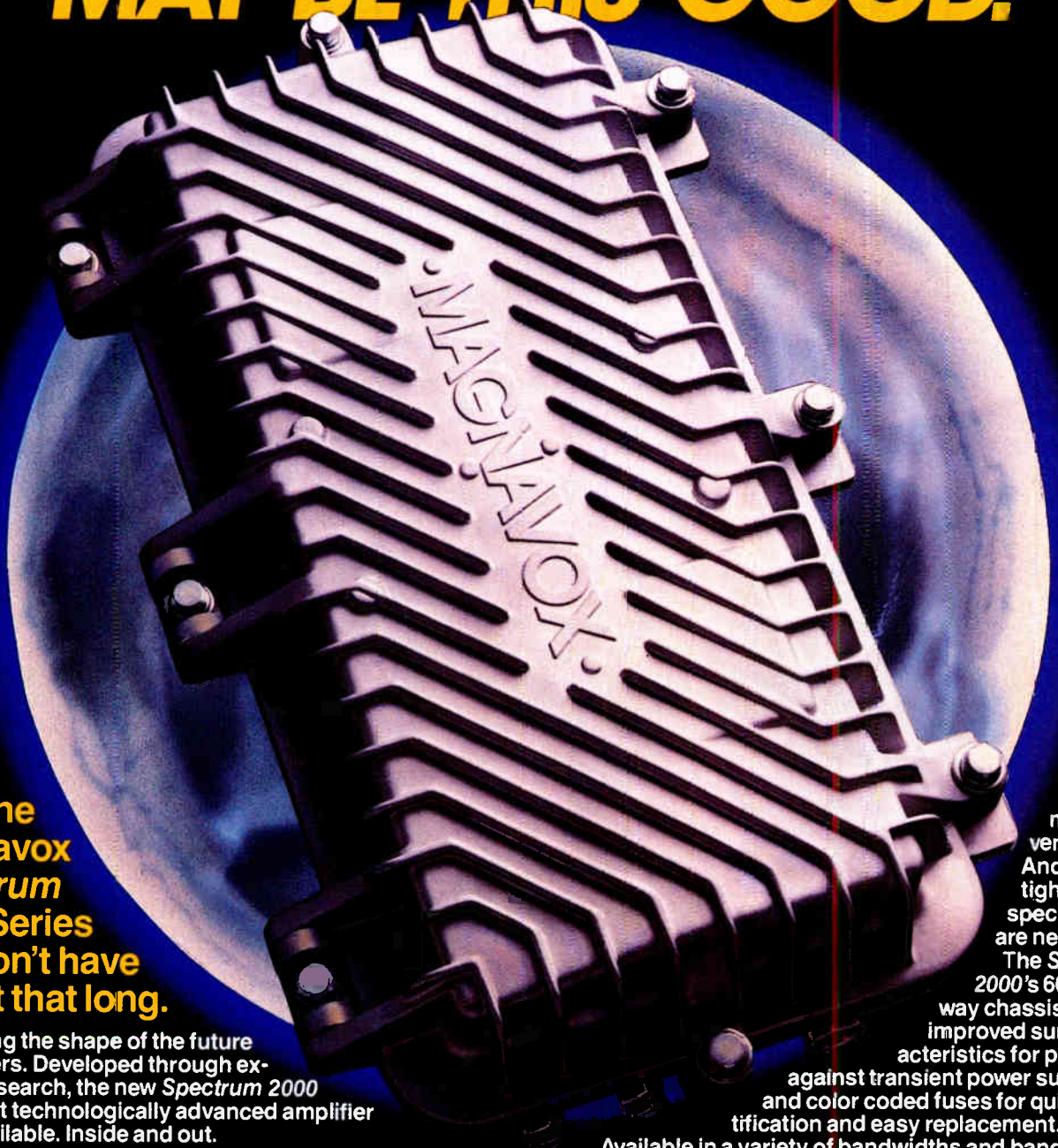
Develop a production plan that establishes how many miles of plant are to be constructed and at what monthly rate they must be built in order to meet your time requirements. Establish start and completion dates.

You also should continuously review the project. Establish on-site displays, schedules, maps and any other visual aids that illustrate the status of the project and enable you to determine the progress to date. Hold weekly status meetings to evaluate progress and status, discuss current problems and review unresolved items discussed at previous meetings. Issue minutes to review at the next meeting. Review makeready matters and delivery schedules or any other items that may affect progress at this meeting.

Utilize a system of positive inventory controls for the receiving and disbursement of system-related materials received on-site and issued or returned by construction personnel. Review material status to ensure sufficient materials are available to complete the project.

*(Continued on page 36)*

# BY THE YEAR 2000, ALL AMPLIFIERS MAY BE THIS GOOD.

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*Reader Service Number 17.*

# The MDU in the rebuild process

**By Rick Cooper**
Broadband Network Design Specialist
Geographic Mapping Systems

Rebuilding MDUs—it's a proposal that makes most of us cringe, engineer and financial manager alike. When we consider the increasing performance and capacity requirements of CATV systems and the questionable condition of many MDU installations, the cause and effect of each seem to be on a collision course. My apologies to those techs who are currently installing CATV subsystems in these buildings and are doing a good job. I suspect, however, there are some systems that are not yet taking future requirements into account.

As we examine our current systems and realize even relatively new systems are now inadequate, we also should look at our current MDU inventory. Chances are the technical quality of the average MDU is somewhat less than that of the current system feeding it. Tomorrow's CATV systems are being rebuilt with an eye toward providing more services at greater performance. With these goals in mind we can create four categories of concern in MDU operation:

1) Performance
2) Theft of service
3) Leakage
4) Maintainability

Not surprisingly, these same four goals are the foremost concerns of overall CATV operations today and in the near future. Just as every apartment building, hospital, school, etc., is unique in its style and manner of construction, so are the MDU subsystems (MDUSs). If we begin to think of each MDUS as a small CATV system merely fed by the master CATV system (rather than just a big residential install) the problems of each take on a new and rightfully more important meaning. After all, when your multimillion dollar rebuild is complete and you're ready for the 21st century, do you want large blocks of customers still fed by copper braid, unshielded fittings, 220 MHz passives and even tube amplifiers?

Charles Thompson

Many MDUs are just '50s-era rooftop antenna systems (loop, of course) with a CATV drop spliced in. Why? It was expedient and cheap. Many others were wired a unit at a time by a succession of installers. Other larger ones were post-wired, each an endeavor of creativity, no two the same. Now we have thousands of MDUs of endless varieties and capabilities. Consider how each of our four categories of concern is affected.

## Performance

Performance can be described as the reliability and quality of the customers' service. There are several common situations that can work against these goals. For example, the following conditions may be found in a larger MDUS:

1) Long RG-59 copper braid feeder cables in loop configurations will require additional amplification with increased bandwidth. This could add to the two line extender cascade limit on your main system design. Shortening these runs or rerouting cables may turn out to be a major project in large buildings.

2) The incredible number of obsolete drop fittings in cascade on these RG-59 feeder loops, hidden behind walls and ceilings, greatly increases the chances of trouble as the bandwidth increases.

3) Old low-bandwidth passives, often concealed, will limit the upper bandwidth of the system.

As the performance tolerances demanded by tomorrow's systems get increasingly tighter, the negative effects of this equipment will become more evident and troublesome.

## Theft of service

Many high-rise MDUSs are configured with wall plate taps, where customers must provide access into their units for installs or disconnects to be made, or time-consuming arrangements must be made with the management to gain entry. Under those conditions, secondary outlets and ancillary services of the future will be hard to control.

At other locations, apartment boxes and pedestals are constantly being mutilated and many taps are in plain sight on outside walls, in closets or basements. As potential revenue-per-customer amounts continue to climb, pressure will increase to provide secure MDUSs. Buildings with pre-wired home runs to heavy-duty lockboxes 8 feet off the ground will greatly reduce pilfering.

## Leakage

Reports on actual signal leakage emissions from MDUs are scarce but are expected to rise dramatically once CLI com-

pliance becomes mandatory. Considering the high levels (up to +55 dBmV) being pushed through copper braid cable, hundreds of unshielded fittings and exposed-circuit passives behind wall plates I doubt that the natural shielding properties of the building construction will be sufficient.

Many institutions and apartment complexes employ a maintenance staff that feels confident making minor repairs (splices) with pliers and crimp ring fittings. Many current installations allow for easy service theft making leakage-producing splicing a problem.

Any installation that has not used leakage-reducing parts and kept splicing to a bare minimum (using home runs to coax-fed lockboxes) will be a problem. Using that assumption, a large percentage of MDUSs may have a leakage problem.

**Maintainability**

This category is directly affected by the three already mentioned. By maintainability I mean MDUS construction that minimizes future maintenance requirements and contributes to the ease of that maintenance. This will complement the growing requirement to provide uninterrupted service, greater efficiency from each tech and fewer truck rolls.

Most converted master antenna TV (MATV) MDUSs are maintenance nightmares and, as a result, many systems refuse to maintain them or guarantee picture quality beyond the CATV/MATV interface. This causes the usual name-calling and passing-of-the-buck where the CATV operation always loses. MDUSs that were individually post-wired are constant vandalism and theft targets that require expensive and constant repairs.

Many larger post- and pre-wired complexes have no constant theme or specifications in design or construction. In fact, many times ease and cheapness of construction was the main criteria—not efficiency and quality of operation! As a result, equipment is located in crawl spaces, attics, pedestals, laundry rooms, maintenance rooms and closets. Worse, these areas are often locked, the keys with the absent or uncooperative manager or on a hook back at the CATV office.

In the past, details of cable routing and equipment location were contained in the individual technician's memory. As systems become larger, more complicated and more efficient, we will not be able to rely on this method. Standardized design and construction combined with concise and "handy" documentation will become a necessity. The number of trouble calls generated by MDUS performance in picture quality, theft, leakage and poor construction practices coupled with the inherent difficulty of actually finding the problem and fixing it make the MDUS a definite weak link in our ability to provide the services of the future.

**Rebuild planning**

Prior to the walkout process a meeting(s) with all concerned should be held and the current state of the MDUS inventory vs. future system requirements discussed. A field study already should have been made with input from the maintenance technicians involved in the day-to-day operation of the MDUs. From this information, each MDU's compatibility with future needs can be determined and applied to the financial resources available. The usual compromises can be made and a set of system or MSO-wide specifications drawn up. Even if no resources can be spared we will know what the future consequences of our inaction will be. The specifications, if carried out, will accomplish four things.

First, the system or contract walkout person will be able to apply a yardstick to each MDUS and determine what signal and distortion levels will be required to serve the building. He can assess what repairs and changes are to be made and what can be done to provide uniform and accessible equipment.

Currently, at best, the designer is provided the actual signal levels that appear at the connection point of each MDUS. That level is provided in the new design. This creates, as an example, a 550 MHz system feeding a 300 MHz system. In a good design, the new specs should be carried out through the subsystem to the subscriber tap. After all, an MDU subscriber is no less important than a residential sub and should be able to receive the same quality of service.

Second, the adoption of a standard "construction code" will eventually make MDUS construction similar enough so the tech, unfamiliar with the building, can make assumptions on where equipment is located, what parts to carry on the truck and what signal levels are correct. Many times, the tech doesn't know if a level is truly low or just "low, but normal."

Third, these specifications can be communicated to the building trades, architects, electrical engineers and even regulatory entities in the area. Most MDUSs requiring conduit or fire-retardant systems are designed by the architect with a MATV loop system in mind. This was fine in the '50s but now CATV is the dominant system and allowances should be made

***"Many MDUSs are just '50s-era rooftop antenna systems (loop, of course) with a CATV drop spliced in."***

A CATV conduit system will cost more than a MATV system but, considering the benefits, arrangements could be made to share costs. Even better, the local franchiser's enthusiasm for better service, quality and availability can be bounced off the CATV provider and directed toward pressuring the building trades into cooperation. It can be argued that CATV present and future services have become important enough to be mandatory in MDU building construction and that specifications should be met before the new building or subdivision can be occupied.

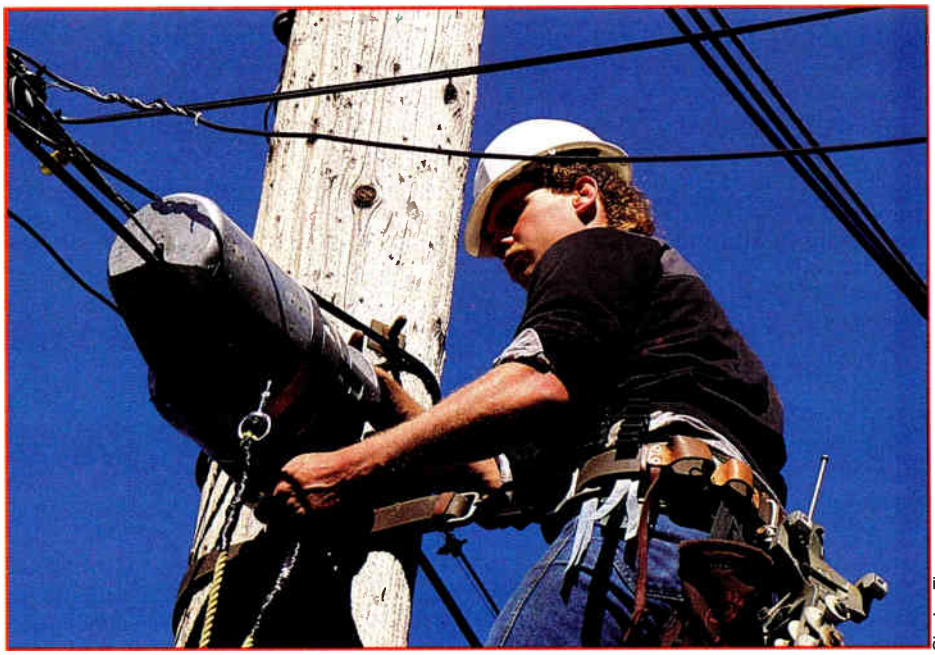
A program such as this also would help ensure that all new construction is properly planned and pre-wired to the CATV system's present and future benefit. Even if the owners do not plan to allow CATV service on their premises, an aggressive program to wire all new construction will ensure the wiring is compatible when CATV does inevitably connect. Many of these suggestions may seem radical but are actually policy in some individual systems and are not new ideas at all.

Fourth, on a management level, standardization and improved performance of MDUSs will improve customer satisfaction and service while at the same time reducing maintenance related overhead. Future services can be integrated without compromise. The experience gained from more professional management and implementation of MDUS rebuilds will undoubtedly help us compete in I-NET or LAN opportunities the future brings.

When a rebuild is planned we invariably assume the greatest picture and service quality degradation will occur at the farthest reaches of the system. Actually, our services may have a more difficult time reaching a cluster of customers just blocks from the headend. This highlights the need for an in-depth planning process before the rebuild construction begins. Input from all those concerned in the operation of the plant should be collected and analyzed to ensure that when complete, the rebuild meets all specified goals.

# How to manage rebuilds and upgrades

**By Larry C. Brown**
Vice President-Engineering
**And Jerald L. Evans**
Vice President-Construction, NaCom Corp.


Charles Thompson

As the United States becomes more fully wired, new-builds of cable plant have become rare, in favor of the more frequent upgrade or rebuild. Rebuilds and upgrades by their nature require that active plant be tampered and tinkered with in the process of renovation. Unfortunately this comes at a time when customer service and system uptime are of paramount importance.

Meanwhile, the last decade has brought with it a myriad of new technical challenges for the system operator. Addressability, VCRs, IPPV, fiber optics, composite triple beat (CTB), 550 MHz, BTSC stereo, Multi-Port and other technical complexities were never heard of in cable TV just 10 years ago.

Contending with all this makes CATV plant construction more of a project management, supervision and technical challenge to the cable operator than ever before. What follows are some suggestions to system operators, based upon our experience in rebuilding and upgrading thousands of miles of cable plant for numerous operators.

### Use careful planning and implementation

The design and planning stages on the front-end of a rebuild or upgrade are crucial. If upgrading (where the goal is to salvage much existing cable), time should be spent carefully spot checking the accuracy of existing system maps. This can be accomplished by a simple walkout. If as-built results are not accurately reflected on the maps, consider adding a 100 percent as-built walkout to the project to confirm exactly what plant is already there before attempting renovation.

In recent years as computer technology has matured, the cost/benefit of CAD (computer-assisted drafting) has dramatically improved. Because plant technical performance margins continue to narrow, availability of accurate system design maps is more critical than ever. Consider adding a step in the rebuild or upgrade project to digitize and update existing system maps into a popular vector-oriented CAD program, such as AutoCAD. This enables quick and easy changes to system design maps. The payback in system maintenance efficiency can be many times the minimal cost for the digitizing process.

The process of salvaging segments of cable and amplifier housings on an active cable plant with minimum subscriber interference is a very sensitive issue in a plant upgrade. Therefore, allow a generous amount of preplanning time for rebuild and upgrade processes and work flow. Formalize how your construction crew will communicate with your maintenance personnel as work progresses. Make a checklist of the procedure for reconfiguring a system powering area into a sequence of steps, stating clearly which switch should be selected and when to select it to achieve the final configuration with minimum service interruption and no "bucking power" problems.

### Go slow and do it right

Accept slower run rates of construction progress on upgrades than you would expect from a new-build. The technical complexities take more time to manage and keep under control than straightforward new-build construction. A 20-mile per month upgrade can require as much management and supervision as a 60-mile per month new-build. Plan accordingly.

When it comes to plant renovation, don't trade quantity for quality. The pain and cost of quality defects caused by realistic "blasting-in" of rebuild or grade plant will linger long after the sh term gratification of "getting done time" is forgotten. Cheaper is not alwa better. Staff for more thorough and profe sional project planning and managemer in your organization. If staffing in-house is not feasible because of a shortage of qualified personnel, consider contracting a total turnkey redesign/rebuild to a qualified contractor who has experienced resources.

***"Accept slower run rates of construction progress on upgrade than you would expe from a new-build."***

The advent of widespread upgrades and rebuilds, along with the technological change our industry has undergone in the last few decades, makes CATV construction today a complex undertaking. It is destined to become even more so in the future. However, it is more manageable if operators recognize and deal with it accordingly. The dividends in so doing are perpetual.

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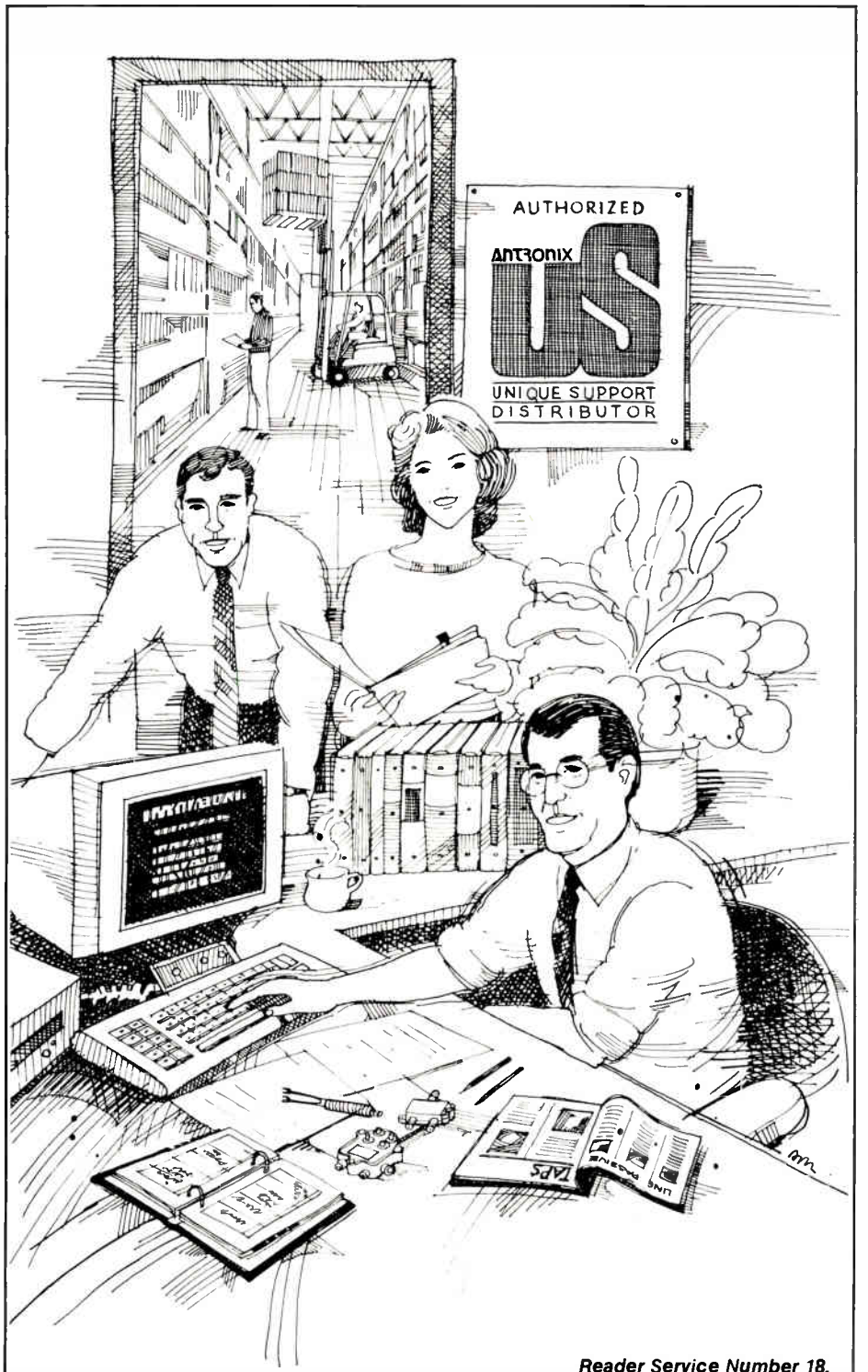


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# CATV and a smarter-than-the-average house

**By Ken Geremia**
Manager of Information Services
**And Ken Jenkins**
Manager of Coaxial Systems, Smart House L.P.

Have you ever been inside a home under construction? It's a confusion of conductors for power, telephone, audio, security, thermostat, doorbell, low-voltage switching and cable TV. This network of wires has grown like so much spaghetti since the days of Thomas Edison and George Westinghouse only a century ago. As the number of wires grow, so also do the number of special outlets and jacks for power, telephone, audio, CATV and even computer data links. Now along with all this enters the concept of home control and automation. You guessed it—more wire.

Distribution and control of power and communications in the home has become a nightmare for installers, users and servicers alike. The chances for miswiring, misuse and misery seem to be aggravated with every new technical capability we add. So, why not rethink the system? Why not consolidate the crazy quilt of conductors strung inside (and outside) our walls into one simple cable that can be installed easily by one contractor? Why not have all the services conveyed by these conductors accessible through a single kind of outlet located throughout the home? Why not have a single system that integrates all services and provides for convenient and flexible control, operation and maintenance? Perhaps simpler can be better!

That's the thinking of more than 60 manufacturers of electric, electronic and gas-fired home products, and more than 60 national trade and research organizations (including the National Cable Television Association) and utilities representing the gas, electric and telecommunications industries. It's also the thinking of the National Association of Home Builders (NAHB) with some 150,000 member firms. In January 1985, NAHB's National Research Center launched what is now known as Smart House L.P. to develop a new system to wire and plumb our homes—a system to become the basis for total home automation.

The Smart House system (slated for commercial availability in late 1991) fully accommodates all kinds of communications technology. Through its coax network subsystem, it fully taps the capabilities and potential of CATV. Let's look at it.

## Coaxial network subsystem

The coax subsystem (shown in Figure 1) is a basic and integral part of every Smart House. It is comprised of coax drop cable, a headend device, directional coupler taps and F-type connectors. Design specifications for the active and passive components of the subsystem call for a useful life of not less than 25 years.

Two coax cables are automatically routed to every convenience outlet in the home because they are included in the unique Smart House hybrid cable (Figure 2) used for all 120 VAC branches. The system will support branch lengths of up to 200 feet. The dual cable approach in the subsystem's tapped-star topology is primarily intended to provide upstream and downstream access at any outlet. However, this configuration can be adapted to accommodate dual cable systems.

Although the hybrid cable will be easily terminated at each universal outlet by an insulation displacement connector tap, the two coax lines will be separately connected to the outlet with directional coupler taps. The coax may be tapped at any outlet location by the wiring subcontractor during the time of installation or the directional taps may be added later at the home-

**Figure 1:** Coaxial subsystem block diagram

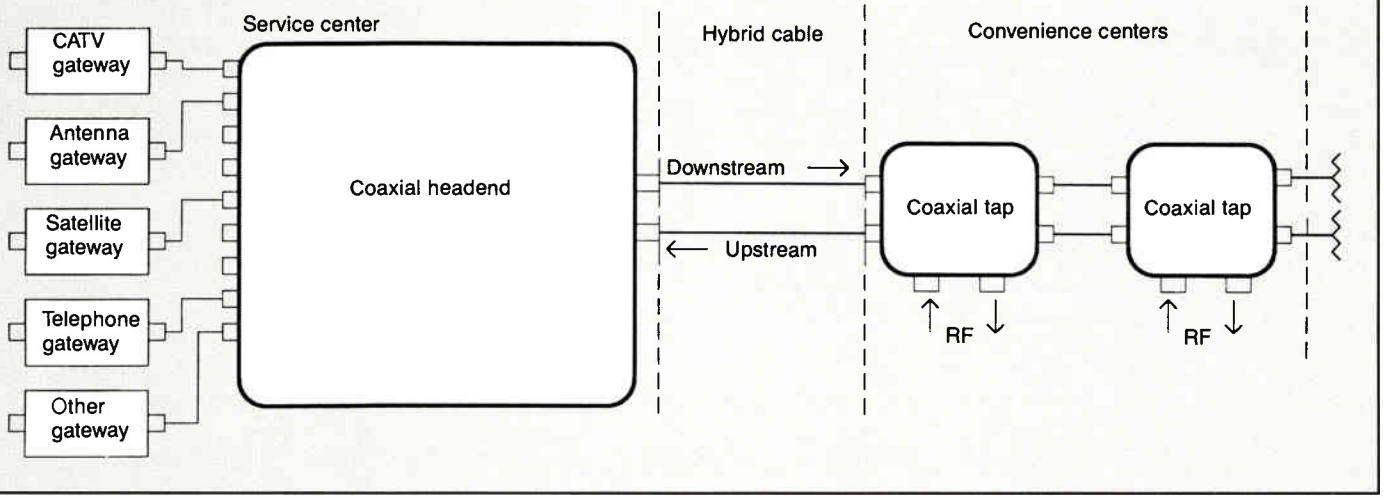
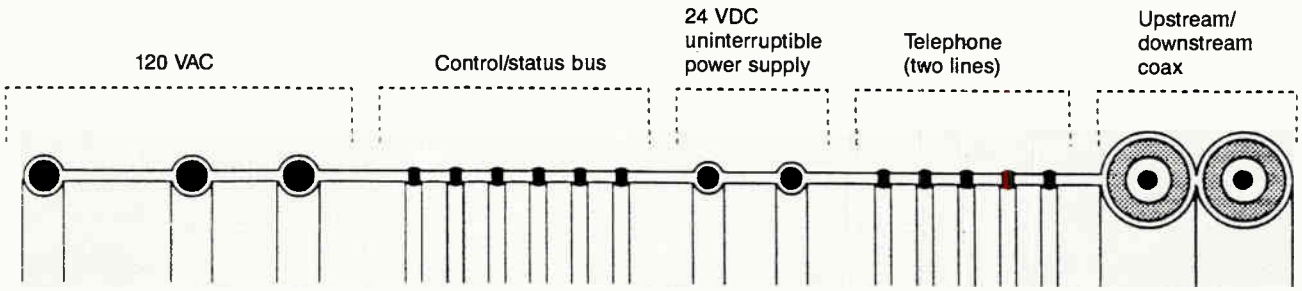


**Figure 2:** Hybrid branch cable



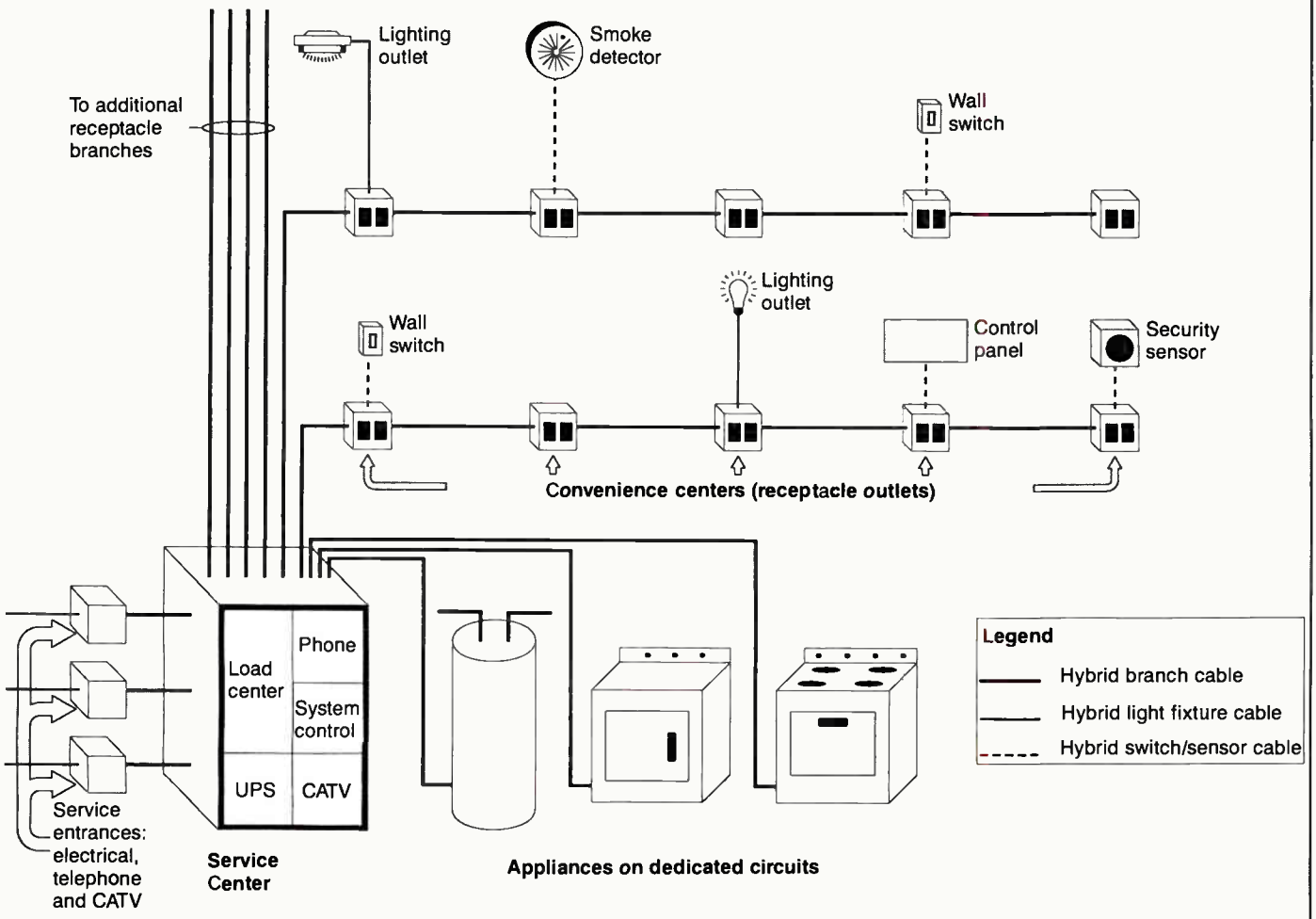

owner's option. Access is gained by removing the outlet face plate.

The taps are integrated; that is, coupling to both upstream and downstream cables is done with a single device. Connection of external appliances is compatible with push-on F connectors at the outlet face plate. The footprint of the universal outlet permits the use of existing plugs and connectors as well as Smart House integrated plugs. They can accommodate both power and RF services in addition to telephone, uninterruptible power supply, control and data lines.

Termination of low voltage lines within the same enclosures that handle high voltage delivery is restricted in conventional installations. However, because of the Smart House closed-loop protection afforded these outlet locations, Article 780 of the 1987 and 1990 editions of the National Electrical Code permits this

*(Continued on page 38)*

**Figure 3:** Typical Smart House installation



# How to prepare Form 320

*This article is based upon the author's presentation that will be shown April 24 on SCTE's Satellite Tele-Seminar Program. For better comprehension, refer to the accompanying Form 320 and instructions.*

**By John Wong**
Assistant Chief, Cable Television Branch
Federal Communications Commission

Let's discuss how to fill out Form 320, the FCC's Basic Signal Leakage Performance Report. You should have already received a copy of this form through the mail. If you haven't, just call (202) 632-FORM; we'll send it to you. As you know, you must return your completed Form 320 to us by July 1. Mail it to: Cable Television Branch, Federal Communications Commission, Washington, D.C. 20554. You'll find this address printed atop the first page of the form, but be sure to send it to the attention of the Cable Television Branch.

But let's say you no longer own the cable system for which you've received a Form 320—then what do you do? In this case, just return the form to us. And please attach to it the new owner's name, address and phone number so we can update our records.

## Section I

Now we'll work through the form, beginning with Section I ("General Information"). This section is preprinted on your form, with the information based on the most recent data the FCC has on file. If anything's wrong, just cross out the errors and write in the corrections. Please don't use "white-out" to cover up the preprinted information, since we need to keep our records up-to-date.

Before we fill out Section II ("Local System Information"), let me answer a question that operators of smaller systems might ask: "What do I do with Form 320? I'm not using aeronautical channels." In this instance, simply write on Line 2 of Section II something like: "Not using aeronautical channels." Then sign the form on the back and mail it to us. And that's all you have to do, but only if your system does not use aeronautical frequencies.

## Section II

So let's go ahead and fill out Section II. On Line 1, write the name, phone number and address of the person or persons at the local system level responsible for this report. This information is necessary if we need to contact that party in an emergency.

Line 2 reads: "Identify in Exhibit A, all precisely offsetted aeronautical frequencies used by this Community Unit." Here you are being instructed to attach a list of aeronautical frequencies (which should have been offset) that you're using at the time you submit Form 320. In the past, when you've notified us of your intention to use the aeronautical channels, there was a tendency—which was encouraged by the FCC—to submit a proposal for as many channels as you could all at once. This gave you the opportunity to have the channels available to use when you needed them.

Under the new set of rules all you must do is to write a letter notifying us that you intend to add channels. Then you can launch those channels without a response from us authorizing you to do so. However, we will respond to your notification to use additional channels only when there's something wrong in your letter. In that case we'll send you a boilerplate letter with a checklist of what you need to do to fix up your notification. After you've made the changes, mail your letter back to us. Then you won't have to suffer a time lag

**Form 320 (front)**

Approved by OMB
3060-0433
Expires 11/30/92

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

BASIC SIGNAL LEAKAGE PERFORMANCE REPORT
FCC FORM 320

Public reporting burden for this collection of information is estimated to average 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Federal Communications Commission, Office of Managing Director, Washington, D.C. 20554, and the Office of Management and Budget, Paperwork Reduction Project (3060-0433), Washington, D.C. 20503.

