CED™

Frequency allocation chart

Communicatio

The Magazine of Broadband Technology

September 1984

Sruki Switzer: Making 525-line work

Mark Elden: 2° impact on ops

Digital TV: Threat to sync suppression?

The TEN DEMANDMENTS

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Be sure you can choose a detector for *any* channel frequency—from 54-300 MHz.

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Demand Frequency Trim Adjustment.

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Demand Audible Tone Alarms.

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VIII

Demand "Standards," not "Accessories."

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Demand Quick Delivery.

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X

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Reader Service Number 2

Magnavox addressed the way to stop subscribers from monkeying around with your signals.

CED™

September 1984

To the left is a picture produced by Sony Corp.'s HDTV system using 1,125 lines. On right is the same picture using NTSC 525-line format.

About the Cover
Pictured is an artist's rendition of an RCA satellite.

DEPARTMENTS

 CED. (USPS 300-510) (ISSN 0191-5428) is published monthly plus periodic special editions by Titsch Communications Inc., 600 Grant St., Denver, CO 80203. © September 1984, Volume 10, Number 9. Subscription Price: 1 year, $26.00; 2 years, $43.00; 3 years, $63.00. OUTSIDE USA 1 yr. $64.00; 2 yrs. $89.00; MUST BE PREPAID IN US FUNDS ONLY! Second-class postage paid at Denver, CO. *CED* is published on behalf of all parties, including the Society of Cable Television Engineers (SCTE). POSTMASTER: Please send address changes to P.O. Box 5208 T.A., Denver, Colorado 80217. MEMBERS OF THE BPA.
BPA

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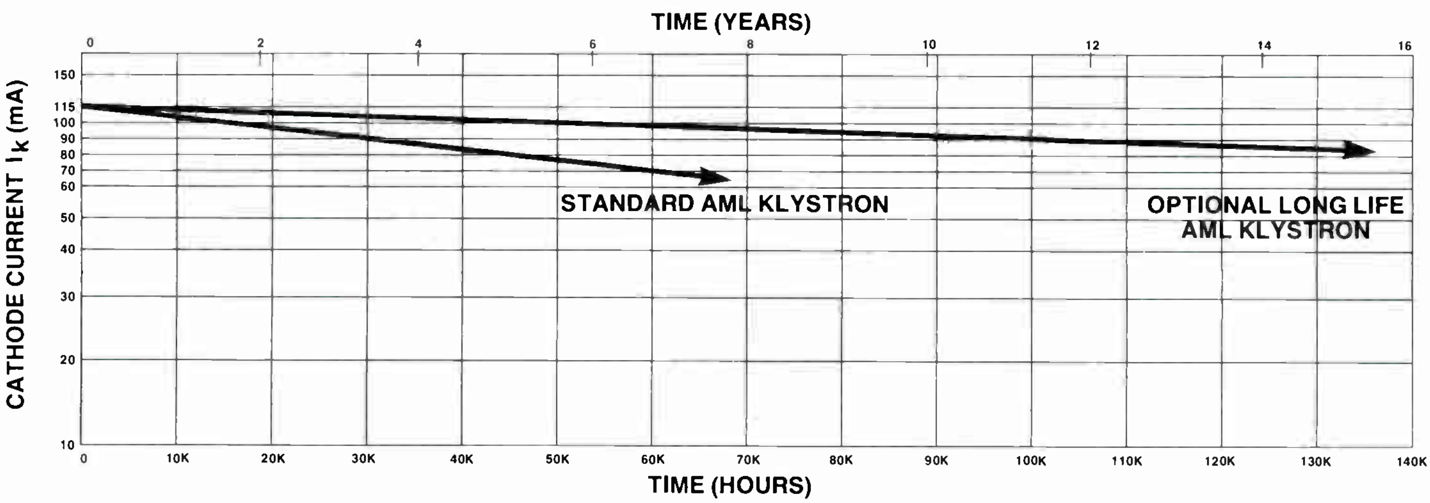

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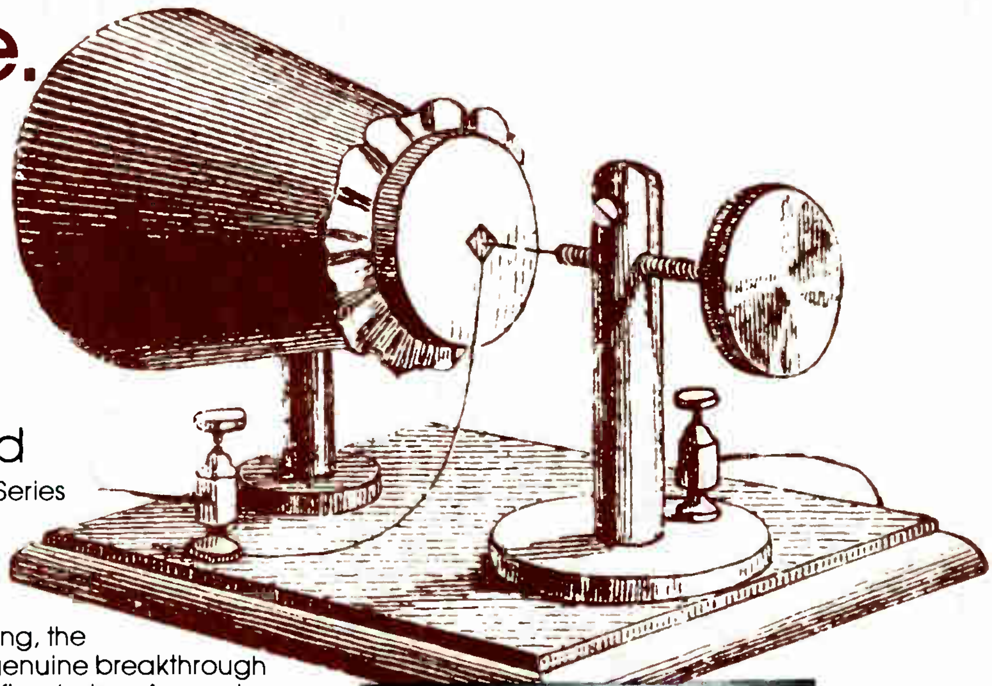
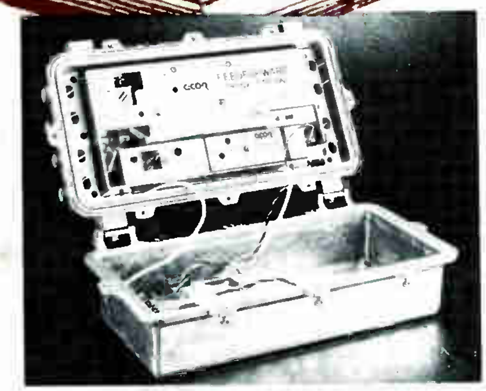


Feedforward

C-COR's new FT-500 Series feedforward trunk stations offer a rare combination of sophistication and simplicity. For one thing, the circuitry contains a genuine breakthrough in broadband amplifier design. A superior delay line called the Triple S™ (Sealed Signal Synchronizer) is cast in a ceramic material, protecting this critical component from moisture, heat and misadjustment. The result: stable performance over extreme temperature variations. Typically, distortions produced by an FT-500 Series trunk are 18 dB below those of a standard amplifier. A system's reach can be extended by as much as 50 percent. Furthermore, an FT-500 Series trunk has only six adjustment points. It's as easy to set up as a standard amplifier. It's sophisticated, yet simple.



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Showtime adds Galaxy I feeds

Showtime and The Movie Channel began dual-feeding their east coast affiliates Aug. 15, supplementing their Satcom IIIR beams with feeds on Galaxy I. Showtime East now is on transponder T-5, while The Movie Channel East is on T-10.

and releases theft of service report

After surveying operators serving two-thirds of all homes passed in Florida, Showtime/The Movie Channel has found 3.7 percent theft by non-subscribers, 6.8 percent theft of pay services by basic subs and 8.1 percent theft of an additional pay service by pay subs. Converter tampering was the biggest single source of theft identified. In addition to the 34 percent of signals stolen this way, 22 percent was taken by mistakes in disconnecting or downgrading subs as well as employee theft. Illegal customer drops accounted for 20 percent of the theft, while black market decoders and front office mistakes each represented 12 percent of piracy.

The report also found five percent a year converter losses. Pay service security is provided by converters and descramblers in 64 percent of systems, while traps secure 34 percent of pay signals.

Seize broadband opportunities: Schrock

Speaking at a Society of Cable Television Engineers training seminar on data Aug. 15, Cliff Schrock, president of C-Cor Labs, urged his 52 listeners to jump on new business opportunities in the broadband network business.

New revenue streams exist in a variety of areas, including teleconferencing, instructional video and surveillance. "The alternative to a transportable uplink that has to be carted all around town to many teleconferencing sites is a permanent uplink facility at a cable headend," Schrock told his Denver audience.

He also suggested operators take a look at security applications. "Think of the number of bridges, heavy traffic sites, dark parking lots and convenience stores that need remote surveillance," Schrock said. "It's a tremendous field."

A switched camera system still needs to be developed, and systems will need agreements to reserve blocks of frequency so they can interconnect, however.

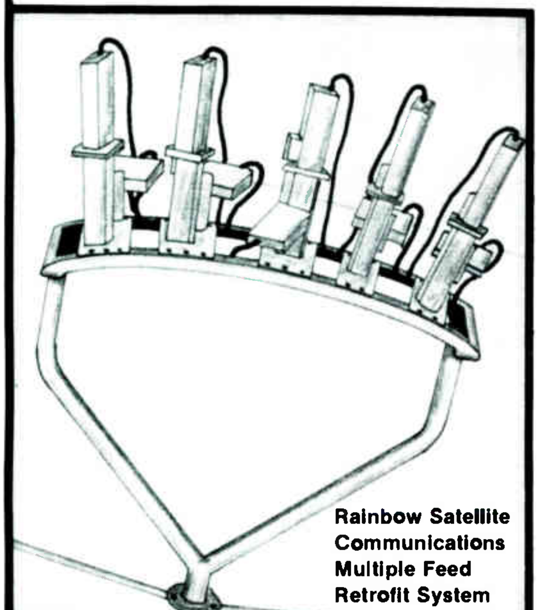
"To get video surveillance at every automatic teller machine in a three-county area, multiple systems must cooperate," he said. "Banks aren't going to want to negotiate three separate agreements."

And the lid could blow off home information systems if cable can broker data bases for PC users, he said. "In the past we used to wonder how we could design an inexpensive keyboard for cable use," Schrock said. "Now we don't need to because of the widespread availability of microcomputers."

Voice services can take a number of forms. Background music and T-1 trunks for large complexes are some of the possibilities, he said. Cable also can serve as the local loop for long-distance voice carriers.

Telemetry services such as energy management, status monitoring, sensing and remote switch control are applications that take very narrow bandwidth, Schrock stressed.

Among the trends to note are a general move away from twisted pair and baseband to broadband networks, especially among Fortune 500-type companies, he added.



September

3-5: Satellite Electronics Show, Opryland Hotel, Nashville. Contact **Satellite Television Technology International**, (405) 396-2574.
5-7: Magnavox Mobile Training Seminar, Buffalo, N.Y. Contact Laurie Mancini, (800) 448-5171.
6-7: The **2nd Swiss Videotex Congress** will be held at the European World Trade and Congress Centre in Basle, Switzerland. Contact, 061/26 20 20.
6-7: TeleStrategies will sponsor "Two-Way Cable TV," to be held in Washington, D.C. Contact (703) 734-7051.
6-8: Eastern Cable Show, Georgia World Congress Center. Contact (404) 252-2454.
10: Knowledge Industry Publications will hold "The Home Video Explosion Conference," at the New York Hilton, New York City. Contact Sheila Alper, (914) 328-9157.
10-11: DBS IV, Washington, D.C. Contact **Phillips Publishing**, (301) 986-0666.
15-19: National Satellite Communications Association convention, Hyatt Regency Hotel, Orlando. Contact Mickey Gorman, (202) 659-2928.
17-18: The South Dakota Cable Television Association will hold its annual convention at the Sylvan Lake Resort, Custer, S.D. Contact Dale Hodgkins, (605) 343-3402.
17-21: FOC/LAN 84, an international exposition for fiberoptic communications and local area networks will be held at the MGM Grand Hotel in Las Vegas, Nev. Contact: Michael O'Bryant, (617) 787-1776.
18-20: Jerrold will hold a technical seminar in Atlanta, Ga. Contact Kathy Stangl, (215) 674-4800.
19-21: Magnavox Mobile Training Seminar, Ogdensburg, N.Y. Contact Laurie Mancini, (800) 448-5171.
20: QV Publishing will sponsor a seminar on "Addressing Addressability," Loews Anatole, Dallas. Contact Barbara Freundlich, (914) 472-7060.
21-23: SMATV/Private Cable Workshop, Washington, D.C. Contact Burrull Communications Group, (608) 873-4903.
22-24: New building designs and technology will be the focus of a conference held by **Cross Information Co.** in Boulder, Colo. Contact Tom Cross, (303) 499-8888.
23-25: The **Illinois, Indiana and Michigan Cable Association** will sponsor the Great Lakes Conference and Expo at the Indianapolis Convention Center. Contact Shirley Watson, (618) 249-6263.
23-25: Pacific Northwest Show, Red Lion Riverside, Boise, Idaho. Contact (406) 259-3026.
24-25: Multi-Tenant Telecommunications Services, sponsored by **Phillips Publishing Inc.** will be held in the Hotel Washington, Washington, D.C. Contact (301) 986-0666.
24-25: TeleStrategies Inc. will hold "Digital Networking Technologies, Economics & Opportunities," in Washington, D.C. Contact (703) 734-7051.
24-26: Wisconsin Cable Communication convention, Olympia Spa & Resort, Oconomowoc, Wis. Contact (608) 256-1683.
24-26: Third Annual NCTA Minority Business Symposium, Washington, D.C. Contact Ed Dooley, (202) 755-3629.
26-28: The Alabama Cable Television Association will hold its fall convention at the Grand Hotel, Point Clear, Ala. Contact Mary John Martin, (205) 288-1821.
27: Microwave Filter will hold its Terrestrial Interference Seminar in its East Syracuse, N.Y., facility. Contact Bill Bostick or Carol Ryan, (315) 437-3953.
30-Oct. 2: The Kentucky Cable Television Association Fall Convention will be held at the Galt House, Louisville, Ky. Contact Patsy Rudd, (502) 864-5352.
30-Oct. 2: The **Midwest National Federation of Local Cable Programmers'** regional conference will be held in Dubuque, Iowa. Contact Susan Korn, (202) 544-7272.

October

1-2: Cashing in on the video marketplace, sponsored by **Phillips Publishing Inc.**, will be held at the Plaza Hotel in Washington, D.C. Contact (301) 986-0666.
1-5: Video Expo New York, New York Passenger Ship Terminal, New York City. Contact **Knowledge Industry Publications**, (914) 328-9157.
5: Atlanta Chapter of Women in Cable seminar, Atlanta. Contact Lynne Parker, (404) 329-0087.
8-11: Tennessee Cable Television Association Convention, Maxwell House Hotel, Nashville. Contact Dan Walker, (615) 256-7037.
9: Southern California Chapter of Women In Cable Meeting, Marina Marriott Hotel, Marina del Rey, Calif. Contact Jeanne Cardinal, (213) 410-7312.
9-11: Blonder-Tongue SMATV/MATV/CATV/TVRO seminar, Summit Hotel, Dallas. Contact Sharon Leight, (201) 679-4000.
10-12: Magnavox Mobile Training Seminar, Philadelphia. Contact Laurie Mancini, 800-448-5171.
10-12: Telcos & Videotex, Sheraton Harbor Island Hotel, San Diego. Contact **Online Communications**, (212) 279-8890.
12-14: SMATV/Private Cable Hands-On Workshop, Dallas. Contact **Burrull Communications Group**, (608) 873-4903.

Atlanta is the site of the Atlanta Chapter of Women in Cable's October seminar

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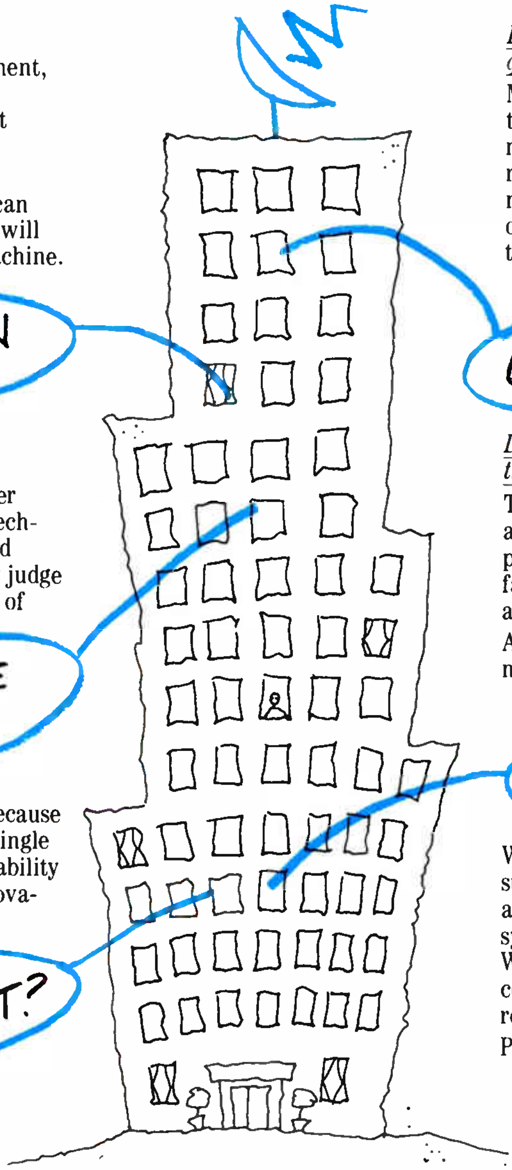

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Reader Service Number 11

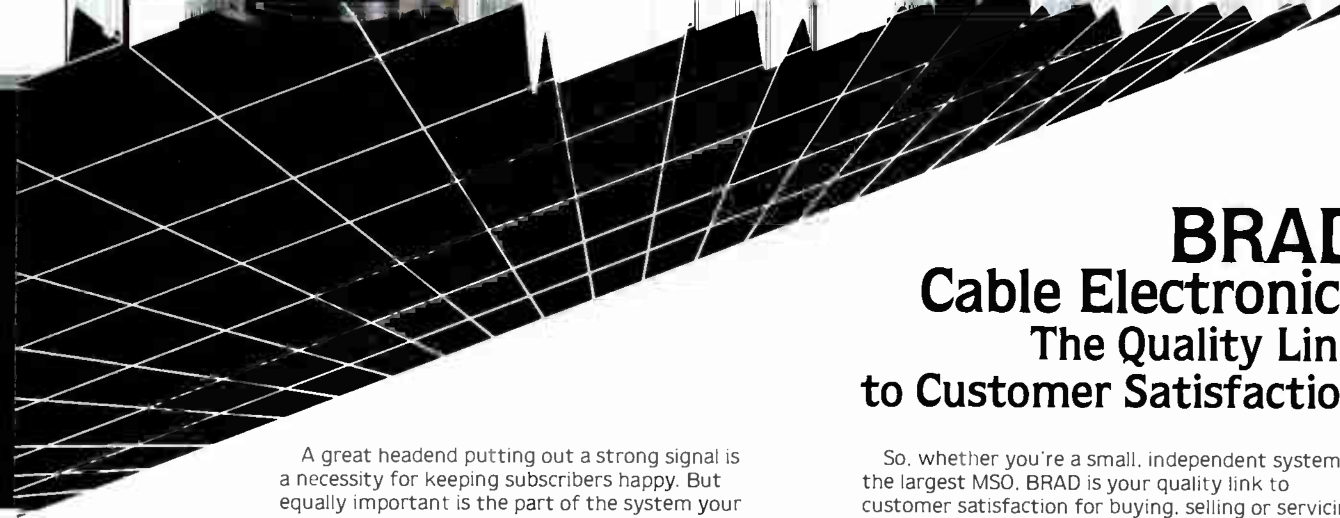
16-18: Mid-America Cable Show, Hilton Plaza Inn, Kansas City. Contact Rob Marshall, (913) 841-9241.
16-18: Jerrold Technical Seminar, Columbus, Ohio. Contact Kathy Stangl, (215) 674-4800.
17: Delaware Valley Chapter of SCTE Meeting, George Washington Motor Lodge, Willow Grove, Pa. Contact Bruce Furman, (215) 657-4690 or John Kurpinski,(717) 323-8518.
17-19: Minnesota Cable Communications Association Convention, Amfac Hotel, Minneapolis. Contact Mike Martin, (612) 861-1166.
19-21: SMATV/Private Cable Hands-On Workshop, Phoenix. Contact Burrull Communications Group, (608) 873-4903.
22-24: PC/SMATV Continuing Education Workshop, New Orleans, La. Contact Larry Hannon, (904) 237-6106.
25-28: MDS Industry Association Annual Convention, Sheraton Washington Hotel, Washington, D.C. Contact Bonnie Guthrie, (202) 466-6250.
26: Terrestrial Interference Seminar, **Microwave Filter** facility, East Syracuse, N.Y. Contact Bill Bostick or Carol Ryan, (315) 437-3953.
29: Addressing Addressibility, Harrahs Triumph Plaza, Atlantic City. Contact Barbara Freundlich, (914) 472-7060. Sponsored by **QV Publishing**.
28-30: Iowa Cable Television Association Annual State Convention, Airport Hilton, Des Moines. Contact Jeff Barnes, (515) 842-7202.
30-Nov. 1: Atlantic Cable Show, Convention Hall, Atlantic City. Contact Jan Sharkey, (609) 848-1000.

