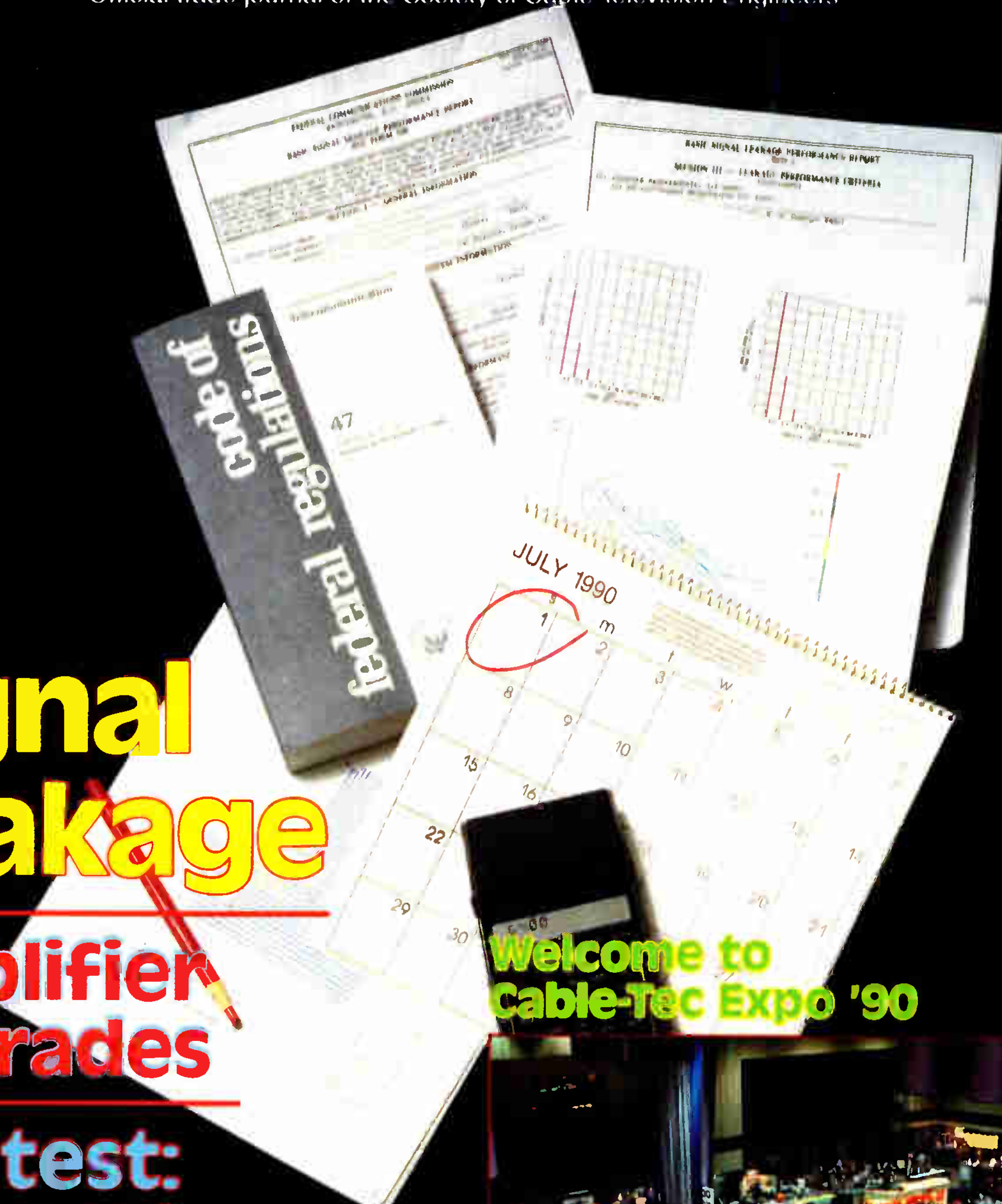
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

Pull-Out F-Fitting Chart



Signal Leakage

Amplifier upgrades

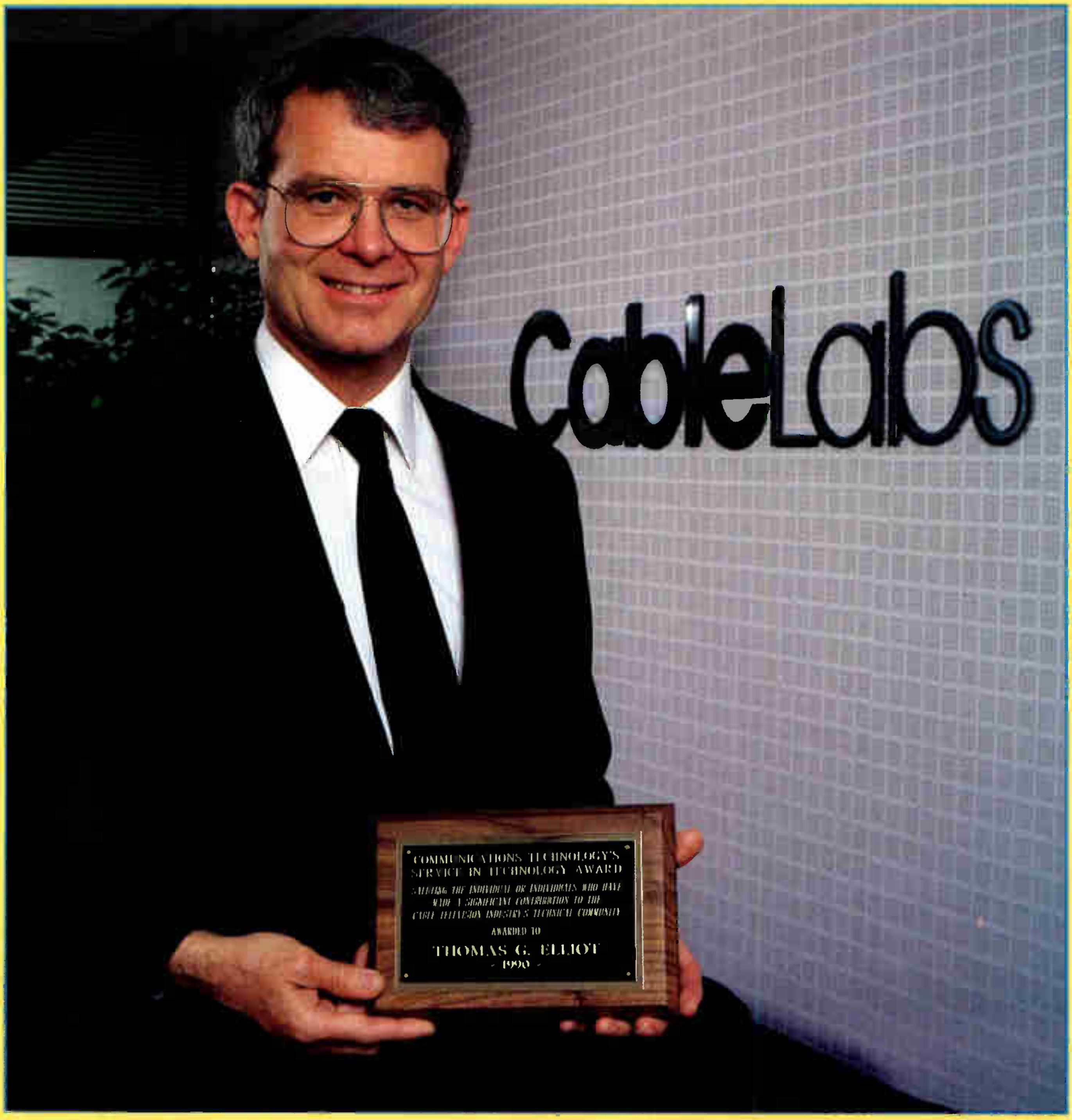
Lab test: Low-cost character generator

Welcome to Cable-Tec Expo '90

June 1990

Tom Elliot:

CT's 1990 Service in Technology award recipient



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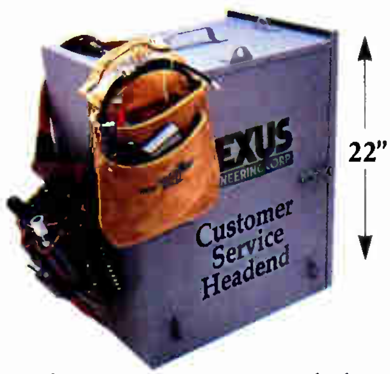
Virtually eliminate customer calls during service interruptions.

Now you can virtually eliminate angry customer calls during service interruptions.

The **Nexus Customer Service Headend** allows you to keep your customers informed when their service is interrupted.

This headend and graphics generator injects channels at any point in your distribution



The Nexus Customer Service Headend
- *weighs less than 50 pounds*
- *rechargeable internal battery*

system to advise affected customers downstream.

The portable unit can be pole or strand mounted, and operated by a single field technician with less than 20 minutes training.

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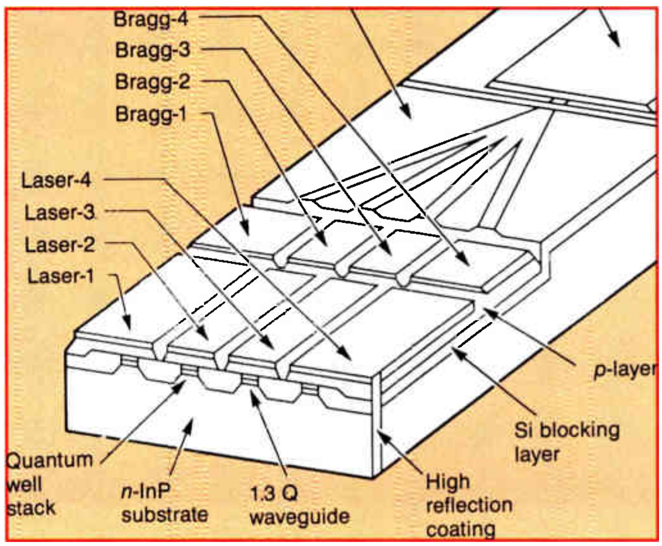

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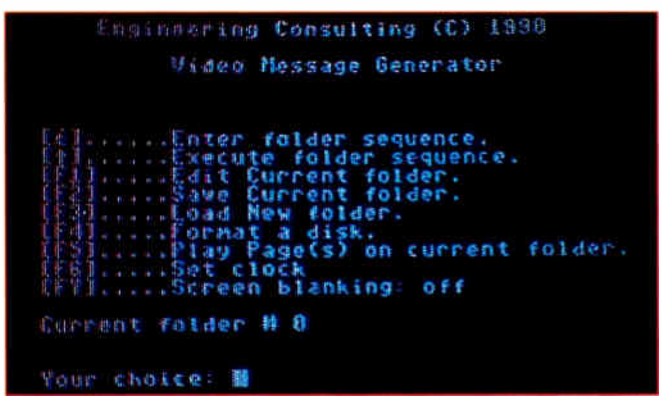

CT's Lab Report 143

Features

Realize The Promise Of The Future Without Sacrificing Your Investment Of The Past

Jerrold Communications has teamed with Cable Television's leading engineers to bring you the best of all worlds with the **SX Amplifier**. You can now expand and upgrade your system without sacrificing your SJ amplifier investment or missing out on the latest technology.

Jerrold's SX Amplifier fully supports over two decades of our SJ technology. At the same time, it is so advanced that our X Series and Cableoptics™ technology is supported as well.

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Future SX channel capacity to 750 MHz has been designed into the passive features. Currently, a full 550 MHz active design combines with improved noise figure and distortion performance to supply whatever services your customers need. Depending on your system requirements, you can choose among FeedForward, Power Doubling or Quadrapower® technologies. All SX test points are easily accessible, plus only three tools are needed for set-up, cutting SX installation time to a minimum. A superior heat dissipation capability translates into long-life and long-term SX reliability.

All of this underscores Jerrold's continuing commitment to cable television through the research and development of technology that supports the dependable Jerrold equipment that is in service today.

To find out how the new SX Amplifier can move your system forward, get in touch with your Jerrold Communications account representative or contact us at 2200 Byberry Road, Hatboro, PA 19040, 215/674-4800.

JERROLD
COMMUNICATIONS

Recognizing the best

Tom Elliot

One year ago this month CT Publications introduced its Service in Technology Award. The award was created to "salute the individual or individuals who have made a significant contribution to the cable TV industry's technical community." Bill and Anna Riker were its first recipients, in recognition of their hard work and dedication that has helped bring the Society of Cable Television Engineers where it is today.

Considering that there are an estimated 40,000 technologists in the cable industry, it is never easy to decide who to recognize with such an award. But after considering the state of CATV technology and its evolution toward increasing standardization, one person more than any other came to mind: Tom Elliot.

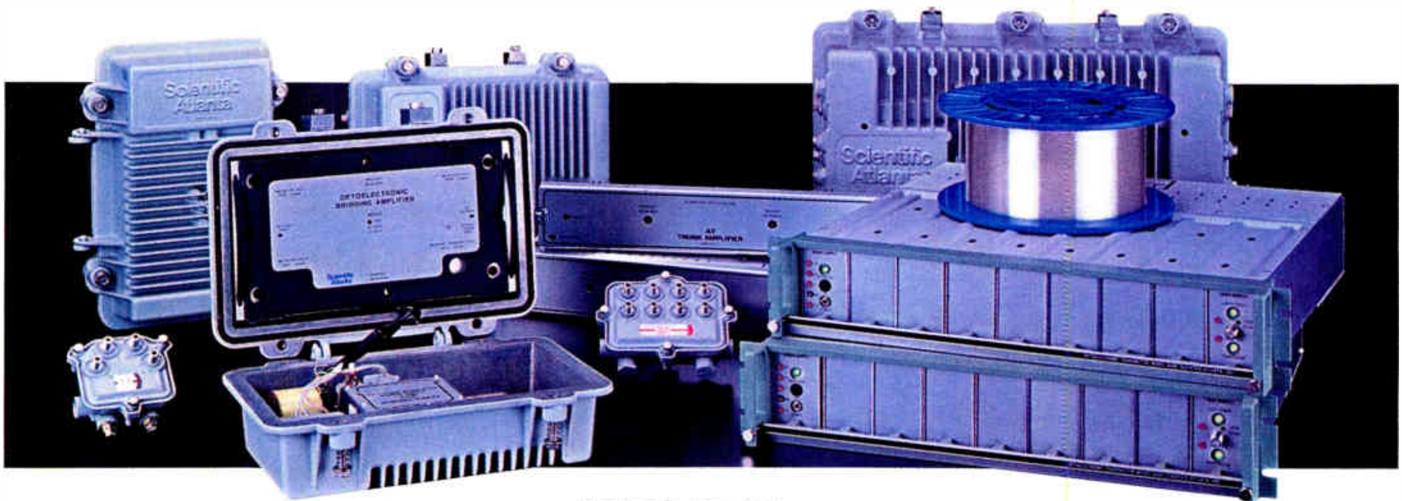
When it comes to standards, practices and procedures, Elliot has played a big part in setting the direction of the industry. CATV has historically not been noted for standardization, in spite of the relative maturity of the business. It has been only the past few years that we've seen a change in this attitude, thanks largely to a few dedicated individuals like Elliot.

Elliot is serving a one- to two-year tour of duty as vice president of science and technology at CableLabs, under a loan agreement with TCI (where he is director of research and development). In his position at CableLabs, Elliot conceives and plans the development and implementation of technology that will impact the future of our industry. He also is active in the SCTE as chairman of the Interface Practices Committee, and was recently elected to the board of directors of the Society.

According to Dave Willis, TCI's director of engineering, "Tom's most significant contribution to the industry is one that is perhaps a bit obscure yet very real. His research into aluminum connectors and cable led to more stringent dimensions and size control, which resulted in better connectorization for our industry." Elliot's desire for improved standards has carried over into his work at CableLabs and his chairmanship of the Interface Practices Committee. You'll also find that many of the sometimes subtle improvements in CATV equipment in today's marketplace have been the result of Elliot's influence. Elliot will receive his award during the SCTE Expo Evening in Nashville, Tenn., and it will be a real honor to salute him for his contributions to our industry's technical community. Congratulations, Tom!

With that said, welcome to the biggest issue ever of *Communications Technology*, and to the best technical show in the cable industry—the Cable-Tec Expo.

Do You Know The Difference Between Telephone And CATV Fiber?



The difference - and it's an important one - lies in our Total Systems Architecture™ approach to CATV. It provides you with the tools to advance your delivery system and protect your investment.

Fiber is fiber. But there the similarity ends. Scientific-Atlanta is the first full line CATV manufacturer to offer it all. Product, system design, service, and support. Introducing the 6450 Optoelectronic Laser Transmitter. Fiber optic cable. And, the 6901 Optoelectronic Bridging Amplifier.

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Telephone or CATV? Sure the fiber is the same. But everything else about a Scientific-Atlanta fiber optics system is better. These differences are what makes Scientific-Atlanta the company to rely on for CATV fiber optics — we do it right.

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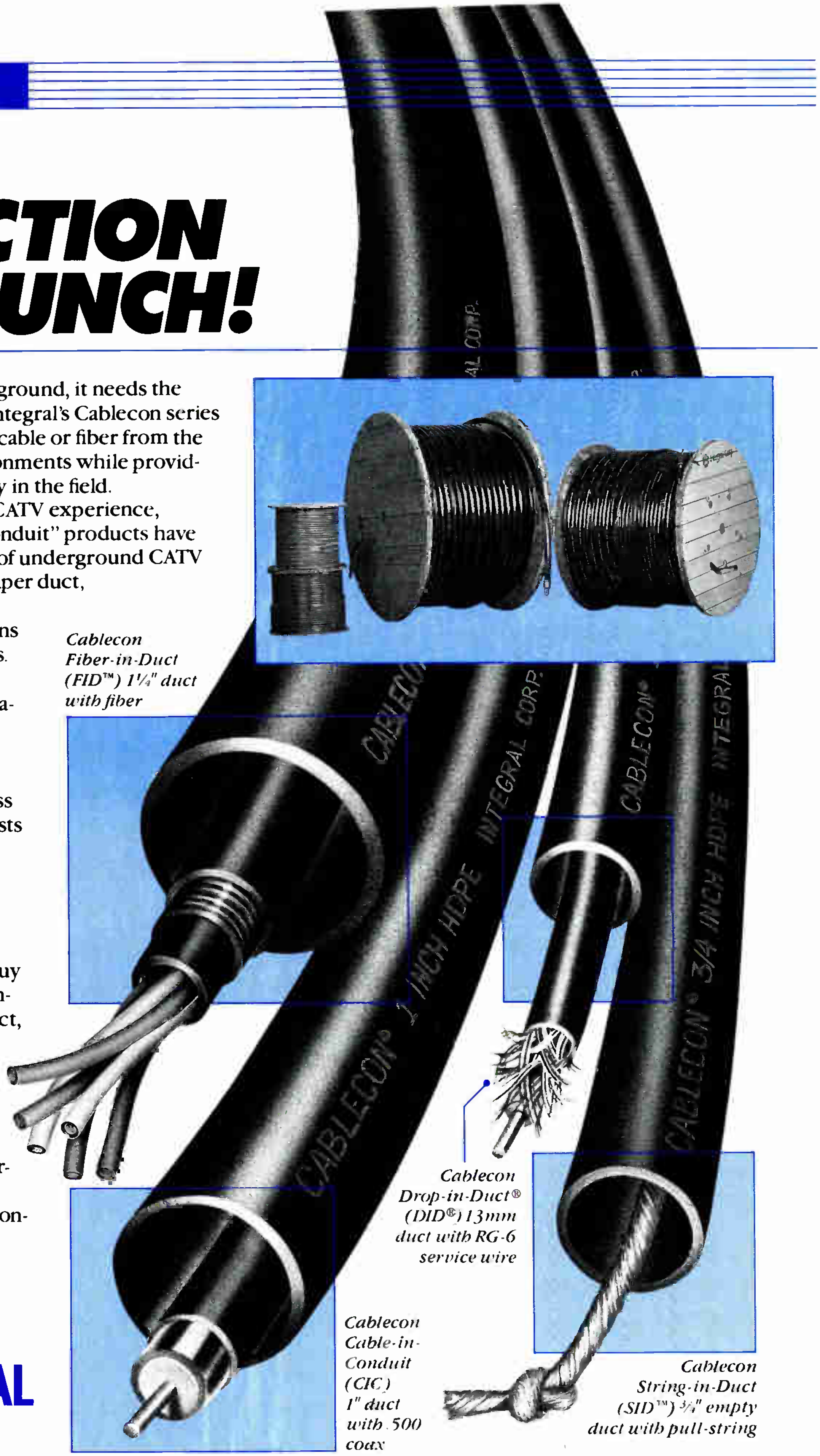
If your cable is going underground, it needs the ***real*** protection of Cablecon®. Integral's Cablecon series is ***guaranteed*** to protect your cable or fiber from the "crunch" of underground environments while providing you with far greater longevity in the field.

Backed by over 10 years of CATV experience, Integral's Cablecon "Cable-in-Conduit" products have made them the leading supplier of underground CATV conduit. While you can buy cheaper duct, none comes close to meeting Cablecon's technical specifications and manufacturing consistencies.

There's no confusion when you buy Cablecon. Duct classifications are not necessary because Cablecon comes one way. Our premium duct systems have comparable crush ratings to Class 200 PVC pipe. Their installed costs are less than Class 160 duct and outperform the so-called "good deal" CATV-160 and DB conduit lines...hands down!

If you're building an underground CATV system, why not buy the best? Buy Cablecon...cable-in-conduit, fiber, string, drop-in-duct, or even empty duct. Dollar-for-dollar, you can expect a whole lot more over 20 years with Cablecon.

To avoid the "20 year crunch" and protect your underground assets, specify only Cablecon—the "user friendly" conduit systems.



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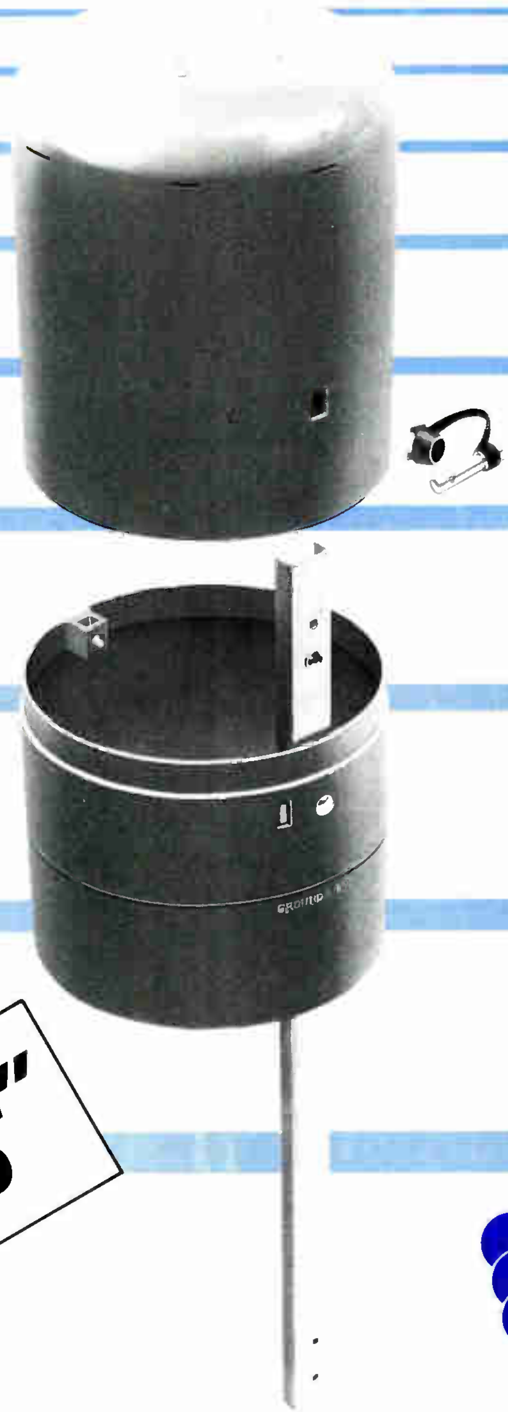

See it "loaded" at SCTE '90

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See us at the Cable-Tec Expo, Booth 736. Reader Service Number 11.

The continuing saga of customer service?

Denver is considered the cable capital of the United States, and as such, you'd be inclined to think that the companies who operate systems in this area would ensure that their properties are model examples of how cable should be done. Apparently for some it is just the opposite.

Consider Denver's Mile Hi Cablevision; It has been the whipping boy of the local media since the system was built. Unfortunately, much of the bad rap Mile Hi receives has been earned the old-fashioned way—with poor service. A perfect example is with one of our own staff members, who ordered a new installation from Mile Hi the week of April 23 during a half-price installation special. A number of other Denver area systems participated in the special, where new subs called an 800 number to order a hookup. The half-priced installation fees were slated for donation to the "Arts for All" program, a very worthwhile charity.

The installation was scheduled for after 5 p.m. on May 8, and just to be sure, she called that same day to confirm her appointment: "I'll be home at 5:20." "No problem," replied the CSR. Guess what happened. She aged gracefully while waiting for the installer who never showed up.

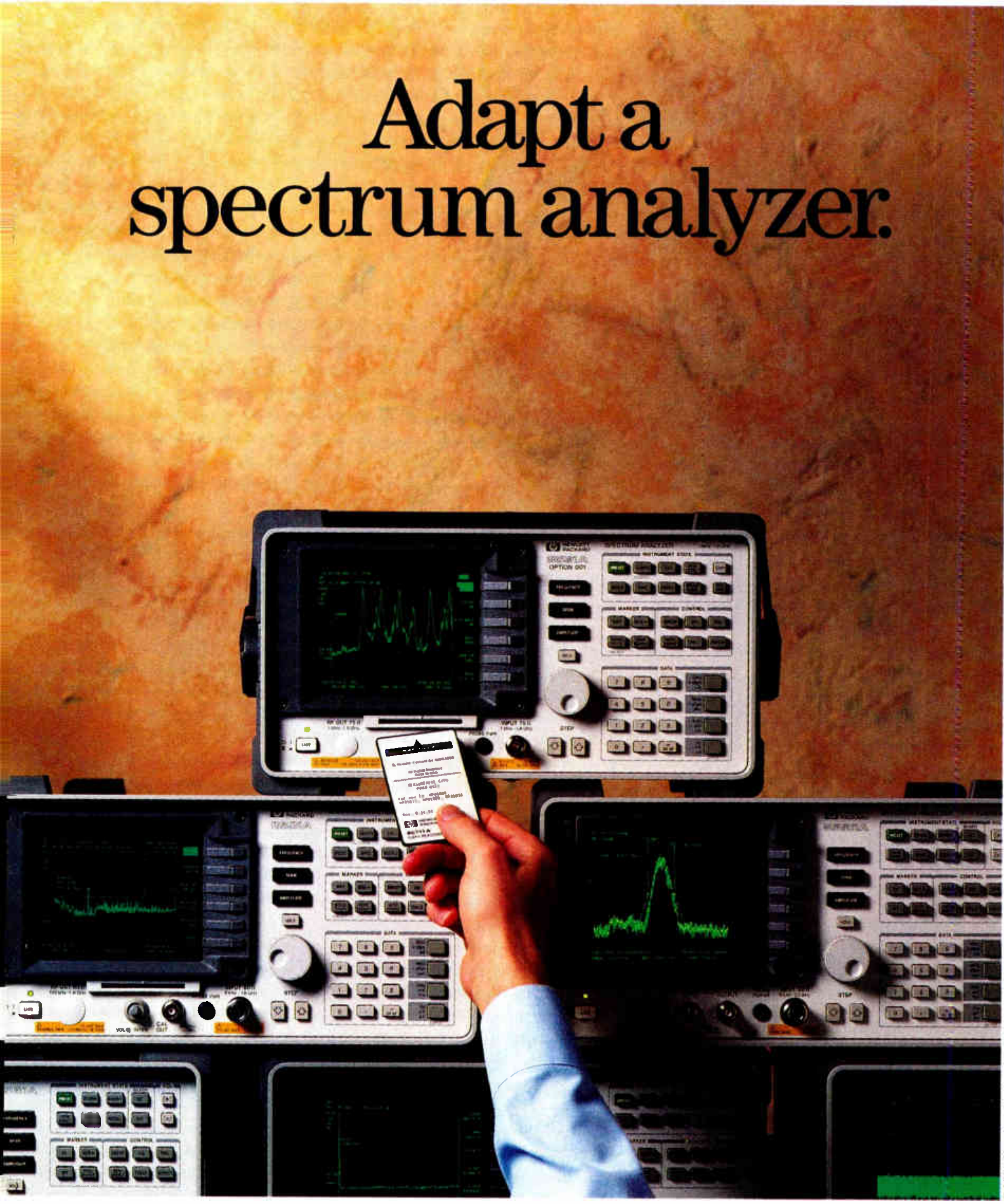
She called Mile Hi the next day and was told by the CSR, "The installer was there at 5 p.m. We'll have to reschedule the installation" (Hmmm...interesting that no tag was hung on the door.) This would-be subscriber was further advised that the installers were of the contract variety and there really was no way for the office to contact them anyway. After a bit of heated discussion with the CSR, she was then referred to a supervisor. The supervisor asked, "Who did you talk to?" "I can't remember his name." The supervisor again: "Well, whoever it was shouldn't have given you this number, but should've handled it himself."

The installation was rescheduled for May 14, with the request that she be called at the office when the installer was ready to go to her house. Will she be called? Will her cable ever be hooked up? Will good customer service prevail? Stay tuned as this exciting saga continues.

Your opinion counts

On page 169 of this issue you'll find a two-page editorial survey. I want to know what you think about *CT* and its editorial focus. Are we headed in the right direction? Anything you'd like to see that we're not doing? Tell us what you like and what you don't like. After all, *CT* is here to help you do your job better—and who better than you to guide us? We're in the communications business and to be truly effective the line of communication between us must be two-way. After you've filled out the survey, please mail or FAX it to us (our address and FAX number are on the back of the form).

It's that time of year again! SCTE's Cable-Tec Expo '90 gets underway this month in Nashville, Tenn. (a complete agenda is in our news section). Without a doubt, this event is the premier technical show in the cable industry. It combines the best of technical training and hardware exhibits, including ample opportunity for hands-on with your favorite manufacturer's products. For each of the last five years expo attendance has been on the increase and this year looks to be no different. At the time of this writing, three of the convention hotels in Nashville have been completely sold out! This kind of enthusiasm makes me proud of *CT*'s association with the Society; our staff will be there in full force, giving you a chance to meet the people who make *CT* the best technical publication in the business.



You'll find it easy to tailor an HP portable spectrum analyzer to your particular tests.

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There is a better way.

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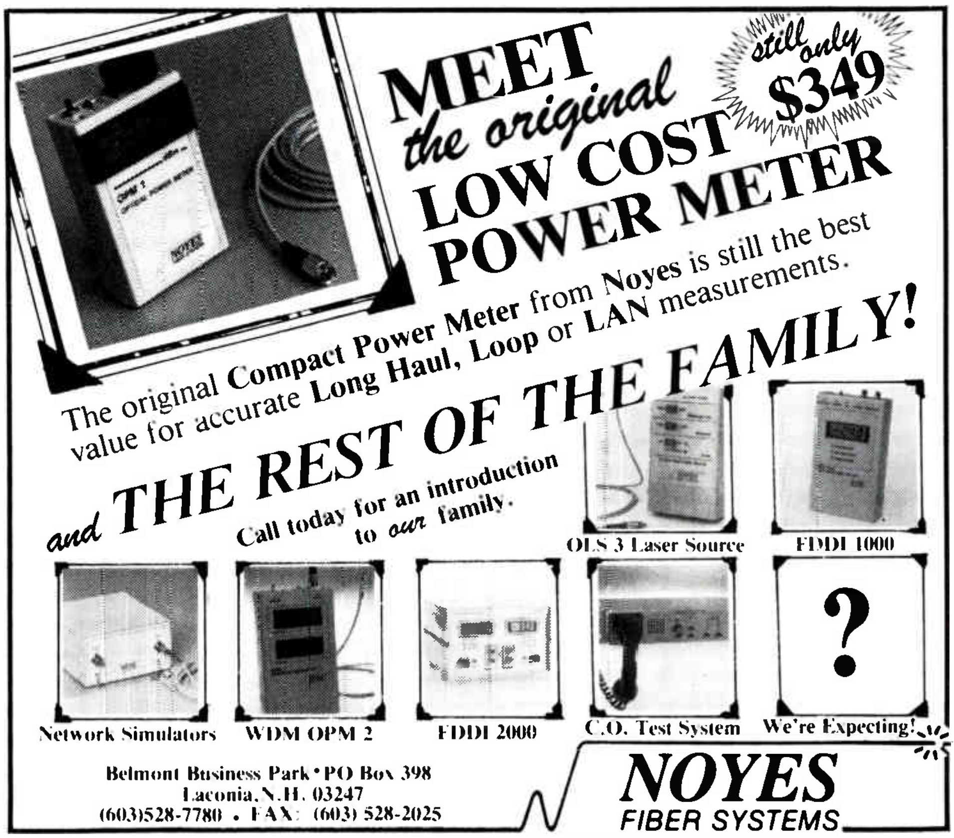
See us at the Cable-Tec Expo, Booth 218. Reader Service Number 13.



Reader Service Number 15.

Kudos

I just wanted to say thank you for all the input and knowledge I get from reading *Communications Technology* magazine. I find it very informative and helpful, and hope you continue to keep up the good work!

I try to do the same out in the field as an I/R tech/crew chief. I am also a new member of the SCTE. I think it's great working in a field as exciting and innovating as ours. I'm looking forward to growing and learning with you.

Paul S. Roman
Brooklyn, N.Y.

AC problems

Are you aware of the availability of filters for AC problems in TV pictures? I'm receiving electrical interference on my off-air antenna that affects Boston Chs. 2, 4 and 5.

Carlos Lopes
Field Technician
United Video Cablevision
Newbedford, Mass.

Editor's note: Because of the broadband nature of noise, any attempt to filter it out of a channel also would filter out some of the picture and/or sound information. There has been limited success with Microwave Filter Co.'s (6743 Kinne St., East Syracuse, N.Y., 13057, (315)-463-1467) co-channel eliminator in reducing some types of electrical interference, although this product is better suited for co-channel problems.

The best solution is to eliminate the interference at its source. I suggest that you establish a dialogue with your local power company since they will be best equipped to track down this kind of problem. Finding power line interference is similar to tracking down CATV signal leakage although it can be a bit more difficult because the whole power system makes a dandy antenna.

From the picture and description included in your letter, the trouble sounds like power line sparking. That kind of interference includes a large amount of broadband RF energy and for 60 Hz power lines has a repetition rate of 120 Hz (hence the similarity to hum bars rolling up through the picture). Power line sparking is common in overhead power systems that use wood poles and often is caused by loose metal hardware. The possible source of sparking doesn't even have to be in physical contact with the power lines.

While you may have limited success in tracking down some of the interference, power companies do not recommend "doing it yourself." The old CATV lineman's technique involving the use of a hammer and portable radio are discouraged because of the possible danger of damaging equipment on the pole. Power company personnel use interference locators that are not all that different from our signal leakage detectors.

One of the best publications I have seen on the subject of RFI is "Interference Handbook," by William Nelson (Radio Publications, Box 149, Wilton, Conn. 06897). The author spent 33 years as an RFI investigator for Southern California Edison and covers the subject in-depth. The book is available in most amateur radio stores and also from the ARRL, 225 Main St., Newington, Conn. 06111.

Outage troubleshooting

I just wanted to drop you a letter of appreciation for printing my article (in the May "Back to Basics.") I was certainly very surprised to see in the latest issue. It's very nice to know that you're open to articles from persons in the field. I do hope that the article benefits others who read it.

Timothy J. Pastor
Line Technician
Continental Cablevision
Painesville, Ohio

Corrections/clarifications

In the article "Headend maintenance: Fixing intermittent level problems" (May 1990 *CT*), the photos for steps 1 and 2 on page 49 were inadvertently switched.

The isokeraunic map on page 24 of the May issue was designed by Chris O'Neil of Jones Intercable.

On page 88, the phone number to call for Biddle's booklet *Getting Down to Earth* should have been (800) 366-5543.

In the "Keeping Track" section of the May issue on page 162, Channelmatic's new southeatern regional sales manager was mistakenly identified as Michael Watson. Watson is the vice president of sales/marketing; the new sales manager is K.J. (Rick) DuRapau (whose picture also appeared). We regret any inconvenience this might have caused.

Last month's "Lab Report" on Times Fiber's 1 GHz cable was performed and written by Ron Hranac.

CableVision.

No one's been more farsighted in designing fiber optic cable than Siecor. As a result, our cable design is virtually the same today as it was nearly ten years ago. In the same time span, many of our competitors have redesigned their cables two and three times or more. And guess what? Their cables now look amazingly like ours.

One reason our design hasn't changed—and the reason it's so widely imitated—is simple. We anticipated the craftsman's most important needs.

In doing so, we introduced stranded loose tube design which groups fibers in tubes. This way, it provides the best protection during stripping and splicing. And makes fibers easy to identify and manage.

Furthermore, we designed a cable that's friendly to fiber—protecting it from environmental stress. And finally, we allowed for changing fiber optic technology. Our cable carries multimode or single mode signals at any transmission rate. It transmits at all wavelengths. And it accommodates the use of evolving splicing techniques.

The fact is, no better cable has come along in the last ten years. And no cable can prepare your system better for the future.

So talk to the company with the vision to see what's ahead in fiber optics. Call 704/327-5998. Or write Siecor Corporation, Literature Department (CO) TV-1, 489 Siecor Park, Hickory, NC 28603-0489.

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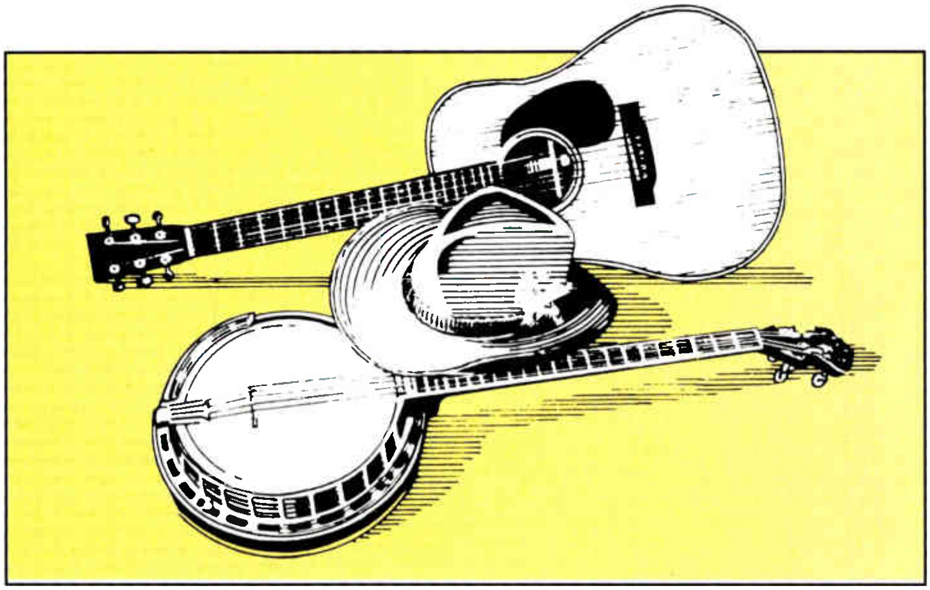

Cable-Tec Expo '90: Schedule of events

NASHVILLE, Tenn.—The Society of Cable Television Engineers will hold its 1990 Engineering Conference and Cable-Tec Expo at the Nashville Convention Center June 21-24. The agenda for the conference and expo is as follows:

Wednesday, June 20
10 a.m.-3 p.m.—NCTA Engineering Committee meeting
4-8 p.m.—Engineering Conference registration

Thursday, June 21
7:30 a.m.-8:30 a.m.—Conference registration
8:30 a.m.-4:30 p.m.—Engineering Conference and Awards luncheon
4:30-5:30 p.m.—Annual SCTE membership meeting
3-5 p.m.—Cable-Tec Expo registration
6-8 p.m.—Welcome reception (sponsored by Anixter Cable TV, AT&T, Raychem and the SCTE Tennessee Chapter)

Friday, June 22
7:30 a.m.-4 p.m.—Expo registration
8 a.m.-12:15 p.m.—Hands-On workshops
12-6 p.m.—Exhibit hall open
7:15 p.m.-12 a.m.—Expo evening at the Grand Ole Opry (Sponsored by Jerrold)

Saturday, June 23
8 a.m.-12:15 p.m.—Hands-On workshops
12 p.m.-5 p.m.—Exhibit hall open
4-5 p.m.—Exhibitor's reception
5 p.m.-7 p.m.—Ham radio operator's reception
7 p.m.-10 p.m.—Closing night reception (sponsored by Scientific-Atlanta)

Sunday, June 24
8:30 a.m.-12 p.m.—BCT/E and Installer Certification Program Examinations
11 a.m.-1 p.m.—Tours of the Nashville Network's studio facilities

Engineering conference

- Session A: Donald Frost, Master Motivator.
- Session B: "Cable's weak link—Tap to TV" with Walt Ciciora (ATC) as moderator and Tom Elliot (CableLabs) and Larry Nelson (Comm/Scope).
- Session C: "Getting it right the first time—Field supervision techniques" with Wendell Bailey (NCTA) as moderator and Alan Babcock (Warner Cable), Dana Eggert (Performance Plus) and Kathy Keating (ATC).
- Session D: "Cable in the 1990s—Boom or bust?" with Paul Maxwell (Transmedia Partners) as moderator and Jim Chiddix (ATC), Tom Gillette (CableLabs), Gary Kim (Multichannel News) and Craig Tanner (CableLabs).
- Also to be included will be Dick Green, president of CableLabs, as keynote speaker.

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 (CableLabs).
- "Signal leakage equipment calibration" with Steve Windle (Wavetek) and Don Runzo (ComSonics).
- "Painless technical writing" with Rikki Lee (editorial consultant) 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 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).
- Also to be included are demonstrations of interactive training techniques, a working amplifier cascade for test equipment demonstrations, product-specific equipment usage classes and hands-on splicing of fiber-optic cables.

CableLabs contributes to committee on ATV

BOULDER, Colo.—CableLabs contributed $100,000 to the Federal Communications Commission's advisory committee on advanced TV service (ATV). This money is earmarked to support production of the dynamic test materials (motion sequences) needed for subjective assessment of the quality and robustness of the proposed ATV systems. According to CableLabs, it is making the contribution because it considers these subjective assessments to be critical to the selection of an ATV system that will serve U.S. viewers with high quality service via cable TV and via broadcast systems.

The FCC Advisory Committee's Working Party on Subjective Assessments will direct the production of a total of 18 motion sequences, each in four distinct high definition TV (HDTV) scanning formats. A set of still test pictures and these motion sequences will pass through the ATV transmission systems under test and the output pictures assessed for quality and impairments by ordinary non-expert TV viewers. At the Advanced Television Test

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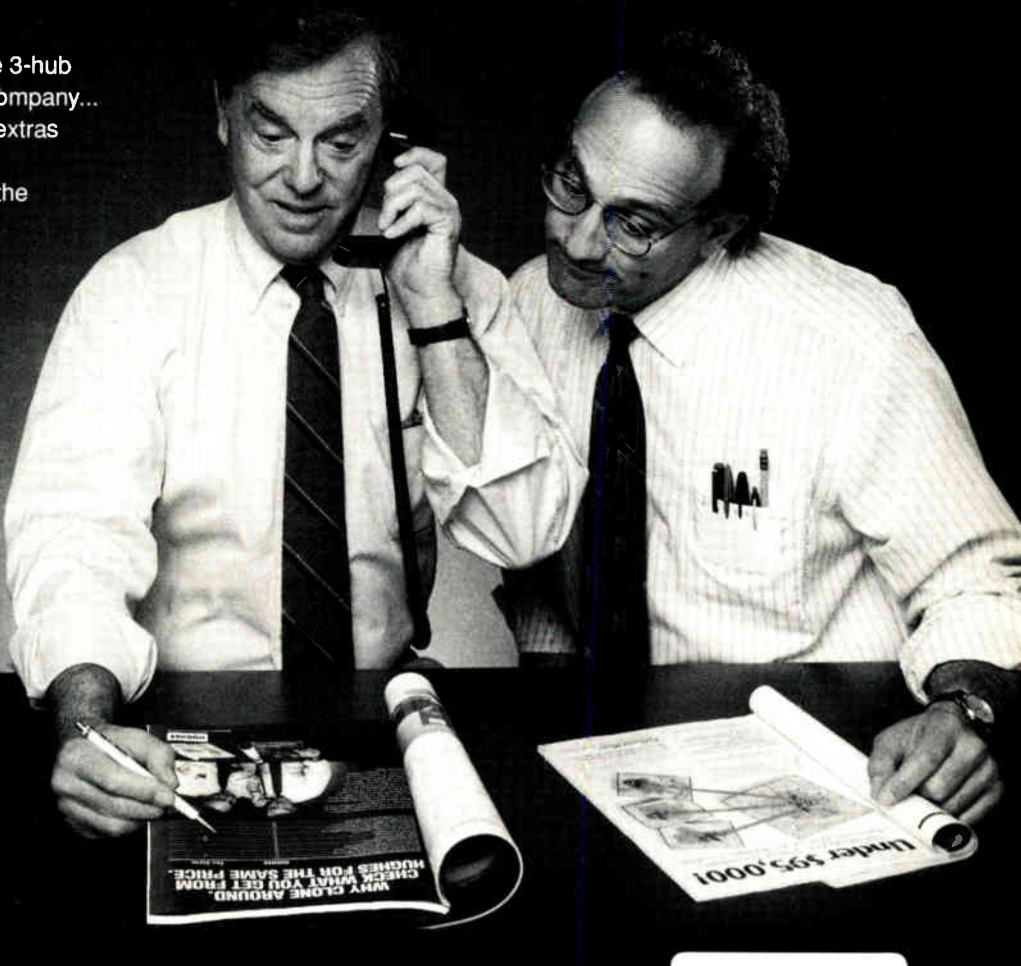

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Reader Service Number 19.

Center in Alexandria,Va., the dynamic test materials will be passed through the ATV systems. Both broadcast and cable transmission simulators are being established at the testing center.

S-A posts record sales

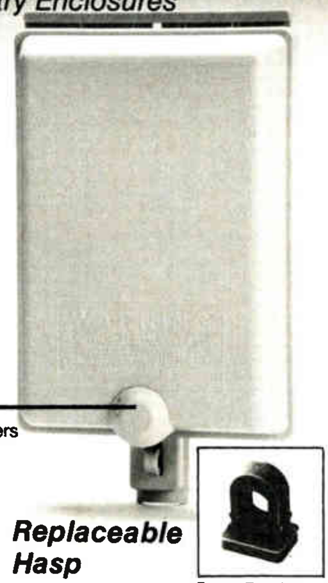
ATLANTA—Scientific-Atlanta reported the best quarterly earnings ever by the company when it announced that the net earnings for the third quarter ended in March were $11.8 million. That is reportedly 22 percent ahead of the same quarter a year ago. Earnings per share were 51 cents, which is a 24 percent increase over the prior year, according to the company. Common shares and common share equivalents were said to have averaged 23 million for the quarter, which is down 3 percent from the prior year.

In other S-A news, several new international contracts were announced. An $8 million contract for a new very small aperture terminal (VSAT) satellite network was awarded by Samart Telecoms Co. Ltd. of Bangkok, Thailand, a licensee of the Thai Ministry of Communications. The network uses small, low-cost satellite terminals to support telephone and data communications throughout Thailand. S-A's Skylinx 25 and Skylinx MCPC (multiple channel per carrier) VSAT systems will be installed at remote sites.

S-A also received orders from Masada U.K. and PTUK for three 30-channel PAL I headends. The headends are to be installed in the Peterborough, Norwich and Bolton franchises in the United Kingdom and will incorporate the company's satellite receivers, Model 6351 PAL I video modulators and Model 6151 PAL I video processors. The three franchises will serve approximately 270,000 homes.

Finally, in a joint announcement with International Cablecasting Technologies, S-A announced the two companies will develop a new product to serve the digital audio market in cable. S-A will complete development of, manufacture, sell and distribute cable headend and subscriber reception equipment for the multichannel digital music package—CD/27—to be programmed and marketed by ICT. The companies plan to use their proprietary technologies to enable the transmission of a pure compact disc standard signal via satellite to cable systems throughout the country that will then be sent to subscribers' homes.

- Sachs Communications Inc., a manufacturer of aerial construction and subscriber installation hardware, opened its new Denver-based training center May 8. According to President Jack Sachs, Denver and Toronto are home to the first of several strategically located training facilities with others slated for New York and Atlanta. Dedication speakers included ATC's Jim Chiddix and Jones Intercable's Brian Throop.
- Chuck Dolan gave his views at the CTAM pay-per-view convention on PPV and DBS (direct broadcast satellite). He promised to solve the current channel capacity problem with the new DBS product Sky Cable. He said, "Sky Cable will add dramatically to the channel capacity of all cable systems" and added the projected 108 channels provided by his DBS effort will provide abundance and affordability to the operator in the area of channel capacity.
- On Friday, May 18, Scientific-Atlanta and Jones Intercable jointly announced the first full-system deployment of S-A's off-premises interdiction technology. Jones' 300-mile, 15,500-subscriber system in Elgin, Ill., is slated to begin installation of the equipment this month or next next month when a 450-MHz CAN fiber upgrade using S-A fiber and distribution electronics is started. No dollar amount was placed on the project.



Effects of AML microwave on CLI

By Dane Walker
Microwave Systems Engineer
Hughes Aircraft Co., Microwave Products Division

Cumulative leakage index (CLI) is one of the most perplexing technical challenges facing the cable TV industry today. Leakage, or signals that stray from the cable or amplifier housing, has been around since the industry's beginning. Years ago the sight of off-the-air TV antennas aimed at passing cables was a familiar one because leaking signals often provided a better quality signal than viewers normally could get off-the-air. Still, in those days of tubes and single-ended amplifiers, signal leakage was not a major problem.

Once we started using push-pull equipment, however, these leakage problems became more of an issue especially as we began taking fuller advantage of our equipment's ability to handle more channels through reduced distortion products and increased bandwidth. For example, we can currently move from the normal off-the-air frequencies of 54 to 108 MHz and 174 to 220 MHz normal to any frequency from 5 to 550 MHz, making signal leakage a threat to a much wider range of communications.

By definition, cable TV systems are supposed to be *closed* RF systems—the signal is delivered to customers by a shielded coax cable. Initially, CATV users were concerned that their privilege of using all but the normal TV broadcast frequencies was in jeopardy if they could not confine their signals. While this is still very true, frequency offsets now provide room to breathe because the services that must be protected are channelized.

