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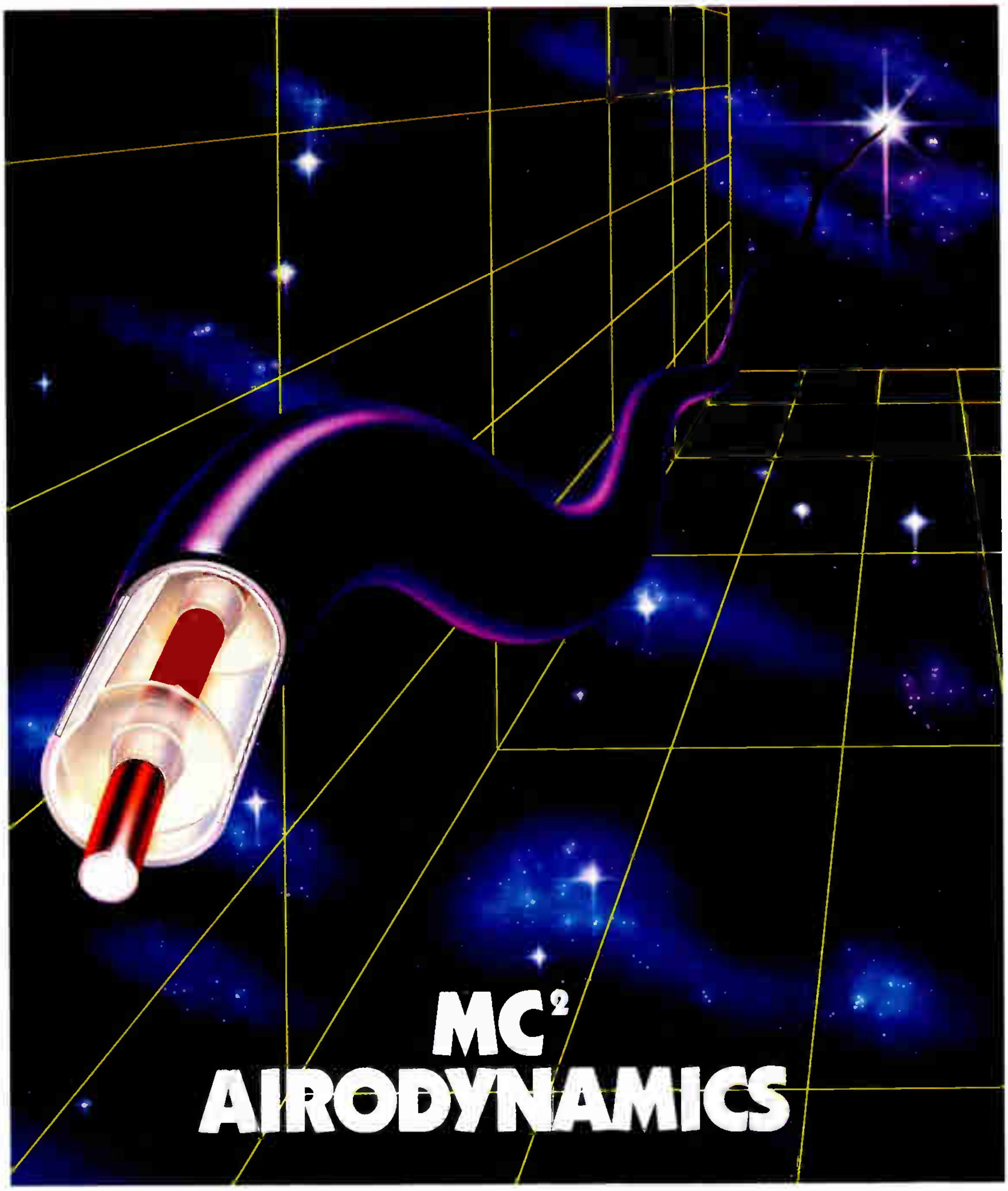


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January 1990

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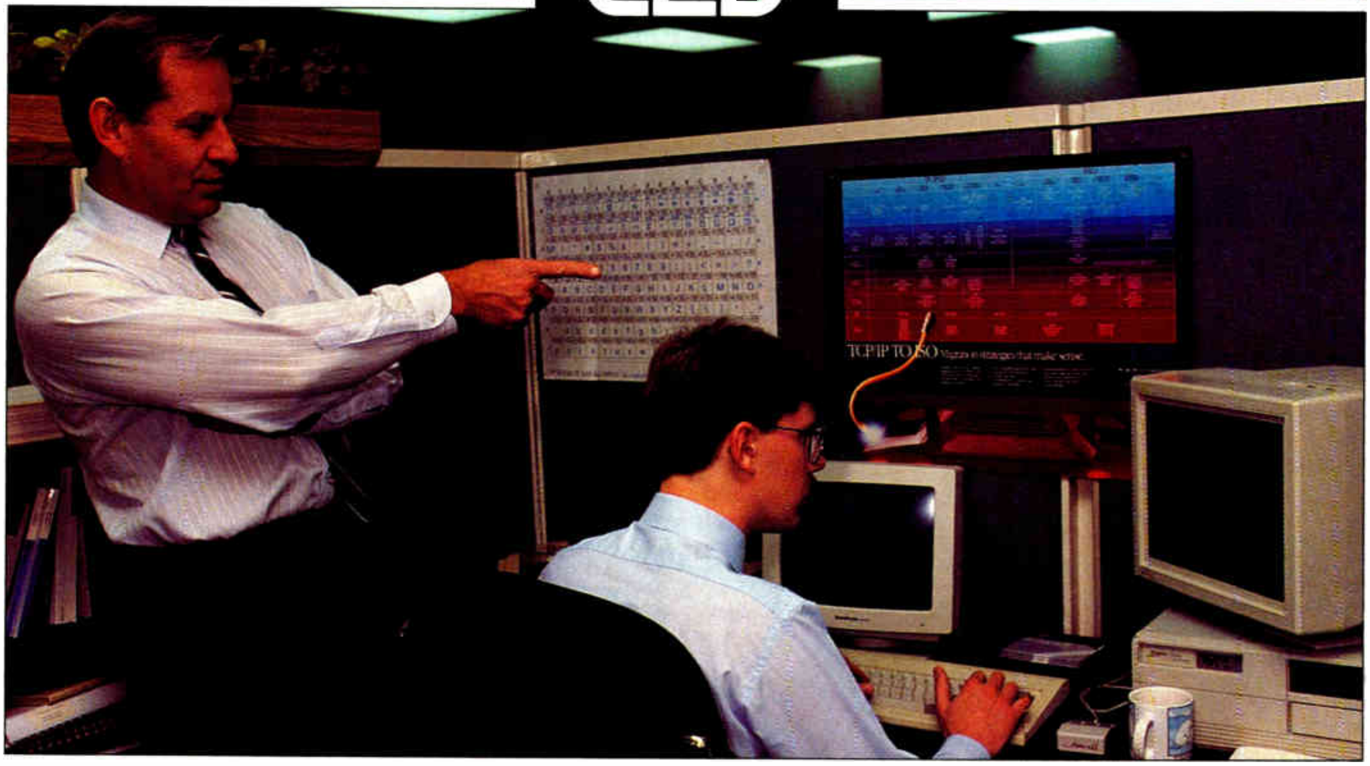




**About the Cover:**
*Nick Hamilton-Piercy, 1989 CED Man of the Year, is framed around the colorful output of Rogers' proprietary signal leakage software, where colors represent varying strengths of radiation. Photo by Rob Stuehrk.*

**CLI COMPLIANCE**


*Using a dipole antenna, pg. 76.*

DEPARTMENTS




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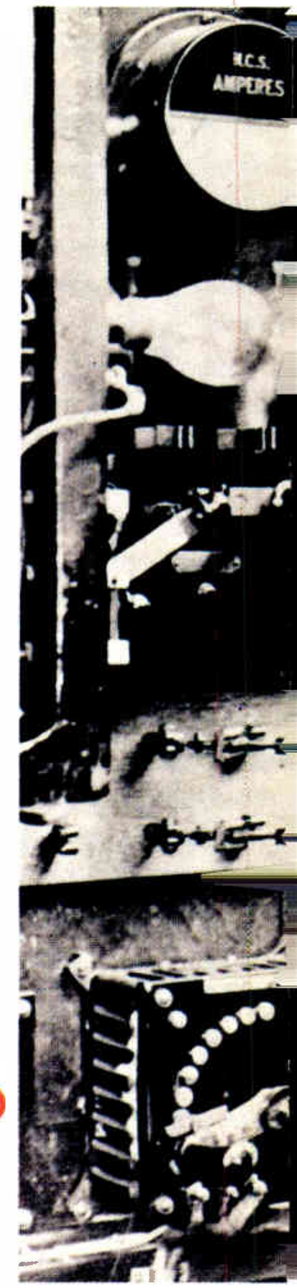


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I Z A T I O N

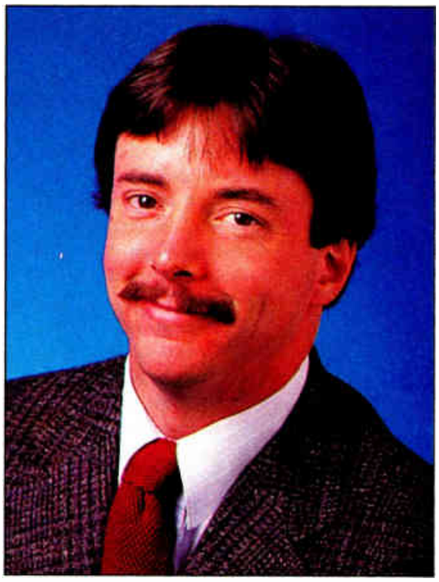
Reader Service Number 4

# IN PERSPECTIVE

## The deadline is coming and we're failing

The recent incident in Graham, Texas, where a cable system there was found to have "enormous leaks" in the midband, is likely to go down in history as the latest benchmark in cable's long history of inability to keep plants operating within specifications. Whereas the Harrisburg incident in 1976 opened the floodgates of concern that eventually led to the creation and adoption of the FCC signal leakage rules now collectively referred to as "CLI," this latest violation points to something much more disturbing.

According to Paragon Cable officials, the local system there missed the huge leaks because its detection equipment was inadequately tuned to "hear" the leakage. It wasn't a case of simple ignorance of the rules or a lack of concern at the system level, it seems it was more a case of inadequate—or ineffective—training of the technical personnel to ferret out and fix the leakage.



This wouldn't be so surprising or worrisome if the industry wasn't just six short months away from the deadline imposed by the FCC to meet the stringent leakage requirements. It points out clearly just how far the industry as a whole is from compliance and that the FAA and FCC are deadly serious about the compliance issue.

Even though a large percentage of system managers believe their systems would pass if a CLI inspection was held today (*CED* Cable Poll, December 1989, p. 132), the facts say otherwise. Systems that have implemented leakage detection and correction programs would be wise to review their programs and make sure that 1.) they understand how to use the monitoring equipment, 2.) they use the proper calculations to get a final CLI number, and 3.) that they have all the necessary information logged and easily accessible.

By shutting down three channels on the spot, the FCC sent a loud and clear signal: that leakage cannot and will not be tolerated. If you're in charge of your system's leakage program, take time NOW to review your process and techniques. Read up on the subject. Ask questions. Run tests. If you don't have enough time, resources or personnel to get the job done, talk to your supervisor. Get everyone involved—before the regulators do, because by that time, it's too late for you and the rest of the industry.

Don't think that you can play the numbers game and do a slipshod job and simply pay the fine. The FCC will come after your popular channels and pull them off the air. If that day comes, you'd better have your resume ready. ■

Roger J. Brown

Roger Brown
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Reader Service Number 5

## FCC shuts down 3 channels because of midband interference

It's finally happened. In November, the Federal Communications Commission (FCC) shut down three midband channels in a Paragon Cable system in Graham, Texas following a complaint from the Federal Aviation Administration that the system was violating signal leakage rules.

The 23-year-old, 23-channel system lost use of The Nashville Network, Lifetime and MTV after it was found to have "enormous leaks," according to one FCC official. Although TNN and Lifetime have since been reinstated on different channels higher in the midband, MTV was still dark, as of press time. Paragon is presently evaluating whether to completely rebuild the 53-mile system or make other modifications to ensure it's a closed system. A decision was expected by the end of December, according to John Neal, division president of Paragon's Southwest Division. "We believe we can be in complete compliance by the deadline, but feel that a rebuild is the best alternative in the long run," said Neal.

Although no final determination had been made by press time, the system could be hit with a fine of up to $20,000 by the FCC. Action was slated to be taken at a Dec. 12 meeting, according to one FCC source.

According to Paragon, the system's personnel missed the leaks during its leakage monitoring program because the transmitter and receivers were slightly mis-tuned. Therefore, although some leakage was detected, a large portion of it went undetected, said Neal.

"If you looked at the paperwork I was receiving (from the system level), there was nothing that would indicate Graham had any problem at all," Neal said, adding that because Graham is a rural system, there was little ingress problems from over-air broadcasters, usually a helpful indicator of leakage. "What this experience shows is that other small, rural operators had better be particularly careful. I know we're not alone."

The FAA regional office in Fort Worth, Texas filed a complaint with the FCC, which then determined the leakage was originating in Graham. According to Bill Anderson, assistant public affairs officer, the interference was coming in over the air-to-ground frequencies. "It sounded to us like a stuck microphone," he said.

## Interactive video: Training of the future

Good news on the employee training front. Recently, 13 major MSOs met to discuss the role of interactive videodisc (IVD) programming for providing customer service and basic technical skills training. Meeting attendees included Jones Intercable, Tele-Communications Inc., United Artists Entertainment, Viacom, KBLCOM, Rogers Cablesystems, Sammons Communications, Times Mirror, WestMarc and American Television and Communications Corp.

Industry vendors were also invited and included: Scientific-Atlanta, Magnavox CATV, C-Cor Electronics and Jerrold, a division of General Instrument Corp. Vendors were invited in an effort to convince them of the logistics of providing interactive videodisc training programs covering the use of



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equipment.

The half-day program began with a presentation by Mike Debloois, president of Miken Corp., who discussed whether IVD was effective, useful and cost effective. (Miken Corp. develops custom IVD programs for clients as well as generic materials used in customer service for the hospitality market.) Stating there were several steps to be applied to any training program, Debloois said it was necessary to ask the following of any program: Does it get the job done (effectiveness)? Is it affordable? Can it be delivered in a timely way? Can you find a direct relationship between dollars and outcome of those dollars? Is the program capable of being altered so it doesn't become obsolete? Is it consistent? How individualized is the training? Does it meet the trainees' needs? Is it meaningful? Will I be motivated?

Saying that trainers are typically using styles that are 50 years out of date, Debloois went through each of the steps as they applied to IVD. In summarization, Debloois stated that "experience says IVD is effective, affordable and the outcome can be measured." Debloois also quoted empirical evidence from several studies which showed that: people prefer IVD; training is occuring more rapidly which makes possible a reduction of training dollars by 40 percent; and when time is held constant, the IVD trainee is achieving 35 percent more knowledge.

The remainder of the afternoon was spent actually reviewing five systems. Jones Intercable demonstrated its two programs: "Customer Service, Your Key to Success; and "Sales Through Service." ATC's "Troubleshooting Cable TV Systems" focused on training skills for installers and technicians, while its "Understanding Upset Customers" dealt with customer service representatives. The fifth system, PacTel's "Refresher Defensive Driving" allows trainees to refresh driving habits through real-life driving experiences.

Although participants in the IVD presentation were optimistic about its use and capabilities, most questioned the feasibility, and cost, of the necessary equipment expenditure. An IVD workstation consists of an industrial videodisc drive, an MS-DOS, PC-AT compatible system controller, high performance graphics/overlay system and high resolution display options. Typically, a system would also use either a mouse or touch-screen for easy entry, although it is an individual preference.

> 'Experience says IVD is effective, affordable and the outcome can be measured.'

The cost of a system is approximately $5,000 to $7,000.

However, according to Mike Franklin, president of Poseidon Systems, who offers the Sony View 5000 as a solution for the IVD hardware system, the cost of hardware can be easily justified if the courseware is available. Based on the day's events, courseware is being made available and hopes are high that this type of IVD will become an integral part in many MSOs' training programs.

## CableLabs, vendors agree to perform R&D

Cable Television Laboratories (CableLabs) has reached separate agreements with the two CATV full-line equipment manufacturers to cooperatively conduct research into picture quality and future headend engineering requirements.

CableLabs will utilize Jerrold's Applied Media Lab to perform subjective testing of picture quality in an attempt to identify the elements that influence NTSC picture quality. These tests will center around five basic forms of picture degradation, including noise, intermodulation, microreflections, envelope delay and phase noise.

This type of testing is not new, but this structure will be unique, according to Tom Elliot, CableLabs vice president of science and technology. The tests will result in a set of parameters system designers can follow to provide high quality pictures to the home, Elliot said.

Jerrold and CableLabs are working to structure the tests, which are expected to be completed early this spring. "The goal is to have it done by the end of the first quarter, but we're more concerned with doing it right," said Elliot.

In a separate but related announcement, CableLabs and Scientific-Atlanta will analyze headend engineering requirements for the development of future headend systems. Elliot said that as headends continue to get more complex in size and perform more functions, a new, overall look at the technology should be taken. "We need to start thinking of our headends as a series of signal sources, destinations and in-between things," and look at issues like reliability and better, more efficient, packaging, Elliot said.

S-A has contributed a full line of headend equipment, including satellite antennas, satellite receivers, modulators and processors toward the research. It was to have been delivered this month.

"This is an example of the kind of cooperative efforts I envisioned coming out of our October meeting in Denver with cable equipment providers," said CableLabs President and CEO Richard Green.

## DS3 fiber field trials begin with ABC feed

In what could have significant long-term implications for the cable industry, the first field trials of terrestrial fiber optic networks for the delivery of broadcast television signals began in mid-December with a live feed of ABC from New York to seven cities across the country.

The trials, coordinated by Bellcore, the research arm of the regional Bell operating companies, will use fiber (and perhaps eventually microwave) to test the efficiency of the medium and compare it to traditional satellite distribution methods. Each of the broadcasters (ABC, CBS, NBC, Fox and PBS) will have an opportunity to use the networks, established between Atlanta, Boston, Indianapolis, Los Angeles, Minneapolis, New York, St. Louis and Washington. About 50 TV stations, manufacturers, suppliers, interexchange and exchange carriers will participate.

Conventional TV signals are being transmitted at 45 megabits per second (the DS3 rate), which travel over a two-way, tree-and-branch-like network which allows broadcasters to distribute and/or receive programming simultaneously to/from any number of affiliate stations.

Although no cable operators or programmers are participating, the tests, if successful technically and affordable economically, may have long-term implications for the industry.

*—Roger Brown and Kathy Berlin*

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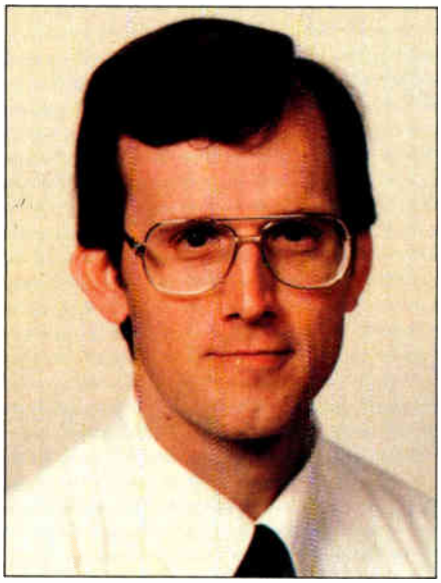


# Delay predistortion

Why in the world would anyone ever want to deliberately distort a video signal prior to transmission? Well, in short, it's because the Federal Communications Commission (FCC) says that it's the right thing to do! Granted, the FCC does not regulate CATV modulators like it does broadcast TV transmitters. But since it's the "right thing to do" for the "big boys," some CATV modulator manufacturers have opted to include delay predistortion as an integral part of the modulation process.

The FCC Code of Federal Regulations, Title 47, Part 73.687 says:

"A sine wave, introduced at those terminals of the transmitter which are normally fed the composite color picture signal, shall produce a radiated signal having an envelope delay, relative to the average envelope delay between 0.05 and 0.20 MHz, of zero microseconds up to a frequency of 3.0 MHz; and then linearly decreasing to 4.18 MHz so as to be equal to -0.17 μsecs at 3.58 MHz. The tolerance on the envelope delay shall be ±0.05 μsecs at 3.58 MHz. The tolerance shall increase linearly to ±0.1 μsec down to 2.1 MHz, and remain at ±0.1 μsec down to 0.2 MHz. (Tolerances for the interval of 0.0 to 0.2 MHz are not specified at the present time.) The tolerance shall also increase linearly to ±0.1 μsec at 4.18 MHz."

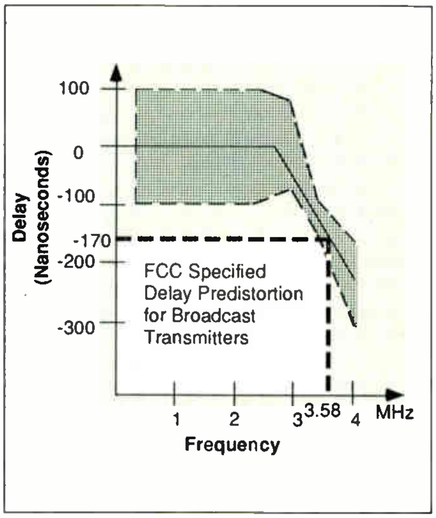
*By Chris Bowick, Director of Engineering, Headend and Earth Station Products, Scientific-Atlanta*

If you're like me, and have trouble visualizing the "mask" described in the above regulation, take a look at Figure 1. Note that the delay specified is not an "absolute" delay. Instead, it is a delay difference with zero nanoseconds as the reference line.

### Is predistortion needed?

Back in March of 1988, I wrote a column[1] on chrominance to luminance delay inequality and described in great detail the problems that can result when the chrominance signal is advanced or delayed in time relative to the luminance signal. The resulting "funny-paper" effect, in which the color information is mis-registered with the luminance information on a video monitor can be quite noticeable. And now, here is the FCC dictating that we deliberately create such a condition.

As it turns out, it was done for good reason...to make up for the distortion that occurs in an "average home TV receiver." As you might imagine, the narrow-band IF filter and sound trap in any garden-variety television receiver creates a substantial amount of




delay near the edges of its passband (read color subcarrier) relative to the center of its passband (read luminance).

While it would certainly be possible to "equalize" the delay across the passband using relatively simple circuit techniques, it was determined that the sophistication and cost associated with putting a delay equalizer in every TV set was too much for the manufacturer to bear. Hence predistortion (perhaps we should call it "precorrection" now that we understand the function) was born and placed within the transmitter to compensate for the delays introduced in the TV receiver, and thus producing a total system exhibiting very little envelope delay.

I mentioned earlier that some, but not all, CATV modulator manufacturers have opted to include delay predistortion as an integral part of their modulators. I have found however, that many of the lower cost units, for example, will not have such a network. Recent lab experiments on the baseband video output ports of TVs and VCRs have shown that while it is true than an "average home receiver" probably does not exist, and that the chrominance to luminance delay inequality of various receivers is poor, and "all over the map," in all cases, removal of the delay predistortion network in the modulator made the chrominance to luminance delay inequality, as measured on the baseband video output port of the TV or VCR, much worse. In other words, the delay predistortion network still seems to be performing the function it was originally intended to do...to negate at least some (but not all in most cases) of the delay expected in the TV set.

I should also mention that the complexity of delay predistortion networks is also variable. There are predistortion networks that are very simple (single section), and which only approximate the required FCC delay but do not stay within the required FCC tolerance mask, to those that are only slightly more complex (three section) and which follow the FCC curve almost precisely. Each manufacturer charts his own course in this regard. The best way for you to determine what's inside the modulator is to look at the baseline of the 12.5T pulse with the demodulator's sound trap in place. If the baseline is flat, the chances are pretty good that at least some form of delay predistortion exists in the modulator. ■

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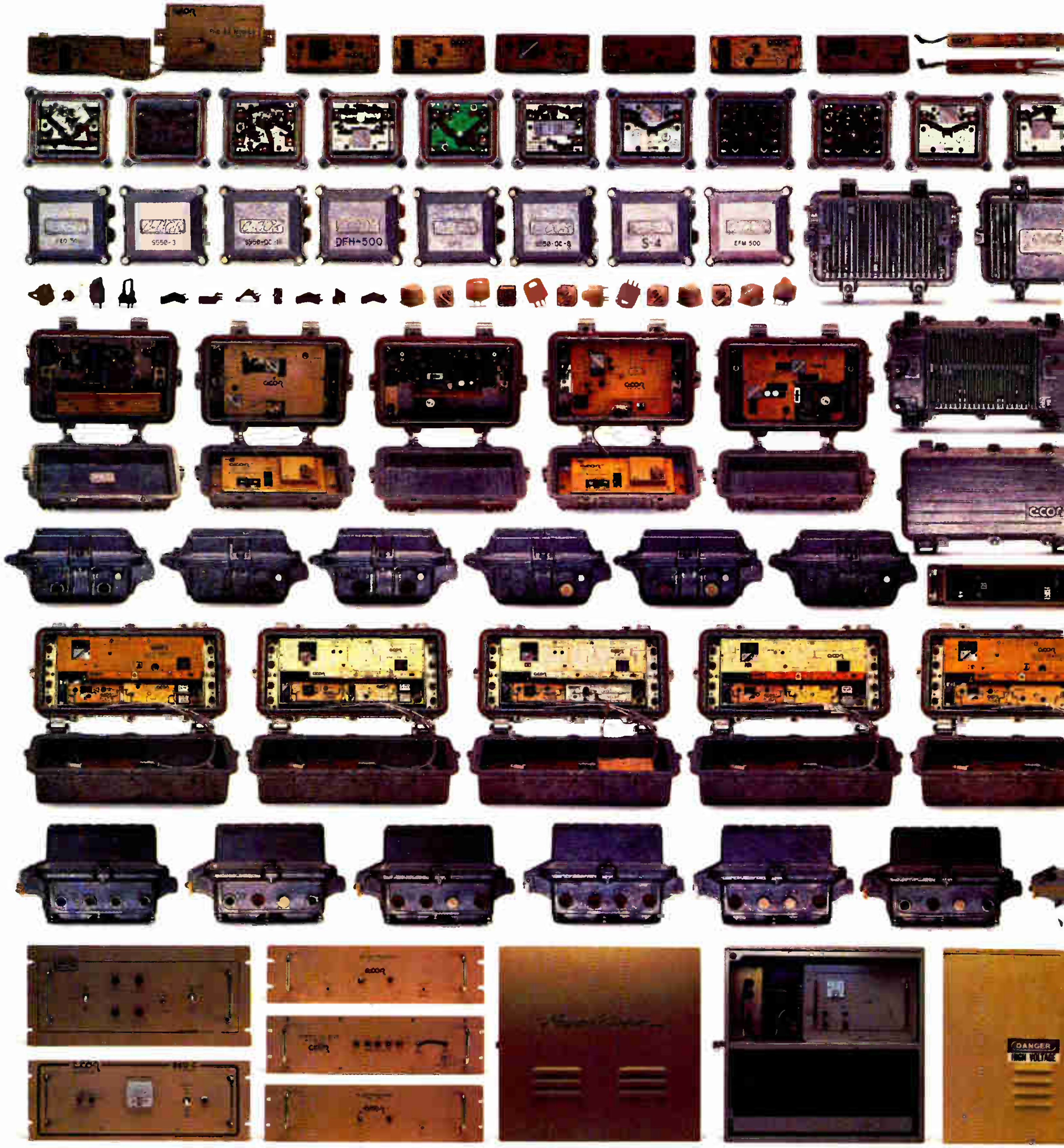

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Reader Service Number 9

# FIN/SYN battle heating up again

Last month, Jack Valenti, president of the Motion Picture Association of America, addressed a gathering of Washington communications lawyers. As usual, Mr. Valenti's colorful rhetoric quickly moved into high gear, and before long he was into his established tirade against the evil monopolists of the television business. I'd heard this warm-up before and braced myself for another Hollywood attack on the big, bad cable industry.

But this time, it wasn't vertical integration in the cable industry that Mr. Valenti was assailing. (Perhaps he read last month's column.) Indeed, he didn't have the cable industry in mind at all. The evil monopolists, this time, were the broadcasting networks—ABC, CBS, and NBC.

The reason for this attack is that the networks are once again seeking to get rid of longstanding FCC rules that limit their role in the production and syndication of television programming. The financial interest and syndication ("FIN/SYN") rules adopted in 1970 prohibit the networks from engaging in the domestic syndication of any television programs and it prohibits them from acquiring any financial interest or property right in programs that are produced in whole or in part by someone other than the networks themselves.

