CED™

Communications Engineering Digest/The Magazine of Broadband Technology February 1982

Special Section: CED Satellite Chart

Product Profile: 5-Meter ESA's

- Satellite Subcarrier Formats
- TVRO's At A Distance
- Multi-Beam Antennas

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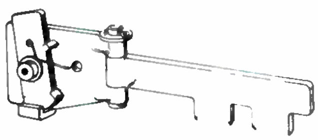

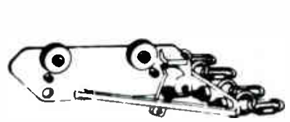

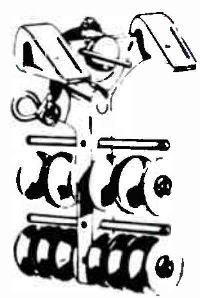

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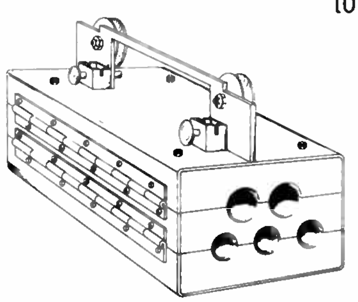

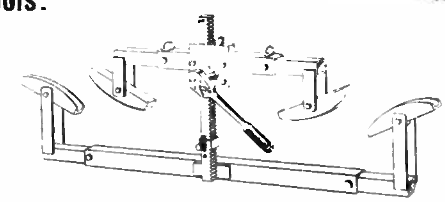

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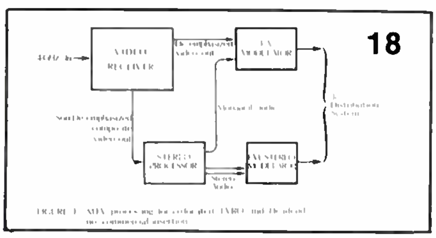

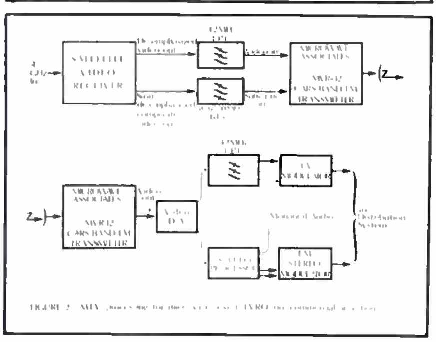

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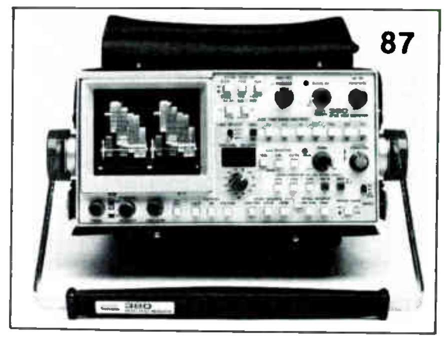

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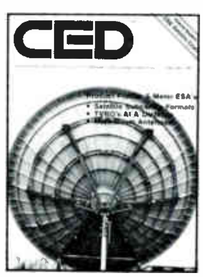

About The Cover:

Earth station antennas have become a generic symbol of the cable television industry as evidenced by the proliferation of magazine and journal cover photos of them. But seldom does one have the opportunity to enjoy their aesthetics from the underside. Photo courtesy of Prodelin, Inc.

 CED (USPS 300-510) is published monthly by Titsch Publishing, Inc., P O Box 5400-TA, Denver, Colorado 80217 © February 1982, Volume 8, Number 2. Subscription Price 1 year, $20.00; 2 years, $35.00. Canada and Mexico add $6.00, and other foreign subscribers add $12.00 per year Second class postage paid at Denver, CO **CED** is published on behalf of all parties, including the Society of Cable Television Engineers (SCTE). POSTMASTER: Please send form 3579 to P O Box 5400-TA, Denver, Colorado 80217 BPA membership applied for May 1981.

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MiniCon delivers the most important capabilities of Oak's larger TotalControl™ addressable system at a lower cost suitable for smaller operations. Like TotalControl, MiniCon allows headend control of every terminal in the system with up to 56 channels and 16 tiered program levels.

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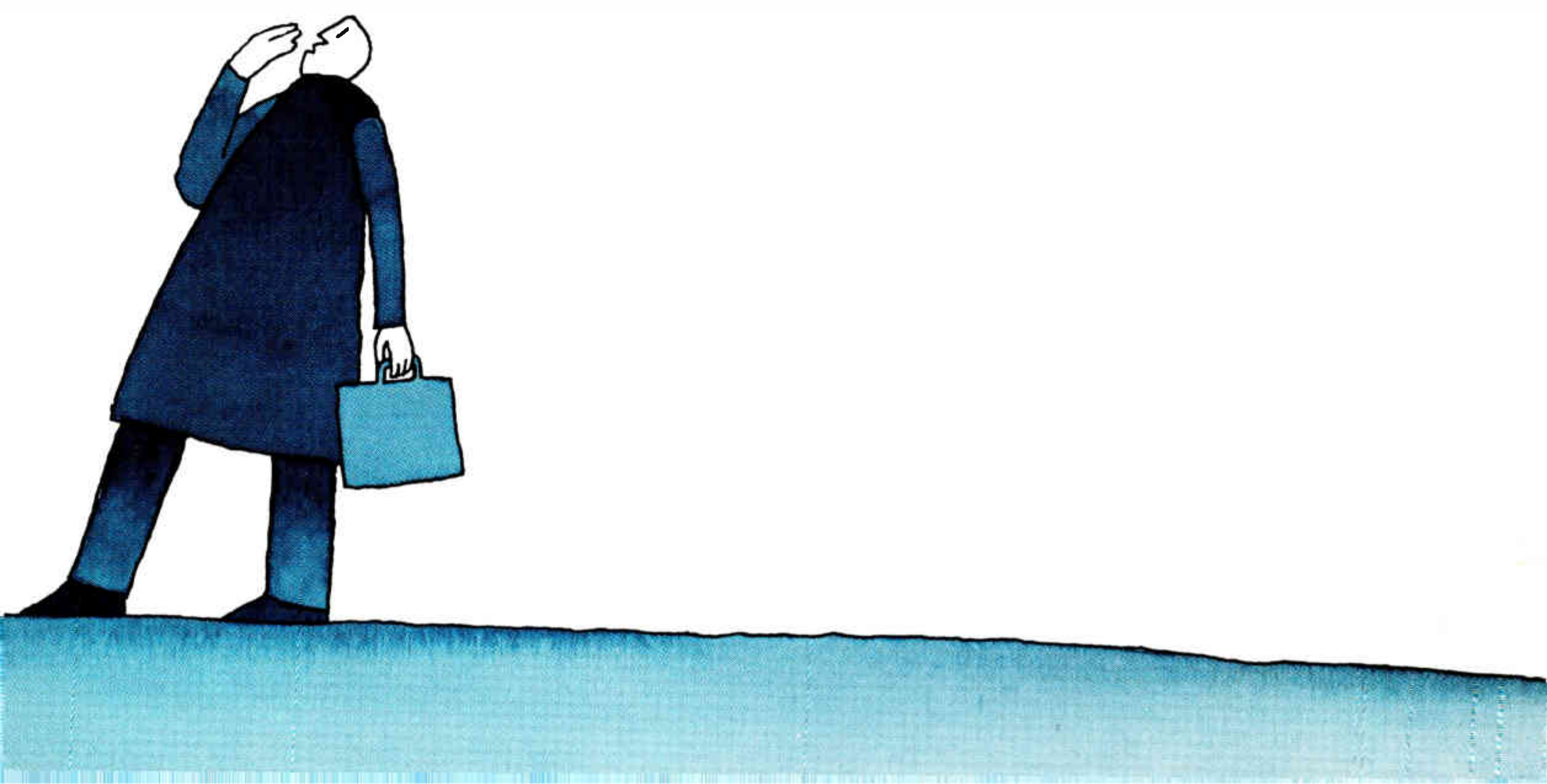

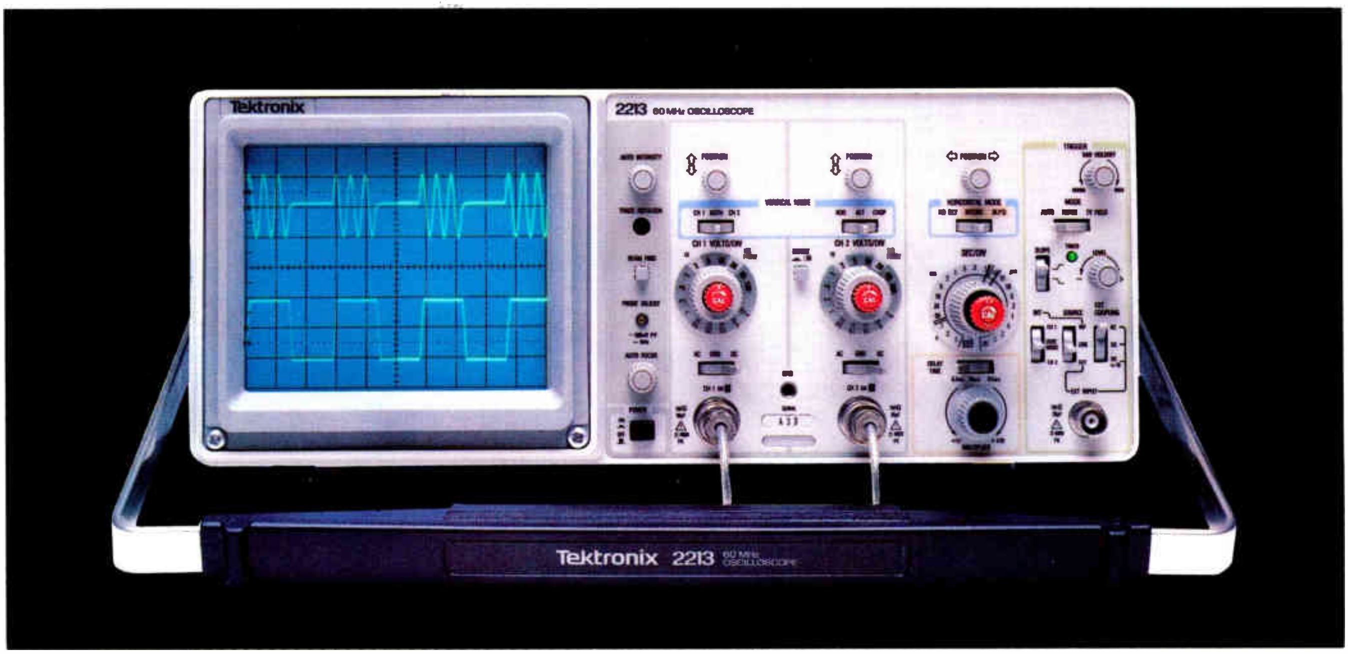

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The 60 MHz Tek 2213 and 2215 introduce a scope design so radically different, it delivers full-range performance at prices well below what was ever possible before.

Not surprisingly, it is from Tektronix, the world's largest and most respected scope manufacturer, and a legend for instrument reliability and value.

Design for the 2213 ($1100) and dual time base 2215 (just $1400) includes some 65% fewer mechanical parts. Fewer circuit boards. Fewer electrical connectors and cabling. Result: a lower purchase price for you plus far greater reliability.

Performance is pure Tektronix: there's the bandwidth for digital and high-speed analog circuits. The sensitivity for low signal measurements. The sweep speeds for fast logic families. A complete trigger system for digital, analog or video waveforms. And, with the 2215, you get fully calibrated delayed sweep for fast accurate timing measurements. New high-performance 10X Tektronix probes are included!

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Delayed sweep measurements: 2213: standard sweep, intensified after delay, and delayed. 2215: A only, B only, or A and B alternately with A intensified by B.

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Dropping a Notch

With the divestiture of the local operating companies required by the Justice Department agreement, the new AT&T will no longer be the country's biggest corporation. Prior to the divestiture, AT&T would have assets of approximately $136 billion, including Western Electric, Bell Laboratories, Long Lines and the 22 Bell Operating Companies. If the restructuring takes place as planned, the BOCs will be spun off to form a separate company with $87 billion in assets. This would keep it as the country's largest corporation. However, the new AT&T that would contain the remaining divisions would weigh in with assets of $49 billion. That's only good enough for a third place finish. According to Fortune 500, Exxon Corporation would become number two with assets totaling $56.6 billion. But then number two is supposed to try harder.

Not the End of Rainbow

Shortly after one o'clock in the afternoon, December 22, the sun was up but there was no Rainbow—Programming Services, that is. What happened was, a tractor trailer truck used for transporting horses to and from Belmont Race Track was sitting unattended on top of a hill near Rainbow's uplink facility in Elmont, New York. It's brakes released and the truck suddenly became an accident looking for a place to happen. Where it happened was the uplink facility. The truck smashed through a security gate and moved the building housing the power supply 16 inches, severing all electrical connections. Facing an 8pm operational deadline, Rainbow engineers worked feverishly to restore power. They ran temporary jumper cables between the shack that houses the generator and the shack that houses the uplink transmitter, restarted power on fewer amps, and by 5pm they were ready to transmit. All of which goes to prove that even a wild truck of horses can't keep Rainbow down.

STC Seeks Bids

Five companies have been asked to submit bids for construction of the two high-powered satellites that will be utilized in Satellite Television Corporation's proposed direct broadcast satellite system. One of the following companies will be given the honor of building the birds that could be part of the country's first DBS venture: Ford Aerospace and Communications Corporation, General Electric Company, Hughes Aircraft Company, RCA Astro-Electronics, and the TRW Systems Group. The request for proposals encompasses six areas including specifications, test and product assurance programs, and other contract requirements. The construction program is expected to take more than three years, with the service slated to begin in late 1985 or early 1986, if FCC approval is granted. Each spacecraft will have three operating transponders with a radio frequency output power of approximately 200 watts. The birds are expected to provide at least 1,700 watts of prime power so the signal can be received by small receiving antennas, generally 2.5 feet in diameter. All proposals are due at STC by April 1982.

Thinking it Over

The Cable Bureau's report on signal leakage was to have been approved by the Interdepartmental Radio Advisory Committee and sent to the FCC commissioners by the end of December. However, the opus has yet to leave the Cable Bureau. Although Wendell Bailey, vice president of science and technology for the NCTA, is obviously a biased source, he seems to think the delay is cause for optimism. "I have to believe the pressure was put on them and they're rethinking what do do," Bailey said. Two months ago, an FCC source said that "an interval of assignment offset requirement" is a good possibility. The Federal Aviation Administration wants cable operators as far away from their frequencies in the 108-136 MHz and 225-400 MHz bands as possible. On the other hand, the cable industry says that's unacceptable and that an offset requirement is unnecessary. The FCC may be leaning toward the FAA's position, but Bailey and others view the silence as a good sign.

Standard Issue

CBS Inc. has asked the FCC to reconsider its decision not to adopt a technical standard for teletext at the present time. When CBS initiated the proceeding in July 1980, it urged the Commission to adopt a standard to further the "rapid introduction of teletext services." The standard sought by the broadcast company would be a "software-based, asynchronous, variable format system" that would be compatible with the videotex standard currently in use in Canada and the system that is planned for introduction in the United States by AT&T. The FCC's failure to adopt a technical standard will cause many licensees "now considering development of a local teletext service" to "seriously question" implementing such a service because of doubts over the technological issues. CBS believes that the adoption of a standard is necessary so it will "spur competition among receiver manufacturers to provide receiver/decoders and to improve teletext technology."

Toasting Information

With all the media bubbling about the new electronic information society and how it portends to ring out the old industrial society, some media moguls recognize that many minds may be boggled by the loosely defined terminology floating around. As intoxicating as the concepts may be, the words and phrases used to describe them often leave one with a less than sober perspective on the future. To help the situation, the *Financial Times* of London is offering a free bottle of champagne to the person who can suggest the most original definition of the phrase "Information Technology." While *Financial Times* staffers are not eligible to compete, you can be sure they will be glad to bend an elbow with who ever wins.

Seminars

February

7-10: The annual convention of the **National Religious Broadcasters** will be held at the Sheraton Washington Hotel in Washington, D.C. Contact the NRB, (201) 575-4000.
9-10: A seminar sponsored by the **Cabletelevision Advertising Bureau** will be held at the Waldorf-Astoria Hotel in New York City. Contact Saralee Hyman, (212) 751-7770.
9-10: The **Arizona Cable Television Association's** annual convention will be held at the Phoenix Hilton Hotel. Contact the ACTA, (602) 257-9338.
10: "Basics of Cable Television," a cable education course presented by the New York Chapter of **Women In Cable**, will be held at the Urban Coalition Building in New York City. Contact Jean Paiva, (212) 683-2900.
14-15: The **Idaho Cable Television Association**'s annual convention will be held at the Red Lion Rivershore Hotel in Boise. Contact Randy Merrell, (208) 785-5705.
16-17: The **Washington State Cable Television Association** will hold its Winter Legislative Meeting at the Vance Tyee Hotel in Tumwater, Washington. Contact Jerry Buzzard, (206) 943-3161.
17: "Basics of Cable Television," a cable education course presented by the New York Chapter of **Women In Cable**, will be held at the Urban Coalition Building in New York City. Contact Jean Paiva, (212) 683-2900.
17: A one-day conference on "The Economics of Marketing Cable TV Security" sponsored by **Paul Kagan Associates** will be held at the Four Seasons Hotel in San Antonio, Texas. Contact Judy Pinney, (408) 624-1536.
17-19: The 22nd annual Texas Show sponsored by the **Texas Cable TV Association** will be held at the San Antonio Convention Center. Contact Bill Arnold, (512) 345-8888.
22-24: Scientific-Atlanta will present a three-day product training seminar in Seattle, Washington, directed toward theory of operation, maintenance of headend, distribution and earth station equipment. Contact Joan Smith, (404) 925-5509.
23-25: Turner Broadcasting System is sponsoring an advertising/production seminar at the Atlanta Hilton. Contact Jayne Greenburg, (404) 898-8587.
23-25: NEPCON West '82 will be held at the Anaheim (California) Convention Center. Contact Cahners Exposition Group, (312) 263-4866.
23-25: The fourth Video Expo San Francisco, sponsored by **Knowledge Industry Publications**, will be held at the SanFrancisco Civic Auditorium. Contact Barbara Katz, (914) 328-9157.
24-26: The **American Newspaper Publishers Association** will be conducting a seminar on newspapers and cable television at the Fairmont Hotel in Denver. Contact Kathleen Criner, (703) 620-9500.
24-26: Scientific-Atlanta will present a three-day product training seminar in Los Angeles, California, directed toward theory of operation, maintenance of headend, distribution and earth station equipment. Contact Joan Smith, (404) 925-5509.

March

3-5: The annual convention of the **Arkansas Cable Television Association** will be held at the Arlington Hotel in Hot Springs. Contact the association, (501) 661-7676.
7-9: The annual convention of the **Ohio Cable Television Association** will be held at the Hyatt Regency in Columbus. Contact the OCTA, (614) 461-4014.
7-9: The **Society of Cable Television Engineers** will host its Sixth Annual Spring Conference at the Copley Plaza in Boston. SCTE member advance registration fee is $300. The non-member advance fee is $450. For information call SCTE, (202) 293-7841.
8-9: A seminar on teleconferencing technologies, sponsored by **Cross Communications** and **Colorado Video**, will be held in Boulder, Colorado. Contact Thomas Cross, (303) 499-8888.
9-10: The **Southeast Printed Circuits and Microelectronics Exposition** will be held at the Sheraton Twin-Towers Convention Center, Orlando, Florida. Contact Cahners Exposition Group, (312) 263-4866.
11-16: The **National Association of Television Program Executives**' 19th annual conference will be held at the Las Vegas Hilton in Las Vegas, Nevada. Contact NATPE, (717) 626-4424.
16-17: A **Blonder-Tongue** MATV/CATV Technical Seminar will be held at the Pacifica Hotel, Culver City, California, in conjunction with **Ellard E. Strassner Co.** Contact Chuck Fitzer (415) 449-0547 or Ellard Strassner (408) 988-7762.
16-18: Information Gatekeepers, Inc., is sponsoring COMSEC '82, the international communications security conference and exposition, at Boston's Hyatt Regency Cambridge. Contact Michael O'Bryant, (617) 739-2022.
16-18: Scientific-Atlanta will present a three-day product training seminar in Kansas City, Missouri, directed toward theory of operation, maintenance of headend, distribution and earth station equipment. Contact Joan Smith, (404) 925-5509.
29-31: The 1982 Information Utilities conference, sponsored by **Online, Inc.**, will be held at the Rye Town Hilton Hotel and Conference Center in Rye, New York. Contact Jean-Paul Emard or Jeff Pemberton, (203) 227-8466.