Currently, the frequencies causing the greatest concern are the aircraft frequencies of 108 to 137 MHz and the 225 to 400 MHz band, or a total of about 34 cable channels. Signal leakage may also interfere with other services outside of these bands and the following three frequencies in particular must be protected:

- The 121.5 and 243 MHz frequencies (both of which are aircraft distress frequencies). The 121.5 MHz frequency is monitored by all control towers, flight service stations and some satellites and is also the frequency transmitted by the emergency locator transmitter (ELT) in downed aircraft. The military equivalent is 243 MHz.
- The 156.8 MHz frequency. While not in the 108 to 137 MHz band, this is the main marine VHF emergency frequency monitored by both the U.S. Coast Guard and Canadian Coast Guard harbor masters and marine operators (among others).

If CATV signals are found on these three frequencies, the Federal Communications Commission will require a very good explanation. To date, carelessness seems to be the most common excuse offered.

So what does this have to do with AML microwave? Modern CATV headend equipment is kept on frequency by use of crystal-controlled input and output converter local oscillators. HRC and IRC operations make use of crystal-controlled comb generators to phase-lock the headend equipment frequencies to a master reference. Changes in the comb's output frequency affect the output frequency of the unit locked to it. The absolute frequency of the comb's fundamental frequency is critical and in the case of an HRC headend, must be kept within ±1 Hz of its absolute frequency.

The headend signals are then fed to the broadband cable system and the frequency at the input of a subscriber's TV set or converter is the same as at the headend. In some cases the headend signals are split with one set of signals feeding into an AML transmitter and the other passively multiplexed onto the cable system.

At this point, we should look at what the AML does to frequency. Remember first that there are two types of AML systems: composite automatic gain control (AGC) and phase-locked.

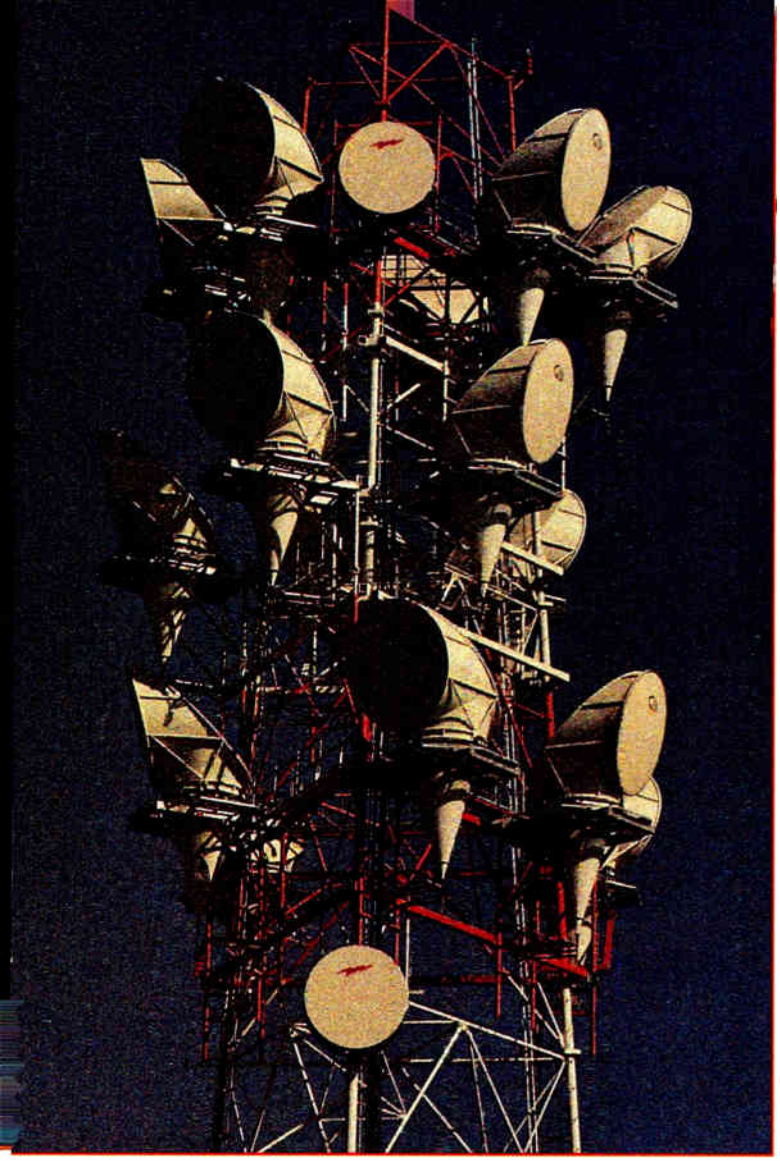
Phase-locked systems

Both types of systems use a crytal oscillator (XO) to keep a solid-state source (SSS) on frequency at the transmitter, thus providing a microwave local oscillator (LO) to be mixed with the incoming VHF frequency. The sum of the frequencies provides the microwave output that is fed to the antennas. This frequency must be kept within 0.0005 percent or approximately ±63.5 kHz. This is the worst case at the low end of the band.

If we allow ±5 kHz for the headend as instructed by Part 76 of the FCC *Rules and Regulations*, the XO used to lock the SSS at the transmitter must be within ±342 Hz of its assigned frequency. This keeps the transmitter in compliance with FCC Part 78 and has nothing to do with the leakage rules (Part 76) at this point.

At the receive end of the link the incoming microwave signal is again mixed with a LO, which in a phase-locked receiver is kept on frequency by a voltage-controlled crystal oscillator (VCXO). This VCXO is phase-locked to the incoming pilot tone. The receiver takes the difference of the two signals, thus giving back the original VHF signal.

Because the receiver uses a pilot tone identical to the XO at the transmitter, both the SSS at the transmitter and the one in the receiver are on precisely the same frequency. Since the transmitter is the sum of the SSS or microwave LO, plus the incoming VHF, while the receiver is the difference of the transmitter



Courtesy Rohn

"With the push for CLI compliance a phase-lock system may be one of the best available investments, especially when the alternative is often to run only a 12-channel system."

output minus the SSS, all that is left is the VHF back on original frequency—not just close but to the cycle. To meet the FCC Part 76.612 requirement in the phase-locked system make sure that the headend complies with Part 76.612 and the *AML receiver is phase-locked to the pilot* and you are done. Take the following situation for example:

VHF Ch. A at 121.25 MHz and Group C (XO = 73.95614 MHz) transmitter

VHF + (XO × 171) = TX output frequency
= 121.25 + (73.95614 × 171)
= 121.25 + 12,646.49994
= 12,767.74994 MHz
= TX output frequency at the receive site

RX output frequency = TX output frequency − (XO × 171)
= 12,767.74994 − (73.95614 × 171)
= 12,767.74994 − 12,646.49994
= 121.25 MHz (or the same at the VHF input to the transmitter)

If we change the frequency of the XO at the transmitter site, the phase-lock loop in the receiver will track it and the output frequency of the receiver will still be the same as the VHF input to the transmitter even though the transmitter frequency will change. The following example illustrates this:

121.250 + (73.9563 × 171) = 121.25 + 12,646.5273
= 12,767.7773 or 27.36 kHz high in frequency

Now at the receive site:

12,767.7773 − (73.9563 × 171) = 12,767.7773 − 12,646.5273
= 121.25 MHz (or the same as the VHF input to the transmitter)

While the transmitter is 27 kHz high in output frequency, the output frequency of the receiver is the same as the VHF input frequency to the transmitter. Therefore, if the headend complies with FCC Part 67.612, the output of the receiver also will comply.

Composite AGC systems

When using a composite AGC system make sure that the XO at the transmitter and the XO in the receiver are on the same frequency as any difference will change the output frequency by 171 times the XO difference in frequency. If we allow 0 Hz drift for the headend and want to keep the output of the receiver within ±5 kHz, we would then divide ±5,000 by 171 and get ±29.24 Hz. This leaves very little room for error. In the following example we again use:

Ch. A at 121.25 MHz and Group C (XO = 73.95614 MHz)

121.250 + (73.95614 × 171) = 121.25 + 12,646.49994
= 12,767.74994 MHz

Now at the receive site we receive the following:

RX input 126.79994 MHz and receiver (XO = 73.956100 − 40 Hz low)

1276.69994 − (73.956100 × 171) = 12,767.79994 − 12,646.4931
= 121.30684 MHz (or 56.84 kHz high in frequency)

This signal becomes a problem when it is fed into the cable system as it no longer complies with FCC Part 76.612. A simple solution is to employ a phase-locked loop system in the microwave receiver. In the case of Hughes AML systems, all non-phase-locked (composite AGC) outdoor receivers can be modified to phase-lock operation with a modification kit.

Indoor receivers are modified to phase-lock with the use of a remote pilot tone generator (like Hughes Model RPG-11). While the first use of the RPG-11 was to pick off a pilot to lock up a number of return sites to the same XO, it also provided a simple way to phase-lock indoor receivers to the transmitter.

(Continued on page 58)

Non-compliance and consequences

The answers and opinions to the following questions are those of John Wong and are not necessarily those of the Federal Communications Commission.

CT: What approach will the FCC take to enforce the new signal leakage rules?

Wong: The FCC expects full compliance with all the signal leakage rules. The approaches used to enforce these rules will begin with a close scrutiny of the filed Form 320s to ascertain the leakage integrity of a cable system. When necessary, we will ask for clarifications and additional information that may include monitoring and signal leakage logs. This follow-up can either be by telephone or mail. If we are still not satisfied, we will ask for detailed information on the method of compliance on signal leakage monitoring and leak repair. At this point, if troublesome questions as to rule compliance remain, we would request a field inspection. Of course, where we feel an inspection is worthwhile, it can be requested at any time. Finally, whatever approaches we set up for leakage compliance will be flexible and readily adjusted to accommodate for changes, both within and outside the commission.

CT: Will on-site inspections be increased?

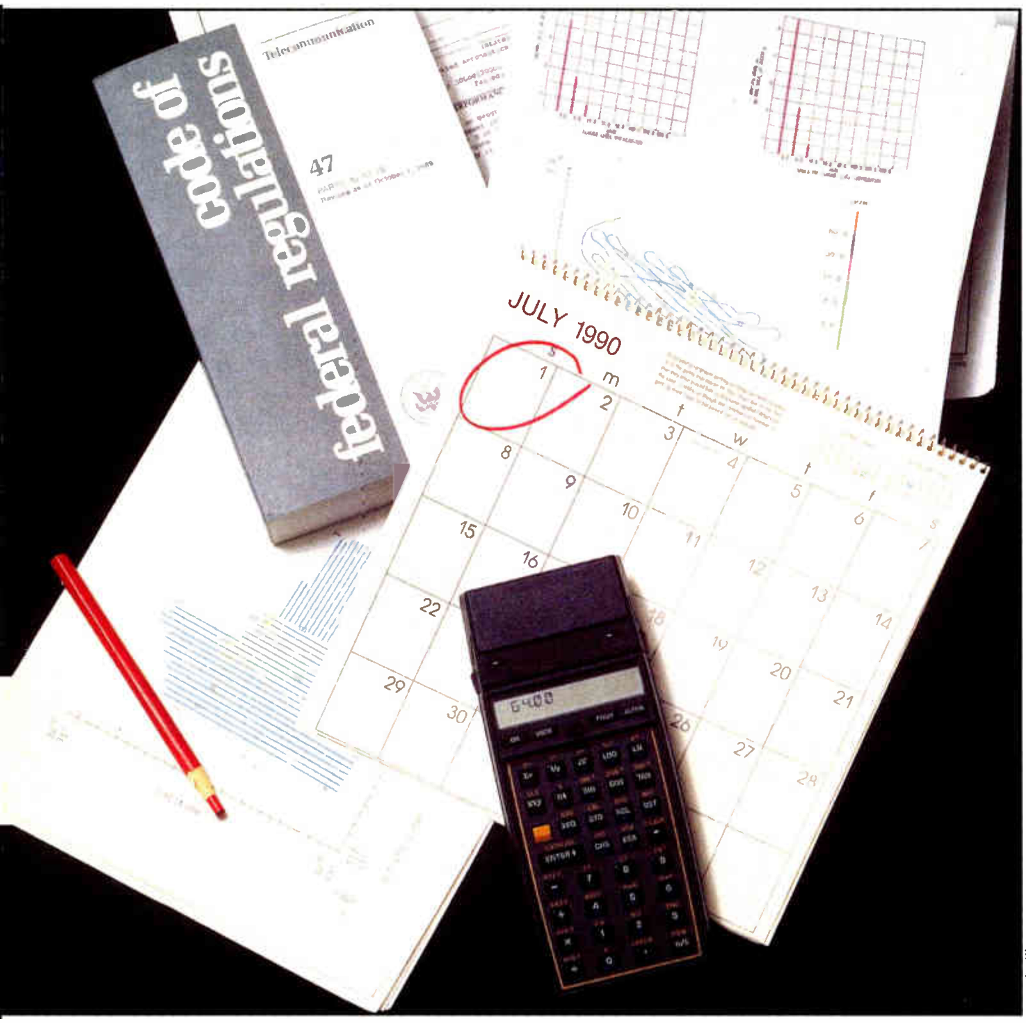
Wong: Yes.

CT: What can a system operator expect during an on-site inspection?

Wong: During most on-site inspections, the FCC field engineer would ride out a portion of the system to look for leaks, ascertain the leakage integrity of the cable plant and generally note the amount of leakage compliance detected during the ride out. After this, the inspector would visit the cable system office to complete the inspection. At the system office, he generally would ask to see the leakage logs, relevant signal leakage filings, the headend and monitoring equipment, and get a feel for the technical capabilities of the system and its technical personnel. He also would probably ask to see other relevant paperwork requirements the system operator must have.

The inspector would generally discuss the problems and violations found and also provide technical advice if necessary. Depending on time constraints and the system personnel's responses, the inspector could even compare the accuracy of the systems' equipment with those used by the FCC. The commission's inspectors are quite knowledgeable and courteous. Finally, keep in mind that they are there as guardians of the spectrum and are serving as public servants to help you.

CT: What will happen if a system fails to comply with the new rules?



Bob Sullivan

Wong: System operators are expected to voluntarily remove their aeronautical channels or reduce the power levels on those channels to below 38.75 dBmV. Operators that fail to do this may be fined up to $25,000 per offense per day, with total forfeiture not to exceed $250,000.

CT: When will systems be considered exempt from CLI compliance?

Wong: They would be exempt if they are not carrying any aeronautical channels or, if aeronautical channels are used, the levels in the distribution plant are less than 38.75 dBmV.

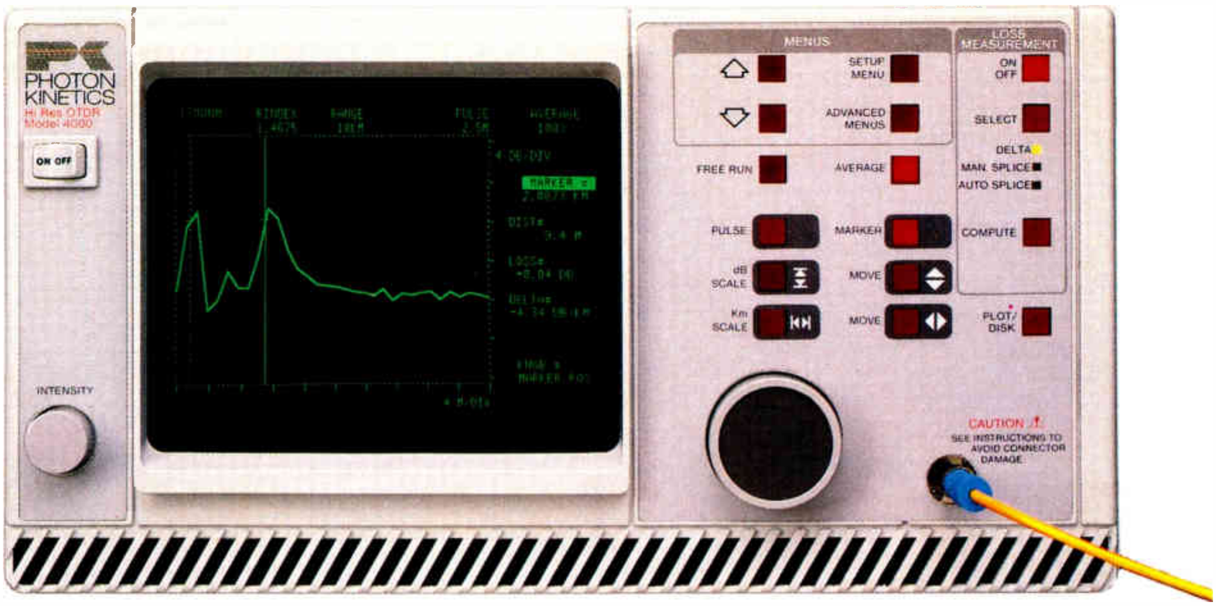
CT: Will any exceptions be made for operators having problems complying, for example, systems that have been purchased recently, are undergoing rebuilds, or were damaged by some natural disaster?

Wong: Other than the exemptions noted previously, operators are expected to comply. As of today, the FCC will only consider waiver applications for systems recently damaged by natural disasters. There are no guaranteed exceptions.

CT: Any comments as July 1 gets closer?

Wong: To the procrastinators, you have had five years. Best wishes. [ ]

PERFORMANCE.



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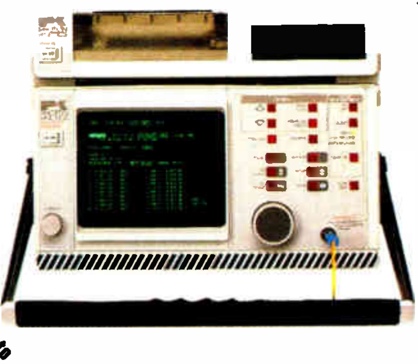

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How to build a calibrated leak

By Ron Hranac

Calibration of signal leakage equipment on a regular basis is mandatory to ensure measurement accuracy. Generally two types of calibration are recommended: direct voltage-source and calibrated field-strength. The first technique is used to establish the general measurement accuracy of a piece of equipment and the second gauges its ability to measure a known field strength.

Direct voltage-source

This method requires that a calibrated RF signal generator be connected directly to the leakage measurement equipment. If the signal generator does not have the same impedance as the unit being tested, then an impedance matching device must be used. As well, the signal generator's level and frequency stability must be good enough to keep the calibration signal on the measurement frequency and at the proper level during the calibration process.

Companies like Wavetek, Marconi, Leader Instruments, Fluke, Hewlett-Packard and others sell high-quality RF signal generators that are suitable for this purpose, although you can expect to pay up to several thousand dollars for one. Most of these are 50 ohm lab-grade generators that will require an external 50 to 75 ohm matching adaptor. I do not recommend the use of CATV bench sweep (or system sweep) generators operated in CW mode for this procedure, since they generally do not have the necessary frequency stability.

An excellent alternative is to use a frequency-agile headend modulator as a calibration signal source. Not only is this less costly than a lab-grade generator but it also will allow you to check the leak detector's accuracy with both CW and modulated carriers. Most of the better quality agile units have the necessary level and frequency stability, are tunable to 1 MHz steps and can be offset 12.5 or 25 kHz to simulate actual aeronautical carrier frequencies on the system. In addition, a frequency-agile modulator can double as the signal source for establishing a calibrated leak.

Let's say your leakage detection equipment has a "0 dB reference" of 20 μV/m at Ch. 16 (C). In this case, after verifying the frequency and level of the signal source, pad the signal down to the equivalent of 20 μV/m (−42.9 dBmV for Ch. 16). Connect the padded signal source to the equipment being checked, peak the leak detector and note the indicated amplitude with an unmodulated input. If readjustment of the leak detector is necessary, follow the manufacturer's instructions.

If you are using a modulator as the signal source, after the CW measurement apply a 1 V video signal to the modulator's video input (you should have previously verified 87.5 percent depth of modulation) and again note the indicated amplitude on the leak detector. Quite likely the reading will be lower than the CW measurement since most leakage detection equipment does not use peak detection. If this is the case with yours, the difference is an additional calibration factor that must be added to readings made in the field when a modulated carrier is used for leakage measurements. (For more information on measurement accuracy, see "Accuracy in visual carrier level measurements," *CT*, November 1989.)

Calibrated field-strength

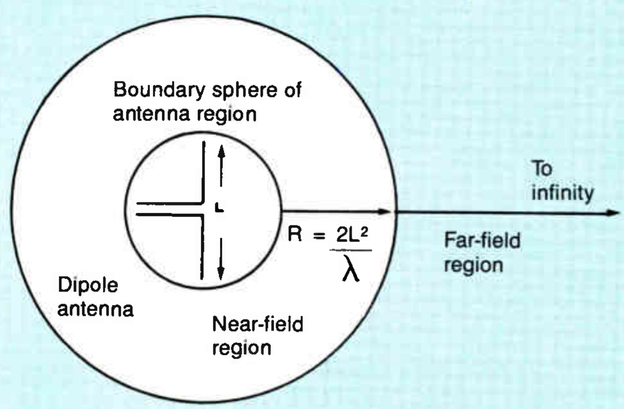
This is also known as the calibrated leak method and allows the relative accuracy of field strength measurements to be determined. A complete leak detection system—antenna, coax and receiver—as installed in a vehicle can be checked. Since this involves the intentional creation of a leak, it is very important that the duration of the calibration be kept fairly brief and that the leak be turned off when the calibration is finished.

Because of the number of variables that can affect the accuracy of open-air field strength measurements, this procedure should be considered secondary to direct voltage-source methods. However, it is convenient to ensure that leakage detection equipment is responding fairly accurately to a certain field intensity.

The following steps should allow you to create a reasonably accurate calibrated leak:

- Place a resonant half wave dipole tuned to the calibration frequency in an open area such as a large parking lot. The antenna should be installed on a non-metallic support at about the same height as the antennas on your vehicles.
- Orient the polarity of the antenna to match that of the leakage detection equipment being checked.
- Connect a signal source to the antenna after ensuring that the source's frequency matches the leakage detection equipment frequency. If the signal source is your cable system, use a single-channel bandpass filter at the input of the antenna to reduce the leakage on other frequencies.
- Find a calibration location that is out of the first dipole's near field (see accompanying figure) and set up a second

Determining an antenna's near field



Courtesy ARRL

μV/m to dBmV conversion

Channel	20 μV/m	50 μV/m
98 (A-2)	−41.19	−33.24
99 (A-1)	−41.66	−33.70
14 (A)	−42.10	−34.14
15 (B)	−42.52	−34.56
16 (C)	−42.92	−34.96

(Continued on page 60)

A 1990 U.K. view of radiation (leakage) and ingress

The following is the first installment of a two-part article on the U.K.'s view today of radiation (leakage) and ingress. This part details the difference between leakage and ingress, while the second installment will cover leakage and ingress measurement.

By Bob Beaumont
And Ian Chamberlain
British Telecommunications

The cumulative leakage index (CLI) in the United States refers to the aggregated radiation (leakage) from a complete system. In the United Kingdom where the limits are specified by the Department of Trade and Industry (DTI) radiation performance is considered in relation to sections of the system. Two U.K. documents define the maximum permitted field strength in various frequency bands.

Document MPT 1520 is titled "Electromagnetic radiation from cabled distribution systems operating in the range 300 kHz-30 MHz," and document MPT 1510 is called "Electromagnetic radiation from cabled distribution systems operating in the frequency range 30-1,000 MHz." Both

Table 1: Frequency allocation for 30 to 860 MHz

Frequency	Allocation	Comments
30-74.8	Fixed/mobile	Note 1
74.8-75.2	Aeronautical navigation	Use prohibited, Note 3
75.2-88	Fixed/mobile	Note 1
88-108	Broadcasting	Note 4
108-117.975	Aeronautical navigation	Use prohibited, Note 3
117.975-121.3	Aeronautical mobile	
121.3-121.7	Aeronautical emergency	Use prohibited, Note 3
121.7-136	Aeronautical mobile	
136-156.6	Space/mobile/amateur	Note 1
156.6-157	Maritime distress	Use prohibited, Note 3
157-216	Private fixed/mobile	
216-242.8	Radiolocation/government	
242.8-243.2	Maritime emergency	Use prohibited, Note 3
243.2-328.6	Government	
328.6-335.4	Aeronautical navigation	Use prohibited, Note 3
335.4-400	Government	
400-405.85	Space/satellite	
405.85-406.25	Emergency satellite	Use prohibited, Note 3
406.25-425	Government	Note 1
425-470	Mobile/amateur/government	
470-582	Broadcasting	Note 4
582-606	Aeronautical navigation	
606-854	Broadcasting	Note 4

Notes: Extracted from Standard MPT 1510
1) Where systems operate close to radio astronomy and space service stations, tighter radiation limits may be necessary in one or more of the frequency ranges 37.75-38.25, 80.5-82.5, 136-144, 150.5-153, 406.25-410 and 606-614 MHz.
2) This note no longer applies.
3) The use of vision/sound/pilot carriers and color subcarriers in this frequency range is prohibited. The radiated levels of any sidebands or of any intermodulation products or spurious frequencies on the system falling within this frequency range shall not exceed +21 dB (μV/m).
4) This limit will apply where distribution in a cabled system is on the same, or overlapping, frequencies as used for off-air TV and FM radio reception in the area and at frequencies used by VCRs. In cases where distribution in a cable system is not on the same, or overlapping, frequencies as used for off-air reception, consideration may be given to relaxation of this limit.

Table 2: U.K. TV channels and carrier frequencies

UHF band 4 channel	Vision in MHz	Sound in MHz
21	471.25	477.25
22	479.25	485.25
23	487.25	493.25
24	495.25	501.25
25	503.25	509.25
26	511.25	517.25
27	519.25	525.25
28	527.25	533.25
29	535.25	541.25
30	543.25	549.25
31	551.25	557.25
32	559.25	565.25
33	567.25	573.25
34	575.25	581.25
UHF Band 5		
39	615.25	621.25
40	623.25	629.25
41	631.25	637.25
42	639.25	645.25
43	647.25	653.25
44	655.25	661.25
45	663.25	669.25
46	671.25	677.25
47	679.25	685.25
48	687.25	693.25
49	695.25	701.25
50	703.25	709.25
51	711.25	717.25
52	719.25	725.25
53	727.25	733.25
54	735.25	741.25
55	743.25	749.25
56	751.25	757.25
57	759.25	765.25
58	767.25	773.25
59	775.25	781.25
60	783.25	789.25
61	791.25	797.25
62	799.25	805.25
63	807.25	813.25
64	815.25	821.25
65	823.25	829.25
66	831.25	837.25
67	839.25	845.25
68	847.25	853.25

these documents are published by the U.K. Department of Trade and Industry, Radio Regulatory Division. For most cable systems it is the MPT 1510 reference that is important but don't forget that some of our equipment such as switching power supplies operates in the lower frequency band so the requirements of the MPT 1520 document also have to be considered.

Both standards provide details of methods of measurement of *systems* rather than individual components. Just as with CLI, the U.K. regulations have specific bands where use of the spectrum is prohibited. It is important to remember that harmonics and distortion products of unmodulated carrier signals on the system also must not fall within the prohibited bands. The use of some frequency bands is totally prohibited, but in the range 30 to 1,000 MHz it is the use of carrier or subcarrier signals that is prohibited; sideband products are permitted but with defined field strengths.

The regulations are becoming increasingly important to cable operators since non-conformance to them can result in a cable system being closed down. The reason for the regulations is to protect the various radio communication services that use the radio frequency spectrum. Services such as emergency radio, radio navigation, broadcasting and cellular radio all compete with the same spectrum used by cable operators. Just try watching television or listening to FM radio when one of the older home computers is running and the problems are obvious. We are operating in the same frequency spectrum as licensed users and as such the licensed users have the legal right to their allocated spectrum.

Figure 1: PAL I curve

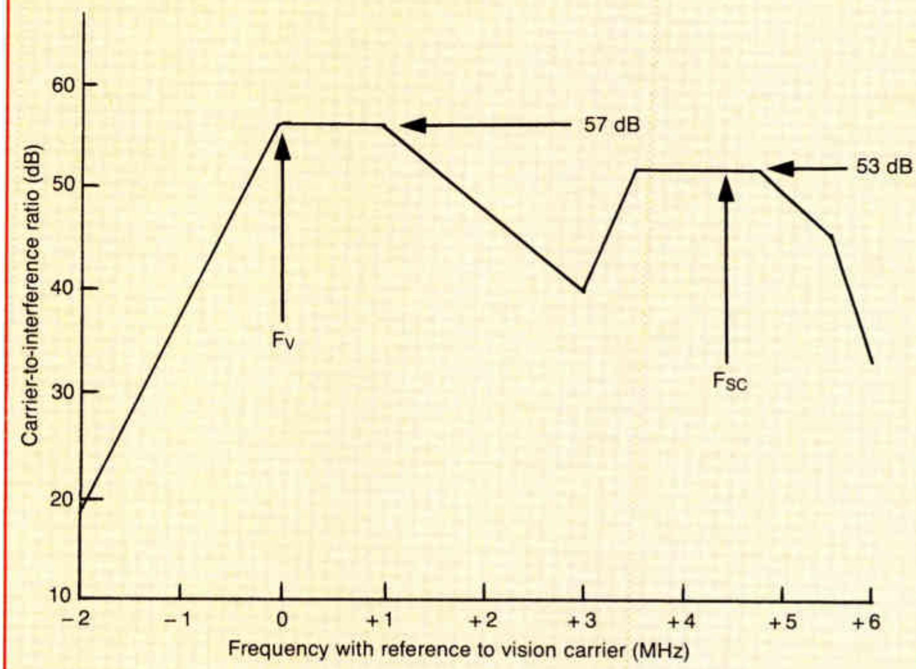
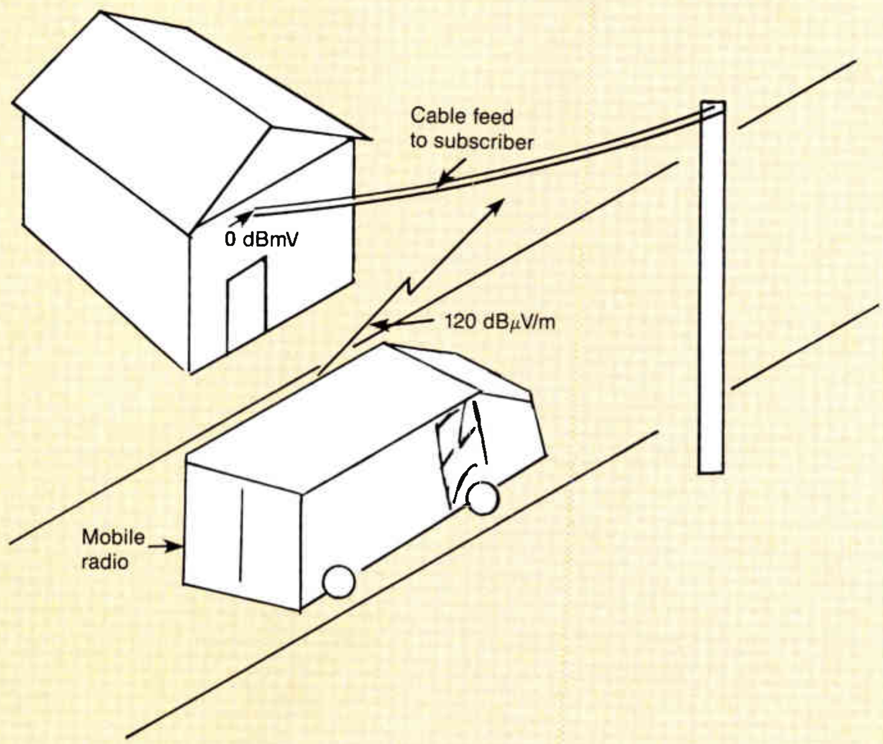


Figure 2: Typical ingress problem at customer home



A loaded U.K. spectrum

The radio spectrum in the United Kingdom is very heavily loaded. TV signals are broadcast through most of the frequency band from 470 to 854 MHz. In the VHF band increasing use of the spectrum has followed the cessation of 405-line TV broadcasting. The bandwidth thus made available is being taken up by numerous mobile communication systems.

Table 1 shows the frequency allocation of the radio spectrum from 30 to 854 MHz and Table 2 shows the U.K. UHF band 4 and 5 TV channel numbers and frequencies of sound and vision carriers. All these channels are used somewhere in the United Kingdom, some as main transmitters and some as low-power fill-ins for shadow areas. The band from Ch. 35 to 38 is used as the video recorder (VCR) spectrum. This part of the spectrum tends to be occupied by (in addition to VCRs) home computers and game machines. It is actually allocated to airport radar systems but these services are being moved in order to accommodate a fifth terrestrial TV channel. The fifth TV channel is due to start broadcasting probably in 1992 and this will use Chs. 35 or 37 depending on geographical location.

Leakage and ingress

Now we will consider the difference be-

(Continued on page 62)

How to improve equipment reliability with contact enhancement

By Mike Dayton Wright
President and Director of Engineering
D.W. Electrochemicals Ltd.

It is unfortunate that one of the most common components in electronics sometimes seems to be the least reliable. While it is true that connectors that have superlative specifications can be manufactured, their performance several years after manufacture seems to fall far short of expectations. Is there any among us who has not been reduced to dumb frustration by a complex system that is unserviceable because what we suspect is a big problem is a simple contact failure somewhere in that system?

Even though large scale integration (LSI) has reduced the number of connections considerably, we still suffer from system crashes, intermittance, noise, signal loss, RF pickup or RF leakage because connectors don't function as they were intended. In many fields the power-consumption efficiency of complex electronics has increased so dramatically that today a 30 MHz 80387 computer can do with 200 watts what it took a mainframe running on several kilowatts to do a couple of decades ago. But with this efficiency the power levels in the connectors also dropped dramatically to the point where connectors are the major source of unreliability. In electronic equipment where several hundred contacts must work perfectly for the system to function, sometimes even the diagnostic routines won't work because of multiple contact failures.

Gold plating isn't enough

Over the last several years I have spent a great deal of time trying to prevent RF signals from getting into low level audio equipment where they inevitably demodulate and foul up the signal. The problems have been multiplied by the industry's unfortunate choice of the "RCA-type" coax connector as its primary interconnect standard. Originally designed as a very cheap connector used to connect crystal phono cartridges in radio consoles, this thing now has been redesigned to within an inch of its life and gold plated in the hopes that paying $20 each for a 3-cent connector will improve its performance. Yet as is the case with many other connectors, the performance increase has not kept pace with the increase in cost.

In low level audio (moving coil cartridges), signal strengths from 30 to 150 mV are not uncommon. And as many audiophiles live in high rises a seeming stones throw away from TV, FM and AM transmitting arrays, RF leakage (and demodulation) in connectors is a major problem. I have run across many cases where the RF leakage into an audio cable is (when demodulated) equal or greater than the audio signal itself!

Of further consideration is that electromechanical contacts exhibit what is called "zero-crossing distortion." Here, for a brief moment after the signal voltage passes through zero, there may be an interruption in current flow caused by the lack of enough voltage to break down a thin film of contamination in the contact interface. This can easily lead to a situation where the distortion in the connectors and switches in the signal path of the signal is much greater than the distortion in the amplifying stages themselves. This is especially true as it usually consists of the very audible high order harmonics. In addition, it is not unusual to encounter unstable losses in the range of 2 to 8 dB because of connector contamination.

"Is there any among us who has not been reduced to dumb frustation by a complex system that is unserviceable because what we suspect is a big problem is a simple contact failure somewhere in that system?"

Much of the technology we developed in trying to cope with these problems has proven to be directly applicable to a wide range of equipment, encompassing biomedical electronics, process control, computers, air-traffic control and CATV (to name but a few). We have found that it is generally easier to make a connector work perfectly at high signal levels than low signal levels, which would seem to suggest that it is easier to stop RF leakage out of a coax connector than into it.

Problems force invention

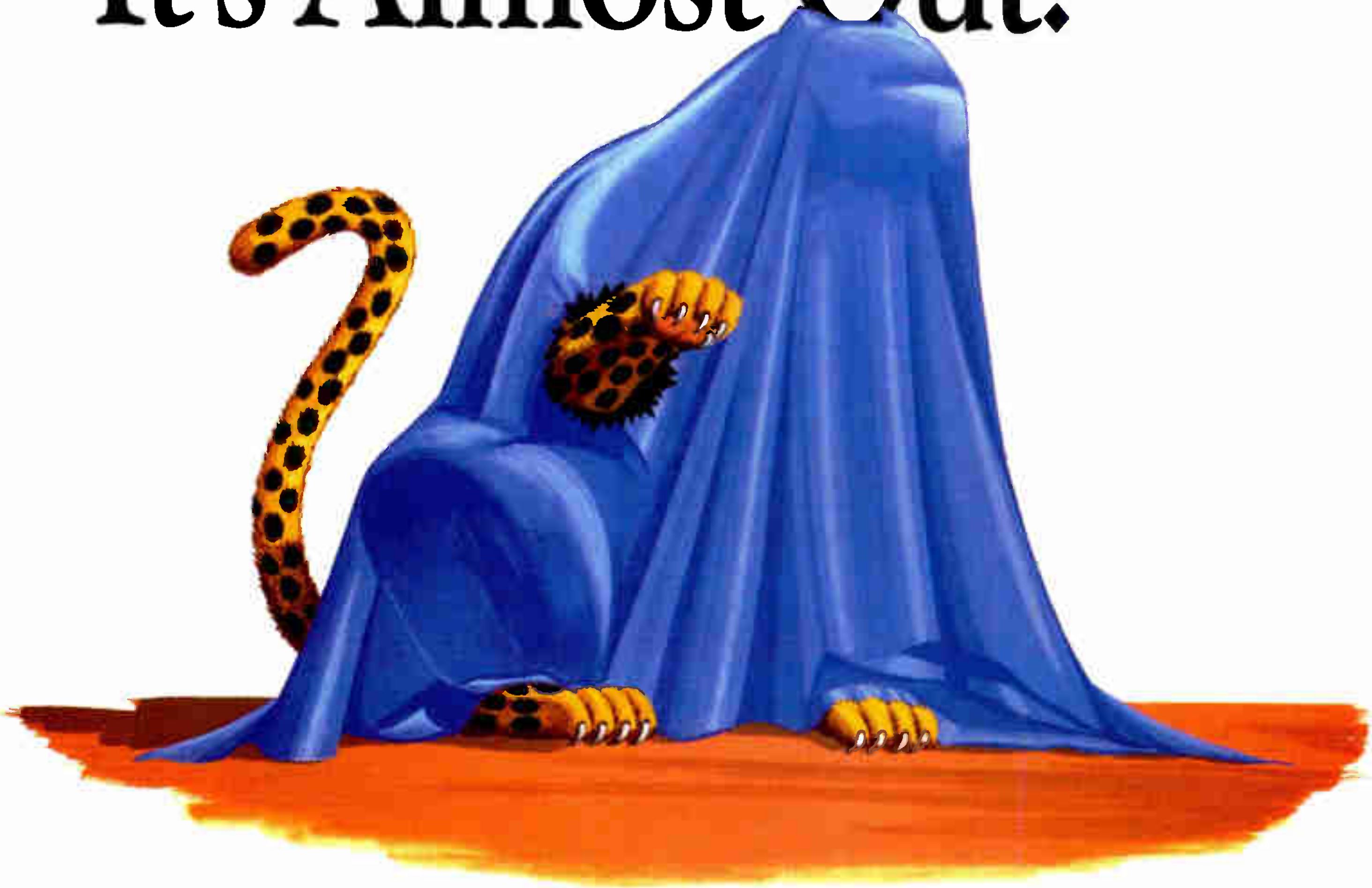
Our product came about because of necessity. Plagued by many contact problems in the middle '70s we prayed for some sort of material that when applied to connectors would make them work the way they were intended. We would want the material to have a low vapor pressure so that it would last, be non-toxic (good technicians are hard to find), act as a lubricant so that we could use it in switches, be thick enough or water insoluable enough so that it would prevent water from entering a connector, have sufficient surfactant action so that it would lift and hold contaminant films in suspension and conduct when in a contact without shorting out to adjacent contacts.

Probably because we took the time to define the characteristics of the material needed, we were in a better position to recognize some potential candidates when we ran across them in the course of other R&D. In 1976 we came across a family of block polymers that showed potential as contact enhancers and even though it took several years to perfect the material we felt it worthwhile. The result is D.W. Electrochemicals' Stabilant 22.

In a coaxial connector used in CATV, not only will a poor contact cause an impedance discontinuity with its attendant potential for image deteriorating reflec-

(Continued on page 65)

It's Almost Out.



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Your rebuild options

By Bob Young
Director, Product Marketing, Distribution Systems Division
General Instrument, Jerrold Communications

This article will review the basic criteria for module/electronic drop-in upgrades (no respacing of trunk or feeder electronics). The primary benefit of a drop-in upgrade vs. a complete rebuild is cost. A drop-in upgrade can do the required system channel expansion at one-quarter the cost of a complete rebuild. Specific details will be offered on the various amplifier technologies and how their performance capabilities benefit total system performance.

For simplicity's sake, this analysis will not consider fiber-optic technology. AM fiber technology has been proven to be of definite value and may offer possible module upgrade opportunities where traditional RF technologies do not exist. However, consideration of this alternative technology is beyond the scope of this article.

A drop-in upgrade requires high technology amplifiers because maintaining existing trunk amplifier and line extender locations demands higher gains with more channels and elevated operating levels. In addition, no loss in system performance can be tolerated. Almost any upgrade (beyond adding only a few channels) requires performance characteristics available only through power doubling, Jerrold's Quadrapower or feedforward technologies.

Limitations

Despite advances in amplifier technologies, the existing system must meet certain criteria to be considered a drop-in upgrade candidate. If the existing cable in the distribution plant cannot support the increased channel capacities without excessive degradation, all of the improved amplifier technologies now available cannot overcome this basic system flaw. It is a good idea that a significant sampling of the condition of the trunk and feeder cables be done as part of the investigation of upgrade possibilities.

The bridger and line extender output levels of the existing system also can restrict a system upgrade. If feeder amplifier output levels are already at relatively high levels (49-50 dBmV) the drop-in upgrade may have to be restricted to the trunk system only. Feeder levels for an existing 300 MHz system must be increased by 1.5 dB, 4.5 dB and 6.5 dB for 330 MHz, 400 MHz and 450 MHz upgrades respectively. Except for feedforward technology (due to its lower crash points) the advanced technology amplifiers are capable of high output levels. However, despite the improvements these amplifier technologies offer, the composite triple beat (CTB) contribution resulting from these higher levels restricts the overall cable plant distortion performance.

In addition, tap levels that are presently too low also may limit a drop-in upgrade. Every decibel of increase to tap levels required for the system upgrade will add directly to the level and gain requirements of the bridger and line extenders. Sometimes these problems can be overcome at a relatively low cost by performing tap faceplate change-outs (if the original vendor's product has maintained backward compatibility). By changing tap values in addition to drop cable improvements, tap levels may be modified without the need for incremental feeder level increases.

Table 1: Upgrade module characteristics

	Noise Figure	Operational Gain	CTB performance CTB	dBmV	Channels
Trunk modules					
• Push-pull	9	27	88	34	40
• Power doubling	9	27	87	35	60
• Feedforward	10	27	92	38	60
Bridger modules					
• Push-pull	11	30	63	50	40
• Power doubling	11	31	67	47	60
• Quadrapower	11	33	70	48	60
Line extenders					
• Push-pull	13	28	63	47	60
• Power doubling	13	30	69	47	60
• Quadrapower	14	32	73	47	60

Table 2: Existing 300 MHz system characteristics

	System 1	System 2	System 3
Longest cascade	20	30	30
Trunk input level (dBmV)	9	9	9
Trunk output level (dBmV)	31	31	31
Bridger output level (dBmV)	47	44	47
Line extender output levels (dBmV)	44	44	44
System performance			
• Composite triple beat	53	53	51
• Carrier-to-noise	45	44	44

Analysis

The analysis in this article examines three different 35-channel (300 MHz system) systems. It will study a total drop-in upgrade to 330 MHz, 400 MHz and 450 MHz for each system. Each of these systems is presently using the standard 300 MHz push-pull technology that was available in the late 1970s or early 1980s. For simplicity we will assume that the existing tap levels are either sufficient or can be inexpensively modified to support the upgrade requirements.

This analysis will detail only carrier-to-noise (C/N) and CTB distortions. The target performance for the upgraded systems has been established as a −53 dB CTB and a 44 dB C/N.

Table 1 offers the performance capabilities of the upgrade modules (trunk, bridger and line extenders) that will be available for the drop-in upgrades. Due to the level requirements for the bridgers and line extenders the application of feedforward technology has been restricted to the trunk system only.

System specifications

System 1 has a 20-amp cascade, followed by one bridger and two line extenders. Bridger output levels of 47 dBmV and cascaded line extender output levels of 44 dBmV are used. This system's design performances were calculated to be a −53 dB CTB and a 45 C/N.

System 2 with a 30-amp cascade has the same trunk levels as System 1 (9 dBmV input/31 dBmV output). However, bridger and line extender levels have been lowered to 44 dBmV and 41 dBmV respectively to get a system design performance of CTB equal to a −53 dB and a C/N of 44 dB.

System 3 was originally designed identically to System 1. However, over time an additional 10 amplifiers were placed after the original 20-amp cascade (now resulting in a 30-amp cascade) without changing the system bridger and line extender levels.

Table 3: System 1 module upgrade

	330 MHz upgrade	400 MHz upgrade	450 MHz upgrade
Trunk technology	P/P	PD	FF
• Input level (dBmV)	9	9	10
• Output level (dBmV)	32	34	37
Bridger technology	P/P	PD	QP
• Output level (dBmV)	48.5	51.5	53.5
Line extender technology	P/P	PD	QP
• Output level (dBmV)	45.5	48.5	50.5
• Gain requirement (dB)	26.5	29.5	31.5
System performance			
• Composite triple beat	53	53	53*
• Carrier-to-noise	45	44	45

* Requires second line extender to be relocated

Table 4: System 2 module upgrade

	330 MHz upgrade	400 MHz upgrade	450 MHz upgrade
Trunk technology	PD	PD	FF
• Input level (dBmV)	9	9	10
• Output level (dBmV)	32	34	37
Bridger technology	P/P	PD	QP
• Output level (dBmV)	45.5	48.5	50.5
Line extender technology	P/P	PD	QP
• Output level (dBmV)	42.5	45.5	47.5
• Gain requirement (dB)	26.5	29.5	31.5
System performance			
• Composite triple beat	56	53	55
• Carrier-to-noise	46	45	44

Table 5: System 3 module upgrade

	330 MHz upgrade	400 MHz upgrade
Trunk technology	PD	FF
• Input level (dBmV)	9	10
• Output level (dBmV)	32	35
Bridger technology	P/P	QP
• Output level (dBmV)	48.5	51.5
Line extender technology	P/P	QP
• Output level (dBmV)	45.5	48.5
• Gain requirement (dB)	26.5	29.5
System performance		
• Composite triple beat	55	54
• Carrier-to-noise	45	44

The present calculated system performance for System 3 is a −51 CTB and 44 dB for C/N. Table 2 summarizes the three existing systems' levels and distortion performances.

Types of upgrades

System 1 can be upgraded to 330 MHz with push-pull technology. This shows the improvements made by the IC vendors in their conventional (push-pull) gain blocks. However, upgrading System 1 to 400 MHz requires the use of power doubling technology in the trunk system and throughout the feeder plant. A 450 MHz upgrade to System 1 requires feedforward trunk and Quadrapower technology in the bridgers and line extenders.

Despite the application of feedforward and quadrapower technology, System 1's upgrade to 450 MHz will require respacing of the second line extender off the longest cascade to get the desired performance parameters. Table 3 summarizes the upgrade analysis for System 1.

System 2 requires power doubling trunk technology in conjunction with push-pull bridgers and line extenders to achieve the 330 MHz upgrade. Consideration may be given to using conventional modules in the trunks of the shorter cascades. A full complement of power doubling modules in the trunk, bridger and line extenders is required for a 400 MHz upgrade. Upgrading System 2 to 450 MHz offers a good example of the importance of the existing bridger and line extender levels in the criteria for a drop-in upgrade scenario. Though System 1 had only 20 trunks in cascade, it required relocation of the second line extender for a 450 MHz upgrade. However, despite its 30-trunk amp cascade System 2 does not require moving line extenders (when using the same feedforward trunk and Quadrapower bridger and line extenders) to achieve its 450 MHz upgrade consistent with system performance requirements.

The differences in the two upgrade scenarios can be directly related to the existing system's bridger and line extender levels. Table 4 summarizes the upgrade analysis for System 2.

Increasing System 3 to 40 channels requires power doubling in conjunction with push-pull bridgers and line extenders. The existing system's high bridger and line extender levels in conjunction with a 30-amp cascade requires use of feedforward trunk, and Quadrapower bridger and line extenders to achieve a 400 MHz upgrade.

The analysis has determined that a 450 MHz upgrade without respacing line extenders is beyond the capabilities of the high performance trunk, bridger and line extender modules. Table 5 summarizes the upgrade analysis for System 3. Note that a 450 MHz upgrade is not possible without moving both line extender locations.

A 450 MHz upgrade to System 3 could be accomplished with AM fiber technology. By breaking up the longer cascades in the existing system into smaller cascades and feeding each of these shorter cascades with an AM fiber node, trunk levels can be reduced without sacrificing overall system C/N performance. This approach would result in less CTB contribution from the trunk system and by that allow for line extender levels appropriate to maintain existing line extender locations.

In summary, the key to the possibilities of a trunk and feeder upgrade (without respacing) lies in the existing system. Cable condition, distribution amplifier levels and tap levels could be major obstacles. Still, today's advances in amplifier technologies and the possible use of AM fiber dramatically improve the chances of doing a module/electronics upgrade. If the required channel expansion can be done in this manner, the operator has the opportunity to avoid spending four times what would be required for a complete system rebuild.

Cheaper, traditional upgrades may be best

By Monte Errington, Rob Lego, Fred Rogers and John Tinberg
Quality RF Services Inc.

Spending large sums of money to upgrade in an industry under fire from the consumer and government regulators may not be beneficial at this time. Less expensive, more traditional upgrade solutions exist. For example, this article will address the following possibilities:

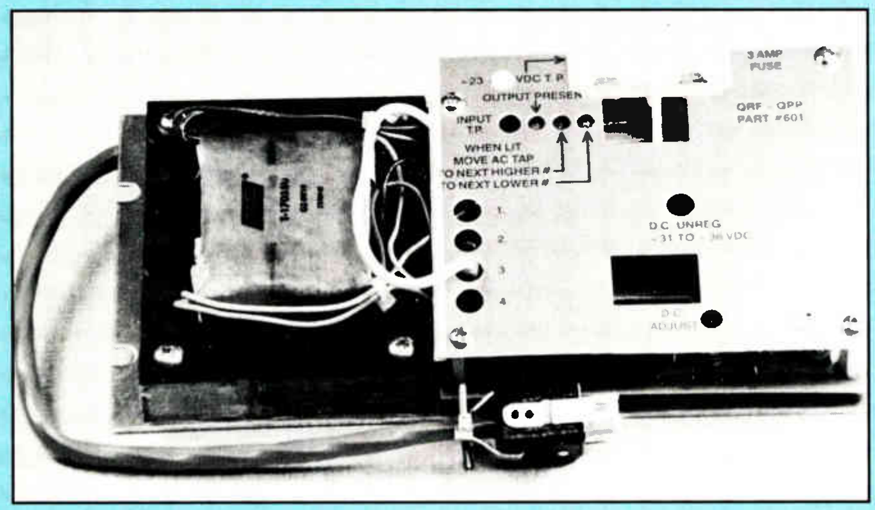
- Hybrid changeouts to achieve higher quality pictures
- Power pack upgrades to reduce outages
- The use of surge protection including thermal breakers to reduce fuse outages
- Replacement of high failure line extenders with trunk stations to stop "killer" pole locations
- Improved system grounding
- Fiber-optic rebuilds

With the presence of even more explosive external forces, the cable TV industry endures more controversy than ever. Cable hungers for newer technologies at a considerably more rapid pace than before, but the price is often translated into much higher rates to the customer. Once again, the headlines are appearing: "Cable rate hike criticized at local council meeting!" As an industry, we often forget that the customer grades our products on results and not our methods that accomplish those results. In other words, they want good pictures that are present when they want to watch them and they do not care how we get them there.

