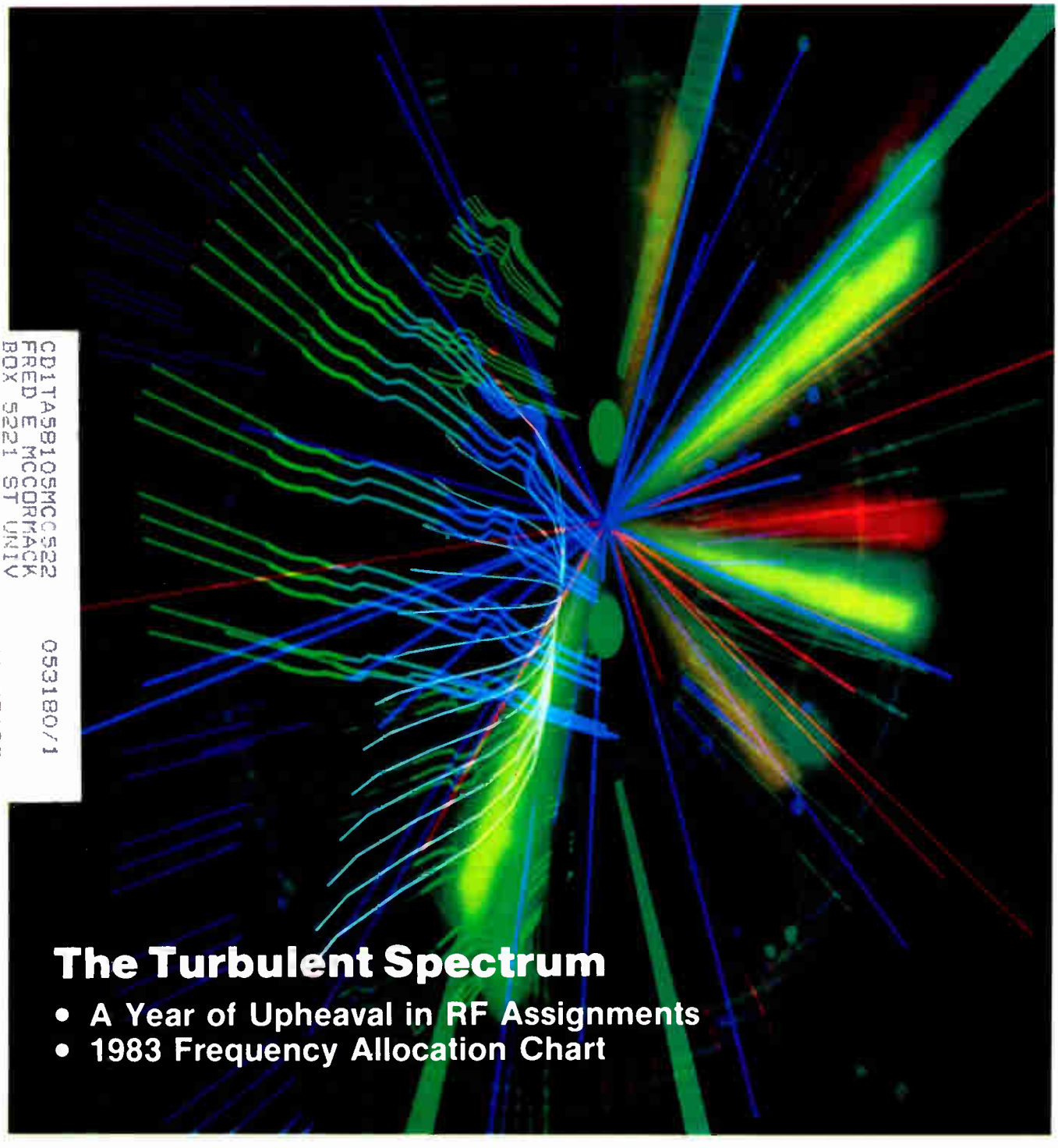
CED™

- **Tech II: LNAs**
- **Expanded Format: *Interface* Covers Business Communications**

Communications Engineering Digest/The Magazine of Broadband Technology August 1983



The Turbulent Spectrum

- A Year of Upheaval in RF Assignments
- 1983 Frequency Allocation Chart

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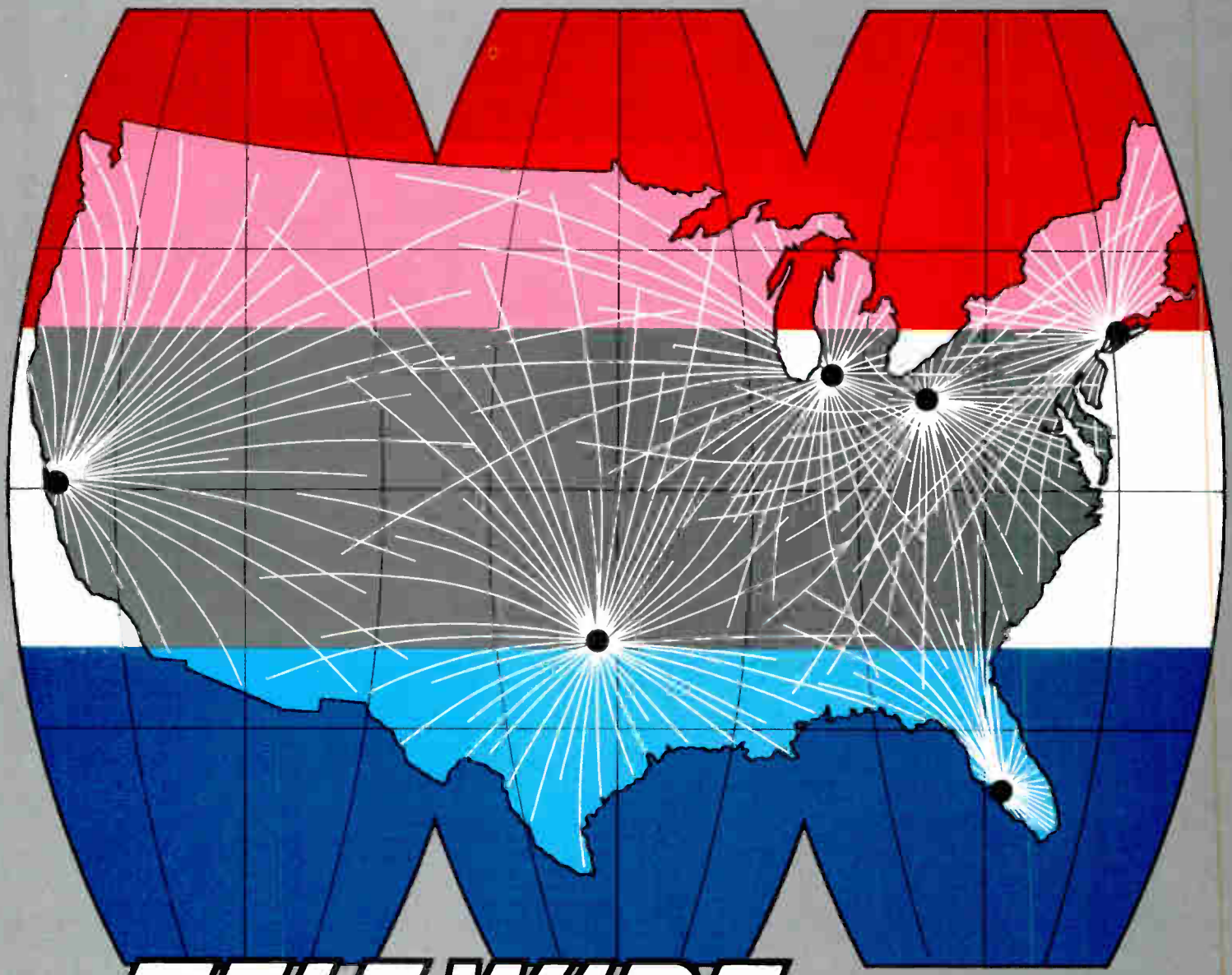

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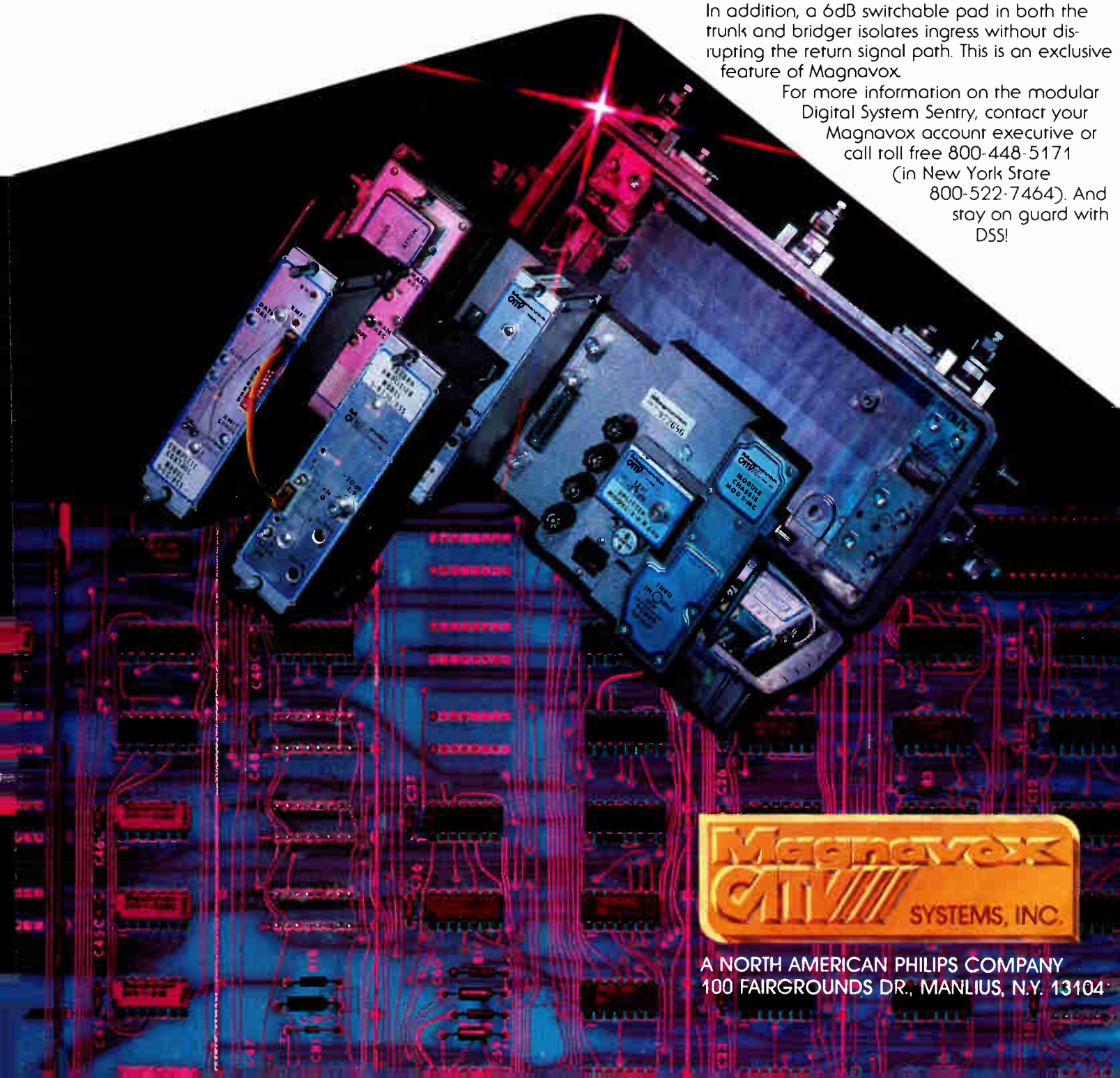

Magnavox CATV SYSTEMS, INC.

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A. D. Little Recommends Jerrold for Philly System

BALA CYNWYD, PA—Noted research and consulting firm Arthur D. Little Inc. was hired by Comcast Corp. to recommend equipment vendors for Comcast's proposed Philadelphia cable system.

In a 136-page report, Little recommended Jerrold Division of General Instrument more often than any other company. According to the study, Little considered, in assessing each vendor's equipment:

- product features and capabilities;
- soundness of technical approach;
- compatibility with other system components;
- risk of unavailability of the product when needed by Comcast;
- ability to satisfy capacity requirements of a large subscriber population as projected in Philadelphia; and,
- estimated cost per subscriber.
- For two-way subscriber response (IPPV) services, deemed to be the most important facet, Little looked at Jerrold, Pioneer, Oak, Tocom and Zenith equipment. Recommended was Jerrold's "Starcom 450 addressable converters with the Starvue SV-A modular attachment for IPPV because of this system's technical elegance, low risk of unavailability and relatively low cost," the report said.

And while the research found one-way addressable converters from Jerrold, Oak, Scientific-Atlanta, Tocom and Zenith "were considered to be viable for Comcast's Philadelphia system," the company recommended use of Jerrold's Starcom 450 one-way addressable boxes because of the best integration of the recommended IPPV system with the one-way boxes.

E-Com, Jerrold and Tocom general purpose digital systems were considered, with Jerrold again getting the nod. The report found Jerrold's Communicom/Metronet system "qualified and attractive", because of its response to innovation, high capacity and flexibility to meet new needs.

Equipment from CableBus Systems, Jerrold, S-A and Tocom was evaluated for home monitoring services, with Little reporting "each of these vendor's systems would be well-qualified" in Comcast's Philly operation. But, Little added, Tocom, because of its experience and capability, would be the first choice to be used for both security and energy management. Apart from energy management, though, Little said Comcast should itself choose "among these home security system vendors based on its own judgment concerning features, cost and terms of purchase." □

CED™

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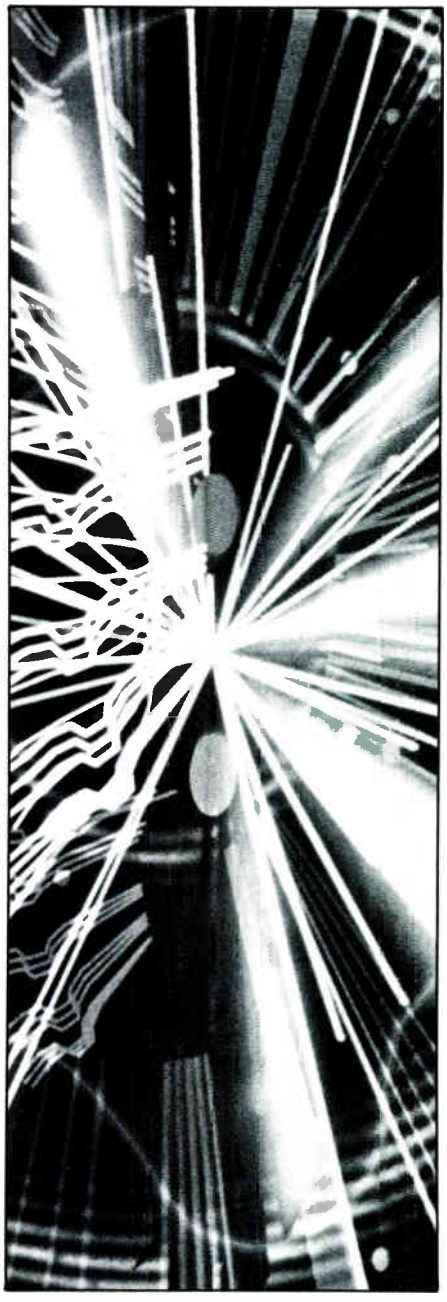
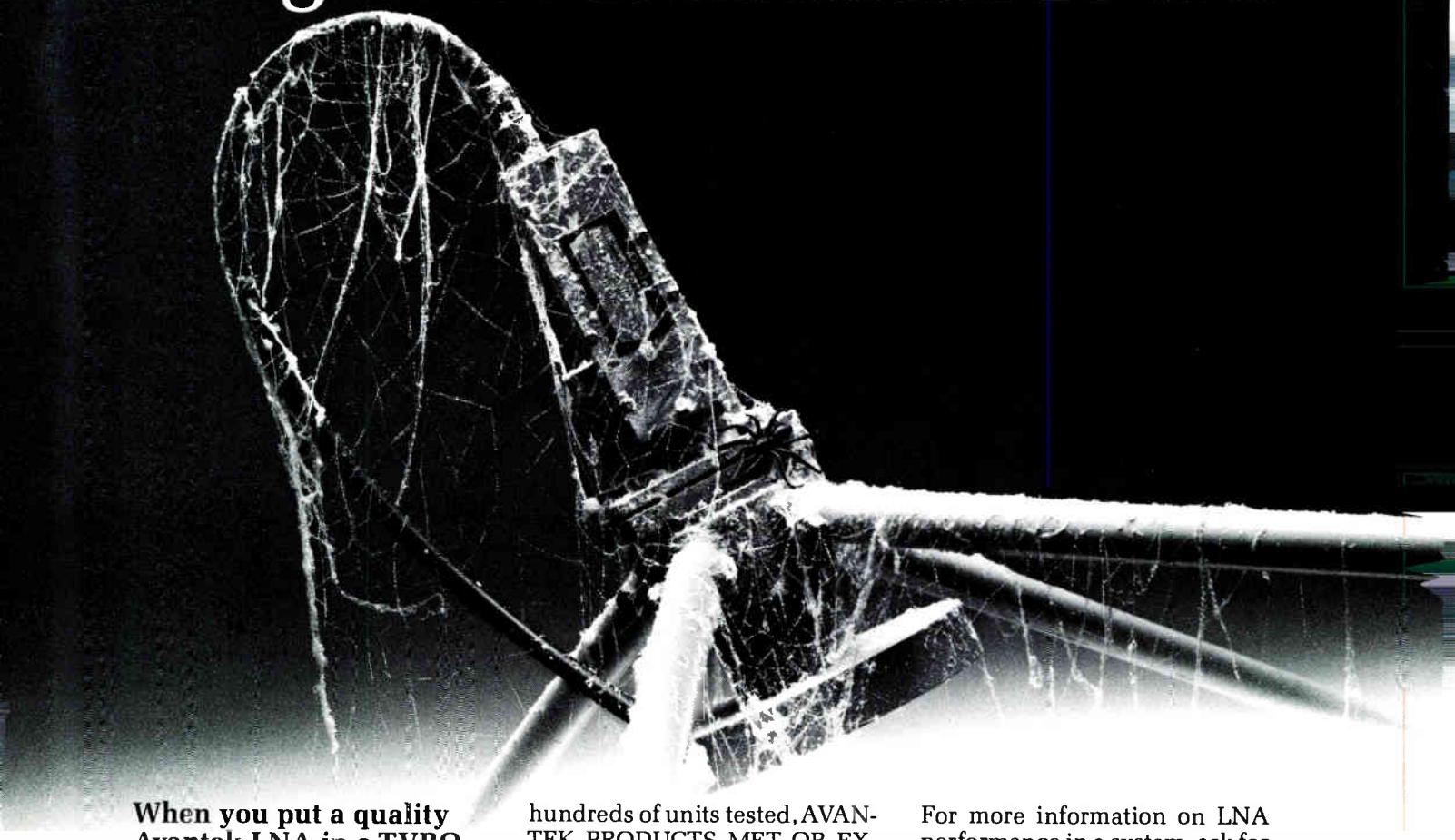


About the cover

While we managed to unravel the complexities of RF spectrum esoterica without the aid of a computer in putting together this year's frequency allocation chart, we definitely needed the machine when it came to illustrating the pace of tech-driven alterations affecting the spectrum in the past year. Dan Graves of Genigraphics Corp., Denver, Colo., is the artist who employed the computer to such good effect on this month's cover.

Forget about Avantek LNAs



When you put a quality Avantek LNA in a TVRO system, you can forget about it. It works that well.

Avantek has sold more LNAs than all other manufacturers combined. There must be a reason. Serious users know that if you don't start off at the antenna with the best signal possible, it isn't going to get any better. The LNA is the key to high picture quality. And the Avantek unit is accepted as the best. That kind of reliability means satisfied customers, with nothing left for you but peace of mind.

Tests prove it!

To put its own claims to the test, Avantek recently took the necessary sophisticated test equipment to the NSOC Show so that anyone could have their LNAs measured against certified US standards. In the open results of hundreds of units tested, AVANTEK PRODUCTS MET OR EXCEEDED SPECIFICATIONS while others did not. If we say our noise figure is 1.29 dB (100°K), then you can count on it being that, or better. You get what you pay for—and probably more.

