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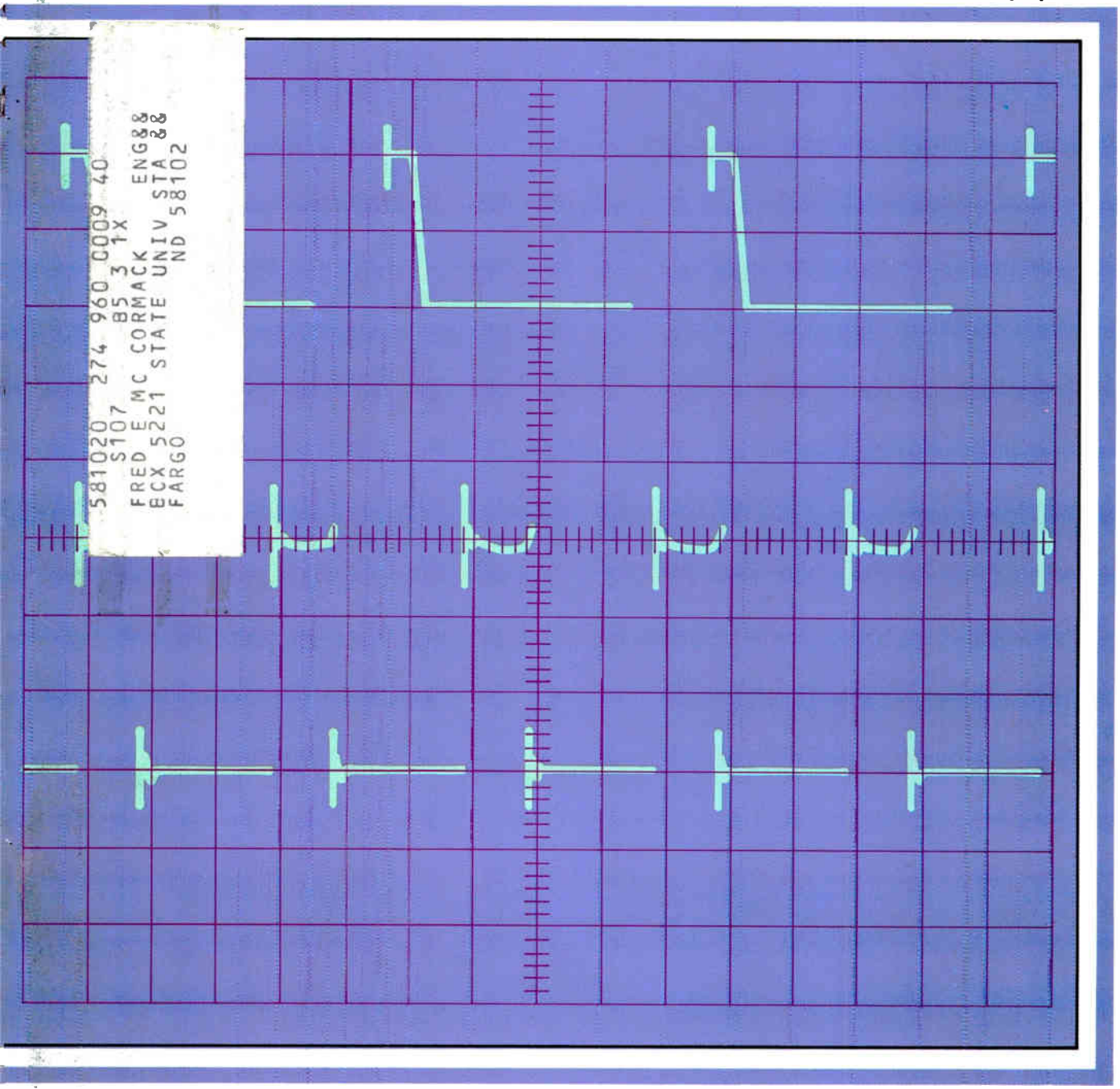

Communications-Engineering Digest
Reporting the Technologies of Broadband Engineering

March 1980
Volume 6, No. 2

Oak stages a seminar in print. Session 1...

Six steps to becoming a converter expert.

New Econo-Line Thirty shown

Step 1. Evaluate your present and future needs. Will the converter you select accommodate your present channel needs and will it handle expected future channel expansion? The "right converter" should still be the right converter five to ten years from now.

Step 2. Compare systems—Block converter or conventional converter? A low-cost block converter shifts a block of CATV channels to a corresponding block of VHF channels. This approach may work where a handful of additional channels are needed, but is not recommended for use in a strong signal area. *For optimum performance, a block converter should never shift channels to UHF,* as many subscribers have sets with non-detented or poor UHF tuners. A conventional or channel-by-channel converter offers a knob or series of buttons to allow your subscribers direct-channel selection without touching the channel knob on their TV set. Though more costly, this converter is best suited for most systems. In the long run, channel-by-channel converters reduce complaints of interference and tuning difficulty.

Step 3. Compare companies. Is the company selling the converter the same company that designed and built it? CATV converters are precision devices that must be closely monitored for quality at *every* stage from drawing board to final testing.

Step 4. Compare warranties. How strong is the warranty being offered? Are you being offered the same warranty as other buyers? Check the length of coverage, what services it includes and what service turnaround time is promised. Don't accept unwritten promises.

Step 5. Compare quality...then price. Only after all of the above considerations have been carefully evaluated can you begin to compare price. A low-cost converter is the "right buy" *only* if it meets the needs of your system.

Step 6. Call Oak. We'll send you literature on the complete line of Oak channel-by-channel and block converters, as well as other tips on how to select the best converter for *your* system. We'll also prove to you that Oak protects your system from lost revenue better than any other manufacturer. For your information packet, call our Locator Operator toll free at 800-323-6556 (in Illinois 800-942-6345) and ask for the CATV information desk.

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A Top Engineer... On Fused Disc Cable

Bob Bilodeau, Vice President, Engineering for Suburban Cablevision of East Orange, New Jersey had this to say in a recent letter to us:

"...our use of General Cable's Fused Disc is based on its electrical properties and its installation handling characteristics.

"Since June, 1975, I've used Fused Disc to construct nearly 1,000 miles of dual trunk cable system. Neither Suburban, nor our contractors have experienced any mechanical difficulties with underground or aerial placement.

"Additionally, we are able to take advantage of the lower attenuation characteristics and lower loop resistance properties in terms of amplifier spacing (electronics density) and the parameters of power supply per mile of plant.

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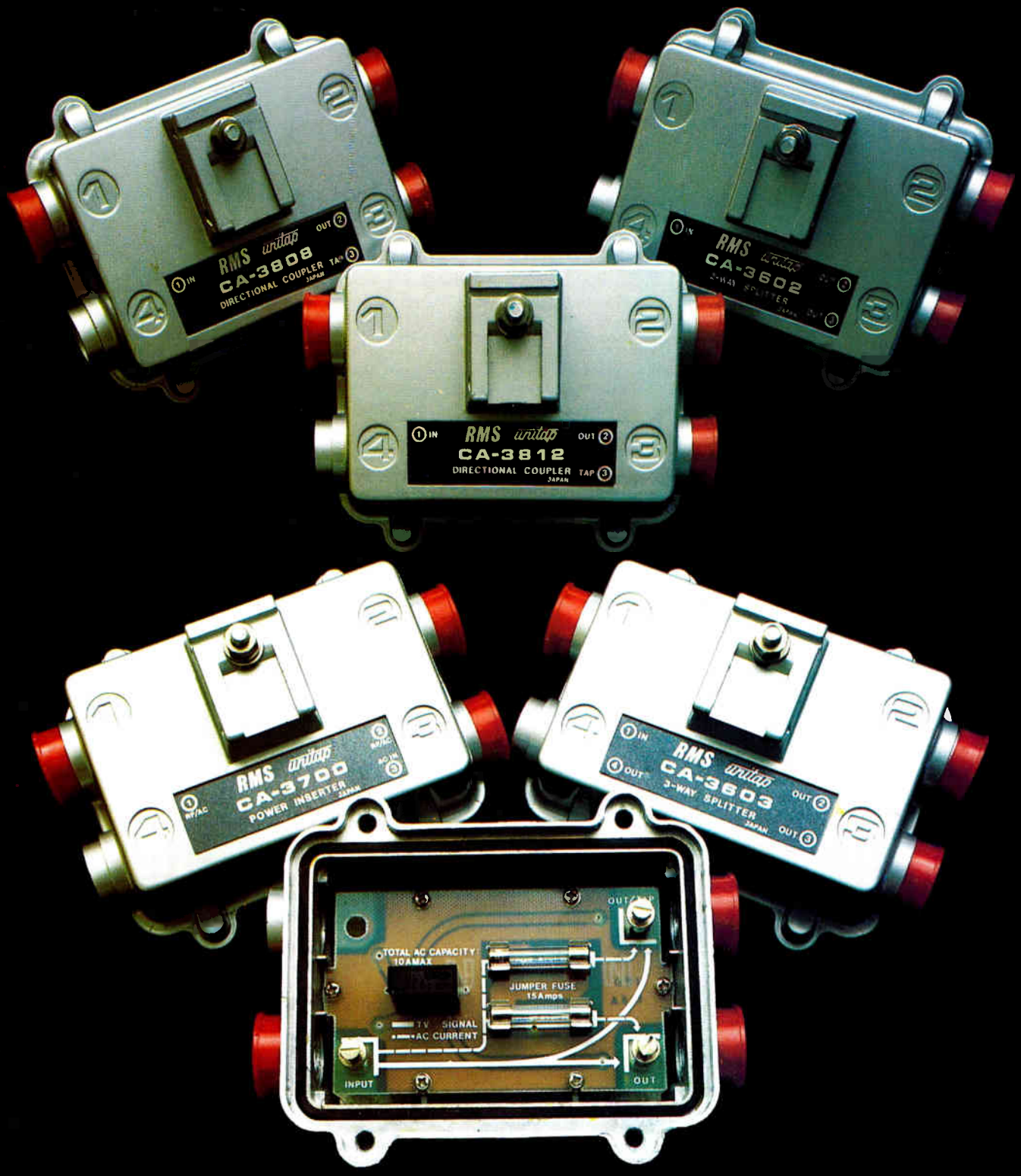

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C-ED News at a Glance

NEW YORK, NEW YORK—**RCA Americom has announced plans to utilize up to eleven transponders on AT&T's Comstar D-2 satellite for cable as a short-term solution to the loss of Satcom 3 last December.** Cable programmers will be able to lease transponders from RCA, subject to preemption, for service starting April 1st. All eleven transponders will be clustered as a second cable network by RCA—the first being all cable programmers now on Satcom 1. RCA hopes to have specific transponder assignments and start dates ready by March 7th.

One transponder has already been taken by Satellite Communications Network, an Ohio-based company which earlier this month received a full-time transponder from Western Union.

RCA also announced plans to launch two satellites next year. The first, a replacement for Satcom III, will be sent up in June, while Satcom IV will be launched in October. Both will be operating by February 1982. RCA is also studying plans for a fifth satellite, which could be launched in 1982.

SAN FRANCISCO, CALIFORNIA—**"Video communications has finally broken out of the hammerlock** the frequency allocations put it into," according to NCTA president Tom Wheeler. "The day it became public policy to limit the frequencies available for television was the day television was limited to programming for the masses. The new technologies have sprung the American consumer from that limitation. **The next ten years of television will be characterized by new technologies supplementing, not replacing, over-the-air broadcasting.** We will use our new technologies to do something which broadcasting has been incapable of doing. We will serve smaller, more unique segments of the population with more targeted entertainment and information." Wheeler, speaking to the National Association of Television Program Executives, explained that the existing technology of television distribution is neither going to disappear nor slip into some kind of marginal never-never land.

WASHINGTON, D.C.—**The FCC has approved a reorganization of its Office of Science and Technology** which Chief Scientist Stephen J. Lukasik says was designed to improve planning, coordination and management of office functions. He said it would enable him to delegate more of his authority thereby allowing him more time to act as the FCC's chief scientific advisor. Under the reorganization, there will be two deputy chiefs, one for policy and one for technology to serve as the major management officials through whom Lukasik will manage and direct the office. The Deputy Chief for Policy will be responsible for spectrum management and international activities, and will direct policy formulation, overseeing the effects of long-range planning and of the actions taken in the operating divisions as they affect policy. The Deputy Chief for Technology will manage technical planning, equipment authorizations and standards, and research and analysis activities. Three divisions will be established to cover the major work areas of the office: examination and approval of equipment (Authorization and Standards Division); spectrum management (Spectrum Management Division), and research in spectrum propagation and innovations in the field (Research and Analysis Division.)