Hybrid replacement mini upgrade

The heart of the CATV amplifier is the

Figure 1: High reliability (brute force) power pack



Station hybrid performances

	Input hybrid	Output hybrid	CTB for 52 channels	Noise figure	DC current at 24 VDC
Step 1	CA4101	CA4201	−85 dB	7.5 dB	430 MA
Step 2	CA4101	CP5206	−87 dB	7.5 dB	439 MA
Step 3	CP5206	CP5206	−88 dB	6.5 dB	500 MA
Step 4	CP5206	MHW5185	−93 dB	6.5 dB	680 MA

"The replacement of hybrids in the field (amplifiers with plug-in sockets) or soldered in at the bench can improve system performance immediately."

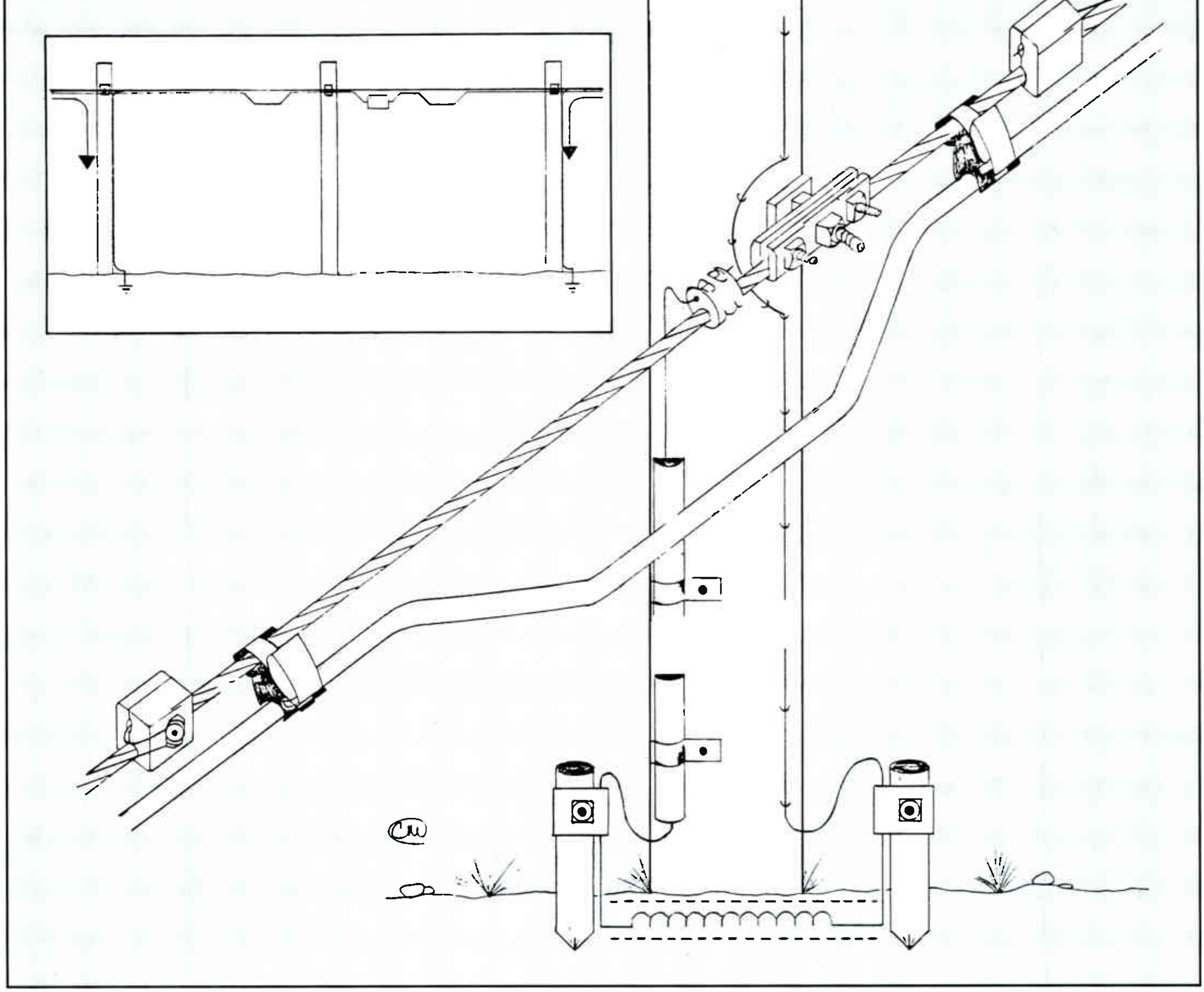
hybrids. These active devices determine the bandwidth, amount of channels used and the output level capabilities. The replacement of hybrids in the field (amplifiers with plug-in sockets) or soldered in at the bench can improve system performance immediately. In an attempt to demonstrate the dramatic hybrid improvements available today an original 1983 vintage 400 MHz trunk module containing no gain or tilt controls had its distortions measured and recorded (see accompanying table).

Next, the output hybrid was replaced with the latest generation conventional hybrid. When this unit was retested, a 2 dB improvement in output distortions was recorded with no improvement in the (7.5 dB) noise figure. To improve the noise figure the input hybrid was then changed to a latest generation hybrid for an improvement to a 6.5 dB noise figure (1 dB improvement), and also a 1 dB improvement in composite triple beat (CTB). To achieve improved distortions beyond latest conventional push-pull technology, the output hybrid was again replaced; this time it was with a power double device.

When retested to the same parameters as the conventional push-pull hybrids, the power double mini upgrade improved the output distortions by an additional 5 dB CTB. The only drawback was an increase of 33 percent module current over conventional hybrids due to the power double hybrid installed in the output section.

With an upgrade using latest generation hybrids, additional over voltage protection becomes extremely important for the reduction of both catastrophic failures and soft failures. Soft failures are reductions in hybrid distortion performance; thus they degrade picture quality. To protect the hybrids from DC supply voltage surges, a transient voltage protector (TVP) should be installed across the DC supply

Figure 2: Grounding a mini upgrade



line to ground.

One condition many operators experienced was failure of AC bypass monolithic capacitors that have a voltage rating below 500 WVDC. This failure occurs predominantly in line extenders but can show up in trunk motherboards. To solve this "burn" problem use only 500 WVDC or higher capacitors.

Replacement of the hybrids can be straightforward and accomplished with the minimum of time and investment. There may be amplifiers that will present problems after upgrade due to low frequency oscillations when subjected to certain lightning or power surge conditions. With the addition of surge protective devices (500 WVDC capacitors, TVP, etc.) or in some cases high-pass filters in bridgers, these problems can be minimized to the operator.

Power supply reliability upgrading

In most cable systems, an amplifier power pack upgrade is often overlooked until total system upgrade is inevitable. Station power pack failures often occur due to a wide range of causes, from lightning and sheath currents to discrete component failures within the power pack itself. Under-rating components or poor design of the power pack can (and many times does) contribute to the premature failure of the trunk and feeder amplifier modules within the station housing.

A closer examination of the number of recurrent station failures will give us a better idea of the action to be taken. If certain stations ("Murphy" locations) have an abnormally high rate of failure, the alternative can be to upgrade these stations with "brute force" power packs originally designed for use with feedforward or power double station applications. This high reliability power pack shown in Figure 1 originally was designed for double power doubled, ST and SJ stations and now solves outages due to lightning and power surge problems. In many cases, these (sometimes called "overrated") replacement power packs must possess an output current rating exceeding the original power supply. The idea behind this is the replacement power packs (by necessity) include highly rated components that in our application will be operating at a much lower capacity. The result will be increased station reliability due to less stress on the power pack.

Other important issues

Grounding in a mini upgrade. Good

(Continued on page 68)

Battery revolution: Energy management charging

In the following article, the author describes a revolutionary new battery management technology for backup power systems that will be displayed in prototype form at this month's Cable-Tec Expo in Nashville, Tenn. Billed as the "energy management charging system" (patent pending), this new product will be manufactured under license by Advanced Communications International Inc. of Colorado Springs, Colo.

By Tristan Juergens
Director of Research and Development
Advanced Communications International

This article concerns itself with the DC branch of an uninterruptible power supply (UPS) system. A generic UPS is diagrammed in Figure 1. We will investigate batteries and the relationship between battery and charger as well as the need for intelligent interaction between these two.

Over the next five years major advancements are expected in battery technology. These changes are being driven by the need for higher voltage and higher momentary currents as well as faster recharge demands of the automotive industry and on a different scale by consumer products (such as the cordless tool and lap-top computer markets).

The battery

A variety of batteries are used in UPS systems. These include the following:

- Lead Acid (flooded, gelled, starved or absorbed)
- NiCad (flooded or sealed)

NiCad batteries are normally used in cycling applications, which means they are called upon to deliver a substantial percentage of their capacity at regular intervals. A phenomenon known as "memory effect," the reduction of total battery capacity when only a small percentage of that capacity is removed with each cycle and economics has limited the applications of these batteries.

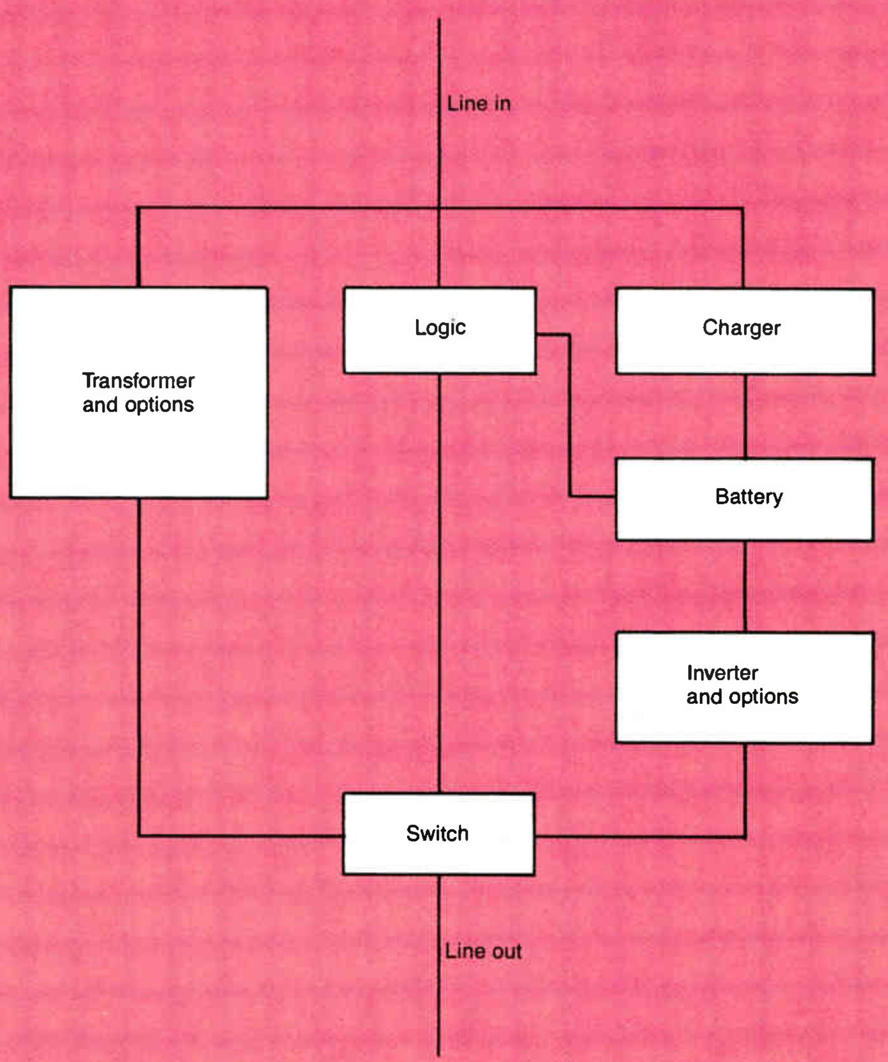
Lead acid or storage batteries are by far the most common variety in use. These batteries come in three "flavors"—flooded, gelled, and starved or absorbed. The descriptions apply to the nature or condition of the electrolyte.

On the outside a so-called maintenance-free flooded lead acid battery may quite closely resemble a gelled or absorbed electrolyte battery. Flooded batteries are most common in the automobile and RV industry. Newer flooded batteries are called maintenance-free because they employ lead grids of more pure lead (lower alloy) content than older batteries, resulting in less water loss under proper charge conditions. The expectation by the manufacturer is that the service life of the battery due to a variety of other failure modes will substantially coincide with the need to add water.

Gelled electrolyte batteries are constructed along generally the same lines as flooded except that silica is added to the electrolyte (sulfuric acid) so that it is in a gelled state. This has the advantage of being mostly spill proof and sometimes is advertised as being leak proof.

Absorbed electrolyte and "starved" electrolyte batteries will be treated the same for the purpose of this discussion. The principal feature is that all the electrolyte is absorbed and retained in the paste and the separator of the cells in the battery. A principal feature of this battery is

Figure 1: Generic UPS system



that through the utilization of a porous separator and a minimum of acid, the oxygen evolved at the positive plate is recombined under pressure to form water through processes at the negative plate when charging the battery. This serves the primary purpose of conserving water in the system. Accordingly, starved electrolyte recombinate technology batteries are more abuse-tolerant, especially in overcharge conditions encountered in many UPS systems.

All batteries have a venting mechanism that has the purpose of keeping gas pressure inside each cell from building to destructive levels, especially if overcharged. Most rectangular flooded or gelled batteries have venting means that operate at fractional PSI levels or are primarily designed to be splash shields. These batteries should be handled carefully and always kept upright.

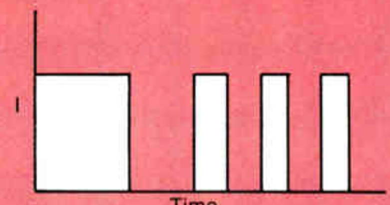
The charger

Charging systems can be divided into two principal categories: constant current and constant potential. In the constant current charger the battery is charged at a specific voltage and low constant current. In float applications for small to moderate size UPS systems (up to several hundred amp hours) a constant current charger that will recharge the system in a reasonable amount of time causes excessive gassing and is therefore seldom used. In some versions of this charger the battery voltage is sensed and the charger switches off and on depending on battery condition. The resulting charge profile is shown in Figure 2.

In the constant potential mode a charger operates at a predetermined voltage that is low enough to allow the battery voltage to come to that level with minimal gassing. Usually these chargers employ a current limiting design that allows the substantially discharged battery to be recharged in 10 to 20 hours. The benefit of this charging method is that the current automatically tapers to near zero as the battery comes to full charge. This is shown in Figure 3.

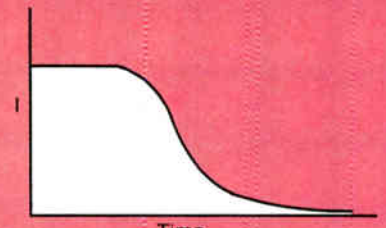
Since the temperature of a battery is usually dependent on the immediate environment that surrounds the battery and also affects its charge and discharge parameters, this variable must be considered when designing a charge circuit. If the compartment containing the battery also contains substantial heat sources, such as large transformers, this may be beneficial when the surrounding ambient temperature is below freezing but could be harmful when the ambient conditions are substantially higher than room temperature.

Figure 2: Value of I (current)*



*Depends on charger design

Figure 3: Current (I) tapers near zero at full charge



Lead acid batteries are generally "happy" when operating between 0° C and 30° C. When temperatures change substantially, such as might be encountered in an outdoor environment, special care must be taken. Since the objective of all charging systems for float applications is to minimize water loss (gassing) from the battery and maintain the battery at the optimum state of charge, it is necessary to adjust the charge voltage at different temperatures to the requirements of the particular battery employed. The manufacturer recommends specific charge and float voltages at various temperatures. Figure 4 shows typical temperature compensation curves for the three types of lead acid batteries discussed.

Examining the charge characteristic of the flooded electrolyte cell in the context of a UPS system utilizing a 36 V battery (18 cells) shows how a proposed charging system might perform at varying temperatures. This is shown in Figure 5. As is evident from Figure 5, an infinite family of curves exists between operational limits of the charger and batteries.

In some cases chargers provide temperature compensation but that is the extent of current technology. Several of the following questions arise:

1) What happens if a cell shorts?
2) How does the system deal with low-level current leaks?
3) What if sulfation-related charge problems develop?
4) How does the charger deal with high resistance contacts?
5) When a battery loses capacity, how will the user know?

In our example of the 36 V battery pack consisting of 18 cells of the proper rating connected in series, it is unlikely that all 18 cells of the three batteries will have identical characteristics or float life conditions. Existing chargers look only at overall battery voltage and are thus ignorant of battery conditions except in a very broad sense. The result in real life is that all too often UPS systems lack the "P" when it comes time to deliver, or are a built-in marketing tool for battery companies. Often one sees cabinets corroded by acid, wiring eaten, explosion hazards, bulged batteries, leaking posts and terminations, and erratic non-uniform cell and battery voltages or even a dead battery in a string of apparently healthy ones. In many cases the problem originated with the charging circuit.

Now we will briefly look in some detail at a typical problem of the many that might be chosen: a low-level short in one cell or between two cells. The reasons for this problem are many and may develop shortly after the battery is placed into service. Our typical charging system, even a constant-potential taper current temperature compensated one, will charge the cell string according to the voltage it senses. Considering that the low-level leak or short will depress the cell voltage of the affected cell by a few mV initially and that it represents a concentration in the otherwise uniform potential gradient, leads us to the conclusion that charging this cell will aggravate the problem. Obviously the stage is set to generate a full-fledged short capable of carrying substantial current.

Since our charger is designed to produce, say, 2.3 V at room temperature, when multiplying by 18 cells we have the following:

$$2.3 \text{ V per cell} \times 18 \text{ cells} = 41.4 \text{ V}$$

But because of the short we now only have a 17-cell battery. So:

$$\frac{41.4 \text{ V}}{17 \text{ cells}} = 2.44 \text{ V per cell}$$

(Continued on page 76)

CATV and ham radio

By Steven C. Johnson, NØAYE
Senior CATV Project Engineer
American Television and Communications Corp.

In the late '70s and early '80s, cable TV and ham radio operators were sometimes like the United States and the Soviet Union in Cold War. Cable systems leaked signal and were more prone to ingress during the early days of midband use and the ham operators were being blamed for the interference. Some cable operators thought the hams should just change to another frequency band to eliminate the ingress problems. The hams thought the cable operators should vacate Ch. E to solve the problem. In fact, the ARRL (American Radio Relay League) petitioned the FCC to require cable to vacate the channel.

Lately, like the U.S. and Soviet friction, the CATV/ham cold war appears to be calming down. The NCTA Engineering ARRL subcommittee, headed by Bob Dickinson, reports very little recent conflict. This may be partly due to cable's increased emphasis on signal leakage correction. Not only has the conflict been reduçed, NCTA and ARRL comments to the FCC were actually on the same side of recent arguments: the A/B switch isolation requirements, TV Answer, Part 15 rules revisions and converter leakage specifications.

Hams in the cable industry are coming out of the woodwork (see accompanying list) and include such industry notables as Wendell Bailey, Walt Ciciora, Bob Luff and Steve Raimondi.

ATC amateur radio clubs

Dave Pangrac (WAØRNP), ATC's director of engineering and technology, is responsible for organizing the first ATC amateur radio club in the ATC/TCI-owned Kansas City division. Pangrac found that having employees who were interested in amateur radio provided several advantages to the cable system (see "Ham radio and cable," by Dave Pangrac, *CT*, December 1987, pg. 80).

The primary motivation was to promote technical training. Employees who were amateur radio enthusiasts were learning RF theory through hands-on operation of transmitting and receiving equipment. The newly acquired knowledge could be applied on the job in troubleshooting, signal leakage detection and location, antenna theory, shielding and isolation, etc.

Bob Sullivan

Second, having the club greatly improved relations between the other local hams and the cable company. Now the company was no longer a faceless entity but an organization of living, breathing human beings the local hams knew by first name. The cable company became friend instead of fiend, especially when bucket trucks and generators were made available for Field Day (an annual simulated emergency operation).

The third advantage was in the area of signal leakage. Now that local hams had a friend in the cable business, they called ATC employees to report locations of cable leakage. Leaks could be identified and fixed more quickly. The employees who got involved in hidden ham radio transmitter hunts learned new skills that could be applied to locating leaks.

When Pangrac moved to the corporate office in Denver, he helped ham operators there start a club. Code classes were held before work and at lunch for those interested. Raleigh Stelle (NYØY), now vice president of engineering of ATC's Austin, Texas, division, surprised the local amateur radio examiners one Saturday morning when he successfully passed all five license level exams in one sitting in addition to the 20 word per minute Morse code test.

A station was set up to allow the licensed hams to operate from the office before and after work, and during lunch. The station first consisted of an HF transceiver and vertical antenna. It was later followed by a 2 meter (144-148 MHz) FM voice rig and packet (digital communications) setup.

ATC's National Training Center already had an active station led by Al Dawkins (KØFRP). Dawkins is a high speed CW (Morse code) operator and has contacted 287 countries to date. During a recent amateur radio sweepstakes contest, he took fourth place in CW and second in phone (voice) for the nation. His ham radio background also has proven useful in teaching RF theory and troubleshooting to students at ATC's National Training Center. Dennis Musser (KA5GTM), technical instructor, is a recent addition to the training center from Cox Cable in Oklahoma City.

The ATC Denver Amateur Radio Club took part in early amateur TV (ATV) experiments (what better mode for cable people to operate) with hams from Jones Intercable (Ron Hranac, NØIVN; Doug Greene, NQ91; and Bob Luff, W3GAC) in March 1988. Hranac later continued work in ATV and helped found a local club, the Western Vision Network.

The ATC Denver station includes packet radio (data transmission) capability. The station acts as a mailbox (sort of a miniature electronic bulletin board) with the ID of ATC and as a relay node for all local operators to use under the call of NØAYE-2. This station was used to assist the Red Cross in passing messages from the Denver area into San Francisco during the 1989 earthquake. Although it was not put into service during Hurricane Hugo, it was standing by ready to help out with any emergency communications if necessary.

The ACKC ARC (American Cablevision of Kansas City Amateur Radio Club) has the distinction of being ATC's first official amateur radio club. The club station was set up in ACKC's engineering office. Now that Pangrac has left, the station is in the capable hands of Noel Scott (KAØTWQ), Don Gall (NØCPN) and Alan Tschirner (KAØTQH), among others. ACKC also provides tower space for amateur repeaters (relay points) in the 145, 220 and 440 MHz amateur bands and an amateur TV repeater. All have been operating without interference to the cable system.

The Oceanic division operates a club station from its office in Honolulu. Kit Beuret (KH6JDE), the division public affairs director, is the chief operator of this club. Presently, the club has eight licensees. Beuret and I recently had a 10 meter (28 MHz) communication between Denver and Honolulu and there is talk of a routine schedule for an industrywide CATV/amateur radio net meeting. In six months the club has contacted all 50 states and 30 countries. As public affairs director, Beuret keeps the rest of the company updated on the club's activities through ATC's *In-Sync* magazine. →

Our Memphis division turned an interference problem around and made allies of the local hams. A 2 meter amateur repeater showed up on 145.25 MHz (Ch. E's video carrier) and also picked up signal leakage at various spots around the city. The system voluntarily offset Ch. E while they corrected the problems and everyone was happy. The local hams later began calling in leakage problems they found, greatly assisting the system with its signal leakage program.

The Albany, N.Y., division has had similar success stories with signal leakage problems, according to Bill Kosek (WA2KXY). Another way they have helped public relations is through donations of scrap cable from ends of reels. These 100- to 200-foot lengths of trunk and feeder cable that are usually thrown away can benefit amateur operators. Retired mobile radios can be salvaged as well. Local ham John Butts (N2JUG) and Richie Hahn (KA2FXH) operate from Manhattan Cablevision in New York. A 10 meter vertical is in place atop the 11 story office building in lower Manhattan. Operation is temporary at this time with no permanent station assembled. Presently, operation is from Butts' desk after normal business hours.

Some CATV vendors have ham clubs as well. Scientific-Atlanta has a very active club at its headquarters in Atlanta, with over 100 amateur licensees among the employees. President Steve Idler (KA9UIE) reports that the club has equipment to operate most of the amateur radio frequency spectrum including HF, VHF, UHF, satellite and packet radio. Pioneer also has an active club including some amateur TV activity, and Magnavox and Jerrold have quite a few hams among their employees as well.

A cooperative effort

By Ron Hranac

A group of Denver-area ham operators has worked closely with the cable industry to establish a relationship that resulted in an amateur TV communications system used to provide live video of severe storm activity to the National Weather Service. What is unique about the communications system is that much of it was put together with equipment donated by various CATV manufacturers.

The heart of the system is a TV repeater that receives NTSC transmissions in the 70 cm amateur band and retransmits them in the 23 cm amateur band. Situated on Lookout Mountain west of Denver, the repeater provides TV communications coverage as far away as Loveland, Colo. Hams active in this mode of communications connect their camcorders or other video sources to a 426.25 MHz transmitter and, with anywhere from about 1-40 W and a directional antenna, send their pictures and sound to the repeater. The signal is converted to 1,253.25 MHz and retransmitted through an omnidirectional antenna, delivering near-broadcast quality TV communications.

When severe weather is imminent, the NWS activates its 23 cm receiver. Hams trained in storm spotting load portable equipment into their vehicles and set up at safe observation points where live video of cloud formations and storm activity can be relayed through the repeater to the NWS. During more pleasant weather, the group provides public service and safety communications for events such as parades, marathons and various civic activities.

Much of the repeater itself consists of modified or custom-built CATV (or related) equipment. The 70 cm receive antenna is a Lindsay low power TV UHF antenna engineered for use on 426.25 MHz. The download is conventional .750 trunk cable and the input bandpass filter is one of Microwave Filter Co.'s 4930 hyperband series. The repeater's receiver is a Scientific-Atlanta 6250 headend demodulator, and a modified DX Communications DSM-160 headend modulator is slated for use as a 1,257.75 MHz aural exciter (to replace the existing ham transmitter).

Prior to activating the repeater, the group experimented with simplex TV transmissions to 70 cm, using S-A and DX modulators as signal sources, a Jerrold line extender modified for 1.3 W output, and Panasonic and S-A converters for receivers. One milestone was the first documented BTSC stereo audio transmission in the ham bands, sending voice on the right channel, Morse code on the left channel and live video of the event.

In operation for about a year now, the repeater would not have been possible except for the generosity of the following companies and the equipment they donated: Andrew Corp. (heliax and connectors), DX Communications (two DSM-160 modulators), Gilbert Engineering (miscellaneous connectors), Jerrold (XQLE Quadrapower line extender), Jones Intercable (Comm/Scope .750 cable, use of lab and test equipment, miscellaneous jumpers and connectors, Lindsay LPI power inserter, Lectro 60 VAC power supply), Leaming Industries (AGC-432 audio AGC), Lindsay Specialty Products (TZU LPTV antenna), Microwave Filter Co. (4930 bandpass filter), Panasonic (converters), Scientific-Atlanta (converters, 6350 modulator, 6250 demodulator), Tektronix (video test signal generator).

Use of amateur radio

It's important to remember that while amateur radio can be used for signal leakage detection, its purpose for two-way communication is emergency communication and support in addition to hobby-type communication. FCC rules prohibit any business or commercial use of amateur radio. Amateur communication should *not* be used as a supplement to or instead of your system's business radio.

The cold war is over! Many cable people are finding amateur radio to be an interesting hobby with benefits carrying over into the workplace. Involvement in amateur radio can lead to local allies in signal leakage control and have a positive effect on public relations. Technical training, creative experimentation and motivation are other side benefits and above all, it's fun!

This year at the SCTE Cable-Tec Expo, Scientific-Atlanta's ham radio club will be hosting the second annual Cable-Tec Expo ham radio reception Saturday night, 5-7 p.m. Hams and would-be hams are all welcome to attend.

If you are not presently a ham radio operator and would like to be, contact one of your friends from the accompanying list for more information about getting involved in ham radio. Or contact the ARRL at 225 Main St., Newington, Conn. 06111, (203) 666-1541.

(Continued on page 78)

The Society of Cable Television Engineers: 21 years of service

By Howard B. Whitman
Manager-Editorial and Promotion, SCTE

The Society of Cable Television Engineers, an organization that has provided technical training to the cable television industry for 21 years, originated with the thoughts and words of one forward-thinking individual.

In an editorial in the November 1968 edition of *Cablecasting* magazine, Charles Tepfer wrote of how cable system engineers were not receiving sufficient recognition or attention. William Karnes of National Trans-Video responded to this piece through a letter stating that system engineers should be acknowledged for their valuable contribution to the young and growing cable TV industry. This suggestion drew resounding support from others in the industry, resulting in *Cablecasting*'s publication of an application for membership in the newly named Society of Cable Television Engineers.

On June 22, 1969, the fledgling Society held its first general meeting in conjunction with the National Cable Television Association's convention. Seventy-nine people, today recognized as charter members of the Soicety, were in attendance. Elections for officers were held at this meeting, which also saw the presentation of the temporary bylaws that would evolve into the national bylaws observed by the Society to this day. To facilitate the establishment of local chapters throughout the country, 11 regions were identified.

At that first meeting, Ronald Cotten of Concord TV Cable suggested that the Society incorporate as a non-profit association. This incorporation also would extend to the regional chapters. The group elected as its temporary officers Ronald Cotten (president), William Karnes (vice president) and Charles Tepfer (secretary/treasurer). Karnes moved that a temporary board of directors be constituted of the three officers and the regional chairmen until a permanent board could be elected by the membership.

The organization of local chapters began in 1970, but was delayed by difficulties with correspondence, dues and miscommunication. It is interesting to note that SCTE was perceived by some as having the hidden purpose of unionizing all technical personnel in the industry. The industry also voiced its concerns that there were no standards established for admission to the Society. These concerns ultimately led to the establishment of the Society's entrance requirements.

Bill Karnes was elected president in 1971, and Austin Coryell served as vice president. The Society again met in conjunction with the NCTA show, this time in July of that year in Washington, D.C. Approximately 110 members were in attendance, but the Society's total membership was over 500 at this point. The development of a certification program remained an important concern to the membership, which grew to 675 in 1972.

"Dedication and belief in the professional development of industry technical personnel...has enabled the Society to achieve its goals."

A prestigious boost

SCTE had gained additional prestige in the industry by 1973, the year in which it was invited to participate in the NCTA's presentation of Outstanding Achievement Awards. The year's new officers included Bob Bilodeau (president), Steven Dourdoufis (Eastern vice president), Robert Cowart (Western vice president) and Charles Tepfer (secretary/treasurer). Bilodeau guided a national membership drive aimed at more experienced CATV personnel.

LRC Electronics became the first sustaining (corporate) member of the Society in 1974. Sustaining membership has since served as a means of allowing individual organizations to show their support of the Society through annual financial contributions.

That year also saw a surge in interest in the Society. As membership neared the 1,000 mark, local chapters were revita-

(Continued on page 82)

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Reader Service Number 29.

Off-air antennas: Part 2

This is the second of a three-part series on understanding off-air antennas.

By Ron Hranac

One of the simplest antennas used in practical applications—and as part of more complex antennas—is the dipole antenna. Also known as a doublet, a dipole usually has an electrical length of one-half wavelength at its resonant frequency. Most dipoles are physically shorter than their respective free space half wavelength because of the following: 1) end effect, or the capacitance at the ends of the antenna's elements due to the presence of insulators or support wires and 2) the free space wavelength-to-diameter ratio of the antenna's elements. The latter affects antennas most at VHF and above because dipoles at those frequencies seldom have end insulators or supports.

A dipole antenna is normally center-fed; that is, the antenna is divided into two elements at its center and the transmission line (or downlead) is connected to those elements (see Figure 1). The free space gain of a dipole is 2.14 dBi and its impedance is about 73 ohms. As well, a dipole is somewhat directional, with maximum radiation perpendicular to the antenna elements and minimum radiation (or nulls) off the ends of the elements. In practice, the proximity of a dipole to the ground and other objects will alter its gain, impedance and directional characteristics. Dipoles by their nature are narrow bandwidth antennas.

One common variation of the half wave dipole is a folded dipole. Offering more bandwidth than a conventional dipole, as well as a higher impedance (typically around 300 ohms), folded dipoles have a parallel element that is not broken at the center and is connected to the ends of the dipole's primary elements (see Figure 2). Otherwise, a folded dipole has the same performance and operating characteristics as an ordinary dipole.

A common use for a dipole in CATV is for signal leakage and CLI measurements. Perhaps even more common but less obvious is the use of a dipole as the driven element of a multielement array such as a yagi (sometimes called a Yagi-Uda antenna, named after its inventors).

Figure 1: Half wave dipole

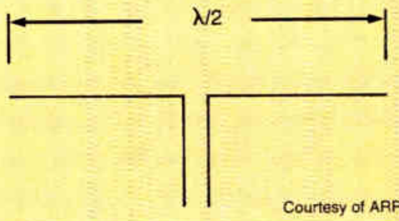


Figure 2: Folded half wave dipole

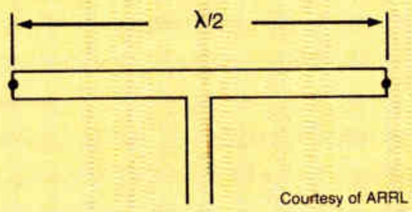


Figure 3: Four element yagi—the maximum signal strength is in the direction of the arrow

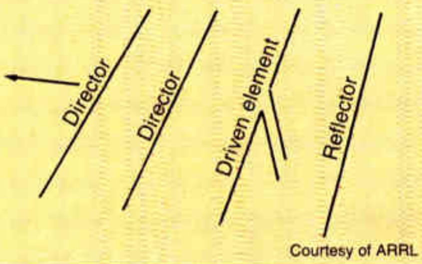
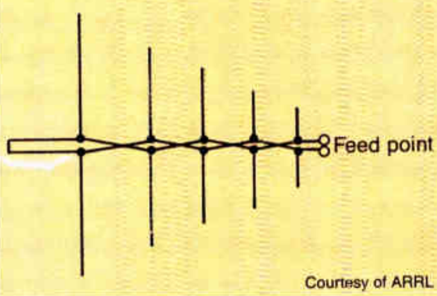


Figure 4: Basic log periodic dipole array—maximum signal strength is off of the feed point end



A yagi is a directive gain antenna that has a dipole as its driven or active element and parasitic elements that may include a reflector and one or more director elements (see Figure 3). Parasitic elements are not directly connected to the driven element or the transmission line, but instead are powered by close-proximity coupling to the driven element.

In most applications, a yagi antenna is relatively unidirectional, favoring optimum performance in one direction only. Generally, the more elements a yagi has—and consequently the longer it is—the higher its gain and narrower its beamwidth. Yagis also can have very good front-to-back ratios. One trade-off for this performance though is fairly narrow bandwidth. CATV yagis are usually designed as single-channel antennas, with gain figures in the 10 to 16 dBi range.

When wideband performance is desired, a log periodic antenna is often the antenna of choice. A log periodic is a system of driven elements and is frequency independent in that its electrical properties vary periodically with the logarithm of the frequency. This provides essentially constant characteristics over its designed frequency range, which can be quite broad.

Several varieties of log periodic antennas are available, including the zig-zag, planar, trapezoidal, slot, V and dipole. The log periodic dipole array as shown in Figure 4—or LPDA—is commonly used in CATV as a wideband single-channel, low-band VHF, high-band VHF or UHF broadband antenna. Like the yagi, an LPDA is unidirectional; it has moderately good gain and front-to-back ratio. However, its favored characteristic is its broadband capability. Typical gain figures are 8 to 12 dBi.

When very high gain and narrow beamwidth are needed—especially at UHF frequencies and above—parabolic antennas are used. This antenna gets its name from the shape of its reflector, which is a curved surface that is part of a parabola. Occasionally used for high gain UHF applications, parabolic designs are perhaps most familiar in CATV as satellite dishes and to a lesser degree as antennas for AML and FML microwave. Gain figures as high as 40 to 50 dBi are not uncommon, particularly at microwave frequencies.

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AMLs and CLI

(Continued from page 31)

A pilot tone channel need only be added to the transmitter at the transmitter site. In the case of a Hughes Model STX-141, a pilot tone transmitter is used. With a Model MTX-132 a channel kit is used and if all bays are full a frequency agile upconverter (the Model AUPC-135) may be substituted. This arrangement will also provide a backup for any upconverter that may fail. Pilot tones are provided with all broadband transmitters so all such systems except those using FM video are shipped as phase-locked systems.

A good investment

Over the years our industry has seen fewer composite AGC systems and more and more phase-lock systems. While the reasons are many, the overriding consideration usually has been improved picture quality. The difference in cost between the two approaches is very small and with the push for CLI compliance a phase-lock system may be one of the best available investments, especially when the alternative is often to run only a 12-channel system. For more information you may request the *Hughes Servicer Bulletin #36 on AML Frequency Stability.* It provides an in-depth look at the operation of composite AGC/non-phase-locked systems.

One additional benefit of an AML system is that each hub site can be considered its own system, at least for the purposes of CLI when using aeronautical frequencies in systems having levels of +38.75 dBmV or more. An AML system user may elect to view each receive site as a separate system since AML systems do *not* provide a hard wire for transportation of signal between the headend and local system at the aeronautical frequencies. (This is a touchy issue with the FCC. In systems where the hub sites are physically separated—for example, non-contiguous communities—each hub site may be treated as if it were a separate system. In cases where the hub sites only partially touch or overlap the call is up to the system operator. But for situations where a large metropolitan-type system has been broken up into smaller hub sites with AML, the entire system must be treated as a single system for the purposes of CLI. Since the AML is phase-coherent—assuming the use of phase-locked receivers—and the metropolitan hub sites form in effect one large contiguous network, the FCC views such a situation as a single system.—Ed.)

Further, eliminating long dry trunk runs with AML will reduce the plant mileage. Not only will there be greater reliability and less maintenance but due to the reduction in plant mileage the CLI pass number of 64 may be easier to meet using the following formula:

$$CLI = 10\log_{10}[(\text{plant miles}/\text{miles monitored}) \times (\text{sum of leaks})^2]$$

Unfortunately, an AML system will not make all your CLI problems disappear. Poorly maintained systems may still present significant problems but a properly maintained system will allow for much easier compliance than will systems that interconnect with cable.

The compliance deadline of July 1, 1990, is rapidly approaching. Don't wait until the last minute. A well-built and properly maintained system should have very little problem complying, so don't put off until July 2, 1990, what should have been done five years ago.


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Reader Service Number 32.

Radiation and ingress

(Continued from page 37)

tween leakage and ingress. They are not the inverse of one another and a system that may be clean from leakage may still have problems with ingress. Ingress performance as such is not defined in the United Kingdom but the quality of signals delivered to the customer is defined by British Standard BS6513. This standard is mandatory in that it forms part of the franchise conditions for a system.

In this standard the maximum interfering level of single frequency interference is specified as 57 dB below the vision carrier voltage in the most sensitive parts of the video spectrum. The degree of protection required is specified by the "W" protection curves published in the International Electrotechnical Commission (IEC) standard IEC 728. This curve gives some relaxation in less critical parts of the video spectrum.

The protection given depends on the transmission system used so that separate curves are published for PAL, NTSC and SECAM standards. The general shape of the PAL I curve is shown in Figure 1. The curves are of particular importance when considering spurious signals that may be generated within the cable system as well as for ingress performance. These parameters therefore in effect define the ingress performance of the system as a whole. The apportioning of ingress performance requirements to the individual component parts of the system, however, remains the responsibility of the system designer.

Consider a customer sitting next to a high power transmitter or a mobile station passing the front door (see Figure 2). The field strength from the transmitter might be, say, 120 dBμV/m (1 V/m) at 150 MHz. If the signal level delivered to the customer is 0 dBmV (the U.K. minimum) the screening factor of the cable feed to the home needs to be 110 dB. This is calculated in the following:

Signal level from a dipole = V
Electrical field strength V/m = E

$$V = \frac{E\lambda}{2\pi} \qquad \text{For } f = 150\text{ MHz } \lambda = 2\text{ m}$$

Therefore:

$$V = \frac{E}{\pi} = E - 10\text{ dB}$$

The calculation assumes that the system being interfered with is a resonant dipole, which is a fair assumption since any cable will act as a number of half wave resonators.

On the other hand, leakage problems are going to show up most in high level parts of the system, amplifier outputs, for example where the ingress can be 30 or 40 dB greater to give a specific level of interference on the cable system. The ingress performance at the input to an amplifier, however, is critical as any signal induced at the input will be amplified by the same amount as the signal.

Our method used to ensure that the system is leakage-tight and ingress-proof is to check out each item of equipment used in the system on an open field site as described in the second part of this article and ensure that field staff are adequately trained in installation techniques. A further check is then made on the overall system performance during the commissioning period and thereafter performance is monitored by field maintenance staff using fairly simple equipment. If a problem is spotted, then more experienced staff investigate the problem in depth.


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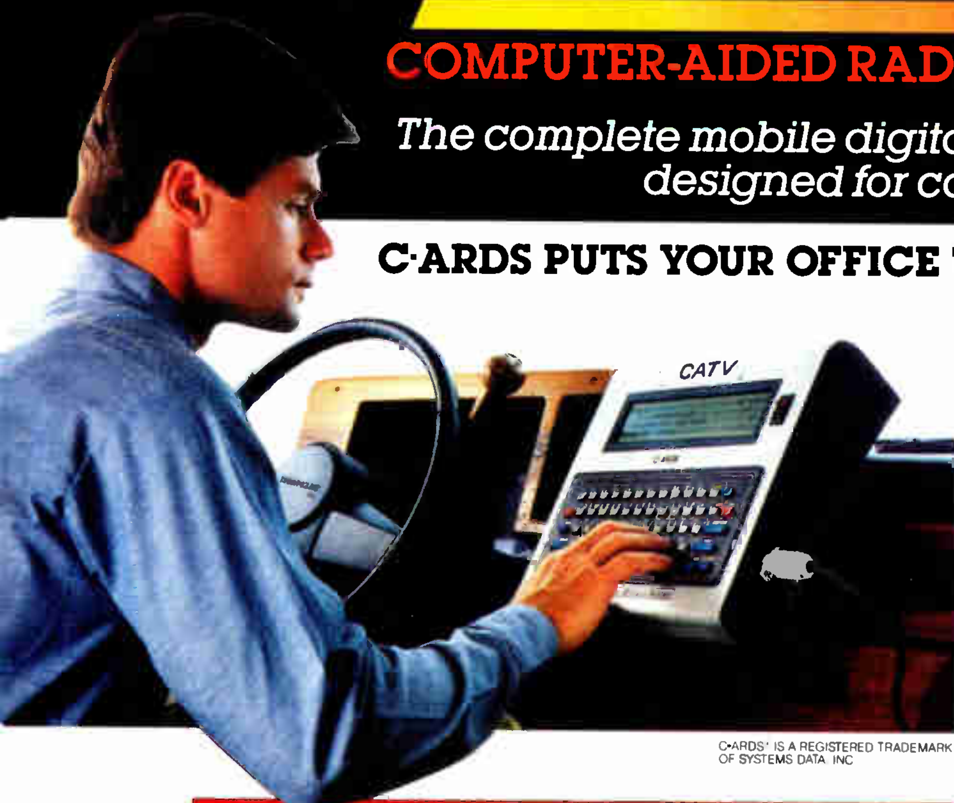

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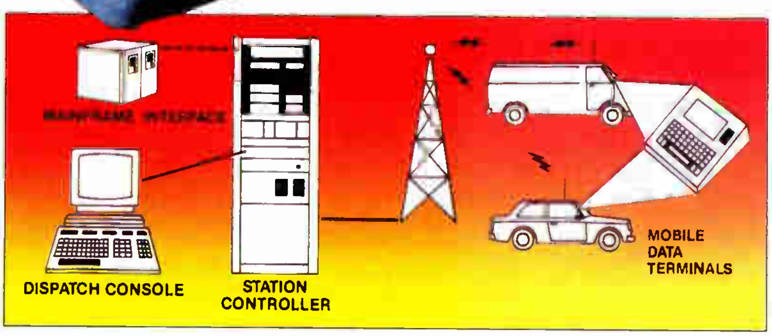

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Reader Service Number 40.

Equipment reliability

(Continued from page 38)

tions, but it can cause loss of signal strength and permit the RF to radiate from the connector. What might seem like insignificant leakage from a single connector can multiply when a whole community is involved to levels that can not only cause a problem with antenna-based TV reception, but (because of rectification effects in the same connectors) cause general RF interference that can disrupt air-traffic control and navigation equipment and endanger human lives.

The problem for many service departments is increased by the sheer number of connectors used in a typical CATV system. Combine this with the wide diversity of corrosion-causing atmospheric pollutants that range from acidic fumes to salt deposits (not a few of which are caused by the salt used on roads that run alongside the CATV cables) and the result is a serious problem in long-term reliability.

While every CATV system seems to have a few unusual problems caused by the disparity of atmospheric pollutants, it is safe to generalize. Corrosion of the ground or outer contact not only results in a poor contact with signal loss, but it causes an impedance discontinuity and allows the RF signal to radiate from the outer conductor of the cable. Most corrosion products themselves exhibit rather non-linear electrical characteristics right up to outright rectification. This rectification component results in a host of other frequencies being generated that frequently interfere with other radio services.

Contact cleaners often provide a temporary solution to these problems. The use of silicone sealants (and in some cases shrinkable tubing, which by limiting or preventing water entry can reduce the degree of corrosion) can extend the useful life of a connector. But the problem with cleaners is that they have to be used on a regular basis and silicones can often cross-link to produce glassy films, which themselves are a source of connector malfunction.

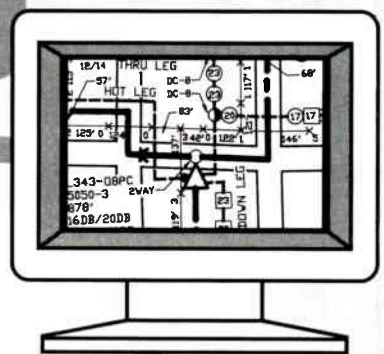
How it works

When Stabilant 22 is applied to a connector it acts in several ways. It has a strong detergent action while being somewhat low in water solubility. Thus, it will often lift corrosion and contaminant films from a contact surface, holding it in suspension. By its very presence in the interstices of a contact pair it provides a barrier against the entry of contaminants. In addition it exhibits thin film semiconductor activity in film thicknesses that are a couple of orders of magnitude thicker than the normal electron tunneling effects present in most of the oils. The result of the latter is that the presence of an electrical field will cause the film to conduct. The switching gradient required to trigger this state is large enough that the material will not "turn on" between adjacent pins and therefore won't short out a coax connector. With good chemical stability and very low vapor pressure it rarely has to be reapplied unless the corrosion or contaminant load from a very dirty connector is too much for the available film thickness to hold in suspension. In addition (as noted before) it's very low in toxicity.

We had numerous favorable reports on the use of Stabilant 22 in all phases of CATV operations from headends to customer taps. In the former, it made a number of antenna systems perform to specification often raising the signal level by 6 to 10 dB. It shocked many engineers to find out just how dependent they are on the connections at the headend and even new equipment can usually be improved. In customer tap service it stops a lot of expensive truck rolls, especially in areas where corrosion is a problem. Used on distribution systems, it not only cleans up the signal but reduces the RF leakage caused by poor ground continuity.

The material comes in two forms: diluted 4 to 1 with isopropanol as Stabilant 22A and as the concentrate (Stabilant 22). The isopropanol is used as a thinner to allow the expensive concentrate to be spread out as much as possible and only a thin film is necessary. The concentrate is used in locations where lubrication is needed as much as reliability.

Because the material will not short out a connector, application is as simple as putting a couple of drops of Stabilant 22A on the outer and inner conductor of the coax connector, dribbling some along the pins of a socketed IC (you don't even have to remove it from the socket!) or smearing several drops along a card edge connector. It's about as an unsophisticated process as you could imagine. In fact it's fast enough that in many computer applications every single contact can be treated in less time than it takes to run a diagnostic program and many times it cures the problems and prevents them from recurring. With a very low vapor pressure the only loss will be due to physical removal of the material. Because of these characteristics an increasing amount of this product is being used to reduce RF leakage and increase performance and reliability in CATV systems.



Amplifier upgrading

(Continued from page 46)

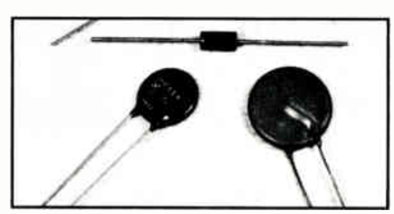
grounding practices can often solve equipment outages. Methods of grounding vary among cable operators, but a field-proven method involves grounding the pole before and after each amplifier. If a power company ground or telephone ground exists at any of these poles, run separate grounds and tie them together with separate ground rods. Some operators place a coil of loops between the ground rods to add impedance to the high frequency surges (see Figure 2). (Check local/state utility requirements before attempting this. Common bonds are required in most cases to eliminate differences of potential between grounds of various utilities.—Ed.)

Line extender mortality. After the use of proper grounding techniques, line extender failures may still exist. In some areas only the addition of an MOV (metal oxide variator) shown in Figure 3 of correct rating across the secondary winding of the line extender's transformer isolated power supply may reduce certain outages sufficiently. Line extender mortality in extreme failure locations may be improved by replacement of the line extender station itself with a manual trunk station of comparable gain utilizing a brute force power supply.

Thermal breakers. Trunk and feeder outage reliability problems can be decreased via the use of thermal breaker devices of sufficient capacity (not to exceed 80 percent of rated value) in place of the trunk line power inserter and sometimes bridger feeder fuses. Often the trunk through fuses are replaced with a very high current shorting bar device like the one in Figure 4 known as a "dummy" fuse. This little trick may help stop more than 80 percent of your system outages due to nuisance fuses blowing and actual amplifier outages.

