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June 1987

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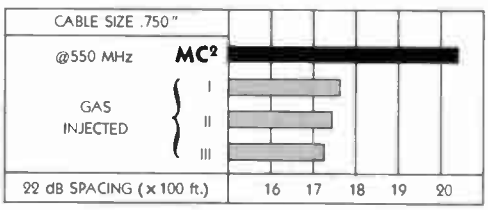

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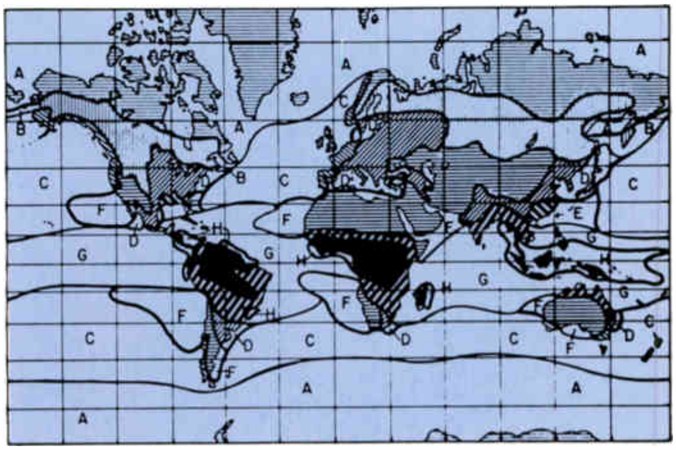

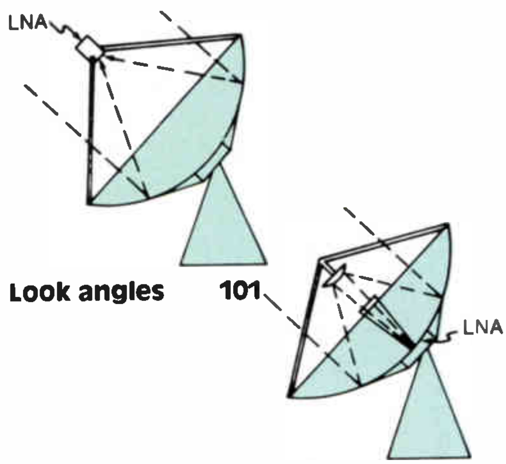

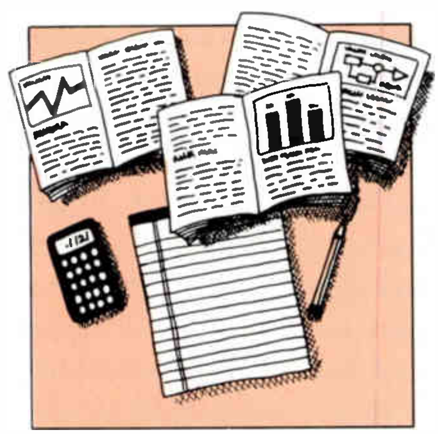

Features

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EDITOR'S LETTER

Ode to an expo

I'm writing this 30,000 feet above the Mississippi River on the way back home from Orlando, Fla., and the SCTE Cable Tec-Expo. We're encountering some turbulence, but after such a great expo, who cares? Needless to say, I'm flying high. Where to begin?

First things first. Overall, the show was extremely well coordinated by the SCTE. The months of planning and hard work culminated in the best expo to date. Congratulations and thanks should go out in spades to Bill Riker and his crew, as well as the SCTE Florida Chapter and the Florida Cable Television Association (FCTA).

CT was bestowed not once but twice with awards. At the annual membership meeting, re-elected SCTE President Bob Luff presented the President's Award to Paul Levine, president and publisher of *CT*, in recognition of the ongoing support and promotion of the Society of Cable Television Engineers. And to top it off, I received an outstanding achievement award. We really appreciate the honor from the SCTE, which serves the cable technical community so well. Thank you all!

Seminar instructors played to standing-room-only crowds at virtually every seminar. This year's workshops were targeted to technicians and engineers during different sessions. And the idea worked extremely well. (Something that other groups should keep in mind.)

The BCT/E Certification Program was evident in the several review courses held, as well as the day of testing. I've written about this subject before, but enrolling in the BCT/E Program is perhaps one of the most significant steps that technicians and engineers can take to further their careers.

Meanwhile, traffic on the exhibit floor was fast and furious. Over 80 exhibitors were represented this year (a record for the expo). Exhibitors reported that business was good and interest was high.

And the festivities simply added to the sensory overflow. The welcome reception hosted by the Florida Chapter and the FCTA was a good opportunity to meet casually with attendees I'd just be chatting with very briefly (and loudly) during the rest of the expo. Expo Evening at Medieval Times was a spectacle not to be missed. I'm not likely to forget the experience very soon.

Off the top of my head, that's some of what happened. If you want to know what went on in more detail and in pictures, catch our wrap-up beginning on page 14. Also, this month's *Interval* gives the Society's own recap of the expo. So, if you weren't able to attend this year, this issue of *CT* is the next best thing. And if you were there, it'll make a good scrapbook of memories.

By the way, you can read Dean Owsley's winning entry in this year's *CT* essay contest on page 84. We've also listed the finalists, all of whom wrote excellent essays. Thanks to everyone who

entered. And we'll do it again next year for Cable-Tec Expo '88, which will be held June 16-18 at the Hilton Hotel in San Francisco.

Back in training

A topic that pops up quite often (and deservedly so) in the industry is that of technical training. This is one subject that cannot be overemphasized. This month's *CT* has several excellent articles that outline various technical training programs for installers and technicians.

To quote the article in this issue by Dana Eggert and Byron Leech, "Most cable operators would agree that technical training is an essential ingredient for reducing service calls and long-term maintenance costs, maintaining technical quality and integrity, increasing employee productivity and improving morale through motivation and incentives." Despite this, training programs still are difficult to implement. We hope these articles provide some solutions to the problem.

Speaking of solutions, Lawrence Lockwood unscrambles video scrambling in an excellent piece beginning on page 24. And finally, rounding out this issue is our focus on satellites, emphasizing earth station look angles and Ku-band considerations. Exclusive for *CT* is a special pull-out wall chart listing all the downlink frequencies for domestic C- and Ku-band satellites. (Special thanks go to Ron Hranac and Paul Vadakin of Jones Intercable.)

IT's official! Our new publication *Installer/Technician* (or *IT*) will bow this September. Everyone here is excited about *IT*, and when *IT* appears, we think the industry will be excited, too. Why? Well, for one thing, our subscribers, mainly cable installers and technicians, will be able to read product-specific articles contributed by the manufacturers, as well as tips on safety, cable electronics theory and so much more.

IT's coming your way.

Toni I. Barnett

COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

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CALENDAR

June

June 1-5: Information Gatekeepers' European Fiber Optic Communications and Local Area Networks Exposition, European World Trade and Convention Center, Basel, Switzerland. Contact Renee Farrington, (617) 232-3111.

June 2-4: Online International's CableSat 87 exhibition and conference, Metropole Hotel, Brighton, England. Contact Pam Howard, 01-868-4466.

June 3: SCTE Rocky Mountain Chapter review on Category IV–Distribution Systems and BCT/E testing. Contact Joe Thomas, (303) 978-9770.

June 7-9: Space and Telecomm Inc.'s annual symposium, Albert Thomas Convention Center, Houston. Contact (713) 225-1950.

June 9: Southern California Cable Association monthly meeting, a discussion of customer-friendly hardware, Inn at the Park, Anaheim, Calif. Contact (213) 684-7024.

June 10-12: Institute for Advanced Technology seminar on local area networks, IAT Training Center, Washington, D.C. Contact (800) 638-6590.

June 11: SCTE Heart of America Meeting Group seminar on BCT/E Category II—Video and Audio Signals and Systems, Holiday Inn Sports Complex, Kansas City, Mo. Contact Wendell Woody, (816) 474-4289.

June 15-17: Northeast Cable Television technical seminar, Roaring Brook Ranch Resort, Lake George, N.Y. Contact Bob Levy, (518) 474-1324.

June 15-17: Online International's Localnet East exhibition and conference, Hilton Hotel, New York. Contact Carol Peters, (212) 279-8890.

June 15-19: Information Gatekeepers' ISDN/Broadband Networks for the Future, Merchandise Mart and Westin Peachtree Plaza, Atlanta. Contact Renee Farrington, (617) 232-3111.

June 16-18: Jerrold technical seminar on applying problem-solving technology, Chicago. Contact Jerry McGlinchey, (215) 674-4800.

June 22-25: Trellis Communications seminar on designing and installing fiber-optic networks, Trellis Training Center, Salem, N.H. Contact (603) 898-3434.

June 23-25: C-COR Electronics technical seminar, St. Louis. Contact Tammy Kauffman, (800) 233-2267 or (814) 238-2461.

June 23-25: Mira Corp.'s product safety seminar, Hilton Inn, Cincinnati. Contact (513) 434-7127.

June 24: SCTE Greater Chicago Meeting Group seminar on certification. Contact William Gutknecht, (312) 577-1818.

June 30: SCTE Satellite Tele-Seminar Program, workshop from Cable-Tec Expo '87, 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888.

July

July 8-11: Colorado Cable Television Association and **Rocky Mountain Cable Television Association** annual convention, Snowmass Resort, Aspen, Colo. Contact (303) 863-0084.

July 14-17: Jerrold technical seminar on applying problem-solving technology in hands-on sessions, Philadelphia. Contact Jerry McGlinchey, (215) 674-4800.

July 15-17: Institute for Advanced Technology seminar on local area networks, Galleria Park, San Francisco. Contact (415) 781-3060.

July 15-18: Mississippi Cable Television Association annual meeting, Royal d'Iberville Hotel, Biloxi, Miss. Contact Millie Smith, (601) 582-3525.

July 16: SCTE Ohio Valley Meeting Group seminar on fiber-optic design, Dayton, Ohio. Contact Charles Hanchett, (614) 221-3131; or Bob Heim, (419) 627-0800.

Planning ahead

July 20-22: New England Show, Tara Hyannis Hotel, Hyannis, Mass.

Aug. 30-Sept. 1: Eastern Show, Merchandise Mart, Atlanta.

Sept. 21-23: Great Lakes Expo, Indianapolis Convention Center/ Hoosier Dome, Indianapolis.

Oct. 6-8: Atlantic Show, Convention Center, Atlantic City, N.J.

Oct. 13-15: Mid-America CATV Show, Hyatt Regency at Crown Center, Kansas City, Mo.

Dec. 2-4: Western Show, Convention Center, Anaheim, Calif.

Anixter acquires Tele-Wire Supply

SKOKIE, Ill.—In a recent transaction, Anixter Bros. acquired Tele-Wire Supply Co., which is located in Long Island, N.Y., and has facilities in Michigan, Texas and Florida. The new company will operate under the name Anixter-Telewire and become part of Anixter's network of distribution centers. Sy Guttenplan, founder and president of Tele-Wire, will continue to direct the business.

Previous acquisitions by Anixter over the past nine months are Simcona Wire and Cable, Ft. Lauderdale, Fla.; Colonial Wire and Cable, Lowell, Mass.; and Delphi Electronics, Philadelphia.

FCC announces new fee schedule

WASHINGTON, D.C.—The Federal Communications Commission announced a set of mandatory fees for various applications filed with the FCC, effective April 1. Any application received without the appropriate fee (in a check, money order or bank draft payable to the FCC) will be returned unprocessed. Some of the fees include business radio licenses (new, modification or renewal), $30; CARS licenses (construction permits, assignments and transfers, renewals and modifications), $135; special relief petitions, $700; initial TVRO authorizations, $200; other TVRO-related filings, $90.

However, the FCC decided that neither a formal application nor a notification to the commission is required when modifying a CARS license to initiate carriage of multichannel sound information.

S-A, Times Fiber sign marketing pact

ATLANTA—Scientific-Atlanta (S-A) announced that the agreement under which its CATV product line will include the full line of RF transmission cable manufactured by Times Fiber Communications is now effective. The agreement was the culmination of talks that began in October 1986 when the two companies signed a letter of intent (CT, 11/86, page 10).

As part of the agreement, all assets of S-A's cable manufacturing facility in Phoenix, Ariz., will be transferred to Times Fiber.

RF Analysts becomes division of Brad Cable

SCHENECTADY, N.Y.—Brad Cable Electronics has acquired RF Analysts Inc., effective May 1. Brad will continue to operate under its corporate name, with RF Analysts a separate division. Also, Brad will continue to develop and market the computer-aided test system developed by RF Superior in Sarasota, Fla.

The acquisition of RF Analysts adds three locations (Fenton, Mich.; West Columbia, S.C.; and Sarasota, Fla.) to Brad's other offices. Brad's corporate headquarters will remain in Schenectady; its service centers are in Tampa, Fla.; Cherokee, N.C.; and Fife, Wash.

- The Jerrold Division of General Instrument Corp. recently sold to Anixter Bros. $21.7 million worth of CATV equipment. Targeted for the rebuild and new-build markets, Anixter's order will be used to maintain a steady supply of products, including addressable and non-addressable converters, stereo decoders and encoders, taps, line extenders and frequency agile modulators.
- Dialogic Communications Corp., a voice processing company located in Nashville, has signed an agreement with Jones Intercable to install the TeleClerk interactive voice processor in seven Jones systems for billing inquiry, pay-per-view and appointment confirmation.
- Sammons Communications has begun a complete system sweep of its cable TV facilities in several of its southern New Jersey communities. The sweep period in a community is

expected to last approximately three weeks; the first sweep was to take place in Cumberland County.

● Control Technology Inc., located in Garland, Texas, announced that Jerry Conn Associates in Chambersburg, Pa., has joined its network of sales rep organizations. Conn will cover the territory of Pennsylvania, Ohio, West Virginia, Virginia, Maryland, District of Columbia, Delaware and the 609 area code of New Jersey.

● Zenith Electronics Corp. stockholders have voted to increase the number of authorized shares of the company's common stock from 50 million to 100 million. The new shares will be available for business expansion programs, stock splits and other future corporate purposes. Zenith also announced its first-quarter 1987 earnings of $1 million, compared to a loss of $4.4 million in the same period of 1986.

● The Texas Cable TV Association announced that its endowed scholarship in communications at the University of Texas at Austin has been awarded to Richard Spethman Jr. The scholarship was formed in memory of John Mankin Sr., the association's first executive secretary and co-founder.

● The TOCOM Division of General Instrument Corp. received an order from Galaxy Cablevision, an MSO based in Sikeston, Mo., to provide converters and remote hub controllers for systems in Texas and Louisiana. Upgrade of the systems is expected to continue for two years.

● American Television and Communications Corp. reached an agreement in principle to purchase the assets of Sinclair Telecable in suburban Indianapolis. The system serves 5,100 basic subscribers with 8,840 passings in unincorporated Hendricks County and the city of Pittsboro, a suburb of Indianapolis.

● Cable Link Inc., located in Columbus, Ohio, recently announced the opening of two branch sales offices; they are San Antonio and Drayton Plains, Mich. Also, there has been an expansion of the company's Columbus facility from 30,000 to 50,000 square feet.

● The DataComm Products Project was formed recently within the 3M TelComm Products Division, Austin, Texas, to market both copper and fiber optic-based products. Also at 3M, the Market Ventures Group was formed within the Electronics Products Division to address design problems associated with electronic connectors and cables used in telecommunications equipment.

● Texscan MSI recently moved into a new 29,000 square foot manufacturing and training facility in the Salt Lake International Center; the company also opened a sales and service office in Atlanta. In addition, Texscan MSI and CompuLink signed an agreement to allow Texscan MSI to license and service CompuLink traffic and billing software to MSI customers.

BCT/E Program endorsed by SCTA

ATLANTA—During its May 5 board of directors meeting, the Southern Cable Television Association (SCTA) voted unanimously to endorse the Broadband Cable Technician/Engineer (BCTE) Certification Program, developed by the Society of Cable Television Engineers. The program was designed to raise the professional status of technicians and engineers by providing standards of competence in broadband communications engineering.

SCTA Director for Engineering Harold Null said, "The (SCTA) has gone on record as being fully supportive of the efforts of the many dedicated members of the SCTE who are working to improve the professionalism, performance and on-the-job knowledge of system technical and engineering personnel."

The SCTA covers a 12-state area that contains over one-fourth of the industry both in total subscribers and number of systems.

Part II: Intellectual property

By Isaac S. Blonder
Chairman, Blonder-Tongue Laboratories Inc

Computer software. As you may have observed, confusion and contradictory court judgments were the rule for many years over the patentability of computer software. Patents cannot be granted to an idea based solely on a scientific truth or a mathematical expression. Einstein's famous $E = MC^2$ was unpatentable. But a new twist to a corkscrew is a prime candidate for the prestigious award—a patent—by our perceptive and discriminating patent office. All due to the courts' decisions, which defined the "mental steps" in which any idea that could be carried out by the human mind without mechanical intervention would be denied patentability. Thus, a patent only would be allowed if novelty and unobviousness rested in at least one physical step of the process.

Patents also must be denied if a claim attempts to obtain a "monopoly" over a mathematical algorithm. The claim also is denied for a computer program where the only novel element in the invention was the addition of an algorithm. A patent grant is feasible where a mathematical algorithm incorporated in a computer program was only a step in a larger process that as a whole performed patentable subject matter functions. You also could get the award of a patent on software designed to access otherwise inaccessible hardware elements and microprogramming "firmware" designed to update a computer's register.

Courts require that claims be analyzed as a whole rather than at the "point of novelty," which means that the statutory nature of a claim is not altered by the fact that in several steps of the process a mathematical equation and a programmed digital computer are used. The involvement of a computer in a claim does not, therefore, by itself negate the presence of statutory subject matter. (Please don't hold my feet to the fire for the turgid phraseology. If you stray too far from the legal language, you also lose the fine distinctions contained therein.)

Your rights

If you are granted a patent these are your rights: The inventor can exclude others from making or using the invention; the patent will last up to 17 years through the payment of regular fees to the U.S. Patent and Trademark office; injunctive relief against infringement, damages to the extent of profits accrued by the infringer and the destruction of all infringing hardware; the tax benefit of capital gains treatment of patented technology.

Before you rush out to your favorite patent attorney and pay for a new set of tires on his Bentley, consider whether your software invention possesses these credentials: The potential income more than compensates for the expense of obtaining a patent; the software has a definable, inventive concept patentable under statutory requirements; the market life of the product is sufficiently long to justify the expense of obtaining patent protection (pay heed to this one); and the concept may be adequately expressed in features that can be patented.

Here's another tough barrier to software protection: The patent law of complete disclosure provides that the specification or description of the invention shall "contain a written description of the invention and of the manner and process in making and using it, in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains, or which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor in carrying out his invention." Thus, a software patent application may prove a much more complex and demanding task for the inventor and the patent attorney than your typical asymmetric corkscrew.

However, the inventor is most ill-served by the U.S. patent laws in the overseas jurisdictions. Foreign patent laws require absolute novelty of the invention for the granting of a patent. Full disclosure, as required in a U.S. patent application, would preclude protection in a foreign jurisdiction if a licensor did not file for a patent in that country within the one-year period provided for under the Paris convention. Patent protection for software, however, consistently has been denied by all countries on the European continent, except Sweden. Until individual nations recognize patentability as means for protection of software a licensor is limited to protecting software by patent in the United States. Your only alternatives for foreign protection are copyright and trade secret contracts.

My thanks again to the authors for permission to abstract this paper from *Computer Jurisprudence* by M.D. Rostocker and R.H. Rines, Franklin Pierce Law Center, Concord, N.H., Oceana Publications

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If this combination of a non-interfering sweep and spectrum analyzer that **weighs ⅔ less** and **costs ⅓ less** sounds like the perfect solution to your maintenance problems, maybe it's time you called to arrange for a demonstration in your system.

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Clockwise from top left: Bob Luff of Jones Intercable is now serving his second term as president of the SCTE. Jugglers were only part of the fun at the poolside reception cosponsored by the Florida Cable TV Association and the SCTE Florida Chapter. Registration exceeded 1,100 for the expo, a 30 percent increase over last year. SCTE Executive Vice President Bill Riker was instrumental in the success of this year's Tec Expo. NASA space shuttle Cmdr. Paul Weitz narrated a fascinating videotape during his guest appearance the first day. (All expo photos by Bart Orlando.)

Cable-Tec Expo wrap-up

By Toni Barnett

On April 2-5, the town of Kissimmee, Fla., boasted a spectacular attraction. More than 1,100 people swarmed to attend the Society of Cable Television Engineers Cable-Tec Expo, and there weren't even any rides or pavilions to play in.

In a nutshell, the expo was an unprecedented success. Attendance was up a whopping 30 percent from last year, the quality of the speakers couldn't have been better and the 98 exhibitors sold out the floor. In fact, they spilled out into the corridors of the convention center.

SCTE's Annual Engineering Conference kicked off the four-day event. The conference provided six quality hours of technical and management sessions and played to capacity crowds.

The highlight of the day was the awards luncheon. Bill Riker, SCTE's executive vice president, presided over most of the awards ceremonies. He first introduced the new officers for 1987 who were elected the previous day. They are: president, Robert Luff of Jones Intercable; Eastern vice president, Mike Aloisi of Showtime/The Movie Channel; Western vice president, Richard Covell of General Instrument/Jerrold; secretary, Ron Hranac of Jones Intercable; and treasurer, Robert Vogel of Hanford Cablevision.

Six members of the SCTE board of directors were elected by the entire Society membership during its annual elections held in January. The 1987 board consists of: Region 1 director—Robert Vogel; Region 2 director—Ron Hranac; Region 3 director—Bill Kohrt of M/A-COM; Region 4 director—Gerald Marnell of Douglas Communications Corp.; Region 5 director—Mike Aloisi; Region 6 director—Gary Selwitz of Warner Cable Communications; and At-Large Directors Richard Covell, Len Ecker, John Kurpinski, Robert Luff and Dave Willis.

The new board was officially introduced to the industry during the awards luncheon. Sally Kinsman, Glyndell Moore and Tom Polis received plaques in recognition of their service on the board during their 1985-87 terms of office. Robert Luff received a mounted gavel for his contributions as last year's president.

SCTE named Rex Porter of Times Fiber Communications as its member of the year. Porter, a charter member of the organization and cable television pioneer, was recognized for his continued support and dedication to SCTE's goals for his recent contribution of $2,500 to the Society's Scholarship Fund.

Robert Luff presented this year's President's Award to Paul Levine, president and publisher of Communications Technology Publications Corp., on behalf of *Communications Technology* magazine in recognition of the magazine's on-going support and promotion of the Society.

During the luncheon, the SCTE officially elevated five of its meeting groups to chapter status. Congratulations go to the Cactus Chapter from Phoenix, Ariz.; the North Central Texas Chapter from Dallas; the Razorback Chapter from Jonesboro, Ark.; the Tip-O-Tex Chapter from Alice, Texas; and the West Texas Chapter from Big Spring, Texas.

The Society also announced the elevation of seven of its members to senior member status. The new senior members are Steve Bell, Gary Donaldson, Larry Massaglia, Jon Ridley, Gary Selwitz, Mike Smith and Walt Ciciora. This brings the total number of SCTE senior members to 172.

Also, the Society announced two additional winners in the Technical Scholarship Program. They are Charles Hutchens (March winner), chief technician for Freedom Cablevision in Sanford, N.C.; and David Soldan (April winner), lead technician for Lincoln Cablevision in Lincoln, Neb. This brings the total number of scholarship winners, so far, to six.

Ten individuals received Outstanding Achievement Awards for exemplary performance in their respective positions: John Green, chief technician for United Artists Cablesystems; William Riley, regional engineer for American Cablesystems Corp.; Dana Rappold, outside planning manager for American Cablesystems of Massachusetts; Garry Bowman, chief engineer for United Artists Cablesystems; Jack Trower, corporate engineer for Wehco Cablevision; Ron Boyer, applications engineer for Microsat South East; Wendell Woody, field sales rep for Catel Telecommunications; Jason Barstow, chief technician for Group W Cable; Pete Daly, service manager for Rollins Cablevision; and Toni Barnett, vice president of editorial for *Communications Technology* magazine.

In addition to the awards already mentioned, several others were honored by the SCTE. For a complete wrap-up of all award winners, please see this issue's *Interval*.

A major highlight of the luncheon was a guest appearance by NASA space shuttle Cmdr. Paul Weitz, keynote speaker. Weitz narrated a fascinating videotape of astronaut activities while in space.

Fine tuning your skills

The technical workshops, given at both the technician and engineer levels, were literally standing room only.

Sally Kinsman and George Salvador gave insight on "A working class on cable system design." The technician workshop covered basic design concepts such as cable attenuation and tap and splitter selection, and included the actual design of a small feeder leg. The engineer level elaborated on the concepts from the technician level and included a larger design extension with trunk and powering.

Steve Biro presented excellent workshops on "Interference elimination with antennas and antenna arrays." The technician level class featured an introduction to antenna radiation patterns, single antenna vs. antenna arrays, AC interference and ghosting reduction. The engineer level focused on phased and diamond arrays, co-channel elimination, UHF ad-

jacent channel protection and terrestrial microwave interference elimination.

"Performing measurements on basic test equipment" was provided by John Shaw and Terry Bush. The technician level covered system response and RF signal analysis: which equipment to use, what each one does, how to hook up the equipment and how to interpret the results. The engineer session focused on how the equipment works, different measurement techniques (pro and con) and advanced analysis techniques.