When your customer wants the finest picture, and you want some peace of mind, suggest Avantek LNAs. They are available from our major national distributors.

For more information on LNA performance in a system, ask for our new applications note, "LNA Noise Figure Vs. Antenna Size."

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Techscope

Twisted pairs

While telcos escalate the campaign to bring cable data services under the local PUC regulatory umbrella (see page p. 16), the movement on the other track in this love/hate relationship appears to be gaining momentum as well. In a keynote speech delivered at the Videotex '83 conference in New York recently, Randy Tobias, president of American Bell Consumer Products, stated, "We believe there is a significant future for the profitable combination of two transmission media—cable and telephone—to move information between data bases and the home. They are both needed—local telephone lines for versatile interactive functions involving retail participants such as stores and banks and one-way and two-way cable systems for broadband data transmission." Company sources say American Bell is investing in such hybrid technology and may have a consumer product out within three years. Meanwhile, contacts continue between local BOCs and various cable companies as both sides explore the possibility of cooperation in the data transmission business. The latest such discussions to surface involve Warner Communications and various BOCs and possibly American Bell as well (p. 23).

Setting the tax record straight

The Mid-American Cable TV Association is tackling a problem that might go well beyond its four-state domain. Noting that Kansas property tax authorities have altered their method of valuation from original cost less depreciation to a trended cost based on arbitrarily assigned lifespans for various CATV equipment categories, the association has issued a call for documentation that would establish real life expectancy for such equipment. The association found that when it attempted to obtain evidence related to cable equipment sale prices, useful lives or obsolescence from manufacturers, suppliers and cable operators, these firms typically had not kept such records or the records were not readily accessible. In its monthly newsletter the association asks, "Can a bureaucrat whose idea that converters have a fifteen-year life and whose distribution equipment category includes pressure taps prevail because our industry can't produce hard evidence to demonstate his ideas about cable system equipment are at best uninformed?" The association, sensing that other regions of the country may be experiencing similar arbitrariness, suggests such information should be collected and made available to everyone who needs its. For starters, the association is asking operators and others to provide data on equipment life and costs to Executive Director Rob Marshall at Mid-America Cable TV Association, Route 1, Lecompton, Kansas 66050, telephone (913) 887-6119.

A better pirate trap?

How effective can use of a return-loss test at the drop site be in thwarting signal piracy? First, the good news. The test, as described in this issue (p. 26) by Lawrence Schuler, chief tech for the Heritage system in Des Moines, has produced evidence considered strong enough by local courts to support issuance of over 70 seach warrants in the past year. Since courts typically require strong proof of intent to steal before they will allow authorities access to the premises to obtain the hard evidence essential to conviction, the return loss test would appear to be an effective way to develop such evidence. The bad news is that courts in Des Moines, like courts just about everywhere these days, are overloaded with a backlog of cases, many involving crimes far more serious than cable service theft. As a result, although all eight searches conducted by authorities and Heritage tech personnel to date have produced concrete evidence of theft, there have been no arrests or attempts to prosecute. Nonetheless, Schuler says, the effort is sending a message to pirates that their activities can be detected from outside the home and that they run the risk of law authorities showing up at their doorsteps with search warrants.

Optical optimism

Apparently, General Optronics Chairman Irving Kahn is meeting with some success in his attempts to convince cable operators that his firm's new line-of-sight laser system constitutes a cost-effective, red-tape-free alternative to microwave. According to Kahn, within the next three to six months a number of MSOs will announce plans to employ the new system in various communities. Kahn made his prediction at a demonstration July 12 in New York City featuring an Atmospheric Optical Communications System that was installed last fall at J.C. Penney's midtown offices. The J.C. Penney system, operating over a bandwidth of 160 MHz, carries three video channels and one audio channel and can be expanded to include data channels as well. According to Dr. C.J. Hwang, president of General Optronics, in other applications the firm's laser system is capable of operating at frequencies up to 450 MHz and of transmitting over distances of more than 16 km. General Optronics' first line-of-sight laser system was installed at the McLean, Va. facilities of MITRE Corp., a non-profit systems engineering and reseach organization (March *CED*, p. 13). A strong selling point for the General Optronics system at the MITRE facilities was the fact that users can avoid the FCC-approval process mandated for installation of microwave transmission systems.

Calling all cable trucks

Cox Cable technicians and maintenance crews have been given a unique community-relations role to play in Tucson. With the cooperation of the Tucson Police Department, Cox is training all drivers, dispatchers, plant maintenance technicians and construction and engineering personnel in the techniques of observing and reporting possible life and property threatening situations as part of the city's Crime Watch program. Cox has two central dispatchers at radio receivers in the company's telecommunications center to whom drivers and technicians will report any suspicious situations. The cable company has between 30 to 50 individuals driving throughout Tucson during day time hours and operates some vehicles on a 24-hour basis.

Firm claims phone line video breakthrough

A small Beverly Hills, Calif.-based firm, SaTV Entertainment Corp., has acquired a controlling interest in the financially troubled CATV distributor and manufacturer Tanner Electronic System Technology, Inc. (T.E.S.T.) to facilitate development of a system that is purported to permit video transmission over a twisted pair telephone line. According to SaTV President Curtis Howard, the patented "Twin Wire Video Transmission System" is able to send up to 10-MHz in analog signals over a 19- to 28-gauge twisted pair directly to the telephone box outside the subscriber's home or to the central telephone facility within a motel, office building or apartment complex. From there the signal is transferred to another twisted pair and transmitted to the subscriber's converter or TV. Howard would not got into detail in describing the system, saying simply that it employs a $1,900 receiver/sender type of device at the point of signal origin and requires repeaters, priced at $1,350, every one and a half to two miles along the telephone line. He said a Bell operating company is field testing the product and that T.E.S.T.'s manufacturing plant in Van Nuys, Calif. will be going into production of the new system shortly.

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Isn't it time you took a close look at the new standard in video receiver systems? For price and performance, nothing even comes close. Or offers you more versatility. For more information, write Gould Inc., Dexcel Division, 2285-C Martin Avenue, Santa Clara, CA 95050. Or call TVRO Marketing at (408) 554-2306 or (408) 727-9833.

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Seminars

August

1-3: A **Community Antenna Television Association** basic technical training seminar co-sponsored by the **Southern Cable Television Association** will be held at the Country Squire Inn, Lake Worth, Fla. Contact (305) 562-7847.

2-3: A seminar on "Communications Strategy in the Year 1 A.D. (after Divestiture)" sponsored by the **Yankee Group** will be held in San Francisco. Contact (617) 542-0100.

4-6: The Third Annual Northwest Satellite Trade Show will be sponsored by **Wespercom Electronics** and held at the Memorial Coliseum in Portland, Ore. Contact Evelyn Kessler, (503) 389-0996.

9-11: A **Jerrold** technical seminar will be held in Denver. Contact Diane Bachman, (800) 523-6678 or (215) 674-4800.

10-12: Magnavox CATV Systems will hold a field training seminar with its Mobile Training Center in Columbus, Ohio. Contact Laurie Venditti, (800) 448-5171; in New York, (800) 522-7464.

11-14: The annual convention of the **Community Antenna Television Association**, CCOS-83, will be held at the Arlington Hotel in Hot Springs, Ark. Contact (305) 562-7847.

13-14: A seminar on the How and Why of Private Cable/SMATV sponsored by **Eagan & Associates** will be held at the Regency Hotel in Denver. Contact Larry Hannon, (904) 237-6106.

15-17: The second annual **National Satellite Cable Association** conference co-sponsored by ***Private Cable*** magazine will be held at the Regency Hotel in Denver. Contact Chery Grund, (303) 798-1274; or Robert Vogelsang, (713) 342-9655.

15-17: Magnavox CATV Systems will hold a field training seminar with its Mobile Training Center in Columbus, Ohio. Contact Laurie Venditti, (800) 448-5171; in New York, (800) 522-7464.

16: A meeting of the **Southern California Cable Association**, with Gillcable Chairman Al Gilliland as guest speaker, will be held at the Airport Hilton Hotel in Los Angeles. Contact (213) 653-6187.

22-24: The fifth annual Satellite Communications Users Conference sponsored by ***Satellite Communications*** magazine will be held at Stouffer's Riverfront Towers in St. Louis. Contact Cathy Chalmers or Cheryl Carpinello, (303) 694-1522.

24-26: The **Rocky Mountain Cable Television Association** annual convention will be held at the Keystone Lodge in Keystone, Colo. Contact Frank Gallik, (303) 249-2676; or Oscar Davis, (505) 538-3701.

29-31: The annual convention of the **New England Cable Television Association** will be held at the Dunfey Hyannis Hotel and Resort in Hyannis, Mass. Contact Gary Cain, (603) 224-3373.

September

7: A seminar on the Economics of Addressability sponsored by **Paul Kagan Associates** will be held at the Hyatt Regency in Atlanta. Contact Genni O'Connor, (408) 624-1536.

7-9: The second annual **Great Lakes Cable TV Expo** will be held at the Indianapolis Convention and Exposition Center. Contact Shirley Watson, (618) 249-6263; or Claude Wells, (312) 693-9800.

8-10: The Eastern Show, the annual convention of the **Southern Cable Television Association**, will be held at the Georgia World Congress Center in Atlanta. Contact (404) 252-2454.

11-14: The International Cable and Satellite Television Exhibition and Conference sponsored by the **Society of Cable Television Engineers**, the **Cable Television Association of Great Britain** and the **Electronic Engineering Association** will be held at the National Exhibition Centre in Birmingham, England. Contact Mark Voss or Mike Loughlin, (713) 463-0502.

12-13: Phillips Publishing Inc. is sponsoring its third annual DBS conference at the Madison Hotel in Washington. Contact Diane Pontisso, (301) 986-0666.

13-16: Technology Service Corp. will present a course on "Digital Communications: Satellites, Networks and Telephony" in Washington, D.C. Contact Linda Billard, (800) 638-2628.

14-16: Magnavox CATV Systems will hold a field training seminar with its Mobile Training Center in Detroit. Contact Laurie Venditti, (800) 448-5171; in New York, (800) 522-7464.

15: The **Public Service Satellite Consortium** will hold a seminar on "Buying Your Earth Station: Making the Right Decisions" at the Shoreham Hotel in Washington. Contact (202) 331-1154.

16-18: An SMATV seminar for start-up companies sponsored by **Eagan & Associates** will be held in Hartford, Conn. Contact Larry Hannon, (904) 237-6106.

19-21: Magnavox CATV Systems will hold a field training seminar with its Mobile Training Center in Detroit. Contact Laurie Venditti, (800) 448-5171; New York, (800) 522-7464.

20-22: A **Jerrold** technical seminar will be held in Syracuse, N.Y. Contact Diane Bachman, (800) 523-6678 or (215) 674-4800.

21-22: A seminar on Advanced Local Telecommunications sponsored by **Probe Research Inc.** will be held in San Francisco. Contact (201) 285-1500.

24-27: The annual conference of the **International Institute of Communications** will be held at the Americana Aruba on the Caribbean island of Aruba. Contact the IIC in London, 01-388-0671.

27: A meeting of the **International Association of Satellite Users** will be held at the Twin Bridges Marriott Hotel in Washington. Contact Donna McCaughey, (703) 437-5457.

27-29: A **Jerrold** technical seminar will be held in Quebec. Contact Diane Bachman, (800) 523-6678 or (215) 674-4800.

Looking ahead

Oct. 18-20: Mid-America Cable TV Association convention, Hilton Plaza Inn, Kansas City, Mo.

Oct 23-25: Televent '83, an international telecommunications conference, Montreux, Switzerland.

Oct. 30-Nov. 2: Joint convention of the Subscription Television Association and the National Association of MDS Service Companies, Century Plaza Hotel, Los Angeles.

Nov. 1-3: Atlantic Cable Show, Convention Hall, Atlantic City, N.J.

Nov. 1-3: Atlantic Cable Show, Convention Hall, Atlantic City, N.J.

Nov. 1-4: The International Videxpo '83, Acapulco, Mexico.

Nov. 2-4: Magnavox field training seminar, Nashville, Tenn.

Nov. 28: International Association of Satellite Users meeting, Washington, D.C.

Dec. 11-12: NCTA's National Cable Programming Conference, Biltmore Hotel, Los Angeles.

Dec. 13-15: Western Cable Show, Anaheim Convention Center, Anaheim, Calif.

Jan. 18-20: Texas Show, San Antonio Convention Center, San Antonio, Texas.

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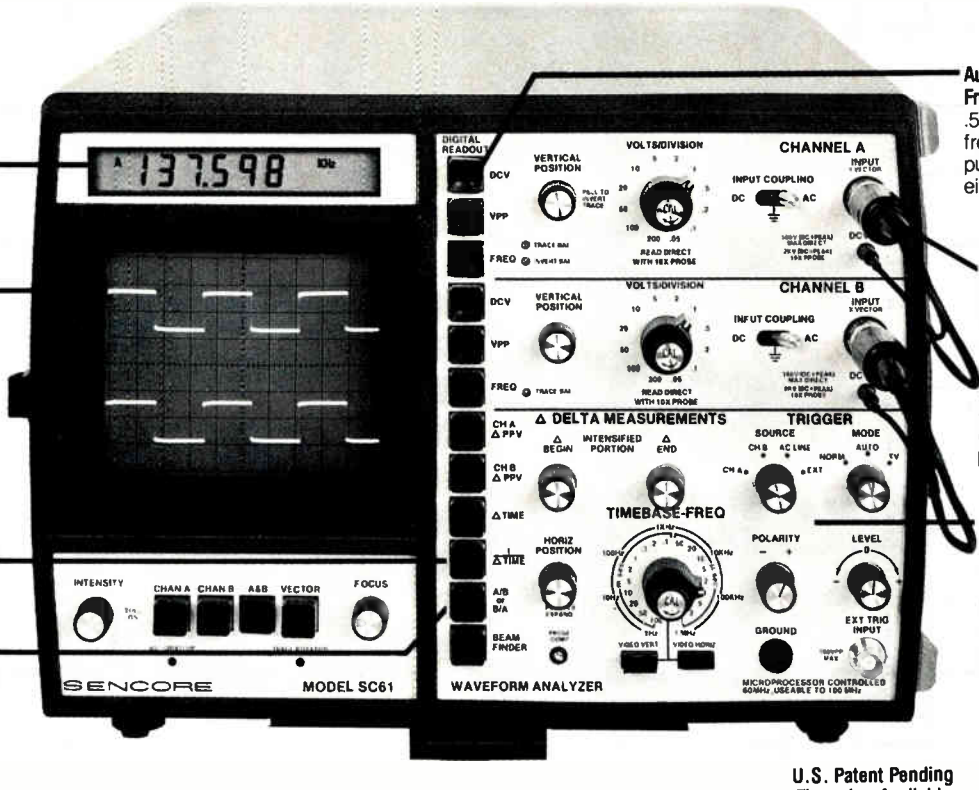

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There are no graticules to count or calculations to make, which speeds every measurement.

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Plus you have everything you want to know about a test point, at the push of a button, which speeds troubleshooting tremendously.

A special Delta function even lets you intensify parts of a waveform and digitally measure the PPV, time or frequency for just that waveform section.

And it's neat. No more tangled leads, piles of probes or dangling cords. The SC61 is an entire test station in one unit.

The one and only. There are other scopes with digital readout, but none of them completely automate every conventional scope measurement so you can automatically analyze any waveform without counting one single graticule. Totally automatic waveform analyzing at the push of a button. It will make all the difference in your productivity.

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In Perspective

The next phase

We call this issue of *CED* "Phase II" as we continue our move into new arenas of cable technology. We introduce *Interface* on page 16 as a regular monthly section relating development in business communications and the other data transmission applications for regional broadband networks. This month *Interface* focuses on such topics as Judge Harold Greene's final decision on AT&T's divestiture, ITT's intra-U.S. data transmission launch, a roundup of various litigative and administrative issues on common carrier status for cable, and Warner Communications' interest in telcos.

Interface will encompass staff-written material plus articles solicited from those involved in business communications. Expansion in this field by MSOs, manufacturers and other companies is accelerating rapidly, with newcomers such as Ungermann-Bass, which is promoting a high-speed, point-to-point broadband modem to cable systems, appearing with increasing regularity. Such players, joining the traditional CATV manufacturing lineup, reflect the fact that in communities where institutional loops are in development, broadband cable is proving itself to be a significant information conduit.

We at *CED* eagerly await progress in these experiments and operations. As we have maintained since we undertook this assignment, the potential for cable's growth into the business data transmission field is great. We believe the name *Interface,* suggesting the technological as well as market connection between traditional cable operators and these new spheres of development, appropriately encompasses all aspects of this broadly defined frontier and will play an expanding role in our overall editorial coverage.

This increased role will not be at the expense of our existing editorial responsibilities, however. Indeed, on page 26, we present a timely article on a return-loss test designed to combat piracy—a problem that continues to plague our industry at staggering proportions. Lawrence Schuler, chief technician for Heritage Cablevision's Des Moines system, has demonstrated that a special adaptation of the return-loss test can permit a cable system to develop evidence of probable intent to steal service without gaining access to a suspected pirate's premises. Such a test can successfully reduce the number of signal thieves at a substantial cost savings for the aggrieved cable system and is obviously worth further investigation.

We also offer our yearly Frequency Allocation Chart with an update on spectrum changes and expansion beyond 400 MHz. As *CED* Editor Fred Dawson reports in an accompanying article, there has been much turmoil on the spectrum front. His article and the chart, which can be removed from the book and mounted, for easy reference, on your wall or over your workbench, or over a hole in your garage, is on page 33. For their assistance in helping us prepare this chart, we'd like to thank Wendell Bailey, vice president of engineering for the NCTA, David Faye of Jerrold, and E.M. Tingley of the Electronics Industries Association. The NCTA and the EIA together came up with their own recommended CATV channel identification plan, which they have labeled as an "EIA Interim Standard." It is a valuable tool and mirrors, in part, what we have presented here.

And, in keeping with our theme of the duties of the earth station engineer as outlined for *Tech II,* we present an article by former Warner Amex staff engineer Roger Hill, who offers a way to use spectrum analyzers in predicting the effects IF filters at the TVRO site will have on picture quality. Also in *Tech II,* our monthly product profile highlights low noise amplifiers, as we compare the various LNAs on the market. *Tech II* begins on page 51.

Finally, in our move to make *CED* not only more interesting to read, but to expand our editorial scope, we offer *NewsSweep* as a new feature. *NewsSweep* will capsulize some of the bits and pieces of technical news and company announcements that do not have a place elsewhere in the magazine. We think all worthy items that might have pertinence to our readers deserve coverage.

After all, that's what we're here to do.

Volume 9, Number 8

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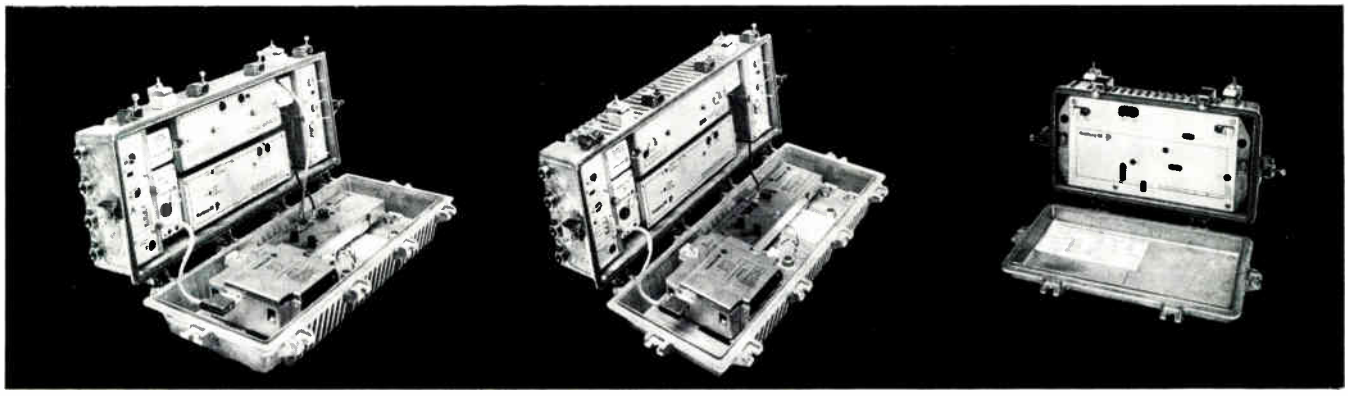

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Big strides underground

New approach saving time and money in Boston construction

BOSTON—State-of-the-art in underground cable system construction appears to be on the verge of taking a quantum leap forward, thanks to successful employment of new technologies in the Cablevision Systems Development new-build here.

