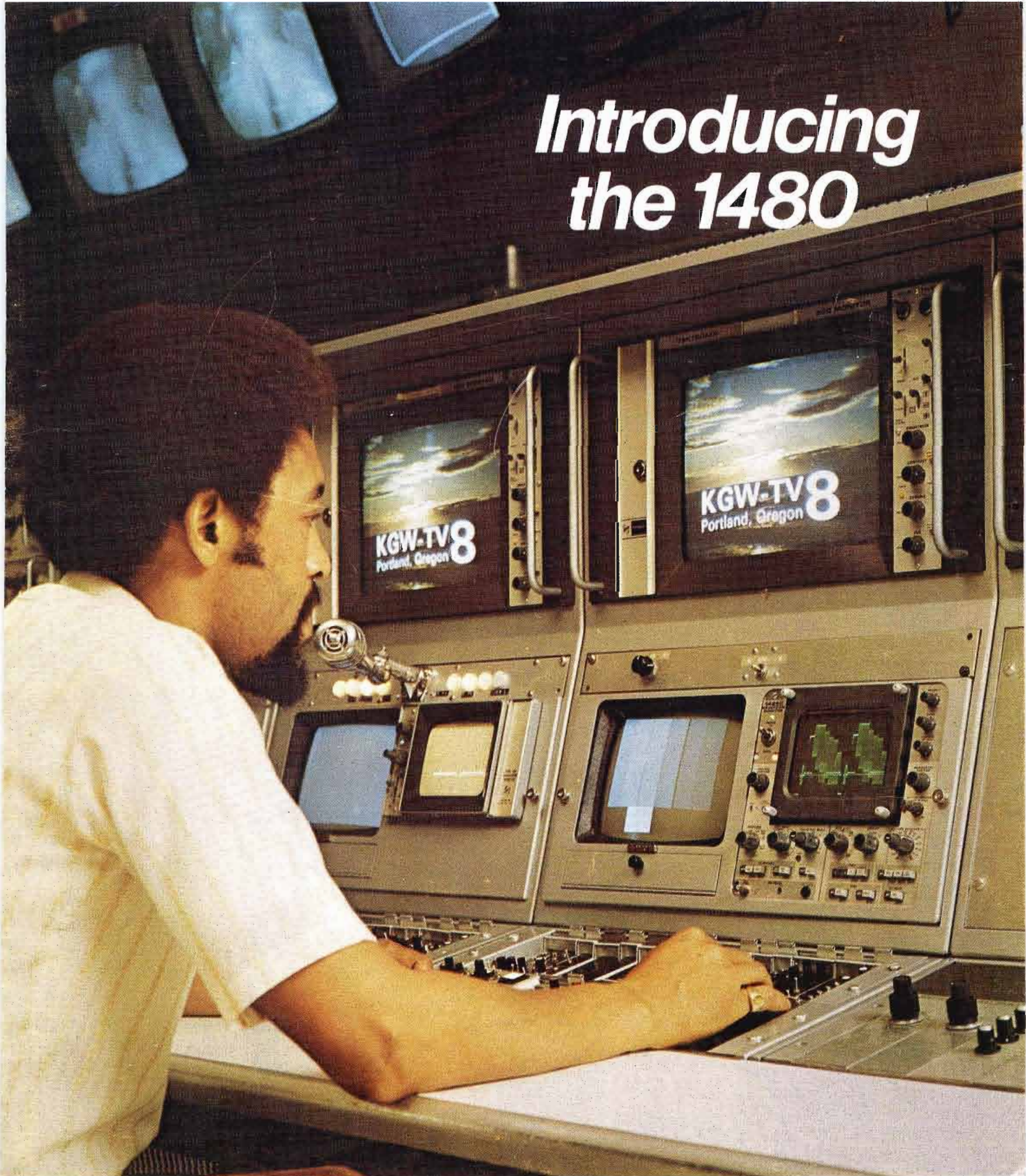


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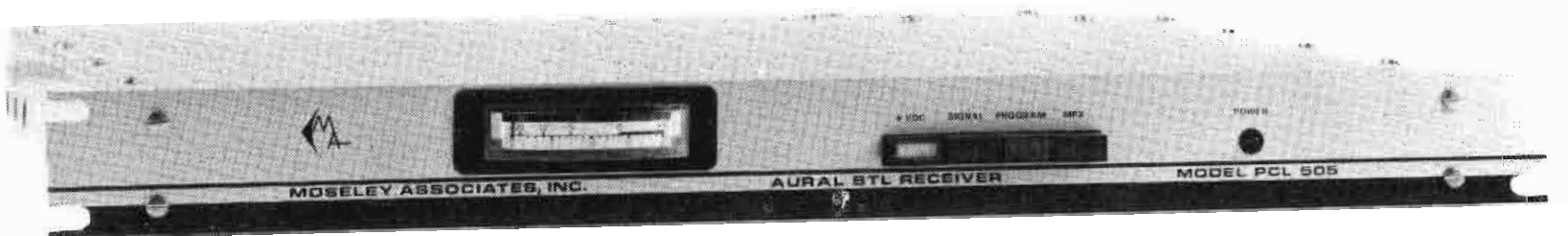
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BROADCAST engineering®

The technical journal of the broadcast-communications industry

in this issue...

17 Telephone Multiplex. Telephone multiplex techniques have been refined for a variety of applications by common carriers and microwave users. By using these developments, the broadcast engineer can better utilize his existing facilities, conserve spectrum and increase the station's return on investment. **J. Walter Johnson.**

24 Antenna Pattern Shaping. Special pattern shaping in the design of antennas make possible efficient coverage of difficult service areas. The antenna described in this article was designed to serve the Los Angeles basin from Mount Wilson.

36 The Audio Engineer As A Professional. The writer passes along professional approaches to recording sessions that help improve the image of the station and the engineer. **Todd Boettcher.**

42 Introducing The 1480. An innovative waveform monitor is introduced to the industry. It features greater CRT brightness, accurate internal standards, and functions that assist the engineer in waveform identification and comparison.

About the Cover

The picture shows a 1480 - described on page 42 of this issue - an all-new waveform monitor. Picture courtesy of TekTronix and station KWG-TV, Portland, Oregon.

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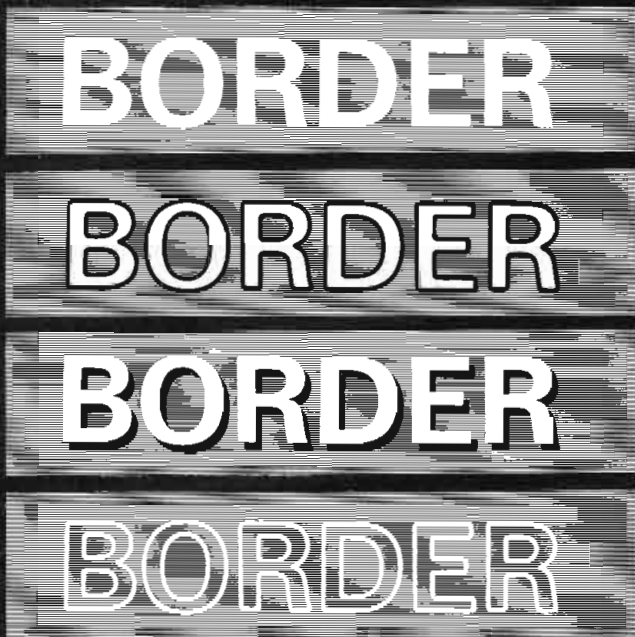
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BORDERLINE GENERATORS

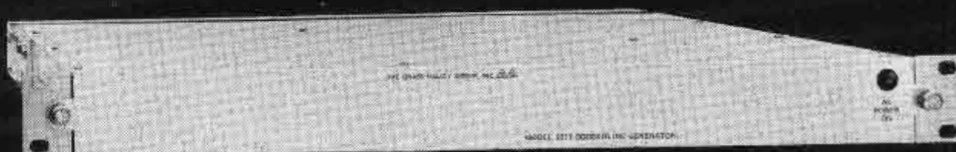


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DESCRIPTION

Grass Valley Group Borderline Generators are used to add borders to captions and titles from camera video signals or character generators. The added borders greatly enhance the insert visibility, and are particularly effective in situations requiring a white insert into a predominantly white scene.

Model 3271 is for use with GVG 1400 Series switching systems and 900 Series special effects equipment. The keying circuitry in the special effects amplifier is utilized for the inserting function, thereby enabling effects such as wipe key between bordered inserts.

Model 3272 is for use with special effects equipment of other manufacturers. It provides a widened key signal output which can be connected to the external key input of most special effects systems. The widened key output, together with a slightly delayed (H and V) title video signal, is used to achieve the border effect.

Model 3273 is a complete system which provides bordered inserts into a composite video signal, such as at the output of a switching system. The unit is entirely self-contained and requires no horizontal or vertical driving signals.

Borderline Generators are available for NTSC, PAL, PAL-M, and CCIR standards.

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DIRECT CURRENT FROM D. C.