Paul Beeman and Ron Hranac gave an enlightening seminar on "Baseband video performance: Theory and application." The technician level workshops included several short performance tests and theory. The engineer level workshops included in-depth discussion of T pulses, VITS, multibursts and chrominance-luminance distortion as they relate to VideoCipher operation.

Paul Heimbach and Virgil Conanan gave the workshop on "Ku-band technology and TVRO calculations." The technician level seminar was valuable for those who plan to install and maintain Ku-band earth stations. Practical discussions included: antenna installation hints, printing procedures, VideoCipher interfacing and audio/video troubleshooting. The engineer level was targeted for chief technicians and engineers who are currently planning, designing or implementing a Ku-band satellite system. Satellite parameters, antenna selection criteria, availability analysis, earth station design and other aspects of Ku-band technology were discussed.

John Wong and Cliff Paul hosted "Questions and answers with FCC engineers." The technician session was geared to the FCC's role regarding enforcement policies and the cumulative leakage index. The engineer level workshop was slanted more to the FCC's role regarding future regulation policies.

"Subtleties of sync suppression scrambling" was presented by Jim Farmer. The technician level covered setting carrier and modulation levels on scrambled signals, how to set up a scrambler and know it is correct and how to spot common problems with scrambling systems. The engineer level covered everything from the tech level plus effects of noise, headswitching and time base errors. Subtleties of receiver performance also were discussed.

Last, but far from least, were the review courses for BCT/E certification. Alex Best conducted the "BCT/E certification Category I review course on signal processing centers." The technician level centered on general knowledge of off-air and satellite antennas, LNAs, LNBs, LNCs, receivers, processors, modulators and demodulators, signal quality, FCC rules, test equipment, and BTSC stereo. The engineer level focused on tech level information in-depth, and included analytical skills for calculation of S/N, C/N and G/T.

Wendell Bailey presented the "BCT/E certification Category VII review course on engineering management and professionalism." The tech and engineer levels discussed the differences between a top quality worker or manager and the true professional. Also reviewed was an understanding of the structure and expectations of the grading committee.

On the floor

Activity on the floor was brisk. The sold-out exhibit floor was continually jammed with genuinely interested technical personnel. Also, an exhibitor training center was available for exhibiting companies to offer formal presentations of their products and related technologies. Quality RF Services gave a presentation on "Setting power doubler amplifier levels." "Store-and-forward impulse technology," "Upgrade/rebuild" and a "Headend demonstration" were offered by GI/Jerrold. Scientific-Atlanta gave a demonstration on "Status monitoring—Testing converters for surge susceptibility." Riser-Bond Instruments provided a technical demonstration on "Time domain reflectometers and cable identifiers," CaLan showed a "Non-interfering system sweep," and The Drop Shop Ltd. made comparative leakage measurements using a complete RFI testing chamber.

All work?

All work and no play? No way! On April 2, the Florida Cable Television Association and the SCTE Florida Chapter co-sponsored a poolside welcome reception for all expo participants and their families. Entertainment in the form of food, drink, jugglers, magician and band were sponsored by: Anixter Communications, Augat Broadband Communications, The Disney Channel, Ditch Witch, Home Shopping Network, Layton Utility Equipment Co., Lindberg Associates/Interstate Cable, PDI, Quality RF, RT/K, Tele-Wire Supply and Triple Crown Electronics.

On April 3, the SCTE hosted its Expo Evening at Medieval Times. Buses were provided for everyone's convenience and safety, and a rowdy time was had by all enjoying a medieval-style dinner and jousting tournament.

Is that all there was? Yes, for this year. But for next year the SCTE has selected the city of San Francisco to host Cable-Tec Expo '88. San Francisco was chosen for many reasons: its ability to better serve the Society membership in the Northwest sector of the nation where there has yet to be an expo; the popularity of the city and its varied attractions; the recently renovated Hilton Hotel will easily accommodate the entire program; and favorable room rates have been negotiated.

This year's Cable-Tec Expo was a huge success and we're positive next year's show will be even better.

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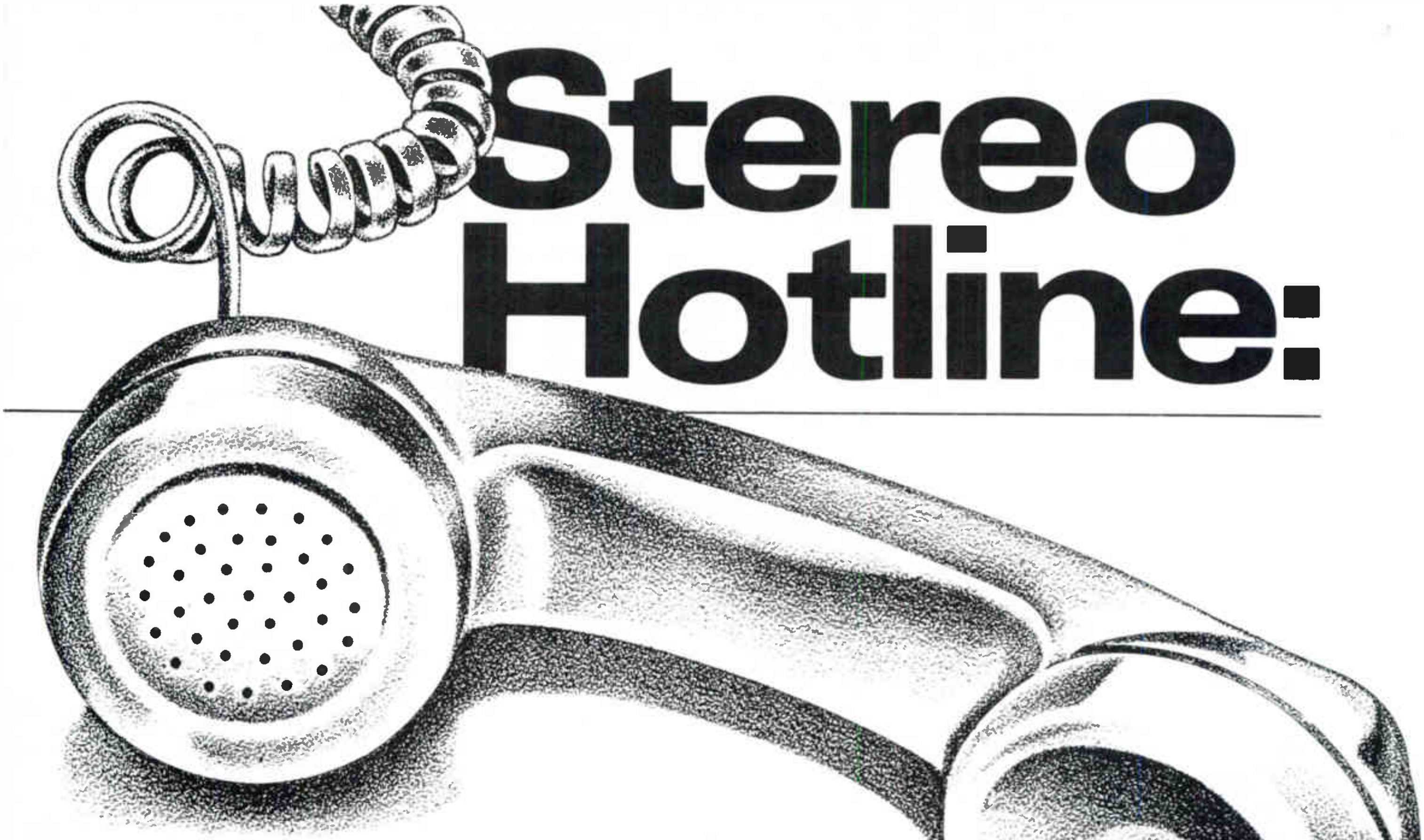

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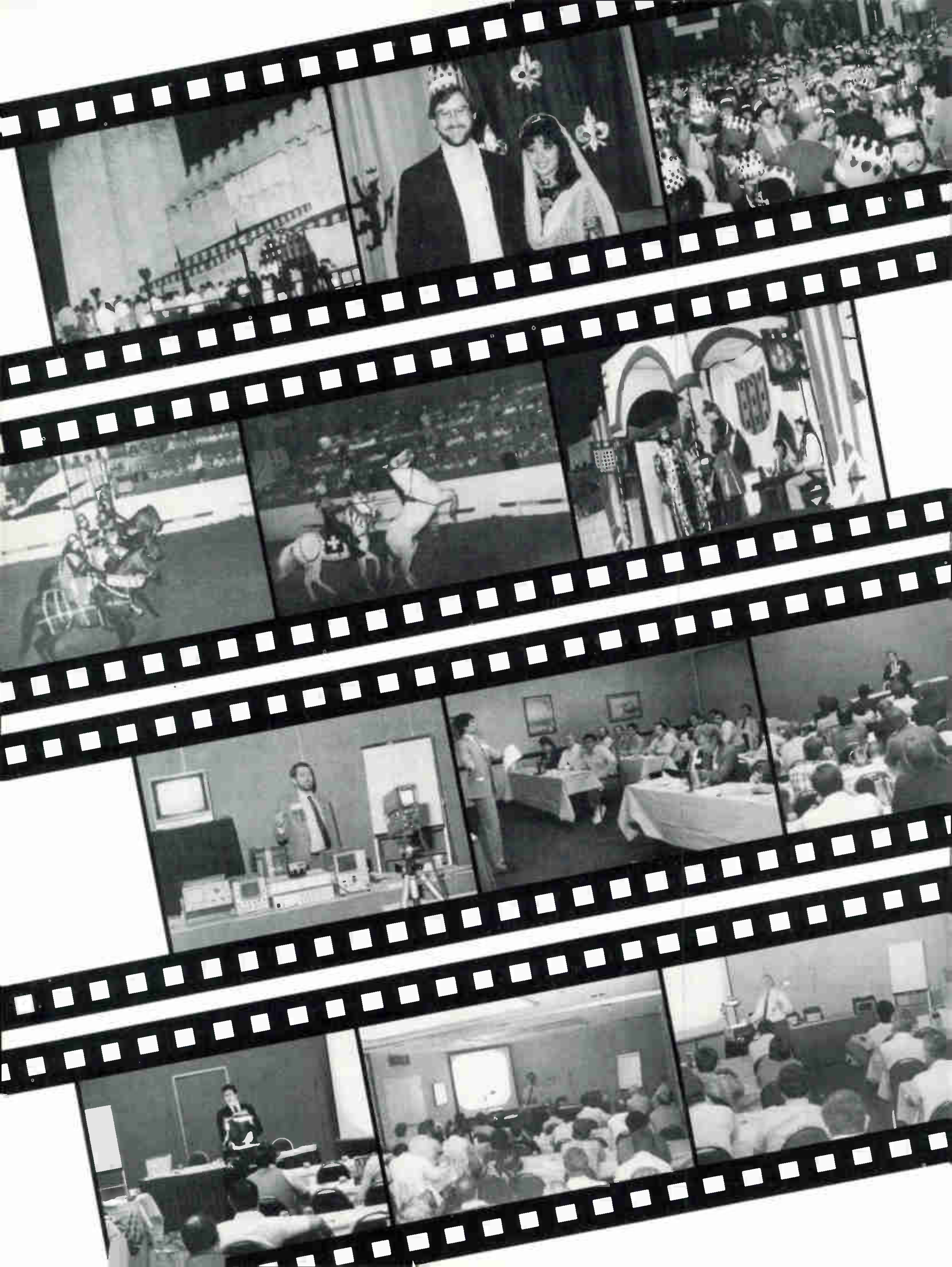

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Encryption using line dicing/rotation. *Scientific-Atlanta's B-MAC encryption.* *Example of encryption using line shuffling.*

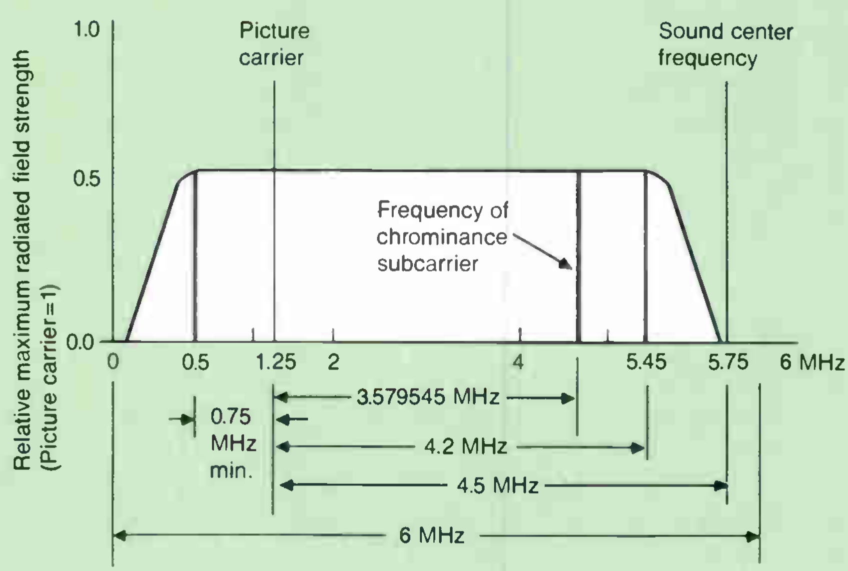
Video signal security

By Lawrence W. Lockwood
President, TeleResources

Why video signal security? A use that quickly springs to mind is for the protection of satellite and/or CATV entertainment programs. This area of application of video signal security will be with us for the foreseeable future—and undoubtedly will expand in its use. However, an area where video signal security has had less general public notice, but one that is expanding rapidly and where market saturation is in the distant future, is "corporate broadcasting" or point-to-multipoint video networking for businesses. As an example, KMart is establishing a satellite network with more than 2,100 sites. One of the major uses for these extensive facilities is to have on-line credit and check authorization. However, one-way video will be an important part of this network. Many other businesses are establishing video nets for such uses as training, sales briefings, product introductions, etc. Some of these other businesses using secure video will be discussed later.

This article will tutorially treat only video signal

Figure 1: Amplitude characteristic of TV transmission channels



'It is conceivable that the corporate. . . market eventually may be bigger than the entertainment one'

Figure 2: Video signal with interfering carrier

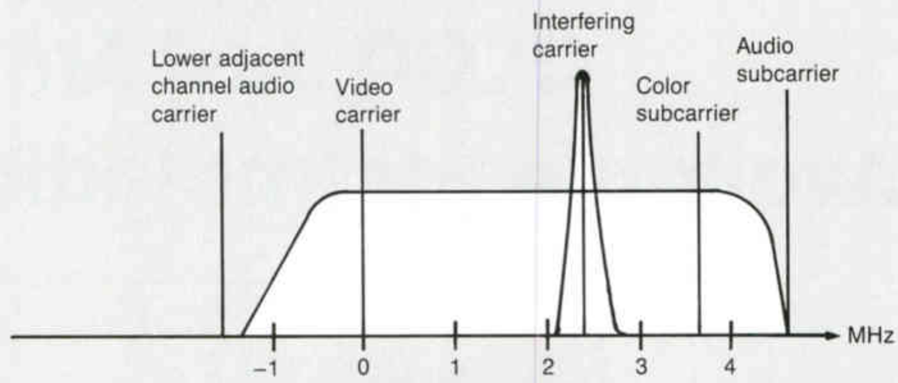
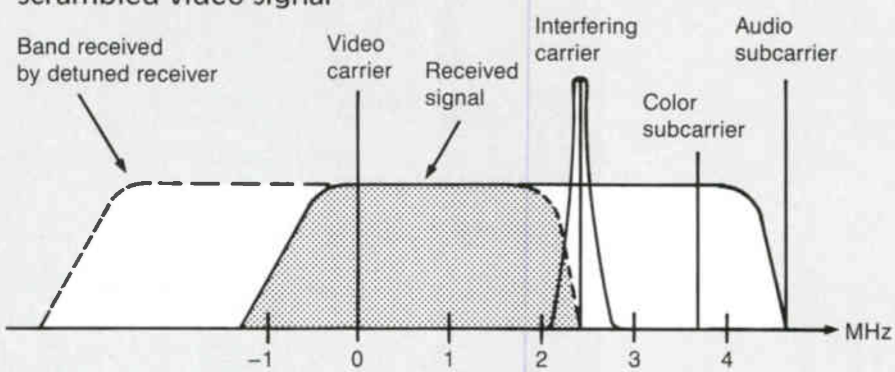


Figure 3: Detuning a television receiver to recover a scrambled video signal



security—or scrambling—and not go into any depth regarding audio security. The methodology for protecting audio from interception by any practical means is quite straightforward and in addition to use by some of the TV transmission techniques the methodology is used by many other communications systems. The audio is PCM (pulse code modulation) digitized resulting in a signal similar to that on a CD (compact disc). This signal is then encrypted—quite often by the federal DES (Data Encryption Standard) algorithm—resulting in a signal that is enciphered (coded) and cannot be retrieved without the use of the key used in the

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Figure 4: Baseband sine wave scrambling system

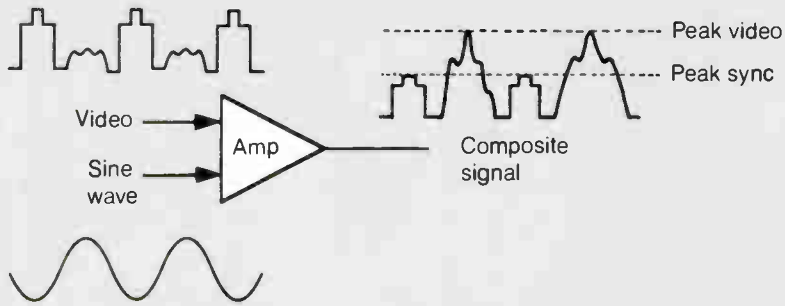
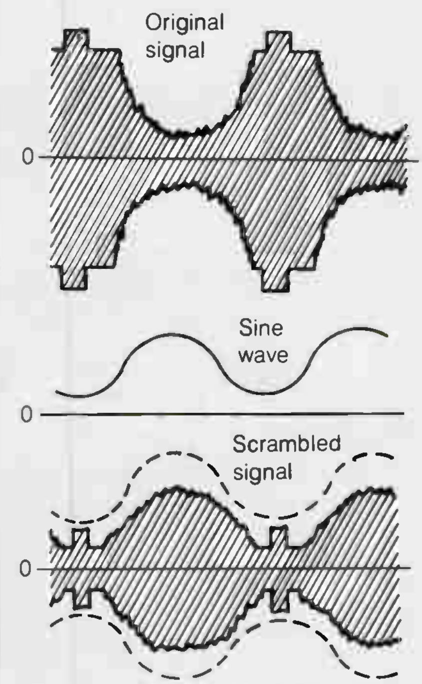


Figure 5: Waveforms for RF sine wave scrambling



encryption process. (In the DES, "encryption is the process of transforming text or data into an unintelligible form called cipher. Reversing the process of encryption and transforming the cipher back into its original form is called decryption. Data encryption is achieved through the use of an algorithm that transforms data from its intelligible form to cipher.")

The video signal can be protected either by *soft* security or *hard* security methods. Generally speaking the hard security methods currently are used only in satellite transmission; the soft methods being more widely used in CATV systems. The soft systems are usually analog-based (both baseband and RF) and the hard systems almost all require digitization of the video signal and the application of an encryption algorithm.

Analog systems

● *RF trapping*

Figure 1 shows the vestigial-sideband amplitude characteristic of TV transmission channels. A common RF scrambling method (used frequently in CATV) is achieved by placing an interfering carrier near the video carrier (Figure 2), thus causing a beat pattern in the receiver that masks the actual video signal.

With this method, scrambling depth depends on the level of the interference carrier and the frequency at which it is located. One possible jamming frequency is 2.25 MHz above the picture carrier, which produces a beat in the receiver at 4.5 MHz that in turn jams the audio signal. Noticeable effects in the video of this interference begin at about 40 dB below the video carrier level with picture destruction occurring when the scrambling signal equals the carrier level (optimum level for operation). For effective descrambling a trap is needed to attenuate the interfering carrier—trap attenuation must be around 40 to 60 dB to avoid any residual effects in the descrambled video.

A weakness in this method is illustrated in Figure 3. In many receivers a degraded picture can be recovered by detuning the receiver away from the carrier as shown. However, the audio still remains jammed. Of course many modern receivers are electronically tuned and cannot be detuned readily.

Other scrambling systems that can be used in either RF or baseband require altering or removing sync for transmission and providing a means in the descrambler of restoring it to regain the picture. The two sync altering methods

Figure 6: Baseband sine wave descrambling system

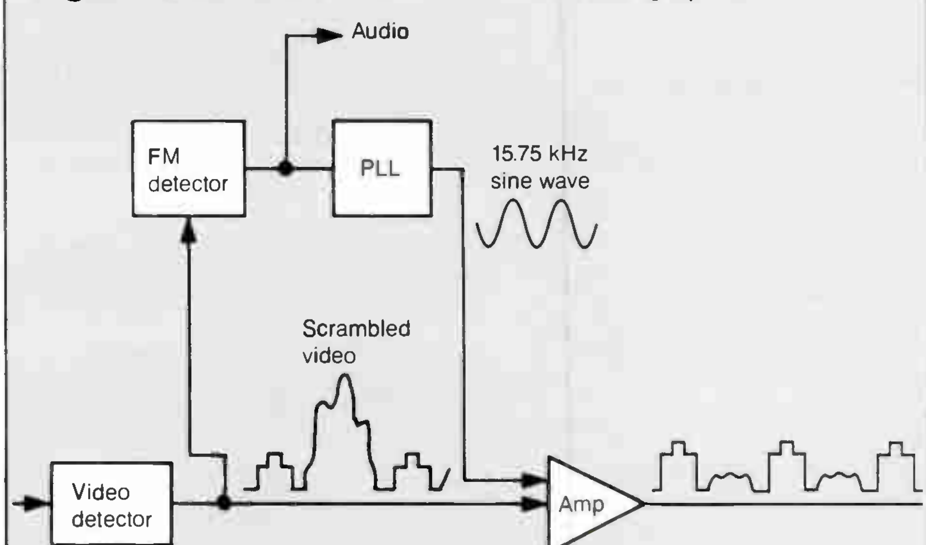


Figure 7: Baseband gated pulse scrambling system

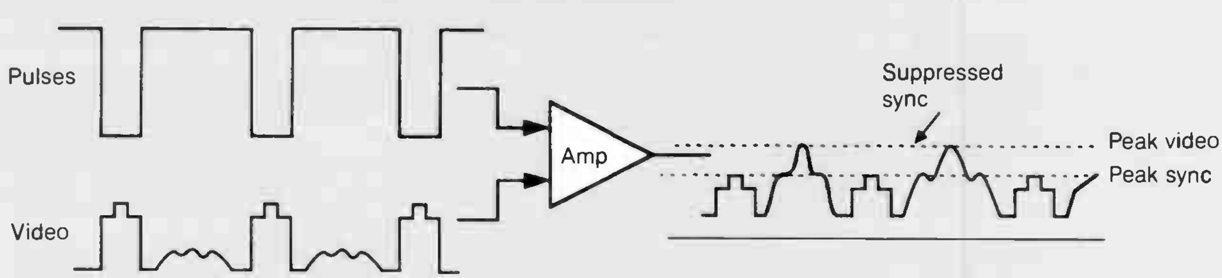


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Figure 8: Waveforms for RF sync suppression scrambling

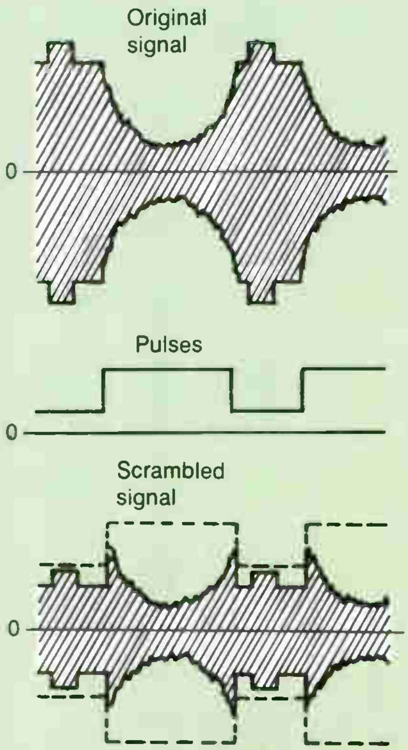

Table 1: Video scrambling techniques

Technique	Comments	Relative security level
Analog		
1) Interfering carrrier	Audio can be high security if interfering carrier is placed 2.25 MHz above video carrier; widely used in CATV.	Low
2) Sine wave	Widely used in CATV.	Moderate
3) Gated sync suppression	Widely used in CATV.	Low to moderate
4) Video inversion	Flicker problems; usually done in conjunction with a sync altering technique; widely used in CATV.	Moderate
Digital		
5) Line shuffling	High memory requirements; used mainly in satellite transmissions.	Very high
6) Line dicing/rotation	Can be done with low memory; used mainly in satellite transmissions.	Very high
7) B-MAC	Can be done with low memory; used mainly in satellite transmissions.	Very high

most widely used in CATV are gated sync suppression and sine wave scrambling. The implementation of these methods in baseband will be described. (RF implementation follows the same technique but the sync altering signals are applied to the modulated RF.)