McCourt Cable Systems Inc., primary contractor for the 800-mile Boston system, has brought together several techniques to produce an installation procedure that cuts underground construction time by at least 40 percent, with attendant cost savings in the 25 percent range.

According to Jerry Crusan, Cablevision's director of group engineering, the McCourt approach, while employing a variety of advances developed by other firms, represents a unique synthesis that constitutes a significant improvement over other techniques the MSO has investigated.

Crusan said the most important elements of the McCourt Boston Integral (MBI) construction system are use of "rock saw" pavement cutting equipment and pre-construction installation of cable in specially designed conduit lines developed by Integral Corp. of Dallas, Texas.

Heretofore, the underground installation construction process typically has involved digging a deep, wide trench; placing plastic conduits that connect at 10- and 20-foot intervals; encasing the ducts in concrete; refilling the trench with gravel; and then pulling the cables through the conduits.

In the new approach, the rock saw, a giant self-propelled saw, moves slowly along the street, cutting a narrow trench. The flexible conduit with cable already installed, is pulled from a seven-foot reel into the trench. The conduit is encased with a specially developed concrete, which is capped with a bituminous concrete that has been infrared treated.

Cablevision Systems has been using the new Integral conduit-encased cable approach for the past year or so, but the Boston project represents the first time the Integral technique has been wedded to the rock saw cutting process, according to Crusan. He indicated McCourt has filled an important role in bringing the two approaches together in a way that permits efficient construction without damage to underground wiring and conduits already in place.

The McCourt technique required approval of the city government in Boston, which initially frowned on the idea out of concern for potential property damage or injuries to people that might result from flying debris generated by the giant saw. The city eventually agreed to permit the new approach on a conditional basis. In the period since MBI construction began May 2, nothing has caused the city to reconsider its decision, and now the system has the full support of the administration.

Before and after shots from the streets of Boston illustrate the difference new McCourt Boston Integral approach makes in impact on roadways and crew.

Crusan said Cablevision Systems Development hopes to win approval for use of the MBI technique in its new franchises in Brooklyn and the Bronx, N.Y., as well as in Chicago and any other systems requiring substantial underground wiring. He said New York, with some 700 miles of underground wiring required in the Cablevision franchises, is an especially important market for application of the MBI system.

Writing in the MSO's internal newsletter, Crusan recently stated, "We're seeing about a 40 percent reduction in construction time... One of the nicest features of this system is that it allows us to get in and out of a neighborhood in a day or two versus one to two weeks under the old method. That's obviously helpful in reducing noise and traffic disruptions, which, in turn, makes life much easier for us."

A 25 percent savings in underground construction costs would cut the current average of $250,000 per mile to $187,500. In the typical large urban system, requiring well over 100 miles of underground installation, this would translate into a savings of approximately $1 million or more in system construction outlays.

Although, in Crusan's opinion, McCourt's marriage of rock saw and Integral conduit techniques makes the Boston-based contractor a prime candidate to employ the technique in other Cablevision franchises, there appears to be no reason why other contractors could not bring the two technologies together using their own methods. With McCourt actively marketing the technique and others likely to follow suit, the innovations in Boston could portend significant savings and time advantages for the entire CATV industry.

—Fred Dawson

Forecast for S-A is optimistic

Based on success of 8500 set-top converters, analysts predict company to break even in fiscal 1983

ATLANTA—Scientific-Atlanta seems to be turning its balance sheet around after problems last year with its troublesome 6700 cable converter, and financial analysts are predicting the company will break even in fiscal 1983 despite large

losses in the first quarter.

Those rosy forecasts are based in large part on the success of the manufacturer's new 8500 set-top converters, which are being shipped out at a clip of 30,000 to 40,000 each month, according to Harry Topliss, chief financial officer at Scientific-Atlanta.

Topliss reports a current backlog of some 600,000 units. Tele-Communications Inc. has placed an order for 200,000 8500s to be delivered over the next 18 months. That deal is valued at approximately $20 million, according to financial analysts.

Scientific-Atlanta has contracted with Matsushita to build the new converters, which sell for roughly $100 each.

The manufacturer also has been selected by CBS to supply earth station equipment to affiliate stations, which will receive syndicated programming by satellite. Each of the more than 200 affiliates will need two earth stations.

Industry analysts put the value of that deal at $20 million to $25 million. However, a final agreement has not yet been signed by the two companies.

Scientific-Atlanta ran into technical and manufacturing problems with the 6700 set-top converter, the predecessor of the successful 8500. Production was scrapped last year, resulting in a loss estimated at $15 million.

The company reported a loss of 26 cents per share during the first quarter of this fiscal year, reflecting the difficulties with the 6700. Earnings amounted to one cent per share in the second quarter and six cents per share in the third, putting the nine-month loss at 19 cents a share. In fiscal 1982, Scientific-Atlanta reported earnings of 63 cents a share.

Topliss refused to speculate on the company's fourth quarter or fiscal 1983 earnings, which will be released in mid-August.

Financial analysts foresee continued strengthening and look for earnings of 19 or 20 cents in the quarter that ended June 30, putting the year's net income at break-even or perhaps one cent a share on sales of some $325 million.

"What's important is the sequential turn from basically nothing in the second quarter to six cents in the third quarter to 19 cents in the fourth quarter," according to Drexel Burnham Lambert's Charles DiSanza. He forecasts earnings of $1 per share on sales of $420 million in fiscal 1984, a prediction echoed by others.

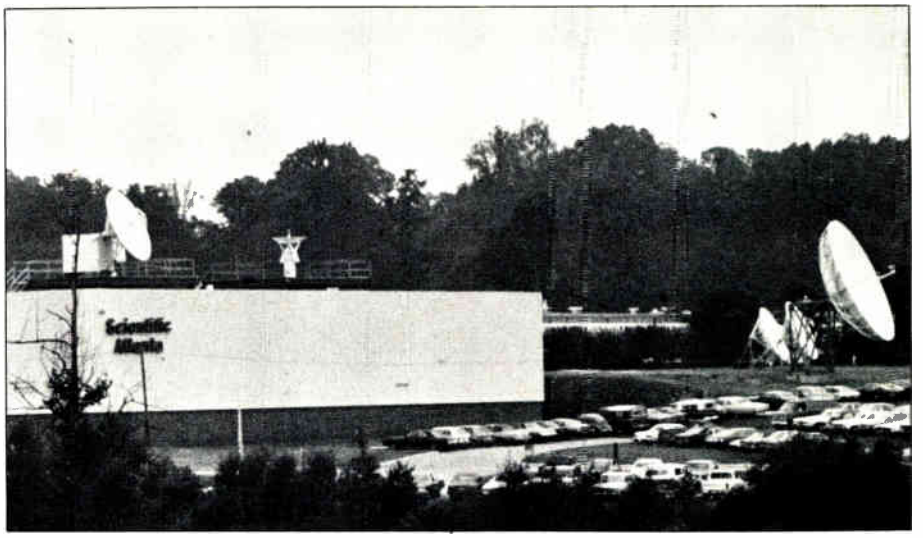
"The converter business has slowed down," said Tony Langham of Prudential Bache. "The field in the past has been dominated by General Instrument and Zenith. It's too early to say how much market share (the 8500 will capture). But it's been well received and it's working well in the field."

Several analysts indicated it was premature to speculate on how the recent naming of Jay Levergood, formerly senior vice president, to the company's presidency would affect its fortunes.

"I don't expect the company to change dramatically," Langham said. "It's an ordinary transition of control. (Levergood) won't make a lot of big changes."

Last month, Wickham Skinner, a professor at the Harvard Business School and a management consultant, was elected to the board of directors. Wickham has served as a consultant to Scientific-Atlanta. He fills a new position on the board, bringing the number of directors to 10.

—Sally Russell



Scientific-Atlanta manufacturing headquarters

S.A.L. Cable deal

Cable TV Industries reaches agreement to buy New York-based equipment distributor for $7.2 million

LOS ANGELES—Cable TV Industries Inc. has agreed in principle to acquire S.A.L. Cable Communications Inc., a distributor of cable TV equipment based in Melville, N.Y., in a deal valued at $7.2 million.

Cable TV Industries will obtain 620,000 shares of S.A.L. common stock by trading nine-tenths of a share of Cable TV Industries common for each S.A.L. share, pending the approval of S.A.L. shareholders.

In addition, the cable equipment distributor and manufacturer will buy the 632,000 shares held by S.A.L. Cable Chairman and President Alan Scheinman for a combination of cash, notes and stock in Cable TV Industries. The stock is valued at about $5 per share. Scheinman owns 50.3 percent of S.A.L.'s outstanding stock. He plans to remain a company officer after the transaction is completed.

Details of the merger remain to be finalized between the two companies.

Last fiscal year, Cable TV Industries had sales of $32 million, while S.A.L. Cable rang up $27 million in business. Company officials said the firms are second- and third-ranked on the hardware side of the industry, behind Anixter Communications.

Both companies distribute a full line of equipment to build and maintain cable systems, from cable and basic hardware to sophisticated electronics. In addition, Cable TV Industries' Aberdeen Co. manufactures small hardware components.

Cable TV Industries has distribution outlets in Los Angeles, Denver, Dallas, Houston, Chicago, Cleveland, Atlanta, Boston and in the Philadelphia area. S.A.L. Cable maintains outlets in Atlanta, Los Angeles, Dallas, Indianapolis and New York.

Scheinman said that no decisions have been made on whether to merge the product lines, maintain S.A.L. Cable as a separate division, or expand into other geographic areas.

John Hyde, director of corporate communications at Cable TV Industries, said the primary motivation behind the merger is to increase its market share in the cable industry and in related fields, including private cable and institutional cable service.

Cable TV Industries also is positioning Aberdeen to market products to the telephone supply industry. With deregulation, Hyde said his company foresees an increasing need for construction equipment for the telecommunications market.

France and Quebec forge cable alliance

NEW YORK—After a year of negotiating, France and Quebec have signed an agreement that will require Quebec to provide the technological expertise needed to establish a cable network in France. France expects to wire 1.5 million homes by 1986 with an additional 1 million homes added per year until 1992. Jean-Francoise Bertrand, Quebec's minister of communications, said that an estimated $50 million to $200 million Canadian will be made by Quebec cable enterprises in the next five to 10 years as a result of the agreement. "The contract will make it possible for Quebec cable industries to invest in different fields of technology, architecture, distribution and programming," Bertrand said. He also hopes it will allow for cultural exchange. Quebec currently receives 2,500 hours per year of French programming. Quebec will sell 100 hours of programming to France this year.

SCTE

SCTE reports gains

1982 financial report shows 22 percent rise in revenue

WASHINGTON—The Society of Cable Television Engineers reports 1982 brought a significant improvement in the organization's financial picture, but it still may review annual dues levels in an effort to find enough revenues to further reduce its operating deficit.

The society's financial statements, presented to the SCTE board in June, show revenues for 1982, at $325,700, were up 22 percent over the previous year's total, with the result that the year-end deficit was trimmed from about $27,000 to just under $17,000. The revenues included $125,700 from training products, $106,000 in individual and sustaining dues, $80,000 from meetings and some $14,000 from a special project and interest income.

Outlays for the year included $137,000 in G&A expenditures, $97,400 for development, production and fulfillment of training materials and products, $72,900 for dues fulfillment and 60,000 for meeting and conference expenses.

In addition to recommending that the board of directors undertake a review of dues in all categories, the organization's staff called for more advanced planning and more care in budgeting to help eliminate remaining deficits.

According to SCTE Executive Vice President Judith Baer, it looks like the organization's first Cable-Tec Expo, held in Dallas in May, will contribute modestly to this year's ledger once financial totals are in, and the event, scheduled next year in March for Nashville, could prove to be an ongoing source of income for the society. Some 400 to 500 new members were signed up as a result of the show, she noted.

The final tally on Cable-Tec Expo attendance was 1,284, with additional exhibitor attendance bringing the total to well over 1,300. Systems operation personnel constituted 34 percent of the attendance total; 12 percent were systems construction people; 25 percent were exhibitor personnel; and the remainder consisted of various miscellaneous categories, such as consultants, government staff and educators.

NewsSweep

■ Burnup & Sims reported losses on continuing operations for fiscal 1983 of $6.8 million or 77 cents per share. Taken with the $6.6 million loss from discontinued operations, that puts the company's net loss at $13.4 million or $1.52 per share for the year that ended April 30. In fiscal 1982, Burnup & Sims achieved net income of $9.4 million or $1.03 on continuing operations.

■ Oak Industries has filed suit against the Foxboro Co., a Massachusetts-based firm. The suit alleges that the industrial products firm used "fraud, and misrepresentation of facts" when it sold its Adec division to Oak in 1980 for $3.9 million. Adec manufactures energy management systems for industry and the government. Oak alleges that the Adec EMS 9000 system was unexpectedly found to "not be finished, or at a stage that would allow us to install it," an Oak spokesman said. Oak has asked the San Diego Federal Court to award it $20 million in compensatory damages and $50 million in punitive damages.

■ United States Satellite Broadcasting Co. plans to spend $168 million on programming alone in its first year of operating a three-channel DBS system slated for a 1986 launch. That was one detail of an ambitious plan laid out by USSB Executive Vice President Robert Fountain last week before a luncheon gathering of the New York Chapter of the National Academy of Television Arts and Sciences. Fountain, who predicted that the nascent DBS industry would be "lethal" to cable television, touted the potential of high-powered DBS systems such as USSB's plan over low-power entrants, whom he conceded will have a head start on gaining a marketplace foothold.

■ RCA Astro-Electronics, a unit of RCA Corp., said it has been awarded a contract "in excess of $120 million" to design and build three high-powered communications satellites to transmit on the Ku band. The birds will be produced for RCA American Communications Inc. to "provide more efficient and reliable distribution of TV services to major metropolitan areas," RCA said. No cable applications were specifically mentioned. The first of the birds is scheduled for launch in 1985. The others should be aloft by 1987, RCA said.

■ Two top General Instrument videotex engineers, who had been barred from working on certain projects because of prior employment at Bell Labs, have been allowed to resume their full duties. A court here agreed that the two engineers, John Gaby and Arthur Mansky, should be enjoined from working in order to prevent leaking Bell's trade secrets. However, the court effectively ended the injunction by limiting it to six months, with that time period having ended on May 1. The judge said the six-month period was enough for Bell to develop customer terminal software of which the two engineers had inside knowledge.

■ C-COR Electronics has gone into the European market as part of its planned worldwide marketing expansion. C-COR Europe BV, to be organized in Holland, will be the European marketing arm of the equipment supplier. Charles Franzetta, international sales manager, noted that activity in the European cable arena "is about to enter an unprecedented growth phase. Many governments have allocated funds for the construction of new systems and the reconstruction of older systems." C-COR expects to have full market representation in Western Europe by this December. It already operates in Scandanavia, Israel, Holland, Saudi Arabia and Argentina. Negotiations are underway to establish a beachhead in Japan.

■ Rogers Cablesystems expects a $13 million loss from operations for the fiscal year that ends Aug. 31. That is the same loss amount as last year, according to Rogers President Colin Watson. For the first half of the year, Rogers reported a $7.8 million loss. Watson predicts a narrower deficit for fiscal 1984 and a possible profit the following year.

■ Wometco Cable TV Inc. reported net income of $1.19 million or 17 cents a share for the second quarter, which ended June 18. That compares to net income of $413,000 or six cents a share during the second quarter of fiscal 1982. For the first six months of the fiscal year, Wometco acquired $2.3 million or 33 cents a share in net income, up from $796,000 or 11 cents a share during the first half of fiscal 1982.

■ PRC Engineering has begun offering project management services to the cable television industry. PRC will act as agent for the cable system owner, supervising individual construction contractors. PRC also schedules performance and maintains quality control.

■ At their annual meeting, TCI stockholders approved an amendment of the Certificate of Incorporation to increase the number of authorized shares of Class A common stock from 40 million to 60 million and Class B common stock from 10 million to 15 million. Also, Bob Magness and John Gallivan were elected to serve three-year director's terms expiring in 1986.

■ Comsearch Inc. is offering a frequency search service in the 11.7-12.2 GHz band for users of temporary TV pick-up point-to-point microwave paths. The service identifies any possible conflict or source of interference that might arise on the proposed frequencies of a temporary TV pick-up path. Information required to initiate the search, which can be implemented within one hour, includes site locations (coordinates), antenna sizes and transmit power.

Telco/CATV skirmishes multiply

Regional actions take spotlight in aftermath of S. 66 passage

Following passage of Cable Bill S. 66 in the Senate June 15, the focus of the telephone industry's struggle to limit CATV incursion into traditional telecommunications territory shifted, at least temporarily, to the regional level.

In the past several weeks an important confrontation has taken shape involving Pacific Northwest Bell and the Portland, Ore. cable operation, Cablesystems Pacific. And there have been new actions instigated against cable companies by BOCs in Connecticut and New Mexico as well as continuing developments in the Northwestern Bell versus Cox of Omaha saga.

S. 66 passed by an overwhelming 87-9 vote, despite efforts by AT&T and other telco entities to alter the measure. In a 55-44 vote prior to the action on S. 66, the Senate defeated a controversial data transmission amendment offered by Sen. James Abdnor (R-S.D.) and backed by the Bell System. The amendment would have subjected cable systems' enhanced services to public utility regulation.

While the cable industry was optimistic that the measure passed by the Senate would eventually be approved by the House, priorities involving consideration of broadcast deregulation and other matters in the House Telecommunications Subcommittee chaired by Rep. Tim Wirth (D-Colo.) appeared to be pushing back House action on the cable bill to late in the summer or beyond.

Meanwhile, in an effort to achieve what couldn't be accomplished on the Senate floor, several BOCs sought to persuade regional public utility commissions that cable's foray into enhanced services is, indeed, cause for regulatory action.

The action in the Northwest began with a decision by Pacific Northwest Bell to revoke the Cablesystems Pacific pole attachment and conduit access rights on grounds that Pacific Northwest considered the provision of data transmission services over the Portland cable system to be a violation of the statutes establishing territories for individual utilities within the state.

The letter of revocation from Pacific Northwest's general counsel, C. Scott McClellan, provided a rallying point for the National Cable Television Association in its efforts to secure passage of S. 66. Issuing a statement in early June labeling the McClellen letter a "smoking gun," the association quoted NCTA President Tom Wheeler to the effect that "no matter how creative their rhetoric or alleged justifications of their legislative position, this letter makes clear the real goal of AT&T and the Bell Operating Companies is to shut down potential competition from cable operators through any means possible."

Although Pacific Northwest decided to reinstate the pole attachment rights, Cablesystems Pacific continued to pursue a suit filed in Oregon state court, insofar as the reinstatement of pole attachment rights did not represent a change in the telco's position on the issue. According to Cablesystems' attorney Clifford Carlsen, "They (the telco) are taking the position, one, that the provision of data transmission services is a regulated activity, and, two, that the state public utilities commission has authority to regulate it."

John Rivenburgh, business network director for Cablesystems Pacific, said the telco is not processing pole attachment applications at the same rate it was prior to the McClellan letter or the lawsuit. He said the situation has had a definite impact on construction for the proposed 800 miles of parallel cable, which is 85 percent complete. He indicated there are four customers requesting service on the institutional loop who will have to wait for service because of the actions of the phone company.

Compounding the problem for Cablesystems Pacific has been action in the Oregon state legislature aimed at subjecting cable operators' two-way services to common carrier regulation. An Oregon House committee defeated such a measure, which was offered as an amendment to a PUC bill with the backing of PUC Commissioner John Lobdell. The amendment would have subjected all intrastate telecommunications services, including electronic banking and home security systems, to PUC oversight.

Rogers Cablesystems, the MSO in control of Cablesystems Pacific, is seeking federal intervention into the developments in Oregon. In a letter from Washington attorney Harry Shooshan, Rogers recently asked William Baxter, chief of the Justice Department's Antitrust Division, to investigate whether Pacific Northwest violated the AT&T/Justice

Revamping AT&T

Judge Greene gives BOCs rights to Bell name and logo, seeks to curb phone rate increases

WASHINGTON—Continuing with the divestiture of the world's largest corporation, U.S. District Court Judge Harold Greene has given approval to AT&T's plan for reorganization, provided certain conditions are met to boost the viability of the spun-off Bell operating companies.