October, 1974

by Howard T. Heads

OTP VHF TV Channel "Drop-In" Plan Still Under Study

The Commission continues to analyze the "plan" prepared by the White House Office of Telecommunications Policy (OTP) for the addition of approximately 65 new VHF TV channel assignments in the nation's top 100 markets (see 4/74 B.E.). All of the new assignments proposed by OTP would be at substandard spacings from existing stations, in many instances by very substantial distances.

A number of factors have complicated the Commission's attempts to study the OTP proposal. For one thing, OTP has continued to revise many of the technical details of the plan, including the criteria used in determining the availability of assignments, and in many instances changes have been made in the channels proposed to be assigned in the various markets. Also, OTP based many of its proposed assignments on specific transmitter sites and OTP has changed many of these sites in an attempt to establish the workability of specific proposals. In most cases, these transmitter sites are far removed from the cities involved and from other TV transmitters serving the market.

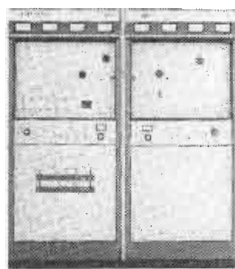
There have already been some requests by individual UHF licensees to implement specific proposals. The United Churches of Christ (UCC) has urged the Commission to adopt the plan as a whole, and has chided the Commission's staff for various aspects of its engineering analysis of the proposal. The plan has drawn fire from existing stations, both VHF and UHF, the former fearing widespread interference as a result of the substandard spacings, while UHF licensees contend that the plan undermines UHF TV broadcasting just at a time when UHF operations are beginning to enjoy reasonable success.

FCC Administrative Law Judge in Novel Decision

In a decision believed to be the first of its kind, an FCC Administrative Law Judge (previously called Hearing Examiner) has proposed to deny two competing applications for a new FM broadcast station in West Virginia. Although the proposed denials are based in part on non-engineering matters, the judge also concluded that the applications, each for a Class B station, proposed height and power well in excess of that required to reach the intended service area. Class B FM stations are required to operate with a minimum ERP of 5 kW with a maximum restriction of 50 kW. For effective antenna heights above 500 feet above average terrain, a power reduction below 50 kW is required. No

(Continued on page 6)

Can't see the forest for the trees?



If the few proverbial trees bearing certain names are hiding the many broadcast equipment possibilities from you, we urge you to step out and examine the whole forest. These days none of us can afford to buy by maker's name alone. The woods are full of brand names, old and new, and we again invite you to glance through a few published features of high powered FM transmitters bearing popular names . . .

Note the considerations that even a quick comparison can reveal. For instance the Sparta 25 kw FM transmitter, due to its modular construction in smaller cabinets, is easier to transport and install in any location, yet through thoughtful design it offers far superior accessibility. APC and VSWR protection may be available at extra cost on some models listed, but on our 625A they are standard.

Making equipment decisions today can be more difficult than ever, with such a thicket of names and claims to choose among. Only careful, detailed comparison should guide your choice, and surely our brief chart above gives reason for you to inquire further of all manufacturers. Evaluation of claims in depth will best serve your interests. And ours.

Start now by getting full, exact specifications on Sparta FM transmitters, AM transmitters, audio equipment and Spartamation systems and components. We want you to write or call us collect, today, for the Sparta equipment information you need.

Manufacturer & Model	GATES FM20H3	CCA FM25000D/DS	COLLINS 831G-1B	RCA BTF20E1	SPARTA 625A
Power Output	21.5Kw	27.5Kw	22.5Kw	20Kw	25Kw
Driver as Auxiliary Capability	No	Yes	No	No	Yes
Automatic Power Control	No	No	No	No	Yes
VSWR Protection	No	No	No	No	Yes
Size of Largest Cabinet	42" W 78" H 32 3/4" D	38" W 76" H 34" D	68-15/16" W 71 1/2" H 27 1/2" D	48 1/2" W 77" H 32 1/2" D	34" W 75" H 25 1/2" D

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minimum effective antenna height is specified.

In the West Virginia case, both applicants, after various amendments to their technical proposals, went into the hearing asking for the maximum coverage permitted by the Rules. The judge proposed to deny both applications, concluding that the proposals were in conflict with sections of the Communications Act dealing with the "equitable distribution of radio service" and requiring stations to "use the minimum amount of power necessary".

The final decision in this case must come from the Commission itself. If this doctrine is adopted, it will be contrary to many past Commission decisions where the Commission has encouraged applicants to make the maximum and most efficient use of their technical facilities.

Revisions to Part 74 Proposed

The Commission has proposed long-sought revisions to Part 74 of its Rules. This part deals with the various auxiliary services, such as remote pickup stations, STL's and the like.

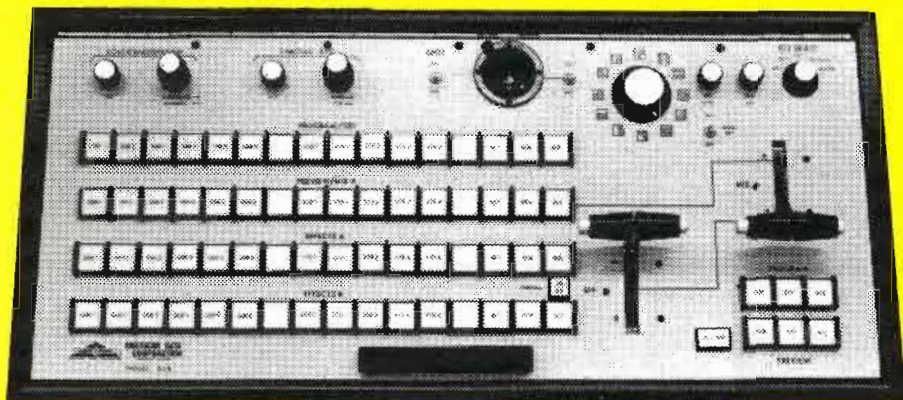
The proposed new Rules are modeled to a considerable extent along the lines of the Rules governing land mobile operation. Log-keeping would be minimized and operator requirements would be substantially relaxed. The Commission confirms its system of priorities on the use of remote pickup facilities with first priority to go to actual program distribution, followed by "order wire" services and miscellaneous communications in that order. We'll bring you more details in next month's column.

Short Circuits

The National Association of Broadcasters (NAB) is scheduling a series of fall engineering conferences in connection with a series of regional meetings. These meetings will be held in New York, Atlanta, Chicago, Dallas, Denver and Las Vegas during October and November, and will feature a wide variety of topics of interest to broadcast engineers...The Commission has emphasized the importance of providing principal city coverage (70 dBu) by an FM station by including a hearing issue on the subject in a recent case...The Commission has ruled that CATV systems may import late-night programming in any manner they choose so long as all stations required to be carried by the system are off the air...The NAB has asked the Commission to permit the operation of television transmitters on a fully automatic basis...The Cable Satellite Access Entity (CSAE) is continuing to study the use of space satellites for cable system programming and networking...The Federal Highway Administration (FHA), as part of a plan to erect roadside signs listing radio stations carrying weather information, has ruled that both AM and FM stations may be listed on the signs...The Commission has proposed to prohibit the manufacturer of power amplifiers which might be used illegally with 27 MHz CB transmitters; the Commission has authority under existing law..."Snowmobiling" was the latest topic of a Fairness Doctrine ruling involving a Schenectady, N.Y. TV station.