SECTION I -- GENERAL INFORMATION

(1) Cable System Owner: _____
Phone Number: (___)_____
Address: _____
_____ (City) ____ (State) _____ (ZIP)
(2) Community Served : _____
(3) Community Unit No.: _____ (4) Physical System Id: _____

SECTION II -- LOCAL SYSTEM INFORMATION

(1) Person(s) Responsible for report:
Name: _____ _____ ___
(Last) (First) (M)
Phone Number: (___)_____
Address: _____
_____ (City) ____ (State) _____ (ZIP)
(2) Identify in Exhibit A, all precisely offsetted aeronautical frequencies used by this Community Unit.
(3) TEST RESULTS: CLI: 10Log1oo: _____.____; 10Log13000: _____.____
Airspace: Passed: ___ Failed: ___

SECTION III -- LEAKAGE PERFORMANCE CRITERIA

For operators electing to conduct measurements on geographical areas that contain more than one Community Unit, fill in the measurement information below. However, the submission of the accompanying exhibits, either B or C, may be incorporated by reference to another Community Unit filing that had undergone the same measurement tests as this Community Unit. Identify that Community Unit by its Community Unit Code Number.

(1) GROUND-BASED MEASUREMENTS: (if used)
(a) Person(s) Responsible for test:
Name: _____ _____ ___
(Last) (First) (M)
Phone Number: (___)_____
(b) Miles of plant tested & % of total plant tested: _____m;_____.__%
(c) Time period of test: From: __/__/____ To: __/__/____
(MM DD YR) (MM DD YR)
(d) Equipment Used: _____ _____ _____.____(MHz)
(Make) (Model) (Test Frequency)

(e) Attach as Exhibit B, the CLI calculation & result including all parameters used. (Identify in this Exhibit all leaks ≥ 50 uV/m, and show their repaired dates, if any.)

FCC Form 320
December 1989

to begin using your new channels.

By supplying us with a correct list in Exhibit A of the aeronautical channels you're using, you'll be helping us compile an accurate data base. So if there's interference on a certain frequency in your area and we know from your Form 320 that you're not using that frequency, we can begin to rule out your system as a possible cause. There will be fewer hassles for you if a problem does occur and you're not at fault.

Continuing with Section II: Line 3 is actually what Form 320 is all about. We ask for the results of the annual CLI test. You could have employed either one of two techniques to measure CLI, ground-based or airspace. For ground-based, choose between two methods of calculation—$I_{\infty}$ or $I_{3,000}$.

To calculate CLI using $I_{\infty}$, do the following: After completing your driveout of 100 percent of your plant, make a list of all leaks greater than or equal to 50 microvolts per meter ($\mu$V/m). Then square the value of each leak and add up these squares. (However, if you monitored less than 100 percent of your plant you must also: Divide the number of miles in your plant by the miles monitored—it should be a number greater than one—then multiply this result by your sum of the squared leak values.) Next, find the $\log_{10}$ of this number and then multiply that log by 10. Write the result on the form in the space following "CLI $10\log I_{\infty}$"

If you want to use $I_{3000}$, that's OK, but it's a bit difficult. To do this, you need to find the radius of your system. In fact, if you can pass $I_{\infty}$, there's no reason why you should bother with $I_{3,000}$. Still, the choice is yours. Whichever method is used, simply put the result of your calculations on the appropriate line. But do not check the space after the word "Passed" on the line beneath your ground-based CLI score, since this refers only to airspace measurements. We'll know from the number you submitted to us whether or not you've passed the CLI test for the ground-based technique. Generally, a number not greater than 64 passes for $I_{\infty}$ and one not greater than −7 passes for $I_{3,000}$.

The aerial approach is usually completed by a consultant, who has provided you with procedures used, charts, graphs and all other necessary information (more about this in Section III)—plus whether or not you've passed. So if an airspace measurement is performed, just check one of the two, "Passed" or "Failed." I don't anticipate too many of you will be marking "Failed."

One more thing about Line 3: Just fill out *one* of the spaces. Some people have wanted to tell us, "I did a CLI $I_{\infty}$, I did a CLI $I_{3,000}$, and I passed the airspace test." In effect, what they did was submit one set of parameters but check off other spaces as well. This creates problems for our data entry people, so please fill out only one space.

## Form 320 (back)

BASIC SIGNAL LEAKAGE PERFORMANCE REPORT
Page 2

SECTION III -- LEAKAGE PERFORMANCE CRITERIA
(Continued)

(2) AIRSPACE MEASUREMENTS: (if used)
(a) Person/Company Responsible for test:
Name: _____
(Last, First, M, or Company Name)
Phone Number: (____)_____
(b) Dates of Test-From: ___/___/___ To: ___/___/___
(MM DD YR) (MM DD YR)
Test Freq.: _____._____(MHz)

(c) Attach as Exhibit C, a full description of the test procedure, a list of the equipment used for the airspace measurements and a detailed description of the area covered by these airspace measurements. (Set forth in this Exhibit all leaks detected during these airspace measurements that were subsequently repaired and their repair dates, if any.)

(d) Recorded data and its analysis:
(i) If analog recordings, include in Exhibit C, a graph of the results and indicate the value of the smoothed out peak values _____uV/m.
(ii) If digitized recordings, include in Exhibit C, a plot of the results and indicate % of points recorded digitally below 10 uV/m: _____%

SECTION IV -- CERTIFICATION

I certify that I am _____(Official Title), of _____(Legal Name of Cable System Owner), that I have examined this Report and that, to the best of my knowledge and belief, all statements in the Report are true, correct and complete, and are made in good faith.

_____(Signature) _____, 19___(Date)

WILLFUL FALSE STATEMENTS ON THIS FORM ARE PUNISHABLE BY FINE AND IMPRISONMENT. 18 U.S.C. § 1001

FCC NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT AND THE PAPERWORK REDUCTION ACT

The solicitation of personal information requested in this Report is authorized by the Communications Act of 1934, as amended. The principal purpose for which the information will be used is to determine eligibility to use the aeronautical frequency spectrum in the provision of Cable Television Service. The staff, consisting variously of Engineers, Communication Industry Analysts, and Cable Technicians, will use the information to determine such compliance. If all the information requested is not provided, processing may be delayed while a request is made to provide the missing information. Accordingly, every effort should be made to provide all necessary information. Your response is required to obtain or to retain the requested benefit.

THE FOREGOING NOTICE IS REQUIRED BY THE PRIVACY ACT OF 1974, P.L. 93-579, DECEMBER 31, 1974, 5 U.S.C. 552a(e)(3), AND THE PAPERWORK REDUCTION ACT OF 1980, P.L. 96-511, DECEMBER 11, 1980, 44 U.S.C. 3507

FCC Form 320
December 1989

### Section III

Now, let's go to Section III ("Leakage Performance Criteria"). Its opening paragraph might confuse you. After reading it, you might ask, "What happens when I'm testing a system that includes more than one community unit?" The paragraph is actually saying that if your test incorporates more than one unit, just submit the one test and refer the other Form 320s (for the other units) to the main unit, the one to which you have attached Exhibit A and B or C.

Another question about that opening paragraph could be, "What if I have two or more different CLI tests that cover the area of my system?" In this case, you have several—for example, let's say two—driveout tests for your system but it incorporates several—let's say three—community units. You might have covered 1⅓ community units in one CLI test and 1⅔ community units in the other test. On one form, provide the necessary Exhibits B and write down the results of both of your tests (no matter how many you have) in Section II. For the other two forms (remember, one form for each community unit) you should refer us to the first form.

By the way, you'll learn more about how to handle situations such as these in a

*(Continued on page 42)*

# Combining MMDS/ITFS adjacent channels

**By Glyn Bostick**
President
**And Andrew Olney**
Electronics Engineer, Microwave Filter Co.

Because of filter limitations, adjacent channels in the MMDS/ITFS band cannot be combined to the same transmission line for transport up the tower to the transmitting antenna. Because of this, two transmission lines are required when adjacent channels are involved at the same facility. An adjacent channel combiner has been designed to overcome the limitations of filters. Adjacent channels are combined using an orthogonal feed system, similar to the method used for handling adjacent, cross-polarized TVRO

**Figure 1:** Four-channel combiner

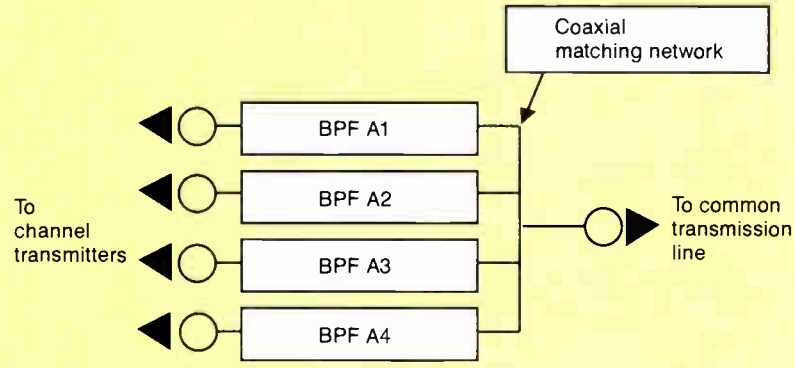
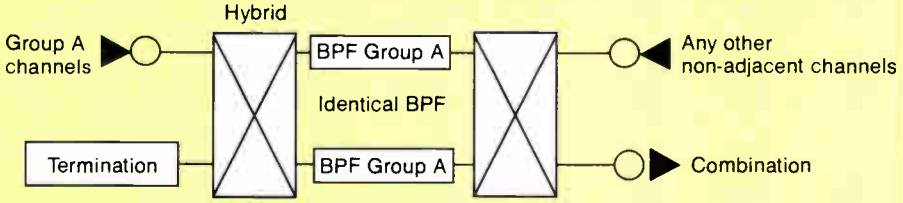
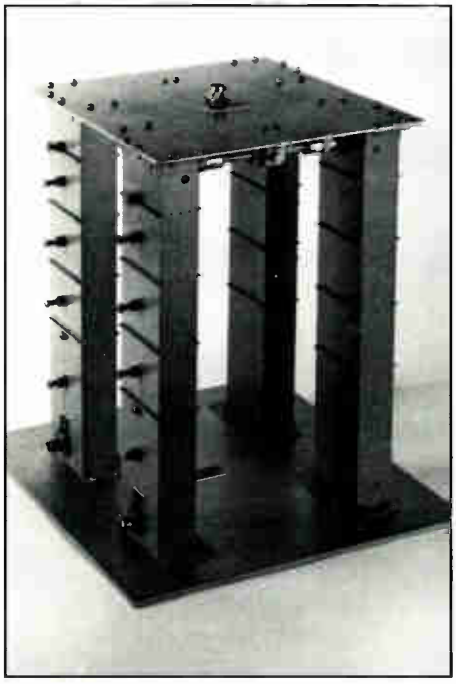



**Figure 2:** Group combiner



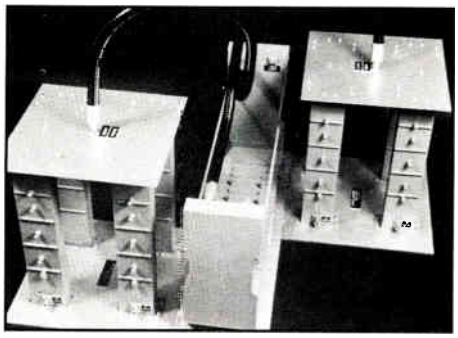



*A four-channel combiner (see Figure 1).*

## Instructional TV fixed service (ITFS) channel allocation

Note: Groups E & F are available for MMDS use.

| Group | Channel Number | Band limit (MHz) | Visual carrier frequency (MHz) | Aural carrier frequency (MHz) | Group | Channel Number | Band limit (MHz) | Visual carrier frequency (MHz) | Aural carrier frequency (MHz) |
|---|---|---|---|---|---|---|---|---|---|
| | A-1 | 2500-2506 | 2501.25 | 2505.75 | | E-1 | 2596-2602 | 2597.25 | 2601.75 |
| A | A-2 | 2512-2518 | 2513.25 | 2517.75 | E | E-2 | 2608-2614 | 2609.25 | 2613.75 |
| | A-3 | 2524-2530 | 2525.25 | 2529.75 | | E-3 | 2620-2626 | 2621.25 | 2625.75 |
| | A-4 | 2536-2542 | 2537.25 | 2541.75 | | E-4 | 2632-2638 | 2633.25 | 2637.75 |
| | B-1 | 2506-2512 | 2507.25 | 2511.75 | | F-1 | 2602-2608 | 2603.25 | 2607.75 |
| B | B-2 | 2518-2524 | 2519.25 | 2523.75 | F | F-2 | 2614-2620 | 2615.25 | 2619.75 |
| | B-3 | 2530-2536 | 2531.25 | 2535.75 | | F-3 | 2626-2632 | 2627.25 | 2631.75 |
| | B-4 | 2542-2548 | 2543.25 | 2547.75 | | F-4 | 2638-2644 | 2639.25 | 2643.75 |
| | C-1 | 2548-2554 | 2549.25 | 2553.75 | | G-1 | 2644-2650 | 2645.25 | 2649.75 |
| C | C-2 | 2560-2566 | 2561.25 | 2565.75 | G | G-2 | 2656-2662 | 2657.25 | 2661.75 |
| | C-3 | 2572-2578 | 2573.25 | 2577.75 | | G-3 | 2668-2674 | 2669.25 | 2673.75 |
| | C-4 | 2584-2590 | 2585.25 | 2589.75 | | G-4 | 2680-2686 | 2681.25 | 2685.75 |
| | D-1 | 2554-2560 | 2555.25 | 2559.75 | | H-1 | 2650-2656 | 2651.25 | 2655.75 |
| D | D-2 | 2566-2572 | 2567.25 | 2571.75 | H | H-2 | 2662-2668 | 2663.25 | 2667.75 |
| | D-3 | 2578-2584 | 2579.25 | 2583.75 | | H-3 | 2674-2680 | 2675.25 | 2679.75 |
| | D-4 | 2590-2596 | 2591.25 | 2595.75 | | H-4 Not Assigned | | | |



*A group combiner (see Figure 2).*

channels at a dish feed. This permits combining all 31 multichannel multipoint distribution service/instructional television fixed service (MMDS/ITFS) channels onto one tower transmission line. Details and test data are presented in this article for the experimental adjacent channel coupler.

**The problem**

The 186 MHz spectrum 2,500-2,686 MHz is allocated to the 31 channels in the ITFS/MMDS band. (See the accompanying table.) The ITFS band was initially reserved for point-to-point transmission of educational TV programming (from campus-to-campus at universities for example). Later, certain channels were licensed for microwave distribution of TV entertainment in the MMDS band (from a central metropolitan transmitter to apartment rooftop dishes for example). Some systems have started to use this band to extend service to remote locations when it is more cost-effective than a plant extension.

Each of the 31 channels is 6 MHz wide —the same as VHF and UHF TV. Since there is no guard band between channels (6 × 31 = 186), adjacent channels cannot be combined without mutual interference using current bandpass filter techniques. To permit filter combination, channels are organized into "groups" of four contiguous non-adjacent channels as shown in the table. Figure 1 shows a typical quadraplexer (commonly called a "quad") for combining four group transmitters to a common transmission line. The 6 MHz guard band on either side of a channel allows use of a bandpass filter with feasible selectivity to isolate it from other channels in the group.

Two non-adjacent groups (A and C for example) have a 6 MHz guard band between their nearest channels (A4 and C1 for example) and therefore can be combined with a group combiner. (See Figure 2 and the accompanying photo.) By using

*(Continued on page 56)*

**Figure 3:** Combining 16 non-adjacent channels

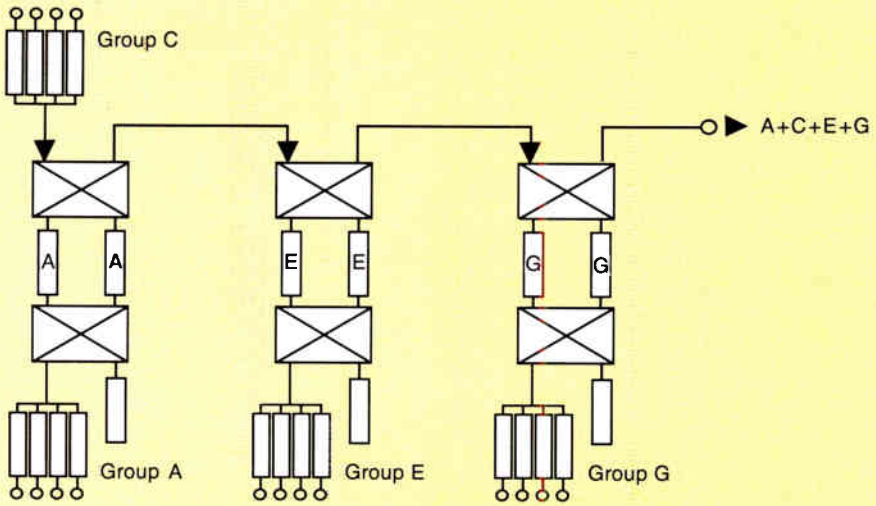



**Figure 4:** Current waveguide scheme

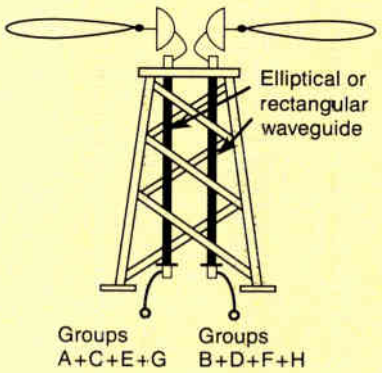



**Figure 5:** Experimental adjacent channel combiner

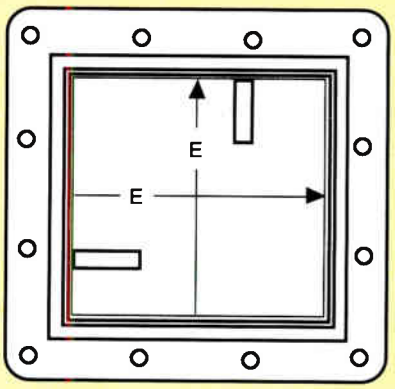
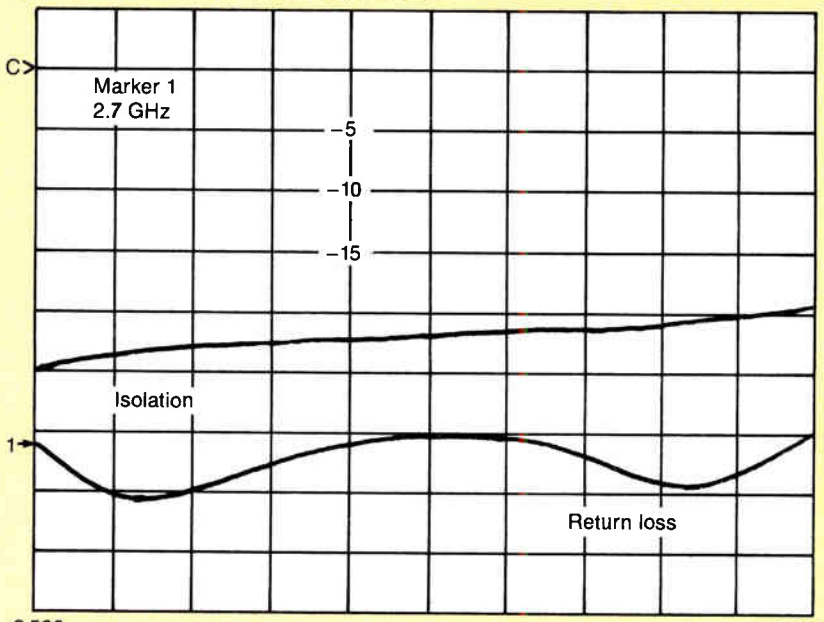



**Figure 6:** 20 dB cross-coupling



## Rebuilds

(Continued from page 24)

Develop construction standards incorporating one or more of the following: the telephone company blue book of system construction standards; the National Electrical Code (NEC); National Electrical Safety Code (NESC); applicable city, county, state codes and local county ordinances; and MSO or system construction standards. Compile a separate, detailed construction specification book, taking all of these references into consideration.

### Better safe than sorry

Safety and safe working conditions should be the focus of any construction project. Federal and state regulations as currently amended and applicable to CATV construction, especially those outlined in the Occupational and Safety Health Act (OSHA), should be reviewed along with contractor and system safety manuals. The safety program should be under direct supervision of the project manager.

It should be the policy of the contractor and system personnel to develop an equal employment opportunity (EEO) plan that meets the following requirements: Affirmative action must be taken by all parties to assure equal opportunity for all employees and prospective employees without regard to their race, color, religion, natural origin, age (except as provided by law), sex, physical or mental handicaps, or military disability (if qualified for the position or status as a military veteran). This applies to hiring, placing, upgrading, promotions, demotions, transferring, layoff, terminating, recruiting and establishing rates of pay. Be sure to comply with all federal, state and local laws including executive orders.

Develop system walk-out procedures that allow the contractor and system personnel an opportunity to review the quality and quantity of work being performed. A complete setup of system maps with *all* as-built notations should be entered, and agreed upon and verified by both contractor and system operator.

Prior to walk-out, system personnel should provide the contractor with a set of design prints equipped with a signature or sign-off space for both parties. The walk-out should be completed by a representative of both the system and contractor.

From this point, work can begin on the construction agreement, and development of the exhibits to be included in the contract and made a part of it.

ADELPHIA COMMUNICATIONS
A.T.C. CABLEVISION IN-
DUSTRIES C-4 MEDIA
DOUGLAS CABLE COMMUNI-
CATIONS FALCON CABLE
HELICON CORP.
LENFEST
GROUP

# Toner TAPS

You can judge us by the companies we keep...

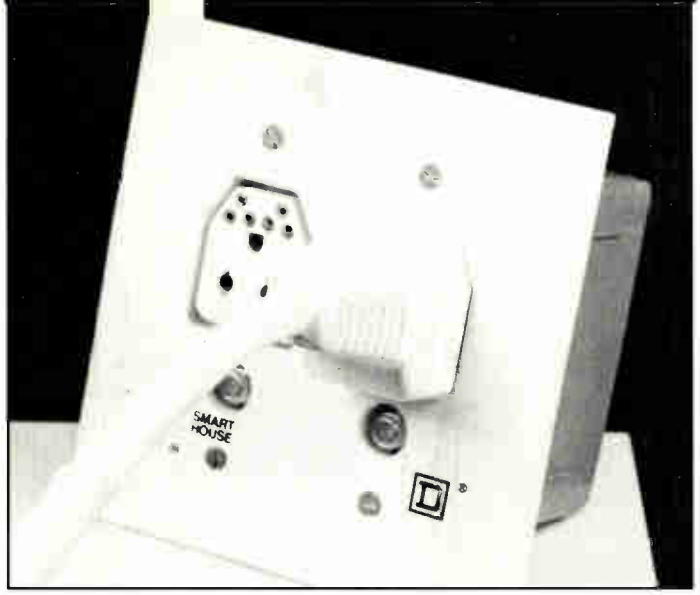
MARCUS
POST
RIFKIN
SONIC
STAR
TRIAD


Toner
cable equipment, inc.

800-523-5947
IN PA 800-492-2512/FAX 215-675-7543
969 Horsham Road/Horsham, Pennsylvania 19044



*Reader Service Number 21.*




John Durand Photography

*The convenience center is the access point for all electrical services and control signals, and serves as universal connection point for "smart" as well as conventional appliances.*

## Smart House

*(Continued from page 31)*

technique. Closed-loop protection renders the high voltage outlet inactive until an appliance is plugged in.

Initial versions of the modular headend device will be able to handle up to eight cable branches with up to eight integrated taps each. Easily expanded versions will handle up to 30 cable branches. Thus, up to 240 coax outputs and 240 coax inputs can be incorporated in a basic home network without suffering significant insertion loss or degradation of the signal.

The Smart House coax subsystem will use RG-59 cable with enhanced shielding to provide better than 100 dB ingress isolation. Determinations are now being made on whether to use a quad shield type using two 95 percent braid outer conductors plus two foils or a dual shield type with foil and 95 percent braid outer connectors. The dual coax portion of the hybrid cable will be color coded white for upstream operation and black for downstream.

### Coaxial headend capabilities

At the hub of the star distribution topology is the coax headend. It is located in the Smart House service center along with the following:

1) A load center that provides ground-fault protection to all high voltage branches;
2) A remote control device to switch breakers feeding 240 VAC dedicated branches. (Note that all control in the Smart House is handled by data signals, thereby enabling the control of all home functions and operations to be assignable to and accomplished by the homeowner's choice(s) of wall switches, sensors, telephone, touch screen TV, hand held remote control devices and even voice recognition systems.);
3) A 24 VDC uninterruptible power supply to serve all low voltage applications (including the headend) and to maintain all logic and alarm systems in the Smart House in the event of a main power failure;
4) A system controller that contains the circuitry for managing operations on up to 30 branch circuits. (Note: For reliability

and efficiency, the Smart House employs a distributed control technique that allocates control responsibilities among discrete controllers.); and

5) A telephone gateway that contains a modem and, in enhanced versions, can interface with and distribute ISDN and optical fiber services.

The coax headend (being designed by Broadband Networks Inc. and the Smart House engineering staff) serves several purposes. It provides for a bandpass of 5 MHz to 806 MHz throughout the system and is available at every cable tap. In addition it is the entry point for external services such as CATV, off-air TV, DBS (direct broadcast satellite), MMDS (multichannel multipoint distribution service), home TVRO and future video services that may be provided by Bell Operating Companies. It also can serve as a two-way communication link between CATV operators and a Smart House, which could open up possibilities for diagnostic, emergency and security services.

The headend can handle multiple in-house generated video/audio (IHGV) signals consisting of video cameras (including S-VHS), laser disc, audio entertainment systems (including compact disc players and the like), high-speed data communications transmission and voice signals such as telephone and intercom. Non-video signals will not interfere with standard, HRC or IRC TV channels. Along with stereo amplifiers and receivers, Pioneer Electronics (USA) Inc. is designing a special coaxial system entertainment adapter that will allow conventional audio and video equipment to take advantage of the Smart House system.

CATV channels are fed through the system on the same frequencies as they are received. Off-air TV channels are transmitted on the same frequencies also. IHGV signals are transmitted on frequencies compatible with current TV receivers but

## Smart House participating firms

AMP Inc.*
Apple Computer
ARCO Solar Inc.
AT&T Network Systems*
Belden Wire & Cable
Bell Northern Research
Bose Corp.
BRIntec Corp.
Broadband Networks Inc.*
Broan Manufacturing Co. Inc.
Burndy Corp.
C-COR Electronics Inc.
Canada Wire and Cable Ltd.*
Carrier Corp.*
Challenger Electrical Equipment Corp.
Computest Inc.
Dicon Systems Ltd.
Domestic Automation Co.
Double Energy Systems
Ducane Industries*
Dukane Corp.
DuPont Connector Systems
Eaton Corp.
Emerson Electrical Co.
Federal Pioneer Ltd.
Gas Research Institute
General Electric Co.
Honeywell Corp.
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JAE Electronics Inc.
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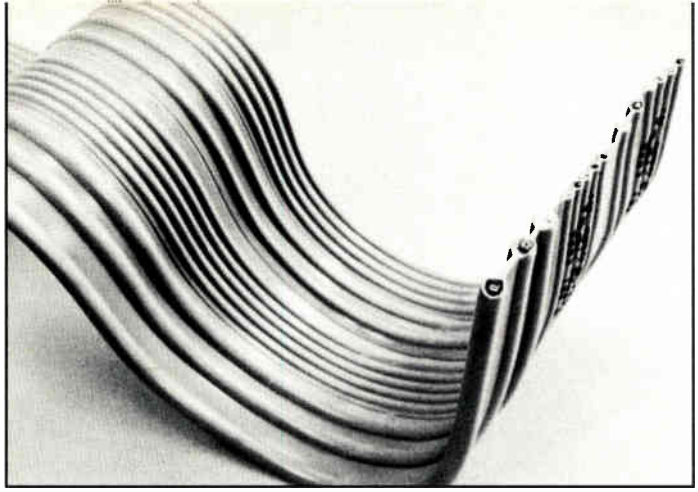
Southwire Co.
Square D Co.*
Teknika Electronics Corp.
Teledyne Laars
Toshiba America Inc.
TRS International Inc.
Water Heater Innovations Inc.
Whirlpool Corp.
Wiremold Co.*
X-10 (USA) Inc.

* Denotes companies that have signed Research and Licensing Agreements



***The multiple-conductor, flat ribbon cable, together with coaxial conductors, comprise the Smart House hybrid branch cable that will connect all power, control and communication services to convenience outlets throughout the home.***

may be allocated to other frequencies for future applications. The Smart House subsystem will be compatible with future advanced TV (ATV) and high definition TV (HDTV) formats. Provision also is made for the distribution of secure video channels, which can only be viewed by special receiving equipment.

The headend can combine internal signal channels with external services channels and it will amplify all signals to offset transmission losses. Network outputs for IHGV are provided from the headend to support the processing of those signals. Signal distortion on the network is minimal. Intermodulation distortion on the average CATV system will be increased by no more than 1 dB. CATV system video carrier-to-noise ratios will be reduced by no more than 1 dB.

Overall, the network will serve to enhance a cable company's efforts to comply with the cumulative leakage index limit of 50 $\mu$V/m at three meters. Although leakage is frequency specific, the Smart House design should not allow leaks in excess of 10 $\mu$V/m at three meters.

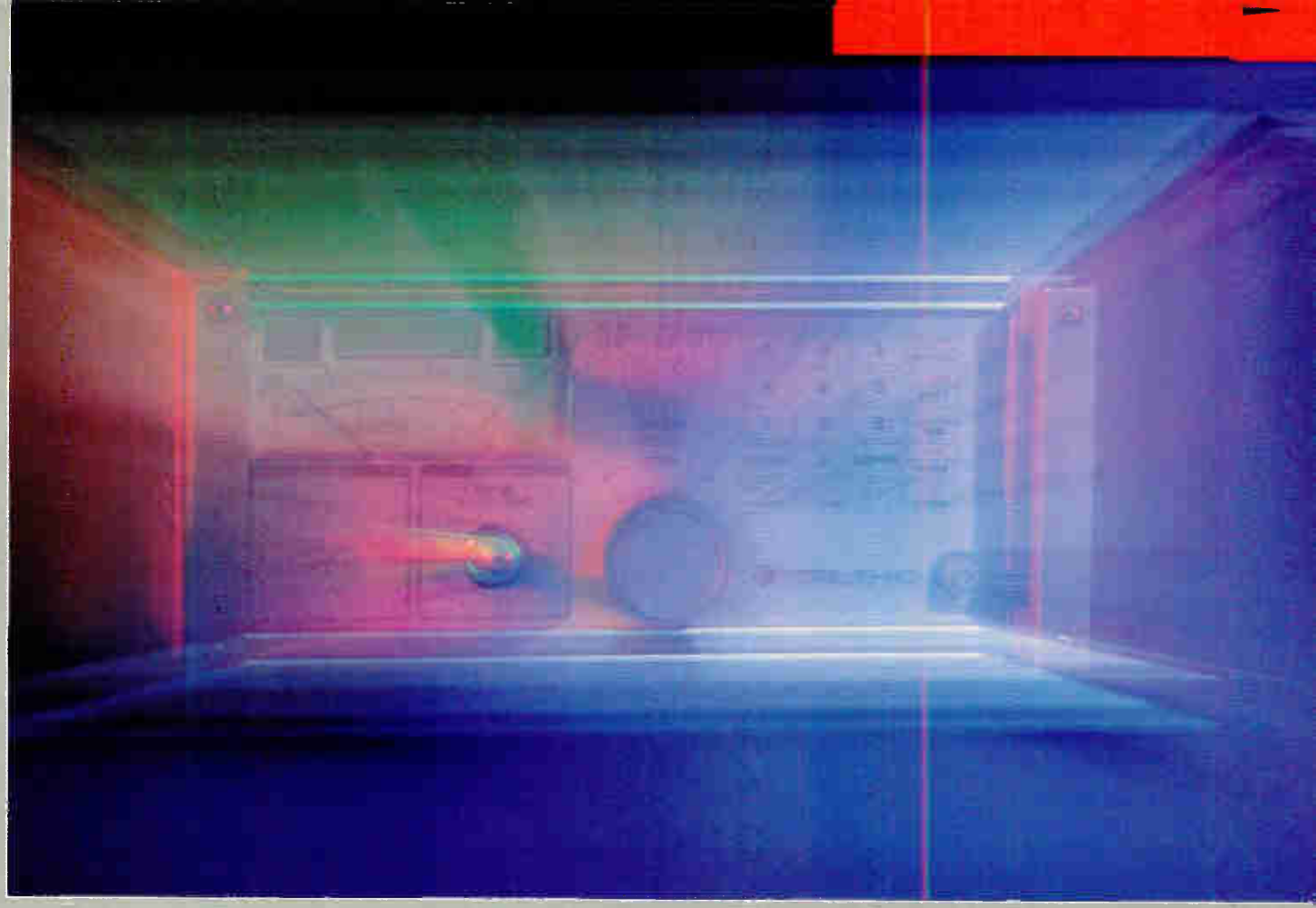
The bottom line for cable operators includes the following:

- *Simplified installation*. No more hassles deciding where the drops are in a home. No more rewirings. No home system expansion problems.
- *Reliable home distribution*. No more home connection concerns. No significant degradation or leakage problems.
- *Unlimited service expansion potential*.

**For more information...**

Smart House L.P. is a for-profit venture. As such, many of the specific details of its design are proprietary. This is for two reasons: 1) portions of the developing technology are patentable and 2) the companies developing the technology are granted exclusive licensing rights for a period of four years from the introduction of product. Up to three manufacturers may negotiate research and licensing agreements with Smart House L.P. to manufacture and market designated products for the system during that four-year period. After that time licensing arrangements can be extended to other manufacturers.

Those seeking information regarding the manufacture of products should contact Bob Hill, director of industry development, Smart House L.P., 400 Prince George's Blvd., Upper Marlboro, Md. 20072-8731.



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TRILITHIC

*Reader Service Number 66.*

# Form 320

*(Continued from page 33)*

similar example later on.

So let's begin filling out Section III. Part 1 refers to ground-based, Part 2 to airspace. Again, you'll fill out either one part or the other, not both. Line 1a asks for the name and phone number of the person responsible for conducting the ground-based tests. Name the person you hired or the one in your system who performed the tests.

Line 1b wants to know how many miles of plant were tested and what the percentage of total plant was tested. This is very easy when you have one CLI test for one community unit. I've seen a case where the system operator performed one ground-based test incorporating 10 community units. What was sent to us were 10 different CLI results. He said, "Even though I performed one test, I broke the system down into community units. Then I determined the percentage of plant that I actually drove out for each community unit and used that figure to recalculate the final result of this test."