In a 159-page opinion, Greene addressed several major reorganization issues, with an eye towards ensuring universal telephone service and affordable local rates. Greene said the court "has concluded that the plan of reorganization will be approved provided that certain inconsistencies with the provisions and principles of the (AT&T/Justice Department consent decree) are corrected."

Perhaps the most controversial of the rulings for AT&T is Greene's decision to give the Bell operating companies full rights to the Bell name and logo. AT&T had hoped to retain the use of the Bell name, particularly for its American Bell subsidiary. Changing the name will be costly for the parent company, AT&T representatives said.

Greene said use of the Bell name by both AT&T and the BOCs would be confusing and run contrary to the severed relationship between the parent company and local entities. "It would lead consumers to believe that there is a continuing close connection between these entities or, worse, that they are all still components of the same company," Greene said.

In the public mind, Greene said, the term "Bell" may primarily stand for the local companies from which customers have traditionally obtained their telephones and service. "To deprive the operating companies of the use of the Bell logo and the Bell name in the (customer premises equipment) are would effectively cripple their efforts to become viable competitors in this market," Greene wrote.

In another move designed to strengthen the BOCs and keep down local rates, Greene ruled that AT&T must pay the remaining costs for providing equal access to any long distance network if the BOCs have not recovered those costs within 10 years. AT&T estimates that it will cost more than $2.5 billion to reconfigure the Bell network to provide equal access.

AT&T had not determined whether it

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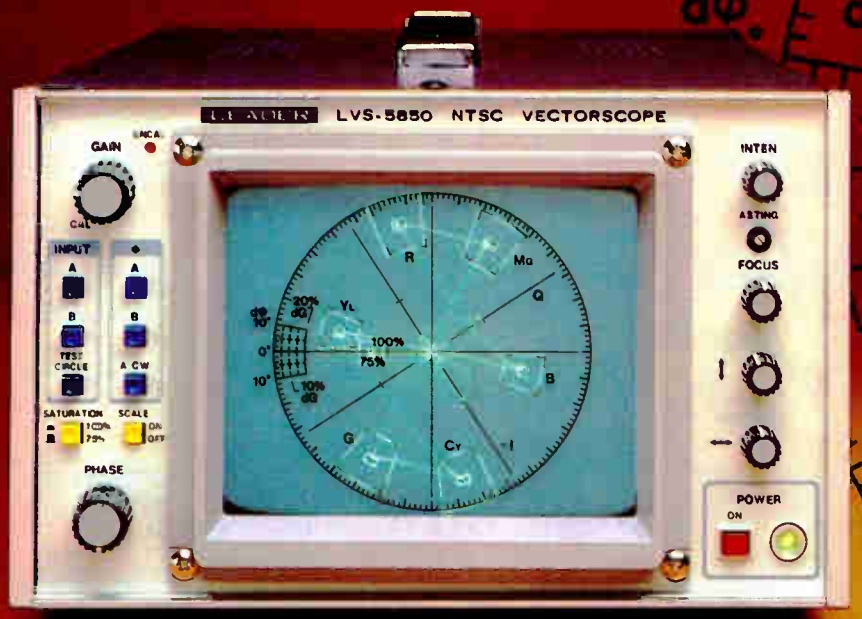

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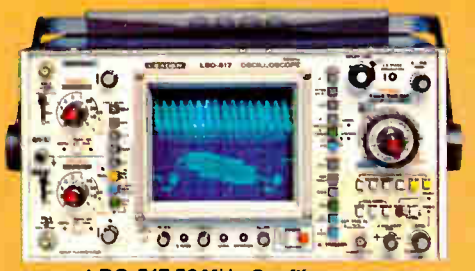

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ITT inaugurating Worldcom network

Telecommunications network in U.S. allows company to enter domestic data communications market

DENVER—Official confirmation of ITT's entry into the domestic data communications market positions more than just another player in this fast-action game, stakes for which will be drawn from a megabillion-dollar pot.

ITT Worldcom, the company that once held a virtual monopoly on world telex services and more recently occupied the lead in non-U.S. data communications, announced that it is completing a telecommunications network in the U.S. that will enable it to begin offering data communications services in the domestic market this fall.

The announcement, made in conjunction with the International Communications Association conference held last month in Anaheim, Calif., means, among other things, an end to the more than 50-year moratorium on competition between ITT and AT&T, two telecommunications industry giants, which, circa 1928, "split the world" telecom market in what then appeared to be half: AT&T took the U.S.; ITT got the rest. Since then, ITT's operations in the telecommunications sphere have grown to 1982 revenues of $6.4 billion. Indications are that the initialing of a new umbrella of ITT units created to effectively manage its vast communications and information services operations worldwide—ITT COINS, of which Worldcom is a part—is anything but euphemistic. As stated in the 1982 annual report, ITT intends to "capitalize on opportunity stemming from the historic divestiture decision on AT&T and eventual opening of this market to competition." Worldcom's new venture appears a strong step in that direction.

The Worldcom network will have packet switching centers in five U.S. cities: New York, Chicago, San Francisco, Houston and Atlanta; while these centers will be on line in September, ITT plans to add another 26 cities almost immediately following. According to ITT Worldcom's Steve Yesenosky, "the beauty of our system is in the nodes" where switching is done, allowing a greater variety of switching patterns. ITT's packet switching system will offer the advantage of data transmission on an interconnectable, stand-alone basis, meaning data need not be returned to a master control location for signal reprocessing before being sent to its desired location—each switching node has send and receive capability.

Other positioning advantages of the ITT system include system capacity already in place and operating between 71 U.S. cities and Europe. In essence, the new U.S. network will enable Worldcom to offer data communications services within the U.S. that it had previously provided only on an international basis. While Worldcom's U.S. service start-up is targeted to three select user-markets, its in-place marketing organization would seem to give it a unique advantage over domestic providers. AT&T, for example, indeed has concentrated on digital packet switching, but only has marketed such services to its own operating companies within the Bell system.

The ironies of positioning in the race for share in the domestic data communications market are further enhanced by what ITT Worldcom considers one of its advantages in U.S. competition. Using lines leased in some cases from AT&T, with whom it once had agreed not to compete, ITT will offer potential clients a lower-cost alternative to hard-wired, leased telephone lines for point-to-point, flat-rate interconnections at speeds of 9,600 bits per second—a service previously available in the U.S. only from AT&T, whose capacity, and profits, were tied up in long-distance transmission of voice. —*Sharon Scully*

Telco/CATV

Department consent decree in considering a revocation of pole attachment rights. Rogers suggested that the action violated guarantees of "informal access" within the consent decree.

Rogers also is seeking a clarification of the consent decree by asking the Justice Department to rule that BOCs cannot offer any unregulated service without first demonstrating to a federal court that there is no possibility that the phone company could use its monopoly power to stifle competition. In its battle with Rogers, Pacific Northwest has taken the position that the consent decree allows BOCs to offer unregulated services if the state PUC approves.

The Oregon PUC will examine the issue of common carrier regulation of enhanced telecommunications services at a hearing on Aug. 19.

Actions by BOCs in Connecticut and New Mexico were along lines paralleling the Pacific Northwest Bell initiative. In Fairfield County, Conn., Southern New England Bell filed comments with the Connecticut Department of Public Utility Control questioning the legality of the security system proposed in the Fairfield County franchise controlled by Cablevision Systems Development.

And in Albuquerque, N.M. Mountain Bell filed a complaint with the New Mexico Corporate Commission arguing that Albuquerque Cable TV's experimental data transmission service is, in effect, a telephone offering and should be regulated as such. The data service offered by the 30-channel Tribune Cable-operated system is in the experimental stage, with users currently participating at no charge.

While these events were unfolding there was also movement in the case involving Northwestern Bell's attempt to stifle Cox of Omaha's Indax and Commline data service operations. The NCTA and other cable operators called on the FCC to pre-empt state regulation and to overturn the Nebraska Public Service Commission's decision, issued last spring, that prohibits operation of Indax and Commline in Omaha without PSC approval.

The National Telecommunications and Information Administration, commenting on the issue raised at the FCC, suggested that the FCC launch a formal inquiry into the common carrier issue. The NTIA, which is a part of the Commerce Department, noted that services such as those provided by Cox generate less than one percent of all phone revenues at the present time but are likely to increase rapidly. The FCC has yet to respond to the claim made by the various parties to the issue.

Revamping AT&T

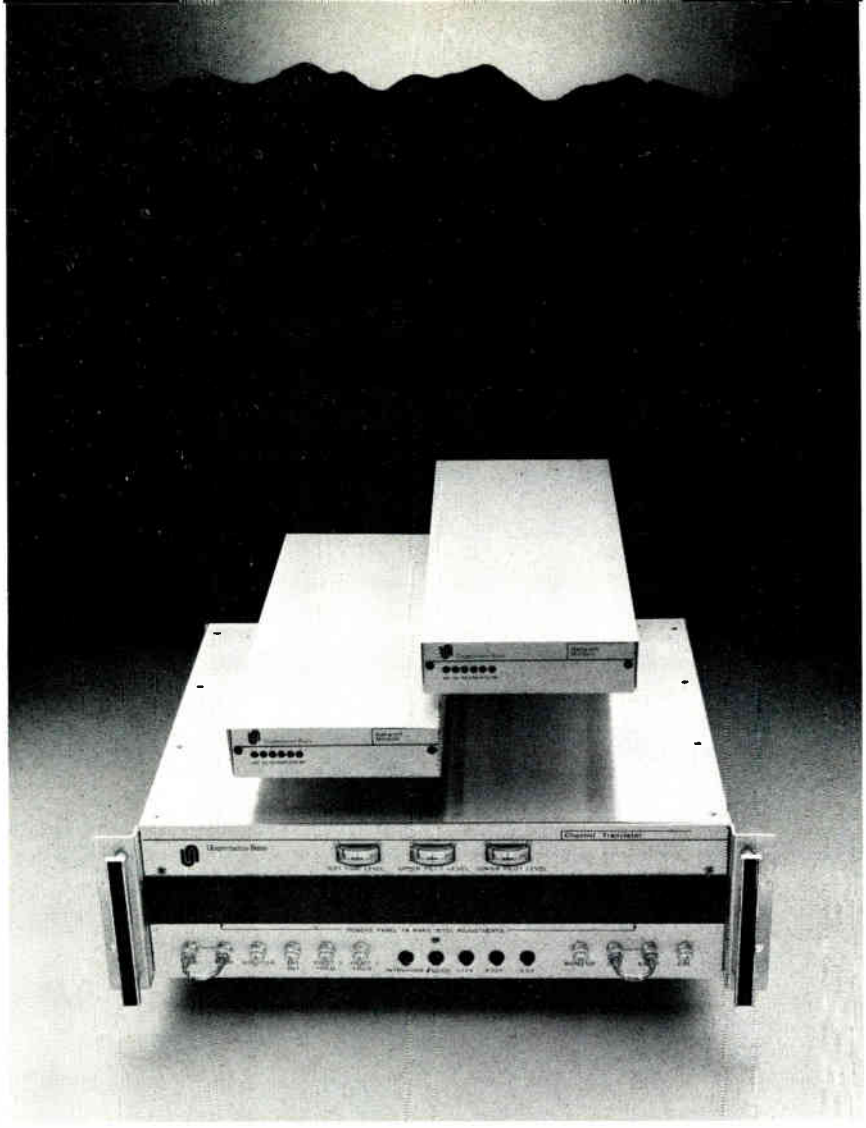
would accept or challenge Greene's decision at press time. An AT&T spokesman said the company was concerned about the rulings regarding the Bell name and equal access. The company has not challenged any of Greene's previous divestiture rulings, and most observers believe the company will accept this one.

The Justice Department, which also must give its stamp of approval to Greene's ruling, indicated that it had no major concerns about the decision.

Greene's ruling was praised by consumer groups, AT&T's competitors, federal and state regulators and Congressman Tim Wirth (D-Colo.), chairman of the House Telecommunications Subcommittee. Most hailed Greene for moving forward with the reorganization process and for attempting to keep local rates affordable.

Greene approved the AT&T/Justice Department consent decree last August, ending the federal government's eight-year-old antitrust suit against the telecommunications giant. Since then, Greene has issued rulings to guide the complex reorganization of the telephone system. Greene's latest decision is said to have removed some of the last remaining issues toward implementing the divestiture as scheduled on Jan. 1, 1984.

The consent decree provides safeguards



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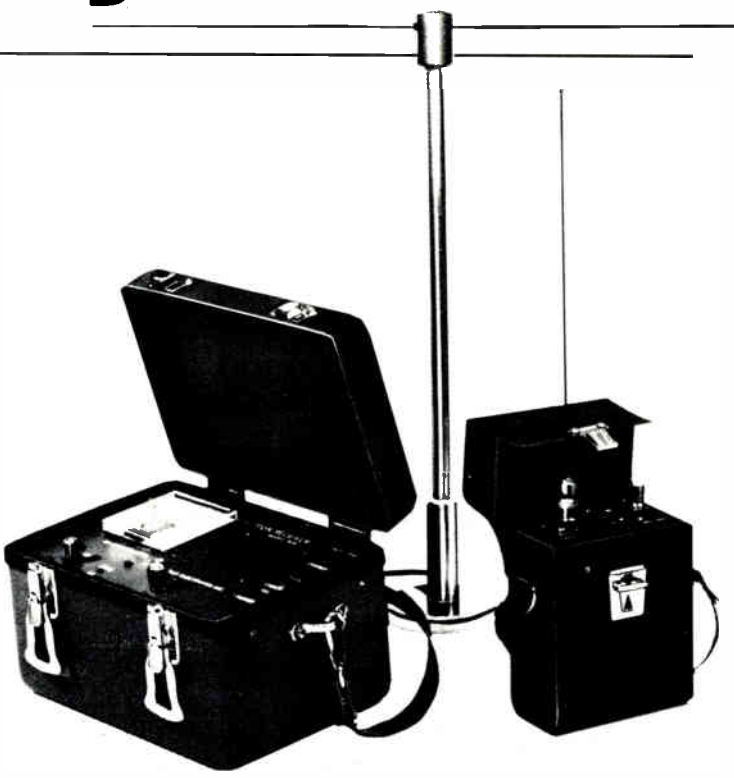

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Warner, telcos talking

Parent company researching use of telco links to provide services such as videotex

NEW YORK—Warner Communications, half-parent of Warner Amex Cable and its QUBE interactive systems, is exploring the use of telcos to provide a less expensive means of delivering transactional services into cable homes.

Thus far, Warner officials said, discussions with telcos—including soon-to-be divested Bell Operating Companies—and other sources say, American Bell Inc., are in a preliminary stage.

At Warner Communications, investigation of the feasibility of using telco links for interactive and transactional services, such as videotex, is underway by Terrance McGarty. A corporate official who is a senior technical advisor at the corporate level, McGarty formerly was with Warner Amex, New York Telephone, and Bell Laboratories. He holds a PH.D. in electrical engineering.

In an interview McGarty confirmed that preliminary discussions have been held with telcos. Specifically, he mentioned Bell of Pennsylvania. He indicated other companies could be involved. But he stressed that "we wouldn't start to see anything serious until the beginning of next year," when the BOCs officially are divested from AT&T.

McGarty said it was his assessment that telco lines could provide transactional services at less expense—especially upstream from the subscriber's home to the transactional headend—than pure interactive cable systems. He mentioned that Southern California Bell, in conjunction with Knight-Ridder's Viewtron videotex experiment, earlier this year filed tariffs that allow for much lower telephone line rates for "Local Area Data Transport" (LADT) than for "usage sensitive" areas, such as voice communications.

"It's quite obvious" from that arrangement, McGarty said, that "the telco provides a much more cost effective way to get interactive services into the home."

Any projects involving Warner properties and telcos would be "business as usual," with the Warner firms using telco lines as a customer—not as the partner in an equity venture, McGarty said. He noted that the AT&T antitrust divestiture settlement bars BOCs from becoming information providers. An equity arrangement, McGarty said, would be "mixing content and conduit," and thus could "get into problems."

Specifically, McGarty said, cable systems seeking to provide interactive services could utilize cable headend hardware downstream, to provide data transmission at a rate more rapid than is possible over the twisted copper pair of telco lines. He said research indicates that subscribers get impatient if they have to wait more than five seconds for a videotex screen to appear; he said a telco line could take as long as eight seconds to come up with requested data.

A spokesman for Warner Amex said, "We encourage cooperative partnerships rather than confrontation with telcos, and hail any projects. . . which will further advancement of cable TV services for the consumer."

—Victor Livingston

Revamping AT&T

against Bell dominance in the electronic publishing and cable television fields once divestiture begins. The decree prohibits AT&T from entering the electronic publishing field for seven years, while the BOCs' entry into such fields is subject to approval by the court.

Many BOCs, faced with the forthcoming loss of long distance subsidies from AT&T, have petitioned state public utility commissions for enormous rate increases.

With the prospect of skyrocketing rates as a backdrop, Greene said, "The fundamental purpose of the decree under the antitrust laws is to create conditions which will reduce the cost of telecommunications service to the public—individual consumers, business and government."

Greene said local rates will rise, but it will not be due to the reorganization of the Bell System. He cited access charge decisions by federal regulators as a source of increasing rates. The modifications required in the court's latest ruling "should assist in moderating the pressure for local rate increases, whatever their source," Greene wrote.

Among other decisions, Greene ruled that the BOCs will be given licensing and sublicensing rights to all AT&T-owned patents, including those issued over the next five years; divides the Bell System's contingent liabilities, for any pending pre-divestiture antitrust cases, on the basis of relative net investment; allows the company to divide its pension plans according to its regional breakdown, while other labor union contracts must be recognized; and removes the divestiture from direct judicial oversight.

M/A-COM develops encoder/decoder

M/A-COM LINKABIT has developed a convolutional encoder/sequential decoder, the LS3655, which performs error correction (FEC) data processing in a continuous data environment. The system combines long convolutional codes with a sequential decoding algorithm derived from the Fano Algorithm to provide enhanced bit error rate (ber) performance across several kinds of digital communication channels.

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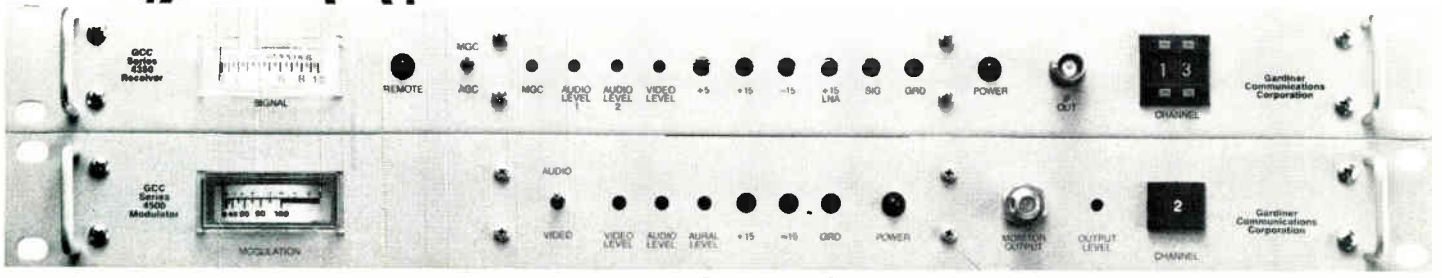

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New computer-PBX tie-in

System developed by Digital Equipment and Northern Telecom winning commitments from major firms

MERRIMACK, N.H.—Digital Equipment Corp. and Northern Telecom, Inc. have developed a Computer-to-PBX Interface (CPI) system which the companies hope will eliminate much of the confusion associated with tieing PBXs to computers.

A number of telecommunications and computer firms, including Rolm, Mitel, Intercom, Data General Corp. and Hewlett-Packard, have committed themselves to developing interface equipment that supports the new CPI specifications.

The CPI is based on the North American network transmission standard set for T-Carrier, which establishes a 1.54-megabit channel that can be sub-divided into smaller units. The CPI permits data switching from a host computer through the PBX to local or remote terminals over standard two-pair telephone wiring. Compatibility with North American T-Carrier specifications also allows the user to employ fiber optics and microwave radio transmission for local or remote access.

One of the major inconveniences associated with setting up PBX-based local area networks has been that proprietary interface techniques, typically employing low-speed connections, make it difficult and costly to fit the right computer to the right PBX. According to a Digital spokesperson, the new CPI approach will permit easy interconnection among products of all suppliers who support the Digital/Northern Telecom system.

Both firms believe their standard, in significantly reducing the cost of PBX-to-computer connection, will have a major impact on the office automation marketplace. According to Peter Janca, PBX marketing manager for Digital, "Agreement to use a common way to interconnect PBXs and computers is a major step for users. It gives them freedom to select the most appropriate products from both the PBX and computer industries, the most flexibility for change and growth, and the lowest risk."