- *Sine wave*

The sine wave technique uses the application of a 15.75 kHz (or other frequency) sine wave to the video signal. If the negative peak of sine wave corresponds to the positive peak of the video signal (sync pulse) or vice versa, the sync signal

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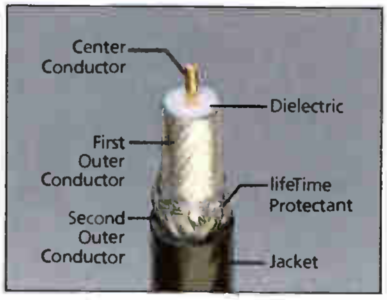

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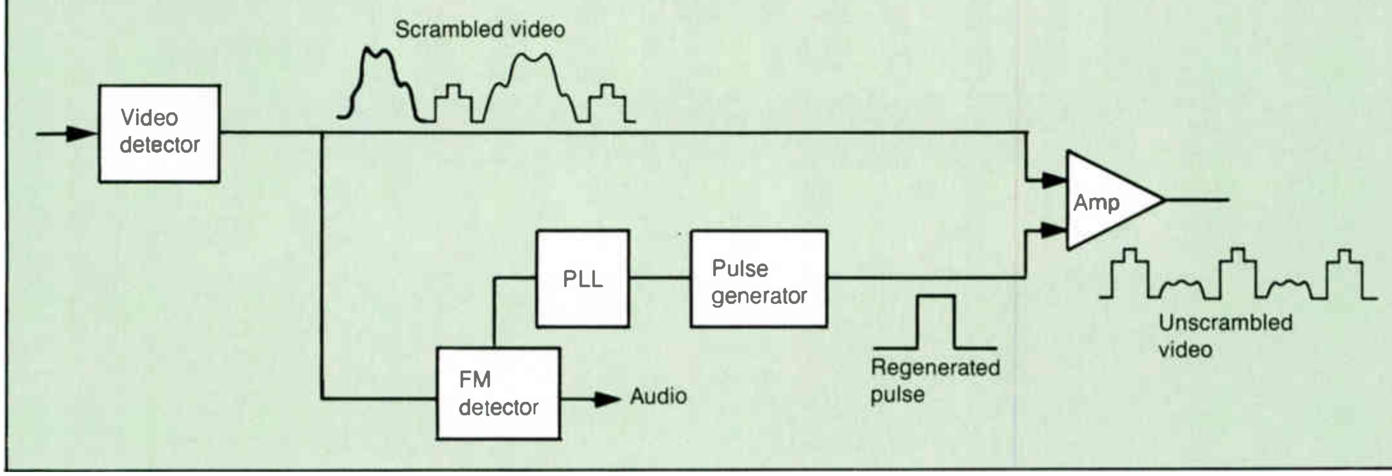
Figure 9: Baseband gated pulse descrambling system



is suppressed below the peak video level. Figure 4 shows a baseband implementation of sine wave scrambling.

If the sine wave scrambling is implemented in RF the sine wave is applied to the RF video signal as shown in Figure 5. This resultant signal "confuses" the sync separator circuits in the TV set and they cease to function properly. The picture generally is unstable and cannot be watched. Unscrambling is done by taking the "scrambled" signal and mixing it with a sine wave of proper phase so as to cancel the added sine wave.

The necessary descrambling sine wave can be sent to the set by either the *out of band* or the *in band* method. The out of band method is not used widely. In this, the descrambling waveform is modulated onto a subcarrier embedded somewhere within the entire TV channel spectrum. This is quite often in the guard band or blank space between VHF Channels 4 and 5 or just at the upper edge of the FM radio band at 108 MHz. Each decoder is tuned to this carrier center frequency so that the descrambling signals can be monitored continuously. An advantage is that descrambling transmission is independent of the channel viewed at the subscriber end. The disadvantages are that a separate subcarrier is required for transmitting the descrambling signal, requiring extra spectrum space, and a second receiver is required also.

The more common method is to transmit the descrambling signal in band, within each channel's composite video signal. In the case of the descrambling sine wave signal, it usually is obtained from a phase locked loop (PLL) circuit that is locked to a 15.75 kHz signal encoded on the audio signal. A block diagram of a baseband sine wave descrambler is shown in Figure 6.

- *Gated sync suppression*

The sync suppression method is similar to the sine wave scheme in that it operates by "upsetting" the sync pulse amplitude in relation to the video signal. Pulses with the same timing as horizontal sync are generated and added to the video to suppress the horizontal sync amplitude. Gated sync suppression in baseband is shown in Figure 7. If the sync suppression scrambling is implemented in RF the scrambling pulses are applied to the RF video signal (Figure 8).

Since the sync pulse is suppressed, the picture acts like the sync pulses are missing and the sync circuitry, which generally picks out the most positive (or negative) signal levels and assumes they are sync pulses, is rendered inoperative. Again the necessary descrambling pulses can be transmitted either in band or out of band. Figure 9 shows a block diagram of a baseband in band gated pulse descrambler. A typical sync suppression is 6 dB, as shown in detail in Figure 10.

- *Video inversion*

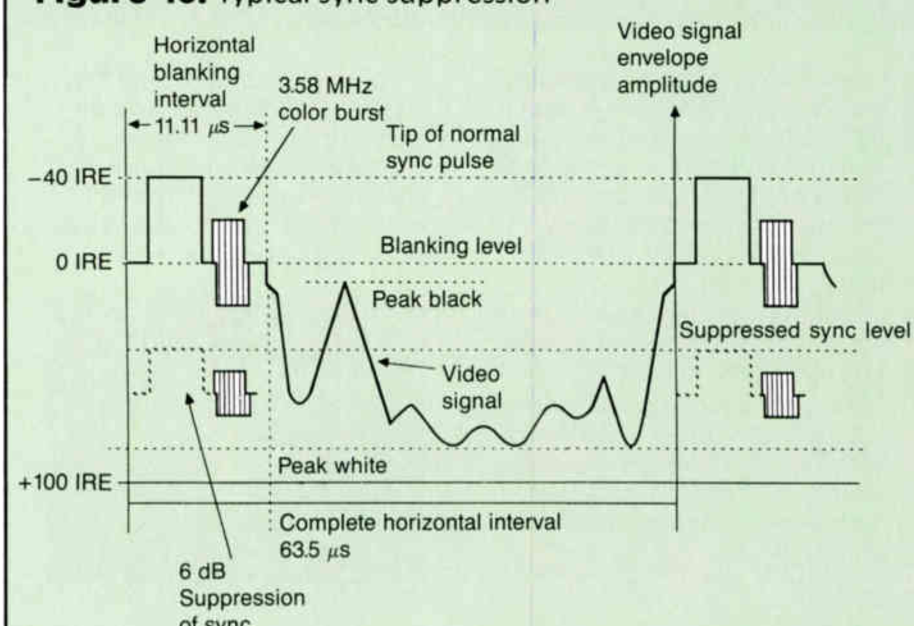
Figures 11 and 12 show a normal video signal and one that has been subjected to video inversion scrambling. Figure 13 shows a block diagram of an in band video inversion descrambler. Flicker is an inherent problem with this method. It is seldom used alone but usually in conjunction with a more complex scheme that also acts on the sync pulses.

- *SSAVI (Z-TAC)*

One method that uses such a combination is the SSAVI (synchronization, suppression and active video inversion) developed by ATC (American Television and Communications Corp.) and the Zenith Corp. It is sold under the trade name of Z-TAC. There are six levels of security:

1) Suppressed sync and inverted video (pseudo-random basis)
2) Suppressed sync and inverted video (APL basis)

Figure 10: Typical sync suppression



(Note that the peak black is well above sync pulses. This "confuses" sync circuits in TV receivers.)

3) Suppressed sync and normal video
4) Normal sync and inverted video (pseudo-random basis)
5) Normal sync and inverted video (APL basis)
6) Normal sync and normal video

The references to APL basis means that the video inversion is done as a function of average picture level (APL) changes. The encoder may be set to one of two APL modes, black or white. APL black causes only bright scenes to be inverted and APL white causes only dark scenes to be inverted. Permutations of these six processes provide the video scrambling. No in band or out of band reference signal is transmitted to facilitate reconstruction of the sync pulses. An oscillator free running at the line frequency (15.75 kHz) is synchronized with the vertical sync pulses and serves as a reference timer for restoration. However, not all horizontal pulses are suppressed. The scrambled signal still contains horizontal sync pulses from about two lines prior to vertical blanking to line 26 of the following field. Encrypted data in the vertical blanking interval signals the decoder whether to select the normal or inverted video signal path.

- *Telease*

An interesting system that uses a combination of sine wave and video inversion for video scrambling is Telease. In Telease: 1) The video is inverted and reduced to half normal amplitude; 2) a 94 kHz sine wave is superimposed on the inverted reduced amplitude video; and 3) the

Figure 11: Normal video signal

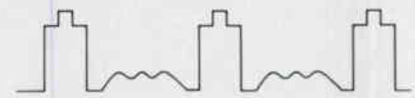


Figure 12: Signal with inversion

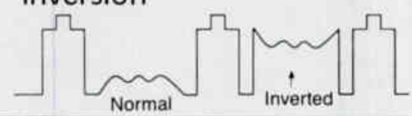
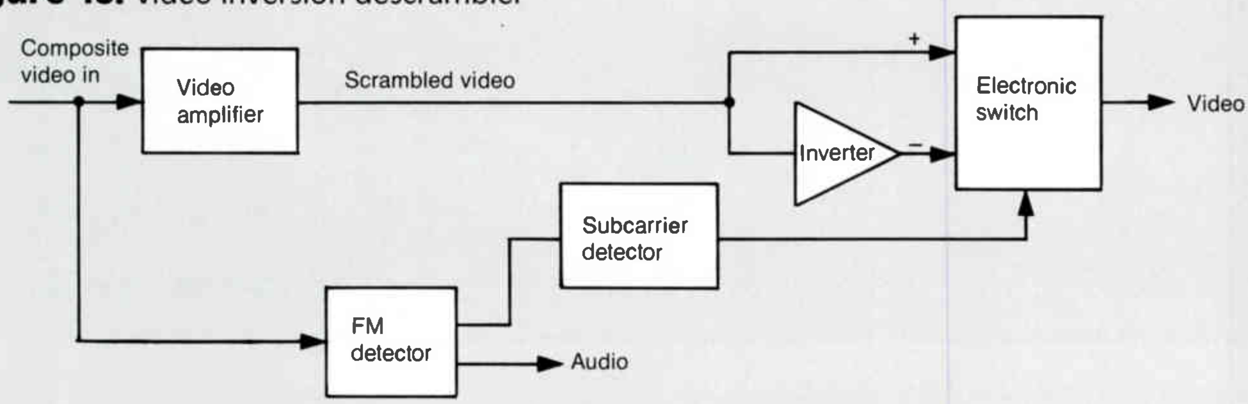


Figure 13: Video inversion descrambler



program audio is modulated on a 15.6 kHz (approximately) subcarrier, which is suppressed, resulting in a double sideband (DSB) suppressed carrier audio signal.

Figures 14 and 15 show block diagrams of the Telease scrambling and descrambling systems respectively.

- *VideoCipher II*

VideoCipher II digitally encodes and encrypts the audio signal for hard security and uses conventional analog scrambling techniques to achieve a moderate level of video security. With this system, the composite baseband color video signal is scrambled by eliminating both the horizontal and vertical sync pulses, by inverting the video waveform and by centering the color burst at a non-standard level. This modified color burst is suppressed to the black level to prevent newer digital televisions, which easily can regenerate sync pulses, from finding it. Although it is in the correct temporal position relative to the video signal, it is unlikely to trigger the horizontal synchronization circuits.

An 88 bit data stream is inserted in the waveform in place of a sync pulse. These 88 bits are used for two-channel digital audio, program control and billing, sync information, security features, and an auxiliary data channel (all functions DES encrypted). Obviously, with this method of audio transmission no 4.5 MHz sound carrier is needed. (See Figure 16.)

Figure 14: Telease scrambling

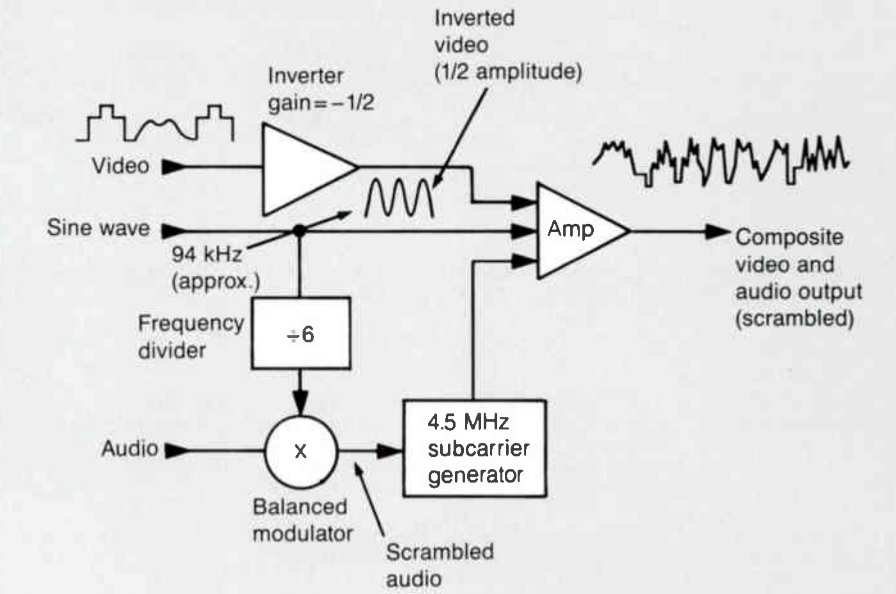
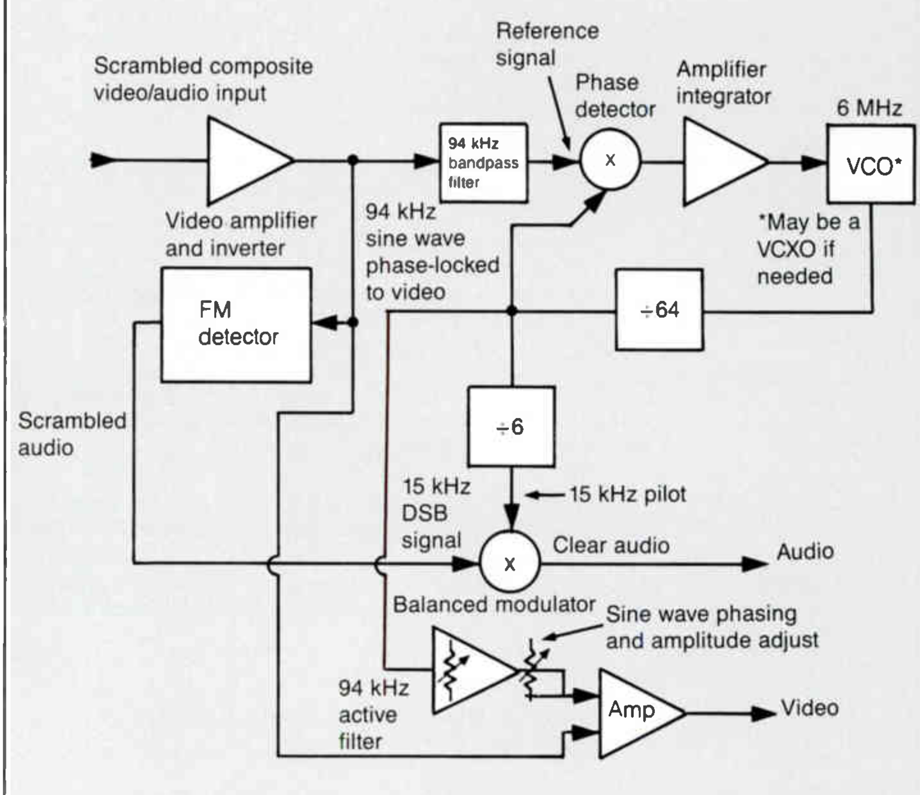


Figure 15: Telease descrambling



Digital systems

As noted previously, all hard security systems for video are digital in nature. This is because the hard security results from the application of an encryption algorithm (quite often the DES algorithm). Encryption algorithms cannot be applied to analog signals but only to digital data. The "hardness" of the DES algorithm is indicated by the size of the key used to encipher—and to decipher—the data. Since this key must be used precisely—or no decryption—and it is 56 bits long, this means that a random search for the key would require 2^{56} or 72 quadrillion tries.

However, the encryption/decryption algorithms have speed limitations. A T1 rate—1.544 megabits per second (MBPS)—can be encrypted/decrypted with ease, and since the digital data rates for audio are less than this, audio can be directly encrypted and decrypted.

The digital data rates for video are much higher. A typical digital data rate for video would result from sampling the video at three times the color subcarrier frequency (3×3.5 MHz = 10.74 Msamples/sec) and at 8 bits/sample, and therefore is $8 \times 10.74 \times 10^6$ = 85.9 MBPS. This is a much higher data rate than can be encrypted/decrypted by the algorithms. Therefore several interesting techniques are used after digitizing the video so that these encryption/decryption algorithms can be used.

In all the techniques (with the exception of the B-MAC system) standard baseband composite color video is first digitized—often in the manner described previously—resulting in the 86 MBPS data rate in TV line after TV line of digital data (bits) instead of analog video. The two techniques most used (excepting B-MAC) are: 1) line shuffling, and 2) line dicing (sometimes called splicing) and rotation.

In each system after the encryption has been done the signal is D to A'd (i.e., it is changed from digital back to analog). This is necessary since the bandwidth required for the transmission of the high bit rate is beyond that of current communication systems (satellites, broadcast, CATV, etc.). When the scrambled analog video is received, the process is reversed. The scrambled analog video is digitized—the same technique used for applying the encryption is used for decryption (as long as the exact key used in the encryption is available at the decrypter) so that the original bit stream representing the original video is available for D to Aing (i.e., changing the digital bit stream back into analog video).

In the application of either line shuffling or line

Table 2: Some scrambling systems in use

Trade name and type of video	Scrambling methods used	Relative security level
Comsat Satguard Analog audio Analog video (Satellite)	Suppresses horizontal sync, audio combined with complex digital 15.734 kHz waveform. Video line inversion, with individual lines specifically.	Moderately high video and audio
Telease Analog audio Analog video (Satellite)	Sine wave (94 kHz) added to video. Audio is modulated on 15.6 kHz (approximately) subcarrier.	Moderate
Oak systems 1) Oak Orion Digital audio Analog video (Satellite)	Video may be inverted; sync missing. Color burst moved to nonstandard location; random video polarity sequences. Audio is digital, with data pulses in horizontal blanking interval. Audio may be further encrypted.	Audio high, moderate video
2) Oak Polaris Digital audio Digital video (Satellite)	Video lines shuffled, DES encrypted. Audio in horizontal blanking interval is digital, DES encrypted.	Very high audio and video
3) Oak Analog audio Analog video (Cable)	Video modulated with 15.7 kHz or 31.5 kHz sine wave; audio is on 62.5 kHz subcarrier.	Low to moderate
4) Oak Sigma Digital audio Analog video (Cable)	Video randomly inverted on scene changes. Sync omitted; vertical and horizontal sync intervals have digitized encrypted audio. Decryption keys are on separate carrier.	Moderate video, very high audio
GI Star-Lok Digital audio Digital video (Satellite)	Sync and color burst are removed, and scanning lines diced and rotated according to DES algorithm. Audio is digital and DES encrypted.	Very high video and audio
Jerrold 1) VideoCipher I Digital audio Digital video (Satellite)	Video lines diced in variable size segments and DES encrypted. Audio is digital and DES encrypted.	Very high video and audio
2) VideoCipher II Digital audio Analog video (Satellite)	Video inverted, sync is removed, color burst is relocated. Audio is digital in horizontal blanking intervals and DES encrypted.	Moderate video, very high audio
3) Starcom Analog video (Cable)	Sync suppression is pseudo-random (6 to 10 dB); audio is clear.	Low to moderate video, audio is clear
TOCOM Clear audio Analog video (Cable)	Video randomly inverted; random sync suppression and video may be compressed; audio is clear.	Low to moderate video, audio is clear
Zenith SSAVI, Z-TAC Analog audio Analog video (Cable, over air)	Video randomly inverted. Random sync suppression. Audio on subcarrier.	Moderate video
Hamlin Analog audio Analog video (Cable)	Random sync suppression similar to SSAVI	Moderate
B-MAC Digital audio Digital video (Satellite)	Video time-compressed, luminance and chroma sent separately. Sync and data sent in random width packets. Non-NTSC format.	High video and audio (very high if DES encryption is used)

dicing some digital memory is required at both the transmit and receive points. If this memory is a full frame store (in some schemes it can be less) that means that every line of a frame is stored as bits (since it has been digitized).

- *Line shuffling*

For the line shuffling technique the lines are picked out of the memory out of order in a specific sequence, and subsequently transmitted in this out of order sequence. It is the sequence specification that in encrypted. The line sequence determination is a low enough rate that the encryption/decryption algorithms can handle it (at the most it would be 15.75 kHz). The Oak Polaris system uses this technique. See the accompanying photographs for an example of encryption using line shuffling.

- *Line dicing*

For the line dicing/rotation technique the same procedure as in line shuffling is followed for digitizing the TV signal and storing lines in memory. However, in this scheme each line is divided into two segments that are interchanged in position for transmission (Figure 17). The length of each segment is changed on a line-by-line basis and it is this change that is encrypted. Again the encryption/decryption algorithms can handle this rate for the same reasons as in line shuffling.

A problem occurs in line dicing/rotation that has to be addressed (Figure 18). In unscrambled video signal transmission in CATV systems, a 5 percent tilt causes no visible effects, whereas with a line diced signal (with no tilt correction) even a 1 percent tilt will cause visible effects (less than 0.5 percent line tilt is required for no visible effects if no correction is applied). Special efforts have to be made to remove any tilt problems. The VideoCipher I and the General Instrument Star-Lok use this technique. See photographs for an example of encryption using line dicing/rotation.

- *B-MAC*

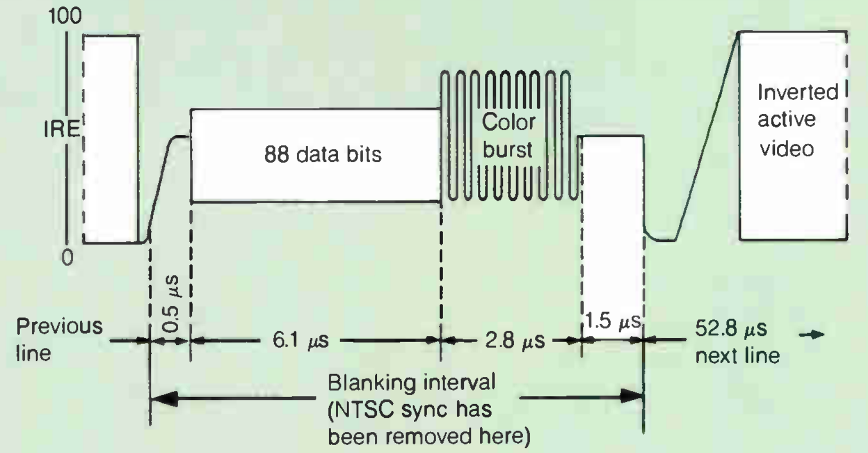
The basic MAC (Multiplexed Analog Components) was developed by the Independent Broadcasting Authority (IBA) in the United Kingdom in 1981. There are several versions of MAC but the one that will be treated here is the B-MAC system developed by Scientific-Atlanta.

The chrominance and luminance are transmitted in a line-by-line time multiplexed, rather than frequency multiplexed (as in NTSC), mode. Again in this method the analog video is digitized and entered into memory—but the *composite* color video is not digitized. The signal digitized for the MAC systems is *component* video (i.e., the chrominance and luminance portions of the video are digitized separately before memory storage). The components are read out of memory in the sequence of chrominance; then luminance at a faster clock rate than they were put in. This technique (called TDM or time division multiplexing) allows the chrominance and luminance for each line to be contained in each line but *separately* (Figure 19), not mixed as in the NTSC standard. Of course, as before, the digital bit streams are converted back to analog for transmission—which is why the system is called MAC.

In the B-MAC system only one chroma component is transmitted per line: even lines B-Y and odd lines R-Y. Cross-color and cross-luminance effects inherent in NTSC are eliminated completely because these components are relayed at separate times within one scan line. By proper time compression and the elimination of horizontal sync there is room left for data.

B-MAC's 52.5 μs active line of luminance is time-compressed to occupy 35 μs. A period of 17.5 μs per line is thereby made available, which is occupied by the time-compressed color-difference signal. The remaining 11.5 μs of each line is utilized for the B-MAC data system. A total of 1.86 MBPS of data accompanies the video, providing digital audio, control and data services. Of this 1.86 MBPS available, 1.573 MBPS is provided by the horizontal blanking interval (HBI). The remainder is accommodated by the vertical blanking interval, and is employed for control, conditional access and text services. Of the 1.573 MBPS HBI data, a total of 1.510 MPBS are absorbed by six channels of digital audio and associated error concealment. The remaining 62.5 kBPS provides a permanent utility data channel.