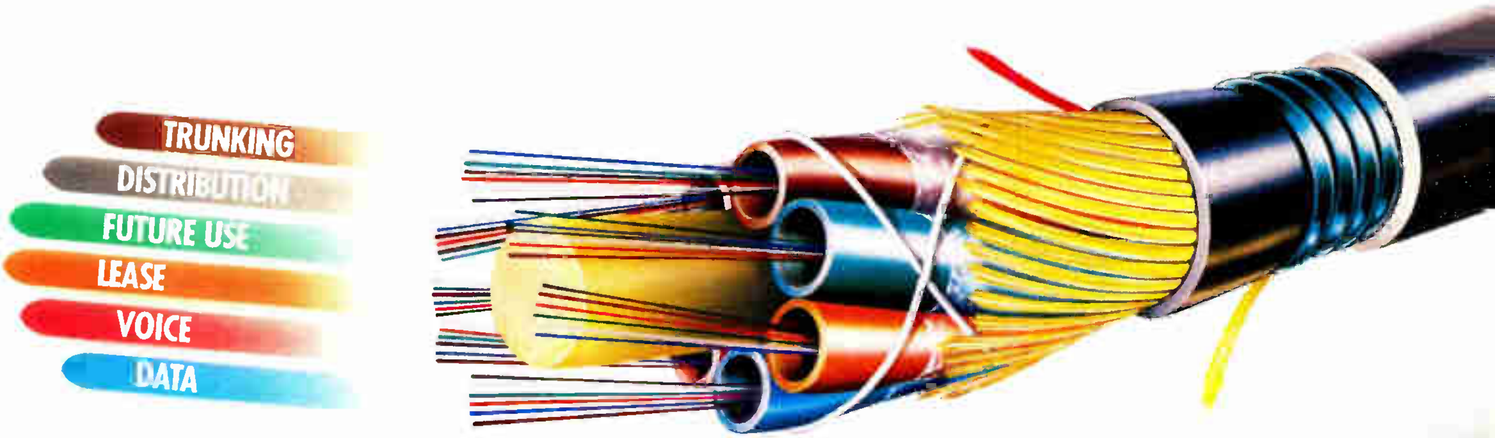
An after-market product we call the "Amazon fuse" or "Amazon breaker" (a thermal breaker and capacitor soldered

Figure 3: Metal oxide variator



Reader Service Number 45.

STAY IN THE LOOP WITH OPTICAL REACH FIBER OPTIC CABLE.



If you install a fiber cable with just enough fibers for your current needs, you may be short-circuiting your installation. Why? Because there are other revenue generators you could be running in the same cable right now if you had the spare fiber.

Think about some of the businesses and industry, financial or educational institutions or other commercial ventures you will be passing with your next fiber run. Companies who would love to have an alternative. And you could loop them in and lease them the space. Provided you have the fiber to spare.

Comm/Scope's Optical Reach™ has a multiple buffer tube and unique Reverse Oscillating Lay (ROL) design which makes it easy to access and identify spare fibers when the time comes to splice them in. Also, the cost of additional fibers is surprisingly low.

With Optical Reach, you will have the capacity to service all your communications needs today and tomorrow. So, do the right thing now and stay in the loop with the best choice in fiber cable.

For more information about Optical Reach or any of our fine cable products, contact your nearest Comm/Scope representative or call us at 800/982-1708.

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Comm/Scope, Inc., PO Box 1729, Hickory, NC 28602. Phone 800-982-1708. Fax: 704-328-3400. Telex 802-166

Reader Service Number 122.

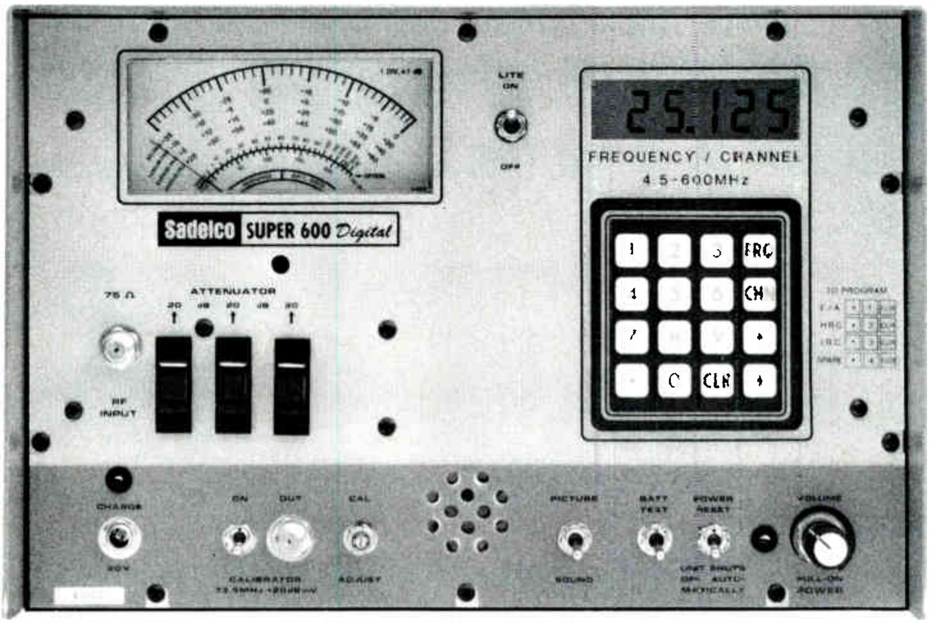

Figure 4: High current shorting bar device ("dummy fuse")

to a standard fuse body) was designed to replace the standard fuse links in areas of random fuse blowing. These Amazon breakers have been extremely useful in high lightning strike areas. Another useful fix for surge problems is the AmpClamp, a small circuit that is installed in line power inserters (see "In the good ol' summertime" by Roy Ehman, May 1989 *CT*.)

Gas discharge surge arresting devices. Gas discharge arrestors are notorious for causing system outages when no other reason for outage is apparent. These surge arresting devices are slow to act on a destructive surge of short duration and high level, and most continue to short (or fire) well after the surge condition has passed. Each firing incident serves to proportionately lower its own voltage rating as well. Many times a shorted gas tube leads to a burned printed circuit board. In many cases there are better methods to protect amplifiers than gas tubes with devices such as thermal current breakers, MOVs and DC surge protection TVPs (see Figure 5).

Fiber-optic rebuilds

Almost all of the fiber-optic budget considerations include the replacement of the plant active devices as well as the elimination of a large percentage of the copper plant. With the installment of reliable and high performance electronics, most of the active devices can and should be reused in the newly shortened cascades.

With these shortened cascades, such issues as flatness and AGC control can be more comfortably accommodated. Where a system may have had to tolerate a lesser reliable form of line extender in the feeder system, it can now substitute the offender with an upgraded manual trunk amplifier utilizing the far more reliable power pack.

Housings and baseplates (motherboards and connector chasses) that seem to cripple the plans of bandwidth expansion are in fact usable. The major limiting factor in the baseplate connector chassis

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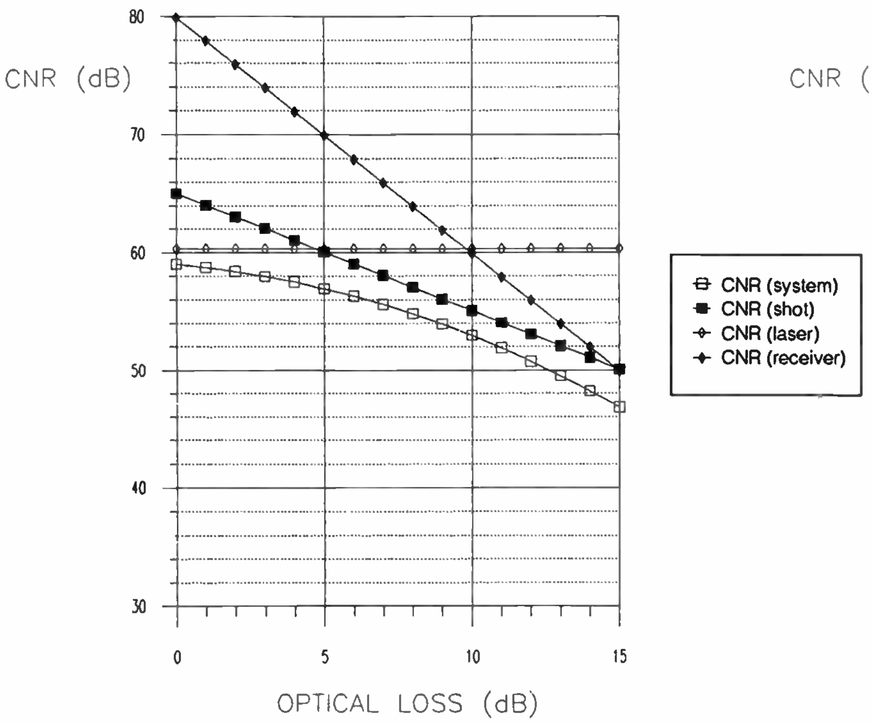
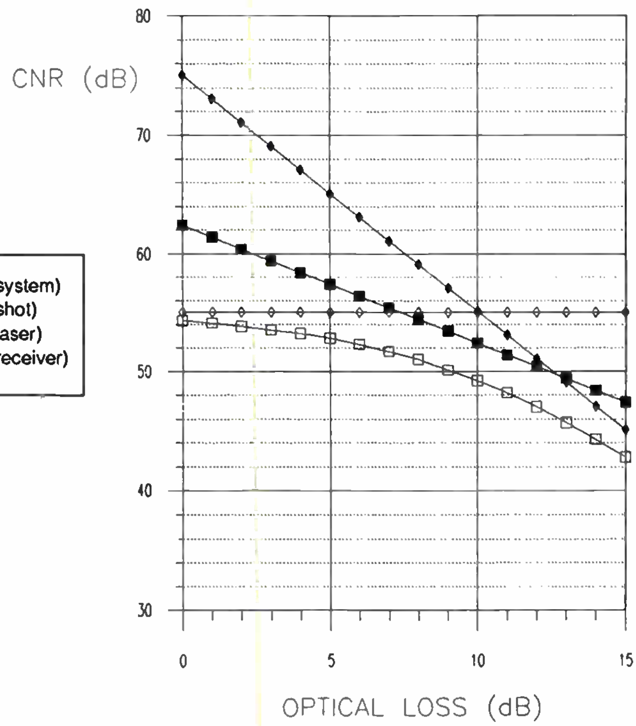
- High performance, long distance, 60 to 80 channels on 1 fiber
- Up to 40 channels on 1 fiber for shorter distances
- Economical, 16 to 20 channels on 1 fiber for rural systems



Model AM5000-80
60 Channel Performance (CW Carriers)



Model AM5000-40
40 Channel Performance (CW Carriers)

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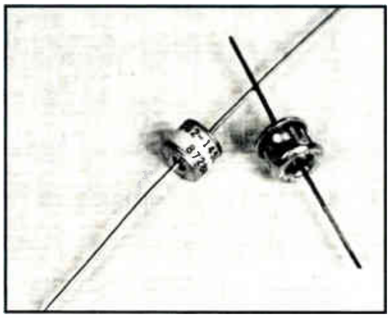
Figure 5: Surge protection devices



is the AC de-coupling chokes that are located in the input/output trunk ports and the feeder legs from the bridger output. Careful selection and use of these AC chokes that have a self resonance outside of the desired bandwidth will create the recovery of the needed return loss at the upper frequencies. The 300 MHz trunk station assemblies of yesterday can now be the 550 MHz fiber interface of tomorrow.

At what price?

The emerging technological developments must implement an increase in performance and reliability. But at what price and time frame? And worse yet, where is all of this money going to come from? Today's borrowing power is rapidly eroding partially because of the steeply accumulated debts vs. the falling market values in our industry. Are we now spending money to bury the technologies we heralded a decade ago? Have we now aligned ourselves to the same "fouls" we pointed at in our competitors with rate increases to subsidize the premature depreciation of the system plant?

The words may be sharp but the reality is equally harsh. Today's trends drive us to a frantic desire for a systemwide replacement. Through the fiber innovations, our purpose is to increase performance and reliability tenfold. There can be no doubt cast nor support denied for what is clearly needed in the way of technology for the future of our marketplace.

However, what is even more clear is the vast amounts of capital needed and the acutely short time frame that exists. Most likely, the largest percentage of performance shortcomings may be stemming from the fewest number of coaxial plant devices and locations. These field-proven procedures can be cost- and time-effectively implemented *now* in order to buy you the time required for adequate future needs.

Batteries and chargers

(Continued from page 49)

At 2.44 V per cell and room temperature we will be overcharging the battery and cause gassing. Moreover, since the culprit cell is in only one battery, we are in effect ruining the other two batteries through overcharging. Worse yet, the overcharge condition in the assembly generates heat that causes the battery to evolve gasses at a lower voltage, resulting in greater charge acceptance and thus more gas evolution, etc. In the end we have a dangerous situation with the charger literally killing the batteries. Bulged leaking cases and an explosion hazard are the typical outcome. What is the solution?

Energy management charging

What is energy management charging? *Intelligent charging!* It is the incorporation of a time-based energy monitoring system in a battery pack that calculates watt hours *in* and watt hours *out*. This means that all charging and discharging of the battery is done through the management system. The system incorporates a microprocessor that is specific to the battery type and manufacturer's recommendations, including temperature compensation for the charge voltage under all environmental conditions.

Benefits of this technology include:

1) Prevents overcharging under all conditions,
2) Stops thermal runaway,
3) Prevents gas build-up conditions,
4) Lengthens battery life by conserving electrolyte,
5) Alerts to undercharge or overcharge conditions caused by internal battery problems,
6) Ensures that back-up power supplies are ready when needed and
7) Full diagnostic output to allow inexperienced personnel to replace nonfunctioning batteries.

Figure 4: Combined temperature compensation graphs

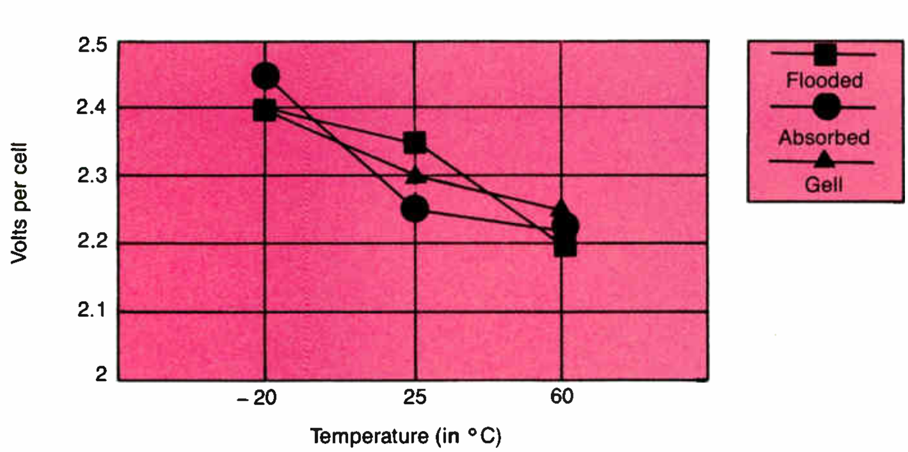
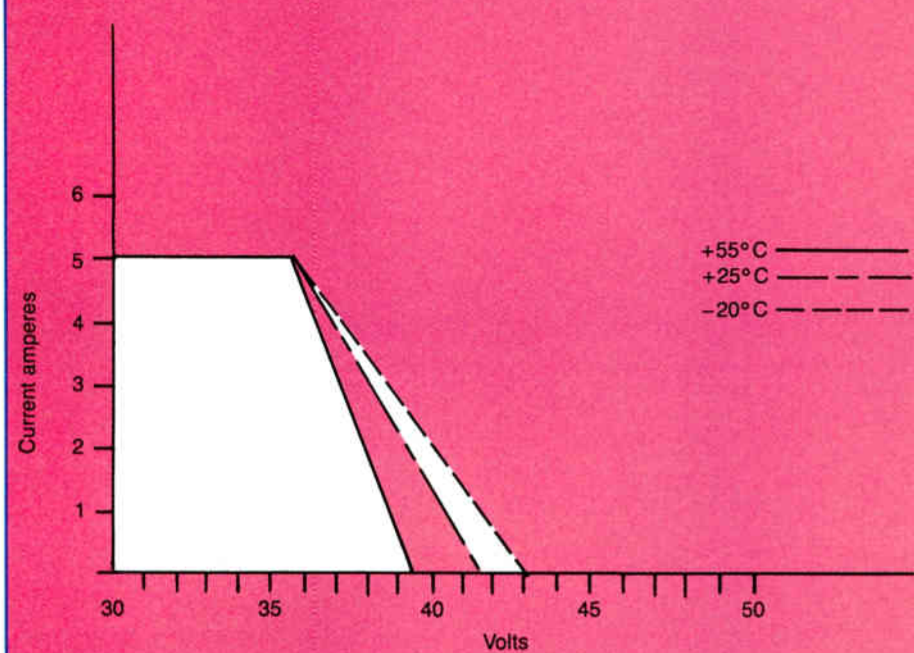


Figure 5: Charging characteristics for flooded lead acid batteries



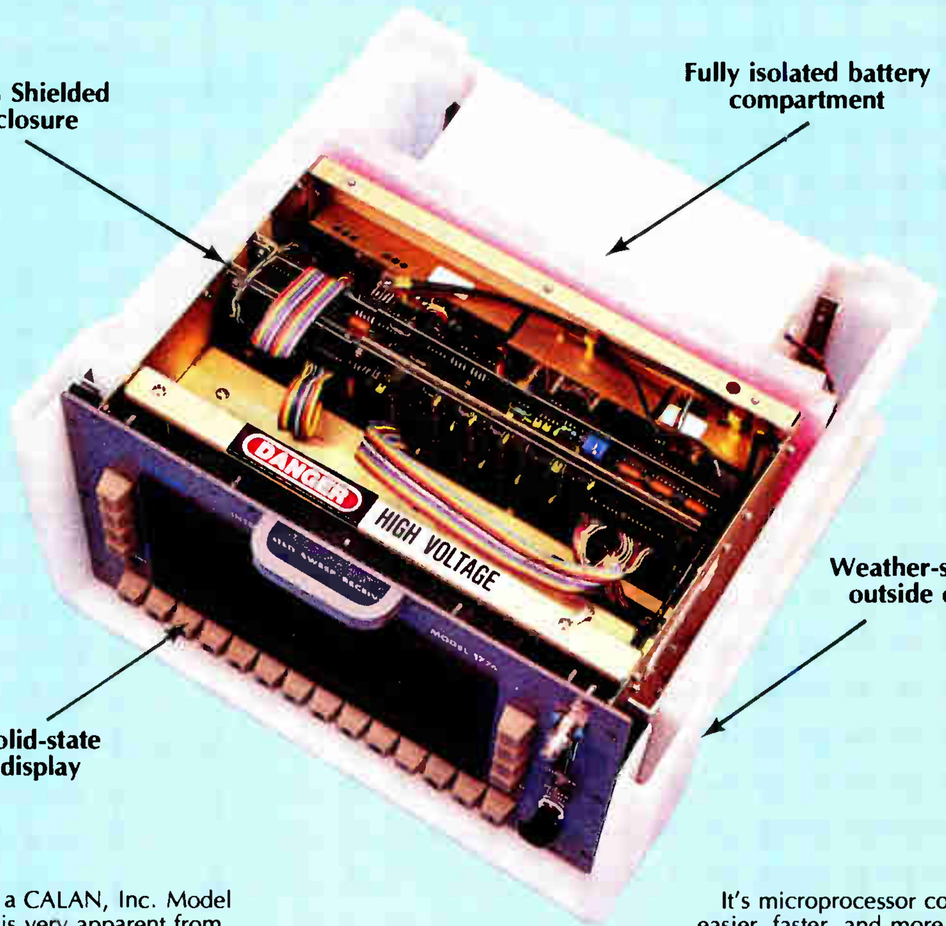
The energy management charging concept is a systems integration approach to batteries and their chargers. In virtually all applications the battery consists of a number of electrochemical units. For obvious reasons it is desirable to do all charge and discharge monitoring at the smallest electrochemical unit. In practice this usually means a 6- or 12-V battery. The charging system treats the entire battery as one unit even though the monitoring portion may treat the battery as many separate units. The basic concept is very simple: energy in = energy out – inefficiency. In most battery systems the charge inefficiency is only a few percent when the battery is being properly charged. Thus limits may be set that are quite accurate to tell the charging circuit what the maximum percentage overcharge may be before the battery voltage should come to acceptable levels and the current of the charger taper to the float condition.

Likewise, the charging condition of the battery may not change from its float parameters (properly temperature compensated) unless a discharge condition is encountered. By continuously measuring voltage and current and integrating these values over time, we can derive the watt-hours into and out of the battery.

From the self-discharge characteristics of a battery at various temperatures it is possible to derive a maximum safe charge current and thus the watt-hour energy budget that the battery needs to be at its design capacity. Therefore when the UPS battery is in its float mode and the charging circuit is called upon to deliver more energy than theoretically required, it will do so only for a very short time. If conditions do not return to what is expected, the system sets alarm flags that may be sent to a remote terminal. If the

(Continued on page 106)

The Inside Story on Reliability



Reliability built into a CALAN, Inc. Model 1776 Sweep Receiver is very apparent from the outside: the totally weather-sealed case; the ruggedized overall construction; the moisture-sealed key covers on the front panel.

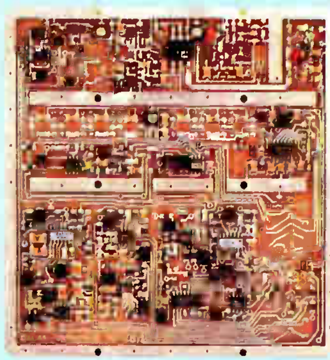
But what really makes this unique equipment reliable is on the ***inside***.

It's high-reliability components throughout the design, allowing incredible stability over temperature and humidity extremes.

It's complete RF shielding, allowing extended dynamic range for precise tests like Composite Triple Beat.

It's a solid-state Electro-Luminescent display, replacing the outdated CRTs.

It's new Surface-Mount RF Technology, making critical RF boards more reliable and more accurate than ever possible before. And a battery compartment that is totally isolated from the electronics, for absolute protection of the unit.



CALAN Surface-Mount RF Technology

It's microprocessor control, making testing easier, faster, and more accurate.

But all of these careful design criteria would be useless without the 75 years of CALAN engineering experience that went into the unit, making it the most reliable test equipment available today.

But if you ask a CALAN user, he'll most likely tell you that he hasn't seen the inside of his unit...just the outside, improving his system performance with no interference, and allowing more with his limited maintenance budget.

Maybe that's the **real** inside story.

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(Continued from page 52)

Ham operators in the CATV industry

The following is a list (in alphabetical order) of amateur radio operators employed in the CATV industry, compiled by Steve Johnson of American Television and Communications Corp.

Name	Call	Company	City, State	Modes
Acevedo, Nelson	KP4FEN	CATV Noroeste	San Antonio, Puerto Rico	SSB,FM,CW
Adams, Mark	KA4WCB	S-A	Atlanta, Ga.	
Adel Sr., John	W5RR	Precision	Richardson, Texas	SSB
Alexander, Gary	KE5BS	Post-Newsweek	Altus, Okla.	2FM,SSB
Allen, Fred	KA0YAE	UAE	New Hope, Minn.	FM,SSB, Newsletter?
Almeyda Jr., William	KN4BX	Prestige Cable	Cartersville, Ga.	CW,SSB,FM
Amos, Alan	KN1O	Jerrold	Stow, Mass.	
Andrews, David	N1ESK	Storer	New Haven, Conn.	2FM,10FM
Atkins, Gary	W0CGR	CSU Tech Service	Ft. Collins, Colo.	HF/CW
Bailey, Wendell	KC3BU	NCTA	Washington, D.C.	
Barnes, Richard	W4IXN	S-A	Atlanta, Ga.	
Barnhart, Bill	AA5HH	CADCO	Garland, Texas	SSB
Bartlett, Dave	N0CQC	UAE	Englewood, Colo.	
Baxter, Frank	K2ZLA	Cable Mgmt Svc	Schenectady, N.Y.	2FM,HF/SSB/CW
Beckham, Chuck	N4XZV	Voltex Batteries	Doraville, Ga.	VHF,HF
Beeman, Paul	KA2MUM	Viacom	Smithtown, N.Y.	
Bentley, Bill	KB5HOX	Times Mirror	Midland, Texas	HF,VHF,UHF, SSB,CW
Beuret, Kit	KH6JDE	ATC	Honolulu, Hawaii	
Blackstone, Larry	W8FZ	Dantron	Milton, Fla.	SSB/CW,80M-10M
Blanchard, David	KA0HIB	Municipal Utilities	Coon Rapids, Iowa	CW,SSB,QRP,2FM
Blumsack, Harvey	W1VIK	Superior Optic	Marietta, Ga.	
Bourne, Dave	WB8TMP	Pioneer	Columbus, Ohio	HF20-10,SSB,Packet
Bowick, Chris	WD4C	S-A	Atlanta, Ga.	
Bowles, Tom	W7VA	King Video	Seattle, Wash.	
Boye, Greg	WB8NGA	ATC	Columbus, Ohio	
Bray, James R.	W0FBC	ATC	Kansas City, Mo.	HF/CW,SSB
Brillhart, Scott	N5JJZ	UAE	Tulsa, Okla.	
Bryan, Tim O.	WH6CAD	Jones	Hilo, Hawaii	HF
Burton, Jack S.	WB2CJS	Cablevision	Woodbury, N.Y.	2FM,440FM
Butts, John	N2JUG	MCTV	New York, N.Y.	
Bybee, Jerry	N7ESQ	TCI	Portland, Ore.	
Caci, Joe	KA2OCF	Magnavox	Manlius, N.Y.	
Cappe, Roger	WA4PEA	Cox	Gainesville, Fla.	2FM
Capron, John	WB2RUQ	Phillips	Manlius, N.Y.	
Carey, Bill	KC4BPK	ATC	Fayetteville, N.C.	
Carr, Mike	N4PON	Paragon	St. Petersburg, Fla.	2FM
Carvis, Timothy	WB9ULP	NYT Cable TV	Cherry Hill, N.J.	2M,440
Cerino, Charles	WB3HVH	Comcast	Philadelphia, Pa.	FM
Checketts, Rick	KA0KZB	Jensen Tools	Phoenix, Ariz.	10M SSB,2FM
Chesney, Tom	WH6CED	ATC	Honolulu, Hawaii	
Ciciora, Walt	WB9FPW	ATC	Stamford, Conn.	
Clayton, Francis	AH6X	Kauai Cable	Kekaha, Hawaii	SSB,FM
Cohen, Jeff	N1ACQ	Harron	Bourne, Mass.	2M,CW40-80
Colegrove, Tom	WA6QBQ	Lectro	Canyon Country, Calif.	220FM,2FM, 440FM,Packet
Coombs, Gary	N4OJW	S-A	Atlanta, Ga.	
Cordero, Francisco	KP4CJ	CATV Noroeste	Aguadilla, Puerto Rico	SSB,CW,FM
Crown, Ron	KH6JI	Kauai Cable	Kalaheo, Hawaii	HF-SSB,2FM, 450FM
Davis, Keith	N9IBS	Comcast	Paducah, Ky.	UHF/VHF,FM, Packet@W4NJA,HF
Dawkins, Al	K0FRP	ATC	Denver, Colo.	
Dean, Brad	K1KEK	TCI	S. Yarmouth, Mass.	FM,SSB,CW
Deierlein, Peter	KD2LN	Magnavox	Manlius, N.Y.	
DellaGuardia, Joe	WB2WLY	UAE	Baltimore, Md.	2FM,80-10AM, SSB,CW
Dickinson, Bob	W2CCE	Dovetail	Bethlehem, Pa.	HF/SSB,CW,VHF, Packet,AMSAT
Dickinson, Ed	WA2FAC	Dovetail	Bethlehem, Pa.	
Ditlow, Doran A.	WA8EOW	UAE	Grand Rapids, Mich.	2FM,6SSB/CW, 80-10SSB/CW
Dudziak, Ted	WA1GPC	EIP Microwave	San Jose, Calif.	2FM,HF/SSB,CW
Ehman, Roy	VE6EV	Jones	Englewood, Colo.	
Eide, Joe	KB9R	ATC	Eau Claire, Wis.	CW,P,RTTY,AMTOR
Evanko, Steve	N2HCR	Blonder Tongue	Old Bridge, N.J.	10M-80M CW/ SSB,2FM
Evans Jr., Bernie	W6JMK	TeSCO	Topanga, Calif.	
Evanyk, Walt	W8KSW	Precision Elec	Richardson, Texas	SSB,AM,FM, CW,FSTV,Packet
Farmer, Jim	K4BSE	S-A	Atlanta, Ga.	
Farmer, Jim	N4IBW	Superior Telecommunications	Atlanta, Ga.	
Ferguson, Jan	W4REN	ATC	Cocoa, Fla.	SSB,FM,CW, Packet,VHF,UHF
Ferguson, Michael	KQ2K	Cable Tech	Syracuse, N.Y.	CW,SSB,FM
Figal, John	WB0CUC	UAE	Denver, Colo.	
Fischer, Dave	W0MHS	Superior Cable	Atlanta, Ga.	
Fitch Jr., William A.	KA2AFG	New Channels	Troy, N.Y.	80-10,6,2
Flessner, Andy	KA9ARM	Insight	La Grange, Texas	2FM,Packet
Flynn, Mike	KA3DDQ	County Cable	Clarion, Pa.	40CW, 10 SSB
Forrest, Mark	WB4HJG	S-A	Atlanta, Ga.	
Friend, Neil	W2AMY	Magnavox	Manlius, N.Y.	
Gall, Don	N0CPN	ATC	Kansas City, Mo.	
Garner, Rodney	WB4ZWK	S-A	Atlanta, Ga.	
Genochio, Frank	W6RXU	Retired	Santa Clara, Calif.	CW/SSB/HF
Goldsworthy, Steven	KB6TMT	Crescenta Valley	La Crescenta, Calif.	2M/220
Graalman, Mark S.	WB8JKR	Buckeye Cablevision	Toledo, Ohio	160-2/SSB,CW,FM
Grant, Chris	W0LA	Wavetek	Indianapolis, Ind.	
Greco, Vincent	KD2TG	Magnavox	Manlius, N.Y.	
Greene, Doug	NQ9I	Jones	Englewood, Colo.	2FM,ATV,Packet,HF
Grunewald, Peter B.	KA2ZHA	Cablevision	Hudson, Mass.	CW
Gunter, Kenneth S.	W5ZJ	Columbia	San Angelo, Texas	CW/SSB-40-20
Gur, Eugene A.	W4TFM	Central VA	Winchester, Va.	SSB,CW
Guth, Eric	WA6IGR	Advanced Cable Services	Denver, Colo.	440 FM
Hahn, Richard	KA2FXH	MCTV	New York, N.Y.	
Hammond, Bill	KK4YQ	Cable Exchange	Signal Hill, Calif.	
Hampton, Jim	WA3YXX	Starview	Claymont, Del.	2M,10M,UHF,ATV
Hanneman, Jerry	WA1PCP	Wander Telecom	San Francisco, Calif.	HF,VHF
Hansen, Tom	N8DGD	UAE	Grand Rapids, Mich.	2FM,SSB,CW
Hanson, Ron	WA0OGS	S-A	Norcross, Ga.	
Harlin, Michael	WA7AID	TCI West	Bellevue, Wash.	HF/SSB,RTTY, Packet,2FM,40m
Harrington, Joel	N7KOJ	KBLCOM	Portland, Ore.	440,2M,Packet
Harris, Jerry	K7JPF	Tektronix	Beaverton, Ore.	
Harris, Michael G.	N6MH	Century Communications	Brea, Calif.	HF,UHF
Hart, Gaylord	WB7ODD	Regal	Englewood, Colo.	
Hart, Jim	N4SV	S-A	Doraville, Ga.	CW
Hartson, Ted	WA8ULG	Post-Newsweek	Phoenix, Ariz.	
Hatch, Earl	AB4AO	ATC	Melbourne, Fla.	HF-SSB,Packet, VHF,UHF
Hawks, Randy	KB0BXY	Hermosa Cablevision	Durango, Calif.	HF,2FM
Hawks, Ros	WB0GKL	Hermosa Cablevision	Durango, Calif.	HF,2FM
Haworth, Jim	WA4QPP	ATC	Maitland, Fla.	2 F M
Hayashi, Ichiharu	JA3ILI	DX Antenna	Kobe-City, Japan	20-10SSB/CW/RTTY, P,Amtor,AMSAT
Haywood, Doyle T.	KC9FJ	Applied Instrument	Beech Grove, Ind.	CW,SSB,FM
Heim, Bob	K8HLH	Erie County	Sandusky, Ohio	SSB,FM,CW, Newsletter?
Heimbach, Paul	WA2YHO	Viacom	New York, N.Y.	
Hemmings, Brian	KA3CTP	Continental	St. Louis, Mo.	2M,440
Henley, L. Lynn	KB4JXY	American Cable	Columbus, Ga.	
Henscheid, Bert L.	WA7CBO	Texscan	Phoenix, Ariz.	
Herrman, Tony	KD0ZE	ATC	Kansas City, Mo.	HF/CW,SSB
Hill, Tommy	KD4EN	Comcast	Meridian, Miss.	HF,VHF,Packet
Hochman, Mike	KX6F	Multimedia	Norman, Okla.	2FM
Hodge, Warren	KC4OOS	ATC	Rockledge, Fla.	
Hodges, Marsha	KA0UIN	ATC	Kansas City, Mo.	2M
Hoffman, Kurt	NT8T	Warner	Akron, Ohio	CW/HF
Holmes, Fredrick W.	N1GIQ	NE Cablevision	Ayer, Mass.	SSB,CW,FM,RTTY, Packet,ATV
Honnold, Fred	W6YKM	King Video	Jackson, Calif.	
Hopengarten, Fred	K1VR	Lawyer	Lincoln, Mass.	HF
Horvath, Robert	N8KPS	Continental	Findlay, Ohio	2FM,80/40M CW
Hranac, Ron	N0IVN	CT	Denver, Colo.	ATV,Packet,2M, 6M,HF
Huf, Ted	K4NTA	Adelphia	Rivera Beach, Fla.	
Hunt, Bill	KC4ILF	Marion County Schools	Ocala, Fla.	
Idler, Steven	KA9UIE	S-A	Atlanta, Ga.	
Jackson, William G.	W8GHK	Cable America	Phoenix, Ariz.	
Johnson, Glenn	WB7UXS	ATC CARS	Emporia, Kan.	HF,2M
Johnson, Kenneth	WA7YHN	Cablevision	Moscow, Idaho	HF/SSB,2FM
Johnson, Rey	K8JCB	UAE	Denver, Colo.	2FM
Johnson, Steve	N0AYE	ATC	Englewood, Colo.	2FM,10SSB,Packet
Johnston, Bob	WB7AHL	TCI	Lander, Wyo.	SSB, FM, PACKET
Jones, Herb	KA4NIF	ATC	Melbourne, Fla.	2FM
Jordan, Peter	KA2HIG	Magnavox	Manlius, N.Y.	
Jordan, Robert	KB5HPG	Times Mirror	Midland, Texas	HF,VHF
Joyner, John	KB2IPC	ATC	Albany, N.Y.	10M/CW,SSB, PACKET
Kallina, Henry	WA5VSG	ATC	Englewood, Colo.	
Karr, Randy	KC4IOT	Channel Master	Clayton, N.C.	HF,2FM
Kasekamp, Marion L.	KK3L	TCI	Cumberland, Md.	HF/SSB, VHF/UHF/FM,10FM
Kaser, Gary F.	AB8Y	Adelphia Cable	Richland, Mich.	160-10/SSB/CW,2FM
Kaylor, William	W9DSM	Phillips	Knoxville, Tenn.	HF/CW/SSB,2FM
Kean, Peter	K2AXI	Mystic Star	Rock Tavern, N.Y.	CW,SSB,FSK
Kellough, Larry	WB9AZQ	Cox	Harahan, La.	80-10,SSB,CW,AM, FM
Kelsey, Charles	WB2EDV	Village of	Mayville, N.Y.	UHF/VHF/FM
King, R. Michael	WB0NCB	Circuit Doctor	Frisco, Colo.	
Knies, Mike	WB8MMR	ATC	Columbus, Ohio	HF,UHF,VHF
Kolins, Jerry	K2PFW	Professional Electric Co.	Schenectady, N.Y.	VOICE, DATA, VIDEO
Kosek, Bill	WA2KXY	ATC	Albany, N.Y.	SSB,AM,FM, CW,AMSAT
Kramer, Jonathan	KD6MR	Communications Support	Lake Forest, Calif.	2FM,Packet
Krebsbach, Ed	KF7KE	TCI	Klamath Falls, Ore.	HF/SSB, CW-2FM,Packet
Kujat, Matthew C.	WB3FNZ	CATV Service	Freeland, Pa.	SSB,CW,FM,2M, 432,6M

Name	Call	Company	City, State	Modes
Kuzmanoff, Chris	WH6CEQ	ATC	Honolulu, Hawaii	
Langevin, Larry	K1GXU	Greater Media	Chicopee, Mass.	160-10 CW, SSB/2M CW,SSB
Large, David	WZ6V	Intermedia	Santa Clara, Calif.	75SSB,VHF,UHF
Lemon, Gary	N0IZF	ATC	Gastonia, N.C.	
Levy, Bob	K2LET	NY Cable Commission	Albany, N.Y.	Silent Key
Lewis, Jon	KH6MS	ATC	Honolulu, Hawaii	
Lies, Gene	NN5A	Jones	Albuquerque, N.M.	2FM
Lloyd, Tom	K0CPI	Vantage	Kirksville, Mo.	
Lonn, Robert	WA6PHN	Cox	San Diego, Calif.	2FM,220,Packet
Louie, Dom	VE7CKL	Rogers	Vancouver, British Columbia	
Luff, Bob	W3GAC	Jones	Englewood, Colo.	2FM,AMSAT
Mackenzie, Kevin	WB6BVM	J.D. McKay Corp.	Aloha, Ore.	
MacLeod, Doug	N8ASM	Comcast	St. Clair Shores, Mich.	2FM
Malo, Butch	KK4CU	Adv Satellite	Ormond Beach, Fla.	2FM
Malson, Tom	N6RLN	Western CATV	Torrance, Calif.	
Marquart, Hugo	N0DYZ	Bismark-Mandan	Bismark, N.D.	80,40,15,10 CW/SSB
Marriam, Scott	KB2BDB	Magnavox	Manlius, N.Y.	
Martin, George E.	WD0FJH	SW MO CATV	Carthage, Mo.	SSB,CW,HF
Maziarz, Joe	K8BIU	NASA Lewis	Cleveland, Ohio	FM,Packet
McArthur, Len	VE3KSU	Cablesystems	Don Mills, Ontario	
McCoy, Cecil	WB4CTF	Cox Cable	Norfolk, Va.	
McDonald, Stan	WA4IZI	S-A	Atlanta, Ga.	
McDonough, Tom	N4YKK	ATC	Cocoa, Fla.	2FM,10M-SSB
McFadyen, Brian	N9HJR	MetroVision	Palos Hills, Ill.	2M FM
McMillan, John	KA4SSB	ATC	Lumberton, N.C.	
Mellring, Chuck	K3GDZ	Capital Cable	Columbus, Ohio	CW,AM,FM
Meyer, Ken	WB9YUY	Door Cablevision	Sturgeon Bay, Wis.	2FM/440FM/Packet
Michael, Tracy N.	AA9Z	TCI	Hartford City, Ind.	CW,SSB,FM,P,RTTY
Michaels, Joe	KA0GIB	ATC CARS	Emporia, Kan.	HF,2M,Packet
Milner, Ed	WA4OHW	Flight Trac	Glen Ellyn, Ill.	
Money, Marshall	N4SIO	Summit	Woodstock, Ga.	
Monroe, Jerry	KC2UT	Magnavox	Manlius, N.Y.	
Moore, Doug	KA0TQJ	ATC	Kansas City, Mo.	HF/CW,SSB
Moore, Marc	KB6HMO	King Video	Tujunga, Calif.	
Moore, Marcus	N4RYD	S-A	Atlanta, Ga.	
Mountain, Ned	WC4X	Wegener	Duluth, Ga.	
Mullan, John	KD2LQ	Magnavox	Manlius, N.Y.	
Musser, Dennis	KA5GTM	ATC	Denver, Colo.	2M,10M,SSB,Packet
Myers, Ron	KH6JQP	Comband Technologies	Virginia Beach, Va.	
Nakashima, Ray	WH6CEO	ATC	Honolulu, Hawaii	
Nelson, Barry	KA9YIS	Warner	DeKalb, Ill.	2M,10M
Newell, Steve	KA8USS		Owosso, Mich.	CW-80M,2FM,440FM
Newton, John	KA2ZZL	Magnavox	Manlius, N.Y.	
Norman, Tom	WA7HFY	UWTV	Laramie, Wyo.	
Nusco, Fred F.	WA2DWO	ATC	San Diego, Calif.	80-20M/SSB,2FM
Nydegger, Charles	WA9HCU	Cardinal	Crawfordsville, Ind.	75SSB,2M,6M,FSTV
Orwen, John	KB0XE	Metrovision	Lincoln, Neb.	
Osterland, Derick	AH6KC	ATC	Honolulu, Hawaii	
Ottinger, Michael A.	NX9Q	TCI	Lebanon, Ind.	FM,AM,SSB,HF, VHF,UHF,P,RTTY
Oyama, Blaine	NH6FM	Jones	Hilo, Hawaii	2M
Pangrac, Dave	WA0RNP	ATC	Englewood, Colo.	2FM,HF/SSB
Pangrac, Mike	N0GVW	Engineering Technologies	Aurora, Colo.	2FM,HF/SSB
Parmiter, Donald	N8LJF	TCI	Zanesville, Ohio	FM
Pastor, Tom	N8HUS	Continental	Painesville, Ohio	
Patrick, Al	WA4URT	S-A	Atlanta, Ga.	
Paul, Cliff	W2JEA	Consultant	Port St. Lucie, Fla.	2M/440/HF
Pearce, Grant	K8BKT	UAE	Grand Rapids, Mich.	160-10,2FM,UHF FM
Peterson, Michael L.	KA0YAD	UAE	New Hope, Minn.	FM,SSB,Newsletter?
Phelps, Alan	KA4DXM	Jones	St. Leonard, Md.	
Piccolo, Tony	WD9GCJ	Texscan	El Paso, Texas	CW,SSB,2FM
Potter, Greg	NM2L	New Channels	Syracuse, N.Y.	CW,DX,Contesting
Preston, Charles	N4SXM	North Georgia Communications	Norcross, Ga.	HF/SSB,V,U,P,ATV, SAT,AMTR,RTTY
Prince, Bradley	N3GMT	Adelphia Cable	Plymouth Meet'g, Pa.	2M
Pringle Jr., J. Leon	W5NA	Pine Belt	Hattiesburg, Miss.	
Proctor, Ken	N2DQD	Mobile Diagnostics	Bricktown, N.J.	
Pruitt, Michael	KC4FMJ	Cablevision Industries	Danville, Va.	20M SSB/CW
Radzik, Jack	N2RK	LRC	Horseheads, N.Y.	75SSB
Raimondi, Steve	W2QUU	UAE	Englewood, Colo.	40SSB
Reed Jr., Oscar	W3FFQ	Reed Associates	Silver Springs, Md.	160-10,2M
Reihs, Warren A.	WB6QKA	ISS Communications	Thousand Oaks, Calif.	2FM
Reynard, Rand	N0DYQ	Anixter	Kansas City, Mo.	2FM,Packet,CAP
Richardson, Earl	W1NIC	Moosehead	Greenville, Maine	
Robertson, Bill	N6VLR	Continental	Lakewood, Calif.	2meter
Rodgers, Gregg	KJ9X	Trilithic	Indianapolis, Ind.	
Rosenberg, Eric	WA6YBT	C-SPAN	Washington, D.C.	VHF/Packet,AMSAT
Roush, Sam	KA8OOT	Rifkin	Point Pleasant, W. Va.	SSB,DX,SSTV,FSTV
Runkle, Fred	K4KAZ	S-A	Atlanta, Ga.	
Rupert, J. Scott	N3DDZ	TCI	Apollo, Pa.	FM,SSB,2M,440
Sabraw, Martin F.	N8IWQ	Starion	Ada, Mich.	CW,SSB,FM,AFSK, ATV
Sambol, Don	K7CS	ATC	Englewood, Colo.	HF/CW
Sanchez, Nestor	N4UJZ	Storer	Miami, Calif.	2FM,10M,ATV, Packet,AMSAT
Schmidt, Bill	KF4CQ	Superior Telecommunciations	Atlanta, Ga.	
Schmidt, Jim	WB9EPW	ATC	Appleton, Wis.	CW/HF
Scott, Noel	KA0TWQ	ATC	Kansas City, Mo.	HF/SSB/CW, 2FM/SSB,Packet
Sell, Bob	WB4OEZ	ATC	Melbourne, Fla.	450 & 6M repeater owner
Sellers, Mike	KI6ED	Comcast	Fullerton, Calif.	HF,SSB,RTTY
Selwa, Paul	NB9K	Trilithic	Indianapolis, Ind.	40-10 SSB/CW,2FM
Serafin, Neil	KE0XL	Cable Exchange	Englewood, Colo.	2FM/10FM & SSB
Sexton, Burl	KO4V	S-A	Atlanta, Ga.	
Seymour, Andy	N0JPD	Telecable	Springfield, Mo.	SSB,CW,FM,Packet
Shaw, Bob	KB8BIY	Pioneer	Columbus, Ohio	2M,220,ATV,10SSB, Packet
Shimko, Gary P.	WA8OTR	Precision	Richardson, Texas	SSB
Shine, Daniel	K1NJX	M/A-COM	Chelmsford, Mass.	
Sicard, Don	K1OSG	M/A-COM MAC	Chelmsford, Mass.	
Siebring, Gary	KA0DWE	Siebring	George, Iowa	HF/CW,2M,Packet
Sigler, Glenn E.	N8IJY	Pioneer	Columbus, Ohio	SSB,CW,2M,Packet
Skinner, Russ	WA8EQX	UAE	Montvale, N.J.	6M,2FM,ATV
Smith, Bill	W5USM	CADCO	Garland, Texas	SSB,CW,FM,Packet
Sokola, Ray	K9RS	Wavetek	Indianapolis, Ind.	
Sotirhos, Jerry	KB7ICS	Heritage	San Jose, Calif.	SSB/HF20,40, 80,2FM,220FM
Spence, Jeff	K0QEJ	US Cable	Merrillville, Ind.	6M,80,40,2FM
Spencer, Ron	N4VOS	Spencer Construction	Stanton, Ky.	
Spilka, Jesse	N2HYR	Brooklyn Queens	Flushing, N.Y.	
Squires, Steve	WB9LKT	UAE	Galesburg, Ill.	
Staiger, Jay G.	KA2HYA	Magnavox	Manlius, N.Y.	
Standridge, Jim	KB2PH	Jerrold	Lakeland, Fla.	
Stannard, Chris	KB4GAA	Storer	Miami, Calif.	2FM,10M,ATV, AMSAT
Stelle, Raleigh	NY0Y	ATC	Austin, Texas	HF/CW
Stephens, Bill	N9HEP	ALM	McHenry, Ill.	2FM,440FM,HF, Digital
Stewart, Columbus	KA8QVZ	UAE	Grand Rapids, Mich.	SSB
Stigberg, Chuck	NT4U	Eastern Technical Communications	Richmond, Va.	HF DX,2M FM/SSB,RTTY
Stofer, Ray	K7JNK	White Sands	Phoenix, Ariz.	
Strahan, Dave	N7LSD	TCI	Seattle, Wash.	
Strebel, Rich	KA3ANO	Adelphia	Macedonia, Ohio	SSB,CW,FM
Sutton, Dave	WA9J	UAE	Galesburg, Ill.	
Swanson, Pete	KA2IAY	Cable Exchange	Liverpool, N.Y.	10,15,20,80, 2FM,Packet
Tash, Gill	WB6WNN	Times Mirror	Irvine, Calif.	
Tauiliili, Sumatala	WH6CDN	ATC	Honolulu, Hawaii	
Taxdahl, Tax	W7KCZ	Telecomm	Ferndale, Wash.	80-10/CW/SSB
Taylor, Jim	K9JT	The Video Term	Milwaukee, Wis.	HF/CW/SSB, VHF/UHF/FM
Thomas, Ray	WB6RUQ	Telecable	Springfield, Mo.	
Thompson, Mike	KA0WJQ	ATC	Kansas City, Mo.	
Tinggaard, Neil	WA0HJI	UAE	Englewood, Colo.	
Tonge, Tim	KA0MWA	ATC	Englewood, Colo.	2FM,Packet, HF/CW/SSB
Troutman, Edwin L.	WA3TFX	Adelphia Cable	Winchester, Va.	
Tschirner, Alan	KA0TQH	ATC	Kansas City, Mo.	SSB,CW,2FM, 440FM,Packet,CAP
Tyrrell, George	K0CPT	HP	Englewood, Colo.	
VanBuren, R.H.	W5ILH	Cablecom	Kirksville, Mo.	2M,10M
VanDamme, Michael	N6MOF	Heritage	San Jose, Calif.	VHF/UHF/FM,P RTTY,HF/AM/P/SSB
Voiles, Art	N5BZL	Texscan	Fort Dodge, Iowa	
Vrooman, Jim	WA2GSX	Magnavox	Manlius, N.Y.	
Vyverberg, Chuck	WB7NNF	Cox	Spokane, Wash.	VHF,Packet
Walker, Dane	WB6JNP	Hughes MW	Torrance, Calif.	2FM,Packet
Wanderer, Bob	KT2D	UAE	Pompton Lakes, N.J..	CW/SSB/160-10, 2FM,440FM
Warburton, Peter	G8UGK	ARCOM	Syracuse, N.Y.	
Warren, Larry	N4ZE	Anixter	Bensenville, Ill.	2FM,80-10 SSB
Wasleske, Bruce	WB9YVT	Jones	Mosinee, Wis.	
Watt, Philip	KB7IQO	TCI	Anaconda, Mont.	
White, Thomas	KB9ACX	Heritage	South Bend, Ind.	AM,FM,SSB,CW
Wicks, Wayne	WA2KEC	ESPN	Englewood, Colo.	2FM,HF/SSB
Wightman, Gary	WA8MCD	Cablevision	Kalamazoo, Mich.	2FM
Wilke, Allen	KE0EN	ATC	Kansas City, Mo.	HF/CW,SSB
Wilkenson, Mike	N5IQP	Precision	Richardson, Texas	SSB,Packet,FM
Williams, Robert T.	K5BFT	Century	Portsmouth, Ohio	
Wiltshire, Dan	KB8BKF	Pioneer	Columbus, Ohio	SSB,CW, Novice bands
Winn, Al	KA9CAS	ATC	Terre Haute, Ind.	2M,10M,Packet, HF Net?
Witherspoon, Brian K.	KB4RAB	Alert Cable TV	Clayton, N.C.	CW
Wolcott, Mike	WB4OEX	S-A	Atlanta, Ga.	
Wonn, Jim	W3GCZ	C-COR	State College, Pa.	
Woods, Emmitte	KA7NEH	Cooke Cablevision	Cle Elum, Wash.	SSB,FM,AM
Wouw, Tony	VE7CCI	ComLink	N. Vancouver, British Columbia	
Wyatt, Tim	KA0TYE	ATC	Kansas City, Mo.	
Yorks, Sal	WD4NZX	Magnavox	Manlius, N.Y.	
Young, Scott	N4HLA	ATC	Memphis, Tenn.	
Younker, Dennis	NE6I	Jones	Spring Valley, Calif.	CW,SSB,FM,160-2
Zeidler Sr., David H.	WB6TBT	LucasFilm	San Rafael, Calif.	2FM,HF/SSB
Zhorne, Brent	WB9FHI	UAE	Galesburg, Ill.	HF/SSB,RTTY, Packet,2FM,440FM

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SCTE history

(Continued from page 54)

lized and new chapters were organized. SCTE changed its bylaws, establishing senior and student members as new grades of membership. SCTE also incorporated in 1974, officially become the Society of Cable Television Engineers Inc.