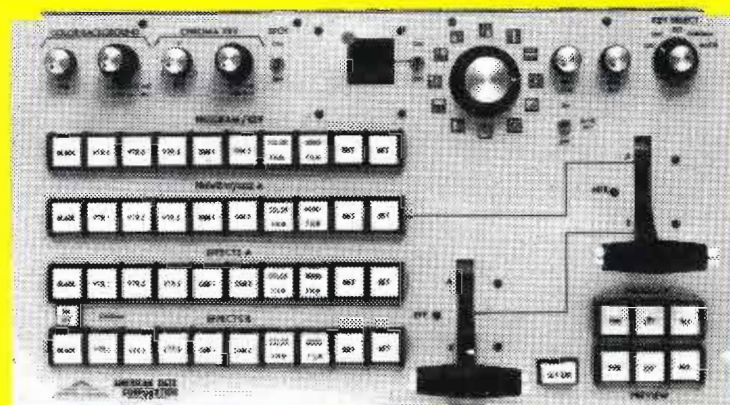
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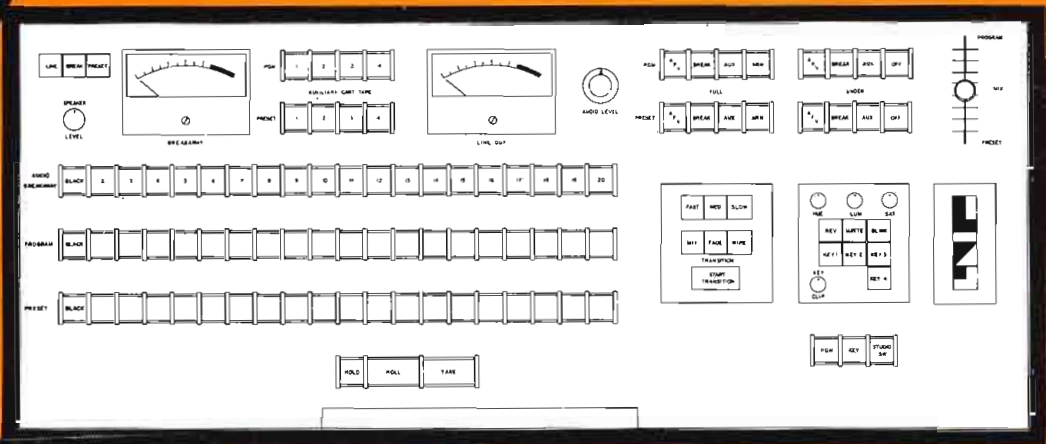
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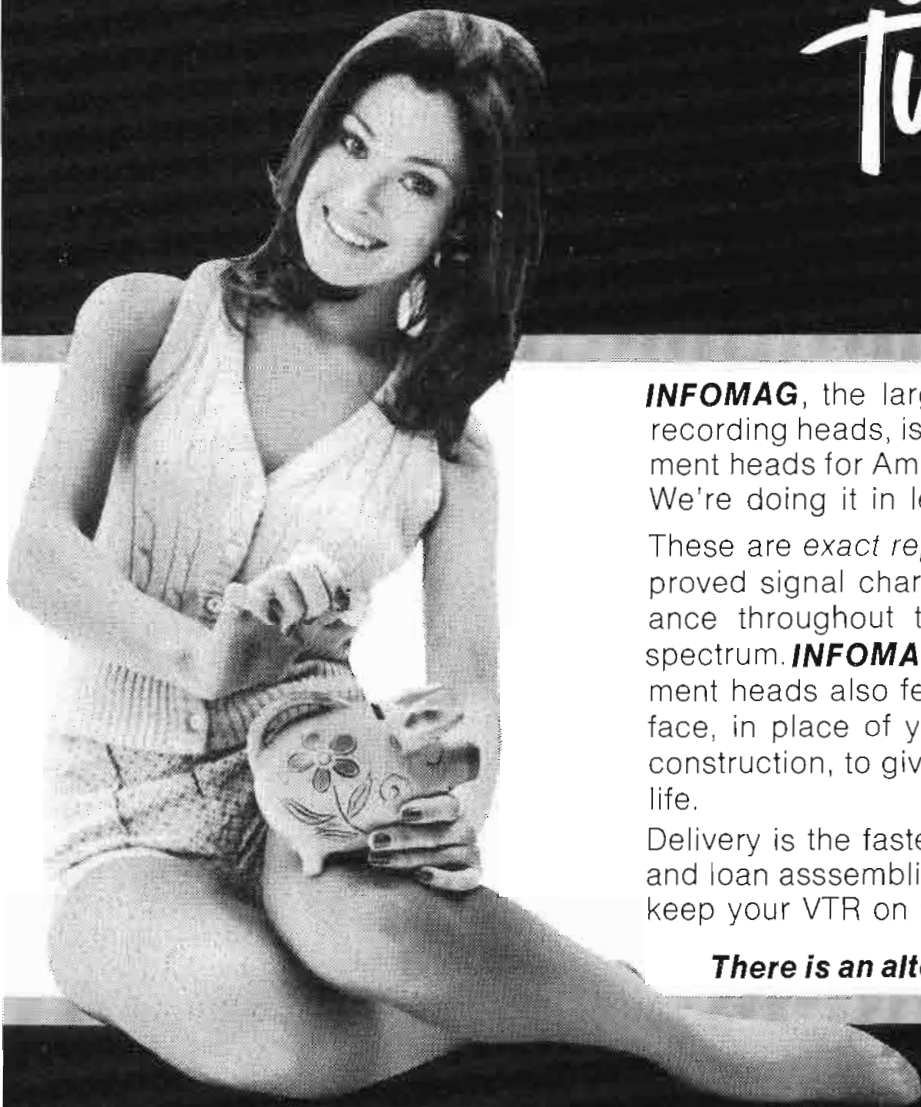


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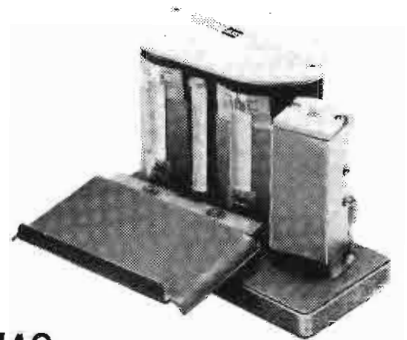
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SMPTE Studies Code System

Piggybacking identifying or code signals on television broadcast signals as now transmitted has challenged engineers and technologists and the Federal Communications Commission, with extensive attention given by the Society of Motion Picture and Television Engineers. More than a year of studies by the SMPTE and technical communications from the SMPTE to the FCC have been published to set forth difficulties with certain proposals for transmitting coded patterns in the television picture area. There was an extensive test of effects on home receiver image areas, analysed by age of sets and by color/black-and-white.

A 48-page reprint from the Journal of the SMPTE is available at no charge upon request to the Society's Headquarters, 862 Scarsdale Ave., Scarsdale, NY 10583. On-going search for a solution is now in the hands of JCIC Ad Hoc Committee on Television Broadcast Ancillary Signals chaired by Robert A. O'Connor (of CBS Television Network) representing NAB. His initial report appears in the Journal of the SMPTE for December 1973, pp. 1017-1020. This is also available upon request to the SMPTE.

An important activity in the search for a code system is a full day of discussion to evaluate the business needs and requirements

planned for the SMPTE Technical Conference at Toronto, November 10-15, under the chairmanship of R. J. Zavada, who wrote the report on the home receiver image area test. Full details will soon be released by the Society.

RCA Exhibits At International Show

RCA Broadcast Systems demonstrated its newest color TV cameras and video tape recorders, including portable units that virtually equal studio equipment in performance, at the International Broadcast Convention Sept. 23-27 in London.

The exhibit marked the first European showing of RCA's new TR-600 compact video tape recorder, a quadruplex machine that features many automated functions for simplified operation.

New circuitry and packaging have reduced the TR-600's weight to 700 pounds—about half that of predecessor models — and its size to three feet wide, two feet deep and five feet high. The recorder will be available in three versions, for operation in the PAL, SECAM or NTSC color standard. The PAL machine was demonstrated at the London convention.

A second video tape recorder demonstration featured the TR-70C, the company's top-of-the-line system, operating in the Quad II format. Quad II is the designation for a group of proposed modifications to 625-line video recording systems.

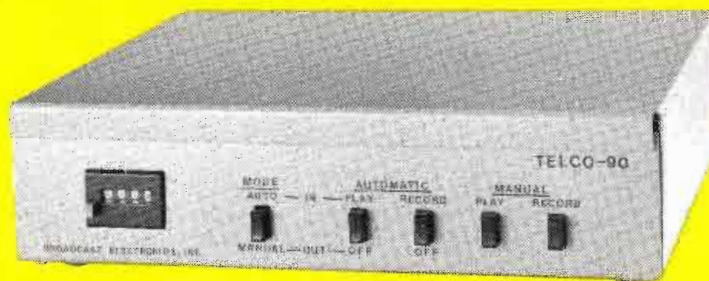
The principle proposals are intended to improve machine performance, provide a second program audio channel, and to reduce costs through operation at 7½ inches per second tape speed, half the normal rate.

Additionally, RCA operated its portable TPR-10 video tape recorder which is credited with producing in-the-field program tapes that are equivalent in picture quality with those made by larger studio systems.

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SMPTE Ready For Toronto Conference

Exhibit space for SMPTE's Equipment show in Toronto has recently gone on sale according to an announcement by SMPTE Exhibit Chairman Robert Dexter, O.E.C.A., Toronto.

The exhibit is being held in conjunction with SMPTE's 116th Technical Conference at the Four Seasons Sheraton Hotel, November 10-15. This is the first time the SMPTE has met in Toronto since 1961, although there were two highly successful conferences in Montreal in 1965 and 1971.

The SMPTE will have 78 booths available for exhibits at the Four Seasons Sheraton. A wide range of professional motion picture and TV equipment will be on display. The price of a 8 ft. by 10 ft. booth is \$600 (\$480 to SMPTE Sustaining Members).

The Exhibit will open on Monday, Nov. 11 at 5:00 p.m., with an Open House sponsored by the exhibitors. From that point, the exhibit will run through 6:00 p.m. Thursday, Nov. 14. Admission to the exhibit will be by conference registration badge or by an exhibit pass, available from exhibitors or at the registration desk at the conference.

A crowd of more than 3,000, representing all facets of the motion picture and television industries, is expected to attend the exhibit.

For further information about the SMPTE Equipment Exhibit, and the Technical Conference, please write to SMPTE, Att: Conference Coordinator, 862 Scarsdale Ave., Scarsdale, N.Y. 10583.