*By Michael Schooler, Deputy General Counsel, NCTA*

## A necessary rule

The syndication rule was deemed necessary to prevent the networks from using their dominant position in the distribution of programming to enter the syndication market in an unfair and anticompetitive manner. Networks had an obvious competitive advantage over other syndicators in selling non-network programming to their own affiliates. And they also had anticompetitive incentives in dealing with independent broadcast stations. They would, for example, have been loath to sell popular syndicated programming to independent stations, even if the independent stations had outbid network affiliates, because such programming could have diverted audiences from their own network affiliates.

The financial interest rule was meant to prevent the networks from exercising too much control over the creative process and the content of programming. The FCC feared that if the networks had a financial interest in programming produced by others, that interest would influence their selection of programming to fill their schedule. Instead of selecting programming on the basis of quality, they would seek to make successes of the programming in which they had a financial interest.

In the early days of television, this was not a problem, because most programs had a single advertising sponsor, and often the sponsor, rather than the networks, selected and purchased the programming. But by the mid-1960's, this pattern had changed. Advertisers could no longer afford to sponsor entire programs. Instead, the networks developed and purchased programming and sold spot commercials to numerous sponsors, for insertion in each program. As a result, the networks gained a more dominant role in the purchasing of programming.

## A third rule

At the same time that it adopted the syndication and financial interest rules, the FCC also adopted a third rule aimed at lessening the networks' dominance in the purchasing of programming. The "prime time access rule" prohibited network affiliates from broadcasting more than three hours of network programs (or syndicated re-runs of network programs) between the hours of 7 p.m. and 11 p.m. This rule guaranteed that, for at least one hour of prime time, the networks' bottleneck control over programming would be removed.

From time to time, the networks have sought repeal of the syndication and financial interest rules, arguing that any conceivable dominance that they might once have had over programming has been eroded by changes in the marketplace. They are routinely opposed in these efforts by the Hollywood studios, by independent syndicators, and by independent broadcasters.

The networks have not yet been able to prevail, but they seem to be gearing up for another attack on the rules. As usual, they're pointing out that they have lost a substantial portion of the viewing audience since 1970 to cable services and independent broadcasters. In addition, the networks contend that mergers and consolidations such as the formation of Time-Warner, Inc. are creating huge entertainment conglomerates with which they cannot effectively compete while constrained by the FIN/SYN rules. Finally, the networks are seeking to ride the coattails of current concern over the ability of United States companies to compete effectively in the international marketplace.

This is the sort of intra-industry battle that is typically settled by agreement. Congress and the FCC, having been caught in the gunfire of extraordinarily heavy lobbying efforts by both sides, are not eager to reenter the fray without some sort of industry compromise.

Meanwhile, however, it's interesting to see the Hollywood studios and independent broadcasters making the case that the networks remain a dominant force in the communication marketplace. Whatever the merits of retaining or abolishing the FIN/SYN rules, the issue serves as a reminder that television viewers still spend a substantial portion of their viewing time watching broadcast stations. It's hard to take seriously the claims of Hollywood and the independent broadcasters that cable has a local monopoly over television viewing when they are simultaneously pointing out that network affiliates, whose signals are available free over the air, are capturing two-thirds of television viewers during prime time and that the broadcast networks still have bottleneck control over program suppliers. ■

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Reader Service Number 10

# Man of the year:

## *Operator cited for leadership in fiber optics,*

*Nick takes time out in the Rogers Engineering lab.* PHOTO BY ROB STUEHRK

Quality, service and innovation. Over the past year or so, those have become the new buzzwords of the cable television technical community. But to Nick Hamilton-Piercy, vice president of engineering and technical services at Rogers Cable TV, they are the cornerstones of his professional philosophy.

It's because of Nick's commitment to service through quality, his pioneering work with advanced television, creation and deployment of a unique urban fiber optic architecture and development of signal leakage measurement and detection gear that he has been named 1989 Man of the Year by *CED* magazine.

### Industry statesman

Hamilton-Piercy, who's been called everything from "statesman" to "a real gentleman" by his brethren, was chosen as Man of the Year by a committee of three senior-level engineers with decades of collective cable industry experience, who were impressed with his technical leadership. Nick's name was high on the list of Jim Chiddix, senior vice president of engineering and technology at American Television and Communications and last year's *CED* Man of the Year; Mike Jeffers, the timeless Jerrold engineer; and David Large, former Gill and Raynet engineer who is now employed by Intermedia Cable Partners.

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To Chiddix, Nick was the proper choice because of his trailblazing work in several different areas. For example, Chiddix says the fiber architecture being deployed by Rogers throughout Canada, which utilizes a fiber loop with redundancy, will serve as the model for urban cable systems everywhere. Secondly, Hamilton-Piercy's leadership on

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## *advanced television and signal leakage detection*

both CableLabs' and the NCTA Engineering Committee HDTV subcommittees was also cited by Chiddix. Finally, Nick's efforts to adapt existing measurement hardware and marry it to proprietary software resulted in cost-effective computerized aerial leakage tests and help keep cable systems tight, says Chiddix.

The affable Hamilton-Piercy, a British subject by birth and now a Canadian citizen, was drawn to electronics and engineering at an early age. "I always liked fiddling with things," he recalls. "It started when I was about 7 or 8 when I got an old power lawnmower and started tuning it up."

To this day, Hamilton-Piercy still spends his time away from the office tinkering with engines. He and his son built a "fun boat" with a supercharged Chevy engine in it that does about 75 m.p.h. In addition, he owns a '68 Charger with a hemi under the hood and he drives a turbo Supra to work everyday. That probably comes as a surprise to those who don't know the 51-year-old father of three (and recent grandfather) well.

"Nick has a wild streak in him which is surprising once you uncover it," says Dr. Walter Ciciora, vice president of technology at American Television and Communications. Ciciora has known Nick for about 10 years, dating back to the time when Ciciora was employed by Zenith. "When I was selling Z-TAC converters, he was the first customer," recalls Ciciora. "Nick and his staff practically lived in our labs, constantly testing and asking questions. He helped shape the product."

Nick followed his youthful instincts and spent his collegiate days at Medway College of Technology in Kent, graduating in 1960 with Chartered Engineer status, something akin to professional engineer status in the U.S. "You don't just go to a university and become an engineer (in the United Kingdom)," says Nick. "You go for what we call an apprenticeship where you indenture yourself for five years to an electronics company." Nick spent his with Elliott Bros. (London) Ltd., chiefly in its radio and radar division.

In return, Elliott Bros. took responsibility for his education and Nick spent time in every department of the company. "They believe an engineer is not fledged until they've done that," Nick says. "So I've done welding, sheet metal, lathe work, built transformers, I've done everything."

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After graduation, Hamilton-Piercy worked for about two years as a project engineer at Spembly Electronics. There he was involved in the design and development of industrial control systems, VLF transmission systems and radar countermeasure systems.

### Looking for greener pastures

In 1962, however, Hamilton-Piercy decided his future was on the other side of the Atlantic. "I think mainly I was a mad bachelor looking for greener pastures and quite frankly there's too many people back home and opportunities were quite minimal, so I felt coming here (Canada) was a better future," Nick explains. "I came to Canadian Marconi Company in Montreal which was doing some pretty exciting stuff."

Starting with Marconi as a project engineer in 1962, Nick designed military tactical radio transmitters. Eventually, he was placed in charge of the RF and analog department, which designed military and commercial products. About 1970, Hamilton-Piercy had his first encounter with CATV via TRW and Hughes, who were interested in some of the work Marconi was performing and how it related to AML and hybrids.

His real entry into the cable industry came in 1974, when he was named director of engineering for Canadian Cablesystems Ltd., a major independent operator serving about 500,000 subscribers, mostly in Ontario. "I didn't particularly want to go into the cable industry, it came across to me as very much a service shop-type operation," Nick remembers. "I said, 'hey, I'm a purist engineer I don't want to meddle with this bunch of guys.' "

However, after numerous attempts, Nick finally accepted an offer of a free weekend and flew to London, Ontario to talk with the president of Canadian Cablesystems and his father, who turned out to be Ed Jarmain, the father of Canadian cable television. "He was the perfect visionary," Nick says of Jarmain. "He knew exactly where fiber was going in 1974, he knew the way two-way was going and he told me cable might be the telecommunication structure of the future. His vision and commitment was so high I said, 'hey, I want to be part of this team.' So I actually took quite a reduction in salary just to join this guy to be part of his dream."

Jarmain, now an octogenarian, has similar fond memories of Nick, who he quickly came to respect, trust and treat as another member of his family. "He's always had an open mind to new things," Jarmain says. "He has a very creative mind and the ability to gather that kind of person around him. Nick and I always saw eye-to-eye; I didn't have to feed him ideas or tell him how to do anything. He's not an ordinary person; in fact, he's brilliant."

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### Excellent R&D group pays off

The seeds planted 15 years ago have resulted in the development of a large technical group that is extremely well-respected. Nick's peers in the industry recognize that he's done a tremendous job gathering and coordinating talent to get the most out of them. "He has one of the premier research and development groups in the cable industry," says ATC's Ciciora. Jeffers agrees: "He has a technical department under him which I think is one of the best in the industry."

Rogers' success with the engineering group show the value of committing resources to technology and its development to improve the CATV infrastructure. While American MSOs are busy down-sizing their technical staffs because of consolidation and decentralizing operations to save money, it's clear Rogers' approach works too. In fact, Nick, a strong-willed and opinionated man, believes U.S. MSOs will

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A stereo generator ought to do more than just light the MTS indicator on a subscriber's television set.

It ought to provide clear channel separation, a crisp audio signal, and reliable performance.

It ought to have advanced features like built-in commercial insertion, a 4.5 MHz output and an AGCL circuit.

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## Putting comments back into context

I have been involved in the converter repair business for over seven years, first as a repair technician, then as a manager, and finally as the owner of Intrasteller Electronics Inc. I have read *CED* magazine since 1982. It would seem during this time articles on independent brokerage/repair facilities have been few and far between. There is, however, a need to inform readers of how to choose independents, and what to expect in the areas of turnaround time and pricing.

One could then imagine my disappointment in *CED*'s November article, "Battling the cable converter pirates" (page 44), an article that not only takes my comments out of context, but suggests that independent repair/brokerage facilities aid in the cable industry's pirate problems when, in fact, Intrasteller is thorough and judicious in its security checks. We felt the article should have dealt in the positive role independents play in the marketplace, with in-depth solutions to piracy problems, not finger pointing. Here then are the facts about Intrasteller Electronics Inc.

Intrasteller Electronics Inc. has been in business for five years. We are honest, hardworking and have an outstanding reputation as a vendor to the cable TV industry. We have always supported cable systems in their quest for secure cable systems, and in fact have consulted customers on making their equipment more secure.

Contrary to the article's statement, "Intrasteller believes that the serial numbering system is not its concern," fact is (that) every unit that is received into Intrasteller Electronics Inc. is labled with a tamper-proof sticker showing the customer number and purchase order. The unit's serial number is also logged when received and then sent out with the repaired unit on packing slips. This has been our process for many years and we have these serial numbers on file. There is, however, no national master computer bar code/serial number system we can plug into, to report and track all brands of converters we receive and ship out daily. For Intrasteller Electronics Inc. to develop such a system, we would have to raise prices substantially, and this is what I was referring to when interviewed.

George Sell is way off base if he believes a unit not going to an OEM (Jerrold S/A, Oak) for repair is destined for the "black market." This is simply not true. First of all, our customers know without our competition, pricing and turnaround times in the converter marketplace would not be as competitive as they are today. Second, Intrasteller Electronics, like most reputable repair facilities, returns all "beyond economical repair" units with serial numbers logged and attached, to each repair customer. They are not misplaced, lost or thrown into a pile, as the article suggests, then sold later to the black market. This is a reckless statement that is not true and is an outrageous insult to the hardworking people at independent repair facilities. Fact is, Intrasteller Electronics has a loyal customer base that is very satisfied with our services. They know Intrasteller Electronics Inc. will repair their units in two weeks or less, with less than a 3 percent failure rate out of box and have a repair bill that saves them money.

Converter/equipment brokerage companies fulfill legitimate needs to cable systems of all sizes. We help systems liquidate old equipment, freeing up precious cash for expansion or purchase of new equipment. We sell (to qualified customers) used equipment at reasonable prices, in many cases of a quality and model they may not otherwise be able to afford. Serial numbers are tracked on warranty work, they are not tracked (for economic reasons) on units sold, in disrepair, to other *qualified* repair facilities.

Contrary to the article, Intrastellar qualifies customers before selling them any product. Fact is, we told this to Mr. Sell during our interview. We explained all potential customers are qualified, through such sources as the *Cable TV Factbook*, credit references, industry references and D&B. This is an important security check, and one that not all callers pass. It is in place to protect the cable TV industry from equipment falling into the wrong hands. An important first step, that is the foundation of our security system, backed up by in-house tracking and a serial number system. Yet Mr. Sell fails to write that Intrastellar Electronics does any of these things. Then, and this is what really outrages us, Mr. Sell falsely implies we are complacent about security.

It's obvious Mr. Sell knows little or nothing about independent repair facilities, let alone Intrastellar Electronics. It would appear he bases his articles on short, taped phone interviews with little or no practical experience with brokerage/repair facilities. We would like to invite *CED* to our brokerage facility located in Algonquin, Ill. We would be proud to give a tour of one of the best repair facilities in the United States. Perhaps then *CED* would be qualified to write in-depth articles on our part of the industry.

**Tom Brannam**
**Intrastellar Electronics**

*Upon reviewing the conversation between Mr. Sell and Mr. Brannam, it appears that* CED *magazine does indeed owe an apology to Mr. Brannam and Intrastellar Electronics. While we maintain Mr. Brannam's printed quotes are accurate, his explanation of the in-house tracking system Intrastellar uses to ensure security were entirely left out of the article. Further, we regret any damage this article may have done to Mr. Brannam's reputation and/or Intrastellar Electronics' business.—Ed.*

## No involvement in latest tests

In response to the article, "Amplifiers and enclosures: The heat dissipation question," (*CED*, September 1989, p. 34) a few points need to be further clarified.

In August 1985, Sacramento Cable did ask several enclosure manufacturers for assistance in the design of a more thermal efficient pedestal. Sacramento Cable did organize and set-up the field tests, as well as evaluated the temperature results from prototypes supplied by Channell Commercial Corp., Superior Metal Products and Reliable Electric/Utility Products.

Tests conducted in Sacramento in 1988, however, were not compiled or reviewed by Sacramento Cable. All raw test data was sent to Channell Commercial Corp., who sponsored the study. Sacramento Cable cannot corroborate the test results.

I hope this helps clarify our position in this matter.

**D. Lee Erickson**
**Director of Engineering**
**Sacramento Cable**

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*Nick takes time out in the Rogers Engineering lab.* PHOTO BY ROB STUEHRK

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# CONGRATULATIONS
# NICK HAMILTON-PIERCY

## MAN OF THE YEAR

Thanks for making us all look better.
Your friends at

Home Box Office

have to become more professional in the future.

"I can't generalize because there are some operators who are very professional, but there is a lack of professionalism on the U.S. side," observes Hamilton-Piercy. "Written procedures, written documentation, written manuals, true Professional Engineers are quite lacking in a lot of systems. Without that infrastructure, some operators are going to have a big problem getting through the next 10 years, I believe.

"One engineer who really stands out is Bob Luff and his group at Jones Intercable. Chiddix (at ATC) wants to go that way but he's had a lot of his team dispersed, so he's having a problem. Alex Best (vice president of engineering at Cox Cable) is getting it together. There are a few other cases, but generally, I would say it goes downhill from there." But he sees a light at the end of the tunnel. "I think others will follow the lead," believes Nick. "They know it's necessary but the pressure to do it may not be quite so harsh on them as it is on us right now."

He continues: "You cannot decentralize standardization or network concepts. Look at any of the established telecommunication carriers throughout the world—they all have a centralized planning standards and practices group. Cable companies which have disbanded theirs are going to find that was the wrong move. The pure engineering standards, practices, quality control, etc. has to be administered from a central location. There's no way we'll survive against telephone companies or other competition if we don't have that. They're infinitely smarter in that area than we are."

### The Rogers takeover

In 1979, turmoil was created within Canadian Cablesystems when communications entrepreneur Ted Rogers purchased controlling interest and incited a "stressful takeover" of the company, Nick says. "We didn't want that at the time, but in hindsight it was the best thing that could ever have happened to us, because he was a visionary himself."

Rogers took his systems, which included central Toronto and a few rural systems, and merged them with the properties Canadian Cableystems owned to form the largest MSO in Canada. A year later, Rogers bought out systems in western Canada and boosted its subscriber count to more than one million. Nick was named vice president of engineering and technical services and today the MSO serves 1.4 million subs in Canada, often enjoying penetration rates in the high 80s and low 90s. In addition, Rogers owns TV stations, radio stations, a cellular radio service, video stores and has a 14 percent interest in CNCP Telecommunications, the alternative Canadian voice and data carrier.

The company recently divested its interests in the U.S., which served 500,000 more subs in locations such as San Antonio and Minneapolis, to Paragon Cable, investing the proceeds in its cellular business and in the fiber optic technology necessary to rebuild CATV systems and prepare them for the future. "We're building the cable operations into what we call the next generation cable systems, which will take us through the year 2000," says Hamilton-Piercy. "But we'll be back in the States again, it's just a transition."

A key technical component of Rogers Cablesystems' vision is fiber optics because of the reliability, bandwidth

and picture quality it brings when integrated into a traditional coaxial tree-and-branch system. Nick performed his first fiber "experiment" back in 1978, when Rogers installed a six-mile, 300 megabits/second digital loop and transported 14 channels from the headend to the cable office. "We did that as an operations trial to see if cable could use fiber at that time. We found that, yes indeed, it could do the work, but, no, it wasn't ready for cable TV yet. We couldn't do analog at all and digital was far too expensive. So we spent $1.5 million, got all the experience we needed and that took all the 'black magic" out of fiber for us."

Things didn't change much until the past couple of years. The work done by Chiddix and Pangrac at ATC got operators and vendors pursuing analog forms of video transmission over fiber and customers began to demand a higher level of service and quality. The two fit together like hand in glove.

**Not good enough anymore**

"Customers were becoming more and more sensitive to picture quality," says Nick. Normal customer complaints and focus group input told them that compared to VCRs, word processors, videodiscs and CAD terminals, cable TV pictures were looking pretty weak. "We also know people are getting bigger TV sets which make the deficiencies even more evident."

Formal surveys were undertaken and the results told the story clearly. Forty-three percent of the subscribers contacted said they had contacted the office by telephone for a variety of reasons in the previous three months. Of that group, half said quality and reliability of the network were their biggest concerns. "We wondered why, if it was so important, we never heard much about it in the cable office," Nick says. "It seems there's a general apathy out there;" that cable has always been the way it is and no amount of complaining will change it.

"So we knew we had to do something if we wanted to remain competitive for the 1990s," he says. "We had to get very much better quality than we have now, better reliability than we have now and if something does go wrong, we have to have very prompt response to fix it."

The first item they tackled was quality. The industry design standard of 40- to 43-dB carrier-to-noise at the subscriber's home was found not to be good enough. An internal study, verified by work done by the CCIR in 1983, discovered that 49 dB C/N was the new minimum spec all systems should adhere to. "You might ask, 'why not go even higher?' It's an economic tradeoff," Nick says. "We'd love to go higher, but the cost goes up exponentially as you improve upon 49 dB."

Then, Rogers engineers looked at reliability. "I can't give you a percentage (of reliability) as telcos do," explains Hamilton-Piercy, "all I know is we've got to make it as reliable as we possibly can and then if the picture goes off, we've got to get it back on very, very fast."

With those goals in mind, the engineers looked at using traditional coax and microwave techniques to improve operations and quickly discovered microwave's limitations. For example, Nick says the Toronto system would have had to use nearly 50 "hops" instead of the 15 presently in place to improve quality. "If you look at the practicality of doing that, it's nearly zero," he says, because of building blockages and multiple power splits. And coax was ruled out because of the cost of wide deviation FM supertrunks.

All roads pointed to fiber optics.

But even fiber has its limitations, and Rogers was forced to design a two-level fiber architecture to get the C/N ratios it was striving for. In the design which gained approval, three phases of construction were called for: the first being fiber rings built around the cities for redundancy using existing FM technology; the second taking fiber to a system of hubs via AM means; and the final phase, which will be built sometime later, will take fiber to the bridger.

**Unique hybrid approach**

In the feeders, Nick and his crew will use the concept of "super distribution" to eliminate reflections and improve reliability and quality. The concept calls for the use of 550 MHz feedforward gear placed in 1 GHz housings and a maximum of just four multitaps in cascade to improve bandwidth. So, multitaps are reduced from 26 to four and connectors are limited to 14, from 60.

"As soon as I put a fiber to that point," Nick says, "I can go straight from 77 channels to 150 channels, which we'd use in a pseudo programming-on-demand, assuming we're permitted to do that by the regulators." (Presently, Canadian operators are prohibited from providing pay-per-view or video-on-demand by protectionist legislation.)

"Even if advanced television turns out to be incompatible and takes two channels, we're ready," he adds. "It doesn't matter what's going to be thrown at us, it's ready. And it doesn't cost that much more—somewhere between $2 and $12 per home" because the costs are shared with CNCP, Rogers Network Services and the cellular business, a luxury that most U.S. operators don't presently enjoy.

"We know we can spruce up the distribution of plain old NTSC by doing these rebuilds," Nick says. But for the long term, the industry has to understand NTSC better, especially what its limitations are, to prepare for improved definition or even high definition signals. To help with that work, Nick chairs advanced television subcommittees for both the NCTA and CableLabs. "We know we have to understand NTSC a hell of a lot better than we do now and understand what cable systems do to NTSC and fix it.

"We have to find out how to fix NTSC pictures because new large-screen sets with line doubling make cable pictures look lousy and the people who are going to be buying those sets are opinion leaders, so I know we're in for trouble," says Nick. "We're going to go through the first half of the 1990s with an improved definition TV set and some supercharged type of NTSC and we've got to make our cable systems work well with those."

That work is well underway, thanks to Hamilton-Piercy. "He guided, encouraged and managed to complete the (NCTA) committee work," says Large. "He held the committee together through some really grubby work that took up a lot of volunteer time."

If this work isn't done, cable could lose its competitive edge and be left out of the HDTV delivery scheme. "If (HDTV delivery) goes the DBS route, it will be because of our own fault," warns Nick. "Cable has the ability to be the best. Whether it will pick up the challenge is the real problem. Many operators have spent $2,000 to $3,000 per subscriber to buy a cable system and that debt does not give much freedom to spend additional capital to get the system up to top-notch condition. It may compromise the picture sufficiently that the DBS people get a foothold."

### Keeping leakage controlled

Another area where Rogers quietly took a lead was signal leakage detection and measurement. An internal project resulted in the construction of hardware consisting of a modified digital receiver integrated with the LORAN airplane navigation system that results in a perfectly plotted grid, with output clearly showing leak severity and location. Up until the time Rogers sold its U.S. properties, plans were underway to offer the flyover service to system operators.

Although the Canadians aren't up against a July deadline to ensure their systems are tight, the pressure is on because they, too, share frequencies with other users. Regardless, experience has shown that signal leakage prevention takes commitment.

"We've flown a number of systems and only a few have been clean," he warns. "I think all of us, regardless of where we are, have a big amount of work ahead. My only word of wisdom is, 'keep at it.' If you're lax for even three or four months, catching up is so hard. And if people haven't started their programs by now, God help them."

The latest piece of the puzzle Hamilton-Piercy and his team are tackling centers around responsiveness. The ultimate goal hinges upon system automation and more efficient communication between subscribers and technicians and promises to make system troubleshooting and maintenance much easier.

One portion of the project is already complete. Dubbed the "big business office," it consists of a pool of 130 customer service representatives who take calls incoming from all of Ontario. With the aid of tones, the CSR knows where the call is originating from and can act as though they're on the spot.

"When you have that many CSRs to call upon, peaks occur at different times, so callers get a higher level of service," says Nick. "We can answer all of our phones 95 percent of the time within 15 seconds. We have our office open 8 a.m. to 8 p.m. seven days a week. Repair answers 24 hours a day, seven days a week. Initially, it's costing us money, but we think it's going to *save* money within probably a year or so."

The second goal is to eliminate the mobile dispatcher as the liaison between caller and technician by placing a terminal in every truck. Called "digital dispatching," the system works when a CSR puts a call through the digital system directly to the truck that's nearest to the problem. Terminals are already in place in some trucks and Rogers plans to have its entire fleet of vehicles outfitted with terminals by the end of 1993.

Eventually, the system will be tied to CAD maps of the cable system. This way, when a caller experiencing a problem makes contact with a CSR and gives his account number, the location is found immediately on the map. The map remembers the locations of the calls and searches for a common piece of plant. After the most likely location is determined, the nearest truck is dispatched.

*Hamilton-Piercy and Len McArthur, senior technologist at Rogers Engineering, look over a 100-channel signal generator, the first of its kind in North America.*

That's not all. Software writers are presently working on a program that will integrate with status monitoring software and tell the technician what the most likely cause of the problem is and how it ought to be corrected. Then, when the problem is corrected, the technician enters that information into the terminal, which in turn instructs a voice response unit at the business office to call the customer and tell him his problem has been solved. The truck does not move until confirmation is made that the problem is indeed fixed.

"We're trying to make the whole process as automated as we can," explains Nick, "because human frailties can get in the way of good service. We're getting the tools to the people to allow them to respond excellently."

Few who know Nick well would deny that he epitomizes the classic English gentleman—he's patient, cordial and well-educated. Yet he's strong-willed and unafraid to do what is necessary to get a project completed. "He's a real gentleman on one hand and on another hand a real tough engineer with strong ideas about what's right and what's wrong," says ATC's Ciciora. "He's often a step or two ahead of what the rest of the industry is talking about and he's usually right. He understands that the industry is maturing and must provide quality and he's helping make that happen."

### A perfect fit

Despite Nick's commitment to quality, he might be a lone voice in the woods if he worked elsewhere. However, he's a perfect fit at Rogers, where quality is the watchword.

"It's great to bring all this technology together and also have a visionary in Ted Rogers, who supports it all," says Nick. "You don't have the frustration where every dollar is always being argued." But don't think Rogers is an easy sell, either. "We had to (sell the value of fiber and other expensive technologies) very, very well. He is always a believer in the highest technical quality of anything he does. So, when I say it was a hard sell, it was an easy sell once we had proof it would make him #1 in quality, then it made sense."

Like most human success stories, Nick's professional strength is bolstered by unfailing strength at home. Nick and wife Beryl, whom he met shortly after moving to Canada, have been married since 1962, weathering the demands placed on Nick over the years. "This job is very demanding," Nick says. "You're away from home a lot and in the evening you've got your laptop on the table, trying to catch up with the work you couldn't do the days you were traveling. But," says Nick proudly," she's been very patient and good and so have the kids (now grown). They're very supportive. If they weren't, you couldn't do a job like this, not well anyway."

Having such an intelligent mind and keen eye as an ally should be comforting for Nick's fellow CATV engineers. If they're smart, they'll spend a lot of time thinking about what he has to say. ■

*—Roger Brown*

# A new decade of technology: What will it look like?

*Ten years ago,* CED *(then* C-ED*) published the January 1980 issue with it's annual Western Show wrap-up. At that time, the "largest Western Show ever" boasted an outstanding 3,700 attendees and Valtec Corp.'s Comm/Scope subsidiary had introduced a new cable which offered access from 5 MHz to 450 MHz, or 50 percent more bandwidth. Scientific-Atlanta also had introduced a new line of 400 MHz products while Zenith Radio Corp. demonstrated its new cable-ready television set.*

*But this is 1990. And while it's amusing to look at cable's past, the future demands more than observation as cable technology continues its furious foray into such areas as 1 GHz platforms, fiber to the tap, off- (or on-) premise addressability and signal security. In order to speculate on what the '90s may bring,* CED *asked several of the industry's technical leaders to get out their crystal balls and visualize what lies ahead.*

*Although the same questions were posed to each interviewee, the answers were varied as each gazed into the next decade. Following are excerpts from each of the interviews.*

*Those interviewed were Wendell Bailey, vice president, science and technology, NCTA; Jim Chiddix, senior vice president, engineering and technology, ATC; John Egan, president and CEO, Anixter Cable TV; Tom Elliott, director of research and development, TCI, and vice president, science and technology, CableLabs; David Fellows, vice president and general manager, distribution, headend and earth station systems, Scientific-Atlanta Inc.; Hal Krisbergh, president, Jerrold Division, General Instrument Corp.; Bob Luff, group vice president, engineering & technology, Jones Intercable; Steve Necessary, director of marketing for subscriber systems, Scientific-Atlanta; Archer Taylor, senior vice president, engineering, Malarkey-Taylor Associates Inc.; and Joe Van Loan, industry consultant.*

**CED: It's expected that the industry will be re-regulated within the next year or two. Do you see that affecting the technical industry?**


*Joe Van Loan*

*Van Loan:* Well, it always does, depending on the nature of it. I guess the two aspects of it is, a lot of cable systems are full now. If the worse of the must-carry came along, it would end up forcing some very rapid channel expansion in order to maintain the status quo, the mix of satellite delivered and off-air signals. That would result in a lot of duplication of channels and of course, depending on how this channel number bit went, (that independent broadcasters keep pushing) it could cause quite a bit of shuffling around channels.