The Society's monthly newsletter, *The Interval*, was first published in March 1975 and gave SCTE new visibility in the industry while publicizing its activities on a timely basis. 1975 also was the year in which the SCTE Member of the Year Award was officially introduced to recognize an individual who had made a significant contribution to the Society. Steven Dourdoufis was honored for his efforts in 1974, but James Collins became the first formal recipient of the award in 1975.

SCTE held its first national Engineering Conference in 1976. This event, which features the presentation of technical papers in panel discussions, has continued to be held on an annual basis.

In 1977, the Society opened its first full-time office in Washington, D.C., and hired its first paid staff. SCTE had consisted entirely of volunteers up to this time. Two years later the first *SCTE Membership Directory* was published and distributed to the Society's 1,000 active members.

From rags to riches

The Society fell upon hard times during the early 1980s and few records exist. However, picking up from 1983, the chronicle continues. The Society's first Cable-Tec Expo was held May 6-8, 1983, in Dallas. This annual training and CATV hardware conference has subsequently been held in such diverse locations as Nashville, Tenn. (1984), Washington, D.C. (1985), Phoenix, Ariz. (1986), Orlando, Fla. (1987), San Francisco (1988) and Orlando again last year. SCTE returns to Nashville for its 1990 event. Cable-Tec Expo includes one day devoted to the Engineering Conference, which continues to be a forum for ideas and education at the forefront of the cable TV industry.

The Satellite Tele-Seminar Program series was created in 1984 to provide technical training videotapes to cable systems across the country. SCTE encourages system operators to downlink and record these programs to accommodate their current and future training needs. To date, the Satellite Tele-Seminar series has uplinked over 80 hours of instructional programming to the industry.

When the Broadband Communications Technician/Engineer (BCT/E) Professional Designation Certification Program was introduced at Cable-Tec Expo '85, 90 attendees became the first BCT/E candidates. The program was created to encourage personal development in CATV technology, recognize individuals for their demonstration of knowledge and assist management in their employee evaluation and promotion processes. Since its introduction, over 1,000 candidates have enrolled in the program and taken a total of over 5,000 individual examinations.

The Technical Tuition Assistance Program was created in 1985 by the board of directors. This SCTE scholarship program has provided educational opportunities to 24 of its members by awarding them tuition assistance for National Cable Television Institute correspondence courses. In 1988, the program awarded tuition assistance for university courses to deserving members for the first time.

In 1986, the number of local SCTE chapters and meeting groups reached 30, doubling the total from one year before. These groups continue to hold low-cost, high-quality technical training seminars across the country, bringing educational opportunities to all levels of industry personnel. In the years since, the Society has experienced tremendous growth in the area of chapter development, with many meeting groups being elevated to chapter status and numerous new meeting groups being established in important areas. SCTE currently has 39 chapters and 16 meeting groups for a total of 55 local groups.

More milestones to come

The year 1987 marked the first time in the Society's history that it owned its own office space. The new national headquarte building, located in Exton, Pa., officia pened in January with a joyous granc ing celebration. The purchase of th rty was made possible by gene ntributions to the Society's New g Fund.

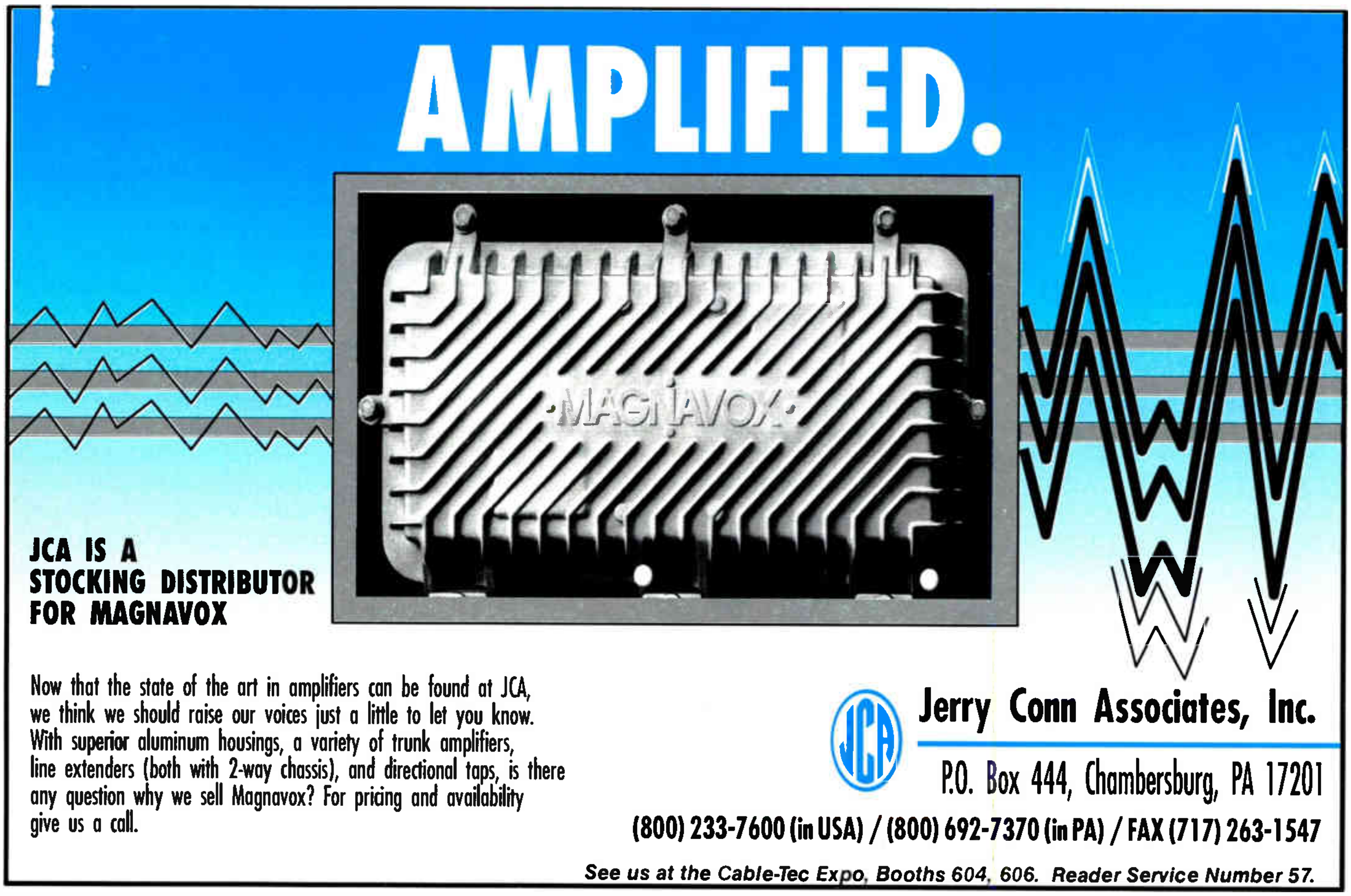
A . milestone in the Society's histo ie certification of the first person to s ssfully complete the BCT/E Certific Program, Ron Hranac of CT Pub ons, occurred in 1987. Hranac was ied at the program's technician leve The first person to be certified at the eng neer level, Les Read of Sammons Con munications, completed the program later that year.

The success of the BCT/E Program prompted the establishment of a new certification process directed at installers, an often overlooked and under-trained segment of the industry. First suggested by Robert Luff of the SCTE board of directors at a 1987 board meeting, the Installer Certification Program was officially premiered at Cable-Tec Expo '89. Richard Covell of the Installer Program Committee developed a comprehensive manual to serve as a study guide for the program that has sold close to 1,000 copies since its publication in 1989. To accommodate the program, a special installer level of membership was introduced. To date, over 500 people have joined SCTE at the installer level.

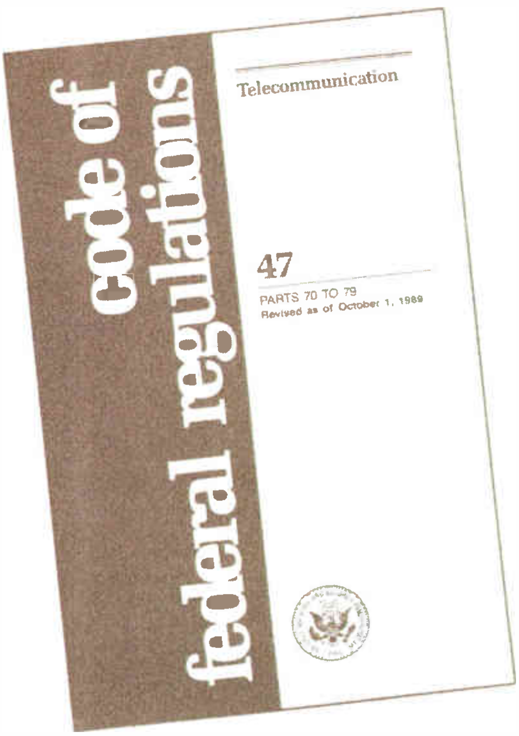
In 1988, SCTE created a Hall of Fame to recognize individuals who have tirelessly given of themselves and shared their knowledge with others for a major portion of their lives. The first inductee into the SCTE Hall of Fame, Cliff Paul, received the honor at Cable-Tec Expo 1988. 1988's expo, held in San Francisco, broke all previous attendance records. Over 1,300 industry technicians and engineers from across the country were in attendance, more than doubling the number of attendees at the expo only three years earlier. The attendance record was broken yet again at Cable-Tec Expo '89 in Orlando, which drew more than 1,500 people.

The Society's membership figures provide a chronicle of its growth. Although SCTE experienced strong growth from 1977 to 1979, the past five years really tell the story. The Society has effectively doubled in size since 1984, when the year-end membership figure was 2,500. This figure grew to 2,700 in 1985, 3,200 in 1986 and 3,800 in 1987, with SCTE reaching the milestone figures of 5,000 members by the end of 1988 and 6,000 members by 1989's end. With the figure currently climbing toward the 7,000 member mark, this growth serves as ongoing testimonial to the value of the organization in the development of the cable TV industry.

It would be extremely difficult to acknowledge in this article each of the individuals whose tireless efforts have helped make these outstanding achievements a reality. However, it is their dedication and belief in the professional development of industry technical personnel that has enabled the Society to achieve its goals and set new ones for the future. We look forward to many more years of service to the industry.



Code of Federal Regulations, Part 76



"Monitoring equipment and procedures shall be adequate to detect leakage...of 20 $\mu V/m$ at a distance of 3 meters."

The following is reprinted from the most recent edition of the "Code of Federal Regulations" (Oct. 1, 1989), Part 76. This section deals with the technical standards and provisions that the cable TV industry is responsible for as set by the Federal Communications Commission.

Subpart K—Technical Standards
76.601 Performance tests

(a) The operator of each cable TV system shall be responsible for ensuring that each such system is designed, installed and operated in a manner that fully complies with the provisions of this subpart. Each system operator shall be prepared to show, on request by an authorized representative of the FCC, that the system does in fact comply with the rules.

(b) All cable TV systems serving 1,000 or more subscribers, and all cable TV systems serving less than 1,000 subscribers that use any frequency spectrum other than that allocated to over-the-air broadcasting (as described in 73.603 and 73.210), shall conduct all tests, measurements and monitoring of radiation and signal leakage to demonstrate compliance with the radiation limits set forth in 76.605(a)(11) as follows:

(1) The cable system operator shall conduct signal leakage measurements in accordance with 76.609(h) at least once each calendar year (at intervals not to exceed 14 months) and shall maintain the resulting test data on file at the operator's local business office for at least five years. It shall be made available for inspection by the FCC on request. This data shall include a description of instruments and procedure and a statement of the qualification of the person performing the tests.

(2) Successful completion of the performance tests does not relieve the system of the obligation to comply with all other pertinent technical standards set forth in this subpart. Additional or repeat tests may be required by the FCC in order to secure compliance with these standards.

Note: Requirements for performing tests to determine compliance with the standards of 76.605(a)(9), insofar as it relates to the ratio of visual signal level to any undesired co-channel TV signal and (a)(10) are hereby suspended for all cable TV systems, pending further action by the FCC.

[37 FR 3278, Feb. 12, 1972, as amended at 42 FR 27182, April 29, 1977; 50 FR 52466, Dec. 24, 1985]

76.605 Technical standards

(a) The following requirements apply to the performance of a cable TV system as measured at any subscriber terminal with a matched termination and to each of the Class I cable TV channels in the system:

(1) The frequency boundaries of cable TV channels delivered to subscriber terminals shall conform to those set forth in 73.603(a) of this chapter: *Provided, however,* that on special application including an adequate showing of public interest, other channel arrangements may be approved.

(2) If no frequency converter is supplied to the subscriber the visual carrier frequency shall be maintained 1.25 MHz ±25 kHz above the lower frequency boundary of the cable TV channel. If a frequency converter is supplied to the subscriber by the cable TV system, the following requirement shall be applied at the interface between the converter and the subscriber's terminal equipment: When the visual carrier at the output of the converter has been tuned to a frequency 1.25 MHz above the lower frequency boundary of a cable TV channel with the converter stabilized at an ambient temperature between 20° C and 25° C, the frequency of the visual carrier shall not vary more than ±250 kHz for a period of at least three hours, during which period the ambient temperature may vary ±5° C about the initial ambient temperature.

Note: A relaxed frequency tolerance will be permitted when both of the following conditions are met: (a) the signal is received by means of a TV broadcast translator station, and (b) the cable TV system carries signals on neither an upper nor a lower channel adjacent in frequency to the channel on which the

translator signal is carried. In such cases, the visual carrier frequency shall be maintained 1.25 MHz ±(25+T) kHz above the lower frequency boundary of the cable TV channel, where T is the frequency tolerance in kHz allowed the TV broadcast translator station pursuant to 74.761 of this chapter.

(3) The aural center frequency of the aural carrier must be 4.5 MHz ±5 kHz above the frequency of the visual carrier.

(4) The visual signal level, across a terminating impedance that correctly matches the internal impedance of the cable system as viewed from the subscriber terminals, shall not be less than the following appropriate value:

Internal impedance:
75 ohms.
300 ohms.
Visual signal level:
1 mV
2 mV

(At other impedance values, the minimum visual signal level shall be $\sqrt{0.0133Z}$ millivolts, where Z is the appropriate impedance value.)

(5) The visual signal level on each channel shall not vary more than 12 dB within any 24-hour period and shall be maintained within:

(i) 3 dB of the visual signal level of any visual carrier within 6 MHz nominal frequency separation, and

(ii) 12 dB of the visual signal level on any other channel, and

(iii) A maximum level such that signal degradation due to overload in the subscriber's receiver does not occur.

(6) The peak-to-peak variation in visual signal level caused by undesired low frequency disturbances (hum or repetitive transients) generated within the system, or by inadequate low frequency response, shall not exceed 5 percent of the visual signal level.

(7) The amplitude characteristic shall be within a range of ±2 dB from 0.75 MHz to 5 MHz above the lower boundary frequency of the cable TV channel, referenced to the average of the highest and lowest amplitudes within these frequency boundaries.

(8) The ratio of visual signal level to system noise, and of visual signal level to any undesired co-channel TV signal operating on proper offset assignment, shall not be less than 36 dB. This requirement is applicable to:

(i) Each signal that is delivered by a cable TV system to subscribers within the predicted Grade B contour for that signal, or

(ii) Each signal that is first picked up within its predicted Grade B contour, or

(iii) Each signal that is first received by the cable TV system by direct video feed from a TV broadcast station or low power TV station.

(9) The ratio of visual signal level to the RMS amplitude of any coherent disturbances such as intermodulation products or discrete-frequency interfering signals not operating on proper offset assignments shall not be less than 46 dB.

10) The terminal isolation provided each subscriber shall be not less than 18 dB, but in any event, shall be sufficient to prevent reflections caused by open-circuited or short-circuited subscriber terminals from producing visible picture impairments at any other subscriber terminal.

11) As an exception to the general provision requiring measurements to be made at subscriber terminals, and without regard to the class of cable TV channel involved, radiation from a cable TV system shall be measured in accordance with procedures outlined in 76.609(h) and shall be limited as in Table 1.

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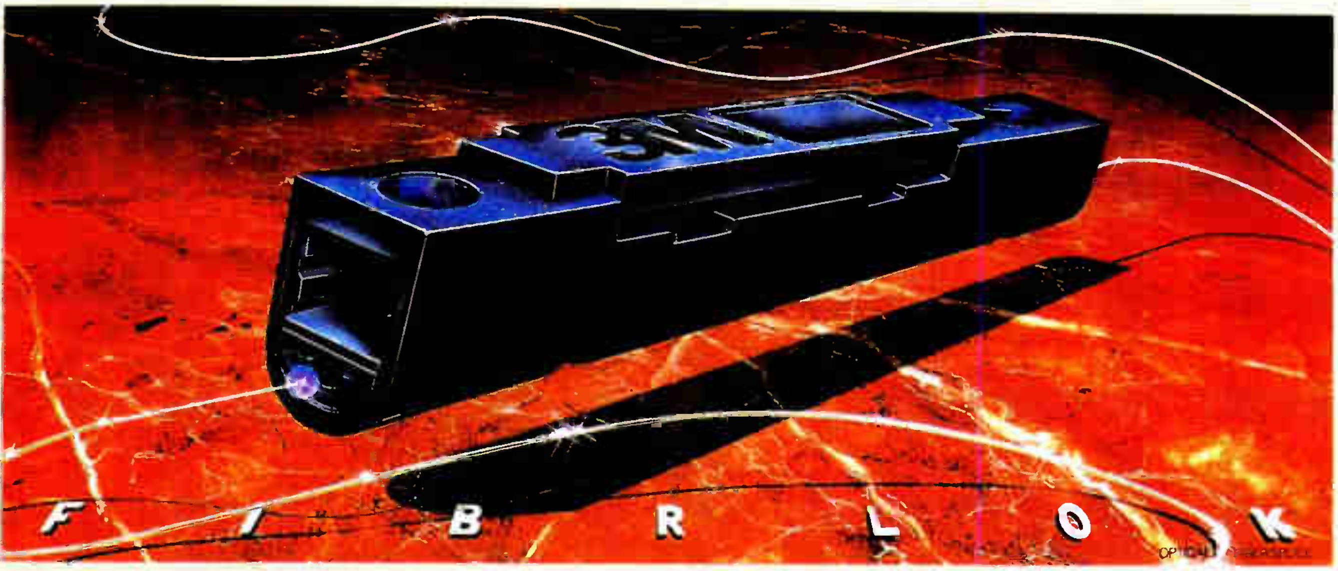

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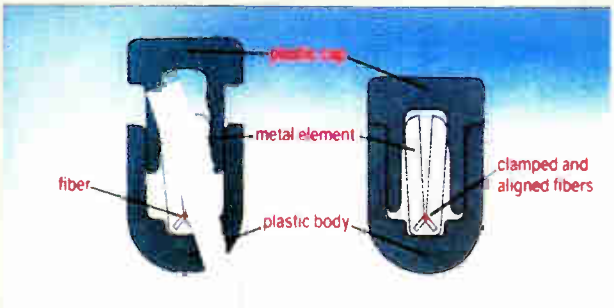

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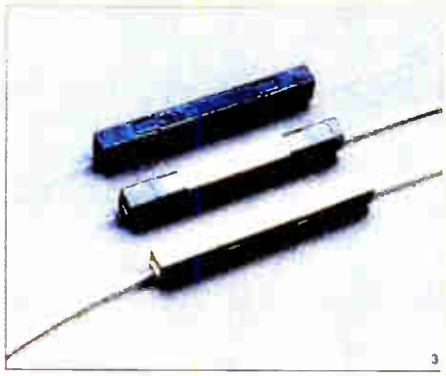

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(b) Cable TV systems distributing signals by using multiple cable techniques or specialized receiving devices, and which, because of their basic design, cannot comply with one or more of the technical standards set forth in paragraph (a) of this section, may be permitted to operate provided that an adequate showing is made that establishes the public interest is benefited. In such instances the FCC may prescribe special technical requirements to ensure that subscribers to such systems are provided with a good quality of service.

Note 1: The requirements of 76.605(a)(1) through 76.605(a)(10) do not apply directly to cable systems. These rule sections or less stringent versions of them may be used as standards by state or local regulatory authorities. No technical parameters in excess of the above rule sections may be required.

Note 2: The requirements of this section shall not apply to devices subject to the provisions of 15.601 through 15.626.

[37 FR 3278, Feb. 12, 1972, as amended at 37 FR 13867, July 14, 1972; 40 FR 2690, Jan. 15, 1975; 40 FR 3296, Jan. 21, 1975; 41 FR 53028, Dec. 3, 1976; 42 FR 21782, April 29, 1977; 47 FR 21503, May 18, 1982; 50 FR 52466, Dec. 24, 1985; 51 FR 1255, Jan. 10, 1986; 52 FR 22461, June 12, 1987]

76.609 Measurements

(a) Measurements made to demonstrate conformity with the performance requirements set forth in 76.601 and 76.605 shall be made under conditions which reflect system performance during normal operations, including the effect of any microwave relay operated in the Cable TV Relay (CARS) Service intervening between pickup antenna and the cable distribution network. Amplifiers shall be operated at normal gains, either by the insertion of appropriate signals or by manual adjustment. Special signals inserted in a cable TV channel for measurement purposes should be operated at levels approximating those used for normal operation. Pilot tones, auxiliary or substitute signals and non-television signals normally carried on the cable TV system should be operated at normal levels to the extent possible. Some exemplary, but not mandatory, measurement procedures are set forth in this section.

(b) When it may be necessary to remove the TV signal normally carried on a cable TV channel in order to facilitate a performance measurement, it will be permissible to disconnect the antenna that serves the channel under measure-

ment and to substitute therefor a matching resistance termination. Other antennas and inputs should remain connected and normal signal levels should be maintained on other channels.

(c) As may be necessary to ensure satisfactory service to a subscriber, the FCC may require additional tests to demonstrate system performance or may specify the use of different test procedures.

(d) The frequency response of a cable TV channel may be determined by one of the following methods, as appropriate:

(1) By using a swept frequency or a manually variable signal generator at the sending end and a calibrated attenuator and frequency-selective voltmeter at the subscriber terminal; or

(2) By using a multiburst generator and modulator at the sending end and a demodulator and oscilloscope display at the subscriber terminal.

(e) System noise may be measured using a frequency-selective voltmeter (field strength meter) that has been suitably calibrated to indicate RMS noise or average power level and that has a known bandwidth. With the system operating at normal level and with a properly matched resistive termination substituted for the antenna, noise power indications at the subscriber terminal are taken in successive increments of frequency equal to the bandwidth of the frequency-selective voltmeter, summing the power indications to obtain the total noise power present over a 4 MHz band centered within the cable TV channel. If it is established that the noise level is constant within this bandwidth, a single measurement may be taken that is corrected by an appropriate factor representing the ratio of 4 MHz to the noise bandwidth of the frequency-selective voltmeter. If an amplifier is inserted between the frequency-selective voltmeter and the subscriber terminal in order to facilitate this measurement, it should have a bandwidth of at least 4 MHz and appropriate corrections must be made to account for its gain and noise figure. Alternatively, measurements made in accordance with the NCTA standard on noise measurement (NCTA Standard 005-0669) may be employed.

(f) The amplitude of discrete frequency interfering signals within a cable TV channel may be determined with either a spectrum analyzer or with a frequency-selective voltmeter (field strength meter), which instruments have been calibrated for adequate accuracy. If calibration accuracy is in doubt, measurements may be referenced to a calibrated signal generator, or a calibrated variable attenuator, substituted at the point of measurement. If an amplifier is used between the subscriber terminal and the measuring instrument, appropriate corrections must be made to account for its gain.

(g) The terminal isolation between any two terminals in the system may be measured by applying a signal of known amplitude to one and measuring the amplitude of that signal at the other terminal. The frequency of the signal should be close to the mid-frequency of the channel being tested. Annual measurements of terminal isolation are not required when either 1) the manufacturer's specifications for coupler directivity or 2) laboratory measurements on a representative sample of the couplers, plus an allowance for the attenuation of drop cables, indicate that the requirements of 76.605(a)(11) are met.

(h) Measurements to determine the field strength of radio frequency energy radiated by cable TV systems shall be made in accordance with standard engineering procedures. Measurements made on frequencies above 25 MHz shall include the following:

(1) A field strength meter of adequate accuracy using a horizontal dipole antenna shall be employed.

(2) Field strength shall be expressed in terms of the RMS value of synchronizing peak for each cable TV channel for which radiation can be measured.

(3) The resonant half wave dipole antenna shall be placed 3 meters from and positioned directly below the system components and at 3 meters above ground. Where such placement results in a separation of less than 3 meters between the center of the dipole antenna and the system components, or less than 3 meters between the dipole and ground level, the dipole shall be repositioned to provide a separation of 3 meters from the system components at a height of 3 meters or more above ground.

(4) The horizontal dipole antenna shall be rotated about a vertical axis and the maximum meter reading shall be used.

(5) Measurements shall be made where other conductors are 10 or more feet away from the measuring antenna.

(i) Annual measurements of frequency stability of set-top converters, when such converters are supplied by the cable TV operator, are not required when either of the following indicates that the requirements of 76.605(a)(2) are met: 1) Manufacturer's specifications based on a repre-

sentative sample of the converters or 2) laboratory tests performed by or for the cable TV system operator on a representative sample of the converters. Proof of performance tests for frequency stability will not be required for converters ordered from the manufacturer prior to Sept. 6, 1977.

[37 FR 3278, Feb. 12, 1972, as amended at 37 FR 13867, July 14, 1972; 41 FR 10067, March 9, 1976; 42 FR 21782, April 29, 1977; 49 FR 45441, Nov. 16, 1984]

76.610 Operation in the frequency bands 108-137 and 225-400 MHz—Scope of application

The provisions of 76.611 (effective July 1, 1990), 76.612, 76.613, 76.614 and 76.615 are applicable to all cable TV systems transmitting carriers or other signal components carried at an average power level equal to or greater than 10^{-4} watts across a 25 kHz bandwidth in any 160 microsecond period, at any point in the cable distribution system in the frequency bands 108-137 and 225-400 MHz for any purpose. For grandfathered systems, refer to 76.618 and 76.619.

Note 1: See the provisions of 76.616 for cable operation near certain aeronautical and marine emergency radio frequencies.

Note 2: Until Jan. 1, 1990, the band 136-137 MHz is allocated as an alternative allocation to the space operation, meteorological satellite service and the space research service on a primary basis. After Jan. 1, 1990, the space service will become secondary to aeronautical mobile service radio. Until Jan. 1, 1990, the band 136 to 137 MHz is excluded from the rule sections regarding protection of aeronautical frequencies.

[50 FR 29399, July 19, 1985]

76.611 Cable television basic signal leakage performance criteria

(a) No cable TV system shall commence or provide service in the frequency bands 108-137 and 225-400 MHz unless such system is in compliance with one of the following cable TV basic signal leakage performance criteria:

(1) prior to carriage of signals in the aeronautical radio bands and at least once each calendar year, with no more than 12 months between successive tests thereafter, based on a sampling of at least 75 percent of the cable strand, and including any portions of the cable system that are known to have or can reasonably be expected to have less leakage integrity than the average of the system, the cable operator demonstrates compliance with a cumulative signal leakage index by showing either that (i) $10\log I_{3,000}$ is equal to or less than −7 or (ii) $10\log I_{\infty}$ is equal to or less than 64, using one of the following formulas:

$$I_{3,000} = \frac{1}{\theta} \sum_{i=1}^{n} \frac{E^2_i}{R^2_i}$$

$$I_{\infty} = \frac{1}{\theta} \sum_{i=1}^{n} E^2_i$$

where:

$R^2_i = r^2_i + (3{,}000)^2$

r_i = the distance (in meters) between the leakage source and the center of the cable television system

θ = the fraction of the system cable length actually examined for leakage sources and is equal to the strand miles of plant tested divided by the total stand miles in the plant

R_i = the slant height distance (in meters) from leakage source i to a point 3,000 meters above the center of the cable TV system

E_i = the electric field strength in microvolts per meter (μV/m) measured pursuant to 76.609(h) 3 meters from the leak i

n = the number of leaks found of field strength equal to or greater than 50μV/m pursuant to 76.609(h).

The sum is carried over all leaks i detected in the cable examined; or

(2) prior to carriage of signals in the aeronautical radio bands and at least once each calendar year, with no more than 12 months between successive tests thereafter, the cable operator demonstrates by measurement in the airspace that at no point does the field strength generated by the cable system exceed 10 μV/m RMS at an altitude of 450 meters above the average terrain of the cable system.

The measurement system (including the receiving antenna) shall be calibrated against a known field of 10 μV/m RMS produced by a well-characterized antenna consisting of orthogonal resonant dipoles, both parallel to and one-quarter wavelength above the ground plane of a diameter of 2 meters or more at ground level. The dipoles shall have centers colocated and be excited 90 degrees apart. The half-power bandwidth of the detector shall be 25 kHz. If an aeronautical receiver is used for this purpose it shall meet the standards of the Radio Technical Commission for Aeronautics (RCTA) for aeronautical communications receivers. The aircraft antenna shall be horizontally polarized. Calibration shall be made in the community unit or, if more than one, in any of the community units of the physical system within a reasonable time period to performing the measurements.

If data is recorded digitally the 90th percentile level of points recorded over the cable system shall not exceed 10 μV/m RMS; if analog recordings are used the peak values of the curves, when smoothed according to good engineering practices, shall not exceed 10 μV/m RMS.

(b) In paragraphs (a)(1) and (a)(2) of this section the unmodulated test signal used on the cable plant shall: 1) Be within the VHF aeronautical band 108-137 MHz or any other frequency in which the results can be correlated to the VHF aeronautical band and 2) have an average power level equal to the average power level of the strongest cable TV carrier on the system.

(c) In paragraph (a)(1) and (2) of this section, if a modulated test signal is used, the test signal and detector technique must, when considered together, yield the same result as though an unmodulated test signal were used in conjunction with a detection technique that would yield the RMS value of said unmodulated carrier.

(d) If a sampling of at least 75 percent of the cable strand (and including any portions of the cable system that are known to have or can reasonably be expected to have less leakage integrity than the average of the system) as described in paragraph (a)(1) cannot be obtained by the cable operator or is otherwise not reasonably feasible, the cable operator shall perform the air-space measurements described in paragraph (a)(2).

(e) Prior to providing service to any subscriber on a new section of cable plant, the operator shall show compliance with either: 1) The basic signal leakage criteria in accordance with paragraph (a)(1) or (a)(2) of this section for the entire plant in operation or 2) a showing shall be made indicating that no individual leak in the new section of the plant exceeds 20 μV/m at 3 meters in accordance with 76.609 of the rules.

(f) Notwithstanding paragraph (a) of this section, a cable operator shall be permitted to operate on any frequency which is offset pursuant to 76.612 in the frequency band 108-137 MHz for the purpose of demonstrating compliance with the cable TV basic signal leakage performance criteria. →

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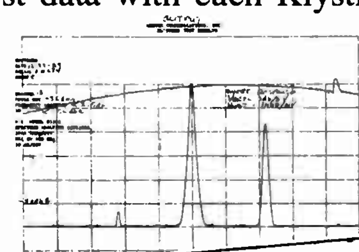

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[50 FR 29399, July 19, 1985, as amended at 53 FR 2499, Jan. 28, 1988; 53 FR 5684, Feb. 25, 1988]

Effective date note: At 50 FR 29399, July 19, 1985, a new 76.611 was added, effective July 1, 1990.

76.612 Cable TV frequency separation standards

All cable TV systems that operate in the frequency bands 108-137 and 225-400 MHz shall comply with the following frequency separation standards:

(a) In the aeronautical radiocommunication bands 118-137, 225-328.6 and 335.4-400 MHz, the frequency of all carrier signals or signal components carried at an average power level equal to or greater than 10^{-4} watts in a 25 kHz bandwidth in any 160 microsecond period must operate at frequencies offset from certain frequencies that may be used by aeronautical radio services operated by FCC licensees or by the U.S. government or its agencies. The aeronautical frequencies from which offsets must be maintained are those frequencies that are within one of the aeronautical bands defined in this subparagraph and when expressed in MHz and divided by 0.025 yield an integer. The offset must meet one of the following two criteria:

(1) All such cable carriers or signal components shall be offset by 12.5 kHz with a frequency tolerance of ±5 kHz; or

(2) The fundamental frequency from which the visual carrier frequencies are derived by multiplication by an integer number, which shall be 6.0003 MHz with a tolerance of ±1 Hz (harmonically related carrier [HRC]) comb generators only).

(b) In the aeronautical radionavigation bands 108-118 and 328.6-335.4 MHz, the frequency of all carrier signals or signal components carrier at an average power level equal to or greater than 10^{-4} watts in a 25 kHz bandwidth in any 160 microsecond period shall be offset by 25 kHz with a tolerance of ± 5 kHz. The aeronautical radionavigation frequencies from which offsets must be maintained are defined as follows:

(1) Within the aeronautical band 108-118 MHz when expressed in MHz and divided by 0.025 yield an even integer.

(2) Within the band 328.6-335.4 MHz, the radionavigation glide path channels are listed in 87.501 of the rules.

Note: The HRC system, as described above, will meet this requirement in the 328.6-335.4 MHz navigation glide path band. Those incrementally related carriers (IRC) systems, with comb generator reference frequencies set at certain odd multiples equal to or greater than 3 times the 0.0125 MHz aeronautical communications band offset, e.g. (6n + 1.250 ± 0.0375) MHz, may also meet the 25 kHz offset requirement in the navigation glide path band.

[50 FR 29400, July 19, 1985]

76.613 Interference from a cable TV system

(a) Harmful interference is any emission, radiation or induction that endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with this chapter.

(b) The operator of a cable TV system that causes harmful interference shall promptly take appropriate measures to eliminate the harmful interference.

(c) If harmful interference to radio communications involving the safety of life and protection of property cannot be promptly eliminated by the application of suitable techniques, operation of the offending cable TV system or appropriate elements thereof shall immediately be suspended upon notification by the engineer in

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charge (EIC) of the FCC's local field office and shall not be resumed until the interference has been eliminated to the satisfaction of the EIC. When authorized by the EIC, short test operations may be made during that period of suspended operation to check the efficacy of remedial measures.

(d) The cable TV system operator may be required by the EIC to prepare and submit a report regarding the cause(s) of the interference, corrective measures planned or taken and the efficacy of the remedial measures.

(Secs. 1, (302); (82 Stat, 290); 47 U.S.C. 151, 302) [42 FR 41296, Aug. 16, 1977]

76.614 Cable TV system regular monitoring

Cable TV operators transmitting carriers in the frequency bands 108-137 and 225-400 MHz shall provide for a program of regular monitoring for signal leakage by substantially covering the plant every three months. The incorporation of this monitoring program into the daily activities of existing service personnel in the discharge of their normal duties will generally cover all portions of the system and will therefore meet this requirement.

Monitoring equipment and procedures utilized by a cable operator shall be adequate to detect a leakage source that produces a field strength in these bands of 20 μV/m or greater at a distance of 3 meters. During regular monitoring, any leakage source that produces a field strength of 20 μV/m or greater at a distance of 3 meters in the aeronautical radio frequency bands shall be noted and such leakage source shall be repaired within a reasonable period of time.

The operator shall maintain a log showing the date and location of each leakage source identified, the date on which the leakage was repaired and the probable cause of the leakage. The log shall be kept on file for a period of two years and shall be made available to authorized representatives of the FCC upon request.

[50 FR 29400, July 19, 1985]

76.615 Notification requirements

All cable TV operators shall comply with each of the following notification requirements:

(a) The operator of the cable system shall notify the FCC annually of all signals carried in the aeronautical radio frequency bands, noting the type of information carried by the signal (TV picture, aural, pilot carrier or system control, etc.). The timely filing of FCC Form 325, Schedule 2, will meet this requirement.

(b) The operator of a cable system shall notify the FCC before transmitting any carrier or other signal component with an average power level across a 25 kHz bandwidth in any 160 microsecond time period equal to or greater than 10^{-4} watts at any point in the cable distribution system on any new frequency or frequencies in the aeronautical radio frequency bands. Such notification shall include:

(1) Legal name and local address of the cable TV operator,

(2) The names and FCC identifiers (e.g. CA0001) of the system communities affected,

(3) The names and telephone numbers of local system officials who are responsible for compliance with 76.610, 76.611 (effective July 1, 1990), and 76.612 through 76.616 of the rules,

(4) Carrier and subcarrier frequencies and tolerance, types of modulation and the maximum average power levels of all carriers and subcarriers occurring at any location in the cable distribution system,

(5) The geographical coordinates of a point near the center of the cable system, together with the distance (in kilometers)

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from the designated point to the most remote point of the cable plant, existing or planned, which defines a circle enclosing the entire cable plant,

(6) A description of the routine monitoring procedure to be used and

(7) For cable operators subject to 76.611 (effective July 1, 1990), the cumulative signal leakage index derived under 76.611(a)(1) (effective July 1, 1990) or the results of airspace measurements derived under 76.611(a)(2) (effective July 1, 1990), including a description of the method by which compliance with basic signal leakage criteria is achieved and the method of calibrating the measurement equipment. This information shall be provided to the FCC prior to July 1, 1990, and each calendar year thereafter.

[50 FR 29400, July 19, 1985]

76.616 Operation near certain aeronautical and marine emergency radio frequencies

The transmission of carriers or other signal components capable of delivering peak power levels equal to or greater than 10^{-5} watts at any point in a cable TV system is prohibited within 100 kHz of the frequency 121.5 MHz and is prohibited within 50 kHz of the two frequencies 156.8 MHz and 243.0 MHz.

[50 FR 29401, July 19, 1985]

Table 1: Radiation limit

Frequencies	Radiation limit (μV/m)	Distance (feet)
Up to and including 54 MHz	15	100
Over 54 up to and including 216 MHz	20	10
Over 216 MHz	15	100

76.617 Responsibility for interference

Interference resulting from the use of cable system terminal equipment (including subscriber terminal, input selector switch and any other accessories) shall be the responsibility of the cable system terminal equipment operator in accordance with the provisions of Part 15 of this chapter. This is provided, however, that the operator of a cable system to which the cable system terminal equipment is connected shall be responsible for detecting and eliminating any signal leakage where that leakage would cause interference outside the subscriber's premises and/or would cause the cable system to exceed the Part 76 signal leakage requirements. In cases where excessive signal leakage occurs, the cable operator shall be required only to discontinue service to the subscriber until the problem is corrected.

[53 FR 46619, Nov. 18, 1989]

76.618 Grandfathering

Cable TV systems are permitted to use aeronautical frequencies that were requested or granted for use by Nov. 30, 1984, under 76.619 of the rules until July 1, 1990.

[50 FR 29401, July 19, 1985]

76.619 Grandfathered operation in the frequency bands 108-136 and 225-400 MHz

All cable TV systems operating in a grandfathered status under 76.618 of the rules and transmitting carriers or other signal components capable of delivering peak power equal to or greater than 10^{-5} watts at any point in the cable system in the frequency bands 108-136 and 225-400 MHz for any purpose are subject to the following requirements:

(a) The operator of the cable system shall notify the FCC annually of all signals carried in these bands, noting the type of information carried by the signal (TV,

aural, or pilot carrier and system control, etc.). The timely filing of FCC Form 325, Schedule 2, will meet this requirement.

(b) The operator of the cable system shall notify the FCC of the proposed extension of the system radius in these bands. Notification shall include carrier and subcarrier frequencies, types of modulation, the previously notified geographical coordinates, the new system radius and the maximum peak power occurring at any location in the cable distribution system. No system shall extend its radius in these bands without prior FCC authorization.

(c) The operator of the cable system shall maintain at its local office a current listing of all signals carried in these bands, noting carrier and subcarrier frequencies, types of modulation, and maximum peak power that occurs at any location within the cable distribution system.

(d) The operator of the system shall provide for regular monitoring of the cable system for signal leakage covering all portions of the cable system at least once each calendar year. Monitoring equipment and procedures shall be adequate to detect leakage sources that produce field strengths in these bands of 20 μV/m at a distance of 3 meters. The operator shall maintain a log showing the date and location of each leakage source identified, the date on which the leakage was eliminated and the probable cause of the leakage. The log shall be kept on file for a period of two years and shall be made available to authorized representatives of the FCC on request.

Table 2: Minimum frequency offsets

Frequencies	Minimum frequency offsets
108-118 MHz	(50 + T) kHz
328.6-335.4 MHz	
108-136 MHz	
225-328.6 MHz	(100 + T) kHz
335.4-400 MHz	

(e) All carrier signals or signal components capable of delivering peak power equal to or greater than 10^{-5} watts must be operated at frequencies offset from aeronautical radio services operated by FCC licensees or by the U.S. government or its agencies within 111 km (60 nautical miles) of any portion of the cable system as given in paragraph (f) of this section. (The limit of 111 km may be increased by the FCC in cases of "extended service volumes" as defined by Federal Aviation Administration or other federal government agency for low altitude radio navigation or communication services.) If an operator of a cable system is notified by the FCC that a change in operation of an aeronautical radio service will place the cable system in conflict with any of the offset criteria, the cable system operator is responsible for eliminating such conflict within 30 days of notification.

(f) A minimum frequency offset between the nominal carrier frequency of an aeronautical radio service qualifying under paragraph (d) of this section and the nominal frequency of any cable system carrier or signal component capable of delivering peak power equal to or greater than 10^{-5} watts shall be maintained or exceeded at all times. The minimum frequency offsets are shown in Table 2.

In Table 2, T is the absolute value of the frequency tolerance of the cable TV signal. The actual frequency tolerance will depend on the equipment and operating procedures of the cable system, but in no case shall the frequency tolerance T exceed $\pm$25 kHz in the bands 108-136 and 225-400 MHz.

[50 FR 29401, July 19, 1985]

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Batteries and chargers

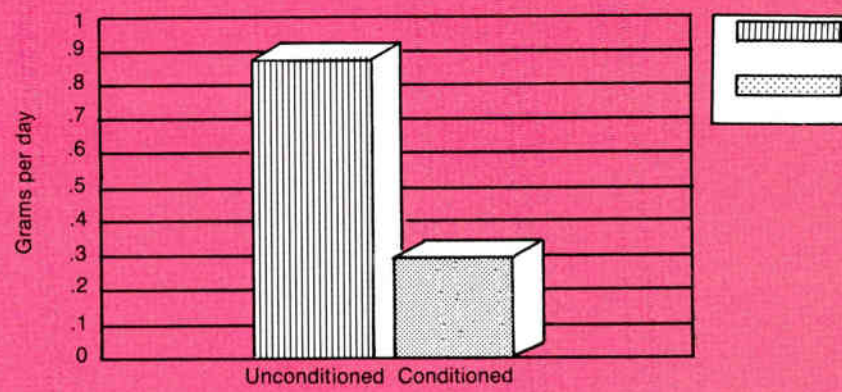
(Continued from page 76)

abnormal condition persists, the charger will shut down with appropriate alarm signals and note the failed battery. Field replacement is thus made accurate and simple.

As can be seen from the description of the system, a natural requirement in a series string of electrochemical units is that all elements of the system should have a nearly identical capacity if a design requirement is that the system should deliver near its theoretical capacity. This then brings us to the next stage in systems integration, which is *capacity matching*.

Although beyond the scope of this article, a brief description follows. Capacity matching is a dirty word to most battery manufacturers. A fact of battery manufacturing life is that all batteries are *not* created equal. There are many reasons for this, all of them related to process control. Since there are a great number of processes involved (not all of them necessarily under the control of the manufacturer) it can be expected that capacity variations will exist.

Figure 6: Battery water loss (14 V at 40°C)



To accommodate the capacity variations, a conditioning process has been developed (patent applied) that, through a specific series of thermal and electrical cycles, optimizes the electrochemical properties in a given cell or battery. The resulting discharge properties of a battery are thus stabilized and can therefore be matched to other batteries of similar discharge characteristics. An additional and very significant benefit of this process is that the float current is reduced to about one-third of the current normally required. The obvious benefit is reduced gassing and therefore extended life of the battery. In laboratory testing gas evolution has been reduced to one-third of unconditioned batteries.

Figure 6 shows the water loss (in grams per day) for one type of battery, before and after conditioning.

When conditioned and matched batteries are built into a power supply equipped with an energy monitoring charge system, the most reliable and cost-effective power supply is the result.

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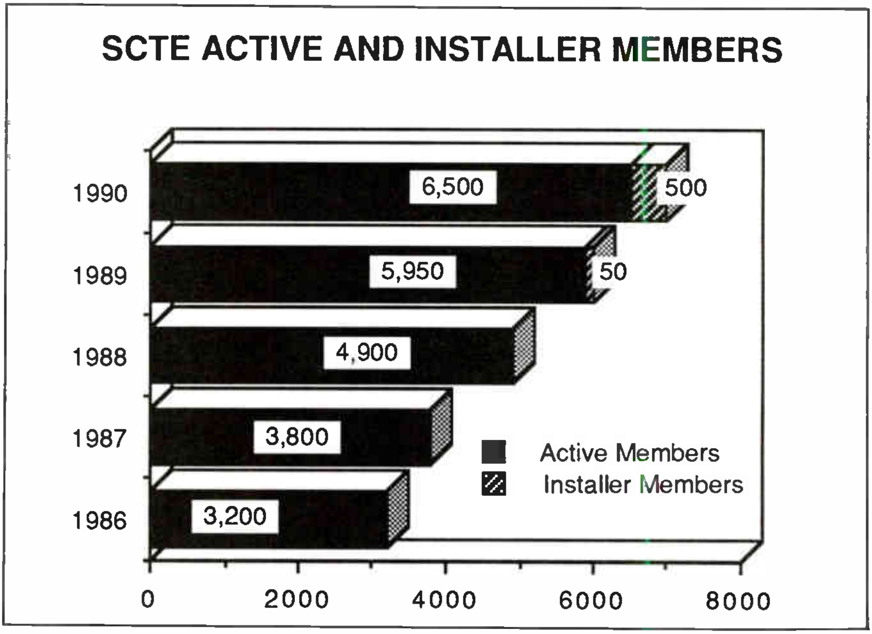
SCTE

June 1990



National Membership Tops 7,000

The national membership of the Society has passed the 7,000 mark. This represents a drastic increase from 1989's year-end membership count of 6,000, which also represented an increase of 1,000 members over the 1988 year-end figure of 5,000.

The figure of 7,000 members takes into account the 6,500 active members, as well as the 500 members that have joined the Society at the installer level since the introduction of the Installer Certification Program in 1989.

The active member count shows that 500 members have joined at this level since January 1990, indicating that according to May 1990's figures, the Society attracted an average of approximately 100 new active members and 100 new installer members a month.

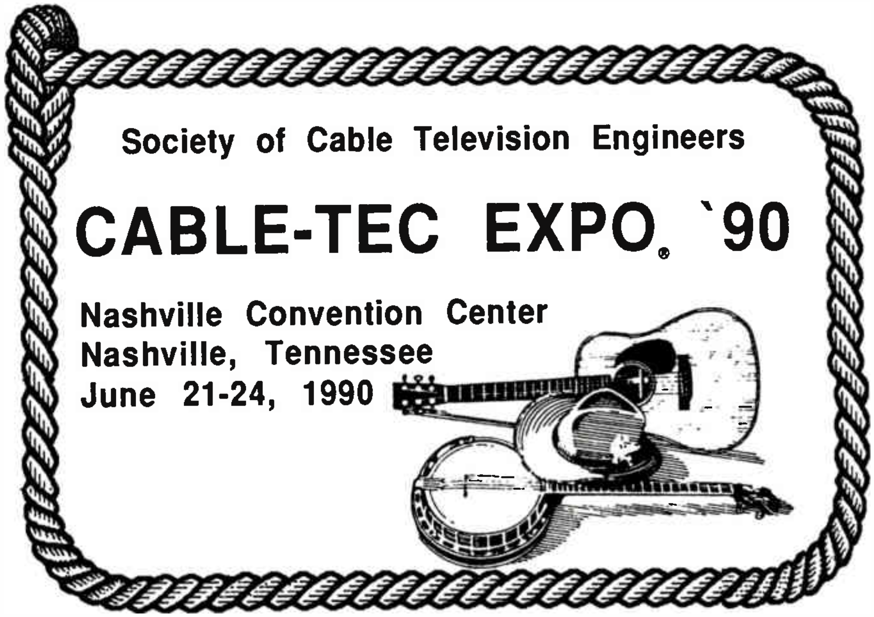
This growth can be partially attributed to the popularity and success of the Society's numerous programs and services, including the Chapter Development Program, Broadband Communications Technician/Engineer (BCT/E) and Installer

Certification Programs and annual Cable-Tec Expo and Engineering Conference.

Since the Society's formation in 1969, SCTE has established a number of programs that have become invaluable to the industry, such as its Chapter Development Program, which develops regional groups of technical personnel to provide much-needed forums for technical instruction and discussion at the local level.

SCTE now has a total of 55 local groups, with 39 chapters and 16 meeting groups. All Society members can benefit from these groups, as they expand each member's knowledge of the industry as well as aiding in individual professional development.

Reaching the 7,000 mark is an important event in the Society's history. This figure indicates the broadband industry's constantly growing appreciation of the training and services provided by the Society. It is highly rewarding to reach this point nearly simutaneously with Cable-Tec Expo `90, which is sure to be the Society's biggest and most important training event yet. We look forward to many more years of service to the industry.



Expo `90 Schedule of Events

Record attendance is anticipated for the 1990 Cable-Tec Expo, to be held June 21-24 at the Nashville Convention Center in Nashville, Tenn. This fully technical conference and trade show will offer a wide variety of educational programs, "hands-on" training sessions and technical workshops, as well as an instructional exhibit floor featuring all areas of cable industry hardware.

The following is a preliminary schedule for the expo, the 1990 Annual Engineering Conference and a variety of events planned in conjunction with the show.