Sorry, but that's wrong. Let me explain. Community units are predominantly used for administrative purposes in Form 320. For example, if you did one ground-based test for 10 community units, write down the miles of plant for the entire system tested. If you tested 90 percent of the plant, keep it at 90 percent for all 10 community units. In other words, the miles of plant refers to the entire test, not individual community units.

On Line 1c, we want to know the time period of the test, from month/day/year of start to month/day/year of finish. If you want to incorporate your last quarter's monitoring as your CLI test, you may do so. In effect, that means you have 90 days to perform your CLI. While this is adequate, I recommend that you drive out your system in the time span of 30 days or less, if you can.

Line 1d of Section III asks for information on the equipment used in the ground-based test: the make or manufacturer's name, the model number and the test frequency used. If you select a test frequency outside the VHF aeronautical bands, show correlation data in Exhibit B. But keep in mind that if FCC field inspectors test for leaks in your plant, they'll be measuring in the VHF aeronautical bands. It's to your advantage to simulate that.

For Line 1e, you must attach as Exhibit B your actual CLI calculations and result, including all parameters used. If you have software that allows you to just press one key to get the result, then find from the program's instruction sheet the formula being used. Put this formula in Exhibit B. This is also good for you, because you'll see what the formula looks like, and it might help you later on.

In addition, you must provide a list of all leaks (and their magnitude) that were greater than or equal to 50 $\mu$V/m when you detected them during your driveout. Include their repair dates, if any. It's generally not necessary to give us the location of those leaks; if we need to know, we'll ask to see your logs. And if you want to include additional information, go right ahead but it isn't necessary.

Part 2 of Section III concerns airspace measurements. Line 2a asks for the name and phone number of the consultant and/or company performing the flyover. In Line 2b, provide start and finish dates of testing, as well as the test frequency used. Attach as Exhibit C a full description of the test procedure, a list of the equipment used and a detailed description of the area covered. This is all fairly routine, and most consultants can give you this information with no problem. Also, please include a list of any leaks detected during the flyover that were subsequently repaired, along with dates of repair.

For Line 2d, you're asked to give the plane's recorded data and its analysis in Exhibit C. Before the advent of inexpensive computers, some consultants elected to use strip charts as they flew over the system. If this technique was used in your test, ask your consultant for a "best fit" curve on the strip chart. As long as that curve is less than 10 $\mu$V/m, you pass. But provide it in Exhibit C and indicate the value of that curve on Line 2d(i).

However, with digitized recording—most consultants now use this technique—you must include in Exhibit C a plot of the results. The percentage of points recorded digitally that fall *below* 10 $\mu$V/m should be written on Line 2d(ii). To pass, 90 percent of the data points must be below 10 $\mu$V/m.

### Section IV

Finally, we come to Section IV ("Certification"). Make sure this form gets certified, which means that everything put in the report is true, correct and complete, and made in good faith. It should be signed by a corporate officer because if we have to approach someone at your system, we'll go to the top first.

So we're finished with the instructions on how to fill out Form 320. Now let's discuss some situations that I mentioned

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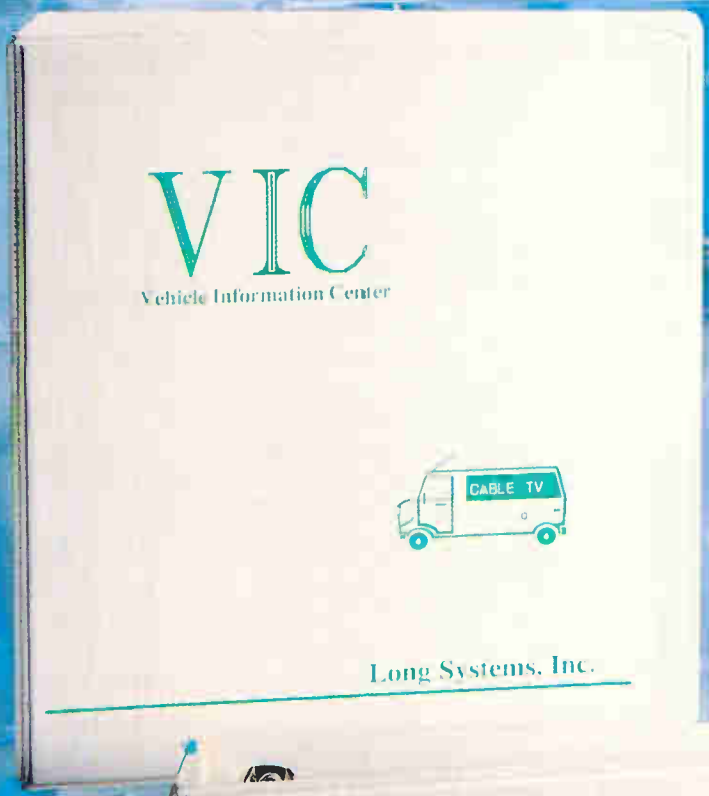


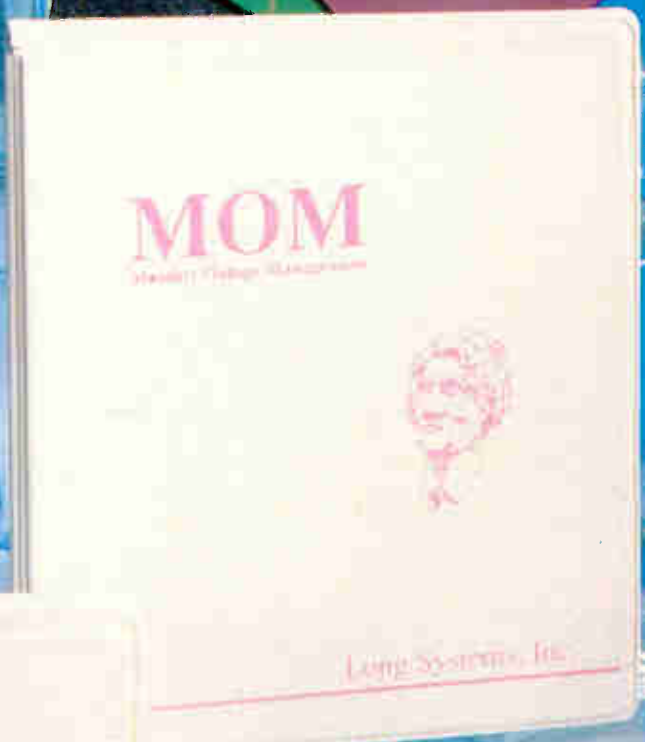


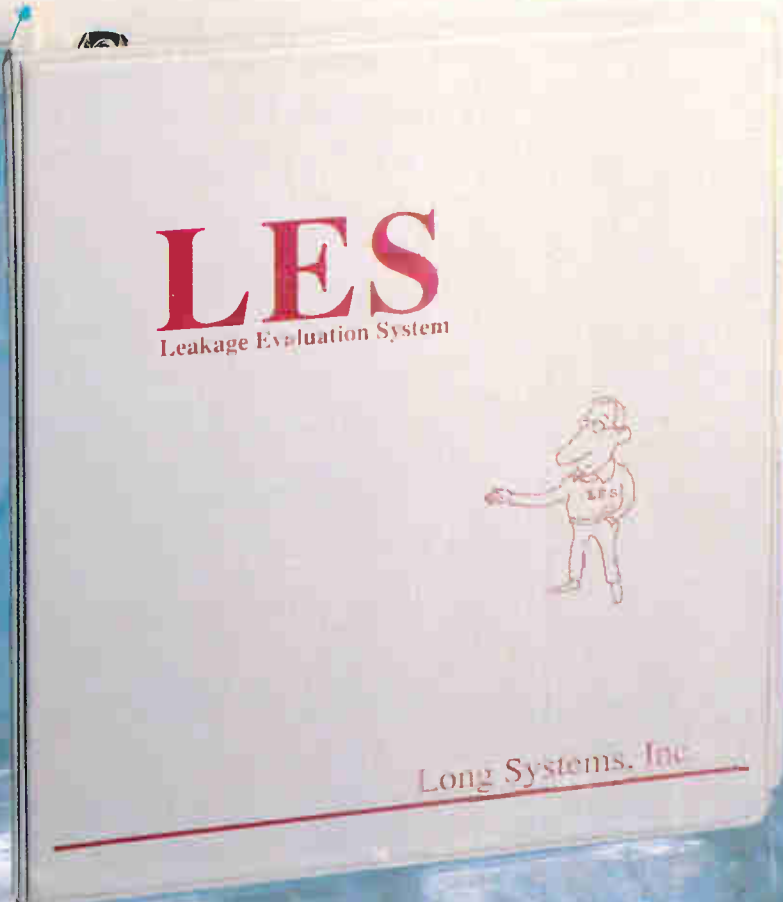


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previously. By the way, these are actual questions that I've received during the past month.

1) You've performed one CLI test that incorporates more than one community unit. Refer to Section II, Line 3, and understand that the results of your CLI test and the calculation used should be the same for each unit. If the figure of merit for your system turns out to be 50 for your I∞and that test covers 10 units, then all 10 of those filings should have 50 as the result.

In Section III, for the ground-based or airspace measurements, your results also should be the same for all of your community units. There's no need to recalculate the area measured for each community unit. In other words, take it easy on yourself. Attach an Exhibit A (listing the offset frequencies you're using) and an Exhibit B for ground-based—or an Exhibit C for airspace—measurements. Then on the other community unit Form 320s, write across the top of Section III, "See community unit number such-and-such." Send all of your forms as one package. That's it. But make sure you have an original signature on each of the forms.

2) You have one community unit that spans across many miles. You might have to perform several—let's say two—CLI tests to cover the entire unit. What we suggest in this case is to write both test results on Section II, Line 3. Then in Section III state the fact that there were two CLI tests performed for this community unit. Also, attach the two Exhibits B or C, whichever method is used.

3) Your system is carrying different sets of aeronautical channels even though it serves one community unit. In that event, attach as many Exhibits A as necessary to present us with the information. Do not photocopy Form 320 and submit two or more forms for the same community unit. We only want to receive one form for each unit.

4) You used a monitoring frequency outside the VHF aeronautical band. In general, we'll accept any test frequency from 108 through 140 MHz. But if you happen to fall outside that area, just write down that frequency and include the correlation factor in your Exhibit B or C.

**Unauthorized entry**

I want to make it clear that the FCC does not give the cable operator any authority to enter the subscriber's premises without the permission of the sub. If leakage is traced to a particular residence and you cannot gain access to the home in order to fix the leak, there's only one recourse you have: Disconnect the sub. In other words, do not use the signal leakage issue as an excuse to intrude upon an individual citizen's constitutional rights. We have received a dozen phone calls in that regard. And make this clear to your techs: You're going to get in trouble if you make unauthorized entries into the subs' homes.

Second, neither the FCC nor I certify any airspace measurement programs, nor did I give permission to any company to use my name in its marketing brochures. Keep that in mind; we do not endorse any company.

Another thing: Some creative filing can occur when someone decides that "if I do numerous CLIs for one community unit, I could pass easier." Let's say your cable plant also serves an area not physically connected by the distribution plant but is interconnected either by microwave or non-cable RF, such as fiber optics or FM supertrunking with signal levels below 38.75 dBmV. In this situation, you may elect to perform one CLI test or several; it is your option.

However, there may be situations where someone might misconstrue this matter of non-cable RF. Some might say, "I have a fiber backbone and nodal systems covering two square block areas. I could do 20 or 30 different CLI tests for my Form 320, and in those cases I could easily

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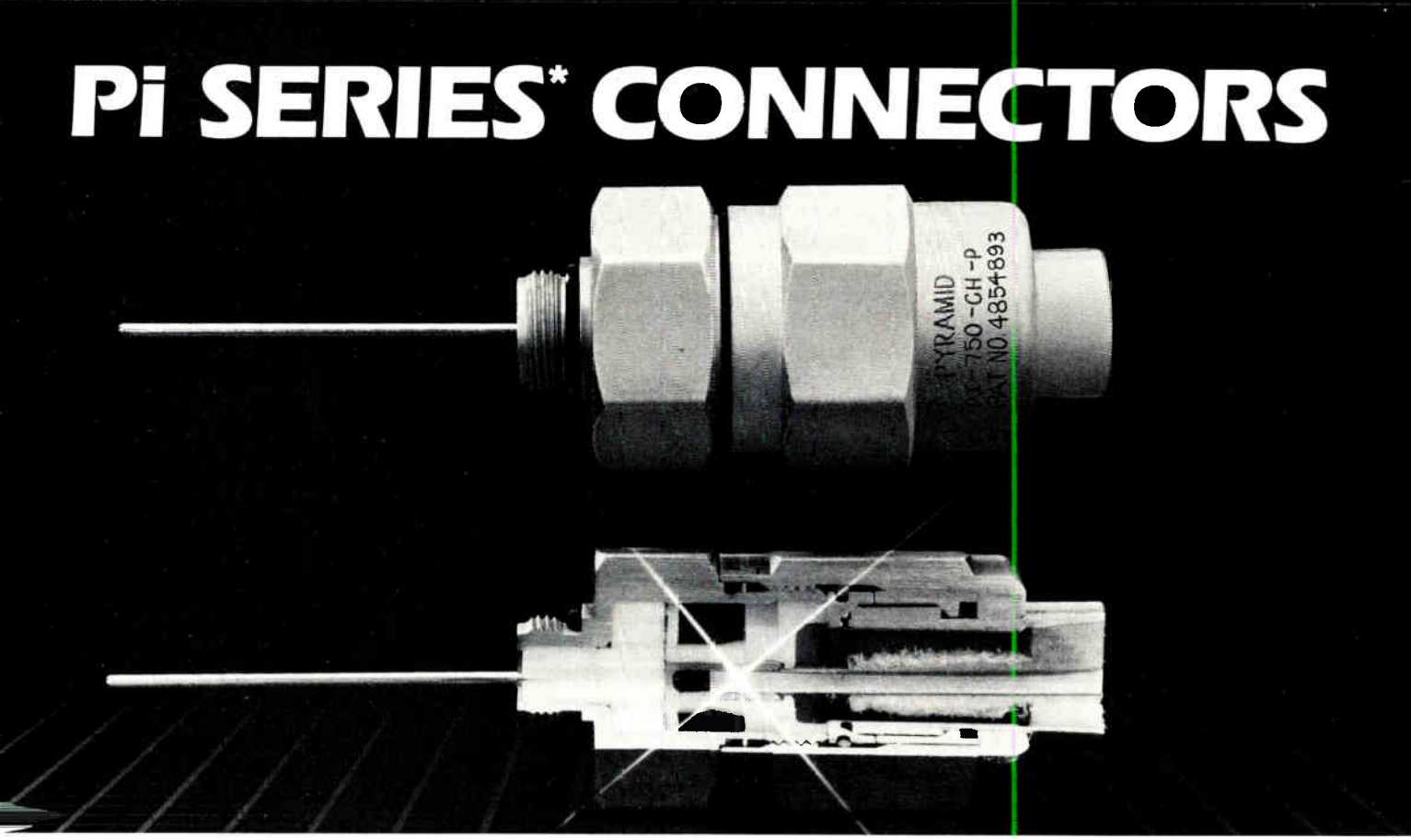


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***Reader Service Number 30.***

pass." If you have to be that creative, you're also begging us to conduct an additional review. We could ask you to conduct more CLI tests or we might even drop in.

Finally, let's review with several examples of some situations you might face when you prepare your own Form 320.

*Case #1*: As mentioned previously, if you notice something incorrect in Section I—which is already printed on your form—cross out the wrong information and write in what it should be. Let's say you're in Small Bluff, Mont., but instead you see "Big Bluff" and your community number contains a mistake. Correct these errors.

Your system in Small Bluff does not use any aeronautical channels. So, you'll write next to Line 2 of Section II: "No aeronautical frequencies used." Then sign Section IV and send the form back to us. You're done.

*Case #2*: You performed one ground-based CLI test but it was for two community units, let's say community unit numbers CM3111 and CM3112. Your result for $I_{\infty}$ is 59.06. On your Form 320 for CM3111, check Section I for accuracy; fill in the information necessary for Sections II, III and IV; and attach your Exhibits A and B.

Moving to the form for CM3112, check Section I for accuracy. Then write in Section II exactly the same data as you did for CM3111, including the result of your CLI (59.06). Then, next to Section III, Line 1, write something like: "See Community Number CM3111." That will automatically refer us to your other form. Complete Section IV and mail both forms to us.

On the other side of the coin, let's say you have one community unit but two ground-based CLI tests. Follow the instructions for completing the form, but with one difference: In Section II, Line 3, you must write both test results, one atop the other, in the space provided for $I_{\infty}$ or $I_{3,000}$, whichever method you've used. Then mention in Section III that two tests were performed. Because of this, you'll also need to attach two Exhibits B.

*Case #3*: Here's how to complete Form 320 if you've done airspace measurements. Once more, check for accuracy in Section I. In Section II, Line 1, give the name, phone number and address of the person responsible for the report. If you've completed a successful flyover, then check "Passed" in Section II, Line 3.

Now move to the second part of Section III, which deals with airspace tests. Fill in the information for Lines 2a and 2b—name of the consultant or company that performed the flyover, the phone number of that company, time duration of the test and the test frequency. Then, for Line 2b, insert the value of the best-fit curve (if an analog recording) or the percentage of points below 10 $\mu$V/m (if digital). Then complete Section IV, attach Exhibits A and C and mail everything to us.

If you mail in your form early, I personally have time to look at it. And you have time to make corrections before the July 1 deadline. If you've already filed, you might have received your form back, along with a boilerplate letter specifying what was wrong with your form. For example, this letter tells smaller, rural operators not using aeronautical channels what to do. It also asks you to help us when you no longer own the system by giving us data on the current owner.

If you have received one of these letters attached to your returned form, make the necessary corrections to your form and mail it back within about 15 days. My phone number is listed on the letter in case you have any questions. Also, instead of putting in the letter every single piece of information that's incorrect, I'll highlight the defective parts of your form. Just make the corrections and mail the form back to us.

That's it. Happy 320 filings!


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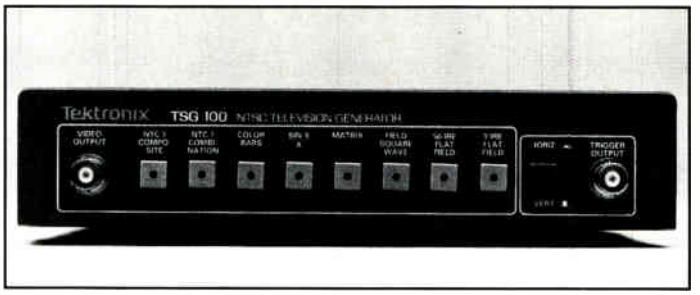
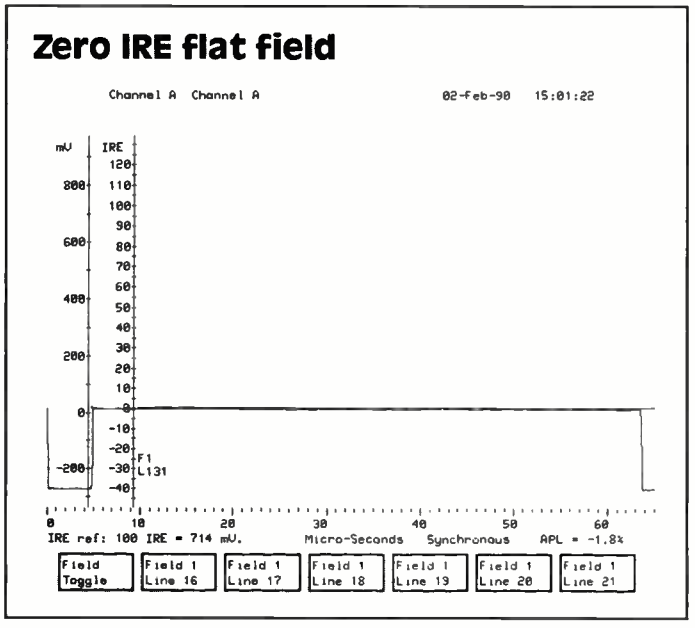
# Tektronix TSG-100 NTSC TV Generator

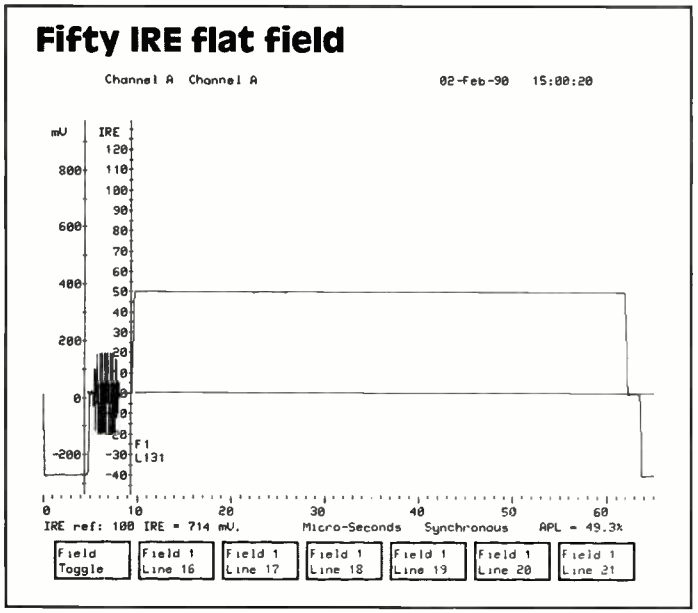
**By Ron Hranac**

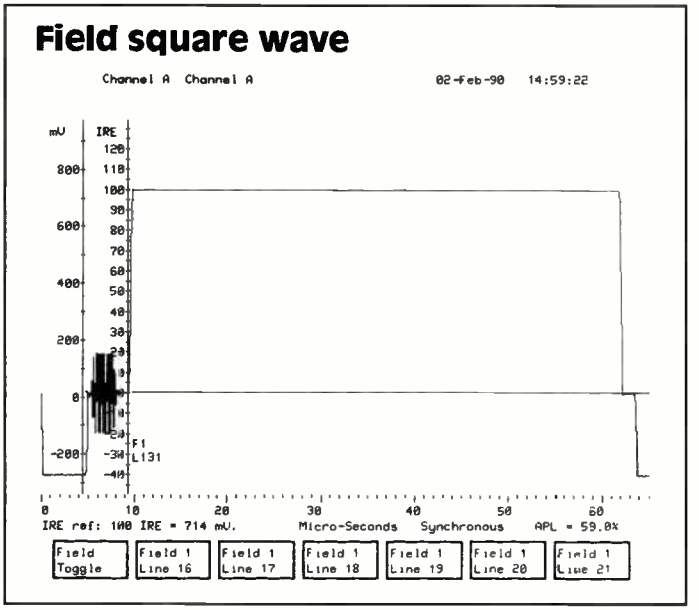
When I think of Tektronix video test equipment, two attributes come to mind: high quality and high price. But a couple years ago, Tektronix introduced its TSG-100 NTSC video generator. What really made it unique was—in addition to the reputation normally associated with the company's TV products—a very reasonable price. For less than the cost of many CATV signal level meters, here was a digital video signal generator. About a year later, the company added a no-cost option to delete the standard test signals and replace them with transmission test signals (a combination perfect for CATV headend testing.)




*CT* obtained a TSG-100 video generator configured with option 01 (transmission test signals) for this evaluation and had it put through the paces in Jones Intercable's corporate evaluation lab.




## The product

The TSG-100 video generator is not much larger than a typical hardbound book. It measures 1.7 inches high, 8.1 inches wide and 12 inches deep; it weighs a little over three pounds. This compact package provides the user with several video signals that are generated digitally as eight-bit words then converted to analog baseband waveforms. The option 01 test signal complement includes NTC-7 composite, NTC-7 combination, color bars, sin x/x matrix, field square wave, 50 IRE flat field and 0 IRE flat field signals.

For conventional oscilloscope measurements of the generated waveforms, the TSG-100 includes a scope trigger output that is switchable between horizontal and vertical rates. The generator also provides a user-adjustable 1 kHz audio tone (factory set at +8 dBm) that is perfect for setting headend modulator audio deviation. If portability is a concern, the generator operates via 120 VAC or an external +11 to +16 VDC source.

*Front panel controls, indicators and connectors*—Eight front

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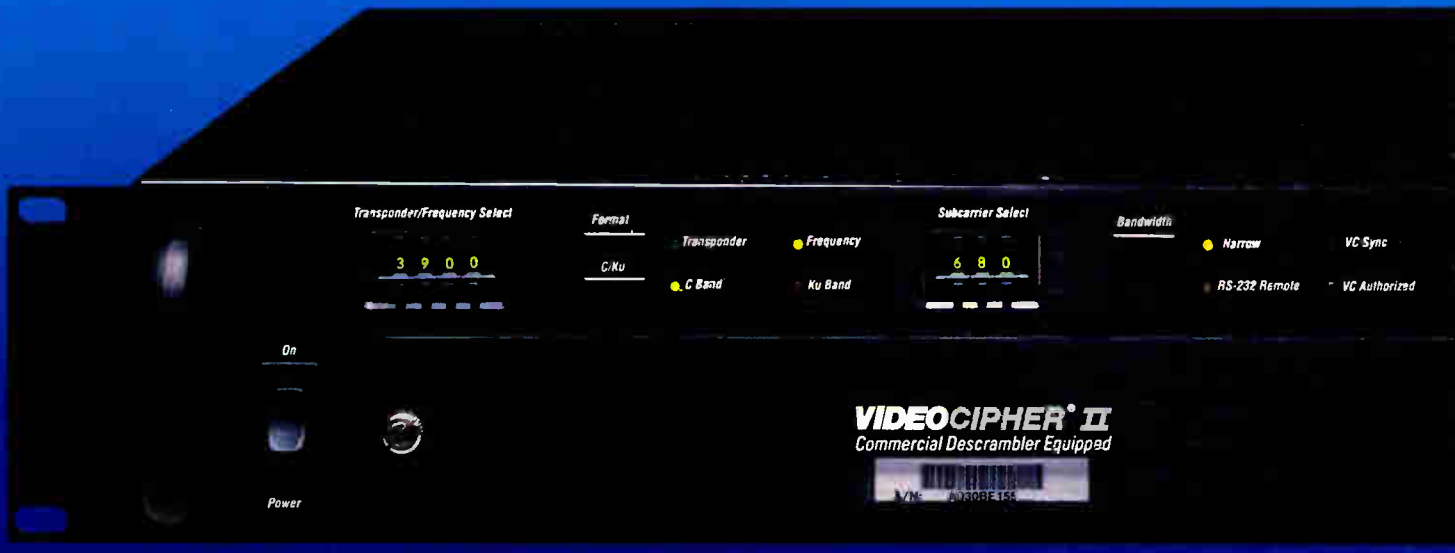


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***Reader Service Number 34.***

## MMDS/ITFS

*(Continued from page 35)*

additional group combiners as many as four non-adjacent groups may be combined. (See Figure 3.) A fifth group cannot be combined with these four groups since its channels would be adjacent to those of two other groups. If more than 16 channels are in use, a second transmission line must be used as shown in Figure 4.

### Combining adjacent channels

Figure 5 shows an experimental combiner for adjacent channels. Two coaxial probes at right angles on a square waveguide excite two orthogonal transmissions; the field strength lines are perpendicular to one another for the two transmissions. Therefore they do not "see" one another. The 20 dB cross-coupling (Figure 6) is due to direct coupling between probes. Work is continuing and isolation greater than 30 dB appears feasible. Thus far, return loss of greater than 30 dB has been achieved.

The combiner connects to a square waveguide for transport from transmitters to antennas. The 3-inch square (0.125-inch wall) weldable aluminum tubing was chosen since it is readily available from metal suppliers nationwide and could be procured locally by the MMDS/ITFS operating facility. The combiner also is a separator of adjacent channels. Therefore a second unit terminates the upper end of the waveguide (Figure 7) to feed the two antennas. Using this method, it is now possible to combine all 31 MMDS/ITFS channels onto one transmission line for transport from transmitters to antennas.

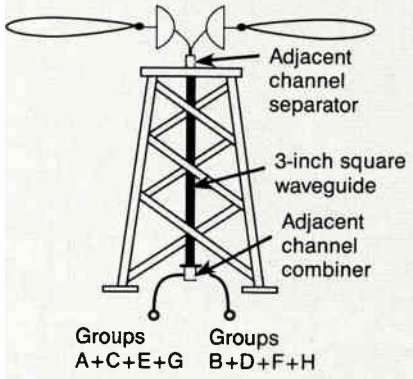
### Speculations

We propose the following as possible solutions to the problem:

1) *Two programs same frequency*—The isolation (Figure 6) was measured using one probe as input and the other as output (to a spectrum analyzer) with the square waveguide terminated in a matched local (RL > 30 dB). Therefore the isolation figure also represents the isolation between the two probes at the same frequency and it would be feasible to combine two different programs having the same channel frequency. These channels also could be separated at the end of the waveguide run without interference. Perhaps this could be the basis for a scheme of denser programming.

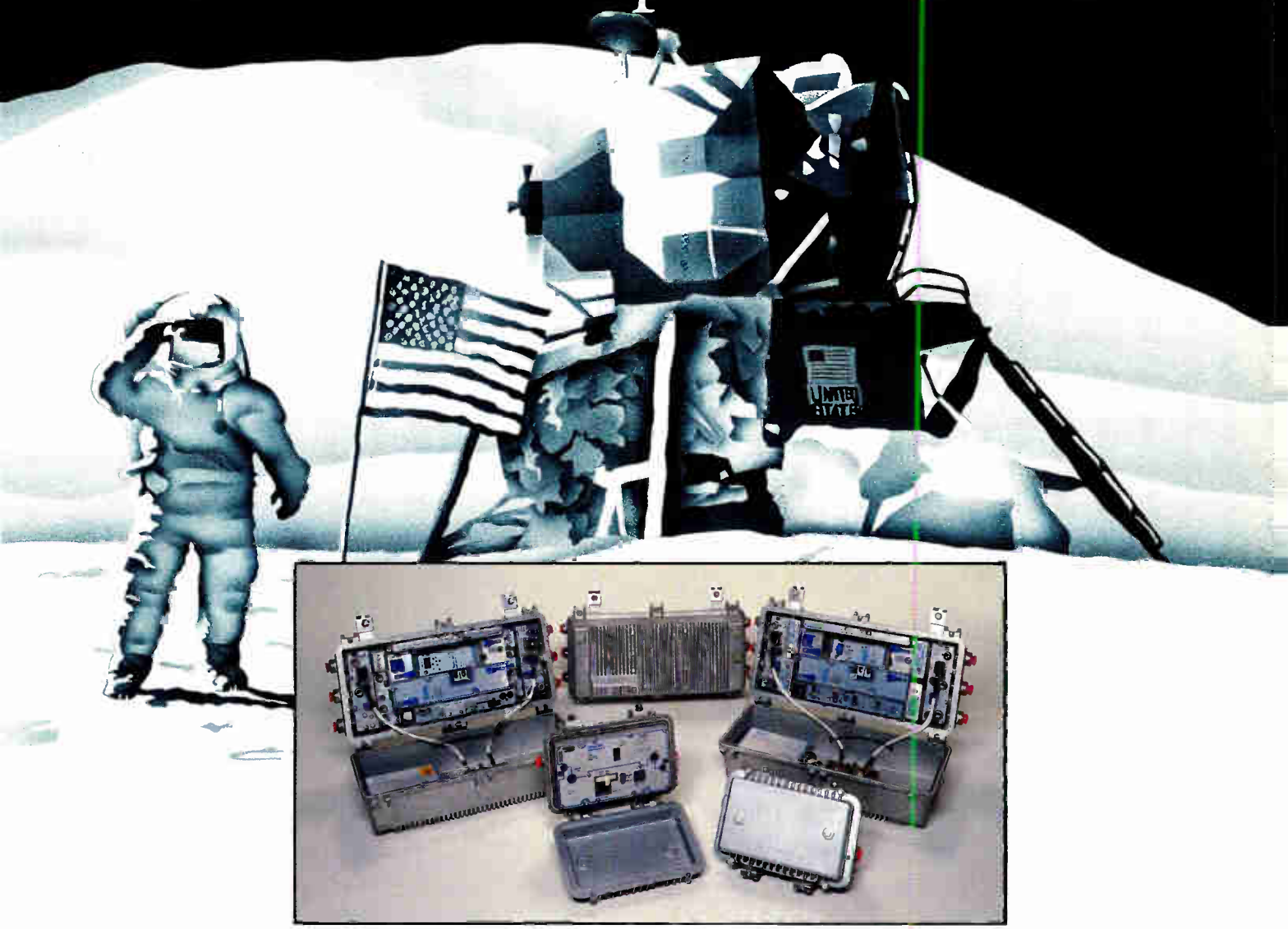
2) *Dual antennas*—If it were possible to design a dual polarized antenna with two crossed dipole feeds, then the "separator" could connect to these two feeds. The result would be one antenna for an arbitrary mix of adjacent channels (up to 31 channels). The implications at the receiving end have not been addressed.

**Figure 7:** Proposed square waveguide scheme




*The authors would like to thank Len Cordone for the experimental models, Diane Bostick for editing and word processing, Rich Green for graphics and Jerry Palamar for the photography.*

# One Small Step For Mankind...





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- Full Plug Compatibility with **Laser Link™** AM Fiber Optic systems — the industry's most widely-used, field-proven AM Fiber Optic System.

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- Modular upgradeability to AM Fiber in single, dual, or multiple Fiber architectures
- Return Laser capabilities for both DATA and Data/Video applications.
- All available RF technologies in popular bandwidths. Feedforward, Power-Addition, and Push-Pull. Plus a unique bridger architecture for unsurpassed performance and efficiency. High-Gain Trunk and Bridger Modules available for easy upgrades.
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PATHMAKERS IN TECHNOLOGY

***Reader Service Number 38.***

# WE'VE GROWN A L
# BUT WE HAVEN'T

Growth is good, and we're proud of our history of growth over the past 25 years. But it doesn't happen by accident. Our growth has been a result of our focused, long-term commitment to the CATV Industry and to providing you with the highest quality products and service. A commitment that produced Parameter I, the first gas-injected dielectric cable, and other state-of-the-art products such as our Quantum Reach, the cable of the 90's.

Today, we still are just as dedicated to producing the best quality and most innovative cable products in the industry. And we are just as committed to serving you, our customer. That means getting to you the product you need, when and where you need it. Moreover, we've never stopped in our commitment to important environmental factors associated with the manufacturing process.

# CABLE-TEC EXPO 1990
# AND ANNUAL ENGINEERING CONFERENCE
# FACT SHEET

**DATES:** Annual Engineering Conference, June 21, 1990
Cable-Tec Expo, June 22-24, 1990

**LOCATION:** Nashville Convention Center
Nashville, Tennessee

**HISTORY:** Cable-Tec Expo '90 is the eighth annual convention/tradeshow sponsored by the Society of Cable Television Engineers, Inc., combining a wide variety of technical programs, hands-on training and breakout technical workshops with instructional hardware exhibits. The Annual Engineering Conference will be SCTE's fourteenth yearly conference dedicated to current engineering issues, FCC compliance and technical management. In addition, the Society has presented more than 60 national technical programs in cities across the United States over the past twenty years, attended by more than 15,000 engineering and technical personnel from the broadband communications industries.