November

1-2: Telephone Bypass Technologies & Economics, Chicago. Contact (703) 734-7051.
10: Atlanta Chapter of Women in Cable Seminar, Atlanta. Contact Lynne Parker, (404) 329-0087.
12-13: Satellite Communications, Washington, D.C. Contact: (703) 734-7051.
13-15: Jerrold Technical Seminar, Spokane, Wash. Contact Kathy Stangl, (215) 674-4800.
14-16: Annual National Translator/LPTV Association Convention & Exposition, Las Vegas. Contact David A. Stone, (714) 794-4704.

Looking ahead

Oct. 16-18: Mid-Atlantic Show, Hilton Plaza Inn, Kansas City, Mo.
Oct. 30-Nov. 1: Atlantic Show, Atlantic City Convention Hall, Atlantic City, N.J.
Nov. 17-20: The American Market For International Programs trade show, Miami.
Dec. 5-7: Western Show, Anaheim Convention Center, Anaheim, Calif.
Jan. 30-Feb.1, 1985: Texas Cable Show, Convention Center, San Antonio,Texas
April 14-17, 1985: NAB, Convention Center, Las Vegas.
June 2-5, 1985: National Cable Television Annual Convention, Convention Center, Las Vegas.
Aug. 25-27, 1985: Eastern Cable Show. Congress World Center, Atlanta.
Sept. 18-20, 1985: Atlantic Show, Atlantic City.
Dec. 5-7, 1985: Western Cable Show, Convention Center, Anaheim, Calif.



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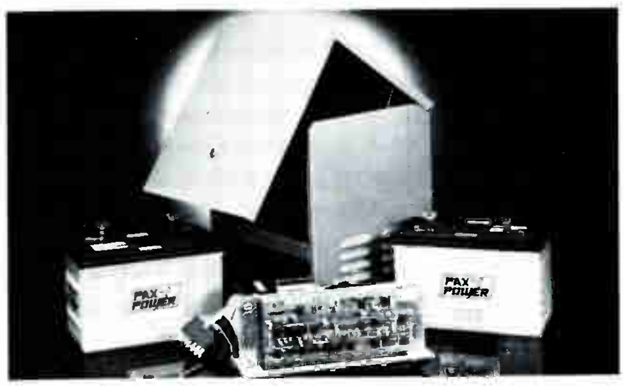

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Reader Service Number 9

Volume 10, No. 9

CED

Act now on stereo must-carry

On July 26, the FCC decided to take final comments before making a decision on mandatory carriage of stereo signals by cable systems. At stake is an estimated $2 billion in possible retrofit costs, according to NCTA.

The engineering community can act now by responding to the FCC's call for comments. According to Alan Stillwell, FCC policy analyst, the commission isn't leaning one way or the other on the issue, although broadcast interests are pushing hard for adoption of must-carry stereo.

The deadline for receipt of initial comments is Sept. 19. After reviewing all submissions, you have the option of replying to statements by other writers by Oct. 4.

All comments should be mailed to William Tricarico, Secretary, Federal Communications Commission, 1919 M Street N.W., Washington, D.C. 20554. Make sure you mention that your comments are in reference to Docket No. 21323.

You may either file formal or informal comments. Informal statements can be sent in letter form (one copy) to the FCC secretary. Formal comments must follow Part O of the FCC rules.

Once a decision is made, the commission hopes to act quickly, with implementation as soon as January or February 1985, or sooner.

Although some cable systems might be able to carry multichannel sound without serious signal degradation or interference with other channels, others will find the damage unacceptable, NCTA believes.

In March of this year, the FCC ruled that all broadcast program stereo signals must be compatible with the Zenith transmission protocols and dbx noise reduction standard. The problem is that cable systems aren't generally set up to carry audio subcarriers that wide.

The result could be adjacent channel sound interference, distortion and noise. NTCA fears that the sound traps wouldn't contain the expanded signal.

Some systems using scrambling might face additional problems, especially if, as some observers believe, certain scrambling techniques use protocols similar to the Zenith and dbx protocols. The result could be that the subscriber terminal gets confused and scrambles regular off-airs when it senses the stereo subcarrier.

Must-carry stereo might force operators to alter or replace every subscriber terminal in their systems. Even the National Association of Broadcasters, a strong proponent of the must-carry rule, acknowledges that many set-top converters now in use are technically incompatible with multichannel sound services.

The point isn't that stereo sound is objectionable. Indeed, some systems will find it an attractive new revenue source, and eventually consumers will demand it.

The point is that a cable system shouldn't be compelled to carry the signals before it is ready and can afford the expense.

On the subject of possible headaches, you might want to take a look at Sruki Switzer's article in this issue on the technical challenge of satellite-delivered video, which is picture quality. He points out that TVRO owners may soon see pictures in their livingrooms that we normally see only in our headends. Something to think about.

Also, Mark Elden, director of engineering for Showtime Entertainment, takes a look at the implications of two-degree satellite spacing for operators.

In this issue, we also take a look at the digital chip set being made by ITT. Some observers fear it could be programmed to automatically recover sync information from the color burst. Goodbye gated sync suppression. It's a tempest, but is it in a teapot? Opinion's divided and NCTA is getting ready to do some testing of its own.

CATA holds last technical seminar

VERO BEACH, Fla.—"Electronic Cable TV Russian Roulette" is the term Ralph Haimowitz, director of engineering for CATA, used to describe the organization's decision to terminate the technical training program he's been running for close to four years.

"The CATA engineering office and seminars have done more for the image of CATA and the industry than anything else since the copyright battle," he said.

Why then is CATA terminating the program?

According to Stephen Effros, executive director for the non-profit association, CATA board members felt that, while they support technical training, they could spend their money better elsewhere, such as in resolving pole attachment and copyright issues.

Haimowitz, however, said the engineering office and seminar program were totally self-sufficient: "The fact of the matter is the engineering office didn't cost CATA money. The seminars brought in enough money to support both the engineering office and the technical training program."

In some cases, though, attendance was down and the board feared it might have to allocate money from its membership dues for the seminars, Haimowitz added.

Calling the seminars a high financial risk for an organization the size of CATA, Effros admitted the seminars were breaking even but said attendance was unpredictable and "like pulling teeth."

Both he and Haimowitz cited the cable industry as responsible for the program's demise. "The industry is not known for supporting its engineers," Effros affirmed.

Haimowitz cautioned that industry apathy toward technical training could lead to more than just the cancellation of programs such as CATA's. Many technicians do not understand the basics of simple feedforward or how to operate a signal level meter, much less how to implement the latest engineering design or how to use the new technology. With these underskilled and undereducated technicians, cable systems will stop serving their customers and someone else will come in and do the job right, he argued.

Several months ago, CATA proposed to the NCTA that they take over the program, but the offer was rejected, Effros said.

Bill Riker, director of engineering for the NCTA, said that although he was unfamiliar with the CATA request, the organization has turned down similar proposals in the past. "A program such as CATA's is better suited for the SCTE or a group more geared toward raising the technical consciousness of the industry. The NCTA sees its position more in the legislative end," he said.

Steve Effros, CATA executive director, blames industry apathy for technical program's demise.

Haimowitz knew after the January CATA board meeting the program would be discontinued, but didn't learn until the July CATA convention in the Lake of the Ozarks, Mo., that the last seminar would be the June workshop held in Chicago. Effros said the seminars would be continued on a private, for-membership-only, basis, with manufacturer's technical programs capable of filling the rest of the void.

Haimowitz does not think manufacturers' seminars can replace the CATA program because they are not generic in nature. The National Cable Institute offers excellent courses, but will only accept applications from systems, and not technicians, he added. Prices for NCTI courses range from $650 and up.

Effros said Haimowitz would be released from his contract if he finds a position before the contract's January 1 expiration date.

Haimowitz said he had been approached by several people to offer the program on a private basis, but wasn't sure whether he wanted to keep fighting industry apathy or would prefer finding a "risk free" comfortable niche in which he could remain for the next 10 to 15 years.

—*Constance Warren*

Security seminar at CATA confab

Addressability weighed

LAKE OF THE OZARKS, Mo.—Digital TVs pose no major threat to their scrambling systems, said most, but not all, manufacturers at a CATA convention seminar on signal security. Jim Emerson of AM Cable TV Industries, Ed Kopakowski of Pioneer Communications and Raleigh Stelle of Texscan all agreed that the new digital sets would have "no effect" on their addressable systems.

Gordon Kelly of Zenith Electronics Corp. wasn't so sure. "I don't know how big a threat it is. The new ITT digital chip set can descramble most RF schemes."

But most of the attention at the workshop was focused on design, feature and cost issues inherent in off-premise systems. Independently-controlled second TV sets for example, "pose questions for which there is no good answer," Kelly said. "Basically, you're looking at a second drop."

The cost to feed a second, independent TV set would be the same as the cost to connect the first set in a home, said Stelle. "You can either run a second drop or multiplex three channels on a single drop with the Tracs system."

Pioneer's Kopakowski agreed on the present need to authorize a second address for a second set.

Emerson, however, claimed there wasn't a need for a second drop with the Tier Guard system. "Since we pass the full band to the home, you can have as many outlets as you want."

Stelle suggested operators take a look at a hybrid system using off-premise technology in high-churn areas and regular set-top converters elsewhere. Texscan plans to introduce an on-board descrambling circuit on the Tracs subscriber card, allowing a mixed strategy, he said. The new boards should be ready in January 1985, he added.

The long off-premise drops have some advantages compared to regular drops, Stelle said. "You'll use 50 to 60 percent fewer line extenders, 20-25 fewer trunk stations and 50 percent fewer amplifiers. Building costs also will be substantially lower—in the range of $135 to $150 per sub for the converter components."

Kopakowski also zeroed in on cost and revenue considerations. "There are three basic issues in security, the first of which is operating costs. Remote dis-

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(IRE WEIGHTING)	−82	–	–	–	−75
Frequency Response (dB to mHz)	±.1/5.5	±.1/5.5	±.1/5	±.1/5	±.1/5
Diff Gain (10-90%) 3.58	.1%	.1%	.25%	.1%	.1%
Diff Phase	.1°	.1°	.25°	.1°	.12°
AUDIO					
Crosstalk (dB/kHz) Audio to Audio	−88/20	−85/15	−80/15	−80/15	−75/20
Hum & Noise (dB below out)/FILTER	−122/15k	−109/*	−92/15k	−104/15k	−109/15k
Freq Resp @ Max Out (dB/dBm)	±.1/30	±.2/24	±.1/24	±.1/24	±.2/24
Over Freq Range	20-20k	30-15k	20-20k	30-15k	30-15k
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connects of non-paying subs can save money."

"You also have to protect basic-only subs from objectionable programming—that will cut churn," he said. "You also need to protect a new revenue stream provided by remotes."

"Sooner or later, the subscriber is going to figure out that he's paying a monthly charge for a remote that he paid a $20 deposit on, and may try to claim he lost the remote. He'll lose the deposit but have free use of the control," Kopakowski said. "You have to be able to disable the remote."

Addressability also is important as a source of future revenues, he said. "We've got 20 operators experimenting with pay-per-view now and at least one system has made some startling discoveries."

"Contrary to some popular opinion, subscribers aren't sensitive to price," Kopakowski said. "You either have winners or losers. You can sell a winner for $5, but can't move a dog for 50 cents."

"The other interesting thing is that PPV doesn't cannibalize pay services like HBO or Showtime," he added. "Consumers get used to ordering movies and soon decide they need pay—one system has gotten a 10 percent pay lift this way."

Theft of service is another good reason to go addressable. "No matter what you do, one or two percent of your subscribers will always find a way to defeat the system," Kopakowski argued. "But you want to stop it there—you don't want to tempt the subscriber by showing a scrambled picture or putting an instrument that can defeat the system in the home."

Only 10 percent of theft comes from "hackers" who build their own decoders or from third parties or internal sources, he said. The big problem comes from tampering with converter boxes.

So the answer is a converter that is physically impossible to enter without evidence of tampering, Kopakowski said. "Unless you do that, people are going to yank out modules, mix wires, pull chips, bend pins and stuff PROMs through aluminum foil. The key is to defeat anybody that gets in."

Emerson agreed that PPV represents a future revenue stream, but also argued that non-entertainment services will be important. "Power monitoring and energy management services can save a utility company money so they'll pay for it," he said.

—Gary Kim

FCC to check FM supertrunk use

WASHINGTON—The FCC's Field Operations Bureau will begin inspecting cable systems using the aeronautical bands for FM supertrunking in 1985, says John Wong, supervisory engineer with the agency's Cable TV Bureau.

Many cable operators have filed with the FCC to use the 108-136 MHz and 225-400 bands for wideband FM trunking, and in May the commission clarified rules for use of the bands.

FCC Form 325, Schedule 2 must be filed prior to use of the frequencies, and the operator must notify the commission before using new carrier or subcarrier frequencies in the bands.

At no time may peak power levels exceed 100 microwatts (38.75 dBmV) at any point along the trunk, and proof of performance tests must be conducted every three months. At no time can leakage amount to more than 20 microvolts per meter at a distance of three meters.

At frequencies up to and including 54

MHz, radiation can't exceed 15 microvolts per meter at 100 feet. At frequencies between 54 and 216 MHz, leakage can't exceed 20 microvolts per meter at 10 feet. Over 216 MHz, the limit is 15 microvolts per meter at 100 feet.

The commission won't allow use of the FM supertrunk frequencies for distribution within a single cable system.

All existing FCC requirements for cable system use of the aeronautical bands apply to FM supertrunking at all peak power levels of 10 microwatts (28.75 dBmV) or higher.

And all supertrunking above the peak power level of 100 microwatts is barred within 100 kHz of the emergency frequency 121.5 MHz. Also prohibited are transmissions within 50 kHz of emergency frequencies 156.8 and 243.0 MHz.

—*Gary Kim*

FCC upholds cable HAM band use

WASHINGTON—"Excessive" was the word the FCC used when it recently denied a request by the American Radio Relay League to prohibit cable TV systems from operating on the 144-150 and 222-228 MHz frequencies assigned to amateur radio service.

The ARRL petition, filed Jan. 12, 1982, said signal leakage from cable TV systems was interfering with amateur radio operations and was particularly severe in the 144-150 MHz range, because of the growth of amateur operators on the 144-148 MHz frequencies.

The ARRL blamed the interference on inadequate shielding, low quality components and poor cable installation and maintenance practices. The league cited cable drops as the biggest source of interference and said the proximity of amateur radio stations to cable TV systems results in amateur signal ingress as well as cable TV egress.

The NCTA argued that adoption of the ARRL proposal would severely limit cable TV operations and was unwarranted because widespread interference had not been demonstrated.

The FCC said in its June 15 decision a violation does not exist if cable TV signal leakage merely breaks the squelch on an amateur receiver in the scanning mode, but does exist if leakage levels exceed limits specified in CFR Section 76.605 (a) (12). These limits are: 15 microvolts per meter at 100 feet from cable on frequencies up to 54 MHz; 20 microvolts per meter at 10 feet from cable in the 54-216 MHz range; and 15 microvolts per meter at 100 feet from cable on frequencies over 216 MHz.

Leakage from cable supertrunks cannot exceed 20 microvolts/meter at 3-meter distance, FCC says.

NCTA's William Riker

Harmful interference also exists if cable signal leakage interferes with a local amateur radio repeater station and its user communications.

The commission urged the two groups to work together to resolve the interference problems.

According to William Riker, director of engineering for the NCTA, two joint ARRL/NCTA committees were established about one year ago to do just that. The groups' missions are to resolve interference complaints, some of which do not stem from cable TV, Riker reports, and to develop good cable TV engineering practices.

—Constance Warren

LPTV signals new headache

WASHINGTON—Headend interference caused by low power television transmitters may grow to be a headache for system engineers scattered across the country. Already, two cable operators have lost bouts with an LPTV operation that could interfere with their reception of distant signals. And the problem seems bound to spread.

Since Sept. 29, 1983, the FCC has issued 255 LPTV licenses and 217 construction permits. At times the commission has had as many as 32,000 requests backlogged, and now is processing between 250 and 300 bids a month.

Recently, the FCC rejected a petition filed by State TV Cable and Viacom Cablevision (Oroville, Calif.) claiming that Global Village Channel 2 in Oroville would interfere with their signals. Both receive distant signals from a transmitter 140 miles away, while the Global Village tower would be 20 miles away.

But the FCC rejected their claim that LPTV receive signal strength at headend would be too strong. The Commission also disagreed with the cable companies' claims of inadequate notification.

Cable engineers should be aware that the FCC allows only 15 days for filing of objections to an LPTV construction permit if the permit is awarded as a result of the lottery.

Objections to transmitter locations can be filed for 30 days after the commission announces construction permits for stations in uncontested markets.

Interference can take a variety of forms. LPTV use of the channel 2 and 3 frequencies, LPTV antenna sites too close to a cable headend and an LPTV transmitter located between a cable headend and a distant imported signal transmitter on the same frequency are some of them.

The FCC granted 567 translator permits since Sept. 29, 1983, and commission officials estimate that as many as 4,000 new translator stations could eventually be authorized. Translators can cause the same headaches as LPTV stations.

Systems can head off potential problems by checking FCC notices.

—Gary Kim

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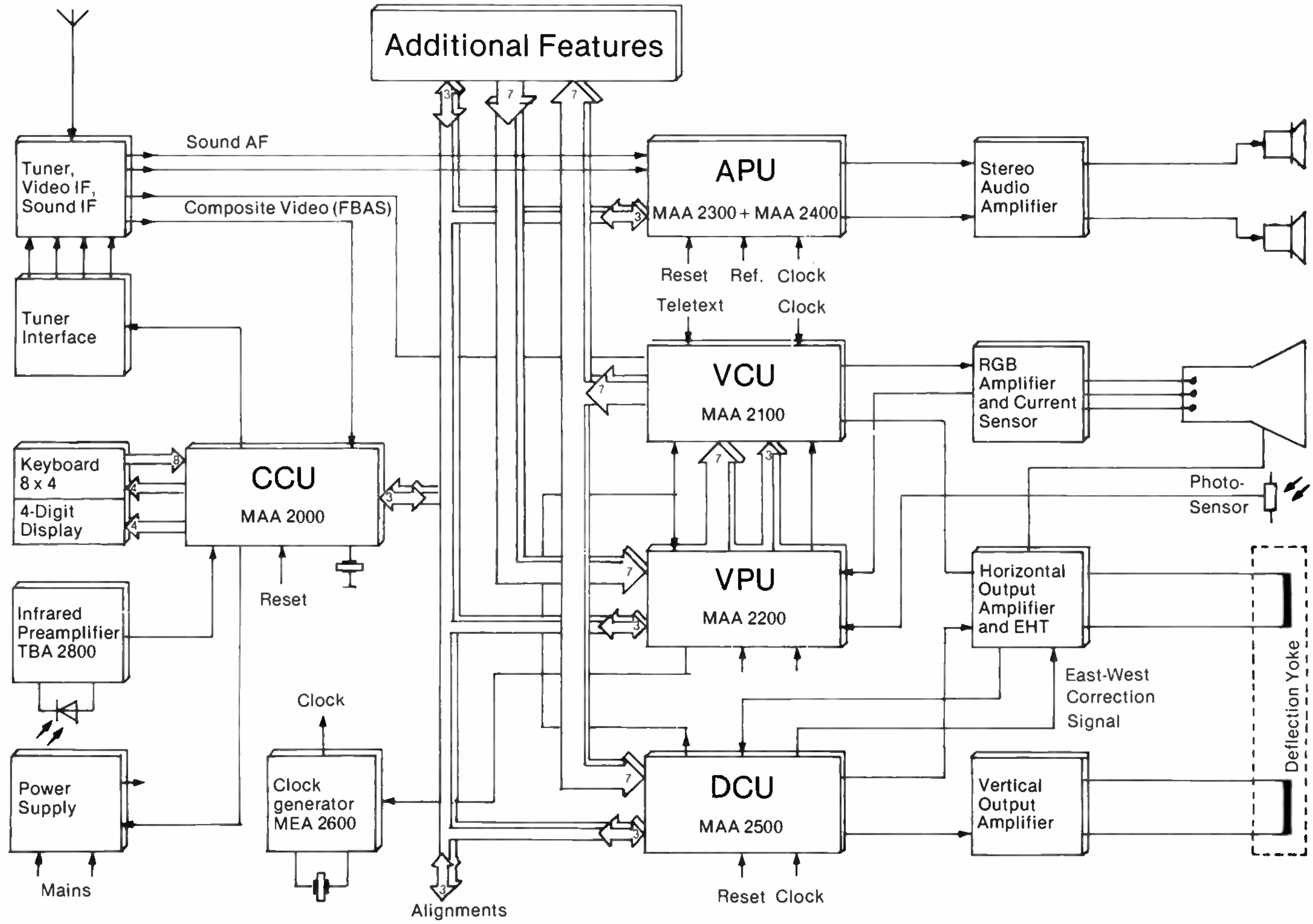

Can digital TVs beat sync suppression?

By Gary Kim

It isn't clear yet whether digital TV receivers will, as some in the industry fear, render gated sync suppression useless as a scrambling technique. But the claims, counterclaims and potential for havoc will be tested this fall as an NCTA Engineering Committee working group prepares to test common gated sync encoders and decoders with some of the new digital sets.

Up to this point, the attention and controversy have centered on a new chip set developed about two years ago by ITT Intermetall, based in Freiburg, West Germany. The company produced a set of five VLSI and LSI circuits on a single board that digitize audio and video signal processing from the demodulator to final output.

Three chips, a codec, a processor and a deflection processor, are responsible for the video signal. A fourth chip processes audio while the last serves as central controller.

Driving the firm's research was a desire to cut production costs. The digital processing circuits would eliminate the time-consuming need for analog trimmer adjustments and automatically align each receiver. Since set-up parameters would be stored in the controller, the microprocessor itself would automatically compensate for such changes over time as picture tube aging.

Although it isn't expected that digital TV sets based on the new Digit 2000 series chips will appear in quantity in the United States until mid-1985 or so, concern, and perhaps alarm, has been expressed because of the set's alleged ability to recover sync from the color reference signal.

Theoretically, it has always been possible to recover the horizontal and vertical sync frequencies from the color burst information, according to Nick Worth, Telecable vice president for engineering. And that is what worries some observers.