NASHVILLE CONVENTION CENTER

Wednesday, June 20, 1990

10 a.m. - 3 p.m.	NCTA Engineering Committee Meeting *(Stouffers Tennessee Room)*
4 - 8 p.m.	Annual Engineering Conference Registration *(First Floor Lobby)*
6 - 8 p.m.	Arrival Night Reception (sponsored by Wavetek) *(Stouffers East Ballroom)*

Thursday, June 21, 1990

7:30 - 8:30 a.m.	Conference Registration *(First Floor Lobby)*
8:30 a.m. - 4:30 p.m.	Annual Engineering Conference *(Mezzanine Ballroom)*
8:30 - 9 a.m.	Opening Remarks
9 - 10:15 a.m.	Session A: Donald Frost, Master Motivator
10:30 a.m. - Noon	Session B: Cable's Weak Link - Tap to TV
Noon - 1:45 p.m.	Awards Luncheon Dr. Richard Green, Keynote Speaker *(Stouffers Grand Ballroom)*
1:45 - 3 p.m.	Session C: Getting It Right the First Time: Field Supervision Techniques
3:15 - 4:30 p.m.	Session D: Cable in the 1990's: Boom or Bust?
4:30 - 5:30 p.m.	Annual SCTE Membership Meeting *(Mezzanine Ballroom)*
3 - 5 p.m.	Cable-Tec Expo Registration *(First Floor Lobby)*
6 - 8 p.m.	Welcome Reception (sponsored by Anixter Cable TV, AT&T, Raychem and the Tennessee SCTE Chapter) *(Stouffers Grand Ballroom)*

Friday, June 22, 1990

7:30 a.m. - 4 p.m.	Cable-Tec Expo Registration *(First Floor Lobby)*
8 - 9:15 a.m.	Workshop Period A
9:30 - 10:45 a.m.	Workshop Period B
11 - 12:15 a.m.	Workshop Period C
Noon - 6 p.m.	Exhibit Hall Open *(West and Center Halls)*
7:15 p.m. - Midnight	Expo Evening at the Grand Old Opry (Sponsored by Jerrold Communications)

Saturday, June 23, 1990

8 - 9:15 a.m.	Workshop Period D
9:30 - 10:45 a.m.	Workshop Period E
11 - 12:15 a.m.	Workshop Period F
8 a.m. - 12:15 p.m.	Cable-Tec Expo Registration *(First Floor Lobby)*
Noon - 5 p.m.	Exhibit Hall Open *(West and Center Halls)*
4 - 5 p.m.	Exhibitors' Reception *(West and Center Halls)*
5 - 7 p.m.	Ham Radio Operators' Reception *(Stouffers Tennessee Room)*
7 - 10 p.m.	Closing Night Reception (Sponsored by Scientific-Atlanta) *(Stouffers Grand Ballroom)*

Sunday, June 24, 1990

8:30 a.m. - Noon	BCT/E and Installer Certification Program Examinations *(Stouffers Grand Ballroom)*
11 a.m. - 1 p.m.	Tours of the Nashville Network's Studio Facilities

Member Profile: Fritz Baker

"Member Profile" is an *Interval* feature that puts the spotlight on *you*, the Society's members. Each month, an SCTE member will be profiled in this feature: his career, his experience, his involvement with the Society.

Members featured will be chosen from all levels within the industry; from engineer to installer, from manager to technician.

Frederick "Fritz" Baker is a regional engineer for Viacom Cablevision's Eastern Systems. Currently based in Nashville, Tenn., one of his duties is supervising the installation of cable drops for Exhibitors at Cable-Tec Expo `90, as well as overseeing the videotaping of the expo's panel discussions and technical workshops.

Fritz got his start in the technical end of the communications industry in his college days. He recalls that while attending Bakersfield College in Ridgecrest, Calif., he went to work at radio station KLOA. Eventually working his way up to the position of chief engineer in 1971, he started working in cable the following year when the owner of KLOA established Ridgecrest Cablevision. He was involved in the system's design, startup and construction.

"We were running AML system signals into the Mohave Desert," he recalls. " We tried to build a first-class system using heat shrink cable. It didn't last. The alkaline soil of the desert eroded the cable three weeks after it was built. You'd look at a brand new amplifier, and the soil had eaten clear through it. We had to keep everything off the ground. It was probably one of the very first rebuilds."

Fritz has worked exclusively in the cable industry since that time, moving to Ohio in 1978 as a regional engineer for Inertie, joining Cable Systems/Audubon Electronics as chief engineer the following year and joining the Viacom staff as a staff engineer in Dublin, Calif.. in 1980.

Fritz Baker (right) and wife Suzi.

In 1981, Fritz was promoted to his current position as regional engineer. He is responsible for tracking and reducing service calls throughout the division. "I analyze why customers need service calls in our systems," he says. "I am striving to improve the reliability of our cable systems by tracking problems and then reducing or eliminating their causes. When fewer customer complaints are generated, we will schedule fewer trouble calls and hold our costs down. This means better service for the customer and fewer rate increases in the future."

"It's a good place to be," Fritz says of his current home base. "Nashville is great." For Cable-Tec Expo `90, he and his staff will be microwaving cable signals into the Nashville Convention Center and distributing them throughout the building.

An SCTE member since 1982, Fritz is a candidate in the BCT/E Certification Program. Although not regularly affiliated with an SCTE local chapter or meeting group, he attends as many local SCTE seminars as he can in his travels for Viacom.

Fritz has written and presented technical papers at the NCTA and Western Shows, and has contributed articles to *Cable Marketing* and *CED* magazines.

→

An amateur pilot, Fritz recalls how he "used to fly to the systems I covered. That was a lot of fun." Besides flying, his hobbies include racquetball and travelling to "fun and faraway places."

Fritz and his wife Suzi have three children: Adam, 14; Denny, 9; and Cathryn, 5. "It's nothing but non-stop soccer," he comments. "Seven days a week they have a soccer game, baseball game or a practice for one of their teams."

One incident that has been highly influential in Fritz's career occured at the beginning of his career in cable TV. "While doing service calls," he recalls, "I went into this house that reeked of dog and cat litter. It was the messiest house I had ever seen. The cat had made everywhere. It was just a disaster area.

"Anyway, I fixed the problem and got back in the truck. I got on the radio, and using fairly mild language, I described the house to my co-workers. When I got back to the office, the phone was ringing, and I did double duty and acted as the system manager when I picked it up.

"It turned out to be the customer I had just visited. 'You have an extremely rude employee' she said, and rattled back everything I had said over the radio. Apparently, she overheard the transmission. I told her 'I'll send the employee back. He didn't mean it.' She said that wasn't necessary. I told her I would let him know about her call and guaranteed he would not do it again. From that point on, I realized I had to improve my professionalism in speaking on the radio and dealing with customers in general."

Fritz looks forward to attending Cable-Tec Expo `90 and continuing to be involved in the Society's activities in the future. "I think SCTE has come a long way," he says. "I've been extremely pleased with the way in which the Society has gone out of its way to fulfill the needs of the entire industry."

SCTE Calendar

The "**SCTE Calendar**" is an *Interval* feature incorporating Satellite Tele-Seminar Program listings(*), news of upcoming national events and announcements of upcoming local SCTE chapter and meeting group seminars.

Dates for 1990

June 6 Florida Chapter: Central Florida Group--Microdyne offices, Ocala, Fla. Topics: "Lightning Protection and CATV Plant" with Roy Ehman of Jones Intercable, "Headend Delivery System, Operation and Maintenance" with Bob Webb of Microdyne, "Satellite Antennas" with Leroy McKay of Microdyne and "New Developing Technologies" with Don Woodworth of Microdyne. Contact: Rick Scheller, (305) 753-0100.

June 11 Greater Chicago Chapter--Location to be supplied. BCT/E testing to be administered in Categories II, IV, V and VII (tentative). Contact: John Grothendick, (312) 438-4200.

June 13 Great Plains Meeting Group--United Artists Cable, Bellevue, Neb. BCT/E testing to be administered (tentative). Contact: Jennifer Hays, (402) 333-6484.

June 13-14 Dairyland Meeting Group--June 13: N.E.W. Media, Green Bay, Wis. June 14: Viacom Cablevision, Greenfield, Wis. "Service Technician Training Seminar" with Gary Wesa of ATC (June 13) and Joseph Sherer of Viacom (June 14). Contact: John Boltik, (608) 372-2999.

June 14 Chesapeake Chapter--Holiday Inn, Columbia, Md. Topic: "New Technologies, HDTV, Fiber, Multiport and VCR." Contact: Keith Hennek, (301) 731-5560.

June 14 Golden Gate Chapter--To be held in San Jose, Calif. Topic: "BCT/E Category IV - Distribution Systems" with Richard Covell of Jerrold. Contact: Tom Elliott, (408) 727-5295.

June 20 Delaware Valley Chapter--Information to be supplied. Contact: Diana Riley, (717) 263-8258.

June 20 Great Plains Meeting Group--United Artists Cable, Bellevue, Neb. BCT/E examinations to be administered in Categories II, IV, V and VII. Contact: Jennifer Hays, (402) 333-6484.

June 21-24 SCTE Cable-Tec Expo `90--Nashville Convention Center, Nashville, Tenn. The best investment in technical education you can make! Contact: SCTE national headquarters, (215) 363-6888.

June 22 Miss-Lou Chapter--Biloxi, Miss. Information to be supplied. Contact: Dave Matthews, (504) 923-0256.

***June 26** Satellite Tele-Seminar Program, *"High Definition Television (Part Two)"* with Walt Ciciora, Ph.D. of ATC, Wayne Luplow of Zenith Electronics Corp. and Norman Hurst of the David Sarnoff Research Center. Plus *"Digital Video: A Future Alternative (Part One)"* with Steffen Rasmussen of ABL Engineering. Videotaped at Cable-Tec Expo `89 in Orlando, Fla.

June 27 New Jersey Chapter--Location to be announced. Topics: "Powering Systems" and "Design." Contact: Jim Miller, (201) 446-3612.

June 27 Palmetto Meeting Group--Information to be supplied. Contact: Rick Barnett, (803) 747-1403.

July 11 Hudson Valley Chapter--Capital Cablevision, Albany, N.Y. Topics: "Video Waveform Interpretation," "Character Generators" and "Video Switching Usages." Contact: Robert Price, (518) 382-8000.

July 11 Mount Rainier Chapter--Location to be supplied. Topic: "First Aid Certification." Contact: Sally Kinsman, (206) 821-7233.

July 11-14 Rocky Mountain Chapter--Breckenridge, Colo. Technical sessions at Colorado Cable Television Association convention on "Management and Professionalism," "People Skills" and "Safety." Second Annual Cable Games to be held. Contact: Steve Johnson, (303) 799-1200.

July 12 Big Country Meeting Group--Brownwood, Texas. Information to be supplied. Contact: Albert Scarborough, (915) 698-3585.

July 18 Dixie Chapter--Montgomery, Ala. Information to be supplied. Contact: Rickey Luke, (205) 277-4455.

July 18 Greater Chicago Chapter--Location to be supplied. Topic: "BCT/E Category II - Video and Audio Signals and Systems." Contact: John Grothendick, (312) 438-4200.

July 18 Razorback Chapter--To be held in Little Rock, Ark. Topic to be supplied. Contact: Jim Dickerson, (501) 777-4684.

July 18 Great Plains Meeting Group--To be held in Omaha, Neb. Topic: "Plant Maintenance." Contact: Jennifer Hays, (402) 333-6484.

July 25 Appalachian Mid-Atlantic Chapter--Location to be announced. Annual Pig Roast and Golf Outing to be held. Contact: Richard Ginter, (814) 672-5393.

July 25 Piedmont Chapter--Location to be supplied. Topic: "Rebuilds and Upgrades." Contact: Rick Hollowell, (919) 968-4631.

July 29 Old Dominion Chapter--Busch Gardens, Williamsburg, Va. Annual gathering to show appreciation for chapter members. Contact: Margaret Davison-Harvey, (703) 248-3400.

***July 31** Satellite Tele-Seminar Program, *"Digital Video: A Future Alternative (Part Two)"* with Steffen Rasmussen of ABL Engineering. Videotaped at Cable-Tec Expo '89 in Orlando, Fla.

*Tele-Seminar Programs may be downlinked by any cable system and recorded for immediate and future employee training purposes. All Tele-Seminar Programs will air from 12-1 p.m. ET on Transponder 2 of Galaxy III.

Chapter and Meeting Group Exchange

This section of the *Interval* has been created to aid in the exchange of ideas and procedures between SCTE chapters and meeting groups. We hope the information reprinted here will assist other chapters and meeting groups in organizing their own operations and give officers ideas in planning their own upcoming seminars.

The following was derived from a letter written by Cascade Range Chapter member Tod Schmit to the chapter's board of directors. It features many useful suggestions that could help each SCTE local group improve its service to its members.

Suggestions for an Improved Chapter

By Tod Schmit
Chief Technician
North Willamette Telecom

As our yearly election of officers approaches I find myself reflecting back on the past two years or so. Our chapter has come a long way in upgrading its format, quality of presentations and general information. Yet I feel we can do better. I would like to challenge the current board and/or the incoming board to address the following issues. This would greatly improve SCTE's impact on its members, as well as fulfilling the stated mission of the organization, which is to promote the sharing of operational and technical knowledge in the cable TV industry's technical community. I suggest the following:

1) Publish a list of the board of directors. Also, compile a list of the local chapter members and/or meeting attendees to include system name, size, location, type of equipment used, etc. This would assist in providing contacts and creating dialogue between people with similar needs and problems. By having this information, we would be able to share information with those who would benefit most.
2) Become more specific in presentations at the chapter meetings. I have found the subjects of recent meetings interesting, but have found the presentations to be too general in scope. I recall one meeting at which we were asked to raise our hands to determine our job titles. All present held a maintenance technician or higher position. These are the people that need the issues presented to them in-depth. I have heard the phrase "We don't want to get too complicated now." If not in these meetings, then where? While working on a problem in the field? We should pick topics and totally examine them.
3) I am concerned about the way we elect our directors. I see a lack of representation from the small and/or independent cable operations. Many of the presentations and structure of the SCTE and its chapters focus on the large systems and MSOs. We need to do one of the following things: a) create two systems or small operations (similar to the OCTA's method) or b) limit the number of board members from one MSO to two representatives. One or both of these suggestions would lead to more diverse representation on the board and add some additional perspective that may now be lacking. We also need to define who is eligible to vote for chapter officers. To just take the votes of those who happen to show up on the day of the election seems to leave some people out, as well as

allowing some people to vote who probably shouldn't.

I thank you for taking the time to read this. SCTE has a great future in serving all cable TV technical personnel. Let us continue to strive to meet this challenge.

If you or your chapter or meeting group has any ideas, information or things that you are doing that might be of interest or help to your fellow groups, please submit this material to:

SCTE Meeting Exchange
c/o Ralph Haimowitz
669 Exton Commons
Exton, PA 19341

Chapter and Meeting Group Spotlight

"Chapter and Meeting Group Spotlight" is a new *Interval* section that will focus on recent SCTE chapter or meeting group events noteworthy for their topic, attendance numbers or innovative approaches to technical training.

The Appalachian Mid-Atlantic Chapter reports that 74 people were in attendance at its March 28 meeting, held at the Holiday Inn in Chambersburg, Pa. The entire event was devoted to a presentation on headend equipment by Scientific-Atlanta headend engineer Martin Mattingly.

The Delaware Valley Chapter held its April 11 meeting at Williamson's Restaurant in Horsham, Pa. Seventy-one members turned out to listen to speakers Frank Ragone of Comcast Corp. discuss the fundamentals of system design and Dave Pangrac of ATC speak on his company's fiber architecture.

At this meeting, the chapter also held a drawing for an all-expenses-paid trip to Cable-Tec Expo `90 in Nashville, Tenn. The winner was Dave Kuykendall of Monmouth Cablevision.

The meeting also saw the installation of new chapter officers: Dan McMonigle, president; Dennis Quinter, first vice president; Chuck Tolton, second vice president; and Rich Blandford, secretary/treasurer.

Frank Ragone of Comcast Corp. speaks on the fundamentals of system design at the April 11 meeting of the Delaware Valley Chapter.

Scott Weber remains on the board as past president.

Chapter member John Kurpinski reported that the chapter, due to many requests from its members, has adopted a "no-smoking" policy for all future chapter meetings.

The Great Lakes Chapter reported attendance of 118 people at its fiber-optics seminar held March 28 at the Holiday Inn in Livonia, Mich. According to chapter secretary Marvin Nelson, presentations were given on the process of manufacturing fiber, understanding fiber specifications and

Delaware Valley Chapter President Dan McMonigle presents airline tickets and hotel accommodations for Cable-Tec Expo '90 to the winner of the chapter's April 11 drawing, Dave Kuykendall of Monmouth Cablevision.

appplications of fiber in the cable TV industry.

The chapter also held elections at this meeting, resulting in the election of Doug MacLeod as president, Dan Leith as vice president, Marvin Nelson as secretary and Barry Houselander as treasurer.

The Ohio Valley Chapter held consecutive meetings March 13 in Cincinatti and March 14 in Cleveland. Both meetings featured presentations on "Antenna Theory" by Gordon Zimmerman of Lindsay Speciality Products and "Signal Processors" by William Gailey of Scientific-Atlanta. Sixty people attended the March 13 event, while 56 people were present the next day.

The Rocky Mountain Chapter held a technical seminar April 7 at the ATC National Training Center in Denver. According to Media Director Rikki Lee, the session began with a demonstration by Tektronix's Steve Stanton of the company's new system sweep. Attendees also viewed a tape of the Satellite Tele-Seminar Program

Scott Weber, outgoing president of the Delaware Valley Chapter, receives a plaque in recognition of his service from 1989 to 1990 from incoming President Dan McMonigle at the chapter's April 11 meeting.

Rikki Lee

United Cable of Colorado's Dan Goffinet and Ron Upchurch discuss ground-based CLI measurements at the April 7 meeting of the Rocky Mountain Chapter in Denver.

that featured John Wong of the FCC discussing how to fill out form 320 for signal leakage.

Following the video, Dan Goffinet of United Cable of Colorado, described his system's approach to performing a ground-based CLI. After lunch, Phyllis Thompson of CaLan demonstrated and described her company's computer-aided testing equipment. George Gonos and Chris Verzulli of US Electronics examined the transmission of signal components with a waveform monitor and vectorscope. Approximately 35 people were in attendance at the seminar.

In its recent mailing to its local members, **The Sierra Meeting Group** listed a BCT/E testing event to be held by its neighboring **Golden Gate Chapter**. This type of cooperation and mutual support among

Rikki Lee

Steve Stanton of Tektronix addresses the Rocky Mountain Chapter on system sweep equipment during the chapter's April 7 seminar.

SCTE local groups is truly admirable and worth noting, as each of the Society's groups, through working together, can support the spread of technical knowledge throughout the industry.

SCTE

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

Editors:—Howard Whitman
Bill Riker

June 1990

Understanding
ne cable system

BACK TO BASICS

The training and educational supplement to Communications Technology magazine.

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Formerly Installer/Technician

Cable basics

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

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

Cross-modulation (X-mod) is literally the "crossing" of modulation from one channel (or channels) to another. Since the horizontal sync pulse has the highest energy content of any of the video components within a TV channel, X-mod typically manifests itself as a vertical bar (or bars) in the viewed picture. If the sync pulses of all channels are at exactly the same horizontal frequency and phase, the bars would be offscreen and only the actual video information of the offending channel(s) would be seen.

Where the bars would fall offscreen, X-mod should be 48 dB below the visual carrier level for non-visibility of the offending video. If on-screen (out of phase or at a different frequency), the carrier-to-X-mod ratio (C/X-mod) should be at least 51 dB.

For systems carrying more than 30 channels, *composite triple beat* (CTB) distortion becomes visible before X-mod and, as a result, some manufacturers no longer specify this distortion for their equipment.

X-mod is a third order product and follows a 20log function in that for every dB the levels of an amplifier are raised, the C/X-mod gets 2 dB worse. Doubling the number of channels carried degrades this ratio by 6 dB and so does doubling the cascade length.

C/X-mod distortion at any point in a cascade of like amplifiers operating at the same levels is equal to that of one amplifier, less 20 times the log of the number of amplifiers in cascade to that point. Here's the formula:

$$CM_t = CM_1 - 20\log(N)$$

Where:

CM_t = total C/X-mod
CM_1 = C/X-mod of one amp
N = number of amplifiers in cascade

For example to find the C/X-mod after 20 amplifiers if one amplifier contributes a 91 dB C/X-mod, make the following calculations:

$$\begin{aligned} CM_t &= CM_1 - 20\log(20) \\ &= 89 - 20(1.301) \\ &= 89 - 26.02 \\ &= 64.98 \end{aligned}$$

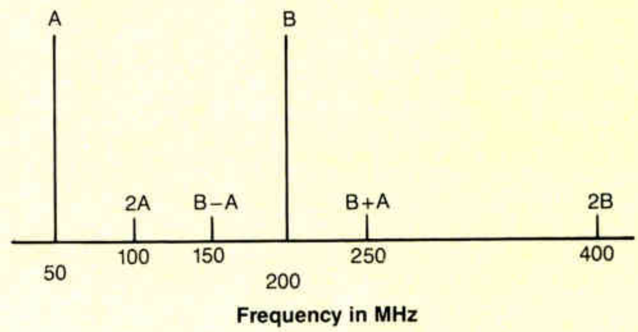
To find the sum of two or more C/X-mod values change their signs, divide by 20 and make the result an exponent of 10. Sum each of these new values, take the log of the sum, then multiply by 20. Here's the formula:

$$C/X_t = -20\log_{10}(10^{-C/X1 \div 20} + 10^{-C/X2 \div 20} + 10^{-C/Xn \div 20})$$

Where:

C/X_t = end of line C/X-mod
C/X1 = first value of C/X-mod
C/X2 = second value of C/X-mod
C/Xn = third (and any other) values of C/X-mod

Figure 1



For example, the trunk portion of a system delivers a 64 dB C/X-mod. The bridger's ratio is 63 dB with the line extenders contributing 65 dB. What would be the end of line (EOL) C/X-mod performance?

$$\begin{aligned} C/X_t &= -20\log_{10}(10^{-64 \div 20} + 10^{-63 \div 20} + 10^{-65 \div 20}) \\ &= -20\log_{10}(10^{-3.31} + 10^{-3.15} + 10^{-3.25}) \\ &= -20\log_{10}(5.6234^{-4} + 7.0795^{-4} + 5.6234^{-4}) \\ &= -20\log_{10}(1.9012^{-3}) \\ &= -20(-2.7209) \\ &= 54.42 \text{ dB} \end{aligned}$$

Discrete second order

When a carrier (A) is applied to the amplifier input, the amplifier output will contain that carrier at a higher amplitude plus its second harmonic (2A), which is twice the carrier frequency. When two carriers (A and B) are applied to the amplifier input, the amplifier output will contain both the carriers plus the second harmonics (2A and 2B), the sum and difference frequencies (±A, ±B). See Figure 1.

Second order distortion produced by one amplifier as a function of level behaves like power, on a 10log basis. For each dB we raise the amplifier levels (provided the amplifier doesn't go into compression) the carrier-to-second order (C/2nd order) distortion gets worse by 1 dB. In order for the C/2nd order *ratio* to get 1 dB worse, the second order *product* has to get 2 dB worse. This is because the carrier level is being raised 1 dB and the product has to increase by 2 dB for the difference between the carrier and product to increase by 1 dB.

If like amplifiers at like operating levels carrying the same channels are cascaded, and if the second order products produced by each amplifier are at the same frequency, level and phase, they will add on a 20log basis, increasing by 6 dB for every double. However, for perhaps a multitude of reasons including phase relationships, the second order products produced in a cascade of like amplifiers tend to add on a random 10log basis such that each time the cascade is doubled the C/2nd order gets 3 dB worse. Many knowledgeable theorists have stated that second order distortion should add on a 10log basis in a cascade of like amplifiers, however these same individuals will be the first to admit that in practice, empirical data indicates that second order distortion accumulation will vary from bobcat **2021** **Non-Rider Vibratory Plow**

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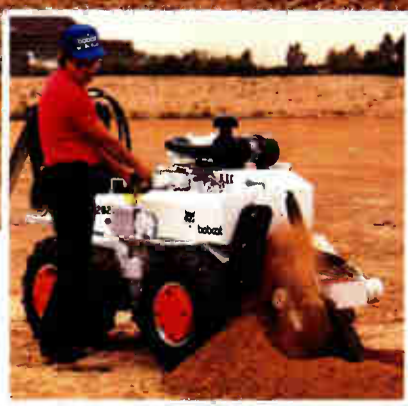

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a 10 to 20log addition, but in the majority of cases closely follows a 15log addition.

Unless you know your amplifiers perform differently, it would be prudent to use the following formula to compute the discrete C/2nd order distortion in your system. To find the C/2nd order at any point in a cascade of like amplifiers operated at like levels, subtract 15 times the log of the number of amplifiers cascaded from the C/2nd order of one amplifier. Here's the formula:

$$C/2_t = C/2_1 - 15\log(N)$$

Where:

$C/2_t$ = C/2nd order after N amplifiers
C/N_1 = C/2nd order of one amplifier
N = number of like amplifiers in cascade

For example, to find the C/2nd order after 20 amplifiers if it is 81 dB for one amplifier, make the following calculations:

$$\begin{aligned} C/2_t &= C/2_1 - 15\log(20) \\ &= 81 - 15(1.301) \\ &= 81 - 19.52 \\ &= 61.4 \text{ dB} \end{aligned}$$

Discrete third order

When a carrier (A) is applied to the amplifier input the output contains the second harmonic (2A) as previously explained, and it also contains the third harmonic (3A) a triple beat product (Figure 2).

When three carriers, A, B and C are applied to the amplifier input, the output will not only contain the second order products of these carriers but the following third order products as well: 3A, 3B and 3C (third harmonics); 2A ± B, 2A ± C, 2B ± A, 2B ± C, 2C ± A, 2C ± B (the second harmonic of any one of the carriers plus or minus each of the others); and finally ±A ±B ±C (any combination of sum and/or difference frequencies that don't result in negative frequencies).

Third order distortion adds on a 20log basis, and for each dB we raise the amplifier's carrier levels, the carrier-to-third order distortion ratio (C/3rd order) gets 2 dB worse. For the ratio to get 2 dB worse, the third order distortion product must get 3 dB worse (higher in level).

To find the C/3rd order product ratio at any point in a system of like amplifiers operated at the same level, subtract 20 times the log of the number of amplifiers in cascade (to that point) from the C/3rd order product of one amplifier. The formula is:

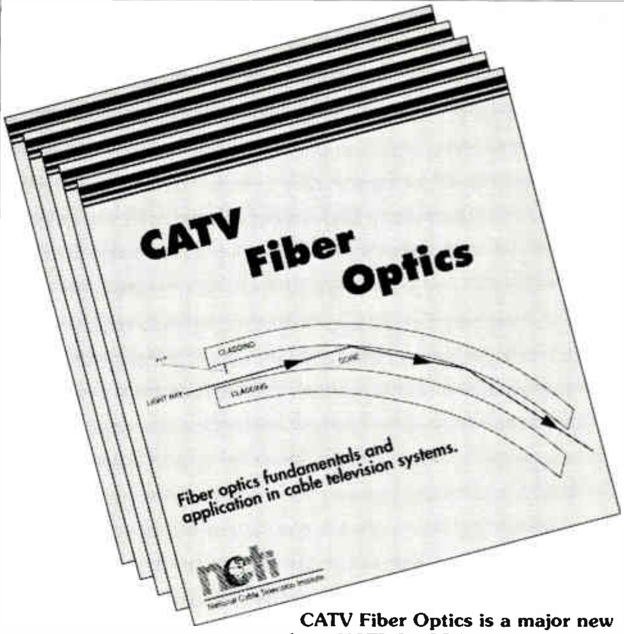
$$C/3_t = C/3_1 - 20\log(N)$$

Where:

$C/3_t$ = C/3rd order at point N
$C/3_1$ = C/3rd order of one amplifier

For example, to find the C/3rd order after 20 amplifiers with each contributing a C/3rd order of 95 dB, make the following calculations:

$$\begin{aligned} C/3_t &= C/3_1 - 20\log_{10}(N) \\ &= 95 - 20\log_{10}(20) \\ &= 95 - 20(1.301) \\ &= 95 - 26.02 \\ &= 68.9 \text{ dB} \end{aligned}$$



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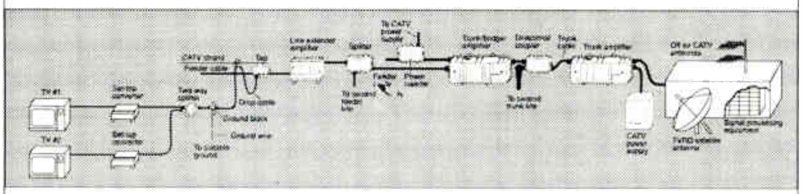

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The formula to compute the sum of different values of discrete third order products is the same as that for X-mod. Since individual third order products seldom cause visual impairment to a TV picture, the formula will not be repeated here.

Composite third order

As each carrier is added, it interacts with all the other carriers producing more and more second and third order beats. Except for Chs. 5 and 6, the TV carriers on a cable system are at 6 MHz increments, causing the majority of the triple beats produced to fall within 30 kHz of a TV carrier. The sheer multitude of these beats (more than 2,000 falling near Ch. 40's visual carrier in a 77-channel system) is sufficient to cause visual interference in a picture even though any individual beat's amplitude is well below the interference threshold of 57 dB below carrier. This energy bundle or composite of the many triple beats is, in fact, called *composite triple beat* (CTB).

When the system is carrying CW carriers, and measured with a spectrum analyzer set to 30 kHz bandwidth and 30 Hz video filtering, the carrier-to-CTB ratio (C/CTB) must be better than 57 dB to *not* cause interference.

Cable channels are normally modulated with video information with the maximum carrier voltage occurring during the horizontal synchronization pulse. Since this pulse has a 15 percent duty cycle, the odds in a non-gen-locked system of the carriers' pulses occurring at the same time is remote and becomes more so as additional channels are added. The net effect modulation is an improvement of approximately 10 dB. For example, a system that measures better than a 47 dB C/CTB with CW carriers will not exhibit visible CTB degradation *most of the time.* It is probable, however, that many of the sync pulses will occur simultaneously at some point, thus reducing some of the advantage gained by the modulation process. In addition, a margin allowing for degradation caused by level and temperature changes is in order. For a stable system, a minimum C/CTB with CW carriers would be 52 dB.

CTB follows a 20log relationship, and for each dB the levels of a well-behaved amplifier are raised, the C/CTB gets 2 dB worse. Adding two devices with the same C/CTB results in a combined C/CTB 6 dB worse.

To find the C/CTB performance at any point in a cascade of like amplifiers operating at the same levels, subtract 20 times the log of the number of amplifiers in cascade from the C/CTB of one amplifier. The equation looks like this:

$$C/CTB_t = C/CTB_1 - 20\log(N)$$

Where:

C/CTB_t = C/CTB after N amplifiers
C/CTB_1 = C/CTB of one amplifier
N = number of amplifiers in cascade

For example, to find the C/CTB after a six-amplifier cascade of like amplifiers operating at the same levels, if one amplifier exhibits a C/CTB of 90 dB, make the following calculations:

$$\begin{aligned} C/CTB_t &= C/CTB_1 - 20\log(N) \\ &= 90 - 20\log(6) \\ &= 90 - 20(.7782) \\ &= 90 - 15.56 \\ &= 74.44 \text{ dB} \end{aligned}$$

This formula is mathematically correct, but the actual measured CTB performance at the ends of typical cascades of six or more amplifiers at system balance temperature normally provides better performance than the mathematical prediction indicates. A 30-amplifier cascade often produces performance more closely related to the C/CTB of one amplifier minus 15 times the log of the number of amplifiers in cascade.

For cascades between six and 30 amplifiers, typical performance seems to vary between 20 and 15log (N) respectively for most manufacturers' amplifiers. No formal agreement has been reached in the engineering community as to why this happens and it is probably safer to use the 20log version of the formula for any C/CTB calculations performed, as improvement gained in long cascades at balance temperature will more than likely be lost by poorer distortion performance at temperature extremes.

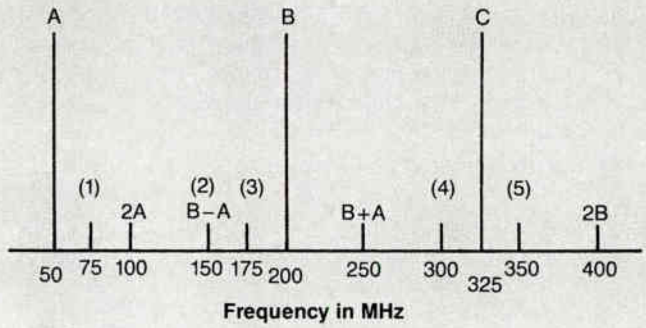
With CTB, doubling the channel loading on a given amplifier, such as going from 30 to 60 channels, will degrade performance in excess of the 6 dB a 20log relationship would indicate. This is because the number of triple beats produced increases on a logarithmic rather than linear basis as channels are added.

Another factor that hurts C/CTB performance when adding channels is that they are usually at frequencies *above* those already carried, and the amplifier devices have their poorest third order performance at the higher frequencies. In a 77-channel system the most beats occur near Ch. 40's carrier, yet the worst case C/CTB performance is at channels above Ch. 70 due to the poorer discrete third order performance at these frequencies.

An estimate of worst case C/CTB performance of an amplifier can be obtained by subtracting 10 times the log of the number of beats that occur at the highest channel from the three tone triple beat that occurs at that channel. To find worst case C/CTB for a 77-channel 550 MHz system, first find the carrier-to-three tone triple beat ratio at the highest channel, either from the manufacturer or by measuring it yourself.

When measuring, find the −A +B +C triple beat product using three adjacent channels at the upper end of the spectrum. The channels of choice for a 77-channel 550 MHz system would be A = 523.25 MHz, B = 529.25 MHz and C = 535.25 MHz. These three carriers will produce a triple beat product at 541.25 MHz. You may have to elevate the levels of the amplifier in order to produce sufficient distortion to be measurable. Check that you haven't driven the amplifier into compression by raising (or lowering) the carrier levels by 2 dB and ascertaining that the CTB product changes no more than 6 dB. From these results calculate what the three tone triple beat distortion will be at the levels you will be operating the system.

Figure 2



(1) = C−B−A
(2) = 3A
(3) = C−B+A
(4) = 2A+B
(5) = 2B−A

These are third order beats that fall between 50 and 400 MHz, a result of carriers A, B and C.

Now find the number of beats that occur in the 541.25 MHz channel, take the log of this number and multiply the result by 10. (Note: You can use Jerrold's *RD-15 CATV Reference Guide* to find the number of A + B − C and 2A − B triple beats that fall in this channel. There are 1,934 such beats occurring near 542.25 MHz.) Subtract the 10log number of beats from the three tone triple beat number. The result should closely approximate the worst case C/CTB beat performance for the type amplifier tested.

For example, the measured carrier-to-three tone triple beat at 541.25 MHz, corrected for level, is 122 dB. The formula to determine approximate worst case C/CTB for one amplifier is:

$$C/CTB_1 = C/3_h - (10\log N)$$

Where:

C/CTB_1 = worst case C/CTB for one amplifier
$C/3_h$ = discrete third order product at highest channel
N = number of A + B + C and 2A − B third order beats that fall in the highest channel.

Substitute in the formula:

$$\begin{aligned} C/CTB_1 &= C/3_h - (10\log N) \\ &= 122 - (10\log 1934) \\ &= 122 - (10 \times 3.29) \\ &= 122 - 32.9 \\ &= 89.1 \text{ dB} \end{aligned}$$

This example was given to provide a feeling for how C/CTB behaves as a function of channel carriage. If you plan to add channels to your system, perhaps the easiest way to determine the degradation of CTB performance that will occur is consultation with the manufacturer of the equipment.

The formula to add unlike C/CTBs is the same as that used to calculate discrete third order and X-mod combinations. The formula states: To add two or more unlike C/CTBs, change their sign, divide each dB value by 20 and make the result an exponent of 10. Sum each of these new values, take the log of the sum, then multiply by −20. Here's the equation:

$$C/CTB_t = -20\log_{10}(10^{-C/CTB1 \div 20} + 10^{-C/CTB2 \div 20} + 10^{-C/CTBn \div 20})$$

Where:

C/CTB_t = combined C/CTB
C/CTB_1 = first C/CTB
C/CTB_2 = second C/CTB
C/CTB_n = next C/CTB

For example, to find the EOL C/CTB at the end of a 16-amplifier trunk cascade with a 69 dB C/CTB, a bridger that measures 64 dB and a two-line extender cascade that has a 62 dB C/CTB, make the following calculations:

$$\begin{aligned} C/CTB_t &= -20\log_{10}(10^{-69 \div 20} + 10^{-64 \div 20} + 10^{-62 \div 20}) \\ &= -20\log_{10}(10^{-3.45} + 10^{-3.2} + 10^{-3.1}) \\ &= -20\log_{10}(3.548^{-4} + 6.3096^{-4} + 7.9433^{-4}) \\ &= -20\log_{10}(1.7810) \\ &= -20(-2.7496) \\ &= 54.99 \text{ dB} \end{aligned}$$

Composite second order

Composite second order (CSO) is similar to CTB in that it is a combination of the amplitude and the logarithmic sum of the number of beats that fall in a channel that can cause interference. Of course only those beats that fall into a visually susceptible portion of a channel's bandwidth need be considered.

To get a number of these beats sufficient to cause visual interference typically requires carriage of more than 70 channels and a tight frequency control of channel assignments such as IRC where second order beats fall within a 1 kHz bandwidth. Fortunately in a 550 MHz, 77-channel system there are less than 30 beats that fall above the visual carrier, which is the most visible area. Due to the relatively high amplitude of the second order products, however, even 30 beats can cause a problem.

Using the formula that says worse case CSO for one station is equal to the C/2nd order product minus 10 times the log the number of second order products falling in the most vulnerable portion of the video bandpass, we have the following equation:

$$C/CSO = C/2nd - 10\log(N)$$

Where:

C/CSO = carrier-to-composite second order
C/2nd = carrier-to-discrete second order
N = number of discrete second order beats falling at 0.5 MHz or above the visual carrier frequency

For example, to find the worst case C/CSO for a 550 MHz amplifier with 77-channel loading where the worst case discrete C/2nd order performance is 87 dB, make the following calculations:

$$\begin{aligned} C/CSO &= C/2nd - 10\log(N) \\ &= 87 - 10\log(30) \\ &= 87 - 10(1.477) \\ &= 87 - 14.77 \\ &= 72.23 \text{ dB} \end{aligned}$$

As with CTB, we will use a C/CTB of 57 dB as the threshold of visibility. Since the carriers will be modulated, an unmodulated C/CSO of 52 dB will be our minimum recommended EOL specification.

Empirical data suggests that CSO adds on a 15log basis in a cascade of like amplifiers. Using the C/CSO value obtained in the previous example for one amplifier, a 20-trunk amplifier cascade would provide the input to the last bridger with a C/CSO value indicated by solving the following equation:

$$C/CSO_t = C/CSO_1 - 15\log N$$

Where:

C/CSO_t = C/CSO at the output of the last trunk amplifier
C/CSO_1 = C/CSO of one trunk amplifier
N = number of trunk amps in cascade

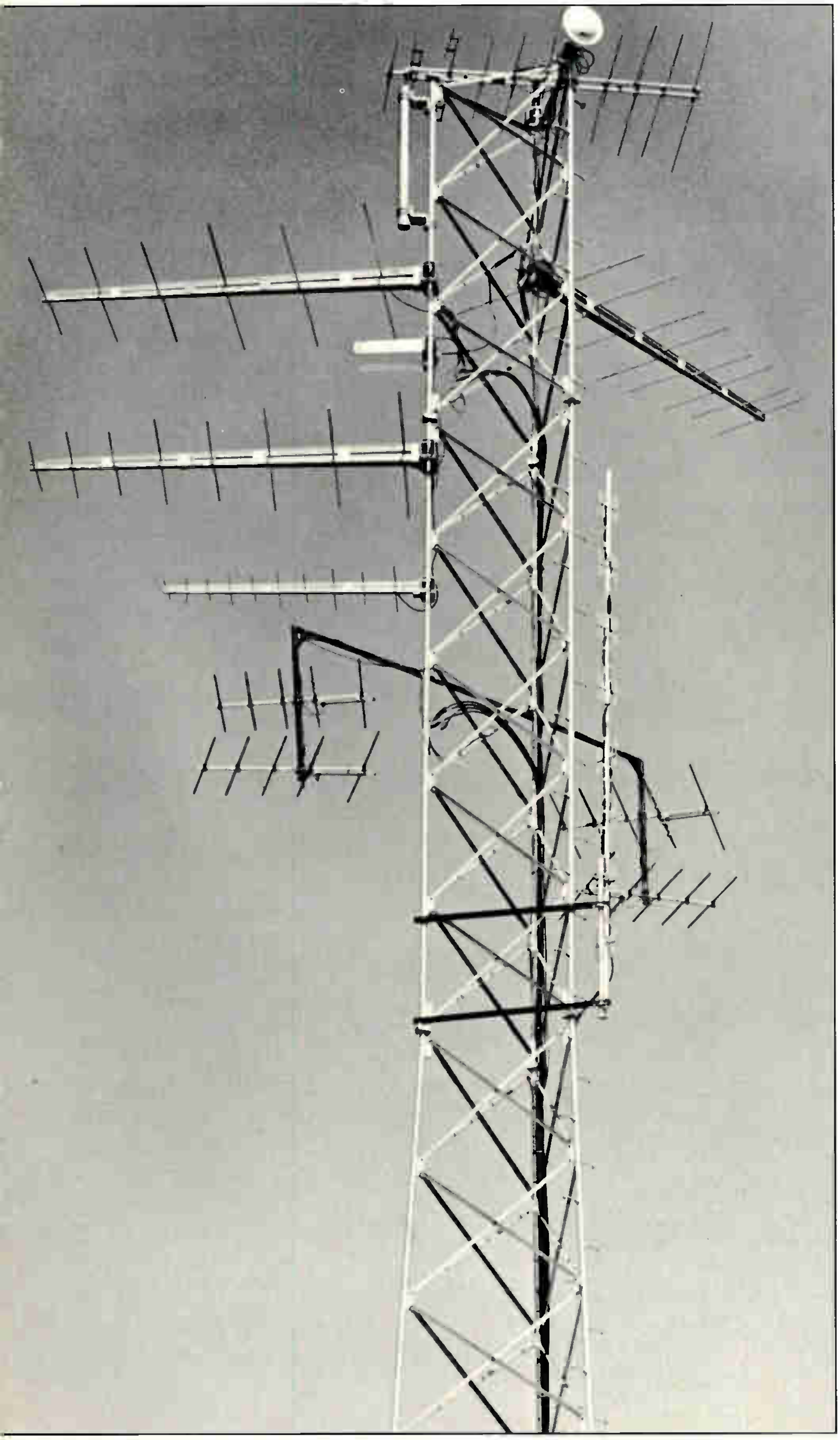
Substituting we have:

$$\begin{aligned} C/CSO_t &= 72.2 - (15\log 20) \\ &= 72.2 - (15 \times 1.3) \\ &= 72.2 - 19.5 \\ &= 52.7 \text{ dB} \end{aligned}$$

While this value meets our minimum requirements, it doesn't include the C/CSO distortion of the feeder portion of the system. The feeder and trunk C/CSO values typically combine on a 10log basis, providing a better ratio than had they added on a 15- or 20log basis. In this example, however, should the feeder contribute an equal amount of C/CSO distortion, the EOL C/CSO would be 49.2, an unacceptable ratio.

In a typical cable system, with the gain of the amplifiers running at nominal, the higher the levels you run the better will be the carrier-to-noise ratio. The same high levels, however, will also increase intermod products. Conversely, lower levels will improve intermod but degrade the carrier-to-noise ratio. System operation is a compromise between noise and intermod.

Figure 1: Various antennas mounted on tower at antenna site



How a cable sy

This article is one of the lessons from the National Cable Television Institute's new course called "Customer Contact Excellence." It is intended as an introduction to CATV for installers, technicians and customer service representatives new to the industry.

By the National Cable Television Institute

One technique for organizing the concept of cable TV in your mind is to think of CATV as "C" for cable, "A" for antenna and "TV" for TV set. These are the main elements of a cable system: an antenna to receive, a cable to carry and a TV set to receive and use the signal. All other parts of the system are auxiliary to these items.

Basic elements

TV signals or channels are collected at *antenna sites* (see Figure 1) usually located in an area that affords the best quality TV reception. Various antennas are mounted on a tower located at the highest elevation on the surrounding terrain and/or in a direct line of sight to another tower or transmitting device. Some systems have more than one tower or antenna site. The TV signals are picked up off-air from the transmission of local broadcast stations.

Signals of *satellite services* (premium services and superstations) are beamed from their origin to a satellite located 22,300 miles above the earth. The signals are relayed back to earth where they are picked up by a *TVRO* (TV receive only) *earth station* like the one shown in Figure 2. Sometimes several cable systems will share a TVRO dish.

Once the off-air and satellite signals have been received at an antenna or earth station, they are protected from outside interference. A *coaxial cable* (coax) is often used to transport these TV signals from the antenna to the headend. Coax ranges in size from the thickness of a pencil up to an inch or more in diameter. It consists of a copper or copper-clad aluminum wire that is insulated with foam or plastic. An aluminum shield and sometimes a wire braid surround the foam. Sometimes coax also has a plastic jacket that protects it against abrasion and weather. Coax is shown in Figure 3.

Sometimes the route and/or distance

stem works

from the antenna site to the headend prevents the use of coax. In these instances *microwave* is used, which is a line-of-sight or point-to-point transmission of signals (see Figure 4). The *microwave link* is from the signals sent from a microwave transmitter at the antenna site to a microwave receiver at the headend. The link consists

Figure 2: TVRO dish

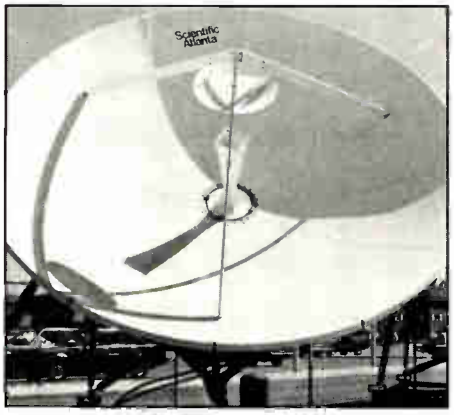
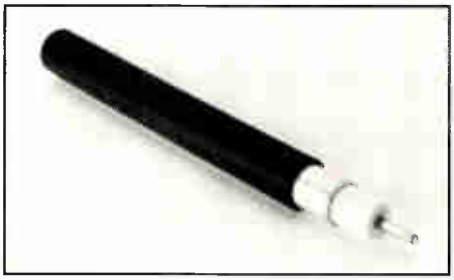


Figure 3: Coaxial cable



of at least one transmitter and one receiver but may include more.

All the TV signals from the coax and the microwave are sent to the *headend* like the one shown in Figure 5. The headend is a small room or building (usually at the antenna site) where all the signals or channels are processed, converted to the proper frequency and amplified. In some cases the signals are unscrambled at the headend then rescrambled before transmission to the customer.

Locally originated programs are produced at many headends. These programs include talk shows, weather information and news. This local origination

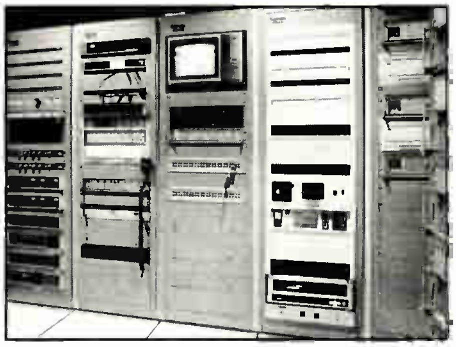
Figure 4: This microwave antenna can receive or transmit

signal is also processed, combined and fed into the cable system by the headend equipment (see Figure 6).

More hardware

Once all the signals have been processed, they are sent over the *distribution system* to the customer. The distribution system or plant consists of three main parts: a trunk line, a feeder line, and a drop line. The trunk line is the backbone of the

Figure 5: Example of signal processing equipment found in system headends



Courtesy of Greeley Cablevision—Greeley, Colo.

cable system. It is either strung overhead between utility poles or laid underground. It is the first segment of the distribution system, and it transports the cable signals to each major area that the cable system serves. There usually are no customer taps off the trunk cable.

As the signals travel through the trunk line they lose strength. To prevent signal weakness or degradation, *trunk amplifiers* are placed every 1,500 to 2,200 feet to boost the signals to help maintain designated strength and clarity (see Figure 7). Trunk line bridging amplifiers (also known as bridgers) are used to extract part of the signals from the trunk line, amplify or strengthen them and then direct them onto the feeder lines. Figure 8 shows a bridger. The *feeder lines* carry the signals to within approximately 100-150 feet of the customer's home. The signals are once again reamplified along the feeder line by a *line extender amplifier (see Figure 9).*

A tap (see Figure 10) is installed in the feeder line and removes some of the signals from the feeder line and sends them to the customer's home via a *subscriber drop cable* (SDC), which is a small coax cable. The drop cable (or just "drop") car-

Figure 6: Four signal sources received by different transmission systems

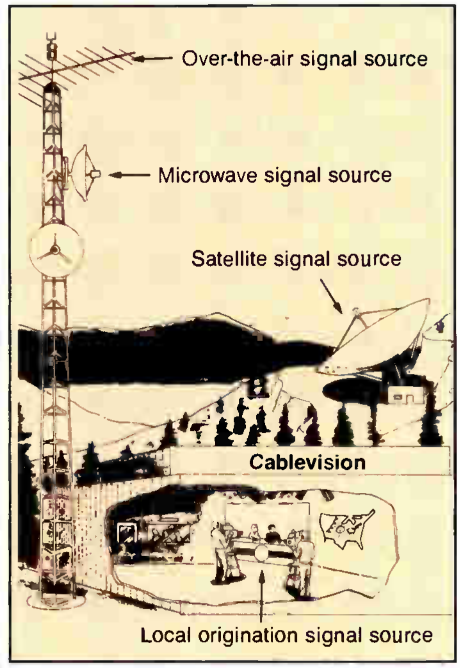


Figure 7: Trunk amplifier

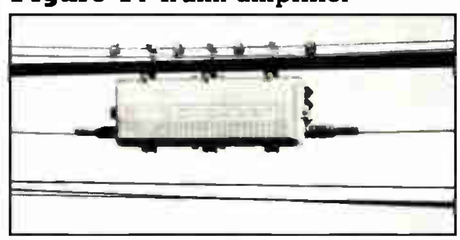
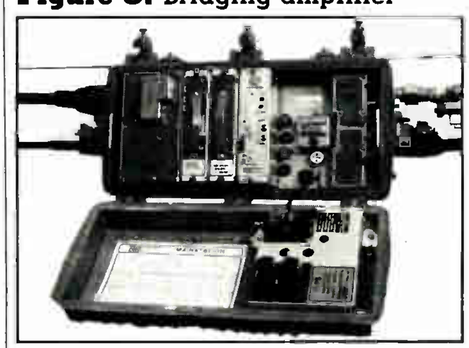


Figure 8: Bridging amplifier



Courtesy of Scientific-Atlanta

ries the signals into the customer's home. The drop is grounded for electrical safety and then the cable is hooked up to the customer's converter or TV set. Also at this point, the signals may be divided so that they can be taken to other outlets in the home to hook up additional TV sets to cable service. Figure 11 sums up CATV signal distribution.