April

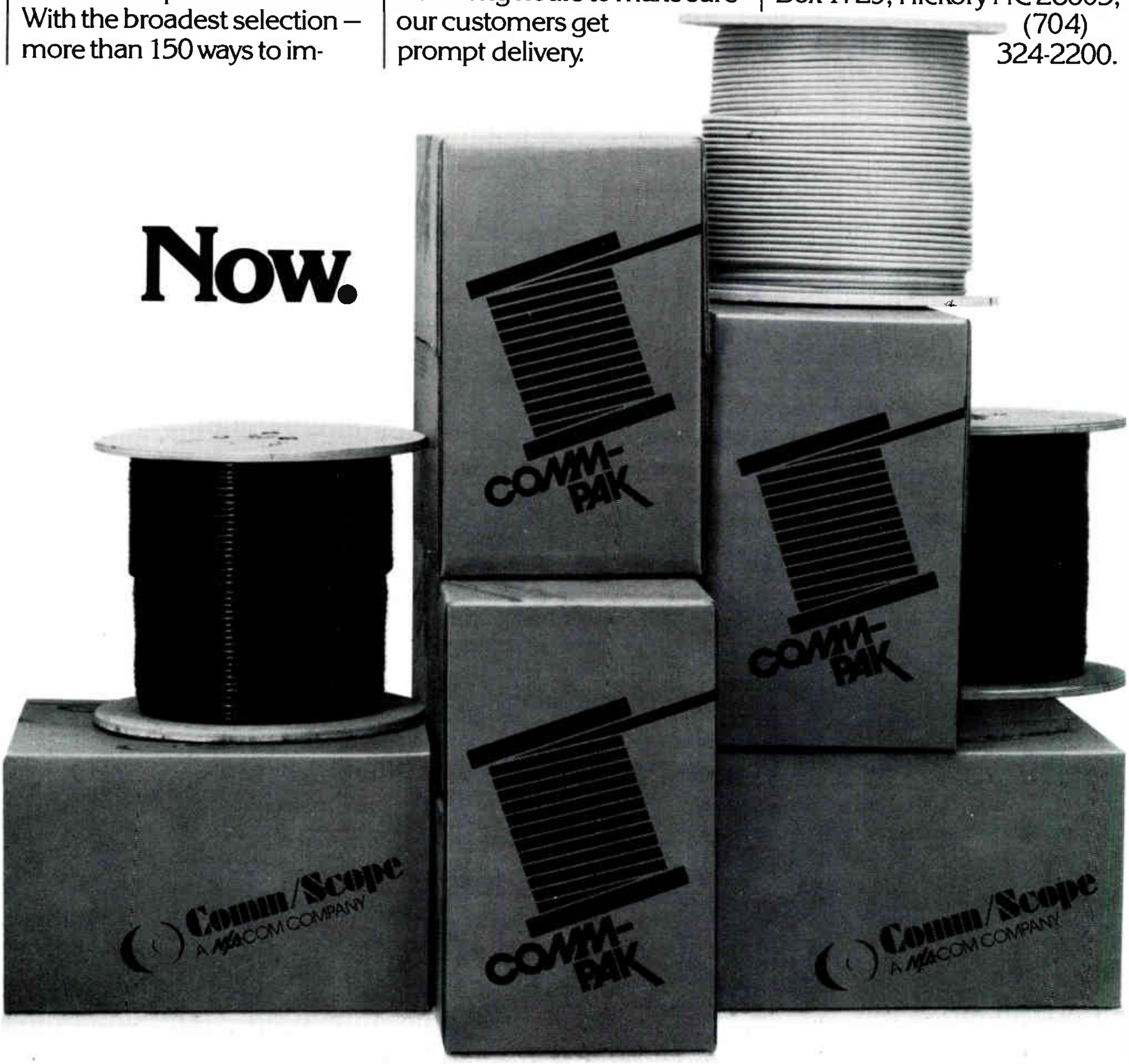
4-7: The 60th annual convention of the **National Association of Broadcasters** will be held at the Dallas Convention Center, Dallas, Texas. Contact the NAB, (202) 293-3500.

May

3-5: The **National Cable Television Association** will hold its annual convention at the Las Vegas Convention Center in Las Vegas, Nevada. Contact the NCTA at (202) 775-3606.
31-June 3: The 25th Anniversary of the **Canadian Cable Television Association** will be celebrated at the Annual Convention and Trade Show to be held at the Sheraton Centre, Toronto, Ontario. Contact Christiane Thompson, (613) 232-2631.

June

3-4: The Eighth Annual **Northeast Cable Television Technical Seminar** sponsored by the **New York State Commission on CATV**, will be held at the Empire State Plaza, Albany, NY 12223. Registration or exhibitor information, contact Robert Levy: (518) 474-1324.



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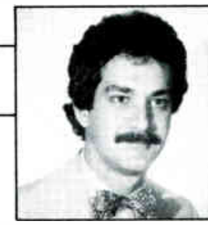
Editorial



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Standards Are A Sometime Thing

Establishing a technical standard in a growing and dynamic industry is a sensitive issue. Viewed idealistically, technical standards should be created to insure uniform quality service to the consuming public, provide compatibility between interconnecting elements of the industry, reduce the level of uncertainty in engineering functions, and encourage the general development of good engineering practices. These ideals are all well and good and should serve as goals to be achieved when establishing standards. But in the real world these goals fail to recognize the explicit economic impacts and implicit political conflicts inherent in technical standards.

Two cases may serve as examples, both of which involve transmission formats that impact on electronic equipment manufacturing and system operations. Major companies such as AT&T, CBS, Time, and others have been prodding the FCC to establish a standard for teletext transmission. CBS, as reported in this issue of **CED**, has again asked the FCC to reconsider its open-entry policy for teletext, stating that failure to prescribe a single system may "slow the development of teletext, thwarting the Commission's goal of facilitating the emergence and implementation of new technological uses of the spectrum." Just one major area that the absence of the standard is retarding is the development of the local teletext service by licensees who express doubts over how to technically position themselves *vis-a-vis* the format that will be employed. Also competition among receiver manufacturers is being stifled without a format standard that would allow them to proceed with the design and manufacture of receiver/decoders.

Another case in which the question of standards is a lively one is in satellite audio subcarriers. The pros and cons are being debated, currently, in the pages of **CED**. Two articles appear in this issue that come down on either side of the question (see "Dealing With The New Stereo Satellite Services: An Operator's Viewpoint" and "Cable Stereo: Some Basic Information on Satellite Delivered Services"). Cable audio services are in their infancy. Standardization at this time might limit program suppliers who need to develop systems according to unique technical and marketing specifications. Also, the consumer audio industry seems to be at the brink of another major revolution with digital gear about to hit the marketplace. A 1982 satellite stereo standard could create the weak link in audio services by the year 1985. While the lack of a satellite transmission format for audio subcarriers may cause some difficulties for system operators in the interim, this may be a case in which the time for establishing a technical standard is not upon us and may not be for a while.

In a complex and youthful industry such as cable television, the ephemeral question of what constitutes the "state-of-the-art" is difficult and multileveled at best. Some sectors of the industry will have achieved higher levels of technical advancement and development than others. In those areas where competition for the perceived market is spurring competitors to push for the state-of-the-art further along, everyone will benefit in the long run in spite of the fact that in the short run confusion will reign for many other adjacent sectors of the industry. Political conflict may arise between various factions in the industry as a result.

When a technical standard is codified its impact ripples throughout the industry. Separate domains of the industry such as equipment manufacturers and suppliers, system operators, common carriers, service suppliers, contractors and consultants, financial investors, and trade associations will be affected. Some will greatly benefit from a standard. Some will be stifled by the limitations and constraints of a standard. Some will lose the race for a given market, having been shut out by those better positioned to take advantage of the technical parameters set down by the standard. And many others will be little affected by the institution of a standard except to the degree to which the standard promotes or retards the general welfare of the industry of which they are a part.

Of course, in all this, timing is a critical consideration. Apart from those situations in which a technical standard emerges out of practice or marketplace competition, to not set a standard at an appropriate time can stagnate a sector of the industry (or the entire industry), especially when companies or individuals resist investing in major developments, the futures of which are totally unclear without standards. On the other hand, to establish a standard too soon may forestall major breakthroughs.

George Sell

Manhattan Cable to Construct Earth Station

NEW YORK, NEW YORK—The New York skyline will take on a new look shortly, as a result of Manhattan Cable's planned construction of an earth station atop its headquarters here.

The U.S. Tower Company is building the earth station that Manhattan Cable officials say will be installed some time during the "first quarter" of the year.

The station will use two spherical antennas, products introduced by U.S. Tower last year. These antennas, 22 feet high by 37 feet long, can receive transmission from eight satellites simultaneously according to the system's engineering director Robert Tenten.

This feature, he noted, will enable the system to expand its capabilities and provide it with more flexibility. Although Manhattan Cable officials would not discuss specific plans for their earth station. Marketing Director Dick Clark stated that the company would be "doing something very significant."

The multi-beam satellite antennas Manhattan Cable will be using have been developed according to U.S. Tower officials, as an economical alternative to multiple dish installation. The antennas have reflectors that have been modularized into rectangular panels composed of .035 aluminum sheeting formed into a contour which is the radius of a sphere in both the horizontal and vertical plans. There is a built-in provision for adjusting the elevation of the reflectors, and each eight by ten foot panel is mounted on four turnbuckles to allow precise phasing of all single reflectors to work together as an efficient antenna.

Warner Amex Trainees Complete Course

DALLAS, TEXAS—The first group of Warner Amex Cable Communications field technicians to participate in the company's joint training program with the National Institute of Technology have just completed the intensive four-week course and are now working in Warner's Dallas system, company officials have announced.

The ten technicians completed a program which included cable television training in customer relations, pole climbing, safety, installation procedures, trouble shooting techniques, and basic electronic maintenance of the QUBE system. The initial group, all from the Dallas area, started classes in November.

This session was the first of several training programs that Warner Amex will be conducting in the city to give local residents career opportunities in cable.

The NIT, a division of the National Education Corporation, is, according to Richard Davis, general manger of the Dallas system, a pioneer in cable television training." NIT plans to open nine more schools within the next three years.

No Holds Barred: AT&T

WASHINGTON, D.C.—The historic agreement with the Justice Department has unleashed American Telephone and Telegraph Company so it can play an integral role in shaping future telecommunications services. The precise ramifications of the accord are yet to be determined, but it is clear that a restructured AT&T will be at or near the focal point of the new information age. It is also a strong possibility that the company could enter the business of coming cable systems.

The agreement is a modification of the 1956 Consent Decree, which prohibited AT&T from competing in unregulated markets. In exchange for permission to enter the enhanced service realm, AT&T must spin off its 22 local operating companies (BOCs)—a portion of the corporation with approximately $87 billion in assets.

The remaining Bell divisions—Western Electric, Bell Laboratories, and AT&T Long Lines—will remain intact. This restructured Bell company will retain approximately $49 billion in assets. With the capital base and the research and development capacity of Bell Laboratories, the new company is expected to vault into the computer and data processing fields with unencumbered vigor.

The terms of the agreement include dropping the Justice Department's eight-year old antitrust suit against AT&T, which has been in the trial phase in U.S. District Court for the District of Columbia for the past 11 months. Trial attorneys for AT&T have said that the case is history, although Federal Judge Harold N. Greene, who has been overseeing the trial, has as yet refused to dismiss it for procedural reasons.

The announcement of the accord has sent representatives of the cable and data processing industries scrambling to ascertain the impact on their respective businesses. It has also triggered action in both the House and the Senate, where legislation is pending that would allow AT&T to participate in the enhanced service marketplace, but through a separate subsidiary. Neither S. 898, the Senate bill, nor H.R. 5158 would have required divestiture of the BOCs.

Most industry representative have been resigned to the fact that AT&T would be allowed to participate in the computer and data processing fields for more time. But the terms of the agreement would also remove the rationale for preventing the new AT&T from owning cable systems, according to many.

"At this point there's no rule against it and presumably until someone comes up with a reason why it would be bad, we have no reason to stop it," said Randy Nichols, administrative assistant to Federal Communications Commission Chairman Mark Fowler and former head of the Cable Bureau.

The cross-ownership rules that prevent telephone companies from owning cable systems in their own service areas would still apply to the BOCs that are spun off.

"Whatever the validity they (the cross-ownership rules) have today, they would continue to have vis-a-vis the operating companies," Nichols said.

Octagon Scientific Enters Development Phase

SYRACUSE, NEW YORK—In the first production effort since incorporation last September, Octagon Scientific—the company started by former Magnavox CATV executives—has announced a joint venture to develop cable hardware.

Octagon Scientific President Daniel Mezzalingua revealed last week that his company has entered into an agreement with Regency Electronics, an Indianapolis-based consumer electronics firm, to produce what Octagon officials describe as "subscriber terminal products."

Octagon will be the design and engineering force behind the product line, while Regency will provide the production facilities. Under terms of the agreement, which were not disclosed, the two companies will form another company to market the products under the Regency name, but with the Octagon logo.

Octagon would not elaborate on what kind of products this venture would produce. Spokesman Dom Maio would only say that it would be a "converter type of product that could do many things," and has been in development since Octagon's formation last fall.

Citing the shortage of cable hardware currently on the market, officials for the two companies say they will produce cost effective equipment designed to compete with the current major vendors including Jerrold, Oak, and RCA. These companies, according to Mezzalingua, are "currently unable to meet market demands."

He is predicting sales of $100 million within three years. Delivery of the products is scheduled to start this summer.

Business Notes

★ **SATCOM, Inc.**, a subsidiary of **Orrox Corporation** has received the first European order for its 12 GHz TVRO satellite system. Gunnar Karlsen, a Norwegian electronics firm, will use the SATCOM equipment in conjuction with its own cable television systems as well as DBS applications. Gunnar Karlsen's order was placed in anticipation of an operational Ku-band transponder OTS-2 Satellite, with programming expected to begin in February 1982. Ku-band is the 12 GHz international frequency band for Europe. The OTS-2 satellite, presently in orbit, is being utilized by Britain's Satellite Television Ltd. (STL) and will be transmitting entertainment programming to Northern European countries, including Norway.

★ **C-COR Electronics**, Inc., has been chosen by GE Cablevision of Grand Rapids, Michigan to supply special mid-split amplifiers for their Grand Rapids cable traffic control system. The equipment order, which totals approximately $270,000, is for a specially built mid-split amplifier that will occupy the B-trunk of the dualtrunk system. The forward bandwidth will be 150-300 MHz while the reverse bandwidth will be 5-88 MHz. GE Cablevision of Grand Rapids will be working with Sperry Systems Management on the 240-intersection system. The first 10 intersections are expected to be operative by this summer with the entire system scheduled for completion by May 1983. Federal, state and city government funds will pay for the construction costs and electronic equipment necessary to activate the cable traffic control system. Cable operators are finding that government funds are available for capital construction in the traffic control area. C-COR will begin delivering equipment to Grand Rapids in March, 1982, with final shipment expected for July 1982.

★ **LNR Communications** has received a major order from Harris Corporation for 12 upconverter and downconverter systems to be part of Atlantic Richfield's private satellite communications network. Four sets of low-noise amplifier systems Model NC4 for the continental US terminals are also to be provided. The order for ARCONET includes 6 redundant Model UC6-D1 upconverter systems with redundancy control switches and input power dividers, and 6 redundant Model DC4-D1 downconverter systems, providing low phase noise, group delay equalization and high frequency stability. A key element of the order is the delivery of two Model AL05SF Frequency Hopping local oscillators for each downlink. This novel feature will allow four satellite transponders to increase the message carrying capacity of the system, which operates in the TDMA mode.

★ **Comtech Data Corporation**, a subsidiary of **Comtech Telecommunications Corporation** announced award of a contract by the State of Arizona to extend the satellite based digital-voice network that Comtech developed and installed for the State's Division of Emergency Services. An initial contract awarded in August 1980 and commissioned in May 1981 provided for complete earth stations at three county seats and antenna subsystems installed at the remaining eleven county seats. This latest contract provides electronic packages to complete three more earth stations in the network by October 1982. This represents another step toward the goal of providing satellite based emergency communications to all counties in the state on a full-time basis.

There's More Than One Way To Move A Headend

Gusting winds had calmed after blowing the rain-filled clouds to the South. The dawn sunrise captured dozens of technicians and laborers preparing for the helicopter lift of the UA-Columbia Cablevision headend to its location atop the 21-story NBC building in downtown San Antonio. Almost stopped by torrential rains and foot-deep mud, the 626 foot vertical airlift would succeed in moving the complete RCA headend along with tons of additional equipment in less than six hours. The alternative was to hand maneuver everything up a winding stairwell.

To prepare for this airlift, RCA Cablevision Systems had fit special lifting pallettes to the headend equipment to meet the requirements of the rooftop staging area. This special preparation by RCA to facilitate on-site installation is not unusual.

To meet a completion schedule for the Philadelphia, PA, Police and Subway Surveillance System, RCA literally hand-delivered specially configured racks and rearranged room layouts for timely, economical installations. And, when another customer required rush headend delivery, the system was put on a rapid cycle build schedule and was flown to the location. RCA on-site crews have the authority to get the job done logistically.

As in the saying, "It's easier the second time around," RCA Cablevision Systems has the experience and expertise to get the job done. We're responsive to customer needs.

RCA Adds New 800 Phone Line

Serving the eastern half of the country, the new number is:

1-800-345-8104

Puzzled About Headend Type?

RCA Cablevision Systems has the capability to custom design and build the headend type of your choice. Pre-assembled, tested, packed and shipped by RCA, all that remains is to unpack, plug-in and turn-on.

Here are some recent custom headends designed and built by RCA:

Type	Facility
HRC	United Cable TV Corp. Cupertino, CA
IRC	American Cable Systems, Inc. Arlington, MA
Standard	Camden Communications Carson, CA

400 MHz-A Serious Consideration

Expanded channel capacity systems are in style and undeniably, we have not yet reached the technological limits of expansion. The strongest benefit of 400 MHz is the additional 17 channels gained compared to a 300 MHz system. But, the increase in bandwidth does not come for free.

Due to the extra channel loading, there is a degradation in the composite triple beat rating of the amplifiers. The higher frequency channels contribute a disproportionate share of the overload due to the inherent limitations of active devices. There is also the decision of whether to install a standard headend and operate at a reduced dB level, or to use a coherent headend risking possible off-air signal ingressing. There is also a coaxial cable loss of 15-17%.

These considerations do not mean that a 400 MHz system will perform inferior to a 300 MHz system, only that the installation cost will be higher. Yet, 400 MHz is cost-effective in yielding a 50% increase in channel capacity versus an approximate 20% installation increase.

RCA Cablevision Systems is committed to 400 MHz and to supplying those operators employing the system. The Model 452 Amplifier, Model 450 line extender and 400 MHz passive devices are available from your RCA sales representative. To obtain a copy of a detailed treatise on 400 MHz, call (213) 891-7911.

TRUNK LINE

Q: We are contemplating converting three UHF channels to channels 2, 4 and 6, then combining them simultaneously on our transportation system line with existing channels 3 and 5. What do you think of this convenient approach of transporting signals from the antenna site to the headend?

A: It may be convenient, but it may also contribute to a mass exodus of subscribers.

In this instance, you are compounding the already existing problem of the equipment working with adjacent channels, even if the incoming signals from the tower site are AGC or level controlled. The UHF channels in your system are without level control.

By attempting this procedure, you may very well experience a 20 dB fade in one channel along with 20 dB increases in the equivalent adjacent channels. If this headend overmodulation occurs, you would require 80 dB performance in the headend box to get a 60 dB system. Also, there is no doubt that using this down-converting procedure will, at some time, result in adjacent channel leakage.

These problems would be visible by subscribers in the home as poor system performance and would probably result in numerous complaints.

Here's what RCA Cablevision Systems suggests: on transportation systems, do everything possible to ensure that the transported signals are non-adjacent channels. This will reduce the requirement for reprocessing equipment in the headend. This consideration is especially valid if the adjacent channels have non-controlled levels. An old adage at RCA that has undoubtably saved customers untold dollars is, "A little bit of planning can eliminate a lot of problems."

If you need help with the planning, contract RCA Cablevision Systems.

RCA's Trunk Line Column answers current questions by readers submitted to Cable Today. All questions sent to RCA become the property of RCA and the publication of the question and the corresponding answer is at the discretion of the Cable Today staff. Questions should be sent to: Cable Today, RCA Cablevision Systems, 8500 Balboa Blvd., Van Nuys, CA 91409.