The other thing is if people happen to be using traps, for example, if there's a channel 14 in the market, and somebody has put HBO on channel 14 with traps, they could end up in a fine pickle because they'd have to change all their traps to move HBO off the channel and make room for the local channel.


*Jim Chiddix*

*Chiddix:* If indeed, whether or not we are deregulated, the unhappiness that has been expressed in Congress, while all together not balanced and fair, is a sign that we've simply got to do a better job with customer service. And there are definitely technical aspects that are customer service. It means improving reliability and signal quality. There's a lot of hard work to be done.


*Hal Krisbergh*

*Krisbergh:* The focus today is where it should be, and that is keeping the customer happy, justify the business you're giving them. Regulation is a way of saying, "I don't care what the customer wants, we're going to put in an artifically determined criteria of performance and pricing and so on because we think we know what's best for the customer." What I'm really suggesting is that the market is already in tune and responsive and the regulatory structure will not alter significantly the fact that the cable operator is already responsive to the consumer.

**CED: What possible regulations could come up that would slow down the pace of technological developments?**


*Tom Elliott*

*Elliott:* I don't know that I could say it would really slow down the pace. It's likely to cause us to use technology that is not the most desirable because we need to get it done quickly. In other words, if we had the opportunity to maybe understand what we're trying to do here and spend three, four, or five years to accomplish it, then we might be able to develop technology, and apply it, that would work well. But if we have to do it overnight, you end up taking what you have on the shelf and doing it.

What you do on a case like that is spend your money. Then there's really no money left to spend to do it over or do it right. So, yes, I think you could say in the indirect cause, the indirect result is that it would slow down technology. It's really a matter of how it phases in. Unfortunately, sometimes these things phase in—people don't pay too much attention to scientific reality—from a political standpoint. You just can't get things done overnight in terms of developing new products.


*Archer Taylor*

*Taylor:* I don't think that there's any intention or anything on the ho-

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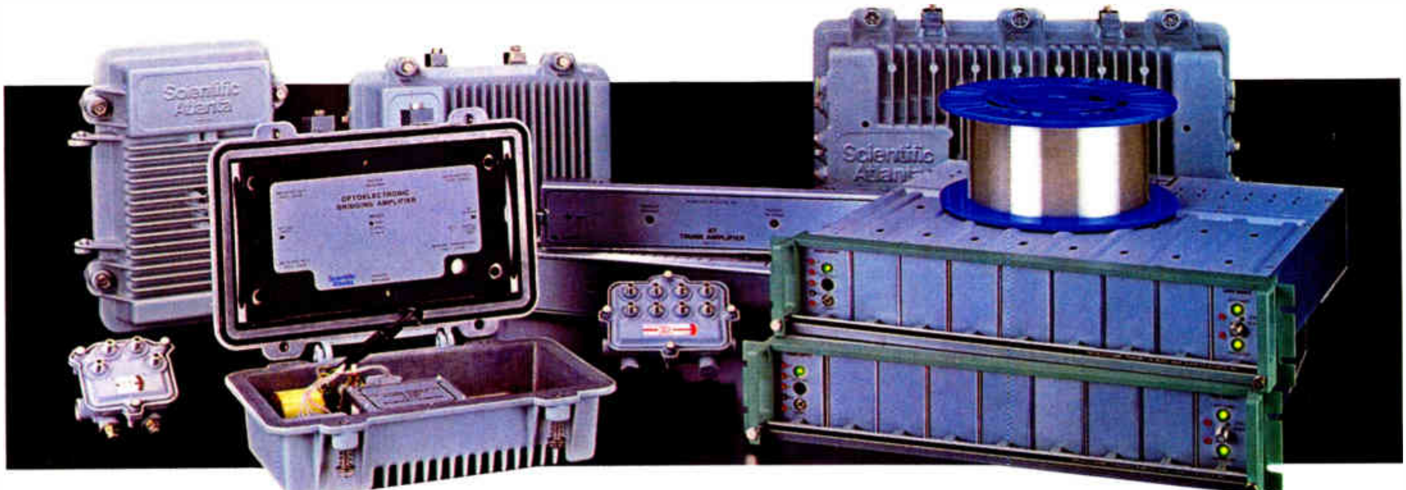

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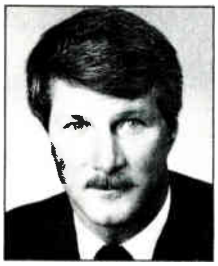
rizon that would slow down technological development of the cable industry. If something happens to hurt the economic health of the industry, that would obviously slow down technology. But as long as the industry remains healthy, it's going to be improving, in fact it's going to have to improve to meet the competition I see ahead; legislation is moving in the direction of competition which could even stimulate more aggressive technology.


*Bob Luff*

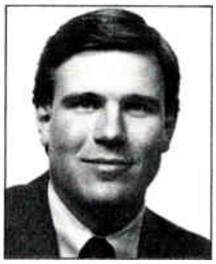
*Luff:* Well, certainly anything that interferes with an operator's business judgment. The primary areas will be how many signals the system carries and how much it's able to charge for them. I know, as one MSO who's been very aggressive in fiber, we would not be doing the fiber projects we're doing if we were under the regulated era that we came from in the early '80s.

When we were de-regulated, we could make long overdue rate adjustments in basic, particularly in basic. That freed up our ability to do much longer scale, much longer pay back, upgrades to our plant—in both channel capacity and more advanced telephone systems that better regulate the quality of service when people call in.

**CED: Will theft of service become more important and require better signal security in the next decade?**

*Bailey:* Absolutely. I think that since we're an industry that charges for pictures, the first thing is that it's unfair to all subscribers if the cable industry does not have good security. Otherwise the people who pay are subsidizing the people who don't pay. Signal security, however, is a tough nut. It's a very tough nut. In order to do this correctly, you need to examine the issue of security, the issue of economy and the issue of transparency. Doing any two of those three is pretty easy. Doing all three of those three is pretty hard.

*Necessary:* We believe it already has become more important. I believe that trend is going to continue and a real simple look at the economics is what reinforces it. If you look at a typical pay channel and the approximate value per month coming out of the cable on that slice of 6 MHz spectrum, it's about $10 a month. On a pay-per-view (PPV) channel, if it's a special event, you can have $30 or $40 in a single few hours during that month. Even on a movie service, when you have, although there's duplication in this number, 12 movies per day at a $4 or $5 per movie price, you're into several hundred dollars per month. So we do believe signal security is going to be more important.


*Steve Necessary*

*Krisbergh:* Absolutely. It's clear that as that box, or that control capability of the home, whether it's inside the home or outside the home, controls more revenue for other services, whether it's PPV or whatever, the justification for defeating that control increases. So the level of security follows the revenue that the box generates. The assumption is that the revenue the box generates is increasing and you need increased security. Over the next 10 years you will definitely see increases in the security of a box simply to match the increase in revenue that the box will be generating.

*Egan:* I don't see much of a difference. I think theft of service is an issue and there will be a continuous effort to try and say, "is the revenue gained worth the additional investment spent?" I don't think anything we're doing here will impact the desire to do that—it's a constant search.


*John Egan*

**CED: How many channels do you think a state-of-the-art system would have by the close of the next decade?**

*Bailey:* I think the technology for building systems with 100 channels on a single cable will exist by then. And it will require, in all likelihood, advances in the traditional cable electronics, as well as new architectural forms such as our modified tree-and-branch using fiber optic backbone. And I see that vendors in our areas are working hard on this equipment even as we speak. So, it will be possible to do that in the very near future.

*Fellows:* In terms of technology, I think—looking at the base hybrid system, the amplifier technology—that a fully loaded, 650 MHz system looks doable. And if you project out 10 years, you probably would guess that a 750 MHz, fully loaded system would be doable. We're showing, in our booth (at the Western Show) an 870 MHz set-top, an 870 MHz headend and 870 MHz fiber and amplifiers. The state-of-the-art of amplifier technology means that you cannot load those all the way from 50 MHz to 870 MHz, but in a number of applications, especially in Europe, you want to hit those UHF channels. You don't need all 131 channels, you just need to be able to hit those top bandwidth. So, I would say, at the end of this decade, 750 MHz, with an option on 870 MHz in certain applications.


*Dave Fellows*

*Van Loan:* I don't know that I'd care to call that one. What I've noticed is that most systems have been adding one or two channels per year. That means in 10 years, 20 or 30 more channels will be required. Say we're averaging 40 channels now, we're probably in the 60 to 70 channel range. That's probably, well, not to confuse that 550 MHz is 84 channels, I would say most systems will be at least 550 MHz and perhaps as much as 1 gigahertz in capacity. If history repeats itself, we would have maybe 60 to 70 channels.

**CED: Will some of the old ideas that haven't been successful, such as DBS, teletext, home banking, and other services the telcos say they can deliver, become viable in the '90s?**

*Taylor:* Sometimes the telcos sound like we did 15 years ago. We thought these things were great too. However, technology is getting better and the public view of these things is changing. It seems that some of them may very well take hold. I think the telcos are going to find themselves somewhat disappointed that these things aren't going to be the great bonanza they thought they were. But yes, I think some of them will begin to take hold.

*Chiddix:* That's a great question. I don't know the answer. I'd like to believe that some kind of information service into the home will become viable in the '90s. I think it's only a matter of time before we get a more computer-literate population. But I've got to say that it's been quite disappointing to date, even with lots of

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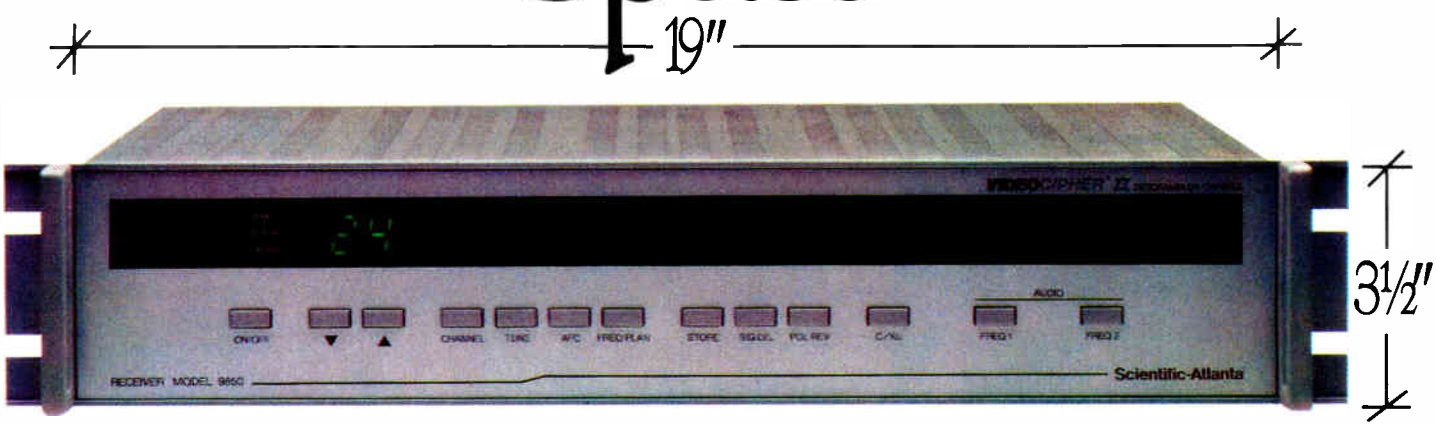


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computers in the home and so forth, that there seems to be almost a complete lack of interest in information services. Our industry has seen that and so have telephone delivered services.


*Wendell Bailey*

*Bailey:* Some will, some won't. I think one thing we've always known in the cable business is technically how to do a lot of these things. The issue has never been the ability to do them, in fact, most of the things the telephone companies tout can be done today on their own network. Why aren't they doing them? It has nothing to do with the technology, it has everything to do with the demand for these services and their usefulness to the average subscriber.

**CED: Concerning the consumer interface issue, will converters still be as dominant or will the interconnect become more transparent?**

*Egan:* That's the one, if I had to bet my money on, it would be that one. Nobody who owns a VCR and a TV set can take cable and say "gee I really like this box." The issue of the box is, in my opinion, and it's kind of a dangerous opinion, one of the things that is causing a rift between suppliers and cable operators. I don't think more money is going to be spent, I think it's going to be redeployed from the top of the TV set to the side of the house or at the pole. A lot of suppliers have been hesitant because they're being asked to develop new product at the risk of endangering an existing product—without much chance of increasing their total revenue.

So it looks, on a cable manufacturer's balance sheet, like all increased cost, no increased margin, no increased share. I view that from my company's point of view as an opportunity because I don't play in that game, right now, but I want to. I think clearly, though, any argument that does include getting it off the set is wishful thinking. It's got to go out of the home. There's just too much complexity and too much capability going into media devices in the home to not take advantage of it.

*Luff:* I think both are going to develop. I think it's a neck-and-neck race between more transparency somewhat stimulated by the set manufacturers, and certainly with MSOs acting as a catalyst, but at the same time, the set-top vendors are not idly sitting by. They're coming out with more features and more economical construction techniques. So, the price/benefit ratio is not widening as quickly as a lot of people thought it would to drive it to the more friendly approach quickly.

*Krisbergh:* My view is that the cable operator will be controlling significantly more activities in the home than he currently controls. It will be integrated in with telephony, data, appliances, audio and CR and all that control—a totally integrated system. The question you ask though is, "How will that control system manifest itself?" The physical location of that box will more than likely be outside the home. So, is it a converter or is it whatever? The answer is well, it's something that doesn't exist today. The home electronics industry has developed in a very helter-skelter way. You have VCRs with tuners in them, TVs with tuners in them, converters with tuners in them. It will evolve that the converter, and these other products, won't have this redundancy and you will have a much more standardized control. At that point, the converters we now know will disappear.

**CED: What are the chances of cable providing telephone services in the local loop?**

*Van Loan:* That's technologically feasible. However, the local loop services are presently highly subsidized by the long distance carriers and I'm not sure the cable industry could compete with the highly subsidized services. If the Bell operating companies offered those services at their true cost to cable industry effectively, it then becomes a regulatory issue—and just a matter of competition. But the technology can be made to be there.

I also think the cable industry ought to be doing research in the area and looking at it, just as the telephone industry is looking at the cable industry. There is not much research being done now. There will be some research done out of the United States by some operators, but nothing really. There's a great concern that we'll get our teeth kicked in if we start something.

*Fellows:* If the barriers between the telephone world and the cable world fall, cable operators will provide, in essence, a bypass service. They will go after the business revenue and not go after the "little old lady in tennis shoes," the residential marketplace. My view is that the telephone industry is very vulnerable to that kind of attack because they make their money on the business side. It's going to be very hard for them to charge a business many thousands of dollars a month for 1.5 megabit T-1 service and yet charge $15 a month for 560 megabit broadband ISDN service, video delivery. And so I think that the cable industry won't go after that marketplace unless the telephone companies come after their marketplace. But if the barriers fall, I think cable can compete in the business telephone segment.

*Elliott:* First of all, I think that's politically a very sensitive question. Technically, we have the wherewithall to figure out how to do that. Whether we want to do that from a political standpoint, and whether we in fact will be allowed to do that over the long run from a regulatory standpoint, I think is very open to debate. I suspect from a technical standpoint that the answer is we can figure out, or actually even know how to do that and as such it's really just a question of, does it make sense politically?

**CED: Will fiber be so integrated into CATV systems in the next decade that it will penetrate into the rural systems?**

*Chiddix:* Sure. I think that in the next decade, fiber trunking is going to be cheap, very reliable and just make a whole lot more sense than coax. And I think it will be in use in virtually every system.

*Fellows:* Yes, I think so. In fact, there are rural applications where fiber is a natural, where you have little pockets of 100 homes spaced maybe a dozen miles apart. What you would do today is put a headend in each of those little hamlets—what you'll do in the future is jump from town to town with fiber and then within the town, distribute on coax.

*Egan:* I think there are three or four applications for fiber optics. I don't think it's a question of any future deal. Rural systems tend to be spread out, traditional cable electronics tend to be distance limited so fiber optics helps you in dense areas by being able to take large amounts of channels with very high quality to different distribution points. In the case of rural environment, we're probably selling as many fiber optic systems now for rural applications where they're trying to connect small pods of population without having to pay the high price of having separate headends in each town.

**CED: How deep will fiber implementation be in the plant?**

*Bailey:* I don't think it will go into the home. I think it is questionable whether it will go into the feeder trunks (because) we can make those trunks do an awful lot just as they are. The backbone trunks will certainly be overlashed before the decade is out. In some instances we will have pushed fiber into the feeders.

*Krisbergh:* Absolutely (go to the home). We'll first go to the nodes that we're doing now, a major node. Then, in three or four years, it will probably go to the tap, certainly by the latter part of the decade it will be to the home.

*Luff:* I think we'll go beyond 10 amplifiers. We tend to vascillate based on economics, system and lots of things, between 16-amplifier and six- or seven-amplifier cascades. There's going to be some very, very significant price reductions.... It's the lasers that tend to hold the price up right now. There's no reason why those won't drop from $25,000 to $1,000 over that time frame. As that cost drops dramatically, then you get dramatic increases in utilization.

**CED: What are the chances of digital technology being employed *instead* of analog during the next decade?**

*Elliott:* You'll certainly see all kinds of things done with digital, without question. But I believe that during that period of time, the bulk of the in-home consumer devices will be VSB-AM. And as such, that's going to tend to tell us that our distribution plant needs to serve those devices.

For the bulk of the subscribers, there will be special purpose kind of digital things being done all over the place. There will also be tremendous amounts of digital processing on both ends of the network, on the input and the output. You're already seeing these "digital television sets" but low and behold, they have a VSB-AM tuner on them—they still want to see that VSB-AM signal into them. Again, with this 15 year life of TV sets, that's just not going to change dramatically in the next decade, in terms of the preponderance of stuff delivered. In terms of people doing more and more digital stuff, I think it's inevitable.

*Taylor:* You have to talk in that, about broadcasting. The chances of over-the-air type broadcasting, terrestrial broadcasting, going digital are, well not quite zero but awfully close to it. That means that if we're going to go digital, its going to come through DBS, through cable, through VCRs, MMDS and so on. What does that mean then with regard to broadcasting itself? Broadcasting's political strength, and they recognize it, is based on localism. None of the other services, except possibly cable, are in a position to do this distribution a real time, local basis, locally originated basis.

Consequently, I think the fact that broadcasting is such a ubiquitous thing, and so important in everybody's economic and personal lives, that the likelihood of digital revolution really becoming widespread doesn't seem very great to me—primarily because of the impact on terrestrial broadcasting. They can't go digital because of the spectrum limitations. Digital transmission requires more bandwidth, in spite of what Dale Hatfield has said.

*Chiddix:* Digital already is destined for a place in certain kinds of supertrunking, longer distance transportation. But I think digital services into the home, I just don't see them making economic sense for a long time. I'd be surprised to see digital transmission into the home being cost effective within a 10 year time frame. Digital delivery into the home raises a whole host of consumer interface issues that we're going to find ways to solve. And it would be the height of folly to turn right around and re-inflict a whole bunch of difficulties on consumers by undertaking digital delivery. We ought to deliver signals in the form that our customers want to use and that's analog, broadband, multichannel, unscrambled.

*Luff:* It's going to happen. I think what's going to happen is, if we're talking a 20 year frame, we'll probably have digital input television receivers, and it might make more sense to be talking about digital delivery to the home. But it's hard to beat the dirt cheap simplicity and economics of analog modulation to the home. It just has so many fewer moving parts.

Fiber itself is such an excellent medium, we're not having to tackle picture reliability or picture quality issues that we have with coax and all the amplifiers in the chain. The consumer's not going to see that much difference between an analog delivered fiber and a digital delivered fiber. Where I think digital is going to have its heyday is replacing FM for the medium- and long-haul system. So I see more of a hybrid digital fiber regional interconnect, statewide regional interconnects and then conversion to AM fiber delivery to the home.

**CED: Do you foresee any change or alteration in the tree-and-branch architecture currently in place?**

*Bailey:* Yes. I think it will become a tree-and-bush architecture. I think that's what the fiber backbone concept of ATC, Jones and Rogers is. It's a modification of the tree-and-branch. It's still a tree-and-branch, it's just that there are little bushes on the end.

*Van Loan:* For television distribution, probably not, with coax especially. With fiber I can envision some hybrid things—a combination of loops and stars and tree-and-branch. What we will end up doing is creating what would be called "virtual" networks. The actual network might be a star or tree-and-branch but the traffic over it might take on a different technology.

*Elliott:* No, I think you'll see refinements of that but I believe that a broadcast type architecture is by definition, the best type of architecture for somebody that's essentially in a wired broadcast business. I'm a very strong believer in the tree-and-branch approach. I do think you'll find it modified and improved, consistent with things like the fiber backbone and approaches like that—there will be quite a little bit of innovative work done along that line.

What might happen then is you'll have the smaller tree-and-branch networks that are fed by something like the fiber backbone system. I think just in terms of serving the subs themselves, we're in that kind of business and it works real well. ■

*—Kathy Berlin*

# Signal quality comes of age at Western Show

Perhaps the best way to sum up the 1989 Western Cable Show in Anaheim is that there was no one unifying theme to all the product introductions made there. But if you stop and think about it for a minute, most of the important announcements centered around one broad goal: signal quality.

From fiber optics (better carrier-to-noise) to power supplies (better efficiencies) all the way to new signal meters and test equipment, most of this year's new gear, while failing to wow the crowd, represented the shift toward quality that many cable system operators have espoused lately.

Leading the charge were the fiber optic vendors. Dual laser systems, return path data delivery and improved specs for both C/N and distortions were the key themes.

For example, Jerrold (which announced that its new formal name is Jerrold Communications) displayed a system based around the new high performance DFB laser developed by Ortel Corp. (*CED*, December 1989, p. 16) Boasting 56 dB C/N and -65 dB CSO and CTB, the two-fiber system will be available in late 1990. Additionally, Jerrold showed a scrambling transparent FM supertrunk system that will accommodate RF and baseband scrambled channels. The Starlite FM-700/S system promises RS-250B medium-haul specs with a 20 dB loss budget over 25 miles.

Scientific-Atlanta introduced an automatic laser backup switch as an option to its fiber system. The switch, developed by Corning, will be available in the spring and is packaged in a modular form inside S-A's 6450 transmitter chassis. It can be used as a backup in either single- or multiple-laser applications.

Anixter Cable TV announced that its Laser Link system is available in a dual laser configuration to give operators a 3 dB improvement in C/N or extend the loss budget by as much as 30 percent in distance. The system, consisting of two transmitters and one receiver, can carry 40, 60 or 80 channels. A new plug-in dual detector module allows for easy upgrade from a single laser system to the new configuration.

Also, a new video return module using a DFB laser, and a data return laser for status monitoring and other interactive uses have been introduced by Anixter and AT&T. Both modules pass the 5 MHz to 30 MHz band and are packaged for outdoor use.

Finally, Anixter showed off a new AT&T fiber cable featuring a lightweight sheath that eliminates the armor. Available with standard depressed clad core used in LXE cable in counts of 6, 12, 18 and 24 fibers or with limited amounts of pure silica core fiber to reduce losses.

Not to be outdone, American Lightwave Systems unveiled two new fiber product lines and additions to its LiteAmp AM product line. The Fiber Network 6000 (FN6000), which replaces the FT1300 product, is an FM system which utilizes distributed intelligence to control channel routing and fiber switching, monitor failures, manage the CATV network and eliminate outages. Optional software allows services like automatic inventory control and spares management.

On the AM side, two reverse path options are now offered. A single-path video or data system with an LED, and a four-channel video return with a Fabry-Perot laser are available. Also, the LiteAmp system can now be configured two ways to deliver 80 channels of video: a two-fiber version offering 51 dB C/N with an 8 dB loss budget, or a four-fiber octave plan delivering 54 C/N. Up to eight receivers can be housed in a steel, pole-mount case. A strand-mount housing will be available in April.

Lastly, a new single-channel system delivers short-haul quality video links. The LC series is designed to deliver 67 dB C/N links between local broadcasters and CATV headends. It's available in multimode or single-mode versions and the entire system can be purchased for as little as $5,000.

Ortel also introduced two new broadband photodiode receivers for CATV applications and two high-speed PIN photodiodes for microwave use. The 2610A and 2610B receivers are an


*Powercast by Power Guard*

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outgrowth of Ortel's 2605A receiver and feature a flatter frequency response and improved noise characteristics. A new proprietary output circuit achieves 7 dB higher gain than an unmatched photodiode. The 2610A is designed for medium performance links with sub-octave frequency plans. The 2610B is suitable for high performance systems.

### The power of power

Reflective of the high level of competition among power vendors, Alpha, Power Guard, Regal Technologies, Lindsay Specialty Products and C-Cor Electronics all showed brand new power and/or standby power units in Anaheim.

Power Guard introduced its new Power Cast, a power supply with a transformer housed in a non-corrosive, all-aluminum cast housing that can be mounted on poles, in pedestals or on the strand. It is available in 5-, 7-, 10-and 15-amp models and in 90-percent and 93-percent efficiency ratings. It is warranted for five years.

Regal introduced a 92-percent efficient ferroresonant power supply, a two-module standby power supply and a new power inserter with Amp Clamp circuitry. The RPS-NSB power supply is output current limited and short-circuit protected via the ferroresonant transformer. The RPS-SB standby unit offers 15-amp output, two- to four-hour standby time, automatic self-test every 18 days and optional remote status monitoring. The power inserter features the patented Amp Clamp technology supplied by Alpha Technologies to protect against transients. While protecting electronic components, it is said to reduce servicing by 60 percent.

Meanwhile, C-Cor showed its new PS 910 power supply. The 15-amp unit operates at 90 percent efficiency at a load of 10 to 15 amps. Electronics can be switched out in less than three minutes without disrupting power. C-Cor's newest standby supply offers 900 watts of power and performs a self-test every 17 days. It is available in pole and pedestal mounts.

Lindsay introduced its Power Shift power supply for sheath current protection. The Power Shift circuit constantly checks the AC voltages on the cable and shifts from full-wave doubler mode to positive half-wave mode when the normal threshold is exceeded. Another feature of the Power Shift is a raised threshold of the transient protection devices to 200 volts.

And Alpha displayed its new XP

# Fiber optics: Planning for the future

In a well-attended afternoon session at the Western Show, Pete Petrovich, of Petrovich and Associates consultants, moderated a technical session on fiber optics, called "Fiber Optic Planning." Stating that fiber was a new technology in the cable industry, but not in the broadband industry, Petrovich introduced Scott Esty, market development supervisor for Corning Inc. as the first speaker.

Esty, who said he wanted to share Corning's perspective on where fiber was going and why it should be a consideration, started his talk with results of a survey. This survey of chief engineers at systems across the country demonstrated the industry's commitment to fiber supertrunk within a few years. "Within five to six years," says Esty, "greater than 50 percent of distribution trunk will be maturing and become the dominant market."

Incentives behind the rapid deployment include: the fiber concept being employed for headend savings; AML fiber supertrunk; additional channel capacity; and the concept of increased system reliability.

The benefits of fiber, according to Esty, are system reliability; reduction in active electronics; ease of system upgrades; return path provisioning; and improved video quality.

The next speaker, Herman Gysel, vice president of engineering for Synchronous Communications, discussed "Fiber Optic Links Above 1 GHz." Stating that fiber optics have been around for six years (using FM) in the 60 dB to 70 dB range, Gysel asked the question "Are we really using fiber to its potential?" Saying the answer is no, Gysel discussed the primary limitation—dispersion. Another limitation is cost. A third limitation, says Gysel, is the cost in design time.

Before concluding, Gysel discussed the frequency response of LNBs as another problem with high bandwidths. In summary, Gysel stated that fiber optic links can be cost effective until 2 GHz (when the cost of parts become prohibitive), Fabry Perot lasers work fine at that bandwidth and that dispersion now has to be active.

Sanford (Sandy) Lyons, sales manager for Siecor, discussed "Fiber Optic Standards and Testing." Lyons stated that the absence of standards could affect economics in the long run and gave three reasons why it was important to establish standards: to ensure satisfactory operation; provide manufacturers with a minimum base requirement; and ensure that cable plant is at least the quality of that of other industries deploying fiber optics.

Saying that since 1981, eight million fiber optic kilometers have been deployed, Lyons pointed out that only 100,000 kilometers of that eight million has been in the cable industry. "The CATV (market) is taking off with fiber but a lot of learned knowledge can be gained from other industries," said Lyons.