**ATTENDANCE:** Attendance is open to individuals within the CATV industry as well as anyone involved in broadband communications. Over 1,500 registered attendees are expected from all levels of the cable television and related businesses, including all levels of non-technical personnel.

**PROGRAM:** The Annual Engineering Conference will be packed with six hours of technical and management papers presented by many of the industry's engineering leaders. The annual membership meeting, held at the conclusion of the conference, will afford attendees the opportunity to meet members of SCTE's Board of Directors. The Awards Luncheon will feature Cable Labs President Dick Green as keynote speaker.

The 2 1/2 day Cable-Tec Expo follows the Annual Engineering Conference and combines practical workshops with "hands-on" technical training and hardware displays. The program features many schoolroom style workshops to choose from. No other activities are scheduled during workshop sessions in order to guarantee maximum attendance and participation.

As with all SCTE activities, the main purpose of Cable-Tec Expo '90 is to provide the maximum amount of training opportunities for the lowest possible cost. The event has been coordinated to fulfill this purpose, as it offers a wide variety of informative, up-to-date technical training programs. Additionally, Expo '90 will give attendees the opportunity to prepare for and participate in the Society's Broadband Communications Technician/ Engineer (BCT/E) and Installer Certification Programs, gaining valuable knowledge and practical skills in the process.

The NCTA Engineering Committee will be holding its June meeting in Nashville prior to the Expo and has invited Expo attendees to sit in on its meeting.

**EXHIBITS:** The exhibit floor has a focus on education, with many industry suppliers presenting live technical demonstrations of their products.

Over 125 hardware exhibitors are expected to reserve space on the Expo '90 Exhibit Floor. Exhibits will include all types of products, supplies, services and equipment used in the design, construction, installation, repair, maintenance and operation of cable television systems. The exhibit floor will also feature a Technical Training Center for further equipment demonstrations.

**SPECIAL EVENTS:** Anixter will sponsor a Welcome Reception on June 21. The Expo's main social event, the Expo Evening, will be held Friday night, June 22, and is sponsored this year by Jerrold. A Closing Reception sponsored by Scientific-Atlanta will be held Saturday night. Scheduled for Sunday, June 24 , is the administration of Broadband Communications Technician and Engineer (BCT/E) and new Installer Certification Program examinations. In addition, tours of The Nashville Network's studio facilities will be available to Expo attendees.

# CABLE-TEC EXPO `90
# SCHEDULE OF EVENTS

**NASHVILLE CONVENTION CENTER**

Wednesday, June 20, 1990

| | |
|---|---|
| 9:00 A.M. - 2:00 P.M. | NCTA Engineering Committee Meeting |
| 4:00 P.M. - 8:00 P.M. | Annual Engineering Conference Registration |

Thursday, June 21, 1990

| | |
|---|---|
| 7:30 A.M. - 8:30 A.M. | Conference Registration |
| 8:30 A.M. - 4:30 P.M. | Annual Engineering Conference and Awards Luncheon |
| 4:30 P.M. - 5:30 P.M. | Annual SCTE Membership Meeting |
| 3:00 P.M. - 5:00 P.M. | Cable-Tec Expo Registration |
| 6:00 P.M. - 8:30 P.M. | Welcome Reception (sponsored by Anixter) |
| 8:00 P.M. - 11:00 P.M. | Hospitality |

Friday, June 22, 1990

| | |
|---|---|
| 7:30 A.M. - 4:00 P.M. | Expo Registration |
| 8:00 A.M. - 12:15 P.M. | Hands-On Workshops |
| Noon - 5:00 P.M. | Exhibit Hall Open |
| 6:00 P.M. | Expo Evening at the Grand Old Opry (Sponsored by Jerrold) |

Saturday, June 23, 1990

| | |
|---|---|
| 8:00 A.M. - 12:15 P.M. | Hands-On Workshops |
| Noon - 5:00 P.M. | Exhibit Hall Open |
| 4:00 P.M. - 5:00 P.M. | Exhibitors' Reception |
| 5:00 P.M. - 7:00 P.M. | Ham Radio Operators' Reception |
| 7:00 P.M. - 10:00 P.M. | Closing Night Reception (Sponsored by Scientific-Atlanta) |

Sunday, June 24, 1990

| | |
|---|---|
| 8:30 A.M. - Noon | BCT/E and Installer Certification Program Examinations |
| 11:00 A.M. - 1:00 P.M. | Tours of the Nashville Network's Studio Facilities |

# PRELIMINARY PROGRAM

## *Engineering Conference*

- **Session A: Donald Frost, Master Motivator**

- **Session B: Cable's Weak Link - Tap to TV** with Walt Ciciora, ATC (Moderator); Tom Elliot, Cable Labs; and Larry Nelson, Comm/Scope.

- **Session C: Getting It Right the First Time - Field Supervision Techniques** with Wendell Bailey, NCTA (Moderator); Alan Babcock, Warner Cable; Dana Eggert, Performance Plus; and Kathy Keating, ATC.

- **Session D: Cable in the 1990's - Boom or Bust?** with Paul Maxwell, Transmedia Partners (Moderator); Jim Chiddix, ATC; Tom Gillette, Cable Labs; Gary Kim, Multichannel News; and Craig Tanner, Cable Labs.

**Plus: Keynote Speaker Dick Green, President, Cable Labs**

## *Expo Workshops*

- **Fiber Optic Splicing** with Mike Genovese, Siecor; and Jim Aberson and Tim Gropp, AT&T.

- **Fiber Optic Testing** with Louis Williamson, ATC; and Mark Connor, Siecor.

- **CLI and the FCC** with John Wong, FCC; and Brian James, NCTA.

- **Signal Leakage Equipment Calibration** with Steve Windle, Wavetek; and Don Runzo, ComSonics.

- **Painless Technical Writing** with Rikki Lee, CT Publications Corp.; and Bill Cologie, Pennsylvania Cable Television Association.

- **Case Studies in Fiber Optics** with Larry Lehman, Cencom; and Ron Wolfe, ATC.

- **Advances in Signal Security Techniques** with Ted Hartson, Post-Newsweek Cable; and Joe Ostuni, Eagle Comtronics.

- **Basic Test Equipment Usage** with Ron Hranac, CT Publications Corp.; and Steve Johnson, ATC.

- **Advances in Corrosion Protection** with Dr. Chak Gupta, Comm/Scope; and Barry Smith, Times Fiber.

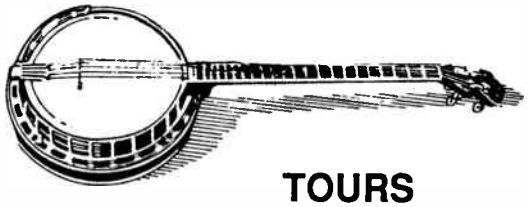
- **OSHA's Gonna Get You If You Don't Watch Out** with Alan Babcock, Warner Cable; Ralph Haimowitz, SCTE; and Roger Keith, Adelphia Cable.

**Plus: Demonstrations of Interactive Training Techniques**
**A Working Amplifier Cascade for Test Equipment Demonstrations**
**Product-Specific Equipment Usage Classes**
**"Hands-On" Splicing of Fiber Optic Cables**

# CABLE-TEC EXPO '90 EXHIBITORS

*(as of February 1, 1990)*

A.D.S. Inc.
Aaron Comm./Advanced Cable
Alpha Technologies
AM Communications
American Lightwave Systems
AML Specialities
Anixter Cable TV
Anritsu America
Antenna Technology Corp.
Applied Instruments Inc.
Arcom/Northern CATV
Augat Communications Group
Authorized Parts Co.
Belden Wire & Cable
Ben Hughes Communications
Blonder-Tongue Laboratories
Brad PTS
Budco
Cable Connector Corporation
Cable Converter Service Corporation
Cable Link Inc.
Cable Security/Power Guard
Cable Services Co. Inc.
Cable Technologies International
Cableready
Cabletek Center Products Inc.
Cadco Inc.
Calan Inc.
Catel Telecommunications Inc.
CATV Services Inc.
C-COR Electronics Inc.
Channel Commercial Corp.
Channelmatic Inc.
CNG Energy Company
Comm/Scope
Commercial Electronics
Comnet
ComSonics Inc.
Corning Incorporated
DH Satellite
Diamond Communications
Digitrace Inc.
Diversified Fastening Systems
DM Satellite
Drop Shop Ltd. Inc.
DX Communications Inc.
Eagle Comtronics Inc.
Eastern International
Electronic Metal Products
FM Systems Inc.
Foresight Products Inc.
Gilbert Engineering
Halls Safety Equipment Corp.
Hewlett-Packard Co.
Hughes Aircraft Co.
Interstate Cable Enterprises
ISS Engineering Inc.
Jackson Tool Systems
Jerrold/General Instrument
Jerry Conn Associates Inc.
JGL Electronics
John Weeks Enterprises Inc.
Kalun Communications Inc.
Kennedy Cable Construction Inc.
Leaming Industries
Lectro Products Inc.
Lemco Tool Corporation
Lindsay Speciality Products Ltd.
Long Systems Inc.
M/A-Com Mac Inc.
Magnavox CATV
Main Line Equipment Inc.
Marmax Sales
Mega Hertz
Midwest Cable Services
Midwest CATV
Midwest Communications Corp.
Monroe Electronics
Moore Diversified Products
Multilink Inc./Micro Sat
NaCom
NCS Industries
Nexus Engineering Corp.
Ortel Corporation
Panasonic Comm. & Systems
Pen-Cell Plastics Inc.
Pico Products Inc.
Pioneer Communications
Plastic Techniques Inc.
Polychem Electronics
Power and Telephone Supply Co.
Power Technologies Inc.
Production Products Co.
Professional Cable Contractors
Pyramid Industries
Quality RF Services Inc.
R.L. Drake Company
Regal Technologies
Reliable Electric/Utility Products
Resource Recovery Systems
Riser-Bond
RMT Engineering
Rohde & Schwarz
RTK Corporation
Sachs Communications
Satellite Engineering Group Inc.
Scientific-Atlanta Inc.
Secagraphics Inc.
Siecor Corporations
Society of Broadcast Engineers
Standard Communications Corp.
Sumitomo Electric
Superior TeleTec Inc.
Tailgater Inc.
Tamaqua Cable Products Corp.
Tektronix Inc.
Telecommunication Products
Telecrafter Products
Tentel Corp.
Texscan
Times Fiber Communications Inc.
Toner Cable Equipment
Trilithic Inc.
Trilogy Communications Inc.
Triple Crown Electronics
TSB Inc.
TVC/Horizon Supply Co.
U.S. Cable Inc.
U.S. Electronics
Viewsonics Inc.
Wavetek
Wegener Communications
Westec Communications
Zenith Cable Products



## TOURS

SCTE has arranged special tours of The Nashville Network's studio facilities at Opryland, USA, on Sunday, June 24. Busses will depart the Nashville Convention Center for the studio every hour between 11:00 A.M. and 1:00 P.M. The entire tour should last two hours door-to-door. Seating is limited and tickets are required. Tickets will be available in the Expo Registration area during the conference on a first come-first served basis.

# CABLE-TEC EXPO '90 REGISTRATION FEES

**(UNCHANGED SINCE 1986)**

| | Until May 18, 1990 | | On-Site | |
|---|---|---|---|---|
| | Member | Non-Member | Member | Non-Member |
| Engineering Conference and Expo* | $195.00 | $350.00 | $235.00 | $390.00 |
| EXPO only | $145.00 | $250.00 | $185.00 | $290.00 |
| Engineering Conference only * | $120.00 | $200.00 | $160.00 | $240.00 |
| Spouse Registration* | $95.00 | $95.00 | $95.00 | $95.00 |

* Includes ticket to the Awards Luncheon on June 21. Additional luncheon tickets are available at $20.00 each.

**ADMISSIONS:** Admission to all events will be through color coded badges to be picked up at the registration desk upon arrival.

**TRANSPORTATION:** SCTE has designated Caravelle Travel Management as the Expo's official travel agency. Supersaver and discounted coach air fares have been arranged and Budget Car Rentals is offering special rates to attendees (see enclosed brochures). Transportation from the Nashville Airport to the hotels can be economically arranged through Downtown Airport Express at (615) 275-1180.

**PLEASE NOTE -** Although you may be able to locate comparably priced air fares through your local travel agency, SCTE receives credit for all flights booked through Caravelle Travel by calling the toll-free numbers listed on the enclosed brochures. Using the official Cable-Tec Expo travel agency will help us by cutting our costs in flying out engineers from the FCC and instructors for Expo workshops.

**ENTERTAINMENT:** The Stouffer Nashville Hotel lobby features brochures covering area attractions, dining, nightlife and sightseeing activities. The discounted hotel rates are in effect for Expo attendees wishing to stay in Nashville for three days before or after the conference.

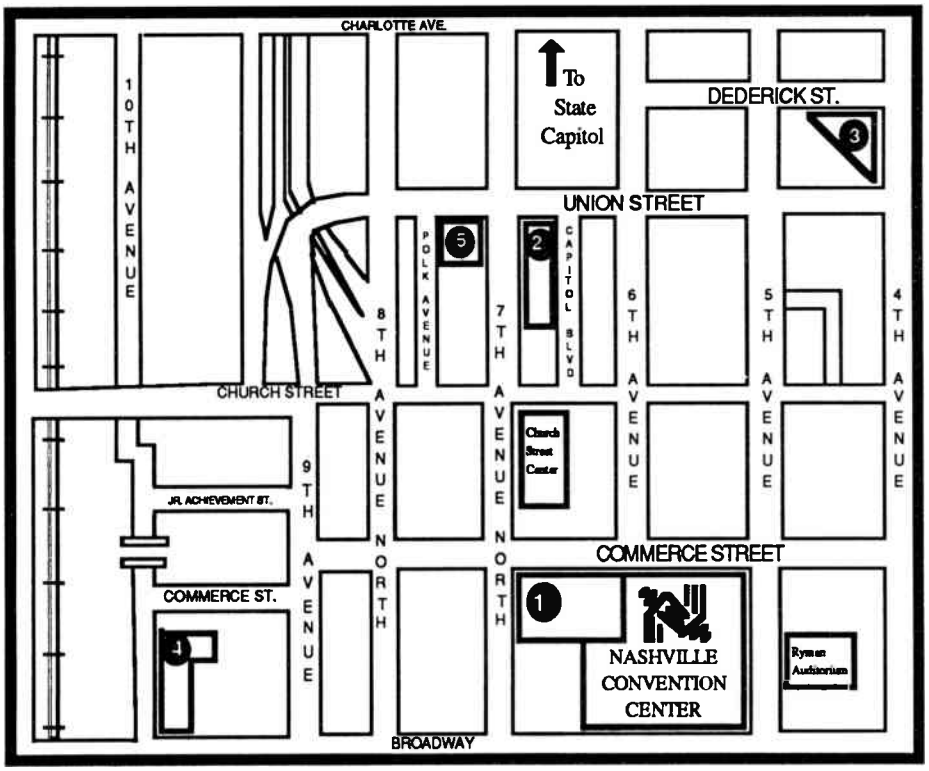
**EVENT SPONSOR:** Society of Cable Television Engineers
669 Exton Commons
Exton, PA 19341
(215) 363-6888

# LODGING

**The Stouffer Nashville Hotel** has been designated the headquarters hotel for Expo '90. It will be the site of the Awards Luncheon, BCT/E examinations and various hospitality events. The Annual Engineering Conference, Expo workshops and exhibits will be held at the Nashville Convention Center (See Map).

Listed below are the Expo hotels, their rates and number of rooms available. Please make all reservations directly with the hotels. City-run shuttle busses operate between all listed hotels and the convention center for a 25¢ fare.

**Make hotel reservations early**, as many will sell out. All reservations must be made by **May 18, 1990**.




| Map # | Hotel | Room Rates (Single/Double) | # of Rooms Available | Telephone for Reservations |
|---|---|---|---|---|
| 1 | Stouffer Nashville Hotel SOLD OUT | $83 (S), $93 (D) | 600 | (615) 255-8400 |
| 2 | Hyatt Regency Nashville | $79 (S), $89 (D) | 300 | (615) 259-1234 |
| 3 | Doubletree | $73 (S), $83 (D) | 300 | (615) 244-8200 |
| 4 | Park Plaza Hotel | $59 (S), $69 (D) | 100 | (615) 244-0150 |
| 5 | Days Inn | $60 (S), $72 (D) | 85 | (615) 242-4311 |

# INSTRUCTIONS

1. **Deadline:** Cable-Tec Expo '90 Registration Forms must be received by SCTE National Headquarters on or before May 18, 1990. Forms received after that date cannot be processed and will be returned to the sender. If you do not preregister for the Cable-Tec Expo in advance, you must register on-site in Nashville.

- Use a separate form for each individual (forms may be copied)
- Appropriate registration and activity fees must be enclosed for this form to be processed.
- Hotel reservations must be made directly with the respective hotels before May 18, 1990.

**A generic room reservation form for all Expo hotels is enclosed in this package.**

2. **Registration Cancellations:** All cancellations must be received in writing by SCTE National Headquarters on or before June 1, 1990. A $50.00 cancellation charge is applicable to all registrations cancelled after May 18, 1990. Substitutions will be accepted until June 15, 1990. **NO REFUNDS WILL BE GRANTED AFTER JUNE 1, 1990.**

3. Telephone requests for cancellations and substitutions will not be accepted. All requests for cancellations must be submitted in writing and be received before June 1, 1990 and all requests for substitutions must be received before June 15, 1990. (SCTE FAX #: 215-363-5898)

4. Return the Cable-Tec Expo 1990 Registration Form with the appropriate fees to:

SCTE
669 Exton Commons
Exton, PA 19341
Attention: Anna Riker

5. Please make flight reservations through Caravelle Travel at 1-800-222-6664 (in Illinois and Canada 1-708-860-8325). Rental car reservations may be made through Budget at 1-800-772-3773.

6. All correspondence concerning hotel reservations should be made directly with the appropriate Expo '90 hotel.

## *PLEASE NOTE DEADLINES*

## MEMBERSHIP APPLICATION

Make check payable to SCTE.
Mail To:

SCTE
669 Exton Commons
Exton, PA 19341

☐ I hereby apply for membership in the Society of Cable Television Engineers, Inc., and agree to abide by its bylaws. Additional member material will be mailed to me within 45 days. Payment in U.S. funds is enclosed. I understand dues are billed annually.

☐ Please send me further information on the Society of Cable Television Engineers, Inc.

SCTE is a 501 (c) (6) non-profit professional membership organization. Your dues may be tax deductible. Consult your local IRS office or your tax advisor.

APPLYING FOR: ☐ INDIVIDUAL @ $40 ☐ SUSTAINING @ $250

Please print or type information. Data will be used exactly as it is submitted here.

☐ MR. ☐ MRS. ☐ MS. TITLE:_____

NAME:_____ TEL. #:_____
First Initial Last Area Code-Number

EMPLOYER:_____ FAX #:_____
Company Name Area Code-Number

CO. ADDRESS:_____
Street/PO City State Zip

USE HOME ADDRESS?_____
Street/PO City State Zip

YOUR SIGNATURE:_____ DATE:_____

Complete the information. Enclose full payment or charge to MasterCard/VISA shown below.

NAME ON CARD:_____ EXP.:_____

MASTERCARD NO.:_____ IB No.:_____

VISA NO.:_____

SIGNATURE FOR CHARGE AUTHORITY:_____

Applications without payment will be returned. Applications from outside U.S., enclose additional $20 (U.S.) to cover mailing expenses.

# CABLE-TEC EXPO REGISTRATION

Everyone must register. ID badges **must** be worn and visible at all times in workshops and on the EXPO floor. To avoid delay, fill in all information requested. Full and complete payment must be sent with this registration form. Make all sleeping room arrangements directly with the appropriate hotels.

Registration Fee includes technical workshops, exhibit hall and hospitality/entertainment events. SCTE Active, Senior and Charter Members must provide Member ID Number. New Members applying at this time must include SCTE Member Application and dues payment.

If you wish to register more than one person, please make copies of this form.

*** PLEASE PRINT OR TYPE** ❑ Mr. ❑ Mrs. ❑ Ms.

YOUR NAME:_____
First M.I. Last

NICKNAME:_____

TITLE: _____ COMPANY: _____

ADDRESS:_____
Street/P.O. Box

_____
City State Zip

TELEPHONE: (_____)_____ SCTE MEMBER #:_____

FAX #: (_____)_____

*** REGISTRATION FEES (until May 18, 1990)** (Please check the appropriate box)

| | Member | Non-Member | |
|---|---|---|---|
| Engineering Conference and Expo | ❑ $195.00 | ❑ $350.00 | |
| Expo only | ❑ $145.00 | ❑ $250.00 | |
| Engineering Conference | ❑ $120.00 | ❑ $200.00 | |
| Spouse - First Name:_____ | ❑ $95.00 | ❑ $95.00 | $ _____ |

(Spouse registration includes: All Sessions, Exhibit Floor and Awards Luncheon)

No. _____ Additional Awards Luncheon tickets @ $20.00 $ _____

**TOTAL AMOUNT ENCLOSED:** $ _____

❑ I plan to take BCT/E Certification Examinations on Sunday, June 24, 1990, from 8:30 a.m. to 12 noon.

❑ I am interested in the Nashville Network Studio Tours scheduled for Sunday, June 24, 1990 between 11:00 a.m. and 1:00 p.m.

*** PRE-REGISTRATION FORM** - must be received **BEFORE MAY 18, 1990.**

*** Cancellation Policy** - A $50 cancellation charge is applicable to all registrations cancelled after May 18, 1990. NO refunds given after June 1, 1990.

*** METHOD OF PAYMENT**

❑ Check (Checks to be made payable to SCTE) ❑ MasterCard ❑ Visa

CHARGE CARD INFORMATION - Complete for MasterCard/Visa shown below:

NAME ON CARD:_____ EXP. DATE:_____

MASTER CARD NO.:_____ VISA NO.:_____

SIGNATURE FOR CHARGE AUTHORITY:_____

NOTE: There are no further discounts available. SCTE Sustaining Membership qualifies only ONE (1) person to register at SCTE Member rate. Additional personnel must be registered at Non-Member fee or submit individual application for membership with full payment.

## Cases

Underwater Kinetics introduced its Kinetics cases that provide protection for communications equipment and delicate instruments. They can be used as shipping cases for field service, sales samples or as original packages for electronics. According to the company, the injection molded ABS cases won't dent, become discolored or show scratches.

An O-ring seal keeps out water, dust and sand and industrial foam provides instruments with shock protection. Adjustable padded dividers sets are available to increase versatility. Other features include a stainless steel piano hinge for increased strength and durability, a fold down padded handle for comfort and space savings and an easy access pressure equalization valve.

**Reader service # 141**

## Modulator

Leaming added the Model FMT411F fixed-frequency modulator to its existing line of audio transmission equipment. Each FMT411F transmits one program audio channel and transmits the program material on any specified frequency between 4.5 and 10, 52 and 88 or 88 and 126 MHz. Audio bandwidths of 3.4, 7.5, 10 or 15 kHz are available.

According to the company, typical uses for the unit include modulation of an audio signal to 4.5 MHz for transmission via microwave or fiber. It may be powered by either the company's KAC707 (powers two FMT411Fs) or the PS420 (powers eight FMT411Fs). Each unit is built in an extruded aluminum case that can be mounted onto a PMU401 19-inch panel mount.

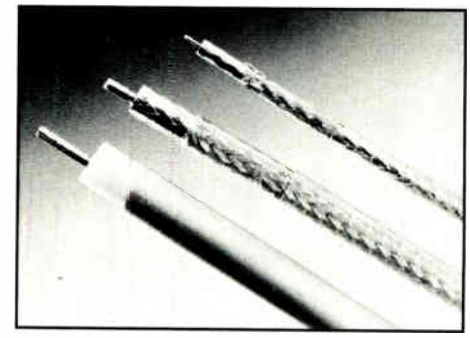
**Reader service # 131**

## Leakage monitor

Aero-Trac's aerial monitoring and location system is said to be able to both measure and locate the source of leakage and was designed to help cable systems pass the FCC's cumulative leakage index (CLI) standards prior to July 1.

The system uses specially equipped aircraft and proprietary technology to locate and measure leakage, flying in a grid system 1,500 feet above the ground. According to the company, the report matches leaks to locations and can help the system prioritize repairs. It can serve as a system's primary CLI monitoring program or verify results of leakage tests taken in the field.

**Reader service # 138**



## Coax

Comm/Scope introduced its improved Plenumax plenum coaxial cables that roll off the reel and into the installation—meeting the NEC (National Electric Code) Article 820 standards for smoke and flame and propagation. These cables are available as RG59, RG6 and RG11 drop cables as well as .500-inch and .625-inch alum-

inum sheathed trunk cables. Plenumax is CATVP rated and so conduit is not necessary.

With the Kynar jacket, the cables are said to be abrasion-resistant, flexible and easy to install. The fluorinated ethylene propylene (FEP) dielectric/jacket construction allows Plenumax to pass all critical UL fire tests, according to the company.

**Reader service # 137**

## Manual

Orion made available its illustrated training manual, *Monitoring and Measuring Signal Leakage*. It covers all aspects of ground-based signal leakage monitoring and measuring as in accordance with FCC signal leakage monitoring, measuring and reporting regulations. It is directed toward the field service technician.

The manual begins with an overview of the signal leakage problem. Also described are FCC leakage regulations, causes of leaks, specific leakage detection equipment, exact leakage measuring techniques and procedures, use of maps and logs, safety practices, effective customer relations, daily goal setting, planning for ongoing compliance and computing CLI. Examples and exercises simulating actual ride-out situations are included.

**Reader service # 135**

## Clock unit

Channelmatic introduced its PCU-1A programmable clock unit at the NAB convention. It has sequential scheduling that enables the operator to schedule and view the daily events in the order in which they will run. It offers the operator an automatic schedule-template generator to create two weeks of schedules quickly. When used with the company's optional PCU PC software, it can create macro schedule events that activate eight control outputs from one event command.

Up to 3,000 events can be loaded and readied for execution. It can control up to 1,000 outputs with the company's BDD-3010A modules. It can be interfaced to a PC operated off-line and offers a parallel decimal and BCD control and optional serial output control. According to the company, the BCD control allows you to upgrade from your existing PCM without rewiring your system. It can be controlled remotely by adding modems.

**Reader service # 136**

## Fastener

Diversified Fastening Systems recently added the #8 screw to its Consert-Screw system. According to the company, the screw provides superior pullout and shear strength and has a small fastener. The screw can replace plastic expansion anchors, plugs and other lightweight fastening products. Installation of the #8 screw is said to be convenient with the #8 Con-Sert tool.

**Reader Service # 115**

## Cable marker

Stranco's comformable plastic Stransnap wiremarkers are said to apply quickly with an applicator wand and snap tightly to prevent slippage. They supply a way to permanently mark cables without disconnecting them. The interlocking design lets the user place any number of markers together for perfect alignment of the legend and legibility is obtained from the deep hot stamping of the letters.

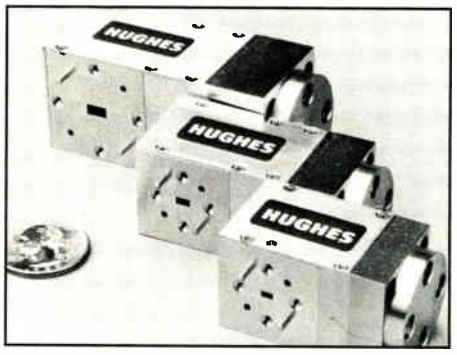
The material is said to be resistant to oil and solvents and has a temperature range of −22° to +212° F. The product is available in 10 sizes on color-coded wands for identification.

**Reader service # 134**

## Trap

Pico developed the Lifeline tier trap, which is a new all-in-one tier trap that passes Chs. 2-6 and 7-13 with no appreciable attenuation while eliminating all other channels. It incorporates patent pending temperature stability technology and welded hermetic sealing as in all of Pico's new series of PT traps. According to the company, the Lifeline tier trap offers technical, mechanical and cost advantages over the traditional method of adjoining two separate tier traps.

**Reader service # 139**

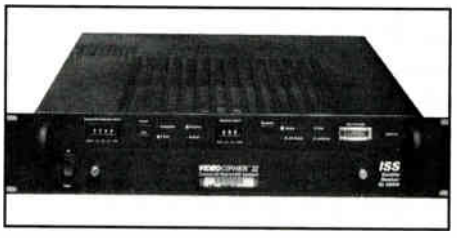



## Oscillators

Hughes Aircraft Co. introduced a new series of millimeter-wave cavity-stabilized Gunn oscillators that employ gallium arsenide Gunn devices operating in a high-Q cavity/waveguide assembly. They occupy a performance window between standard Gunn oscillators and phase-locked oscillators.

According to the company the units offer improved stability over standard Gunns while having noise performance rivaling that of high-stability PLOs. Typical phase noise for a U-band cavity stabilized oscillator is −115 dBc/Hz from the carrier. They feature an integral isolator and are available at frequencies ranging from 18 to 96 GHz.

**Reader service # 133**



## Satellite receiver

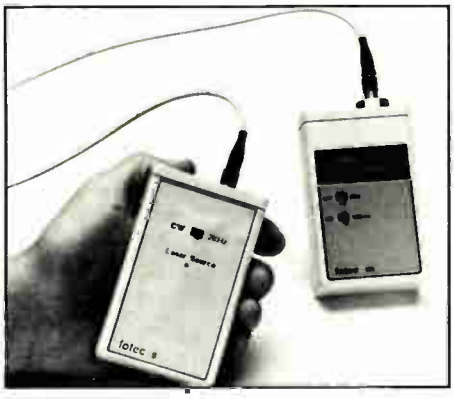
ISS Engineering announced the second generation of its C/Ku-band IRD satellite receiver, the Model GL5020 A that features convenient front panel access to the descrambler module. It is designed to be VideoCipher II Plus ready and will not become obsolete with the release of the new descrambler, according to the company.

The unit has separate C/Ku-band inputs for dual antenna/feed. It has one of the lowest temperature rises of any IRD because of its ample ventilation. It incorporates a switchable narrow bandwidth filter that has been optimized to reduce or eliminate terrestrial interference. Each

unit is tested with the VM700 video analyzer and a computerized proof-of-performance printout is shipped with each unit. The receiver can be remote controlled via its RS-232 interface and a serial communications software disk (PC/XT/AT compatible) is provided with the unit.
**Reader service # 123**

## Ladder racks

Knaack Manufacturing Co. announced its Weather Guard ladder racks now come with an improved black finish that adds durability. Other features include a 48-inch wide 1,500-pound carrying capacity, a built-in cab screen that adds safety and stability to the rack and an extra cross member over the center of the bed that allows carrying of shorter ladders and material. The racks are available for full-size (Model 1250) and mini (Model 1350) pickups.
**Reader service # 132**



## FO test source

A new fiber-optic test source has been introduced by Fotec. The Model S780 minilaser is designed for all users of single-mode fiber systems. The product uses a 1,300 nm laser diode with FC connector interface for single-mode fibers. The laser output is approximately −6 dBm and is optical-feedback stabilized to enhance loss measurement accuracy. Output modulation can be selected to be either CW or 2 kHz "tone."

The unit is small enough to fit into a pocket or a tool kit and it weighs 6 ounces. It uses a 9 V battery or optional AC adaptor for portable or on-site applications.
**Reader service # 111**



## Computer program

Computer Services Co. introduced its Cable Systems Control computer program designed for small CATV/SMATV operators who need to control and bill on a single- or multisite system. The program will handle converters, taps, tag numbers, dispatch scheduling by dates, histories and accounts. It has an unlimited subscriber base (although 25,000 is recommended). Other features include calendar files for install and service calls to ensure daily control of issued orders, status and account histories on each sub, bifling per site or all sites options and all areas are password protected.
**Reader service # 129**

## Addressable products

Scientific-Atlanta introduced its addressable subscriber products for the Japanese market. These include the Model 8591 set-top terminal and the System Manager V.

The Model 8591 set-top terminal has

Japanese character labeling on the set-top and remote. Other features include a standard VHF VCR bypass feature, baseband video and stereo audio outputs, downloadable output channel, eight-event 14-day VCR timer and last and favorite channel recall.

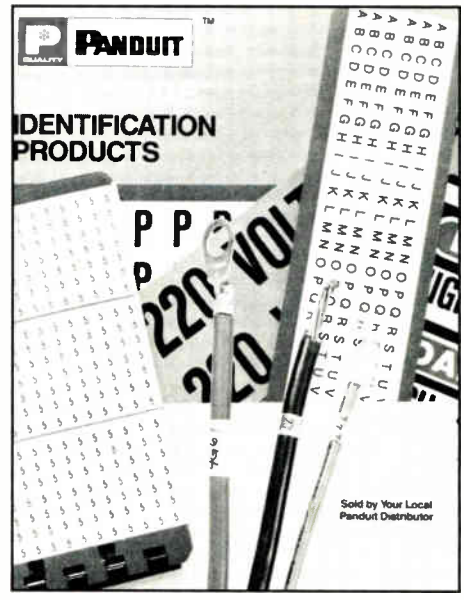
The System Manager V also uses Japanese character language interface. Up to 50,000 subscribers can be accommodated and the system is designed to be compatible with the Model 8591 set-top terminal. The system has integrated headend/set-top control, information software to perform link control, set-top management, pay-per-view headend management and report and test functions.
**Reader service # 120**

## Modulator

The Model HM55 adjacent channel modulator for use in satellite master antenna television (SMATV) and small cable systems was announced by Holland Electronics. It features a low drift crystal oscillator that is said to be capable of meeting all FCC offset and stability requirements. Additional internal filtering provides adjacent channel capability with all spurious harmonics down 60 dB at an output level of 55 dBmV.