Pre-Sunrise Power Reduction

In our June issue we ran an article on pre-sunrise. What we didn't do was to show how the power division ratio would look for 250, 500, and 1000 Watts. For those of you who would like to try the arrangement described in the article, here is your reference chart.

1	2	3	4	5	6
TRANSMITTER POWER WATTS	POWER DIVISION RATIO	POWER TO DUMMY	POWER TO ANTENNA	R DUMMY OHMS	R ANTENNA OHMS
1000	19/1	950	50	53	1009
500	9/1	450	50	56	504
250	4/1	200	50	63	252

Power reduction data to 50 Watts for various transmitter power outputs. Load to transmitter with resistances shown 50 Ohms.

"I jumped from tugboat to television



after I got my First Class FCC License"

What do you do with your off-duty hours if you work in the engine room of a tugboat? Well, if you're Richard Kihn of Anahuac, Texas, you learn electronics with CIE. As he tells it: "Even before I finished my course, I passed my First Class FCC License exam and landed a job as broadcast engineer with KFDM-TV in Beaumont, Texas. Then in my first year at KFDM, I finished my CIE course, earned two raises and became a "two-car" family! Not bad for an ex-tugboat hand! "I'd recommend Cleveland Institute of Electronics to anybody interested in broadcasting."

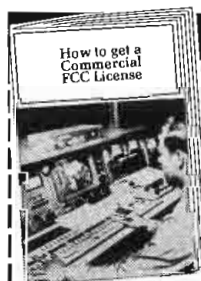
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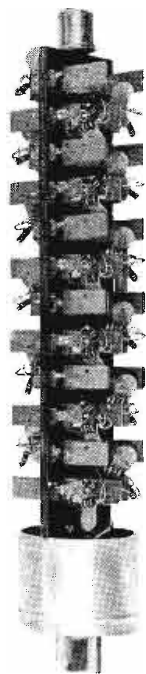


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SBE Fellows

In each of the next several issues of **Broadcast Engineering**, as in the past three issues with the cooperation of the publisher, the qualifications and experience of one of the SBE Fellows will be presented. In this issue we have selected Charles Hallinan who served two terms as President, two terms as Executive Vice President, and later served for several years as Executive Secretary.

At the present time Hallinan is an Engineering Sales Representative for CCA Electronics, Gloucester City, N.J. Previous to that he was Chief Engineer for a number of years for WKOP AM-FM, Binghamton, N.Y. It was while in that position that he founded Chapter 1, Binghamton, N.Y., the first SBE chapter, and served as its chairman. Shortly after, he was elected to the position of Executive Vice President of the SBE.

He was elected to the grade of Fellow in 1971. His petition reads: "For the many years of devoted service to the Society of Broadcast Engineers, Charles Hallinan, Senior Charter Member #99, is hereby proposed for the membership grade of Fellow. Through his efforts the Society grew from a few hundred members and a few local chapters to over 1200 members and 18 active local chapter."

Progress of the SBE under the influence of Charles Hallinan was substantial. Some of the things he has been instrumental in bringing about were mentioned in previous issues of other SBE Journals and in newsletters to members. Charley is not typical of the VIP; he is an extremely modest, hardworking man, preferring to stay somewhat in the shadows as far as publicity is concerned. However, he never ceases to extol the benefits of joining and promoting the SBE. He played a significant part in forming virtually every early chapter of the SBE.

Chapters In The Making

**Chapter 1: Binghamton, N. Y.
Chairman: Douglas S. Colborn
Horseheads, N. Y. 14845**

The 2nd Annual Mini-vention is scheduled for October 11th in cooperation with Chapters 2 and 22 at the Owego Treadway, Owego, N.Y. Larry Taylor of WENY TV is coordinator of this program. This is an all-day event with equipment exhibits.

**Chapter 2: Northeastern Pa.
Chairman: Paul Evanosky
Pittston, Pa. 18640**

Chapter will cooperate with Chapters 1 and 22 (see above) on October 11th Mini-vention.

**Chapter 9: Phoenix, Az.
Chairman: Leo Anglin
Phoenix, Az. 85001**

Last announced meeting, reported in previous issue, was July 19th. Program was presented by Tektronix.

**Chapter 11: Boston Mass.
Chairman: Ross B. Kauffman
Needham, Mass. 02192**

Chapter met on May 21st at WGBH TV Studios when the present officers were re-elected for another 1-year term. Officers are: Chairman, Ross B. Kauffman, WCVB TV; Vice Chairman, Mike Goldberg, WGBH TV; Secretary-Treasurer, Steve Cohn, WSMW.

At this meeting the chapter also announced details of the Mini-vention, to be called "Min-Con 74", which will be held November 1st and 2nd at the Sheraton Yankee-Drummer Inn, Auburn, Mass. There will be 60 booths which are available to manufacturers and others associated with broadcast engineering services on a first-come, first-served basis.

The location at the Auburn-Worcester Interchange, Rt. 12 intersection of I-290, was selected for the convenience of motorists. Technical papers to be presented include one by Max Thomas of Kaiser Television on UHF-TV Transmitters, and Lionel Wittenberg, WSMW-TV on Economics of Strobe Lighting for Towers. Further information available from Mike Goldberg at WGBH-TV, Boston.

Chapter 15: New York, N. Y.
Chairman: John M. Lyons
Woodside, N. Y. 11377

Members and guests met on Thursday August 8th at the WQXR Presentation Theater, New York Times Building, 229 West 43rd St., to hear Dean Sargent, Consultant, talk about Broadcast Practices and Measurements; his discussion centered on understanding the latest FCC rules and regulations on the taking of field measurements as a general practice. A question-and-answer session followed. Sargent is an independent consultant in broadcast engineering.

Chapter 22: Central New York
Chairman: Mort Miller
Syracuse, N. Y. 13214

The chapter is cooperating with chapters 1 and chapter 2 in sponsoring the Mini-vention on October 11th at the Owego Treadway Inn, Owego, N.Y. No summer meetings were scheduled.

Chapter 25: Indianapolis, Ind.
Chairman: Joe Missick
Indianapolis, Ind. 46202

The July meeting of the chapter included a tour of the facilities of Ft. Benjamin Harrison. No further information was received up to press time except a report that Harold E. Ennes has been making excellent recovery after having been stricken ill just as the tour was to start. Those who wish to send a card may forward it to Ennes at 1175 Parkway Drive, Beech Grove, Indiana 46107.

Chapter 26: Chicago, Ill.
Chairman: Bradley Anderson
Chicago, Ill. 60680

On July 23rd, at Omega Recording Studios, 20 West Hubbard St., Bill Raventos of Electro-Voice presented a program on the New Developments in Microphones, including the small "Tie-Tack" Electrecs. Further information on future Chicago chapter meetings is available from Brad Anderson, 996-7912; Jim Grinnell, 263-0800, Ext 223; Bob Churchill, 729-5215, and Ken Steininger, 598-5838. Chapter sustaining members include Telemation Productions; Mike Dyer, Distributor; Rich Engineering; and Swiderski Electronics.

Chapter 32: Tucson, Az.
Chairman: Hobart J. [Bart] Paine
Tucson, Az. 85717

The August 16th meeting, held at KOLD-TV Studios, featured Mr. Frank Santucci, Senior Product Manager, Ampex, Redwood City, Calif., who demonstrated the VPR-

7900 and the TBC-800 digital time base corrector. Bill Roh of Roh's Initiated arrangement of the program which was made possible by Don Bowdish of Ampex field service. Results of election, held in July, are: Chairman, H. J. "Bart" Paine, Univ. of Arizona College of Medicine; Vice Chairman, George Nickle, KOLD-TV; Secretary-Treasurer, Charles Glickman, University of Arizona, College of Engineering; Board Member, Armand Sperduty, N.R.A.O.

Appointed as Director of Programs is Eugene Stough of KUAT-TV; and as Director of New Memberships is Bill Roh, Roh's Inc.

It was noted that the chapter enjoyed a 400% increase in membership in the past year.

Chapter 33: Southwestern Ohio
Chairman: John McNally
Cincinnati, Ohio 45219

The chapter was officially chartered and a \$100 rebate check received to cover "seeding" expenses. Information on future meetings is available from Chairman McNally at 1511 Woodview Lane, Hamilton, Ohio 45013.

Chapter 34: Albuquerque, N.M.
Chairman: Guy D. Smith
Albuquerque, N. M. 87110

The chapter received official notification from SBE Headquarters office of its charter along with a check for \$100 to cover "seeding" expenses. Information on future meetings will be available from Guy D. Smith, Chairman, KRZY/KRST, 2401 Quincy, N.E., P.O. Box 3280, Albuquerque, N. Mex.

Louisville, Kentucky
Chairman: Charlie Kendall
Louisville, Ky.