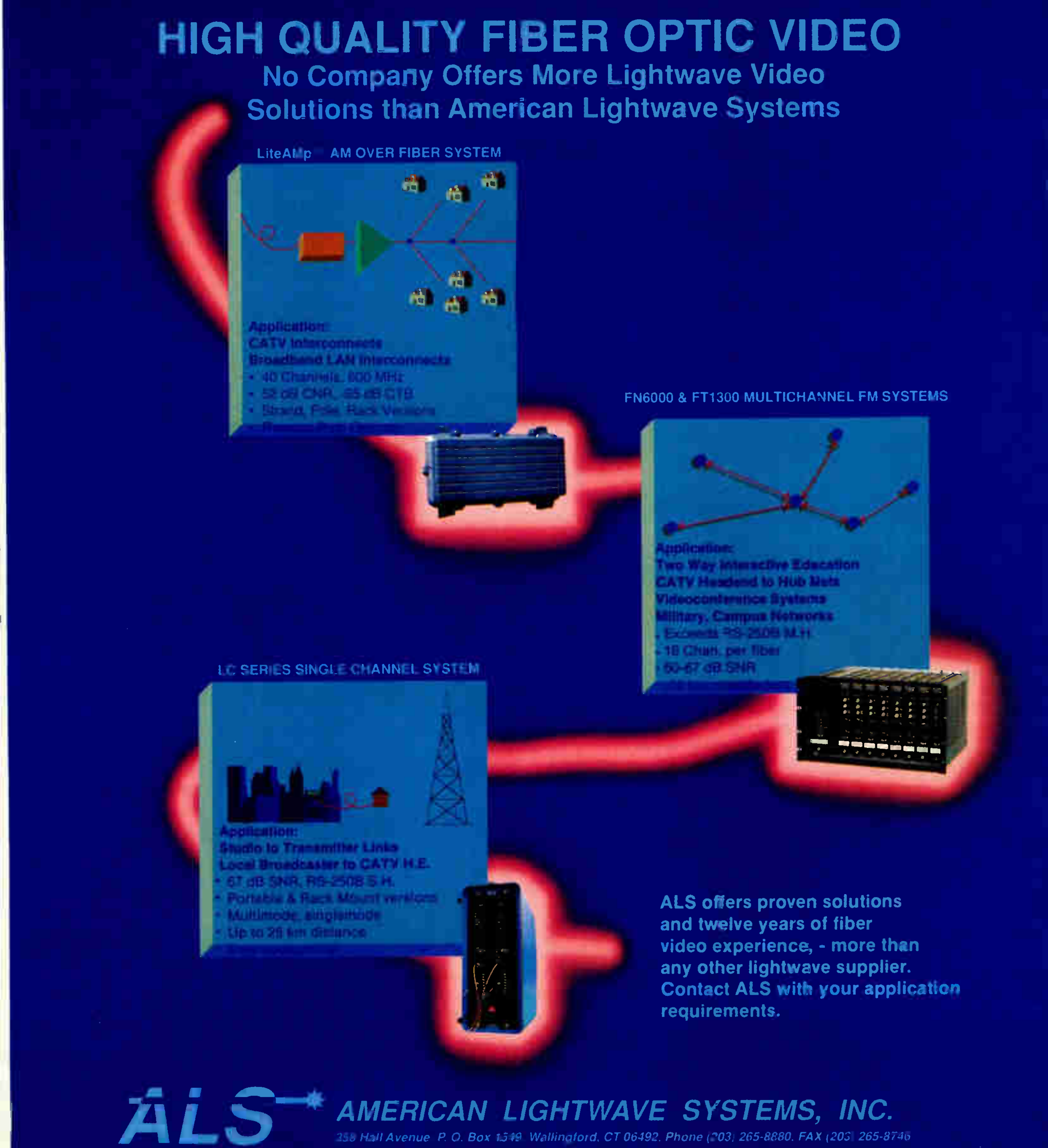
Lyons listed several major documents currently being used on fiber optic standards. Stating that CATV will continue to ramp up overall fiber optics in the U.S., Lyons said there were three areas ripe for standards and testing: fiber, cable and performance.

Ron Wolfe, manager of ATC's national training center, presented a paper called, "Thought Process for ATC to use Fiber." Saying fiber is a simple issue at the center of debate, Wolfe stated ATC's reasons do not involve bandwidth or the press to become a technical leader. Rather, it's a question of money: Can we (ATC) save money by doing it? Wolfe then discussed an ATC case study of a system to determine whether the installation of a fiber backbone is a viable alternative during rebuild (*CED*'s Fiber Optics Application Guide, September 1989, p. 8.)

The final speaker for the fiber session was Rob Yates, director of studies, DTI Telecom, Inc., who discussed "Planning for Fiber Optics in Cable Television Systems." Yates, who said planning is really tactical in a sense, said there were three reasons for planning: optimize rebuild and investment plans; building in new capabilities (HDTV, data); assist in building a hybrid plant system architecture; and in making basic technology decisions.

At this point, Yates paused to make a comment on reliability. "Consider a supertrunk with 32 amp cascade going out for one hour a year. With fiber it could be one hour every five years. Equate that to 12 minutes a year and you'll find the subscriber is happier because outage time is diminished." Algorithmically looking at it, Yates said it was an iterative process to come up with an outcome. Look at your objectives and output to do planning functions. ■

*—Kathy Berlin*




Reader Service Number 18

series of power supplies. The units are 20 percent lighter, much smaller physically and utilize modular circuit boards and soft-key controls (*CED*, December 1989, p. 18).

**New test equipment**

Several new pieces of test equipment, designed to make a tech's job easier or to deliver new information, debuted at the Western Show.

FM Systems exhibited a variety of products, some previously announced and some brand-new, aimed at helping cable systems measure the quality of their signals, not just their strength. Each test instrument operates independently or in conjunction with the others. All measure modulation performance on existing program video and audio, without interrupting ongoing programming.

The Modulation Measurement Center (MMC) brings all TV modulator

*FM System's Modulation Measurement Center*

test points for up to six channels to the front of the rack. The Cable Stereo Performance Meter measures BTSC stereo separation and stereo pilot level at the 4.5 MHz stereo modulator, 41.25 MHz TV modulator IF and channel 3. The Audio Modulation Meter measures audio modulation on the 41.25 MHz sound IF carrier, while the Video Modulation Meter measures video depth of modulation and the Video Volt Meter measures baseband video with sync, white and composite video measured in volts peak-to-peak or IRE units.

FM Systems' digital meters are accurate to within 1 percent and require no calibration or adjustment. The products allow cable operators to measure and set levels to provide consistent channel-to-channel brightness, sound volume and stereo separation.

Several new devices have also been developed by CaLan. The first is the Cub Receiver Model 1775, used to perform sweep and level measurement testing in one box. For high resolution

# Where do we go from here?

"Fiber has had a dramatic impact on the (CATV) industry," said Jim Chiddix, senior vice president of engineering and technology for ATC and moderator of the Western Show's second fiber session, "New Developments in Fiber." "We're now focused on the technology and what it can do, our comfort level is up. It's only natural to see how else it can be used."

With that thought, Chiddix introduced the first speaker, David Lang, director of solid state research for AT&T Bell Labs. Lang focused on "Fiber Optic Components for CATV Applications" and began with a question. "Fiber optics evolved primarily as a digital medium; what is the status of components as they apply to analog TV?" Saying that fiber is a mature technology, Lang's first message was that fiber is not a problem—it will meet the needs of the industry for years to come—the problem starts with lasers.

The issues that apply to lasers made for CATV application are noise, performance and distribution of characteristics for number of devices, said Lang.

Lang went on to say lasers must be tested under appropriate test conditions (only hero lasers in lab conditions reach quantum limits), the most stringent of which is a loaded continuous wave (CW) carrier. The three specifications for testing are: CW test, live from headend (6 dB to 12 dB better than CW) and hero specification which is the best device ever made.

Lang ended his discussion with a look at the three kinds of optical amplifier research: semiconductor amplifier (made from a laser chip); Raman fiber; and Erbium-doped fiber amplifiers (doped with rare earth Erbium).

The next speaker, Howard Westlake, research engineer for Optical Transmission Systems, British Telecom Research Labs, focused on "Optical Amplifiers: Getting Close." Westlake looked at both the what and why of optical amplifiers. Saying an optical amplifier is a device which increases optical signal direct amplification, Westlake felt it offered significant advantages, including a minimum of electronics; 1 THz bandwidth; transparency with fiber; physical compactness; and the ability to provide other functions such as frequency/wavelength translation and rate switching.

In summary, Westlake said optical amplifiers have high gain and wide bandwidth available commercially; linearity can be a problem, particularly where input levels are high (not to exceed 15 dBmV—this doesn't seem to be a problem with Erbium); and the first applications are likely to be line amps for range increase or split-loss compensation.

Martin Lawrence, head of advanced device development for British Telecomm and Dupont (BT&D) focused his discussion on the use of a lithium niobate modulator which he stated was a technology as old as fiber, but young compared to TV.

Characteristics of the lithium niobate modulator include: it's very broadband relative to requirement; is lossy (3 dB to 5 dB per chip); and has good modulation depth (20 dB easily achieved). The problem is, the harder you drive it, the more non-linearity you get; if you don't drive it hard enough, you won't get the output. Present limitations are the need for sophisticated packaging; RF coupling loss between sets of electrodes; refractive index matching is required; devices are configured as 50 ohm loads; and they require medium power RF drives.

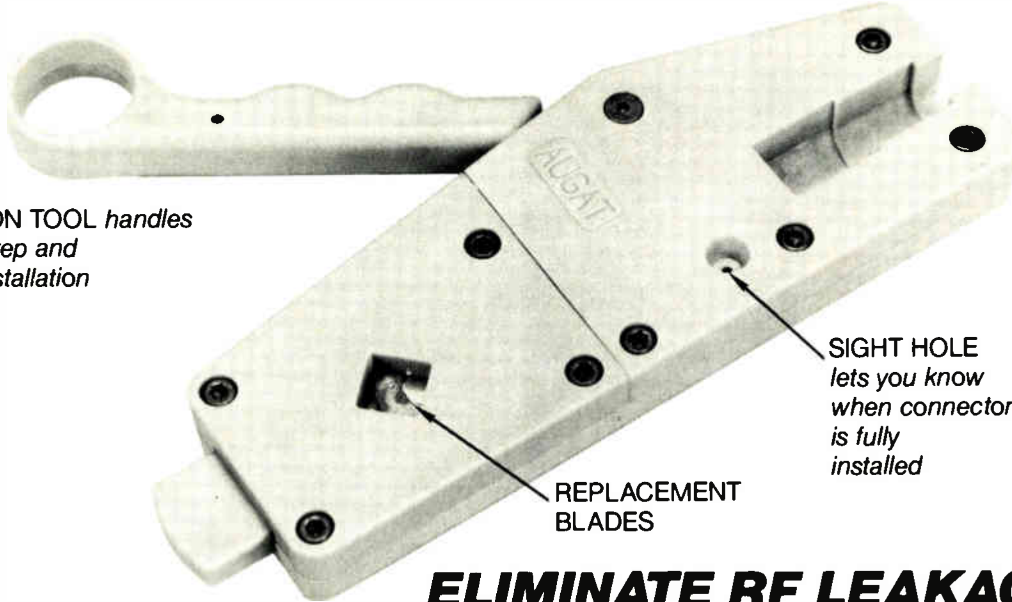
In summary, Lawrence stated ordinary BH lasers may be suitable for low channel, short haul transmission; DFB lasers should be suitable for mid-range applications of 20 to 40 channels over longer distances; and miniature YAG lasers, with lithium niobate external modulators, are suitable for 60 to 120 channels over long-haul distances.

The last speaker, Dave Robinson, director for Cableoptics, Jerrold Communications, spoke about the new Jerrold/Ortel DFB laser, which will be available later this year. Robinson opened his talk with the specifications for the DFB laser specifically designed for cable TV: higher power (greater than 4 miliwatts); lower noise (RIN +60 dB/Hz); lower distortion (-65 dB or better CTB/CSO); and manufacturable. "This is not a hero device," said Robinson. "The real story is it's manufacturable for cable operator use."

There are two improvements in the DFB laser: design of the optical cavity and coupling efficiency internal to the laser module.

In summary, Robinson stated the AM laser satisfies performance requirements; improves flexibility and economics; opens new possibilities for supertrunks; and suggests a promising future for CATV fiber applications. ■

*—Kathy Berlin*

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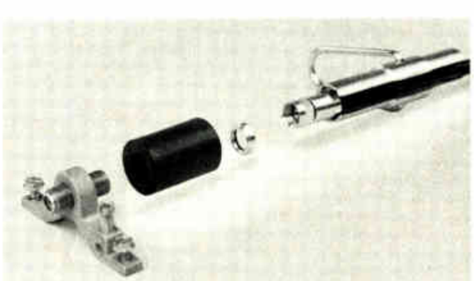

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sweep testing, it's used with the Model 1777 transmitter. In the analyzer mode, a full spectrum view of both video and audio carriers is displayed (a single channel "zoom" function can be used to perform C/N tests). Up to 10 traces can be stored in memory, an optional memory unit will store up to 80 traces, 18 references and eight set-up tables.

An automated mobile system for detecting and documenting signal leakage was also shown by CaLan. Dubbed

*CaLan's fiber optics loss test*

ALAN (Automatic Leakage And Navigation), the system logs leakage locations while the vehicle is driven. Signal leakage reports are then generated. Two components, a vehicle measurement system (consisting of navigation module, antenna and electronics) and a desktop workstation with computer and software, make up the system.

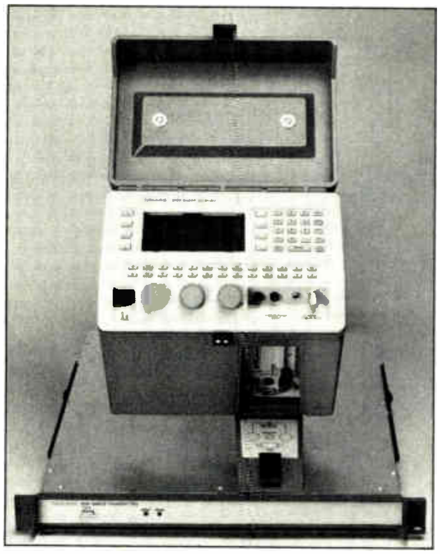
Also, a new fiber optics loss test set to measure cable loss or optical power

*CaLan's 1776 and 1777*

at any point in the system was exhibited. The set consists of a 1300 nm transmitter and power meter calibrated at all three communication wavelengths.

Finally, revised software (Rev. 3.1) allows expansion and enhancement of CaLan's 1776 receiver. Additional memory can be addressed and more information can be stored and then downloaded to a printer or DOS computer. All 1776 receivers can be upgraded to Rev. 3.1 specs.

Tektronix announced a new non-interfering CATV sweep system. The system is programmed to inject sweep pulses across any selected portion of the

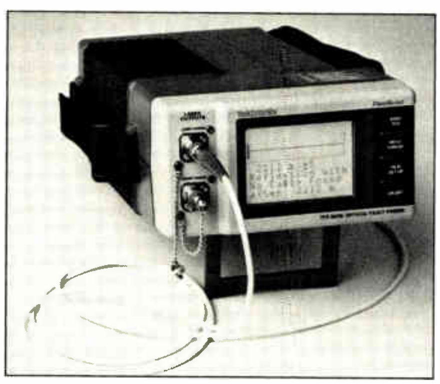


*Tektronix's sweep system*

5 MHz to 600 MHz band and fire the pulses only during the vertical blanking interval, thereby eliminating interference.

Two units comprise the system: a rack-mounted transmitter and a battery-operated, 17-pound portable receiver. The transmitter is fully frequency agile and the receiver is about the size of a signal level meter and features normalization to eliminate flatness errors and internal storage of up to eight different traces. Other features include an LCD display, optional built-in printer, keypad to type in any necessary info, temperature probe, AC/DC voltmeter and spectral display of all carriers at once. The transmitter is priced at $6,900; the receiver is $7,900.

Tektronix's FiberScout handheld fiber optic fault finder is now being



*Tektronix's FiberScout*

marketed by Anixter. The unit was designed to address restoration requirements. The front panel has four button (only two of which are needed for measurement) and an LCD display. It can operate for up to six hours on a rechargeable battery pack.

# Future testing of HDTV systems spelled out

Upcoming testing of proposed advanced television systems was the focus of one Western Shown technical session moderated by Craig Tanner, vice president for advanced television projects at CableLabs. Tanner opened the session by concisely laying out HDTV's future role.

First, as the future of home entertainment, it is seen by some as a key to the resuscitation of the consumer electronics industry, as a solution to the U.S. trade deficit and as a model of successful Japanese techniques and technology in development and manufacturing. It is seen as a merging point for computer technology and the television screen, and as a classic exercise in our highest and best usage of the electro-magnetic spectrum. Some characterize it as an economic engine for implementing fiber optics to the home and even as an important future tool in U.S. defense capabilities.

Tanner said, though, "The significance of HDTV in these areas really, in the end, depends on the fundamental commercial success of HDTV in the home, a success that is not at all clear or certain. Without that wide base of mass programming services in high definition video and the related high volume, low per unit cost manufacturing business, the scale of industrial involvement could remain small, limiting the advancement of HDTV technology and its expansion into other applications."

Tanner also identified the various proponent systems that are before the FCC and the three system channelization methods that they all fall into.

Tanner pointed out that both quality and channel capacity requirements will be impacted more by the simulcast approach than the other two. Tanner speculated that broadcast stations may end up preferring simulcast since it would give them a second channel allocation and possibly, eventually, a second service capacity.

He also addressed the question of the speed at which HDTV will be implemented. Unlike those who argue that it will be a long time coming, Tanner suggested that all the technological knowhow is in place, at least in professional hardware, and that bringing the high cost of this equipment down is the only real impediment to a rapid deployment. Refinement, packaging and cost reduction are all that is necessary. Manufacturing ingenuity may result in a shorter time frame than many talk about. Strategic thinking is called for.

With testing of hardware about to begin, the first panelist, Gary Chan, a staff engineer with Rogers Cable in Alberta, Canada, discussed the set-up of objective testing being established. Cable transmission testing will be divided into three catagories: objective measurements, threshold and ranging tests (recorded for subsequent subjective assessments).

Discreet frequency interferance, random noise, cross modulation, intermodulation, micro-reflection, effects of high level sweep, hum modulation, ICPM, peak power and the effect of automatic gain control will be objectively tested. Co-channel and adjacent channel interferance is not included because they would be duplicated under terrestrial broadcast testing.

After detailing the equipment to be used for the injection of controlled noise levels, Chan explained that impairment will be increased 1 dB every three seconds until an expert panel of viewers agree that perceptable noise can be seen from the ATV picture. Following a pause, the C/N ratio is measured. Then the impairment is decreased 1 dB every three seconds until the panel indicates the noise is no longer visible, and then that C/N is measured. This sequence is repeated five times until the peaks and valleys of measurement, within 3 dB of each other, renders a threshold point that would be the average of the last four cycles. The attenuator is then set to the threshold and the noise level measured, recorded and saved for archival reference.

The final objective test is ranging. The lower boundary is set at 3 dB below threshold. Then the impairment by noise is taken up to a level unacceptable for everyday viewing and this is identified as the upper boundary. Five intermediate steps down to the threshold are recorded and these will be used for later formal subjective assessment by a panel of lay viewers. Chan concluded his talk with a video presentation of a simulated testing procedure.

Heading up the FCC Working Party 6 on subjective assessment and working for both the Advanced Television Test Center and CableLabs, Bronwen Jones presented an overview of subjective testing of HDTV systems. She pointed out that both ambient luminance and screen luminance will be standardized, all viewing will be at three times picture height and standardized angles, common test materials will be used, and a common display. And pains have been taken to scale the terminology to be used in rating quality and impairment.

In quality testing, there will be no obvious test vs. reference pictures. Viewers will be asked to rate both anywhere on a graphic scale. A/B impairment comparisons will take place between a test picture and a reference picture, with the test picture being the only one altered with varying test levels. The reference picture is presented alternately only for baseline purposes and the test picture is rated by the viewer on a scale from imperceptable to very annoying.

Walt Ciciora, vice president for technology at ATC, reiterated his argument that due to testing, standards setting and set cost factors, HDTV will take quite a long time before significant penetration occurs. He also cited historical comparisons with the introduction of color television, his conclusion being that cable systems will be ready for HDTV long before HDTV is ready for the home. In fact, he projects that it will not be until 2007 before we have 10 percent penetration of homes with HDTV sets.

Among impediments to the introduction of HDTV, Ciciora identifies what he refers to as the "consumer electronics constraint." If you don't have enough HDTV sets out there, you don't have a business, the "chicken and egg" problem.

Along the way, Ciciora argues, we must improve NTSC because it will be with us well into the HDTV era. A combination of pre-processing, improvements in the transmission path and improvements in the receivers are all necessary.

Meanwhile, there will be a slow but steady improvement over the next 10 to 15 years in the quality of VCRs that do pose an evolving threat to cable, Ciciora concludes.

Since the improvements that cable needs to implement to get ready for HDTV are the same that are needed to improve NTSC and meet the challenge of improved VCRs, and if the timetables are correct, cable will be ready for HDTV well before consumers are ready to pay the high costs of HDTV receivers.

*—George Sell*

# Comparing drive-outs to flyovers

If you thought nothing new could be said about signal leakage, and the upcoming FCC CLI compliance deadline of July 1, 1990, you have another think coming.

Those who attended the technical session at the Western Show on CLI/ flyovers, moderated by Brian James, director of engineering with the NCTA, heard field-level comparisons of ground-based data gathering versus aerial surveys as presented by Brent Bayon, manager of engineering with Viacom Cablevision, and Chris Duros, general manager of CableTrac Inc.

Bayon explained that Viacom compared drive-outs to flyovers on the same system at the same time, and was pleased with the results of using either method. The six ground-based vehicles with two-man crews each required three days on one and two days on another for two separate drive-outs of the system, while the aerial survey took four hours to accomplish.

While the aerial survey was less expensive and took less time, the drive-outs allowed techs to identify specific locations for repair. What about cost-effectiveness of two-man vs. one-man crews? Bayon said two-man crews blitzing the system was probably more efficient. For a slow and easy approach, the one-man crews work fine.

A follow-up question on the actual costs differentials between ground-based drive-outs vs. flyovers produced the response that the flyover costs $4,000 while the ground-based work, including crews and vehicles, costs a little more.

The conclusion of the test showed that leaks that are significant in the air were less so on the ground and vice versa. Directionality of propagation of signal may explain this. The second flyover showed a pass, but the simultaneous second drive-out showed failure. The FCC has decreed that either method is valid to use.

Another case study was presented by Chris Duros of CableTrac Inc., a flyover service. Duros agreed that flyovers lack the resolution of ground-based CLI in terms of pinpointing leaks but FCC compliance does not require that specific leaks be identified, only whether the cumulative radiation exceeds the established limits. However, he showed how, using plotting and specific tracking during a flyover, hot spots can be identified for later limited drive-outs for leakage repairs.

Bob Dickinson of Dovetail Systems addressed the number crunching side of signal leakage. He discussed calculating CLI 3000 and CLI infinity and pointed out that CLI 3000 is kinder and gentler to a large system's sum of leakage but, unlike CLI infinity, requires knowledge of specific leak locations, which is difficult to know when using aerial survey data. In order to be able to use CLI 3000 for calculating signal leakage based on flyover data, Dickinson proposed using a "zone" approach rather than identifying specific leaks and measuring each leak's distance to the center of the system. Leakage levels measured within these zones could then be surveyed and the distance of the zone to the center could serve as the distance figure when calculating CLI 3000.

The zones would be concentric circles about the center of the system. Leaks located within each zone would be treated as statistically the same distance from the center. To keep the average error (1/2 maximum error) to ± 0.5 dB, zone dimensions would be 2 dB from the inner to the outer bourder, which when translated to voltage is 1.259 times. The actual distance between borders or radii of the concentric circles would vary from 1.5 to less than 1 kilometer and the total area of each zone would also vary in size.

The benefits of the zonal approach is that the zones replace actual distance of specific leaks from the center, it can be set up to limit error, and can be used in computer programs to compute CLI 3000. While Dickinson pointed out that the FCC has not officially sanctioned this new method, given the lower cost and less time required for a flyover, it does provide an easy way.

Richard Hickman, corporate engineer with MetroVision, reported some good news. They have been doing ground-based CLI in all of their systems four times per year since 1986 and have had no manpower increases due to this consistant analysis. In fact, it seems time has been freed up for repairs and upgrade projects. He urges the purchase of a good computer software program, that each person doing the testing have adequate test equipment to support the system and management approval.

Hickman's records show service calls reduced as CLI numbers lowered while, in the same time period, plant miles have increased and customer count has gone up. He also credits CLI with improving the technician's interest in maintenance and they have been more observant of potential problems.

Post-Newsweek's vice president of engineering, Ted Hartson, presented a talk that was billed by him as motivational. He urged that, since time is running out, especial effort must be made to be sure that what work is done to bring systems into compliance is actually what it is reported to be.

He mentioned one system that consistantly had high readings. He recently found a leak of 13,000 μV caused by a piece of cable in underground conduit that had been scalped during initial construction in 1981. It was in a back lot and hard to get to. But, as he said, "The more you look for, the more you find and the less you look for, the less you find. There is a direct relation." Intellectual honesty is crucial along all lines of communication.

He suggested that it is self-delusion to think that you can drive-out 75 percent of a system and fix the leaks and when done, what was not fixed would be the CLI. For example, with a 100-mile system, if you drive-out 75 miles and fix six 1,000 μV/m leaks and the resulting CLI is -1, there would be a statistical probability of two 1,000 μV/m leaks in the remaining 25 miles of the system. "You can be cute about that," says Hartson, "but when John Wong (of the FCC) comes to town, he's not going to hire Peter Pan and give him a Sadelco. He's going to get in a truck and drive up and down the streets. And when he drives up and down enough streets that he's found enough leaks to get to 64, it's game, set and match."

Hartson advised that techs and crews get to know the personalities of their systems. He suggests that until we know the frequency and degree of new leaks that our systems generate in a given typical time frame, we must continue to be out there working to get tighter operating systems. This must be done to be confident that the numbers we come up with are true and consistant, and can be replicated by anyone else.

*—George Sell*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As part of *CED*'s full coverage of the Western Cable Show, what follows is an alphabetical company-by-company rundown of new products introduced during the show.

### Anixter Cable TV

In addition to the products listed above, Anixter introduced Raychem's new EZ Grip aluminum connector. The connector was designed for use with Comm/Scope's Quantum Reach aluminum cable. The connector is environmentally sealed and operates from 4 MHz to 1000 MHz with a return loss of 30 dB or greater.

### Arvis Video Information Systems

In case there was any doubt that the beginning of the end of videotape is upon us, Arvis displayed its laser disc commercial ad insertion system. Consisting of a video compiler for tape-to-disc transfer, a Panasonic disc recorder and Panasonic videodisc players, the system allows operators to offer up to 400 lines of resolution from a one-time dub off tape.

Also, Arvis has added the Arvis 5000 single-channel insertion system for small operators who want to share in local ad revenues. Features include vertical/interval switching, video presence detection, battery back-up and the ability to dedicate up to four players per network. Additional networks can be piggy-backed.

### Blonder-Tongue

A new agile audio/video demodulator allowing for front-panel tuning of 395 channels, including broadcast UHF/VHF assignments and CATV IRC/HRC assignments from 54 MHz to 801 MHz. The AD-1 demodulates any NTSC signal to baseband and provides a 4.5 MHz subcarrier and broadband multiplex output for BTSC.

### CableLabs

The Boulder, Colorado-based R&D consortium announced that it will join Tele-Communications Inc. and Continental as minority investors in Eidak Corp., a programming copyguard process. CableLabs believes the technology, which distorts programming when taped by a VCR and rendering it unwatchable, is "important to the cable industry" because it will "enable cable to generate more confidence on security among copyright holders," said Dr. Richard Green, president of CableLabs.

Secondly, CableLabs' board of directors approved a $3.5 million operating budget for 1990. Nearly $2 million will also be allocated for research projects and a $750,000 capital budget was established for 1990.

### C-Cor Electronics

Introduced in Anaheim was C-Cor's line of 9000 MHz main line passives. Seven models, including a two-way splitter, three-way splitter, -8 dB directional coupler, -12 dB directional coupler, -16 dB directional coupler, splice box and power inserter, are included in the line. All are two-way AC power passing devices enclosed in die-cast housings equipped for strand, pole or pedestal mounting.

C-Cor also announced the first shipment of its previously-introduced high performance feedforward trunk amps

Reader Service Number 22

to Riverview Cablevision in New Jersey as well as an agreement with Rogers Cablesystems to supply extended bandwidth line extenders for the Canadian MSO's rebuilds, beginning in the second quarter of 1990. The LEs include 1,000 MHz housing with 550 electronics.

### Jerrold Communications

While causing a bit of stir with its demonstration of an integrated remote control/telephone, Jerrold stressed that the product was only a prototype and a demonstration of how the two devices could be integrated. However, "real" products like a remote that turns on both the converter and TV, converters with Oak, Hamlin and Zenith compatibility and other "consumer friendly" devices were shown.