"Since the sync frequencies are integrally related to the color reference frequency, we've known for years that it's possible to recover sync there, at least in principle," Worth says. "Whether or not it's possible to do so in practice is what's not verified."

"Right now, there isn't a whole lot of hard evidence one way or the other," he adds.

Much of the concern centers on how easy it would be for hackers to tamper with the system. At present no TV set manufacturers are proposing to include software in their versions of the chip set that would make possible routine overriding of sync suppression scrambling.

"As the program is now written by ITT, the processor couldn't alter or defeat sync," says ATC's Bob Rast, senior vice president for corporate development. "Right now, we're depending on the good faith of the manufacturers—assuming they wouldn't include such capabilities in their sets as a marketing feature."

"As long as they don't do that, we're OK," he adds.

But what some observers worry about is the possibility that the microprocessor could be altered or replaced by another circuit that would override sync suppression.

Of course, this can be done now, with analog sets. "I've heard that for a few dollars, you can buy a circuit that introduces a gated level shift and adds a timing circuit," Rast says. "You sample sync and adjust the timing until you get the sync."

Zenith's Bill Thomas, director of CATV Communications Products, agrees. "For $50 now you can get a kit to defeat sync suppression. For $300 you can buy an illegal decoder, and it won't be any cheaper to defeat sync on the new ITT chip set."

So the real question isn't whether the chip set can defeat sync under certain conditions—Zenith has run tests of an altered chip set and has been able to recover the sync from the color burst.

"The picture jumps around a little bit, But you can recover a viewable picture," Thomas says. Recovered sinewave suppressed signals gave a more degraded picture, he adds.

The question is how difficult it would be for consumers to achieve such a result.

"It's a fairly major proposition, but a competent TV technician might be able to do it," Thomas says. "Given all the parts, it's possible. But acquiring the parts would take somebody of great sophistication and skill."

"In theory, at least, if you can do it once, then with the proper parts others might be able to replicate the feat," Thomas speculates.

"You'd really need to be very, very familiar with the set," says Oak Communications Director of Corporate Research and Development Mircho Davidov. "It would almost require previous experience working with the devices at the factory. But you can't underestimate the audacity of the hacker."

So the crux of the matter is whether the digital set is easier to tamper with than current analog models. What has not been proven is that it's possible to defeat sync suppression in the normal mode of operation with the ITT chip set.

"It's not true that the digital set defeats sync suppression," argues Pioneer's Larry Brown, general manager of engineering. Pioneer also has tested the ITT circuit, having sent a few to Japan for testing in a couple of sets. "We found no descrambling effect," Brown says. "In fact, the depth of scrambling seemed to increase."

"It's true the set and circuitry can be modified to render sync suppression moot, but any set can be modified to defeat it. Digital circuitry poses no inherent threat to sync suppression as a method," Brown argues.

"Even if sync could be recovered this way, it's probably safe to say you wouldn't get a perfect signal," Worth adds. "The contrast and brightness registration would be off, and the picture might show a sync bar."

"In any case, it isn't a straight-forward proposition," he cautions.

"And nobody ever said sync suppression was a totally secure method," Rast says. "Digital TVs could make it easier to defeat, but as long as the manufacturers don't produce a set that defeats, I think we're okay."

According to Thomas, even some analog sets made in Europe have the ability to lock on to the vertical and horizontal sync pulses in the color burst.

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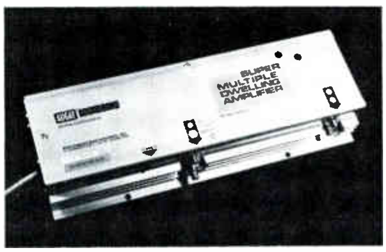

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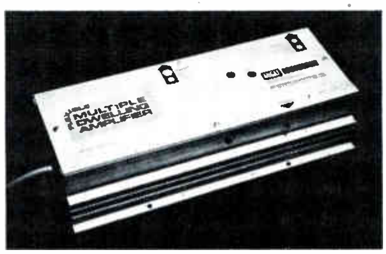

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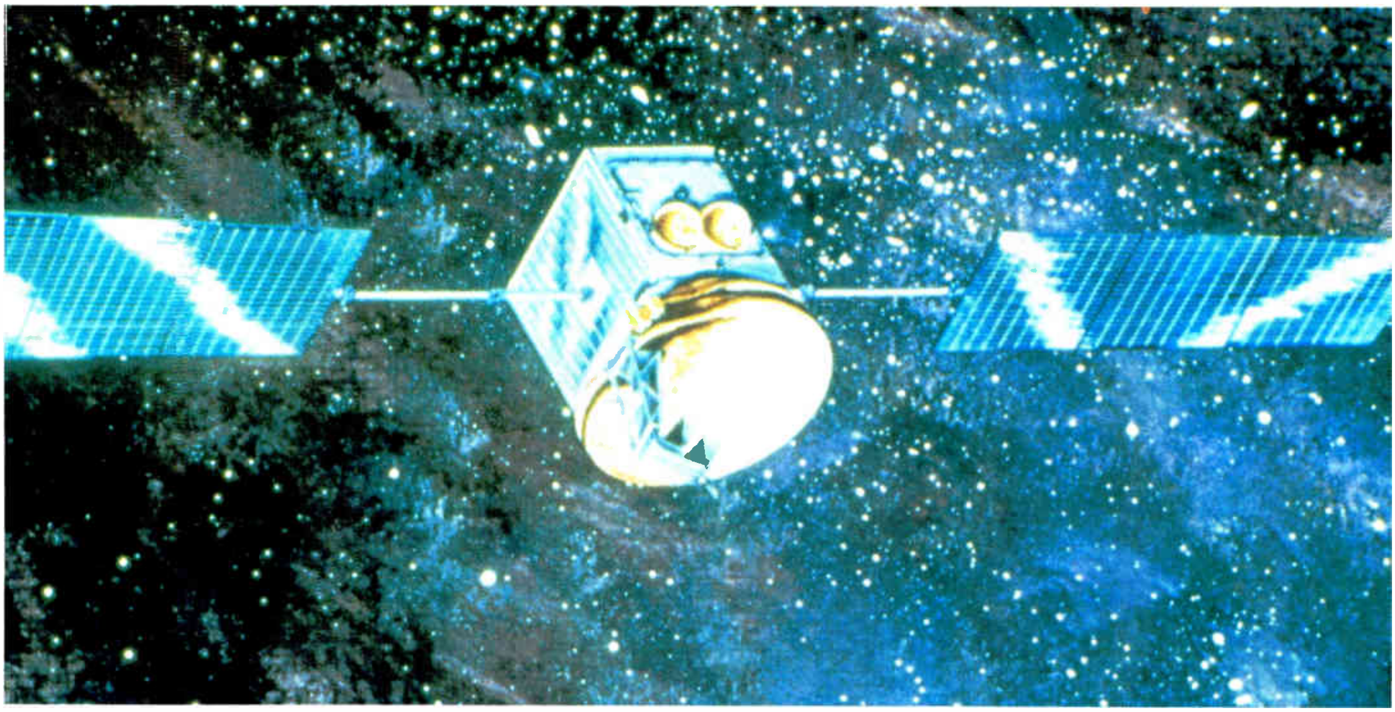


2° spacing possible operator headache

Mark Elden
Director of Engineering
Showtime/The Movie Channel

With the recent phenomenal expansion of domestic satellites, the demand for satellite communication services is expected to grow steadily through the end of the century. To meet this growing demand, additional satellite systems must be licensed in the orbital arc. However, U.S. domestic satellite systems can only be placed in a finite and limited orbital arc. Operations in the 6/4 GHz bands require a minimum elevation angle of 5 degrees above the horizon. For coverage of the 48 continental states (CONUS), the usable orbital arc extends from 55 degrees to 136 degrees West. To cover CONUS and Hawaii, the usable arc reduces to 85 degrees to 136 degrees West. If CONUS and Alaska are to be served, the arc reduces to 115 degrees to 136 degrees. (At 12/14 GHz Ku band the usable arc is even smaller. Rain attenuation in this band limits the minimum elevation angle to approximately 10 degrees above horizon and results in a usable arc of only 63 degrees to 129 degrees W.)

Since 1981, the FCC has been re-examining its satellite policies, with a look at reducing the 4 degree satellite spacing order. If a uniform 3 degree orbital spacing were implemented instead of four degree spacing, there would be room for only four additional U.S. satellites in the usable arc. If a reduction to 2 degree spacing were implemented, the number of U.S. satellites in the orbital arc could be doubled. The minimum required spacing between two satellites in orbit is not governed by a concern for their actual collision, since a one degree orbital spacing equates to a separation distance of about 450 miles (in addition to the three dimensional space aspect). The concern with closer satellite spacing is the level of interference that is conveyed from one satellite to the other. There is a limit on how close satellites can be placed to one another in orbit without having to impose severe restrictions on ground segment transmit and receive hardware specifications and capabilities.

In its April 27, 1983, report and order, the FCC concluded that a 2 degree orbital separation between U.S. domestic satellites in the 12/14 GHz band is technically feasible with minimum hardship on existing carriers and users (this is because earth station antennas are more directive at higher frequencies). The FCC, therefore, immediately implemented a 2 degree orbital spacing for newly launched satellites in this band. In the 4/6 GHz band however, all concerned parties contended that an immediate implementation of 2 degree orbital spacing in this band would cause serious difficulties and would incur significant costs to both carriers and users. The FCC then took a more cautious approach adopting 2 degrees as the basic long-term orbital spacing criterion in this band and implemented a transitional arrangement to the uniform 2 degree separation providing a combination of 3 degree, 2.5 degree and 2 degree orbital spacings.

Closer spacing, new standards

To achieve a uniform 2 degree orbital separation, with acceptable interference between satellite signals, the FCC proposed improvements in earth station antenna sidelobe performance (3 dB actual improvement and 10 dB cross-polarization isolation standard—see appendix 1 for details). It should be made clear however, that receive-only antennas need not comply with the new performance standards. These new antenna performance standards only define the assumed level of interference protection in a closer satellite environment. Parties installing new receive-only earth stations have the option to decide for themselves whether to purchase earth stations that meet the new 2 degree ruling or whether to accept responsibility for increased interference levels at their receive locations (this does not apply to transmit antennas). The FCC will continue to maintain the current licensing procedures at the 4 degree spacing antenna reference pattern for the purpose of terrestrial interference protection for downlink receive stations.

The operator of a receive-only facility then has the choice of whether or not to upgrade the antenna to comply with the new FCC two degree spacing antenna reference pattern. The following analysis attempts to shed some light on the extent of interference and its severity if necessary steps to comply with these rulings are not taken by the receive ground stations.

The performance of an earth station is estimated by calculating the carrier-to-noise (C/N) from the downlink and the noise contributions of the uplink. A typical clear sky link calculation for an earth station that complies with 4 degree spacing FCC antenna patterns are shown in Table 1 for different size antennas at 4 degree and 2 degree spacing (desired satellite surrounded by two identical satellites of EIRP = 36 dBW each). The calculations take into account all typical satellite interference factors (terrestrial, internal and adjacent satellites).

Table 1

Video Carrier to Noise Ratio (dB) Antenna Pattern (32-25 log 0) EIRP = 36 dB

Antenna	Total C/N dB 4°	2°
3.0 M	10.5	8.6
5.0 M	13.2	11.6
7.0 M	16.4	14.8

Separate evaluations necessary

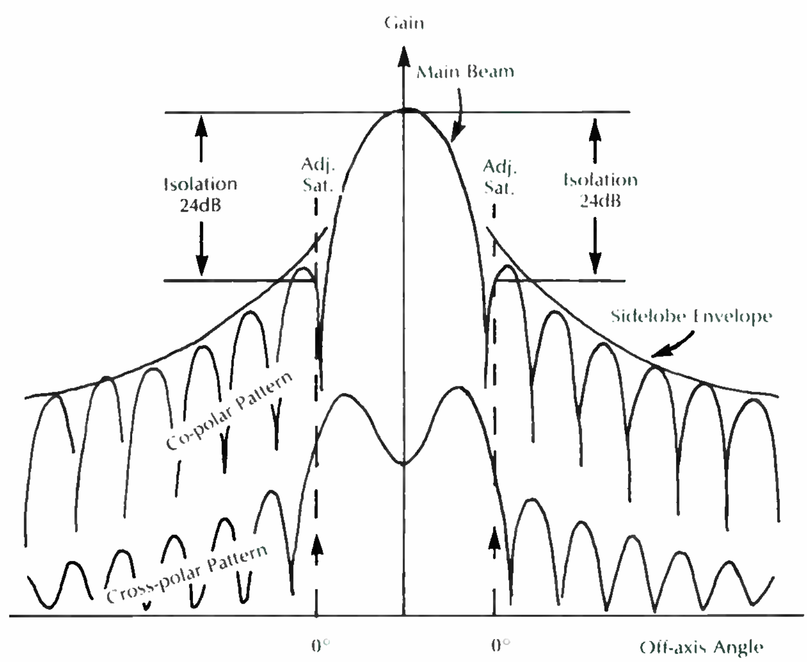
It can be seen that changing from 4 degree to 2 degree spacing will cause about a 2 dB degradation in calculated total video carrier-to-noise performance (C/N). If our minimum acceptable C/N is 9 dB (threshold point), then it might be inferred from the above table that the 5.0 M and 7.0 M antennas will operate satisfactorily, while the 3.0 M antenna performance falls below our minimum acceptable criterion by 0.4 dB. However, the above analysis is not complete because it combines the carrier-to-thermal noise with the carrier-to-interference, without treating the carrier-to-interference as a separate item. The interference factors must be evaluated separately and given independent acceptance criterion for a TV picture to have acceptable quality (this is because one's perception of interference is much more acute than that of random noise).

It has been reported (FCC 76-1169 Declaratory ruling January 7, 1977) that for video interference into video with zero frequency separation between video carriers, interference is first detectable at a protection ratio of 18 dB, clearly noticeable at 16 dB and unacceptable at 14 dB. Also reported was that video interference into video has a worse effect on the received TV signal than either high speed data or FM/FDM interference. TV interference appears as wavy horizontal lines, high speed data appears as random impulses and FM/FDM shows up as thermal snow.

Test considerations

Although analyzing interference in a TV picture is a complex task (the nature of the TV signal itself and the physiological complexities of human observations of the TV image do not allow an easy analysis), several subjective tests have been conducted by independent organizations to determine the effects of interference in a TV picture and to develop an objective for a minimum carrier-to-interference ratio. For example, CCIR recommended 20 dB; ITT, 18 dB; RCA Americom, 18 dB; NCTA recommends 18 dB; and other organizations recommend values between 18 and 31 dB. A recommended carrier-to-interference protection ratio should not be construed as a rigid requirement for a viewable picture. If a receive station is operating with a carrier-to-interference value below the

Figure 1—Typical antenna radiation patterns



recommended levels, the result is that a larger percentage of viewers will notice some degradation due to the presence of interference. Also, the above tests were performed in a contolled laboratory environment and no results have been reported for a real dynamic satellite environment where all potential sources of interference exist simultaneously. Additionally, results of these tests depend on the judging audience (experts or non-experts), on the method in which the test is being conducted (still slides, moving pictures or a combination), on the nature of the picture itself (high or low chroma contents) and so on. The lack of standardization of testing methods is one of the causes of the many controversies surrounding acceptable carrier-to-interference values.

The results of a test shown in Table 2 clearly illustrate that thermal carrier-to-noise (C/N) and carrier-to-interference (C/I) are two separate and different entities, each one having its own individual subjective effect. The test was conducted in SA laboratories with Dr. Alan McBride, Steve Chaddick and Tom Mock. The configuration used color bars for the wanted signal and flat field for the unwanted signal (worst case test). The test allowed different values of interference levels to be injected onto a signal with different values of C/N.

Table 2

C/N dB	C/I dB	Results
10	infinite	Moderate but not excessive—impulse noise slightly objectionable.
infinite	18	Cross hatching definitely visible in cyan and green areas (cross hatching even more noticeable when viewed in monochrome).
10	18	Impulse noise as above combined with cross hatching.

The above results indicate that the subjective effects of C/I and C/N are different, that cross hatching was the dominant degradation with video interference into video while impulse noise was the source of degradation in low C/N conditions.

Despite the limited information that tests of this nature contain, a review of their reported results strongly suggests that a total combined carrier-to-interference ratio objective of at least 18 dB is required for acceptable pictures (non-broadcast quality).

Once a criterion for carrier-to-noise ratio has been established, we can proceed to determine how existing antennas will perform in a 2 degree satellite spacing environment.

Antenna performance

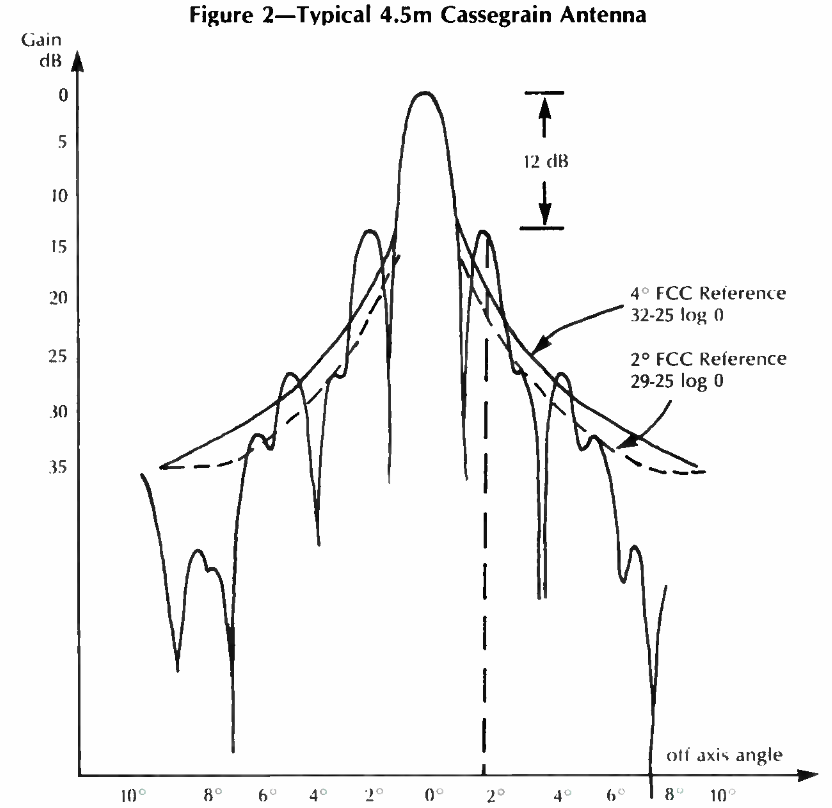
Interference in the received satellite signal generally originates from the following sources:

- **Terrestrial microwave** — The 4/6 GHz band that C-band satellite services operate on are shared with terrestrial microwaves around the country. The terrestrial carrier frequencies are offset by 10 MHZ from the satellite designated carrier frequencies so interference is reduced somewhat. However, terrestrial interference is causing severe interference conditions in many systems. Solving terrestrial interference problems may involve inserting appropriate filters, erecting artificial shields, installing the antenna in a pit or relocating the antenna to a more tolerable site. The generally accepted level of interference from a terrestrial system into a satellite earth station is 25 dB. FCC licensing of a TVRO provides protection from future interference conditions at the earth station location.

- **Internal interference** — Adjacent or cross-polarized transponders in the satellite couple some of their energies into the desired transponder causing undesired interference. The level of this interference is established by the skirt selectivity of the transponder filters and the cross polarization performance of the earth-satellite link. The generally accepted level for internal interference is 26 dB.

- **Uplink adjacent satellite interference**—Uplink stations transmitting to adjacent satellites spill some of their energies into the desired satellite. The level of this interference is determined and limited by the transmit antenna off-axis discrimination angles spe-

Figure 2—Typical 4.5m Cassegrain Antenna



cified by FCC antenna radiation patterns.

- **Downlink adjacent satellite interference**—A receive antenna looking at one satellite ideally should receive signals only from that one satellite. The antenna pattern, however, has sidelobes which detect and receive signals from adjacent satellites causing unwanted interference in the received picture.

The total carrier-to-interference at the receive station (desired to be 18 dB) is the combined effect of all the above factors and is given by:

$C/I_{tot} = C/I_{terr} + C/I_{int} + C/I_{adj.U} + C/I_{adj.D}$, where:

C/I_{tot} = total carrier-to-interference received at earth station (18 dB),
C/I_{terr} = carrier-to-terrestrial interference (25 dB),
C/I_{int} = carrier-to-internal interference (26 dB),
$C/I_{adj.U}$ = carrier-to-uplink adjacent satellite interference (26 dB),
$C/I_{adj.D}$ = carrier-to-downlink adjacent satellite interference,
$+$ = power summation

The only factor under the control of the receive station in reducing total interference level is the downlink adjacent satellite interference source. To determine the required carrier-to-adjacent satellite interference of a receive station that will yield 18 dB of total carrier-to-interference, we substitute the appropriate values in the above equation:

$$18 = 25 + 26 + 26 + C/I_{adj.D}$$
$$10^{-1.8} = 10^{-2.5} + 10^{-2.6} + 10^{-2.6} + 10^{-x}$$
$$C/I_{adj.D} = -10 \log (10^{-1.8}-(10^{-2.5} + 10^{-2.6} + 10^{-2.6}))$$
$$= 21 dB$$

Isolation key

We conclude that the receive earth station must be of such quality to be able to provide 21 dB of isolation to adjacent satellites in order to meet a total C/I of 18 dB in the final received TV picture.

The antenna quality that affects adjacent satellite interference isolation is determined by the antenna gain at the off-axis angle. In our analysis and for the sake of simplicity, we will assume a homogeneous space segment where the desired satellite is surrounded by an identical satellite on each side.