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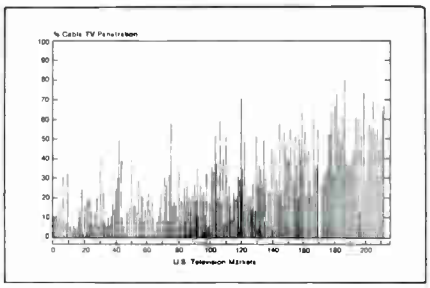

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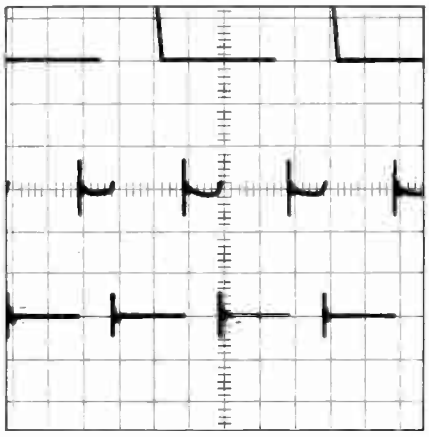

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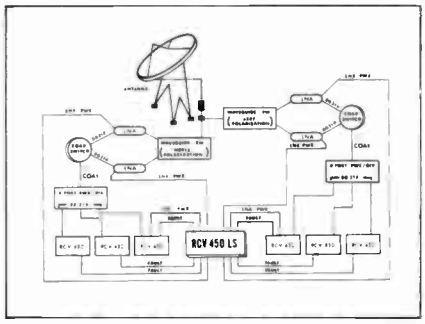

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FEATURES

DEPARTMENTS

Cover: Artists' rendition of sweep generation CRT screen. By Brad Hamilton.

Editor's Letter

The SCTE's Spring Engineering Conference and Annual Meeting adjourned on the 6th of February in Phoenix after an extremely successful series of technical presentations and business meetings. The entire event appeared well-planned and well-coordinated. Our congratulations to the entire SCTE staff, the panel moderators, and speakers for a job well done.

Particularly impressive, however, was the assembly of talent present at the technical seminars. Without exception, the speakers demonstrated an extremely high degree of expertise in their respective fields, and evoked an enthusiastic response from the audience.

Incidentally, tapes of the entire proceedings are available from the SCTE. For further information, contact Judith Baer, SCTE, 1900 L Street, N.W., Suite 614, Washington, D.C. 20036, or call (202) 293-7841.

One highlight of the conference was a "roasting" of Tom Polis, following an awards ceremony in which Polis was named Member of the Year. *C-ED* would like to extend its congratulations to him; this recognition is richly deserved, as can be seen in the related news story on page 10 of this issue.

Also in this issue, *C-ED* presents an article on deregulation prepared by Early D. Monroe. The article is based on an FCC report also authored by Mr. Monroe, and we think you'll find his conclusions rather interesting.

Last but not least, this March issue of *C-ED* also features a special section on test equipment.

Paul A. FitzPatrick

Labor Department Awards Purchase Order To SCTE

WASHINGTON, D.C.—The Society of Cable Television Engineers has been issued a purchase order by the U.S. Department of Labor, SCTE executive vice president Judith Baer has announced.

The purchase order calls for SCTE to develop a cable television industry information and assistance guide dealing with the use of Comprehensive Education & Training Administration (CETA) and the Private Sector Incentive Program (PSIP). The publication will include a historical summary, a self-assessment profile on skills needed and the availability of CETA resources. What an employer in the cable TV business can expect from CETA, success stories relevant to the industry and samples of typical CETA paperwork with instructions also will be a part of the SCTE guide. Expected publication date is May 30, 1980.

Additionally, SCTE will develop a publicity handout explaining PSIP in simple, get-involved terms. Release date on the handout is June 30, 1980.

"SCTE is proud to be the first in the cable television industry to be awarded a CETA purchase order for the development of these materials," said Baer. "We intend to produce a clear, comprehensive document that will become a standard reference for all members of the cable/broadband industry. Once this project is completed, we hope to go on to bigger and better things with DOL's assistance. The fact that SCTE was awarded the grant solidifies its position as a primary communicator and educator for the industry," concluded Baer.

SCTE Honors Polis As Member Of The Year

PHOENIX, AZ.—Tom Polis, Director of Engineering and Operations for Comcast, was honored as the 1980 Member of the Year at SCTE's Annual Awards Luncheon, February 5.

The Member of the Year Award, the highest recognition given to an individual by SCTE, is presented annually on the basis of accomplishments and achievements on behalf of SCTE.

Polis was chosen for his significant contributions toward SCTE's goals and presence in the industry. His time, energy and thoughts were instrumental in the formation of SCTE's new manpower recruitment endeavor. The program's objective is to help with manpower training, management development, and growing industry involvement with new technology.

Following Polis' recommendation, SCTE initiated the Technical Resource Manpower Pool, consisting of resumes of recent college graduates interested in joining the cable television industry. SCTE members, looking for new personnel to fill job openings, can obtain copies of the resumes from SCTE. Subscribers can receive the resume service on a one-time or 12-month basis. The resumes present credentials of graduates of colleges, universities and vocational schools across the nation, who have the technical background, ability and aptitude for employment in the cable industry. Started in the summer of 1979, SCTE is just now building an effective resource "bank" of resumes. There is no cost to either participating students or schools.

"Polis was the real organizer behind the Technical Manpower Resource Pool," notes SCTE executive vice president, Judith Baer. "Thanks to him, we've taken the first step in a major industry recruitment program. With the industry facing a significant technical personnel shortage in the next ten years, it is imperative that this issue be addressed immediately. Polis had the foresight to recognize the problem and come up with a workable solution. We want to applaud his efforts," she concluded.

Polis has been recognized as one of the industry's most technically competent and broadly experienced members. Currently, he serves as Comcast's Director of Engineering and Operations for new system development, a position which requires him to be responsible for overseeing the building of all new properties.

Prior to joining Comcast just three months ago, Polis spent six years with Magnavox CATV Systems. During his time there, he served as Manager of International Sales and Technical Services, Manager of Field Engineering and Product Manager for Active

Devices. Polis presented technical papers at the SCTE Reliability Conferences and has conducted technical training seminars in the U.S., Mexico, Belgium, Holland and Switzerland.

SCTE Manpower Recruiting Campaign Receives Industry-Wide Support

WASHINGTON, D.C.—Kenneth Gunter, current treasurer of the Society of Cable Television Engineers, has taken responsibility to solicit support from the cable television industry towards SCTE's Manpower Recruiting Program. Developed in 1979, the effort is a direct result of an idea from SCTE Senior Member Tom Polis and was further developed by SCTE executive vice president, Judith Baer.

The SCTE manpower recruiting program will include publication of brochures promoting the cable television industry to graduating students of colleges and universities, trade and vocational schools as well as those attending high school. Distribution of these brochures is expected to exceed 250,000 copies. A carefully planned national advertising campaign in consumer and youth-oriented publications will also fit into the program.

"The industry has responded favorably to this program," said Gunter. "Eight companies had given SCTE $1,000 each by January 31, 1980. They are: Comm/Scope Co.; Home Box Office; Hughes Communications Products; Magnavox CATV Systems; Sammons Communications; UA-Columbia; Viacom International, and Warner Cable Corp. More companies have pledged funds and as of January 31, 1980, SCTE is slightly more than half-way toward the budgeted amount of $15,000 to get this program off the ground by September 1980," he concluded.

For further information about SCTE's Manpower Recruiting Program, call Kenneth Gunter at 915-655-0634 or the SCTE office at 202-293-7841.

CATV Test Data Forms Available From SCTE

WASHINGTON, D.C.—Five different cable television system operations test forms are available from the Society of Cable Television Engineers. The forms are three-hole punched, padded in sheets of 50, and color-coded for easy identification.

The forms cover 24 Hour System Variation Data; Subscriber Tests; 24 Hour System Variation; Headend Tests; and System Test Data. Single copies of the forms were published by SCTE in 1978 in The Interval. The forms were developed by a group of industry engineers during an effort to release a CATV measurements handbook by the National Cable Television Association in 1977. No further distribution of the forms had been made.

The 24 Hour System Variation Data form allows for documentation of the measurement date, system location, test points, name of the individual conducting the test and graphic documentation of the data.

Test point, equipment used, personnel conducting the measurement, channel, run number, time, temperature and dB documentation are included on the 24 Hour System Variation form.

Subscriber Tests notates test point, location, trunk amplifier, extender, channel, visual, aural, differential sound, signal-to-noise, response, radiation, intermod, hum, co-channel, and terminal isolation, as well as personnel, system and date of measurement.

The form for Headend Tests includes channel, call letter, station location, class, grade, nominal frequency, FCC assigned offset, visual frequency, aural frequency, differential of visual-to-aural and response as well as personnel, system and location identification.

System Test Data requires system name, location, date, a Statement of Qualifications and a List of Equipment, including model, manufacturer, type, serial number, and calibration information.

Each form is 8½" x 11", and can easily be collated into a notebook for reference. Price for the forms is $2.50 each per pad; ten or more of one form only are $2.00 each. Proceeds from the sale of these measurement and test documentation forms will go to the SCTE scholarship fund. Payment must be included with all orders. SCTE will not ship without payment in full at the time of placing an order.

Order from: SCTE, Inc., 1900 L Street Northwest, Suite 614, Washington, DC 20036.

National Scholarship Program Set By SCTE

WASHINGTON, D.C.—Judith Baer, executive vice president of the Society of Cable Television Engineers, has announced a national scholarship drive developed to encourage consideration of cable television engineering as a dynamic and viable career opportunity, and to assist SCTE members who are already employed in the industry in furthering their education. The program is designed to encourage growth of current SCTE membership as well as recruit additional personnel into cable television and broadband communications.

Through the sale of SCTE Senior and Active Member plaques, SCTE had raised $1,520 for scholarships by November 1979. The Upstate New York SCTE Chapter forwarded $250 and pledged an additional $50 in December. In January 1980, Baer herself donated $100. These monies now total nearly $2,000 which will be distributed in awards by the end of 1980. Allocation of the scholarships has been decided through an SCTE Scholarship Committee appointed by SCTE president, Lawrence Dolan at a board of directors meeting in early February.

"This is a very ambitious program," said Baer. "SCTE will be promoting donations from state and regional associations, members, non-members, and anyone else willing to listen," she continued. "It will take a minimum of $20,000 annually to reach SCTE's goal of helping at least two people in each state complete their educations and hopefully join this industry, plus assist our own members as well. Anything over that $20,000 figure will go directly to further scholarship and assistance programs expressly for SCTE members."

For information regarding the SCTE scholarship fund, please call the SCTE office in Washington, DC, at 202-293-7841.

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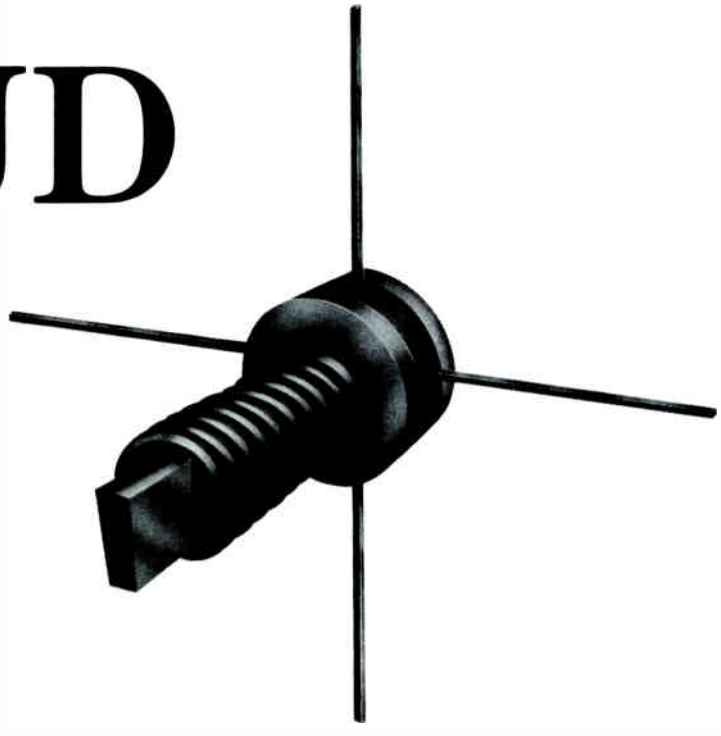

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Teletext/Viewdata Systems Mean "Profound" Change in TV Usage

WHITE PLAINS, NEW YORK—A just-published book on teletext and viewdata systems says this technology must overcome serious user resistance to new ways of using the television set if it is to succeed on a large scale. "The changes it entails in established ways of doing things are so profound that they will never take place in a matter of months, or even in a year or two," the authors warn.

The book, *Videotext: The Coming Revolution in Home/Office Information Retrieval*, contains first-hand reports on the BBC's Ceefax service in England, on the British Post Office's Prestel project and on various tests of these technologies in the U.S. by CBS, Knight-Ridder, GTE and others.

It is written by Efrem Sigel, editor in chief of Knowledge Industry Publications; Colin McIntyre, editor of the BBC's Ceefax; Max Wilkinson of the Financial Times, and Joseph Roizen of Telegen. It is published by Knowledge Industry Publications, Inc., White Plains, NY 10604.