Recently many cable systems have replaced (in parts of their plants) coax with *fiber optics* (see Figure 12). This is a thin, flexible glass fiber that may be composed of two or three layers of different kinds of glass. It carries the TV signals in a beam of light with very little distortion. The light can carry a large quantity of information (such as data) in addition to TV signals. The potential channel capacity of fiber-optic systems is very large—perhaps as many as 1,000 or more channels in a single glass fiber. In addition to increased channel capacity, fiber optics (or just "fiber" for short) offer reduced maintenance costs and improved picture quality.

When used in the trunk and feeder lines of the distribution system, equipment and installation costs of fiber are the same or a little bit higher when compared with the

Figure 9: Feeder line with line extender amplifier and two-way tap

Courtesy of United Cable Television of Colorado

Figure 10: Tap

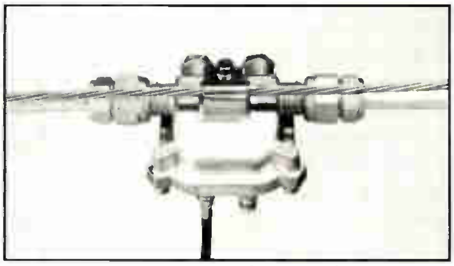


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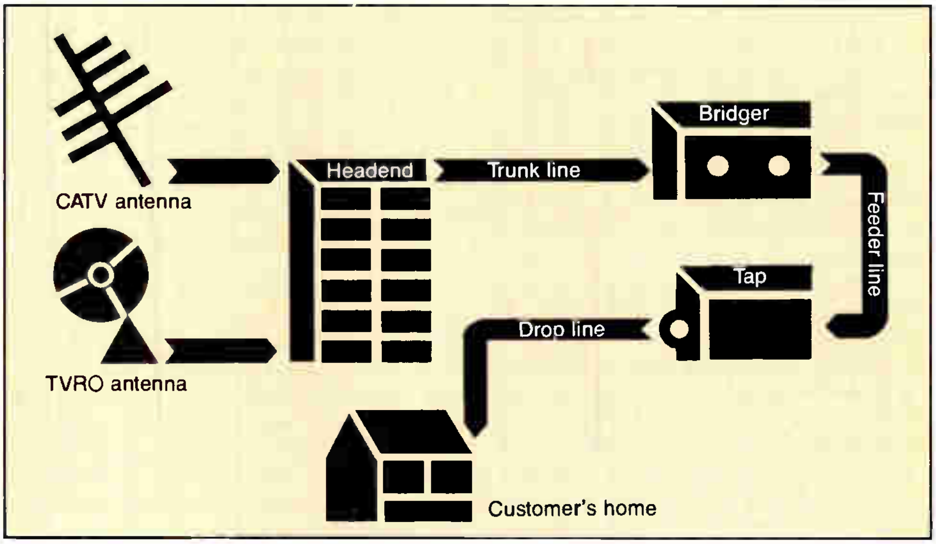
Figure 11: CATV system signal distribution

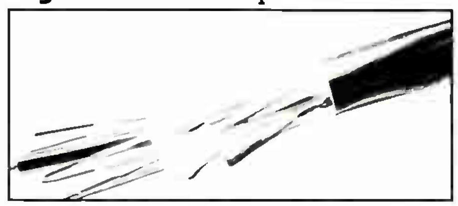


costs of coax. Because of the similar cost and increased benefits, fiber is being installed in more and more cable systems when new areas are built or parts of the system are rebuilt. However, it is not presently advantageous to use fiber to run directly into the customer's home.

Equipment in the home

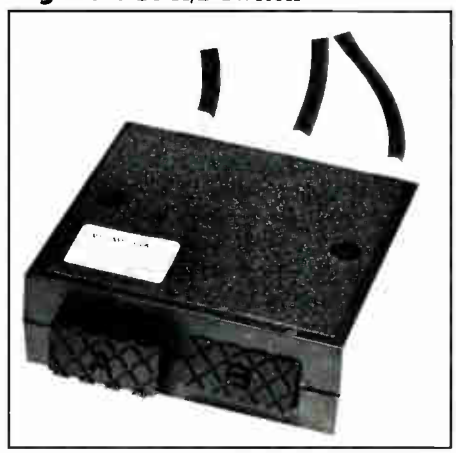
An *A/B switch* like the one shown in Figure 13 is a selector switch used to switch between two signal sources such as a converter (source A) and a VCR (source B) to a single TV set. It also may be used to switch between receiving over-the-air broadcast channels and cable channels. In other words, the A/B switch may be used to turn cable service on and off.

Figure 12: Fiber optics



Courtesy of Siecor

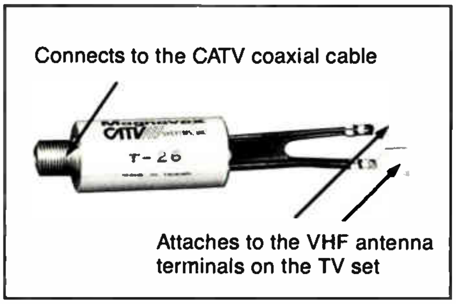
Figure 13: A/B switch



Courtesy of Viewsonics

Figure 14: Addressable set-top converter with remote control

Figure 15: Drop line matching transformer



Courtesy of Magnavox CATV Systems

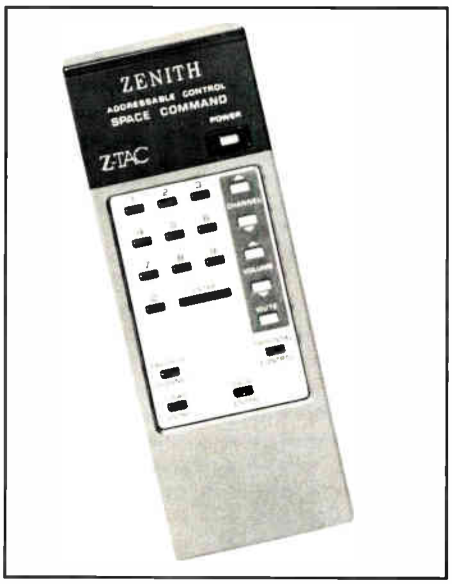
A *converter* (see Figure 14) may also be called a home terminal unit, a channel selector or a box. It is an electronic device that changes or converts the frequency of the TV signals. It may vary in size from that of a cigar box to approximately the size of a shoe box. It is used to do the following:

- Receive more than 12 channels of programming.
- Receive a premium service or pay channel distributed on a special channel.
- Provide additional shielding to prevent unusually strong TV signals from affecting reception on other channels. (This problem is called direct pickup).
- Save wear and tear on the TV set channel selector.

An *addressable* converter allows the cable system to turn it on and off in order to receive certain premium channels or pay-per-view events.

A *descrambler* is a device that unscrambles the TV signal that has been scrambled at the headend before being distributed over the cable. Sometimes the descrambler is built into the converter.

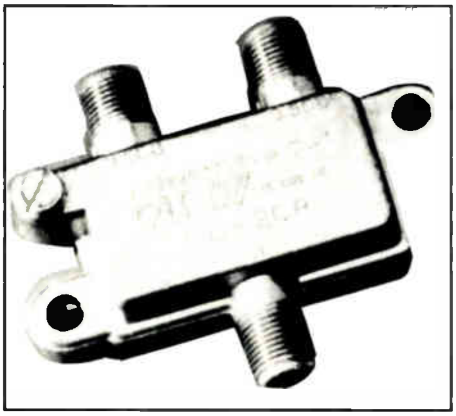
Figure 16: Remote control



Signals from premium channels are often scrambled so only customers who have paid for the premium service can view the channel.

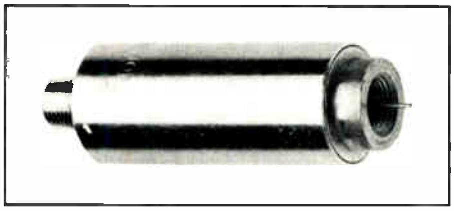
A *matching transformer* is a small device that changes or transforms the signals carried by the drop cable into signals that can be used by or will match the TV set. Figure 15 shows a drop line matching transformer. A *parental control device* (lock) is a device that enables the customer to block or lock out any channel, until needed. Figure 16 shows a remote control. It is a hand-held unit that automatically changes the TV set to a desired channel from a remote distance from the set. It must be used with a compatible converter.

Figure 17: Two-way drop line splitter



Courtesy of Magnavox CATV Systems

Figure 18: Drop line trap

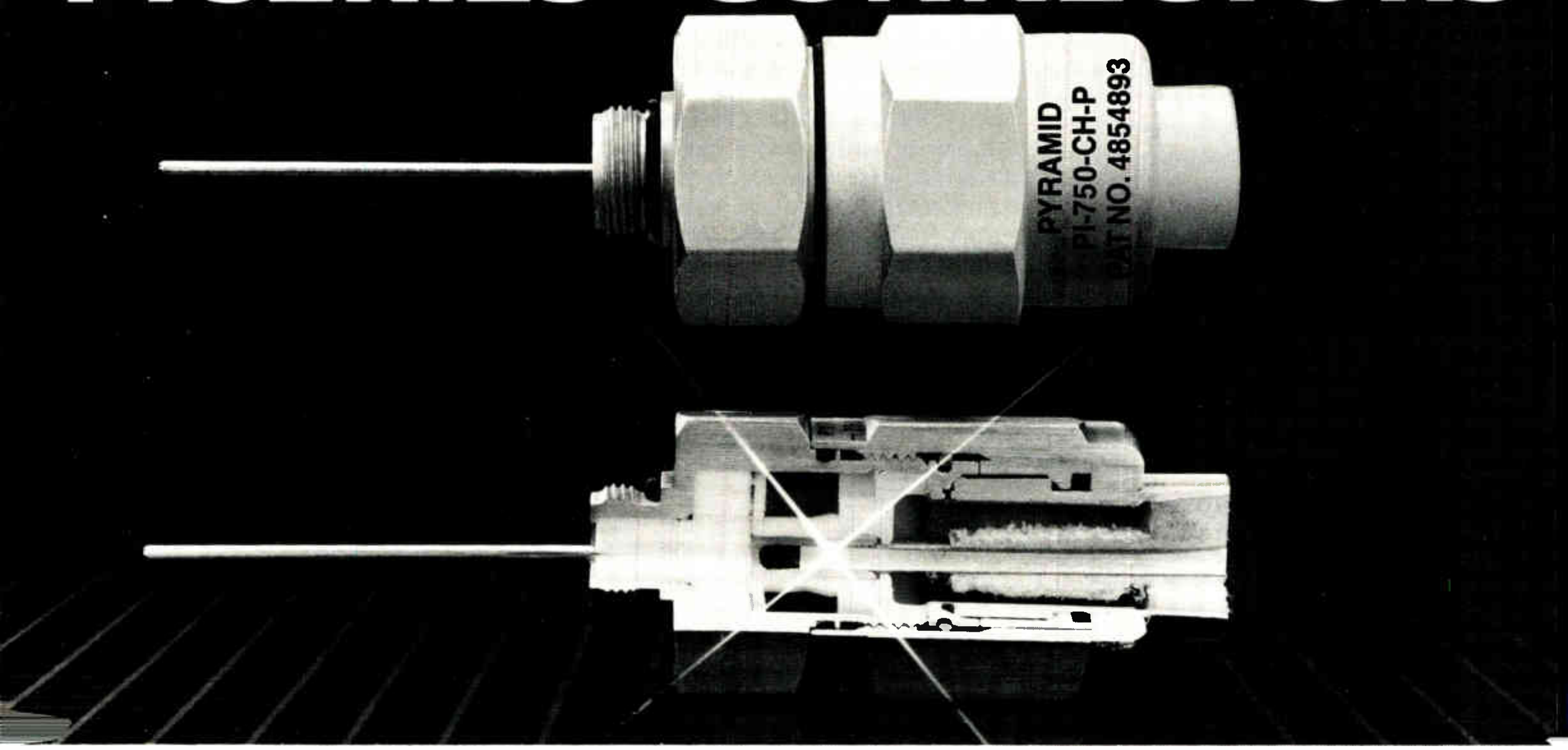


Courtesy of Eagle Comtronics

A *splitter* is a device used to divide the TV signal into two or more parts. For example, part of the signal may go to a TV set in one room and another part to a TV set in another room. Figure 17 shows a two-way drop line splitter. A *trap* is a device that traps a cable channel or part of the signal so it cannot pass into a household that does not subscribe to that cable channel. It is typically used to control which premium or pay channels a customer receives before those channel's signals enter the home (see Figure 18).

This article is reprinted courtesy of the NCTI.

PI SERIES* CONNECTORS



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- Low-end torque required during wrenching operation; metal to metal positive stop.
- Standard 2" pins.
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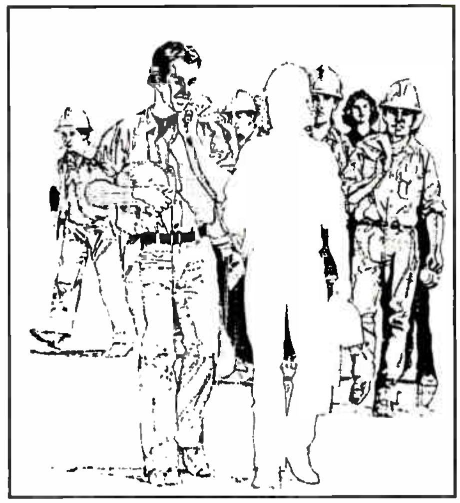
Reader Service Number 89.

Reader Service Number 87.

Steve's law of choices

By Steve Allen
Chief Engineer, Jones Intercable, Roseville, Calif.



Choices—we all make them every day. We decide what clothes we are going to wear, what we are going to eat, what route we are going to take to work, what time we plan to arrive. Choices are a natural part of our everyday life and we usually hate it when other people make our choices for us. If you are like me at all, you resent it when someone tells you what you should wear or how you should act. However, if you are a supervisor, that is precisely what you are doing each time you remind associates to put out their cones or put on their hard hats. By reminding associates of their responsibilities, you are overriding their rights to make their own choices, wrong or otherwise.

By making choices, we open ourselves to a system called natural and logical consequences. Choices always open two avenues toward a resolution; one is usually the correct one and the other is the wrong one with its ramifications.

"Choices always open two avenues toward a resolution; one is usually the correct one and the other is the wrong one with its ramifications."

A hard choice

For example, let's say I have been instructed in the use of a hard hat, and understand and agree with the reasons why I should wear it. In getting out of my truck to do a disconnect, I decide (choose) *not* to wear the hard hat. While climbing the pole, I dislodge a bolt that was resting on top of the guardarm from some previous construction. The bolt falls, striking me on the head, causing me to lose my grip on the pole, and I fall to the ground, breaking my leg. My incorrect choice of action has resulted in a *natural* consequence of not wearing a hard hat, namely, the injury. However, I made the choice and have to live with the results. A *logical* consequence of my incorrect choice is a disciplinary action for violation of my company's safety policy. I broke the rules and must be accountable for my actions.

As a supervisor, your natural tendency is to nurture and protect your staff. This may result in infractions being overlooked because you don't want to be labeled as a "hard ass" or a tyrant. This willingness to overlook misbehavior or provide constant reminders only undermines the overall efficiency or safety level you wish to attain. If associates only put out their cones when you are looking or remind them, the whole program is ineffective because there are no logical consequences. Associates may be willing to risk the natural consequences if they perceive there will be no logical consequences as a result of the wrong choice.

It also is quite common for a supervisor to feel guilty for disciplining an associate for misbehavior or a violation of policy. You hate to do it, because it was only a minor violation, or something like that. But by not carrying out the logical consequences of a misbehavior (when the natural consequences have already taken place) you don't hold associates accountable for their choices or the lessons to be learned from them. We all learn more from our mistakes than from our successful encounters with decisions.

By providing proper training and clear expectations, a supervisor does the associate and company a service by consistently carrying out the logical consequences of improper behavior. The associates learn to expect the logical consequences and are more accepting of them because they willfully made the decision to ignore the rules. By the way, this works on your kids, too.

Installer's Tech Book

Converting dBmV to μV/m

By Ron Hranac

Channel 51 or OO (385.2625 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
−60	8.09	−36	128.23	−10	2558.44	16	51047.68
−59	9.08	−35	143.87	− 9	2870.62	17	57276.44
−58	10.19	−34	161.43	− 8	3220.89	18	64265.23
−57	11.43	−33	181.12	− 7	3613.90	19	72106.77
−56	12.82	−32	203.22	− 6	4054.86	20	80905.13
−55	14.39	−31	228.02	− 5	4549.63	21	90777.04
−54.64	**15**	−30	255.84	− 4	5104.77	22	101853.52
−54	16.14	−29	287.06	− 3	5727.64	23	114281.53
−53	18.11	−28	322.09	− 2	6426.52	24	128225.98
−52	20.32	−27	361.39	− 1	7210.68	25	143871.92
−51	22.80	−26	405.49	0	8090.51	26	161426.95
−50	25.58	−25	454.96	1	9077.70	27	181124.01
−49	28.71	−24	510.48	2	10185.35	28	203224.49
−48	32.21	−23	572.76	3	11428.15	29	228021.62
−47	36.14	−22	642.65	4	12822.60	30	255844.47
−46	40.55	−21	721.07	5	14387.19	31	287062.22
−45	45.50	−20	809.05	6	16142.69	32	322089.10
−44.18	**50**	−19	907.77	7	18112.40	33	361389.92
−44	51.05	−18	1018.54	8	20322.45	34	405486.16
−43	57.28	−17	1142.82	9	22802.16	35	454962.95
−42	64.27	−16	1282.26	10	25584.45	36	510476.83
−41	72.11	−15	1438.72	11	28706.22	37	572764.42
−40	80.91	−14	1614.27	12	32208.91	38	642652.25
−39	90.78	−13	1811.24	13	36138.99	39	721067.69
−38	101.85	−12	2032.24	14	40548.62	40	809051.25
−37	114.28	−11	2280.22	15	45496.30		

Channel 52 or PP (391.2625 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
−60	8.52	−36	130.22	−10	2598.29	16	51842.69
−59	9.22	−35	146.11	− 9	2915.33	17	58168.45
−58	10.34	−34	163.94	− 8	3271.05	18	65266.08
−57	11.61	−33	183.94	− 7	3670.18	19	73229.74
−56	13.02	−32	206.39	− 6	4118.01	20	82165.13
−55	14.61	−31	231.57	− 5	4620.48	21	92190.79
−54.77	**15**	−30	259.83	− 4	5184.27	22	103439.76
−54	16.39	−29	291.53	− 3	5816.85	23	116061.32
−53	18.39	−28	327.11	− 2	6526.61	24	130222.95
−52	20.64	−27	367.02	− 1	7322.97	25	146112.55
−51	23.16	−26	411.80	0	8216.51	26	163940.98
−50	25.98	−25	462.05	1	9219.08	27	183944.80
−49	29.15	−24	518.43	2	10343.98	28	206389.46
−48	32.71	−23	581.68	3	11606.13	29	231572.79
−47	36.70	−22	652.66	4	13022.29	30	259828.94
−46	41.18	−21	732.30	5	14611.26	31	291532.86
−45	46.20	−20	821.65	6	16394.10	32	327105.25
−44.18	**50**	−19	921.91	7	18394.48	33	367018.13
−44	51.84	−18	1034.40	8	20638.95	34	411801.12
−43	58.17	−17	1160.61	9	23157.28	35	462048.45
−42	65.27	−16	1302.23	10	25982.89	36	518426.89
−41	73.23	−15	1461.13	11	29153.29	37	581684.54
−40	82.17	−14	1639.41	12	32710.53	38	652660.79
−39	92.19	−13	1839.45	13	36701.81	39	732297.45
−38	103.44	−12	2063.89	14	41180.11	40	821651.25
−37	116.06	−11	2315.73	15	46204.85		

Channel 53 or QQ (397.2625 MHz)

dBmV	µV/m	dBmV	µV/m	dBmV	µV/m	dBmV	µV/m
−60	8.34	−36	132.22	−10	2638.13	16	52637.70
−59	9.36	−35	148.35	−9	2960.04	17	59060.47
−58	10.50	−34	166.46	−8	3321.21	18	66266.93
−57	11.78	−33	186.77	−7	3726.46	19	74352.72
−56	13.22	−32	209.55	−6	4181.16	20	83425.13
−55	14.84	−31	235.12	−5	4691.34	21	93604.53
−54.90	**15**	−30	263.81	−4	5263.77	22	105026.01
−54	16.65	−29	296.00	−3	5906.05	23	117841.12
−53	18.68	−28	332.12	−2	6626.69	24	132219.91
−52	20.96	−27	372.65	−1	7435.27	25	148353.18
−51	23.51	−26	418.12	0	8342.51	26	166455.01
−50	26.38	−25	469.13	1	9360.45	27	186765.59
−49	29.60	−24	526.38	2	10502.60	28	209554.44
−48	33.21	−23	590.60	3	11784.11	29	235123.95
−47	37.26	−22	662.67	4	13221.99	30	263813.41
−46	41.81	−21	743.53	5	14835.32	31	296003.51
−45	46.91	−20	834.25	6	16645.50	32	332121.40
−44.45	**50**	−19	936.05	7	18676.56	33	372646.35
−44	52.64	−18	1050.26	8	20955.44	34	418116.08
−43	59.06	−17	1178.41	9	23512.39	35	469133.95
−42	66.27	−16	1322.20	10	26381.34	36	526376.95
−41	74.35	−15	1483.53	11	29600.35	37	590604.66
−40	83.43	−14	1664.55	12	33212.14	38	662669.32
−39	93.60	−13	1867.66	13	37264.63	39	743527.21
−38	105.03	−12	2095.54	14	41811.61	40	834251.25
−37	117.84	−11	2351.24	15	46913.40		

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

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Why standbys won't always operate

By Jud Williams
Owner, Performance Technologies

You are tending a balky power supply with only 6 amperes being drawn from it and the darn inverter just won't come on. Nothing seems to solve the problem. The batteries check out OK, a new inverter has been installed, and there's still no standby voltage when the ferro is turned off. You scratch your head and hesitantly reconnect everything and hope the problem will somehow go away. You think, "How strange. A 14 amp power supply won't start up into a mere 6 amp load. Why?"

Later in the day, a call comes in reporting an outage. You go to another power supply location and the circuit breaker has tripped for the umpteenth time. How exasperating! Again, why? The power supply is delivering only 80 percent of its rated current.

"Unfortunately, the power supply...is in some instances looking into a veritable short-circuit due to the enormous capacitance distributed throughout the system."

Short-circuit

Unfortunately, the power supply (even though it is designed to deliver 14-15 A into a resistive load) is in some instances looking into a veritable short-circuit due to the enormous capacitance distributed throughout the cable system. Part of this capacitance results from the numerous electrolytic capacitors located in the DC power supplies in the various amplifier locations. When a capacitor is completely discharged, it may initially draw what amounts to short-circuit current when voltage is applied. Multiply this times the number of amplifiers you have hanging on a particular AC power supply and you can see what kind of problem can exist. (And this doesn't take into account the capacitance of the coax.)

Let's say we have a particular AC supply powering 14 amplifiers, and the filter capacitor in each of these units is 1,000 μF (microfarads). This means the inverter will be looking at a total of 14,000 μF. If all of these capacitors are discharged and hit the inverter simultaneously, the initial surge can easily exceed the power supply's output capacity. This phenomenon is not uncommon wherever standby power supplies are in use.

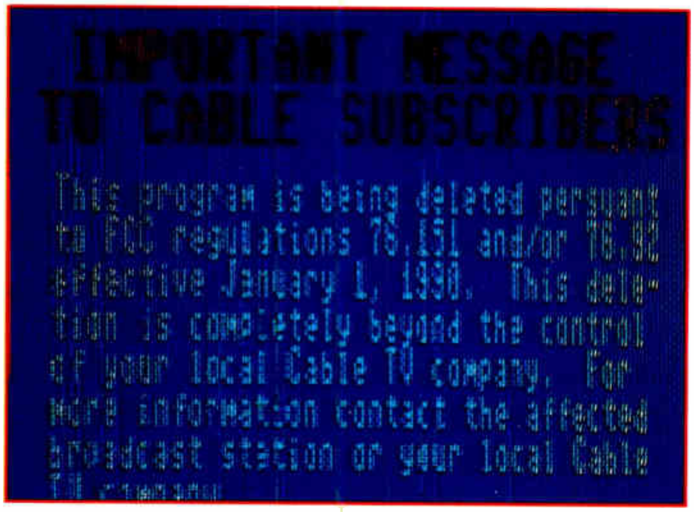
There are certain applications for standby power supplies, as in elevators, where they are required to turn on motors that have enormous starting capacitors. These instances require the inverter to deliver a momentary surge of current to get things going, then settle back and operate with a normal amount of current drain.

In the CATV field there are basically two different types of power supplies in use. One is based on the saturable-core oscillator system while the other is the driven inverter. The saturable-core inverter is a self-oscillating type with the advantage of being short-circuit proof. In the past, the inherent short-circuit proof feature limited the type of load it could comfortably start into. As a result of proper design the difficulty of starting into the heavily capacitive CATV load has been eliminated. The problem continues to exist however, where older standbys are still in use. The apparent solution for this situation is to retrofit those units with newer, higher powered types.

As for driven-type inverters, they can usually handle the sudden surges caused by a heavily capacitive load if their circuit breakers are of the proper design. High magnetic breakers or automatic resetting circuit breakers are often recommended as the solution to ending the nuisance tripping often associated with this type of inverter.

Reader Service Number 94.

The VIDG video page generator includes an EPROM cartridge, instructions and a video jumper for the computer.



The default text page in the cartridge is a sample syndex message.

Engineering Consulting's VIDG video page generator

By Ron Hranac

I was thumbing through the "Classifieds/Business Directory" section of this publication a few weeks ago and ran across an ad that had a familiar look. The company, Engineering Consulting, runs similar ads for Commodore 64 products in ham radio publications that I subscribe to. But what really caught my eye in this ad was a video character generator cartridge for C-64 computers—and it was less than $200! So we obtained a Model VIDG video page generator EPROM cartridge for this month's "Lab Report," and ran it through its paces in Jones Intercable's corporate engineering lab.

The product

Enginering Consulting's VIDG video page generator is a software cartridge for Commodore 64 computers. It is shipped with an instruction sheet and an 8-inch DIN-to-BNC video jumper cable. The cartridge itself is a standard C-64 style EPROM cartridge, measuring 2 5/8 inches × 25/32 inch (about the size of a pack of cigarettes).

The cartridge turns a Commodore C-64, SX-64 or C-128 computer into a low-cost character generator. The supplied video jumper cable provides an interface to the computer's DIN video jack, allowing easy connection to a video monitor or headend modulator input. The character generator functions include the ability to display text messages in three different letter sizes on up to 24 lines. Flashing and crawling (the manufacturer calls it scrolling) are available, and the lines can be any of 16 different colors. The latest software version supports up to 300 text pages in 30 folders, and as many as 99 folders of 10 pages each can be stored on disk. A clock can be displayed in the lower left corner of each page.

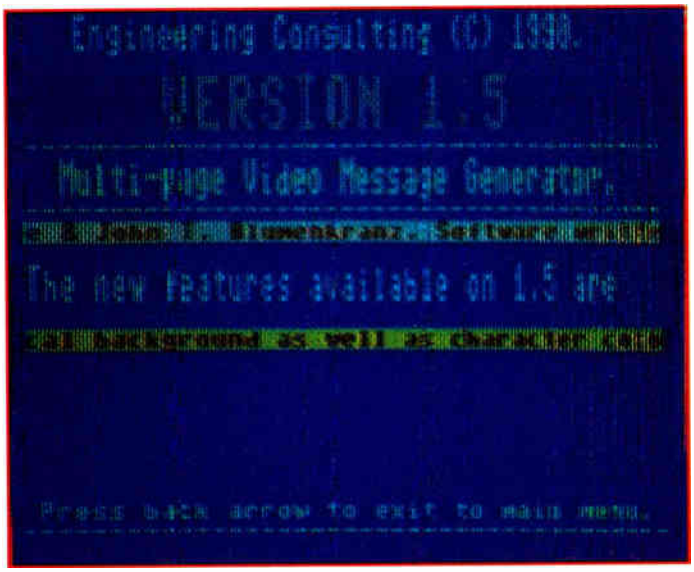
When first turned on, a Commodore equipped with the VIDG plug-in cartridge will display a default sample syndex message. If pages of text have been stored on disk and the disk is in the drive when the computer is turned on, the the default display will be what was stored on Folder #0 on the disk. Alternatively, the manufacturer can permanently store one user-created folder of 10 pages in an EPROM cartridge for an additional cost.

The Commodore's function keys (F1-F7) control most of the character generator's menu items. F1 is used to bring up the edit screen where pages of text are created. F2 saves pages to an initialized disk, F3 loads previously saved pages from the Commodore's disk drive and F4 is a utility function that will initialize blank disks. F5 brings up the "play multiple pages" screen, used to define what pages will be displayed. F6 is to set and turn on the clock; if this function is activated, all pages will have the clock displayed in their lower left corner. F7 turns a screen blanking feature on and off.

Additional command keys are used when the edit screen is active. The back arrow (←) will cause a line to crawl, but the software limits this to a maximum of two lines in the smallest letter size (up to 240 characters per crawl). When the edit screen is

VM-700 measurements

Parameter	Measured
Peak-to-peak video amplitude	125 IRE (0.89 V)
Sync amplitude	49.7 IRE
Sync risetime	96 ns
Sync falltime	88 ns
Sync width	4.46 μs
H line frequency error	within 0.02% of reference
Burst amplitude	25.2 IRE
Cycles of burst	15.3
Burst frequency	within 0.1 Hz of reference
Equalizer width	2.29 μs
Serration width	2.33 μs
VBI width (field 1)	20.0 lines
VBI width (field 2)	20.5 lines



The cartridge also contains a sample text page that displays many of the features available in the character generator.

not active, the back arrow also can be used to enter the page editor.

The up arrow (↑) followed by number 1, 2 or 3 flashes a single line of text at the size indicated by the number. An asterisk (*) followed by number 1, 2 or 3 can be used to set text size on a line. For either command, 1 is the smallest text size with 40 characters per line at single line height, 2 is a medium size with 40 characters per line at double line height, and 3 is the largest with 20 characters per line at triple line height.

The @ symbol sets the line position on the display screen. For example, @12 would place the text on display Line 12, @01 on Line 1 and so on. A pound symbol (£) followed by a two-character command defines line color. The first character of that command sets text color and the second character sets background color. The 16 available colors and their respective command characters are: black (0), white (1), red (2), cyan (3), purple (4), green (5), blue (6), yellow (7), orange (8), brown (9), light red (a), dark grey (b), medium grey (c), light green (d), light blue (e) and light grey (f).

The documentation provided with the cartridge is a one-page instruction sheet. I found that a little trial and error was necessary to learn the capabilities of the software, since the instruction sheet is little more than an overview of the character generator's operation. The VIDG is by no means a Texscan-quality character generator, but for the cost it provides a number of basic features that make it especially useful to operators who may be unable to afford a full-sized unit. At the time of the evaluation, the VIDG's cost was $189, and the manufacturer indicated that a modem option to allow remote programming and operation was near completion.

Lab measurements

The cartridge itself contains the software that operates the Commodore, and, as such, the measured video quality is what the computer produces, not the VIDG. Because there are no video test signals generated by a Commodore, distortions such as differential gain and phase, chrominance-to-luminance gain and delay, frequency response, etc., could not be measured.

A Tektronix VM-700 automatic video measurement system was used to characterize a few basic video parameters and,

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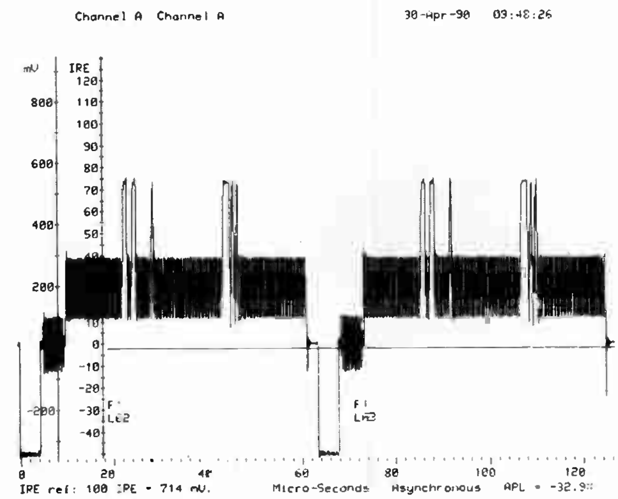
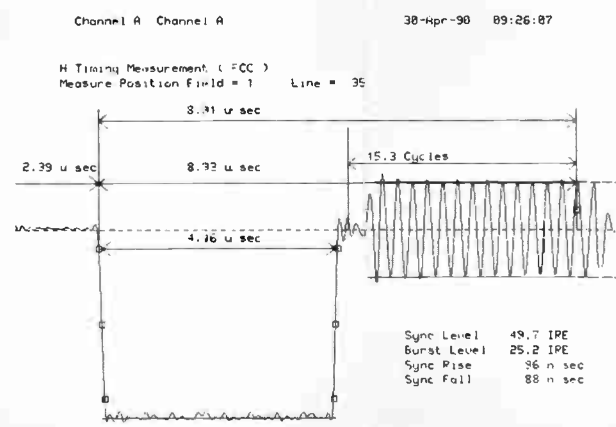
2H display



Horizontal blanking



while not broadcast quality, a Commodore's output video is useable on a cable system. The accompanying table summarizes what was measured; unfortunately, the computer has no internal adjustments to vary any of these parameters.

The subjective quality of the displayed text is good. Some newer digital TV sets may have problems with the Commodore video; as well, some scrambling systems might not get along with the computer's video. My only real complaint is about a glitch that occurs when the character generator changes from one displayed page to the next. (In addition to the modem option being developed by the manufacturer, the software is currently being converted to 100 percent machine code, which will increase the speed of screen updates and should eliminate the glitch between pages.)

Keeping in mind that the VIDG is a low-cost character generator, you won't find advanced editing features like home, line copy, justification, centering or random page access, although the user can sequence the pages and/or folders in any order. Display features like roll, pop-up, edges and frames (for characters, words or pages) also aren't available. But then, for a character generator that costs less than $200 (not including the computer), those things shouldn't be expected.

For more information, contact Engineering Consulting, 583 Candlewood St., Brea, Calif. 92621, (714) 671-2009.

How to overcome writer's block

By Rikki T. Lee
Editorial Consultant

You were "volunteered" three weeks ago to write a report on improving plant integrity. Drafters did a superb job on the graphics last week and you finished the research only yesterday. The report's due tomorrow, but you put off writing the report until the very last minute—5 p.m., to be exact; now it's time to get busy.

An hour later, you're still sitting there, gazing at a nearly blank screen. You can't get any further than the title of the report and your name. No one's there to interrupt you but yourself. It's hard to concentrate while you're playing with your calculator, browsing through a journal or walking to the coffeemaker for a "well-deserved" break.

So what's wrong? You've got writer's block, a serious (but not fatal) problem that prevents you from turning ideas into written words. Usually the words are there all right, floating in your brain. All you need is to flip the switch that'll transmit the information to your fingertips. Some culprits blocking you include lack of preparation, little or no self-motivation, procrastination, poor nutrition, fear or hatred of writing, boredom and drugs or alcohol.

Instead of staying at work, shovel your notes, outline, graphs, etc., into your briefcase and go home. Eat a *light* supper (without your usual beer/wine), then retreat to your private office. Clear all nonessentials off your desk and lay out your materials within reach. Try to create the conditions for your best concentration: background music, proper lighting and so on. In other words, get in the mood for intense work.

Writing should be easy now, right? Nope, you're still in agony since you can't come up with an introduction. So who says to begin at the beginning? Study your outline and choose the part easiest to write. Maybe it's the part that you have the most notes on, that you feel most excited about or that you personally know the most about. Write that section first, then jump to others, until only the intro remains.

However, if you still have trouble writing the introduction:

1) Use a chart, graph, photo, etc.—something that shows the problem so you can describe it. For example, one of your charts illustrates the rising trend of service calls. Reference and describe this chart in your introduction, then state the problem that your paper addresses.

2) Tell a personal experience that focuses on the situation you'll cover, like: "As a service tech, I found that many subscriber complaints could be solved by tightening connectors at or near the drop."

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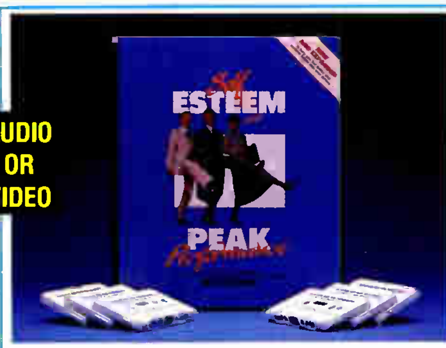

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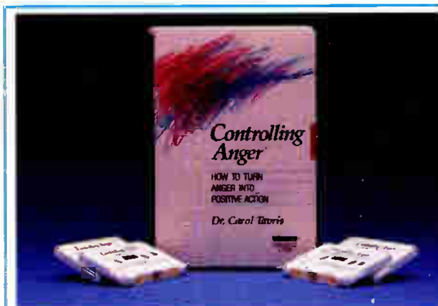

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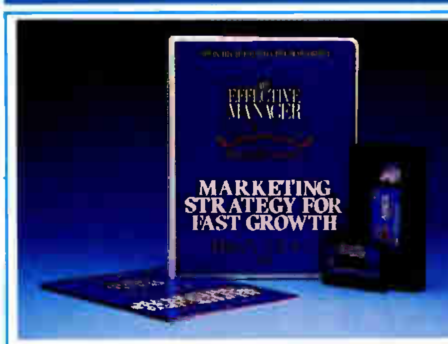

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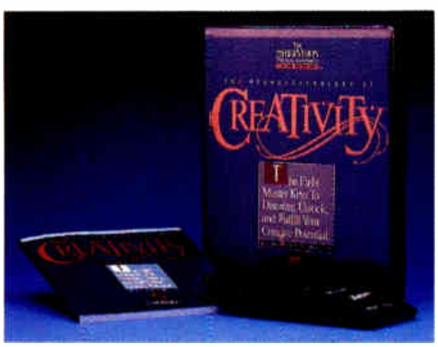

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A personal touch also helps you overcome boredom.

3) Ask a series of questions that will be answered in your report. For example: "Does our plant have adequate integrity? And just what is considered adequate? What cost-effective methods can improve our signal levels and supply a quality signal to our most remote sub?"

Another means to chisel away at writer's block is to get out a tape recorder and start dictating. At first, say anything you want until you focus on some words in your outline. In no time, you'll be stringing sentences together. Now, transcribe the good stuff. Then continue recording and transcribing. As soon as you're off the ground and feel you can write without a crutch, ditch the recorder and write freely.

Throughout this discussion, we've mentioned the outline. If you have one before you begin, great—but be sure to follow it closely. If you don't have one, then you'll get lost on your journey. A good outline provides the road, street lamps, all the signs and signals, and your road map. Imagine traveling in unfamiliar terrain without these!

It's a rule: Don't start any writing project without an outline, which is actually a skeleton for the body of your report. Or else you'll find yourself in a high risk category for writer's block. After a while, you'll get into the habit of preparing an outline, even if it's just a list of topics in the order in which you will cover them.

Better luck next time

So you finally finished that report. (And you even have time for two hours of sleep—congratulations.) Although you barely survived this bad experience, don't swear off writing for good. Instead, be smarter next time: As soon as you receive another writing assignment, prepare a timetable that begins with your first action (such as research) and ends with the paper's due date. And give yourself a lot of time in between.

Make a schedule you can be comfortable with. Stay flexible, build in time for Murphy's Law and update your timetable as needed. Also add a day or so (if possible) between the time that you study all your notes and the time that you actually write. Let's call this interval "mental processing," time enough for your brain to digest the data and even create sentences you can use. Here's a typical schedule:

Project timetable for *CT* article, "Spectrum analyzer comparisons":
June 1-6: Do research, run tests
June 8-13: Compile notes, prepare graphs
June 14-15: Study notes/mental processing
June 18-19: Write first draft
June 21-22: Revise first draft
June 25-26: Submit to supervisor
June 27-29: Final revisions/final OK
July 2: Mail article

A sense of purpose

Let's time travel to the future. Why, after writing several papers and implementing some ideas from this column, do you still suffer from writer's block? And why do you always wait until the last minute? Take a moment to assess your situation. You'll probably conclude that you lack time and/or talent to write. Wrong; what you really lack is a strong sense of purpose. In other words, you have no idea what earthly good your writing will accomplish. You only care about getting the job done.

Let's jump back to the present. Before you grudgingly start another writing project, ask yourself: "How can writing this make a positive difference in my career? How can reading it contribute to the growth of my colleagues and my company?" So, from now on *always believe you can make a difference*. As you write, keep in mind your purpose: to make a difference. Then you can kiss your writer's block goodbye, forever.

Figure 3: Analog fiber-optic communication system with WDM

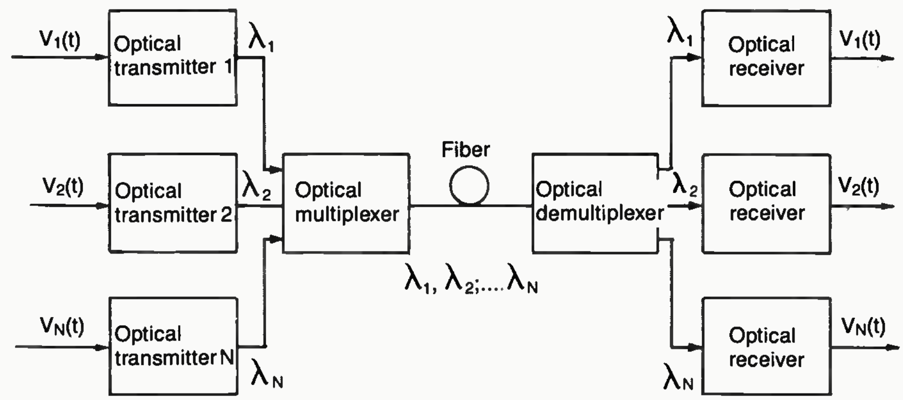


Figure 4: PIC providing a four-wavelength multiplexer

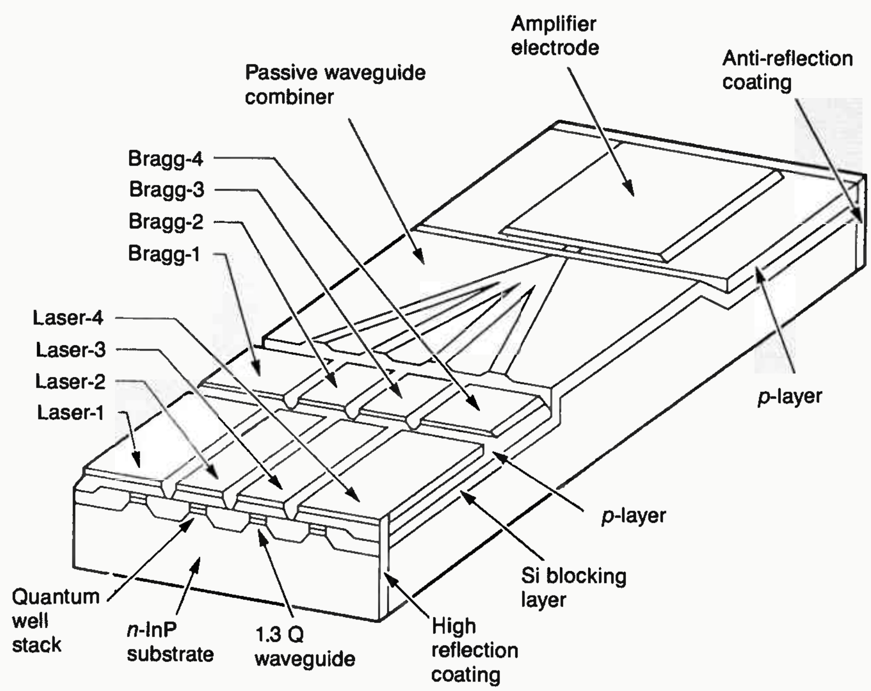
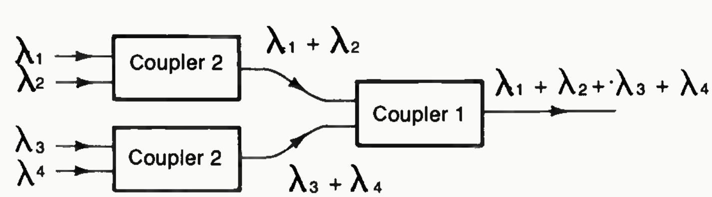


Figure 5: Cascaded WDM couplers to provide more transmission channels



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bandwidths in frequencies, while in light communications, physicists measure bandwidths in wavelengths. Since $c = f\lambda$ (where c is the speed of light, f is the frequency of light and λ is the wavelength of the light) then $-df/d\lambda = c/\lambda^2 = 177$ GHz/nm at 1,300 nm and 133 GHz/nm at 1,500 nm. This may be more readily apparent with a simpler analysis: c/1,300 − c/1,301 = 177 GHz and c/1,500 − c/1,501 = 133 GHz. The frequency bandwidth available on fiber is enormous and can be derived at any wavelength with use of this frequency/bandwidth definition.

The recent emergence of prototype tunable semiconductor lasers offers the promise of frequency-agile optical transmitters and receivers for future broadband networks. One type of laser called the distributed Bragg reflector (DBR) laser is one that is tunable (by a voltage control). However, the present range of tunable lasers is about 1,200 GHz, which is only a small fraction of the optical fiber bandwidth[1]. In Figure 1, for example, the window from 1.50 to 1.58 μm corresponds to 10 terahertz (10,000 GHz). A rough figure for the total bandwidth available on a single-mode fiber transmission system (including that around 1,300 nm) is about 20 THz (20,000 GHz).

One familiar (if not efficient) use of this bandwidth is the transmission of frequency division multiplexed (FDM) signals on a fiber, e.g., CATV fiber supertrunking and/or fiber backboning (see Figure 2).

Wavelength division multiplexing

A more efficient use of the available optical bandwidth is accomplished using wavelength division multiplexing (WDM) shown in Figure 3. The analogy of WDM to FDM is apparent—the frequencies of the lights used in the WDM are FDM'd by optical means. An example of a photonic integrated circuit (PIC) that provides a DBR laser, a multiplexer and an optical amplifier (for more details on optical amplifiers see *CT*, January 19, 1990, "Optical Amplifiers," by Lawrence Lockwood) is shown in Figure 4.

This particular PIC was developed at AT&T and—with all four lasers simultaneously transmitting at 26 Gb/s—transmitted a total of 8 Gb/s on a single fiber over a distance of 36 km (22 mi). More channels can be added to the transmission by the simple method shown in Figure 5. Principles used in optical demultiplexers are shown in Figure 6.

From childhood we remember a prism producing colors from sunlight—i.e., separating wavelengths—a diffraction grating produces the same results. A


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dramatic application of WDM using fiber-optical amplifiers was done by a research group from Bellcore's Red Bank, N.J., laboratory. Sixteen distributed feedback (DFB) lasers spaced at 2 nm intervals in the 1.55 micron band were used in conjunction with high-density wave division multiplexers and a broadband erbium-doped fiber amplifier (EDFA) to pump 100 studio-quality FM TV channels to 4,096 individual terminals simultaneously over a distance of 9 km.

The first, seventh, ninth, 11th, 14th and 15th lasers were modulated with 622 Mb/s data (the equivalent of four compressed HDTV signals) and each of the remaining lasers was modulated with 10 FM NTSC signals, subcarrier multiplexed between 300 and 700 MHz. The wavelengths from the DFBs were combined in a 16-by-16 star coupler, which had an isolator attached at the output.