The May meeting, with Charles Kendall as presiding officer, featured a demonstration of the P.B.S. Satel-

lite Antenna. John Ball gave a description of the antenna and told the locations of the Canadian Satellites Guide I and Guide II. Tom Reeves gave a technical description of the receiver needed to receive and process the signals from the satellites. Reception was good but with some local interference from AT&T land facilities. Paul Kelly was chairman for the June 19th meeting which included a tour of the KET facilities with the main point of interest being the Ampex RA-4000 Automatic Programmer and how it is used to speed the editing of video tape programs.



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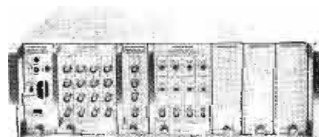
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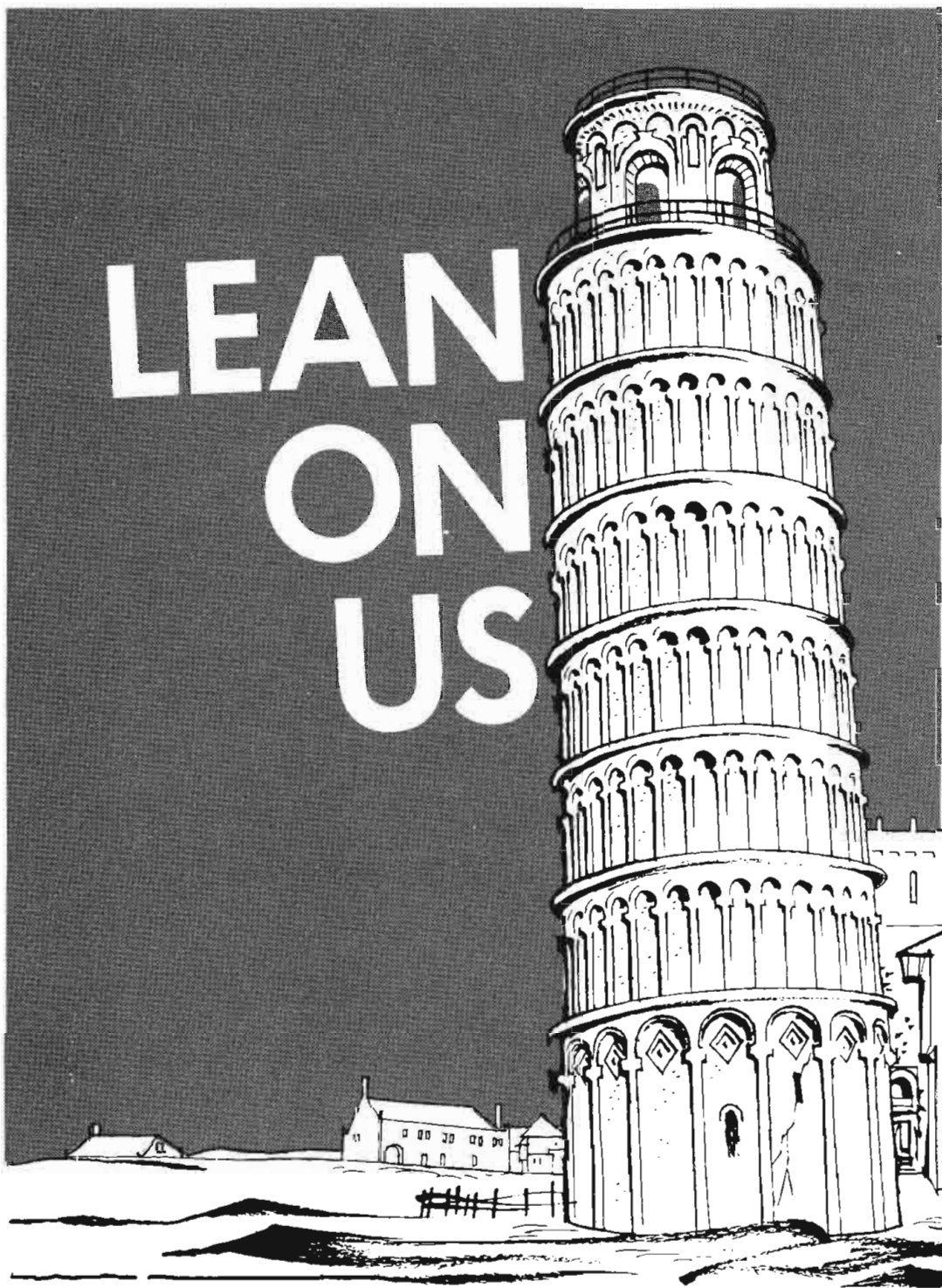
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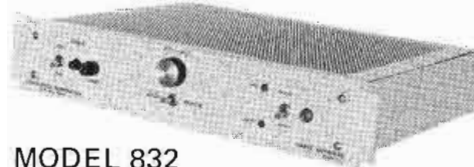
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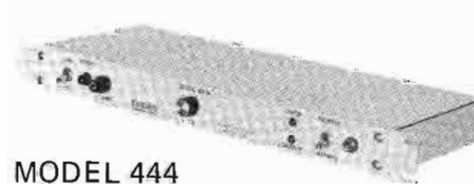
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CABLE engineering

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Temperature effects on the system

By Kenneth Wayne

The hot summer is over and CATV technicians are relieved because the cooling weather will eliminate many cable system problems. Many, but not all.

The temperature effects on cable systems is a year-round problem. The most notable and quickest to remedy is the center conductor pull-outs in the dead of winter. This happens when there is an extreme drop in temperature and has its worst effect on improperly constructed or maintained systems. Center conductor pull-outs will continue to recur until the aerial constructed system is rectified with a good relashing job, satisfactory expansion loops, and good quality connectors.

The temperature effects on cable systems of a continuing nature are most prevalent during the period from spring through fall. The obvious problem being temperature variations and atmospheric conditions causing poor signal propagation and reception.

The first place to start eliminating problems would be at the head-end. When the temperature is in the area of egg cooking time on the sidewalks, the inside of the head-end building on the rocky butte above timberline can also be hotter than.....! That problem should be eliminated with air conditioning. That is where the signal is being processed and that is where it should have the opportunity to be at its very best.

The office personnel can possibly make do with a fan to blow the hot air around as perspiration has a cooling effect when it evaporates from the body. Electronic equipment generates its own heat with no way to cool itself lower than the ambient temperature, and combining these generated temperatures

with Mother Nature's warmth ultimately leads to rapid deterioration. The head-end should be at a thermostatic controlled temperature. With a constant cool temperature, the equipment that operates 24 hours a day, every day, will function longer and more efficiently and not require costly, unnecessary maintenance.

Problems can also occur with cable when it is extremely hot. The cable lengthens as the temperature increases simply because metals expand with heat.

There are four dissimilar metals hanging on poles of a cable system. The messenger of galvanized coated steel, the coaxial cable shield of aluminum, the center conductor of copper, and the stainless steel lashing wire. All the metals have different rates of expansion and contraction. Throw in the black poly jacket and the white foam dielectric and we find there is a lot of movement going on between the shady alleys and sunny streets.

Now, consider the temperature of, say 60 degrees at midnight and the surface temperature of 160 degrees at 2:30 in the afternoon sun. It is certain that somewhere, something is going to give. Usually it is the lashing wire that breaks

and that eyesore should be fixed as soon as it is noticed because that is where you may find yourself on Christmas Eve, fixing the center conductor pull-out when it's 20 degrees below zero!

We find, too, that the system has gained a vast amount of footage on a very hot day. This gain has made the distance between amplifiers longer and the cascade of the system is at the top of the list of priorities. System engineers have determined the proper spacing of amplifiers with acceptable tolerances utilizing different sizes and types of coaxial cable.

With proper spacing, utilization of AGC, the correct compensators, good construction practices, and lots of luck, the subscribers at the extremities should have just as good pictures as the head-end. They will if the system levels are maintained. But, if trouble calls come in from the end of the line, subscribers complaining of weak, snowy pictures and the TV looks good at the head-end when it's 100 degrees in the shade, then probably the system isn't compensating for the stretched out cable.

If the cable only expands 1 percent on a system plant of 100 miles, that adds an additional mile to the system. That could mean more amps are needed if that expansion in the cascade of the system hasn't been compensated for. (Not to mention, the thermal noise...the random motion of electrons in the whole of the system that have become more active in the heat...the signal to noise ratio, and the noise relations in a cascade of identical amplifiers.)

Over the years, technicians have found that the biggest problem of amplifier failure in the heat of summer is the individual amplifier power supplies burning out. This is caused by the plain fact that it gets



"WHEN I SAID, 'HAVE IT ON MY DESK WEDNESDAY MORNING,' I MEANT THE INVOICE!"

downright hot in those little weatherproof, airtight equipment housings and power supplies generate a vast amount of heat. Reflective colors and finned alloy cases are helping to eliminate the problem, along with advanced technology. A good technician can find the weak power supplies and replace the modules before they fail. If only he had the time and wasn't trying to chase down the sporadic-E co-channel interference.