Videotext is a term describing the display of textual information on a specially adapted TV set or computer terminal. Such information can either be broadcast in unused lines of the regular TV signal (a version known as teletext) or transmitted by phone lines from a central computer data bank containing hundreds of thousands of pages (a version called viewdata).

The "established habit of watching TV as a pastime, for entertainment only" is cited as a major obstacle to growth of videotext services. In the first two years of Ceefax service by the BBC in London, only 15,000 sets equipped to receive the transmissions were sold, the book notes.

Besides the Ceefax and Prestel services in Britain, videotext systems have been developed in France and Canada, and are being tested in the U.S. The book notes the lively interest in the technology on the part of telecommunications companies like GTE, computer manufacturers like IBM and publishers like Dow Jones. Among the conclusions of this book are:

- The initial market for viewdata services will be among business and professional users used to paying a premium for information delivered quickly. Consumers in their homes will be much slower to adopt such a service.
- The British Post Office may have made a major error in applying the "information utility" concept to published information.
- The notion of a home information/entertainment center in which consumers will want every type of device for storing information and entertainment is a "science fiction" concept. In reality, "consumers will pick and choose," the authors assert, and buying one type of device, e.g., a video recorder, may mean rejecting another type, e.g., a videotext decoder.
- It will take years of patient investment on the part of information suppliers before a substantial number of consumers are ready to accept videotext services.

Videotext: The Coming Revolution in Home/Office Information Retrieval contains 25 full-page photographs

illustrating the various systems discussed. These include Ceefax, Prestel, Antiope, Telidon and others. Also included are appendices with names and addresses of organizations around the world involved in the new technology, as well as names and addresses of firms providing information for the Prestel service in Britain.

New Cable Television Computer System

ATLANTA, GEORGIA—A new program designed to provide cable television systems with rapid access to current information on customers and system operations has been announced by International Business Machines Corporation.

IBM officials said the System/34 Cable TV Online Customer Service System is designed to sharpen internal controls, heighten service representative productivity and supply management with meaningful information for operation of their system.

The Installed User Program handles inquiry, order entry, billing, accounts receivable, marketing and management reporting and can be operated by administrative personnel with no extensive data processing experience.

Highlights of the system provide:

- Inquiry to subscriber and prospect information by name, address, and account number.
- Pending work order control for installation management.
- Interactive order processing with automatic pricing of installation and service charges.
- Coupon and statement billing with optional cycle billing.
- Automatic past due reminder and disconnect notices.
- Timely financial, managerial and marketing reports.
- Extensive accounting and auditing controls.
- Support of multiple and remote customer service centers.
- Support of multiple cable systems and multiple franchises.

The program is now available at a monthly cost of $310 for 24 months for a paid up license.

NASA Awards RCA Experiment Study

CAMDEN, NEW JERSEY—The Special Systems activity of the RCA Government Communications Systems Division recently received a contract from NASA to conduct an Electronic Message Experiment Study. In order to operate this experiment task, RCA American Communications, Inc., installed a 56-kilo-bit per second data service, via satellite, between an existing earth station at the Lyndon B. Johnson Space Center, Houston, Texas, and a new 5 meter station, Rockwell International, Downey, California.

"At present," said Dennis J. Waywood, RCA GCS manager of Special Systems, "NASA handles more than 60,000 pages of communications a month, most of which are sent over slow speed facsimile terminals requiring two to six minutes per page. This experiment involves the latest in high-speed terminal equipment capable of producing high-resolution facsimiles at only 10 to 20 seconds per page."

Hughes' Satellite Application Considered

By Pat Gushman,
Washington Bureau Chief

Several years have passed since the FCC adopted its open-entry satellite policy in lieu of selecting applicants on the basis of comparative hearings. However, with the heavens becoming increasingly crowded, some interests are urging the Commission once again to consider the comparative merits of proposed systems. Western Union and Southern Pacific Communications, for example, have challenged the applications of Hughes Communications for two orbital slots and Hughes attorneys say they are actually trying to get a freeze on all satellite applications while current and anticipated applications are evaluated.

Western Union is seeking denial, it says, because the Commission must preserve suitable orbital expansion opportunities for a system such as Westar. SPC is seeking denial of the applications because if they are granted, they "may preclude SPC from obtaining a position in the C-band orbital arc from which effective service to at least the 48 continguous states could be achieved. Western Union has made some of the same arguments against RCA's application for SATCOM IV. Now Hughes' attorneys are arguing that when the FCC adopted the open-entry policy for the domestic satellite service, it specifically rejected the approach being urged by Western Union and SPC.

Attorneys for Hughes have pointed out that there is no provision in the FCC's existing satellite policies or rules and regulations for license terms or renewals in the satellite radio service, no provision for mutually exclusive satellite applications, and no comparative standards by which to judge the merits of competing applicants. "An abrupt change in the FCC's policies and rules, such as is urged by Western Union and SPC," they argue, "not only would be contrary to the due process considerations that must guide the commission, it would create chaos in the domestic satellite service."

The FCC sees a time when the total number of applications for new domestic satellites may exceed the number that could be accomodated in the orbital arc useful for U.S. service, but it has stated that a rulemaking approach would be desired to avoid potential conflict. Attorneys believe that such a rulemaking could signal the end of the present open-entry policy and could accompany the "second generation of domestic satellites." That time has not yet arrived, according to Hughes.

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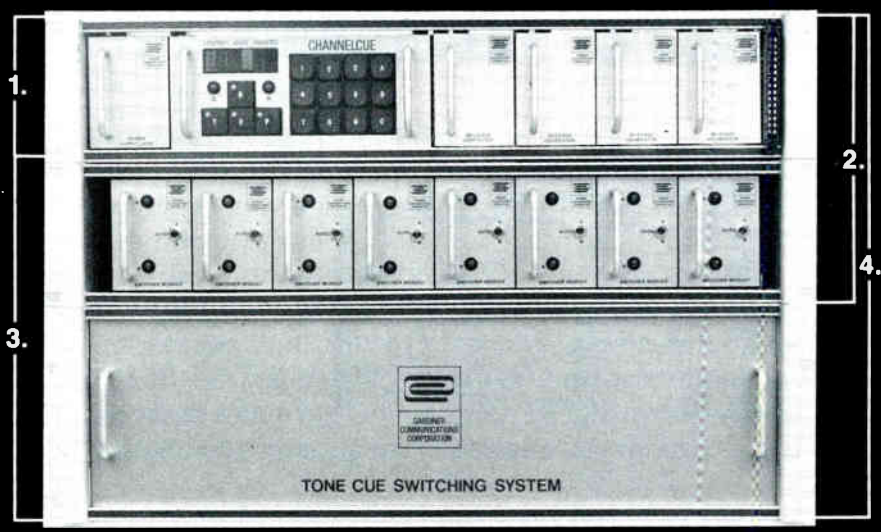

2.
Expanded Basic unit provides time switching for up to eight channels with 2,552 switch functions.

4.
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In line with our *Notice of Proposed Rule Making and Notice of Inquiry in Docket No. 18397*, the standards we are proposing here are aimed primarily at furthering the quality of service rendered the public. Secondarily, we hope that the standards will help secure a degree of compatibility among systems which in the future may be useful for accomplishing system interconnection. . .

In 1972, with the adoption of technical standards in the *Cable Television Report and Order*, the Commission chose to limit the standards to the carriage of television broadcast signals, declining at that time to formulate standards applicable to cablecast programs. The Commission indicated that the technical standards adopted are minimal and should be augmented as soon as possible with standards concerning other technical areas such as:

1. Standards for cable television receivers (a television receiver specifically designed for use with a cable television system);
2. Frequency allocations within the cable network;
3. Standards for class II, III and IV channel;
4. Standards for envelop delay, differential gain and phase;
5. Standards on permissible cross-modulation, 'ghosting,' [and]; hum [and]
6. Standards for cable carriage of aural broadcast programming.

In an effort to augment the minimal standards adopted and to formulate standards in the above areas, the Commission indicated the need for tapping a large body of expertise in order to develop more technical and economic information than is ordinarily available through the rulemaking process. Therefore, the Commission established a task force of experts to advise it in specifically designated areas.

In addition, in its *Reconsideration of the Cable Television Report and Order*, FCC 72-530, 36 FCC 2d 326 (1972), the Commission stated that:

> The general question of federal preemption of technical standards has been uniformly raised by a number of parties. Our technical standards provide only a start. They will be expanded and refined to meet changes in the state of the art. We see no reason why franchising authorities may not now require more stringent technical standards than those in Subpart K.

On February 3, 1972, the Commission created the Cable Television Technical Advisory Committee (C-TAC) to deal with problems of technical standards. The committee functioned through a Steering Committee and nine panels. The panels were concerned with identifying appropriate technical parameters to be measured; recommending the necessary methods and instrumentation; determining the significant relationship between quality ratings and such factors as cross-modulation and intermodulation beats, ghosting, and hum modulation of r.f. carrier; identifying critical performance and design characteristics of TV receivers for cable television; identifying and evaluating critical performance characteristics of input equipment for class II channels; identifying and evaluating current practices involving technical operations; investigating the need for, and feasibility of, developing interchangeability standards at the interface between cable TV service drop and terminals other than a broadcast TV receiver for use on class III or IV cable TV channels; describing the technical operating environment involved in the formulation of cable standards; and identifying areas of need for technical performance specifications with regard to providing desired interactive services. The Steering Committee and panel members consisted of individuals with recognized expertise in their telecommunication fields, representing such diverse interests as electronic equipment, broadcasting, cable system operations, common carriers operation, trade associations, communication consultants, educators, and civic groups. Some objectives of C-TAC were to:

> . . .develop full, detailed, and reliable technical information, and the engineering principles based thereon, concerning those factors related to the quality and interchangeability of signals transmitted and received by means of. . . Cable Television Channels. . .

Pre-empted Standards

On April 15, 1974, the Commission adopted the *Clarification of the Cable Television Rules and Notice of Proposed Rulemaking and Inquiry*, FCC 74-384, 46 F.C.c. 2d 175, which elicited public comments on the question of whether the field of cable television technical standards should be totally preempted by this Commission or whether a moratorium on additional non-federal standards should be imposed until the completion of the work of C-TAC and the adoption of further federal standards. With the adoption of the *Clarification Report and Order in Docket No. 20018*, FCC 74-1168, 49 FCC 2d 470 (1974), the Commission stated that:

> . . .Our approach to regulation in general, and technical standards in particular, must be sufficiently flexible to allow for new development, without at the same time creating such a climate of uncertainty as to deter the commitment of major economic resources to these developments. We have come to realize that this is a delicate balance. It might as well be achieved by continuing our present approach of incomplete federal standards complemented by additional state and local standards. But we are persuaded now that such a balance is more likely to be achieved through the adoption of nationwide standards, more complete and refined than our present standards, with built-in flexibility in the interim allowing for liberal waivers in those instances in which:
>
> 1. We have set no standards and there is a demonstrated state or local need for a standard; or
> 2. Our standard is demonstrably inadequate to meet clear state or local needs or conditions.

The Commission emphasized in this proceeding its Congressional mandate to foster and promote ". . .a rapid, efficient, nation-wide and world-wide wire and radio communications service. . . ." Indicating that cable television was becoming an integral link in that system, the Commission further stated that

> [t]he long term goal of an efficient nationwide communication system cannot be achieved if one segment of that system develops with a multiplicity of jurisdictionally mandated, non-uniform, technical characteristics that may result in incompatibility.

In preempting the field of technical standards, the Commission indicated that there

> . . .is a necessity to rationalize, interrelate, and bring into uniformity

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the myriad standards now being developed by numerous jurisdictions. . .

while encouraging, at the same time, the development of supportable alternative standards at the state and local level.

C-TAC Final Report

The C-TAC Steering Committee indicated in its Final Report that:

> Many technical standards in the established electronics and communications industries are sponsored by industry and voluntarily controlled through the exercise of good judgment and competitive pressures.

In an attempt to identify what type of technical standards are appropriate at the government level and what standards can best be established by industry measures of good engineering practice, C-TAC classified regulatory standards in three distinct categories. They are:

Type 1 Interference and Harm: These standards are necessary to avoid interference or physical harm to others. Strict limits on signal leakage or out-of-band signals are examples of this type of standard.

Type 2 Compatibility and Inter-Operability: These are standards that are necessary for compatibility or a working together of related parts. An example would be the distance between the rails on a railroad track. The exact value is not so important as is the general agreement on the value chosen so that interconnected equipment performs properly. Type 2 standards are essential when large areas of service and multiple independent parties are involved.

Type 3 System Performance: These standards are necessary to assure a means for judging technical performance of the system—a means by which the consumer and community served can measure fair value. Such performance includes the determination of effects that system operation may have on signal quality and the limits of acceptability of such effects. Generally established by the industry, these standards need not have regulatory enforcement but should be consistent with rules established by regulatory agencies.