Dealing With The New Stereo Satellite Services: An Operator's Viewpoint

Increased use of the technical capabilities of satellite transmission means increased complexities for the system operators and engineers. An article which appeared in October, 1981 *CED* by Dom Stasi of Warner Amex Satellite Entertainment Company ("TV In Stereo") prompted the following response from the Chief Engineer with the San Jose, California system. At the conclusion of this article, Dom Stasi offers his reaction to the problems and criticisms expressed.

By David J. Large, chief engineer. Gill Cable TV.

Recently, two new services which incorporate stereo audio information have become available for cable system operators—Warner Amex's MTV: The Music Channel and CBS Cable. Both of these services are designed to be incorporated as part of a basic (non-tiered) offering and are delivered with some commercials included and available time slots for additional local commercial insertion. The intention of the suppliers is that a simulcast technique be used with standard monaural audio for the television, and separate stereo on a carrier in the FM band.

Reception, Microwave Transmission—MTV

An explanation of the basic stereo transmission system used by Warner Amex's MTV appeared in the October 1981 issue of **CED**. In that article, Dom Stasi reviewed the mathematical reasons for MTV's choice of non-standard 6.62 MHz (L+R) and 5.80 MHz (L-R) subcarriers for aural signals and their reasons for wider subcarrier deviation (237 kHz peak vs. 100 kHz peak). Also mentioned was the critical need for identical treatment of the two aural subcarriers to preserve stereo separation. To that end, MTV suggests a direct connection from the satellite video receiver to a stereo transmission processor (as manufactured by Catel, Leaming, or Wegener). Figure 6a on page 00 shows the spectrum of the MTV signal in the region of the subcarriers. Note the wide deviation L+R subcarrier to the right and the much narrower L-R to the left. The chrominance subcarrier at 3.58 MHz is to the extreme left.

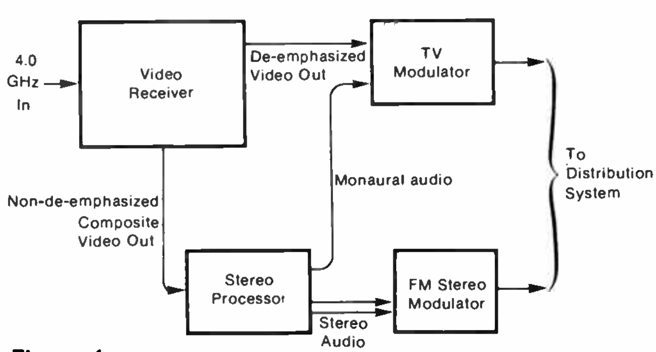


Figure 1
MTV processing for co-located TVRO and headend, no commercial insertion.

For operators fortunate enough to have their TVROs co-located with their studio facilities, a simple direct connection from receiver to sideband processor as in Figure 1 should be all that is required. In our installation, however, we found that the wideband de-emphasized output from a standard Microdyne 1100TVR could not be used as the 6.62 MHz subcarrier was considerably reduced in amplitude below the 5.8 MHz subcarrier. We had to use a non-de-emphasized output to drive the stereo processor. As of this writing this has not been resolved with MTV.

Because of this situation a more formidable problem is presented to the operator who employs a microwave link from his earth station. If the stereo processor is placed at the TVRO site, he then has video, monaural audio and stereo audio, to transmit. If he chooses to place the processor at the headend or studio receive site, then he must transmit both a de-emphasized video and non-de-emphasized subcarriers, being very careful not to disturb the gain or phase relationship of the subcarriers. Figure 2 shows an acceptable way of accomplishing this when using an FM microwave link with subcarrier capability. Note that the 5.7-7.0 MHz filter must have very flat response.

Reception, Microwave Transmission—CBS

CBS has chosen a fundamentally different stereo transmission format. A normal 6.8 MHz monaural aural subcarrier (with control tones added) is used and a second subcarrier at 5.8 MHz carries an already multiplexed stereo audio signal. Figure 6b on

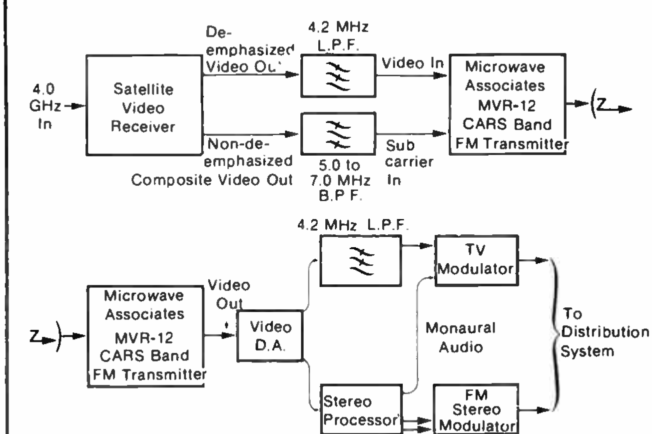


Figure 2
MTV processing for microwave-linked TVRO, no commercial insertion.

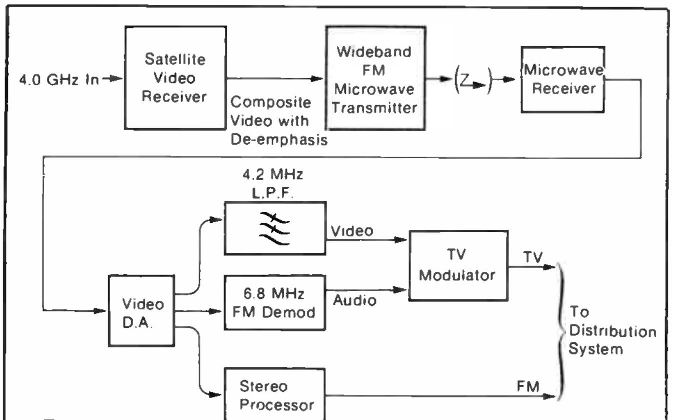


Figure 3
CBS processing for microwave-linked TVRO, no commercial insertion.

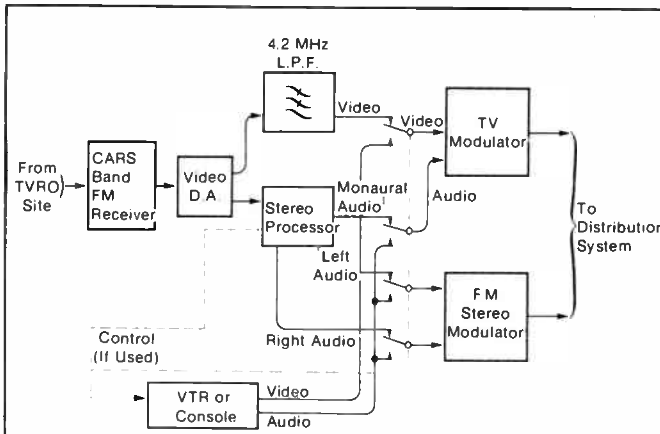


Figure 4
MTV studio set-up with commercial insertion.

page 20 shows the CBS subcarrier spectrum with the multiplexed FM on the left and the monaural to the right. If a microwave transportation link is required, the entire composite video output with de-emphasis can be fed to a wideband FM microwave transmitter for transmission to a remote headend if required. Figure 3 shows a typical equipment setup for reception and transmission of a CBS signal. Note that the multiplexed FM subcarrier is not in a normal broadcast format and, therefore, cannot simply be converted to an appropriate FM band channel. Rather, a special format utilizing deviations as wide as +550 kHz is used. The reason for this is that with the comparatively low carrier-to-noise ratios present in the satellite transmission line, a wider deviation must be used to gain sufficient FM advantage to deliver a broadcast quality signal. In order for the cable operator to use the signal, it must be demodulated and remodulated in a standard broadcast format. Leaming Industries is the originator of this particular format and is a supplier of the necessary equipment. FM stereo modulator is required.

Commercial Insertion—MTV

One of the appeals to the system operator of the growing family of satellite delivered basic services is the availability of time slots for locally inserted commercials. Both MTV and CBS provide for such insertions and, in fact, provide tones for the purpose of activating VTRs.

In the case of MTV, we have at baseband three separate audio signals, L+R (monaural audio for the TV modulator), and the separate L and R signals going to the stereo FM modulator (at least these are available in the Catel equipment). This means that either the video switcher must have three audio-follows-video auxiliary contacts available or that a stereo audio setup be used and the L+R signal be created at the console output. Figure 4 is a simplified diagram of the switching necessary to accomplish the former.

I have assumed for that diagram that only monaural commercial audio is available. Should stereo audio be available, the same switching would be used, but a device to generate the L+R commercial signal would be necessary.

The most significant simplification in Figure 4 is that the switching between satellite programming and local insertions is done asynchronously ("crunch" switching) with resultant non-professional looking program output. For a proper insertion, a sync detector should be used on the satellite video and fed to both a vertical internal switcher and a time base corrector on the VTR output.

Commercial Insertion—CBS

The audio considerations associated with the CBS format signals are somewhat different. The Leaming equipment only handles the stereo signal. Models are available for either monaural or stereo commercial insertion upon receipt of an external contact closure. The cable system operator must also provide equipment for video and monaural audio switching and, if automation is desired, detection of the control tones on the 6.8 MHz subcarrier. Figure 5 is a simplified diagram of such a setup for manual insertion. The same considerations mentioned above in MTV commercial insertion with respect to slaved time base corrector and synchronous switching apply to CBS also.

Cable Signal Transportation

While some operators may be fortunate enough to have their studio facilities located at the headend, many of us are not and are linked by microwave or transportation cable of some sort. The challenge, then, is to deliver the signals to the headend with as little degradation as possible, particularly in view of the fact that our advertisers will be looking very critically at the quality of the end product!

Gill Cable, faced with a ten-amplifier transportation link from studio to headend, has chosen to use a full complement of video FM equipment (such as made by TOMCO or Catel). A total of six such links (plus several standard AM channels) carry various advertising-supported channels. The result is that the measured video signal-to-noise ratio at the headend is typically 55 dB, certainly acceptable quality in our opinion.

Dolby Audio

Gill Cable has a very rich FM option for its customers. As a dual-cable system it has the advantage of two FM bands on which to offer programming. At present, Gill's "A" cable carries 31 separately processed FM broadcast signals plus stereo sound

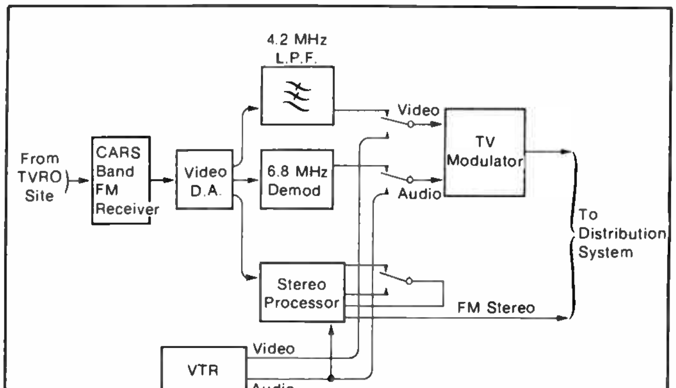


Figure 5
CBS Cable processing with commercial insertion.

from Gill's own movie channel. The aural signals of all basic service channels are processed and presented at full 75 kHz deviation on the "B" cable so that subscribers can enjoy better fidelity and lower noise sound via their own high-fidelity equipment. Despite this inducement, Gill's second outlet penetration is only about 23 percent of basic subscribers, with certainly less than half of those used for FM receivers.

The upshot of all this is that even in a system with a very strong FM service and where, furthermore, subscribers are accustomed to simulcast stereo sound, no more than ten percent of the audience is likely to use the facility. Multiply that percentage by the rather small percentage of the high fidelity receivers in use that have Dolby decoder capabilities, and you have a negligibly small number of subscribers who can take advantage of the additional noise reduction possibilities.

Dolby encoded signals, to be fair, are compatable to a considerable degree with standard FM receivers. Through use of 25 microsecond rather than 75 microsecond pre-emphasis, the compromises tend to be evened out. In A-B comparison tests run for us by MTV, the difference was inaudible at the high average signal level typical of MTV's product. At lower levels, however, one would expect to find some high frequency peaking.

For the operator who feels uneasy about offering "non-standard" FM signals in his product, one solution is to use Dolby decoding in the stereo processor equipment and then standard modulation. This would preserve the Dolby advantage on the satellite link while offering a more standard signal to the subscriber.

Toward a Standard

Either of these formats could form the basis for a standard. Both have their advantages and disadvantages. The CBS method offers a low cost way for a small operator to take the service through use of a monaural 6.8 MHz sound channel. On

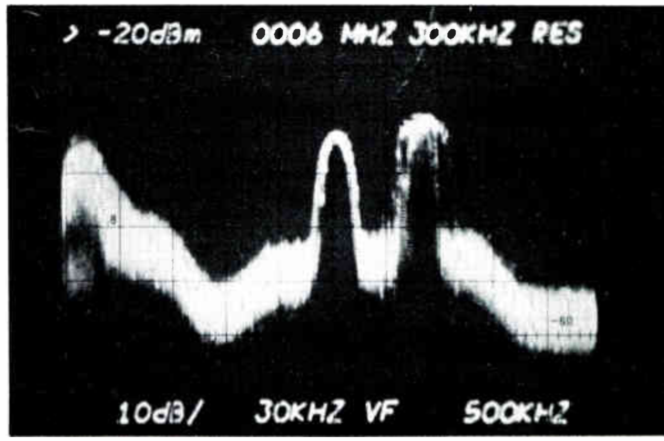


Figure 6a *MTV Subcarrier Spectrum*

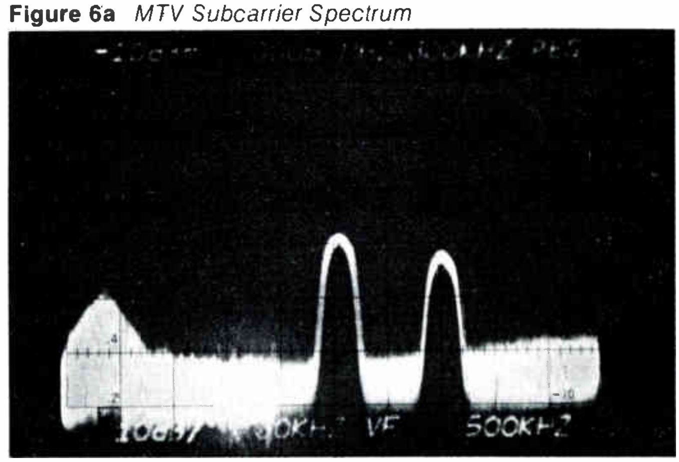


Figure 6b *CBS Subcarrier Spectrum*

the other hand, the stereo transmission is a single vendor system which I certainly consider a non-ideal situation.

MTV offers a system which has multiple vendors and is well specified, but through use of non-standard subcarriers and deviations is more difficult to implement for the small operator who may wish to use the simulcast sound. MTV also does not offer non-Dolby television sound.

I feel that barring an industry-wide agreement on a stereo sound transmission method that takes into account the various conditions under which operators will have to utilize the signal, the NCTA or SCTE should step forward and set such a standard. This would simplify matters for program supplier, hardware supplier and operator.

David J. Large joined Gill Cable TV four years ago and holds the position of vice-president of engineering.

By Dom Stasi, director of engineering, Warner Amex Satellite Entertainment Company.

An operator's viewpoint is a very welcome and necessary ingredient to the suitability of any design. Consequently I sought, and received, the indepth viewpoints of numerous operators prior to developing the sum and difference dual subcarrier scheme used by Warner Amex Satellite Entertainment Company. The viewpoint of the operators I spoke with formed a substantial representative sample of the CATV industry, and did not accord with the views expressed by Dave Large in his article entitled *Dealing With The New Stereo Satellite Services: An Operator's Viewpoint.* In addition, I believe Mr. Large's article contains misconceptions the casual reader would accept as accurate, and I would like to refute these in the interest of balanced reporting.

The selection of 6.62 MHz as the L + R frequency was not an engineering endeavor but a marketing based signal denial technique to encourage the proliferation of stereo processors and the attendant FM hook-up that is basic to the MTV philosophy. The choice of a lower than 6.8 MHz frequency was a logical one, mathematically based, but primarily intended to reduce composite deviations and their effect upon the FM threshold. As is clearly evident with The Movie Channel, we are utilizing 6.8 MHz as the L + R component, thus yielding a fully compatible stereo baseband. On The Movie Channel, stereo is offered as an option only and no source denial is needed.

I've clearly indicated that subcarriers must be accessed at the composite video output of a satellite receiver. This is standard practice with ancillary services carried in-band, above video. Rather than assume that Mr. Large made so elementary a mistake as to attempt to squeeze subcarriers from the baseband output port, I'd like to think he would simply prefer the convenience of a single all inclusive output from the receiver. None exists. If I interpret Mr. Large's comments correctly, he states some further resolution of this recommended configuration is needed. None will be forth-coming. Persistence in accessing subcarriers at the filtered baseband output is simply acting contrary to good engineering practice, and in opposition to abundant advice to that effect from those of us at MTV as well as equipment manufacturers overall. To wit, a signal severely rolled-off above 4 MHz was, and will be, obtained by design.

Subcarriers are deliberately removed from video immediately following demodulation. This is to prevent the possibility of subcarrier to chrominance intermodulation products from appearing in the reproduced picture. No commercial grade receiver should be without this feature, and this is by no means the port at which to access subcarriers. Accessing both video and subcarriers at the clamped video output jack for re-transmission is simple to be sure, but will impose serious performance penalties. Subcarriers ravaged by the output low pass filter are low level, distorted remnants not suitable as origination signals in any format. Furthermore, the presence of "non-de-emphasized subcarriers" at the composite video output is irrelevant. Pre- and de-emphasis is carried out upon the modulation intelligence and not on the carrier or subcarrier signals to any desired end. Mr. Large's subcarrier level problems are the result of utilizing an unsuitable output port contrary to advice, and not the product of some yet unresolved pre-emphasis oversight at MTV.

Addressing Mr. Large's statements regarding Dolby encoding, most cable system TVROs are small aperture affairs with carrier to noise ratios on the order of 12dB or thereabout. They are efficient, solid and inexpensive. The downside, however, lies in the minimal margins inherent to such systems before perceptable degradations occur. Those most common are impulse or random noise in the video, while the audio portion seemed reasonably solid. The audio does, of course, suffer degradations similar to those of video. The inadequacies of the audio systems in most home TV receivers, however, simply prevent their reproduction. This comfortable situation is subject to drastic change when a subscriber takes the stereo hook up. The whole gamut of pops, clicks, buzzes and hisses are, to widely varying degrees, alive and well within the audio, especially when received by a marginal TVRO, and will be reproduced with startling clarity by your subscriber's expensive stereo system. With MTV these conditions were anticipated and provisions made to minimize their effect.

Mr. Large has alleged that on MTV we employ "non-standard" deviations. Analysis of the MTV carrier spectrum will show two high level audio subcarriers, both of which are deviated ±237kHz (75kHz+10dB). This is the deviation limit specified by the satellite manufacturer for optimum audio performance on a video channel, thus yielding lower noise per unit bandwidth compared to more conservative transmission modes. Deviation standards *per se* are predicated upon the nature of the transmitted signal. The NCTA Satellite Engineering Subcommittee, in 1981, recommended standards for CATV. As a member of that committee, I would hardly violate its guidelines.

In addition, as readers are aware, the MTV audio transmission system incorporates Dolby noise reduction encoding. The decision to utilize noise reduction was not arrived at lightly, and when applied in reception can yield a considerable improvement in performance. Low cost decoders, (less than $50) are available for consumer use and can provide up to 10dB of additional quieting to your subscribers.

The selection of Dolby B as the reduction medium was a response to its high degree of compatibility, a point proven in innumerable worldwide tests over the last decade. The allegation that such processing emphasizes source noise is not applicable to MTV where *all* tapes (source) are Dolby "A"companded and enjoy fully -20dB of source noise reduction prior to transmission, and conversion to Dolby "B". As far as an existing decoder population is concerned, recall if you will,that the first color transmitter went on the air before anyone owned an NTSC receiver. More directly let's recall how pioneers within our own industry showed the foresight to begin, and sustain, satellite transmissions when only one CATV system owned an earth station! As engineers, it is our franchise and responsibility to improve the state of the medium when the technology exists to do so compatibly.

The body of work done by Dr. Dolby and his associates was probably the finest bit of audio engineering done in twenty-five years, and cannot be lightly dismissed. To elect not to utilize its advantages simply because few decoders exist in place is the type of mind set that would have our industry transmitting black and white signals over a terrestrial network.