Sporadic-E

Of all system problems, the hardest to explain is the occurrence of sporadic-E co-channel interference. The subscriber is sitting down in the old easy chair on a pleasant evening ready to watch the six o'clock news on channel two. All of a sudden, little horizontal bars show up in the picture. They may immediately vanish only to reappear as big black bars that wipe out the picture. Maybe the picture will start rolling and there will be an audible high frequency

whistle, only to disappear again. It can happen for just a second or two on one channel or last for days on several channels. What is it?

Simply put, this type of co-channel interference is skip. It originates at a minimum of 500 miles to a maximum of roughly 1500 miles for a single hop. I have heard people say of this phenomenon that they have seen pictures from clear across the country show up on their sets. Not only that, but the reception was better on the skip transmission than on the local.

The severe co-channel sporadic-E interference that shows up usually in the late afternoons (though it can occur anytime of the day) occurs most often in the spring and fall. This type of co-channel is limited to the low-band only (2-6) and any other co-channel interference on the high-band or co-channel of a prolonged nature is from signal propagation of a local source. That source could be as much as 300 miles within range of the receiver

depending on the terrain of the country.

At The Head-end

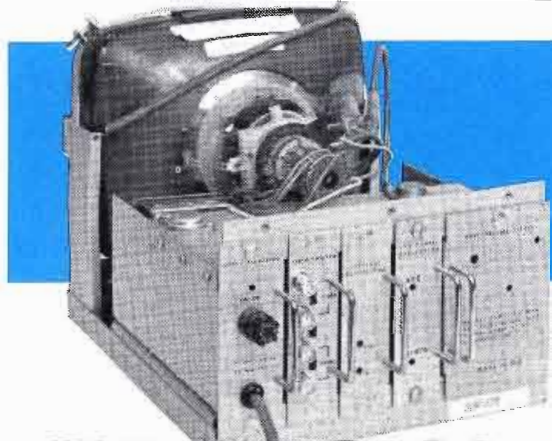
Little or nothing can be done about minimizing the effects of sporadic-E interference. It is something we must cope with as long as transmissions are received over the air. But, if you are having problems with co-channel on the high band, almost any good technician or engineer can, at least, minimize that co-channel if the co-channel is getting into the system at the head-end and is not just scattered here and there within different parts of the system.

Sporadic community interference can be caused by MATV systems located within close proximity to receivers on CATV such as in apartment complexes. It can be caused by translated signals gaining backdoor entrance right into the subscriber's set. Local signals carried on the same channel as the broadcaster without a frequency change can show up as two signals at the receiver. Most of these problems can be eliminated with proper shielding of equipment or isolating devices. It is obvious though, that there is nothing that the system can do to repair unshielded tuner wiring without infringing on the local TV repairman. You can show the customer that it is not really cable problems as much as it is receiver problems by showing him a picture with a portable test set. That doesn't cure his problem, but he, at least, will know that it is not the cable.

In the part of the country where I live, the major signals are picked up nearly 100 miles away. Much of the terrain is rugged mountainous areas sweeping down to rolling prairies and valleys mixed with rivers, lakes, snowcapped peaks, and irrigated fields. Beautiful country, yes, but not ideal for signal transmission. The mixtures of air temperatures, thunder and electrical storms, just plain clouds, and even dust storms show the effects on the received signals. When these atmospheric conditions exist and they are happening 30 or 80 miles away between the transmitter and the head-end, it definitely is difficult to explain to the customer.

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Let me tell you he's worked out just fine. He's done his job well, my workers' compensation rates have actually gone down, and he's sick less than anyone in the whole place. You know, in the beginning I thought I was doing the guy a favor; now I've found that John has really done me one.



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temperatures that cause most system problems, but rather the rapid changes of temperatures. These changes affect the weather which can cause interference, materials which fail because of rapid deterior-

ation, and signals that are blocked and diffused. We can keep ahead of the equipment, but the atmospheric conditions we have to try and explain away.

INDUSTRY NEWS

Public Access Being Tested

A long thought-of concept in public access cable television is being tested at the country's first fully active, bi-directional dual cable communications system, Big Valley Cablevision, Inc., owned by Continental Cablevision, Inc.

In what may prove to be an innovative step forward, Big Valley is giving complete responsibility for the operation of its public access channel to the community. "We feel involvement is the real key to success in public access cablecasting", says Executive Vice President Raymond E. Joslin, "and it's our hope that the more responsibility the community actually has in the operation of the channel, the more involved they'll want to get."

While still in the planning stage in 1972, Big Valley decided to construct the 500 mile system as six separate but interconnected "hubs" the boundaries of which were determined using school, political and census tract information. Each of the six hubs has the potential of inserting and distributing information to its hub or all six hubs from an access center centrally located. To encourage use of this potential, the company will purchase and maintain portable videotape and editing equipment and a time base corrector.

The next step was to call a meeting of representatives from approximately 60 ethnic community organizations so they could learn more about public access and the company's plans for the free public access channel. Out of that meeting came a seven-member steering

committee charged with the responsibility of setting up the election of an advisory council which will establish a charter and operational procedures for "The People's Television Channel." It was then decided by the steering committee that the council will consist of twelve members, seven of which will be the highest vote-getters in each of the following ethnic categories: American Indian, Black, Caucasian, Chinese, Filipino, Japanese and Mexican-American.

As Big Valley Cablevision, Inc. prepares to initiate local origination programming this fall, the steering committee is moving ahead with its plans for election of the advisory council and formation of the "People's Television Group", an organization which, if successful, will truly put the "public" in public access cablecasting.

Two-Way Tests Begin In Denver

Two University of Denver units have begun designing an experiment to use two-way cable television to tell viewers more about social services and their local governments. Such interactive systems enable viewers to respond or question a central information source via television cable networks.

DU is one of seven universities or non-profit research organizations to win a \$100,000 grant recently from the National Science Foundation to design such an experiment.

The University of Denver Research Institute's industrial economics division and the mass communications department will work with the city of El Segundo, Calif., Hughes Aircraft Corp., Teleprompter subsidiaries and the Los Angeles educational TV station. El Segundo's two-way cable system, the most advanced in the U.S. will be the basis for design of the experiment.

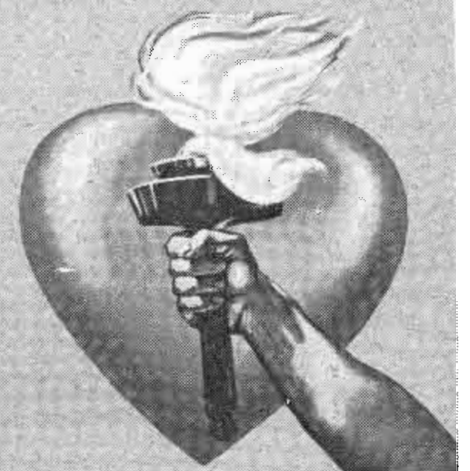
The project will be concerned with citizen government communications systems which can provide feedback to local officials, and citizen information systems, including provision of information on social services.

NFS expects to support from one to four of the experiments being designed under the recently-announced grants, according to Paul I. Bortz, senior research economist and project director for the University of Denver participation.

The experiment being designed by DU researchers will seek information on cost, audience interest, impact of programming, and problems of governance in such interactive television cable communications, Bortz said.

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CTIC Asks FCC Not To Change Franchise Rules

The Federal Communications Commission should not adopt rules to govern cable television franchise expiration or cancellation, or the continuation of service when either occurs, according to comments filed independently by five staff members of the Cable Television Information Center.

W. Bowman Cutter, the center's executive director, and staff members Edwin A. Deagle, Jr., Stanley Gerendasy, Susan C. Greene and John C. McGuire filed the comments in response to the FCC's notice relative to an inquiry on the advisability of adding specific rules to Section 76.31 (a) (3).

The group told the commission that "The disruptions and dislocations that may occur upon expiration or cancellation pose local problems, to which local solutions should be devised." Additionally, they said in cases where local franchises do not deal

(Continued on page CE-8)



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October, 1974

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CE-7

with these issues state law governs the respective rights and liabilities of the parties, "and any political consequences that may result will be felt locally."

The four noted that state and local laws also govern franchise renewals and any negotiations involved in that process. "To require every franchise to include procedures for negotiating renewals may well conflict with local law," they said.

The filing observed that reimbursement of an original franchisee when a change of ownership occurs at the expiration of a franchise may be illegal in some jurisdictions.

The group also declared that arbitration may in some instances be a proper alternative to judicial proceedings in order to determine system value upon expiration or cancellation of a franchise, but it should not be uniformly required by federal law.

The four told the commission that the problem of disruption of service upon cancellation of a franchise is not a widespread one. They noted that this rulemaking was initiated by the FCC's desire to prevent disruption of service to subscribers and to prevent economic damage to cable operators who are unable to successfully negotiate a guarantee of receiving fair value from a new franchisee if renewal is denied. However, "We suggest that such an approach draws the Commission into assuming responsibility for the soundness of local policymaking, a result which is directly contrary to its stated goal of sharing regulatory responsibility with local franchising authorities," they stated.

"The Commission should take note of the increasingly responsible attitude with which local governments approach cable franchising, and encourage them to continue to do so by leaving them some of the important policy choices for which they will be held accountable in any event," they concluded.