The new remote includes built-in TV turn-on information so that TVs which are programmed to turn on at a fixed channel after they are powered down can be switched on with a single remote control.

Two new baseband converters compatible with Oak, Zenith and Hamlin scrambling schemes were also unveiled. Jerrold's Impulse 7000 box will handle Oak and Hamlin, while a Tocom 5507 converter has been made Zenith Z-TAC compatible. They will be available in early 1990.

### Leakage Detector Systems

A new handheld receiver/antenna system designed to detect cable system leakage was shown. The CLIx system, developed through a joint venture of CableBus Systems Corp. and Newport Cablevision Inc., consists of a transmitter that injects a carrier 10 dB below the video carrier level and the receiver which locks on the carrier and detects leakage. High sensitivity allows for the detection of a leak equivalent to 20 µv/m at 10 feet from 160 feet.

### Lindsay Specialty Products

Several additions were made to the product line, including two cumulative leakage index (CLI) antennas designed to eliminate the "frenzy in the marketplace over CLI," says Mike Dowling, national sales manager. The first, the CLVA series, can be installed on a van or truck roof through bolts or clamped to the ladder rack with a double "U" bolt assembly. The antenna is in a polyester square housing and supported in an aluminum frame at a minimum of 10 inches above the van roof. Both the CLVA-1, 75 ohm, and CLVA-2, 50 ohm, antennas feature full CLI bandwidth design in order to conform to the measurement requirements of CLI.

Also for CLI applications is a portable Yagi Antenna. The hand-held antenna operates with a meter hooked to it and can pinpoint leaks within inches, according to Dowling. The antenna has 6½ dB of gain and is available with a 10 dB amplifier. The Yagi antenna weighs three pounds.

Lindsay also announced a new line of 1 GHz passives. The GHz 100 Series passive boards are compatible with existing Lindsay 100 Series housings

### Magnavox

Magnavox displayed the three different methods of transmitting signals via fiber optics: AM, FM and digital. The

digital system offers eight channels per fiber, dual wavelength capabilities and the ability to send signals 50 km. Magnavox officials expect to offer the product early in 1990, at about the same price as FM gear.

A new AM optical receiver is expected to debut in the second quarter. It resembles those offered by other manufacturers, but will be placed in a traditional CATV housing in order to minimize the investment on the strand.

**Midwest CATV**

Midwest CATV, a division of Midwest Corp., announced it will market and distribute Sumitomo Electric's amplitude modulated and pulse-code modulated (PCM) fiber transmission equipment and related products. All products distributed by Midwest will be supplied and serviced from Sumitomo's facility in Research Triangle Park, N.C.

In a related announcement, Midwest also signed Noyes Fiber Systems in order to offer fiber test instruments to the cable industry. Both announcements stem from Midwest's vision of "fiber being very strong in 1990," says Christopher Sophinos, vice president and chief operating officer of Midwest.

Also announced was an agreement with Florida Wire and Cable to provide strand for the cable market in what Midwest sees as an "upcoming strand shortage," says John Johnson, vice president for materials for CATV.

Midwest also announced the move to Garland, Texas, with a full distribution facility (Midwest's sixth facility) in order to provide total coverage of the U.S. CATV market. Midwest's Sync Service (a warehouse on wheels) is also being expanded to cover 10 states.

In a final statement by Midwest, the company announced the first multi-dwelling unit (MDU) application of Matrix, the off-premise addressable device offered by the distributor. It is being installed in a 200-unit apartment complex in Wilkes Barre, Pa.

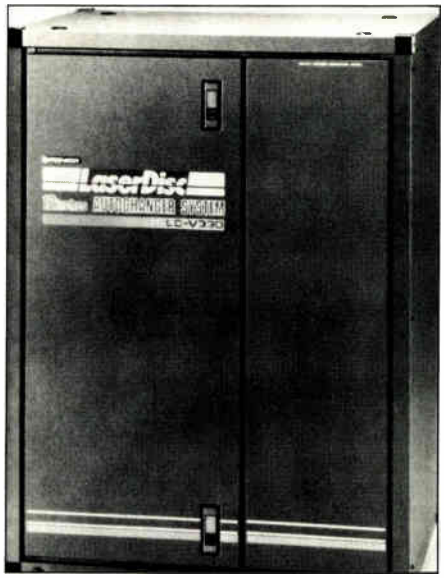
**Nexus Engineering Inc.**

Nexus announced the roll out of Nexus Display Systems for the U.S. CATV market. Nexus Display offers more than eight standard products in order to achieve the best price performance says Alan McInnes, president. Products offered by Nexus Display include a master controller, computer based system that automates video/audio switching and VCR playback. Various configurations allow control of eight VCRs and three other composite video sources for automation of local origination, syndex applications and billing requirements.

Also offered is the System 2000 production unit for text and graphics titling capabilities and the System 500 multi-site character generator designed to allow one operator to service up to 14 sites via phone lines.

**Pioneer Communications**

Even though the technology was originally introduced about two years ago with a music video jukebox application in mind, Pioneer re-introduced its laserdisc autochanger with the idea of using it to program a stand-alone pay-per-view business.



*Pioneer's Laser Disc™ Autochanger*

Up to 72 12-inch discs can be loaded in the machine and events can be scheduled almost back-to-back, since only 25 seconds is required to change discs. The system consists of the player and a computer which can schedule the desired sequence of events, commercials and/or promotions.

Also, Pioneer introduced a new addressable controller designed for the mid-sized cable system. The PC-based system allows an operator to pre-schedule up to 256 PPV events and simultaneously run six events.

**Regal Technologies**

The new RC-83 plain vanilla converter offers 83 channel tuning capability in a small box. Features include last channel recall, accelerating scan, favorite memory recall, a non-volatile memory and complete infrared downloading capability of seven different features/functions.

### Scientific-Atlanta

A new ANI controller that improves the throughput of ANI transactions was demonstrated. The unit enables direct ANI input regarding PPV events into a S-A System Manager IV or V addressable control system to reduce ordering logjams.

The controller uploads the "buy" info to the billing computer for posting after the order is received. The standard system consists of an IBM PS/2 Model 502, hard disk, 5 MB of RAM, three serial communication ports and color monitor. It supports 100,000 converters and performs almost five transactions per second.

Availability is scheduled for middle of 1990.

Also, the company exhibited its version of the EIA MultiPort device and announced it is taking orders for the device. S-A is building 200 units priced at $130 each, which will be available next summer.

### Standard Communications

Standard introduced an IRD option for its Agile headend satellite receivers, a new RF block downconverter and a sales agreement.

The IRD option, called the Agile IRD, was designed to integrate a VideoCipher descrambling module into the operation of two of Standard's CATV receivers (the Agile 40C/K for large systems and the Agile 32C/K for smaller systems) without modification. This option eats up seven inches less rack space and features include RF shielding, individual power supply and full function indicators.

The new downconverter was designed for upgrading and converting 270 MHz to 700 MHz satellite CATV systems to 950 MHz to 1450 MHz frequencies. The ODC1A converter is a self-contained RF device that upgrades polarity to the new 950 MHz to 1450 MHz block conversion frequencies.

Finally, Standard's SatCom division will provide audio/video satellite receivers to 180 PBS affiliates across the country. The agreement is part of a three-year replacement program to upgrade existing PBS equipment.

### Zenith Cable Products

The first "learning" multi-brand remote control was shown. The PCC-IQ is pre-programmed to operate 41 brands of TVs, 40 brands of VCRs and 50 brands of cable converters, but can also learn up to 120 separate functions to control many other devices, such as CD players.

The unit is an enhancement of the PCC-II and devices will be available in the first quarter of 1990.

The second generation of Zenith's Phase Modulation scrambling system was also rolled out. Called PM-II, the system includes 256 program tags for greater PPV and tiering needs, 84-channel program mapping, built-in real-time IPPV and more headend control.

### Subcommittee officers announced

With a full year under its belt, the SCTE Interface Practices Committee held its anniversary meeting December 13 at the Western Show. Following are the new 1990 officers, along with current addresses and telephone numbers:

- Chairman: Tom Elliott, director of research and development, TCI and vice president, science and technology, CableLabs; 1050 Walnut St., Suite 500, Boulder, Colo. 80302, (303) 939-8052.
- Secretary: J. Kendall Williams, CATV product development manager/Raychem, 300 Constitution Drive, Menlo Park, Calif. 94025-1164, (415) 361-2213.

### Subcommittees

- Chairman, Drop Interface: John Swinmurn, technical director/Raychem, 300 Constitution Drive, Menlo Park, Calif. 94025-1164, (415) 361-2496.
- Chairman, Aluminum Interface: John Radzik, product manager/Augat Communications Group, 901 South Avenue, Horseheads, N.Y. 14845, (607) 739-3603.
- Chairman, Interface Testing: Rex Ickes, director of engineering/Pyramid Industries Inc., 3700 North 36th Ave., Phoenix, Ariz. 85019, (602) 269-6431.

*—Roger Brown and Kathy Berlin*

# Fiber optic CATV distribution in Germany

An integrated system which provides both CATV and telephone service to the home has been designed under contract to the Deutsche Bundespost and is planned for pilot installation in early 1990 in Koln. The CATV portion of the network is designed to be functionally equivalent to the coaxial system now being installed, while offering advantages in reliability and future expansion possibilities.

### CATV evolution in the FRG

In 1982, the Deutsche Bundespost began an ambitious plan to extend cable television service to the majority of citizens in the FRG. The multi-tiered system culminates in a coaxial cable distribution network whose bandwidth, initially 300 MHz, has been expanded to 450 MHz. By the end of 1986, 26 percent of households had been passed by the network and by the end of 1988 that was expected to grow to approximately 40 percent.[1]

This network and its bandwidth expansion have previously been described at Montreux.[2] The coaxial portion consists of "trunk"lines (level 2.2d in the hierarchical network) connecting local distribution networks (level 3) whose nominal service area is 8.5 km by 8.5 km.

At the higher levels of the network, signal transportation has been via a variety of coaxial and microwave links. It is expected that digital transmission over optical fiber will gradually replace the other methods and that..."*this development is a logical and consistent step in the Deutsche Bundespost's long-term plan to reach the integration of all telecommunication services in an optical fibre-based digital network*".[3]

As a further step toward extending the advantages of fiber to the home, the Deutsche Bundespost entered into a contract whose first phase is the development and pilot production of a system that is capable of providing both telephone and CATV services. Delivery of hardware is planned for the end of 1989. The field trial, including 192 telephone lines and 96 video connection points, will take place in Koln in 1990.

*By David Large, Raynet Corporation*

*©Symposium Record, 16th International TV Symposium, Montreux, Switzerland, 17-22 June 1989, CATV Sessions, pp. 122-137*

This CATV pilot system, a modification of Raynet Corporation's proposed U.S. topology,[4] is designed to integrate into an existing "level 3" service area.

### Coaxial topology and limitations

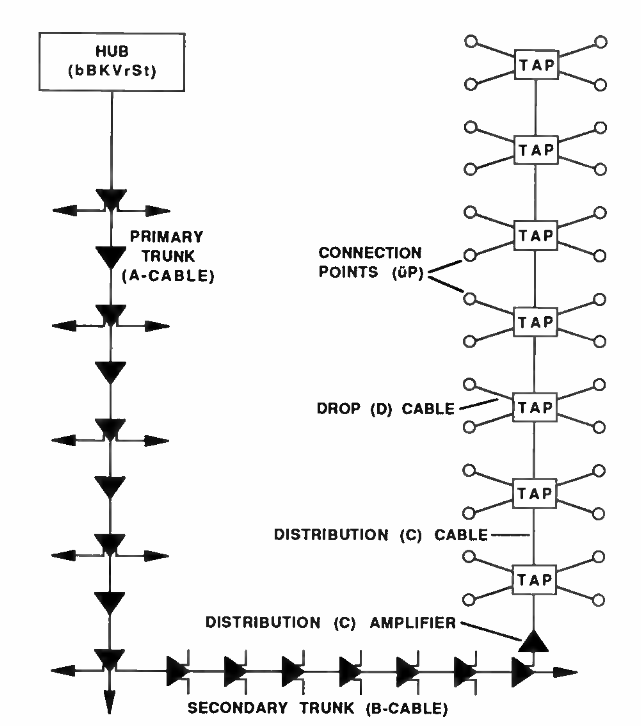



Figure 1

Figure 1 is a simplified schematic diagram of the BK-net local signal distribution network. Trunk ("A" and "B") cables, containing up to 20 total amplifiers in cascade, feed distribution amplifiers which drive passively tapped "C"cables. Two-, three- and four-port taps of varying coupler ratios feed signals to drop ("D") cables which connect to residences.

The various elements in this network define its performance limitations:

**Trunk amplifiers.** Because the trunk cables contain most of the electronic devices between the average subscriber and the hub, the failure rate of (or loss of power to) those devices is the primary factor determining service reliability. For the same reason, this cascade of active devices limits the attainable signal-to-noise ratio.

**Distribution amplifiers.** The distribution amplifiers operate at an output level 13 dB to 16 dB higher than trunk amplifiers in order to serve as many taps as possible. For that reason, they contribute disproportionately to the total intermodulation distortion (IM) in the network.

**Taps.** The in-line taps are not perfectly matched to the "C" cable. As a result, signal reflections and re-reflections take place along the tapped line. The magnitude of the resultant "ghosts" is a function of the magnitude of the mismatches and the loss of the connecting cable. The visual off-set of the ghost is a function of the distance between the mismatches. Its subjective visibility is a function of both the magnitude and offset.[5] In current systems the multiplicity of such "close ghosts" has not been a problem. The potential for carriage of high definition television signals (HDTV), however, may cause a re-assessment of that because of three factors:

- Greater horizontal resolution that will be able to resolve more closely spaced vertical lines.
- Closer viewing distances as a function of picture size, made possible by larger screens and picture resolution improvements that will encourage their use.
- Use of time compression in some HDTV formats (including specifically the multiplexed analog component for-

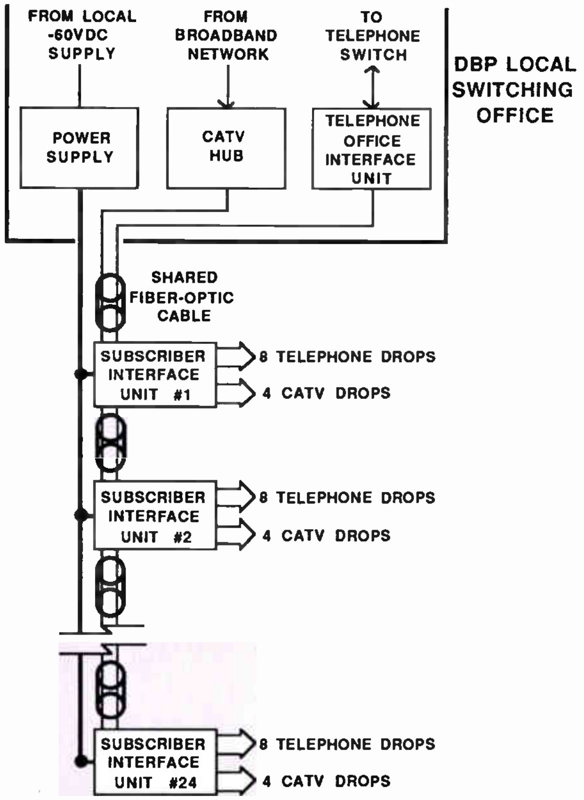



Figure 2

mats) which, on expansion for viewing, further offsets any ghosts on the viewing screen relative to the desired picture.

### The pilot system

Figure 2 shows the basic topology of the new combined network and the relationship between the CATV and telephone systems. Either system can also be installed alone as well as jointly. The first trial of the telephone system was scheduled to take place at New England Telephone (a NYNEX company) in 1989.

On the telephone side, an Office Interface Unit (OIU) provides the interface between the central office switch and a Time Division Multiplexed (TDM) digital optical signal that is transmitted down one of two telephone fibers. As shown in Figure 3, a portion of that signal is optically tapped off at each Subscriber Interface Unit (SIU) and converted back into analog form for connection to eight telephones through standard twisted pair drop cables. Analog output signals from the telephones are converted to digital optical signals at each SIU and transmitted up the other fiber to the OIU and hence to the central office. Power for the network is transmitted through a copper cable that is deployed along with the fiber.

The input to the CATV network comes from a normal BK-net hub (b-Breitbandkommunikation-Verstarkerstelle or bBKVrSt) output. Broadband CATV signals are transmitted through separate fibers from the telephone signals. Like the telephone network, a portion of the signal is optically siphoned off at each SIU. The optical receiver converts the signal back into analog form where it is amplified and drives up to four subscriber connection points (ubergabepunkt or uP) through standard coaxial drop cables.

This bus network is inherently more efficient than star networks because much less fiber is used per customer and because the cost of optical transmitters and receivers are shared among many customers. Compared with separate CATV and telephone networks, additional economies arise from the sharing of power systems, fiber cable structure, SIU housings and construction costs.

### Tapped fiber topology for CATV

Figure 4 shows the same area as Figure 1, but constructed using the new fiber topology. The broadband (47 MHz to 446 MHz) output of the hub is split and used to amplitude modulate laser distribution transmitters. Each transmitter drives one single-mode fiber optic transmission line. That line serves several SIU units. The intermediate SIUs are served via a series of optical couplers and the fiber terminates on the last unit.

Within the SIU, an optical receiver recovers the original VHF/UHF spectrum which is then amplified and fed through four "D" cable drops to termination points in houses.

The transfer characteristics of this network are designed to match those of the existing coaxial network so as to allow an evolutionary changeover to



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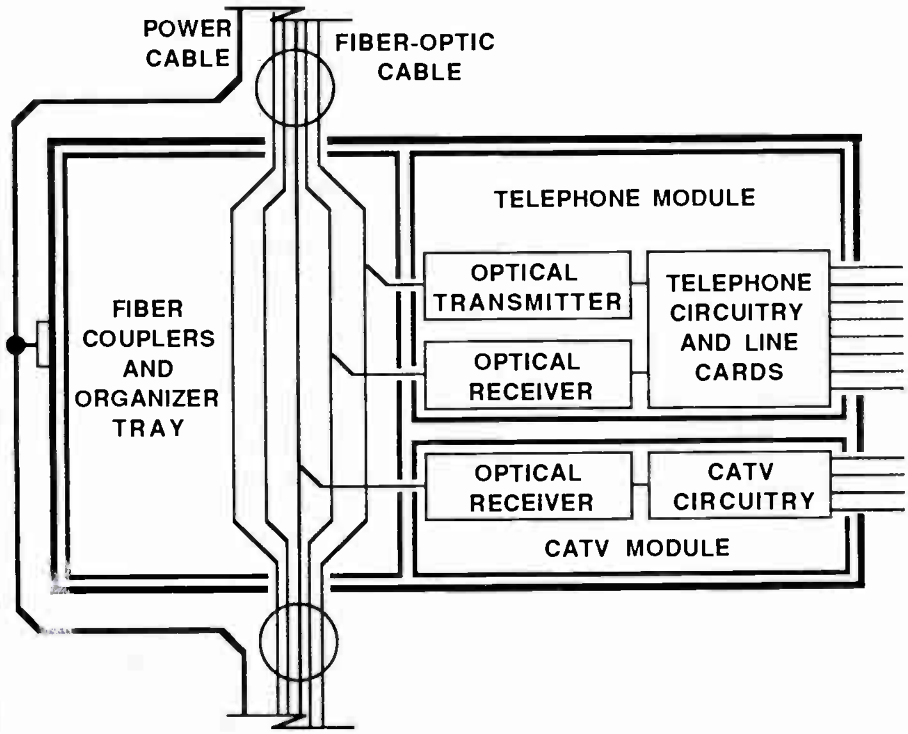

Figure 3

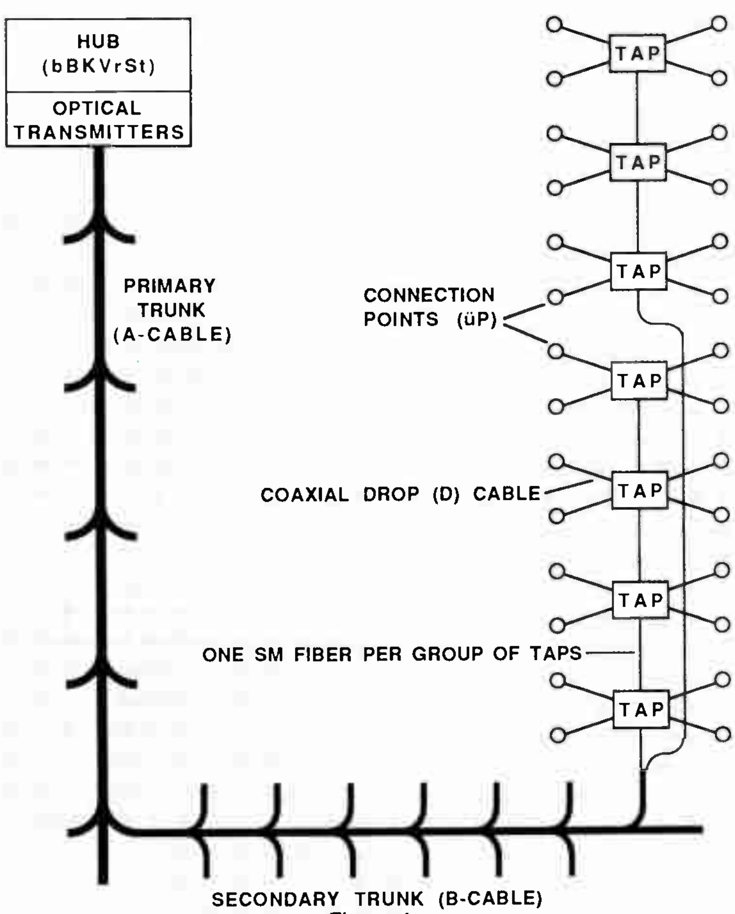

Figure 4

the new technology. The consumer-friendliness of the BK-net is preserved since no converter or format conversion equipment is required in houses. In fact, the subscriber features will be indistinguishable.

The new network will, however, offer many advantages to the network operator, including:

- **Reliability.** Only two pieces of active equipment lie between any customer and the hub: the SIU and the laser transmitter.
- **Freedom from catastrophic failures.** In the coaxial system, failure of an amplifier near the hub can result in service interruption for thousands of customers while failure of a laser transmitter will affect less than 100 connection points.
- **Virtual elimination of ghosts.** Optical components are readily available that are much more precisely matched than coaxial components. Additionally, the square-law nature of optical detectors results in a ghost level at RF that is twice as low (measured in dB) as that in the optical network.
- **Elimination of signal leakage.** The optical network has zero signal leakage, leaving in-house equipment as the only remaining source of radiation. Thus, concerns about using frequencies allocated to other users of the RF spectrum can be minimized.

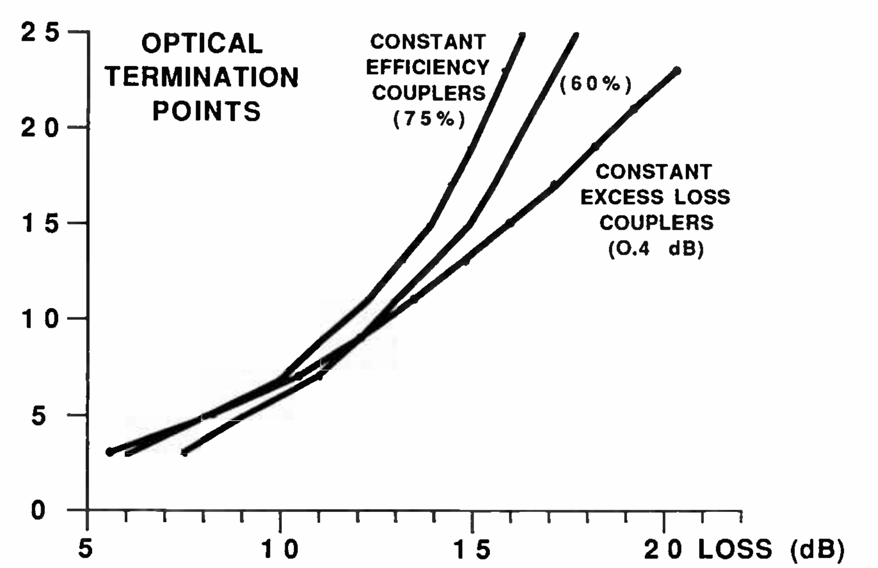


Figure 5

- **Savings in system alignment cost.** The characteristics of coaxial amplifiers change with both temperature and aging. Although automatic gain and slope controls make a first-order correction for this variation, it is common to periodically realign trunk lines to optimize performance. This cost is eliminated with the optical system.

### AM video through fiber

Realization of this new CATV network is dependent on the availability of electro-optic components for fiber-based AM video transmission. This rapidly developing technology has been spurred by the cable television industry's desire for a cost-effective way to upgrade existing coaxial networks.

ATC Corporation, the second largest cable system operator in the United States, proposed a fiber-reinforced coaxial architecture as an alternative to conventional rebuild strategies. In its 1987 proposal, ATC published a model specification for an AM fiber-optic link that it felt was adequate for the purpose.[6] The support given this proposal by vendors and other operators has resulted in a great deal of development within the past two years.

As of this date, more than 10 vendors have demonstrated or specified products for AM video. Other major cable operators have made commitments to field deployment of fiber-optic hardware and have developed alternative hybrid coax/fiber topologies.[7,8]

All of these systems are based on the use of multiple point-to-point AM fiber links connecting coaxial distribution networks. Since these lines are typically less than 10 km long, optical budgets of 10 dB are considered adequate.

The construction of a passively tapped optical system, however, requires greater optical budgets. The question of theoretical limits on attainable performance has been dealt with by David Grubb of Jerrold.[9] For trunk line applications, he predicts a practically achievable budget of 15 dB for 80 channel single fiber links using 5 mW lasers and 50 percent optical modulation index.

The development of higher powered optical sources will allow a considerable improvement on that figure. The upper limit (aside from safety considerations) is controlled by non-linear phenomena in the fiber itself.[10,11] For relatively long point-to-point links, the limit is about 12 mW, while for 5 km lines such as might be used for tapped distribution purposes, the limit is over 20 mW.

Based on this data, and a reduction in required channel count from 80 to 36, practical optical budgets of 20 dB to 21 dB should be attainable without requiring fundamental breakthroughs in device technology. Greater budgets will be possible with the development of such components as low-noise optical amplifiers.

The number of taps that can be served from each laser has a strong effect on the per-subscriber cost of the network. Figure 5 shows the maximum number of taps that can be served as a function of optical loss through the couplers. This graph includes data for two kinds of couplers: those having a fixed excess loss (0.4 dB) and those with a fixed efficiency (60 percent and 75 percent). In either case, of course, the total optical budget must be greater to account for fiber loss, connector loss and margin.

Although optical components are not yet available to allow serving large numbers of taps from each laser, the point has been reached that technology trials are practical. The Deutsche Bundespost/Raynet Koln installation is such a trial.

### The Koln pilot installation

Figure 6 shows the layout of the pilot system. Although the served residences happen to be located along a complete circle, the network is electrically a single-ended bus.

An Office Interface Unit interfaces with the local switch and provides service to 192 telephones connected to 24 SIUs distributed along a pair of fibers in the 3.1 km long cable. The CATV hub is provided with a broadband feed from the local cable system containing 23 video channels plus FM radio service. Service is provided to 96 CATV connection points from the same 24 SIU locations.

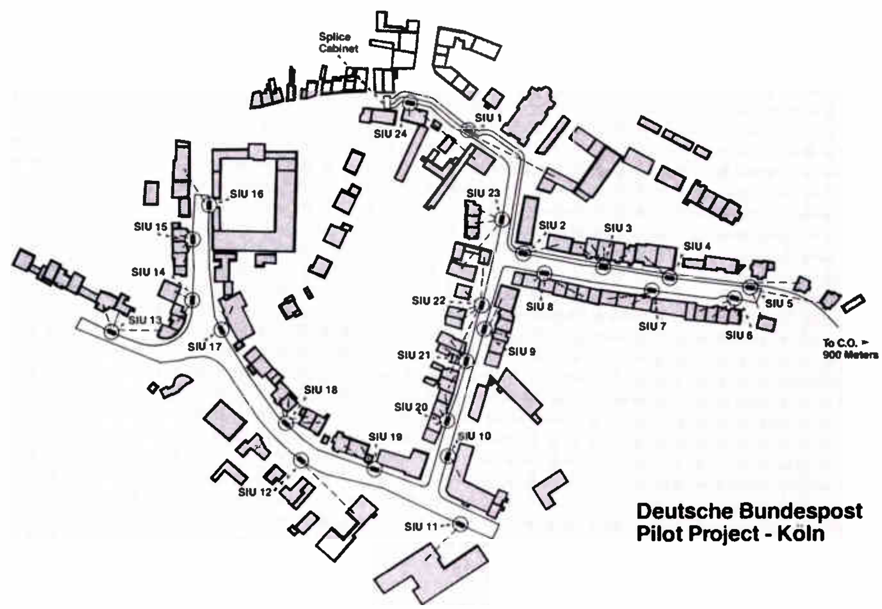


Figure 6

Power for both networks is provided from the central office location via a power cable that is installed along with the fiber optic cable. A nominal −48 VDC is supplied to the SIUs, backed up by the central office batteries.