The cable television technical standards codified in Part 76, Subpart K of the Commission's Rules can be grouped into three similar C-TAC categories; Interference, Interface, and System Performance. Interference standards are those which are necessary to preclude undesired signals from impairing desired signals. Cable signals causing interference or harm to the off-air reception of a non-cable subscriber, or to other services are examples falling into the interference standards category.

Interface standards are those which are necessary for stations, systems, and telecommunication components to work together and/or interconnect. These standards allow compatibility of signals among systems, and/or common utilization of terminal equipment. Cable standards applicable to frequency boundaries, aural and visual carrier designations, are examples of interface standards codified in the cable rules.

System Performance standards are those which measure the quality of cable system performance at the subscriber's terminal. Cable technical standards applicable to signal-to-noise, undesired low frequency disturbances, level of rms voltage of aural carrier, visual signal level, amplitude characteristic, and coherent disturbances are examples of system performance standards incorporated under Part 76, Subpart K of the Commission's Rules.

Cable Complaints

The Commission's Cable Complaint Service (CCS) received approximately three thousand cable complaints and inquiries between January and October of last year. Approximately 10 to 15 percent of these complaints were directly related to the technical performance of cable systems. These technical performance complaints can be grouped into two categories—interference and system performance—with slightly more than half of the complaints falling into the interference category. In addition, it is noted that very few complaints were received from communities where cable systems are operated by a Multiple System Operator (MSO), or communities with three or more over-the-air commercial television broadcast stations. The complaints generally came from small communities with less than three over-the-air television stations.

When the CCS office receives a complaint, the cable system is notified of this filing and given approximately fifteen days to resolve the problem and report back to the Commission with a description of the problem and the action taken, or at least the proposed action, to remedy the problem. The complaint and its resolution are then placed in the cable system file maintained by the Commission. Depending on the number of complaints, the system's inability to resolve a complaint, or some other unusual technically oriented conflict, the Commission may request the assistance of the Field Operations Bureau (FOB) in resolving the conflict.

The Commission is aware of instances in which the cable service to a complaining subscriber has been deliberately disconnected. While this practice of resolving a technically oriented complaint appears to be an anomaly, the Commission currently has no rule to assist a subscriber whose service has been disconnected. In situations of this nature, the CCS office simply attempts to assure that the remaining subscribers receive quality television broadcast signals consistent with the Commission's technical standards.

Slightly more than half of the technical performance complaints fall in the interference category; interference or harm to the off-air reception of the public or to other services. The Commission's congressional mandate requires that the public not be subjected to undesired interference from other telecommunications services, including cable systems. Therefore, this paper recommends retaining the interference standards which currently apply to all cable systems *regardless* of the system's characteristics, location, the degree of over-the-air-television competition, or the community's participation in handling cable related complaints.

However, for the remaining technical performance complaints (which fall into the system performance category) it is expected, if the recommendations are adopted by the Commission in the immediate future, that there will be a slight reduction in the number of complaints to be resolved by the Commission. The immediate decline is expected because of the proposed recommended action to exclude cable systems from interface and system performance standards for cable sys-

tems furnishing premium signals for an extra fee; cable systems located in markets with at least three commercial television stations; cable systems located in communities containing local or state technical standards; or cable systems in communities with a functioning government or government-sanctioned cable office. Since it appears that the majority of system performance complaints come from small communities not satisfying any of the above conditions, the percentage of technical performance complaints should again increase to the current level as more small communities and/or rural areas are wired which do not satisfy any of the above requirements.

Based on the limited number of non-interference complaints received by the Commission, and the fact that the vast majority of these complaints came from communities where no alternative or optional television service is available, it would appear that deregulation of the Commission's non-interference standards can occur in most communities. Furthermore, based on the limited experience with the Commission's decision to preempt state and local technical standards coupled with an analysis of the waiver requests submitted to the Commission by various municipalities, it now appears that consistent with the Commission's overall cable deregulation objective, a re-evaluation of the preemption decision is warranted.

In the 1976 preemption decision, the Commission was of the opinion that uniformity of standards was the correct approach to promote a nationwide cable television system. As a result, state and local technical standards were preempted. It now appears that the developing cable television industry has prompted the establishment of a number of private cable organizations and associations providing cable technical assistance. [Some of these organizations are: National Cable Television Association (NCTA), Cable Television Information Center (CTIC), Society of Cable Television Engineers (SCTE), National Cable Television Institute (NCTI), Cable Television Resource Center (CRC), and others.] With the aid of these organizations and others prior to the preemption decision, uniformity and standardization in the cable television industry progressed at a rate consistent with that in other telecommunications services. However, since the preemption decision, cable technical advances appear to have slowed compared to these other telecommunications services. By way of analogy, the Commission notes in the video tape industry that technological advancement appears to be progressing in the private and public sectors without federal attempts to standardize tape sizes or to incorporate uniform standards. As a result, you now find inexpensive 1/4 inch video tape equipment furnishing good quality signals as well as the more expensive 2 inch equipment furnishing excellent quality signals. Competition, market place pressures, good engineering practices, plus supply and demand are more likely responsible for video tape technological advances and development even though many of these tapes are not compatible. Furthermore, it is questionable whether we would now have the diversity in cost, quality, and tape size that now exists if the federal government had intervened to standardize the video tape industry. It is therefore recommended that federal involvement in the cable non-interference, technical area should be similar to the government's involvement in the video tape industry, which is virtually non-existent. However, this is not to suggest one should expect noncompatibility between cable systems and television broadcasting if the technical standards are deregulated or deleted at the federal level.

With the Commission's minimum technical standards and the preemption of state and local government technical standards, it appears that the Commission has removed technical standards and specifications from the competitive, good engineering practice area. The author is now of the opinion that this competitive element should be reinstated. Accordingly, it is recommended that the preemption of state and local government technical standards be removed and technical competition again be encouraged. It is believed that the end result of this move will be a more technically advanced cable industry furnishing better service to the public. Moreover, standardization and uniformity are areas which can best be handled by the industry since the minimum Commission's standards in this area fall in the non-interference category.

Because of cable's direct dependence on the public for success or failure, the public has a more significant role to play in cable's development and operation at the local level than is now available at the federal level with the federal standards. Among other options, the public impact on cable's development can be exercised through the election process. If the public demands technical superiority from a potential cable operator, then the primary entities involved in determining whether the cable system delivers this superiority are the public, local officials, competing services, and the cable operator. It appears to be the responsibility of the cable operator not to enter into a contract or franchise based on technical specifications and promises he cannot meet.

In view of the above, the author is not persuaded at this time that standardization and uniformity, if at all necessary, are not being accomplished without dependence or reliance on the Commission's technical standards, or the Commission's preemption of state and local technical standards. Accordingly, it is recommended that the Commission's preemption decision be removed to allow marketplace competition, the cable industry, public, and local governments the primary role in the development of technical standards in this closed circuited telecommunication industry.

Interference Standards

These standards are necessary if the Commission is to continue to protect other telecommunications systems from interference by cable systems. Moreover, if protection is to continue for off-air, non-cable subscribers receiving interference from cable systems, interference standards should be maintained by the Commission. Many pioneer cable regulators recall quite vividly the early days of cable before the Commission incorporated radiation or leakage standards. Then, the Commission received numerous allegations of cable systems intentionally causing interference to non-cable subscribers, off-air reception, in an attempt to increase their cable subscribers. This practice no longer seems to exist because of the Commission's radiation standards. Moreover, the Commission's interference standards, directed at protecting air navigation and aeronautical and marine emergency radio services, are unquestionably necessary since they involve safety of life.

Therefore, it is recommended that

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the technical standards codified in Sections 76.605(a) 12, 76.610, 76.611 and 76.613 be retained and enforced by the Commission. These standards are applicable to signal leakage or radiation on all cable channels, signal leakage in the frequency bands 108-136 and 225-400 MHz, operation near specific aeronautical and marine emergency frequencies, and interference from a cable system, respectively. They should be retained and the Commission should continue the preemption of state and local government standards in these areas.

Interface Standards

Spectrum allocation and tuning requirements appear to be the foundation for any cable interface standards. These are standards which allow cable systems to be interconnected among themselves as well as to other telecommunications systems (e.g. broadcast station, microwave stations and satellites). Moreover, interface standards also influence the compatibility of the subscriber's terminal equipment. Television receivers, for example, have been designed to accommodate the frequency allocation plan for television broadcast stations in the United States. Many have argued that without a cable channel plan, a cable-compatible television receiver will not be forthcoming, nor would systems be able to interconnect to transport programs interstate.

The Commission's limited version of a cable channeling plan is specified in Sections 76.605(a) (1), (2) and (3). This section, which is only applicable to cable channels carrying television broadcast stations, simply requires that the cable television channel delivered to subscriber terminals conform to the numerical designation of over-the-air television broadcast stations in the United States. This standard was incorporated to preclude cable subscribers from having to purchase a new television receiver in connecting to cable systems. Moreover, the Commission felt that a receiver purchased for compatibility with one cable system should also be compatible with any other cable system in the country in view of the transient nature of our society.

It should be noted that the Commission has no channeling plan for cablecast programs including cable origination, premium, audio, lease and two-way channels. Furthermore, the off-air television receiver is currently being used as the primary equipment at the subscriber's terminal for reception of programs distributed by cable systems, and these programs include cable origination, premium, audio, etc. It appears that good engineering practice, realistic business practices, and economic pressures are responsible for the industry approach to design and construction of cable systems which are compatible with off-air television receivers, and at the same time allow interconnection between cable systems as well as other telecommunication systems. There appears to be no need for Commission technical standards specifying cable frequency boundaries when the market place dictates that unless the cable system delivers cable program on frequencies compatible with the public television receiver there will be very few, if any, cable subscribers. In addition, it is noted that no complaints from the Cable Complaint Service related to our minimum interface standards or called for additional interface standards.

The author can find merit in the C-TAC argument that a cable channel plan ". . .is the keystone to industry expansion and mass consumer utilization." However, when the cable industry appears to be expanding without a federally adopted channel plan, the Commission's intrusion into this area seems unnecessary. C-TAC also indicates that a cable channel plan ". . .is a means of guaranteeing equipment interchangeability; . . .development of manufacturing economies resulting from large quantity production and a stable market." It is noted that the premium cable channels delivered over cable systems may fall in many different locations on the frequency band used by cable systems, and as a result, may require special premium equipment at the subscriber's terminal. However, this premium equipment appears to be readily available in large quantities. Furthermore, there are currently approximately 3,997 cable television systems in operation serving 9,895 separate communities in this country. Of these systems, review of most of the FCC 325 forms indicates that cable systems are utilizing basically the same channeling plan. This development appears to have taken place without the Commission's involvement. Therefore, it may be that interface standards, if and when needed, are resulting from economic pressures, and the development of good engineering practices through the work of the cable industry, professional trade, corporate and educational institution.

System Performance

These are standards incorporated in the cable television rules to ensure subscribers of a satisfactory television broadcast station signal over a cable system. These minimum standards were initially incorporated because of the number of cable subscriber complaints concerning poor quality signals from cable systems located primarily in rural areas. In the early days of cable television, systems serving areas which had three or less commercial, off-air, television stations could offer a less than satisfactory quality signal over the cable and still have a high subscriber penetration. The cable service sold in these areas primarily because the cable system either offered more than what was available locally or the quality was slightly better on at least one of the cable channels than what could be picked up off-air.

The presumption that has increasingly guided the Commission in the post-war era is that the competitive forces of the marketplace in the absence of market failure can more effectively promote the public interest than regulatory intervention. The application of this principle to the cable technical standards requires the identification of the underlying competitive forces which shape cable operators' decisions concerning the technical quality of their signal delivery into the home. For this purpose, the author relied upon the literature on the consumer demand for cable television service. That is, estimation of consumers' preferences for cable service signifies the marketplace forces that dictate cable operators' profit maximizing behavior. The results of the literature reviewed lead to the conclusion that where at least three primary network signals are available off-the-air with at least a Grade B reception, the marketplace offers sufficient incentive for cable operators to supply high quality signal reception. For example, the Hopkins Cable Project concludes that the number of households that will subscribe to cable television in urban areas is "very sensitive to any increment in network service quality provided by the cable."

That is, cable operators in areas with good off-air signal reception and at least three network signals, will lose a substantial number of subscribers, and resultantly, a large percentage of their revenues, if the quality of their signal delivery becomes unacceptable to the consumer. On the other hand, where over-the-air signal reception is poor or where there are less than three network signals available off-air in the community, it is unclear whether the marketplace provides sufficient incentives for cable operators to provide good siognal quality. For example, while Professors Noll and Peck and Dr. McGowan estimate that about 10% of the households offered service in areas with three or more off-air signals will subscribe to a cable system providing only improvements in the quality of the local signals, they estimate that about 60% or more of the households offered service in areas with less than three off-air network signals will subscribe to a cable system offering the local signals plus the importation of affiliated stations to provide three-network service. In other words, it appears that households have a much greater propensity to pay for the affiliated signals that are unavailable over-the-air in their area than for improvements in the technical quality of the local signals where three or more signals are available locally. As a result, it is unclear whether a reduction in signal quality delivery by a cable operator in an area with less than three off-air signals will markedly reduce consumers willingness to pay for cable service.