If the adjacent satellite EIRP is identical to the wanted satellite EIRP, i.e. homogeneous space segment, the $C/I_{adj.D}$ will just be equal to the isolation the receive antenna is providing to its adjacent satellite. If the adjacent satellite is of different EIRP the $C/I_{adj.D}$ can only be accurately calculated using the detailed equations of appendix 2.

Figure 1 shows an illustration of a typical antenna co-polar and cross-polar radiation pattern. On this antenna pattern also is plotted a left and a right adjacent satellite at an angle 0 from the axis of the main beam. For this receive antenna to provide 21 dB of isolation to adjacent satellites, a 24 dB isolation to each adjacent satellite on either side must be provided (since 24 + 24 = 21 dB). If the adjacent satellite is cross polarized (i.e. transponder 5 in desired satellite is horizontal but in adjacent satellite is vertical), the antenna generally can provide 4 to 6 dB additional isolation and the requirement for adjacent satellite isolation on each side will be reduced to around 19 dB (sidelobe polarizations are very dependent on weather conditions; during periods of rain, the depolarization of the incoming signal may reduce this additional isolation to zero).

As a general rule to determine how your antenna will respond in a homogeneous closer satellite spacing environment, obtain the radiation pattern from the manufacturer of your antenna, plot the adjacent satellite with the desired spacing angle and determine the isolation that the antenna provides at this angle. The isolation should be in the order of 24 dB on each side (or 19 dB if adjacent satellite is cross-polarized). Note that antenna radiation patterns change slightly with transponder frequencies. One should work on the worst case radiation pattern. (Technically the satellite spacing angle viewed from the antenna (topocentric angle) is slightly different than the actual angle in orbit satellite spacing (geosynchronous angle) because of the earth's radius. An average topocentric angle for CONUS is approximately 1.08 multiplied by the geosynchronous angle—appendix 3 gives the formula to derive a topocentric angle from a given earth station location and a given geosynchronous angle.)

Figure 2 is an illustration of a typical 4.5 M cassegrain antenna that meets 4 degree FCC patterns. It can be seen that the antenna has sidelobes at 2 degrees and that it provides only 12 dB of isolation to an adjacent satellite at this spacing. We can expect interference degradation in received picture in a homogeneous 2 degree spacing environment. (Note that at 3 degrees (current separation between F-3R and Galaxy I) the antenna provides 25 dB isolation.) This antenna, at 2 degrees, provides a performance 12 dB short of our criterion for copolarized adjacents and 7 dB short for cross polarized adjacents. (A 4.5 M prime focal feed antenna is expected to have better sidelobe characteristics and may provide better performance.)

Figure 3 is an illustration of a 4.5 M antenna that meets new FCC pattern requirements. The isolation provided at 2 degrees is 23 dB and just about meets our criterion of 24 dB. If the adjacent satellite is fully or partially cross polarized, our criterion will be easily met and the picture will be acceptable.

Figure 4 is an illustration of a typical 3.0 M antenna. The broken trace is an existing pattern, the solid trace meets the new FCC pattern (except at 1 degree). It can be seen that at 2 degrees the old antenna provides only 14 dB of isolation (i.e. expect interference in picture). On the other hand, 2 degrees in the new antenna falls inside the main beam and is 23 dB down and just about meets our

continued on page 55

Figure 3—New 4.5M Antenna

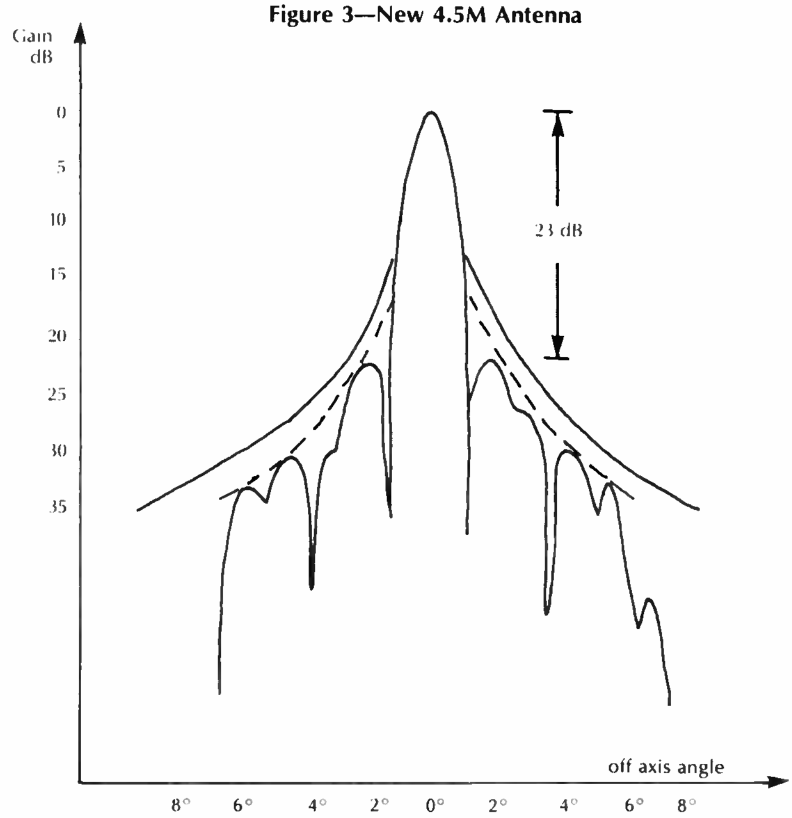
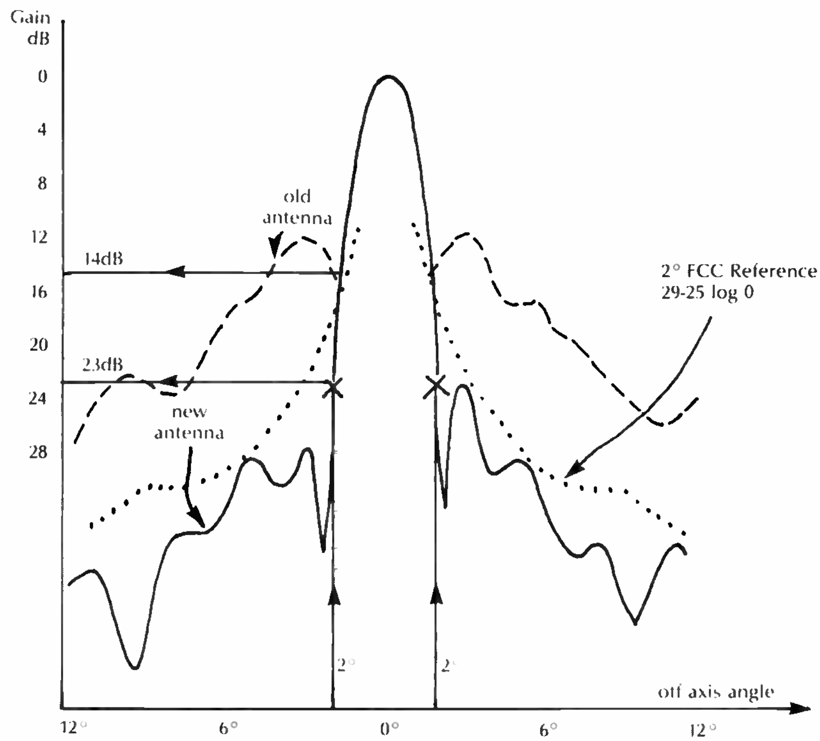
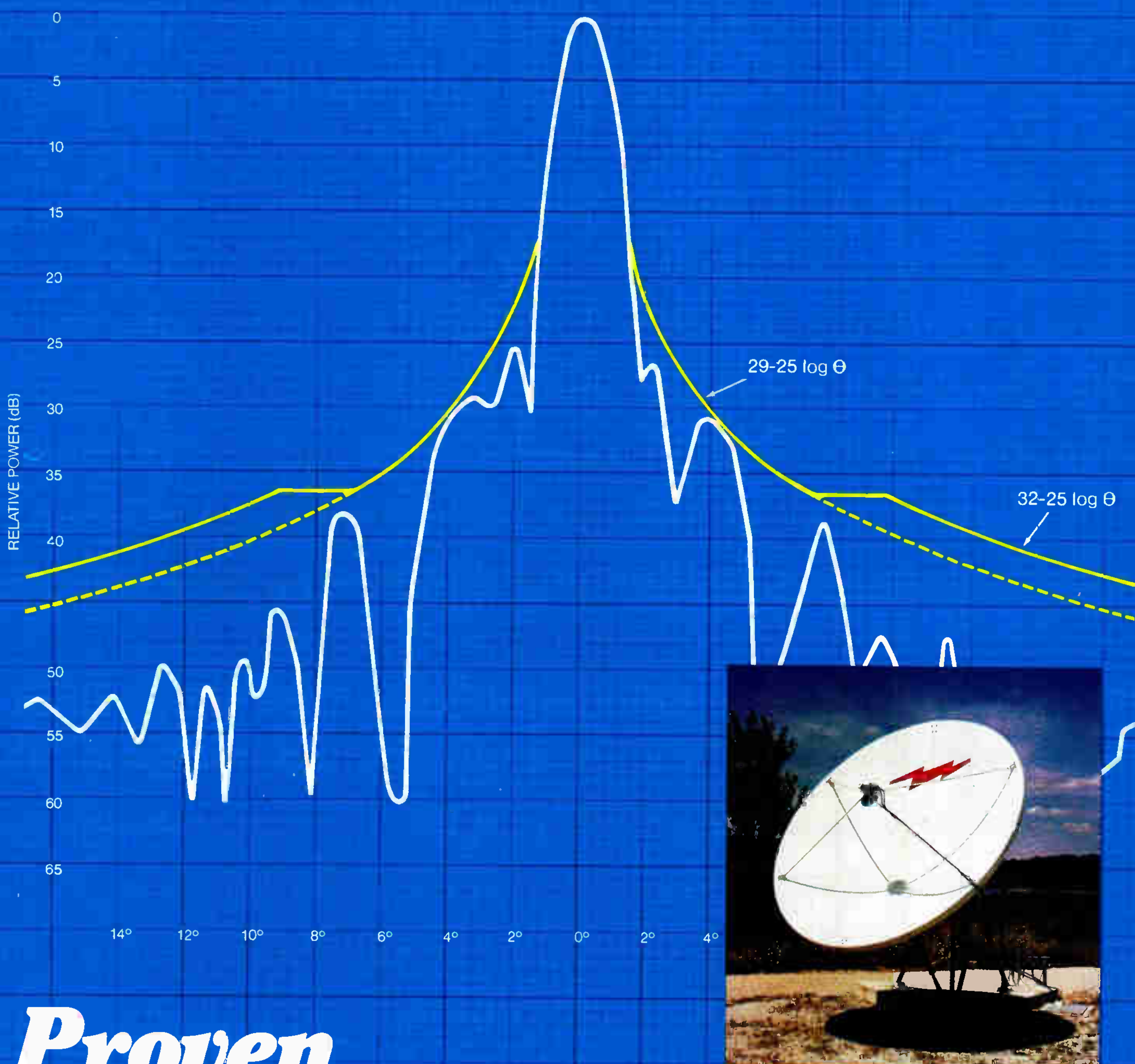


Figure 4—3M Antenna





Proven

"Proven" means that the new Andrew 4.5 metre receive-only earth station antenna has been thoroughly evaluated on our automated test range. Far-field range testing provides essential proof of antenna performance. As can be seen in the pattern range data shown above, 2° performance is available today. This 4.5 metre antenna will minimize adjacent satellite interference. It's 4 GHz patterns surpass FCC requirements—for 2° satellite spacing—enacted in August 1983.

The 4.5 metre antenna embodies the same quality and state-of-the-art technology characteristic of all Andrew products. Patented beam shaping feed technology and superb reflector surface accuracy produce high gain and excellent pattern control. Segmented reflectors are utilized for efficient handling and low shipping costs. Rugged metal construction throughout.

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Picture quality

The technical challenge of DBS

By Israel (Sruki) Switzer,
Cable Television Engineering

The Sony HDVS (left) and standard TV set (right) show the difference in picture quality between 1,125- and 525-line screens.

The question I'm asked most frequently as an adviser to cable system management is, "What will be the impact of DBS on cable?" My response is I do not worry much about the economic impact of DBS. Cable offers so much in terms of value of service that it always will compete successfully with DBS in urban and suburban areas dense enough to support cable. I do, however, express serious concern about the impact of DBS on cable technology.

That concern was heightened and crystallized by recent announcements that such long term cable service stalwarts as HBO, CNN, WTBS and ESPN will start to market their services by DBS. After all, they are at present missing a substantial market that cable doesn't reach but DBS could. My concern is that cable subscribers soon will have the opportunity to compare, side-by-side, a cable-distributed service and the same service distributed by DBS. The DBS-delivered picture will be perceptibly better than the cable-delivered picture, particularly on the better-quality TV sets and video monitors now available. DBS subscribers will, no doubt, have the option of using somewhat larger-than-usual receiving antennas and will be capable, therefore, of receiving studio-quality pictures. The satellite is becoming the distribution medium of choice for the television networks. DBS subscribers will have the option of network-quality pictures right in their living room. Cable subscribers don't have this option. Cable-delivered pictures are compromised in comparison to the network transmission standard.

Quality considerations in cable systems have been concerned almost exclusively with noise and distortion. As with other frequency division multiplexed (FDM) transmission systems, cable systems tread a narrow path between the two. Signal levels that are too low result in excessively low C/N and consequent S/N, while signal levels that are too high produce excessive distortion. Inadequate C/N results in snowy pictures. The limiting distortion in multichannel cable systems is now third order intermodulation. This results in waterfall effects in non-coherent carrier systems and crosstalk in coherent carrier systems. All of these effects are, of course, objectionable.

The cable system business has evolved in a market environment in which variety, i.e. the number of signals, is more important than image quality. Systems operate with adjacent channels to pack the most signals into the least amount of system bandwidth. Coherent carrier techniques that reduce distortion decrease peak composite signal levels and minimize the subjective impairment effects of intermodulation. Video signal synchronization is being used by some systems to reduce further the subjective effects of transmission distortion. Manufacturers of the thin film hybrid gain modules that are almost universally used in cable television repeater amplifiers are producing gain modules with remarkably good specifications for noise, distortion and flatness of frequency response.

Mediocre S/N

Notwithstanding the remarkable sophistication of the equipment and the transmission technology, cable television image transmission must be considered mediocre by the standards employed in the television production industry. The cable television industry understandably tends to stretch the capabilities of the available equipment to the utmost. The FCC rules allow C/N as low as 36 dB. C/N in cable systems is measured in a 4 MHz bandwidth. It turns out that C/N in 4 MHz bandwidth translates almost directly to video weighted S/N with only minor numerical correction. Most recently designed cable systems aim for a C/N of 43 dB. Although many cable subscribers, particularly those close to the distribution headend, enjoy a higher C/N ratio, many accept what video professionals would consider mediocre S/N. There is a similar pressure in regard to intermodulation distortion, where cable systems are willing to compromise on image quality to gain maximum economic efficiency.

This situation has arisen because cable television systems, by and large, do

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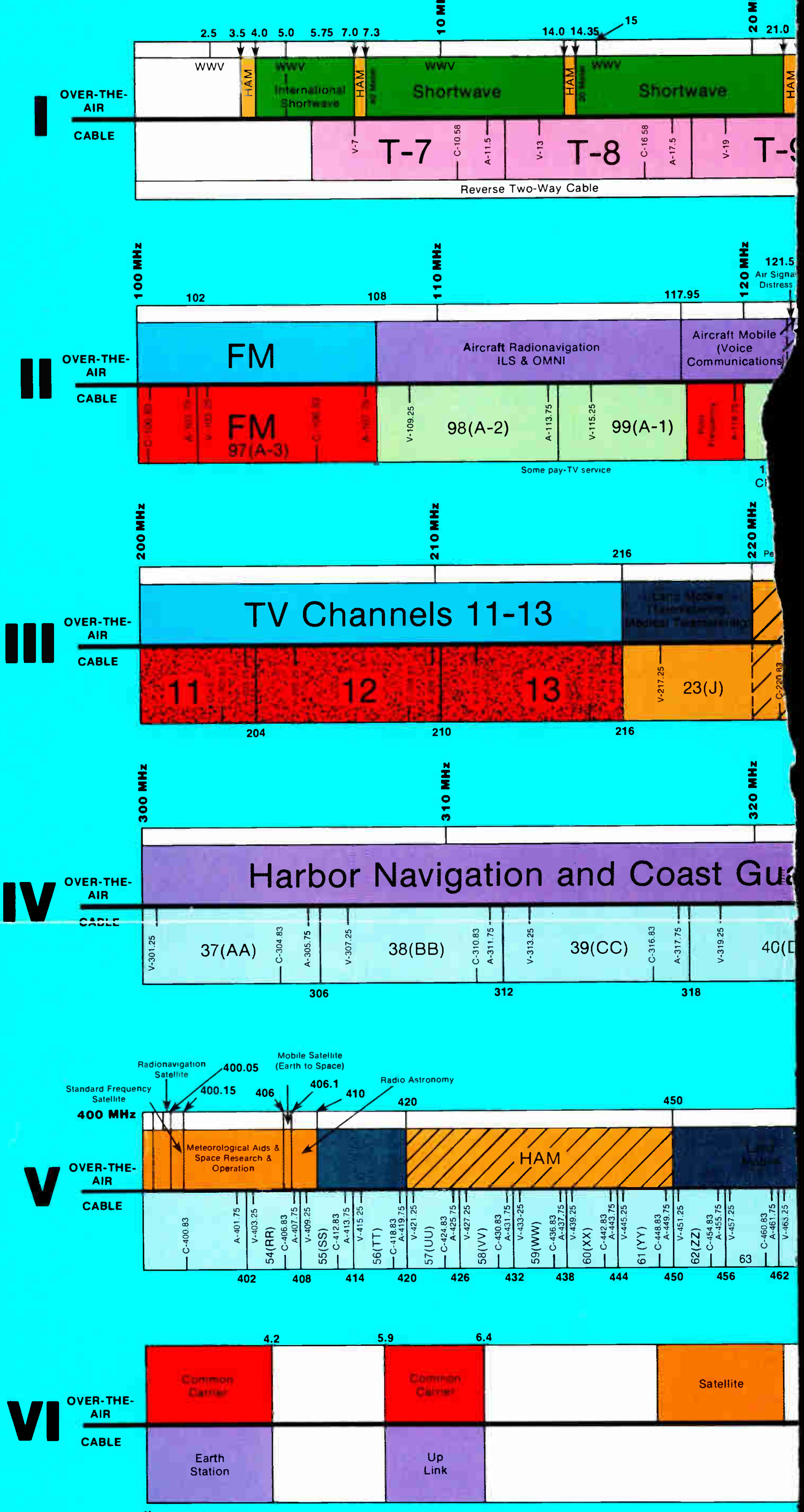

CATV channel designations reflect the new Cable Television Channel Identification Plan recommended by a joint committee of the Electronic Industries Association and the National Cable Television Association. Former, standard designations appear in parentheses. It should be noted that some manufacturers using phaselock IRC channel spacing avoid using Channel 5 and 6 as designated on this chart. Instead they set the frequencies so that the

video carr
with numb
channels

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CED's CATV Frequency Allocation Table

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(Pull out for entire chart)