Operation of the two networks is independent except for the common

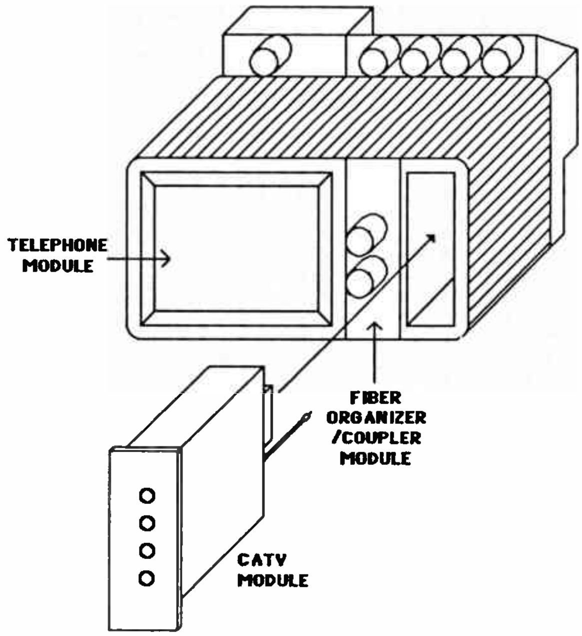


Figure 7

powering scheme and a common optical safety system. The safety system monitors the optical cable for continuity and, in the event of a break, shuts down the lasers in both telephone and CATV networks.

### Mechanical considerations

The SIUs are mounted in handholes in conformance with standard DBP practice. To facilitate access for servicing, the housing will be mounted to a hinged cover as shown in Figure 7. Although only the CATV drop cable is shown, similar service loops will be provided for telephone drop lines, optical and power cables.

The problem of independent service access for telephone and CATV technicians is solved with a three section housing as shown in Figure 8. The center module contains the fiber organizer tray and optical couplers, the left hand module the various circuits required for the telephone service and the smaller right hand module (shown removed) the video circuits. An optical pigtail from the coupler carries signals to the CATV module.

The common power cable and the telephone drop cables are connected directly to the main housing while the CATV drop cables are connected to the front of the module.

### Expected performance

The goal for the television system is to deliver the same picture quality as the equivalent BK-net distribution system. That network is required to meet the following critical performance specifications:

- 47 MHz to 446 MHz operational bandwidth.
- 64 dB Composite Triple Beat and Composite Second Order distortion levels.
- 51 dB weighted video signal-to-noise ratio.

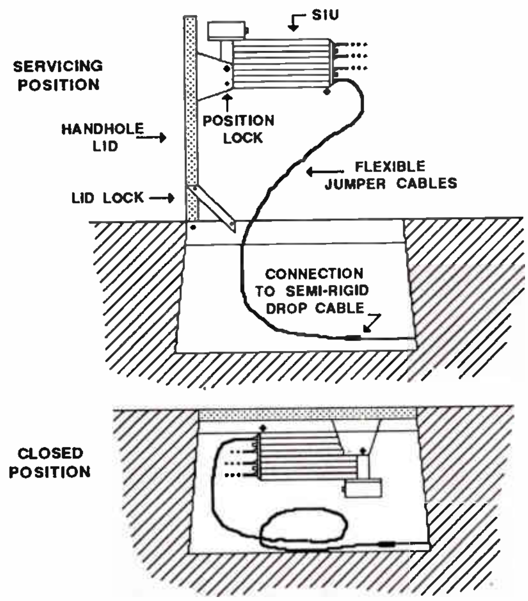

Figure 8

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Anyone wishing to voice their opinions or comments on articles published in *CED* may do so in writing: Editor, CED Magazine, 600 South Cherry Street, Suite 400, Denver, Colorado 80222.

# A mechanical splice yielding fusion performance

Angled Rotary Mechanical Splice
Polishing Tool

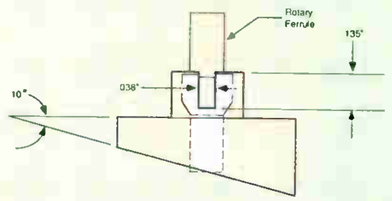



Figure 1

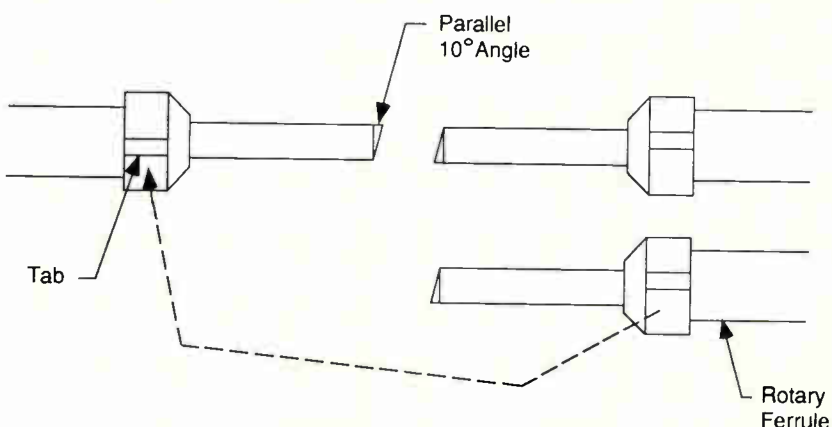



Figure 2

The Angled Rotary Splice (ARS) was designed for cable TV application to yield improved performance over the AT&T Enhanced Rotary Mechanical Splice (ERMS). This article will present data from field applications that illustrate performance characteristics equal to or better than fusion splices.

Mechanical splices and their associated optical reflections have proven to be usable in all optical-glass-fiber transmission systems. As documented, optical reflectances or return losses occur in all operating optical-fiber systems both discretely, as Fresnel reflections at abrupt changes of index-of-refraction, and continuously, as inherent Raleigh backscatter. This Raleigh backscatter level found in all normally transmitting fibers is approximately −31 dB.

*By J.A. Aberson, AT&T Bell Laboratories and J.R. Anderson, Fiber Optic Engineer, Anixter Cable TV*

Moreover, backscatter and Fresnel reflections (from splices, connectors, taps, couplers, and detectors and lasers—which have some of the highest reflections as a result of built-in air gaps) are entirely equal in the two types of transmission systems that exist: digital and analog.

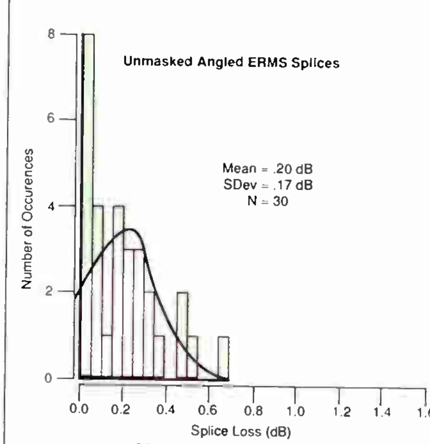
While backscatter is unavoidable, Fresnel reflections are controllable to a large degree, and acceptable values that assure proper transmission quality are attainable.

Because they are located away from the ends of fiber spans and are widely spaced, reflections from fiber splices—especially mechanical splices—are easily accessible and clearly visible via OTDR, and hence, have been the focus of most attention, discussion and testing. Conversely, reflections from all end-point and other closely-spaced components like connectors, cross-connects, taps, couplers, and sources and detectors are not conveniently measurable with either OTDR or new continuous-wave techniques. Consequently, little mention has been made so far concerning actual installed performance of anything except mechanical splices. This bias will remain the case until a new generation of test equipment and techniques evolve; so in the meantime, lab and factory values or "specs" will be "known" and accepted for connectors, etc., while splices will continue to receive intense testing scrutiny.

## Analog systems

Although no broad analog experience yet exists to enable any standard for reflections from mechanical splices and other discrete components, some recommendations are being made nevertheless that contain sufficient conservatism to withstand current and future uncertainties about equipment and service. The most conservative goal is for a worst-case return-loss of −40 dB which will assure quality performance for AM analog video transmission. (Because of source intensity-noise and intermodulation effects, AM systems are more sensitive to optical reflections than FM analog systems. So far, FM requirements are equivalent to digital.)

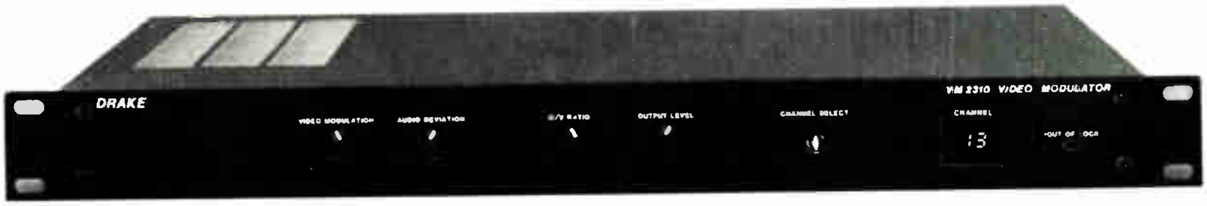
For polished mechanical splices to achieve reflections that are always lower than −40 dB, enhanced fiber end-finishes are required. A field usable technique based on reported work has been developed, implemented and




Bidirectional 1.3 μm Splice Loss
*Cox Cable, San Diego*

Figure 3

# Prepare to Modulate

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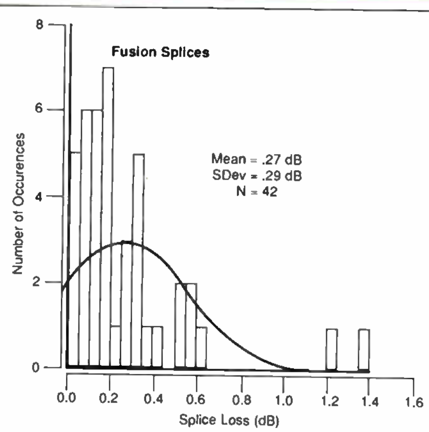
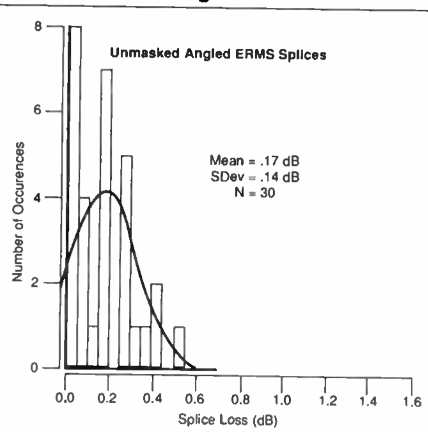



**Bidirectional 1.3 μm Splice Loss**
*Cox Cable, San Diego*
**Figure 4**




**Bidirectional 1.55 μm Splice Loss**
*Cox Cable, San Diego*
**Figure 5**

verified for splicing AM-analog systems. Figure 1 shows the schematic representation for polishing a 10 degree angle onto the fiber in a Rotary Mechanical Splice. Figure 2 illustrates how two ferrules with complementary 10-degree faces can be joined together. This configuration, where the tabs are aligned, is called the "passive" or untuned splice. Because the end-face angle is so shallow, these splices can be rotated or tuned to minimize optical loss. To tune splices, an "active" signal must be placed onto one of the fibers. In the results following, both "passive" and "active" splices will be shown.

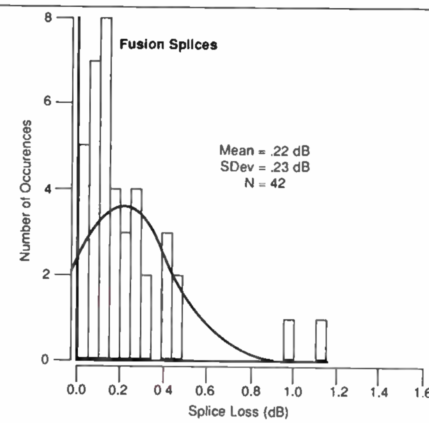
## Angled-splice results

During late 1988 and all of 1989, cable system operators installed and verified AM-analog optical systems. Data from four specific job locations will be given. In two instances, rotary mechanical splices with 10-degree angled ends were used. In two others, standard 0-degree rotarys were used.

The ARS features a modification of the 0-degree polished ERMS used in both digital and analog applications. The 10-degree angle polish introduced in the ARS ensures that reflective products are refracted out of the splice. The performance of this technique in the field adds little time to the ferrule preparation. The data presented will illustrate that the 10-degree angle polish also exhibits lower average insertion loss than fusion joining methods, with equivalent splice reflectance characteristics.

For the first job, Cox Cable in San Diego planned the installed spliced cable as a test bed for direct comparison of transmission performance on fibers that are rotary spliced only vs. fibers that are fusion spliced only. Fusion is well recognized for being "reflectionless," hence, any differences seen in performance would be attributable to reflection from the mechanical rotary splices.

To accomplish this, it was specified that in the 12-fiber cable-span, five fibers were to be spliced, all with angled rotarys; the remaining seven fibers were to be spliced all with state-of-the-art core-imaging fusion splicing. Cox further specified that all splicing was to be done by one crew. This inexperienced crew was trained and supported on-site by experienced fusion splicers and by experienced rotary splicers, and closely monitored by the CATV engineers.

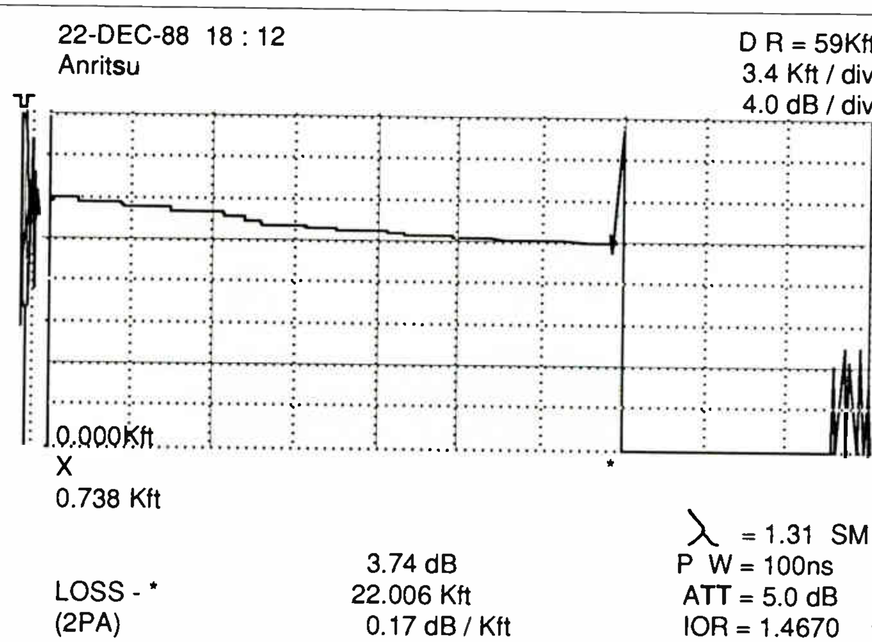



**Bidirectional 1.55 μm Splice Loss**
*Cox Cable, San Diego*
**Figure 6**

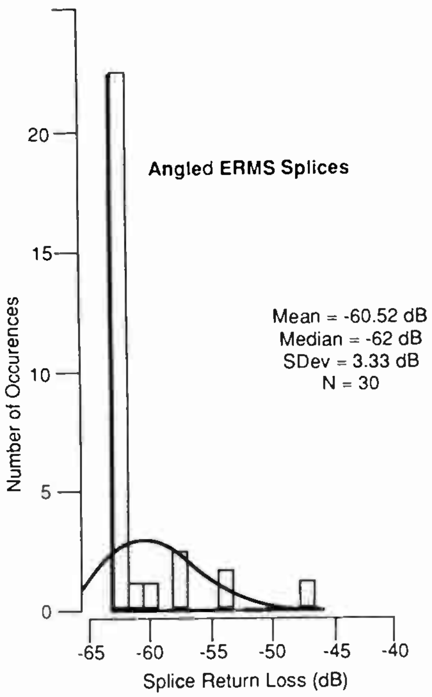
Splicing times were nearly identical for both approaches, although the fusion splicing machine did show sensitivity to ambient temperature and humidity variations. Bidirectionally averaged OTDR splice-loss results, at both 1310 nm and 1550 nm, for this completed installation are shown on Figures 3 through 6.

As these show, splice-loss statistics also are nearly similar for the two methods at both wavelengths. The rotary splices, however, show lower maximum losses than fusion (about ½ dB compared to about 1 dB, respectively).

Figure 7 shows a typical one-way OTDR trace for one of the ARS fibers. The splice reflections seen on this trace



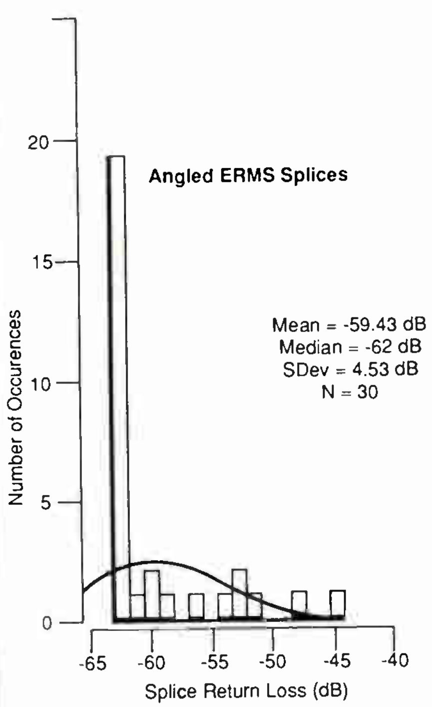

**OTDR Trace (six splice points)**
*Cox Cable San Diego*
**Figure 7**




**1.3 µm Splice Reflectance**

*Cox Cable, San Diego*

**Figure 8**




**1.55 µm Splice Reflectance**

*Cox Cable, San Diego*

**Figure 9**

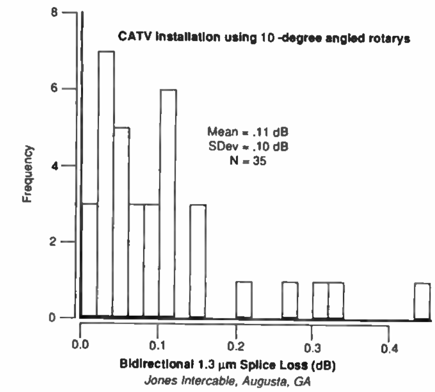



**Figure 10**

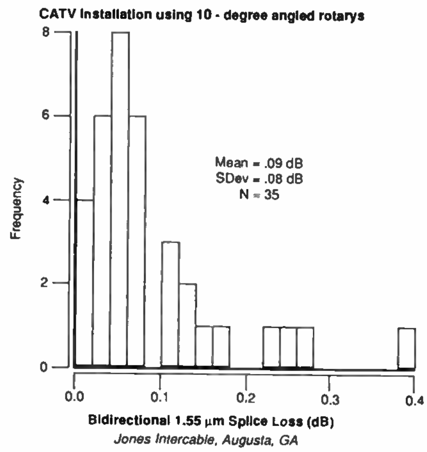



**Figure 11**

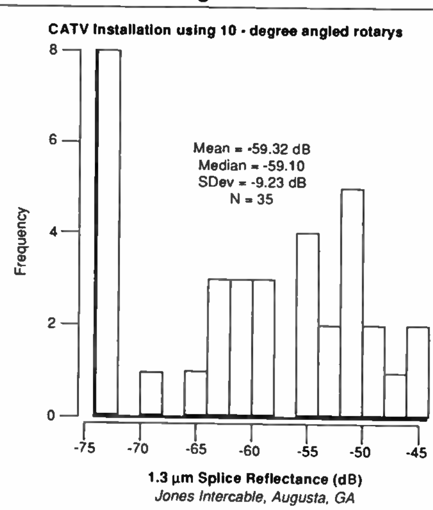



**Figure 12**

are virtually identical to those seen for fusion spliced fibers. Figures 8 and 9 give the 1310 nm and 1550 nm splice return-losses for all 30 of the angled rotary splices. (All fusion splices measured −62 dB, which was the OTDR resolution limit.)

None of the mechanical splices had a return loss that was greater than −44 dB. The system tests for carrier-to-noise (C/N) and intermodulation (second-

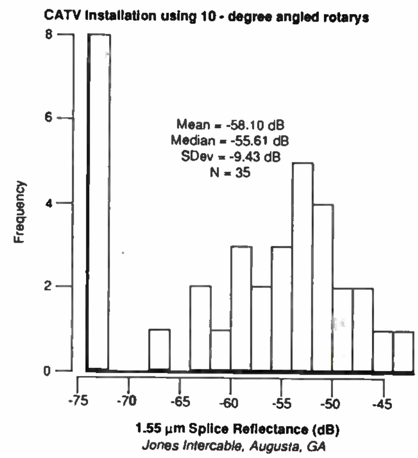



**Figure 13**

order, S/O, and composite triple beat) values cannot differentiate between rotary spliced and fusion spliced fibers. C/N was less than −57 dB and S/O and CTB were less than −65 dB. These numbers are 5 to 6 dB lower than those required by the system specifications.

At Jones Intercable's Cable Area Network (CAN) installation in Augusta, using 10-degree angled ARS splicing, identical performance values were achieved. Figures 10 through 13 give the loss and return-loss distributions for the 35 fiber splices made for the first phase of the job. Again, no reflections exceed −40 dB, and splice losses were "actively" tuned with a local injection/detection/measurement test set (LID/M) to final averages of about 0.1 dB.

## Results of ERMS

For two other CATV companies, (Continental Cablevision in Pompano Beach, Fla. and TCI in Pacifica, Calif.), however, installers chose to use standard 0-degree polishing rotary mechanical splices. Splice loss data furnished by these companies are presented in Figures 14 and 15. For the first of these, Continental tuning was with an "optimizer" LID which had no measurement capability. On TCI's job, tuning was done by an experienced crew which used a combined LID/M. The splice losses they produced (as given by the bidirectionally averaged OTDR data on Figure 15) are, for any splicing method, the reliably lowest reported from an actual field location thus far.

For both Continental and TCI, although return losses averaged −41 dB with maximums of about −30 dB, system C/N was still better than −57 dB and S/O and CTB were below −65 dB. Thus, performance of these systems, all with standard Rotary Mechanical Splices, is the same as for 10-degree angled rotary spliced systems (which, of course, is the same as for fusion spliced systems).

## Conclusions, recommendations

Data gathered from working closely with customers who operate both digital and analog transmission systems verifies that standard 0-degree rotary mechanical splices, whose splice losses are the lowest reported (see Figure 15) and whose return losses average −41 dB, can be used satisfactorily. In fact, this body of data shows that any mechanical splice that creates reflections that are no greater than −30 dB will be fully acceptable for all known and planned installations.

The maximum return loss needed for these may actually be closer to −40 dB. To address this possible eventuality, the Angled Rotary Splice has been developed and implemented. From multiple field usages of this splice, return losses typically are the same as fusion's (see Figure 7), and splice losses typically are better. Consequently, there are no performance restrictions whatsoever on any digital or analog optical-fiber system that uses rotary splices. ■

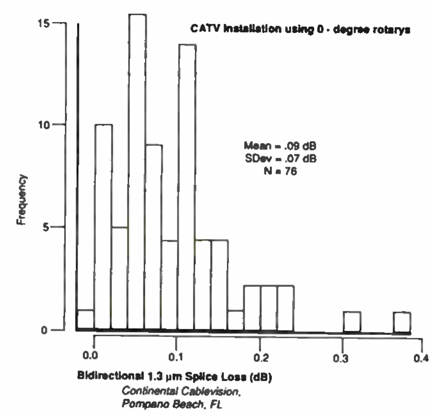



**Figure 14**

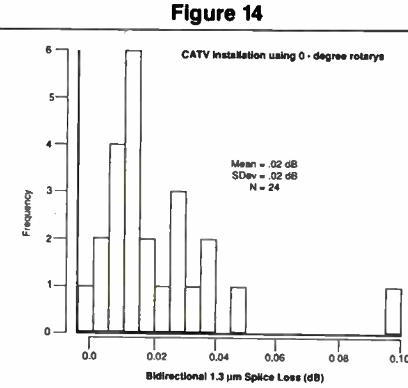



**Figure 15**

# CLI measurements with the dipole antenna

COMPLIANCE

Once a leak has been detected during a CLI rideout it must be accurately measured. One of the most common methods of doing this is with the signal level meter and a dipole antenna. While accurate measurements can be made using this method, care must be taken to insure the dipole is properly tuned and placed prior to recording the measurement.

## Tuning the dipole

Two physical dimensions of the dipole having a direct affect on the accuracy of the measurement are width and length. Width is derived from the following formula: $W = 11808 \div F$.

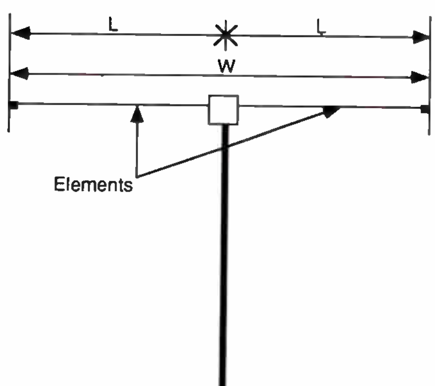



Figure 1

where:
W = width in inches
f = frequency in megahertz

Width is calculated in the above formula based on a full wave dipole.

In the case of a half wave dipole then W would equal W * 0.5, and for the quarter wave dipole W would equal W * 0.25.

*By James H. Kuhns, District Technical Trainer, Continental Cablevision of Michigan*

Length is calculated using:
$L = W \div 2$.

```
10 CLS
20 CLEAR
30 INPUT "Frequency in megahertz"; FREQ
40 W = 11808 / FREQ
50 L =  W / 2
60 A$ = "WIDTH = ##.### LENGTH = ##.###"
70 PRINT USING A$; W; L
```

Table 1

where:
L = length in inches
W = width in inches

In Figure 1 we see that length is one half of the total width of the dipole. The sole function of length is to assure the two elements are centered. The electrical importance of centering the elements and how centering can affect the accuracy of the signal level measurement is beyond the scope of this paper. References are provided should the reader wish to get additional information pertaining to the specific electrical properties of the dipole antenna[2].

If you have access to a computer, the BASIC[1] program shown in Table 1 may be used to calculate width and length.

If you are using a factory built dipole such as the Wavetek RD-1 you adjust each element for the proper length and then verify the adjustment by measuring the width from one element tip to the other. If the antenna is of the homemade variety take extra care to assure that the elements have the proper length and width parameters for the desired frequency. At this point the dipole is properly tuned.

For correct placement of the dipole on a vehicle follow the antenna manufacturer's guidelines. While instructions may vary slightly from one vendor to the next, as a general rule the dipole is mounted as close to the center of the vehicle as is practical. When the measurement is made it is important that the dipole be placed parallel to the radiating source (Figure 2) which in most cases is cable and strand. This parallel placement procedure must be used when making hand held measurements as well. Failure to do so will result in erroneous readings.