It now appears that, at least in television markets with three or more commercial television broadcast stations, marketplace pressures, good engineering practice, realistic business practices, and economic factors result in the quality of the cable signal being at least equal to the over-the-air signals in the market. Cable systems after all are engaged in the direct selling of their cable service to customers in these markets where they must compete with over-the-air services. Good quality service over the cable appears to be the foundation of a successful cable system which competes with over-the-air services. Therefore, where households can receive at least three affiliates over-the-air signals with at least Grade B reception, the marketplace provides sufficient incentive to offer a high quality signal to cable subscribers.

It is further noted that many systems located in television markets with at least three commercial television broadcast stations also offer a premium channel for an extra fee. It appears to be the practice of the industry to offer premium channels without any impairment in the signal or without any compromise in the quality of the signal. A cable system capable of offering a good quality premium signal is also capable of offering the same quality to a non-premium signal. [There could be a small cost involved with replacing some head-end equipment. However, it is commonly understood that the major expenses associated with constructing and replacing cable equipment are associated with the cable distribution plant, and no cable distribution plant equipment has to be replaced to up-grade non-premium cable channel service to the signal quality of a cable premium channel.] It appears to be common practice in the cable industry that when a system decides to offer a premium channel, the quality of the non-premium signal is first upgraded. Cable systems find it necessary in these three or more television station markets to offer a good premium signal primarily for two reasons. First, subscribers will not subscribe if they feel the quality is not at least within a certain range of the quality they get in theaters, and second, competition from other premium systems (e.g. Multipoint Distribution Service, MDS, and Broadcast Subscription Television, BSTV) may claim a potential cable premium subscriber if the quality of the cable premium signals is not at least equal. Since the same marketplace forces apply to the technical quality of broadcast signals on cable in markets with three or more signals as do to the quality of the premium channel, there appears to be no further need to maintain technical standards for non-premium signals. The author feels that the public, the cable system and the local government are in much better positions to determine the need for non-premium technical standards in their respective communities, especially since enforcement of technical standards can best be administered at the local level.

C-TAC even admits that system performance standards need not have "...regulatory enforcement but should be consistent with rules established by regulatory agencies." It appears that of the three categories of technical standards, system performance standards can best be achieved by voluntary controls through the exercise of good engineering practice, sound business judgment, and competitive pressures in television markets with at least three commercial television broadcast stations. Therefore, with the exception of the interference standards, and the limited interface standards, the remaining technical standards fall into the system performance category. In view of the above, the author is of the opinion that at least in markets with three or more commercial television stations the public, local government, cable system, and other market forces are better able to address system performance standards.

Three Television Station Markets

There are 139 television markets with at least three operating commercial television stations. There are 131 television markets with four or more assigned channels of which one commercial channel is unassigned in 90 of the 131 markets. In addition, there are presently pending approximately 233 applications for new stations, including competing applications for the same channel as well as non-commercial educational stations. All of the television markets with three operating commercial television stations are listed in the top 100 major television markets referenced in the cable television rules. The latest Nielson Television Index (NTI) report indicates that only 4% of the households in the country are capable of receiving between 1 and 3 television broadcast stations, and 96% of the American households receive at least four television stations. Moreover, the preliminary results of a study currently being conducted by the Department of Commerce's National Telecommunications and Information Administration ITS office entitled *TV Channel Map* (contract No. FCC-RA-0035-7) indicates 182,766,000 people are capable of receiving three or more television broadcast Grade B signals, and a total of 4,909,000 persons can receive no Grade B signals.

Television viewing households are heavily concentrated in a small number of major urban areas. According to the *Syndicated Exclusivity and Signal Carriage Notice of Proposed Rulemaking in Dockets 20988 and 21284*, 33 percent of the 73.9 million television homes are in the ten largest television


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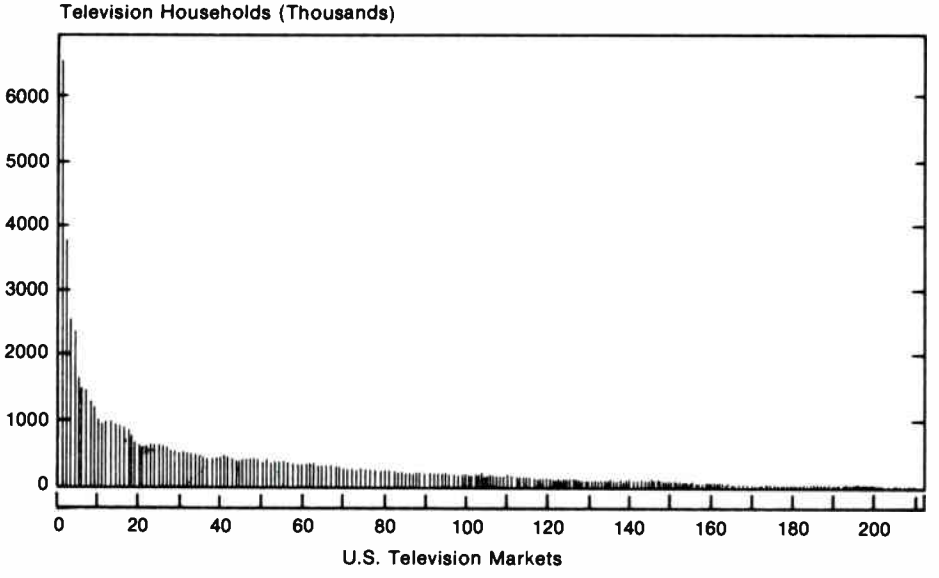
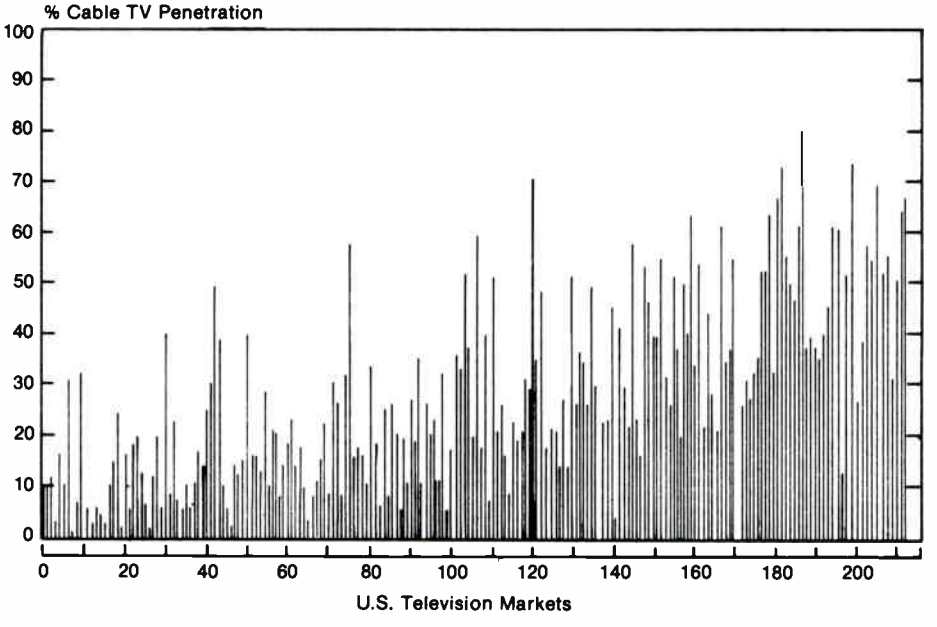
markets, 86 percent fall within the 100 largest markets. The three largest markets (New York, Los Angeles, and Chicago) contain roughly the same number of television households as the 123 smallest markets. This distribution of television households is reflected in the following graph:



There appears to be general agreement among most telecommunication experts that cable systems located in communities with at least three commercial television broadcast stations must compete with the quality of the local television station's signal and programs in securing cable subscribers. Therefore, as indicated above, cable systems attempt to offer a better quality signal and more diversity on cable systems than what is normally available off-the-air. Documented studies and experience over the years have demonstrated that this concept is especially true in markets where there are at least three commercial over-the-air television stations. However, the balanced scale (of a market with at least three commercial television stations, and a cable system) could shift in favor of the cable system where there are less than three commercial television stations present. At this time, there is no current data available to allow a different opinion. However, this concept becomes progressively more favorable to cable systems located in markets with the least number of commercial television affiliated stations, and more favorable to television broadcast stations with many over-the-air stations available including the three major network affiliated stations. In markets where there are no local television Grade B signals available, the author found cable penetration, on an average, to be closer to maximum penetration. Television markets with at least three commercial or network-affiliated television broadcast signals



appear to be at the cut-off point where competition between these two services are approximately equal.

There are anomalies to this concept, for example, in communities such as New York City. Since cable television growth is greatly influenced by the availability of satisfactory off-air television, cable growth patterns have been uneven, and, according to an FCC report, "the progression of development has been the opposite of the growth of television broadcasting. Broadcasting began with the largest markets and greatest population concentration; cable began with the more isolated markets that had no broadcast service. Where local television service is the most difficult to obtain by ordinary home reception means [as in New York City] but can easily be made available by a cable television system, cable growth has been the most rapid. As a result, cable penetration varies from as little as 2 percent in a market such as Baltimore, to as much as 79 percent in the Palm Springs, California market." The graph below confirms the fact that cable penetration is higher in smaller markets or markets where over the air reception is unsatisfactory.

Therefore, in these non-optional, less than three television station markets, it appears reasonable at this time to maintain minimum system performance guidelines at the federal level. However, this may not be necessary in non-optional television communities where the local government has established standards, and/or where a functional government or government-sanctioned cable office exists. It is assumed that where local technical standards and/or a cable office are present, procedures are available at the local level to resolve service complaints.

However, further deregulation may also be warranted in less than three commercial television station markets. If the local franchise body has chosen not to establish technical standards for reasons of their own, then the Com-

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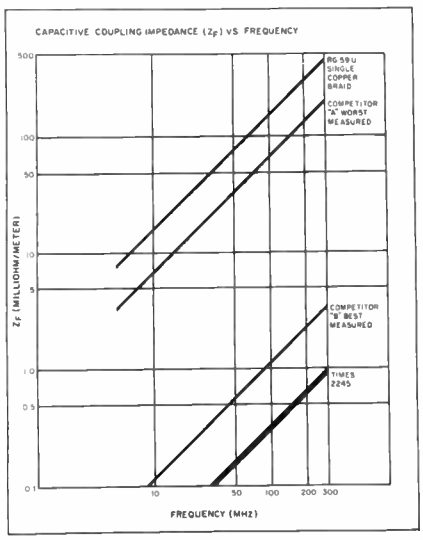

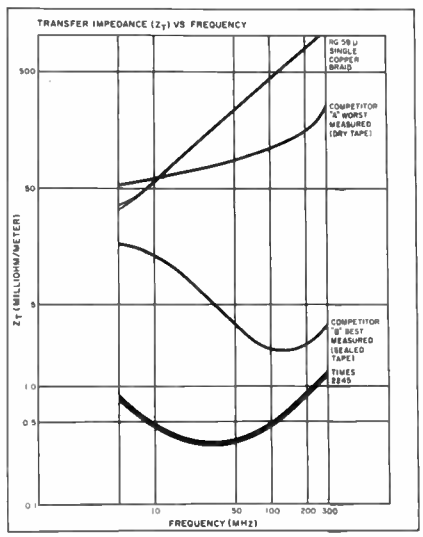

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Special Feature

Luff On Test Equipment

An exclusive interview with Bob Luff, vice president of engineering for U-A Columbia, on the subject of test equipment in cable.

C-ED: Bob, shifting as you are from the NCTA, as vice president of engineering, into an operations position, what is the difference in perspective between that operations environment and the NCTA, within the context of the NCTA's role in establishing testing standards and encouraging the development of test equipment for the cable industry?

Luff: Well, I guess my response to that is that, at the NCTA, we were looking at the entire cable industry from the smallest cable system to some of the large metropolitan systems—the multiple AML sites with perhaps a couple of hundred subscribers on the end. In the Washington structure we were trying to establish and define everyone's concern regarding the amount of government regulations, the complexities and the cost of it all, and the necessity of it. It seems that, no matter how careful you are today, government regulations eventually end up restricting innovation and development two, three, four, or even five years down the road, whenever technology tries to make a major step forward. At any rate, the primary emphasis in the Washington environment and the NCTA environment frankly was looking at the government regulations and keeping those minimum standards of performance as reasonable as possible, applied evenly across the whole industry, and fully anticipating that, at the local cable system levels—and the position that I now find myself in—everyone will take those standards as absolute minimum performance standards of the systems and exceed them as much as practically possible from the operational standpoint. Now that I'm on this side of the fence—the operations side—it's really a matter of looking at the quality of signal that we give to subscribers, the training we give our people, and the test equipment and performance evaluation of the system itself. All these factors are quality controls which we use to keep the signal level up there as high as we possibly can, in accordance with our own internal standards—which by the way are getting higher all the time with better technology.