Telco gains control of Alaskan cable system

Pacific Telecom takes over interest of Daniels & Associates and others in Anchorage-based MultiVisions

ANCHORAGE, Alaska—Pacific Telecom plans to buy out its three biggest partners and thereby increase to 95 percent its ownership of MultiVisions, a cable system now under construction here. If the deal is approved by the Alaska Public Utilities Commission, the independent telco will take over the interests of Daniels & Associates and company founders Bob Uchitel and Bob Gould. A group of local limited partners will retain a 5 percent interest. Originally, Pacific Telecom, Daniels & Associates and the founders had roughly equal interests in the company. The value of the transaction has not been disclosed. Uchitel and Gould will continue to operate the company as chairman and president, respectively, through the end of the year. Visions, a MultiVisions subsidiary, provides an MDS pay TV service to some 11,000 subscribers in the Anchorage area. When the Anchorage cable system is complete in 1985 after an investment of some $50 million, it will pass 70,000 homes. Pacific Telecom, the nation's sixth-largest independent telco, is a subsidiary of Portland-based Pacific Power and Light.

Cracking down on piracy

Return-loss test can provide courts evidence to support search warrants

By Lawrence T. Schuler
Heritage Cablevision, Inc.

The difficulty in proving cable piracy revolves around access. To prove cable theft, a continuous connection between a feeder cable and a television set must be established. In the past, to establish this the company would need to trace the connection from the easement directly to the converter or TV set. But the cable company and its employees only have legal access to the utility easement and must obtain permission to enter the homeowner's property and house.

The cable pirate knows the access limitations of the cable company. And he knows the company cannot successfully prove theft without access to his property and home. He knows it is difficult for the cable company to continuously monitor and disconnect non-paying users. Because it is fairly easy to connect or reconnect to the cable system, the pirate today is really daring the company to do something other than disconnect him.

What is needed are some counter measures to the challenge and romance of cable piracy. The public needs to realize that cable piracy is true theft, that it can be proven and that the company *will* prosecute to maintain the integrity of its services.

The return-loss test and special audit procedure described in this paper present a technique that allows the cable company to develop sufficient evidence — while operating within the confines of the easement — to establish probable cause for issuance of a search warrant. There is no need for access to private property or the homeowner's residence. There is also no legal need for the homeowner's permission to conduct either the special audit or the test.

This test and special audit procedure will not, in themselves, provide conclusive physical evidence of theft. They do provide substantial electronic and physical evidence of the existence of such a continuous connection, so that probable cause is supported. After a search warrant has been issued and served, the search itself will provide the remaining physical evidence of the continuous connection. This evidence is gathered in the presence of law authorities, and the entire special audit and test process will produce a well-documented and legally obtained body of evidence to support prosecution.

Most cable technicians and engineers are familiar with the return-loss test used to check the impedance match of a transmission line over a given band of frequencies. This test is in common use today. Since a transmission line is a "lump" reactive circuit (where the reactance is created by structural design), this test is, in effect, a test of a transmission line's structural integrity.

This same test can be conducted on a "component-reactive" or "tuned" circuit (where the reactance is created by discrete components). The input circuits in most television sets, converters and stereo receivers are examples of component-reactive or tuned circuits. The remainder of this paper discusses the return-loss test conducted on both tuned circuits alone and on tuned circuits connected by transmission lines.

Before discussing the results of the return-loss test as they apply to CATV lines, two matters need to be discussed: the basis for return-loss testing and the effects of forward attenuation on return-loss test results.

Basis for return-loss testing

Transmission lines and electronic circuits used in cable television have an approximately equal impedance of 75 ohms across the band of frequencies they are designed to pass. Transmission lines, such as trunk, feeder and drop cable, are designed to have an impedance of 75 ohms across the entire frequency spectrum. A tuned circuit, on the other hand, will have an impedance of 75 *only* at its tuned frequency or band of frequencies. For example, a bandpass filter will have an input and output impedance of 75 ohms only within the band of frequencies it is designed to pass; outside of that band its impedance will be something other than 75 ohms. The swept return-loss response of a tuned circuit will appear approximately equivalent to but *opposite* its swept passband response.

The return-loss test is based on the principle of "power transfer," which states: total power is transferred from one circuit to another when the output and input impedances are equal. If the impedances are not equal, then some or all of the power is reflected back to the source, with the amount dependent on the mismatch. The test is conducted by transmitting a swept-frequency signal to the circuit under test and detecting the amount of this signal returned or "reflected" from the circuit.

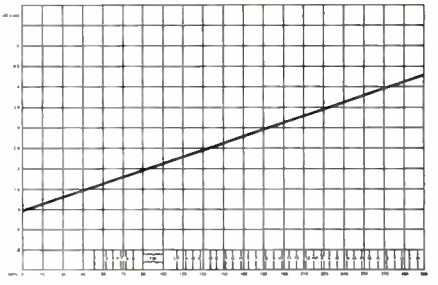
Testing the return-loss of a tuned input circuit, such as those found at the input of most CATV converters, television sets and FM receivers, requires an electronic connection only to the input of the device. If the losses in a connecting length of transmission line (drop cable) are considered, then the return-loss of these input circuits can be tested successfully without physical access to the device itself. The return-loss test, therefore, has a definite advantage where access to a residence is restricted or not desirable. Since legal access is always allowed within the CATV easement, the return-loss test is practical for use in detecting whether or not a receiving device is connected to the cable inside the residence. With the reasonable proof that a receiving device is connected to the cable, which this test provides, "intent to steal" can be shown.

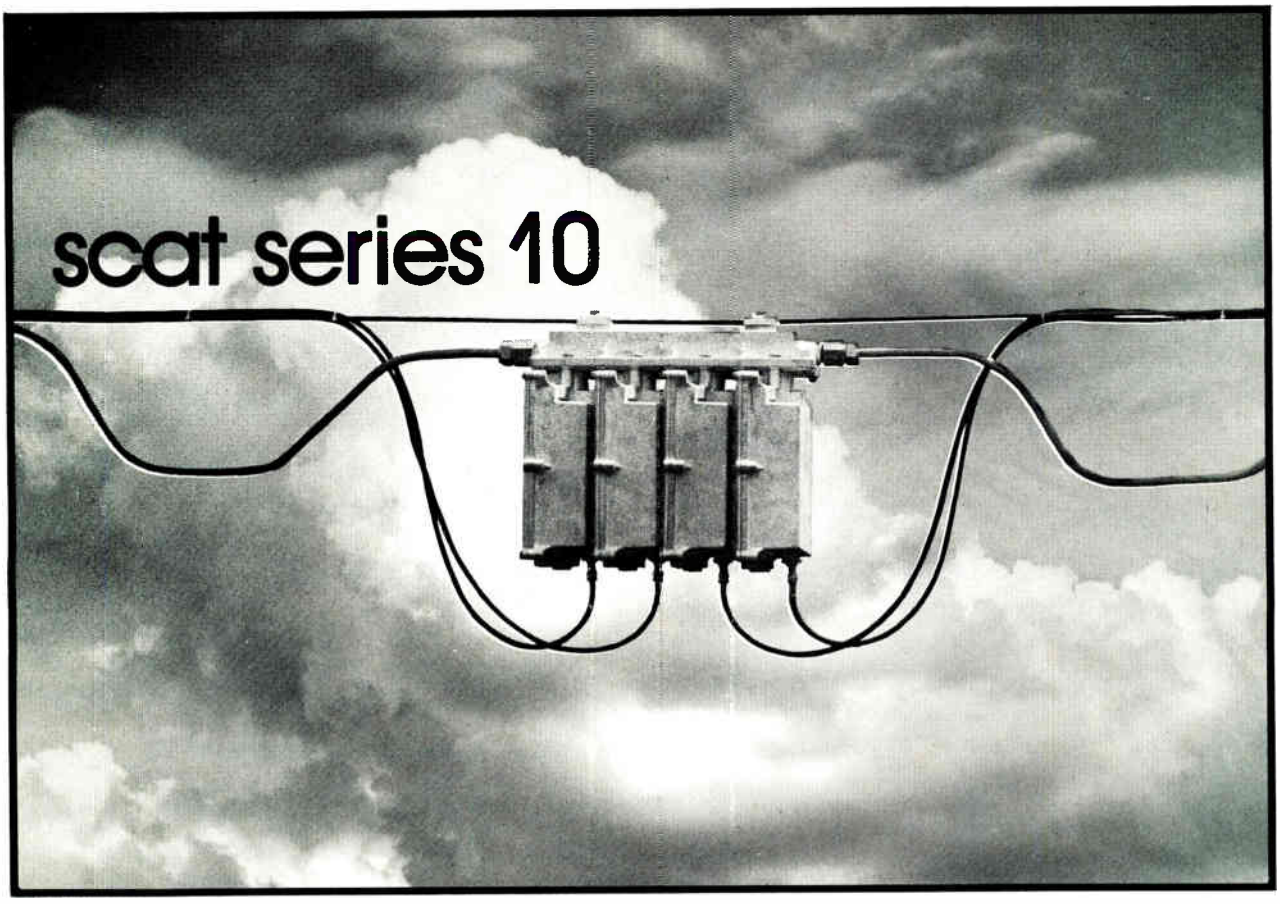
Forward attenuation

Forward attenuation in the drop cable over a given frequency band plays a part in the results determined by the return-loss test. Any length of transmission line has an inherent loss, which usually increases with the frequency. This loss is negligible when considering the return-loss between the sending circuit and the receiving circuit on a printed circuit board. But when we connect the two circuits with an RG-59 drop of 150 feet or so, the attenuation does affect the results.

The loss of a CATV cable is proportional to the frequency. The length of the cable will determine the insertion (or flat loss) at all frequencies and is also proportional. Figure 1 shows the frequency versus loss

Figure 1. Frequency vs. loss/100 ft. RG-59/u





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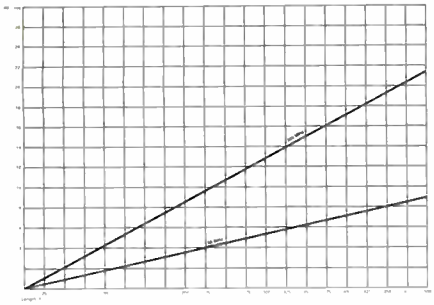
per 100 feet for a typical RG-59 transmission line.

Figure 2 shows the relationship between length versus loss for a typical RG-59 transmission line. An analysis of RG-6 cable would show similar results.

To conduct a return-loss test on a tuned circuit at the end of a transmission line the test signal must do two things. First, it must pass once down the line to get to the circuit under test. And second, the portion of the signal reflected must travel back over the same line. This is important to remember, as the transmission line responses may obscure the test results, particularly if there is a problem in the line (such as staples, kinks, water, or corrosion).

Figure 2. Length vs. loss RG-59/u



The return-loss test results

Figures 3, 4 and 5 show what happens when a mismatch causes some or all of the signal to be returned to its source. Figure 3 shows the near-ideal return-loss of a 75 ohm, low-capacitance terminator. Notice that very little signal is returned. Figure 4 shows the response of an open. Notice that the impedance is infinite and a total mismatch with the signal source impedance. This causes all of the signal to be returned. Figure 5 shows the response produced by a short. Notice the similarity to the response of an open. Once again, there is a total mismatch, causing all of the signal to be reflected.

If a 100-foot length of drop cable is inserted between the source and a 75-ohm resistor, a short or an open, we will see similar results, but with the addition of the cable's two-way response. These results can be seen in Figures 6, 7 and 8,

Figure 3. Return loss of a 75 ohm terminator

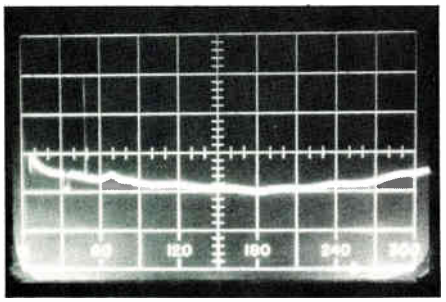


Figure 4. Return loss of an open

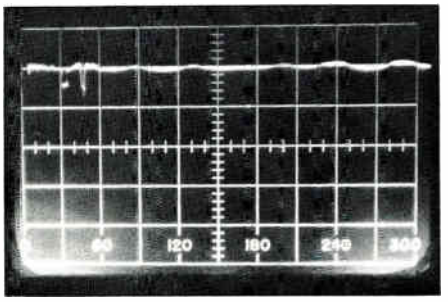


Figure 5. Return loss of a short

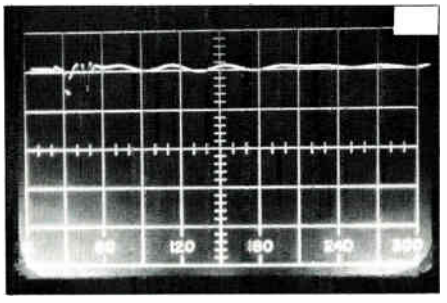


Figure 6. Return loss of 100 ft. RG-59 terminated in 75 ohms

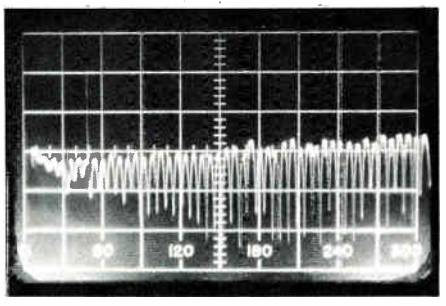
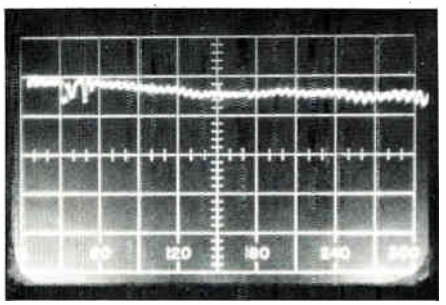


Figure 7. Return loss of 100 ft. RG-59 shorted



respectively. Figures 6, 7 and 8 show test results with a length of good drop cable. It is relatively easy to see what would happen to the various ripples and bumps with a length of cable which has some structural deficiencies. Figure 9 shows the test results of a length of bad cable terminated with the test resistor.

If we conducted the same return-loss test on a typical 35-channel converter and analyzed the resulting response of

Figure 8. Return loss of 100 ft. RG-59 open

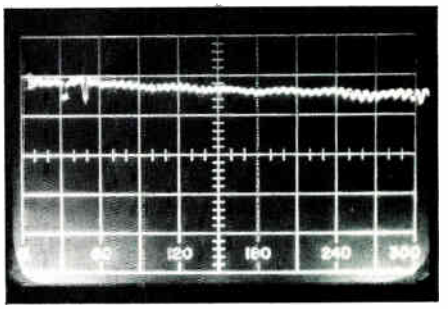
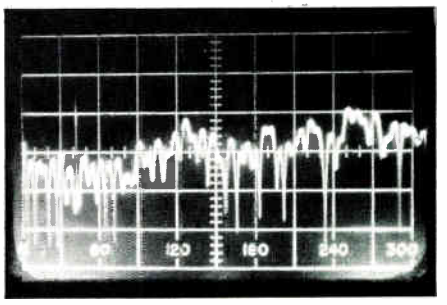


Figure 9. Return loss of 100 ft. BAD RG-59 terminated in 75 ohms



the tuned input circuit, we find the following (refer to Figure 10):

- Below about 50 MHz, nearly all of the signal is reflected back because of a high pass filter.
- As 50 MHz is approached, the response goes down (gets better) rather sharply. This would be the "knee" of the high pass filter and the beginning of the broad passband range.
- As the frequency is increased we find a rather deep notch or dip in the response toward the optimum return-loss. This can be related to the particular channel the converter is tuned to at the time (channel 4 in this particular case).
- Above this, we see the general response of the remainder of the circuit caused by the components and structural composition.

It is easy to see that the converter identifies itself through this test. The converter's response to the return-loss test is completely different from the response of an open-ended cable that would be expected at a residence without any connection to the cable system. Adding a 100-foot drop between the signal source and the converter reveals similar identifying features, but with the cable response added. See Figure 11.

These return-loss test responses (other than opens or shorts) characterize the presence of a tuned circuit connected to the cable line. The device's response to the return-loss test is its "signature." The ability to test for and record (via photo-

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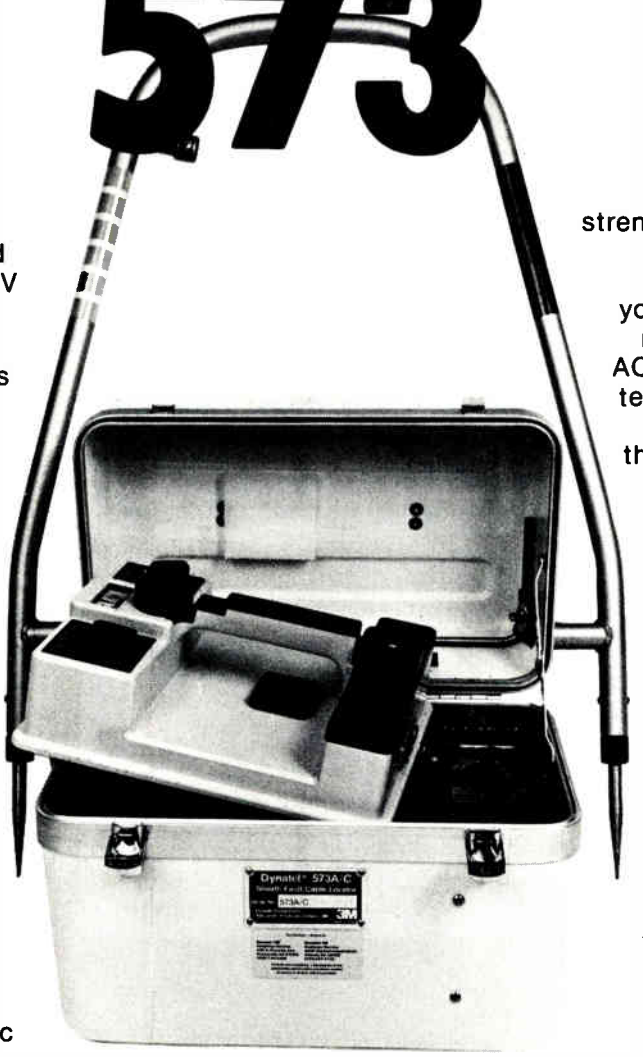

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Figure 10. Return loss of a converter tuned to channel 4

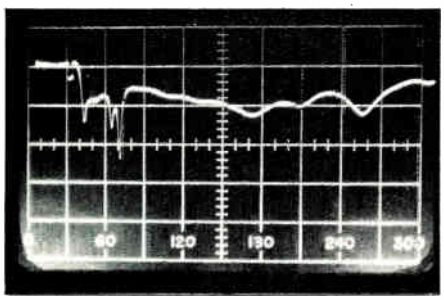
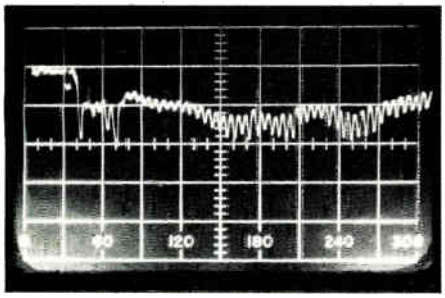


Figure 11. Return loss of a converter tuned to channel 4/100 ft. RG-59



graphs) these signatures will allow the company to present verifiable evidence to support probable cause (intent to steal).

There are a considerable number of connection and channel combinations which are possible inside a home. For example, there may be a TV connected directly, two hot outlets or three different converter models inside a home. Such extravagant combinations are not likely, however, particularly in the case of cable pirates. Most of the drops tested will probably fall within three basic categories:

- A single converter, converterless TV or a stereo with one hot outlet;
- No connection at all (which is indicated by an open);
- Drop problems which mask the response in such a way that the connection is suspect but not certain.

The return-loss test results may not always be conclusive. The condition of the drop line can affect the test results. When this happens, the drop should be completely removed. Later, a recheck or follow-up may reveal another drop has been installed illegally and it should be retested. The fact that the drop was removed and illegally reinstalled is strong evidence in itself.

Sample test procedure

Following is a sample of the return-loss test procedure employed at Heritage Cablevision's Des Moines system, using a standard Avantek sweep set. Other equipment could be used.