The Cable Television Information Center, a part of The Urban Institute, is a private, nonprofit advisory group which assists local governments in the development of cable television in the public interest.

NEW PRODUCTS

Transmission Line Test System

Accurately measure telecommunications transmission line return loss and discontinuity position with the new **Scientific-Atlanta** Model 1691 Fault Locator.

The magnitude and exact location of faults caused by bent, crushed, corroded, misaligned, broken, or otherwise damaged transmission line is obtained rapidly and directly. The Model 1691 is used for quality assurance measurements during installation or as a preventive maintenance check on operating waveguide and coaxial systems. Return loss can be measured over a 60 dB dynamic range and with a distance display resolution of 0.1 foot over a 500-foot range.

Resultant echo distortion is easily obtained from these measurements. Units cover the frequency ranges of 1.7 to 11.7 GHz.

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Digital Clock/Calendar

Chrono-log is pleased to announce a new digital clock/calendar featuring standby power capabilities for up to several hours during power failure. The instrument will operate from either 115 V or 230 V AC, 50-400 Hz.

Several time base selections are offered including an internal line-synced multivibrator which will free-run at .01% stability during power failure, several internal crystal oscillators with stabilities as precise as 10^{-7} /week, or external customer supplied frequencies.

Buffered TTL compatible BCD outputs are provided in positive or negative logic and either parallel and/or character serial (bit parallel) format. The clock/calendar features an attractive dot-formed shaped-character LED display.

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Underground Equipment

The **Ditch Witch** R30 has become the newest member of the Ditch Witch line of Modularmatic underground equipment.

The Modularmatic concept comprises a basic vehicle which, by using

interchangeable socket-mount modules, has the capability of performing many varied underground job functions.

Components available for the Modularmatic R30 include three different trenching modules, a vibratory plow, combo, utility backhoe, reel carrier, clean-sweep broom, hydraulic boring unit and hydraulic breaker.

The original 30-horsepower R30 trencher first was marketed one and a half years ago. It was redesigned to fit into the Modularmatic concept and joins the R40 and R65 Modularmatics to cover the field from 30-horsepower to 65-horsepower.

The Modularmatic R30 is available with either a 30-horsepower air-cooled gasoline or 36-horsepower liquid-cooled diesel. It is a four-wheel drive vehicle built on a rigid one-piece frame and has full hydraulic control of all modular components and operational functions. **Travel speed during trenching and plowing is controlled hydraulically.** A four-speed transmission is used for mobilizing and provides a selection of four mechanical digging chain speeds, plus reverse.

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Distribution Amp

A new, compact "Blue Chip" 40 MHz to 300 MHz trunk amplifier with distribution and automatic gain control was announced today by **TOCOM, INC.**

The new 300-TAD uses thin film hybrid amplifiers designed especially for CATV applications.

Preceding the trunk input amplifier is a plug-in pad or cable simulator to set input levels in the proper range and a plug-in equalizer to adjust the input slope.

Following the low noise input amplifier is a diode attenuator for automatic gain control, a plug-in equalizer to adjust the output slope, a diode slope pad for automatic slope control, a plug-in low frequency filter to attenuate all frequencies below 40 MHz, and the output amplifier for additional gain and high output capability.

Signal for the automatic gain control and automatic slope control is sampled at the trunk output.

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Telephone Multiplex For The Broadcaster

By J. Walter Johnson

Coastcom, Concord, Calif.

In recent years, the broadcast, telephone and entertainment industries have become more specialized. Each has pushed to the forefront of its particular technology, often neglecting to take advantage of paralleled efforts in closely related industries. An outstanding example of this is the limited use of telephone multiplexing techniques in the broadcast industry.

Multiplexing is the technique of dividing a single broadband trans-

mission facility, such as a cable or a microwave baseband, into multiple narrower band channels. This can be done in the frequency domain by frequency division multiplex (FDM), or in the time domain by time division multiplex (TDM). TDM is coming into greater use by the telephone industry to increase cable capacity, however, FDM multiplex is by far the most common multiplexing technique and also the most compatible with existing broadcast systems.

Of the several FDM techniques used, single sideband (SSB) is the

predominant method of generating telephone multiplex channels.

Multiplex Generation

Telephone multiplex channels are most commonly generated at 4 kHz intervals in a 12 channel group from 4 to 52 kHz or 60 to 108 kHz. Higher density systems are generated by stacking five groups of 12 channels each to form a 60 channel supergroup. Five supergroups are combined to form a 300 channel master group and so on, until 1200 or 1800 channels are loaded onto one microwave carrier for transmission across the country.

Figure 2 shows a block diagram of a Coastcom SBC 700 CCITT standard multiplex channel. The voice signal is fed to an input amplifier and onto a diode peak limiter which is used to prevent any unusually strong signal from overloading the microwave system.

The voice signal and the carrier oscillator signal are fed to the balanced mixer modulator which nulls out the carrier and leaves the voice information modulated around the suppressed carrier frequency. The output of the mixer is a double sideband suppressed carrier signal. The channel filter selects the desired sideband, and the demodulator simply reverses the process.

An audio notch and low pass filter are used to remove undesired signaling tones or adjacent channel crosstalk.

Multiplex Interface

If the channel is used for dial telephone service or mobile radio base station control, a termset and signaling unit are usually required. The termset serves to interface the 2-wire telephone switchboard or radio control unit to the 4-wire multiplex channel.

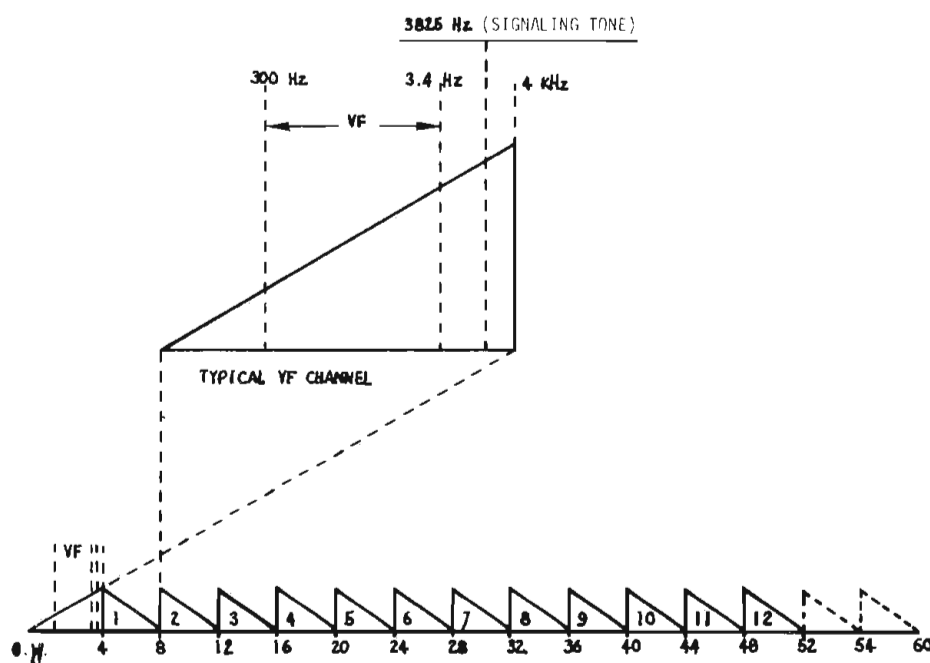


Fig. 1 CCITT group A multiplex frequency plan.

Management Highlights

Over the years, telephone multiplex techniques have been refined for a variety of applications by common carriers and large private microwave systems users. By utilizing developments in these related industries, the innovative broadcast engineer can better utilize his existing facilities, conserve spectrum and increase his station's return on investment.

The signaling unit is required to multiplex the dial pulses along with the voice signal. When the phone is picked up, a tone is transmitted and interrupted by the dial pulses. There are three common methods of signaling: The international CCITT standard is an out-of-band 3825 Hz tone above the voice; Bell Telephone uses an inband tone of 2600 Hz; and the new commercial multiplex systems use the channel carrier, which is restored and pulsed to transmit the signaling information.

Program Multiplex

On The Telephone Network

U.S. broadcast networks pioneered by the Bell System in the 1930's and 40's standardized around a lower sideband 5 kHz multiplex channel with a carrier frequency of 88 kHz. This channel was designed to be carried along with 600 to 1800 voice channels on the national telephone network.

TV network audio transmission in the United States followed the same pattern while the video was carried separately on a dedicated facility. International standards, developed in the 1950's, called for a 10 kHz lower sideband channel with a carrier frequency of 96 kHz. Today, many emerging nations are building their national broadcast networks utilizing 15 kHz program circuits, while in the U.S. a significant number of smaller radio stations still receive broadcast network feeds transmitted via a 3 kHz voice grade channel.

The filter and IC technology developed in the 1960's has reduced the cost of both voice and program multiplex by more than 60 percent in the last decade, making it practical to provide a 10 kHz program channel with little or no loss of voice channel capacity over earlier 5 kHz designs. FM sub-carrier sound diplexing techniques developed for TV STL's and inter-

city microwave links, offer a high performance 15 kHz program circuit at a fraction of the cost of a single sideband multiplex system utilizing complex channel filters.