It mounts in a standard 19-inch rack and has all controls on the front panel with an auxiliary AC outlet on the rear. It is available in Chs. 2-28 (O).
**Reader service # 140**






## Catalog

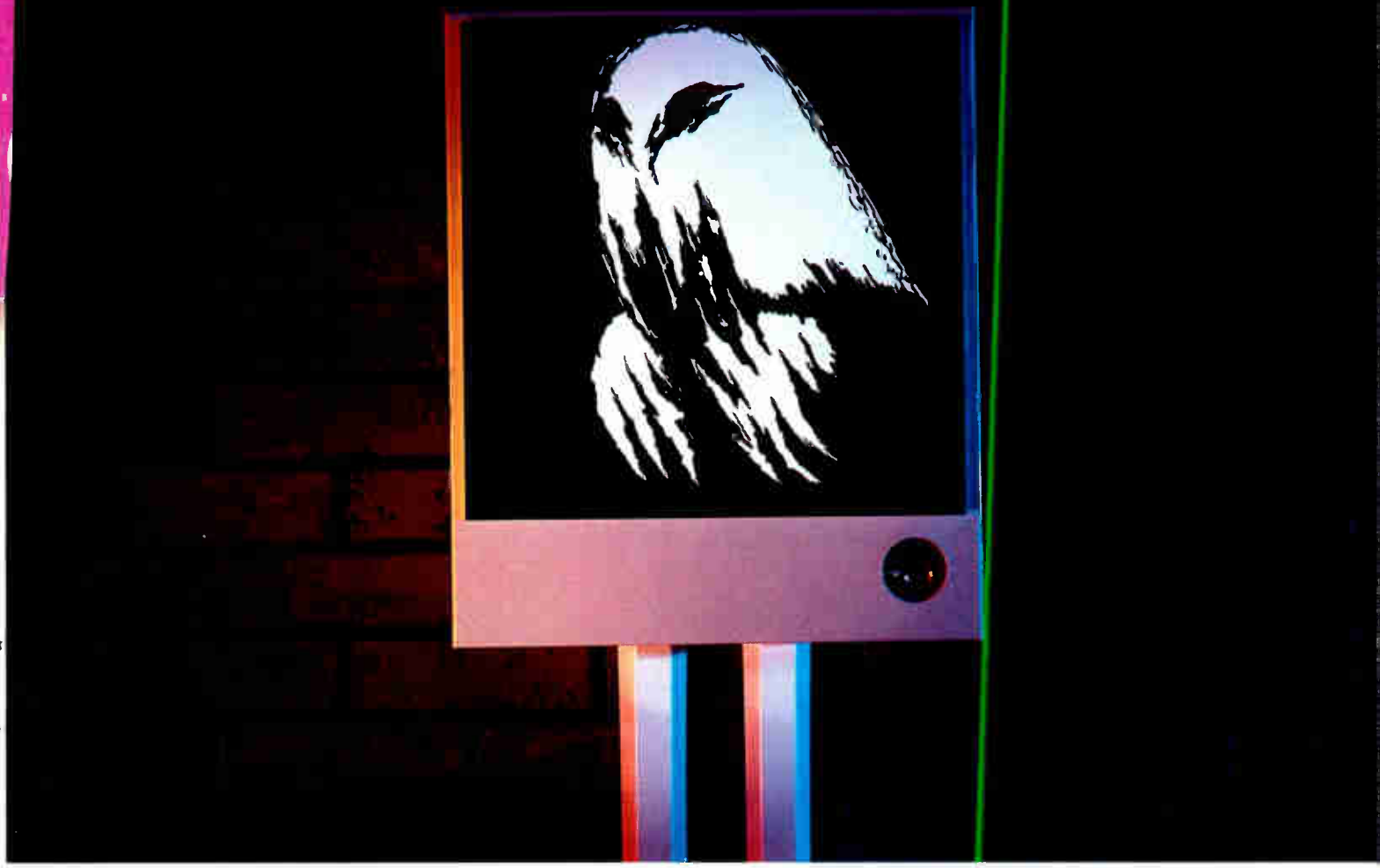
A 52-page color catalog describing the complete line on Panduit Pan-Code identification products is available free from the company. The catalog details size and material information on wire markers available in books, cards and tape with thousands of standard legends available. Also included are the EDP computer printable labels and Pan-Mark label marker software.

The products feature crisp, sharp legends for high, permanent visibility. Materials are available to meet indoor, outdoor and underground applications including OEM, maintenance, quality control and field service.
**Reader service # 128**

## FO link system

RF Technology announced its RF-FOM-13L fiber-optic link system. It is based on a 1,300 nm laser and is capable of transmitting video plus four high quality audio channels over a distance of 35 miles unrepeated. Available features include 70 MHz injection, repetition or output that allows the system to be used as a spur from an existing heterodyne microwave backbone system. Comprehensive diagnostics, alarms and test waveforms are said to provide unprecedented field servicability of the system.
**Reader service # 130**

# THE BEAST™ STOPS THIEVES.



## Stop The Thieves And You'll Stop Signal Leakage In MDU's.

Thieves who steal your service are the most common cause of signal leaks in MDU's.

So shut out those thieves with The Beast™ high security apartment box. Made with 16 gauge aluminized steel, box-in-a-box construction, and stainless steel arc welds, The Beast is virtually vandal proof. And when equipped with our SuperLock locking system, even employee tampering is almost impossible.

## Make 'Em Pay For It.

Thieves not only get you in trouble by causing serious signal leaks, they also steal your revenues. But if you've installed The Beast, they can't get into your box. So they'll have to get their cable service the old fashioned way–they'll have to buy it.

This increase in subscribers, plus lower maintenance and leak detection costs, helps make The Beast cost efficient in almost any MDU application.

Dress up The Beast™ with our new lines of molding and accessories.

## The Beast Looks Great With Our New Molding.

To make wiring quicker and servicing simpler, Cable Security has always offered a full line of custom features and options for The Beast.

Now with our new line of plastic and metal molding and accessories you can order everything you need at one time from Cable Security.

***Reader Service Number 47.***

## Trust Cable Security For Your CLI Solution.

Theft means signal leaks. It's as simple as that. And wherever you've got MDU's, you've got a high probability of theft.

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No wonder you'll find The Beast working for almost every major MSO and in almost every major city.

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**Cable Security**

801 Fox Trail
P.O. Box 2796
Opelika, AL 36801
800-288-1506

## Signal generator

Leader Instruments Corp. introduced its Model 425 component video test signal generator at the NAB conference. It features a patent pending shark fin pattern that improves observation of relative timing over a wide range of frequencies. It complies with RS-170A and generates 23 kinds of component test signals, including color bars, 100 percent line sweep and 5T, 2T pulse and bar, and nine kinds of composite test signals including 100 percent multiburst, red raster and five-step staircase.

Component output is switchable between 3-wire (Y, R-Y, B-Y) and 2-wire (Y, time-compressed chroma) systems. It is compatible to both Betacam and M II by changing ROM. Available options include black burst and remote control.

**Reader service # 124**



## Connector kit

Jensen Tools introduced its 273-piece RS-232 commercial connector kit to aid on-site fabrication and maintenance of RS-232 cable connectors. It can be used to make straight null modem hookups, fabricate economical patchcord connections between keyboard and TNC for packet radio or for many other DB25 applications.

The kit includes 16 plug (male) and 6 receptacle (female) 25-pin connectors, 100 stamped and formed pins and sockets, 50 cable ties, one insertion/extraction tool and a compact plastic storage box. Connector hoods are available separately.

**Reader service # 125**

## Wrench

The newly developed triple-square lineman's wrench specifically designed for utility lineman was introduced by Lowell Corp. It features reversible ratcheting action and a three-in-one combination head fitting the three most common utility pole fasteners. Its "bolt-thru" structure allows nuts to be taken up no matter where they are on the bolt or lug.

The 10-inch and 12-inch heavy-duty ratchet handles are available in ductile iron or stamped steel plates. Sockets fit square nuts for 1/2-inch, 5/8-inch and 3/4-inch bolts on utility pole hardware.

**Reader service # 127**

April 1990

Focus on troubleshooting

# BACK TO BASICS

The training and educational supplement to Communications Technology magazine.


Formerly Installer/Technician

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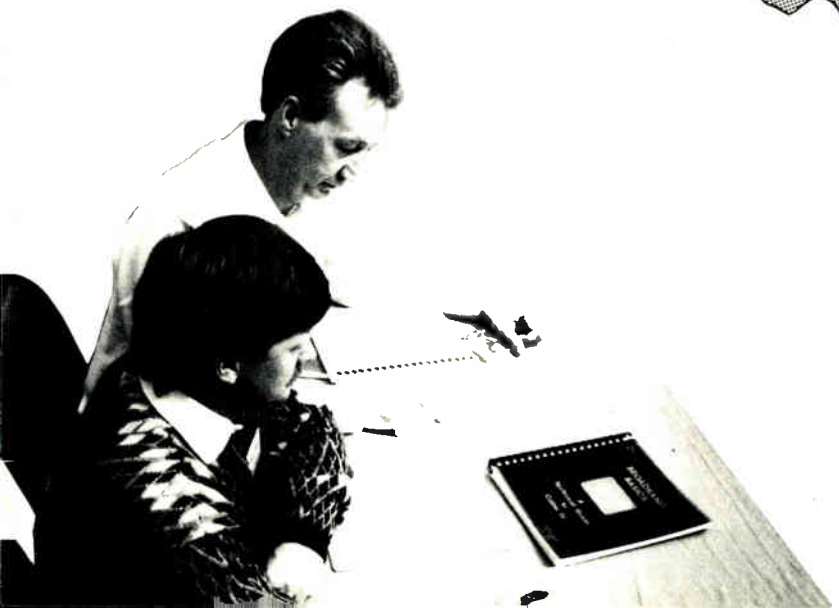

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***Reader Service Number 49.***

# Getting the most out of your SLM

**By Steve Windle**
Product Marketing Engineer, Wavetek

Signal level meters (SLMs) are commonly used to measure signal levels, check hum and test carrier-to-noise ratio. These are very important tests that probably are performed most frequently on the cable system. Many SLM owners may not be aware of some of the other tests that may be performed using this unit. This article will discuss some tests normally not done with an SLM that may be performed with one for quick trouble-shooting in a pinch.

## Frequency accuracy

Although video carrier frequency accuracy may be easily and efficiently measured using a device designed specifically for that purpose, this measurement also may be performed using a combination of general purpose equipment on hand. A low-cost signal generator and frequency counter, or a precision synthesized generator that would eliminate the need for a frequency counter may be used in this "zero beat" frequency measurement technique. This method may be looked upon as old-fashioned and is a little more difficult to set up, but it does the job.

The measurement is performed by matching the signal generator frequency with the signal to be measured, and counting the signal generator frequency. (The signal generator output frequency is easier to count using a low-cost frequency counter because it is the only signal present at the counter input and is unencumbered by modulation.) The proximity of the generated signal to the signal to be measured can be monitored using the SLM audio output. The SLM should be tuned to measure the level of the system signal to be frequency counted.

As the signal generator output approaches the frequency of the signal to be measured, a tone decreasing in pitch will be heard in the SLM's speaker. The frequency of the tone is equal to the difference in frequency between the test signal and the signal to be measured. Slowly vary the signal generator's frequency until the difference is at minimum (null the tone). At this point the frequency counter (or the precision signal generator) will indicate the frequency of the signal to be measured.

**Figure 1:** Frequency accuracy

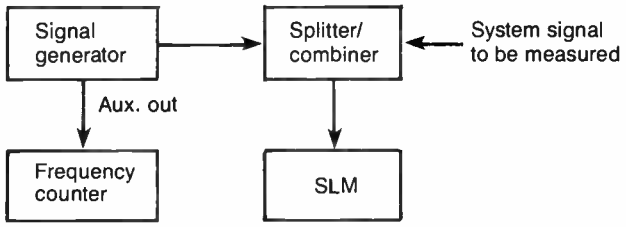
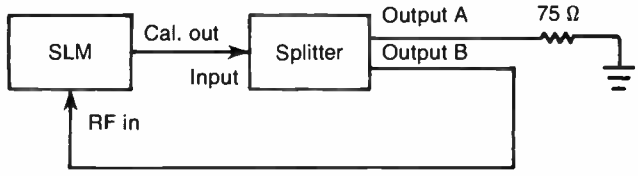



**Figure 3:** Through loss (splitter)




## Return loss

Although this test may be better performed using a bench sweep setup, use of an SLM provides a quick check. A signal or noise generator, a return loss bridge and an SLM are required.

Return loss is a relative measurement, a comparison of RF energy sent into the device under test vs. the energy reflected. The minimum difference between RF into the device and RF reflected is the return loss. If the device absorbed all of the energy applied it would be a perfect load and have infinite return loss. Bad return loss is caused by some impedance mismatch, either at the point of connection to the device or within the device itself. In a cable system poor return loss is usually caused by damage to the cable, loose connections, water in the cable, etc.

To measure return loss, connect the output of a signal or noise generator to the bridge's input port and the bridge's output port to an SLM. If using a signal generator, tune the SLM to the generated frequency, and measure and record the level with the bridge test port open. Then connect the device under test to the bridge test port, and measure and record the level. The difference between these two measurements is the return loss at that frequency. For other frequencies, repeat this procedure at those desired.

A noise generator simplifies the procedure by eliminating the need to tune the generator. The SLM may be tuned through the spectrum to determine the worst case frequency (the highest reflected level).

## Splitters and taps

To thoroughly test a splitter or tap, a bench sweep setup should be used, or at least a noise generator and SLM. However, a quick go/no-go test may be made using only an SLM (with a calibrator output). The SLM calibrator is connected to the input of the device with the output connected to the RF input of the SLM. The loss is determined by comparing the device's measured

**Figure 2:** Return loss

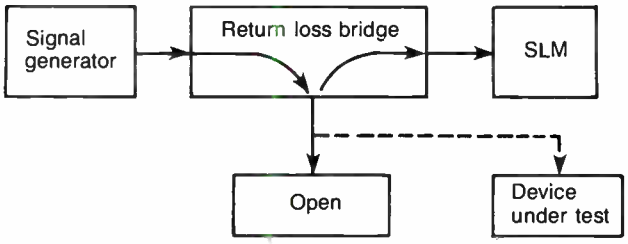



**Figure 4:** Isolation (splitter)

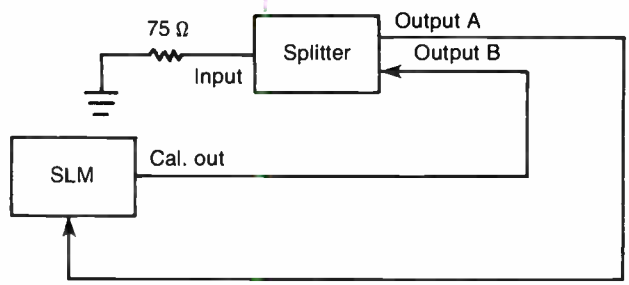


**Figure 5:** Through loss (tap)

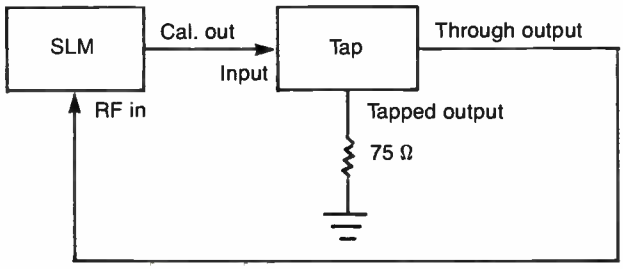
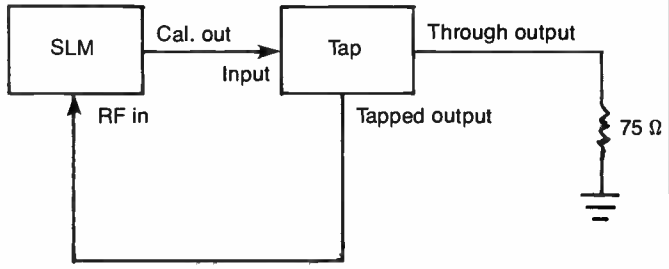



**Figure 6:** Tap loss




output level to the known calibrator level. During these measurements, it is important to terminate unused splitter or tap ports with a 75-ohm (Ω) terminator as shown in Figures 3-7.

In splitters, the parameters to be measured are through (insertion) loss for each leg of the splitter and isolation. The tests are performed as shown in Figures 3 and 4.

A splitter is a broadband power divider. Four- and eight-way splitters are simply multiple two-way splitters in series. The typical through loss for each leg of a two-way splitter is 3.5 dB. For four- and eight-way splitters, the typical through losses are 7 dB and 11 dB respectively. Typical isolation between legs of a two-way splitter is 20 dB to 30 dB. For four- and eight-way splitters the isolation will vary depending on the splitter's internal configuration, but should always be greater than 20 dB.

There are three significant parameters to test on a tap (broadband directional coupler): through loss (input to through output), tap loss (input to tapped output) and isolation (tapped output to through output).

To test through loss, calibrate the SLM and connect as in Figure 5. Measure the tap's through output level. The difference between the SLM calibrator and the through output level is the through loss (typically less than 1 dB).

To test tap loss, calibrate the SLM and connect the tap to it as shown in Figure 6. Measure the tapped output level. The difference between the calibrator and the tapped output levels is the tap loss. The tap loss should be the nominal value of the tap (i.e., a 20 dB tap should have a tap loss of approximately 20 dB).

To test isolation, calibrate the SLM and connect the tap as in Figure 7. Measure the tap's through output level. The difference between the SLM calibrator output level and the through output level is the isolation. Ideally no signal should reach the through output but in practice the isolation is typically 20 dB plus the tap loss.

**Figure 7:** Isolation (tap)

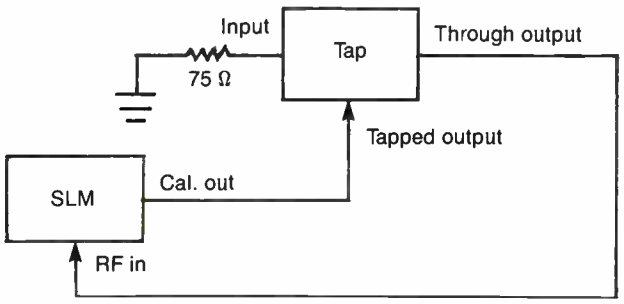
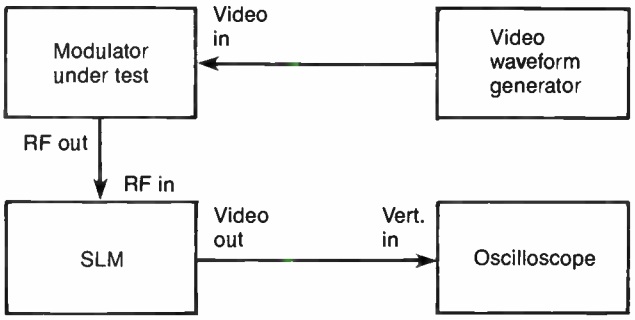



**Figure 8:** Percent modulation




## Percent modulation

The percent modulation test is an operating test for modulators. Modulators used for local origination or incoming signal translation can change the modulation depth of a video signal, and both under- and over-modulation can degrade picture quality. The test can be performed with a variety of equipment but this procedure requires only an SLM with a detected video output and an oscilloscope. The alignment should be made with a 1 volt peak-to-peak input signal to the modulator (which may be provided by a low-cost waveform generator) for the sake of precision.

First, connect the SLM video output to the vertical input of an oscilloscope. Set the scope vertical sensitivity to 100 millivolts per division, DC coupled; and the horizontal time base for 5 milliseconds per division, external trigger. Some scopes don't trigger well on a composite video signal. If this is the case, set the scope for line trigger and let the trace crawl slowly across the display.

Tune the SLM to the video carrier desired for measurement. Adjust the meter's attenuator to provide a reading in the upper portion of the scale. Ground the scope's vertical input and adjust the vertical position control to align the trace with the bottom graticule line. Un-ground the scope's vertical input and adjust the vertical sensitivity vernier to align the video signal's sync peak exactly eight divisions above the bottom graticule line. This establishes zero and 100 percent modulation reference levels (12.5 percent per division). The scope controls may interact, so repeat this procedure until the two reference levels are established without further adjustment of the scope controls.

The downward spike immediately to the right of the sync pulse is a modulation test flag. This test flag should extend downward to exactly one division above the bottom graticule line. (This corresponds to 87.5 percent modulation.) If the flag doesn't show correct modulation depth, adjust the modulator accordingly. ■

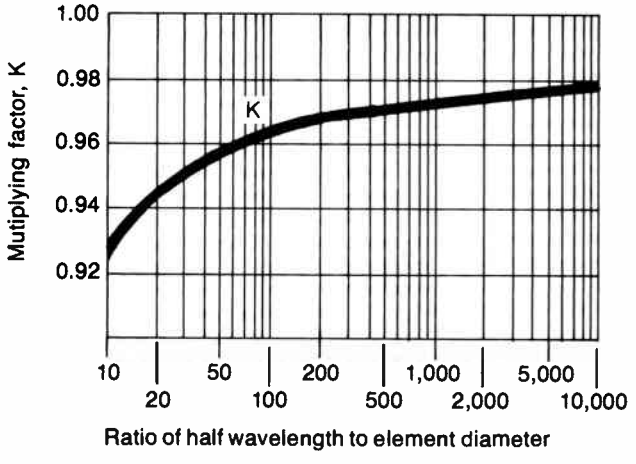
# How to build a signal leakage dipole

**By Ron Hranac**

With a few dollars worth of parts and a couple hours of your time, you can construct a dipole antenna for signal leakage measurements. While there are a variety of high quality commercially manufactured dipoles available to the cable industry, you may have hit that stumbling block known as the "system operating budget" when it actually comes time to buy one.

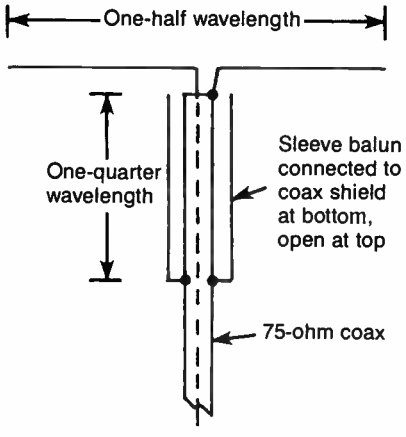
A dipole (or doublet) antenna is one that is broken at the center for connection to some sort of transmission line. Most dipole antennas are one-half wavelength long at their resonant frequency, hence the term "half-wave dipole." By their nature, dipole antennas are bidirectional with maximum signal intensity perpendicular or broadside to the antenna elements. Minimum signal strength occurs off the ends of the antenna. Furthermore, the Federal Communications Commission requires that signal leakage measurements be made with (or correlated to) a half-wave dipole.

**Figure 1**




Source: *The Radio Amateur's Handbook*

**Figure 2:** 1:1 coaxial sleeve balun




## The long and short of it

Most confusion about the construction of dipole antennas is related to their physical length. The electrical length of a dipole is seldom the same as its physical length in wavelengths. The length of a half-wave dipole in free-space can be found with the formulas:

Length in feet = 492 ÷ frequency in MHz **(1)**

Length in inches = 5,904 ÷ frequency in MHz **(2)**

In practice, half-wave dipole antennas are almost always shorter than their free-space length because of two factors: 1) end effect, or the additional capacitance caused by the presence of insulators that support the ends of a dipole, and 2) the ratio of an antenna's conductor length to its diameter. Since dipoles used at VHF frequencies usually are constructed of tubing or rod and don't require end-supporting insulators, the second factor plays the biggest part in determining the physical length of a dipole used for signal leakage measurements. →

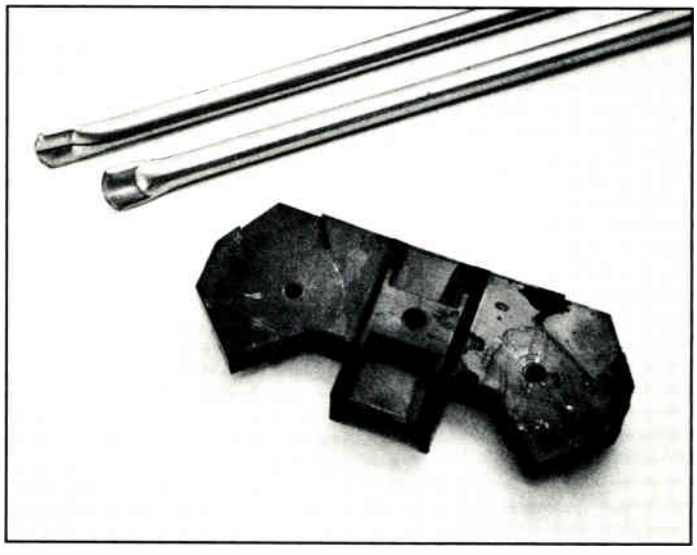
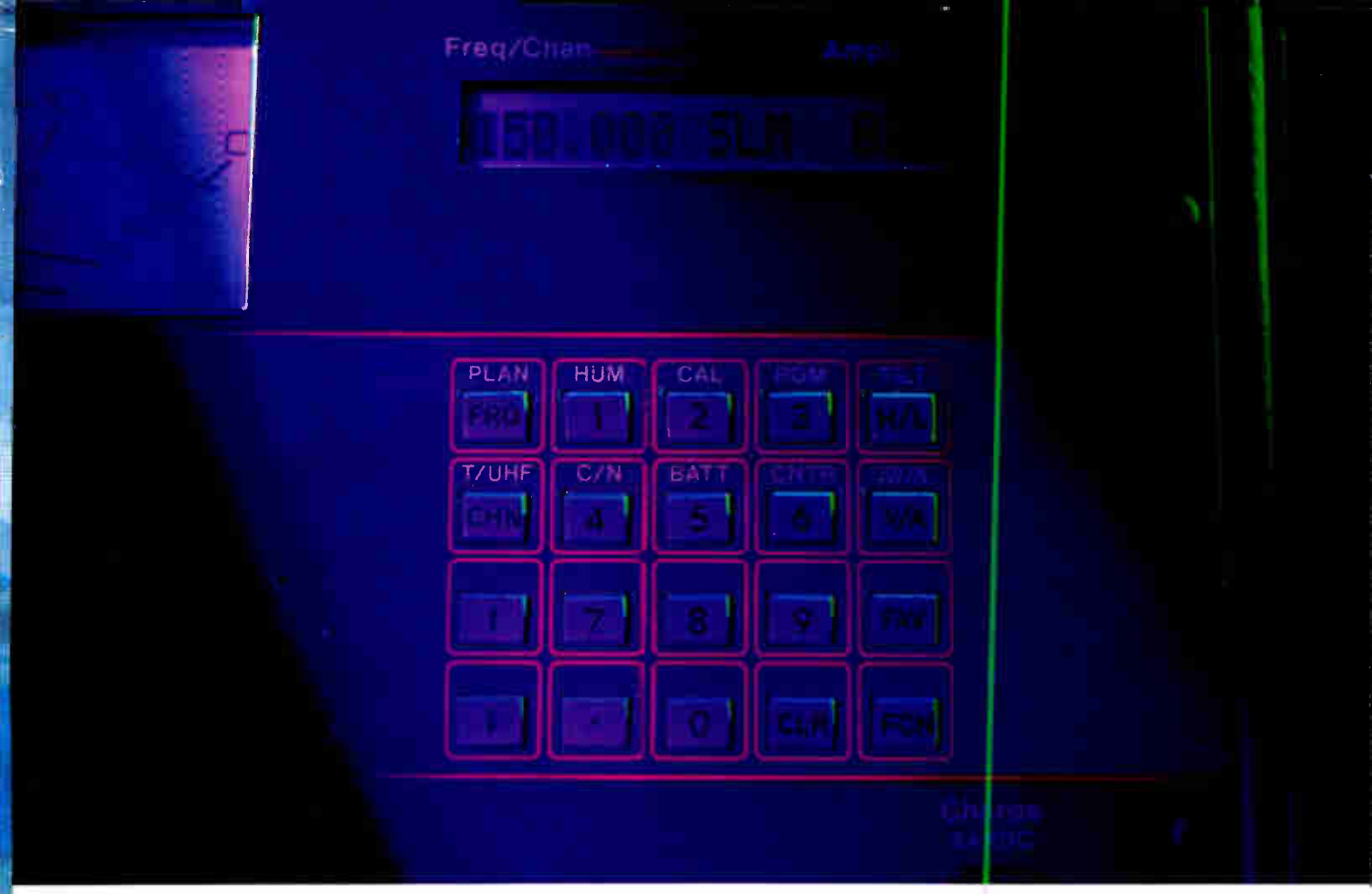


***Photo 1:** Drill out the rivets that hold one of the plastic brackets and a pair of elements to the TV antenna's boom. Use the longest elements, each of which should be about 4 feet long. The plastic bracket will be the dipole's center support, and the two TV antenna elements will be fabricated into the dipole's two elements.*




# The new Wavetek SAM 2000. Push a button and your old world comes to an end.

After you try the new SAM 2000, anyone else's signal level meters will seem like a waste of time.

By comparison, they are.

Because Wavetek's SAM 2000 has just redefined what a signal level meter should do, and how fast it should do it. So the world of Cable TV testing as you've known it has just ended.

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CAL feature permits instant field calibration for temperature variations and test probe, and it even shows when an error in calibration has occurred.

HI/LO pilot button quick-steps between system pilots.

Semi-automated C/N test prevents errors in measurement of this critical system parameter. The SAM 2000 easily locates power supply or filter problems through measurement of system hum modulation.

Two-button tilt function displays mathematical difference between the programmed hi and lo pilot, with realtime update.

Two-button Delta Video/Audio feature quickly displays video-audio level ratio.

The SAM 2000 comes packaged in a compact, lightweight, extremely durable weatherproof ABS plastic case, with built-on strand hooks. Even when open it can handle a sudden shower. And for night use an optional battery powered light illuminates the entire face of the unit.

The new Wavetek SAM 2000. In every way, it's designed to make the most of your time. So don't waste any in getting one.

For more information and the name of your nearest Wavetek sales rep, call us at 1-800-622-5515. In Indiana, 317-788-5965.

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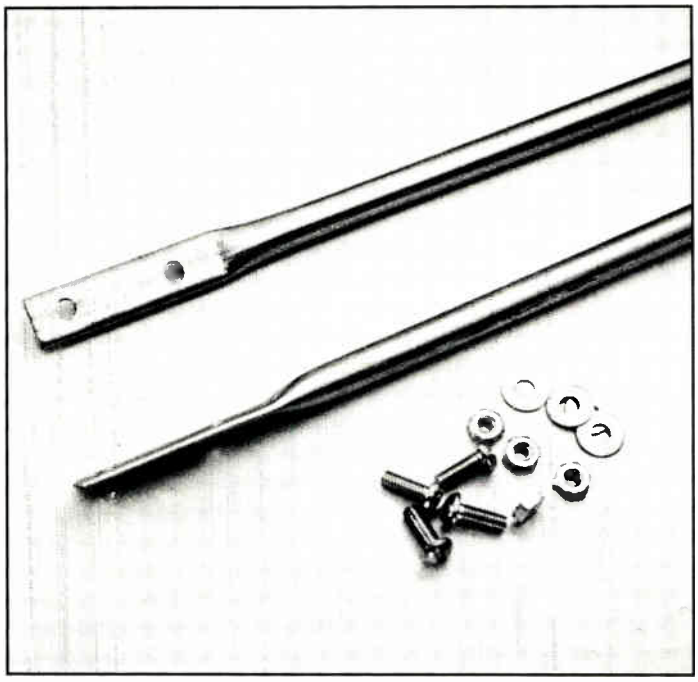

**Photo 2:** *Flatten about 1¾ inches of one end of each element in a bench vise. Drill two 1/8-inch holes in each of the flattened ends, about an inch apart. Drill corresponding matching holes in each half of the plastic bracket. Select machine screws, washers and nuts of a suitable length and diameter to attach the elements to the bracket.*

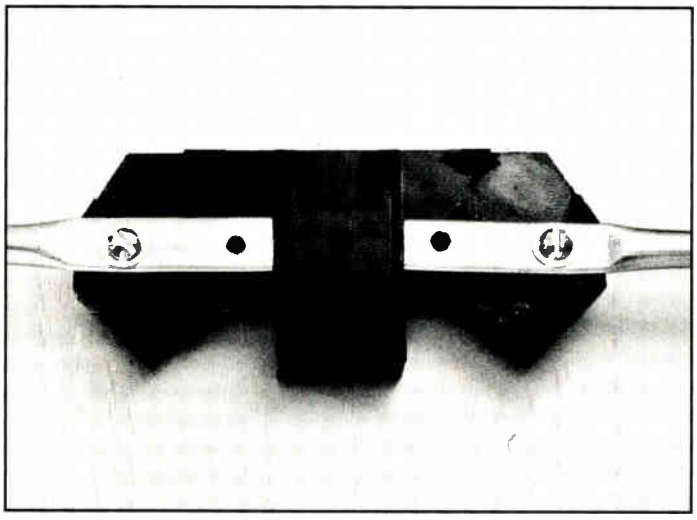

**Photo 3:** *At this point, attach the elements to the plastic bracket using only the outer holes. The center holes will be for connection of the transmission line to the elements.*

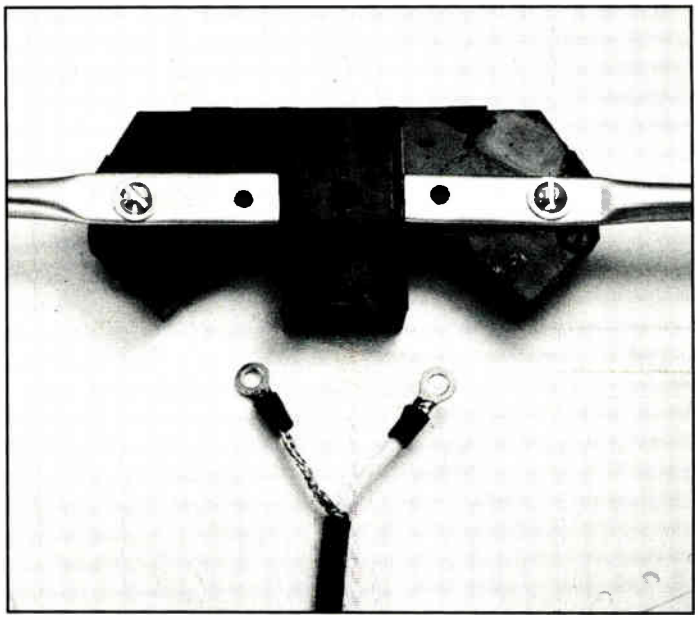

**Photo 4:** *Strip back about 1½ inches of the jacket from one end of a 15-foot piece of copper-braid RG-59 cable, and separate the braid from the center conductor/dielectric. Remove about ¼ inch of dielectric to expose the center conductor, and install crimp-on automotive lug connectors on both the center conductor and shield. Solder after crimping to ensure good connections.*

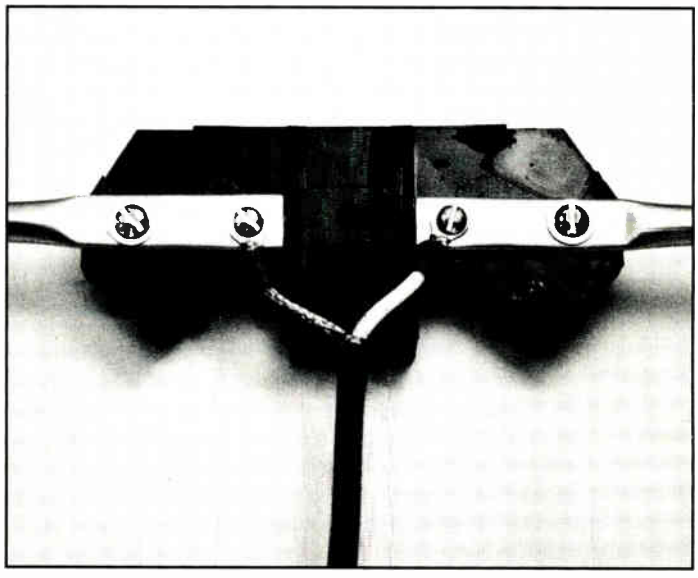

**Photo 5:** *Attach the RG-59 transmission line to the dipole elements with suitable hardware. Make sure the screws are long enough to go completely through the plastic bracket so the element mounting also is secure. Using a tubing cutter, trim the elements so the tip-to-tip dipole length is the calculated half wavelength. In this case, that dimension is 42.75 inches, including the gap between the two elements on the plastic bracket. Make sure each side is even; the dimension from the center of the plastic bracket to the end of each element should be half of the tip-to-tip length, or 21.38 inches.*

To determine the physical length of a half-wave dipole that is not supported at its ends by insulators (i.e., one constructed of tubing or rod) use the formulas:

Length in feet = (492 × K) ÷ frequency in MHz **(3)**

Length in inches = (5,904 × K) ÷ frequency in MHz **(4)**

where:

K = a multiplying factor obtained from the curve in the graph in Figure 1.