C-ED: How do you see the relationship between the SCTE and the NCTA?

Luff: Well, they both have a very important role. The NCTA, as I just mentioned, is the primary motivator of industry standards at the federal level; some relating to good engineering practices, some that are just developed for the industry in general. I think the NCTA will perhaps always be the focal point of discussion and setting of industry-wide standards. The SCTE, on the other hand, has made a very significant contribution in the application of those standards. Training seminars all over the country have been sponsored by the SCTE on almost every facet of cable television, from construction to earth stations, microwave, and one upcoming unit on two-way applications. So both organizations make a very, very important contribution.

C-ED: Do you ever work with technicians in your present capacity?

Luff: Yes.

C-ED: What is their level of training—is it satisfactory to you?

Luff: I don't think anybody is terribly comfortable with the overall status of training. It's not just cable television, it's almost any field where technology is growing very rapidly. There's got to be a major full-time effort concentrating on upgrading in-house capabilities. That's a very high priority in my mind, particularly now as we are moving into these higher levels. We have major AML distribution sites, 35 channel systems, two-way, and so forth. The training aspect of the technician is very important. After all, he not only installs the equipment to begin with, but keeps it functioning, and anticipates trouble so that the system is not down during the prime time.

C-ED: What about the test equipment manufacturers? Are they doing enough to train and educate the technicians?

Luff: Well, they vary, of course. What each of the companies actually does and the contribution they make in this area varies according to the manufacturer. Some, in my opinion, are very good and some are so-so. I think as a competitive edge for their products, all of them are going to respond to what's happening this year and in the next five years by conducting more seminars, and publishing better operational manuals for the technicians in their industry. It's no longer enough to simply manufacture a very high quality piece of test equipment and put it on the CATV system, and that's the end of the business transaction—particularly under present circumstances. With expanded bandwidth, measurements are becoming more important than they once were; manufacturers must go back to their old customers and update operating procedures on their old equipment—address the calibration aspects of the equipment, or whatever else might be necessary to insure that that equipment is being used to the maximum extent possible for the new problems that the systems are encountering.

C-ED: Specifically in the area of test equipment, how do you see the configuration of what technicians are using today changing over the next few years, especially if we get into a broader band operation, and so forth?

Luff: I think there are three factors here that I'd like to talk about that are catalysts of change. First, there is higher bandwidth, whether it's from 12 channels to 20 channels, from 20 channels to 35 channels, or beyond 35. Secondly, we're seeing cable move into larger and larger metropolitan areas, with more and more subscribers dependent upon a single headend, or single trunk amplifier or microwave link. And thirdly, we're seeing two-way return links becoming more and more of an issue not only at the franchise time, but even in developed systems. These three factors are having a major impact on the type of test equipment a system must have and the type of personnel that it must employ to utilize that test equipment, and perform the necessary operational procedures to obtain the management-type information that one needs to constantly monitor the system and anticipate the problems before they occur and shut down a system of that magnitude. So it's a three-barrel situation. Number one, the cable management itself must be cognizant of the newer requirements that are imposed by broader bandwidths and two-way technology. In addition, the fact that there are more subscribers tied on means that reliability becomes more and more of an issue. Management must see this and make a commitment to budget time and money for the right amount of equipment and the right kind of equipment. Hopefully, there's a lot of engineering input from their chief engineers, chief techs, and even installers. Last but not least, test equipment is very, very expensive, and it's going to continue to be more expensive as the requirements placed upon the factors that I mentioned continue to expand. That will make the equipment even more expensive. Now, we anticipate a piece of equipment will remain functional in some capacity in our systems for ten years or more. So it's a big decision. When you buy something, it's not just for a year or two, and then you phase it out. This purchase has to be able to withstand the test of time and durability and everything else. So if all of this occurs you have a very substantial investment in capital; now you have to go back and look at the personnel who are going to implement the use of the equipment. At that point it comes down to a question of what does management need in terms of information; what kinds of new practices or procedures do you need to initiate in order to a) insure you're getting maximum return on the equipment you bought and b) to assure that you are putting out the best possible group of signals for your subscribers. Once the necessary tests are within the grasp of technology, then it comes back again to the management role: what kinds of figures and tests do we need to make and how often, and what do we do with them by way of recording them in a log or some other format so that we can *see* a slow decline in performance, and then address it before it becomes catastrophic. The technician may agree with that type of requirement, but may not have received the right kind of training on that piece of equipment—the new piece of equipment. He may even be utilizing an older piece of equipment in a different role than he's familiar with. So in addition to a sizable investment in the hardware equipment itself, there will also be a significant investment in training of personnel. The upshot of all this is that there must be a stepped-up level of training, supported by the manufacturer who sells the equipment and services it in-house. There must be training programs set up in-house, and by cooperative efforts of the SCTE and the NCTA, and perhaps other organizations that are involved in broadband technology.

C-ED: That leads to another question, related to the 400 MHz equipment now being proposed in major markets within the franchising process. First of all, has this equipment been tested satisfactorily and secondly, is there test equipment available today to work on this equipment once it's installed?

Luff: Well, there is a trade off in 400 MHz. It is obvious that it is technically possible to have a 400 MHz broadband distribution system. However, it doesn't come without a cost—both a monetary cost for the higher level of specification, and also a cost in the way of reliability. It's just a statement of pure mathematics that on an average, each individual subscriber will be served through a higher number of amplifiers and active devices whether through microwave and AML and a number of trunks, or just directly through trunks. For this reason, reliability is much more of an important consideration than it previously was. There is also cost in serving a complete area; it's a little bit harder to fill in the cracks and crevices of a whole metropolitan area franchise. Or if you've gone for the whole county, there are just some corners of the county that are very

difficult to reach in a 400 MHz system, without dropping in wild card AML sites or microwave to serve a relatively small pocket of population that is no less deserving of the same type of signal service as the rest of the franchise area, but will by necessity raise the overall cost of the whole area in order to serve those in the awkward section.

In conclusion, it can be done, but there are tradeoffs which the franchising authority, the subscriber himself, and the operating company must address. Specifically on test equipment, there are a lot of areas in which test equipment will have to be changed if 400 MHz is the wave of the future. The most notable problem is that the signal level meters do not go to 400 MHz at the present time. Some manufacturers—all of them in fact—can upgrade old models, or put new models out. And some can do this easier than others. Some meters have plug-in modules and it will be a matter of redesigning the module. Others that are not plug-in modules, the whole equipment is a single integrated piece which will have to have a minor redesign and then be reissued as a 400 MHz apparatus. But I'm not into test equipment manufacturing and I don't mean to anticipate what problems they may or may not have or what looks to be like a simple redesign of a module. It just may be physically impossible to put everything that needs to be changed into a certain geographical space of that module. And the manufacturers may even have to completely redesign the front side. It generally takes—I'm told—about a year from the inception of a proposed change to the point in time where it's actually out on the market and advertised. Exactly where we are in that year's time phase, I honestly can't say. It all depends on how soon a particular manufacturer zeroes in on the fact that some of the industry, at least, may be expanding to 400 MHz. They may have started the process earlier than one of their competitors. But there are some other important influences—like the national convention which is an opening time of the new model year. If that equipment is primed and ready to go for exhibition at the national convention, that will speed up the process. If the manufacturers just miss the national convention it would seem to slow down the industry's preception of the equipment and the ability to see it and touch it, play with it, and as a result, the ordering would probably be a little slower. Our company, in addition to those inputs, rarely buys a piece of equipment without a first-hand engineering evaluation here at our laboratories in San Angelo, Texas. And we generally require one or two samples and put them through their maneuvers on the test bench and take them out in the system and put them through their maneuvers out there. That's a further extension of this inauguration of new equipment, test equipment into the market.

As for spectrum analyzers, it all depends. Some just by previous design inherently cover up to 500 MHz so there would be very little impact on a number of these spectrum analyzer models that are out in the industry. Some spectrum analyzers stop at 350, some stop at 300 MHz, and again those would require some kind of modification or extension of capability to meet new requirements. Again it's subject to different manufacturers and how they've approached the same problem. Distortion measurement apparatus would seem to cause a snag. There aren't too many on the market today above 300 MHz and I am sure the test equipment industry is looking at that very seriously.

C-ED: With all these new developments, and the considerable number of dollars the manufacturers have to put into something like that, do you anticipate the arrival of some of the larger test equipment people into the cable industry—maybe Hewlett/Packard and Tektronix, for example, which would not have been as active as some of the smaller manufacturers?

Luff: That's difficult to answer. I would guess that from my vantage point, there seems to have been an insurgence of those other companies previously outside the cable industry making significant inroads into our industry, selling us more sophisticated test equipment. And anything that happens, whether it be 400 MHz, or two-way, or AML, whatever it may be, would certainly give other manufacturers of equipment additional opportunity in the industry. Also, as no one will deny, those companies perceived as being traditionally CATV manufacturers of test equipment started many years ago and have provided an extremely valuable service in the past. No doubt they will continue to do so in the future. It's just that right now, we're seeing some major cable franchises being constructed in major metropolitan areas and the economics are entirely different. In that kind of situation where there are several hundred thousand subscribers, all being fed from one or maybe two major CATV headend sites, the type of equipment in service, and the budget for test equipment to the sites is not as restrictive as it was back in our more traditional days of development. So there is more flexibility for buying spectrum analyzers from outside the industry that have a lot of features and can economize on personnel, are very easy to calibrate, and not as likely to be misread.

C-ED: From your perspective, does it seem to you that operators are utilizing test equipment to its fullest potential, or is there room for improvement?

Luff: I don't know how strong to make my response, but it's extremely clear that we can better utilize the equipment that is already sitting on our shelves. And that is simply a two-fold problem, one of management themselves not fully understanding the versatility of the many pieces of equipment which they have purchased for their technical staff. Often management doesn't realize that with perhaps a very minor investment in training, either through an SCTE seminar or through more formalized training, or just requesting the manufacturer to come and analyze how his staff is using the equipment, they can use the equipment more efficiently or in broader roles both on the management side and on the technical side. I've got to say that too often pieces of test equipment, in particular the more expensive pieces of equipment, are looked at as much as trophies of position as they are utilitarian devices. And when a problem just begs for application of very expensive spectrum analyzers, some of the personnel observed seem to be intimidated by the idea of using that device. So they use something else which they are more comfortable with through past experience, or other systems, or the type of training they received previously, and leave the device that was specifically bought for that application on the shelf. Yet, at the same time, these technicians would fight until the cows came home if someone suggested turning the piece of equipment in, or shipping it to another system. I think what we are going to see is more usage of test


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equipment through external factors such as those I have mentioned; more and more subscribers being tied to a cable system headend, and this very important parameter of reliability. I think that from the engineering standpoint, management standpoint, marketing standpoint, franchise authority standpoint, the cable industry is in a posture already of better anticipating problems and working at minimizing the more traditional reaction to problems. We are seeing just routine measurements on a daily, weekly, or monthly basis recording various signal levels, noise measurements and other type parameters so written and kept in a CATV headend log. Analysis is being done where you can see signs of a certain channel beginning to fall off or noise beginning to build up in a certain area. You know there is a problem and you have plenty of time to respond to that issue choosing your own convenient time, therefore minimizing repair cost and the chance of the system going down during prime viewing hours. The company then has a better overall image in the community which makes life easier for everyone. And because we are going to be using the equipment more routinely for perhaps even some very sophisticated measurements, I see now the return on the investment of this testing equipment is really beginning to pay off. It's a shame that the industry has been in a phase—for a number of reasons, high construction commitments and rapid growth—so we haven't had the luxury of being able to sit down on a routine basis and constantly observe some of the more formal aspects of reliability. Now we are able to, and we're going to get our money back on the equipment. And the subscriber in the long run is going to be much better off.

C-ED: Bob, do you foresee a time when a given cable system will be automatically tested or sampled at every point along its line, and all that data processed by a computer? In other words, will there be a constant testing built into the system, with redundancy also built in so that there doesn't have to be a technician in the field taking measurements?

Luff: There's no question that there is going to be a constant growth of procedures when it comes to quality control. We may or may not simply install very expensive boxes at the ends of cable runs all over the community, sending back digital information or some kind of information confirming that all is well right up front. We may go through a transitional phase of first running tests manually with the equipment and procedures and the confidence factor that we already have. As we begin to see the pay off for that effort—less system down time, higher signal quality, more subscriber satisfaction,. more confidence in our equipment and operating procedures—the test equipment manufacturers may then analyze that and be able to better design an automated device that will take some or all of those test parameters and design it around an automated format that can compete cost effectively by doing it with personnel. I don't foresee the day when we will never have personnel with test equipment randomly sampling CATV systems and doing their thing. It's not enough to just sample it and get a reading that it's not working properly; sooner or later a human hand is going to open up a box or go to some piece of equipment to determine what's wrong and replace it. A machine is not going to do that for us.