Figure 16: VideoCipher II horizontal line format

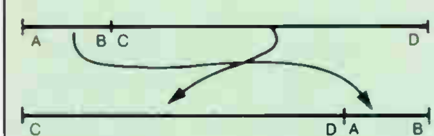


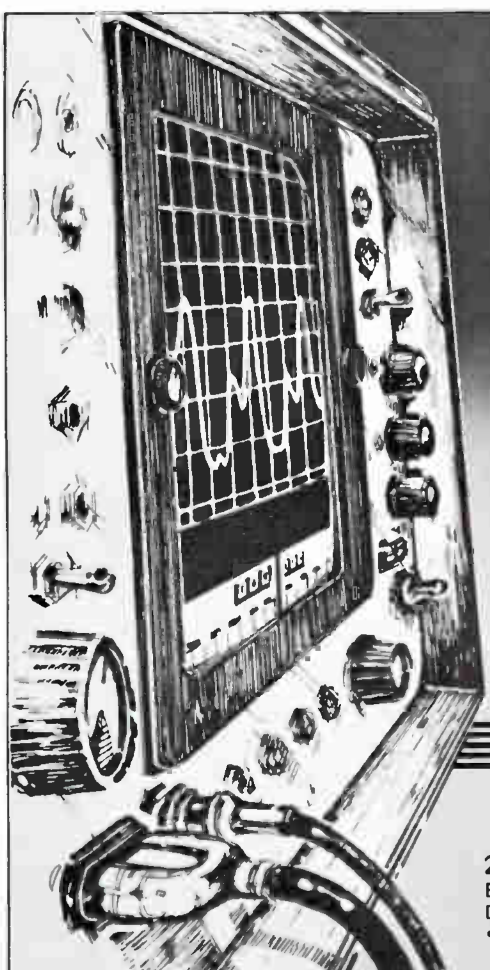
- *B-MAC encryption*

Video encryption in the B-MAC system is accomplished by line translation or time shifting each line (Figure 20). The width of the digital data packet is varied, sending more (or less) data on one line than on the preceding line. This either advances or delays the start of each line, producing a slewing of the individual lines. No data is omitted, it merely is sent in advance or saved for later. It is this sequence of advance/delays that is encrypted and as before, the encryption/decryption algorithms can handle this rate.

This method is being used by the Australian Broadcast Corp. (ABI) for program distribution (via Australia's AUSSAT I satellite) to TV stations and to individual homesteads in the outback. It also is used on many commercial satellite networks (e.g., Holiday Inns' Hi-Net, the previously

Figure 17: Line dicing/rotation scrambling





noted KMart satellite net and others). An example of Scientific-Atlanta's B-MAC encryption is shown in the accompanying photographs.

Conclusions

Table 1 shows a general summary of the generic methods of video scrambling while Table 2 presents a list of widely used equipment—a brief description of the scrambling technique used by each and an evaluation of the degree of security. (It should be emphasized here that when examining/evaluating any specific analog sync altering scrambling systems that careful note be made as to whether the scrambling techniques are implemented in baseband or RF.)

As previously noted, the area of business application of video security is growing rapidly. Scientific-Atlanta (which actively is pursuing the commercial TV markets) expects its Echelon (B-MAC) system to claim a 15 percent share of the data market through 1991 and an 80 percent share of the video. Some of its major customers are Ford Motor Co., EDS, Private Satellite Network, Satellite Conference Network, VideoStar, AT&T, Hi-Net and Bonneville Communications. Some of the satellite nets serve major businesses (e.g., VideoStar has 650 sites serving such clients as Computerland, Eastman Kodak and Texas Instruments; Satellite Conference Network will deploy more than 1,000 video receive stations serving the banking and financial industries; Private Satellite Network's clients include J.C. Penney, Merrill Lynch and Digital Equipment Corp.) The video services are used for such functions as employee training, sales briefings, product introductions and others. Even the Mayo Clinic is establishing secure satellite transmission facilities for three new clinic locations, enabling doctors to consult with each other, with the added advantage of live TV images of diagnostic procedures and patient examinations.

The observations here of hard security video have been made only of schemes that utilize satellite transmission. However, it is probable that the future will see considerable corporate video transmission by optical fiber. All the current hard security video systems can be adapted rather easily to fiber-optic transmission. The main change would be that the D/A (digital-to-analog) function in the transmitter and the A/D (analog-to-digital) function in the receiver would be eliminated: that is, the transmission will be purely digital and not analog. This will pose a slightly greater problem for B-MAC compared to the line shuffling or line dicing methods. This is because Scientific-Atlanta's B-MAC digitizes the video by PAM (pulse amplitude modulation) rather than by PCM (pulse code modulation) used by the other methods, and optical fiber transmission is very poor with any amplitude modulation. However, this problem can be overcome quite simply: PCM the PAM.

From this it is apparent that video security is much more than protection of home entertainment. It is conceivable that the corporate hard security video market eventually may be bigger than the entertainment one.

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Figure 18: Line tilt problem in line dicing/rotation

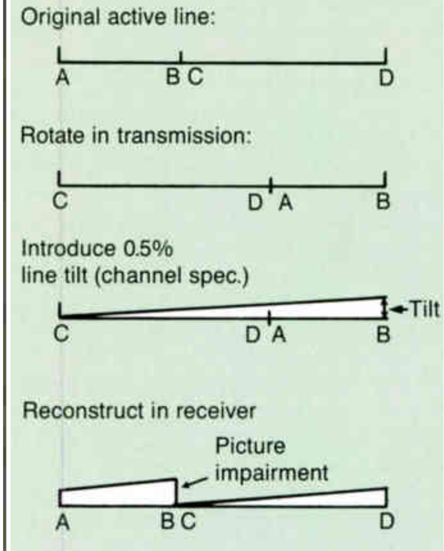


Figure 19: B-MAC horizontal line format

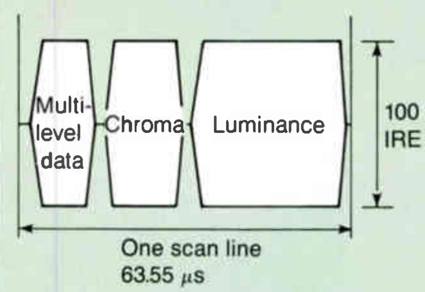
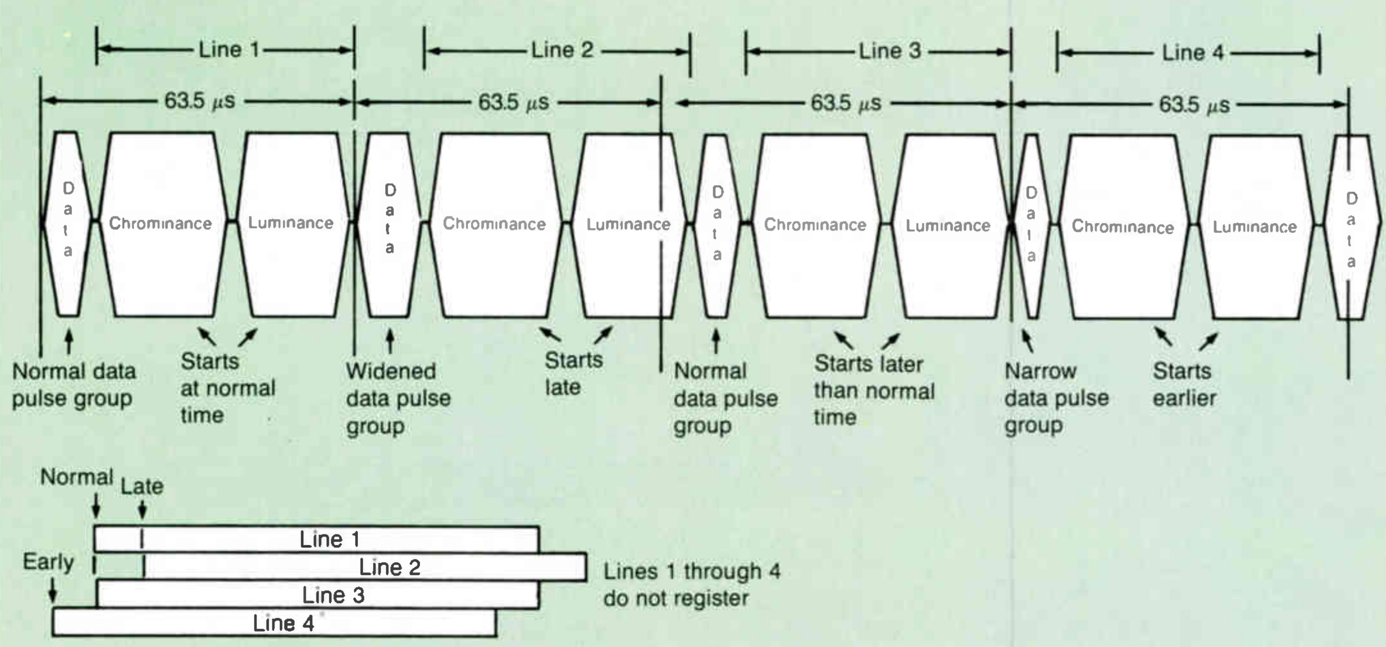


Figure 20: B-MAC video scrambling



Ku-band satellite transmission for cable TV

This article treats the subject of Ku-band satellite TV transmissions from the viewpoint of the ground segment or the receiving earth station. It, therefore, is intended as a tutorial for cable television engineers who work for systems that are planning to receive programming from Ku-band satellites. Uplink and satellite performance parameters are discussed and included only to the extent that they affect the overall performance and serve as a benchmark for design of the receiving earth station.

By Norman Weinhouse
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Ku-band is an old radar designation for frequencies in the range of 12 to 15 GHz. In the world of communication satellites, it denotes the frequency of two classes of satellite service. There is a broadcast satellite service (BSS), which operates from 17.3 to 17.8 GHz in the uplink and 12.2 to 12.7 GHz in the downlink. There are no satellites currently flying utilizing the BSS band but several construction permits have been issued (and revoked) by the FCC. The second class of service is the fixed satellite service (FSS). The FSS utilizes 14.0 to 14.5 GHz in the uplink and 11.7 to 12.2 GHz in the downlink. The BSS band is regulated by the Mass Media Bureau of the FCC and the FSS band is regulated by the Common Carrier Bureau of the FCC. This paper deals with the FSS Ku-band and in particular the downlink since cable operations will, for the most part, be on the receiving end of the satellite transmission.

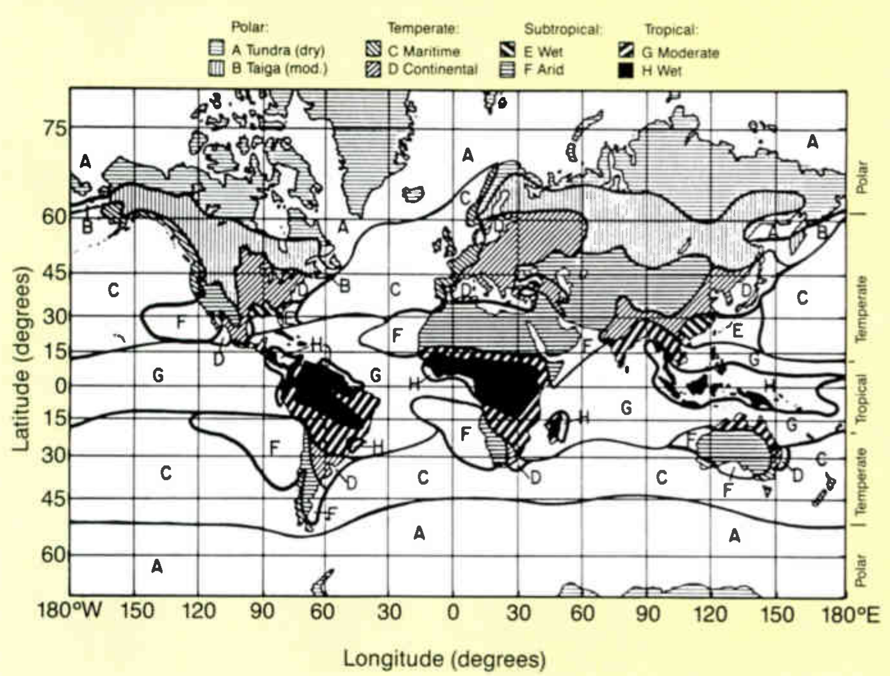
The band 11.7 to 12.2 GHz is very nearly three times the frequency band 3.7 to 4.2 GHz of C-band. Therefore, the wavelength is one-third that of C-band. A parabolic antenna at Ku-band will have a beamwidth about one-third of the beamwidth of a C-band antenna with the same diameter. Since the gain of an antenna is proportional to the square of the frequency, a Ku-band antenna will have about 10 dB more gain than a C-band antenna with the same diameter. A 3-meter (10-foot) diameter antenna at Ku-band is electrically equivalent to a 9-meter (30-foot) diameter antenna at C-band.

The 'clear' channel

The frequency band 11.7 to 12.2 GHz is set aside by the FCC primarily for satellite downlinking. There are a very limited number of licenses (about 50) issued to common carriers for use in the local television transmission service (LTTS), which operates in this same frequency band on a secondary or non-interfering basis. Since the possibility of interference is so small, the FCC does not license receive-only earth stations in this band. The FCC will not even accept applications for license of receive earth stations. It would be prudent when planning a Ku-band earth station in the 11.7 to 12.2 GHz band to notify the common carrier LTTS licensee in your area. The geographic coordinates of the station and the antenna used should be given in the notification.

This "clear" channel of operation provides a great deal of freedom to anyone planning a Ku-band earth station. Any site that can support the antenna with a clear unobstructed view of the geostationary arc can be used. It need not be co-located with a C-band station although it could be.

Figure 1: Global model for rain rate climate regions



Since there are no primary terrestrial transmitters to interfere with satellite receiving earth stations, there are no primary terrestrial receivers to be victims of interference from a satellite. Ku-band satellites, therefore, can concentrate more power on the Earth than C-band ones. Early Ku-band satellites have about 20-watt transmitters on board. The RCA K1 and K2 satellites have 45-watt transmitters. The RCA K3 and K4, to be launched in 1989 or 1990, will have 60-watt transmitters. The BSS satellites will have either 100-watt or 230-watt transmitters.

Although the Ku-band satellite service does not share frequencies on a co-equal basis with terrestrial service, there are a multiplicity of satellites in the orbital arc operating at the same frequencies. A receiving station must depend on the discrimination of its antenna to protect it from interference from other satellites. Furthermore, there does not currently exist a "standard" frequency and polarization plan at Ku-band. The consequence of this non-standardization is that polarization isolation cannot be counted on in planning an earth station.

From a practical standpoint, it would be prudent for the earth station planner to purchase an antenna meeting the FCC sidelobe envelope requirements of Paragraph 25.209 of the FCC rules and regulations. An antenna of 2.4 meters in diameter or greater meeting these requirements should provide adequate protection from adjacent satellite interference.

Precipitation

Ku-band transmission is subject to deeper fades and more frequent fades than C-band transmission. This is because the shorter wavelength (2.5 centimeters vs. 7.5 centimeters) is affected more than the longer wavelength. Satellite links need not provide the same level of protection (fade margin) as terrestrial links, since only a small portion of the path passes through the Earth's atmosphere. However, unlike C-band service, effects of precipitation must be included in the planning of a Ku-band service.

The effects of precipitation have been thoroughly studied and solid engineering prediction models for rain fades exist that have been experimentally verified in a large number of cases. Rain fades are dependent on *rain rate* and the length of the path through rain. In the case of satellite transmission, the path length depends on how much atmosphere the signal passes through, or the elevation angle of the antenna. It follows, therefore, that rain fades will depend on local conditions and the location of the earth station with respect to the satellite.

The effects of snow in the atmosphere are not nearly so bad as rain regardless of the rate of snowfall. However, an uneven accumulation of snow in the dish can cause a serious de-focusing effect, which will reduce the antenna gain and increase the sidelobes. It also can cause mispointing effects, further reducing the gain on the mechanical boresight axis. In this regard, the effects are not much different than at C-band, especially for dry snow. The effects of wet snow are far more degrading than dry snow. It is obvious that a dry snow condition will always degrade to a wet snow condition when the inevitable thaw occurs, if the accumulation is

Figure 2: CONUS rain rate climate regions with region D subdivisions

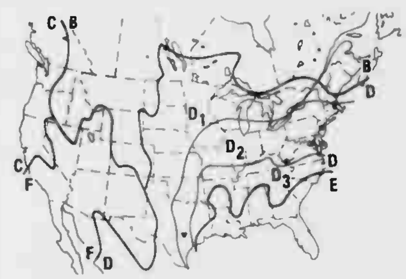
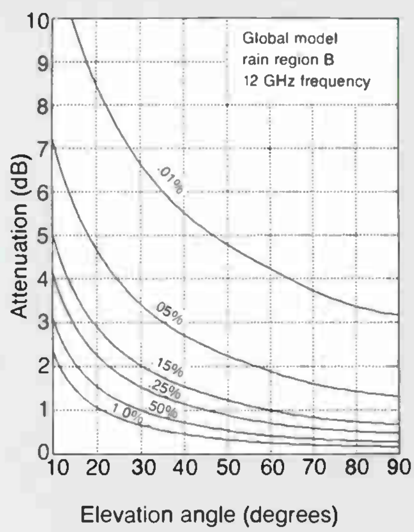


Figure 3: Region B reliability data



allowed to stay in the dish.

The net effect for those cable operators whose philosophy it has been to sweep the snow out of antennas when pictures degrade, is the more vigilant. A good rule of thumb is to be alert to potential problems if the weather prediction is for more than two inches of snow. The alternative, for reliability, is to equip the antenna with an automatic snow removal heating system at some additional expense.

Several models exist to predict attenuation due to rain[1]. The Crane global attenuation model[2] is recommended for use in planning satellite systems because it is quantitative and has been proven accurate. The global model relates point rain rate (for which much statistical data exists) to attenuation at various frequencies. The global model correlates well with measured attenuation data[3]. Figures 1 and 2 show the rain rate climate regions worldwide and for the continental United States (CONUS) in particular. Figures 3 through 9 provides data for all of the rain rate regions in the CONUS. In the following section, it will be shown how these charts can be used in the design of earth stations in the Ku-band. For those who wish to "fine tune" a reliability prediction,

use Reference 2, if rain rate data exists for the site planned for your earth station.

Link analysis

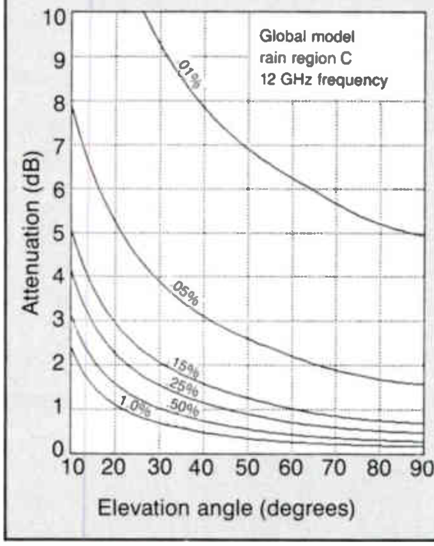
The link analysis and examples provided here apply to the RCA K1 satellite at 85° west longitude. The modulation parameters used in this satellite for transmission to cable systems have been optimized to provide a reasonable compromise between clear weather signal-to-noise ratio and fade margin. In the transmissions from this satellite, the deviation of the main carrier by video is 9.2 MHz, and if subcarrier is used for audio, the deviation of the main carrier by the subcarrier is 2 MHz. The receiver to accommodate these signals should have a bandwidth of approximately 24 MHz.

For an FM receiver operating above threshold, the video signal-to-noise ratio (peak luminance signal to RMS noise) can be expressed by:

$$(S/N)_V = 6\,m^2 \left(\frac{B}{fm}\right) (C/N)_{PD}\,(PW) \qquad \textbf{(1)}$$

Where,
$(C/N)_{PD}$ is predetection carrier-to-noise ratio.
m is modulation index $\left(\frac{\Delta F}{fm}\right)$,
ΔF is deviation of main carrier by video,
B is predetection bandwidth,
fm is highest modulation frequency (4.2 MHz for NTSC),
PW is combined pre-emphasis and weighting improvement factor (12.8 dB for U.S. and CCIR standards)

Figure 4: Region C reliability data



Substituting appropriate values for ΔF and B, this equation reduces to:

$$(S/N)_V = [(C/N)_{PD} + 35]\ (dB) \qquad \textbf{(2)}$$

The predetection carrier-to-noise ratio is:

$$(C/N)_{PD} = (C/N)_U \oplus (C/N)_D \oplus (C/I)_T \qquad \textbf{(3)}$$

Where,
$\oplus$ denotes power summation:
$(C/I)_T$ is total carrier-to-interference power ratio
$(C/N)_U$ is uplink C/N
$(C/N)_D$ is downlink C/N

Clear weather $(C/N)_D$ is:

$$(C/N)_D = [(EIRP)_S + G_R - T_R - A_D - (k+B)]\ dB \qquad \textbf{(4)}$$

Where,
$(EIRP)_S$ is satellite EIRP – dBW
G_R is receiving antenna gain – dB
T_R is receiving system noise temperature – dB°K
A_D is downlink clear weather space loss = 205 dB
k is Boltzmann's constant = −228.6 dBW/°K
B is bandwidth – dBHz = 73.8 dBHz

Substituting and assuming the use of an LNA or LNB with 2.5 dB noise figure, and antenna noise temperature of 40°K:

$$(C/N)_D = [(EIRP)_S + G_R - 74.8]\ dB \qquad \textbf{(5)}$$

In a rain fade, the carrier-to-noise is modified by adding two addition factors:

$$(C/N)_{DF} = [(EIRP)_S + G_R - Fade - 74.8]\ dB \qquad \textbf{(6)}$$

should be greater than 8 dB to remain above threshold.

Where,
Fade = $L_R + T_e$, L_R is rain attenuation (in dB), T_e is change in system noise temperature and

Figure 5: Region D_1 reliability data

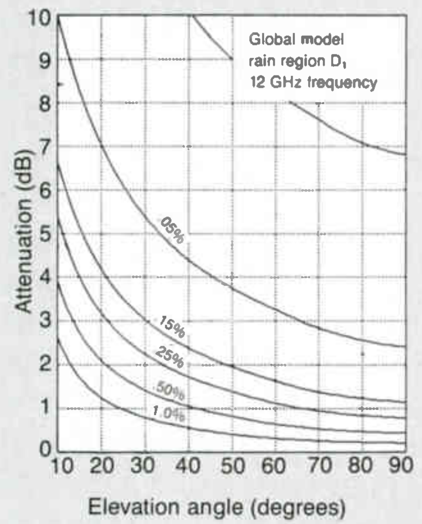
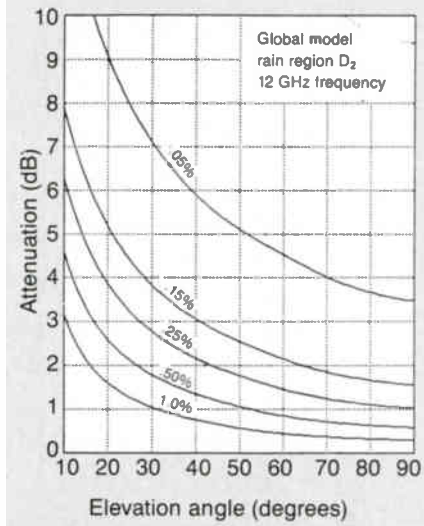


Figure 6: Region D_2 reliability data



is expressed by:

$$T_e = 10\log\left[\frac{T_R + T_O\dfrac{(L_R - 1)}{L_R}}{T_R}\right]\ \text{dB}$$

Where,

L_R is rain attenuation (in numeric)

T_O is ambient temperature (290°K). The sum of L_R and T_e represents the total fade in rain.

Equation 6 is the expression that a designer of a receiving earth station has to work with. He must know the satellite EIRP for the site. Satcom K1 EIRP footprint is given in Figure 10. He can then determine what size antenna to use for a desired S/N and reliability.

Since the S/N is dependent on $(C/N)_{PD}$, and Equation 6 is $(C/N)_D$ in 24 MHz bandwidth, it is necessary to combine Equations 3 and 6:

$$(C/N)_{PD} = [EIRP_S + G_R - (L_R + T_e + 74.8)] \oplus (C/N)_U \oplus (C/I)_T$$

A reasonable assumption for $(C/I)_T$ is 26 dB and for $(C/N)_U$ it is 26 dB. Therefore:

$$(C/N)_{PD} = [EIRP_S + G_R - (L_R + T_e + 74.8)] \oplus 23\ \text{dB} \qquad (7)$$

Design example

Location of earth station site is latitude 33°N, longitude 97°W (near Dallas). The desired $(S/N)_V$ in clear sky is 53 dB, with a desired availability of 99.95 percent.