When we at Warner Amex Satellite Entertainment Company developed an audio system for MTV, we did so with the efficiencies and limitations of CATV in mind. Therefore, when properly applied, even a small aperture earth terminal should deliver audio performance in excess of 75dB above the noise—quiet enough to please even the most discriminating subscriber without sending you to the poor house.

Cable Stereo: Some Basic Information On Satellite Delivered Services

By Ned Mountain, marketing manager, Wegener Communications, Inc.

As a cable engineer, you need only take a casual look at the various transponder basebands to see that things are changing. You will see many "familiar" signals (video plus a single 6.8 MHz audio subcarrier) as well as a wide variety of other subcarrier schemes. Just compare the basebands of F_3#3(WGN) and F_3#24(HBO), and you will quickly see what we mean.

Cable engineers need to know not only what these signals are, but also how to use them as the program supplier intended. To this end, we will take a look at the various formats, their applications, and how the signals can best be processed for cable distribution.

Services Available

In addition to providing standard TV audio, a given transponder may be carrying any one or all of the auxiliary audio signals: stereo TV sound, audio-only feeds for the cable industry, or audio-only feeds primarily for non-cable distribution.

We have attempted to list all existing auxiliary services that will be encountered on "cable birds" in Figure #1. Bear in mind that other satellite transponders are transmitting audio-only programs in a mode known as SCPC (single channel per carrier). This type of transmission fills up the transponder with audio carriers and no video will be present. A good example would be Westar 3 transponder #4.

As of this writing, there are three systems being used on cable transponders to transmit stereo sound: the Leaming System (used by CBS Cable and Bravo), the Warner Amex System (used by MTV and The Movie Channel), and the Wegener 1600 System (used by WFMT, Seeburg Music, Satellite Music Network, Bonneville Beautiful Music, Moody Bible, Continental Radio, and Family Radio).

The Leaming System

The Leaming system provides two audio channels on a single multiplexed subcarrier. The audio baseband is formatted around conventional FM stereo broadcast techniques with some additional constraints. L+R audio is transmitted from 50 to 15 kHz. L-R is transmitted as a Double Sideband Suppressed carrier signal centered at 38 kHz. A pilot signal of 19 kHz is transmitted as reference, eliminating the necessity of pilot regeneration at each receive location. This signal (with additional composite pre-emphasis) typically deviates the subcarriers ± 400 kHz. The composite multiplex subcarrier is used to modulate the main carrier at

Figure 1

Subcarrier Audio Services on the Air 1/1/82

Service	Satellite	Transponder	Subcarrier Frequency	Format
Satellite Radio Network	F_3	2	6.2 MHz	Standard mono audio
Satellite Music Network (Pop Adult)	F_3	3	5.58 L 5.76 R	Wegener 1600
Satellite Music Network (Modern Country)	F_3	3	5.94 L 6.12 R	Wegener 1600
WFMT	F_3	3	6.30 L 6.48 R	Wegener 1600
Bonneville Beautiful Music	F_3	3	7.38 L 7.56 R	Wegener 1600
Seeburg Music	F_3	3	7.695 (7.5 kHz mono)	Wegener 1600
The Movie Channel	F_3	5	6.8 (L+R) 5.8 (L-R)	Warner Amex
Moody Bible	F_3	6	5.58 L 5.76 R	Wegener 1600
Continental Radio	F_3	8	6.30 L 6.48 R	Wegener 1600
MTV	F_3	11	6.62 (L+R) 5.8 (L-R)	Warner Amex
Family Radio	D_2	4V	5.58 L 5.76 R (East) 5.94 L 6.12 R (West)	Wegener 1600
CBS Cable	W_3	6	5.8	Leaming
Bravo	D_2	3H	5.8	Leaming

typical levels of 3 to 4 MHz of peak deviation. (3.5 to 6 dB above the level of a normal 6.8 MHz subcarrier.)

Reception of this signal requires that the following steps be taken: demodulation of composite wideband subcarrier; Baseband composite de-emphasis and re-modulation of FM band carrier by composite signal.

In addition, Leaming provides a switchable "whistle filter" to eliminate audible beat notes that can occur between 15.734 kHz sync multiples and the 19 kHz pilot. The filter provides deep notches in the baseband at 15.734, 31.468, and 47.202 kHz to prevent these beats from forming. Check with the program supplier using the Leaming system for the proper hardware to receive his service. A block diagram of this system is shown in Figure #2.

The Warner Amex System

Warner Amex has chosen a dual subcarrier system for transmission of their stereo services. L+R (monaural) audio is transmitted on one subcarrier and L-R audio is transmitted on another. Peak deviations of ±200 kHz are used on each subcarrier, and main carrier deviation by the subcarrier is approximately 2.0 MHz. The two subcarriers each employ 75 microsecond pre and de-emphasis. The system is designed such that remodulation on cable FM with 75 microsecond pre-emphasis will make the signal identical to Dolby-FM broadcasts. A block diagram of the Warner Amex system is shown in Figure #3.

For optimum demodulation of the Warner Amex system, baseband audio gain and phase errors must be held extremely low. The uplink audio chain (manufactured by Wegener Communications, Inc.) is carefully monitored and regularly checked for gain and phase accuracy. Note we are discussing recovered audio and not subcarrier gain and phase, as subcarrier amplitude levels can vary slightly without audible degradation. The amount of stereo separation that you will receive in your headend is a function of gain and phase equality in your stereo processor demodulator. Since decoder design is critical, Warner Amex has taken the trouble to evaluate the vendor designs of stereo processors and given appropriate approvals. Be sure to check with Warner Amex to ensure the unit you are purchasing is on their approved design list. To do otherwise would compromise your subscribers.

It should be noted that a non-standard L+R (mono) subcarrier frequency of 6.62 MHz was chosen for MTV to deliberately encourage the cable industry to provide full stereo to subscribers. The Movie Channel, on the other hand, transmits the L+R signal on a conventional 6.8 MHz subcarrier giving the operator the choice of full stereo. Program suppliers need to utilize their transponder basebands according to *their* marketing and technical objectives for that service. MTV is a good example of non-standardization being used to insure that marketing objectives will be met.

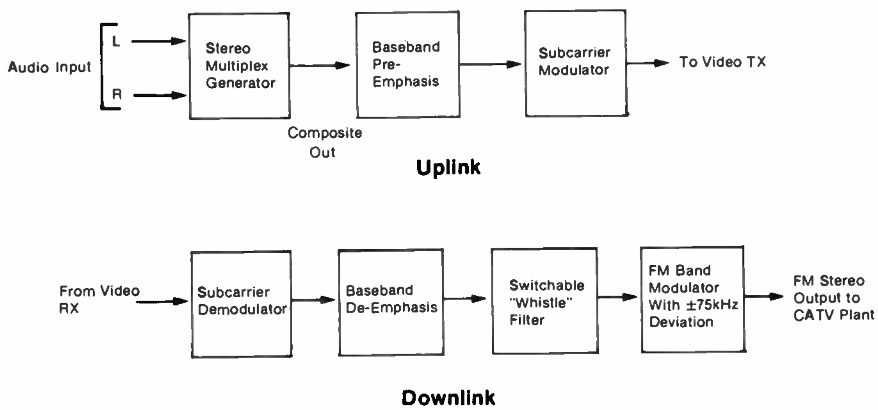
The Wegener 1600 System

The Wegener 1600 System made its debut in early 1981. This system transmits discreet left and right audio as individual low level subcarriers. Subcarrier levels, deviation, and spacing have been optimized for spectrum efficiency consistent with full fidelity program channel quality. Using the Wegener System it is possible to transmit at least eight mono (four stereo pairs) subcarriers along with video and 6.8 MHz program audio. A look at F_3#3 (WGN) will reveal a total of thirteen subcarriers and an occupied transponder bandwidth that is still well within the emission designator. Other transponders on which the Wegener low level subcarriers can be seen are F_3#6 (WTBS), F_3#8 (CBN), and Comstar D2 (NCN). Since levels of these subcarriers are 4 to 6 dB *lower* than recovered 6.8 MHz audio, subcarrier spacing is only 180 kHz, and subcarrier deviations of only ±50 kHz are used; a conventional subcarrier demodula-

tor will not provide satisfactory reception. In addition, a proprietary adaptive pre- and de-emphasis system (compander) is used to optimize the recovered signal-to-noise ratio. If the demodulator and audio processor compander characteristics do not *exactly* match those of the uplink, channel frequency response and dynamic accuracy will be affected. In general, listening to these subcarriers on conventional demodulators will result in a noisy signal with unnaturally high frequency peaking.

As in the case with Leaming and Warner Amex, the program supplier using this system should be consulted as to hardware necessary to receive his service. A diagram of the Wegener System is shown in Figure #4.

Figure 2
The Leaming Composite Subcarrier Stereo Transmission System

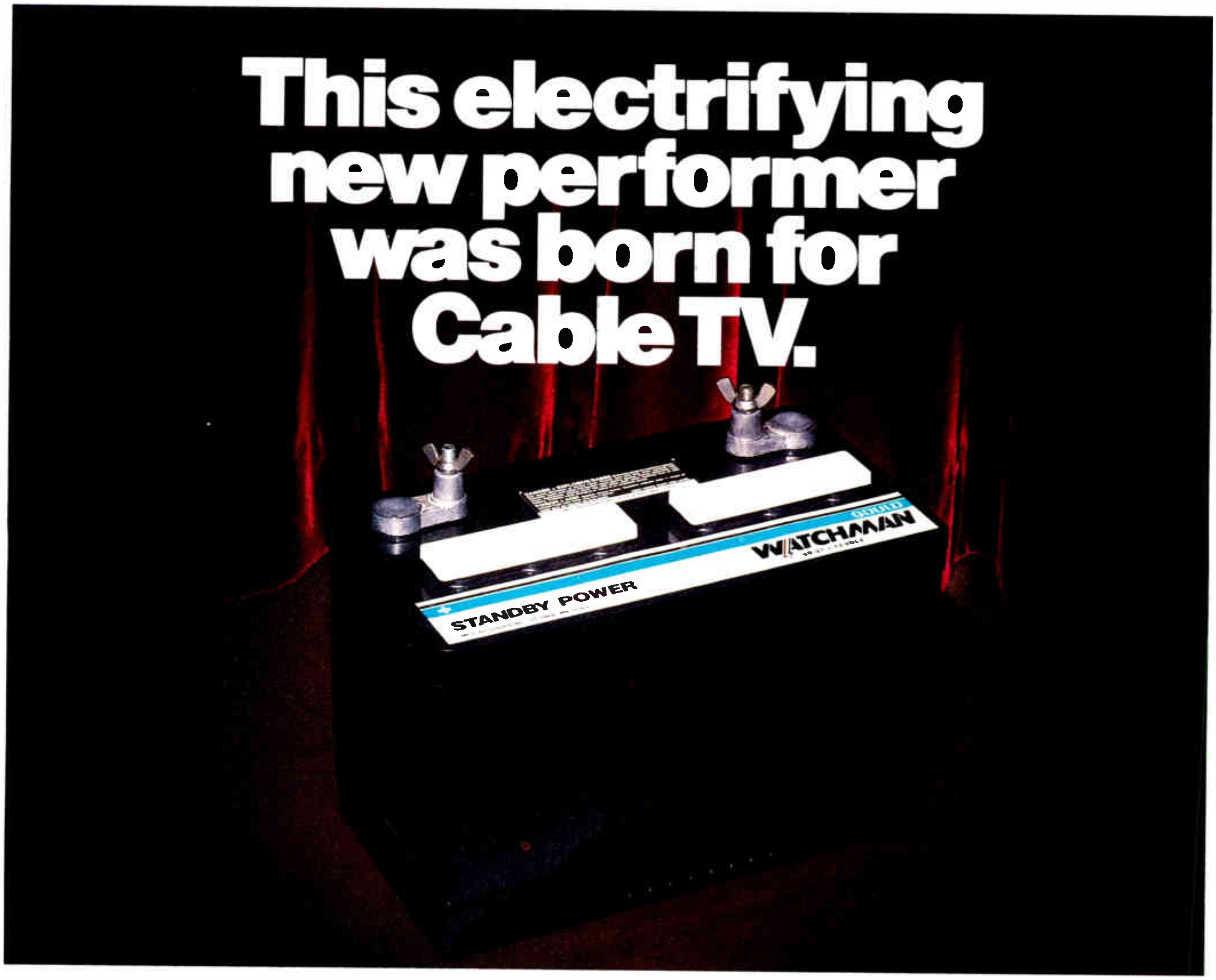


Common Pitfalls

Since many of the stereo satellite services require different treatments in the headend, it might be wise to point out a few of the more common pitfalls that can be encountered.

Use the correct port on your satellite receiver. Most commercial grade satellite receivers have two types of "video outputs": the most obvious is the one usually labeled "VIDEO OUT". This port contains the purest video with clamping and video de-emphasis. Since the de-emphasis curve has little effect at subcarrier frequencies, the receiver manufacturer usually provides additional filtering to roll off the high end of the baseband (above 4.2 MHz). It has been my experience that subcarrier demodulators connected to this port will exhibit totally unpredictable performance which varies from receiver to receiver and subcarrier demod to subcarrier demod. Do not use the video out port to demodulate subcarriers.

The second type of port generally available contains the entire baseband in an unfiltered, unclamped condition with



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video de-emphasis. This port is usually labeled "composite out", "baseband out", "unfiltered video", etc. This is the port you want. Believe it or not, most service calls are from people trying to use the wrong port on the receiver!

Unique situations such as video FM supertrunk and terrestrial microwave from TVRO to headend will present a new set of challenges. The best suggestion is to contact the vendor and program supplier for these special cases as they are all unique.

The Last Mile

Once you finally get the stereo audio at the headend, it is not a simple matter of just injecting the signal on the FM band and adjusting the level! Cable engineers have a "last mile" problem called FM stereo - the neglected stepchild of the cable industry. FM stereo signals are almost as "fussy" as video with regard to noise, beat susceptibility, etc. and some care needs to be exercised in adding quality stereo signals to your system. Guidelines should be used when adding the FM stereo carrier to the cable plant.

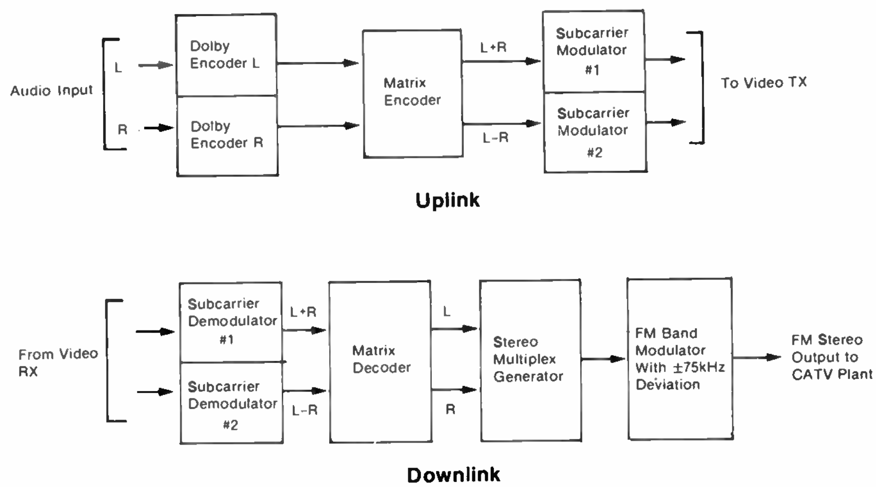
A minimum spacing of 400 kHz is necessary between any two FM stereo carriers. Do not select a frequency for your satellite stereo service that falls less than 400 kHz from any FM signal available to your subscriber's tuner, either direct off-air or processed. 400 kHz spacing is entirely satisfactory, but nothing less.

Select only standard FCC assignments when allocating FM channels. Such non-standard frequencies as 107.0, 88.4, etc. cannot easily be tuned by many of today's digitally synthesized tuners. Standard FM assignments always end in an odd integer (107.1, 88.3, etc.).

Do not run an FM stereo signal through FM equalizing traps as stereo performance can be severely degraded as a function of trap bandwidth. FM traps can be used, however, to effectively clear out

Figure 3

The Warner Amex Stereo Transmission System



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MICHAEL G. HARRIS
Vice President, Engineering
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"Higher gain, less distortion, high reliability and *superb* AGC . . . I'd hate to be without it." That's what Mike Harris says about Century III feedforward amplifiers. And, he should know. Mike uses them to solve some pretty tough problems in entire systems and long-haul applications throughout the country.

In a Connecticut system, Mike uses feedforward entirely, greatly reducing the number of amplifiers required. He used it in Huntington, West Virginia to upgrade a low band run to a 21 channel system by simply replacing the low band amplifiers with feedforward amplifiers. In Virginia, Mike had to contend with a dead run of cable 10 or 12 miles long through some very inaccessible areas. "It had to go 6,000 feet across a mountain without an amplifier," he says. "Use of feedforward made this possible." And, in San Pablo, California, Mike needed to increase his bandwidth and get a good signal at the head end for distribution throughout the system. He installed feedforward directly into existing locations and now has a very stable signal with high reliability. "We've been able to eliminate a lot of inaccessible head ends, with an accompanying cost savings by using feedforward," Mike comments.

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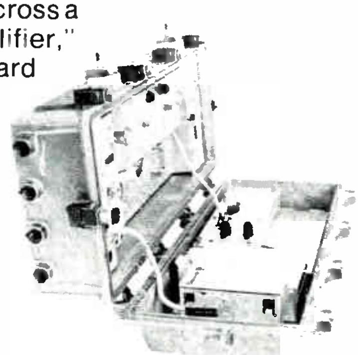

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a portion of the FM band from a broadband input and make that spectrum available for locally injected signals.

Run the FM stereo carrier at levels sufficient for reasonable signal-to-noise ratios at subscriber drops. FM mono to stereo degradation is considerable and needs to be taken into account. Figure #5 illustrates the detected mono and stereo detected signal-to-noise ratios measured on a typical cable system. Note that the typical aural carrier level of channel 6 video minus 15 dB provides only a 55 dB stereo signal-to-noise ratio which translates into moderate background "hiss". For reasonable FM stereo performance, we suggest that the carrier be set at a channel 6 video minus 10 dB level at the headend, resulting in a detected stereo signal-to-noise ratio of 60 dB - not great, but definitely acceptable to the average listener. (For additional information, we suggest reviewing my 1980 and 1981 NCTA Convention papers - available in the NCTA technical paper transcripts or upon request from Wegener Communications.)

Program suppliers need to utilize their transponder basebands according to their marketing and technical objectives for that service. MTV is a good example of non-standardization being used to insure that marketing objectives will be met.

Conclusion

We hope this article has provided some insight into the world of satellite delivered audio services and how to use them. It is my sincere belief that these services will proliferate and become a popular and welcome addition to cable entertainment packages in the 1980's. With a little thought and planning, the cable engineer can be ready to implement these services with a minimum of surprises.