The test connections are shown in

Figure 12. Test set-up

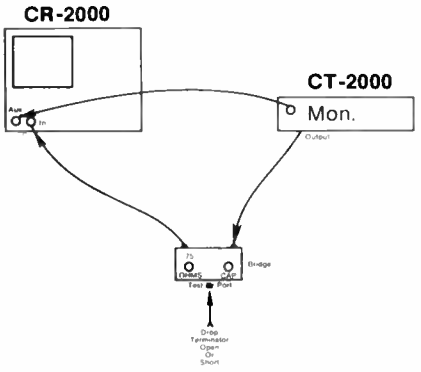


Figure 12. These connections may vary slightly, depending on the test equipment types used. The test equipment shown in Figure 12 is a return-loss bridge and standard Avantek sweep set. (Note that the auxiliary pilot input to the CR-2000 is used to prevent loss of the 50 MHz sweep sync that could occur because of the higher losses involved in the return-loss test.)

Equipment controls should be set as follows for the Avantek 2000. If other equipment is used, consult the manufacturer's manuals.

1. CR-2000:
- Sweep width set to full
- Sweep rate to remote lock
- Input attenuator to 15 dB
- Trigger to line or display
- Video gain to 10 dB per division
- Video filter to narrow

2. CT-2000:
- Set the output attenuators to out

3. Return-loss bridge:
- Set the variable resistor to 75 ohms
- Set the variable capacitor to 0 (zero)

With the test port of the return-loss bridge open, set the vertical position so that the response is approximately along the 5 dB line (first line from the top with the attenuator on 15). This will place the perfect match return-loss response near the bottom of the screen and can be checked by terminating the bridge test port with a high-quality 75 ohm terminator.

If other types of test equipment are used, the desired display will be as above, with the response of an open near the top and that of a near-perfect match near the bottom. The sweep generator (transmitter) and sweep receiver/display must be adjusted accordingly. Use attenuators to approximately set the terminated response and the vertical position to set the open response.

Once the test equipment controls have been set, no further adjustment will be needed to conduct the test. Connect the bridge test port to the drop in question and take a picture of the response for the record.

Determining addresses to test

A basic auditing program is essential to identification of the potential cable pirate. A list of addresses which need a first field-check may be made from several sources, such as:
- Non-pays who have been disconnected but the converter has not been returned;
- Friends and neighbors who may report that a person has cable but is bragging about not paying for it;
- Employees who find "weird" or "different" wiring or fittings at a tap.

Once the initial list is developed, an audit should be conducted. The audit should include a check of the records, a physical check at the tap and an attempt to collect any converters (if applicable). If the converter is collected during this step, the drop should be disconnected or removed and the records annotated. If a converter is not collected, entry is refused or it is verified that the drop was reconnected illegally since a previous disconnect, then the return-loss test should be conducted in pursuit of prosecution.

If an address is recommended for the return-loss test and possible legal action, it is extremely important to remember that the drop and any hardware be left connected as found. When a search warrant is issued, the connection will be important evidence of tampering and will be needed to prove that there is a

Continued on p. 72

Special Section

Frequency Allocation

The turbulent spectrum

Handful of RF allocation changes puts new face on video, data markets

By Fred Dawson

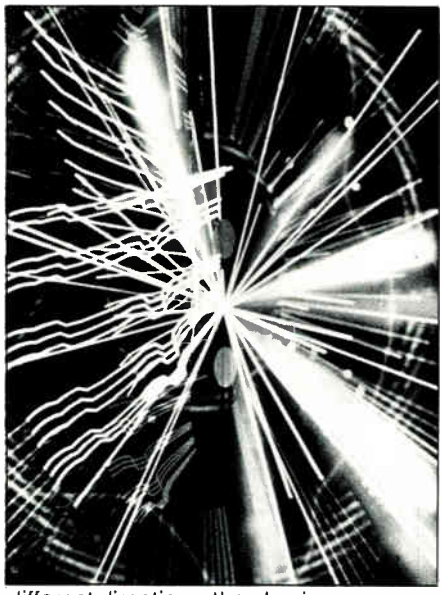
In the past year or so the stage has been set for what promises to be an unprecedented free-for-all in competition for market position among purveyors of telecommunications services.

Although the shifts and additions in frequency allocation show up on this year's *Frequency Allocation Chart* (p. 35) as relatively minor alterations in the status quo, those small segments marking new RF spectrum assignments represent some of the most significant decisions the FCC has ever made. In less time than it has taken to build cable franchises that were awarded under an entirely different set of conditions, a host of new, potentially competing approaches to delivery of video entertainment and data services has been waved through the starting gate.

The list includes direct broadcast satellite services at 12.2 to 12.7 GHz; multichannel MDS at 2.5 GHz; digital termination service at 10.55-10.68 MHz; cellular radio service at 825-845 MHz and 870-890 MHz, with space in the UHF zones of 512-608 MHz and 614-806 MHz also available on a secondary basis; and one- and two-way paging, which, with recent allocations between 929 and 932 MHz, has been granted a quadrupling of spectrum space since the start of 1981.

Along with these developments in over-the-air spectrum allocations have come significant changes in the profile of frequency allocations pertaining to CATV. In January 1982 the National Cable Television Association and the Electronic Industries Association formed a Joint Engineering Committee Channelization Working Group to facilitate standardization of channel identification.

The group's recommended Channel Identification Plan, covering the spectrum range through 648 MHz, is incorporated into this year's *Frequency Allocation Chart* and appears to be well on its way to acceptance in the industry. With manufacturers of television receivers and converters currently going in many



different directions, the plan is seen as an important step toward ensuring the modicum of compatibility necessary to making "cable-ready" TV sets useable in all cable systems.

The group's recommended channel designations do away with the combination letter/number system followed by the FCC. Instead, channels are numbered 1 through 99 with prioritization as follows:

- Channels 2-53 are implemented first.
- Channels 1 and 54-65 come next.
- Once channels 1-65 are implemented, channels 98-99 must be used. Inclusion of these two channels in devices with fewer than 65 channels is optional. Channels 98 and 99 must be implemented jointly.
- Channels 66-94 are the next set to be implemented.
- Channels 95-97, located in the FM frequency allocation zone at 90 through 108 MHz, were included in the plan to complete the available spectrum, according to the working group's memorandum on the plan. "Compliance with this Channel Identification Plan does not require that these channels be included," the group says. "Therefore, utilization of these channels by a cable system is on a voluntary basis and recommended signal carriage is for services other than those involving transmission of a picture (standard or scrambled) to a customer. Many television receivers currently on the market and compatible units to be produced in the near future contain traps to attenuate the FM band, thereby greatly reducing the source of cross modulation and intermodulation interference to TV. Inclusion of these traps inhibits the reception of these signals." Both Zenith Corp. and General Electric Co. have objected to the naming of channels 95-97 on grounds that the action could cause confusion and even lead to video programming of those channels in some cable systems.

DBS

Perhaps the biggest attention getter at the FCC last year was the DBS authorization process. There are now eight entities that have won permission to proceed with development of DBS service, and another five applications are pending.

The U.S. cleared an important hurdle in DBS development last month when the 25 Western Hemisphere nations participating in the Regional Administrative Radio Conference in Geneva reached agreement on a plan that generally meets this country's DBS goals. Most significantly, the U.S. won approval for eight orbital positions, each with the maximum of 500 MHz of spectrum space providing up to 32 channels of service.

However, these orbital slots are not in the arc, ranging from 170 degrees west and proceeding east at about 10-degree intervals, that the U.S. had hoped for. Instead, owing to the needs of Canada and Mexico, the U.S. had to accept an extension of the arc eastward and westward with gaps put in to accommodate

other countries' satellites. Satellites in the two western-most U.S. slots, at 175 and 166 degrees, and in the eastern-most slot, at 61.5 degrees, will only be able to serve the western and eastern time zones, respectively, while satellites in the remain ing five slots will be able to serve up to half the country from any one position. It had been hoped that coverage of half the country would be possible from all eight slots.

Another drawback to the eastern-most slot is that satellites operating from that position will have poor eclipse-time protection during the months of the fall and spring equinoxes. The satellites would go dark as early as 9:23 p.m. and remain dark for as long as 72 minutes as the earth, passing between the sun and the satellites, cut off the energy source for the satellites' solar-powered batteries.

The one key issue the U.S. lost on in the conference pertains to the minimum amount of transmission power permitted for DBS authorization. The U.S. delegation pushed hard for a power standard (-107 of power flux density to the square meter) that would result in signal strength sufficient to allow installation of home antennas 75 centimeters in width.

The standard finally adopted (-105 pfd per square meter) permits signal strength that limits antenna width to one meter or more. Countries, including Canada, who supported this standard did so because they anticipate much of the service delivered from the new K-band birds will be distributed terrestrially by cable or other means. The U.S. took a reservation on this portion of the agreement, stating that it would proceed with setting its preferred power standard for domestic DBS service while striving to minimize the impact on the assignments of other countries.

There has been disagreement over just how much impact, if any, the institution of DBS service in the U.S. will have on the cable television industry. Most applicants have indicated their ventures are predicated on demand for video entertainment in areas not served by cable. For example, Satellite Television Corp., the Comsat subsidiary that initiated action on DBS and was the first to win FCC approval, estimates a potential subscriber universe of five million homes in areas unserved by cable or broadcast television.

On the other hand, there are some applicants who have speculated that DBS ultimately will be competing with cable, both through delivery of service to SMATV operators and through direct door-to-door competition for residential subscribers in cable markets. Robert Fountain, executive vice president of United States Satellite Broadcasting Co., which intends to launch its three-channel DBS system in 1986, recently told the New York Chapter of the National Academy of Television Arts and Sciences that USSB believes DBS will be "lethal" to cable television.

While many experts would disagree with this assessment on grounds that DBS would be hampered by its limited channel offerings (most applicants call for under five channels per satellite), others note that by co-locating satellites in orbital slots, purveyors could combine offerings in such a way as to provide up to 32 channels of service to any one home receiver. William Prichard, president of Direct Broadcast Satellite Corp., has advocated such an approach, but so far the DBS companies have taken a "go-it-alone" stance that portends much more competition among themselves than with the cable television industry.

The FCC's designation of the 12.2-12.7 GHz frequencies for DBS will result in the displacement of private fixed service microwave users currently operating in those frequencies. As with other FCC frequency allocation decisions in the past year, the commission's action has stirred strong protest from some of these users. The County of Los Angeles Department of Communications, for example, said the proposals for accommodating displaced 12 GHz users are impractical and that the city will be severely burdened with added equipment costs if it has to move to other frequencies.

One of the proposed slots suggested for these users by the FCC is the 12.7-13.2 GHz band, where the CARS band is located. The NCTA and a number of MSOs have filed objections to such a move. Said the NCTA: "These users, who obviously must be relocated somewhere, do not have the same multichannel needs as cable operators, and it is questionable whether the congested CARS band is a sensible place for their relocation."

The FCC has also proposed that in conjunction with the shift of users to new spectrum space the allocation of microwave frequencies be made according to technical transmission characteristics instead of by type or class of communication service, which is the current standard. Under this proposal cable and private radio would be permitted to operate microwave gear in the 2 and 7 GHz bands, which broadcasters have had to themselves for studio-to-transmitter links and for sending signals from electronic news gathering equipment back to the studio. By opening these spectrum spaces to CARS, the FCC indicated there would be less reason to object to the shift of 12.2-12.7 GHz microwave users to the current CARS band frequency slot.

ATC, for one, disagreed, saying that the 2 and 7 GHz bands "could be so congested in major metropolitan areas that CARS frequencies will not be readily available. In short, ATC does not believe that having (such) frequencies available under the commission's new rules will offset the adverse impact on cable television operators if the 13 GHz band is opened up to private fixed service users."

The FCC is expected to issue a final ruling on relocation of these users next month.

Multichannel MDS

Another frequency allocation of potential concern to cable operators is the decision to permit eight channels for multichannel MDS systems in the 2.5 GHz space that had been reserved strictly for instructional fixed television service (ITFS). Under the FCC's ruling, issued in the last week of May, the eight MDS channels would be available for two, four-channel MDS systems in each market. While the commission grandfathered all ITFS channels currently authorized or applied for, it said no further ITFS applications will be accepted on the eight MDS channels reallocated to MDS.

The commission proposed to use a lottery to determine which applicants will be awarded multichannel MDS permits.

Digital Termination System

Although it was approved by the FCC over a year and a half ago, the category of spectrum allocation known as Digital Electronic Message Service (DEMS) and more commonly referred to by the name applied to its main design element, Digital Termination System (DTS), is still in the nascent stages, with significant developmental implications for CATV.

DEMS is a common carrier microwave service intended for two-way transmission of digital data, voice and low-grade video among office buildings or institutions within cities. The typical DEMS system, in a fashion similar to cellular radio, will divide the city into several segments, with a DTS facility operating in each segment. These facilities, or nodes, will link various user stations via microwave to a central station, which serves as a switching point for intracity DTS communications and as an interconnection point with microwave networks and satellites for intercity communications. Each applicant is allowed only one channel per city, but, since the 10 GHz signals are highly directional and propagation is naturally limited, each channel can be reused repeatedly. Up to thirteen DEMS operators can compete in any community.

While most cable operators have shown no interest in the service, and many see it as another reason to shy away from competing in the data transmission marketplace, Cox Cable and Warner Amex have opted to seek approval for DTS operations, seeing the service as a complement to broadband cable delivery of data services. In its application to the FCC asking for permits to operate DTS in seven cities, Cox stated it would use DTS "to extend services to areas not wired... and to connect existing cable locations."

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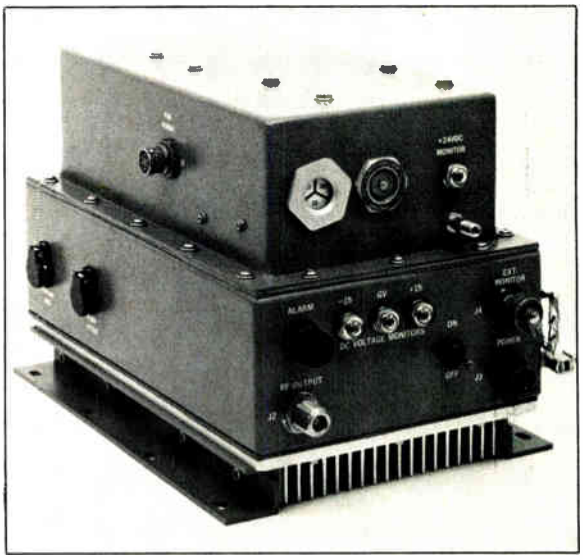

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Relating S/N to C/I at TVRO sites

A Warner Amex solution to predicting IF filter effects on picture quality

By Roger Hill
Staff Engineer
Warner Amex Cable Communications, Inc.

Every CATV operator desires a well-engineered and operating TVRO. However, in spite of proper site selection, some TVROs experience terrestrial interference that renders satellite programs totally unacceptable. Even TVROs that are operating well, are FCC licensed and are frequency protected can receive interference.

One such TVRO had operated well for several years until the local municipality built a water tower several hundred feet away. The tank proved to be a perfect reflector, bouncing terrestrial microwave directly at the TVRO as soon as it was installed.

In older systems, where headends were built on the highest site available to permit the best quality pickup of off-air signals, an upgrade of the system to receive satellite programming often results in placement of the TVRO at the same high elevation, right in the line of site of terrestrial microwave. And even in systems where the main TVRO has been remotely located to avoid terrestrial interference, a second, backup TVRO may be installed at the headend site on the theory that signals with impulse noise are better than no signals at all when something happens to the supertrunk connection between the remote TVRO and the headend.

In such cases of likely interference, chances are good the operator has installed IF filters just to obtain a picture. The IF filters are a natural choice. They are easy to install and relatively inexpensive, and they are insensitive to the transponder, which simplifies ordering.

Typically, the operator's approach is to figure out how to achieve acceptable picture quality once the main disaster—terrestrial interference—has been averted. However, while any picture is better than no picture at all, it would be better if the operator knew what is going to be on the system to ensure minimum engineering standards are met. Even for the operator wanting to install a TVRO as a backup, it is best to know what the resulting picture quality will be before making any purchases.

All of these instances have come up in operations at the corporate microwave/RF engineering group at Warner Amex Cable Communications, Inc. Although many field visits to systems experiencing interference have developed a feel for estimating degree of improvement by IF filtering, it still is difficult to accurately predict the improvement that filtering will yield, even when C/I measurements are made, until the filters are installed and a signal-to-noise test set is used. Since more systems have a spectrum analyzer that can measure up to IF frequencies (70 MHz) than have a S/N test set, it would be helpful to be able to relate S/N to C/I with filters.

This relationship cannot be demonstrated with a simple set of equations. Instead it will be shown graphically. The graph will be an aid in predicting S/N with a given C/I and IF filters for a TVRO.

Procedures

The tests were conducted with typical equipment at the Warner Amex cable system in Dallas. The TVRO used was a 5-meter prime focus antenna with a 100° K LNA. This probably is not the typical TVRO in a Warner Amex system; the typical TVRO is a 5-meter cassegrain with a 120° K LNA. However, in the link budget calculations, the B/T is identical for the two TVROs.

The antenna was peaked on Satcom IIIR in azimuth, elevation and cross polarization. The satellite video receivers had threshold extention, which is also fairly typical. The IF filters were

Figure 1

IF Filter Test Set Up

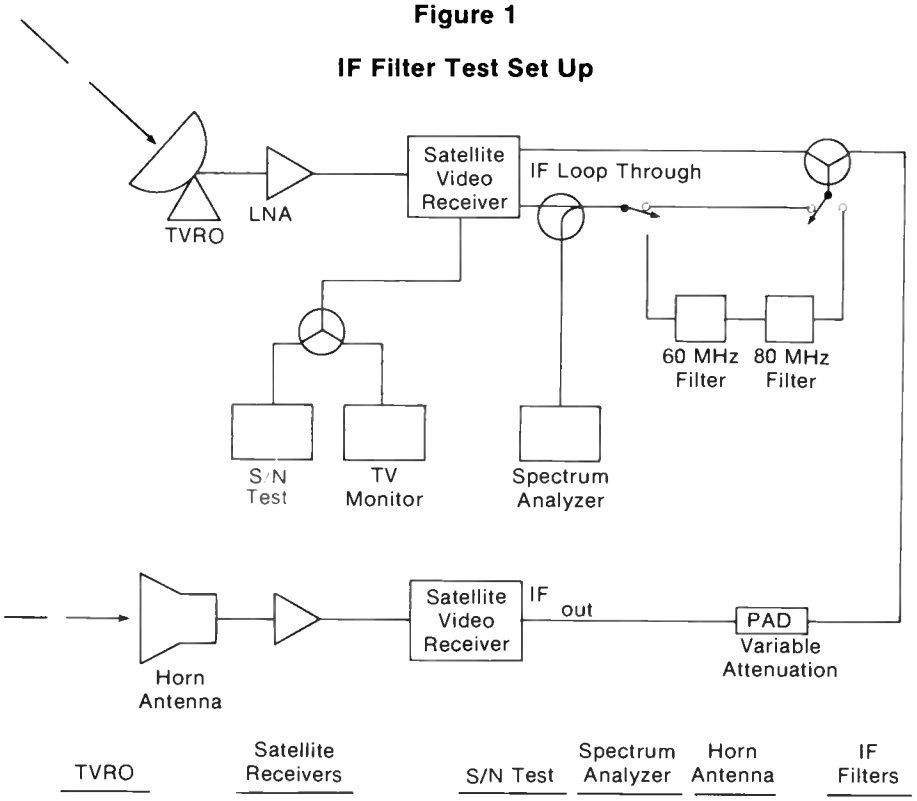
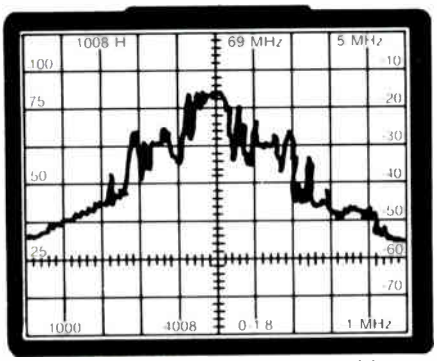
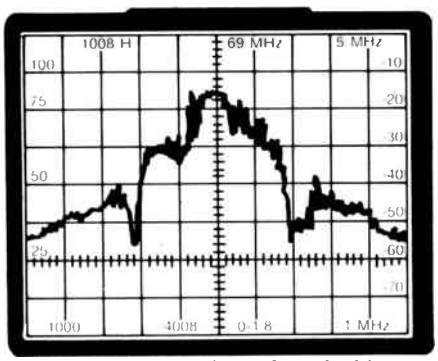