Once a signal level reading has been taken and it's accuracy assured the reading must be converted from dBmV read by the SLM to µV/m. µV/m readings are frequency dependent and a chart for dBmV to µV/m can be generated from the BASIC computer program as shown in Table 2. ■

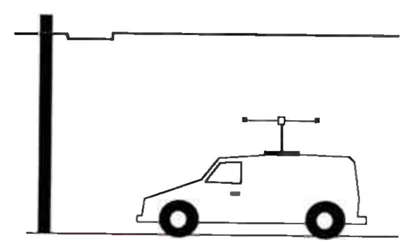


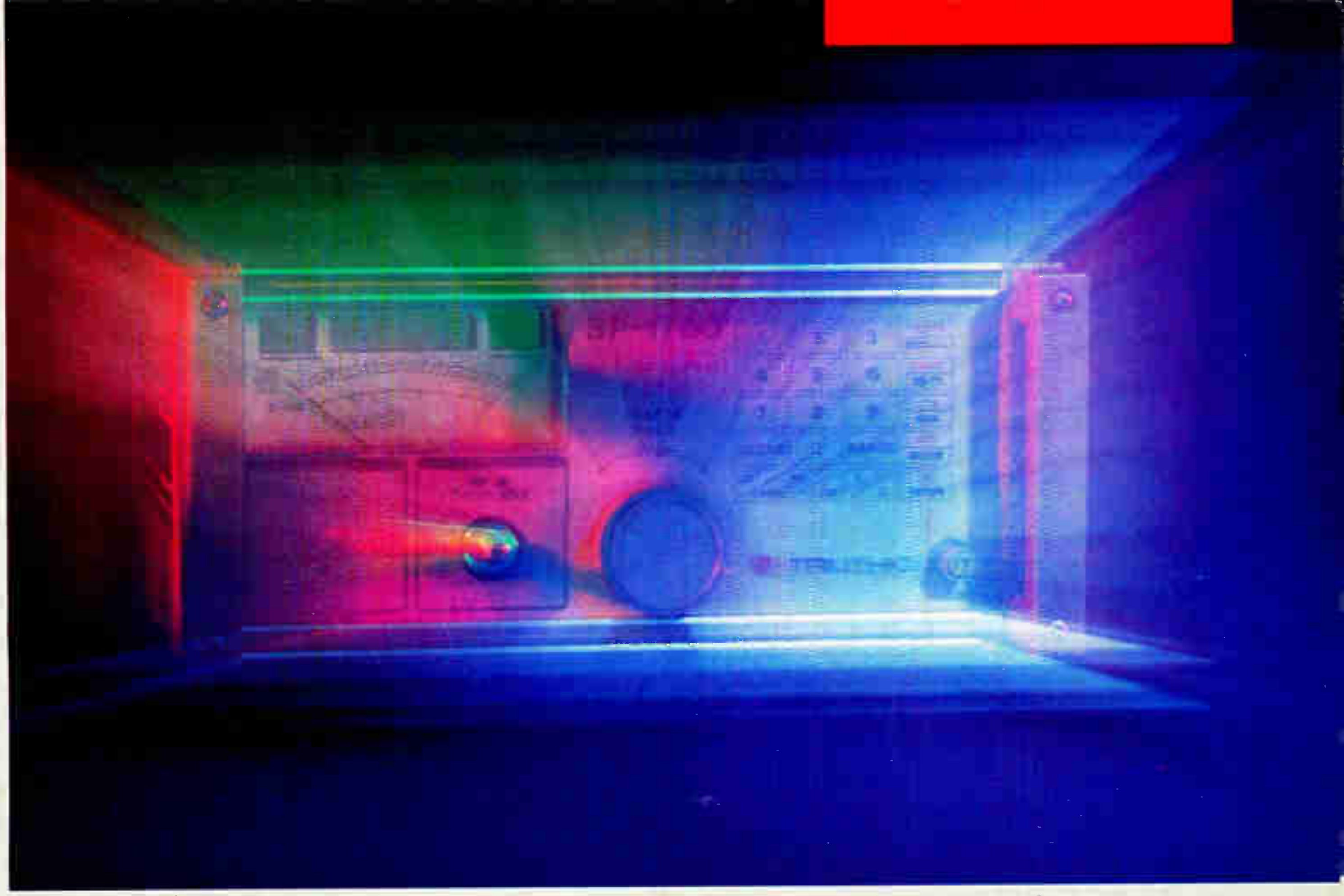
Figure 2

```
10 A$ = "###    #######.##        ###    #######.##"
20 INPUT "Frequency in megahertz";FREQ
30 LPRINT "Frequency in megahertz ====>";FREQ
40 LPRINT
50 LPRINT "dBmV                µV/m           dBmV           µV/m"
60 LPRINT "==================================================="
70 FOR DBMV = -60 TO 0 STEP 1
80 UVM = (.021 * FREQ) * (1000 * (10 ^ ((DBMV / 20)))
90 UVM2 = (.021 * FREQ) * (1000 * (10 ^ ((DBMV = 60) / 20)))
100 LPRINT USING A$; DBMV; UVM; DBMV + 60; UVM2
110 NEXT DBMV
```

Table 2

## References

[1]Microsoft GW BASIC
[2]Wayne Tomasi, "Electronic Communications Systems", Prentise-Hall Robert L. Shrader, "Electronic Communication", McGraw-Hill



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# Total quality management

In recent months the cable TV industry's service standards have been scrutinized more intensively than ever before. Numerous studies tell us that our customers are dissatisfied with our service. They are concerned about outages, poor reception and busy phones. Their complaints echo from City Hall to the halls of Congress.

The cable operator is faced with the challenge of improving service. While cable operators have been coming to grips with the service issue, an interesting movement has developed in American industry: Total Quality Management (TQM). TQM might be the vehicle for improving cable TV's service problems.

## Not a primary goal

Quality service, or a quality product, has always been accepted as a business goal. But in many cases, quality has not been considered the primary goal, and quality standards have declined. Where this has happened, entire economies have been affected. Japan's experience with manufacturing quality products is a good example.

Following World War II, Japan rebuilt a war-shattered economy and developed an export based economy, the success of which is obvious today. Key to the development was selling Japanese products overseas. Initially, their products had a poor reputation for quality and were difficult to sell on the world market. By the 1960s, however, Japanese quality was world renowned, and their export success followed.

W. Edwards Deming is a statistician and management consultant who helped develop the system of quality control for Japanese industry that led them to their current success.

He applied the principles of Statistical Quality Control (SQC) to manufacturing, measuring quality with statistics. Japanese manufacturing engineers recognized that they had to build products that had absolutely no defects if they were to succeed. The Deming Management Method helped them achieve that.

In the early 1980s, U.S. business began to discover Deming. The automotive industry in particular looked to the Deming approach to quality in developing new product lines. Where applied properly, the concept paid off.

At the same time the automotive industry was awakening to the threat of foreign competition (and developing a response), the Department of Defense was experiencing a number of well publicized problems in its procurement programs that produced equipment built with poor quality that performed poorly in the field. Worse, the acquisition costs were excessive. The DOD developed a program called Total Quality Management (TQM) in 1988 incorporating principles of the Deming Management Method and SQC. In January, 1989, the DOD issued *A Guide for Implementation* that summarizes the improvement strategies of TQM:

TQM begins with Management Commitment; requires a working environment where all employees seek continuous improvement; is measured, ultimately, by customer satisfaction; involves quality awareness throughout the entire organization; focuses on prevention, rather than inspection; and encourages elimination of non-value added activity.

## Gathering a following

In the past three years the TQM movement has gathered considerable momentum. In addition to the DOD commitment, which will have a vast ripple effect as contractors in every defense related industry accept TQM, the U.S. Commerce Department and the Bush Administration strongly support quality management. The Commerce Department established the annual Malcolm Baldridge Award for quality in 1987 to "promote quality awareness, to recognize quality achievements of U.S. companies, and to publicize successful quality strategies."

An important principle of TQM is that it is a process of continuous improvement that affects all aspects of a business. In a manufacturing environment this means that quality must be achieved at every step in the manufacturing process if the ultimate goal—defect free products—is to be realized. An example is the practice of rework in a factory.

Rework results when the manufacturing process uses a final quality check, after the product has been built, to determine if it should be released for distribution. If the product doesn't meet the final quality control standards, as happens too often in American industry, it is diverted to a rework station where defects are corrected and it can be released. While the practice does intercept defective goods and presumably prevent them from leaving the factory, it is a very inefficient method of ensuring quality for several reasons.

First, the cost of rework as a percentage of total manufacturing costs can be quite high, increasing the overall cost of manufacturing. Maintaining a rework crew that can replace or repair other crew's work is an expensive redundancy.

Second, by relying on a final check at the finished stage the manufacturing is overlooking quality control at intermediate stages. Because quality is not integrated into the process, the crew that made the mistake in the earlier stage might continue to make mistakes which are corrected in rework. The cumulative affect is isolation of manufacturing stages insofar as their quality of craftsmanship affects the finished product.

The TQM approach is integrative. Quality is measured at every step of the manufacturing process and the product is not allowed to move to the next stage until all preceding work is correct. If this is implemented properly, the final quality check should never reveal a defect, and rework is eliminated.

The actual method used to identify, analyze and correct quality problems at each stage can be complex and is never a simple activity, whether the product is automobiles or service drops.

Deming stresses accurate measurements of quality using statistical controls. Before products can be built without defects on a consistent basis, several steps of analysis must take place. Using upper and lower control limits a range of random variances is established, and excursions outside the limits are examined for their cause. At this stage, the causes are referred to as special causes because they are unique and not part of the repetitive manufacturing process. When the special causes are eliminated, the process is in a state of statistical control and

*By Steve Hubbard, Jones Intercable*

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the measurement of extremes will be within upper and lower control limits.

At this point, long term, consistent improvements in quality are possible. The final goal is never really reached. With the TQM method, the process of analyzing, changing and refining is an end to itself. As TQM principles are applied to increasingly minute causes, the process moves from rough adjustments to predictable refinements. If at any point the process stops, production is likely to revert to the original state of poor quality and unpredictable performance.

### Relating TQM to cable TV

The advantages of TQM might seem to be more applicable to the manufacturing world than to service based industries like cable TV. However, in his newest book, *Out of the Crisis*, Deming applies the TQM method to the service industry. He points out that a business that provides a service, such as the cable industry, is as much dependent on the ability to deliver a quality service for its existence as a manufacturer is on delivering a quality product.

In fact, the application of TQM is more direct with service than manufacturing in some respects. For instance, TQM focuses on the process of achieving quality, requiring top management to establish an ongoing commitment to exploring, refining and improving the product in a never ending process. Our delivery of cable TV service fits this model well. The cable business is itself a process. Our CSRs interface with thousands of customers in a highly transactionalized environment. Receiving the customer's order and entering it into the computer is a process. Generating the field work orders and routing them to field craftsman is a process. The process continues as service begins, bills are generated on a monthly basis, and service levels change when premium channels or PPV events are ordered.

In addition to our process orientation, the cable TV environment has another characteristic that will ease TQM implementation—we are already used to constant change. With the expansion of the business in the last 10 years we have been forced to improve our methods of doing business many ways. The implementation of addressable converters, Automatic Response Units, ANI systems, computer scheduling systems and improved computer billing services are all technical responses to the challenge of maintaining service standards to an ever increasing customer base.

### The manufacturing process

The TQM approach to manufacturing also applies to cable TV. In addition to our mission as providers of service, cable operators are also manufacturers, a fact which is often overlooked. Our factory floor is not located in a building, however. It encompasses an entire franchise area, and instead of producing thousands of cars a year, we build thousands of miles of cable plant and hundreds of thousands of cable drops. Each of these is a manufacturing product, and can be measured, evaluated and improved using statistical control and TQM techniques.

Cable operators could look at the process of producing drops for an example of how TQM will improve their service and reduce production expenses. In the past, cable operators, on the whole, have had few specifications or guidelines for their craftsman to produce consistently defect-free drops, even though we have been aware that drop related issues comprise as much as 50 percent of customer service problems.



 

In this application, the TQM approach would begin by establishing valid guidelines and procedures and training installers in their implementation. Next, the results would be measured by inspecting drops in the field. In the initial stages of measurement, large variations in consistence—special causes—will be observed. They must be identified and corrected to bring the system into statistical stability. At that point, real, permanent improvements can be made.

In the case of drops, the payoff for the operator is at several levels each of which is economically beneficial. First, the amount of rework, described above, will be vastly reduced. In this case rework occurs when a reconnect is done on a drop that is deficient. Every operator is aware of the situation in which a simple reconnect, which should take 15 minutes, instead takes an hour as the installer puts in grounding equipment, reroutes cable that is improperly attached, changes fittings and adds environmental protection that was left out during the original installation.

This kind of rework is extremely expensive, especially considering the operator is paying for the work to be done twice, first by the contractor or employee who did the initial install, and second by the rework installer.

## The cost of poor work

Even more of an impact than the rework cost is the poor service that is provided by a defective drop. If a customer disconnects because of poor service (and a large number do), what is the cost to the operator? One method of assessing the cost might be to look at the cost of a basic subscriber acquisition in the cable system.

Another method of assessing the cost of a lost subscriber is to look at the cost of acquiring that subscriber in a system purchase, a cost that ranges up to several thousand dollars.

In the past we lived with the scenario of disregarding the cost of poor quality because our systems were growing so fast their growth masked basic problems such as customers who disconnect because of poor quality service.

It won't be that way in the future. We are moving away from an expansion mode in many of our systems to an operating mode. In this environment our successes will be measured in small increases in subscriber penetration. One, two, or three percent increases in basic penetration will be demanded of us and we will be forced to concentrate our efforts on retaining customers.

Total Quality Management is the best method of doing this. With the current nationwide interest in TQM, an MSO's commitment to this movement would signal national policy makers that the cable industry is serious about improving customer service quality. Who knows, a cable operator might even win the Malcom Baldridge National Quality award. ■

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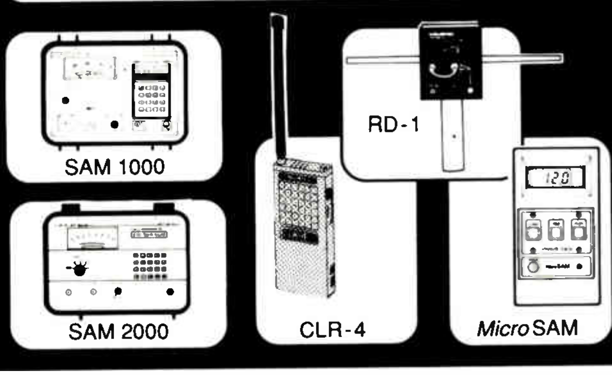




# Easier testing with a CATV analyzer: Part IV

Thus far in this series we've discussed some of the advantages of using a portable, spectrum analyzer-based CATV analyzer. We've described the basic operation of the instrument as well as important measurement techniques that enable us to make fast, accurate measurements on a cable system. However, our CATV analyzer has much more to offer than just traditional spectrum-analyzer functions. This final article takes a look at new capabilities and "convenience" features made possible through the use of internal microprocessors and then examines special CATV functions and tests programmed into the instrument. Our examples use the HP 8590 CATV analyzer series made by Hewlett-Packard Co.

## Advanced functions and features

We've seen that the CATV analyzer has three keys for basic operation: *Frequency, Span* and *Amplitude*. The remaining keys on the front panel, grouped in sections, activate additional menus of softkeys or directly implement a function. In the *Control* section, for example, the BW key accesses a softkey menu that allows you to change resolution and video bandwidths. In the *Marker* section, the *Peak Search* key places a marker on the displayed signal of the highest level and also activates the marker menu for further selections.

Other keys offer quick task execution. After a marker is placed upon a signal, for example, the *Signal Track* key holds it at screen center as the span is narrowed. For a hard copy of test results, the *Copy* key sends displayed information on the CRT directly to a printer or plotter. These copies can be annotated with a screen title by using the *Display* key.

Other capabilities found in modern spectrum analyzers perform even more sophisticated functions. Markers, for example, not only simplify testing by locating signal peaks, but also perform amplitude and frequency measurements very quickly, displaying the results on the CRT. Trace functions give you control of three active traces that can be used individually or together. For example, a *Max Hold* softkey captures and displays the peak amplitude of a modulated carrier. A *Video Average* softkey (similar to video filtering) helps locate beat signals by smoothing the carrier modulation. In addition, trace-math and trace-normalization functions simplify frequency-response testing.

Microprocessors have also made possible greater storage capabilities within the analyzer. Up to 50 combinations of control settings, traces and instrument states can be saved in non-volatile memory for later reuse. Memory cards, approximately the size of a credit card, provide essentially unlimited storage capacity. Computation abilities have been increased as well, as evidenced by the instrument's ability to adjust reference level and amplitude scale corresponding to selections of external preamplifier gain, input impedance (50 or 75 ohms), and amplitude units (dBm, dBmV, dBuV, volts or watts). Stored calibration programs allow the analyzer to automatically test and adjust itself without additional equipment. Also, the analyzer can be controlled by a computer to execute programs for such applications as proof-of-performance tests and headend monitoring.

The CATV analyzer is a "smart" instrument that can be programmed to copy manual measurements, make decisions, perform calculations and interact with the operator. Certain complex series of operations and calculations have been stored in permanent memory and are available as single-key or one-button functions. These include:

1. **Maximum-to-minimum peaks**: A softkey places markers on the highest and lowest signals displayed. Then the analyzer reads out their frequency and amplitude differences. This function is helpful for measuring peak-to-peak variations in the frequency response of the system.
2. **Fast fourier transform (FFT)**: A softkey implements a special computer algorithm used for analyzing low-frequency AM such as 60 Hz powerline hum. With the FFT, the analyzer displays a low-frequency spectrum about the modulated carrier. Modulation components (for example, 60 Hz harmonics) are viewed as individual sidebands relative to the carrier.
3. **CATV measurements**: A softkey activates the CATV menu of single-key functions that turn the spectrum analyzer into a CATV tester. A discussion of how these functions are used to perform cable-television measurements follows. Other single-key functions measure third-order distortion, 3- and 6-dB bandwidth points, and percent AM. Customized single-key functions can be developed on a computer and loaded into the analyzer by computer or memory card.

*By John Cecil, Mary Jane Pahls, Hewlett-Packard Co., Signal Analysis Division*

## CATV functions and tests

The special functions and tests in the CATV analyzer greatly simplify and shorten the tasks of an engineer or technician working on the trunk or at the headend. These single-button tests

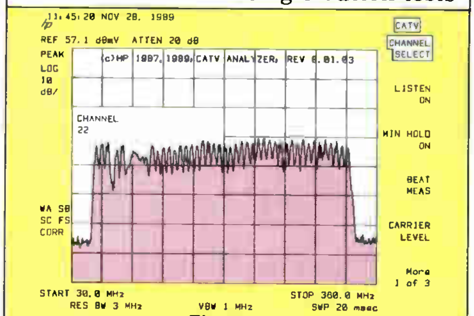


**Figure 1a**

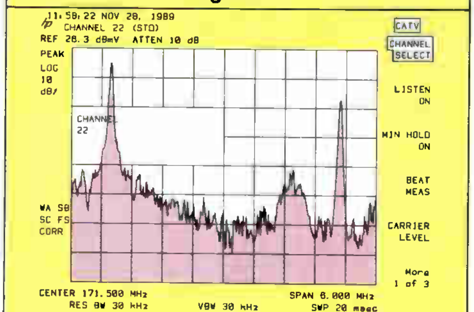


**Figure 1b**

are simpler to set up and execute than manual measurements. Calculations proceed quickly, and test times are short. Tests are repeatable since they are done the same way each time. The ability to quickly produce (in about 20


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seconds) a copy of test results using a printer eliminates the problems of recording results with a scope camera. Five special functions are used in executing CATV tests:

**Channel Select** allows you to tune to TV signals by entering just the channel number (Figure 1a); the step-up and step-down keys are used to step between adjacent channels. Then the analyzer displays a 6 MHz span that includes the visual and aural carriers of the channel. This is a convenient point for starting and ending tests (Figure 1b).

**Tune Configuration** sets the analyzer for the channel-assignment type, or frequency configuration, of your system. Four formats are available: *Standard Channels, HRC Channels*, and *IRC Channels* as defined by EIA IS-6 Channel Identification Plan, or *Air Channels* for broadcast TV frequency allocation as defined by FCC Numerical Designation of Television Channels (Codes of Federal Regulations Section 73.603).

**Listen On** enables the analyzer's FM demodulator and speaker so that you listen to the aural carrier while viewing the channel spectrum.

**Trace Minimum Hold** helps to resolve intermodulation products (beats) that are close to the noise or modulation level. This function continuously places the minimum level of Trace A into Trace B while Trace A displays current trace data. Using the *Video Average* function with *Trace Minimum Hold* on the active trace makes the beat even more discernible. Both functions lower the displayed noise and modulation around the beat so that its amplitude and frequency can be measured with the markers.

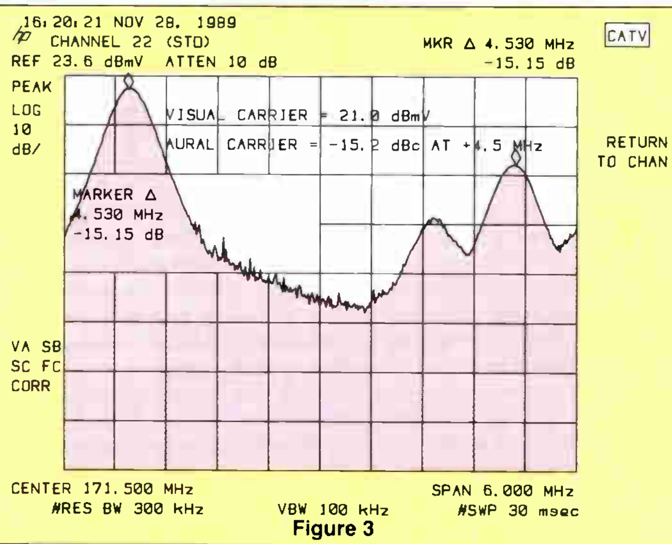


Figure 3

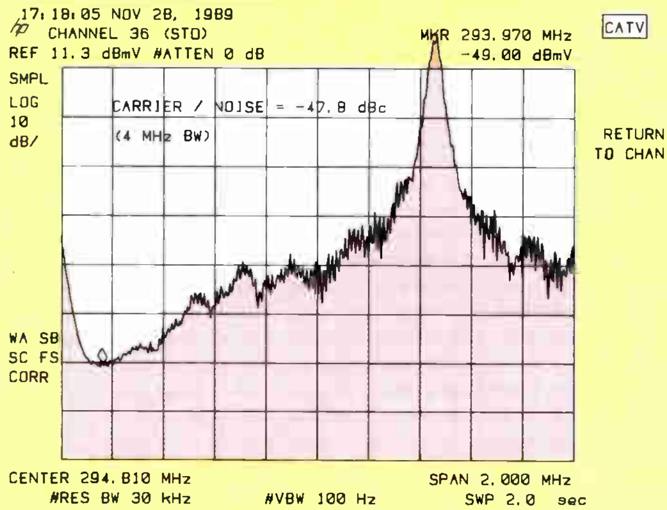


Figure 4

**Beats Measure** combines several functions to make a single, convenient function for identifying intermodulation products and interference signals.

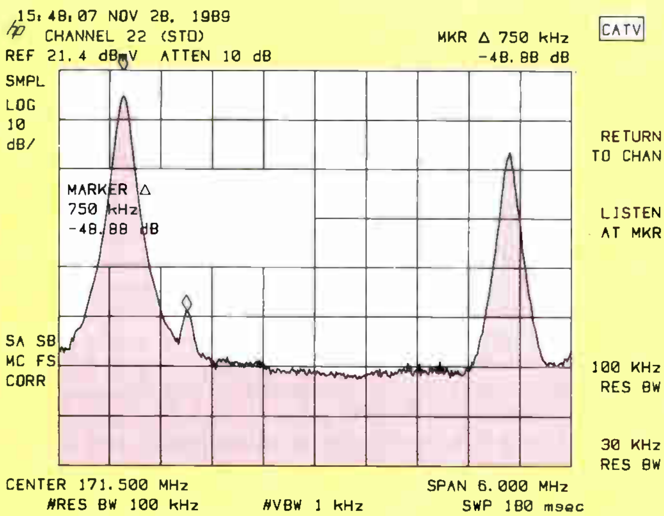


Figure 2

The analyzer first places a marker upon the visual-carrier peak level (using the technique for the carrier-level test that is described next) and enables the delta marker. Then, the analyzer implements the *Trace Minimum Hold* function and displays only the minimum-held trace. By moving the marker to any displayed beat, you can identify its frequency and amplitude relative to the visual-carrier peak. (See Figure 2.) Selecting *Listen at Marker* and either AM or FM lets you listen to the beat modulation.

The CATV tests that reside in the analyzer are among the most commonly made proof-of-performance and system-maintenance tests. These tests include the following:

**Carrier Level** measures the carrier peaks, with or without modulation. The analyzer displays the visual-carrier level and the relative aural-carrier level. A 300 kHz resolution bandwidth is used to capture the total power of the

visual carrier while rejecting the energy from adjacent carriers. The active trace is put into maximum hold and several sweeps are taken to ensure accurate measurement with the markers of the peak amplitude. The trace is then put into a store/view mode and numeric results are displayed on the CRT. See Figure 3.

At this point, test results can be recorded manually, screen data can be sent directly to a printer, or CRT-trace and analyzer-state data can be stored. This test, and the other CATV tests, can be repeated for all channels across the CATV band by using the step-up and -down keys to step between channels.

**Carrier Noise** measures the ratio of the peak carrier level to the minimum noise between channels. The carrier is moved to center frequency and the span reduced to 2 MHz. The peak of the carrier is measured with the same technique used for *Carrier Level.* The resolution bandwidth is reduced to prevent overlapping of the lower channel's aural signal and the visual signal being measured. The guard band between channels is displayed: the visual carrier is shown to the right and the lower-channel aural carrier to the left. The analyzer pauses the test and displays a message asking the operator to make adjustments as necessary.

This interaction adds measurement flexibility, allowing the operator several choices: turning off the modulation or the carrier, raising the displayed-noise level, or tuning to a vacant area in the band. When the test is continued, the noise is averaged, and a marker is placed upon the lowest displayed noise level. Then the ratio is calculated, referenced to a 4-MHz noise-power bandwidth, and read out on the display (Figure 4).

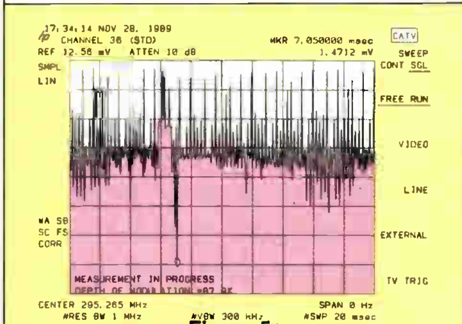
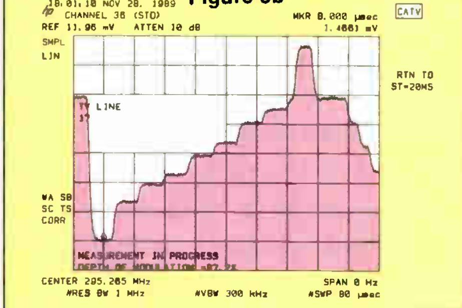



Figure 5a

Figure 5b




**Depth of Modulation** measures the percent of amplitude modulation (AM) on the visual carrier. This test uses a new technique very different from interpreting horizontal-line waveforms. The visual carrier is centered and moved up to the reference level, and the resolution bandwidth is widened to capture the modulation. The amplitude scale is changed from log to linear (volts), and the span is set to zero hertz in order to demodulate the carrier and display the resulting video signal in the time-domain.

The analyzer measures the mini-

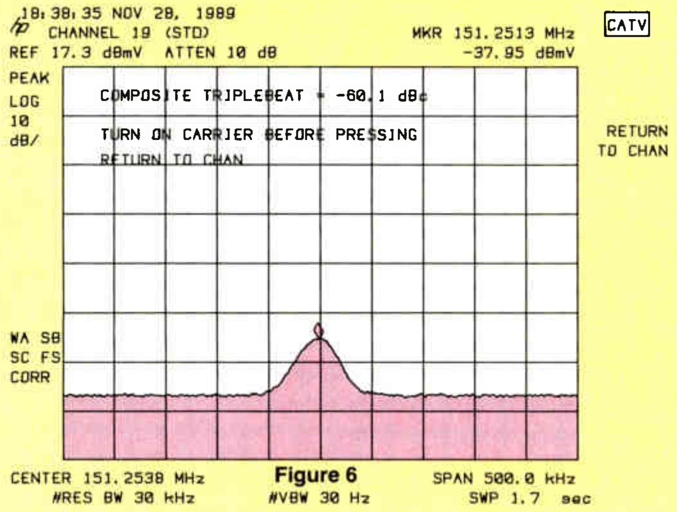


Figure 6

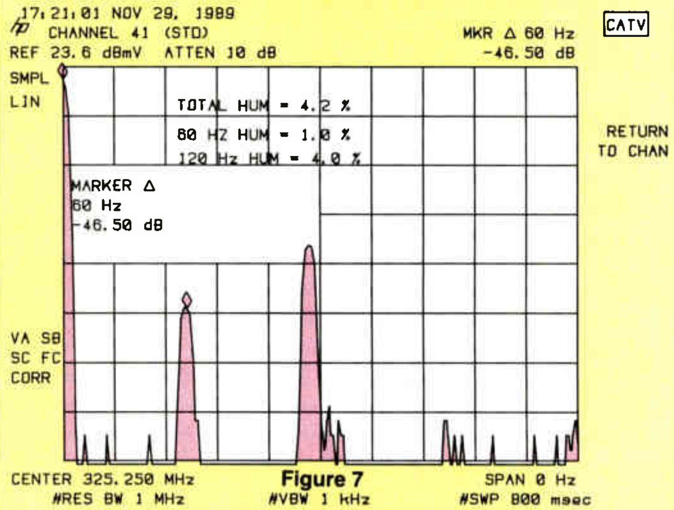


Figure 7

mum signal amplitude, which corresponds to the white level, and the maximum, which is the sync-pulse peak. The percent modulation is calculated and displayed using the ratio of these two levels as they are continuously measured (Figure 5a). Updates are made every three seconds. Modulator adjustments can be made during the measurement while the results are viewed on the CRT.