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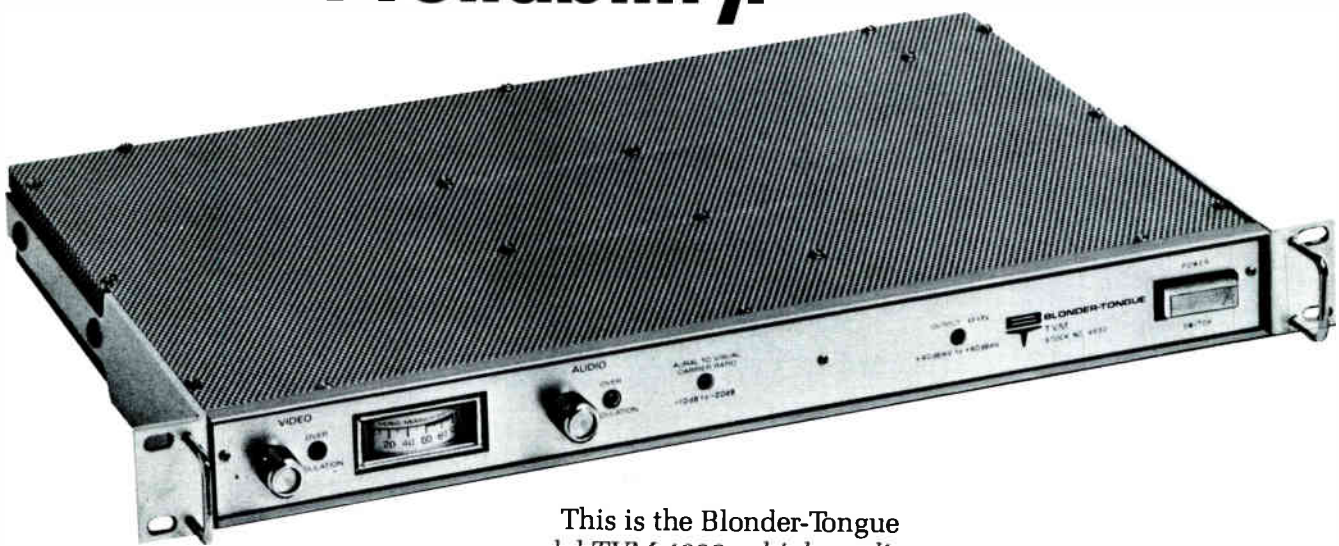

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TVRO Redundancy

By Milton L. Deever, President, Comtech Data Corporation

In any rapidly growing and changing environment some things that should be done are overlooked or get low priorities because of more pressing demands on resources—first things first. The cable TV industry, especially the satellite TVRO portion, certainly qualifies as "rapidly growing and changing." Probably the largest single change is the ability, largely via satellite, to provide premium pay programming to cable subscribers. It is the source of greatly increased revenue potential and has changed the image of cable television. But are we doing everything we should in response to the changes?

In the past, cable was perceived by customers as a means to an end. They couldn't get TV any other way, so they accepted whatever they could get. When the picture deteriorated or went away, they complained but generally shrugged it off after service was restored, even after hours of being down. Now with premium programming, where the customer is paying a lot more and with cable being put into urban areas where alternatives are available, the customer can reasonably expect more reliability of service. CATV is now comparing itself favorably with the broadcast networks and even feels it provides unique services. Concurrently the customer's standard of acceptable performance is rapidly rising to what he is accustomed to seeing from the networks. And what is that?

How often do you see an "outage" on a network program? And for how long? My perception is only qualitative, but if asked these questions my answer would be (a) not very often and (b) not for very long. I've talked to network people who say their standard is to be "on-line" 99.98 percent of the time. This means a station can only be down 1.75 hours per year. I'm led to believe that the networks consistently beat this requirement. I have also been told by network people that the satellite sun-outage-time alone is enough to deter them from becoming too heavily dependent on network transmission via satellite. Depending on the particular earth station design and location, sun-outage-time can exceed one hour per year. (Several minutes per day, primarily during the spring and fall). This leaves less than an hour for outages from all other causes to even come close to network standards.

Service Protection

So how do the networks, the telephone company and the other satellite common carriers that currently distribute the networks' signals operate with so few outages for such short durations? Reliable equipment is an obvious answer, although not good enough. They do it via redundancy. They have standby equipment ready to switch on-line automatically when the primary equipment fails. Let me give you an example of how big the impact of redundancy is. In this example let's assume an equipment has a MTBF (mean time between failure) of 20,000 hours and it takes four hours to repair when it fails. It would take about this amount of time to replace a LNA when you consider (a) the time to find out there is a failure, (b) time to get to the site and (c) replacement time. Without redundancy (called "unprotected" or "single-thread" operation), this equipment is out of service four hours in every 20,000, on average. This equates to 1.75 hours per year, equal to the network requirement mentioned above. By adding redundancy, the down-time for the redundant equipment drops to 0.75 seconds. Even if you allow two seconds for automatic fault detection and switching, the total down time is 2.72 seconds. Obviously, redundance is very effective. So why isn't there more redundancy in CATV earth stations? A few reasons I hear are:

1. The cable itself and the trunk amplifiers, splitters, etc., aren't redundant so CATV is inherently "single thread." Why make only part of the system "protected"?
2. Redundancy is very expensive.
3. The customers are accustomed to outages, and get aggravated, but don't cancel. Why pay to solve a problem that isn't hitting us in the pocketbook? Putting up with a little static from our customers is a way of life.

Let me answer each of these points.

1. The earth station equipment is considerably more complex than trunk line amplifiers, etc., and thus more prone to failure than line equipment, even assuming better quality parts and more conservative design in the earth station equipment. In addition, the earth station is "in-line" with all customers, while the other equipments tend to be distributed. A failure of a trunk amplifier may only disrupt service to part of the customer complex.

2. Redundancy is expensive, but not nearly as expensive as it was only two years ago. Then, when TVRO stations had only one receiver, redundancy meant more than doubling the price of the equipment (except for the antenna). The number of receivers per earth station has been increasing, and the average station probably has four receivers now. Thus adding a redundant receiver and an automatic video switch is now a much lower percentage. One receiver can back up several other receivers with appropriate switching. Additionally, the back up receiver can be used on-line to carry traffic even when there are no failed receivers. It then is really used-not just sitting idle in reserve. The cost impact of receiver redundancy is only that associated with the automatic switch—approximately 5 percent of the earth station cost.

Protecting the LNA is a tougher problem, but a more important one. If an LNA fails, all channels on the polarization received through that LNA fail. Although from a

device point of view the LNA should be highly reliable, it is sensitive and is exposed to a much harsher environment than are the receivers.

The reason LNA protection is a tougher problem is that each LNA has another LNA in reserve and requires an expensive waveguide switch. Thus, a protected dual polarized TVRO system requires four LNA's instead of two, plus two waveguide switches and control equipment. The cost impact here is about 20 percent to 25 percent of the station cost. The cost impact is less if you take into account that at least one of the reserve LNAs should have been purchased anyway as a spare. I say "should have been" because I'm continually amazed by the fact that so few cable operators buy adequate spares for on-site replacement. They apparently would rather be down for hours while waiting for a replacement to be flown in than pay in advance for spare.

3. Customer acceptance of loss of service was addressed in the introduction. As they pay more and become more dependent on this source of entertainment, their dissatisfaction with outages rises. Even so, the impact of this factor on penetration or on "churn" is difficult to measure, so the cost to the cable operator for providing poor service isn't too tangible. However, with intense competition for new franchise rights someone is going to promise the better service I'm describing or a sophisticated franchising agency will demand it. Under such circumstances the cable operator will get hit in the pocketbook if he doesn't respond. Then a domino effect could take place where existing franchise holders will be put under pressure to upgrade or lose the franchise if they don't meet some specific level of service. Thus, if the above comments have some validity, operators should be considering the addition of service protection to their system. I would like to describe our approach.

Video Receiver Protection

The Comtech RCV-450S automatic video switch is shown

Figure 1.

in figure 1. It provides automatic substitution of our RCV-450A receiver for one of up to six on-line receivers on either polarization, should they fail. If our RCV-450F (fixed tuned), or RCV-450A receivers are used as the on-line units they include fault detection of (a) out-of-range power supply voltage, (b) video signal presence, and (c) audio signal presence. These three functions are combined into a

summary fault output so that if any of the three fail, a signal is sent to the switch and the back up receiver replaces the failed unit. If the on-line receivers do not have this set of failure indicators, the switch can operate on the video sync output alone.

Each on-line receiver is assigned a priority. In the event that more than one receiver fails before repairs are made, the back-up receiver substitutes for the highest priority unit. The front panel has LED lamps showing failed receivers. manual and remote overrides are included. No external power for the switch is required since it receives its power from the back up RCV-450A receiver. The back up receiver, when not substituting for a failed unit, can carry traffic. However, this traffic is interrupted on failure of any of the other receivers and so must be the lowest priority signal.

LNA Protection

The Comtech RCV-450LS automatic switch is shown in figure 2. It operates in conjunction with the receivers and drives two waveguide switches (one for each polarization). If all receivers on one polarization indicate a failure, the LNA switch assumes a LNA failure. The waveguide switch is commanded to switch the antenna input into the back up LNA; power is shifted to the back up, and the back-up LNA output is switched on-line. See figure 3 for a block diagram of

Figure 2.

a representative system. No video switch is shown in order to simplify the diagram. Either LNA can be given the primary on-line assignment. Latching relays assure operation in the back up mode until the faulty LNA is repaired, and the switch is manually reset.

Mentioned earlier, the LNA is a sensitive device and operates in a tough environment Thus, by also putting replacement LNAs in this environment, there is a risk of failing the back-ups at the same time as the primary units (lightning, etc.). Care is taken to isolate the off-line unit from such effects. While in the off-line position, the waveguide switch presents a shorted waveguide to the input to the LNA. The power line is opened at the LNA and at the switch (located at the receivers). Also the output of the LNA is switched off. This leaves only temperature variation as an environmental problem-a relatively low risk.

Summary

The cable television industry is being judged by increasingly harsh standards of performance by customers and franchising agencies. Frequent and/or long "outages"

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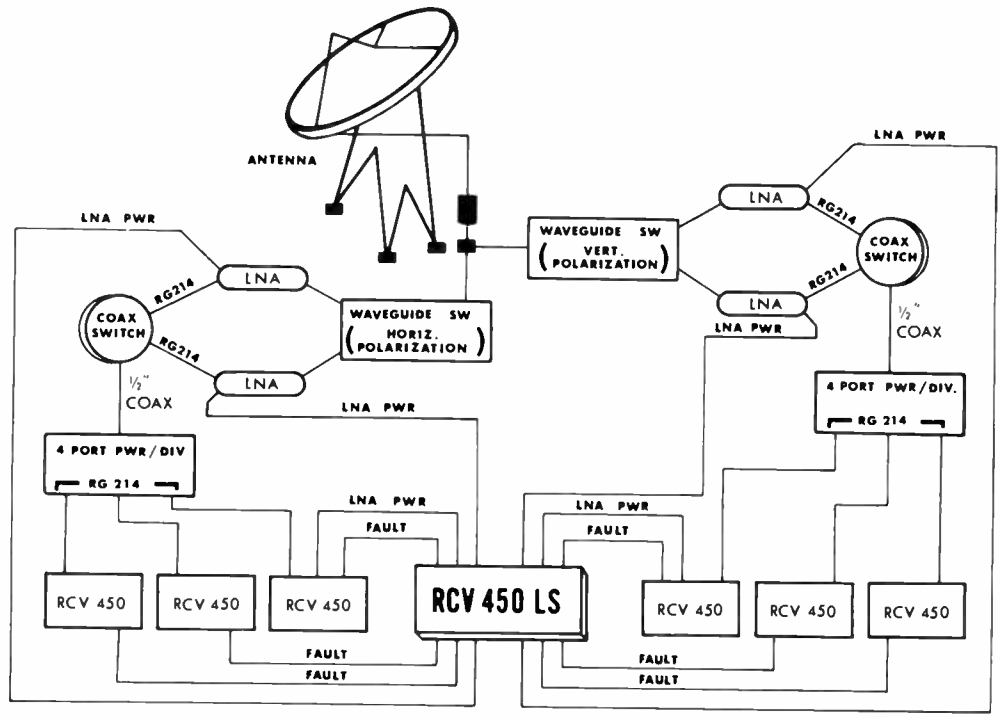
Figure 3.



are becoming far less tolerable as customers become more dependent on programming for which they are paying a highly visible premium. Incorporating redundancy in the TVRO station helps reduce outages dramatically. The cost is between 5 and 25 percent of the TVRO station cost, but is a much smaller percentage of the total plant investment, so should not be prohibitive. Premium revenue requires premium service which doesn't come free. C-ED