Figure 3

Reference Satellite Video With Interference



Reference Satellite Video Signal with Interference for C/I = 10 dB



Reference Satellite Video Signal with Interference for C/I = 10 dB and with IF Filters at 60 MHz and 80 MHz

Figure 4

Signal-to-Noise vs Carrier-to-Interference

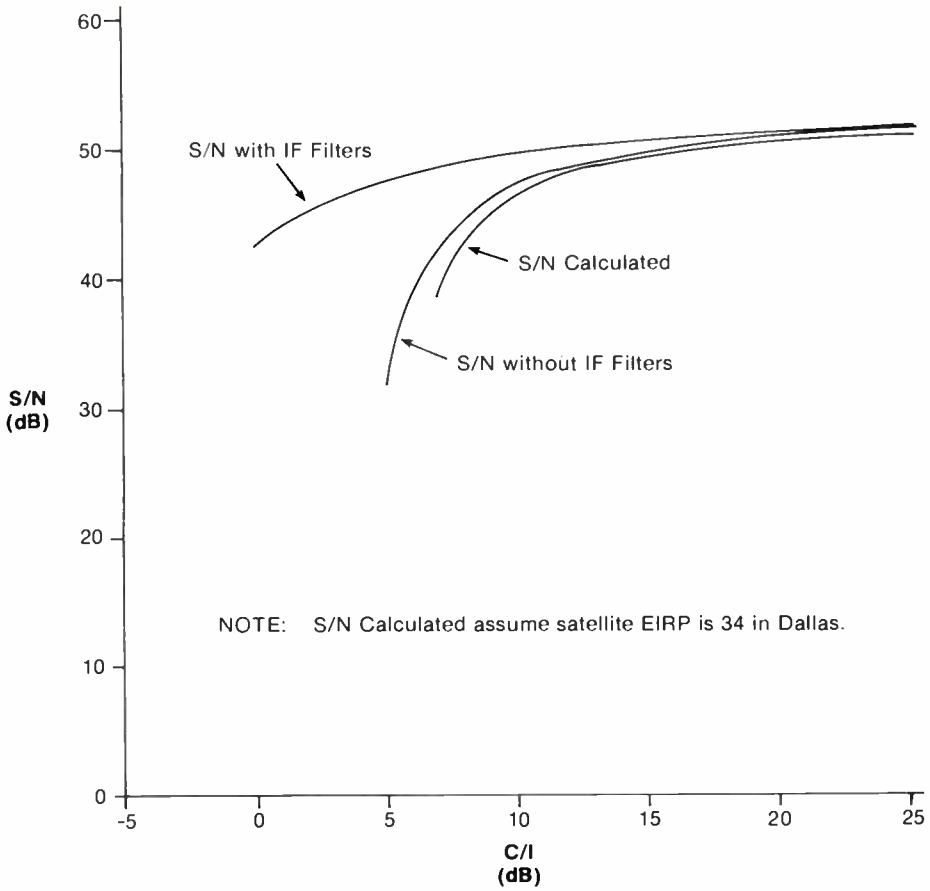


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EXHIBIT 1

Relationship Between Phase Distortion and Time Delay

When there is a linear phase characteristic of a circuit, there is a constant time delay. The phase characteristic of a typical band stop filter is shown in Exhibit 2. It clearly shows that the phase response is not linear over the entire operating frequency band, so a constant time delay will not exist. This response is frequency dependent and will give some phase angle for a given frequency.

It is not too difficult to find an engineering text book that shows that the slope of a line defined by phase per frequency is time delay.

Reference 1 directly relates the two as:

$$\text{delay } T = \frac{B \text{ (radians)}}{W \text{ (radians/second)}}$$

$$T = \frac{B}{W} \text{ seconds}$$

Reference 2 uses a more mathematical approach and defines a nonlinear phase as $H(f) = \Theta(f)$.

Then $H(f) = Ke^{j\Theta(f)}$,
$H(f) = Ke^{j\Theta(f + fc)}\, U(f + fc)$.

Then uses a Taylor series to get

$$\Theta(f + fc) = \Theta(fc) + \frac{f\, d\Theta(f)}{df}\Big|_{f = fc} \approx -Wctc$$

where delay $t_c = \frac{-\Theta(fc)}{2\pi fc} = \frac{-\Theta(fc)}{Wc}$

where $\Theta(fc)$ is the phase angle at a given frequency.

Reference 1: "Telecommunication Transmission Handbook," John Wiley & Sons, Inc. 2nd Edition, 1981, Roger L. Freeman

Reference 2: "Communication Systems," A Bruce Carlson, McGraw Hill, 2nd Edition, 1975

EXHIBIT 2

Typical Phase Characteristic For A Notch Filter

Z in ohms, α in nepers, and β in radians
ω_1=lower cutoff angular frequency
ω_2=upper cutoff angular frequency
$\omega_0 = (\omega_1\omega_2)\,½ = 1/(L_{1k}C_{1k})½$
$= 1/(L_{2k}C_{2k})½$

$\omega_2 - \omega_1$=width of stop band
$\omega_{1\infty}$=lower angular frequency of peak attenuation
$\omega_{2\infty}$=upper angular frequency of peak attenuation

Full-Section Attenuation α and Phase β Characteristics

When $\omega = \omega_0$

$\alpha = \infty$

When $\omega_0 < \omega < \omega_2$

$$\alpha = 2\cosh^{-1}\frac{\omega(\omega_2 - \omega_1)}{\omega^2 - \omega_0^2}$$

$\beta = -\pi$

When $\omega_2 < \omega < \infty$

$\alpha = 0$

$$\beta = 2\sin^{-1}\frac{\omega(\omega_2 - \omega_1)}{\omega_0^2 - \omega^2}$$

Reference: "Reference Data for Radio Engineers," ITT Howard W. Sams and Co., Inc., 2nd Printing, 1977

Exhibit 4; Conclusion

BW:	Noise BW = 10 log BW = 10 log(32.5 MHz) = -75.1	
C/I_{ADJ} Sat:	= 26.7 dB	
C/I_{XPOL}:	= $C/I_{Ant\ Up}$ ⊕ $C/I_{Ant\ Down}$ ⊕ C/I_{Sat} = 35dB ⊕ 35dB ⊕ 33dB = 29.5 dB	
C/N_{DOWN}:	= EIRP - LFS - BOLTZC + G/T - BW = 34 - 196.0 + 228.6 + 22.6 -75.1 = 14.1 dB	
C/N_{UP}:	= 33 dB (typical)	
C/I: C/I	= $C/I_{terrestrial}$ ⊕ C/I_{XPOL} ⊕ C/I_{ADJSAT} = C/I_{terr} ⊕ 24.8	
C/N C/N	= 14.1 ⊕ 33 ⊕ 24.8 ⊕ C/I_{terr} = 13.7 ⊕ C/I_{terr}	NOTE: ⊕ denotes power addition

Conclusion

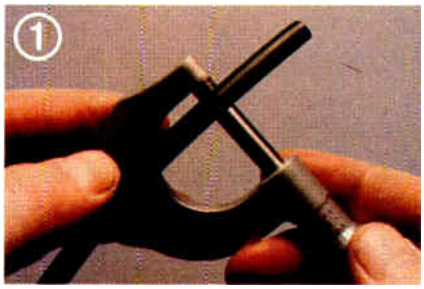
If filters can produce a drastic improvement in satellite video reception with terrestrial interference. There is no replacement for a well-engineered TVRO, with the C/I being greater than the minimum criteria. But when there is no way to avoid interference, IF filters can improve the S/N and only affect the linear distortion parameters of the video signal.

This is not to suggest that IF filtering is the only solution to reducing terrestrial interference. There are other filters that notch out the interference at RF, and the use of artificial shielding is very effective in reducing interference. In fact, when the interference is exceptionally strong, a combination of these techniques may prove to be the best solution. **CED**

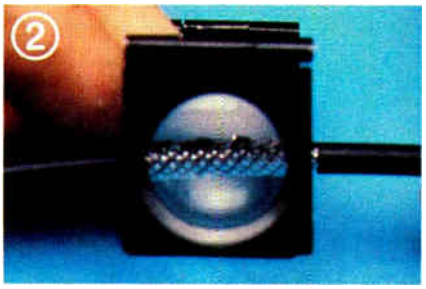
Roger Hill recently became staff engineer for the specialized common carrier, Argo Communications Corp., following a year and a half stint at Warner Amex Cable Communications, where, as staff engineer, he wrote the accompanying paper. Hill began his career in communications as a staff engineer with RCA Americom in June 1980 after graduating with a B.S.E.E. from West Virginia University.

Caveat Emptor*

Anybody who buys drop cable ought to try this little test.

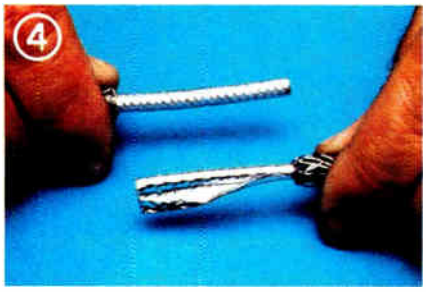


Measure the overall outside cable diameter with a micrometer. If it is not .242", connectors may not fit properly and performance might be affected.



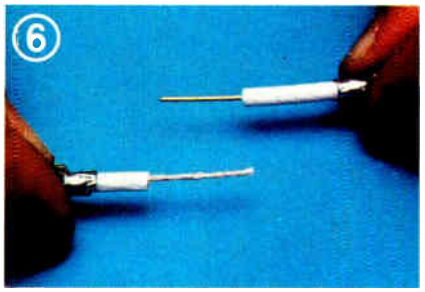
Carefully strip jacket off one inch of cable. If you ordered 67% braid, make sure 2/3 of the foil is covered by braid—not 1/2 or less.

Check the braid impression on the underside of the removed jacket. A deep impression indicates a jacket which is too tight. This may cause difficult "F" connector installation. An extremely shallow impression indicates a jacket which is too loose.

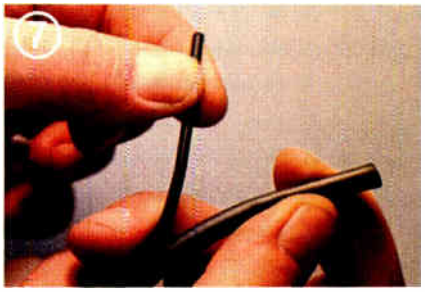


Now, strip off some jacket and braid, and expose the foil. If the aluminum/mylar shield peels off easily, it is not bonded. Duobond II® provides a strong bond to prevent the foil from pushing back during termination.

Measure the core in several places to make sure it is .143". On foil cables, measure over the foil to make sure it is .148". If out of tolerance, the connectors may not fit properly.

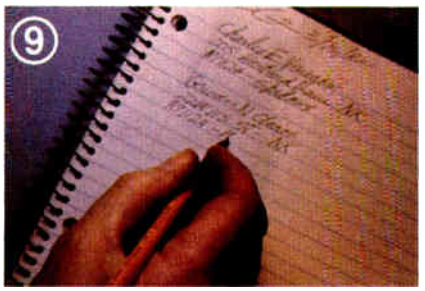


Remove a few inches of dielectric. If you find "fuzz" on the center conductor, intermittent contact may result. If the installer scrapes off the fuzz with a knife he runs the risk of damaging the copper cladding. Belden® cable stays smooth and clean every time.



On messengered cable, make sure the messenger separates without tearing into the jacket and exposing the shield.

Is every reel of cable 100% sweep tested? All Belden® drop cable is (RG 59, 23 dB min.; RG 6, 26 dB min.). You don't have to accept anything less.



Count your callbacks due to cable or termination problems. The little extra that it costs to use Belden gives you a big extra in performance reliability and value.

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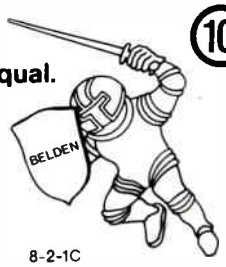

Don't believe everything you hear—or read. Even this. Test it for yourself. For more information, contact: Belden, Electronic Wire and Cable, P.O. Box 1980, Richmond, IN 47374. Phone: 317-983-5200.

*Let the buyer beware—especially when it comes to drop cable.

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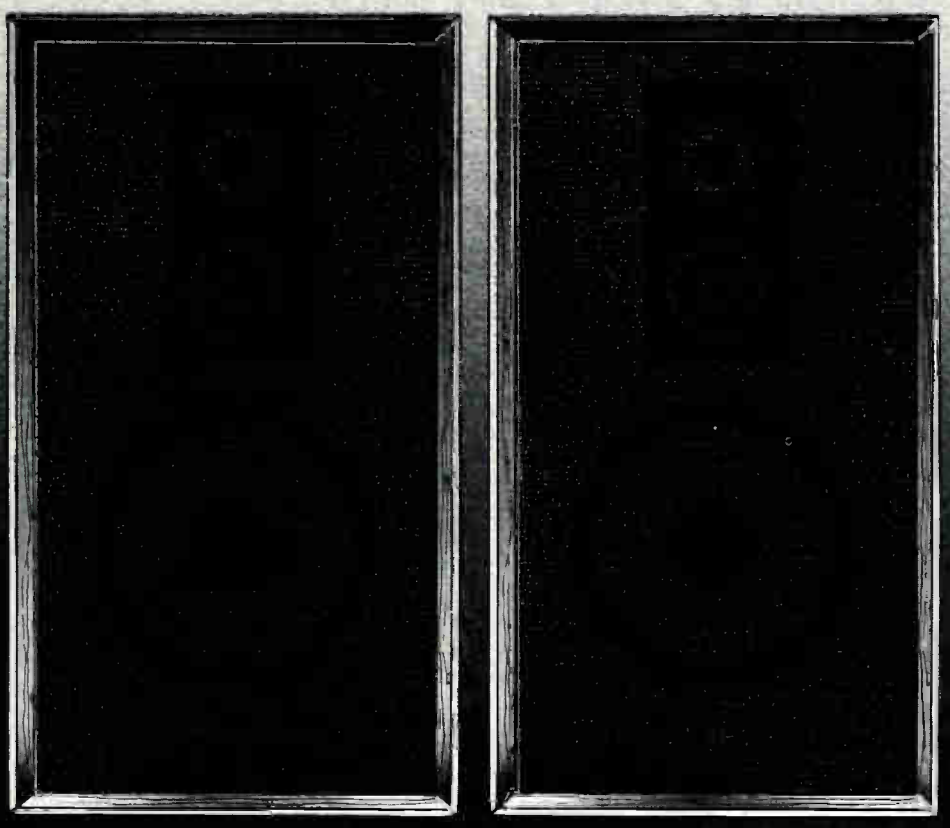

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Co. Name and Product	Frequency Range	Gain	Noise Temperature	Gain Flatness	Gain Slope
Amplica					
ACD305314	3.7—4.2 GHz	50 dB min.	80° K	±0.5 dB/500 MHz ±0.25 dB/40 MHz	.01 dB/MHz max.
ACD305321	3.7—4.2 GHz	50 dB min.	100° K	±0.5 dB/500 MHz ±0.25 dB/40 MHz	.01 dB/MHz max.
ACD305328	3.7—4.2 GHz	50 dB min.	120° K	±0.5 dB/500 MHz ±0.25 dB/40 MHz	.01 dB/MHz max.
Avantek					
AW-4289	3.7—4.2 GHz	48 dB min./ 53 dB max.	80° K max.	±0.5 dB	.01 dB/MHz max.
AWC-4215	3.7—4.2 GHz	48 dB	120° K max.	±0.5 dB	.01 dB/MHz max.
California Amplifier					
C40115-75	3.7—4.2 GHz	50 dB min.	75° K max.	±0.5 dB/500 MHz	.01 dB/MHz max.
C40115-100	3.7—4.2 GHz	50 dB min.	100° K max.	±0.5 dB/500 MHz	.01 dB/MHz max.
C40115-120	3.7—4.2 GHz	50 dB min.	120° K max.	±0.5 dB/500 MHz	.01 dB/MHz max.
General Instruments, RF Systems Division					
LNA-85	3.7—4.2 GHz	50 dB min.	85° K max.	±0.5 dB max.	.015 dB/MHz max.
LNA-100	3.7—4.2 GHz	50 dB min.	100° K max.	±0.5 dB max.	.015 dB/MHz max.
LNA-120	3.7—4.2 GHz	50 dB min.	120° K max.	±0.5 dB max.	.015 dB/MHz max.
Harris					
6303H	3.7—4.2 GHz	50 dB min.	140° K max.	±0.8 dB/500 MHz ±0.25 dB/40 MHz	.01 dB/MHz max.
6303D	3.7—4.2 GHz	50 dB min.	100° K max.	±0.8 dB/500 MHz ±0.25 dB/40 MHz	.01 dB/MHz max.
6303A	3.7—4.2 GHz	50 dB min.	70° K max.	±0.8 dB/500 MHz ±0.25 dB/40 MHz	.01 dB/MHz max.
M/A-COM MVS					
MC2016-1	3.7—4.2 GHz	50 dB	85° K	±0.5 dB/500 MHz	.015 dB/MHz max.
MC2016-5	3.7—4.2 GHz	50 dB	120° K	±0.5 dB/500 MHz	0.15 dB/MHz max.
LNR Communications					
NC4-45SC	3.7—4.2 GHz	50 dB, 55 dB or 60 dB	50° K max.	±0.5 dB/500 MHz	±0.3 dB/10 MHz max.
CF4-60	3.7—4.2 GHz	50 dB min.	60° K max.	±0.5 dB/500 MHz	±0.1 dB/10 MHz
NC4-28S	3.7—4.2 GHz	60 dB	30° K max.	±0.5 dB/500 MHz	±0.3 dB/10 MHz max.
Scientific-Atlanta					
300-1	3.7—4.2 GHz	50 dB	120° K max.	±0.5 dB/500 MHz ±0.25 dB/40 MHz	±0.5/500 MHz
300-3	3.7—4.2 GHz	50 dB	90° K max.	±0.5 dB/500 MHz ±0.25 dB/40 MHz	±0.5/500 MHz
Winegard					
SC-8085	3.7—4.2 GHz	50 dB min.	85° K max.	±0.5 dB max.	.015 dB/MHz max.
SC-8100	3.7—4.2 GHz	50 dB min.	100° K max.	±0.5 dB max.	.015 dB/MHz max.
SC-8120	3.7—4.2 GHz	50 dB min.	120° K max.	±0.5 dB max.	.015 dB/MHz max.