Individual horizontal lines can be viewed during the test by selecting the *TV Line #* softkey and entering the line number. Figure 5b shows the gray-scale waveform of line 17. The modulation-depth measurement continues, in this case, only upon the selected line.

**Composite Triple Beat (CTB)** measures the third-order-intermodulation distortion relative to the peak carrier level. Because the CTB products align in frequency with the visual carrier, the carrier must be momentarily disabled during the test. The analyzer zooms-in on the signal and measures the carrier peak with the same technique used for Carrier Level. Then the display prompts the operator to turn off the carrier. At this time, the test conditions can be modified as was allowed with Carrier Noise: Some possible modifications are moving the CTB products up on the display, tuning to another part of the CATV band, or tuning-off from carrier center to measure composite second-order distortion.

When the test is continued, an average level for the composite products is found, and the relative difference between it and the carrier is displayed (Figure 6). The analyzer then prompts the operator to turn on the carrier again. The speed of this test minimizes disruption to customer service. HUM measures the power-line related distortion on a visual carrier and displays the percent AM for the 60 Hz and 120 Hz components of hum and the total hum (square root of the sum of each component squared). The carrier must be unmodulated because the 59.94 Hz vertical rate causes interference with the test.

The test setup is similar to that for Depth of Modulation: The visual carrier is demodulated in zero-hertz span with a wide bandwidth and linear gain. The FFT function analyzes the resulting time-domain signal for hum components. Then the numeric results are displayed along with a low-frequency spectrum of the hum—Figure 7 shows the carrier at the extreme left and the 60 Hz and 120 Hz components to the right. The FFT measurement technique is fast, accurate and provides useful troubleshooting information about the hum source. For example, excessive 60 Hz hum points to shielding problems while too much 120 Hz hum may indicate a faulty power supply.

**Cross Modulation** uses the FFT function in a similar manner to the hum test, in this case to measure the 15.7 kHz sync interference on an unmodulated visual carrier. Although this measurement can be made in the frequency domain, using the FFT is much faster. In Figure 8, the visual carrier is at the left and the 15.7 Hz sideband is to the right.

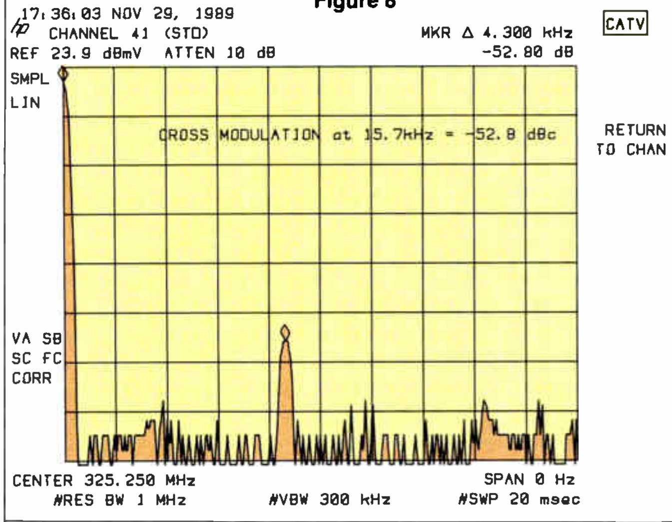


Figure 8

*Frequency Response* displays the flatness (or frequency response) of a CATV system without disruption of the picture or digital-data transmission and without the use of a sweep generator. This function works on systems with or without horizontal-sync-suppression scrambling. In a two-step process, the analyzer compares a reference trace taken at some point in the system (for example, the headend) with an active trace taken at a different point (for example, the trunk amplifier). Because the CATV channels rather than a sweep generator are used for the signal source, all or any part of the system can be tested, including new cable sections as they are installed.

In the first step of the process, the analyzer develops a CATV-system reference trace from the measured carrier peaks. The operator only needs to enter the start and stop frequencies corresponding to the frequency spectrum to be tested and press the *Frequency Response Setup* softkey (Figure 9a). The resulting reference trace (Figure 9b) is then stored in one of 50 nonvolatile memory locations.

After moving to a new position in the CATV system, the operator recalls the reference trace—no analyzer adjustments are required because control settings are recalled with the trace. When the *Frequency Response* softkey is pressed, the analyzer compares the spectrum at the present location with the recalled reference trace. The difference between these traces is the measured system flatness which is continuously updated every two seconds (or eight seconds for *systems* with scrambled channels). The operator can make trunk-amplifier gain and slope adjustments while observing the changes to the system on the CRT. Display markers can measure "suck-outs" and ripple in the response as demonstrated in Figure 10.

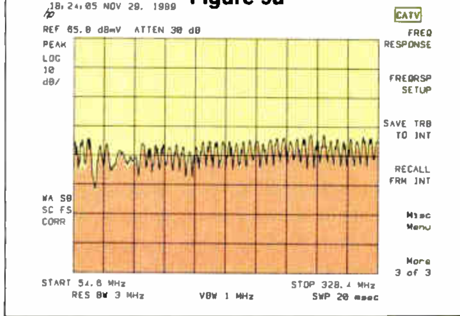


Figure 9a

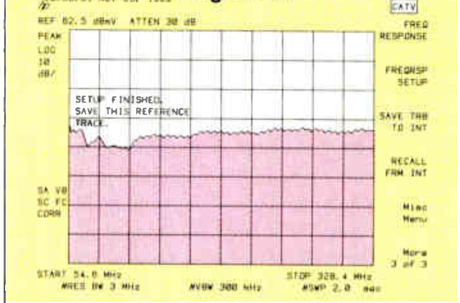


Figure 9b

These specialized tests are not the only ones that the CATV analyzer is capable of performing. As a fully functioning spectrum analyzer, it can be used to execute custom programs or to perform many additional tests manually. With the addition of a dipole antenna and preamplifier, the analyzer measures signal leakage. Co-channel interference is located by searching for additional carriers at 10 kHz offset from the visual carrier. Other tests include measuring stereo-sideband level and FM deviation (using markers and the maximum-hold function or the carrier-null technique). ■

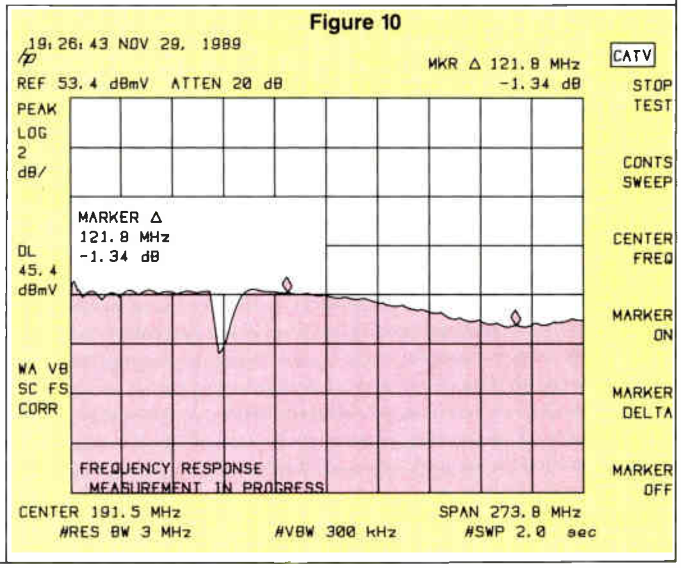


Figure 10

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## WHAT'S AHEAD

### SCTE

*Following is a list of SCTE technical seminars with contact name. If known, location and seminar topic are listed.*

**January 11** *Big Country Meeting Group* Sweetwater, Texas. Contact Albert Scarborough, (915) 698-3585.

**January 16** *Sierra Meeting Group* "20 Year Plant" featuring sessions on "Coaxial Cable" presented by Comm-Scope, "Connectors and Interface" presented by Gilbert Engineering, "Environmental Considerations" presented by Channell Commercial and "Quality Control and Inspection" presented by Sacramento Cable. Contact Steve Allen, (916) 786-2469.

**January 17** *Dixie Chapter* Contact Greg Harden, (205) 582-6333.

**January 17** *Greater Chicago Chapter* "BCT/E Category I, Signal Processing Centers." Contact Joe Thomas, (312) 362-6110.

**January 17** *Ohio Valley Chapter* Contact Bill Ricker, (614) 236-1292.

**January 17** *Mount Rainier Chapter* "Installers." Contact Sally Kinsman, (206) 821-7233.

**January 17** *Dairyland Meeting Group* Contact Bruce Wasleske, (715) 842-3910.

**January 20** *Cactus Chapter* "System Design." Contact Harold Mackey Jr., (602) 866-0072, ext. 282.

**February 13** *Greater Chicago Chapter* (Tentative) BCT/E testing to be administered. Contact Joe Thomas, (312) 362-6110.

**February 16** *Miss-Lou Chapter* Biloxi, Miss. Contact Charles Thibodeaux, (504) 641-9251.

**March 7** *Sierra Meeting Group* "Trunk Sweeping and Preventive Maintenance" with presentations by Calan, Wavetek and SAC Cable at the Oxford Suites Hotel, Roseville, Calif. Contact Steve Allen, (916) 786-2469.

**March 8** *Big Country Meeting Group* Abilene, Texas. Contact Albert Scarborough, (915) 698-3585.

**March 21** *Greater Chicago Chapter* "Safety." Contact Joe Thomas, (312) 362-6110.

**April 18** *Sierra Meeting Group* "Signal Security and Scrambling Techniques" presented by Scientific-Atlanta and "Satellite and System Theft of Service" with Jim Allen of the NCTA. To be held at the Oxford Suites Hotel, Roseville, Calif. Contact Steve Allen, (916) 786-2469.

**April 20** *Miss-Lou Chapter* Baton Rouge, La. Contact Charles Thibodeaux, (504) 641-9251.

### C-COR ELECTRONICS INC

C-COR Electronics "state of the art" seminars are three-day events designed to instruct relatively new technicians in basic theory, installation and maintenance of cable TV systems. Attendance is limited to a maximum of three persons from one system. The fee is $195. Call Teresa Harshbarger, (800) 233-2267, ext. 326 to register or for additional info on any of the following 1990 seminars.

**January 16-18** San Diego, Calif.
**February 13-15** Charlottesville, Va.
**March 20-22** Atlanta, Ga.
**April 24-26** Albany, N.Y.
**May 22-24** Allentown, Pa.
**June 19-21** Indianapolis, Ind.

### FC²

Fiberoptic Communications Corp. offers 5-day fiberoptic splicing and termination workshops. All workshops are held at its training facility in Sturbridge, Mass. The fee is $1,495 for 1-3 students and $1,195 for more than four students. For details or registration call, (508) 347-7133.

January 22-26
February 26-March 2
March 19-23
April 23-27
May 21-25
June 25-29

### Etcetera

**February 12-14, 1990** *Second Annual HDTV Conference and Exhibition* will take place at the Hyatt Regency Crystal City at the Washington National Airport. The conference is jointly sponsored by *HDTV World Review* and *HDTV Newsletter*. For registration or additional info call, (800) 635-5537 or (203) 226-6967.

**March 26-29, 1990** The *North Central Cable Television Association* annual trade show and convention will be held at the Hyatt Regency, Minneapolis, Minn. For information call Mike Martin, (612) 641-0268.

Do you have a technical event or seminar you'd like to publicize? Just send a notice of your event to: CED, Event, 600 S. Cherry St., Ste. 400, Denver, CO 80222, (303) 393-7449.

The CABLE POLL

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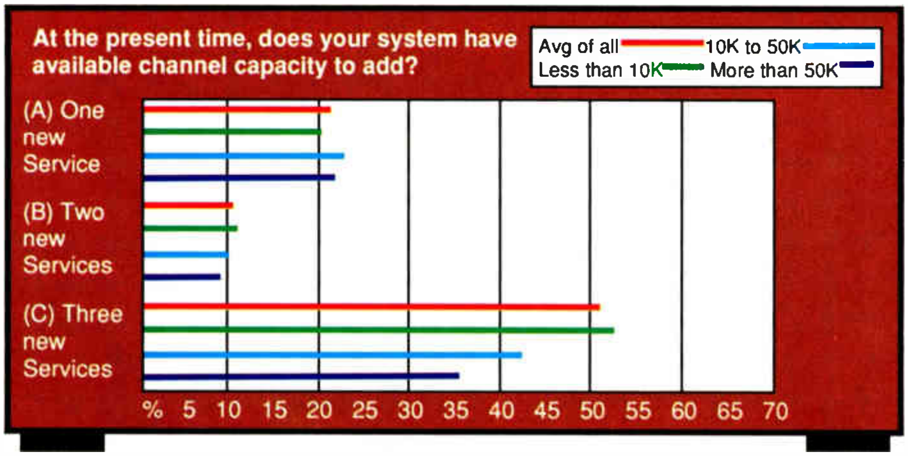
# Half of all operators surveyed say they have capacity to load three extra channels

It is widely assumed in the cable business that most systems today are fully loaded and simply do not have available capacity to squeeze in any more programming services. According to this conventional wisdom, which frequently is cited in the debate over the prospects of the two comedy channels and other new services hoping to gain carriage, fallow channels are an endangered species that will be saved from extinction only by the spate of rebuilds now underway.

But statistics from the Cable Poll™, in what is believed to be the first thorough documentation of unused capacity, reveal that there probably are many more fallow channels out there than assumed. Interviewed by Cable Poll™ researchers, 51 percent of the nearly 400 operators surveyed said their systems have available capacity to add three or more new services. Eleven percent of operators said they were capable of adding two new channels and 22 percent said they had room for one new service. The poll has a margin of error of plus or minus five percent. An extrapolation of the figures, based on the mid-points of the responses, indicates that the typical cable system has available capacity to add 1.95 channels.

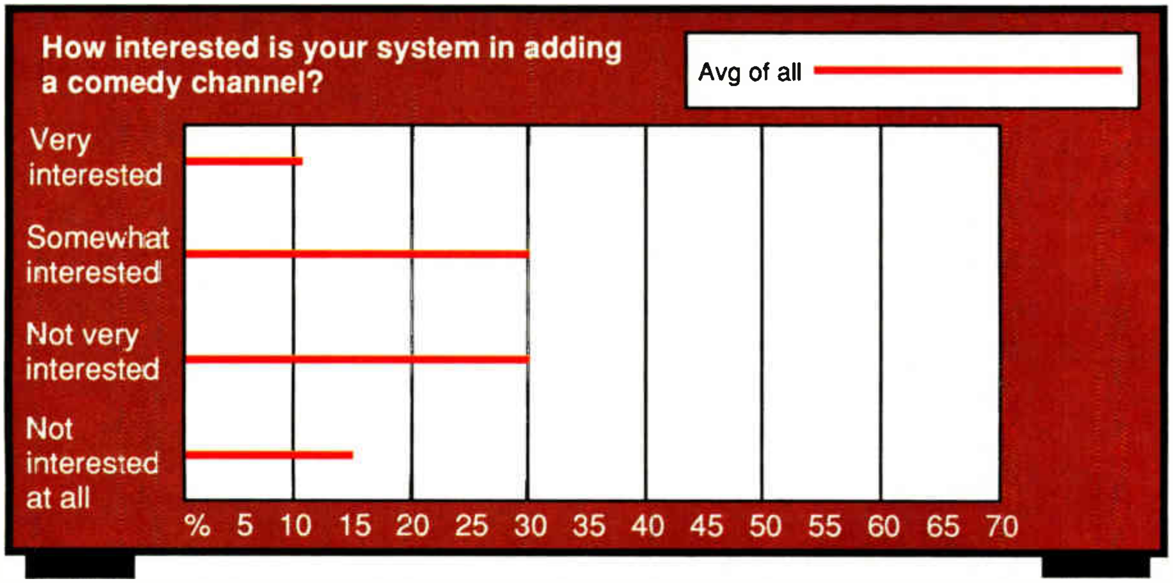



Several MSO and program network executives who were asked to comment on the data, however, said it would be wrong to conclude from the statistics that all or most of those dark channels in fact are usable. Much of this capacity could be tied up in dedicated but unused LO or PEG channels; others could become usable only after a converter retrofit or upgrade, while still others may have been committed by MSO headquarters to the slow rollout of a new service.

On the other hand, a close scrutiny of the statistics indicates that available capacity may be greater than assumed because the pace of the industry's rebuilds may be further along than is assumed. That conclusion is prompted by a breakdown of the data on available capacity according to a system's number of subscribers and size of MSO ownership. While 41 percent of systems owned by top 25 MSOs said they had three or more available channels, 70 percent of those owned by MSOs outside the top 100 said they had that much excess capacity. And at individual systems, the number saying they had three or more channels available runs in inverse proportion to number of subscribers served. These older, "classic" segments of the industry are believed to have begun rebuilding before their urban counterparts.

Even granting those caveats, the executives still expressed surprise at the statistics on available capacity. "That's just amazing to me," said TKR President Paul Freas in a comment typical of many. But he and other MSO chiefs, while conceding that their systems could accommodate a few more channels if necessary, said that's a big "if," given the continuing escalation of programming costs. In an operational sense, the executives said, channel capacity is of less meaning as a critical yardstick than financial capacity, and on that count many said their programming budgets are fully loaded.

"The problem we have is that without adding anything, our programming rates will go up about 12 to 15 percent just from built-in increases" as rate increases agreed to in earlier years begin to kick in, said the CEO of a top 10 MSO who asked not to be identified because he was disclosing budgetary information. "If you have put TNT on, as we did, you will get a 15 percent increase in the out years. And for many of the other, older services, if you have longer-term contracts, you have built-in increases in many cases," this CEO added. "So when I look across my systems, what I see is costs increasing 13 percent on average with no increase in programming. You then add that many of us have committed to the Goodwill Games, and you're over 15 percent for the year



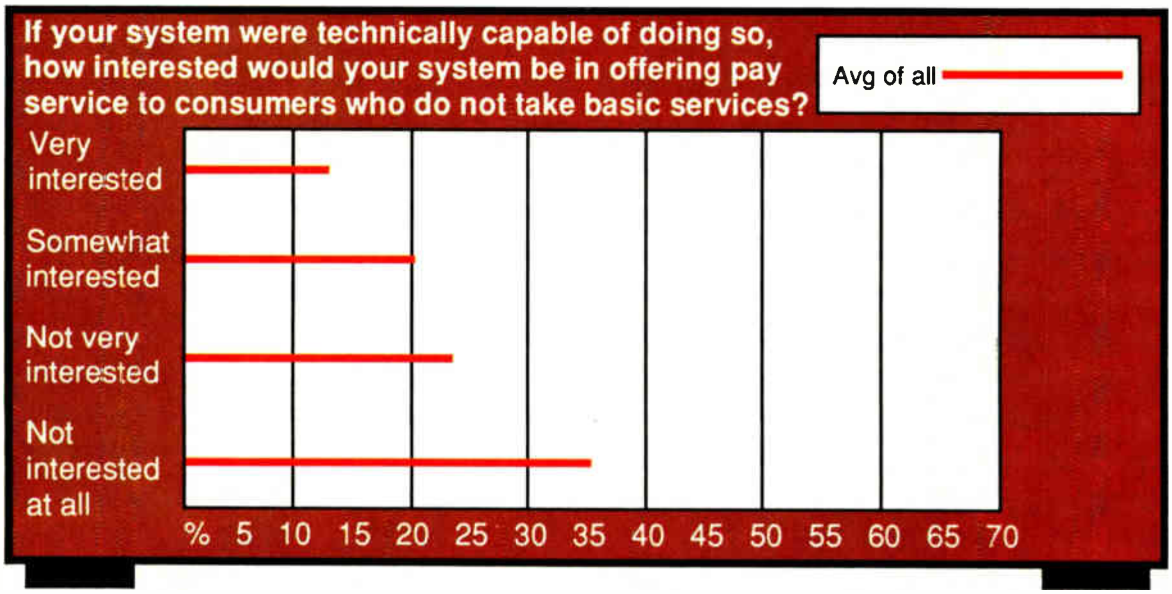

before you add any new services."

Given that most systems are carefully husbanding their available channels for budgetary reasons, the programmers which do stand a good chance of grabbing one of these unused channels are those which now split a channel, said Nick Davatzes, president of Arts & Entertainment Network. "I would think it makes perfect logic (to give a dark channel to a service now carried part-time)," Davatzes said, pointing to three factors. "One, you have a longstanding business commitment to do that; second, it is cost-effective because you already are paying for the service; and third, you can pick up on the ability to serve the consumer the way it (the channel) was designed."

Also contending for those precious spots on the dial are The Comedy Channel, the HBO service which launched last month to a universe of roughly four million, and HA!, which plans an April launch. As part of the survey on available capacity, operators were asked how interested they are in adding a comedy channel, and the results show that the industry is about evenly divided on the topic.

Overall, 12 percent of operators said they were very interested in comedy, counterbalanced by the 16 percent who said they were not interested at all. The bulk of the industry falls in the middle, evenly split at 30 percent each among those who are somewhat interested and not very interested. Interestingly, that breakdown remains fairly constant among operators of small, medium or large systems or whether the system is owned by a small, medium or large MSO.

The survey also attempted to gauge operator interest in the concept of offering pay service to customers who do not take basic. Surprisingly, about a third of all operators surveyed said they were very or somewhat interested in marketing pay separately from basic. The positive responses are noticeably greater at smaller systems and those owned by smaller MSOs, segments of the industry which tend to have high penetrations and where additional subscriber revenue often is dependent on increased pay ratios. ■



# The Visibility of Consequences

Years ago, I took a course in Behavioral Science which was designed to improve understanding of the motivation of teams in the workplace. The most important lesson from that course was that the most effective method of modifying behavior is to make the consequences of the behavior clearly evident. This seems like such an obvious concept, yet it is very often clearly violated. We'll investigate an important cable industry case in point.

## The direct pick-up problem

Consumer electronics products have claimed to be "cable-ready" for several years. It would seem obvious that this means that the product should be capable of full performance when connected directly to the cable system. Many of these "cable-ready" products fall far short of this goal. One example of how they fall short is the direct pick-up (DPU) problem. DPU is a situation where the internal shielding of the product's radio frequency (RF) circuits is inadequate. External signals are directly picked up and mixed with the cable signals to produce unpleasant results. While this phenomena applies to all types of signals including Citizen's Band, pager service, mobile radio, etc., it is most troublesome with off-air TV signals.

In the case of a strong off-air signal, the TV or VCR picks up the signal directly. If the cable system carries the same signal on-channel, the cable version of the signal will arrive sometime later because of the slower propagation of RF energy in a coaxial cable relative to free space. The off-air signal appears as a pre-ghost, displaced some distance to the left of the cable signal. Depending on the relationship of the phases of the carriers of the two signals, the ghost may be positive, negative or a non-linear combination of the two which has some positive and some negative characteristics. It can be quite unpleasant. If the cable system has the channel's carrier off-set, nasty diagonal bars may appear rolling through the picture.

From the cable subscriber's point of view, the DPU problem is the cable company's fault. The logic is simple and obvious even though it's wrong. When the TV set is connected to an external antenna, the picture is sharp and clear. When it is connected to the cable, there is a nasty ghost. Sometimes there is indeed ingress into the cable system due to faulty connectors or a crack in the cable. But if the Cumulative Leakage Index (CLI) program is in effect, this should not be the case. The service technician can prove the cause of the DPU problem to himself by connecting a well-shielded converter between the cable system and the consumer's receiver. The converter's output and the TV's tuner should be on a channel not used over-the-air locally. If the ghost disappears, the answer has been found.

It is likely that this demonstration may confuse the non-technical subscriber. The best subscriber demonstration is made with a separate TV receiver that is well shielded. If the service technician can show that his receiver has no ghosts while the subscriber's receiver does, at least the cable system is cleared of blame.

The cable system may also be cleared of one subscriber. The subscriber may not wish to continue service even though the problem is not with the cable system. If the receiver is just recently purchased, he may be able to complain to the dealer of the manufacturer. Usually, that is too much trouble. Engineers from TV manufacturers who participate in the Electronic Industries Association (EIA) joint engineering committee with the NCTA report they have essentially no complaints from their customers over DPU. Thus they are unable to justify adding expense to their products or establishing design programs to eliminate DPU.

## What can be done?

The ultimate goal is to motivate the consumer electronics manufacturer to produce products which are immune from DPU problems. An intermediate goal is to motivate the subscriber to not purchase products suffering from DPU. How can this be done when it is difficult to even explain DPU to the subscriber? The answer is to apply the principle of the visibility of consequences. We must make visible—at the point of purchase—the consequences of purchasing a "cable-ready" product which suffers from DPU.

This can be done only if the customer can clearly see products which are demonstrated on an in-store cable system that is properly installed and maintained. The in-store system must not have ingress itself. If it does, all the receivers in the shop will look bad. If the in-store system presents quality signals to the receivers on display, the subscriber will naturally choose the best picture. All that is necessary is for the subscriber to know to tune to a channel which is strong off-air.

Having a well performing in-store cable system is important to the store sales crew. First, customer complaints are minimized. Second, it becomes easy to steer customers to better performing, usually higher margin products. From the cable operator's perspective, the likelihood of happier subscribers will result.

Yes, wiring stores is expensive. Getting cable to the store is expensive. Yes, maintaining the in-store system is a hassle. But how does that compare with the cost of lost subscribers and the cost of truck rolls to explain that DPU is not a cable system problem?

Loss of sales, negative feedback from the sales force, and an inability to demonstrate a "cable-ready" receiver on the in-store cable system will clearly make visible the consequences of inadequate shielding in consumer electronics products. The design priorities in the consumer electronics manufacturer's engineering lab would surely change in the face of such experiences. ■

*By Walter Ciciora, Vice President of Technology, American Television and Communications*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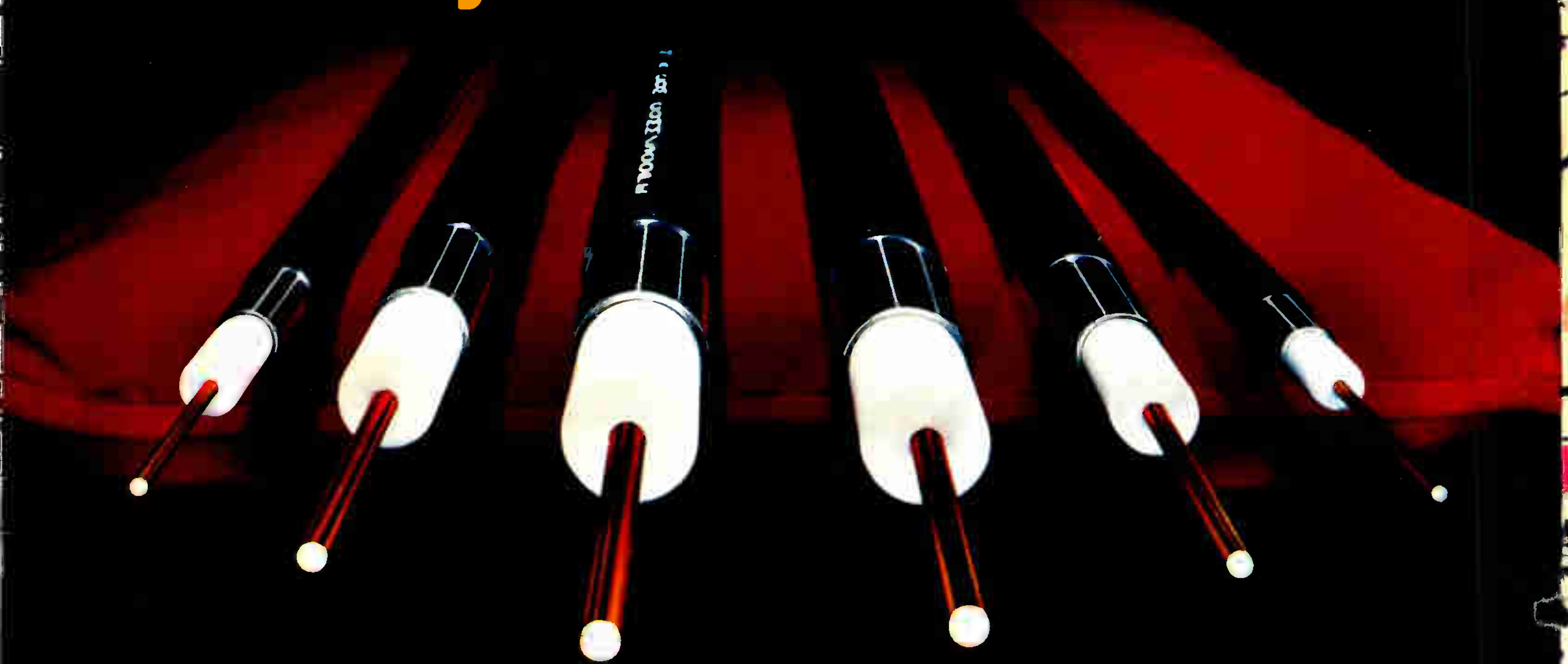

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