To determine K, first calculate the free-space half wavelength of the desired frequency, and divide that result by the diameter of the conductor you will be using to construct the dipole. Then locate that ratio along the bottom of the graph; where that

*(Continued on page 18)*

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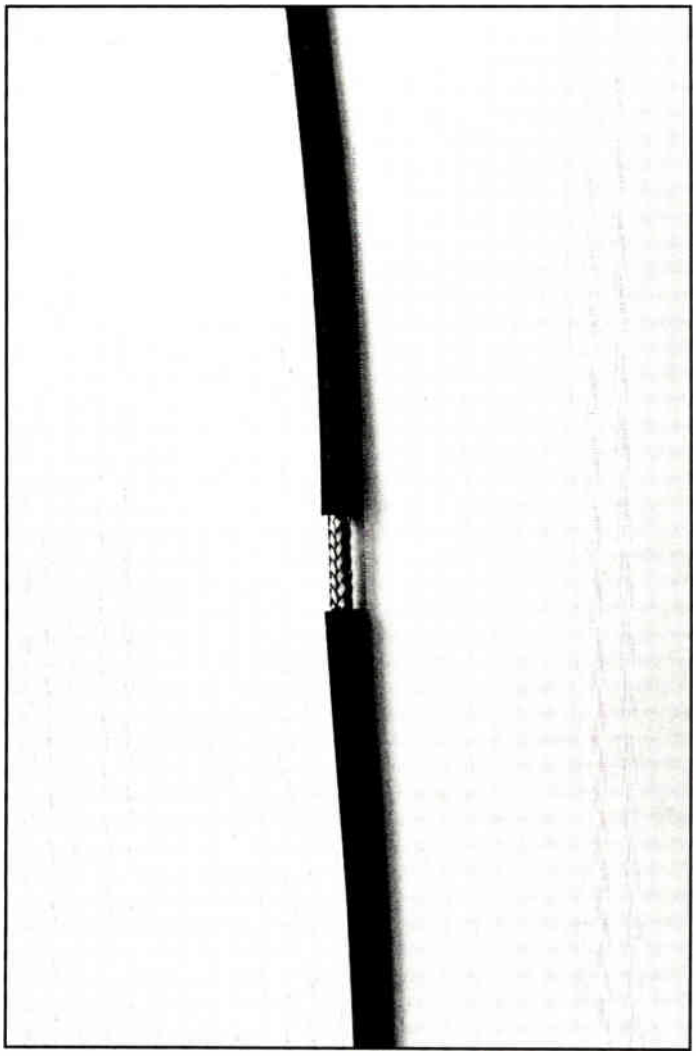


**Photo 6:** *Measure 21.38 inches down the coax from the antenna (from the end of the jacket where the center conductor and shield separate). At this point, remove about ¾ inch of jacket from the RG-59, being careful not to cut through the shield.*

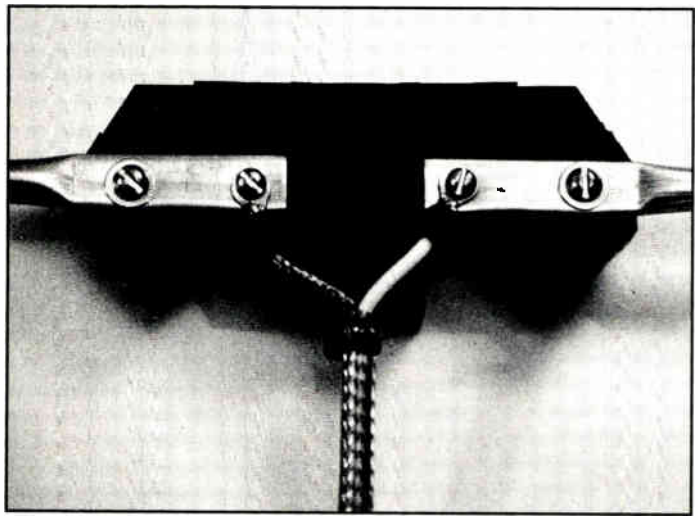


**Photo 7:** *After removing a couple feet of shield from a piece of RG-8, slip that shield over the RG-59's jacket. At the top end, secure the RG-8 shield to the RG-59 with a tie-wrap. Make certain that the RG-8 shield does not come in contact with either the RG-59 shield or center conductor, but is as close as possible to the end of the RG-59's jacket.*

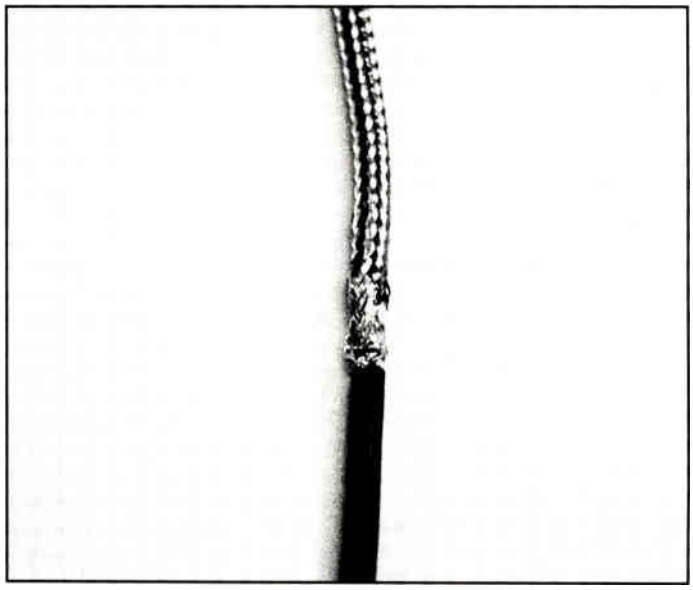


**Photo 8:** *Trim the other end of the RG-8 shield to line up with the RG-59's exposed shield. After tinning the RG-59's shield, solder the RG-8 shield to it.*

## Dipole antenna

*(Continued from page 8)*

number intersects the curve above it corresponds to the appropriate K factor on the left side of the graph.

### Parts is parts

I built the dipole for this article out of parts of an old TV antenna I had in the garage at home, some copper-braid RG-59 (more on this later), a short piece of RG-8 coax, an F connector, a small piece of heatshrink tubing, a couple of crimp-on automotive lug connectors, an old mop handle, and a handful of screws, washers and nuts. To do this yourself, you'll also need some hand tools, a soldering iron, some solder, a drill, drill bits, your wife's blow dryer, a tape measure, a tubing cutter and a calculator.

This dipole is for Channel 16 (C), with an offset video carrier frequency of 133.2625 MHz. From Formula 1 or 2, the free-space half wavelength for Channel 16 is 44.3 inches. The elements from the TV antenna I used for this project were 3/8-inch (0.375) in diameter, making the length-to-diameter ratio 118.13. This results in a K factor of about 0.965 that when plugged into Formula 3 or 4 yields 42.75 inches for the tip-to-tip length of the project dipole.

Photos 1 through 10 will guide you through the assembly of the antenna. One important part of this dipole (shown in detail in Figure 2) is the sleeve balun. A 1:1 balun is necessary because the coax feeding the antenna is electrically unbalanced, and a dipole is electrically balanced. Since the 75-ohm coax impedance is fairly close to the approximately 73-ohm impedance of a horizontal half-wave dipole, a 1:1 balun will prevent the transmission line from becoming part of the radiating elements of the antenna and subsequently distorting the antenna's directional characteristics. Commercially made dipoles often use a broadband transformer-type balun; the sleeve balun shown here is usable only at the antenna's design frequency.

I recommend the use of copper-braid RG-59 (Radio Shack 278-1327 or equivalent) for the antenna transmission line because it will allow you to solder the bottom of the sleeve balun

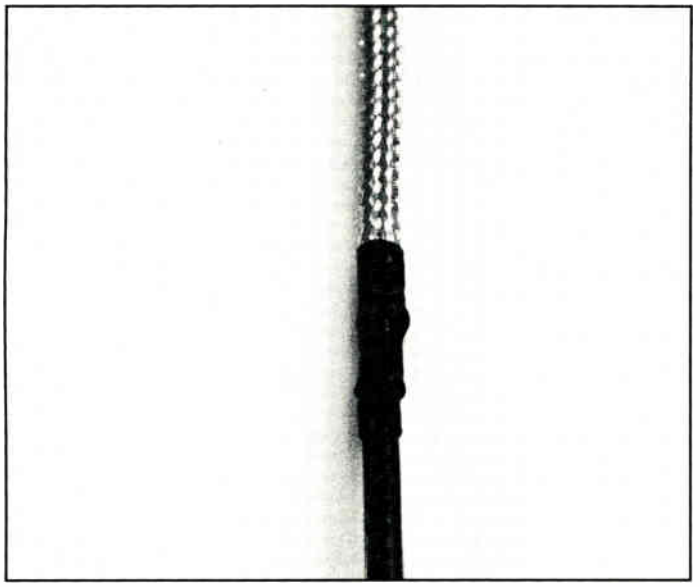


**Photo 9:** *Install a small piece of heatshrink tubing over the solder connection and shrink it with a blow dryer.*

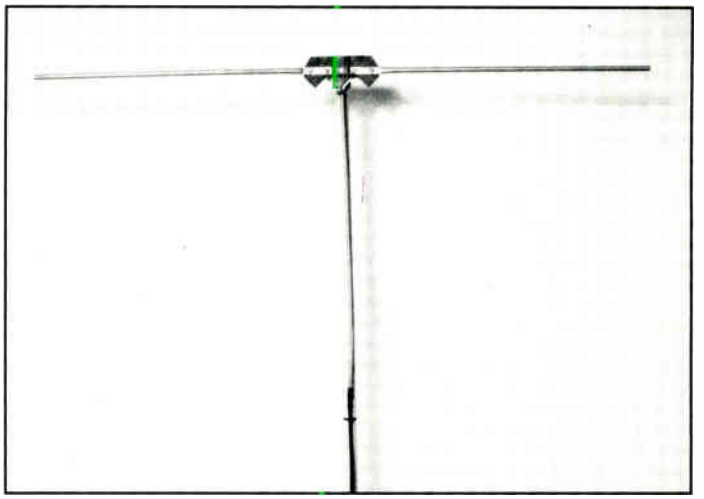


**Photo 10:** *Attach the plastic bracket to a suitable wooden handle or piece of PVC pipe, tie wrap the transmission line to the handle in a couple places and install an F connector on the other end of the RG-59. The completed dipole is now ready for leakage measurements; be sure to account for the loss of the RG-59 transmission line (add it to your meter reading). In this case, the 15 feet of RG-59 has less than 0.5 dB of loss at Channel 16.*

to the RG-59's shield. The copper-braid shield from a piece of RG-8 makes a nice sleeve balun. The balun, which is one-fourth wavelength long, should have a finished length equal to half of the tip-to-tip length of the antenna and a diameter approximately twice that of the transmission line shield outer diameter. Note that the dipole tip-to-tip length is the dimension of concern here, not the combined length of the individual pieces of tubing in the antenna. This is because of the gap between the two elements on the plastic center support.

Two words of caution if you build this antenna at home: 1) If you're doing it on the kitchen table, plan to finish before dinner time (I didn't) and 2) don't use the handle from one of your wife's good mops (I did). Believe me, the results will be far worse than any visit from the FCC. ■

# Signal leakage software Q & A

**By Richard Amell**
Staff Engineer, MetroVision Inc.

*What is signal leakage software and what will it do for cable operators?*

The control of RF leakage in cable systems requires a systematic and well-organized approach. It is not unusual for well-maintained cable systems to develop as many as four leaks per mile of plant per year. Old or poorly maintained systems can exceed that number of leaks many times over.

The FCC (Federal Communications Commission) requires cable operators to log pertinent data about every leak located. Work orders must be issued for each leak repair and leakage data accumulated must be analyzed carefully to intelligently prioritize repair work.

Calculation of CLI (cumulative leakage index) using FCC-mandated formulas is a tedious and error-prone process. Well-written software is designed to handle *all* the calculations and record keeping involved in the leakage control process, saving cable operators valuable time, increasing accuracy of calculations and providing complete records acceptable to the FCC.

*Do I need signal leakage software?*

All cable operators must comply with the FCC rules on RF leakage and CLI. Few operators have the necessary staff to properly handle the large amount of data that is a natural byproduct of the leakage control process. Many operators do not have adequate technical staff to handle the calculations and measurement conversions required in the leakage control process. Signal leakage software is designed to help operators comply with the FCC rules with minimum staff at the lowest cost possible.

*I have heard signal leakage software described as "overkill." Is it?*

Is use of a latest generation leakage detection meter rather than a signal level meter to locate and measure leakage overkill? Using a computer to make difficult or tedious calculations and handle large data manipulating processes such as payroll or accounting is considered good business practice.

Achieving full and accurate compliance with the FCC rules on signal leakage while maintaining detailed, neat and complete records should be the goal of all cable operators. The RF signal leakage issue is one of the most serious issues ever faced by the cable community. Use of the tools available to help you deal with the serious problem can hardly be termed overkill.

*Is signal leakage software expensive?*

Generally, one of the major leakage software packages can be purchased for less than half the cost of one medium-priced absolute reading leakage detection meter. The software will probably be the most inexpensive piece of your leakage control equipment.

*I'm proficient in the use of Lotus 1-2-3. Can't I develop my own leakage control software?*

There are several spreadsheet macros being used in the cable industry to calculate CLI. A complete signal leakage software package handles all aspects of leakage control data including long-term data storage, generation of printed reports and statistical analysis of completed repairs.

These programs took hundreds of hours to write and debug, and are designed to be easy to use. Writing even a simple spreadsheet macro can take many hours. Your staff's time may be better spent analyzing the leakage data and making necessary repairs.

*What computer hardware do I need to run signal leakage software?*

The software packages available to the cable industry all operate under MS-DOS on PC, XT, AT and, in some cases, PS/2 and local area network computer systems. (Note: PCs or XTs should be avoided due to their slow operating speed, but can be used if necessary.) The large amount of data to be stored makes a hard disk an absolute necessity. A minimum of 512K of RAM is recommended. A printer is required to generate reports. Color displays ease data entry but most leakage software packages support monochrome display.

A minimum computer system that can adequately run available signal leakage software packages can be purchased new for less than $2,500 in most areas of the United States. Many cable operators already have the necessary computer hardware available in their systems.

*Do I need a separate signal leakage software package for each of my cable systems?*

That's up to you. A good signal leakage software package can handle the data for multiple systems, limited only by available hard disk storage space. Most operators assign a computer and software to each system. Some have chosen to place the computer and software at the central office and maintain the data for several systems at a single location.

*What features should I look for when evaluating signal leakage software?*

Available software packages are filled with features to make your job easier but be sure the package you choose has the following:

a) Capability to calculate $I_{infinity}$ and $I_{3000}$ CLI without the need to enter the radial distance with every leak.

b) Capability to assign a "modulation correction factor" to provide for full compliance with FCC rules regarding calibration of leakage test equipment to an unmodulated carrier. (Part 76.611, Paragraph C)

c) Consistently high operating speed regardless of the number of leaks stored. Ask for a demonstration with several hundred leaks stored in the system's files.

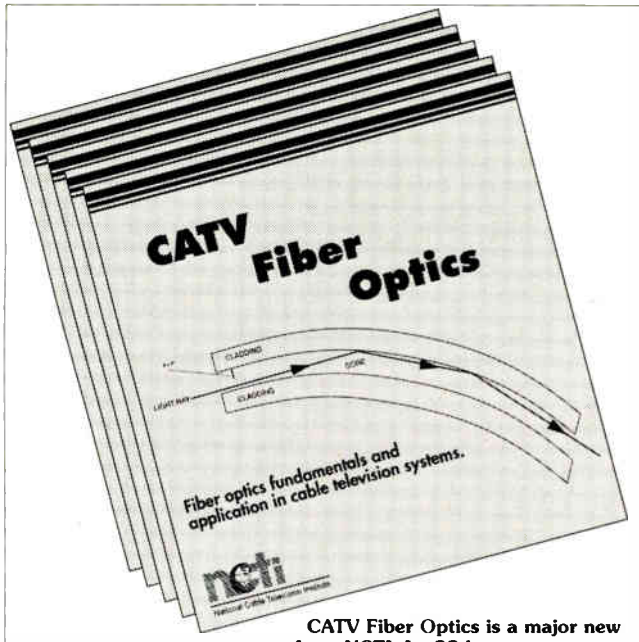
d) Capability to wire-link to hand-held or lap-top computers or computerized leakage detection meters (e.g., Wavetek's CLM 1000). Leakage data can be entered on the remote devices and downloaded to the computer, eliminating the need to transcribe the data. Demand a demonstration of this capability.

e) Capability to accept leakage measurement data in numerous formats (e.g., dB, dBmV or microvolts/meter)

f) Capability to calculate the leakage level at 10 feet (three meters) when the measurement was made at a distance other than 10 feet.

g) Dependable after-purchase service and support. Ask operators who are using their software extensively what they like or dislike about their software.

Your decision to purchase should be based on ease of use and availability of desired features. Cost should not be the key factor since most available signal leakage software is very competitively priced. ■

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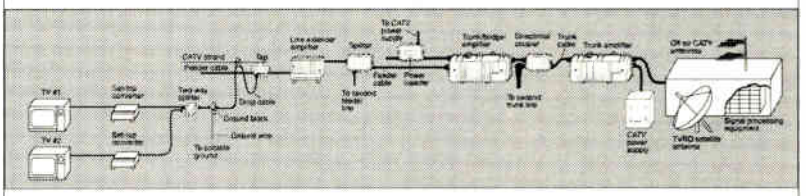

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# Outage troubleshooting

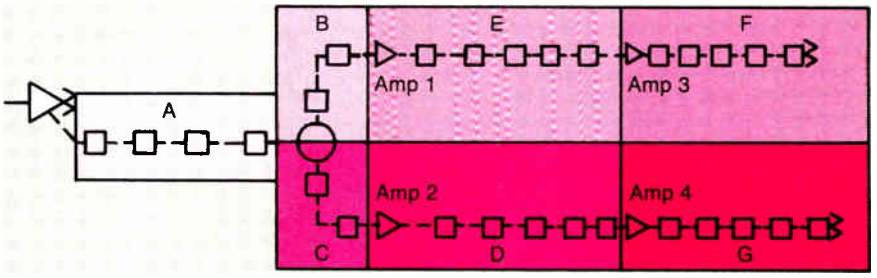
**By Timothy J. Pastor**
Line Technician, Continental Cablevision

As a line technician, it is my job to make sure that hundreds of miles of cable plant are in top running condition at all times. From the headend to the subscriber tap, my responsibility lies. I'm sure many of you reading this are in the same position.

Keeping this in mind, we must remember that customer service is our number one priority. Without the customer, none of us would get very far in this industry. Everyone plays a part in customer service, from the president of the company on down. We, as technicians, play our part by physically keeping the cable on and operating all the time. Many outages are uncontrollable, and downtime quickly becomes an issue we must be concerned with. (Goodness knows our supervisors are.)

After countless outages and many meetings with my peers and supervisors, I decided to take a stand, get creative and make my life a bit easier. Some outages are inevitable and, at times, take some time to track down and troubleshoot. And here's a key point: Outages often affect areas that could be up while you troubleshoot!

**Figure 1**




*"Outages often affect areas that could be up while you troubleshoot."*

How? Consider Figure 1. Let's say a short develops at Amplifier 2 or beyond, and the fuse keeps blowing at the line extender amplifier. You go to the splitter and measure a short on the leg that feeds Amp 2. As it is now, Amp 1, 3 and 4 are out as well.

My solution was to adapt a splitter faceplate that can be temporarily plugged in at any splitter location. This splitter has a small project box mounted on the front, in which there are three switches (one for input and one for each output). These switches control AC flow through that leg but do not restrict RF flow.

By plugging in the adapted splitter and switching off AC to the trouble leg, I get the rest of the system up (making my boss very happy). Now only Segments D and G remain out during troubleshooting while Segments E and F are running.

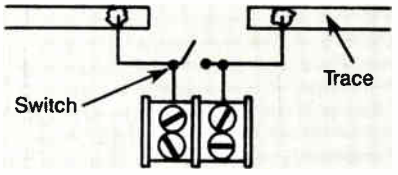
Modification of the splitter is very simple and inexpensive. It has come in handy on many occasions and, as I mentioned earlier, keeps the customers happy.

### Another modification

I modified another piece of gear that has proven useful—a line power inserter (LPI) faceplate. I got this idea after a particular area I look after began to get on my nerves. About once every two months a certain LPI in the system burned up. No one could figure out why and the system powering design prints indicated all should be OK.

I was convinced there was too much current draw but needed to figure out how to physically check it with minimal downtime. Again, I cut into the AC controlling traces on the circuit boards of an LPI and remoted these points to a terminal strip mounted on the faceplate. Then I got fancy and shunted the terminals with a switch. (See Figure 2.)

**Figure 2**




There was a brief outage when I pulled the old faceplate off and plugged in my modified plate. With the switches on, the modified plate worked as normal. All I had to do was hook my ammeter to the terminals, turn the switch off and, system still running, measure the current flow on each leg.

This method proved valuable. In the previously mentioned situation, use of the modified faceplate showed an 18 amp draw on a supply rated at 15 amps maximum output. After I tracked down the problem, I took another current reading. What do you know—it was 11.3 amps draw, just as the system powering design prints indicated. (I guess those things are pretty accurate after all.)

I hope these two troubleshooting tips prove as valuable to your system as they have to mine. This brings me to my next point: Don't be afraid to make suggestions and use your imagination. It can only benefit you and the customers you serve. Be creative and use your talents. If you make a good discovery, write about it so I can build one too! ■

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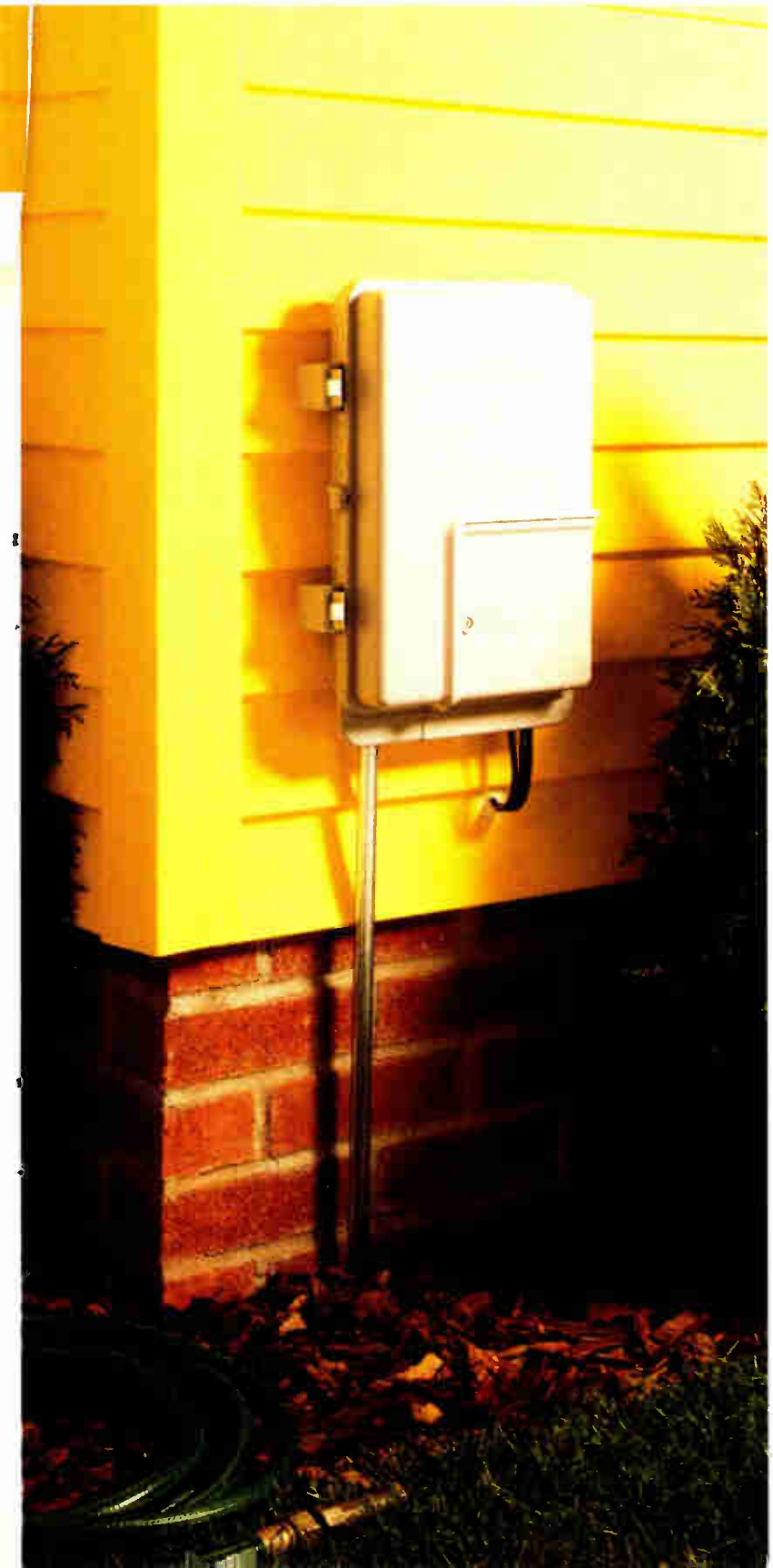


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# Basic electronics theory

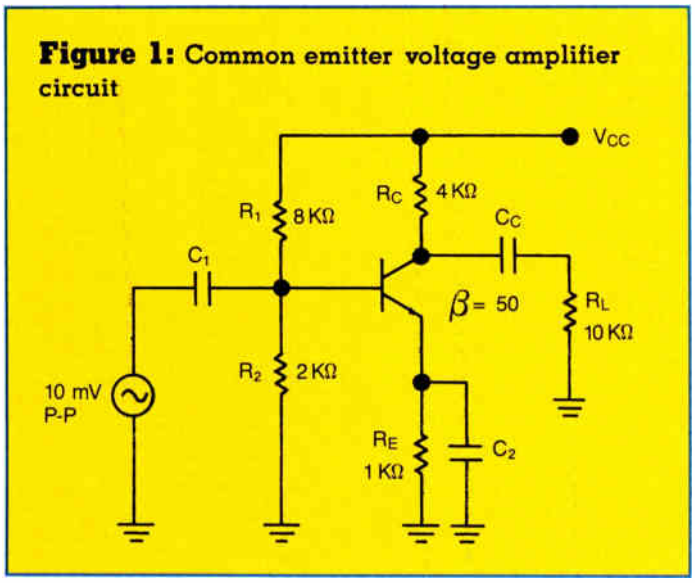


**Figure 1:** Common emitter voltage amplifier circuit

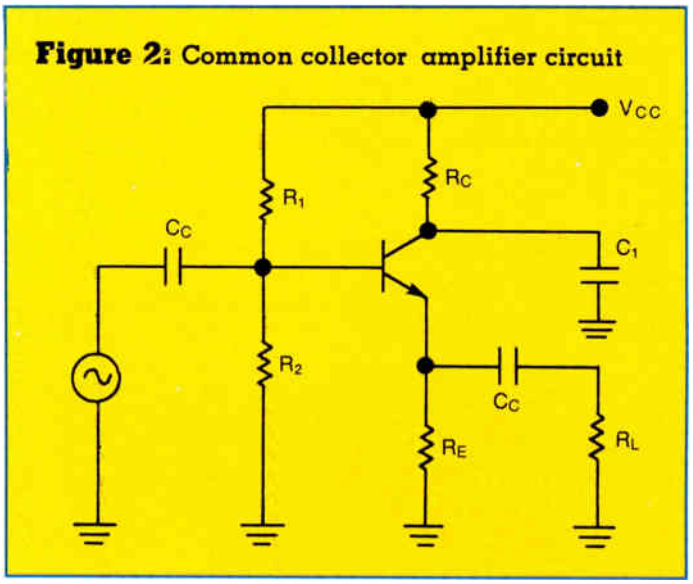


**Figure 2:** Common collector amplifier circuit

*This is Part XX (and the final installment) of a series about basic electrical and electronic principles, designed for the individual with little or no training in either electricity or electronics.*

**By Kenneth T. Deschler**
Cable Correspondence Courses

This month we will use a transistor circuit to enlarge or amplify a signal voltage applied to its base. We will concentrate on small signal amplifiers because they are the most commonly used in CATV. A small signal amplifier is defined as an amplifier having a signal whose peak-to-peak value is less than 10 percent of the DC emitter current.

Small signal amplifiers are more commonly called *voltage amplifiers* to separate them from large signal or power amplifiers. Figure 1 shows a common emitter voltage amplifier circuit.

## Amplifier operation

In Figure 1 we see that an AC signal having an amplitude of 10 millivolts (mV), peak-to-peak, is applied to a coupling capacitor ($C_1$). Coupling capacitors are used to isolate the signal source from the DC voltage present on the base. The value of the DC voltage on the base is determined by a voltage divider made up of $R_1$ and $R_2$. The value of this voltage can be determined by the following formula:

$$V_B = \frac{V_{CC}}{R_1 + R_2} \times R_2$$

$$= \frac{10\ V}{10{,}000\ \text{ohms}} \times 2{,}000\ \text{ohms}$$

$$= .001\ A \times 2{,}000\ \text{ohms}$$

$$= 2\ V$$

Thus, the base now has 2 V, ± 5 mV, on it. Let us now find the DC voltage on the emitter. Its value is found by subtracting the 0.7 V drop across the base-emitter junction from the value of the voltage on the base:

$V_E = V_B - 0.7\ V$
$= 1.3\ V$

The emitter current can be found by dividing the emitter voltage by the emitter resistance:

$I_E = V_E \div R_E$
$= 1.3 \div 1000$
$= 1.3\ mA$

As was pointed out in our last lesson, the current in the collector of our circuit is approximately the same value as the current in the emitter, therefore, $I_C$ also equals 1.3 mA.

Before we can find the amount of voltage gain for this circuit we must first find the value of the AC emitter resistance ($r_e$).

$$r_e = \frac{25\ mV\ \text{(a constant value)}}{I_E}$$

$$= 25\ mV \div 1.3\ mA$$

$$= 19.2\ \text{ohms}$$

Now that we have found the AC emitter resistance let us also find the AC collector resistance ($r_c$).

$$r_c = \frac{R_C \times R_L}{R_C + R_L}$$

$$= \frac{4\ K \times 10\ K}{14\ K}$$

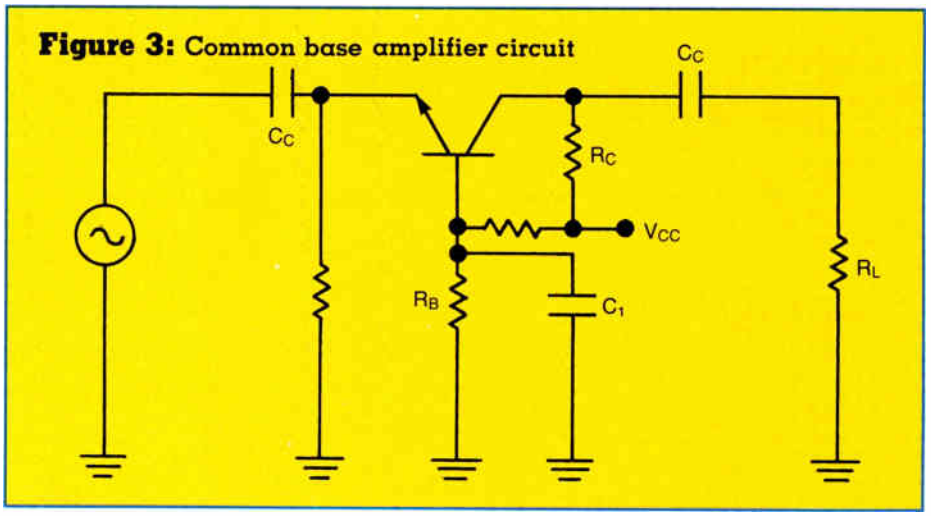


**Figure 3:** Common base amplifier circuit

$= 2.86\ K$

If the emitter circuit of Figure 1 did not have a capacitor (C-2) to bypass the AC signal around the emitter resistor, then the voltage gain would be:

$$A_V = \frac{R_C}{R_E + r_e}$$

$$= \frac{4000}{1019.2}$$

$$= 3.925$$

With a gain of only 3.925, the output voltage is:

Output = $A_V \times$ input
= $3.925 \times 10$ mA
= 39.25 mV

With the addition of C-2 across the emitter resistor, the voltage gain of Figure 1 now becomes:

$$A_V = \frac{r_c}{r_e}$$

$$= \frac{2860}{19.2}$$

$$= 149$$

This means that the output signal from this amplifier will now be:

Output = $A_V \times$ input
= $149 \times 10$ mV
= 1.49 V

From this we can see that bypassing the emitter resistance significantly improves the voltage gain of an amplifier circuit.

## More configurations

Another amplifier circuit commonly used in CATV equipment is the common collector amplifier (sometimes called an emitter follower). They are used to match the high impedance of a preceding circuit to a low impedance load. Figure 2 shows a common collector amplifier circuit containing a collector bypass capacitor ($C_1$).

A third amplifier configuration is the common base amplifier. This amplifier (shown in Figure 3) has its base common to both input and output signals. They are used primarily as radio frequency (RF) amplifiers because of their low input impedance and high output impedance characteristics.

## Recommended reading

I regret that this is the last article of this series and would like to thank Kenneth

Millburn for his proofreading skills. I strongly recommend that you continue to study this fascinating field. The following is a recommended list of textbooks on electronics theory:

*Elementary:*
Loper, Ahr, and Clendenning, *Introduction to Electricity and Electronics*, Delmar Publishers.
Steinberg and Ford, *Electricity and Electronics*, American Technical Publishers.
Buban and Schmitt, *Understanding Electricity and Electronics*, McGraw-Hill Publishing Co.
Petruzella, *Electricity and Electronic Fundamentals 1 and 2*, McGraw-Hill Publishing Co.