Cable Programming for March

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
C-SPAN (times approximate) Mondays 9:00 a.m. to 6:00 p.m. Tuesdays 10:30 a.m. to 6:00 p.m. Wednesdays 9:30 a.m. to 6:00 p.m.			195*/# Thursdays 9:30 a.m. to 6:00 p.m. Fridays 10:30 a.m. to 5:00 p.m.	F1, #9
CBN		24 hrs.	No	F1, #8
ESPN Monday thru Thursday 6:00 p.m. to 4:00 a.m. Friday, 6:30 p.m., to following Monday, 4:00 a.m.				F1, #7
Front Row		2:30 pm-2:30 am	481*/#	E,C F1, #12 P,M F1, #10
HBO	1	2:00 pm- 1:09 am	Program	F1, #24
	2	2:30 pm- 1:42 am	729*/#	F1, #22
	3	6:00 pm- 1:16 am	Scramble	F1, #23
	4	5:30 pm-12:46 am	835*/#	F1, #20
	5	5:00 pm- 1:20 am	Duplication	
	6	6:00 pm- 1:39 am	940*/#	
	7	6:00 pm- 1:45 am	Take-2 E.	
	8	2:30 pm- 1:31 am	592*/#	
	9	3:00 pm- 2:35 am	Take 2 W.	
	10	5:00 pm-12:47 am	681*/#	
	11	6:00 pm- 1:35 am		
	12	6:00 pm- 1:14 am		
	13	5:00 pm- 1:15 am		
	14	5:00 pm- 2:00 am		
	15	3:30 pm- 1:30 am		
	16	3:30 pm- 1:40 am		
	17	6:00 pm- 2:17 am		
	18	6:00 pm- 2:02 am		
	19	5:30 pm- 2:40 am		
	20	5:30 pm- 1:45 am		
	21	6:30 pm- 1:57 am		
	22	3:00 pm- 2:12 am		
	23	3:00 pm- 1:23 am		
	24	5:30 pm- 2:25 am		
	25	5:30 pm- 2:46 am		
	26	6:00 pm- 1:08 am		
	27	5:00 pm- 2:12 am		
	28	5:30 pm- 2:00 am		
	29	2:00 pm- 1:30 am		
	30	2:00 pm- 1:07 am		
	31	5:30 pm- 1:56 am		
HTN		8 pm-10 (11) pm	517*/#	F1, #21
KPIX (time permitting)		2-4 hrs. per day	No	F1, #1
KTVU		7 am-1 am (weekdays) 7 am-4 am (weekends)	No	F1, #1
MSG Sports Start times only; stop times are subject to length of events			438*/#†	F1, #9
	1	9:00 pm	17 7:00 pm	
	2	3:30 pm	18	
	3	9:00 pm	19 8:00 pm	
	4	8:00 pm	20 7:50 pm	
	5	7:30 pm	21 8:00 pm	
	6	7:50 pm	22 12:00 pm	
	7	8:00 pm	23 8:30 pm	
	8	7:00 pm	24 8:00 pm	
	9	1:00 pm	25 7:30 pm	
	10	8:00 pm	26 8:30 pm	
	11		27 7:50 pm	
	12	7:30 pm	28 8:30 pm	
	13	7:50 pm	29 7:30 pm	
	14	8:00 pm	30	
	15	7:30 pm	31 8:30 pm	
	16	7:30 pm		

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
Modern Talking Pictures		12 pm-5 pm (weekdays) 7 am-12 pm (weekends)	048*/#	F1, #22
Newstime		24 hrs.	276*/#	F1, #6
Nickelodeon		10 am-11 pm (weekdays) 9 am-11 pm (weekends)	749*/#	F1, #11
PTL		24 hrs.	No	F1, #2
Reuters 4:00 a.m. to 7:00 p.m. Monday thru Friday			No	F1, #18
SPN 10 pm-8 pm (Mon.-Sat.) 24 hrs. (Sun.)		429*/# auto switch to commercial, on/off respectively 517# end SPN, begin HTN 517* end HTN, begin SPN		F1, #21
Showtime	1	3:15 pm- 2:43 am	576*/#††	E, C, F1, #12;
	2	3:00 pm- 2:05 am		P, M, F1,
	3	6:00 pm-12:43 am		
	4	6:30 pm- 1:39 am		
	5	5:15 pm- 1:25 am		
	6	6:00 pm- 1:00 am		
	7	5:30 pm- 1:43 am		
	8	3:15 pm- 2:30 am		
	9	3:30 pm-12:43 am		
	10	6:30 pm-12:49 am		
	11	6:00 pm- 1:13 am		
	12	5:45 pm- 1:38 am		
	13	6:00 pm- 1:30 am		
	14	6:00 pm- 1:00 am		
	15	3:15 pm- 2:38 am		
	16	3:30 pm-12:48 am		
	17	6:30 pm- 1:08 am		
	18	6:00 pm- 1:38 am		
	19	5:15 pm-12:00 am		
	20	6:00 pm- 1:36 am		
	21	6:30 pm- 2:49 am		
	22	3:15 pm- 2:18 am		
	23	3:30 pm-12:00 am		
	24	6:30 pm-12:43 am		
	25	6:30 pm- 1:42 am		
	26	5:15 pm-12:40 am		
	27	6:00 pm- 1:19 am		
	28	5:30 pm- 1:43 am		
	29	3:15 pm- 2:40 am		
	30	2:30 pm-12:59 am		
	31	6:00 pm-12:31 am		
SIN		2:30 pm-1 am (weekdays) 4 pm-12 am (Sat.) 11 am-11:15 pm (Sun.)	No	Westar II, #7
Star Channel		9:30 am-2:20 am	311*/#E. 519*/#W.	F1, #5
Trinity (KTBN)		24 hrs.	No	F1, #14
WGN		5:42 am-3 (3:30) am (Mon.-Thurs.) 24 hrs. Sat. & Sun. Ends 3 am on Sun.	No	F1, #3
WOR		6:30 am-1:30 am		F1, #17
WTBS		24 hrs.	No	F1, #6

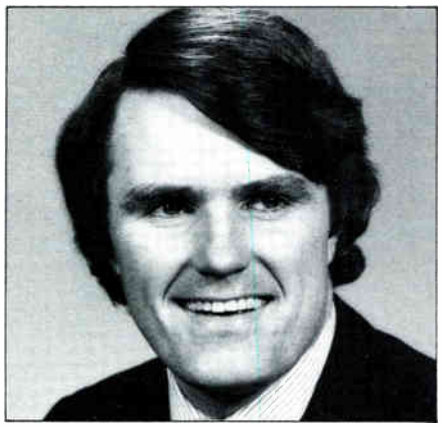
E = eastern
C = central
M = mountain
P = pacific

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

† Commercial substitution 601*/#; Thurs. baseball 706*/#.
†† On-line 679*/#; off-line 753*/#; access 843*/#.

★ **Anixter-Pruzan** has announced the appointment of **Matt Plonsky** as regional vice president. In his new capacity, he will assume sales and operational responsibility for the three Anixter-Pruzan Warehouse Districts in Chicago, St. Louis and Dallas.

Matt joined Anixter six years ago and since that time has worked a number of executive assingments in sales operations, purchasing and marketing.



John Egan

★ **John Egan** has been named executive vice president of **Anixter-Pruzan**, a division of Anixter Bros., Inc., it was announced by Bruce Van Wagner, vice president of operations. Egan replaces Bob Behringer who resigned to pursue other business interests.

Egan, who will direct the day to day operations of Anixter's Pruzan division in the CATV, telephone and power markets, assumed his new position last month.

For the past six years Egan has been Eastern sales manager for CATV for Anixter-Pruzan. Last year he was named vice president of the Eastern region. He will relocate to Anixter's Corporate headquarters in Skokie, Illinois.

★ **Daniel J. Altiere** has joined **Blonder-Tongue Laboratories, Inc.**, Old Bridge, New Jersey as vice president/human resources, it was announced by Ben H. Tongue, president. In his newly created position, Mr. Altiere has responsibility for all activities pertaining to employee relations and employee development programs for the company.

Mr. Altiere was formerly manager/corporate administration at Bobst Champlain, Inc., Roseland, New Jersey, and also held personnel management positions at Burroughs Corporation and Western Electric Company.

A graduate of Bethany College, Bethany, West Virginia, Mr. Altiere resides in Warren with his wife and their three children.

Daniel J. Altiere

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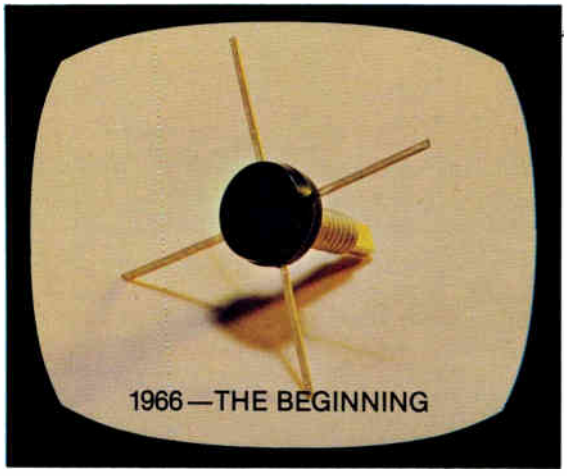

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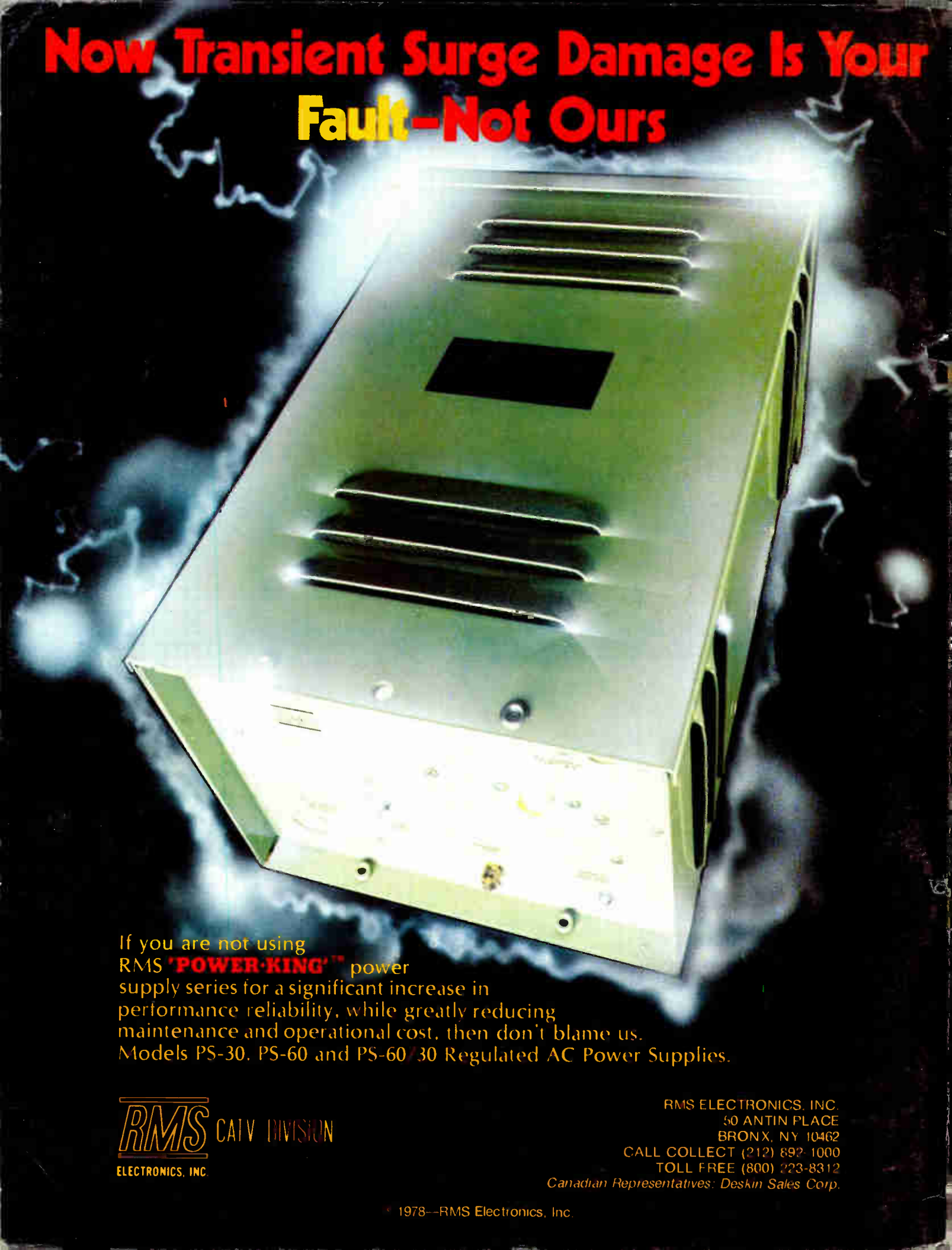

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