1. From Equation 2, for a $(S/N)_V$ = 53 dB, $(C/N)_{PD}$ = 18 dB.
2. From Equation 7, for a $(C/N)_{PD}$ = 18 dB, $(C/N)_D$ = 19.6 dB.
3. Station is in rain rate region D_2 (Figure 2). At this point a calculation of the antenna elevation angle must be made. Use the following formula:

$$EL = -\arctan\left(\frac{\cos\theta\cos\alpha - R/D}{\sin\theta/\sin AZ}\right)\ \text{(degrees)}$$

Where,

$$AZ = 180° + \arctan\left(\frac{\tan\theta}{\sin\alpha}\right)\ \text{(degrees)}$$

α is earth station latitude

θ is relative longitude or satellite longitude minus earth station longitude ($\theta < 90°$)

R is radius of Earth (3,957 miles)

D is radius of satellite orbit (26,244 miles)

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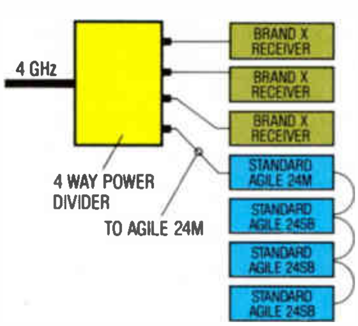

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Figure 7: Region D_3 reliability data

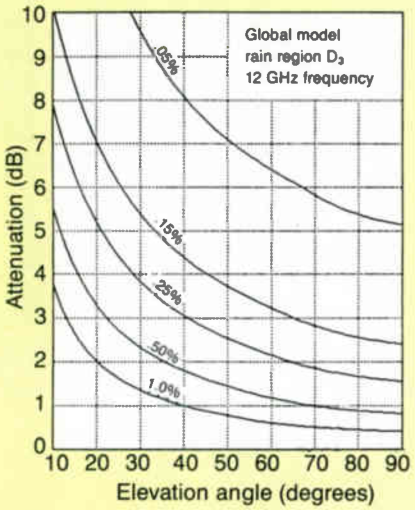


Figure 8: Region E reliability data

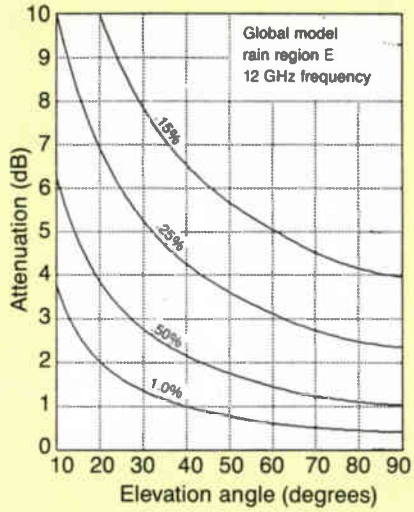
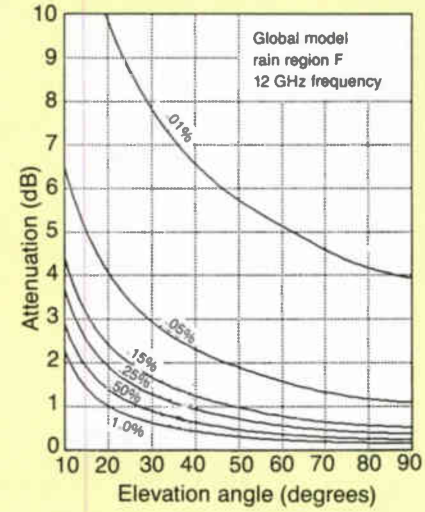


Figure 9: Region F reliability data



With satellite at 85° W.L., solution of this equation yields an elevation angle of 49°. From Figure 6, rain attenuation is 5.1 dB for 99.95 percent availability.

$$T_e = 10\log\left[\frac{265 + 290\left(\frac{3.24 - 1}{3.24}\right)}{265}\right] = 2.4\,\text{dB}$$

Total fade is 5.1 + 2.4 = 7.5 dB. From Figure 10, EIRP is 47 dBW. Using Equation 5, and substituting for $(C/N)_D$ = 19.6 dB, the antenna gain should be:

$$G_R = (C/N)_D - \text{EIRP} + 74.8$$

$$= 19.6 - 47 + 74.8 = 46.4\ \text{dB}.$$

It should be noted that this value of gain also will satisfy Equation 6 for minimum faded $(C/N)_D$ of 8 dB.

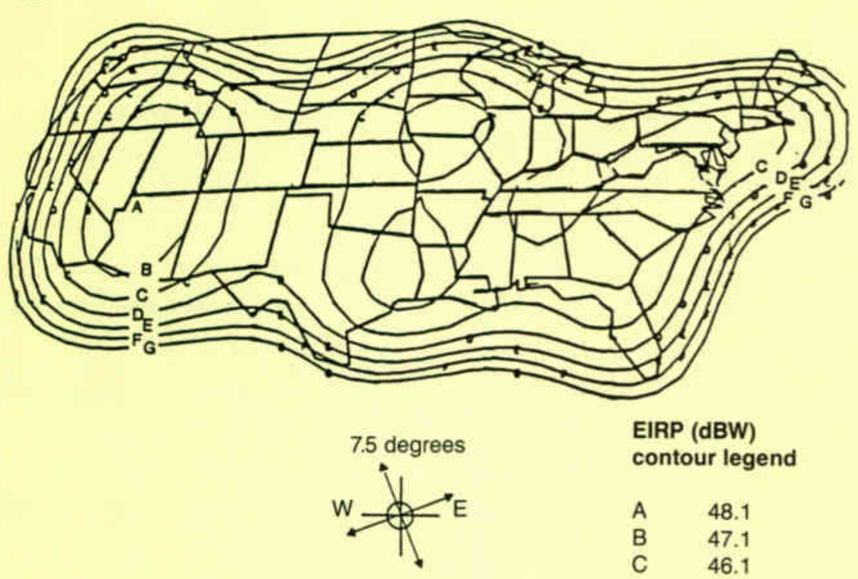
$$(C/N)_D\ \text{faded} = 19.6 - 7.5 = 12.1\ \text{dB}.$$

This analysis shows that a 2.3-meter diameter antenna will satisfy the requirement of $(S/N)_V$ of 53 dB in clear weather, with greater than 99.95 percent availability at this site.

In this case the $(S/N)_V$ was the critical limiting design factor. In some other region where the rain rate or elevation angle is less favorable, the critical design factor for dish size might be availability.

It can be shown that a target value of 99.95 percent availability (4.38 hours per year) can be obtained everywhere in the CONUS (except southern Florida) using a 3-meter antenna with Satcom K1. In southern Florida a 3-meter antenna will provide 99.90 percent availability to a $(C/N)_{PD}$ of 8 dB.

Figure 10: RCA Satcom K1 CONUS beam EIRP contours



EIRP (dBW) contour legend	
A	48.1
B	47.1
C	46.1
D	45.1
E	44.1
F	43.1
G	42.1

Other factors

There are several precautions that must be taken for a successful installation at Ku-band. Remember, the wavelength of the Ku-band frequency is one-third that of C-band. It follows, therefore, that much tighter tolerances are required in the microwave portion of the earth station. The components have been designed for these tighter tolerances, but mishandling or poor practice at installation could destroy these tolerances and thereby cause considerable degradation. For example, do not attempt to use a C-band dish, install a Ku-band feed and expect performance as if it were a Ku-band design. Use antennas from reliable manufacturers. The RMS deviation from a paraboloidal surface should be less than 0.025 inches.

Extreme care should be exercised in assembly of a sectionalized dish. Don't force fit anything. Mating holes should line up without force fit. Don't overtorque or undertorque bolts.

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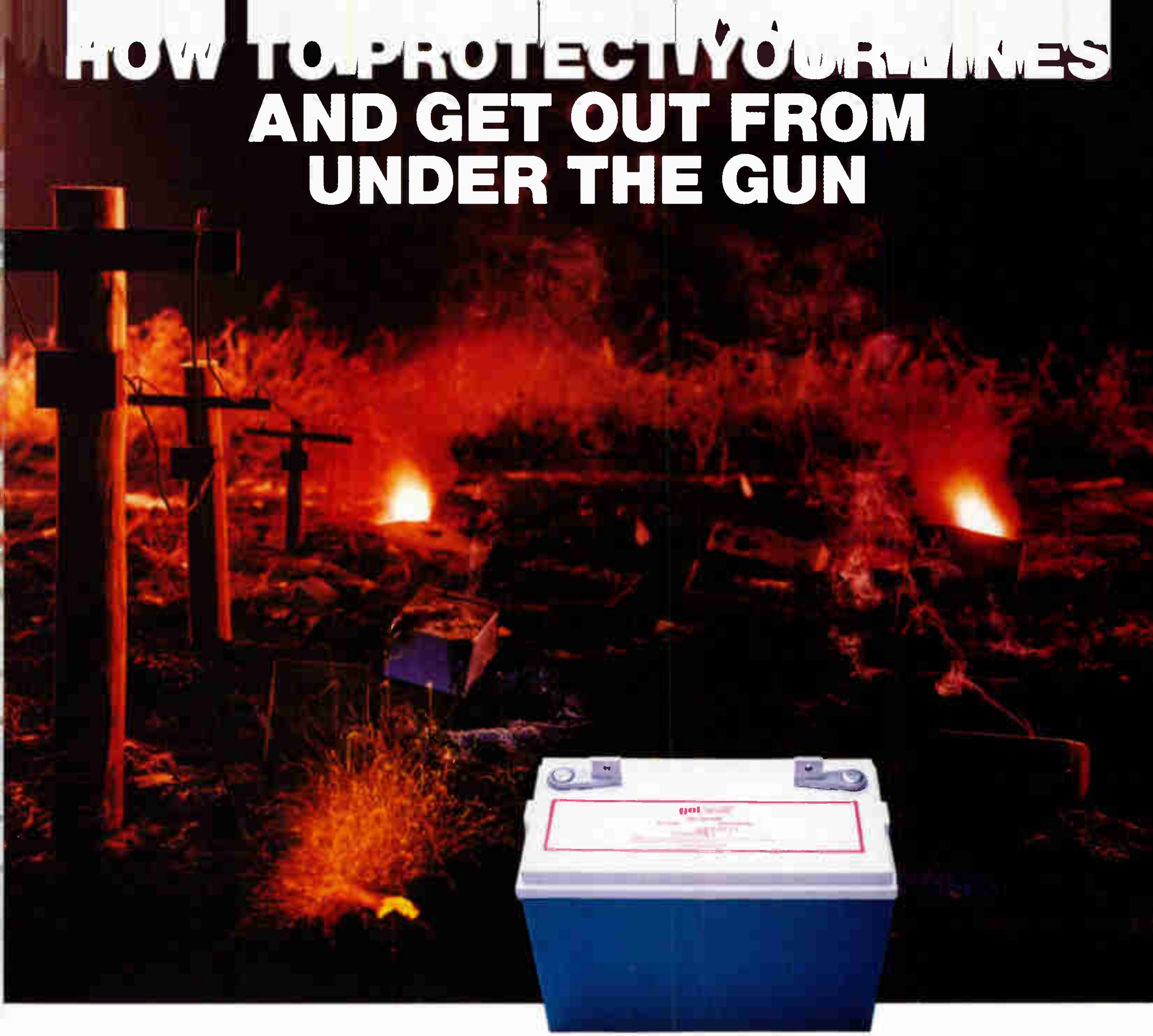

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Reader Service Number 35.

Technical training: Meeting your needs

By Dana Eggert
Industry Consultant
And Byron Leech
National Cable Training Institute

Most cable operators would agree that technical training is an essential ingredient for reducing service calls and long-term maintenance costs, maintaining technical quality and integrity, increasing employee productivity and improving morale through motivation and incentives. Why, then, does technical training still seem to be difficult for many CATV technical departments to provide?

There are numerous existing technical training programs available ranging from basic to complex, self-study to vocational school, reasonably priced to expensive, all of which would provide some benefit to the employee. Perhaps the missing link in CATV technical training is organization—an organized training program addressing the specific needs of the employee "student" *and* the system.

When amplifier vendors visit a cable system and display their wares, it is easy for the technical staff to evaluate—the products have to meet minimum technical specifications, be price competitive and must obviously meet the system's needs for projected growth and service. In addition, the staff knows exactly how the products work and how and where they fit into the system.

If a technical training vendor calls on your system, the situation can be completely different. While the product may be an excellent program, what industry specifications does it meet? How does it compare in price and effectiveness to another program? Where and how does it fit into the organization? Will it meet the students' needs? And what kind and how much of a commitment will it require from management to be successful?

Investing the time and money into a training program does not have to be difficult nor unreasonable. And, with a little creativity and continuous support from management, the program will be successful.

What should a training program do?

The first step is, in fact, establishing management's own objectives and desired results of a technical training program. When, for example, a cable system commits to thousands of dollars of amplifiers, the management has already determined that the objective is to upgrade or rebuild the cable system with more channel capacity, better security, etc. The desired return on the investment is increased pay penetration, service call reduction, increased pay-per-view revenues, increased addressable converter rentals and so forth.

Establishing the purpose for training and the training objectives should be a process similar to purchasing amplifiers. Technical training goals might include increasing productivity, reduce service calls, raise the "quality quotient" or the employees' attitude toward quality performance, increase the employees' safety awareness and increase the overall level of technical workmanship. The acceptable return might include a 30 percent reduction in service calls and a 20 percent increase in production. This creates a dollar savings to the cable system, and a reduction in outages, illegal hookups, maintenance costs and on-the-job accidents.

Once these objectives are established, management must maintain a commitment to them. Like the rebuild, once you begin the program, you cannot stop halfway through and expect to achieve the same return or results.

Once the company has determined its needs for a training program, the next step is to determine what each technical employee's training needs are. Many of us have suffered through a literature or algebra class that we knew we would never in our adult lives ever be able to apply the information—and often that has been the case. Similarly, trying to fit the same technical training

Technical training needs assessment questionnaire

1. How long have you worked for the company?
2. How long have you been an installer?
3. Are you now required to perform installations? Can you perform a drop installation without assistance?
4. How many hours of on-the-job training did you receive for this position? How many hours of class training or off-the-job training did you receive for this position?
5. Are you required to climb poles? Did you receive any formal training from the company on pole climbing? From another company?
6. Do you check your safety belt before each climb? Do you wear a hard hat during a climb? Do you climb within the normal climbing space?
7. Have you ever had a pole climbing accident? More than one? Do you feel you need additional pole climbing training?
8. What is the average time it takes you to install a normal drop? What areas of drop installation cause you frequent delay in completing the drop?
9. Have you ever had a citation while driving a company vehicle? Have you ever had an accident while driving a company vehicle? Do you wear your seat belt while operating your vehicle?
10. Have you ever had CPR training? If so, was it more than one year ago?
11. Have you ever had a conflict with a subscriber that you could not resolve by yourself? Do you introduce yourself to the subscriber before beginning the drop? Have you received any customer service training? If so, how many hours?
12. Do you have any problems in completing the work order accurately?
13. Do you understand the purpose of grounding the drop?
14. Are you required to take signal level measurements for each installation? Do you know how to operate a signal level meter?
15. Are you required to take signal leakage measurements at each drop? What is the first thing you check if you discover signal leakage at the drop?
16. Have you ever had any technical math training?
17. How frequently are you unable to troubleshoot a problem drop and have to call your supervisor or indicate the problem on the work order? Daily? Weekly? Monthly?
18. Do you want to work toward training for another position? If so, what position would you like to work toward in the next two years? In the next five years?
19. Have you ever supervised others? Have you ever had supervisory training?

'Investing the time and money into a training program does not have to be difficult nor unreasonable'

program to every technical student demonstrates the same principle and is not necessarily the most cost-effective approach to meet the desired results.

Determining what your students' needs are perhaps is the most time-consuming part of this process. However, using a job description (with management's objectives built in) for each technical position in your organization, you can determine more easily areas of weaknesses consistent in the entire technical work force that could be addressed in a uniform program, as well as specific areas that should be addressed in individual student curricula.

Ideally, to glean the most information, technical employees should be interviewed by their supervisor or the designated training supervisor. However, a questionnaire built from the respective job description also can determine the employees' weaknesses and needs as well as their objectives for professional growth. From this questionnaire the supervisor can develop an individual curriculum to meet those needs.

Based on the results of the interview or completion of the questionnaire, the training supervisor can develop a technical training curriculum for each student on a time and dollar investment continuum. Further, if the cumulative results for all installers indicate similar recurring problems or areas that should be addressed through training for all technical employees in that position, an almost uniform training curriculum could apply to those employees.

Investing in the development of in-house programs to address those symptoms common to an entire work force is, of course, a feasible option; however, many already existing training resources are available from which to build your curricula.

Multiple resources

Fortunately, many technical training "products" are available to the industry. The types of information delivery include self-study, vendor-sponsored seminars, equipment-specific workshops, in-house customer service by a training consultant, certification programs, and video and audio tapes. Ideally a curriculum would include multiple types of training resources.

Self-study programs:

An important aspect of any training program is to provide a solid basis of technical information needed to perform in a job position. One of the most reliable sources to provide that very basic (yet very necessary) foundation is the self-study program. While many such programs exist, the only CATV-specific program is provided by the National Cable Television Institute (NCTI).

While many may have accused self-study courses of being outdated, their programs, nevertheless, have a proven track record of increasing productivity. In a 1984 comparison between identical test groups in a Canadian system using NCTI training to a California system not yet using NCTI training, the overall results indicated an 18 percent increase in productivity in the Canadian system and a savings of roughly $27,000 the first year, with a initial training investment of $4,000—almost a five-fold return on the training investment. (Since this study, NCTI has continued to upgrade and further improve its programs and predict as good if not better productivity results with its product.)

Self-study requires good discipline on the part of the student and may not fit every student's needs, but it can play an instrumental role in meeting the needs of the company.

Certification programs:

Used in conjunction with self-study programs, the SCTE-sponsored Broadband Cable Technician/Engineer (BCT/E) Certification Program provides an almost ready-made training curriculum for technicians and engineers that is certainly cost-effective. This program is primarily based on a self-study principle with SCTE providing an

Reader Service Number 37.

Installer job description

Position: Installer
Purpose: To represent the company at all times in a professional manner while performing installation tasks including drop installation, drop disconnect, vehicle operation, adminstrative requirements; and to perform all tasks using quality and safe procedures.
Responsibility:
1. Performs routine drop installations at the rate of six (6) per day, as assigned.
2. Performs routine drop disconnects at the rate of ten (10) per day, as assigned.
3. Checks the signal levels at each newly installed drop.
4. Checks for signal leakage at each newly installed drop and at each reconnected drop.
5. Climbs poles to perform drop installations and disconnects using company required safety procedures.
6. Climbs ladders to perform drop installations and disconnects using company required safety procedures.
7. Operates a company-issued vehicle according to company-required safety procedures and maintains the vehicle's external and internal appearance.
8. Accurately and thoroughly completes work orders for each assigned work activity.
9. Maintains all company-issued tools and equipment in good working order.

extensive bibliography of study materials. However, through regular attendance at local SCTE chapter meetings, technicians and engineers are exposed to training specific to the BCT/E exams.

This type of program has several advantages. First, it is already organized to address the most common yet important areas of performance for technicians and engineers. In addition, the program is inexpensive ($15 to apply to the program, then $10 per exam), yet ensures the knowledge and skills most applicable and important to those positions through examination.

Finally, as with most certification programs, there is a "post-graduate" aspect built into the program. In order to maintain a current status on the BCT/E certificate, the technician or engineer must participate in on-going technical training accredited by the BCT/E Program, or retake the exams every three years. This aspect is key in meeting and maintaining management's goal for continued quality performance.

Jones Intercable has taken the concept of certification-type training one step further by developing a similar program for its installers. The Jones Installer Certification Program will be the first in the industry for this position. The program will include individualized curricula and exams for each area of required performance and incorporate all types of training resources including self-study, videotape, seminars and workshops, as well as some of their own training tools developed in-house.

Workshops and seminars:

There are numerous seminars and workshops held across the country that provide valuable CATV-specific technical training along with other, equally important topics, such as basic supervision, time management, basic writing skills, project management, computer skills and so forth. This type of information delivery is cost-effective in that a large group of employees can receive the same information required for a level of performance in a short period of time; for example, customer relations or CPR. On the other hand, if a single employee needs more specialized training—for example, microwave training—a week-long seminar is specific to that need. Another advantage to including this type of training in the curriculum is that the employees bring from the session information that is immediately applicable, significantly improving their short-term productivity. If the new skills applied are then regularly reinforced by their supervisor or the system's management, these skills will become a permanent part of their on-the-job performance.

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Reader Service Number 40.

Advanced installer curriculum

Year one:

Source	Training topic	Format	Time Required	Price	Date Complete	Grade
NCTI	Installer-Tech	self-study	12 mos.	$350		
SCTE	Confident Climbing II	videotape	30 min.	$ 0		
SCTE	dB and dBmV	videotape	30 min.	$ 0		
Local	CPR	seminar	2 days	$ 75		

Year two:

Source	Training topic	Format	Time Required	Price	Date Complete	Grade
Magnavox	Mobile Technical Van	seminar	3 days	$300		
AMA	Writing for Success	self-study	6 mos.	$ 95		
Pryor	Basic Supervision I	audiotape	2 wks.	$ 90		
Contract	Customer Relations II	workshop	2 days	$100		

riculum provides many of the same advantages as seminars and workshops. In addition, visualizing the desired work activity continues to be an effective means of learning.

One of the most cost-effective technical training videotape resources is the SCTE. Through a series of tele-seminars transmitted over satellite, this organization has provided the opportunity for cable systems to record the entire library of SCTE videotapes. Other important resources for CATV-specific videotapes are equipment vendors.

Other sources:

Although not necessarily to be included in a specific curriculum, there are some training "freebies" that should not be overlooked and are important for reinforcing the more formal training methods. These include regular staff meetings, monthly safety meetings, technical libraries (books, videotapes and other training materials) and intermittent on-the-job inspections by the employee's supervisor.

Putting the curriculum together

Now that the company's and student's needs have been established and the most applicable resources have been defined, it is simply a matter of organizing the training program with respect to time and available financial resources into a curriculum. If, for example, your training budget equates to roughly $250 per employee per year, you simply build a curriculum within this framework. Although the training budget tends to be strictly a management decision, management should be reminded that the lower the training budget, the longer the training will be stretched out; hence, the longer management will have to wait for the desired results. However, budgeting large sums of money for a training program is equally as ineffective without an organized approach.

To follow through on the "seasoned" installer

Basic installer curriculum

Year one:

Source	Training topic	Format	Time Required	Price	Date Complete	Grade
NCTI	Installer	self-study	12 mos.	$240		
SCTE	Confident Climbing I	videotape	30 min.	$ 0		
SCTE	Coaxial Cable Basics	videotape	30 min.	$ 0		
Gilbert	Connectors	videotape	45 min.	$ 50		
SCTE	Cable Handling and Installation	videotape	30 min.	$ 0		
SCTE	SLM Basics	videotape	30 min.	$ 0		

Year two:

Source	Training topic	Format	Time Required	Price	Date Complete	Grade
Intext	Technical Math	self-study	12 mos.	$350		
SCTE	dB and dBmV	videotape	30 min.	$ 0		
SCTE	SLM: Errors and Accuracy	videotape	30 min.	$ 0		
Local	CPR	seminar	2 days	$ 75		
Contract	Customer Relations	workshop	2 days	$100		

who completed the questionnaire, the accompanying two-year curriculum might be organized into the program. A new installer, on the other hand, will need a more basic curriculum.

Once these individual programs are set up, it is a relatively simple task to administer the program. In fact, most of the effort of tracking the student's progress can rest with the student. It is management's responsibility, then, to reinforce the new skills and higher level of performance as well as administer the incentive program, consistently recognizing each student's series of accomplishments.

If you are still not convinced that a technical training program can be cost-effective, relatively easy to set up and specific to the needs of management and employees, you may want to compare some of your cable system's technical statistics to the following. Then rethink the opportunities a technical training program provides:

- One NCTI installer course = 16 service calls (at a conservative $15 per call).
- One $20,000 FCC fine for signal leakage = 57 NCTI technician courses.
- One full-time service technician ($18,000/year) = 60 Magnavox mobile training seminars.
- One complete BCT/E Certification = six service calls ($15 each).
- One on-the-job minor accident ($400) = one Hewlett-Packard "How to Use a Spectrum Analyzer" videotape.
- Ten unhappy subs disconnected ($1,200/year) = 12 customer service workshops.

Advantages of home study

By Stephen J. Simcic
Vice President of Academic Affairs
Cleveland Institute of Electronics

We are living in a world of constant change; nowhere is this as rapid as in electronics. Subjects taught only a few years ago are being eliminated or changed drastically. In order to cope, technicians must involve themselves in lifelong learning.

The technician can keep abreast by reading trade periodicals, joining technical societies, attending manufacturer seminars and enrolling in technical courses. The average technician will become obsolete within five years without a commitment to lifelong learning. You no longer can graduate from a technician program and rest on your laurels; constant information updating is necessary.

If you have not done any technical reading and completed a training program over five years ago, you are becoming technically obsolete. It would be difficult to catch up with the current state of the art without some type of additional formal training. This might involve a night course at a local university, a seminar sponsored by a technical organization or a home-study program.

Home study might be the wave of the future. No longer is it considered "second rate." Universities throughout the United States are expanding extension programs—really, home-study programs. Today's technicians demand a convenient method to update their skills.

Certain advantages are obvious. The most notable is being able to study at whatever time is most convenient for you. It is not necessary to attend a class that might conflict with your employment hours, medical emergencies and social activities. (I personally do not think that this is a major advantage. Certain individuals need the rigidity of a classroom environment. These people cannot budget their time effectively and are constantly putting things off for the future. Do you fall into this category? If so, develop the discipline to devote time to home study.)