Figure 4

The Wegener 1600 FM Stereo Transmission System

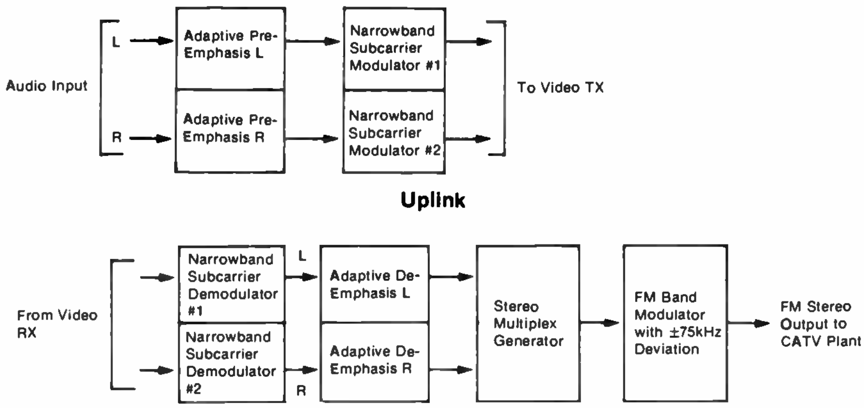
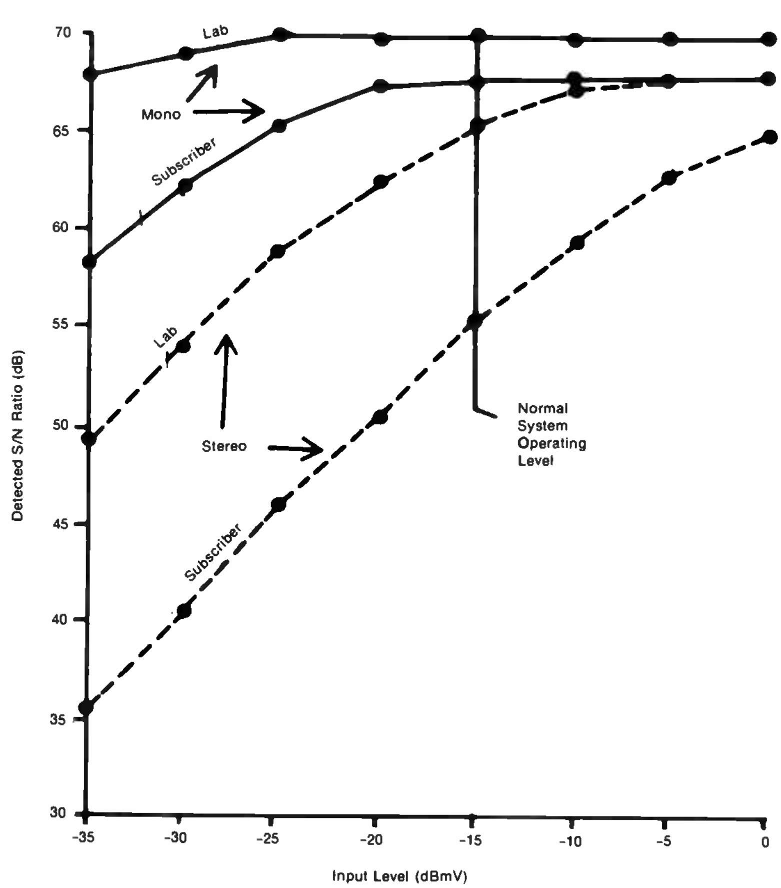


Figure 5

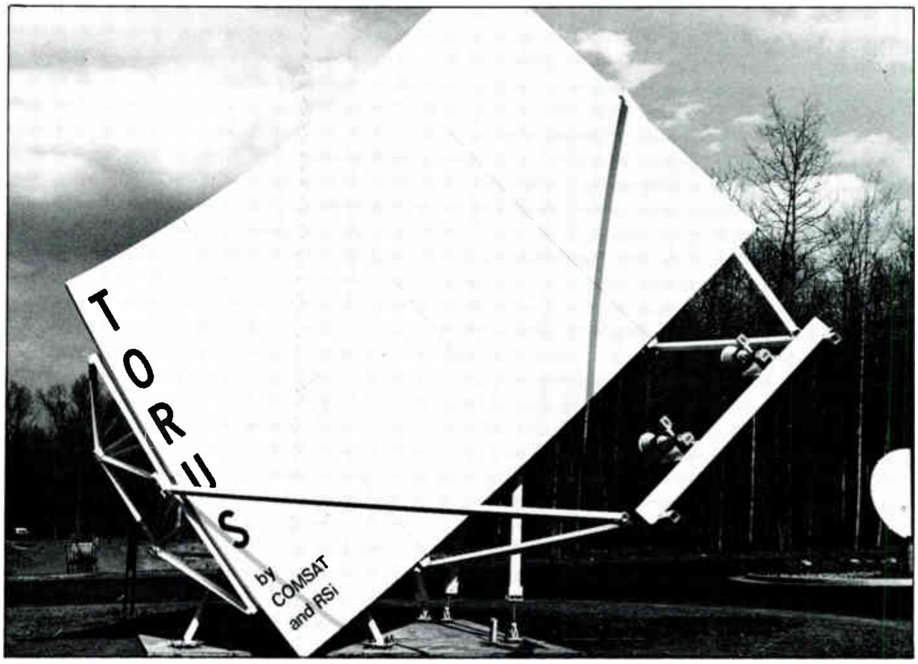
Mono to Stereo Degradation as Measured at Both Lab and Sub-Drop on San Angelo, Texas Cable System. Cascade was 20 Trunk, 1 Bridger, and 1 Line Extender.



Ned Mountain is marketing manager for Wegener Communications, Inc., an Atlanta based company dedicated to development of satellite auxiliary services. His prior experience includes two years as a senior engineer with UA-Columbia Cablevision and eight years with Motorola Communications and Electronics, Inc., systems engineering group. He holds a BSEE degree from the University of Pittsburgh.

The Torus 4.5-Meter Multibeam Satellite Earth Station Antenna

By Jim Travis, sales manager for COMSAT Maintenance and Supply Center.



The Torus 4.5-meter antenna.

Description

The model 450TC torus antenna provides constant quality signals from multiple satellites, simultaneously utilizing the same reflecting surface. It also provides the versatility of switching easily from one satellite to another (see Table I). The offset design of the torus provides a gain equivalent to a 4.5-meter parabolic antenna with significantly lower sidelobes. This results in much less interference from signals from either terrestrial microwaves or adjacent satellites as close as 2° apart. By dedicating a feed to each satellite, at least 17 sharp beams may be received within a 50° orbital arc simultaneously.

Model 450TC consists of 12 uniquely contoured, rigid AccuShape panels manufactured of high strength aluminum. AccuShape is a precision metal contouring process proprietary to Radiation Systems, Inc. The precision-tooled panels, which are parabolic in one plane and circular in the plane of the satellite equatorial orbit, are supported by a steel backup structure. All like parts are interchangeable and are factory set with no field adjustments required.

Projecting to the front of the reflector are spars which support a tray on which multiple feeds are positioned along the orbital arc. Two feeds are furnished, and additional feeds can be ordered. Each

Table I

Features of the Torus Antenna

- Simultaneous multiple satellite access (up to 17 satellites)
- Constant signal quality with low sidelobes
- Savings in equipment, real estate and maintenance costs
- Rugged all-metal construction; trouble-free operation
- Quick access to alternate satellites by simple feed reorientation
- Capability of simultaneous operation at 4/6 and 12/14 GHz

feed has a protective radome window which uses a unique breathing system to eliminate the need for expensive pressurization equipment. The assembled reflector/feed structure is mounted on steel supports which orient the antenna toward the satellites. These supports contain fine-tuning adjustment screws for optimum positioning of the antenna. Model 450TC has sufficient reflector surface accuracy and mount stiffness to operate with Ku-band satellites. By selecting the proper feeds, the torus antenna can operate in C-band only, Ku-band only, or in both bands simultaneously.

The model 450TC torus antenna was developed and patented by COMSAT. Under an exclusive license from COMSAT, Radiation Systems, Incorporated/SATCOM Technologies, Incorporated manufacture the torus. RSI and SCT have over 20 years of experience in design and production of communications antennas, assuring the customer of a truly superior product. The COMSAT Maintenance and Supply Center (M&S Center), through an agreement with the manufacturer (RSI/SCT), offers the torus for sale. The M&S Center also specializes in complete earth station installation, equipment repair, calibration, integration, fabrication, parts supply, and related training programs. The M&S Center, established in 1968 as a full service field support organization for the COMSAT earth station network, now offers its state-of-the-art technology and expertise to the commercial telecommunications industry.

Jim Travis spent nine years with Ampex and was involved in Federal Marketing. He has been with COMSAT for two years.

Table I Cont.

Options

Feeds with the following polarizations:

Receive Only	**Receive/Transmit**
Single linear	Orthogonal linear
Dual linear	Coplanar linear
	3-port linear frequency reuse (2-port orthogonal receive, 1 transmit port copolarized)
	4-port orthogonal linear frequency reuse

Specifications—Model 450TC

Electrical

Frequency		
	Receive	3.7-4.2 GHz
	Transmit	5.925-6.425 GHz
Gain		
	Receive	43.2 dBi
	Transmit	46.1 dBi
VSWR		1.25:1
	Beamwidth at Midband	
Receive	-3 dB	1.15°
	-15 dB	2.25°
Transmit	-3 dB	0.75°
	-15 dB	1.45°
	First Sidelobe Level	-20 dB
	Radiation Pattern*	32-25 log θ dBi 1° $\leq\theta\leq$48° -10 dBi 48° $\leq\theta\leq$180°
Antenna Noise Temperature (ref. omt port), Typical 10° Elevation		36°K
Cross-Polarization Discrimination 1 dB Beamwidth		-30 dB

Mechanical

Reflector Size	~36 ft wide × ~15 ft high
Feed Interface	
Receive	CPR 229G
Transmit	CPR 137G
Net Weight	~5500 lb

Environmental

Wind Loading at 32°F	
Operational	30 mph gusting to 60 mph
Survival	125 mph with no ice;
Pointing Accuracy	0.035° rms in 30-mph winds gusting to 45 mph; 0.070 rms in 45-mph winds gusting to 60 mph.

DISCOVER THE BENEFITS OF OUR MULTIPLE-BEAM ANTENNA

Only SIMULSAT® can see all domestic satellites at once with consistant performance on each bird. This means that you can see from Satcom I (135° W) to Comstar D3 (87° W) with the performance characteristics of a 4.6 meter antenna. This is the only existing antenna in the world to accomplish this.

Simulsat is not just an idea on the drawing boards, it's in operation today, working for major MSO's and Television Broadcasters.

New programs and services are constantly being added to a continually increasing number of satellites. In the past, multiple satellite reception required the construction of an Antenna Farm. Simulsat can save you valuable capital and real estate. Make a smart investment for your business and let Simulsat be your plan for the future.

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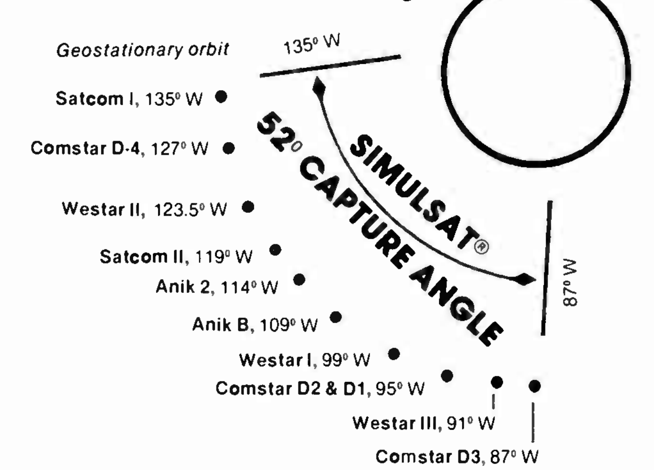

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Placing TVRO Antennas At A Distance

By C. Douglas Rasmussen, product marketing manager, Hughes Microwave Communications Products.

This article discusses cost effective ways to extend the distance between TVRO antennas and other equipment associated with cable systems. The technique discussed herein provides greater flexibility for the antenna site which can reduce the need for new property and/or buldings. The ability to locate TVRO antennas at distances greater than one-half mile from the cable headend will help to overcome restrictions due to terrain, frequency coordinations, zoning, cost and other criteria. Also included is a technical review of basic down-link calculations and considerations that will enable cable operators to verify that system performance will not be adversely affected by extended antenna/headen distances.

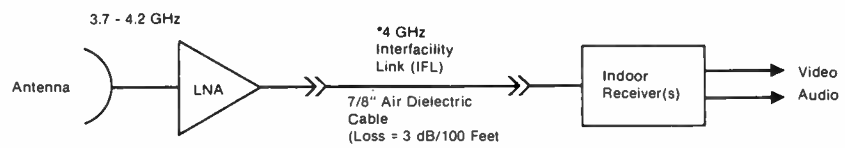
First Generation TVROs

Early TVROs utilized video receivers requiring a 4 GHz RF input direct from the antenna and low noise amplifier (LNA). The output from these receivers was baseband video and audio. Conversion from 4 GHz to video often included 1, 2, or 3 intermediate (IF) stages. As a result of this RF-IN/Baseband-Out approach, the cable or interfacility link (IFL) between outdoor and indoor equipment required the use of expensive, low loss, 4 GHz cable.

Figure 1 is a block diagram of a typical first generation TVRO. For the most part, the antenna and LNA determine the system figure of merit (G/T). Signal losses and minor mismatches beyond the LNA will have minimum impact on system performance, providing losses (IFL + Power Divider) are less than about 25 dB or one-half of the LNA gain. When using a typical LNA having a gain of 50 dB, any losses above 25 dB will begin to degrade system performance (i.e. G/T, S/N, C/N).

Figure 1

Typical First Generation TVRO.

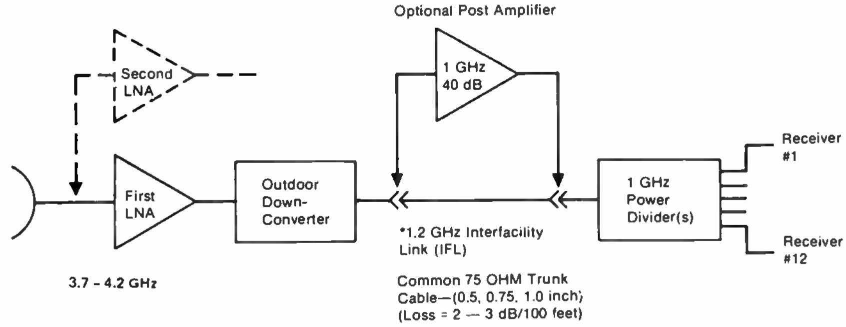


*Case A One Receiver System
Typical Limit of 800 Feet at a Cost of $3200 for Cable Only.

*Case B Five Receivers System
Typical Limit of 400 Feet at a Cost of $1600 for Cable Only.

Figure 2

Typical New Generation TVRO.



*Case A One Receiver Using 1.0 Inch Trunk Cable
Typical Limit is 950 Feet at a Total Cable Cost of $850.

*Case B Five Receivers Using 1.0 Inch Trunk Cable
Typical Limit is 350 Feet at a Total Cable Cost of $300.

*Case C Five Receivers Using 1.0 Inch Trunk Cable and Post Amplifier
Typical Limit is 2300 Feet at a Total Cost for Cable and Post Amplifier of $3000.

As indicated in Figure 1, the practical limit for distance between the antenna and receiver(s) is somewhere between 400 - 800 feet. These relatively short distances place undue constraints on the antenna location site as well as cable operators pocketbooks. This 400 - 800 foot distance may not allow antenna positioning to take advantage of natural shielding (frequency coordinations) or more aesthetic locations. These factors, along with the availability and handling of bulky 7/8ths inch air dielectric cable add further difficulties. Additional system complexity and cost may be incurred as each receiver duplicates the first down-conversion stage from 4 GHz.

New Generation TVROs

The advent of a mass satellite distribution network for cable systems, including the use of multiple receivers and even multiple antennas at a given site, has prompted hardware manufacturers to look for new cost effective techniques. Early TVRO systems employed up to three receivers per system. New requirements typically use eight or more receivers for each polarization at each site. In addition to cost, manufacturers' new designs have to consider performance, frequency agility, antenna size and location and the number of receivers used in each cable system.

Modern TVRO receivers employ "block downconversion" which replaces the need for RF downconversion circuitry in each receiver. Block downconversion is a technique by which the entire 500 MHz band (24 transponders) is converted from 4 GHz to 1.2 GHz in a single step. This not only reduces receiver cost by utilizing a single RF downconverter for multiple receivers (up to 12 receivers for each polarization) but also eliminates the need for expensive 4 GHz IFL cabling. The use of this new industry standard IF frequency of 1.2 GHz also appreciably extends the maximum distance between antenna and receivers.

Figure 2 is a typical block diagram of a new generation TVRO. As shown, substantial savings are possible by using common 75 ohm trunk cable in conjunction with a TVRO using a 1.2 GHz interface. IFL cost savings are doubled when programming is received from both horizontal and vertical polarizations. The cable operator can now save money or "buy distance" at locations where the antenna must be greatly removed from the existing headend. The interconnect cable (IFL) for a typical distance of 350 feet now costs about $300 (4 GHz cable costs about $1,400). The $3,000 cost of an old 4 GHz IFL of 400 feet now will extend the distance to 2,300 feet using trunk cable. This $3,000 price includes the cost of trunk cable and a 40 dB gain, 1.2 GHz post amplifier. Further use of a 60 dB gain LNA (costing about $500 more

Table 1

Characteristics of IFL Cables

Description	Frequency	Diameter (inches)	RF Loss (per 100 feet)	Approx. Cost (per foot)
Air Dielectric	4 GHz	.87	3 dB	$4.00
Foam Dielectric	4 GHz	0.5	7 dB	$1.50
Trunk Cable	1 GHz	0.5	3.1 dB	$0.30
Trunk Cable	1 GHz	0.75	2.7 dB	$0.50
Trunk Cable	1 GHz	1.0	2.0 dB	$0.90

Table 2

Terms and Definitions

EIRP: Effective Isotrophic Radiated Power from a satellite transponder to a particular point on earth* (use EIRP of 30 dBW, worst case, for SATCOM I).

IFL: Interfacility Link is the cable or cables used to interconnect outdoor equipment at the TVRO antenna to indoor equipment.

BLOCK DOWN- CONVERSION: Heterodyning the entire 3.7 to 4.2 GHz satellite band down to 905 to 1450 MHz in a single conversion. A single downconverter signal can feed multiple receivers. (Typically up to 12 per polarization)

α: Free Space loss between satellite and point on earth* (use 196 dB typical)

GA: Antenna Gain* (use 44 dB for typical 5 Meter)

TA: Antenna Noise Temperature

LO: Loss between antenna and LNA* (use 0 dB when LNA is connected direct to antenna)

GP: LNA Gain* (use 50 or 60 dB)

TP: LNA Noise Temperature* (use 120°K)

GD: Downconverter Gain* (use 10 dB for Hughes Model ODC-463)

TD: Downconverter Noise Temperature* (use 2610°K for Hughes Model ODC-463 with a 10 dB noise figure)

L1: Cable loss between LNA and downconverter* (use 4 dB for typical focal point antennas and 1.0 dB for cassegrain)

L2: Cable loss between downconverter and post amplifier if used.* (dependent on cable loss and lengths, see Table 1 and Figure 6)

G1: Post Amplifier Gain* (use 40 dB)

T1: Post Amplifier Noise Temperature* (627°K for 5 dB noise figure)

LPD: Power Divider Loss* (use 3 dB for 2-4 receivers and 12 dB for 5-7 receivers)

PR: Power input to receiver(s)

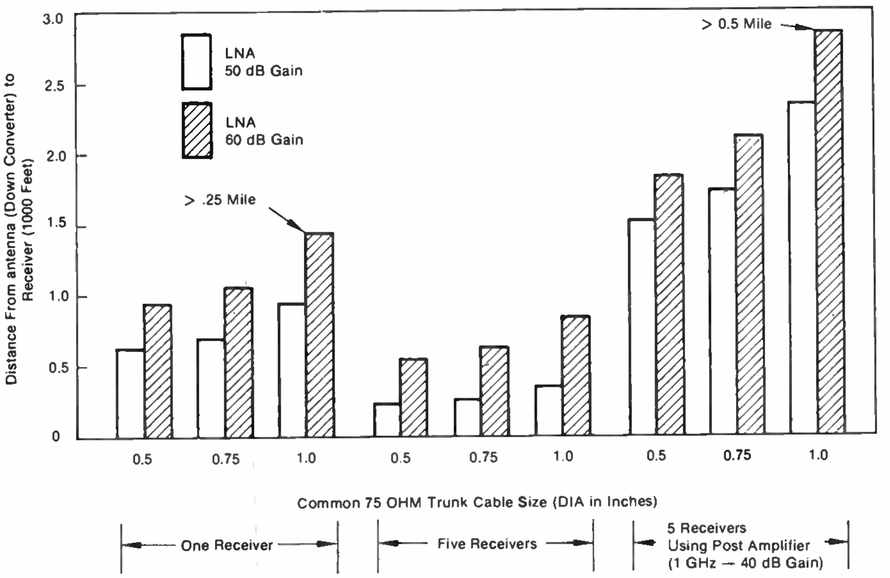
TR: Receiver Noise Temperature* (use 8880°K for Hughes Model SVR-463 Receiver with 15 dB noise figure)

TO: Ambient Temperature* (use 290°K)

*Indicates values used in sample calculations. Use specific values where applicable.

Figure 3

Antenna Receiver Distance Trade Offs.



than a conventional 50 dB gain LNA) will extend the antenna/receiver distance more than one-half mile for some applications.

Special Considerations

Figure 3 shows a graph of antenna/-receiver separations as a function of types of cables and other variables. Table 1 is a listing of common types of IFL cables, their associated RF losses and relative costs. This information should assist the cable operator in making an economic comparison between co-locating an antenna (TVRO) with existing headend equipment vs. new property and/or facility acquisitions. In cases where frequency coordination, zoning and other conditions are not a problem, the use of low cost trunk cable (1 GHz) may not be an important economic consideration.

Special attention may be required when TVROs use an IF signal within the UHF band. Radio frequency interference (RFI) caused by near-by broadcasters may pose the same problem with the IFL cable as to the cable system itself. Receiver design using the industry accepted 1.2 GHz IF frequency, such as the Hughes Model SVR-463, are immune to broadcaster interference at the down-converter and in the IFL.