The amplifier consisted of a 3-meter erbium-doped fiber pumped by 90 mW from a 980 nm pump laser producing signal gains of 17 to 24 dB over the range of wavelengths supplied by the 16 DFBs. The output amp was split by cascaded 1-by-8 and 1-by-4 splitters to achieve distribution to 4,096 terminals. A 16-channel

Figure 6: Basic structures used in optical demultiplexers: (a) prism demultiplexer; (b) grating demultiplexer

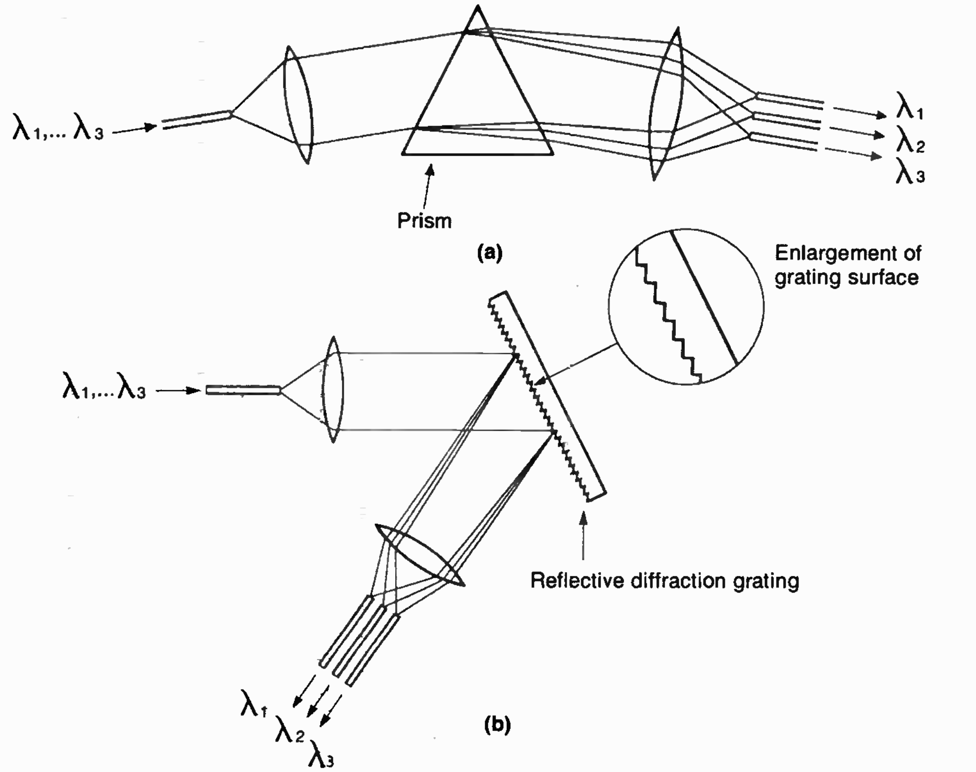
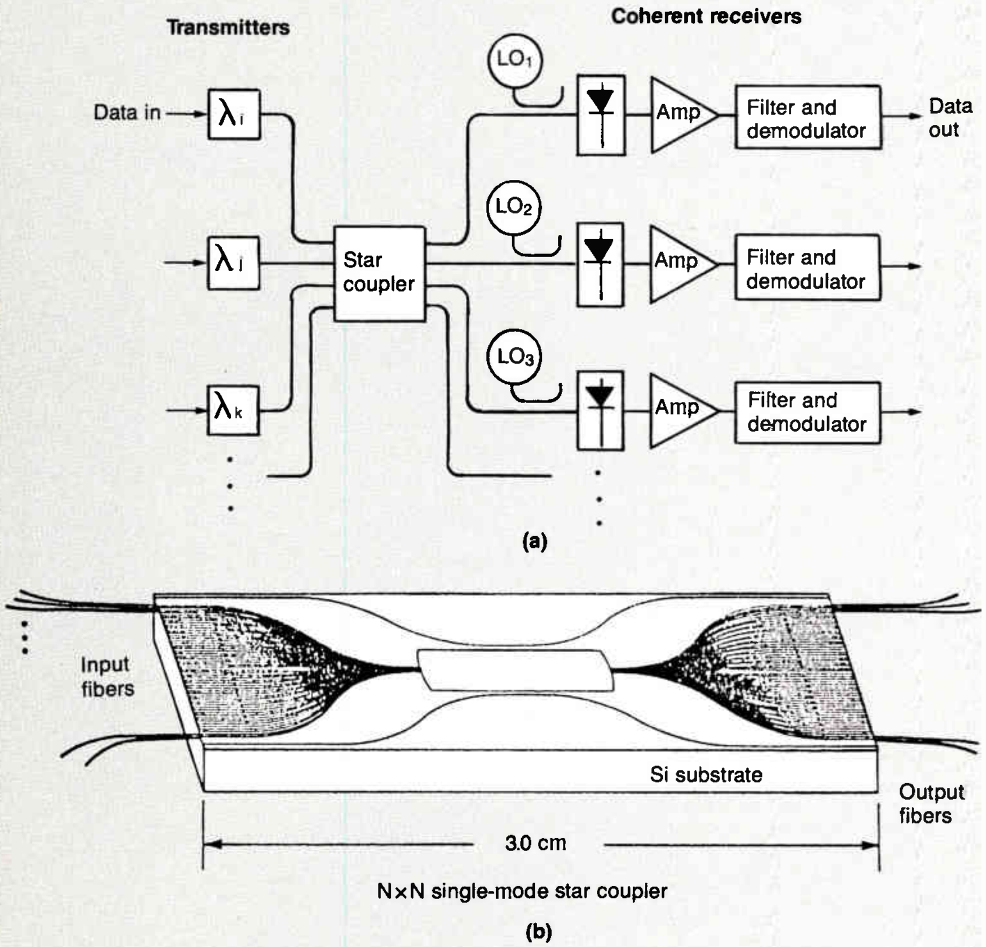


Figure 9: (a) Coherent detection provides a way to isolate densely packed WDM channels in a star-coupler network; (b) N×N single-mode star coupler



Conclusions

For ultrahigh capacity networks for distribution of TV or other broadband signals, the high channel packing densities allowed by the selectivity of coherent detection may be as important as the improved sensitivity these techniques provide.

In a passive-star network, both an input and an output fiber connect each terminal to the central coupler. One can assign fixed wavelengths to the receivers and provide tunable lasers to the transmitters, making it possible for any transmitter to access any receiver by tuning to its preassigned frequency (that is, "phone number"). Alternately, it may be desirable to fix the transmitter wavelengths and provide tunable receiver local oscillators to allow for the possibility of a broadcast mode in which many receivers simultaneously detect the same transmitted signal.

The passive-star network can provide a total throughput equal to the bandwidth of the single-mode fiber. It is possible, in principle, to build an FDM star network with an arbitrarily large number of terminals, which accesses the total fiber bandwidth.

In theory, if the previously mentioned 1,200 GHz tunable range of lasers is used at say 10 GHz channel intervals and each channel carried 40 frequency division multiplexed TV channels (the current capability used in fiber backbone CATV systems) then a single fiber could carry 4,800 TV channels. Whatever specific number of channels proves feasible in the future for use in the field, it can be large—in the thousands. When such a capacity becomes available, then after using a couple hundred channels for standard CATV distribution one still has thousands left. These, with addressable tuning, move the capabilities of individual services on a CATV tree-and-branch system close to that of a switched-star system. When even more of the 20,000 GHz optical bandwidth is made usable by future hardware developments, the number of channels becomes staggering.

While the demonstrations of these techniques for greater utilization of the available optical bandwidth to transmit many channels are exciting views of the future, it must be emphasized that it will be in the future. Even at the galloping rate of developments in fiber-optic transmission, it will take some time before these applications are common usage in the field—but that future looks really bright.

References

1 "Non-Coherent Photonoic Frequency-Multiplexed Access Networks," I. Kaminow, *IEEE Network*, March 1989.
2 "Optical Heterodyne Communication Systems Move to the Field," R. Linke, *Laser Focus World*, April 1990.
3 "OFC '90: From Multiple Star to Simple Splices," J. Hecht, *Lasers & Optronics*, January 1990.
4 *Fiber-Optic Handbook for Engineers & Scientists*, F. Allard, McGraw-Hill, 1990.
5 *Optical-Fiber Transmission*, E. Basch, Sams & Co., 1987.

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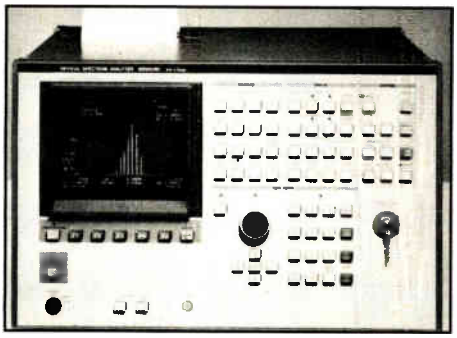
or 32 MHz IF bandwidth of 20 Hz to 4.5 MHz or 15 Hz to 8.5 MHz and audio bandwidths of 150 and 350 kHz. Direct selection of the desired channel is provided by front panel thumbwheel switches. The product is just under 2 inches high and mounts in a standard 19-inch rack.
Reader service #163



Spectrum analyzer

Anritsu's new MS9001B1 optical spectrum analyzer handles wavelengths from 600 to 1,750 nm and features enough dynamic range (50 dB) to accurately characterize the fundamental mode of DFB optical laser diodes. It has 0.3-second sweep speed that is achieved with an integral 16-bit microprocessor. The sweep speed allows accurate optical measurements at sweep widths of 2 nm or less. Long sweep times (to 7 seconds) are also available. Wavelengths are read to 2-pm resolution with ±1 nm accuracy.

The unit has a level measurement range of −70 to +10 dBm using both InGaAs PIN and silicon PIN photodiodes for long and short wavelengths respectively. Level accuracy is ±2 dB, linearity is ±0.5 dB over a 10 dB range, ±1 dB over a 20 dB range and ±3 dB over a 60 dB range. It has sufficient non-volatile memory to store as many as 10 measurement settings. It includes a thermal printer for creation of hard copy documentation and GPIB for remote operation via external computer. It has a wide range of automatic functions, including averaging, peak search, peak center and wavelength calibration.
Reader service #177

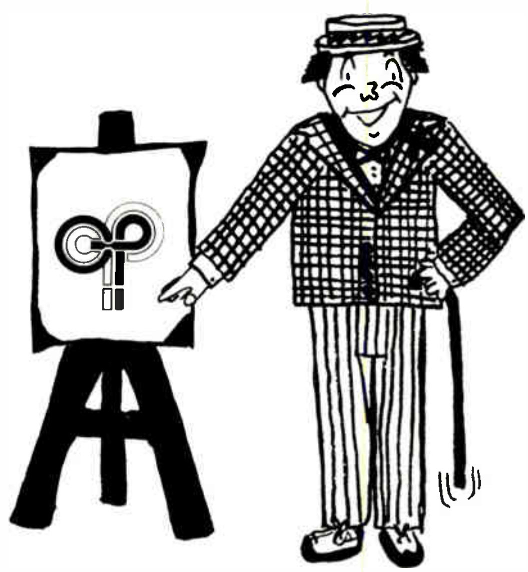
Fusion splicer

Siecor's new M90 fusion splicer for single-mode and multimode fibers is the only unit available that combines the company's LID-SYSTEM unit and lens profile alignment system (LPAS) in one unit. The LID-SYSTEM unit is designed to eliminate the possibility of a bad splice being accepted. The LPAS feature uses a built-in computer to locate the center line of both fibers being fused. Fibers are then aligned on both the X and Y axes prior to fusing. This feature provides coarse fiber alignment to enhance the speed of the alignment process.

Splice loss averages 0.02 dB with return loss measurements typically greater than 60 dB with the product. According to the company, completed splices can be made in 40 seconds. The splicer evaluates the cleaved fiber ends and unacceptable results are shown on the display. The splicing process can be observed on a high contrast LCD monitor and two views of the fibers are shown simultaneously. The unit is 35 pounds and 16.5 inches by 12.6 inches by 7 inches. It is equipped with standard 110/220 VAC power cord and a built-in rechargeable battery.
Reader service #170

Software

Perfect Sync announced the Air/Traffic controller software system (or A/T). It is a PC-based operational software package

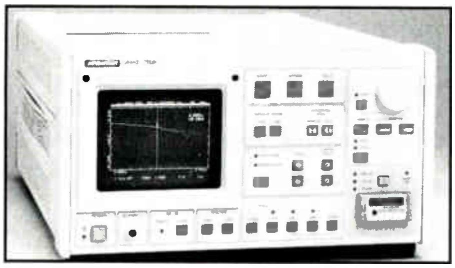


for advertising sales departments. Like original equipment manufacturer (OEM) software, it performs routine jobs like importing schedule files from T&B software, manual editing of schedules, manual control of channels, sending of schedules to inserters, retrieval of logs from inserters, printing of log reports and creation of verification files for export to T&B.

According to the company, the package also provides functions that OEM software does not, including an integrated software system and provisions for complete hardware status monitoring, enhanced manual control and a review status report feature that lets the user review at any time (on the computer screen) the operational status of any channel, as well as detailed results of the most recent status check and log retrieval.

Other features include a sophisticated report generator, automatic printing of reports, operational history reports, single-cell multijobbing, simplified user interface, a "fail-safe" menu design (where if nobody presses a key for 10 minutes, A/T automatically saves all data and returns to the main menu) and a "just-in-time" schedule-sending where schedules are automatically sent to inserters during prime time (when phone rates are lower) the night before air. According to the company, the internal design is more sophisticated than OEM versions.

Reader service #162



OTDR

Advantest is offering its Q8460 optical-fiber reflectometer that has distance ranges of 15, 50 and 100 km. It has a reading resolution of 5 cm and a measuring accuracy of ±0.5 m and has a reflection mode that eliminates the problem of locating "close together" high reflection connection points. This reflection mode complements the instrument's backscatter mode that offers optical masking when loss measurements are needed across these connection points.

The 32-frame waveform memory is backed up by battery power that is said to enable retention of data taken on-site and making the comparison of waveform change easier. It also includes a built-in printer.

Reader service #166

Brochure

A new brochure for Allied's trench shoring product line was produced by the company. It details the features of the aluminum hydraulic Tren-Shores that are said to allow underground construction crews to be safe and productive.

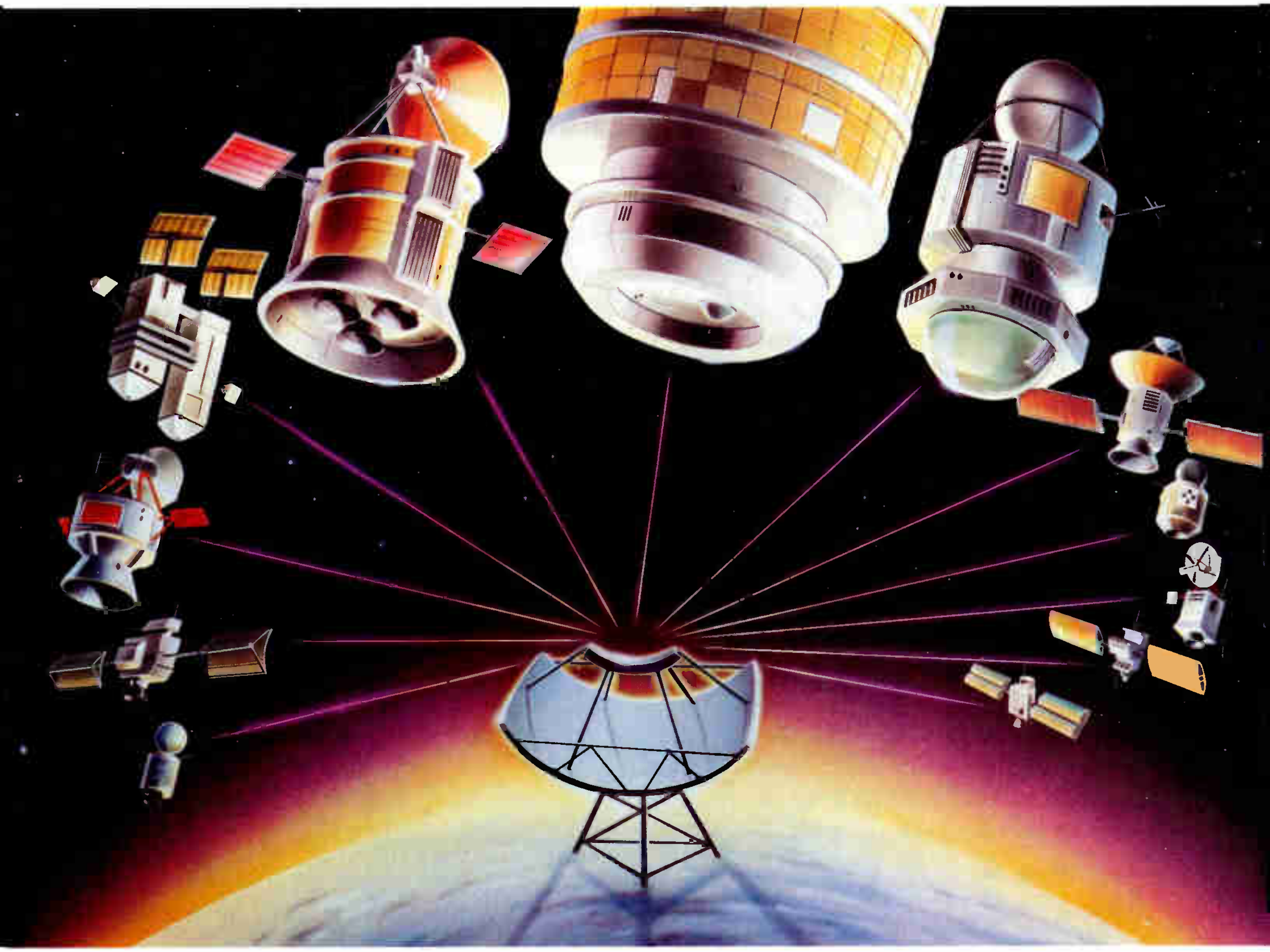
The Tren-Shores brace trenches up to 12 feet wide or 20 feet deep and feature a patented finger guard protector. OSHA compliance requirements for safe shoring are referred to in the brochure and a mini-quiz is included promoting trench safety options.

Reader service #179

CLI software

CNG Energy Co.'s C-ARDS CLI software package is integrated with a radio dispatch system and is said to make measuring, correcting and reporting signal leakage quicker and less costly. The company's C-ARDS is a computer-aided radio dispatch system that dis-

SIMULSAT® sees them all... up to 35 satellites SIMULTANEOUSLY!



SIMULSAT is the multi-beam earth station that sees all domestic satellites within a 70° view arc *simultaneously*... while maintaining consistent broadcast quality performance on each satellite.

Listen to what SIMULSAT users have to say:

"For our satellite system, we didn't want an antenna farm. We installed Simulsat and gave up just one parking space but now have the advantage of reaching 35 satellites. We're very pleased with Simulsat's performance and feel prepared for the new generation of replacement satellites."

SIMULSAT is available in three sizes and sees all domestic C & Ku Band satellites from SPACENET 2 at 69° to SATCOM F1R at 139°. SIMULSAT also meets 2° spacing requirements.

Find out why so many satellite users have avoided or replaced antenna farms with SIMULSAT, the world's only earth station that performs like thirty-five parabolic dishes.

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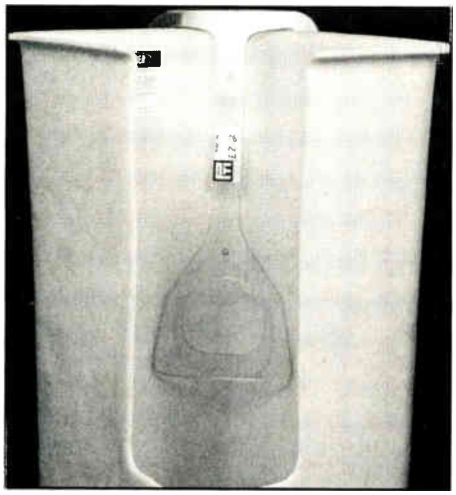
See us at the Cable-Tec Expo, Booth 912. Reader Service Number 124.

patches trouble calls and installation orders. The new proprietary software package is said to make CLI measuring, correcting and reporting more efficient and less costly.

The software works as follows: Field personnel input CLI measurements into mobile data terminals, which is then transmitted to the office. Because dispatchers can instantly produce and transmit authorized work orders, immediate corrective action to solve CLI leakage problems can occur.
Reader service #165



Ladder accessory

Plastic Techniques introduced its EZ-Step ladder accessory that works like a stirrup to give the user a leg-up and out of an aerial lift bucket. According to the company, the specially developed plastic will hold a service technician's weight even when wearing a heavy belt.
Reader service #171

OTDR software

The PKL-3000 OTDR Tools automation and data analysis software for optical time domain reflectometers was developed by Photon Kinetics. According to the company, with the product, optical fiber manufacturers no longer have to rely on operator subjectivity in fiber evaluation. The software program uses a personal computer to automatically set up an OTDR and perform a series of pass/fail tests according to user-defined parameters. The product is designed to use an IBM-compatible PC with GPIB interface. The software is said to speed the process of data acquisition and analysis with the company's Model 3100X and Model 3200 OTDRs.

The software detects point defects and measures splices, normalized attenuation and attenuation uniformity. DOS files are used to store data for later printing, analysis and/or transfer to other computer programs. Automatic OTDR measurements can be performed faster than manual testing and the use of a computer to set up and initiate the test yields more consistent results, according to the company.
Reader service #157

Sub control program

Computer Service Co. released the V1.2 of its Cable Subscriber program for CATV/SMATV systems. It has an unlimited subscriber base (although 25,000 is recommended), search/locate by account number, name, street, phone and tag and calendar files for install and service calls to ensure daily control of issued orders. Other features include up to nine separate headend/sites to allow different tax areas and/or states, up to three converters per sub and up to two tag numbers per sub.

Status and accounts history on each sub are provided as well as billing per site or all sites options. All areas are password protected with up to nine passwords. Free technical assistance and upgrades are available (with support option).
Reader service #172

Receivers/ downconverters

Scientific-Atlanta announced two satellite communications beacon receivers and downconverters. The products were unveiled at Cable and Satellite Europe in London. The Model 7751 is designed for use with C-band satellites and the Model 7752 operates over Ku-band satellites.

The units convert the RF signal to an IF frequency to be used by the beacon receiver. The beacon receiver provides DC output voltage, which is in turn used by the antenna controller to ensure accurate pointing of the antenna. The front-panel design is said to simplify operation. In addition to the beacon select switch, a front-panel switch selects the B output voltage gradient. A front-panel potentiometer is provided to adjust the B out-

put DC voltage offset and front panel jacks are provided to measure DC voltage. Front-mounted LED displays indicate power, loss of phase lock, low beacon level and high beacon level. A rear panel summary alarm port allows remote reporting of alarm conditions.
Reader service #174

Rubber cement bandages

A rubber-based cement and gum rubber bandages specially designed for use in making waterproof cable splices were made available by GMP. GMP C Cement is used for bonding rubber and synthetic insulation and sheathing materials. Its adhesive properties are especially suited for use with DR Tape. It is available in a 4-ounce can with a built-in applicator. The GMP rubber splice bandages are manufactured from pure gum rubber and measure 4 inches wide by 14 feet long by 0.03 inches thick.
Reader service #176

Audiotape course

The "Language of Microwaves" audiotape course by Scott Training Associates explains microwave principles, devices and systems in simple, easy to understand language, according to the company. The company recommends the course for engineers and technicians with no formal microwave training and for non-technical persons in marketing, finance, purchasing, personnel, QA, PC and manufacturing. The course consists of four 90-minute audiocassettes, over 75 charts and drawings and a glossary of microwave terms.
Reader service #158

Logic card

Cableware Electronics introduced its APM-1 logic card for Alpha AP-660 and AP-960 standby power supplies. The upgrade logic card has a built-in digital voltmeter for precise float voltage settings and a remote probe for true battery temperature. Using a microprocessor, the product measures AC line voltage, battery voltage and high and low limits for each.

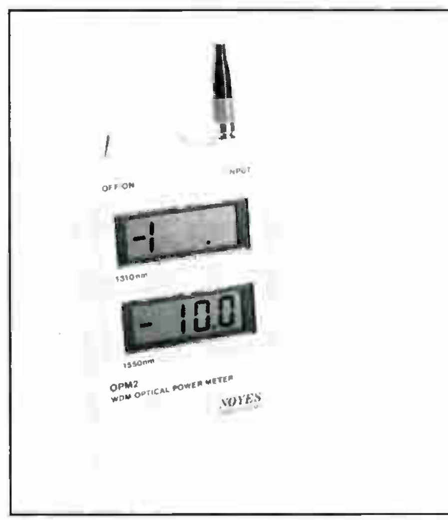
It records time, date and length of the last power failure so intermittent line problems can be found. Total standby time is recorded so optional hour meters are not needed and the status of the power supply and its batteries are sent using infrared

light so a technician may check the power supply from the service truck. A serial port is included so a portable computer can be used to read power supply status.
Reader service #164

Processor

FM Systems' CST800/FMT815 stereo processor provides full frequency agility for the two input subcarriers so that any Galactic Radio channel can be selected. It also provides full output frequency agility so that any channel in the FM band can be selected. Therefore this product can re-establish service on any channel by tuning the subcarrier input and FM band output frequency to the channel that has failed and turning off the defective channel to prevent spurious interference.

The company's standard package is frequency agile in the FM band output frequency so that the FM band frequencies can be changed in the field as necessary to rearrange channel assignments. The subcarrier input frequencies are fixed, which according to the company help hold down channel costs. The new Galactic Radio spare channel is said to keep service going while the regular channel is being repaired and the product also can be used when the output channel of a fixed output frequency-type processor must be changed.
Reader service #169



Power meter

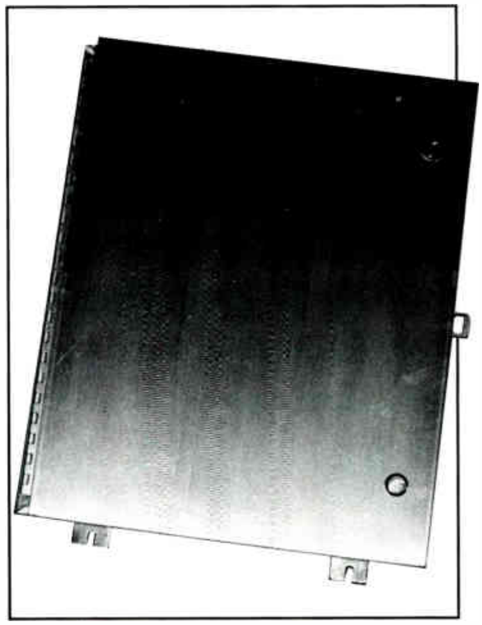
The OPM 2 WDM optical power meter is new from Noyes Fiber Systems. It is said to simultaneously measure and display 1,310 and 1,550 nm signals without sacrificing accuracy. It is designed for troubleshooting optical multiplexers, measuring cross talk in WDM systems and as an alternative to using expensive dual laser

loss test sets at both ends of a fiber span.
Reader Service #160

Antenna deicing, rain blower controls

Environmental Technology introduced its computerized LCD-3 and LCD-4 antenna deicing and rain blower controls that offer an alternative to thermostatic or manual control. The LCD-3 automatically controls antenna deicing heaters that operate between 17° F and 38° F during precipitation and for one hour thereafter. The LCD-4 controls rain blowers and operates at temperatures above 17° F during precipitation and for one hour thereafter.

According to the company, sunlight does not reduce the strength of the UV stabilized housing and combining the temperature and moisture sensors simplifies installation. A bypass switch option permits on-site testing and the control changes back to automatic operation after 40 hours if the operator leaves the switch in the wrong position by accident.
Reader service #175



Enclosures

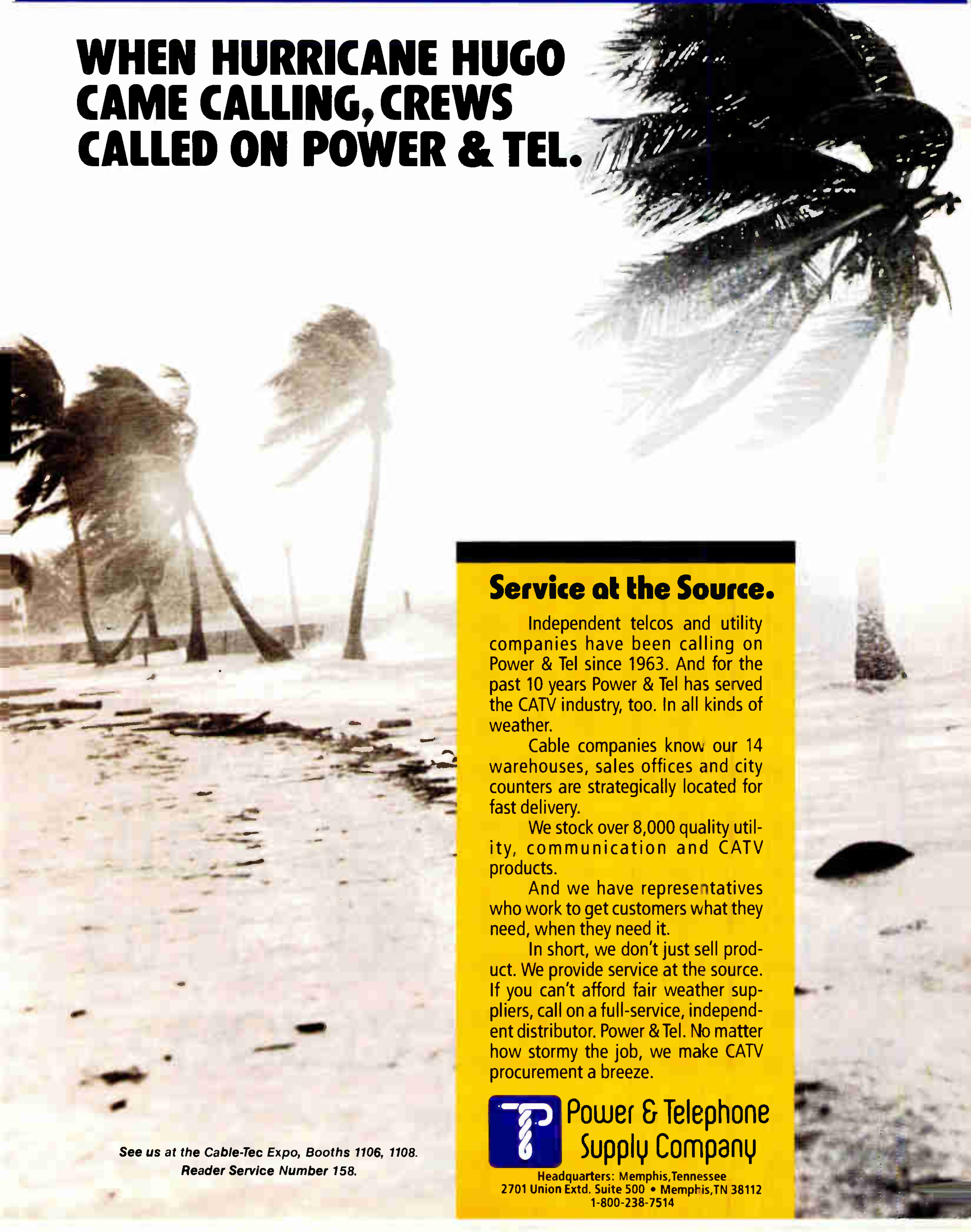
Hennessy Products introduced its Specline enclosures that are available in either type 304 stainless steel or 5052-H32 aluminium. All models are NEMA 4X, UL and come standard with oil-tight quarter-turn latches, eliminating the problems and hassles of the old screw clamp design. Enclosures can be modified or fabricated to OEM prints and specifications.
Reader service #173

OTDR

Antel Optronics introduced the LANprobe OTDR for LAN and CATV applications. It incorporates interchangeable 850, 1,300 and 1,550 nm OTDR cards in a laptop PC, which provides the computing capability for running the OTDR system. and signal processing software. At 850 nm, typical specifications for fault detection include 10 cm resolution and 29 dB dynamic range; at 1,300 nm, 20 cm and 27 dB respectively.
Reader service #181

Design book

Cable Television Technology and Operations by Eugene Bartlett was published by McGraw-Hill. It covers everything from basic circuits to network distribution systems and explains how to design and operate cable TV systems. It is subtitled *HDTV and NTSC Systems* and introduces standard NTSC and HDTV systems. It examines construction, performance characteristics and design methods for coaxial cables and cable systems. It also includes basic principles and components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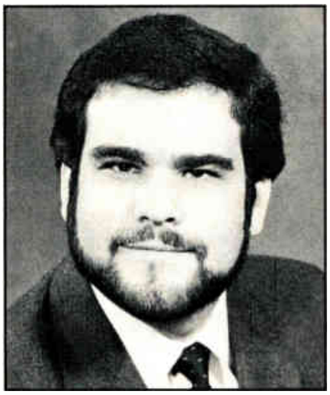
Reader Service Number 158.

Jones promoted **Tracy Jenkins** to director of programming. Previously she was manager of programming.



Kohrn

Pro Brand International announced the appointment of **Neil Kohrn** as CEO and executive vice president. He has had over 10 years of satellite communications experience with companies like Scientific-Atlanta, Wegener Communications and AEI Music Network.

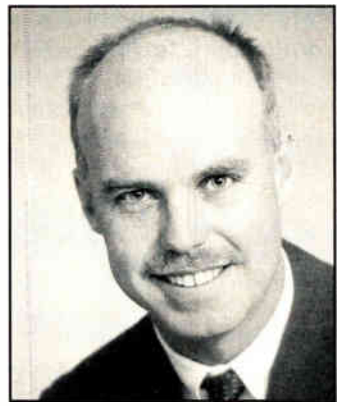
Douglas Ceballos joined the **National Cable Television Institute** as a technical trainer. Previously he was regional system standards, safety and training manager for Rogers Cablesystems of Minneapolis.

Laser Precision promoted **Lee Della-Croce** to key accounts manager. Most recently she was regional sales manager.

Arthur Saxon was named president of the cable TV subsidiaries of **The Lenfest Group**. Previously he was vice president of administration for the company.

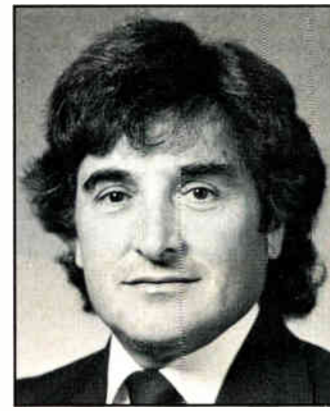
Continental Cablevision appointed **Joseph Hayes** as the new general manager of its five-town system based in Middleboro, Mass. Most recently he was the marketing manager of the company's northeast Massachusetts district.

Midwest CATV named **Mary Rose Shearer** national sales manager of the LAN division. She joined the company last year as the company's LAN representative on the West Coast.



Anthony

H. Franklin Anthony was named chairman of the board of directors of the **New England Cable Television Association**. He is senior vice president of Continental Cablevision.



Ferbrache

Tektronix announced the resignation of **David Friedley** as president and CEO. He held the position since 1987 and prior to that he was vice president and general manager of the Communications Group.

In other Tektronix news, several new appointments also were announced.

Rex Ferbrache is the new director of technical strategy for the TV division. Formerly he was the engineering man-

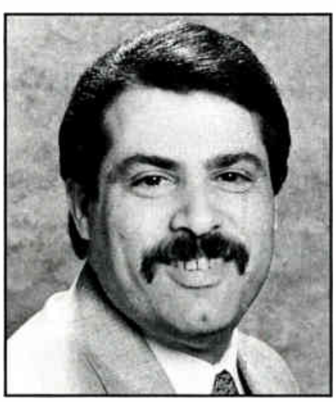
ager for the TV signal processing business unit. .

Fibush

David Fibush was promoted to engineering manager for the TV signal processing business unit. Formerly he managed and developed broadcast video tape recorders for Ampex.

Bhaskar Pant is the new Pacific Rim market development manager for the Tek's TV division. He has been with the company 13 years, seven of which he spent as the northeast region sales manager.

Tom Jordan was promoted to southeast region sales manager for the TV division. He is an eight-year veteran with the company.



Christenson

Tom Christenson was promoted to northeast sales manager of the TV division. Formerly he was a sales manager with the company.

Loren Swenson was named president and **Joycelyn Steil** was elected executive vice president of **Cycle Sat**. Prior to this, Swenson was COO for the company and Steil was vice president, traffic.

Grubb

John Grubb was promoted to director of marketing services by **ADC Telecommunications**. Most recently he was manager of marketing services.

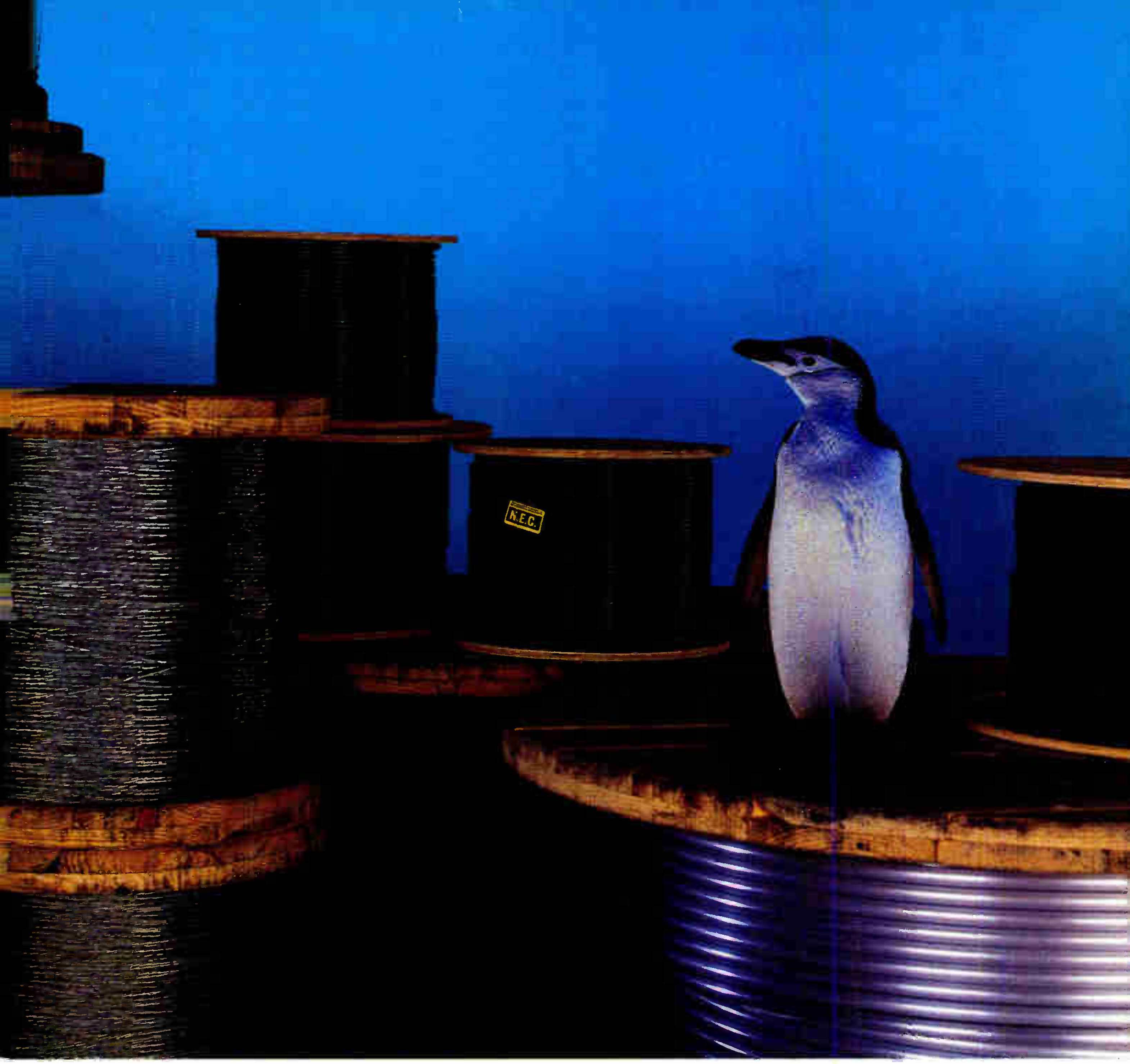
Beck

Daniels Communications made the following new appointments.

Kirsten Beck joined the company as vice president of international development. Most recently she was senior editor of *Television Business International* and *Channels*.

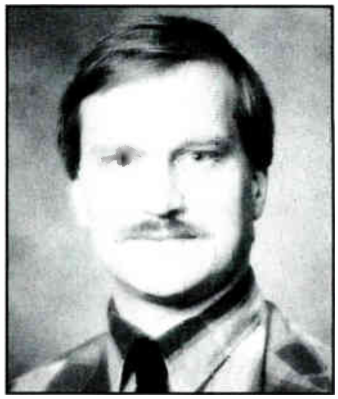
Jim Hanson was promoted to vice president of finance and taxation by Daniels. Prior to this he was tax specialist.

Vision Cable's Phil Giordano was promoted to director of operations. Previously he was marketing and commercial development manager.


N.E.C.

(Continued on page 214)

Glass



Yount

Zappetillo

Comm/Scope announced three new appointments. **Robert Glass** was named applications engineer for CATV. **Carroll Yount** and **John Zappetillo** were appointed district sales managers for the company.

The Virginia Cable Television Association elected its new officers and directors for the 1990-1991 year that begins July 1. **Franklin Bowers**, vice president and general manager of Cox Cable Hampton Roads, was elected president; **Thomas Waldrop**, chairman and CEO for Media General Cable of Fairfax County, was elected vice president; **Joseph Price**, regional manager of Adelphia Communications, was elected treasurer; and **Donald Perry**, president of Gloucester Cablevision, was elected secretary.

Newly elected to the board of directors are **Charles Dopp**, general manager of Storer Communications, and **Troy Fitzhugh**, general manager of Columbia Cable of Virginia.

Several people were re-elected to the board. These were **William Day** (general manager of Warner Cable Communications), **Ronald DeForrest** (manager of Sammons Communications of Virginia), **John Evans** (president of Arlington Cable Partners), **H.W. Goodall** (vice president and general manager for Continental Cablevision of Virginia), **Kevin Nolan** (manager of Lynchburg Cablevision), **Virginia Benzier** (account manager for Home Box Office) and **Cheryl Fiumara** (regional director for The Disney Channel).

Rosendahl

Century Southwest Cable Television's new vice president of operations is **William Rosendahl**. He will continue acting as vice president of Century Communications' corporate affairs and remain host of Century's public affairs program, *Century Cable TV Press Conference*.

To Tom Elliot

in Technology" Recipient

AD INDEX

Back to Basics

June

June 1: Alaska Cable Television Association annual convention, Juneau-Wrangell, Alaska. Contact (907) 772-3292 or (800) 327-2571.

June 3-6: Canadian Cable Television Association annual convention and Cablexpo, the Edmonton Convention Center, Edmonton, Alberta. Contact (613) 232-2631.

June 3-6: The Cable Television Association of Maryland, Delaware and the District of Columbia annual spring meeting, Ocean City, Md. Contact Wayne O'Dell or Patricia Rodriguez, (301) 266-9111.

June 3-9: Banff Television Festival, Banff, Alberta. Contact (403) 762-3060.

June 6: SCTE Florida Chapter technical seminar on lightning protection and CATV plant, headend delivery system, operation and maintenance, satellite antennas and new developing technologies, Microdyne offices, Ocala, Fla. Contact Rick Scheller, (305) 753-0100.

June 6-8: Women In Cable and the University of Denver cable management program on "Engineering for the Non-Engineer" via uplink, Atlanta, Dallas, San Francisco and Tampa, Fla. Contact Nancy Ring, (312) 661-1700.

June 7: SCTE, CTAM, Women In Cable and Minorities in Cable New York Chapters joint forum, "Our Issues and Challenges: 1990 and Beyond," Omni Central Hotel, New York. Contact Marge Owens, (516) 678-7200 or Sue Walker, (201) 585-6469.

June 10-13: BPME, Bally's Hotel, Las Vegas, Nev. Contact Gregg Balko, (213) 465-3777.

June 11: SCTE Greater Chicago Chapter technical seminar, BCT/E Categories II, IV, V and VII testing to be administered (tentative). Contact John Grothendick, (312) 438-4200.

June 11-12: AT&T fiber-optic training on building and distribution and outside plant (testing optical fiber), AT&T National Product Training Center, Dublin, Ohio, and AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

June 11-13: New York State Commission on Cable Television and **SCTE** Northeast technical seminar and trade show on technologies for the '90s, Roaring Brook Ranch Resort, Lake George, N.Y. Contact Al Richards, (518) 474-1324.

June 13-14: SCTE Dairyland Meeting Group technical seminar on service technician training, N.E.W. Media, Green Bay, Wis. (June 13) and Viacom Cablevision, Greenfield, Wis. (June 14). Contact John Boltik, (608) 372-2999.

June 13-14: National Satellite Technology Institute certification seminar for satellite professionals entering the commercial private cable market, St. Louis. Contact Kay Zupke, (800) 622-5990.

June 14: SCTE Chesapeake Chapter technical seminar on new technologies, HDTV, fiber, MultiPort and DCR, Holiday Inn, Columbia, Md. Contact Keith Hennek, (301) 731-5560.

June 14: SCTE Golden Gate Chapter technical seminar on BCT/E Category IV—Distribution systems, San Jose, Calif. Contact Tom Elliott, (408) 727-5295.

June 20: SCTE Great Plains Meeting Group technical seminar, BCT/E examinations to be administered in Categories II, IV, V and VII, Bellvue, Neb. Contact Jennifer Hays, (402) 333-6484.

June 20: SCTE Delaware Valley Chapter technical seminar. Contact Diana Riley, (717) 764-1436.

June 21-24: SCTE Cable-Tec Expo '90, Nashville Convention Center, Nashville, Tenn. Contact SCTE national headquarters, (215) 363-6888.

June 22: SCTE Miss-Lou Chapter technical seminar, Biloxi, Miss. Contact Dave Matthews, (504) 923-0256.

June 25-29: Fiber Communications Corp. fiber-optic workshop, Sturbridge, Mass. Contact (800) 776-0518.

Planning ahead

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.

Oct. 30-Nov. 1: U.K. Cable Television Association convention, London.

Nov. 28-30: Western Show, Anaheim, Calif.

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SALES ENG, S, 60K	CH TCH, E, 40K	HDEND MICRO, NY, 27K
SALES ENG, E, 60K	TCH MGR, MW, 40K	LN TCH, W, 13/HR
SALES ENG, W, 60K	MGR/TCH, SW, 35K	LEAD TCH, W, 12/HR
DIST ENG, MW, 45K	CH TCH, NY, 27K	SW TCH, E, 12/HR
TCH MGR, E, 40K	PL MGR, W, 40K	LN TCH, SE, 25K
PL MGR, N, 38K	TCH MGR, SE, 32K	LN TCH, SW, 12/HR
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For post (2), the applicants should have experience in the laying, splicing, and jointing of coaxial cables and fibre-optic cable in underground construction and in buildings. Experience in the installation of equipments such as amplifiers, taps and splitters etc. for a cable television system will be an advantage.

Salaries offered will commensurate with qualifications and experience. Appointment will be on a contract basis with end of contract bonus , annual leave and medical insurance.

Applications in strict confidence with detailed resume, and contact phone number or fax number as well as recent photo should be sent to:

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- SERVICE TECHNICIAN
- MAINTENANCE TECHNICIAN

SUBMIT RESUMES TO:

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It's been a good year

By Jack L. Trower
President, Society of Cable Television Engineers

It's hard to believe that this month marks the end of my year as president of the Society. It seems that the year has gone by fast in some respects and in others it seems to have been an eternity. When I ran for and was elected president, I did not realize the many challenges that go with the job. I do know that it has been an enjoyable year; one that I will remember for the rest of my life. It has truly been an honor and a privilege to serve you as president.

During this year we have had a hard look at some of the programs, rules and procedures of the Society. There were special committees formed to evaluate our programs and additional work load placed on the national staff to help strengthen the rules and procedures of the Society. This year also has been a time when I believe I've heard every suggestion possible to change or improve the Society and its program; this is good. Progressive change is what keeps any group viable. But suggesting change without the accompanying action will not suffice. If you think that change is what is needed in the Society then you must make yourself available to work toward that change. You cannot sit back and expect someone else to do it for you and expect to see the change you want.

Where's the new blood?

When I was elected president I was overwhelmed by the number of people who told me to call if I needed them. I believe that this pattern of stepping forward to help is prevalent with the membership of the Society. One problem I see with this is that it always seems to be the same members who are in the forefront to help. In my assignments for committees, I have been no different than anyone else. I have depended on those members who are always ready and able to do the job. I was able to use a few new faces but not enough to relieve those tried and true veterans. We need to involve some "new blood" to help those who have worked long and hard for the betterment of the Society. Otherwise we will burn out those members who have always done everything and we will have nobody ready to take their place.

I would like to take this opportunity to say thank you to a few people who have helped make this year possible. First, I would thank WEHCO Video and my boss, Jim Wilbanks, for all the support I have received during my term in office. It is no small endeavor for a small company such as ours to donate the time and money requried to do this job. I would also say a "special thanks" to Charlotte Dial who has kept me on track and helped me balance all the requirements of my regular job and the job as president. Only a dedicated professional could have done that. Of course, a big "thank you" goes to my wife Kelly. She has given me that support she always has for 26 years and has understood the reason for the traveling I've had to do. Thanks also to the SCTE board of directors and the national staff for their help in making the year go as smooth as possible. We surely have a professional staff working on our behalf and they got better and better.


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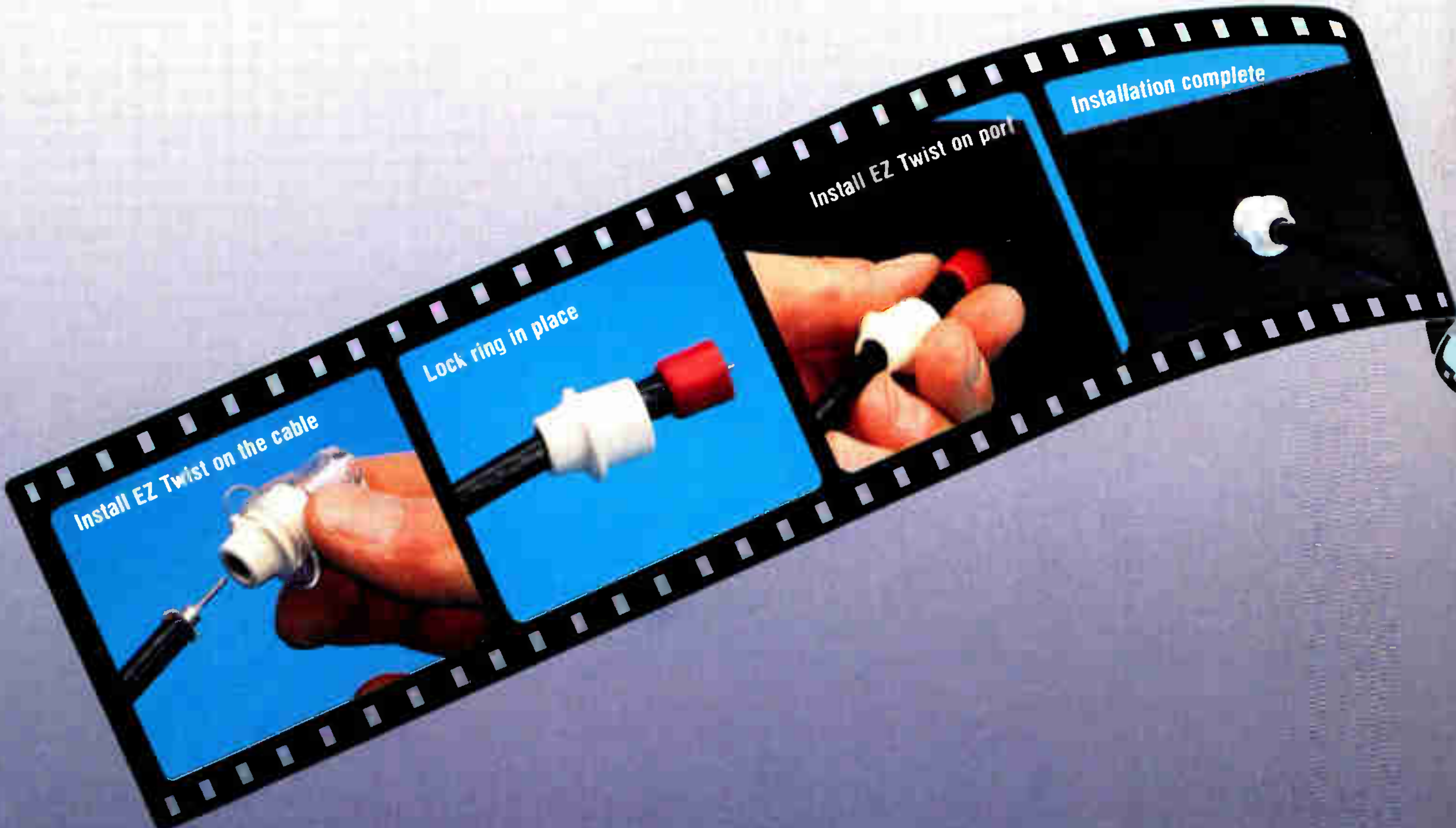

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