*Intermediate:*
Miller, *Modern Electricity—Electronics*, Prentice Hall.
Fowler, *Electricity Principles and Applications*, McGraw-Hill Publishing Co.
Schuler, *Electronics—Principles and Application*, McGraw-Hill Publishing Co.

*Advanced:*
Grob, *Basic Electronics*, McGraw-Hill Publishing Co.
Schrader, *Electronic Communications*, McGraw-Hill Publishing Co.
Malvino, *Electronic Principles*, McGraw-Hill Publishing Co.

**Test your knowledge**

1) Define small signal amplifiers.
2) What is another name for a small signal amplifier?
3) Why does a bypass capacitor improve gain in a common emitter amplifier?
4) What is the main advantage of a common collector amplifier?
5) What are the main characteristics of a common base amplifier? ■

**Answers to quiz**

1) An amplifier having a signal whose peak-to-peak value is less than 10 percent of the DC emitter current.
2) Voltage amplifier.
3) Because it reduces the resistance of the emitter circuit thus allowing more current to flow through the transistor.
4) It matches the high impedance of a preceding amplifier to a low impedance load.
5) Low input impedance and high output impedance.


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DMV

# Cable basics

*This is Part I of a series on the basic elements of cable TV measurements.*

**By Richard G. Covell**
Applications Engineer, General Instrument/Jerrold

Georg (no "e") Simon Ohm, a German physicist, investigated galvanic currents and established the relationship of voltage, current, resistance and power. An ohm is the unit of resistance in which 1 ampere (A) of current will dissipate 1 watt (W) of power. One ohm also is the unit of resistance in which a potential of 1 volt (V) produces a current of 1 A.

In its basic form, Ohm's law as a formula is written:

$$R = E \div I$$

Where:
R = resistance in ohms
E = electromotive force (EMF) in volts
I = current in amperes

For example, to find the resistance of a circuit in which the application of 1 V causes 1 A of current to flow, you would make the following calculations:

$$R = E \div I$$
$$= 1 \div 1$$
$$= 1 \text{ ohm}$$

Using algebra (multiplying both sides of the above equation by I) we find the equation for voltage is:

$$E = R \times I$$

For example, to find the voltage across a 20 ohm resistor if 2 A of current is flowing through the resistor:

$$E = R \times I$$
$$= 20 \times 2$$
$$= 40 \text{ V}$$

Again using algebra we find the formula for current is:

$$I = E \div R$$

For example, to find the current through a circuit if its resistance is 10 ohms and the voltage applied to the circuit is 10 V:

$$I = E \div R$$
$$= 10 \div 10$$
$$= 1 \text{ A}$$

Ohm also stated a relationship with power. He said that 1 A of current flowing through 1 ohm of resistance will produce 1 W of power. To have a 1 ohm resistor produce more power it would be necessary to have more current flowing through it. To achieve this higher current the electromotive force (EMF) would have to be increased. To state the proper relationship, multiply the EMF in volts by the current in amperes to find the power in watts. The formula is:

$$P = E \times I$$

Where:
P = power in watts
E = EMF in volts
I = current in amperes

For example, to find the power dissipated in a circuit when the application of 10 V causes a current of 10 A to flow:

$$P = E \times I$$
$$= 10 \times 10$$
$$= 100 \text{ W}$$

Substituting "R x I" for "E" in the previous equation we have another formula for power:

$$P = R \times I^2$$

Rather than developing each possible formula for finding R, I, E or P when any two of the other values are known, use Table 1.

## Logarithms

Just what is a logarithm? According to Webster, it is "...in mathematics, the exponent of the power to which a fixed number (the base) must be raised in order to produce a given number (the antilogarithm): logarithms are normally computed to the base of 10 and are used for shortening mathematical calculations: abbreviated log (no period)."

Stating the definition for logs (to the base 10) again: The log of a number is the exponent of 10 required to equal the number. For example, the log of 100 is 2, for you must raise 10 to the second power (10 with an exponent of 2) to equal 100.

The log of 1,000 would be 3, for 10 would have to be raised to the third power to equal 1,000. The log of 10,000? It's 4, because 10 to the fourth power equals 10,000, and the log of a number is the power (or exponent) to which 10 must be raised to equal the number.

What's the log of 20? The formula to compute the carrier-to-noise (C/N) and carrier-to-distortion numbers at any point in a cascade of like amplifiers requires the log of the number of amplifiers in cascade. If you memorize the log of 20, you'll be able to find the C/N or carrier-to-composite triple beat (C/CTB) performance at the end of a 20 amplifier cascade when you know the performance for a single amplifier. Since 20 is somewhere between 10 and 100, the log of 20 must be somewhere between 1 and 2. It is 1.3.

It's simple to find the log of any number. For less than $20 you can purchase a calculator that has a log button on it. Just key in the number for which you wish to find the log, touch the log button and there's your answer!

## Decibel

A decibel (dB) is, by definition, one-tenth of a bel. A bel is the unit for expressing, in logarithmic terms, the ratio between two power levels.

The number of bels equals the $\log_{10}$ of power 1 ($P_1$) divided by power 2 ($P_2$). The number of decibels equals 10 times the $\log_{10}$ of $P_1 \div P_2$.

For example, to find how much greater in dB the output power of a linear amplifier is if the output power ($P_1$) is 100 W and the input power ($P_2$) is 50 W:

$$dB = 10\log (P_1 \div P_2)$$
$$= 10\log (100 \div 50)$$
$$= 10\log (2)$$
$$= 10 \times 0.301$$
$$= 3.01 \text{ dB}$$

Therefore, the output power is 3.01 dB greater than the input power.

With the 10log function, each double in

**Table 1: Finding unknown values using known values**

| Known/ Unknown | I & R | I & E | I & P | R & E | R & P | E & P |
|---|---|---|---|---|---|---|
| I = | | | | $E \div R$ | $\sqrt{P \div R}$ | $\sqrt{P \div E}$ |
| R = | | $E \div I$ | $P \div I^2$ | | | $E^2 \div P$ |
| E = | $I \times R$ | | $P \div I$ | | $\sqrt{P \times R}$ | |
| P = | $I^2 \times R$ | $E \times I$ | | $E^2 \times R$ | | |

value is equal to a 3.01 dB increase while a −3.01 divides the value in half. Each 10 dB change is a factor of 10. Cable parameters that follow the 10log function are power, noise and second order.

Since the product of voltage and current equals power, we may express these units of measurement in decibels too. Voltage (in dB) equals 20 times the log of the ratio of voltage 1 ($V_1$) divided by voltage 2 ($V_2$).

For example, to express in dB the voltage increase caused by an amplifier that produces a 240 V output ($V_1$) with a 120 V input ($V_2$):

$$\begin{aligned} dB &= 10\log (P_1 \div P_2) \\ &= 10\log (100 \div 50) \\ &= 10\log (2) \\ &= 10 \times 0.301 \\ &= 3.01 \text{ dB} \end{aligned}$$

Therefore the output voltage is 6 dB higher than the input. (Note: the input and output impedance must be the same for the formula to be true.)

Each double in a 20log function is an increase of 6 (actually 6.02) dB, while each halving is a 6 dB decrease. It takes a 20 dB change to change the original value by a factor of 10. Cable parameters that follow the 20log function are voltage (dBmV), hum, third order discrete, CTB and cross-modulation (X-MOD).

While a dB can express a relationship between two known quantities (which use the same units of measurement), a dB has no absolute value unless it is referenced to a measurement unit. For example, 0 dB (or 3 dB, 6 dB or 40 dB) is valueless, but if we let 0 dB equal 1 milliwatt (mW), a 10log or power function, then 0 dBm equals 1 mW and 3.01 dBm would equal 2 mW while −3.01 dBm would equal 0.5 mW. Likewise, if we let 0 dB equal 1 millivolt (mV), a 20log function, then 0 dBmV equals 1 mV and 6.02 dBmV would equal 2 mV with −6.02 dBmV equal to 0.5 mV.

Table 2 shows the relationship between decibels as they apply to power (10log) and voltage (20log). Since it takes 3.01 dB (not 3 dB) to double a power function and 6.02 dB (not 6 dB) to double a voltage function, some of the mW and mV values in some cases have been rounded off.

## Decibel millivolt

Early TV signal levels were measured with a field strength meter calibrated in microvolts ($\mu$V). Gain and loss measurements were awkward, since they had to be expressed in linear terms. The decibel was adopted in the early '60s and was initially defined (by Jerrold) as dBj. The decision to express signal levels in decibels required selecting a reference voltage so level readings would have an absolute value. A black and white TV set gave a good picture if 1,000 $\mu$V could be brought to the antenna terminals, so it was arbitrarily decided to make 0 dB equal to 1,000 $\mu$V, which by definition is 1 mV. The formula was:

$$dBmV + 20\log [E(mV) \div 1]$$

Therefore:
0 dBmV = 1 mV

Since every 6.02 dB (6 dB is close enough) change is a double when we speak of voltage (a 20log function), then 6 dBmV would be close to 2,000 $\mu$V and 12 dBmV (another 6 dB increase) would double the voltage again to 4,000 $\mu$V and so on. After 10 6 dB increases from 0 dBmV you're at 60 dBmV and the voltage is equal to 1 million $\mu$V, (or 1,000 mV or 1 V). As you can see in Table 3, going negative from 0 dBmV reduces the voltage, with −6 dBmV equal to approximately 500 $\mu$V.

In summary, each 6 dB change either doubles or halves the voltage, and each 20 dB change affects the voltage by a factor of 10. You now have enough information to find the actual voltage level of a 46 dBmV carrier. Since 0 dBmV equals 1,000 $\mu$V, increasing the level by 20 dB would raise it by a factor of 10 to 10,000 $\mu$V. The next 20 dB increase (to 40 dBmV) would raise the level another 10 times bringing it to 100,000 $\mu$V. The last 6 dB needed to achieve 46 dBmV doubles the 100,000 to 200,000 $\mu$V (actually 199,526 $\mu$V). Pretty simple! Of course 200,000 $\mu$V is the same as 200 mV or 0.2 V. Knowing the voltage out of the amplifier at the measured channel and the resistance of the cable (75 ohm impedance), you can compute the power produced.

## Return loss

The transfer of energy from one device to another is best achieved when both devices are of the same impedance. If they differ, some of the energy will be reflected back toward the transmitting device. A measure of this reflected energy is called return loss (RL) and expresses how far down (in dB) the reflected signal will be from that of the incident signal entering that device. These measurements are specified over a given bandwidth and at a given impedance. It is based on the worst case for the device at the worst case frequency. Typical return loss is better than the specification at most frequencies. →

**Table 2:** Relationship between power dB and voltage dB

| 10log function (power) | | 20log function (voltage) | |
|---|---|---|---|
| dBm | mW | dBmV | mV |
| 30 | 1000.0 | 60 | 1000.0 |
| 27 | 500 | 54 | 500 |
| 24 | 250 | 48 | 250 |
| 21 | 125 | 42 | 125 |
| 20 | 100.0 | 40 | 100.0 |
| 18 | 63 | 36 | 63 |
| 15 | 31.5 | 30 | 31.5 |
| 12 | 16 | 24 | 16 |
| 10 | 10.0 | 20 | 10.0 |
| 9 | 8 | 18 | 8 |
| 6 | 4 | 12 | 4 |
| 3 | 2 | 6 | 2 |
| 0 | 1.0 | 0 | 1.0 |
| – 3 | 0.50 | – 6 | 0.50 |
| – 6 | 0.25 | – 12 | 0.25 |
| – 9 | 0.125 | – 18 | 0.125 |
| – 10 | 0.1 | – 20 | 0.1 |
| – 12 | 0.063 | – 24 | 0.063 |
| – 15 | 0.032 | – 30 | 0.032 |
| – 18 | 0.016 | – 36 | 0.016 |
| – 20 | 0.01 | – 40 | 0.01 |
| – 21 | 0.008 | – 42 | 0.008 |
| – 24 | 0.004 | – 48 | 0.004 |
| – 27 | 0.002 | – 54 | 0.002 |
| – 30 | 0.001 | – 60 | 0.001 |

**Table 3:** dBmV to μV conversion

| dBmV | μV | |
|---|---|---|
| 60 | | 1,000,000 |
| 54 | 500,000 | (1 V) |
| 48 | 250,000 | |
| 42 | 125,000 | |
| 40 | | 100,000 |
| 36 | 63,000 | |
| 30 | 31,500 | |
| 24 | 16,000 | |
| 20 | | 10,000 |
| 18 | 8,000 | |
| 12 | 4,000 | |
| 6 | 2,000 | |
| 0 | | 1,000 |
| – 6 | 500 | (1 mV) |
| – 12 | 250 | |
| – 18 | 125 | |
| – 20 | | 100 |
| – 24 | 63 | |
| – 30 | 32 | |
| – 36 | 16 | |
| – 40 | | 10 |
| – 42 | 8 | |
| – 48 | 4 | |
| – 54 | 2 | |
| – 60 | | 1 |
| | | (1 μV) |

The higher the RL number, the further down the reflected signal is, and the better the match. (Match is another way of expressing RL, and describes how well the impedance of the device matches that of the desired impedance over the specified bandwidth. A 30 dB match is equivalent to a 30 dB RL.)

When a manufacturer specifies its 5 to 400 MHz directional coupler has a 16 dB RL, it is stating that the level of any signal between 5 MHz and 400 MHz reflected from any port will be at least 16 dB lower than that of the signal applied. RL can be measured using a return loss bridge, which is nothing more than a precision directional coupler having extremely good isolation between its input and tap ports.

To measure the RL of a device, the bridge is connected (utilizing the in port of its directional coupler) to the item under test. The signal source is connected to the out port of the internal directional coupler. Any reflected signal from the device under test appears at the tap port. The tap and insertion losses of the typical return loss bridge are 12 dB, and this loss must be allowed for when making measurements. (Note: For accurate measurements this test requires that all other ports of the device under test are terminated with precision 75 ohm terminators.)

The formula for RL with respect to voltage is:

$$RL = 20\log (E_r \div E_i)$$

Where:
$E_r$ = reflected voltage
$E_i$ = incident voltage

For example, to find the RL of a device when, with 1 V applied, 0.15 V is reflected:

$$RL = 20\log (E_r \div E_i)$$
$$= 20\log (1.0 \div 0.15)$$
$$= 20\log (6.6667)$$
$$= 20 \times 0.8239$$
$$= 16.48 \text{ dB}$$

The formula for RL with respect to impedance is:

$$RL = 20\log [(Z_d + Z_a) \div (Z_d - Z_a)]$$

Where:
$Z_d$ = desired impedance
$Z_a$ = actual impedance

For example, a well designed splitter with an impedance of 70 ohms is connected to a 75 ohm system. To find the RL of the splitter in this environment:

$$RL = 20\log [(Z_d + Z_a) \div (Z_d - Z_a)]$$
$$= 20\log (145 \div 5)$$
$$= 20\log (29)$$
$$= 20 \times 1.4624$$
$$= 29.24 \text{ dB}$$ ■

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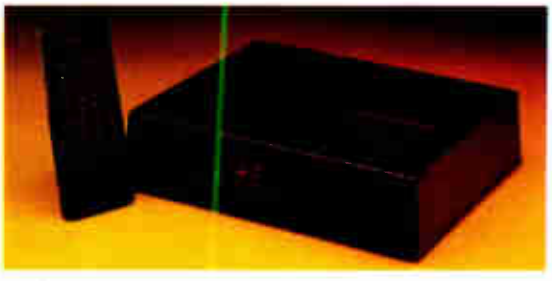

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*Reader Service Number 25.*

# Customer contact: Actions and words speak loudly

**By Saconna Blair**
National Quality Assurance Coordinator
Jones Intercable Inc.

Good customer contact can mean the difference between a business success and failure. We must all strive for customer satisfaction because without customers there is no purpose for our jobs. Sometimes it's easier to understand the difference between good and bad customer contact by relating to personal experiences when you were the customer.

I frequently stop at convenience stores for gas and snacks. There is a big difference in the attitudes displayed from one chain to another. One thing that really bothers me is when I walk up to the counter to pay and the person moves at a snail's pace, looks at me and frowns. When I explain that I would like to pay for the gas with a credit card and pay cash for the soda, the frown I was greeted with turns into a disgruntled sigh. At this point I can't wait to get out of there and try to avoid ever stopping at that place again.

It is a fact that we remember unpleasant experiences better than pleasant ones and I know that I am more likely to relate this negative experience to others. I guess this supports the theory we've all heard about bad news traveling fast.

In that same vein, when you arrive at a customer's home to do an install, don't sigh and look weary when you are asked to reroute the cable from the south wall of the living room to the north. After all, the customer is paying to get cable service and you should try to accommodate him or her whenever possible. When you go on a service call and discover the customer did not know the TV set was supposed to be tuned to Channel 3, don't roll your eyes and shake your head (in front of the customer anyway)—not everyone is as knowledgeable as you on the finer technical points of cable TV.

Our business grows one customer at a time and the impression customers receive when they order cable, have it installed or have a service call will remain on their minds until proven differently. Courtesy is one part of that impression.

Another part of that impression is conveyed through the words you speak to a customer. It is important to give clear and complete information. One area I'd like to focus on is the use of technical terms. When you speak to and around customers you should keep in mind that technical terms may have no meaning or could even be offensive. You need to be sensitive to a customer's knowledge of cable terminology.

One such word that was used in the past was "radiation." As soon as subscribers hear this word they start to imagine cable causing cancer (not a beneficial perception). Or imagine how a customer might interpret you saying "There's a problem with your *addressable box*. Maybe it needs a *hit*, but it might be a problem with the *trunk*. We've been having trouble down at that *ped*, you know." At this point the customer may think there is a problem with the address on his mailbox and that you want to hit the box or him. And there is a problem in your car trunk or at someone else's pad?

Sure, this is a little exaggerated, but it is easy to understand that words can have alternate meanings. The following list contains words used on a daily basis that could confuse a customer:

| | |
|---|---|
| Drop | Radiation |
| Pedestal | Nonpay |
| Jumpers | Whips |
| Hookup | Hit |
| Addressable | Converter box |
| CSR | Downgrade |
| Trunk | Feeder |
| Amp | dB |
| Cable plow | Alley bore |
| Road bore | Signal leakage |
| Headend | Off air |
| Microwave | Bird |

You must answer questions and educate your customers. Keep in mind that you are the expert in cable and using technical terms may only confuse the customer if not explained properly. As a technician, you need to remember each subscriber is an individual. You choose success or failure through the body language and words you use when dealing with customers. ■

# Installer's Tech Book

# Converting dBmV to μV/m

By Ron Hranac

## Channel 43 or GG (337.2625 MHz)

| dBmV | μV/m | dBmV | μV/m | dBmV | μV/m | dBmV | μV/m |
|---|---|---|---|---|---|---|---|
| −60 | 7.08 | −36 | 112.25 | −10 | 2239.69 | 16 | 44687.63 |
| −59 | 7.95 | −35 | 125.95 | − 9 | 2512.97 | 17 | 50140.35 |
| −58 | 8.92 | −34 | 141.31 | − 8 | 2819.60 | 18 | 56258.40 |
| −57 | 10.00 | −33 | 158.56 | − 7 | 3163.64 | 19 | 63122.96 |
| −56 | 11.23 | −32 | 177.90 | − 6 | 3549.66 | 20 | 70825.13 |
| −55 | 12.59 | −31 | 199.61 | − 5 | 3982.79 | 21 | 79467.10 |
| −54 | 14.13 | −30 | 223.97 | − 4 | 4468.76 | 22 | 89163.55 |
| **−53.48** | **15** | −29 | 251.30 | − 3 | 5014.03 | 23 | 100043.15 |
| −53 | 15.86 | −28 | 281.96 | − 2 | 5625.84 | 24 | 112250.26 |
| −52 | 17.79 | −27 | 316.36 | − 1 | 6312.30 | 25 | 125946.86 |
| −51 | 19.96 | −26 | 354.97 | 0 | 7082.51 | 26 | 141314.70 |
| −50 | 22.40 | −25 | 398.28 | 1 | 7946.71 | 27 | 158557.70 |
| −49 | 25.13 | −24 | 446.88 | 2 | 8916.35 | 28 | 177904.67 |
| −48 | 28.20 | −23 | 501.40 | 3 | 10004.31 | 29 | 199612.32 |
| −47 | 31.64 | −22 | 562.58 | 4 | 11225.03 | 30 | 223968.71 |
| −46 | 35.50 | −21 | 631.23 | 5 | 12594.69 | 31 | 251297.03 |
| −45 | 39.83 | −20 | 708.25 | 6 | 14131.47 | 32 | 281959.90 |
| −44 | 44.69 | −19 | 794.67 | 7 | 15855.77 | 33 | 316364.21 |
| **−43.02** | **50** | −18 | 891.64 | 8 | 17790.47 | 34 | 354966.48 |
| −43 | 50.14 | −17 | 1000.43 | 9 | 19961.23 | 35 | 398278.95 |
| −42 | 56.26 | −16 | 1122.50 | 10 | 22396.87 | 36 | 446876.33 |
| −41 | 63.12 | −15 | 1259.47 | 11 | 25129.70 | 37 | 501403.49 |
| −40 | 70.83 | −14 | 1413.15 | 12 | 28195.99 | 38 | 562583.97 |
| −39 | 79.47 | −13 | 1585.58 | 13 | 31636.42 | 39 | 631229.59 |
| −38 | 89.16 | −12 | 1779.05 | 14 | 35496.65 | 40 | 708251.25 |
| −37 | 100.04 | −11 | 1996.12 | 15 | 39827.89 | | |

## Channel 44 or HH (343.2625 MHz)

| dBmV | μV/m | dBmV | μV/m | dBmV | μV/m | dBmV | μV/m |
|---|---|---|---|---|---|---|---|
| −60 | 7.21 | −36 | 114.25 | −10 | 2279.53 | 16 | 45482.64 |
| −59 | 8.09 | −35 | 128.19 | − 9 | 2557.68 | 17 | 51032.36 |
| −58 | 9.07 | −34 | 143.83 | − 8 | 2869.76 | 18 | 57259.25 |
| −57 | 10.18 | −33 | 161.38 | − 7 | 3219.92 | 19 | 64245.94 |
| −56 | 11.42 | −32 | 181.07 | − 6 | 3612.81 | 20 | 72085.13 |
| −55 | 12.82 | −31 | 203.16 | − 5 | 4053.64 | 21 | 80880.84 |
| −54 | 14.38 | −30 | 227.95 | − 4 | 4548.26 | 22 | 90749.80 |
| **−53.64** | **15** | −29 | 255.77 | − 3 | 5103.24 | 23 | 101822.95 |
| −53 | 16.14 | −28 | 286.98 | − 2 | 5725.93 | 24 | 114247.22 |
| −52 | 18.11 | −27 | 321.99 | − 1 | 6424.59 | 25 | 128187.49 |
| −51 | 20.32 | −26 | 361.28 | 0 | 7208.51 | 26 | 143828.73 |
| −50 | 22.80 | −25 | 405.36 | 1 | 8088.08 | 27 | 161378.49 |
| −49 | 25.58 | −24 | 454.83 | 2 | 9074.98 | 28 | 181069.65 |
| −48 | 28.70 | −23 | 510.32 | 3 | 10182.29 | 29 | 203163.49 |
| −47 | 32.20 | −22 | 572.59 | 4 | 11424.72 | 30 | 227953.18 |
| −46 | 36.13 | −21 | 642.46 | 5 | 12818.75 | 31 | 255767.68 |
| −45 | 40.54 | −20 | 720.85 | 6 | 14382.87 | 32 | 286976.05 |
| −44 | 45.48 | −19 | 808.81 | 7 | 16137.85 | 33 | 321992.43 |
| **−43.18** | **50** | −18 | 907.50 | 8 | 18106.96 | 34 | 361281.44 |
| −43 | 51.03 | −17 | 1018.23 | 9 | 20316.35 | 35 | 405364.45 |
| −42 | 57.26 | −16 | 1142.47 | 10 | 22795.32 | 36 | 454826.39 |
| −41 | 64.25 | −15 | 1281.87 | 11 | 25576.77 | 37 | 510323.60 |
| −40 | 72.09 | −14 | 1438.29 | 12 | 28697.61 | 38 | 572592.50 |
| −39 | 80.88 | −13 | 1613.78 | 13 | 32199.24 | 39 | 642459.35 |
| −38 | 90.75 | −12 | 1810.70 | 14 | 36128.14 | 40 | 720851.25 |
| −37 | 101.82 | −11 | 2031.63 | 15 | 40536.44 | | |

## Channel 45 or II (349.2625 MHz)

| dBmV | μV/m | dBmV | μV/m | dBmV | μV/m | dBmV | μV/m |
|---|---|---|---|---|---|---|---|
| −60 | 7.33 | −36 | 116.24 | −10 | 2319.38 | 16 | 46277.65 |
| −59 | 8.23 | −35 | 130.43 | − 9 | 2602.38 | 17 | 51924.37 |
| −58 | 9.23 | −34 | 146.34 | − 8 | 2919.92 | 18 | 58260.10 |
| −57 | 10.36 | −33 | 164.20 | − 7 | 3276.21 | 19 | 65368.91 |
| −56 | 11.62 | −32 | 184.23 | − 6 | 3675.96 | 20 | 73345.13 |
| −55 | 13.04 | −31 | 206.71 | − 5 | 4124.50 | 21 | 82294.58 |
| −54 | 14.63 | −30 | 231.94 | − 4 | 4627.76 | 22 | 92336.04 |
| **−53.79** | **15** | −29 | 260.24 | − 3 | 5192.44 | 23 | 103602.74 |
| −53 | 16.42 | −28 | 291.99 | − 2 | 5826.01 | 24 | 116244.19 |
| −52 | 18.42 | −27 | 327.62 | − 1 | 6536.89 | 25 | 130428.13 |
| −51 | 20.67 | −26 | 367.60 | 0 | 7334.51 | 26 | 146342.76 |
| −50 | 23.19 | −25 | 412.45 | 1 | 8229.46 | 27 | 164199.28 |
| −49 | 26.02 | −24 | 462.78 | 2 | 9233.60 | 28 | 184234.62 |
| −48 | 29.20 | −23 | 519.24 | 3 | 10360.27 | 29 | 206714.65 |
| −47 | 32.76 | −22 | 582.60 | 4 | 11624.42 | 30 | 231937.65 |
| −46 | 36.76 | −21 | 653.69 | 5 | 13042.81 | 31 | 260238.32 |
| −45 | 41.24 | −20 | 733.45 | 6 | 14634.28 | 32 | 291992.20 |
| −44 | 46.28 | −19 | 822.95 | 7 | 16419.93 | 33 | 327620.64 |
| **−43.33** | **50** | −18 | 923.36 | 8 | 18423.46 | 34 | 367596.40 |
| −43 | 51.92 | −17 | 1036.03 | 9 | 20671.46 | 35 | 412449.95 |
| −42 | 58.26 | −16 | 1162.44 | 10 | 23193.77 | 36 | 462776.45 |
| −41 | 65.37 | −15 | 1304.28 | 11 | 26023.83 | 37 | 519243.72 |
| −40 | 73.35 | −14 | 1463.43 | 12 | 29199.22 | 38 | 582601.04 |
| −39 | 82.29 | −13 | 1641.99 | 13 | 32762.06 | 39 | 653689.11 |
| −38 | 92.34 | −12 | 1842.35 | 14 | 36759.64 | 40 | 733451.25 |
| −37 | 103.60 | −11 | 2067.15 | 15 | 41244.99 | | |

## Channel 46 or JJ (355.2625 MHz)

| dBmV | μV/m | dBmV | μV/m | dBmV | μV/m | dBmV | μV/m |
|---|---|---|---|---|---|---|---|
| −60 | 7.46 | −36 | 118.24 | −10 | 2359.22 | 16 | 47072.65 |
| −59 | 8.37 | −35 | 132.67 | − 9 | 2647.09 | 17 | 52816.38 |
| −58 | 9.39 | −34 | 148.86 | − 8 | 2970.08 | 18 | 59260.96 |
| −57 | 10.54 | −33 | 167.02 | − 7 | 3332.49 | 19 | 66491.89 |
| −56 | 11.82 | −32 | 187.40 | − 6 | 3739.11 | 20 | 74605.13 |
| −55 | 13.27 | −31 | 210.27 | − 5 | 4195.35 | 21 | 83708.33 |
| −54 | 14.89 | −30 | 235.92 | − 4 | 4707.27 | 22 | 93922.29 |
| **−53.93** | **15** | −29 | 264.71 | − 3 | 5281.64 | 23 | 105382.54 |
| −53 | 16.70 | −28 | 297.01 | − 2 | 5926.10 | 24 | 118241.15 |
| −52 | 18.74 | −27 | 333.25 | − 1 | 6649.19 | 25 | 132668.76 |
| −51 | 21.03 | −26 | 373.91 | 0 | 7460.51 | 26 | 148856.79 |
| −50 | 23.59 | −25 | 419.54 | 1 | 8370.83 | 27 | 167020.07 |
| −49 | 26.47 | −24 | 470.73 | 2 | 9392.23 | 28 | 187399.60 |
| −48 | 29.70 | −23 | 528.16 | 3 | 10538.25 | 29 | 210265.81 |
| −47 | 33.32 | −22 | 592.61 | 4 | 11824.12 | 30 | 235922.12 |
| −46 | 37.39 | −21 | 664.92 | 5 | 13266.88 | 31 | 264708.97 |
| −45 | 41.95 | −20 | 746.05 | 6 | 14885.68 | 32 | 297008.35 |
| −44 | 47.07 | −19 | 837.08 | 7 | 16702.01 | 33 | 333248.85 |
| **−43.48** | **50** | −18 | 939.22 | 8 | 18739.96 | 34 | 373911.36 |
| −43 | 52.82 | −17 | 1053.83 | 9 | 21026.58 | 35 | 419535.45 |
| −42 | 59.26 | −16 | 1182.41 | 10 | 23592.21 | 36 | 470726.52 |
| −41 | 66.49 | −15 | 1326.69 | 11 | 26470.90 | 37 | 528163.84 |
| −40 | 74.61 | −14 | 1488.57 | 12 | 29700.84 | 38 | 592609.57 |
| −39 | 83.71 | −13 | 1670.20 | 13 | 33324.89 | 39 | 664918.88 |
| −38 | 93.92 | −12 | 1874.00 | 14 | 37391.14 | 40 | 746051.25 |
| −37 | 105.38 | −11 | 2102.66 | 15 | 41953.54 | | |

(For the formula used to derive the conversion data in these charts, see May 1989 *Installer/Technician*'s "Installer's Tech Book.")

# Troubleshooting tips: Extenders, bridgers, amps

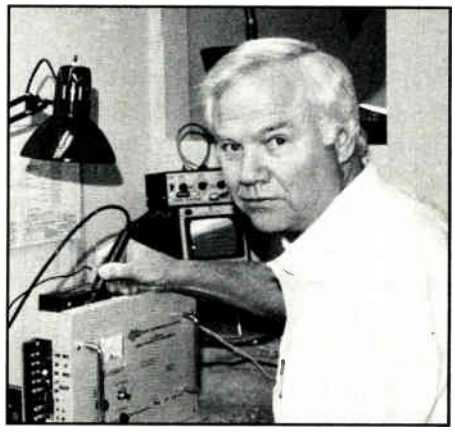
**By Jud Williams**
Owner, Performance Technologies

One of the purposes of this column is to pass on useful tips to technicians doing bench work. This article will examine distribution equipment. There are many variations of line extenders, bridgers and trunk amplifiers in the field. They all look different depending on the manufacturer but actually they are very much the same. This may come as a surprise to you but it is very true.

The major differences are in the packaging of the various amplifiers; in other words, variations in chassis and housings. This also may include differences in form. Some amplifiers have an integral power supply while others have AGC/ASC (automatic gain and slope controls).

The vast majority of modules in use today use *hybrids* as their amplifying devices. The hybrids function as complete amplifiers and provide the desired gain required for the module's particular use. The two most common hybrids have gains of 17-18 dB and 34-35 dB, and may be referred to as *gain blocks*. Most of the available modules sweep out to 400-450 MHz while others go as high as 550 MHz.

Since these hybrids are so commonly used, troubleshooting, for the most part, is greatly simplified. The most difficult areas of repair are generally the sections that perform the AGC/ASC functions. Some technicians may find the power supply sections difficult to understand.



## Factory foul-ups

When the equipment is factory-fresh some failures and malfunctions may be due to faults overlooked by the manufacturer's testing and inspection groups. Poor or missing solder joints are common reasons for these failures. Usually, the troubleshooting procedure here is to visually inspect the equipment for missing solder connections. Continuity testing with an ohmmeter also can be useful. It is often the bench technician's intuition that is required to detect and correct these deficiencies.

Once the equipment is a year or so old, the most common failures are the hybrids in the RF section of the modules, and the electrolytic capacitors in the power supply section. For instance, a 450 microfarad ($\mu$F), 50 volts DC (VDC), 85° C capacitor often is used where it would be far more reliable to use a 1000 $\mu$F, 65 VDC, 105° C capacitor. When making the repair, the 105° C capacitor is your best choice as a replacement.

The problem with electrolytics is that the electrolyte eventually dries up causing the capacitance to change. This will show up as a hum bar on the TV picture. It is a good practice to replace the electrolytic capacitors of all amplifiers that arrive at the bench just as matter of course so the module will operate trouble-free for a much longer time. Another reason for upgrading the electrolytics is that they tend to absorb damaging transients.

## Critical conditions

When evaluating the condition of a hybrid two important things to observe are the sweep response and current being drawn from the power supply. The first test is, of course, carried out using a sweep generator with a bandwidth of at least 550 MHz. A bench-type DC power supply with a range of 0-30 volts and a current rating of at least 2 amperes is ideal for powering the hybrid while being tested. For convenience, a plug-in test fixture for the hybrid also should be utilized.

The sweep response of a good hybrid will be fairly flat although some may have

a slight tilt built into them. A defective hybrid will exhibit a response curve starting quite high at the lowest frequency (55 MHz) and then dropping off abruptly as the frequency of the sweep increases.

By observing the current consumption you can weed out marginal hybrids. A typical 18 dB hybrid has current consumption down around 200 milliamperes (mA), while 34 dB models may be closer to 300 mA. The newer power doubler amplifier modules run considerably higher in current consumption, well over 400 mA. If the current consumption is considerably higher than specified by the manufacturer, it should be considered faulty.

When using the sweep generator to troubleshoot complete amplifiers such as trunk modules or line extenders, be on the lookout for low responses (at the 55 MHz end) that go up in gain as the frequency increases. This is usually an indication of a short on the input or output. The usual culprit is a shorted glass surge suppressor. Since these devices are of dubious value, merely clipping them out should suffice.

A common problem for some of the older amplifiers is an intermittent condition caused by the pin connectors coming loose from the foil of the PC board. Test points also seem to break loose on occasion and require resoldering.

When the power transformer has burned, it is usually due to either a shorted rectifier or electrolytic. This is because the manufacturer placed the fuse in the wrong location. The most effective place for a fuse is always between the transformer secondary and the rectifier. In any case, should you be required to replace a power transformer, be sure to carefully check for a faulty rectifier and electrolytic capacitor.