Home study can offer the most up-to-date training available. Local colleges often cannot change their curricula as fast as a home-study school can. For example, training in microprocessor technology was offered by home-study schools in the mid-'70s. Many local colleges only now are offering training in this area—some 10 years later.

The majority of home-study schools offer laboratory training that reinforces the theory being taught. These labs are designed specifically for the individual; all equipment is yours to keep. Compare these "personal" labs to a resident school lab. Typically it assigns three or four students to work as a group. Time is limited and equipment is shared by many classes. One student wires the experiment, another takes data and the others merely observe. Essential skills in using tools and equipment, identifying components and interpreting schematic diagrams usually are overlooked.

Students who merely observe lab experiments really do not learn as well as those who perform the experiments. In home study, students must participate in the laboratory experiments and therefore retain much more of the theory. Having their own laboratory also enables the students to rework experiments that may have been performed months ago. You do not have this ability in resident training.

'The average technician will become obsolete within five years without a commitment to lifelong learning'

Quality of instruction is of the utmost importance. A local college often will gear its course for the average student. An above-average student might be bored with the watered-down program. Home study offers a viable alternative. Typically each lesson is written by a subject specialist; the student is learning directly from the source. In resident training the textbook is written by a specialist, too. However, the instructor only may use the textbook as a source of homework problems. Entire chapters may be skipped because of time restraints. Quality can vary immensely.

The best home-study schools offer a considerable amount of individualized attention. Instructors are available on toll-free telephone lines. Students can ask any question—and they often do—many related specifically to their job. You cannot get this one-on-one instructor/student relationship at a large college.

Another advantage to home study is cost of education. It probably offers the "biggest bang for the buck" of any method of study. Tuition covers all lessons, equipment, experimental hardware, service and phone consultation. There are no hidden costs.

Employers also gain. If all of their new employees complete the same industry-specific course, the employer knows that all of the employees have a base technical knowledge. The employer does not have to worry about updating employees where some are "ivory tower" geniuses and other are below standard, but instead can gear future training from this baseline.

The home-study institution typically will work with industry in preparing custom training programs. These programs often are constructed from various standard programs that the school offers. An employer thus can tailor-make a program for the workers. There are considerable time and cost savings for employers selecting this approach.

The major difficulty facing home-study schools today is student motivation. Each school

Reader Service Number 44.

surveyed has its own method to keep up the students' spirits and thereby to keep them studying. This is not a problem if a company decides to work with a school in providing motivation. This may involve tuition reimbursement, on-the-job study time or promotions. Schools provide motivation through instructor contact (via telephone), interesting lab experiments and certification of completion, as well as in some cases a school newspaper. The help lessens the students' feeling of "going it alone."

Selection

At this point, you may wonder how to select the home-study school that is right for you. First of all, make certain that the school is accredited through the National Home Study Council. A listing of qualified schools can be obtained by contacting the council at 1601 18th St., N.W., Washington, D.C. 20009, (202) 234-5100.

Next, see if the school offers any academic "upward mobility." Can credits earned in vocational programs be applied toward an associate degree, for example? The best of the home-study schools will offer degree programs. Narrow your field down to a few schools that are teaching the subject area that you are most interested in. Call them to receive a course catalog and compare the curricula. Don't be afraid to ask questions.

Remember that your tuition dollars are for a good education, not expensive toys or fancy hardware. If two schools offer the same program but one offers a lot of hardware while the tuition is the same, watch out. You don't get something for nothing. Request a sample lesson from each school you're looking at and compare the lessons. Obviously, you'll want to choose the school with the best lessons. After all, you are paying to learn and you can get the hardware separately for less.

Evaluate the school's service by asking for information. Are the people at the school courteous? Do you get information rapidly? If you can't get a catalog rapidly, how good do you think the service is? And remember to request a sample lesson.

Home-study lessons are different from the normal college textbook. Each lesson is both classroom and teacher and must anticipate questions a student may have. It also has to take you a step at a time. The lesson should be conversational and have specific objectives. There should be quizzes after every few topics. This will allow you to measure lesson comprehension *before* taking the lesson examination. If you do poorly on the quizzes, you should reread the topics in question. If something seems puzzling, call the school at once.

The school measures student performance by having you work multiple-choice exams. You fill out an answer sheet and mail it to the school. It is graded, the grade is recorded, and your graded answer sheet is mailed back to you. Instead of doing a few "monster" exams, you do many as you progress. You also can go over the exam questions you missed. This way your grades give a much more detailed and accurate picture of what you've learned. So instead of a single grade for Electronics 101, for example, you have individual grades on a variety of different subjects, and perhaps a few comprehensive exams.

Home study enables you to get clarification on exam questions just by picking up the phone. You thus have the opportunity to ask detailed questions and get a satisfactory answer. In a residence school you're often lucky to get the exam administrator's attention. You're apt to get a clipped answer, even if the administrator does know the subject. Grade appeals afterward are usually out of the question.

In a home-study course you probably won't face the problem of trying to learn from someone you can't get along with. The home-study schools maintain a staff of instructors so if you do run into a personality conflict, you can ask for another instructor. Home study does not delay your progress with courses that are filled up and only are offered once or twice a year. You can start at any time.

But home study isn't for everyone. Nothing is handed to you merely because you occupied a seat in a classroom for awhile. It takes initiative and determination as well as plain hard work. But consider the qualities employers seek. Home-study graduates will get more than just information about electronics. They gain problem-solving skills and work habits that make them self-starters. Given the competitive nature of businesses today, who would you hire?

Drop installation training

By Levon Djerrahian
Marketing Manager, Sachs Communications Inc.

In cable TV's earlier years, drop installations were in no way standardized or organized as they are today. Each installation represented an improvisation by installers who used their better judgment to complete the drop. Since the industry had no past to build upon, know-how and experience were non-existent.

With the advent of cable TV came cable hardware, each product requiring a different technique for installation. As the industry started to settle down to some form of stability, standards and norms for installation techniques were developed. Experienced installers trained newcomers, but this proved inadequate as a basis for training. Cable companies realized the need for standardization in hardware and techniques used, to reduce costly recalls and to extend plant life.

Recall costs due to poor quality hardware and/or incorrect installation techniques can account for up to one-fourth (sometimes even more) of the cost of service calls. Considering the fact that all of this can be prevented at installation time, it becomes obvious that there is a great need to train personnel on the correct usage and installation technique pertinent to the product being used. In short, the three ingredients for longevity are installation technique, quality product and knowledge of the product's proper usage.

Most system operators have some form of training program for new installers and technicians. This comprises teaching rules and regulations, pole clearances, and theory mostly in electronics. Classes usually are followed by field experiences where senior staff shows the apprentices how to apply the theory learned. This is followed by actual installations in the field by the apprentices until they convince the supervisor that this is what they want to do and are capable of doing well. It takes about six months before a trainee becomes financially productive, so all of the time and effort spent in training is strictly an investment in the future.

Training programs like this are excellent in themselves but still leave a few minor but important gaps. First, new and improved drop installation hardware is being introduced at an accelerated rate, especially in recent years. If not installed exactly as specified, these items do not perform properly and can be a cause of drop failure, leading to costly recalls. Second, radically new drop installation techniques now are being developed with an eye on avoiding problems associated with ingress and egress. These changes are unavoidable and it is very important that not only the trainee but the veteran technician as well be kept abreast of such developments.

'The three ingredients for longevity are installation technique, quality product and knowledge of the product's proper usage'

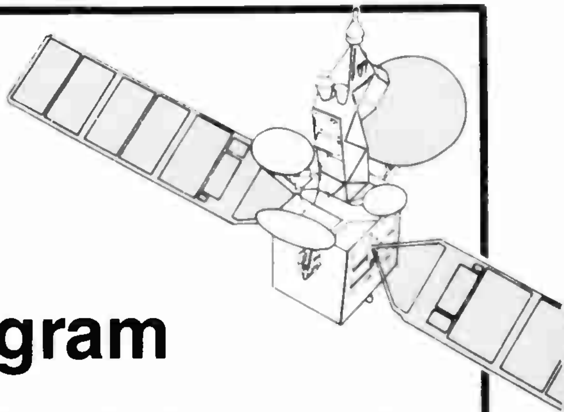
Seminars and workshops

One very effective way of bringing the experienced senior staff up to date with techniques is for them to attend seminars dealing with the subject. Instruction sheets can help explain the basic installation procedures of an item, but these cannot replace the two-way communication that is available in seminars. Ideally, these seminars also should include a hands-on workshop to familiarize users with the new products and to give them a feel for the techniques being introduced.

Labor is an expensive commodity. Drop installation labor costs account for a chunky 18 percent of the total cost of a build. So, installation should be done properly the first time. To avoid service call cost buildups, longevity and endurance must be taken seriously into consideration at the time of building the plant, whether a new-build or a rebuild.

The cost of a plant is very high, so it must be built to last. It is a pity to have to prematurely rebuild because poor quality items were used and did not last as long as they should have. Drop hardware represents about 2 percent of the cost of a build. This small figure plays a major role in deciding on the longevity and cost efficiency of a plant. Coupled with proper training, it could make the difference between profitability and failure.

With rebuilds and new-builds that are the major expenditures in the immediate future, systems must invest in the reliability and performance of their plants. Given the proper training coupled with refresher courses on new techniques, installers and technicians become very cost-efficient and, as probably the only contact of the system with the end-user, they can be excellent public relations officers for the company. ■



SCTE
Satellite
Tele-Seminar Program

As a continuing service to the industry, SCTE provides uplinked videotape programs on technical training each month, making them available to cable systems across the country for downlink recording. Tele-Seminar programs may be received by any cable system and recorded for immediate and future employee training purposes.

Upcoming Dates For 1987

JUNE	30	"Video and Audio Signals and Systems – Part II," a BCT/E Category II review course featuring Paul Beeman of Viacom Networks; plus the SCTE promotional videotape.
JULY	28	"Engineering Management and Professionalism," a BCT/E Category VII review course featuring Wendell Bailey of the NCTA.
AUG.	25	"Q. and A. Session with FCC Engineers," featuring John Wong of the FCC and Cliff Paul consultant for RT/K.
SEPT.	29	"Ku-Band Technology and TVRO Calculations," featuring Paul Heimbach and Virgil Conanan of HBO.

The Satellite Tele-Seminar Technical Training Program Series is made possible through contributions from the following SCTE Sustaining Member Companies:

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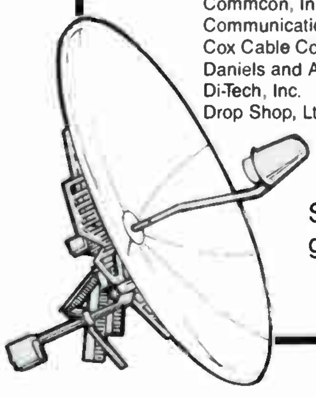
Texas Cable Television Association
Theta-Com CATV/Texscan
Times Fiber Communications
Toner Cable Equipment Company
Triangle Communications Systems
Trilogy Communications
Triple Crown Electronics, Inc.
Tulsa Cable Television
U.S. Cable, Inc.
United Artists Cablesystems Corp.
United Video, Inc.
Viacom Cablevision
Wavetek Corporation
Western Communications, Inc.
Zenith Electronics Corp.

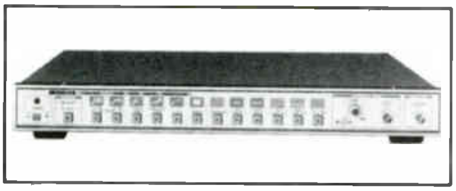


SPECIAL NOTE:

SCTE's Satellite Tele-Seminar time schedule has changed! Until further notice, all Tele-Seminar programs will air from 12 to 1 p.m. (formerly 1 – 2 p.m.) ET on Transponder 7 of Satcom IIIR.

PLEASE MAKE NOTE OF THIS CHANGE ON YOUR CALENDAR!

Reader Service Number 1.



Signal generator

Leader Instruments has announced its Model LCG-410 digital video test generator. The product features precision NTSC, EIA, SMPTE and full-field color bars, stairstep, modulated stairstep and other functions. All signals are synthesized from a 10-bit digital-to-analog converter for precision and long-term stability.

For more details, contact Leader Instruments Corp., 380 Oser Ave., Hauppage, N.Y. 11788, (516) 231-6900; or circle #132 on the reader service card.

Set-top terminal

Scientific-Atlanta has introduced its Model 8528 digital set-top terminal, operating at 550 MHz to allow maximum channel capacity and incorporating all the features of the Model 8525. The product allows frequency line-ups (standard, HRC, IRC and EIA) and service authorizations to be programmed through an infrared remote control receiver.

Options such as parental control and remote enable/disable are programmed via the subscriber options transmitter, a desk-top transmitter used by the cable operator. This is said to eliminate the need for PROM programming, allowing the operator to place the terminal in the field without opening it.

For more information, contact Scientific-Atlanta Inc., 1 Technology Pkwy., Box 105600, Atlanta, Ga. 30348, (404) 441-4000; or circle #122 on the reader service card.

Protected cable

The Comm/Scope Division of General Instrument has introduced its Cable Guard cable. It was designed to address special cable protection requirements when something more than standard jacketed yet not as much as steel armored cable is needed. The jacket design incorporates air cells, surrounded by linear medium-density polyethylene, that act to absorb forces applied to the cable conductors; these air cells are said to act as an effective barrier to cut through as well.

According to the company, Cable Guard maintains the same degree of flexibility of standard cable and is lightweight with the same ease of connectorization of standard jacketed cable.

For more information, contact General Instrument's Comm/Scope Division, P.O. Box 1729, Hickory, N.C. 28602, (704) 324-2200; or circle #124 on the reader service card.

Impedance tester

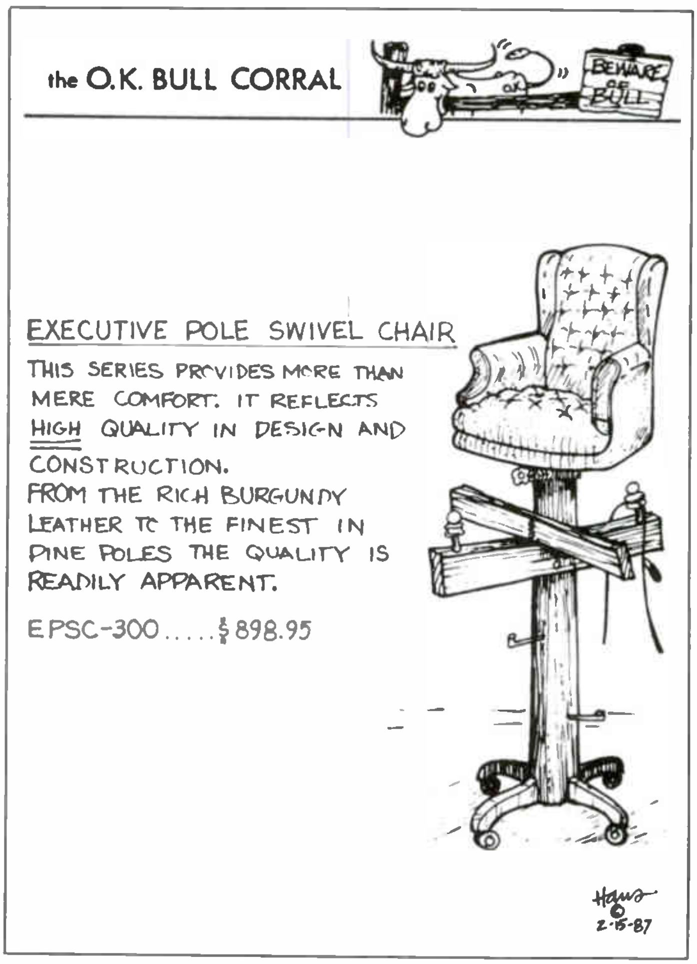
The Sensitek VIT 64 variable impedance tester from Biddle Instruments utilizes very low test voltages (peak of either 0.2 or 1 V) and is said to prevent damage to components on loaded backplanes or circuit cards. Connections to the measurement nodes can be made either from a 64-pin DIN connector on the instrument face or via an optional test pod.

Internally, the tester's software addresses the correct nodes for a "learn" and selects voltage, sampling time, gain and tail impedance that provides an adequate signature with 12-bit resolution. Options include a special mode that permits the operator to watch a unit test point by point, plus single-step and loop testing.

For additional information, contact Biddle Instruments, 510 Township Line Rd., Blue Bell, Pa. 19422, (215) 646-9200; or circle #129 on the reader service card.

LAN guide

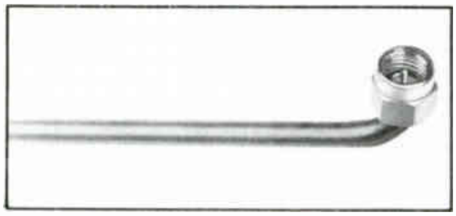
National Semiconductor is offering its new



Courtesy Parallex

product guide describing the company's IEEE 802.3 local area network products. The guide contains product data sheets and application notes detailing the LAN chip set, consisting of the serial network interface and coaxial transceiver interface.

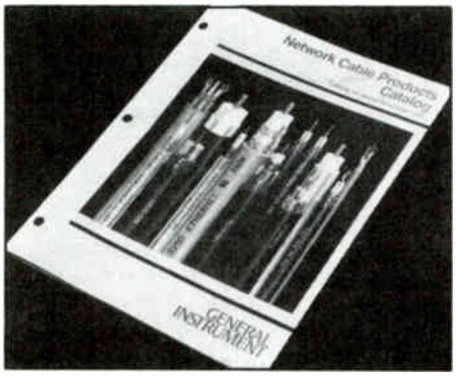
For more information, contact National Semiconductor, P.O. Box 58090, Santa Clara, Calif. 95052-8090, (408) 749-7421; or circle #130 on the reader service card.



Cable assemblies

According to Precision Tube Co., its new right-angle coaxial cable assembly series provides improved VSWR, lower insertion loss and greater economy. Available in .141 and .085 copper cable and in lengths up to 24 inches, the assemblies are said to assure performance ratings 20 percent better with savings as much as 20 percent over conventional right-angle plug connector-cable devices.

For more details, contact Precision Tube Co. Inc., Church Road and Wissahickon Avenue, North Wales, Pa. 19454, (215) 699-5801; or circle #127 on the reader service card.



Cable catalog

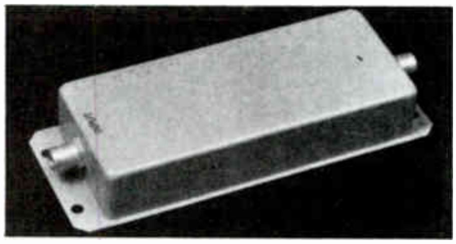
The Network Cable Division of General Instrument is offering its color catalog of cable products. It describes the company's line of conventional and plenum network coaxial cables. Also included in the catalog are satellite antenna cables, special application cables and twisted-pair cables.

For more details, contact Network Cable Division of General Instrument Corp., P.O. Box 1729, Hickory, N.C. 28601, (800) 982-1708; or circle #138 on the reader service card.

Grounded trap

Northeast Filter Co. has introduced its Perm-aTrap, a new trap with a solid brass grounding block, crimped RTV-sealed sleeve and punched wrap-around label. The product is grounded through substantial metal interference rather than resistance iron soldering. The RTV seal is accomplished through bonding action to the outer sleeve rather than a pressure rubber/metal seal. Connector ports also are sealed by this process.

For more details, contact Northeast Filter Co. Inc., 14 Corporate Circle, East Syracuse, N.Y. 13057, (315) 437-7377; or circle #139 on the reader service card.



Low-pass filter

Microwave Filter's Model 5620 low-pass filter is used on the input of a LAN translator to reduce the bandwidth used for point-to-point data. Limiting the bandwidth allows use of an additional service in the broadband system. The product passes 10.75 MHz of the possible 18 MHz band; its passband is 5 to 30.5 MHz with approximately 4 dB loss at 40.5 MHz. Impedance is 75 ohms and connectors are type F.

For further details, contact Microwave Filter Co. Inc., 6743 Kinne St., East Syracuse, N.Y. 13057, (315) 437-3953; or circle #134 on the reader service card.

Business Directory

DONLEY INTERNATIONAL INC.

"Satellite Communications Equipment"

STOCKING DISTRIBUTOR FOR
HEADEND & DISTRIBUTION EQUIPMENT

CATV MATV SMATV

JD Thomas
President

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Houston, Texas 77055
(713) 956-2984
800-231-0629 #538

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CHANNELCUE

We Repair:
Channelcue Audio/Video Switching Equipt, Line Equipt., & Field Strength Meters

LEE ENTERPRISE
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P.O. Box 590
Deshler, NE. 68340
(402) 365-7520

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THE INSTALL PEOPLE.

"SERVING THE INDUSTRY SINCE 1974"

- Aerial Installs
- Underground Installs
- Drop Transfer
- Commercial Developement
- Design
- Tap Audits
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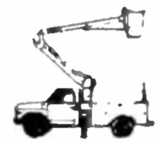
P.O. Box 6494
Orlando, Florida 32853
1-305-898-7134

Reader Service Number 52.

AERIAL BUCKET TRUCKS

Large selection geared for CATV
Telsta • Versalift • used & reconditioned.

Contact us for further information.

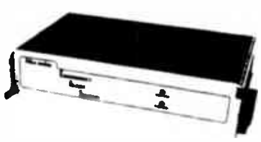


Bucket Trucks

STANDARD TRUCK & EQUIPMENT CO.
1155 Hill St., S.E. Atlanta, GA 30315
Established 1929
1-800-241-9357
In Georgia (404) 622-4461

Reader Service Number 53.

Emergency **A**lert **S**ystem
From
IdEA/ONICS



(701) 786-3904

- ★ Emergency access to all television channels, including midband and superband. 54 channels.
- ★ The perfect way to improve community relations and provide an invaluable service.
- ★ Easy installation and operation
- ★ Standard 19" Rack Mounting.
- ★ Compatible with all headends
- ★ 14 Day Delivery.
- ★ Full One Year Warranty.
- ★ **54 channels for under $3,000.** (12 channel units also available)

IdEA/ONICS
Box 224 Mayville, ND 58257 701-786-3904

Reader Service Number 54.

INDEPENDENCE ELECTRONICS INC.

CONVERTER SPECIALIST
-REPAIR-
BUY/SELL USED EQUIPMENT

DOUG JONES, President
(816) 836-1094

119 S. Main
Independence, MO 64050

Reader Service Number 55.

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CONTRACT INSTALLERS, INC.

UHF Radio Equipped Trucks • Uniformed Installers

HOUSE INSTALLATIONS
Aerial · Underground · Pre-wire
APARTMENT INSTALLATIONS
Post wire · Pre-wire · Commercial Building
Tap Audits

Install or Remove Traps and/or Converters
Drop change over for System Rebuilds

LENNY FISCHER
(414) 582-7087

P.O. Box 1564
Appleton, Wisconsin 54913-1564

Reader Service Number 56.

TNT

TechNeTronics Inc.
192 Route 9W
New Windsor, N.Y. 12550

CONSTRUCTION (MDU, Aerial, Underground, LAN) ★ AUDITING MAPPING ★ ENGINEERING

CALL ANDREW HEALEY at (914) 561-7880

As always, the results of our work as well as the workmanship itself are fully 100% guaranteed by TechNeTronics-the name you can depend on.

Reader Service Number 57.

Training for a better system

By Rickey Luke
Vice President of Engineering, Storer Cable

Many people believe that the cable industry is much like a utility—a company that has a monopoly on a particular service and is "the only game in town." This type of thinking has led in some cases to the attitude toward subscribers of "That's the way it is. If they don't like it, that's too bad." In the real world, however, every time cable customers get a bill they make a decision about whether to keep the cable service or not. As a matter of fact, every time customers turn on the television set or use some cable-related service, they make a decision whether to keep cable or not.

Since cable television is a service business dependent on people, we must monitor continually how much the efforts of our employees affect our operation—their ability to get the job done, their motivation and their technical background. Fortunately for the cable industry, there are multiple opportunities to increase one's technical background. There are opportunities for formal electronics training through correspondence schools or through attending classes at educational institutions at night. Strictly cable-oriented courses also are available. Additionally, the Society of Cable Television Engineers has many hands-on seminars that add to our employees' technical expertise. The whole idea is to enable them to rationalize in theory what the solution to a problem is and then implement it. Without this education, they are back to the old trial-and-error procedure to find solutions to problems.

One of the personnel objectives of a cable company is to have its employees continually stretch themselves to provide an efficient and productive operation. With proper training, motivation and goals established for our employees, we not only will keep customers, but also will be acquiring additional ones.

Employee involvement

Since we are a service-oriented business and every aspect of our business deals directly or indirectly with the public, it is important that all of our employees are totally involved in our operations. In order to promote complete involvement by our employees, they must have a history of the industry and the company. Employees also must understand that a commitment to training has to be made to provide the highest quality service to our customers. Employees committed to training will want to do their best to keep all the customers satisfied with cable services and the system.

Training means professionalism. Whenever a customer shows inappropriate behavior (such as anger or hostility), employees are able to *think* instead of feel, *act* instead of react and remain in control. Professionalism is a very important part of the job of installers and service technicians, since their attitude and behavior affect the customer's image of the employees and the cable system. When installers or service people conduct themselves in a professional manner, the customer feels in good hands and will react well to them and to what they say. That makes their job easier.