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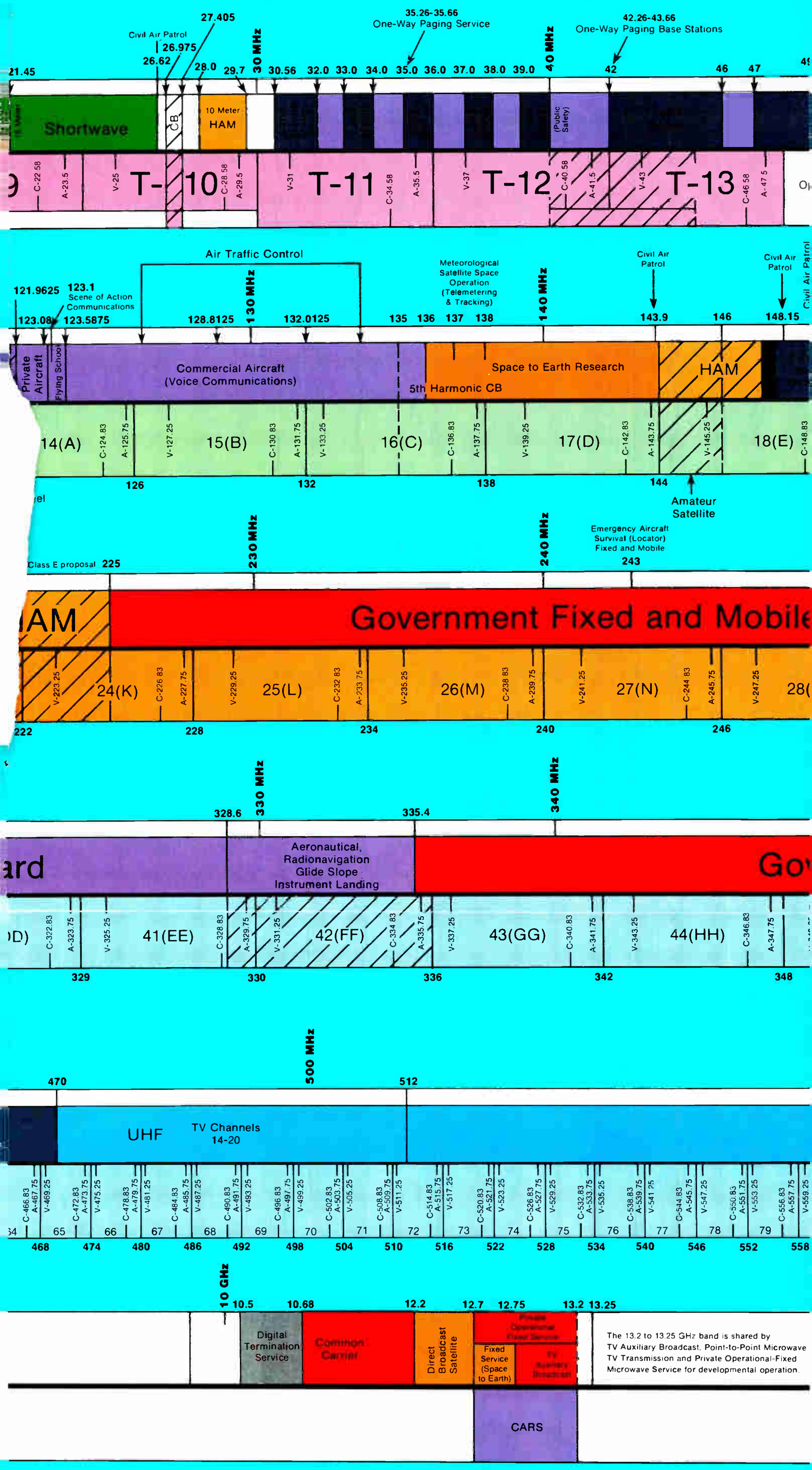

ers are at 79.25 MHz and 85.25 MHz, respectively, and usually designate those channels
ers other than 5 and 6. The joint EIA/NCTA committee has not chosen to give these
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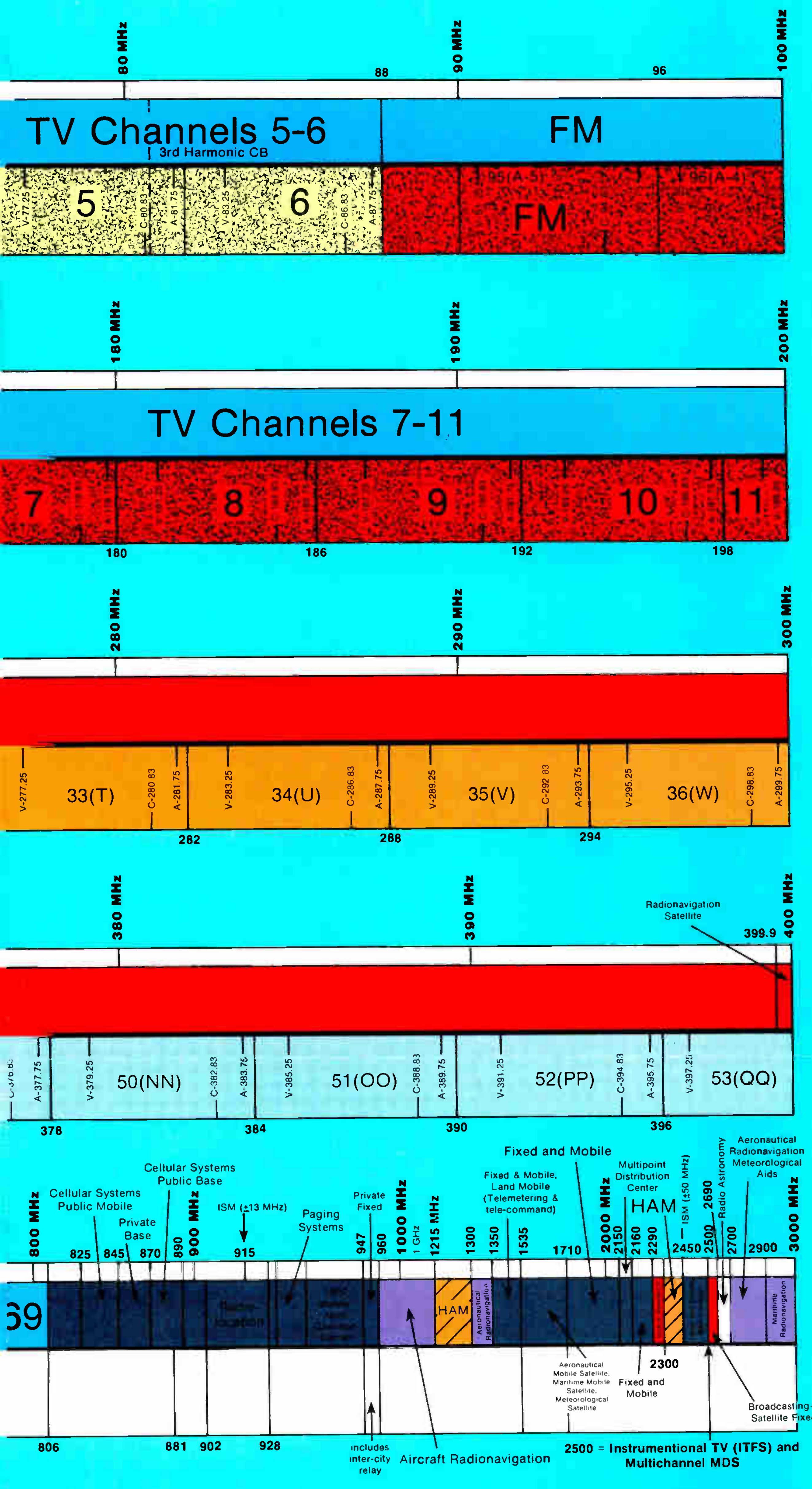

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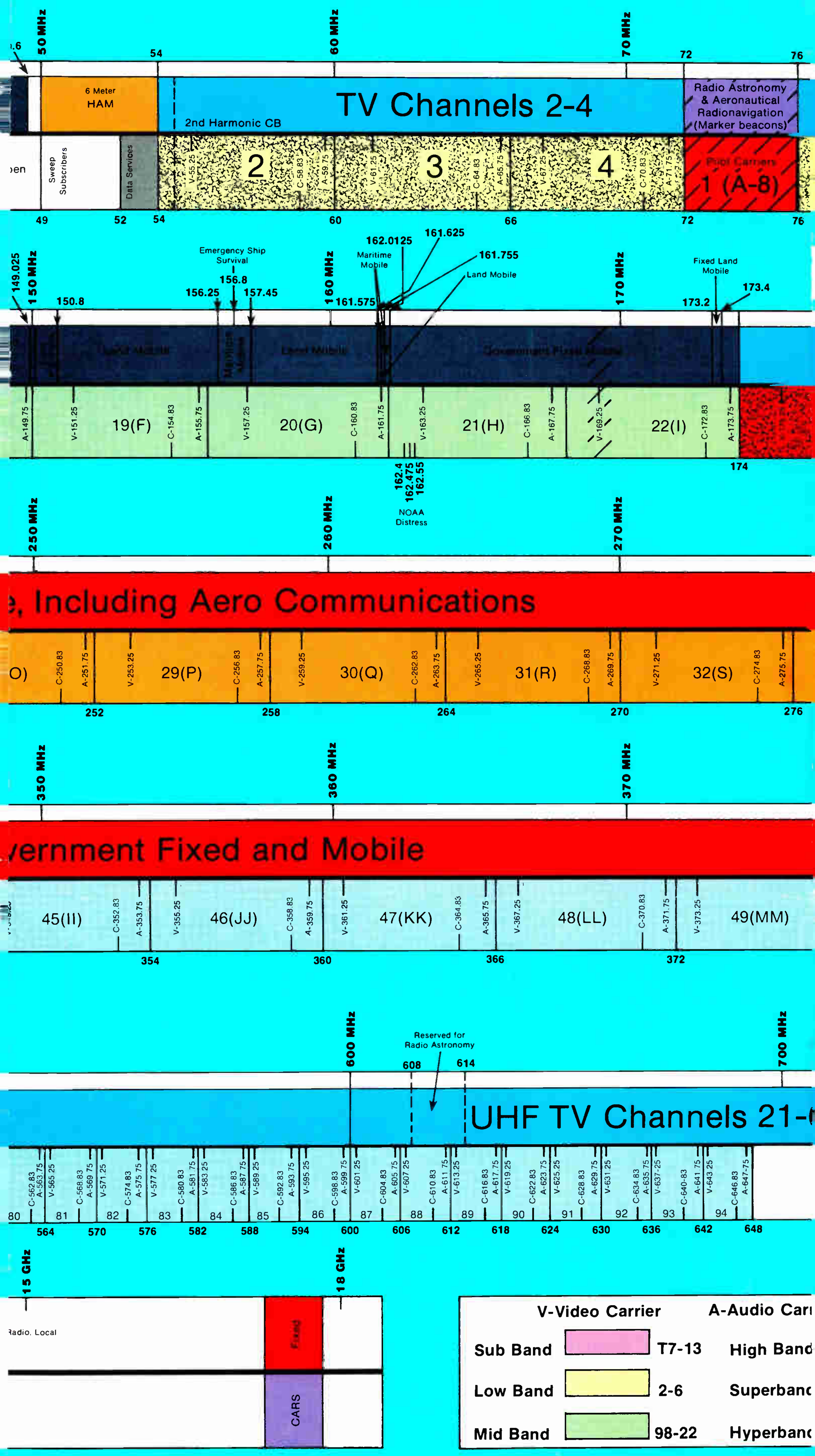


not serve sophisticated viewers. Most subscribers served by mediocre cable systems have mediocre receivers—by professional standards—and would not know a really good picture if it popped out of the screen and offered to make coffee. The present cable television market judges the value of the service by the number and variety of television program services, provided practical standards of "barely-perceptible" impairment are achieved.

Cable transmission engineers generally have overlooked one major parameter that, in my view, also affects transmission quality. The effect of multiple, closely spaced reflections is not fully understood. I believe that these reflections, arising from the small impedance mismatches caused by the myriad of connectors and devices in the transmission path and the small imperfections of the coaxial cable itself cause a slight smearing of crispness. The visual effect is that of a reduction of transmission bandwidth, even though we know that the broadband transmission system has not itself directly reduced the transmission bandwidth. Our operations engineers get complaints from subscribers who have a chance to compare good quality local television signals as received directly from a local broadcaster with those signals received through the cable system. There is a small but noticeable impairment that does not have to do with C/N, intermodulation or signal processing considerations. I attribute the impairment, as I have said, to multiple, low level reflections in the cable system.

High quality transmission of NTSC signals

I consider this a topic of major importance. I am concerned that the new DBS services will point out picture quality imperfections in cable service. I am told that COMSAT is designing an all-digital origination center (Las Vegas) with the objective of providing absolute state-of-the-art program origination for its DBS service. I believe that DBS service will be capable of providing higher quality image transmission than that of the present terrestrial television broadcasting system and certainly better than that of the present cable systems. Cable television systems must anticipate this competitive pressure and respond with significant improvements in cable-distributed image quality.

High definition television (HDTV—1125-line) has excited a great deal of interest in the professional television community and is starting to get attention from the popular press. The present HDTV concept originated with NHK and has been implemented in demonstrations by several Japanese equipment manufacturers—Sony, Matsushita and NEC. The May 1983 International Television Symposium in Montreux, Switzerland, had a large-scale HDTV demonstration with special programs taped by CBS and several European and USSR broadcast authorities. Sony staged an impressive HDTV demonstration at the 1983 NCTA convention in Houston.

HDTV: a decade away

HDTV is spectacular, particularly when projected onto a large screen by a good quality projector. Images approach 35mm motion picture quality. The HDTV screen, as proposed by NHK, has a 5:3 aspect ratio compared to the 4:3 aspect ratio of conventional 525-line systems. The 5:3 aspect ratio approximates current wide-screen motion picture presentation. Frame/field rate remains 30/60. The improvement in definition results in a significant increase in video bandwidth—about 20 MHz compared to th 4.2 MHz used by present broadcast systems. The system has, of course, high-fidelity stereo. HDTV features:

- 1125 scan lines,
- 5:3 aspect ratio,
- increased video bandwidth,
- non-NTSC color encoding, and
- high fidelity stereo sound.

These attributes, however, result in serious imcompatibilities with present broadcast television receivers. There is general acknowledgment that it will take many years to introduce HDTV as a broadcast service.

Just before going to Montreux, I read an account of Joe Flaherty's presentation on HDTV at the NAB convention earlier this year. Flaherty is chief engineering executive at CBS. He was complaining that there hadn't been any major improvement in television program origination quality in the last few years. HDTV was a new breakthrough in this area. This report moved me to write to him. I pointed out that 99.9 percent of the television audience in this country has yet to see a good 525-line picture.

I believe that we will experience a generation (10 years) of improved 525-line television before HDTV (1125-line) becomes a major factor in television broadcasting. It might turn out that improved 525 services will actually delay introduction of 1125-line HDTV services because of the renewed investment in high quality 525-line receiving equipment. HDTV can follow as a cable service in due course.

Americans have a long-standing reputation of not caring about television picture quality. I believe that there are Americans who can be sold on quality video, and who will pay a reasonable price to get it. I believe that this quality market segment subscribes to cable and that cable is the best way to reach it.

There was a similar situation in phonographs thirty years ago. CBS developed the LP microgroove record. Recording engineers were able to produce records with much better audio quality than had ever been produced before. The existing phonographs simply could not reproduce the sound quality that the recording artists and engineers were putting into the new records. People had LP players but the pickups, the amplifiers and the loudspeakers just weren't good enough. Improved phonograph components were developed and found a ready market for high-fidelity audio. There has been a continuing market for improvements in audio equipment over the last thirty years. We may finally have achieved the end of the technology chain in audio as PCM techniques provide "ultimate" recordings, and amplifier and loudspeaker engineers find it increasingly difficult to wring out the last minor imperfections in audio reproducing equipment.

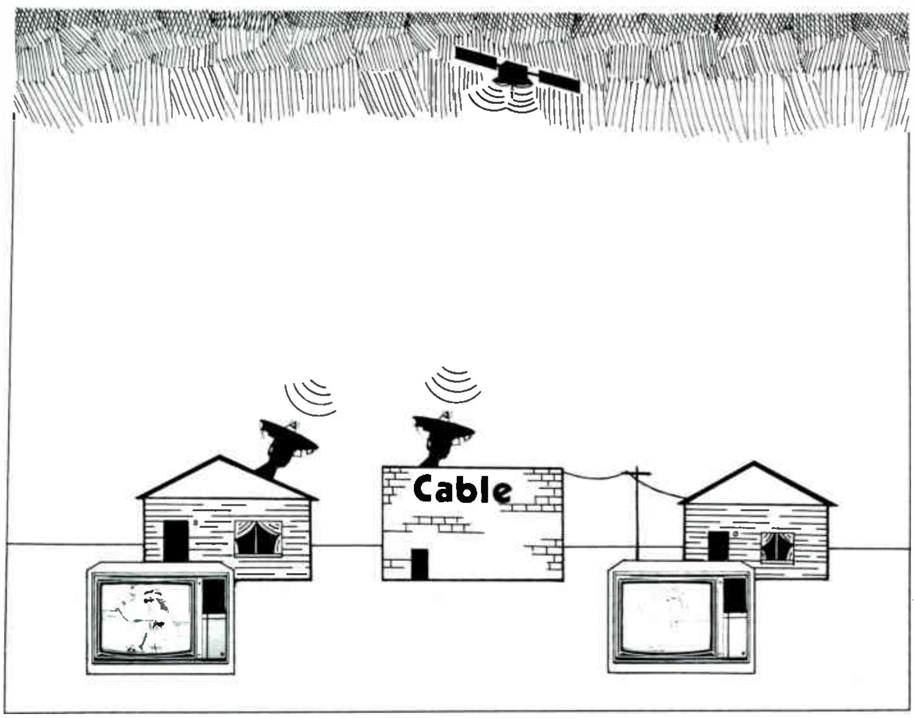
There are three ways to provide high quality 525-line service:

- improve color encoding technique,
- improve transmissions and
- improve color decoding technique and other aspects of image display.

Enhanced video

Cable television presents a unique opportunity to introduce new color encoding techniques. Most cable systems firmly control subscriber terminal equipment, the addressable programmable converter/descramblers that are provided to control access to cable television services. The equipment is owned by the cable system and provided to the subscriber as part of its overall service. Much of this equipment operates in a baseband mode, i.e. it consists of complete demodulators that provide a composite video output. These baseband subscriber terminal units could just as easily provide improved color decoding with RGB output to the subscriber's video monitor. This could be improved decoding of NTSC encoded color or it could be optimum decoding of a new, more sophisticated color encoding system, such as the proposed C-MAC component system.

Program originators, such as national pay-TV networks, could originate in both conventional NTSC video and an improved 525-line mode. Cable systems could similarly distribute in both modes; most have spare channel capacity during a changeover period. When a cable system has completed a changeover of all of its subscriber terminal equipment, it would distribute in the improved mode only, although program originators would have to distribute in dual mode to allow for a longer period of changeover in all of their affiliates. Alternatively, a cable network operator could provide headend decoding and transcoding equipment for those affiliates not immediately prepared to change from NTSC distribution. Cost and complexity would be comparable to the video enciphering that some of these network operators will be providing soon.



Signals received directly from the satellite (left) are better in quality than those delivered by cable (right).

Conversion more difficult for broadcast

Television broadcasters would have more difficult conversion, since they do not have the dual service transmission capability that many cable systems have. The market created by cable systems would, however, speed the introduction and acceptance of new standard receiving equipment. Local broadcasters would, however, be under competitive pressure, since the cable-distributed networks would be taking advantage of the improved transmission technologies. Local broadcasters could meet this competition by setting up direct feeds of enhanced video to cable systems in their service area.

I am not an expert in the detail of various enhanced 525-line video systems that are being proposed, but I do perceive that they offer a significant potential and that cable systems can speed the introduction of a worthy enhanced-video proposal.

Improved transmission: A perfect picture

The cable television industry is substantially committed to its present plant. It would be a very expensive and difficult task to replace amplifiers or other major components in existing or under-construction cable systems. Feedforward amplifiers, with significantly reduced distortion (at least 16 dB reduction in third order intermodulation) are on the brink of widespread acceptance and availability. Widespread retrofit of existing systems will, however, be quite expensive. Use of feedforward amplifiers in cable system trunks would improve system C/N but would still leave the system with the problem of multiple, low level reflections.

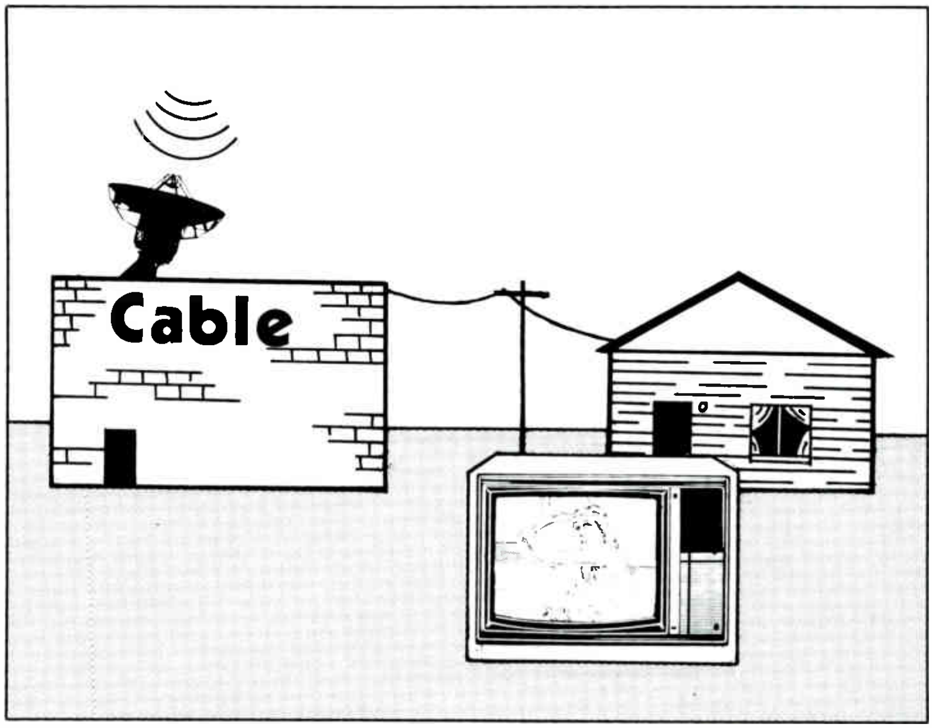
Most new cable systems have spare bandwidth available. I am proposing to several of my client systems that this bandwidth be traded for quality in the traditional way, by use of frequency modulation (FM) transmission. In the first phase of an image quality improvement program, the cable system would use FM transmission of ordinary NTSC video. FM transmission in a cable system would require 18 MHz of spectrum. Most new urban cable systems have enough spare spectrum to provide conventional VSB-AM transmission (6 MHz per channel) and high quality FM transmission (18 MHz per channel) at the same time. I call the service "perfect picture." The FM video service would also have high quality stereo sound, probably in the form of discreet L and R subcarriers, but possibly in PCM digital format.

FM transmission would remove S/N as a quality compromise in cable system transmission. Other quality degradations in cable systems, such as intermodulation and reflections, have different, less visible, less objectionable manifestations in FM video transmission (intermodulation in the baseband and small degradations in differential phase and gain).

Subscribers who opt for the "perfect picture" service would be provided with special FM video receivers that would tune the desired FM video channel, demodulate and descramble it and provide both composite and RGB outputs (as well as baseband stereo L and R sound outputs). The "perfect picture" subscriber would be expected to have a high-quality video monitor or projector in order to enjoy the benefits. It wouldn't make much sense to remodulate "perfect picture" to NTSC VSB/AM for an ordinary receiver. The special FM video receivers would be adapted from the DBS receivers that will be manufactured in volume. The principle difference will be in the tuner. The DBS receivers tune 12 GHz. The cable version will, of course, tune cable FM video channels in the 50-550 MHz range.

Major cable television services now are distributed by satellite. Most broadcasting networks now (or soon will) distribute their services by satellite as well. Another way to look at my proposal is that it splits the satellite receiver. These satellite-based video transmission systems are designed to provide professional grade transmission. "Perfect picture" places the satellite downconverter at the cable system headend and places the rest of the receiver in the subscriber's home in order to maximize transmission quality. It puts the TVRO right in the living room!

The second phase of a transmission improvement involves the introduction of enhanced color encoding with compatible optimum decoding and other image display improvements in the subscriber terminal box.