What we covered here are common problems of fairly new amplifiers that were properly handled in the field. Most of the service involving these types of failures should be done in-house, leaving the more complex problems to be solved by a regular repair facility. ■

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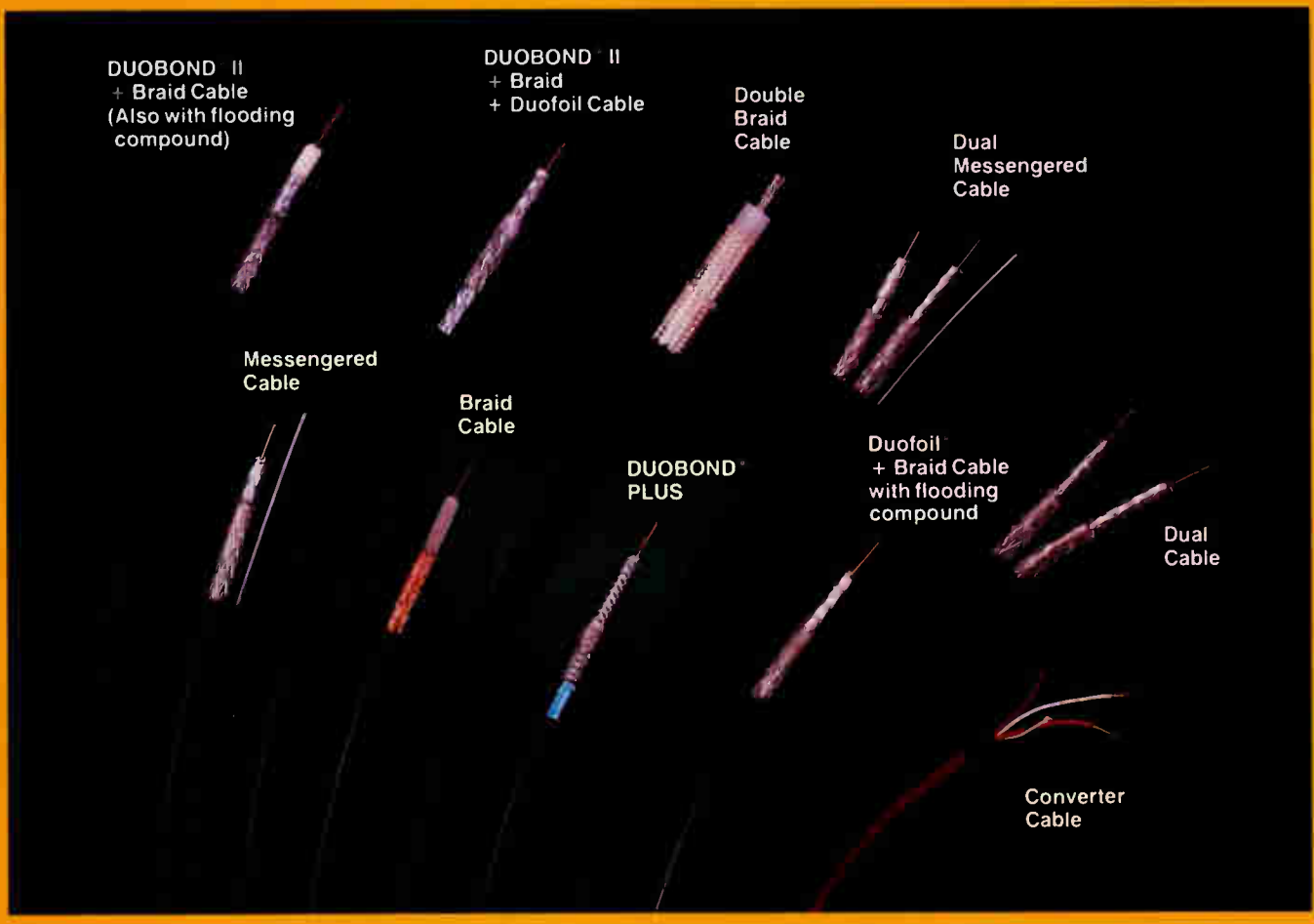


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*Reader Service Number 71.*

# Less time out for your system

**By Chuck Hatter**
Senior Engineer, Altair Corp.

Outages are an unfortunate fact of life for every cable operator. Major storms, electronics failures, power utility outages and vandalism are causes of many outages, usually during a holiday or, worse yet, the Superbowl. Preventive maintenance, standby power and redundancy are ways to reduce outages, but what about the inevitable outage that can't be prevented? How much time does it take to find and repair the problem? System impairments and outages need to be dealt with swiftly to avoid compounding your subscribers' aggravation.

## Solving the problem

There are three components needed to solve each outage:

1) trained technicians with tools and test gear,
2) spare equipment and
3) information about the equipment and the problem.

Technicians should be thoroughly trained from the trunk amp to the subscriber's TV set before taking the responsibility of being on-call. If your system also requires the on-call technician to respond to headend problems, then additional training in all facets of your headend operation also is needed.

The headend should be stocked with a variety of spare parts including LNAs/LNBs, receivers, VideoCiphers and, hopefully, an agile modulator and demodulator for processors. The tech's truck should carry any line gear used in the system as well as short pieces of trunk and feeder cable for emergency restoration. A small gasoline powered generator for power outages is a blessing if one is available. If your system has a lot of underground equipment in vaults, a gasoline powered water pump is almost a necessity. Hand baling a flooded vault during a rainstorm is next to impossible, and you don't have the time to wait on natural drainage.

## The more info, the better

The area that can save the most downtime is information. Locating, identifying and resolving the cause of the outage can be taken care of more effectively by having as much information as possible available. A status monitoring system will instantaneously alert the operator of various abnormalities and indicate a location where the tech can begin assessing the problem. Systems utilizing status monitoring know what a time-saver that information is.

What about systems that rely on the subscriber complaint method to determine the problem? The person taking the complaints and forwarding the information to the responding tech should be as accurate as possible. Not only should this person have a thorough knowledge of the town in question or up-to-date maps, but also familiarity with signal problems and distortions. Being able to communicate symptoms such as beats in the picture, hum bars, no signal and snowy picture can give the tech clues as to what component or equipment should be tested first, possibly saving a great deal of time.

Cross-referencing the complaint addresses with system electronics maps back to a common point of origin for the tech is extremely important in saving time as well as saving the tech from unnecessarily climbing a lot of poles. Any information that the CSR, dispatcher or person taking the calls can give to the responding tech is beneficial in resolving the problem quickly.

Let's assume that the tech is sent to the correct location and the problem is beats and cross-modulation. Arriving at the suspected problem amplifier, signal levels are taken at the input and output. Most systems are designed with like outputs for trunk amps and like outputs for line extenders (depending upon the deration for

line extender cascades), but what was the input supposed to be? What was the AC voltage before? What was the DC voltage before? Is this the correct pad and equalizer? Was it designed to be powered from the input or output? Was the trunk module recently replaced because of problems? This information and more needs to be kept with all active components.

To assess the cause of the problem all information about the suspected equipment needs to be known. This includes trunk/bridger amps, line extenders and power supplies. Without accurate information about how the equipment was previously set up and working, the technician can only guess that the input levels, voltages, etc., are correct or incorrect.

Preventive maintenance information also should be noted inside the equipment to provide a history of work performed on it. The information should be kept in the housings of the equipment rather than logs in the office or in a truck. It is much easier to read a card in the amp on a pole than to climb down, look up the amp number, cross it with the logs, remember all of the information and climb back up the pole.

***"Locating, identifying and resolving the cause of the outage can be taken care of more effectively by having as much information as possible available."***

The best time to update your equipment with this information is during a sweep balance so the desired levels can be noted. This also is a good time to verify the system powering is correct. Don't assume—check it out and record it, and save countless hours in the future.

## AD INDEX

## April

**April 7: SCTE Rocky Mountain Chapter** technical seminar on CLI, system troubleshooting and computer-aided testing, ATC National Training Center, Denver. Contact Steve Johnson, (303) 799-1200.

**April 9-10: AT&T** fiber-optic training on testing fiber, AT&T National Product Training Center, Dublin, Ohio, and fiber-optic training on rotary mechanical splice, AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

**April 9-11: Magnavox** mobile training center seminar, Los Angeles. Contact Amy Costello Haube, (800) 448-5171.

**April 10: SCTE Central Illinois Chapter** technical seminar, Pekin, Ill. Contact Ralph Duff, (217) 424-8478.

**April 10: SCTE Lake Michigan Meeting Group** technical seminar, Grand Rapids, Mich. Contact Grant Pierce, (616) 247-1701.

**April 11: SCTE North Central Texas Chapter** technical seminar. Contact M.J. Jackson, (800) 528-5567.

**April 11: SCTE Dairyland Meeting Group** technical seminar on installer certification, Howard Johnson Motor Lodge, Eau Claire, Wis. Contact Bruce Wasleske, (715) 842-3910.

**April 11: SCTE Palmetto Meeting Group** technical seminar. Contact Rick Barnett, (803) 747-1403.

**April 12: SCTE Chesapeake Chapter** technical seminar on CLI, Holiday Inn, Columbia, Md. Contact Keith Hennek, (301) 731-5560.

**April 14: Snake River SCTE Meeting Group** technical seminar, BCT/E and installer certification exams to be administered (tentative). Contact Marla DeShaw, (406) 632-4300.

**April 16-18: AT&T** fiber-optic training on fiber to the customer, AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

**April 16-20: AT&T** fiber-optic training on installation and splicing, AT&T National Product Training Center, Dublin, Ohio. Contact (800) TRAINER.

**April 17-19: Magnavox** mobile training center seminar, Phoenix, Ariz. Contact Amy Costello Haube, (800) 448-5171.

**April 17-20: Siecor Corp.** technical seminar on fiber-optic installation and splicing for LAN, building and campus applications, Hickory, N.C. Contact (800) 634-9064.

**April 18: SCTE Great Plains Meeting Group** technical seminar, UA Cable, Bellvue, Neb. Contact Jennifer Hays,

### Planning ahead

**May 20-23:** NCTA National Show, Atlanta.

SCTE

**June 21-24:** SCTE Cable-Tec Expo, Nashville, Tenn.

**Sept. 16-18:** Eastern Show, Washington, D.C.

**Sept. 18-20:** Great Lakes Expo, Indianapolis.

**Oct. 2-4:** Atlantic Cable Show, Atlantic City, N.J.

**Oct. 9-11:** Mid-America Show, Kansas City, Mo.

(402) 333-6484.

**April 19: SCTE Sierra Meeting Group** technical seminar on signal security and scrambling, VideoCipher II technology and satellite and system theft of service, New Roseville Community Center, Roseville, Calif. Contact Steve Allen, (916) 786-2469.

**April 20: SCTE Miss-Lou Chapter** technical seminar, Baton Rouge, La. Contact Dave Matthews, (504) 923-0256.

**April 23-24: AT&T** fiber-optic training on testing fiber, AT&T National Product Training Center, Dublin, Ohio, and AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

**April 23-25: ElectroniCast Corp.**'s annual Monterey fiber-optics futures conference, Plaza Hotel, Monterey, Calif. Contact (415) 572-1800.

**April 23-25: AT&T** fiber-optic training on underground lightguide, AT&T Bell Laboratories, Chester, N.J. Contact (800) TRAINER.

**April 23-26: AT&T** fiber-optic training on splicing fiber, AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

**April 23-27: Fiberoptic Communications Corp.** fiber-optic workshop, Sturbridge, Mass. Contact (508) 347-7133.

**April 24: SCTE Chattahoochee Chapter** technical seminar, BCT/E Categories II-V to be administered (tentative), Perimeter North Inn and Conference Center, Atlanta. Contact Richard Amell, (404) 394-8837.

**April 24: SCTE** Satellite Tele-Seminar Program on signal leakage, CLI and the FCC (Part II), supervisory and management skills (Part II) and SCTE Installer Certification Program. To air from 12-1 p.m. ET on Transponder 2 of Galaxy III. Contact (215) 363-6888.

**April 24-26: C-COR** technical seminar on basic theory, installation and maintenance of CATV systems, Albany, N.Y. Contact Teresa Harshbarger, (800) 233-2267.

**April 24-26: C-COR** technical seminar on broadband LAN technology, Charlottesville, Va. Contact Teresa Harshbarger, (800) 233-2267.

**April 24-26: Magnavox** mobile training center seminar, Santa Fe, N.M. Contact Amy Costello Haube, (800) 448-5171.

**April 25: SCTE New Jersey Chapter** technical seminar on CATV basics, Victor's Holiday Inn, Wayne, N.J. Contact Art Mutschler, (201) 672-1397.

**April 25: SCTE Dairyland Meeting Group** technical seminar, Madison, Wis. Contact Bruce Wasleske, (715) 842-3910.

**April 25-26: Jerrold** and **CTAM** Cable Insights technical seminar, Loews Anatole Hotel, Dallas. Contact Kathy McHale, (800) 523-6678 or (800) 562-6965 in Pennsylvania.

**April 25-27: AT&T** fiber-optic training on aerial lightguide, AT&T Bell Laboratories, Chester, N.J. Contact (800) TRAINER.

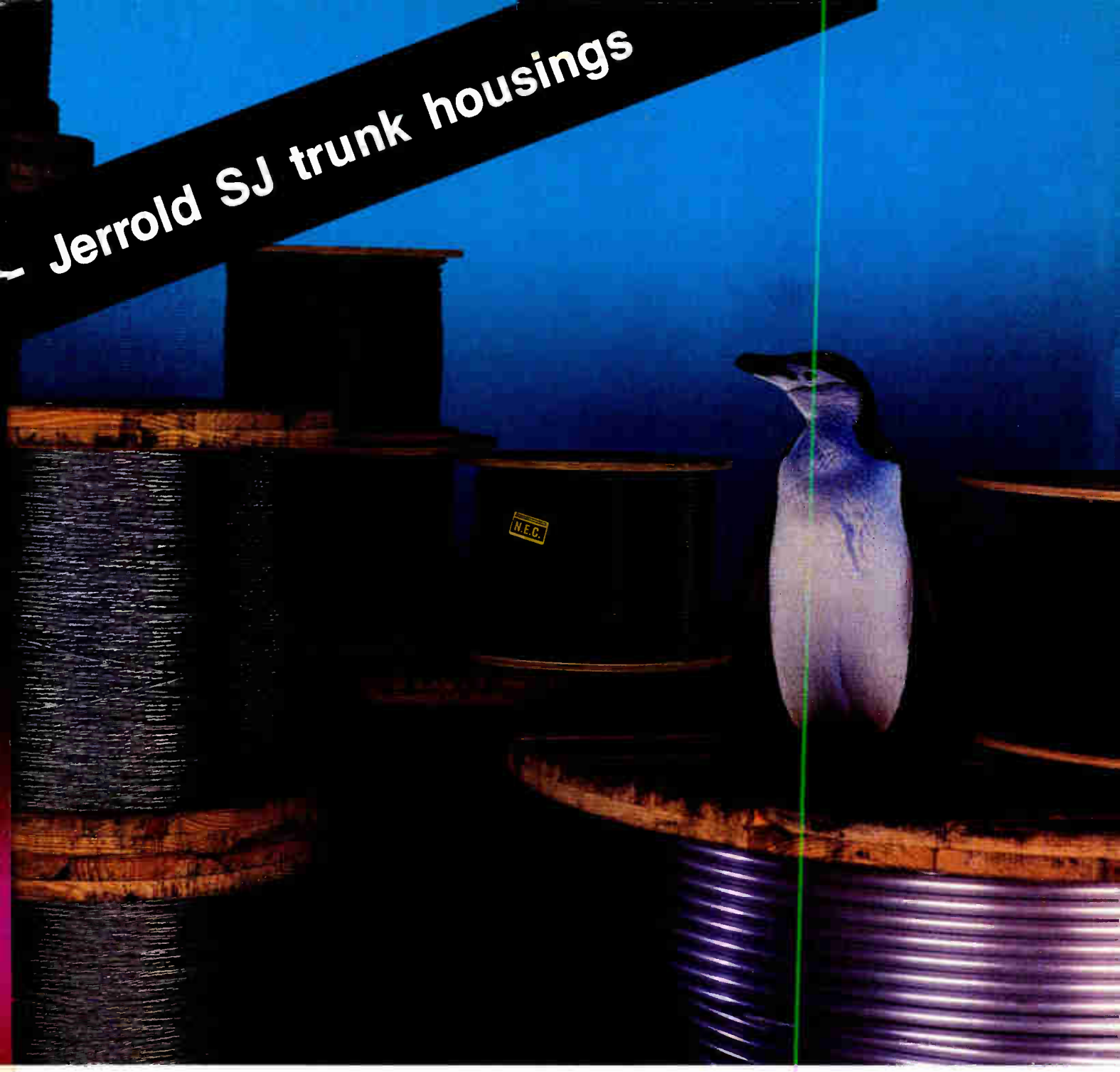
**April 25-28: AT&T** fiber-optic training on splicing fiber, AT&T National Product Training Center, Dublin, Ohio. Contact (800) TRAINER.

**April 26: SCTE Golden Gate Meeting Group** technical seminar on understanding video, VITS and studio lighting and operations, Italian Gardens Restaurant, San Jose, Calif. Contact Tom Elliot, (408) 727-5295.

**April 28: SCTE Tip-O-Tex Chapter** technical seminar. Contact Mike Strakos, (512) 664-8715.

**April 30-May 1: AT&T** fiber-optic training on assembling connectors, AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

**April 30-May 4: AT&T** fiber-optic training on installation and splicing, AT&T National Product Training Center, Dublin, Ohio, and AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

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**Western Region**
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# KEEPING TRACK

**Cable Television Laboratories** made several new appointment announcements. **David Eng** will serve as senior electronics technician for CableLabs. Previously he was director of engineering for Rogers Cable TV.

**Suzanne Nielson** was hired as technical writer. Formerly she worked with Quarterdeck Systems in Boulder, Colo.

CableLabs also appointed **Stephen Dukes** to serve as project manager for advanced network development. He previously held the position of vice president of technology for the Street of Dreams projects.

**David Chang** was named to serve on CableLabs' Technical Advisory committee's Steering Subcommittee. He is a professor in the department of electrical and computer engineering at the University of Colorado at Boulder. In addition, he is a director of ATC and serves on its Executive Committee.

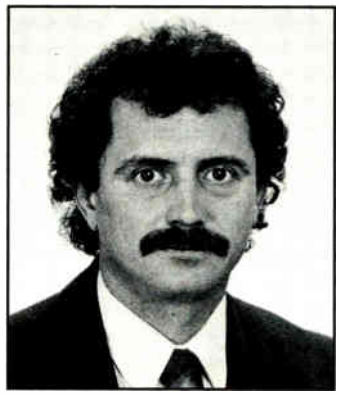
**Aleksander Futro** will serve as director of technology assessment for CableLabs. He most recently worked for US West Advanced Technologies on business case for new services/products and opportunity assessment of full-motion video over fiber and broadband switched networks.

**Larry Lehman**, Cencom's Cable Associates vice president for technology, was named chairman of the Technologies for New Business Subcommittee of CableLabs' Technical Advisory Committee (TAC). He also occupies the chairman's seat on the TAC Steering Subcommittee.

**Bob Mannett** joined **NCS Industries** as sales engineer. Prior to this he was sales application engineer for Anixter.

Two promotions were made by **Jerrold Communications. Alan Amos** has worked closely with the company's New England accounts and now is the manager of territory sales for the Northeast region.

**Steve Cimino** was named senior account manager for the Northeast region. He was an account executive handling the Newhouse and Cablevision Industries accounts.



*Corning*

**Valco Mechanical Inc.** announced the appointment of **William Corning** as vice president/CATV Eastern division. Formerly he was general manager-CATV/LAN for AM Communications.

**Business Systems Inc.** announced several staff additions. **Gene Craddock** was named director of operations for BSI. He most recently was an MIS consultant with Ernst and Young.

**Svietlana Moroz**, who previously worked as an advisory systems engineer for Computer Task Group, was appointed senior programmer/analyst for product development.

The company also named **Kathy Hanlon** as programmer/analyst for product development. She formerly worked for First Financial Management Corp. as a programmer/analyst.

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*Reader Service Number 78.*

# What is going on out there?

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

My daughter and her husband have been on cable for several years. They enjoy it. But their comments track alarmingly the growing complaints coming from senators, congressmen, states attorneys, mayors and councilmen.

*Service*: Why does it take 20 minutes on hold to report a performance failure, while the new installation number is answered on the second ring?

*Price*: Why is the monthly charge higher than in other nearby communities? Why does it cost only $8.95 in overbuilt areas, but $16.95 elsewhere in the same community?

*Converters*: Why does the customer have to use a converter with a TV set that was sold as "cable-ready"? Why does the customer have to pay extra every month for additional outlets? Why does a remote cost up to $5 a month when the list price to the cable operator is only $6 to $10?

*Convenience*: Why do so many customers still have to juggle three different remotes—one for channel selection, one for volume control and a different one for the VCR? Why is the ID superimposed in the corner of the screen always "3," no matter which program channel is being viewed? Why won't the cable remote turn the TV set on? Why does the TV set always come on to Channel 2 instead of 3?

We all know the answers. But before city and state attorneys complain about discriminatory pricing—lower prices in overbuilt areas—they ought to look at the discriminatory franchising that lies at the root of the problem. Franchisee Number One agrees to a 60-page document specifying all sorts of costly conditions, including mandatory service availability to all households, underground as well as aerial, affluent as well as poor, low density as well as high; while Franchisee Number Two is permitted to serve only those households it considers to be most profitable, and is not bound by the other onerous conditions imposed on the original franchisee.

NAACP complains because a questionnaire on customer program preferences allegedly was deleted from mailings to black households (although how the billing firm 3,000 miles away could separate the black invoices is not explained). But where is NAACP when overbuild franchises are granted permitting service only in the affluent, secure developments, mostly white, without a parallel requirement to provide competitive service to economically depressed areas?

That exclusive franchises would probably be declared illegal has been widely recognized from the beginning. But the unfairness of awarding unconditional overbuild franchises is so blatant that discriminatory pricing to meet overbuild competition was simply inevitable. It is as if the defending champion fighter were held to Marquis of Queensberry rules while allowing the challenger to operate on the principle of the street brawl.

But not all the complaints are so easily countered. Telephone answering is not uniquely a cable TV problem. Try calling Amtrak for its schedule and reservations; or an airline; or the metro mass transit; or even city hall. The "merry run-around" was not invented by cable TV operators. Technology is helping, with automated call handling routines and recorded messages. But they are expensive and peak loads can still be aggravating, at best.

And, may I ask, how many of the 9,000 systems out there are still handling calls "on hold," while manually retrieving customer files? Nearly 8,000 of the 9,000 systems, averaging less than 1,500 subscribers each, serve less than 25 percent of the total subscriber base. These smaller systems are less likely to have installed sophisticated telephone systems. Probably 90 percent of all complaints by city fathers actually represent only a small fraction of all subscribers.

### What are the answers?

Introducing competition by overbuilding in affluent, largely new developments occupied mostly by white families, does not even come close to addressing the problem. The magic of competition might help—fair competition, that is. Would it be fair for a telco to use cut-rate pricing to compete with cable TV, while placing most of the burden of the high cost of its switched digital optical fiber plant on the backs of its non-competitive ratepayers?

If cable TV systems were operated as if they were monopolies, they would surely be regulated as monopolies. But they are not classical monopolies like the telcos for which there is no alternative service. Access to alternative sources of video programming is becoming increasingly available to compete with cable TV. Nearly 3 million backyard dishes are already in use. DBS activity is intensifying. The $1 billion proposal by the consortium including Murdoch, Cablevision Systems and NBC, eventually will provide 108 DBS channels receivable on 18-inch flat plane antennas. FCC seems poised to relax the present daunting requirements for licensing MMDS, thereby enhancing the viability of "wireless cable" competition. Municipal governments, the FCC and Congress are clearly entertaining the idea of encouraging the telephone monopoly to provide competition for cable TV.

It may already be too late to forestall adverse legislation and regulation. It is never too late to develop good customer service. Friendly, courteous, responsive customer service is becoming at least as important as technology, if not more.

***"Friendly, courteous, responsive customer service is becoming at least as important as technology, if not more."***

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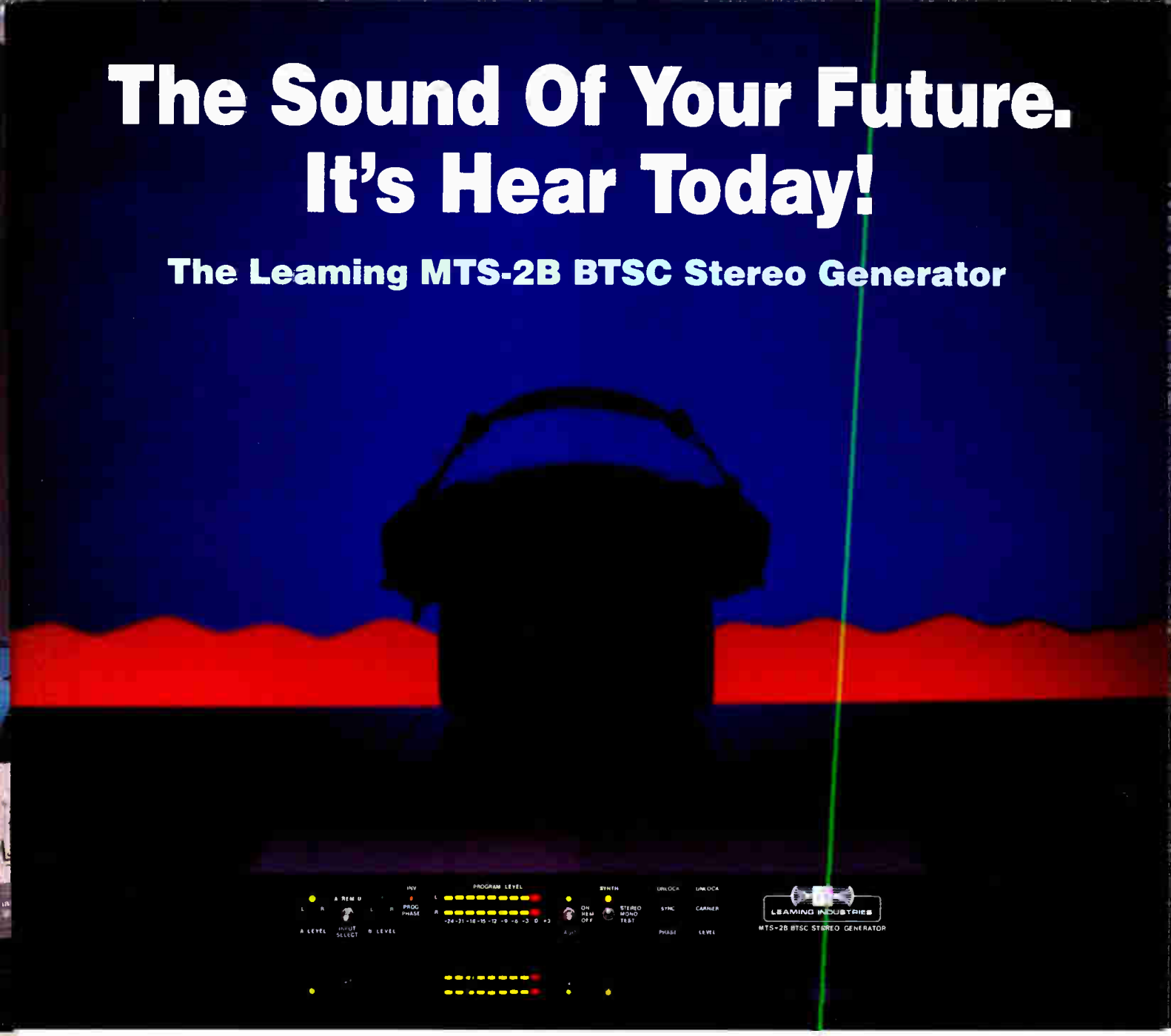


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# It's for the taking

**By Jack Trower**
President, Society of Cable Television Engineers

When I travel to different areas to talk at SCTE chapter/meeting group meetings, at the trade shows or even to individual members of the Society, I am amazed at the number of people who are not aware of the benefits available to the membership. One of the programs they seem to lack the knowledge of and participation in is the SCTE Scholarship Program. This program has been in existence since November 1986. From that date through the end of 1989 the SCTE Scholarship Committee has recommended and approved 26 scholarships. This seems to be a very small number—and it is. A check with the Scholarship Committee reveals that this is nearly everyone who has ever made application for tuition assistance. What this program needs more than anything else is applicants.

The application process is very simple. A call to the SCTE at (215) 363-6888 or a note to the SCTE (at 669 Exton Commons, Exton, Pa. 19341) will get you a Technical Tuition Assistance Application very rapidly and once you receive it you will see how simple it is. I urge the members who feel they can benefit from this program to get an application, fill it out and send it to the national SCTE office.

The Scholarship Program is one that the SCTE is very proud of. This program helps to meet one of the purposes of the Society, that being to encourage, sponsor, promote and award technical scholarships. Many company and individual donations have been received by the Society to further this purpose of awarding scholarships. I could single out any one of them, especially the NCTI, for the effort they have expended in making the Scholarship Program grow. This time though, I'd like to say a few things about a friend of mine. I can't say he's my friend alone, because I would guess he knows everyone in the industry and would count most of them as friends. He has also been a good friend, as well as being a Charter Member, of the Society. He is the person that started our scholarship fund with a $2,500 donation from his own pocket. He has reached in that pocket many more times to donate to the program so that now he has contributed nearly $10,000 of his own money to the Tuition Assistance Program.

I asked him why he did this and he told me, "This industry has been very good to me. I want to give something back to it, so what better way than helping people who need it." I am sure that all of you know that I've been talking about Rex Porter. He definitely puts his money where his mouth is. The Society is very fortunate to have a friend like Porter who believes in the reasons we exist. He likes to tell me that "uncle" would get it anyway but I know what the percentages are. He also says there's more to come. Anyway, I want to say "thank you" to Rex Porter and wish to say we *really appreciate you*, money or not.

***"I am amazed at the number of people who are not aware of the benefits available to the (SCTE) membership."***

### Something to really use

Another program that does not seem to be used as much as it could be is the Satellite Tele-Seminar Program. This program was originally introduced in 1984, but still seems to be a new or unknown item to a lot of our members. The Society presents these programs on the last Tuesday of each month on Transponder 2 of Galaxy III. This month there will be a special edition of the program that will be shown on Tuesday, April 24, 11 a.m. to 1 p.m. ET. This program will feature John Wong, assistant chief of the Federal Communications Commission's Cable Television Branch.

Wong will talk about and answer the most-asked question concerning the new FCC Form 320 that has been mailed out to all cable system operators for CLI certification. Nobody should miss this teleseminar. This subject is very important to all of us in the industry and one we definitely cannot ignore for our companies' well-being and the well-being of our industry. There have been and will be other subjects covered in the SCTE Satellite Tele-Seminar Program throughout the year. These seminars focus on items we deal with in our day-to-day jobs. We can use them individually or in our chapter/meeting group programs. Remember they are being presented to help you and will only do so if you take advantage of them.

These two programs are but a part of the programs and benefits the Society has for its members. You should look into the others and take advantage of them all. You can find out more about these programs and the happenings of the Society by reading this publication, which is the official journal of the Society, *The Interval*, which is the official newsletter of the Society, or by contacting the Society's national headquarters.

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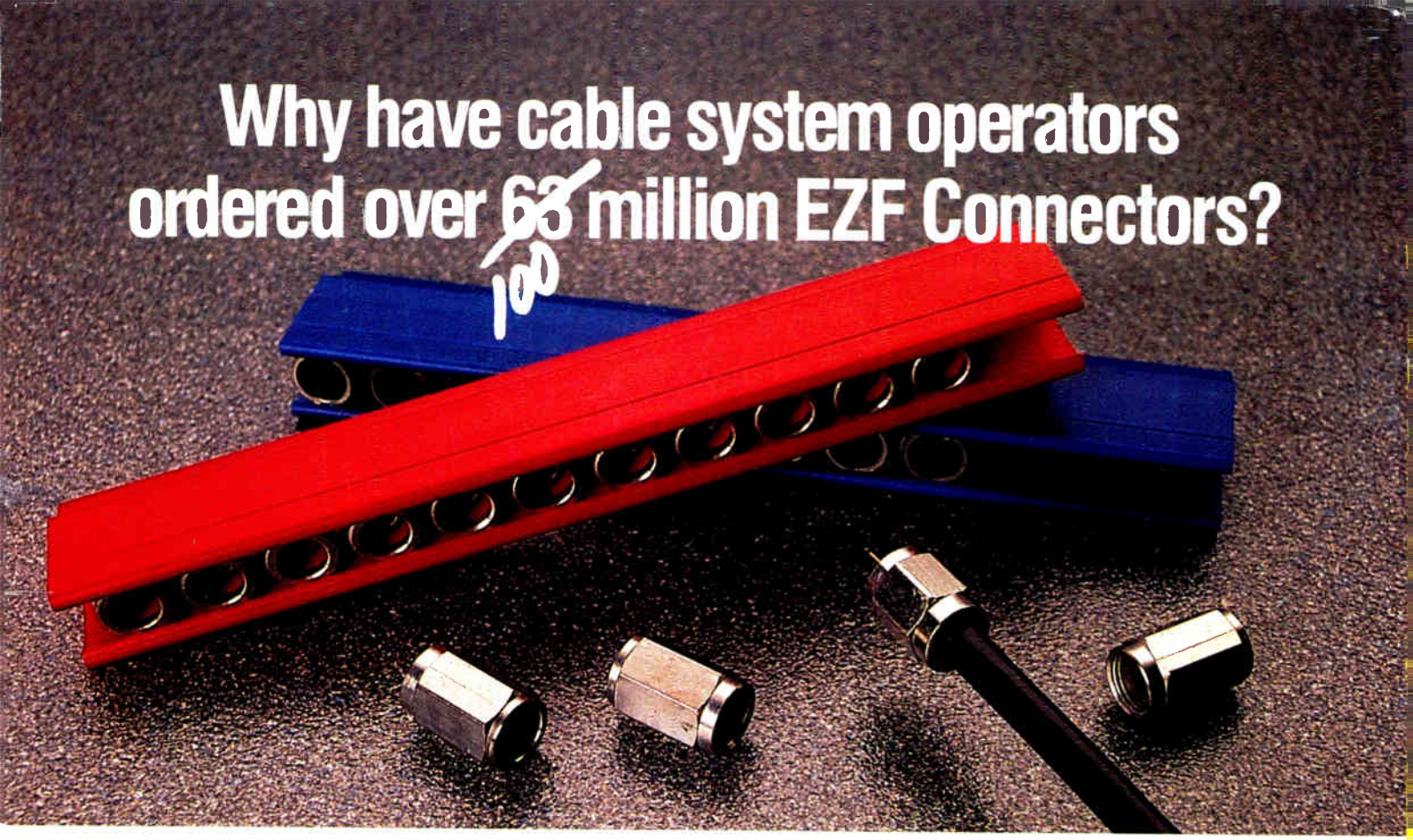

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