Linear Group Delay	Parabolic Group Delay	Ripple Group Delay	VSWR Input/ Output	AM/PM Conversion	Power Output @ 1 dB Compression
.01 ns/MHz max.	.001 ns/MHz² max.	.1 ns p-p max.	1.3/1.5 max.	.1 deg/dB @ -15 dBm	+10 dBm
.01 ns/MHz max.	.001 ns/MHz² max.	.1 ns p-p max.	1.3/1.5 max.	.1 deg/dB @ -15 dBm	+10 dBm
.01 ns/MHz max.	.001 ns/MHz² max.	.1 ns p-p max.	1.3/1.5 max.	.1 deg/dB @ -15 dBm	+10 dBm
.01 ns/MHz max.	.001 ns/MHz² max.	0.1 ns peak-to-peak max.	1.25 max./ 1.25 max.	.1 deg/dB @ -5 dBm	+10 dBm
.01 ns/MHz max.	.001 ns/MHz² max.	0.1 ns peak-to-peak max.	1.3 max./ 1.5 max.	.1 deg/dB @ -5 dBm	+5 dBm
.01 ns/MHz max.	.001 ns/MHz² max.	0.1/ns/max.	1.25:1 max./ 1.50:1 max.	1 deg/dB max. @ -15 dBm	+10 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	0.1/ns/max.	1.25:1 max./ 1.50:1 max.	1 deg/dB max. @ -15 dBm	+10 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	0.1/ns/max.	1.25:1 max./ 1.50:1 max.	1 deg/dB max. @ -15 dBm	+10 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	N/A	1.20/1.5 max.	.1 deg/dB max. to -5 dBm	+10 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	N/A	1.20/1.5 max.	.1 deg/dB max. to -5 dBm	+10 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	N/A	1.20/1.5 max.	.1 deg/dB max. to -5 dBm	+10 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	0.1 ns peak-to-peak max.	1.3:1 max./ 1.5:1 max.	.1 deg/dB max. @ -15 dBm	+7 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	0.1 ns peak-to-peak max.	1.3:1 max./ 1.5:1 max.	.1 deg/dB max. @ -15 dBm	+7 dBm min.
.01 ns/MHz max.	.001 ns/MHz² max.	0.1 ns peak-to-peak max.	1.3:1 max./ 1.5:1 max.	.1 deg/dB max. @ -15 dBm	+7 dBm min.
>.01 ns/MHz max.	>.001 ns/MHz² max.	N/A	1.2:1/1.5:1	>.1 deg/dB max. to -5 dBm output	+10 dBm
>.01 ns/MHz max.	>.001 ns/MHz² max.	N/A	1.2:1/1.5:1	>.1 deg/dB max. to -5 dBm output	+10 dBm
±0.1 ns/MHz max.	±.01 ns/MHz² max.	0.3 ns p-p max.	1.25/1.25	.03 deg/dB max. for input of -60 dBm for 50 dB gain, -65 dBm for 55 dB gain and -70 dBm for 60 dB gain	±10 dBm
±0.1 ns/MHz max.	±.01 ns/MHz² max.	0.3 ns p-p max.	1.25/1.25	0.5 deg/dB	±10 dBm
±0.1 ns/MHz max.	±.01 ns/MHz² max.	0.3 ns p-p max.	1.25/1.25	.03 deg/dB max.	±10 dBm
NGT ±0.015 ns/MHz	NGT ±.0015 ns/MHz²	NGT .1 ns p-p	1.25/1.5 max.	N/A	0 dBm min.
NGT ±0.015 ns/MHz	NGT ±.0015 ns/MHz²	NGT .1 ns p-p	1.25/1.5 max.	N/A	0 dBm min.
<.01 ns/MHz max.	<.001 ns/MHz² max.	N/A	1.20/1.5 max.	<.1 deg/dB max. to -5 dBm	+10 dBm min.
<.01 ns/MHz max.	<.001 ns/MHz² max.	N/A	1.20/1.5 max.	<.1 deg/dB max. to -5 dBm	+10 dBm min.
<.01 ns/MHz max.	<.001 ns/MHz² max.	N/A	1.20/1.5 max.	<.1 deg/dB max. to -5 dBm	+10 dBm min.

LNA Manufacturers

Amplica Inc.
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(805) 498-9671

Avantek Inc.
3175 Bowers Ave.
Santa Clara, Calif. 95051
(408) 727-0700

California Amplifier Inc.
3481 Old Conejo Rd.
Newbury Park, Calif. 91320
(805) 498-2108

General Instruments
RF Systems Division
1 Taco St.
Sherburne, N.Y. 13460
(607) 674-2211

Harris Corp.
Satellite Communications Division
P.O. Box 1700
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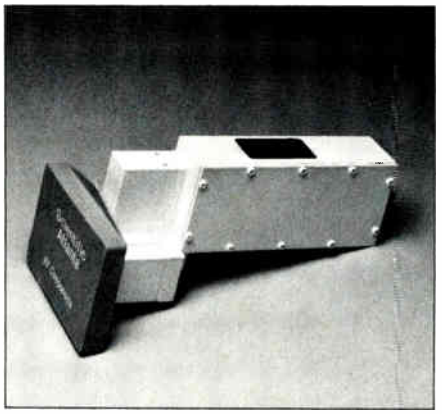
(305) 724-3000

LNR Communications
180 Marcus Blvd.
Hauppauge, N.Y. 11788
(516) 273-7111

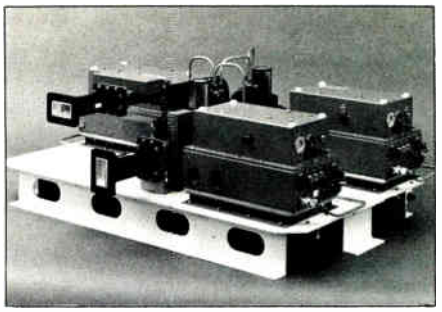
M/A-COM MVS Inc.
63 Third Ave.
Burlington, Mass. 01803
(617) 272-3000

Scientific-Atlanta Inc.
4311 Communications Drive
P.O. Box 105027
Atlanta, Ga. 30348
(404) 441-4100

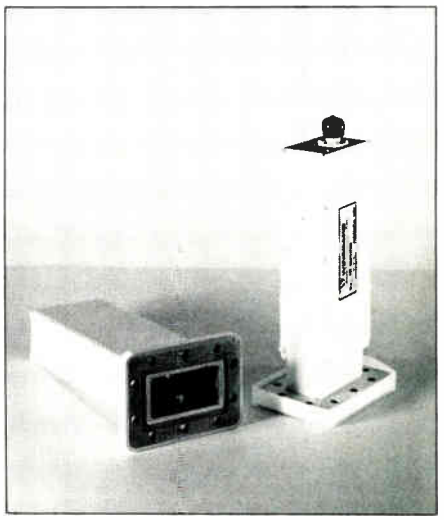
Winegard Co.
Satellite Communications Division
3000 Kirkwood St.
Burlington, Iowa 52601
(319) 753-0121



Scientific-Atlanta's 300-1 LNA



LNR NC4-45SC tridundant system



Winegard SC-8120 LNA

Continued from p. 32
continuous signal path between the feeder cable and the TV set.

Documenting the audit process

The first step in seeking legal action is proper documentation and record keeping of the audit program. The audit program documentation will be particularly important if the address has been found illegally connected and disconnected more than once. A written procedure for the audit program should be available for use in court, if necessary.

The form to be used for documenting the return-loss test should provide space for all necessary information, including space for the response photograph.

Use of test results

The results of the return-loss test must be compared against a reference file which contains various combinations of drop length, converters, channels, TV(s), stereos, opens and so on. This file would be developed from bench tests or other controlled testing.

If the return-loss test at an address shows an open, which usually can be determined by the service personnel making the test, then the drop should be disconnected from the tap and the tap terminated. This address would be a likely candidate for a future audit or recheck.

If the return-loss test at an address shows a bad drop or an indefinite connection (sometimes the two are indistinguishable), but it is suspected as an illegal connection because of previous disconnects or other reasons, then the drop should be removed. This may be a key in future audits if the resident puts up a new drop and reconnects to the tap. When this happens, the audit and return-loss test should be repeated. The fact that the drop was taken down by the company and replaced illegally is strong evidence in itself. Any return-loss response, other than an open, will then provide conclusive evidence in support of this fact.

If the response found is similar to one or more of those in the reference file, the drop and connection to the tap should be left alone. It is important that the connections to the tap remain as found until the search warrant is served. During the actual search, the drop and connection can be removed and used as evidence. Modified traps or non-standard cable and fittings would be important evidence.

The audit documents and test results are then forwarded through channels for use in the search warrant and court process. The audit documents and the return-loss test results provide the "reasonable cause" needed to obtain a search warrant.

It is important to remember that daily work habits and job performance are also important. If audit, installation, service and office work procedures are followed properly, no one will have reason to believe the cable company did not do its job (failing to disconnect an address or not attempting to retrieve a converter).

A company representative, preferably a technician, may need to accompany the police or sheriff during a legal search to identify equipment and remove (for evidence) any unorthodox connections, cables, fittings, converters, televisions, stereos and so on. The tap should be terminated at the time of the search. The tap itself may become evidence if the pirate has broken some tap ports trying to remove terminators or traps.

A cooperative county attorney is needed for criminal search warrants, or a writ of replevin for civil suits. Legal advice should be sought for both processes. It is beyond the scope of this paper to describe the various courses which can be taken either in the criminal or civil courts. Regardless of which direction is pursued, thorough documentation is the key to a successful outcome.

Acknowledgment

The author wishes to thank the Des Moines "Line Techs" for their assistance in developing this test. In particular, thanks go to Sean Fitzgerald, Doug Findley, and Dennis Dyer, for their invaluable help in conducting the bench tests and field tests. **CED**

At $760, SAM Jr. isn't the lowest-priced signal level meter you can buy. But it's the only low-priced meter that doesn't ask you to make sacrifices.

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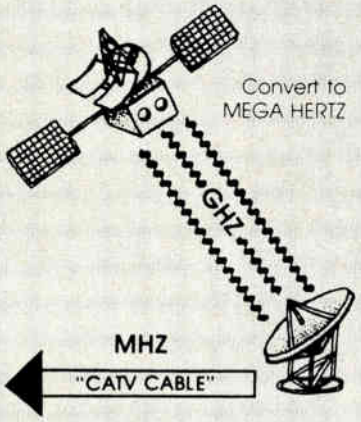

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(213) 434-9951

EQUIPMENT FOR SALE

QUAN.	MFG.	DESCRIPTION
2	Gardiner	GCC 5.6 meter earth stations with dual feed
4	Gardiner	Model 2100, 100° 60 db LNA's
17	Gardiner	Model 4100, 24 channel, satellite receivers
24	Catel	Model TM-2400A Modulators Channels 2,3,4,5,6,C,D,E,F,G,H,7,8,9,10,11,12,13,K,O,S,T,U,V,
4	Oak	MKIII Scramblers
1	Phasecom	Channel A Modulators
9	RCA	Signal Processors Model ACEXSCOTOP Channels 3 in I out, 8 in J out, 10 in L out, 13 in M out, 16 in N out, 22 in P out, 2 ea. 40 in Q out, 44 in R out
1	S.A.	Model 6150 Signal processor channel 50 in E out
3	S.A.	Model 68-14 combining networks
1	Arvin	Model TW-2 Telweather
1	Avantek	Model CT2000A Remote Sweep Transmitter
6	—	19" Racks 6' high
1	Rohn	Model 80 Goyed 100' tower with 6 antenna side arms
9	Anixter-Mark	Antennas channels 3,8,10,13,16,22, 2 ea. 40,44
1	Wegner	Model 1602 Stereo processor Disney
1	Wegner	Model 1602 Stereo processor MTV
1	Rohn	100 ft. Guide Tower

Contact: Howard Crow
Apollo Cablevision (813) 645-4625

Advertiser's Index

Frequency Chart

Cable Services
Compucon
Times Fiber

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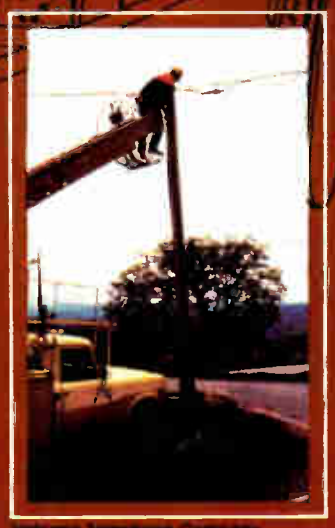

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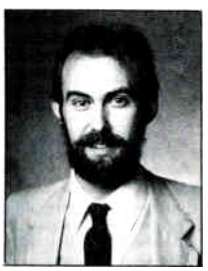
People News

■ **Magnavox CATV Systems Inc.** has appointed **Paula Corapi** communications coordinator. As communications coordinator, Corapi will be in charge of coordinating the company's marketing communications, including the Magnavox house organ, corporate newsletter and catalog.

■ Due to the expansion and reorganization of its national sales force, the **Communications Division** of **Tektronix** has appointed new national sales managers for its three business units and promoted four of its sales engineers. **Tim Jordan,** who most recently served as regional sales manager for the New York region, takes over as national sales manager for the Television Products Business unit, while **Dale Jones,** a Tektronix veteran of 10 years, is in charge of the Frequency Domain Instrumentation Business unit. The third appointed national sales manager was **Mike Griffin,** who is now responsible for the Communications Network Analyzers Business unit. Griffin spent the last three years as a Tektronix data communications analyzer specialist.

The four engineers promoted were: **Jim Quinn,** to consulting sales engineer; **Ken Umberger,** to senior sales engineer, **Bill Montgomery;** to senior sales engineer; and **Dave Walters,** also to senior sales engineer.

■ **Cable Networks Inc.,** a 3M subsidiary, has named **Rich Contrera** project engineer of the metropolitan transmission center, a four-channel microwave network 3M plans to build to interconnect CATV systems in the greater New York/New Jersey metropolitan area. Contrera, who previously served as director of operations at Rogers UA Cablesystems for eight years, will supervise all the technical aspects, construction and operation of the MTC system.



■ **Anixter Microsat,** a supplier of CATV equipment to Canada, has appointed **John Wilson** central regional sales manager in charge of directing sales to the cable industry in Ontario and Manitoba, Canada. Wilson previously worked for Cable Systems Engineering, a Rogers Cablesystems' division, as group leader-component evaluation and, prior to that, spent eight years at Lindsay Electronics.

■ The recently formed **Local Area Network Division** of **General Instrument Corp.** will be headed by **Stephen Toadvine,** who has become vice president and general manager of the division. Toadvine will supervise the marketing, sales, engineering, operations and finance departments of the LAN division. He formerly served as vice president of Bausch & Lomb.

General Instruments also named **Edward Kearney** vice president of investor relations. Kearney formerly served as vice president, investor relations and communications, for Morton Thiokol Inc., which is headquartered in Chicago.

■ The recently-created position of director, information management, at **GTE Communications Products** has been filled by Jerry Anderson. In his new post, Anderson will be responsible for planning, implementing, maintaining and controlling the development and application of computer and network-based information systems throughout the company. Anderson has been with GTE since 1968.

■ **Eric Rowland** has also joined Magnavox CATV Systems as product specialist for the company's converter products. In this position, Rowland, a former sales representative for C-COR Electronics, has overall marketing and technical responsibility for the development of Magnavox converter products.

■ **Mark Powell** has been named Mid-Western Regional Sales manager for **Diamond Communications Products Inc.** He is responsible for both the telephone and CATV markets.

■ **Robert Vetter** has been promoted to general manager at **RHG Electronics Laboratory.** In his new post, Vetter has operating and supervisory responsibility for manufacturing, scheduling and data processing.

■ **Peter Robinson** has been named senior vice president of **Manhattan Cable TV.** Robinson formerly served as vice president, cable investment for ATC's headquarters in Denver, Colo.

■ **Atlanta Tomberlin Inc.,** a Georgia-based Cable TV service company, has hired **Bill Brown** as marketing director. Brown brings to Atlanta Tomberlin 15 years of experience in the communications field. In his new position, he is responsible for national and international marketing.

■ **D. Max Henderson** has been named president and chief operating officer of **Panduit Corp.** A former executive vice president of Panduit, Henderson succeeds Jack Caveney, who will retain the posts of chairman and CEO.

■ **John Kernan,** former vice president of Deltak Corp., has been appointed vice president of planning and product development at **Gill Management Services.** In his new position, Kernan oversees product planning, development and quality assurance for all GMS systems. He has been involved in the data processing field since 1969.

■ **Mucip Cable TV Services** has appointed **Dave Clark** regional manager of its Wheaton, Ill., office. Clark, a 10-year CATV veteran, most recently served in a managerial capacity for Storer of New Haven, Conn.

■ **TCS Cable** has elected **Richard Behr** to serve as its vice president and general manager. By accepting the post, Behr, whose previous CATV experience includes positions with Jerrold, Magnavox CATV and others, takes over responsibility for the operation of the CATV construction company.

■ **Channelmatic Inc.** has added **Tom Walsh, Al Taylor** and **Dwain Keller** to its staff. Walsh, previously a manufacturing manager for Tektronix, takes over as operations manager, with responsibility for design and for the company's manufacturing operations. Taylor, the former on-air personality/engineer for WYDD-FM and TCS Sports in Pittsburgh, Pa., will serve as advertising director in charge of advertising and technical writing. Keller, who was named marketing manager, will oversee new product development and applications. He formerly served as branch manager for Skaggs Video in San Diego.

■ **William Schmidt** has been appointed product marketing manager of **Leader Instruments Corp.** with responsibilities for the marketing and sales of Leader's industrial test instrument product lines. Schmidt most recently worked as an aerospace test equipment sales engineer for North Atlantic Industries in New York, N.Y.

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In Orbit

Signal	Day	Start/ Stop	Alert Tone	Trans-ponder
Satcom 3R				
ACSN-The Learning Channel	Weekdays Weekends	6 a.m./4 p.m. 6 a.m./1 p.m.	192°/#	16
ARTS	Daily	9 p.m./12 a.m.	311°/# (E,C,M) 519°/#(P)	1
Cable Health Network		24 hrs.	361°/#	17
CBN		24 hrs.	414°/#	8
Cinemax		24 hrs.	None	20 (E,C) 23 (M,P)
CNN		24 hrs.	024°/#	14
CNN Headline News		24 hrs.	635°/# 541°/#	15
C-SPAN		24 hrs.	None	19
Daytime	Weekdays	1 p.m./5 p.m.	307°/#	22
ESPN		24 hrs.	048°/#	7
Eternal World Television Network	Daily	8 p.m./12 p.m.	762°/#	18
HBO	Daily	24 hrs.	None	24 (E,C), 13 (M,P), 22
HTN Plus	Daily	4 p.m./4 a.m.	207°/#	16
Modern Satellite Network	Weekdays	10 a.m./1 p.m.	243°/# 421°/#	22
The Movie Channel		24 hrs.	None	5
MTV: Music Television		24 hrs.	None	11
National Jewish Television Network	Sundays	1 p.m./4 p.m.	None	16
Nickelodeon	Daily	8 a.m./9 p.m.	311°/# (E, M, C) 519°/# (P) 749°/#	1
PTL		24 hrs.	None	2
Reuters	Weekdays	4 a.m./8 p.m.	None	18
Showtime		24 hrs.	576°/#	12 (E,C) 10 (M,P)
Spotlight		24 hrs.	None	4
USA Blackout Network		Varies	295° 601°/#	22
USA Cable Network		24 hrs.	601°/#	9
WGN		24 hrs.	None	3
WTBS		24 hrs.	None	6
The Weather Channel		24 hrs.	None	21
Satcom 4				
BizNet	Weekdays	7 a.m./2 p.m.	None	15
Bravo	Daily	8 p.m./6 a.m.	None	2
Business Times on ESPN	Weekdays	6 a.m./8 a.m. (P)	048°/#	6
FNN: Financial News Network	Weekdays	7 a.m./7 p.m.	975°/# 738°/#	2
National Christian Network	Daily	24 hrs.	073°/#	7
The Playboy Channel	Daily	8 p.m./6 a.m.	None	12
SPN		24 hrs.	429°/#	3
Trinity Broadcasting Network		24 hrs.	None	17
Westar 5				
ARTS	Daily	9 p.m./12 p.m.	None	12D
BET	Daily	8 p.m./2 a.m.	406°/#	12X
Daytime	Daily	1 p.m./9p.m.	307°/#	12D
Satellite News Channel		24 hrs.	None	4X, 6D 7X, 8X, 9X
SelecTV		24 hrs	840°/# 619°/#	3D
Spotlight		24 hrs	None	11D
The American Network	Daily	15 hrs./day	None	10X
The Disney Channel	Daily	7 a.m./11 p.m.(E, P) 6 a.m./10 p.m. (C) 8 a.m./12 p.m.(M)	None	6X(E,C) 5X(M,P)
The Nashville Network	Daily	9 a.m./3 a.m.	866°/# 674°/#	9D
WOR		24 hrs.	None	2D
Galaxy 1				
SIN		24 hrs.	819°/#	6
GalaVision	Weekdays Weekends	4 p.m./4 a.m. 24 hrs.	None	20

North American Communications Satellites

Location: Degrees West Longitude	Satellite: Present	Satellite: Future
67		Satcom 6 (May 86)
69		Spacenet 2 (Sept 84)
72	Satcom 2R (Aug. 25)	
74		Galaxy 2 (Sept 83)
76	Telstar 1	
79	Westar 2	
83	Satcom-4	
87	Comstar D3	
88.5		Telstar 3 (1985)
91	Westar 3	Spacenet 3 (Feb 85)
94	SBS-3	
95	Comstar D2 & D1	
96		Telstar 2 (1984)
97	SBS-2	
99	Westar 4	
100	SBS-1	
103		GSTAR A-1 (1984)
104.5	Anik D-1	
105		GSTAR A- 2 (1984)
108.5		Anik C-1 (1984)
109	Anik B	Anik D-2 (1984)
112.5	Anik C-2	
114	Anik A-3	
117.5	Anik C-3	
119	Satcom 2	
122		Spacenet I (May 84)
123	Westar-5	
127	Comstar D4	
131	Satcom 3R	
134	Galaxy 1	
136	Satcom 1	
139	Satcom 1R	
143	Satcom 5	

Orbital slots and launch dates often change without notice

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*CE-D Product Profile November 1981

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