High definition services

HDTV creates special problems for cable transmission. Raw HDTV has significantly increased video bandwidth. Transmission, even by spectrum conservative VSB-AM, will require substantially increased bandwidth compared to 525-line video. For purposes of discussion, I will assume 20 MHz of bandwidth for noise calculation purposes.

It has become customary to calculate cable system noise (for NTSC transmission) in a 4 MHz bandwidth. The random KTB noise in a 75 ohm system in a 4 MHz bandwidth is 1.1 microvolt or -59 dBmV. Overall transmission noise is calculated by taking into account amplifier noise figures and system operating levels. As I have said, the FCC minimum standard is 36 dB C/N. A C/N of 43 dB would be considered more usual for a good cable system. This 43 dB C/N degrades by 7 dB to 36 dB C/N in the 20 MHz bandwidth of an HDTV transmission. HDTV service subscribers will probably have increased service and the 43 dB S/N that we consider good for NTSC images might very well not be acceptable for HDTV images. I have not seen any published figures for S/N corresponding to various grades of HDTV transmission.

All in all, I fear that large-scale, multichannel HDTV service on cable will not be feasible without significant bandwidth reduction technology.

Frequency modulation might not be an available noise reduction option for HDTV transmission. We can realistically talk about 18 MHz transmission channels for enhanced 525-line "perfect picture" service. FM for 20 MHz HDTV video would probably require at least 60 MHz per channel. This would cut our newest 500 MHz systems down to eight channels per cable. This kind of channel capacity reduction might be acceptable in Europe, but it is not acceptable here.

Some kind of bandwidth reduction technology would be very desirable. Feedforward amplifier technology might produce the 7 dB improvement in cable system C/N that conventional transmission would require. Some reduction in amplifier loading because of a reduction in the number of channels would also help somewhat. All in all, I fear that large-scale, multichannel HDTV service on cable will not be feasible without significant bandwidth reduction technology. I am sure that HDTV proponents are aware of this problem and that practical HDTV proposals will come forward with accompanying practical bandwidth reduction technologies.

I believe that image transmission improvement in cable will come about through a new public interest in high quality video. It will first take the form of enhanced 525-line video, which will be followed, some considerable time later, by HDTV services. Cable systems will lead in the introduction of enhanced 525-line transmission by providing FM transmission along with improved color encoding techniques.

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2° spacing

criterion for co-polarized adjacents and will meet the criterion for cross-polarized adjacents (only if the antenna is perfectly aligned with the satellite). Also note that the 3 M antenna has its nulls at around 2 degrees.

In general, at 2 degree spacings, antenna alignment becomes much more critical since satellites are now closer to each other.

The above analysis is for the purpose of illustration only. For the purpose of accuracy, a similar analysis should be carried on actual manufacturers' data patterns and extended to two adjacent satellites on each side.

New antennas needed

Up until now, the most important measure of satellite received signal quality has been signal-to-noise ratio (thermal) with interference factors playing a secondary role. If C-band satellites move to uniform 2 degree spacing, the dominant mode in the evaluation of signal quality is expected to be interference. According to available data, a total carrier-to-interference ratio of 18 dB is required for acceptable non-broadcast pictures. To attain this level of interference protection, the receive antenna must provide 24 dB isolation or more to each of its immediate adjacent satellites. It is unlikely that existing antennas conforming to the 4 degree FCC pattern meet this desired criterion. These antennas will have to be either retrofitted to reduce their sidelobes or replaced with new antennas that have better sidelobe performance. In either case, antennas must have their radiation patterns examined to determine the degree of adjacent satellite isolation protection they provide.

Note: Due to space limitations, appendices 1, 2 and 3 are available by writing to Mark Elden, Showtime/The Movie Channel, 1633 Broadway, New York, N.Y. 10019.

Communications Engineering & Design

TECH II

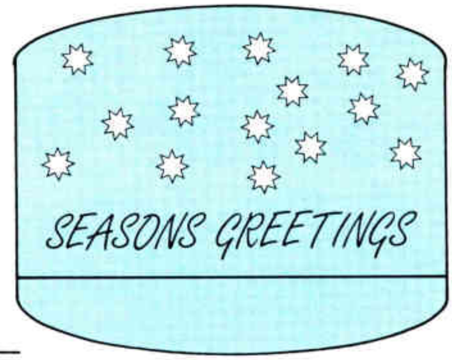
CED's feature supplement and Product Profile

September 1984

- Trends in character generators
- Automatic ad insertion no snap
- Product profile: commercial insertion equipment

Automatic insertion system

Trends in character generator technology



By Gary B. Hoffman
National Accounts Manager
MSI/Compuvid Division Texscan Corp.

Character generators, those electronic typewriters that fill many channels on cable systems in the United States, are developing new and exciting features and capabilities. What should a cable operator expect from his text channel and what should he demand of his equipment? This article will seek to answer these questions both for the small system operator and the urban build.

Cable systems have from their origins sought to fill their excess channel capacity with some form of local automated programming that could in turn carry some local advertising. The early message wheels, weather dial scanners and newswire printers gave way in the early 1970s to digital color weather displays. By 1980, all major character generator manufacturers offered microprocessor-controlled display units with several "pages" of memory storage. These products differ in several important aspects: character resolution, color choices, memory capacity, communications capability, and graphics enhancements.

Character resolution

Character resolution refers to the number of dots that make up each alphanumeric character. Early display units generated a 5 x 7 pixel character, later expanded to 9 x 16 and then 16 x 20, today's medium-resolution standard. Resolution depends on the character storage capacity of the display unit and the frequency of the "dot-clock generator," the oscillator circuit that shifts the pixels row by row onto the screen.

The greater the pixel matrix, the more well-formed the character appears. Since each pixel is essentially a square, a certain amount of "stepping" or "aliasing" occurs with any line segment except horizontals or verticals. Thus, curves and diagonals appear stepped or jagged when displayed on units with coarse resolution but appear smoother at finer resolutions.

Texscan has recently introduced a high resolution character generator for cable television called the SpectraGen 4. This model SG-4 uses a 32 x 64 pixel matrix for each character, and employs a 28 MHz dot clock oscillator for a 35 nanosecond horizontal pixel size.

Color choices

Color has been an important feature of cable character generators from the earliest fixed-format red-blue-green units to today. Depending on the amount of memory used to store color combinations, current models offer color choices ranging from white characters over a choice of eight background colors per line of text to a full choice of 256 colors (including hue and intensity) on a character-by-character basis.

The former offers hardly any variety while the latter presents the keyboard operator many choices, even aesthetically poor combinations (e.g. green characters on a purple background!). A common compromise allows the operator to choose from a pre-programmed set of character and background color combinations which allow variety but restrict choices to a set of eye-pleasing combinations.

The recent downward price trend of solid state random access read-write memory chips (called RAM) has accompanied the introduction of chips with larger and larger capacities. Today, 64K chips sell for what 2K or 4K chips cost in the past. The 256K chips are gaining acceptance and the one megabyte chip that holds a million bits of information is just around the corner.

Cable character generator memories have kept up with this pace so that today memories of 100-200 pages are standard, replacing the previous 16 to 20 page standards. Today's units can be expanded to hundreds or even thousands of pages of RAM.

The advantages of RAM in a character generator include its attributes of low cost and high speed access. On the other hand, its disadvantage is that data stored in RAM is volatile and disappears when power is turned off.

Backing up RAM

Several techniques have been adopted by character generator manufacturers to overcome the volatility of RAM memory. Most obvious is to provide a standby source of power, either a storage battery-to-AC inverter system or some kind of internal battery backup. Another technique is to use a non-volatile form of memory for page storage. Magnetic bubble memory retains its data when the power is turned off, but it has the drawbacks of slow access compared to RAM and may be affected by magnetic fields and power surges. Nevertheless, bubble memory remains popular among cable operators, especially at remote headends.

Magnetic disk and tape storage media can be used to back up the RAM memories of a character generator system. Cassette tape storage is low in cost but slow to store and retrieve data. Faster mini-floppy disks can be used to store a system's memories (a "system disk") or can extend the RAM memories with pages stored on disk (a "page disk"). Winchester hard disks have extremely large amounts of storage capacity and can provide up to 10,000 pages of storage in a character generator system.

Some character generator units have disk operating systems built in and others communicate with an outboard computer that itself uses a disk storage system.

Other memory preservation techniques are beginning to emerge in the computer industry and will likely find their place among cable character generators. The most promising are CMOS-type solid state memories that remain their data when the power fails by drawing a low current from an auxiliary battery, typically a long life lithium battery mounted on the circuit board.

Communications capability

Most cable character generators have at least some communications capability. Many will receive the popular cable newswires, the National Weather Service's forecast wire, and perhaps a local weather sensor system. Some allow their local keyboards to be remoted to great distances using the telephone or cable modems. But the really versatile units are those that communicate with each other to allow networking and multichannel operation. (For a full discussion of networking techniques, see the author's article, "Text Service Typology" in the June 1983 issue of CED).

With the ability to transfer blocks of memory pages between units, one character generator can act as a remote offline edit unit to one or more slave units. The keyboard operator can create or change pages in the local data base and then send them in batches to the character generator channel at the cable system headend. This technique minimizes transmission times, especially important when long distance telephone lines are used to carry the data.

Graphics enhancements

One of the most exciting areas emerging in the cable character generator arena is the display of graphic images to enhance a textual message, especially an advertising message. Many character generators have extra "graphic" characters included with the alphanumeric characters in the font set. These graphic characters can be assembled like building blocks or mosaic tiles on the screen to make recognizable images. Such graphics dress up otherwise dull pages of text with eye-catching pictures. Because these mosaics can only take on the color combinations of the characters that would otherwise appear on the screen, a full color image is not possible.

The trend toward full color displays can only be accomplished by departing from the traditional character generator design (a "character or block-mapped" display) to a bit-mapped graphics display. In this type of device, each pixel on the screen is represented by data in memory. Thus as data is moved or changed, the screen can appear to animate its image.

The Datamax UV-1, still marketed by Texscan as the TUV-1, was an early graphics display generator that mixed text and animated graphics. The UV-1 employs the "Zgrass" language with Basic-like commands optimized for animated displays. It is very fast in manipulating images but text displays are slow.

Display units now appearing on the market are based on low-cost home computers and can do many of the character generators and graphics display functions discussed here. However, these units do not provide a "legal" video output compatible with the NTSC color standard (EIA RS-170A). In particular, home computers do not deliver an interlaced scanning signal as do most character generators or the UV-1. In practice this means that while there is no restriction on their being carried on a cable system, these signals may not be received properly on some home TV sets nor can they be recorded on most videotape machines.

New graphic standards

The newest entrants to the graphics scene are display devices that receive and display data transmitted in the newly-accepted videotext standard called "North American Presentation Level Protocol Standard", also known in Canada as "Telidon." As NAPLPS becomes more commonly used for videotext and other computer graphics fields, its appeal to cable operators will increase.

Most think of NAPLPS in connection with home terminals, but since the mass-produced videotext terminal has not yet hit the market, videotext itself remains a latent communications medium. In the meantime, NAPLPS graphics display generators can be used to

Perhaps the biggest hindrance to greater acceptance of graphics in cable TV is the large amount of labor required to produce a good image and display it properly.

produce video at the headend similar to the traditional text generators.

Perhaps the biggest hindrance to greater acceptance of graphics in cable television is the large amount of labor required to produce a good image and display it properly. At the same time, videotext information providers are constantly building libraries of NAPLPS images which could be adapted to cable operators needs with minimum efforts.

To help cable operators employ graphics in their automated channels, Texscan has established a Creative Services Department to create both mosaic and bit-mapped graphics for the cable operator. Initial distribution of these graphics will be on diskettes, but a dial-up data base is envisioned for the future. Most of the graphics on each diskette will be general in nature but tied to specific themes, such as sales events, type of business, or holidays.

Cable operators can add their own text with an advertising message such as the name of the advertiser, location, hours, and sales information. For character generator mosaic graphics, the cable operator merely has to type over a graphics page with text from his keyboard. NAPLPS images can only be displayed on special graphics equipment, but the addition of text will be similarly entered from a keyboard or computer terminal.

Automatic commercial insertion no snap

But technology and signalling methods improve

By Constance Warren

Reliable tone detection and verification printout systems are the criteria Joanne Skripkowski looks for in insertion equipment.

Last September, ATC's Albany, N.Y., system ordered a new automatic commercial insertion system. The device was delivered in January, but was recalled to the factory shortly thereafter because of a faulty logging mechanism. Some six months and countless phone calls later, the unit was finally working. By that time, the Albany system had gone through three separate devices. The operator also had learned that the device, which the manufacturer had claimed was "in production" on the purchase date, had never made it past the prototype stage before being sold.

While the Albany operator's situation may have been worse than others, it is by no means unique. It is just one of the "growing pains" any maturing technology inevitably experiences.

Most system engineers agree that commercial insertion technology is becoming more reliable. But there are still some bugs that need to be worked out.

Cue tone decoding is one of those bugs. The first problem is caused by the different signalling methods used by the networks. These include DTMF, DTMF tones placed on a separate audio carrier, vertical interval signalling, MTV's 19 kHz pilot tone and the inaudible digital signal used by the Satellite News Channel in 1983.

To receive different tones, the commercial insertion device must be reprogrammed. Once reprogrammed, though, the device doesn't always work.

"The manufacturer told us the system (used in Albany) could address any number of satellite cue tones, but things didn't work out that way. The device would switch away from the network but would not switch back," Paul Olivier, manager of production services for ATC, explained.

Another, albeit minor, irritant is that MTV tone decoding requires a stereo decoder.

Tone detection techniques also are not always reliable. Ad insertion systems using phase locked loops to detect DTMF tones may lock onto tones slightly off frequency or mistake complex audio for a cue tone, says Joanne Skripkowski, studio engineer for Viacom's Cleveland system.

Newer units use a DTMF decoding chip that measures the duration of the burst and digitally counts the frequency and compares it to a reference. This method is more precise and can be enhanced by placing filter circuits before the chip. These circuits filter out all other frequencies except the range in which the DTMF tones occur, she added.

Random access insertion creates different headaches, particularly at 25 and 55 minutes after the hour when most networks send down their tones. "Multichannel systems with random access capabilities frequently can't insert ads simultaneously," Olivier claimed. Since 'collision scheduling,' the sending of tones at the same time, is the rule rather than the exception, these systems are essentially useless, he added.

Al Scjarback, director of engineering for United Cable of Colorado, said an algorithm calculating the probability of collision scheduling needs to be developed before multichannel random access capability can become a reality.

Ad insertion ills also are a programming concern.

"Cue tones are inconsistent," Paul Muhly, advertising director for United Cable of Colorado, said.

"There is a lack of quality control on the network's part. Different networks use different kinds of signalling methods and a lot still have a person pushing the button," Al Scjarback, elaborated.

Tones sent too late leave empty black space and tones sent too early cut the video short. Both lead to sloppy insertion, he added.

DTMF tones also mask the audio and are annoying to the viewer, Skripkowski said. The MTV pilot signal is above the hearing range, but can only be used by one network since the inserter cannot detect which tone belongs to which network.

There is a task force considering using vertical interval signals, she said. But "many programmers are finding out the vertical interval is a pot of gold," Scjarback added.

Olivier, who is assisting the NCTA signal frequency committee in developing tone signalling recommendations, defended the networks, saying they were becoming more responsive.

"Initially, the tones and scheduling of breaks were not reliable enough for us to use on an unattended, fully automated system. We didn't know when or if the tone would come down or how long the break would be. We now keep an operator there only as an emergency back-up," he explained.

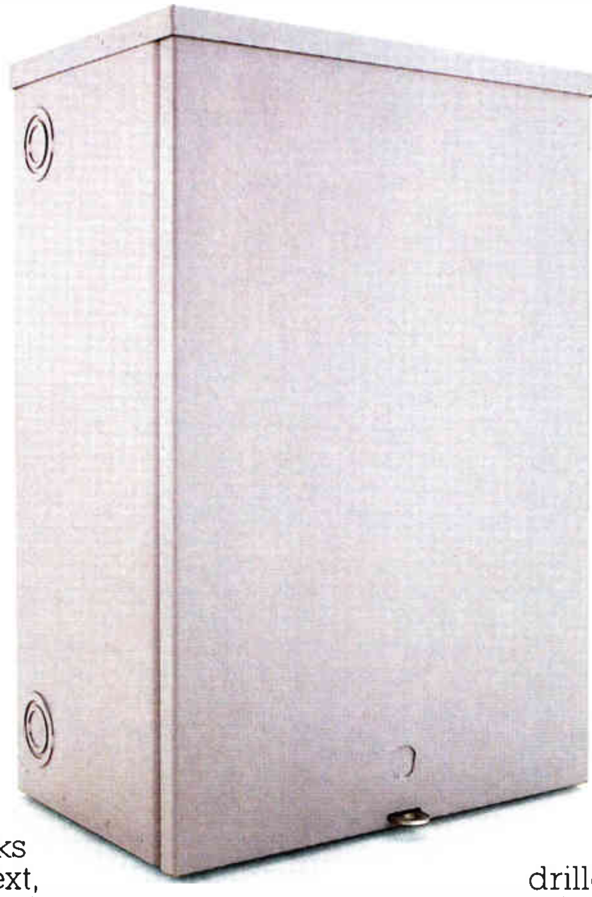
Systems lucky enough to make it through the detection and insertion stages may run into other troubles, Skripkowski warned.

"Most insertion systems assume the commercial ran in its entirety, if the tones were there, but that may not have been the case," she argued.

With 3/4-inch tape, it's possible the picture will break up. For that reason, "Viacom of Cleveland is looking at an automation unit that monitors picture quality," she said.

Such a unit would monitor the sync pulses off the tape and if X number of

Details Enclosed



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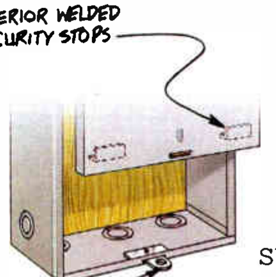

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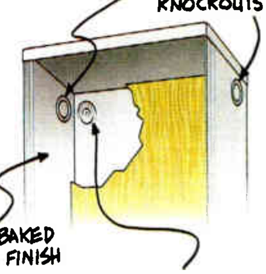

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Reader Service Number 30

pulses were missing, it would assume the commercial broke up. Skripkowski recently witnessed a demonstration of a unit with this capability.

Standardization is also needed, the engineers agreed.

"Different generations of the same manufacturer's equipment operate entirely differently. The operator must be retrained to learn how to use the new hardware and how to program the software. Confusion arises when the operator has more than one piece of equipment and is trying to program a piece of equipment remotely," Skripkowski said.

Inroads, though, have been made in pre-roll times, with most networks agreeing to an eight second pre-roll. This should help assure clean switching from network to local commercials, if all else goes well, Olivier said.

Most system engineers attribute the equipment bugs to two factors: inexperience and insufficient field testing.

"A lot of the units I have looked at look homemade," Skripkowski said. "The industry is growing up so manufacturers are learning a lot of lessons," Scjarback, a broadcast veteran, added.

And, perhaps the lesson manufacturers need to learn most during the cable advertising industry's maturation is that

Insertion equipment has become more reliable says ATC's Paul Olivier.

it doesn't pay to bring equipment to market prematurely, especially if it's not going to be well-supported.

"There is no question, the equipment sometimes isn't field tested. If it were, it would be more expensive," Ralph Haimowitz, director of engineering for CATA, affirmed. Manufacturers also forego field testing to get the equipment out early to pre-empt the competition.

While the drawbacks of releasing equipment too early can outweigh the benefits (witness the ATC Albany case), there is no real solution to the field testing dilemma, given today's competitive market, the engineers said.

Manufacturers can, however, reduce the likelihood of equipment failure by spending more time in quality control and simulated testing. They also can mitigate the impact of equipment failures by providing support.

"With something brand new, the manufacturer has to back it up, because once you lose your reputation it's almost impossible to get it back," Haimowitz cautioned.

One way Haimowitz suggested manufacturers can cut down on the cost of support is by providing a complete operations/maintenance manual.

For the most part, though, the equipment has improved immeasurably in the last two years, the engineers said. United Cable of Colorado, which has been using a manual system, is tendering a proposal for an automatic unit. The last five or six large ATC systems to acquire commercial insertion units have had their devices up and running almost immediately after training. And Jim Scofield, manager systems engineering for Heritage Communications, said "we've been very pleased with the commercial insertion systems we've been using."