Employees want to be part of the team and are expected to contribute to the team effort. Therefore, as a supervisor, you should set high expectations and always encourage them to meet these expectations. When these expectations are met by the employees, you should exemplify and compliment them. Always compliment good work when it is done. If, however, the

AD INDEX

'Don't say that you support training and then let your actions show that training is in fact in last place'

job is not being done correctly, do not allow it to continue. Regroup, coach and retrain the employees. Whenever opportunity allows, broaden their horizons with increased responsibility.

A supervisor must be willling to make an extra effort in order to get employees to stretch themselves. In many cases, this is where employee training is begun and completed. The supervisor must understand that training is much more than getting the employees to know the basic functions of their duties. Also, training employees consists of more than just dishing out information.

In order for employees to be effective, a supervisor must make certain that they are absorbing facts and sharpening their skills. As a supervisor, you must make training a priority in your own mind. It is easier to let other pressing problems take priority; however, this can have a negative influence on your training outcome. Make no mistake: The people who work for you can read your priorities, whether stated or unstated. Don't give mixed messages. Don't say that you support training and then let your actions show that training is in fact in last place. Make it as easy as possible for training to be scheduled. Also make it easy for your people to participate in training. Once this has been accomplished, make sure refresher sessions and retraining also are available.

It is necessary to reinforce good performance. When you observe employees using the skills learned in training, give them a verbal pat on the back. Also, monitor their performance and make sure that you insist that all new skills are being used. Talk frequently with your people and ask them how they're doing. Understand their point of view. Listen to their ideas and suggestions; they may have a perspective that you don't. Your employees may provide you with information when you need to make decisions. These points will make learning an interesting and prosperous experience for both the supervisor and the employees.

Employee advancement

A dead-end job without any possibility of advancing is thoroughly demoralizing. Some supervisors turn off their best workers by giving them more of the same work. Many such employees become disgruntled and feel they are being punished for being good workers. Cross-training, on the other hand, is seen as a reward, the opportunity to learn something new. It helps everyone when technicians and installers are able to handle all field operations. Everyone benefits when customer service representatives who answer the phones all day are able to do other internal operations, or when lead technicians or internal operations people are able to understand the operation of the whole company.

Cross-training prepares employees for future advancement. But it is not one smooth road. It can be an uphill battle much of the way, but most people know that an effective training process is never easy.

With good performance reviews, however, you can do much to help people over the rough spots. The important thing is that every performance review should end on a positive note. It is your job to point out shortcomings as you see them because you are looking for improvement. Then discuss what additional coaching and retraining is needed, and end the performance review with encouragement to continue the good work. Let all employees know that cross-training is making them more valuable. The evidence shows that cross-trained employees have the best morale and are the most loyal to the company.

In conclusion, a quote form Walt Disney: "You can dream, create, design and build the most wonderful place in the world . . . but it requires *people* to make the dream a reality."

Congratulations

Dean Owsley
Regional Technician
Cardinal Communications

Dean's essay, entitled "There is a time," was chosen as the winner of our first annual essay contest. Dean won, but there were a good many strong competitors. And we felt it only fair to have a list of the finalists accompany Dean's essay.

Again, congratulations to Dean, thanks to all of those who entered, and the very best of luck to all next year.

There is a time


The Owsley Family.

There is a time—a time for communication in the engineering community and a commitment of support to the Society of Cable Television Engineers.

Dramatic improvements in broadcasting technologies are generating new opportunities in today's television industry. The growing number of delivery systems, programming needs, competitive technologies and marketing concepts are only a few examples of the cable industry's short-term and very promising long-term challenge. Timely inroads into these expanding technologies are only possible through communication in the engineering community and a commitment of support to the Society of Cable Television Engineers.

Communications Technology, through its printed pages, has inspired and motivated its readers to organize meeting groups across the United States—generating technical seminars and SCTE chapter development.

Communications Technology gives me precise and quantitative information on new technologies, products, news, calendar of events, feature articles and updates on the Society of Cable Television Engineers via the SCTE *Interval*. When one considers the complex nature of the cable industry, *Communications Technology*, through its talented and professional staff, is the eyes, ears and voice of progress.

There is a time—a time when one magazine stands out in our minds as the leader. A leader in the engineering community with continuing support of the Society of Cable Television Engineers. . .and *my* time is gauged by the arrival of my next issue of *Communications Technology*.

Dean Owsley

The Finalists:

Ken Abel
Cablecom of Fargo
Fargo, N.D.

John Cogley
Armstrong Utilities
North Lima, Ohio

Alan Feldhausen
Beatrice Cable TV
Beatrice, Neb.

Pam King
Jones Intercable
Englewood, Colo.

Deborah Logiacco
Brookhaven Cable TV
Port Jefferson Station, N.Y.

Denny McLean
Tele-Communications Inc.
Hamilton, Mont.

Stan Muntz
Tele-Communications Inc.
Englewood, Colo.

Todd Parr
Jones Intercable
Green Bay, Wis.

Don Patten
Harmon Cable Communications
Sulphur, Okla.

Dwight Sallee
Lawton Cablevision
Lawton, Okla.

Donald Schiller
The Las Colinas Association
Irving, Texas

David Schroeder
Concord TV Cable
Concord, Calif.

Craig Waskow
Dowden Cable Systems
Williamsburg, Iowa

Tom Wimler
Dowden Cable Systems
Mound, Minn.

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ic Satellites

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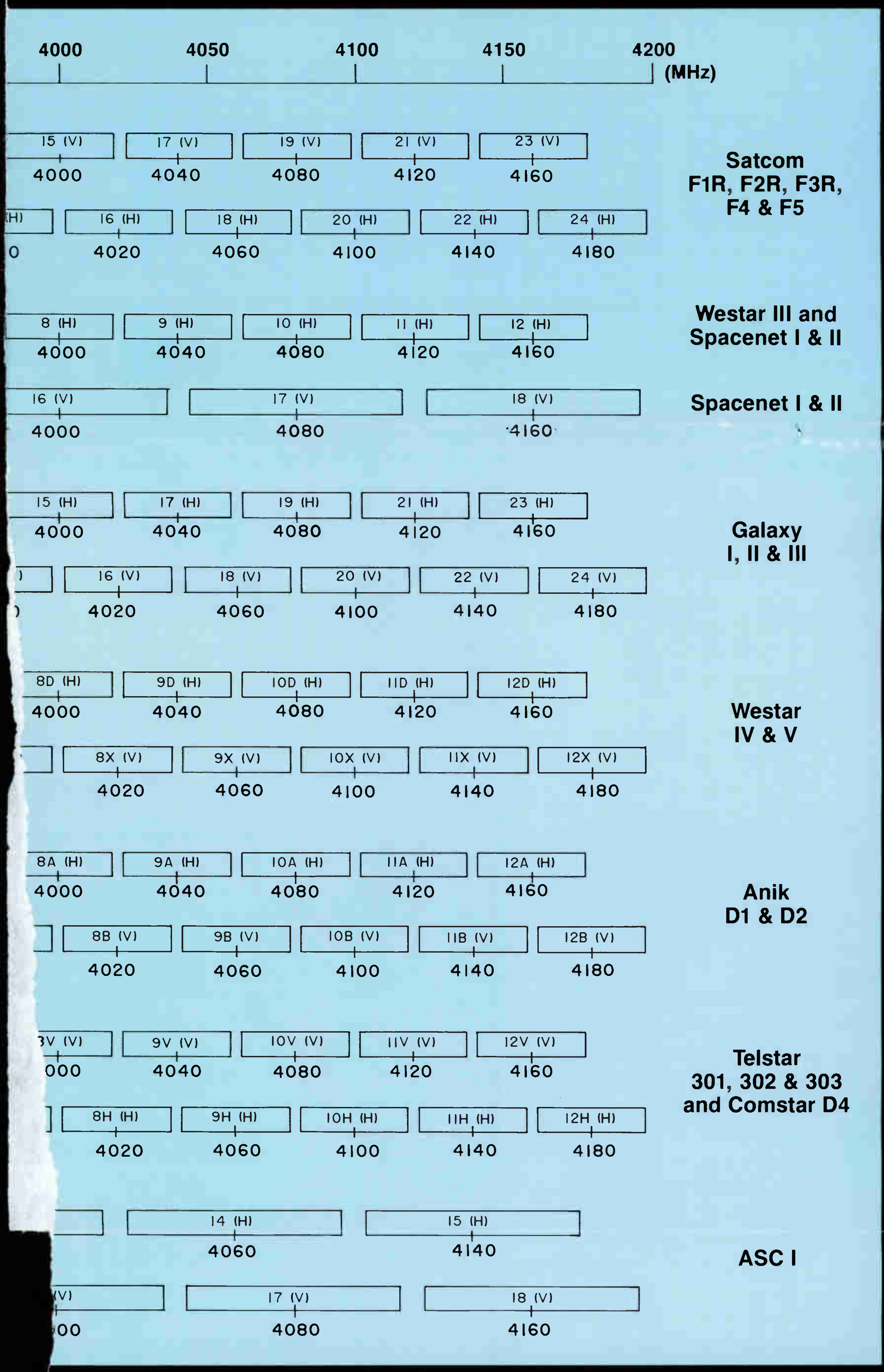
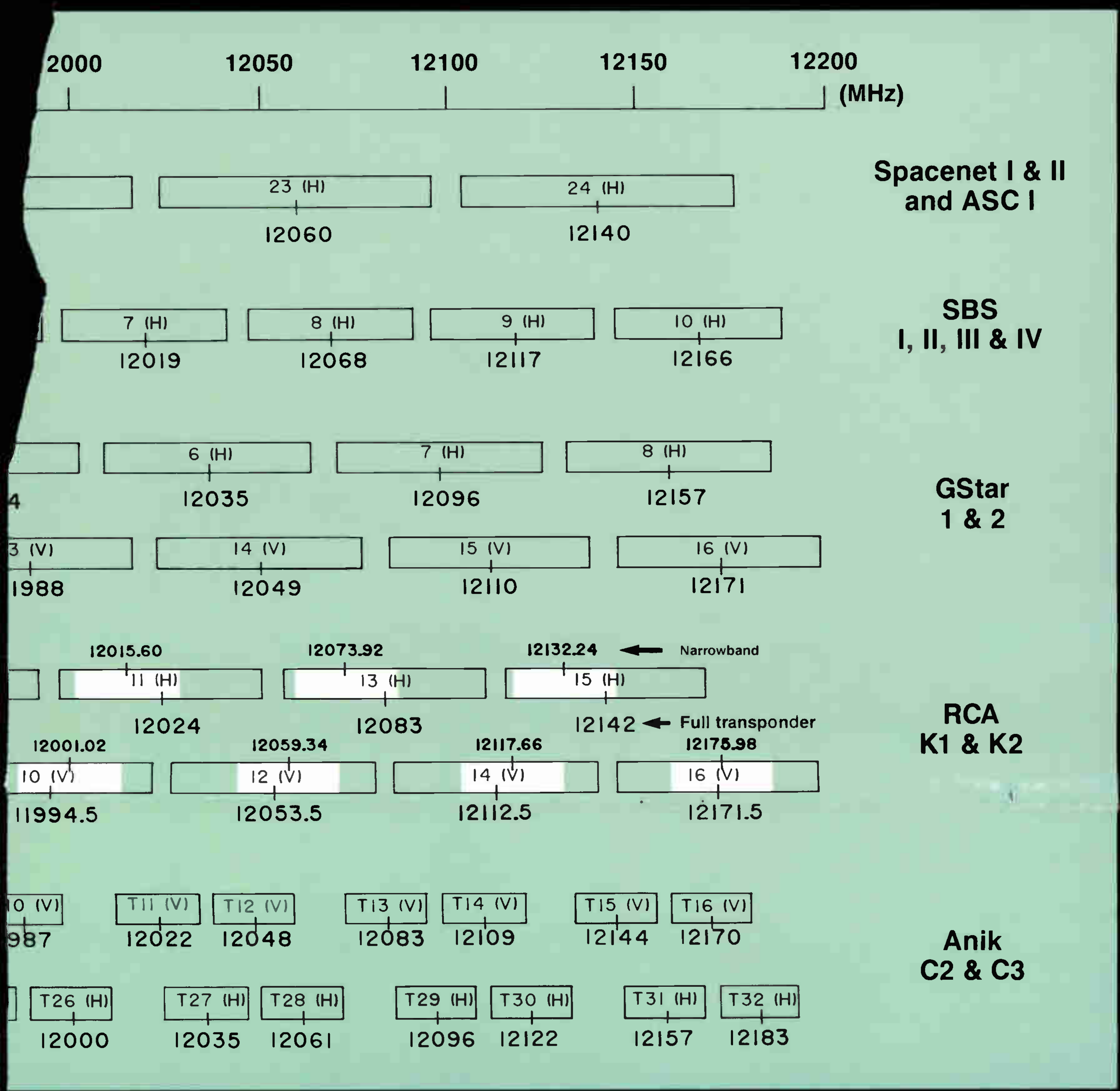
for horizontal, V for vertical.)





Publications Corp., P.O. Box 3208, Englewood, Colo. 80155. Special thanks to: WESTSAT Communications, DX Communications and Standard Communications.

Agile Omni, the industry's most advanced receiver designed by the most relied upon name in the business... Standard.

With the new Agile Omni, you need no other receiver.

Standard designed it for cable TV operators, broadcasters, CATV, SMATV, and business and special teleconferencing networks—now and in the future.

An onboard microprocessor permits selection of any band available from domestic satellites, including the 32-channel ANIK C2. Channel tuning provides direct reading of the transponder-assigned channel number and a format control permits selection of six frequency band formats—24-channel C-band, SBS/USAT and Spacenet already installed. Select channel and format, and the microprocessor controls frequency, channel spacing, transponder bandwidth, audio frequency and bandwidth, and antenna and video polarity—automatically.

Omni's flexible design can handle up to three separate subcarriers including stereo programming or data. Omni also will accept descrambling modules—eliminating the need for expensive add-on descramblers.

For CATV and SMATV applications, severe microwave terrestrial interference is minimized by optional internal SAW notch filters, automatically programmed to switch in. A 30 MHz low DG/DP LC bandwidth filter is standard, and a second internally installed optional filter of 18, 22, 26, or 36 MHz bandwidth can be controlled by the microprocessor, or manually switched.

Standard's proven RF loop-thru circuitry and blockdown conversion technology combine, with better image rejection and lower differential gain and phase, to provide excellent video performance. C/N threshold is an impressive 6.5 dB at the wide 30 MHz bandwidth.

Agile Omni is an affordable, flexible receiver designed to keep you in business, a commitment Standard backs with its unique 5-year warranty program. Contact us for further information.

Standard Communications
P.O. Box 92151
Los Angeles, CA 90009-2151
Toll free 800/243-1357
(In Calif. 800/824-7766, ext. 275)

Engineered to a new Standard

Operating functions including MGC, AGC, AFC, level sets, normal/invert video, clamp/unclamp video, audio subcarrier frequency selection, video and IF test points are conveniently located on the front panel. Meter reads C/N ratio, signal strength or center-tune.

Format control enable selections of desired satellite system. Direct-reading channel selector displays transponder-assigned channel. Second selectable subcarrier and space for optional third subcarrier or descrambler modules.

Pull-out Wall Chart

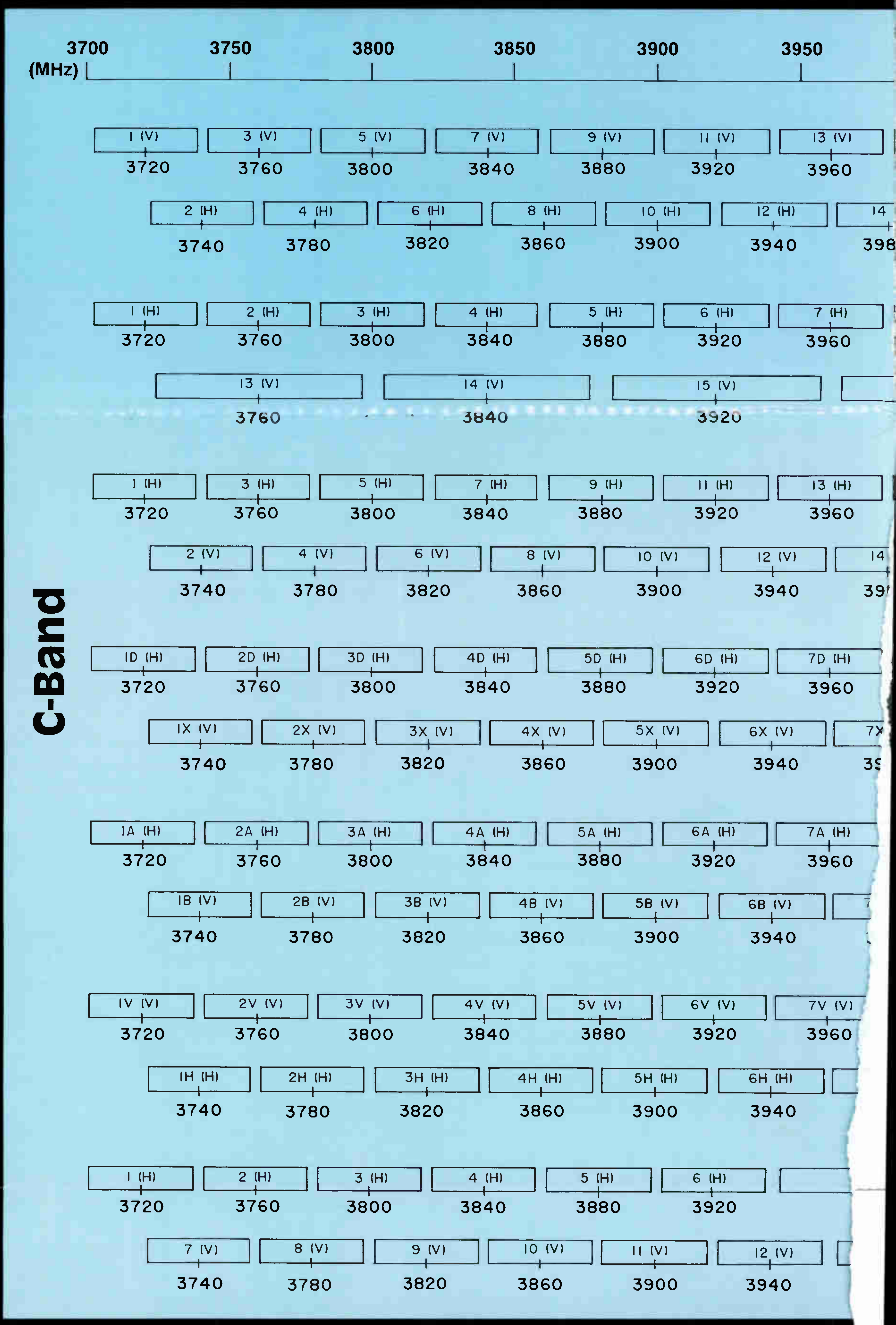
COMMUNICATIONS TECHNOLOGY'S

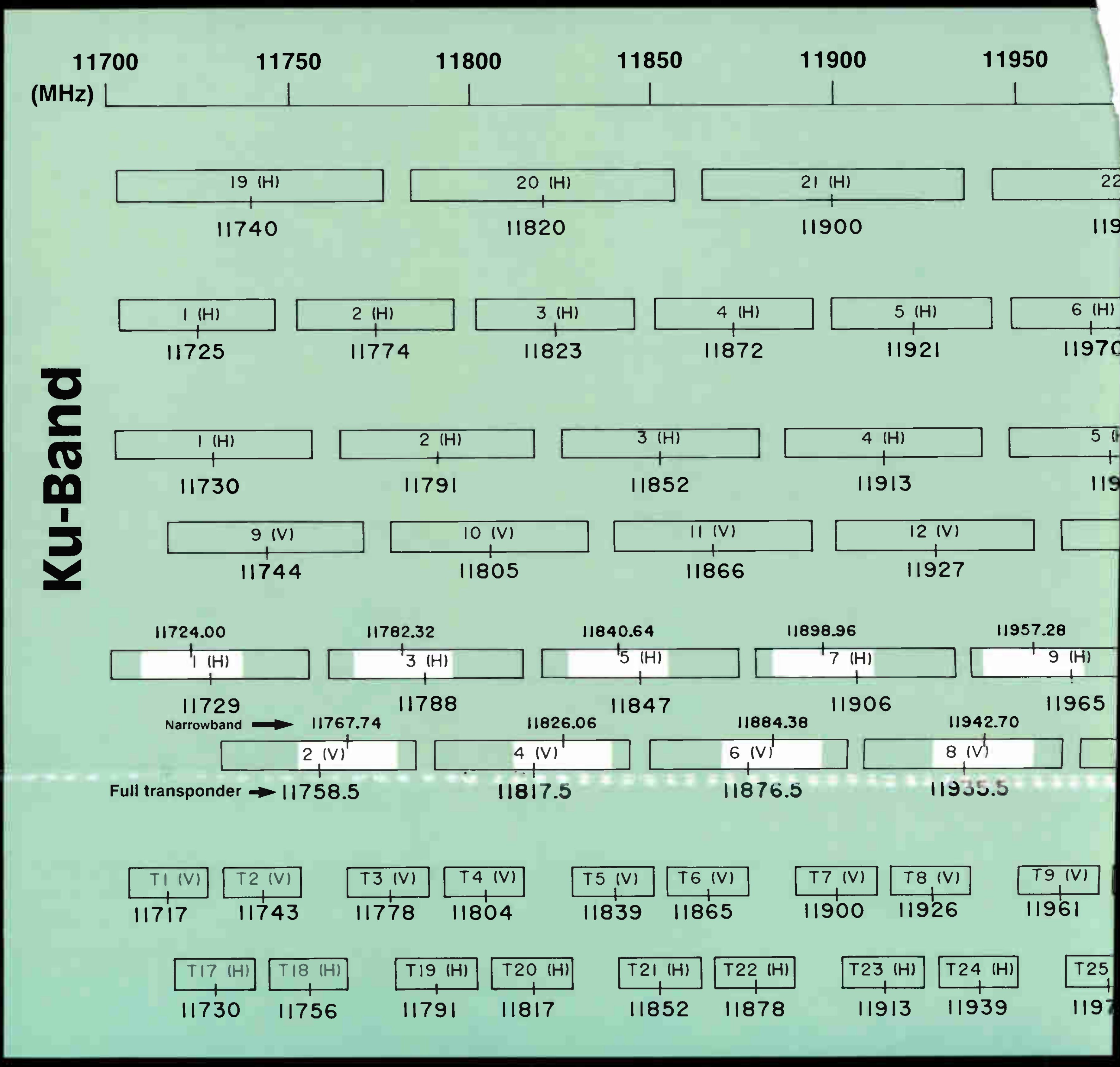
Downlink Frequencies For Domestic Satellites

COMMUN
TECHNO

Downlink F
For Domest

(Numbers within bars indicate transp
designate signal polarity: H





Compiled by Ron Hranac and Paul Vadakin, Jones Intercable Inc.

Satellites and cable TV

By Ron Hranac and Bruce Catter
Jones Intercable Inc.