Performance Considerations

Basic performance for a specific terminal will be defined by the TVRO equipment manufacturer, the frequency coordination or by cable system engineering. The following section reviews basic design analysis in order to verify negligible performance degradation when employing a long IFL. Table 2 is a listing of terms and definitions used including values for sample calculations while Figure 4 shows the mathematical model used for power and noise temperature analysis. Generally,

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if the system is properly designed for the appropiate power input to the receiver, noise temperature is of secondary importance. Selection of parameters should take noise temperature into account.

Using the value for terms indicated in Table 2 and a 50 dB gain LNA, equation 1 (see figure 4) is reduced to:

$^{P}R = -(36 + \text{IFL Losses})$ dBm

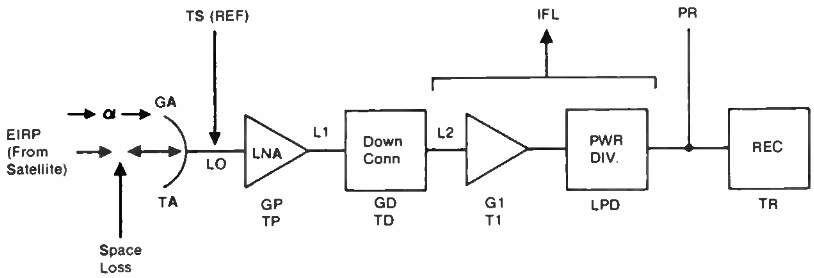
A typical minimum input (P/R) for the Hughes Model SVR-463 receiver is -55 dBm. Under these conditions, the maximum allowable loss in the IFL and power divider is 19 dB. Using the cable loss values in Table 1, maximum IFL length for various trunk cable are:

0.5 inch	Cable	612 feet
0.75 inch	Cable	703 feet
1.0 inch	Cable	950 feet

If five or more receivers are required, a power divider (LPD) loss of dB must be included. Use of a 1 GHz post amplifier (G1 = 40 dB) in a five receiver system will increase the maximum IFL to 2350 feet.

Figure 4

Power and Noise Temperature Analysis.



$$PR = EIRP - \alpha + GA - LO + GP - L1 + GD - L2 + G1 - LPD \quad \text{(Equation 1)}$$

$$TS = \frac{TA}{LO} + \frac{(LO-1)\,TO}{LO} + TP + \frac{(L1-1)\,TO}{GP} + \frac{L1,\,TD}{GP} + \frac{(L2-1)\,TO,\,L1}{GP,\,GD} + \frac{L2,\,T1,\,L1}{GP,\,GD} + \frac{(LPD-1)\,TO,\,L1,\,L2}{GP,\,GD,\,G1} + \frac{LPD,\,TR,\,L1,\,L2}{GP,\,GD,\,G1} \quad \text{(Equation 2)}$$

(See figure 3 for typical IFL values under various conditions.) Care should be exercised when using a post amplifier since receiver inputs higher than the maximum ^{P}R can cause undesirable intermodulation products. In those cases the cable manufacturer's value for looses at low frequencies (950 MHz) should be considered (see Figure 5). Typical maximum power input for the Hughes Model SVR 463 is -25 dBm.

As previously mentioned, noise temperature contributions from the IFL are of secondary importance. The first five terms for system noise temperature (^{T}S) given in equation two can be ignored in determining the effect of the long IFL. The first three terms are usually the dominant ones and have no bearing on the situation under consideration. The contribution to system noise temperature by the fourth and fifth terms are negligible even under the worst case conditions of cable loss between the LNA and downconverter (L1 = 4 dB) and downconverter noise temperature (TD = 2610°K).

$$\text{Fourth Term: } \frac{(L1-1)\,t_o}{GP} = \frac{(2.51-1)\,290}{10^5}$$

= 0.0044°K for 50 dB LNA and 0.00044°K for 60 dB LNA

$$\text{Fifth Term: } \frac{L1 \cdot TD}{GP} = \frac{2.51 \cdot 2610}{10^5} = 0.065°K$$

for 50 dB LNA and 0.0065°K for 60 dB LNA

With a post amplifier and power dividers the third and fourth stage contribution of noise is:

$TS = 7.3 \times 10^{-4}\,(L2-1) + 3.51 \times 10^{-5}\,(L2)$ for a 50 dB LNA

$= 7.3 \times 10^{-4}\,(L2-1) + 3.51 \times 10^{-6}\,(L2)$ for a 60 dB LNA

From power considerations above, L2 can be 47 dB with a 50 dB LNA and 57 dB with a 60 dB LNA. The worst case noise contribution can be 38.3°K (TC = 38.3°K). In a system where the first three terms add up to 145° (typical for a 120° LNA) this represents a degradation of 1.02 dB in overall noise temperature.

For a system without the post amplifier, the expression for system noise temperature is:

$$TS = \frac{TA}{LO} + \frac{(LO-1)\,To}{LO} + TP + \frac{(L1-1)\,To}{GP} + \frac{(L1-1)\,To}{GP} + \frac{L1,\,TD}{GP} + \frac{(L2,\,LPD-1)\,To,\,L1}{GP,\,GD} + \frac{L2,\,LPD,\,TR,\,L1}{GP,\,GD}$$

The last two terms represent the contribution of the third stage which includes the IFL and power divider. These terms give a worst case contribution of

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1.76°K or a total system degradation of 0.05 dB.

EXAMPLE – 5 RECEIVERS

1200 foot IFL   50 dB LNA

1.0 inch 75 ohm trunk cable

This length of line needs a post amplifier since the power to the receiver would be about -63 dBm using a 1 inch cable without an amplifier. Even the most favorable EIRP would leave no gain margin in the system.

$Pr^1 = -(36+24-40+12) = -32$ dBm

$Pr^2 = -(36+18-40+12) = -2$ dBm

Pr^1 assumes an IFL cable loss of 2 dB per hundred feet worst case.

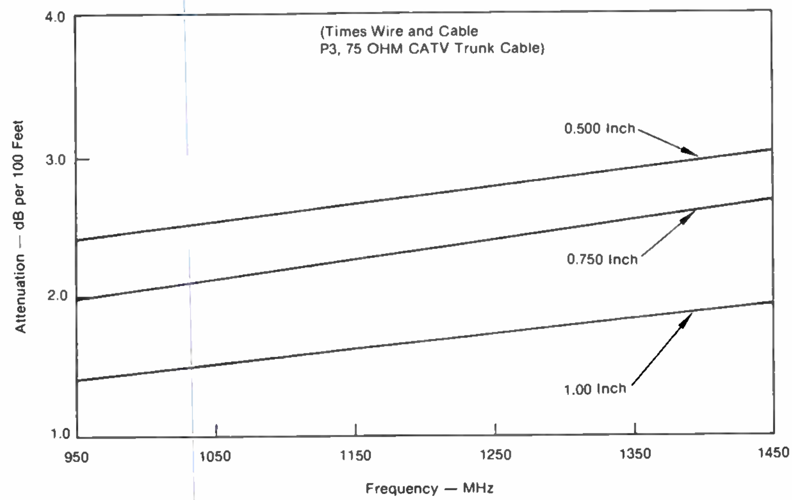
Pr^2 assumes a cable loss of 1.5 dB at the lowest frequency (950 Mhz).

Use of the 1.0 inch cable yields a receiver drive level of -24 dBm which is slightly higher than the previously mentioned maximum receiver drive level of -25 dBm. The minimum drive level of -32 dBm permits the use of a lower cost 0.5 inch cable. If only one receiver is to be used (no power divider), this length of line can be accommodated using a 1 inch cable and a 60 dB LNA without a post amplifier.

The above example using a 0.5 inch cable, post amplifier with five receivers contributes only 4.0° K or 0.12 dB degradation to system noise temperature of 145°K.

Figure 5

Trunk Cable Attenuation vs. Frequency.



Conclusions

The use of a block downconversion TVRO system adds flexibility to selection of the antenna site. This flexibility saves dollars without adversely affecting system performance. Longer IFL lengths will help to utilize existing facilities and can help in adding a second or third antenna to an already cleared (frequency coordination) site. Additional cable cost savings are realized when multiple cables are required for dual polarization and redundancy. Use of the block downconversion (1 GHz) technique also permits multiplexing the interconnect signal from the new (second) TVRO with the signals on an existing 4 GHz cable.

The author acknowledges the assistance from and the satellite technical expertise of Norman P. Weinhouse.

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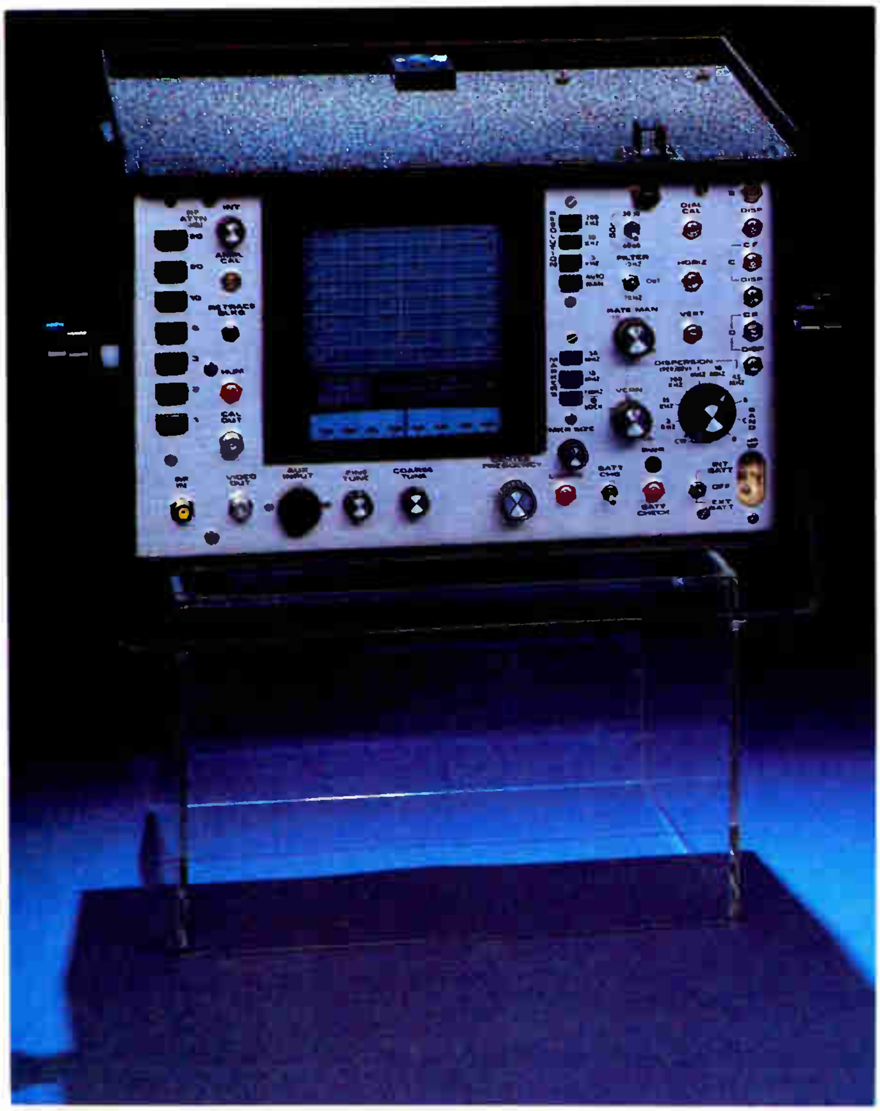

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Simulsat—The Future Of Satellite Television

Eugene P. Augustin, president, Antenna Technology Corporation.

Simulsat is a simultaneous multiple satellite antenna terminal; that is, it is one single antenna capable of receiving satellite transmissions from multiple satellites simultaneously without adjustment or degradation in performance from one satellite to another. Until the introduction of Simulsat, an operator desiring to obtain programming from more than one satellite was required to either reposition his antenna from one satellite to another or to have multiple antennas. Simulsat eliminates these problems by giving the operator one antenna capable of viewing all satellites within range of the antenna. The antenna has a 57-degree field of view; thus, without degradation in performance, Simulsat is capable of looking at every commercial satellite currently in domestic geosynchronous orbit over the United States.

Simulsat is based on research that began in Great Britain in 1945 and was continued by Bell Telephone Labs in 1959. Since that time a continuum of programs has been carried on by NASA,

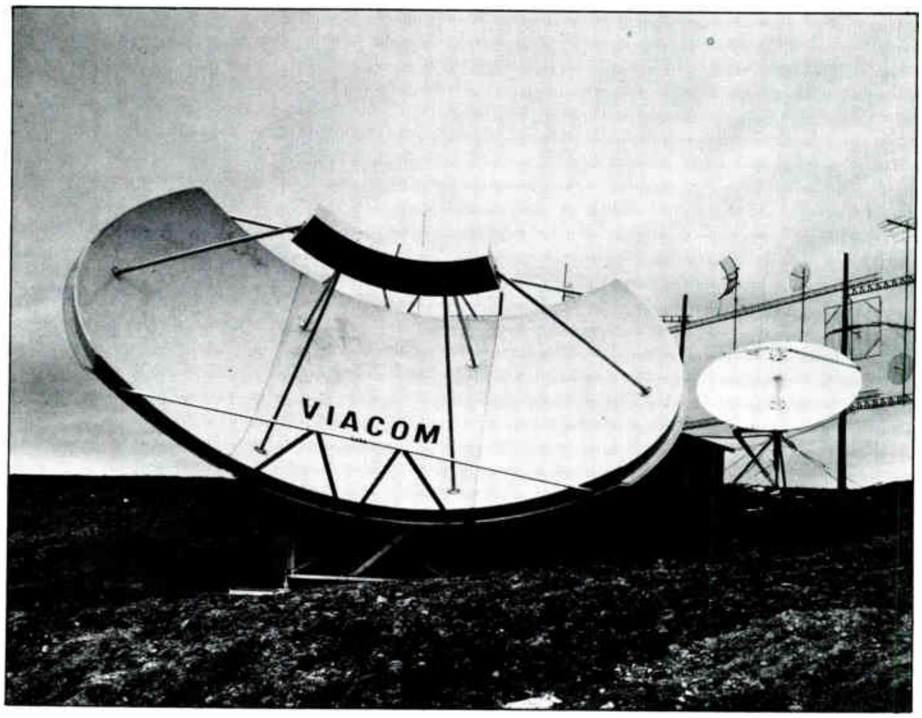

Figure 1
Simulsat installation in California.

the U.S. Air Force, the U.S. Army and other government agencies.

So, Simulsat is really not a new antenna, but an improvement of an old technique. The old technique was limited in application because of the limitations of technology when it was first discovered. The primary limitation of Simulsat is spherical aberration. In order to collimate energy from a plain wave to a point source through a single reflecting surface, Fermi's principle of least path dictates a parabolic reflector. A spherical reflector is a deviation from a parabolic reflector having aberration. The greater the curvature, the more loss in gain and the higher the sidelobe performance of the antenna.

Spherical Aberration

The classical approach to the solution of spherical aberration problems has been threefold. First is the choice of a large radius of curvature: the larger the radius of curvature, the less the spherical aberration. However, large radius of curvature implies large structure. Large structure is counter to the desires of a practical antenna system. Large radius of curvature also dictates large focal length or large F/D ratio, usually on the order of one. Thus a 16-foot diameter antenna would have a 16-foot or more focal length. This does not lead to practical structures.

Antenna Technology Corporation's approach to the problem involved integrating the feed structure design of the required radiation characteristic and matching that to the reflector surface to provide optimum performance and a minimization of spherical abberation.

Figure 1 is a photograph of a Simulsat installation in California. Simulsat consists of a 16-foot by 26-foot reflector, a universal mount, a feed support structure and the feeds for each individual satellite. The feed support structure is physically capable of holding 20 dual polarized feed systems. Thus, Simulsat is capable of 20-satellite operation should there ever be

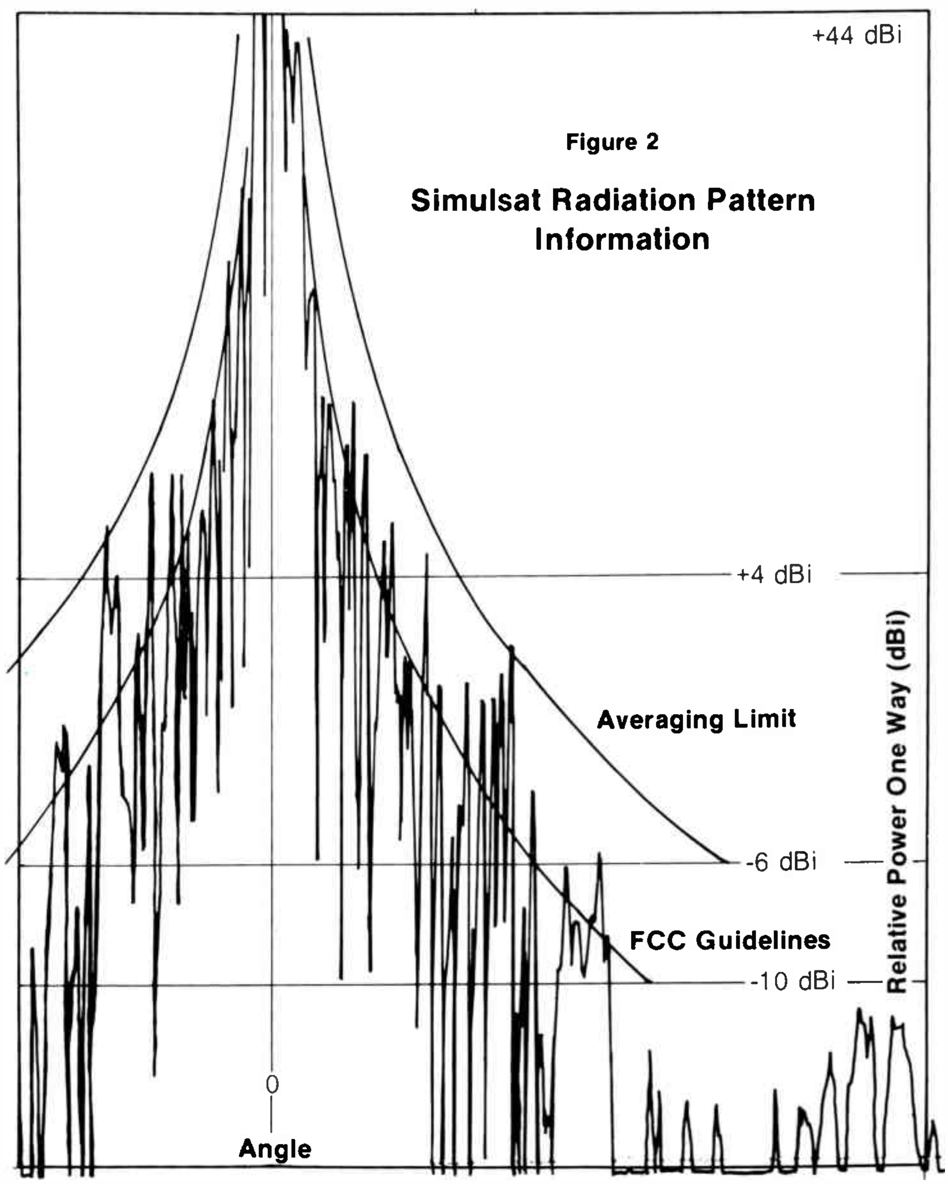

Figure 2

Simulsat Radiation Pattern Information


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that many satellites placed within its 57-degree field of view. Table 1 is a summary of Simulsat's performance characteristics.