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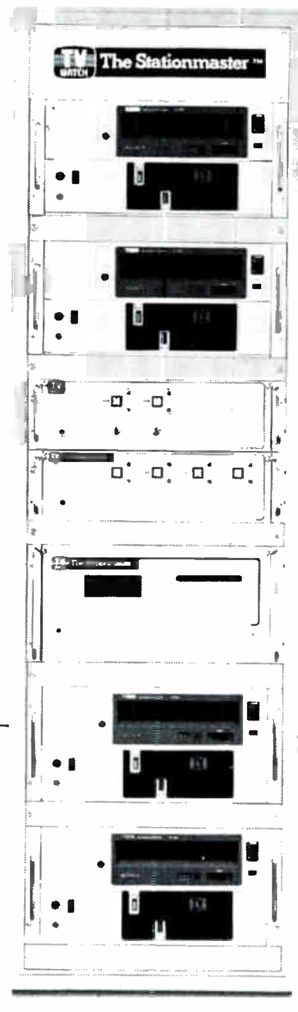

Level I
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Level II
Random Sequence

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Reader Service Number 32

Commercial insertion equipment

Company name	Model	Mode of operation	Number of channels	Number of VTRs	Events/ entries
Adams Russell, video information system division	ARVIS 7200/7500	random access	standard: up to 4; 2 more, optional	6 Sony 3/4-inch VP-5000s	100 different 30 second spots
Beston Electronics	Marquee CG-800A, System 1	ROS	1	alphanumeric generated messages & graphics	16 pps of 8 lines (32 characters per line), 64 events
same as above	Marquee CG-800A, System II	ROS, can skip spots	1	same as above	100 pps of 12 lines
Cable Graphic Sciences	System 1500	ROS	1 LO channel, 3 satellite channels	VCR control optional	70 pages, 960 characters per page
Channelmatic	Spotmatic	random access	multiple	up to four per channel	100 commercials per tape
same as above	Spotmatic Jr.	multiple spot mode, spot sequential mode	1	1	N/A
Control Video	Sequencer with ASSI	random access	4	2, expandable to 30	140, expandable to 1500
Falcone International	Autoserter 1	upgradable to random access	1, expand-able to 4	N/A	N/A
same as above	RAMS 5000	random access	N/A	N/A	N/A
Kavco	commercial insertion system	random access	16	7 VCRs per channel	N/A
Lake Systems	La-Kart	random access	N/A	expandable to 30 ½-, 3/4- or 1-inch VCRs	more than 1,000 different individual events
Microtime	C-150	N/A	N/A	up to 4	N/A
Monroe Electronics	3000R-14F	ROS	2	1	N/A
(H.A.) Solutec	SOL-6800	can mix VTR formats, with one spot on one cassette	multichannel	8	100 events/ day/channel

Tone decoder	Programmable pre-roll	Video	Audio	Memory	Other Features
cue tone, can interface with customer-supplied subcarrier detection	N/A	(in/out) BNC type (x8) 1.0 ± 2 Vp-p, 75 ohms, NTSC, compatible EIA-RS 170A	audio level controls-limiter/ compressor, 50-15,000 Hz frequency optional stereo	floppy disc stored for 7 days of unattended operation	remote communications diagnostic capability, sales management and accounting reports
built-in tone decoder, contact closure	N/A	outputs: 2-1 V p-p into 75 ohms	N/A	ROM 16 lines of 3 characters title line memory, 1K RAM page display memory; RAM crawl line memory	4-color background, automatic centering
same as above	same as above	same as above	same as above	same as above, digital tape for message storage	see above
cue tone decoder/video switcher	N/A	single channel NTSC compatible. 1 Vp-p into 75 ohms	N/A	nonvolatile floppy disk storage	128 colors offered, nonvolatile floppy disk storage and five graphic fonts
DTMF tone decoder module	programmable pre-roll delay	N/A	N/A	N/A	automatic logging feature, 80 line EPSON printer, and stereo pro-cessor interface
microcomputerized satellite tone decoder, secondary tone decoding	yes	1 V p-p, 75 ohm for both input and output (output source terminated)	0 dBM nom., 600 ohms balanced	N/A	logging and verification print-out, vertical interval switching and automatic return to satellite for VCR failure
satellite tone, contact closure	yes	N/A	N/A	N/A	commercial verification, VTR backup and CRT
digital decoder	N/A	input; 0.2-5 Vpp, 1 VPK—PK normal; output: 1.4pp adjustable NTSC type video 1v normal	input: 100 mv-5v pp, 0 dB output, 600 ohm 0 dB normal level	N/A	automatic bypass, machine control card, and optional preview switcher
programmable digital decoder	N/A	N/A	N/A	64 K random access memory;	power supply, real time clock scheduling menu printout, spot verification
DTMF module	yes	3 level, vertical interval switching matrix provides broadcast specs for video and audio switching		CI Processor holds in memory multiple instruction sets for tasks assigned	local or remote programming, automatic return to network, complete logging and verification printout (remote or local)
N/A	external pre-roll, touch sensitive screen	N/A	N/A	N/A	redundancy, monitoring status of each segment
satellite tone decoder, can select multiple network tone decode sequences	adjustable pre-roll cues	input: 1 Vp-p into 75 ohms, reference: 1Vp-p looping	input: 10K ohms, unbalanced; output impedance: 600 ohms, unbalanced	N/A	audio-video bypass default system, automatic TBC interface, logging interface connector and operational safeguards
cue tone decoder	yes	N/A	N/A	N/A	data logger, external printer, diagnostic self-test mode, remote override of program source cues
cue tone presence detector LEDS	N/A	inputs: 12 max.; outputs: 2 of 75 ohms	input; 12 max., output: 2 bal-anced +4 or +8 dB, 600 ohms w/transformer	N/A	system status monitoring; real time and multiprogrammed; alphanumerical document "descripter" data base, optional automatic logging system

Company name	Model	Mode of operation	Number of channels	Number of VTRs	Events/ entries
Sony Broadcast	BVC-10/40	random access	N/A	40 cassettes can be loaded in bin	over 200 preprogrammed sequences with more than 900 events/sequence
T.R. Pitts Co.	Ad-Vantage	front panel manual channel insertion	1	1 60-minute tape	120 per cassette
Telecommunication Products Corp.	NEXUS 1	random access	1 computer for each channel	3 VTRS	255 per channel
Tele-Engineering	Ad Cue 84	random access; ROS, fixed position or combination	2	2 VCRs , 1 extra video source	198 commercial blocks
same as above	Ad Cue 100	random access	12	24	200 commercial blocks per channel
Texscan	CSR-92	random access	1	up to two	more than 2,000
TV Watch	Station-master Level 1	ROS	N/A	varies with size of system	N/A
same as above	Station-master Level II	random sequence can program a month in advance	same as above	same as above	2,400 per channel
same as above	Station-master Level III	random access	3	up to 4 VCRs with 1 channel	N/A
Videodisc Broadcasting	Ad Mint	random access	2	2 VCRs per channel	200 time program entries per week
Video Media	Q Star	sequence switching	N/A, upgradable to multichannel	6 VTRs	N/A
same as above	VMC-200	random access	up to 63	N/A	N/A

Tone detection	Programmable pre-roll	Video	Audio	Memory	Other features
N/A	system uses algorithm for control of cassette elevator	see manu-facturer	see manu-facturer	memory save mode	management and control system, event override, local or remote VTR writer, crash protec-tion, manual override
satellite tone decoder	adjustable delay for commercial starts	input: 75 ohm; output: 75 ohm	input: TVRO, 600 ohm, balanced, VTR, Hi Z unbalanced; output 600 ohm balanced	N/A	override switch, manual insertion button, timing control, automatic bypass to network in case of power failure
satellite tone decoder with subcarrier audio signal capability	yes, VTRs prerolled from stop mode	input: 75 ohm terminated; output: 75 ohm	input: selectable 600 ohm balanced or high impedance unbalanced; output: 600 ohm balanced	N/A	3 levels of commercial verification, 5-hour memory backup, automatic bypass to network in case of VTR failure, vertical interval switching
PROM memory can be programmed to receive 3 different cue tones	field-selectable pre-roll	N/A	N/A	10K ROM, 4K RAM time program memory, 16K RAM log memory	commercial verification; automated billing interface; remote log retrieval, programming and verification; video presence monitoring and automatic return to network
digital tone decoder with AGC	N/A	N/A	balanced, 600 ohm with VCR level adjustment	can store 7 days worth of programming	verification printout, log memory capable of retaining 3,200 spots, remote programming, programming verification, standby power supply, vertical interval switching
can program as many as 10 DTMF tone sequences per channel	automatic pre-roll averaging	input: all 1Vp-p, terminated in 75 ohms; output: program video to modulator or transmitter (1Vp-p, 75 ohms)	input: all 600 ohm single-ended; output: program audio to modulator or transmitter (stereo or monaural, 600 ohm open ended) ended)	96K, protected by fail safe power supply and batteries	programmable cue tones, veritical interval switching, stereo audio, operator override, hard copy printouts, internal monitoring, bypass in case of system malfunction and remote control of VTRs
digital tone recording system	N/A	N/A	balances the program audio line from VCR output imped-ance to 600 ohm	32K	verifier logging device, 12 hour summary and battery backup
digital tone decoding	N/A	N/A	N/A	(EPROM)	remote verification, remote programming, error checking and Epson printer
same as above	N/A	N/A	N/A	64K, expandable to 256K	verification on all channels, ITT Qume display terminal, remote programming, Epson printer and "test" tape
DTMF decoding, separate input and contact closure	digital sequence and pre-roll timing	N/A	N/A	12K ROM, 4K RAM, 16K RAM log memory	remote log retrieval, video presence monitoring, electronic clock and calendar and vertical blanking switching
DTMF decoder	N/A	N/A	N/A	8 event memory	remote control of 43 devices, event-by-event comment entry, manual override and printer output
N/A	N/A	N/A	N/A	N/A	manual override and control; vertical interval switching; auto-logging and billing options

Commercial insertion manufacturers

Adams Russell
Video Information Systems Division
1370 Main St.
Waltham, Mass. 02154
(617) 894-8450

Beston Electronics
P.O. Box 937
Olathe, Kan. 66061
(913) 764-1900

Cable Graphic Sciences
2939 Larkin Ave.
Clovis, Calif. 93612
(209) 292-0246

Channelmatic Inc.
821 Tavern Rd.
Alpine, Calif. 92001
(619) 445-2691

Control Video
1640 Dell Ave.
Campbell, Calif. 95008
(408) 866-7447

Falcone International Inc.
P.O. Box 3067
Marietta, Ga. 30060
(404) 427-9496

Kavco Inc.
3931 Image Drive
Dayton, Ohio 45414
(513) 898-2003

Lake Systems Corp.
55 Chapel St.
Newton, Mass. 02160
(617) 244-6881

Microtime Inc.
1280 Blue Hills Ave.
Bloomfield, Conn. 06002
(203) 242-4242

Monroe Electronics Inc.
100 Housel Ave.,
Lyndonville, N.Y. 14098
(716) 765-2254

H.A. Solutec Ltd.
4360 Iberville St.
Montreal, Quebec
Canada H2H 2L8
(514) 524-6893

Tele-Engineering Corp.
2 Central St.
Framingham, Mass. 01701
(800) 832-8353

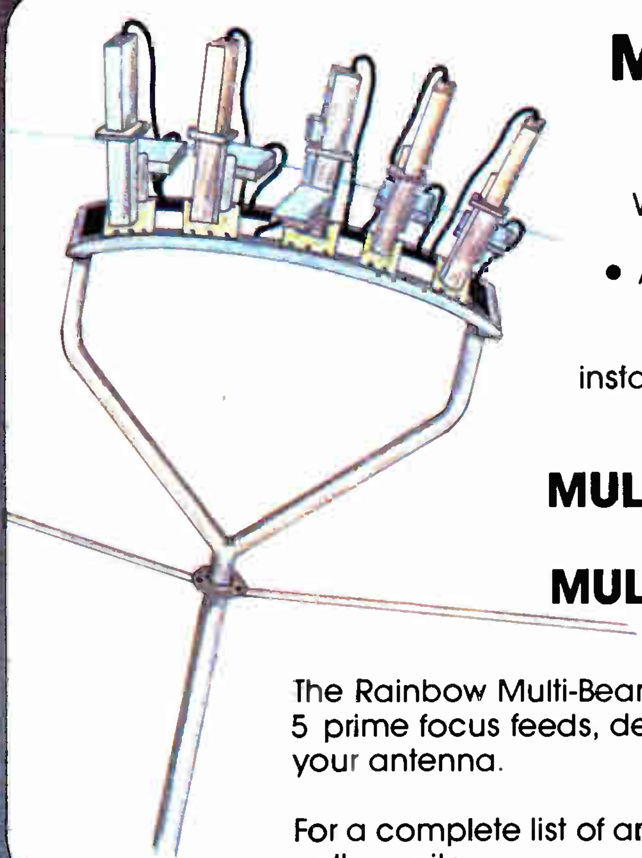
Texscan
3855 South 500 West
Suite S
Salt Lake City, Utah 84115

TV Watch
1819 Peachtree Rd., NE
Atlanta, Ga. 30309
(800) 554-1155

Videodisc Broadcasting Co.
1425 Greenway Drive
Suite 210
Las Colinas
Irving, Texas 75038
(214) 258-6090

Videomedia
211 Weddell Drive
Sunnyvale, Calif. 94089
(408) 745-1700

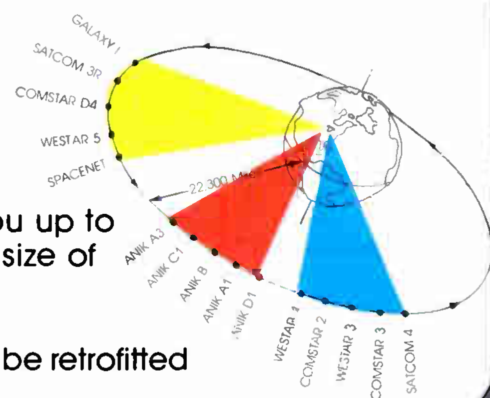
5 Star General



MULTI-BEAM FEEDS

- Maximize your programming capability, by receiving Galaxy I, Satcom III R, Comstar D-4, Westar 5 and Spacenet with the use of one dish.
- Add to system revenues, through tier expansion.
- Eliminate additional land acquisition and the installation costs of multiple dishes, while increasing your earth station investment.

MULTI-DISH? OR MULTI-FEED?



The Rainbow Multi-Beam Feed allows you up to 5 prime focus feeds, depending on the size of your antenna.

For a complete list of antennas that can be retrofitted call or write:

RAINBOW SATELLITE COMMUNICATIONS

Attn: Brian Wilkes
734 N. 3rd St. • Suite 417
P.O. Box 395 Leesburg, FL 32748
(904) 326-8030

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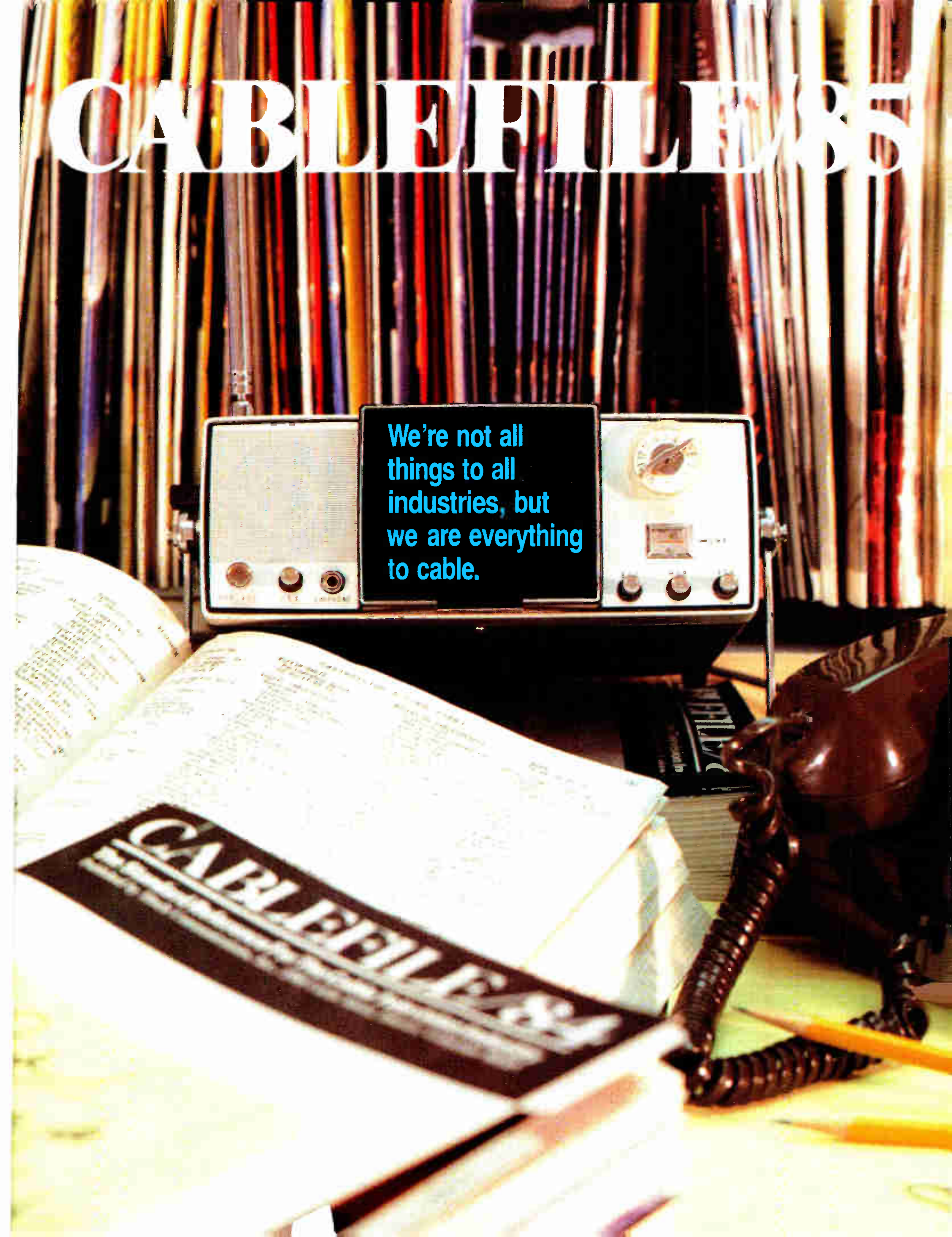
Reader Service Number 34

Advertising Index


CABLEFILE/85
We're not all things to all industries, but we are everything to cable.
CABLEFILE/84

Data communications

LTI introduces RF modem family

The first of a planned series of RF modems has been introduced by Link Telecommunications Inc. The Model 5010 is a crystal-controlled, high-speed device designed for operation on dual cable systems. Data rates up to 2 Mbps, error rates better than 1 bit in 10^{12} and a MTBF of more than 200,000 hours are claimed. Using phase-continuous FSK modulation, the 5010 is selectable at time of purchase for 50-104.75 MHz transmit and receive frequencies.

Collision detection and jam protection provided by an oscillator turnoff and RF output crowbar are standard. The 5010 is rated for operation at temperatures between 0° and 55°C. RF transmitter output is adjustable between 40 and 58 dBmV, and receiver input is variable between -10 and 10 dBmV. Receiver bandwidth is 2 MHz ± 50 kHz at 6 dB.

The 5010 should be available by Nov. 1 at a cost of $495 in quantities of 100. Mid-split fixed frequency modems and frequency-agile modems for dual and mid-split cables will be introduced later in the year, the company says.

For more information, contact Kay Fairweather, LTI director of product marketing, 2400 Computer Drive, Westborough, Mass. 01581, (617) 366-7400.

Headend remodulator complies with IEEE standards

HR-105 headend remodulator is IEEE 802.4 compatible

Concord Data Systems has announced immediate availability of its Token/Net HR-105 headend remodulator. Designed for token-passing, single cable local area networks, the device complies with IEEE 802.4 token bus standards. The HR-105 upconverts low frequency reverse-path channels for retransmission in the forward path. It uses a 32-bit preamble and provides common clocking, eliminating the need for AGC and timing circuitry.

The rack-mountable unit features a 5 megabits per second data rate, self-test and diagnostic checks. The HR-105 works with Concord's Token/Net system.

For more information, contact Tony Bolton, director of product marketing, Concord Data Systems Inc., 303 Bear Hill Road, Waltham, Mass. 02154, (617) 890-1394.

Software

S-A addressable management sys. for small ops.

Scientific-Atlanta has introduced the Series 8500 System Manager III, an addressable management system for small- to mid-sized cable systems. Serving up to 20,000 set-top terminals, the package includes computerized billing, converter control, PPV management, system security and management reporting functions. System hardware includes an IBM-XT microcomputer with a 10 Mb Winchester hard disk drive, a CRT and interface, a 160 cps dot-matrix printer and a real-time battery back-up clock.

Optional features include streaming tape backup, advanced communications protocol, a bar code reader and bulk downloading.

For more information, contact Stephen Necessary, market manager for subscriber products, Scientific-Atlanta, One Technology Parkway, Box 105600, Atlanta, Ga. 30348, (404) 441-4000.

COBIAS automates ad billing/verification

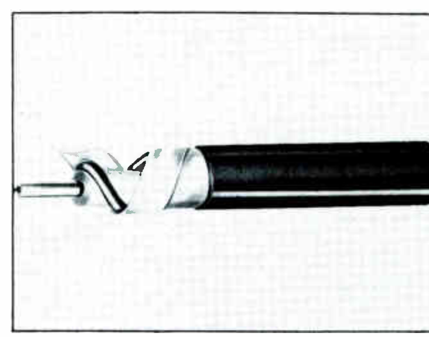
Tele-Engineering Corp. has released COBIAS software for cable advertising operations. The package interfaces with Tele-Engineering's commercial insertion equipment. COBIAS provides automated billing, verification, mailing list management, spot sales monitoring, scheduling, accounts receivable, receivables aging and receivables allocation.

COBIAS runs on any IBM-PC or compatible computer configured with 128K memory, two double-sided/double density 320K 5¼-inch floppy disk drives, a color monitor, color adapter board, printer interface, RS-232 interface and keyboard. An Epson RX100 or SX100 printer and D.C. Hayes Smartmodem 300 or 1200 also are necessary.

For more information, contact Tele-Engineering Corp., 2 Central Street, Framingham, Mass. 01701, (617) 877-6494.