LNA noise figure vs. noise temperature

Noise figure (dB)	Noise temperature (°K)
0.6908	50
0.7542	55
0.8167	60
0.8783	65
0.9390	70
0.9989	75
1.0580	80
1.1163	85
1.1739	90
1.2306	95
1.2867	100
1.3420	105
1.3966	110
1.4506	115
1.5039	120

Parabolic antennas

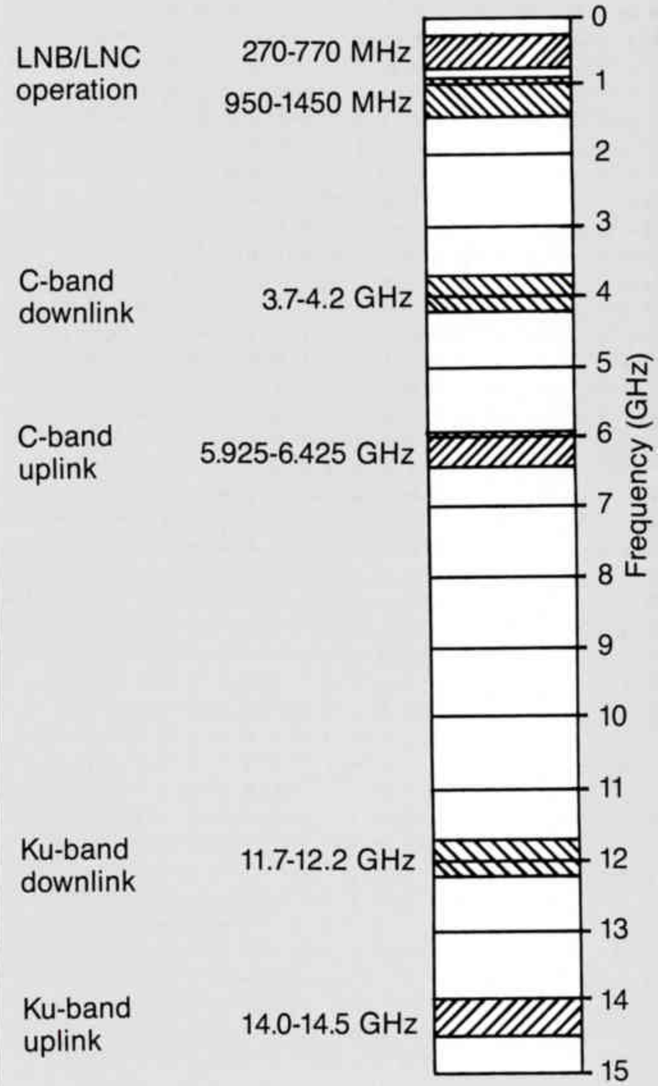
$$\text{Gain(dB)} = 20\log D + 10\log(10.2E) + 20\log F$$

$$\text{3dB Beamwidth} = \frac{66.4}{FD}$$

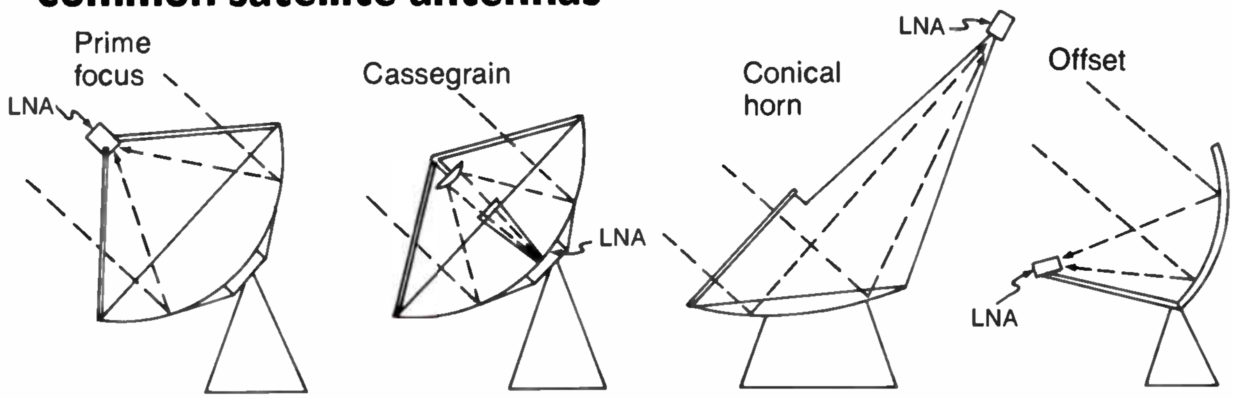
For the above formulas:
- D = Antenna diameter in feet
- F = Frequency in GHz
- E = Antenna efficiency (Percentage, typical 55%)

Note: These formulas apply only to the main beam and do not consider side-lobes.

Satellite frequency bands



Common satellite antennas



Satellite antenna pointing angles

Antenna azimuth $= 180 + \tan^{-1}\left(\frac{\tan D}{\sin X}\right)$

Antenna elevation =

$$\tan^{-1}\left(\frac{[\cos D \times \cos X] - 0.15126}{\sqrt{[\sin D]^2 + [\cos D \times \sin X]^2}}\right)$$

Where:
X = Site latitude
Y = Site longitude
Z = Satellite longitude
D = Z − Y

Problem

You have just installed a new earth station antenna to receive signals from Galaxy III. To what azimuth and elevation do you set your antenna, assuming the following?

Antenna site latitude: 41° 22′ 03″ N
Antenna site longitude: 105° 38′ 56″ W
Satellite (Galaxy III) longitude: 93.5° W

Solution

First you must convert your site latitude and longitude from degrees-minutes-seconds to decimal degrees.

Latitude:

41°		= 41.0000
22′	= 22/60	= 0.3667
03″	= 3/3600	= 0.0008
		41.3675 = 41.37°

Longitude:

105°		= 105.0000
38′	= 38/60	= 0.6333
56″	= 56/3600	= 0.0155
		105.6488 = 105.65°

For this example, then
X = 41.37°
Y = 105.65°
Z = 93.5°
D = 93.5 − 105.65 = −12.15

The antenna azimuth is found using the formula:

$$\text{Azimuth} = 180 + \tan^{-1}\left(\frac{\tan D}{\sin X}\right)$$
$$= 180 + \tan^{-1}\left(\frac{\tan[-12.15]}{\sin[41.37]}\right)$$
$$= 180 + \tan^{-1}\left(\frac{-0.22}{0.66}\right)$$
$$= 180 + \tan^{-1}(-0.33)$$
$$= 180 + (-18.43)$$
$$= 161.57°$$

The antenna elevation is found using the formula:

Elevation

$$= \tan^{-1}\left(\frac{[\cos D \times \cos X] - 0.15126}{\sqrt{[\sin D]^2 + [\cos D \times \sin X]^2}}\right)$$
$$= \tan^{-1}\left(\frac{[\cos(-12.15)\times\cos(41.37)] - 0.15126}{\sqrt{[\sin(-12.15)]^2 + [\cos(-12.15)\times\sin(41.37)]^2}}\right)$$
$$= \tan^{-1}\left(\frac{[0.98 \times 0.75] - 0.15126}{\sqrt{[-0.21]^2 + [0.98 \times 0.66]^2}}\right)$$
$$= \tan^{-1}\left(\frac{[0.74] - 0.15126}{\sqrt{[0.04] + [0.65]^2}}\right)$$
$$= \tan^{-1}\left(\frac{0.59}{\sqrt{0.04 + 0.42}}\right)$$
$$= \tan^{-1}\left(\frac{0.59}{\sqrt{0.46}}\right)$$
$$= \tan^{-1}\left(\frac{0.59}{0.68}\right)$$
$$= \tan^{-1}(0.87)$$
$$= 40.95°$$

North American C-band satellite frequency/transponder conversion table

Channel or dial number	Uplink frequency in MHz	Downlink frequency in MHz	Satcom F1R, F2R, F3R F4 & F5	Telstar 301, 302 & 303, Comstar D4	Anik D1 & D2	Galaxy I, II & III	Westar IV & V	Spacenet I & II	Westar III	ASC I	Morelos 1	Channel or dial number
1	5945	3720	1 (V)	1V (V)	1A (H)	1 (H)	1D (H)	1 (H)	1 (H)	1 (H)		1
2	5965	3740	2 (H)	1H (H)	1B (V)	2 (V)	1X (V)	13L (V)*		7 (V)	1N(V) & 1W(H)*	2
3	5985	3760	3 (V)	2V (V)	2A (H)	3 (H)	2D (H)	2 (H)	2 (H)	2 (H)		3
4	6005	3780	4 (H)	2H (H)	2B (V)	4 (V)	2X (V)	13U(V)*		8 (V)	2N (V)	4
5	6025	3800	5 (V)	3V (V)	3A (H)	5 (H)	3D (H)	3 (H)	3 (H)	3 (H)		5
6	6045	3820	6 (H)	3H (H)	3B (V)	6 (V)	3X (V)	14L (V)*		9 (V)	3N(V) & 2W(H)*	6
7	6065	3840	7 (V)	4V (V)	4A (H)	7 (H)	4D (H)	4 (H)	4 (H)	4 (H)		7
8	6085	3860	8 (H)	4H (H)	4B (V)	8 (V)	4X (V)	14U(V)*		10 (V)	4N (V)	8
9	6105	3880	9 (V)	5V (V)	5A (H)	9 (H)	5D (H)	5 (H)	5 (H)	5 (H)		9
10	6125	3900	10 (H)	5H (H)	5B (V)	10 (V)	5X (V)	15L (V)*		11 (V)	5N(V) & 3W(H)*	10
11	6145	3920	11 (V)	6V (V)	6A (H)	11 (H)	6D (H)	6 (H)	6 (H)	6 (H)		11
12	6165	3940	12 (H)	6H (H)	6B (V)	12 (V)	6X (V)	15U(V)*		12 (V)	6N (V)	12
13	6185	3960	13 (V)	7V (V)	7A (H)	13 (H)	7D (H)	7 (H)	7 (H)			13
14	6205	3980	14 (H)	7H (H)	7B (V)	14 (V)	7X (V)	16L (V)*		13 (H)*	7N(V) & 4W(H)*	14
15	6225	4000	15 (V)	8V (V)	8A (H)	15 (H)	8D (H)	8 (H)	8 (H)	16 (V)*		15
16	6245	4020	16 (H)	8H (H)	8B (V)	16 (V)	8X (V)	16U(V)*			8N (V)	16
17	6265	4040	17 (V)	9V (V)	9A (H)	17 (H)	9D (H)	9 (H)	9 (H)			17
18	6285	4060	18 (H)	9H (H)	9B (V)	18 (V)	9X (V)	17L (V)*		14 (H)*	9N(V) & 5W(H)*	18
19	6305	4080	19 (V)	10V (V)	10A (H)	19 (H)	10D (H)	10 (H)	10 (H)	17(V)*		19
20	6325	4100	20 (H)	10H (H)	10B (V)	20 (V)	10X (V)	17U(V)*			10N (V)	20
21	6345	4120	21 (V)	11V (V)	11A (H)	21 (H)	11D (H)	11 (H)	11 (H)			21
22	6365	4140	22 (H)	11H (H)	11B (V)	22 (V)	11X (V)	18L (V)*		15 (H)*	11N(V) & 6W(H)*	22
23	6385	4160	23 (V)	12V (V)	12A (H)	23 (H)	12D (H)	12 (H)	12 (H)	18(V)*		23
24	6405	4180	24 (H)	12H (H)	12B (V)	24 (V)	12X (V)	18U(V)*			12N (V)	24

Polarization for each transponder denoted in parenthesis.

*72 MHz bandwidth transponders.

Courtesy WESTSAT Communications

North American Ku-band satellite frequency/transponder conversion table

Anik C2 & C3 Transponder	Uplink frequency in MHz	Downlink frequency in MHz
T1 (V)	14017	11717
T2 (V)	14043	11743
T3 (V)	14078	11778
T4 (V)	14104	11804
T5 (V)	14139	11839
T6 (V)	14165	11865
T7 (V)	14200	11900
T8 (V)	14226	11926
T9 (V)	14261	11961
T10 (V)	14287	11987
T11 (V)	14322	12022
T12 (V)	14348	12048
T13 (V)	14383	12083
T14 (V)	14409	12109
T15 (V)	14444	12144
T16 (V)	14470	12170
T17 (H)	14030	11730
T18 (H)	14056	11756
T19 (H)	14091	11791
T20 (H)	14117	11817
T21 (H)	14152	11852
T22 (H)	14178	11878
T23 (H)	14213	11913
T24 (H)	14239	11939
T25 (H)	14274	11974
T26 (H)	14300	12000
T27 (H)	14335	12035
T28 (H)	14361	12061
T29 (H)	14396	12096
T30 (H)	14422	12122
T31 (H)	14457	12157
T32 (H)	14483	12183

GStar 1 & 2 Transponder	Uplink frequency in MHz	Downlink frequency in MHz
1 (H)	14030	11730
2 (H)	14091	11791
3 (H)	14152	11852
4 (H)	14213	11913
5 (H)	14274	11974
6 (H)	14335	12035
7 (H)	14396	12096
8 (H)	14457	12157
9 (V)	14044	11744
10 (V)	14105	11805
11 (V)	14166	11866
12 (V)	14227	11927
13 (V)	14288	11988
14 (V)	14349	12049
15 (V)	14410	12110
16 (V)	14471	12171

SBS I, II, III & IV Transponder	Uplink frequency in MHz	Downlink frequency in MHz
1 (H)	14025	11725
2 (H)	14074	11774
3 (H)	14123	11823
4 (H)	14172	11872
5 (H)	14221	11921
6 (H)	14270	11970
7 (H)	14319	12019
8 (H)	14368	12068
9 (H)	14417	12117
10 (H)	14466	12166

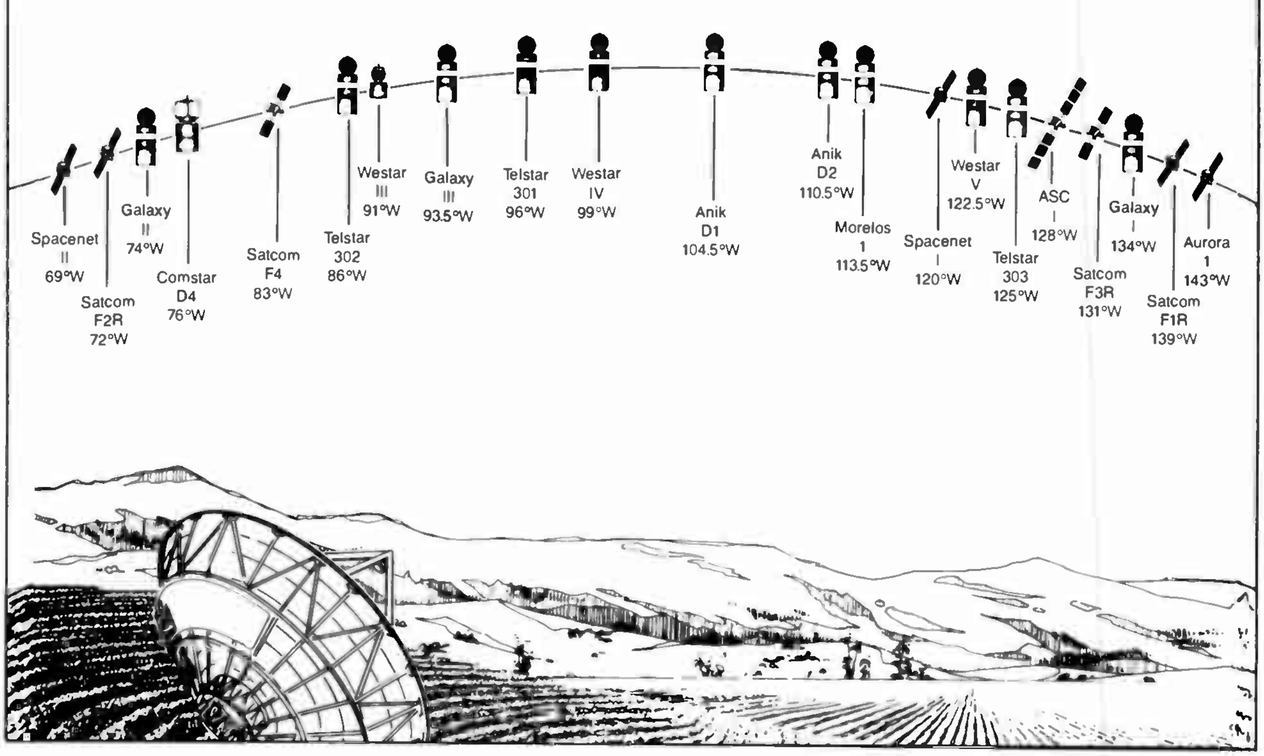
RCA K1 & K2 Transponder	Uplink frequency in MHz	Downlink frequency in MHz
1 (H)	14029.0	11729.0
2 (V)	14058.5	11758.5
3 (H)	14088.0	11788.0
4 (V)	14117.5	11817.5
5 (H)	14147.0	11847.0
6 (V)	14176.5	11876.5
7 (H)	14206.0	11906.0
8 (V)	14235.5	11935.5
9 (H)	14265.0	11965.0
10 (V)	14294.5	11994.5
11 (H)	14324.0	12024.0
12 (V)	14353.5	12053.5
13 (H)	14383.0	12083.0
14 (V)	14412.5	12112.5
15 (H)	14442.0	12142.0
16 (V)	14471.5	12171.5

Spacenet I & II, ASC I Transponder	Uplink frequency in MHz	Downlink frequency in MHz
19 (H)	14040	11740
20 (H)	14120	11820
21 (H)	14200	11900
22 (H)	14280	11980
23 (H)	14360	12060
24 (H)	14440	12140

Downlink polarization for each transponder denoted in parenthesis

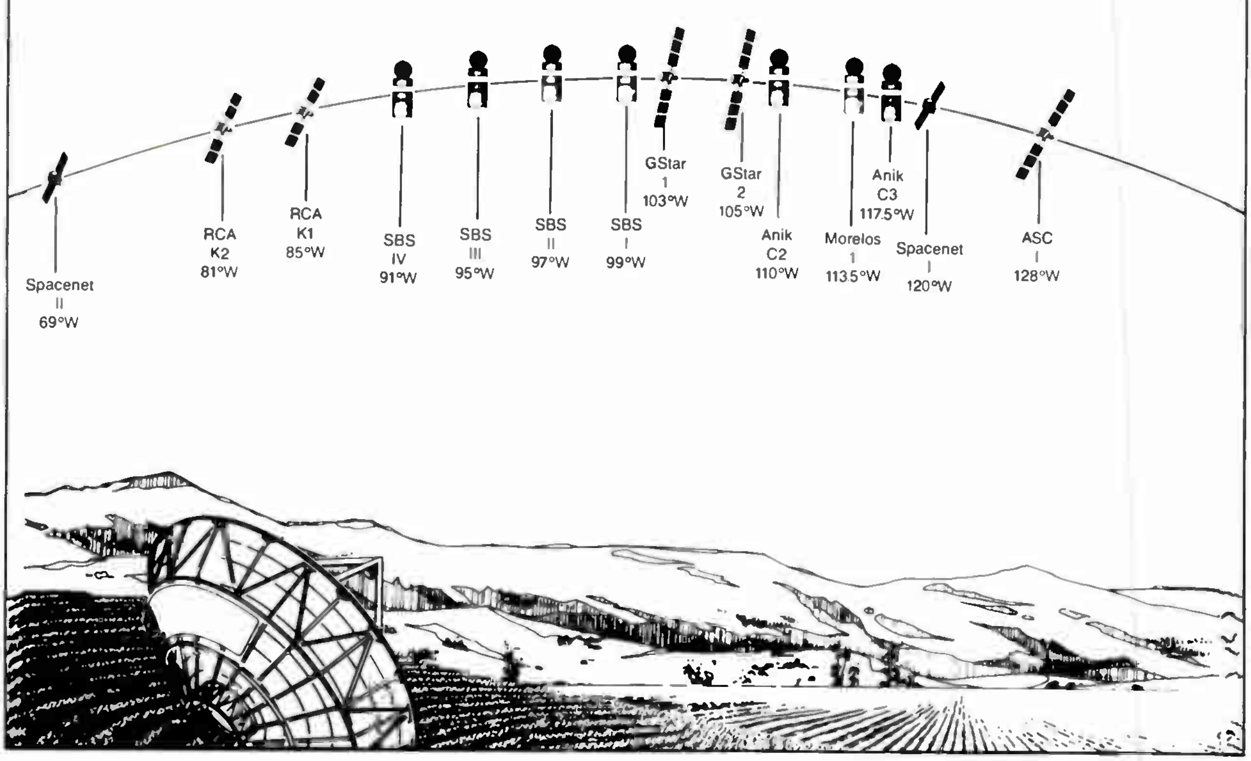
Courtesy WESTSAT Communications

C-band satellite locations



Courtesy WESTSAT Communications

Ku-band satellite locations



Courtesy WESTSAT Communications

Super VHS technology

By Walter S. Ciciora, Ph.D.
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Recently, JVC announced a new product, "Super VHS." (JVC is the company that invented and introduced VHS (video home system) consumer videotape recording.) Super VHS is an advanced recording and playback technology that has strategic implications for cable. It generates the sharpest, clearest pictures ever seen on consumer television receivers. This opens the door to increased cable subscriber sensitivity to higher video quality.

The new videotape format achieves better than a 66 percent increase in horizontal resolution—75 percent has been demonstrated, with 88 percent speculated as the maximum obtainable improvement. Luminance and color artifacts have been reduced substantially. The first products will be available in Japan by the time this article appears. The United States should see products in the fall and a heavy presence at the June EIA (Electronic Industries Association) Consumer Electronics Show in Chicago.

A new TV display device with special input terminals will be required to obtain the maximum benefits of Super VHS. There is some controversy over the technical details of these inputs.

Licensing of this new technology will be tightly controlled. Manufacturers who have stimulated price erosion, in particular the Koreans, will be excluded. Some have speculated that this is a primary motivation for the introduction of this technology at this time. Super VHS will open up a new high-end tier for machines and tapes. The Japanese manufacturers desperately need a means to deal with exporting countries not constrained by the strong yen vs. the dollar. A 20 percent to 30 percent price premium is expected for these products.

Salespeople worth their salt should be able to step up buyers to the first significant demonstrable improvement in video quality in years. Large screen and projection TVs particularly will benefit.

Don't panic

There is no need for cable operators to panic; Super VHS penetration will be slowed by the need for special input terminals on the display device. However, ignoring cable implications of Super VHS would be hazardous. The biggest danger is the potential for a radical change in the videotape rental business. A likely scenario: rental of premium early release Super VHS tapes, followed by standard VHS to "mop up" the residual demand.

The rental business has dealt with two formats before, Beta and VHS. But Super VHS has the advantage of the promise of higher margins. Imagine watching HBO after a rented Super VHS tape. The results are likely to be very troublesome—especially on big screen TVs. Physical distribution of video may achieve a greater product differentiation with Super VHS. This is an extension of earlier VCR strategy offering something unavailable off-air or on cable: quality VHS hi-fi sound. Super VHS combined with VHS hi-fi on a large screen with quality speakers will be a new home experience.

Camcorders will cause still more consternation. A camcorder is a convenient, portable package that includes a camera and a recorder intended to replace the home movie. When Super VHS camcorders become available, subscribers will be perplexed even more over better pictures from inexpensive home equipment than are available on cable. This issue must be considered seriously.

Currently, VHS copies are noticeably worse than originals. Super VHS copies will have much less degradation from generation to generation. The movie industry's concern over copy protection will increase.

Now some good news for cable: Assuming favorable resolution of input terminal issues, Super VHS will motivate TV and VCR manufacturers to add the EIA multiport (IS-15). This could accelerate the use of set-back descramblers by cable subscribers, resulting in an improvement in the consumer electronics interface situation.

Let's take a closer look at some technical details. TV resolution is measured by the number of alternating black and white lines resolved on the TV screen. Vertically, the number is determined by the scan line structure, defined by the NTSC standard and limited to 490 lines. (*NTSC* stands for the National Television Standards Committee, which created the black-and-white and color standards used in the United States, Japan and several other countries. A TV industry wisecrack states that NTSC really stands for "never twice the same color.")

Horizontally, resolution is determined by the video bandwidth. Because the TV picture is three units high and four units wide, the horizontal resolution measure is reduced by three-fourths to make it easily comparable with the vertical number. Broadcast baseband bandwidth is 4.2 MHz, yielding a maximum of 328 lines.

This rarely (if ever) is achieved in practice. Upper 200s is considered good. Standard VHS resolution is only 230 to 240 lines. Super VHS achieves better than 400 lines of horizontal resolution—430 was demonstrated with 450 speculated as maximum. Closest competition comes from the laser disc video player with almost 400 lines. However, laser disc technology still has color artifacts.

The color television system "shoehorns" color information into a system intended for black and white. The principal consequences are: 1) smeary colors, 2) erroneous rainbow patterns and 3) crawling dots. None of these artifacts are much of a problem on small screens or at large viewing distances, but they're intrusive with larger screens. Super VHS eliminates them and will shine on projection TVs or large screens of 30 inches or more.

Obtaining these benefits requires special TV input terminals; two candidates are *RGB inputs* and *C/Y inputs*. RGB inputs separately control the red, green and blue electron guns of the picture tube. The TV receiver is freed from color compromises with special input video while still able to display ordinary video delivered via the antenna terminals. RGB terminals now are available on top-of-the-line sets. They're also an optional part of the EIA multiport.

C/Y inputs are not used on any consumer products at present but achieve certain manufacturing economies while retaining most of the benefits of RGB inputs. The principal difficulty with C/Y is its incompatibility with present add-on devices. It would be a shame if Super VHS failed to follow established and agreed-upon U.S. technical standards. By setting its own de facto standard, Super VHS would be frustrating the process by which standards have been set in the United States for decades.

Super VHS recorders require premium VCR tape. Super VHS machines will play cassettes previously recorded on standard machines with the usual VHS video quality; Super VHS-recorded cassettes won't play on standard machines. Super VHS cassettes will have an identifying notch and better tape. Blank Super VHS cassettes will work for standard recording, but standard cassettes won't work for Super VHS recording.

The gaps in the Super VHS machine's heads are much smaller, so they can accommodate the higher frequencies that yield greater resolution. A disadvantage may be greater potential for clogging.

Upping the ante

Sony's earlier announced "Super Beta" is compatible with the older Beta format. Since Super VHS abandons compatibility with VHS, it yields a much greater improvement than Super Beta. Super VHS is considered by some to be a competitive response to Super Beta. If that's so, Sony has just upped the ante with extended definition or ED-Beta. This new format, like Super VHS, abandons compatibility with its predecessor format in order to yield a greater improvement in horizontal resolution. ED-Beta claims 500 lines of horizontal resolution. If this is a horsepower race, will we see an ED-VHS?

There are some things you should do to prepare for the arrival of Super VHS and ED-Beta. If your VCR has VHS hi-fi, rent a hi-fi movie to play through your stereo to appreciate an enhanced home video experience. This fall, visit a TV dealer that features high-end product and get a demonstration of Super VHS or ED-Beta to calibrate your eyeballs. If you have the opportunity to be in Chicago in June, visit the EIA Consumer Electronics Show and look for Super VHS.

Consider ways to obtain the maximum technical video quality out of your cable system to minimize the disparity subscribers will experience when they compare it to Super VHS and ED-Beta.

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