Table I

Typical Performance of Simulsat

Frequency	3.7-4.2 GHz
Gain (4GHz)	44
Beamwidth	1.0 degrees
Minimum (Satellite) Separation	3 degrees
Maximum Beam Separation	57 degrees
Polarization Isolation	25 dB
Adjacent Satellite Isolation	25 dB
Feed Flange	CPR 229-G
Size	16' x 28'
Mount	8' Triangular Base
Weight	3600 pounds
Wind	80 Miles per hour-4 cubic yard foundation 125 miles per hour-12 cubic yard foundation

Range Testing

Simulsat has the performance characteristics of a typical 4.6- to 5-meter antenna for each and every beam position across 57 degrees of arc. In order to substantiate the performance claims on Simulsat, Antenna Technology Corporation undertook the task of measuring the radiation characteristics on a typical production Simulsat antenna. The tests were conducted on Comtech's antenna range in St. Cloud, Florida. This range consists of two towers one mile apart. One tower is approximately 80 feet high and the other 120 feet high. The 120-foot tower was used as a source antenna tower and was equipped with 3-meter antenna to transmit a signal to the 80-foot tower. Simulsat was installed on a hydraulically operated turntable atop the 80-foot tower. This turntable allowed Simulsat to be moved in azimuth, elevation and roll angle so that automatic radiation pattern measurements showing the gain, beamwidth, and sidelobe performance characteristics could be made. The measurements were made using Scientific Atlanta antenna radiation pattern measurement equipment. The radiation pattern tests were witnessed by Lester E. Polisky, vice president and general manager of EMEC Division, Comsearch, Inc. Figure 2 is a typical radiation pattern measured on Simulsat. The measured gain for all beam positions of Simulsat was 44 dB across the 57-degree arc. Typical 5-meter antennas have published gains of 43.5 to 44.5 dBI. Hence, Simulsat has the gain characteristics of a typical 5-meter antenna. As shown in the radiation patterns, its beamwidth and sidelobe characteristics are very much like those of a typical 5-meter antenna and generally better than a cassegrain type antenna. The tests were conducted using six feeds in Simulsat, spaced in adjacent pairs. One pair was located in the center of the antenna, the second pair was located at the left edge and the third pair was located at the right edge. The maximum separation from left edge to right edge was 57-degrees. The minimum separation between all feeds was three degrees. Thus

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Simulsat is capable of receiving signals from all satellites from Comstar D3 at 87 degrees west to SatCom I at 135 degrees west with no degradation in performance from all locations in the United States. All satellites from 83 degrees west to 135 degrees west can be viewed with one Simulsat antenna over more than half the United States.

Simulsat vs. 5-Meter

Simulsat comparison tests were performed by ATC at its factory in Orlando, Florida by erecting a 5-meter prime focus antenna next to Simulsat. Carrier to noise measurements were made on several transponders on several satellites in a short time frame on both antennas. The same electronic equipment was used for all tests. The only change was the substitution of Simulsat for the 5-meter antenna. In all cases the carrier to noise measurements indicated a 0.5 dB to 1.0 dB better carrier to noise ratio on the 5-meter antenna than was achieved with the Simulsat. Noise floor measurements showed Simulsat to have 0.1 to 0.2 dB higher noise floor. Thus, Simulsat has about 10 degrees higher noise temperature than a typical 5-meter antenna.

In addition to the tests conducted by ATC at its facility, Peter Petrovich of Viacom Cable conducted side by side tests on Simulsat and a 5-meter scientific Atlanta cassegrain antenna. Both antennas are located on a mountain top near Pittsburg, California, and within sight of the microwave tower installations on Mt. Diablo. Petrovich used the same electronics, cable and measuring instruments on the SA 5-meter that he used on Simulsat. He first conducted his tests on the 5-meter. He checked SatCom I at 135 degrees, Comstar D2 at 95 degrees, and Anik III at 114 degrees. He then moved all of his equipment to the Simulsat antenna and with three feeds in place one on SatCom I, the second on Anik, and the third on Comstar he proceeded to repeat his tests. His independant measurements of carrier to noise on Simulsat and the 5-meter antenna showed the 5-meter antenna to be on the average 1 dB better than Simulsat. These were the results that were predicted prior to his performing the tests.

Real Cost

The true cost comparison for Simulsat is not the purchase price of Simulsat versus the purchase price of several 5-meter antennas. The hidden intrinsic value arises from the fact that the foundation design, the foundation location, building permit time, planning commission involvement and the myriad of other hindrances associated with the installation of a TVRO are performed only once with Simulsat. Hence its cost comparison of approximately two and one-half 5-meter antennas is perhaps too conservative when one considers the hidden costs of the additional 5-meter systems.

Another Simulsat plus is the ease with which an additional feed or feeds can be added to the system for special purpose feeds or special events. One can have a spare feed on the shelf at all times so that special purpose events can be added by merely installing the feed for that satellite should it not be one of the satellites one's system is presently viewing. This will allow special feeds without disruption of other services at an extremely economical cost.

Eugene P. Augustin, founder and president of Antenna Technology Corporation, has thirty years of experience and has held several positions of responsibility in the antenna and microwave fields. Mr. Augustin founded Microwave Specialty and served as its president from 1969 to 1978. He has also served as executive vice president of Comtech Antenna. He is a graduate of San Diego State University where he received both his bachelors and masters degrees.

Product Profile

Featured in this month's **CED** Product Profile is the 5-meter earth station antenna (ESA). The particular size antenna chosen (5 meters) is the most common size used in commercial application by operating CATV systems. Some of the antennas included in the following chart may be somewhat larger or smaller than 5-meters but were included in an attempt to be comprehensive. The majority of the twenty antennas identified in the chart are television receive only (TVRO) but when the manufacturer of the antenna also offers a transmit/receive version in the same size, this will be indicated as optional. For the purpose of uniform comparison, the multibeam antennas with performance characteristics equivalent to the 5-meter antenna are not included in the chart. However, two of the multibeam antennas, the Simulsat and the Torus antennas, are the subjects of short articles elsewhere in this issue of **CED**.

All of the ESA's featured are paraboloidal in terms of reflector shape. Some are constructed of fiberglass, others of aluminum. Manufacturers of metal reflector antennas typically offer feed and reflector de-icing heaters as an option.

Two types of mount are shown, polar and elevation-over-azimuth (El/Az). In the case of El/Az types, the range of vertical and horizonal positioning is expressed in degrees. Readers should check the options column for remote motorized and automatic microprocessor controlled versions.

Other categories of technical specifications listed on the chart are electrical, such as gain expressed in dBi, half power beamwidth (at −3 dB point) expressed in degrees, voltage standing wave ratio (VSWR) at its maximum, the type of polarization, and the noise temperature measured at 10° elevation expressed in degrees Kelvin. The angle for the noise temperature measurement is admittedly low but was included to give the reader some sense of this parameter. The input flange is, in most cases, the standard CPR-229G.

Included among the options featured on some antennas are the types of feeds. The most common type of feed is the prime focus feed although nearly as many have the more efficient cassegrain type feeds. Other options sometimes offered are high performance shrouds, strut extensions for alternative mount structures, various remote controlled tracking or feed positionings, reflector elements for extension of antenna size, Ku-band versions, and trailer-mounted transportable versions.

Next month's **CED** Product Profile will feature coaxial cable used in feeder distribution in operating cable systems.

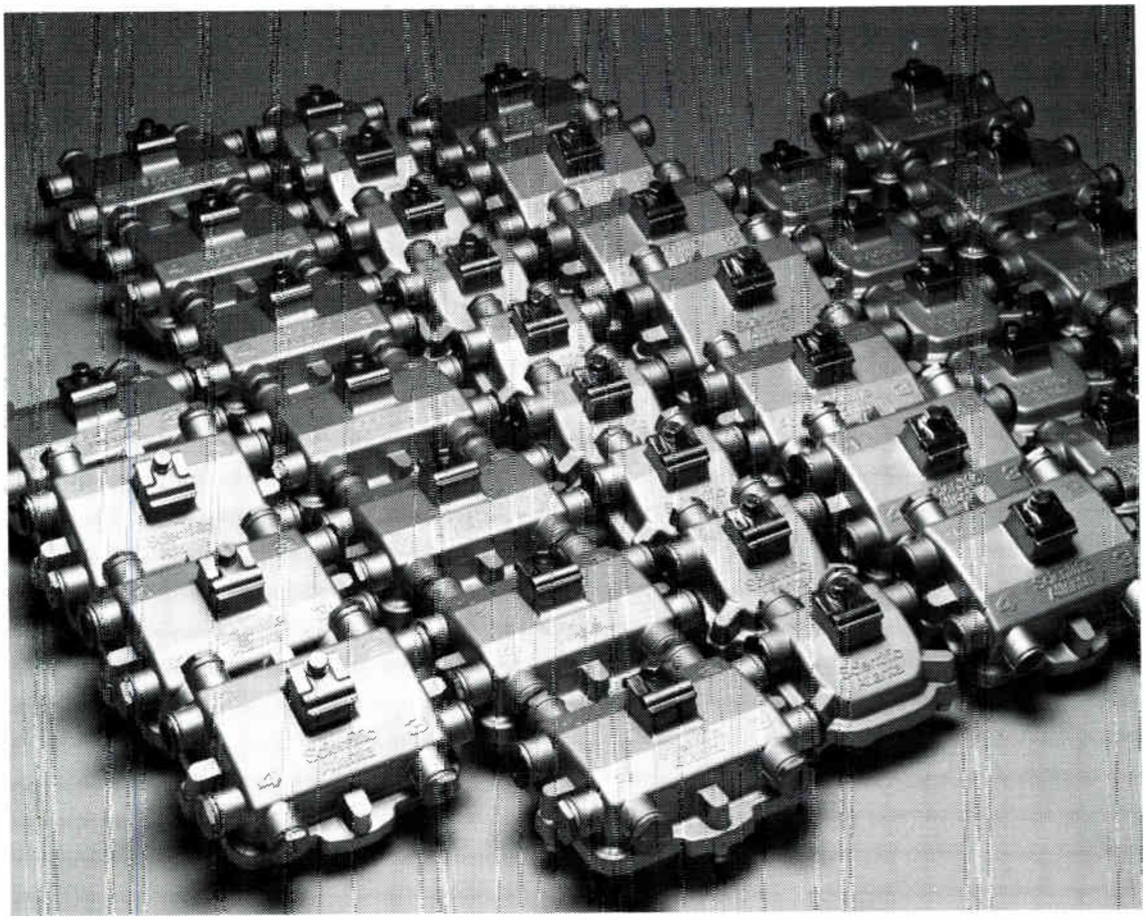
5 Meter Earth Station Antennas

Product Profile

Type	Reflector	Mount	Gain	Half Power Beamwidth	VSWR	Polarization	Noise Temperature	Input Flange	Options
Andrew Corp., Orland Park, Illinois									
4.5 M TVRO	Alumunium paraboloid, 2 piece with torsion box edges	EL (0°-68°) AZ (0°-60°)	44.2 dBi	1.3°	1.3 max.	Linear, single or dual	@ 10°, 30K	CPR-229G	Cassegrain or prime focus feed; high performance shroud; installation kit; 4 piece segment reflector; mount strut extension; feed and reflector de-ice heaters; receive/transmit version; trailer-mounted version.
Anixter-Mark, Des Plaines, Illinois									
5 M TVRO	Aluminum paraboloid, 24 petal	EL (5°-90°) AZ (0°-360°)	45.1 dBi	.97°	1.3 max.	Linear, dual	@10°, 40K	CPR-229G	Cassegrain or prime focus feed; high performance shroud; feed and reflector de-ice heaters; installation without crane.
Antenna Technology Corp., Las Vegas, Nevada									
5 M TVRO	Fiberglass paraboloid, 3 piece	EL (0°-90°) AZ (0°-120°)	44.3 dBi	1.0°	1.2 max.	Linear, single or dual	@ 10° 36K	CPR-229F	Prime focus feed only; 90° switchable or continuous polarizations; remote control with position readouts; portable version for trailering.
Comtech Antenna Corp., St. Cloud, Florida									
5 M TVRO	Fiberglass paraboloid, 3 piece	EL (0°-60°) AZ (0°-360°)	44.3 dBi	1.1°	1.3 max.	Linear, single or dual	@ 10° 35K	CPR-229F	Cassegrain or prime focus feed; circular polarization; motorized polar mounted version with motorized feed; transmit/receive version; trailer mounted T/R version.
Dalsat, Inc., Plano, Texas									
4.5 M T/R	Aluminum paraboloid 3 piece	Trailer, EL (0°-90°) AZ (0°-180°)	43.1 dBi	1.2°	1.2 max.	Linear, single or dual	@ 10° 32 K	CPR-229G (XMT CPR-137G)	Cassegrain feed only; feed and reflector de-ice heaters; 6 outriggers.
Fort Worth Tower Co., Fort Worth, Texas									
5 M TVRO	Fiberglass paraboloid, 2 piece	EL (5°-65°) AZ (0°-360°)	44.5 dBi	1.03°	N.A.	Linear, single or dual	@ 10° 53K	CPR-229G	Prime focus feed only.
Gabriel Electronics, Inc., Scarborough, Maine									
4.9 M TVRO	Aluminum paraboloid, 4 piece	EL (5°-65°) AZ (0°-360°)	44 dBi	1.1°	1.25 max.	Linear, single or dual	@ 10° 35 K	CPR-229G	Prime focus feed only; polar mount.
Gardiner Communications Corp., Houston, Texas									
5.6 M TVRO	Fiberglass paraboloid 8 petal	EL (10°-55°) AZ (65°-140°)	45.5 dBi	.96°	N.A.	Linear, dual	@ 10° 35 K	CPR-229G	Prime focus feed only.
Harris Corp., Melbourne, Florida									
5 M TVRO	Fiberglass paraboloid, 3 pieces	EL (5°-70°) AZ (0°-360°)	44.3 dBi	1.1°	1.25 max.	Linear, single or dual	N.A.	CPR-229G	Cassegrain and prime focus feeds; expandable to 6 meter; motorized EL; portable version for trailering.
Hero Communications, Hialeah, Florida									
5 M TVRO	Aluminum paraboloid, 24 segments	Polar, motor driven	44.5 dBi	.86°	1.15 max.	Linear, single or dual	@ 10°	CPR-229G	Automatic microprocessor controlled polar tracking; feed only; circular polarization.

Product Profile

Type	Reflector	Mount	Gain	Half Power Beamwidth	VSWR	Polarization	Noise Temperature	Input Flange	Options
Hughes Microwave Communications Products, Torrance, California									
5 M TVRO	Fiberglass paraboloid, 4 pieces	EL (0°-70°) AZ (0°-360°)	44.5 dBi	1.2°	1.5 max.	Linear, single or dual	@ 10° 37 K	CPR-229G	Cassegrain or prime focus feed; expandable to 6 meters; also 3.7 meter version expandable to 5 meters.
Microdyne Corp., Ocala, Florida									
5 M TVRO	Fiberglass paraboloid, 2 pieces	EL (2°-65°) AZ (0°-360°)	44 dBi	1.1°	1.3 max.	Linear, dual	@ 10° 37K	CPR-229G	Prime focus feed only; circular polarization; trailered version (3 piece reflector).
Microwave Specialty Corp., San Diego, California									
5 M TVRO	Fiberglass paraboloid, 3 piece	EL (5°-65°) AZ (0°-360°)	43.9 dBi	1.1°	1.25 max.	Linear, single or dual	@ 40° 25K	CPR-229G (XMT CPR-137G)	Cassegrain or button-hook feed; expandable to 6 meter; TVRO version.
National Microtech, Inc., Grenada, Mississippi									
5 M TVRO	Fiberglass paraboloid, 3 piece	Polar	43 dBi	N.A.	1.3 max.	Linear, dual	N.A.	CPR-229F	Prime focus feed only; microprocessor controlled tracking; portable version for trailering.
Prodelin, Inc., Hightstown, New Jersey									
5 M TVRO	Fiberglass paraboloid, 12 piece	EL (0°-65°) AZ (0°-360°)	44.5 dBi	.95°	1.25 max.	Linear, single or dual	@ 10° 31K	CPR-229G	Cassegrain or prime focus feed; transmit/receive version; installation without crane; 12/14 GHz version.
SatCom Technologies, Inc., Norcross, Georgia									
5 M TVRO	Aluminum paraboloid, 12 panel	EL (5°-90°) AZ (0°-180°)	44.75 dBi	.92°	1.25 max.	Linear, single or dual	@ 10° 37K	CPR-229G	Cassegrain feed only; motorized drives with 3-axis controller; feed and reflector de-ice heaters; Ku-band upgrade; transmit/receive version.
Scientific Atlanta, Inc., Atlanta, Georgia									
4.6 M TVRO	Aluminum paraboloid, 12 panels	EL (20°-65°) AZ (0°-120°)	43.5 dBi	1.12°	1.3 max.	Linear, dual	@ 10° 37K	CPR-229G	Cassegrain feed only; steel pier foundation; transmit/receive version.
Scientific Atlanta, Inc., Atlanta, Georgia									
5 M TVRO	Aluminum paraboloid, 24 panel	EL (15°-60°) AZ (0°-110°)	44.5 dBi	.86°	1.3 max.	Linear, dual	@ 10° 31K	CPR-229G	Cassegrain feed only; EL (4°-44°); very low sidelobe version; transmit/receive version; 1.8 meter base extension; outrigger base assembly.
Star View Systems, Poca Hontas, Arkansas									
5 M TVRO	Fiberglass paraboloid, 3 piece	Polar	45 dBi	N.A.	1.2 max.	Linear, dual	N.A.	CPR-229G	Prime focus feed only; El/Az or remote motorized tracking mount; trailered version.
United States Tower Co., Afton, Oklahoma									
5 M TVRO	Aluminum paraboloid, 2 pieces	Polar, manual	45.5 dBi	0.9°	1.3 max.	Linear, dual	@ 10° 29K	CPR-229G	Cassegrain or prime focus feed; feed and reflector de-ice heater; motorized feed.



International News

French Videotex Compatibility Breakthrough

VELIZY, FRANCE—The French telecommunications administration has announced a technological breakthrough that will link compatible computers, enabling most existing data bases in France to become part of a national videotex system.

Intelmatique, the promotional arm for the nation's telecommunications administration, said that existing data bases using IBM Series 1, Prime, Honeywell, or Hewlett-Packard computers will now be able to participate in the country's videotex experiments.

The new development, called "Multitel", was developed by the Cap Gemeni Sogetti (CGS) software group. The multitel hardware-software package, attached to a mainframe computer, will translate existing computer protocols into the French Antiope standard. Customers can then access these computers by using Teletel's videotex center. In the past, companies had to translate computer protocol into compatible language, and then put the information into teletel's data base.

Three companies are now using Multitel in a videotex trial underway in the Velizy area. France's largest mail order retailer, La Redoute, Les Trois Suisse, and publishing house Didot Bottin are involved in the Teletel 3V trial now underway, according to Intelmatique.

Japan Fiber Optics Tour Releases Findings

NEW YORK, NEW YORK—The Japanese are strongly committed to development of independent fiber optics technology, members of an American technological study mission to Japan have reported.

According to Paul Polishuk, President of Information Gatekeepers, and team leader of the group, "although the U.S. has a clear technological edge in fiber optics applications for telephone and in the areas of standards and connectors, the Japanese have developed a lead in plastic fibers, singlemode fibers, low loss fibers, graded index lenses, laser sources, and passive components."

The group's findings were based on visits to industry, trade, and research organizations including the Visual Information Systems Development Association, the Opto-Electric Industrial and Technological Development Association, Toray Industries, and the Hitachi Central Research Lab.

The participation also noted that the Japanese expressed strong concern over the decision on the Northeast Corridor Project and the rewrite of the Communications Act.

Infomart/Times Mirror Launch Joint Venture

TORONTO, ONTARIO—Infomart and Times Mirror have launched a joint venture that will sell Telidon systems to commercial videotex operators in the United States. The new company will be equally owned by Infomart of Toronto and Times Mirror Videotex Systems Inc.

The company's operations will begin with the Times Mirror's home videotex field trial to be launched in southern California in March 1982. Utilizing Canadian-developed Telidon technology, the trial will be the most ambitious videotex service yet introduced in the United States.

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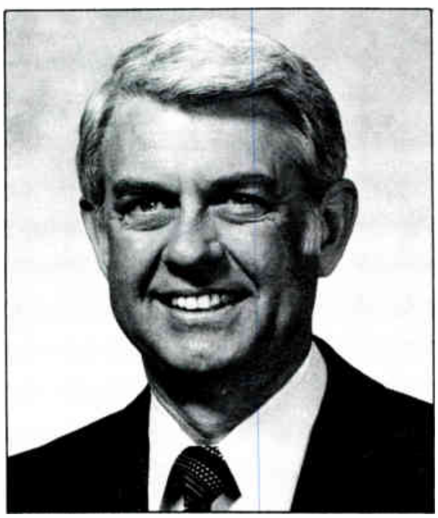
People News

★ **American Microsystems, Inc.**, and **Austria Microsystems International**, a joint venture of **Voest-Alpine AG** in Austria, has named its Board of Directors. **Glenn E. Penisten**, chairman of the board and president of American Microsystems will be the chairman of the Austria Microsystems International board. **Dr. Stephen Forte**, and **Dr. J. Leland Seely** will also represent American Microsystems on the board. Both are vice presidents of American Microsystems: Dr. Forte, for marketing and sales, Dr. Seely, for research and development. Representing Voest-Alpine on the board will be **Otto G. Zich, Dr. Alfred Koch** and **Dr. Friedrich Vogel**. Mr. Zich is Group Vice President for Data Processing and Electronics at Voest-Alpine, Dr. Koch is Senior Vice President finance and Dr. Vogel is Vice President legal.