Distribution

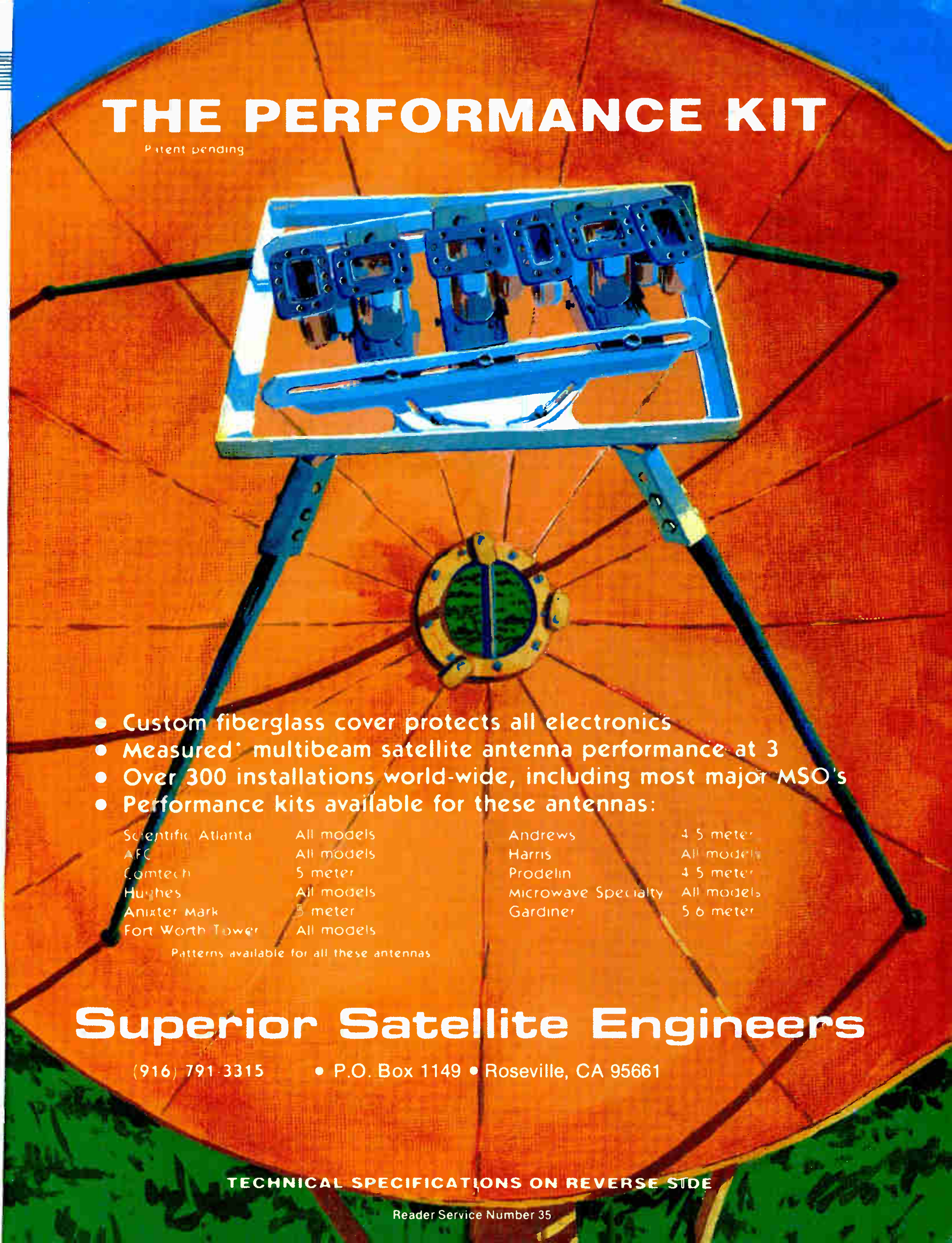
Subminiature cable



Times Fiber coax cable

A series of subminiature teflon coax cables for use in high speed data communications has been developed by Times Fiber Communications. These cables, which can transmit computer data in confined areas, have a propagation velocity of 80 percent or more and diameters ranging from .055-.100 inches.

For more information, contact Times Fiber Communications Inc., 358 Hall Ave., Wallingford, Conn. 06492, (203) 265-8500.



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AFC All models
Comtech 5 meter
Hughes All models
Anixter Mark 5 meter
Fort Worth Tower All models
Andrews 4 5 meter
Harris All models
Prodelin 4 5 meter
Microwave Specialty All models
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Patterns available for all these antennas
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TECHNICAL SPECIFICATIONS ON REVERSE SIDE
Reader Service Number 35

Low-cost microwave system unveiled

A low-cost, video FM microwave radio system for use in short haul applications including CATV, SMATV, teleconferencing and transmission between broadcast END receive sites and studios has been unveiled by M/A-COM. This system, the MA-23CC, operates in the 21.2-23.6 GHz band.

For more information, contact M/A-COM MVS Inc., 63 Third Ave., Burlington, Mass. 01803, (617) 272-3100.

CWY releases equipment

CWY Electronics has released a new accessory mounting bracket and a new line of apartment security boxes. The bracket, designated model ZB, enables mounting of multiple dwelling enclosures and can be used for retrofitting existing enclosures. The new line of apartment enclosures features aluminized steel construction and all welded construction. Security is provided through a hingeless, lid removal system with "security stops" welded on the front cover.

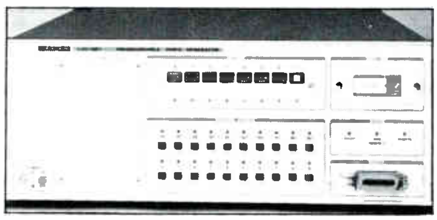
For more information, contact CWY Electronics, P.O. Box 4519, Lafayette, Ind. 47903, (800) 428-7596.

Test

Programmable video generator debuts

A programmable video generator, the LVG-1601, that generates RGB and sync signals for testing monochrome and color CRT displays has been introduced by Leader Instruments Corp. Eleven standard patterns stored in memory permit testing of color purity.

For more information, contact Leader Instruments Corp., 380 Oser Ave., Hauppauge, L.I., N.Y. 11788, (516) 231-6900.



Leader programmable video generator

Construction

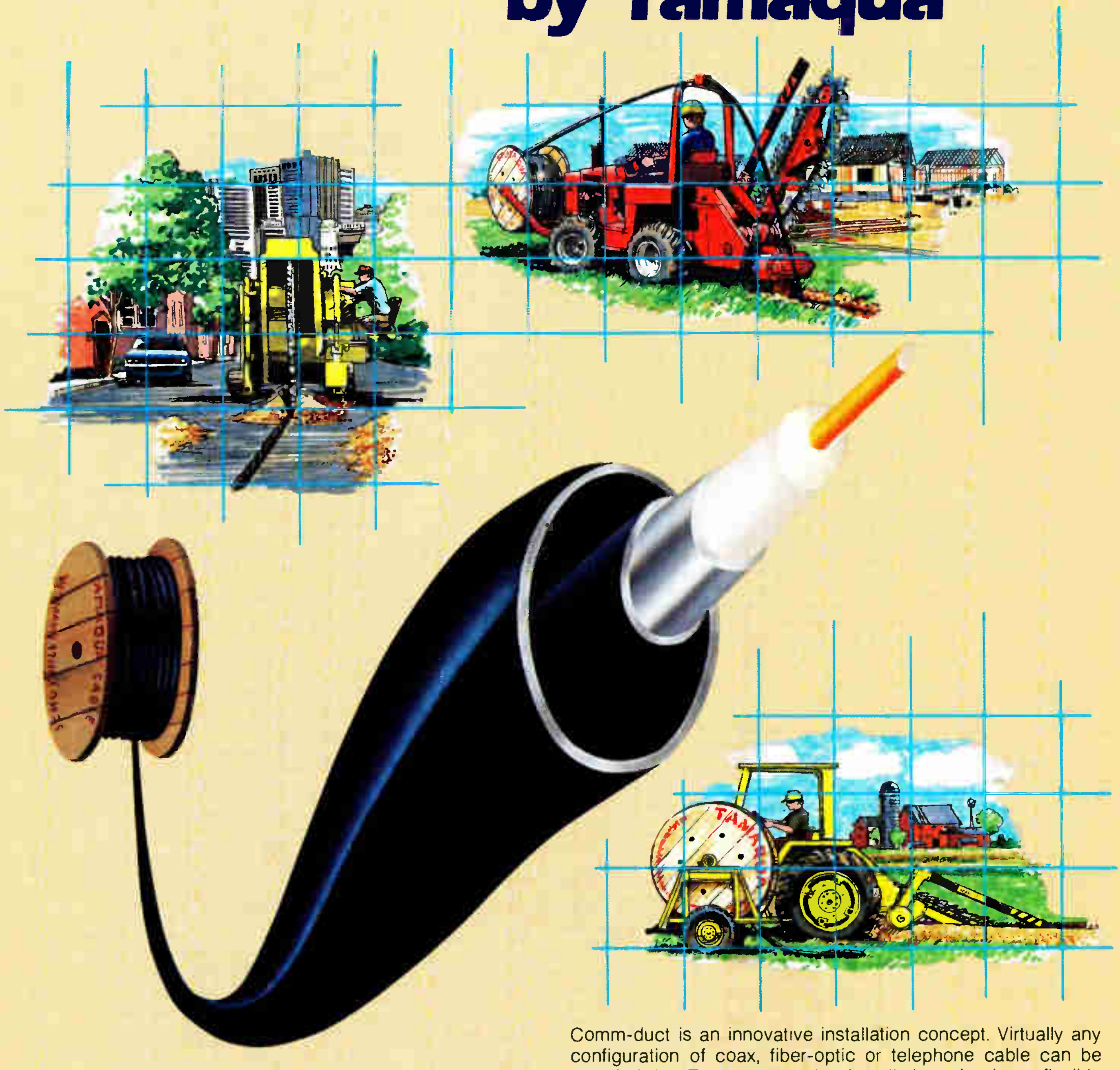
'Sidekick' premieres

Ditch Witch 1025 SK Sidekick

A backhoe/loader combination, called the 1025SK Sidekick, has been developed by Ditch Witch. The machine features a 2,500-pound capacity loader and a backhoe that can dig to depths of 10 feet. The operator's seat revolves 180-degrees. The unit's 35 HP class engine is side-mounted to provide both power and economy.

For more information, contact Ditch Witch, The Charles Machine Works Inc., P.O. Box 66, Perry, Okla. 73077, (405) 336-4402.

COMM-DUCT™
by Tamaqua



Comm-duct is an innovative installation concept. Virtually any configuration of coax, fiber-optic or telephone cable can be supplied by Tamaqua to the installation site in a flexible polyethelene duct system ranging in nominal pipe sizes from 0.5 to 4.0 inches. Tamaqua warrants the entire system, duct and component cable.

Comm-duct is superior to rigid conduit systems because it can be plowed-in avoiding trenching, select backfill, tamping and re-seeding. Where trenching or concrete cutting is required, trench or cut widths can be greatly reduced since working space for system assembly is not required.

Comm-duct used in conjunction with the appropriate installation practices has proven installed cost savings of 25% to 40% over other conduit systems without giving up the advantages of extended cable life or the ability to replace or add cables without disturbing underground plant.

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CABLE PRODUCTS CORP.
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Schuylkill Haven, PA 17972 (717) 385-4381

Represented by:
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ZR Concepts
P.O. Box 135
Riverton, N.J. 08077
609-786-0270/or -0053

For more information, please see our card on page 25.
Reader Service Number 48

People

The Rocky Mountain chapter of the Society of Satellite Professionals (SSP) has elected officers. **Irl Marshall**, Satellite Broadcasting Inc. president, was appointed president of the chapter and **Hal Josephson**, vice president of Telemedia, vice president. Board members include **David Corbin**, American Satellite; **Lloyd Covens**, *Channel Guide*; **Virginia Ostendorf**, V.A. Ostendorf Inc., and **Cheryl Carpinello**.

John Bowler has been named vice president, operations, Zenith Cable Products. He most recently served as general manager, color monitor operations, Zenith Systems and Components Group.

The Jerrold division of General Instrument has promoted **Paul (Pete) Morse, Jr.** to vice president of marketing for the subscriber systems division and appointed **Daniel Hoy** vice president of sales and **Bernard Cory**, manager of the subscriber division's manufacturing engineering department. Most recently, Morse was director of planning and analysis.

L. Dameron, III

Lawrence Dameron, III has been named publisher of *Cablefile*, an annual directory for the cable TV industry. **Rosalie Hein**, the former assistant managing editor of *Cablevision Magazine*, has been appointed editor of the directory.

Katherine Rutkowski has been promoted to the post of director of technical services for the Science and Technology Department of NCTA. Reporting directly to Wendell Bailey, NCTA Vice President for Science and Technology, Rutkowski publishes *Techline*, NCTA's monthly newsletter for the engineering community. She also is responsible for publishing the annual NCTA technical papers volumes, and organizes the technical program at all NCTA conventions. Rutkowski has been with NCTA four years.

Times Fiber Communications has elected **Kenneth Coleman** and **William Tuxbury** as senior vice presidents. The company also announced that its three divisions—cable TV, RF cable products and communications systems—will function as autonomous units. Coleman will head the cable division and Tuxbury, the RF cable products division.

Gary Vandemark has been promoted to vice president and general manager, satellite communications products for California Microwave Inc. Vandemark, who joined the company in 1974, most recently served as director of programs for the satellite communications division.

Magnavox CATV Systems Inc. has appointed **Howard Freeland** account representative. Prior to joining Magnavox, Freeland was national sales manager of Gardiner Communications.

WE'VE MOVED!

The Denver headquarters for *CableVision, CableFile, CED, Two-Way Radio Dealer, RCR* and *Mobile Radio Handbook* is now:

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Denver, CO 80203
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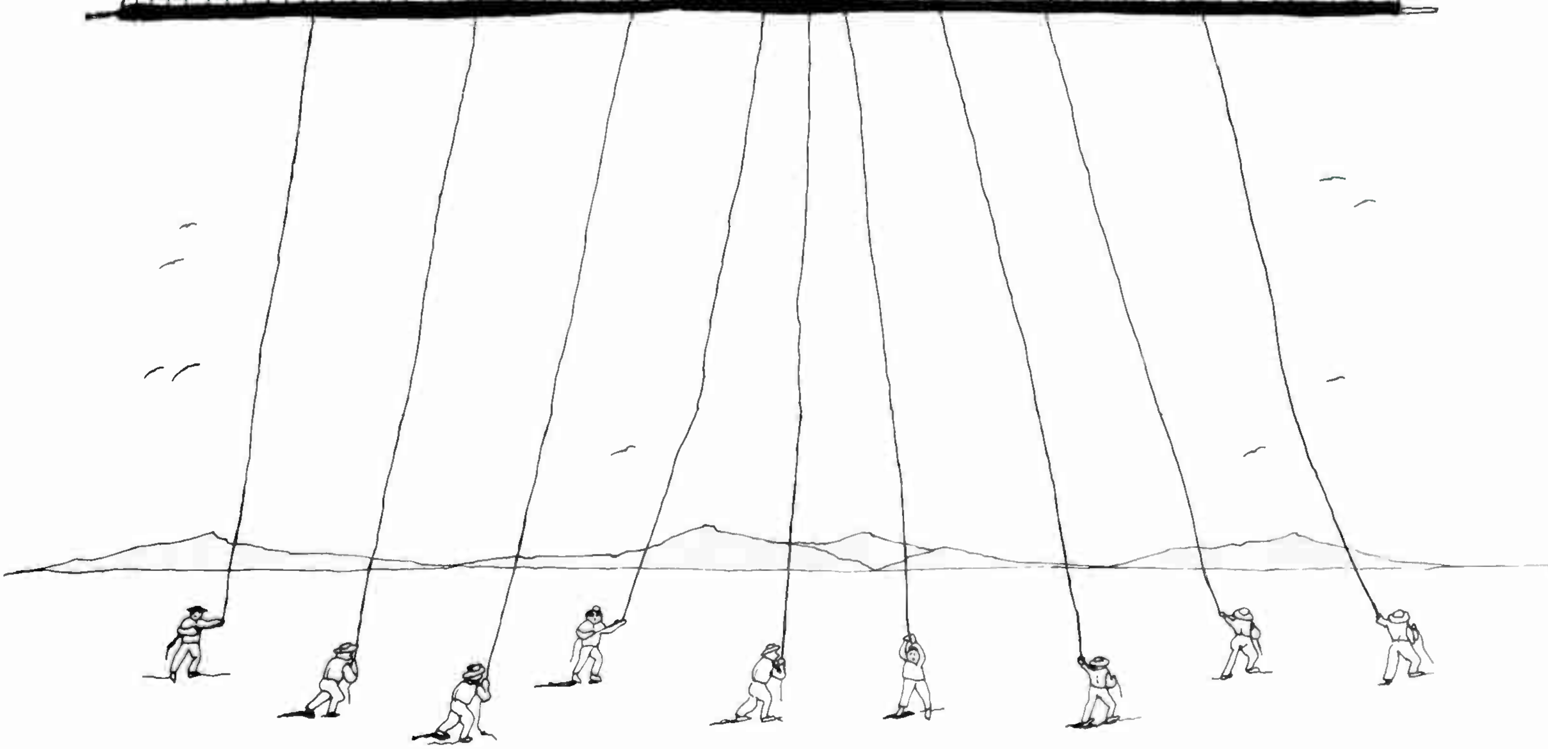

Los Angeles
101 N. Robertson Blvd.
Suite 206
Beverly Hills, CA 90211
(213) 659-3965

New York
101 Park Ave.
Suite 401
New York, NY 10178
(212) 661-7410

Washington, D.C.
1701 K St., N.W.
Suite 505
Washington, D.C. 20006
(202) 835-0900

Satcom 3R

Signal	Day	Start/Stop	Alert Tone	Transponder
Dow Jones Cable News		24 hrs.	None	6
Electronic Program Guide		24 hrs.	None	3
ESPN		24 hrs.	048*/#	7
Eternal Word Television Network	Daily	8 p.m./12 a.m.	762*/#	18
FNN	Weekdays	6 a.m./7 p.m.	975*/# 738*/#	4
Genesis Storytime		24 hrs.	None	8
HBO		24 hrs.	729*/#	(E,C) 24 (M,P) 13
HTN		4 p.m./4 a.m.	207*/#	16
The Learning Channel	Daily	6 a.m./4 p.m.	192*/#	16
Lifetime		24 hrs.	361*/#	17
Lifestyle		24 hrs.	None	3
Love Sounds		24 hrs.	None	8
Moody Bible		24 hrs.	None	3
Modern Satellite Network	Weekdays	10 a.m./1 p.m.	243*/# 421*/#	22
The Movie Channel		24 hrs.	None	(E) 5
MTV: Music Television		24 hrs.	None	11
National Jewish Network	Sunday	1 p.m./4 p.m.	None	18
Nice and Easy		24 hrs.	None	8
Nickelodeon	Daily	7 a.m./8 p.m.	311*/# (E,M,C) 519*/# (P)	1
PTL		24 hrs.	None	2
Reuters News View		24 hrs.	None	6
Satellite Radio Network		24 hrs.	None	2
SCAN		24 hrs.	None	6
Showtime		24 hrs.	576*/#	(E,C) 12 (M,P) 10
Sports Time Cable Network	Weekdays Weekdays	7 p.m./1 a.m. 1 p.m./1 a.m.	None	4
UPI Cable News		24 hrs.	None	3
USA Cable Network		24 hrs.	601*/# 438*/#	9
USA (during blackout)		varies	295*/#	22
Video Concert Hall	Daily	4 a.m./6 a.m.	None	16
WFMT		24 hrs.	None	3
WGN		24 hrs.	None	3
WTBS		24 hrs.	024*/# 017*/#	6
The Weather Channel		24 hrs.	None	21

Major Communications Satellites Serving North America

Location: Degrees West Longitude	Satellite: Present	Satellite: Future
41	TDRS 1***	
67		Satcom 6**(5/86)
69		Spacenet 2***(10/84)
72	Satcom 2R**	
74	Galaxy 2**	
76	Telstar**302 (Aug. 31)	
76	Comstar D1/2**	
79	Westar 2**	
81		ASCI***(9/85)
83	Satcom 4**	
86		Telstar 303**(5/85)
87	Comstar D3**	
89	SBS 4* (late Aug.)	
91	Westar 3**	
93.5		Galaxy 3**(9/84)
95	SBS 3*	
96	Telstar 301**	
97	SBS 2*	
99	Westar 4**	
100	SBS 1*	
103		Gstar 1* (11/84)
104.5	Anik D1**	
105	Anik C2*	
105		Gstar 2* (4th Q/84)
108.5		Anik C1* (10/84)
109	Anik B1***	
109		Anik D2** (11/84)
114	Anik A3**	
117.5	Anik C3*	
119	Satcom 2**	
122	Spacenet 1***	
123	Westar 5**	
127	Comstar D4**	
128		ASC 2*** (9/86)
131	Satcom 3R**	
134	Galaxy 1**	
136	Satcom 1**	
139	Satcom 1R**	
143	Satcom 5**	
171		TDRS2*** (late/84)
TBD		Spacenet 3*** (3/85)

* Ku-Band
** C-Band
*** Dual C/Ku-Band

Orbital slots and launch dates often change without notice.

Satcom 4

Signal	Day	Start/Stop	Alert Tone	Transponder
Biz Net	Weekdays	6 a.m./1 p.m.	None	15
Bravo	Weekends Weekdays	5 p.m./6 a.m. 8 p.m./6 a.m.	513*/#	2
KKGO-FM		24 hrs.	None	17
National Christian Network	Daily	8 p.m./3 p.m.	073*/#	7
The Prime of Life	Daily	4 p.m./7 p.m.	None	7
The Playboy Channel	Daily	8 p.m./6 a.m.	869*/#	12
Santa Fe Communications		24 hrs.	None	23
Trinity Broadcasting Network		24 hrs.	None	17
WPIX		24 hrs.	None	21

Westar V

Signal	Day	Start/Stop	Alert Tone	Transponder
American Christian Television System	Daily	8 a.m./2 a.m.	None	2X
Arts & Entertainment	Daily	(E) 8 a.m./4 a.m.	307*/# 519*/#	12D
Hi-Life Channel	Daily	6 p.m./6 a.m.	None	10X
Meadows Racing Network	Fri.-Sun. Tues. & Thurs.	7 p.m./11 p.m.	None	11X
The Nashville Network	Daily	(E)9 a.m./3 a.m.	674*/#	9D
The Pleasure Channel	Sun.-Thurs. Fri.-Sat.	11 p.m./5 p.m. 11:30 p.m./5:30 a.m.	None	11X

Contact programmer's technical department for more information on transponder use and alert tone.

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Signal variability often causes annoying distortion like tearing, jamming, flashing, buzzing, and streaking in television reception.

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CRX 5000 58 CHANNEL CORDLESS REMOTE CONTROL CONVERTOR WITH HANDHELD CHANNEL SELECTOR

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Reader Service Number 45

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