Dr. Seely will be responsible for plant construction and semiconductor manufacturing start-up and Dr. Forte will head the marketing and design organization for Austria Microsystems International. Dr. Forte is well known throughout Europe for his association with AMI and earlier with General Instrument Microelectronics and the Marconi Company.

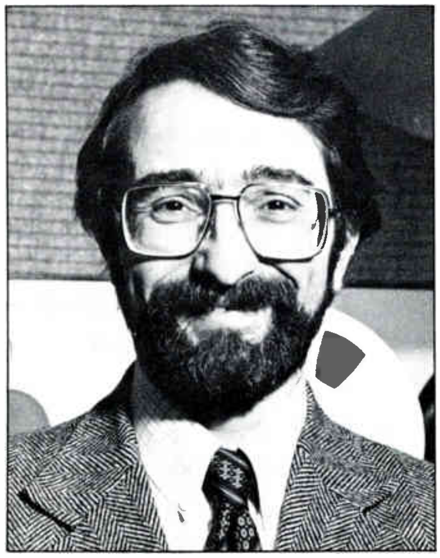


Glenn E. Penisten

★ **Vladimir G. Nikanorov** has been named vice president of engineering for **Muzak**. Mr. Nikanorov assumes full responsibility for all of the current engineering operations, as well as the implementation of anticipated technical advances.

Mr. Nikanorov comes to Muzak from Bonneville Broadcast Consultants where he was technical director of that organization. His new appointment is the culmination of more than 17 years of experience in the field of broadcast audio engineering both in this country and abroad.

Mr. Nikanorov received his training in electronics in the USSR, graduating in 1965 with a Masters in Electronics Audio Engineering from the Moscow Electronics Institute.



Vladimir G. Nikanorov

★ **Alex Orloff**, sales manager of the test and measurement department of **Hitachi Denshi America, Ltd.**, has become national sales manager of the test and measurement division, handling oscilloscopes, waveform monitors and soon to be announced products to extend the current product line.

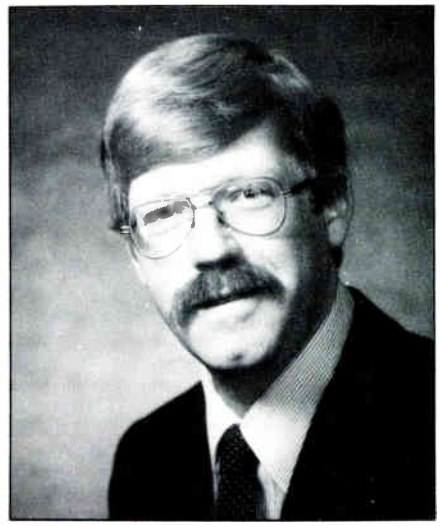
★ **CableBus Systems Corporation** of Beaverton, Oregon, has announced the appointment of **Mr. John Trudel** as vice president, marketing. Mr. Trudel will be responsible for CableBus' marketing and sales.

Trudel comes to CableBus from Tektronix, Inc. Most recently he was responsible for worldwide competitive analysis, strategic planning, and new product definition/introduction for the company's portable oscilloscope business unit.

Mr. Trudel received his MSEE from Kansas State University, his BEE from the Georgia Institute of Technology, and has twenty years of experience in the communications, computer, and test equipment sectors of the electronics industry.

★ **Skip Dunn**, vice president of sales at **Comprehensive Video Supply Corporation**, has announced the appointment of **Micki Lindenbaum** as his assistant. Ms. Lindenbaum's experience includes more than 12 years at Hitachi Denshi where she was involved in both the technical and administrative aspects of marketing and sales.

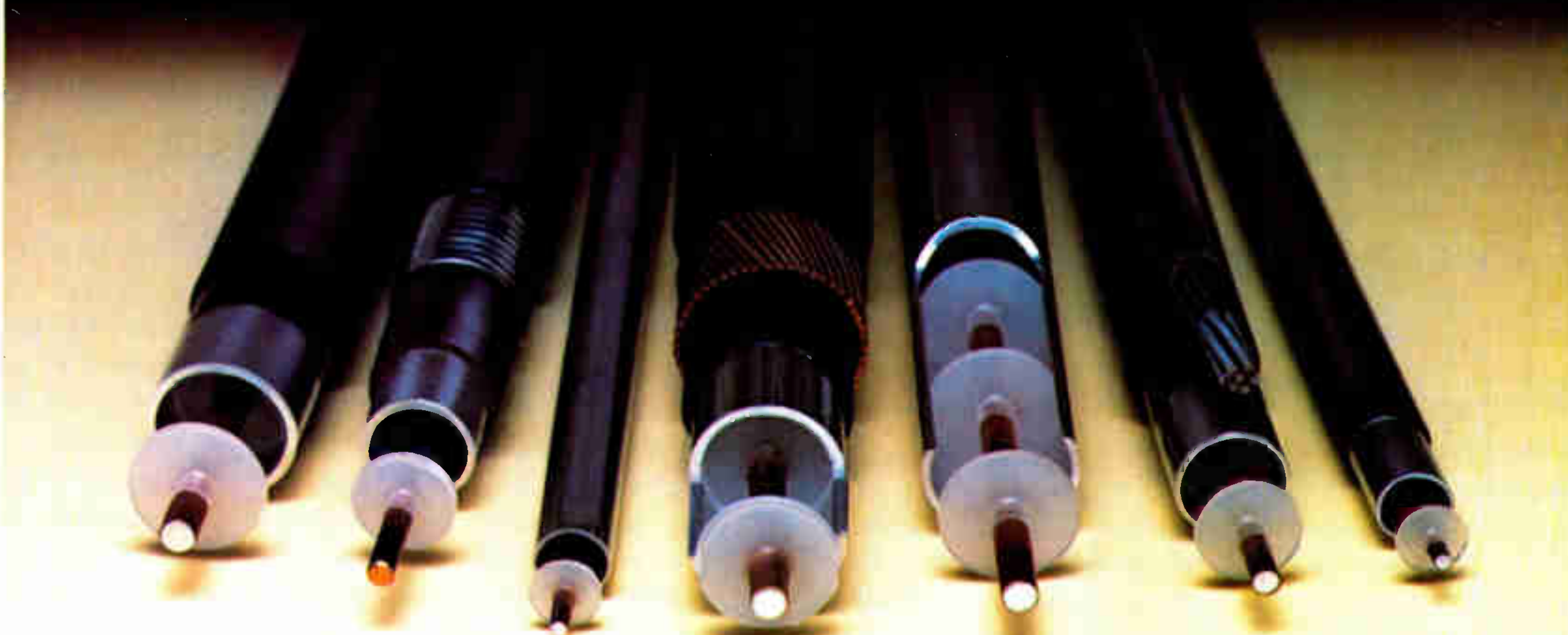
★ **Tele-Engineering Corporation** of Framingham, Massachusetts, has announced the appointment of **W. Dann Robinson** to the position of director of special projects. His responsibilities will include franchise support, cable system design, and the development of broadband information networks.



W. Dann Robinson

★ **Frank C. Weaver** has been appointed manager of communication satellite marketing at **RCA**. Mr. Weaver is responsible for marketing communication satellites in the domestic telecommunications industry. Previously, as manager of marketing administration, he was responsible for News and Information, advertising and business analysis. He joined RCA in March 1977 as a marketing representative responsible for sales of satellite systems, subsystems and technology.

★ **Harold Bjorklund** has been appointed national sales manager for **Sylvania-CATV Division** of **GTE Products Corporation**. Bjorklund will have responsibility for direct sales for the Division's cable television products which are marketed in all 50 States, Canada, Mexico, Europe and other foreign countries. Bjorklund, before rejoining General Telephone, held several sales management positions and most recently was Western Regional Sales Manager for the Jerrold Divsion of General Instrument.

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Product News

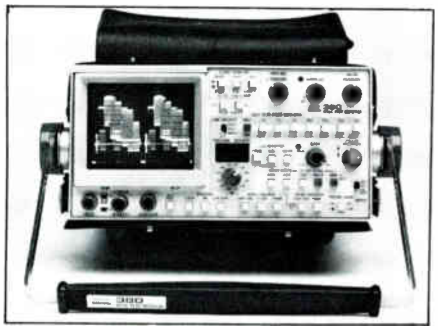
Tektronix Introduces Three-In-One Portable 380 NTSC Test Monitor

The Portable 380 NTSC Test Monitor from **Tektronix, Inc.**, incorporates the functions of a waveform monitor, vectorscope, and an oscilloscope, and enables the user to examine the entire video signal. The only product of its kind in the world, the 380 is manufactured in Japan by Sony/Tektronix Corporation, a joint venture company. A PAL version of the product will be introduced by Tektronix later this year.

The Portable 380 NTSC Test Monitor measures 112mm (4.48 inches) × 237 mm (9.48 inches) × 372 mm (14.88 inches) and weighs only 5.5 kg (12.1 pounds). The price of the instrument will be between $5,000 and $5,500.

Capable of many measurements required for television, the 380 performs by itself as a precise measurement unit as well as for normal signal monitoring in television production. The new product is optimized for use in field applications like ENG, EFP, and other portable operations, such as testing and measuring broadcast equipment in the studio, mobile production van, and at the transmitter site.

For additional information contact Tektronix, Inc., P.O. Box 500, Beaverton, Oregon 97077; 1-800-547-1512. In Oregon, call 1-800-452-1877.



Tektronix 380 Portable Test Monitor

GTE Lenkurt Prints Fourth Edition of *Engineering Considerations*

GTE Lenkurt Inc. has announced the fourth printing of its authoritative book *Engineering Considerations For Microwave Communications Systems*, by Robert F. White.

Tutorial in nature, this book assembles in one volume, in a readily usable form, practical information on the planning and engineering of line-of-sight microwave radio paths. The book is written for engineers engaged in microwave planning. However, it is sufficiently general to be used by executives and engineers in other fields for a technical overview of microwave communications systems. The emphasis is on technique and practice, although considerable theoretical discussion is included, to aid in the understanding of important microwave transmission phenomena.

For a copy of *Engineering Considerations For Microwave Communications Systems*, write GTE Lenkurt Incorporated, Dept. C720, 1105 County Road, San Carlos, Calif., 94070. Payment by check or money order is requested with your order.

Sadelco Introduces New 719D Installers SLM

Sadelco has introduced a new model signal level meter designed for the professional installer. The 719D incorporates many new Sadelco design innovations and is housed in a new low-profile, impact resistant case. It is a lightweight (7 lbs.), portable, low-cost unit, ideal for contractors and antenna installers.

The meter reads directly in dBmV to indicate signal levels and provides continuous coverage from 54-216 MHz VHF-TV band, FM band, CATV mid-band, and 470-812 MHz for the UHF-TV band.

For additional information please contact: Sadelco, Inc., 75 West Forest Avenue, Englewood, N.J. 07631, (201) 569-3323.

Ben Hughes Introduces New DCT Coring Blade

Ben Hughes Communication Products Co. has announced the introduction of a newly designed DCT coring tool blade which is more efficient and does not clog, even under the most difficult conditions. In addition to this improved blade, a new handle has been fashioned from a high technology polymer for higher impact strength. This new polymer will not crack or chip, even at extreme operating temperatures. The anodized T-Bar will not blacken the installer's hands or gloves.

The new DCT coring tool has the versatility of being used manually with the T-Bar handle or for power operation, by removing the T-Bar handle to expose a drill shaft. No special adapters are required. The DCT coring tool is a complete unit in itself. It is now available from Cable Prep distributors, for the .412, .500, .625, .750, .875, and 1.000 inch aluminum sheathed cables.

For information contact Ben Hughes Communication Products Co., P.O. Box AS, Old Saybrook, CT 06475; (203) 388-3559.

T4 PUTS TIMES TECHNOLOGY TO WORK FOR YOU

To deliver the superior dielectric performance you need, Times' Cable Television Division harnessed the latest advances in polymer chemistry and molecular engineering to create T4: a new generation of gas-injected dielectrics for trunk, feeder and drop cables.

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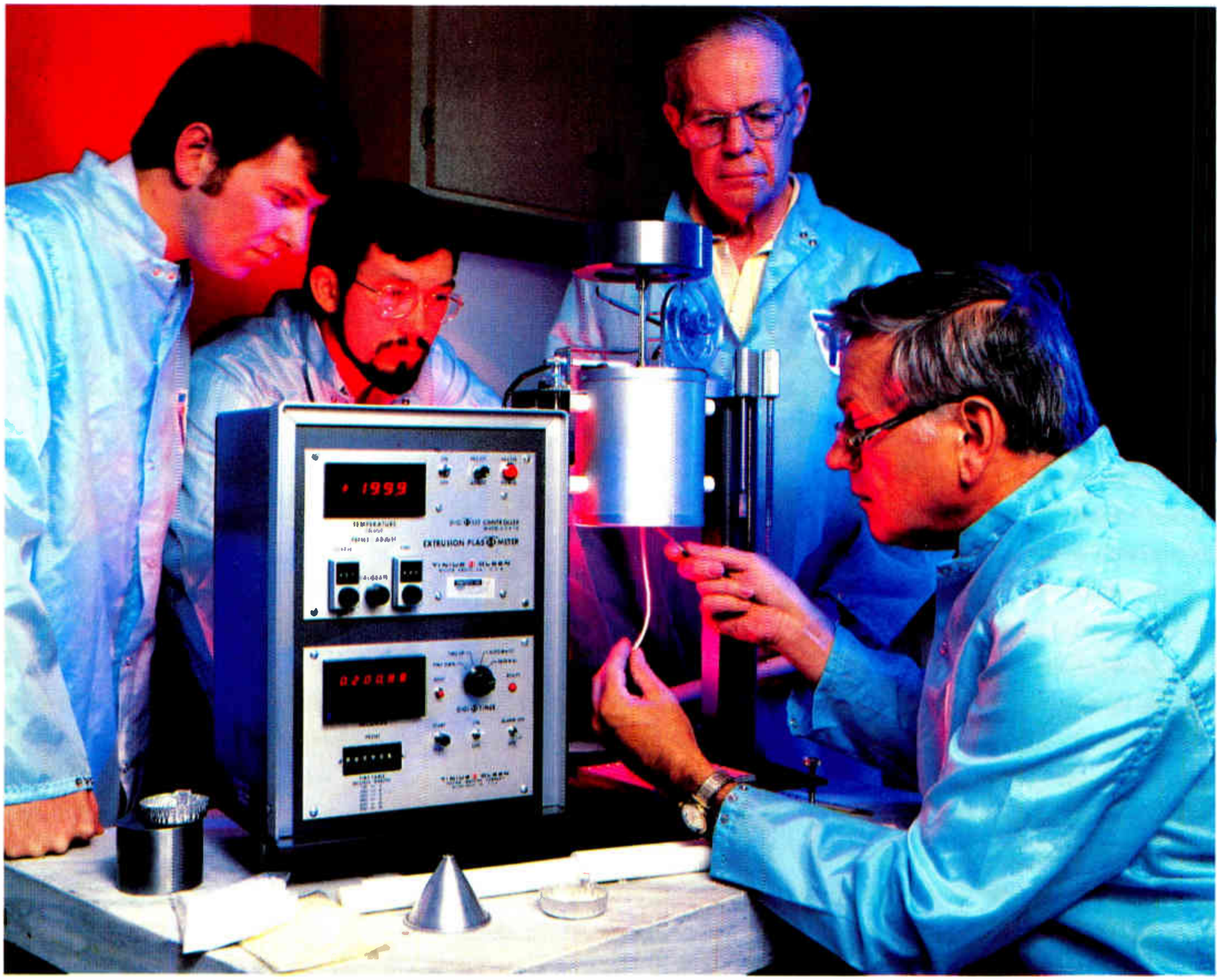

Outstanding Electrical Performance

T4 provides a more uniform cell structure to give you improved structural return loss and outstanding attenuation performance.

Total Product Line

The T4 foam dielectric system is available in Times' full line of coaxial trunk, feeder and drop cable, ready now for specification on your next build.

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Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
ARTS		9:00 p.m./12:00 a.m.		Satcom III-R,#1
ACSN	Weekdays Weekends	6:00 a.m./4:00 p.m. 6:00 a.m./1:00 p.m.	192*/#	Satcom III-R,#16
BET		11 00 p.m./2 00 a.m.	018*/#	Satcom III-R,#9
Bravo		8:00 p.m./6:00 a.m.		Comstar D-2, #3H
CableText		24 hrs.	None	Satcom III-R,#6 Vertical Blanking
CBN		24 hrs.	None	Satcom III-R,#8
CBS Cable		4:30 p.m./4:30 a.m.	524*/#	Westar III, #6
Christian Media Network	Mon.-Sat. Sunday	7:00 p.m.-2:00 a.m. 9:00 p.m.- 2:00 a.m.		Satcom III-R, #16
Cinemax		24 hrs.	None	Satcom III-R,#20 (E,C) Satcom III-R,#23 (M,P)
CNN		24 hrs.	None	Satcom III-R,#14
Cable News Network II		24 hrs.	None	Satcom III-R #15
C-SPAN	Weekdays Sundays	10:00 a.m. to 6:00 p.m. Precedes USA Network, three to four hours	195*/#	Satcom III-R,#9
ESPN		24 hrs.	None	Satcom III-R,#7
Eros	Mon.-Sat.	12:00 p.m.-5:00 a.m.		Westar III, 7 12 (Fri., Sat.)
Escapade		8:00 p.m./6:00 a.m.		Comstar D-2,#4V
Eternal Word Television Network		7:00 p.m./11:00 p.m.		Westar III,#12
GalaVision	Weekdays Weekends:	8:00 p.m./3:00 a.m. 24 hrs.		Satcom III-R,#18
HBO		24 hrs.	Program 729*/# Scramble 835*/# Duplication 940*/#	Satcom III-R,#24 (E,C) Satcom III-R,#22 (M,P)
HTN		8:00 p.m./2:00 a.m.	207*/#	Satcom III-R,#21 (P)

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
Lifestyle		24 hrs.	None	Satcom III-R,#3
The Movie Channel		24 hrs.	None	Satcom III-R,#5
Modern Satellite Network	Weekdays Weekends	noon/5:00 p.m. 8:00 a.m./1:00 p.m.	243*/#	Satcom III-R,#22
MTV: Music Television		24 hrs.	None	Satcom III-R,#11
National Christian Network		6:00 a.m./8:00 p.m.	073*/#	Comstar D-2,#4V
Nickelodeon		8:00 a.m./9:00 p.m.	311*/# (E,C,M) 519*/# (P)	Satcom III-R,#1
North American Newstime		24 hrs.	None	Satcom III-R,#6
PTL		24 hrs.	None	Satcom III-R,#2
Preview Channel	Weekdays	10:00 a.m.-1:30 p.m.	207*/#	Satcom III-R, #21
Private Screenings	Fri.-Sat.	12:00 a.m./3:00 a.m.		Westar III,#7
Reuters	Weekdays	4:00 a.m./7:00 p.m.	None	Satcom III-R,#18
SIN		24 hrs.	None	Westar III, #8
SPN		24 hrs.	None	Westar III, #9
Showtime		24 hrs.	None	Satcom III-R,#12 (E,C) Satcom III-R,#10 (M,P)
Trinity (KTBN)		24 hrs.	None	Comstar D-2, #9V
USA Network		24 hrs.	None	Satcom III-R,#9
WFMT		24 hrs.	None	Satcom III-R,#3 Subcarrier
WGN		24 hrs.	None	Satcom III-R,#3
WOR		24 hrs.	None	Satcom III-R,#17
WTBS		24 hrs.	None	Satcom III-R,#6

Calliope: Weekdays 6:00 p.m. to 7:00 p.m.; Saturdays 8:30 a.m. to 11:30 a.m.

The English Channel. Tuesdays: 11:30 p.m. to 1:30 a.m.; except February 2 when the program will run 11:00 p.m. to 1:00 a.m.; February 9, 11:30 p.m. to 1:30 a.m.; February 16, 11:00 p.m. to 1:00 a.m.; February 22, 11:30 p.m. to 1:00 a.m. Saturdays: 12:00 p.m. to 1:00 p.m.; will not be seen on the 27th. Sundays: 10:30 p.m. to 12:30 a.m.

E=eastern M=mountain
C=central P=pacific

Alert tones listed are for sign-on, sign-off.

All program times are listed for the eastern time zone, unless otherwise noted

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Whether you're adding one pay channel, 15 pay channels, or 15 tiers of service with 120 channels, Eagle's Descrambler can handle it all. Select only what you need. In the future, channels can be added to the headend scrambler with our simple plug-in module. The headend unit integrates with all manufacturer's modulators and processors and is compatible with all Standard/HRC/ ICC configurations.

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