As of this date, subcarrier diplexing techniques have found limited application in land line common carrier network service. However, due to the favorable cost and performance advantages of diplexing the audio over the video on a single satellite link, Canadian and U.S. domestic satellite common carriers have adopted these latest diplexing techniques for TV audio and cue channels.

Telephone multiplex systems have a controlled dynamic range. In order to prevent overloading the long distance telephone network, the peak audio is usually hard limited 10 dB above average program level. The 1,200 adjacent channels also generate a noise and crosstalk floor approximately 40 to 60 dB below average program level. This noise floor is normally the controlling factor in program signal-to-noise on a national network.

In order to overcome similar limitations in the recording industry, audio engineers have developed compandors (compressor-expander) without most of the drawbacks of the older telephone compandors. These units have the ability to take a 15 kHz program channel with a 90 dB dynamic range and compress it down to a 30 to 45 dB dynamic range before it is delivered to the transmission equipment. In this manner, peaks which would normally heavily distort are brought down well within the linear region of the multiplex transmission equipment. Low passages, which would normally fall below the noise floor, are lifted out of danger. At the far end, the program material is faithfully restored by a very linear expander to its original dynamic proportions.

This same technology makes it practical to provide very high quality STL's and long haul stereo network intercities over otherwise

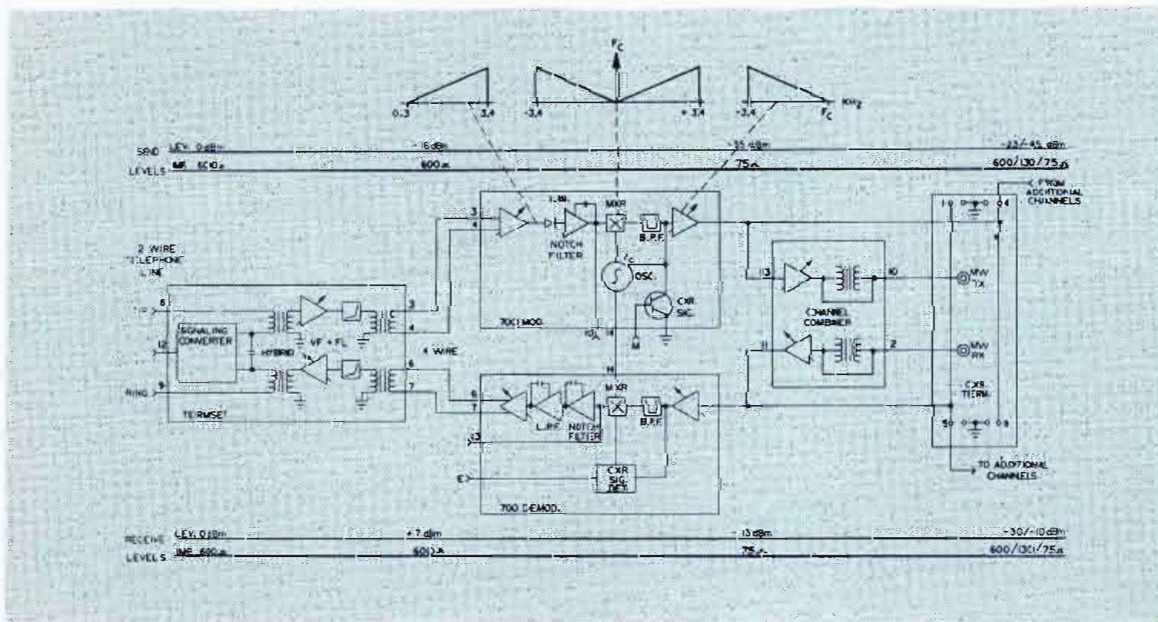


Fig. 2 SBC 700 multiplex channel.

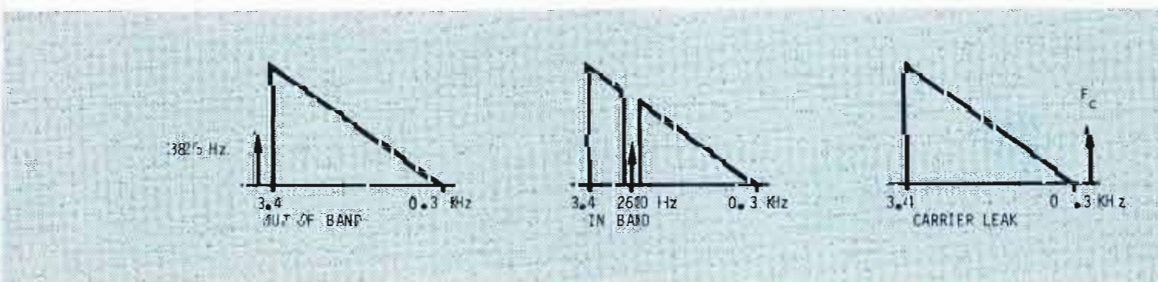


Fig. 3 Signalling frequency plans.

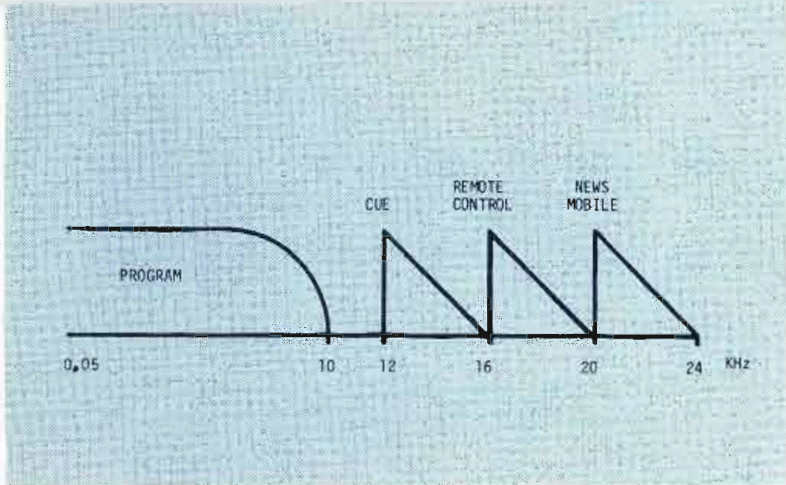


Fig. 4 Typical broadcast STL.

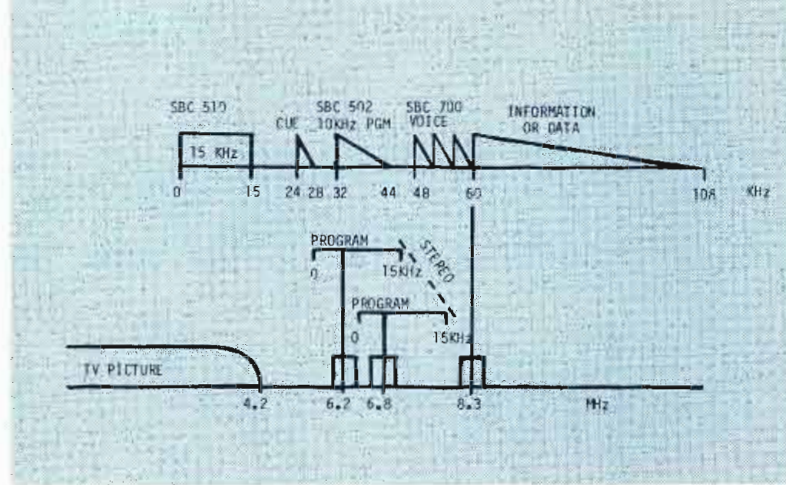


Fig. 5 Typical VOV frequency plan.

marginal facilities.

Utilizing Telephone Multiplex

Telephone multiplex techniques can greatly increase the capacity, return on investment and usefulness of broadcast STL's or intercities. For example: FDM multiplex can be used on a 960 MHz AM radio station STL or intercity to provide a program channel from 50 Hz to 10 kHz with voice multiplex channels from 12-16, 16-20 or 20-24 kHz. These multiplex channels can provide remote transmitter control, a service channel, two-way radio

control, intercity news relay, facsimile, data or teletype.

On multiple hop intercities, no intermediate equipment is required. By the addition of a nominal amount of end terminal equipment, the intercity system capacity can be greatly increased. These same techniques can be used on a 150 or 450 MHz remote pickup unit to provide a remote control or cue channel.

FM Station STL's

Multiplex techniques can be readily used on FM broadcast STL's by moving the voice channels

higher on the STL baseband. On a parallel dual microwave stereo STL, the program filter cuts off at 15 kHz and voice channels are placed above 16 kHz. On a composite stereo STL, the channels are placed above 16 kHz. On a composite stereo STL, the channels are placed above 60 kHz.

TV STL's

On a video link, some exciting benefits are possible. Due to the video interference on a TV STL and the fact that the majority of the baseband is used to transmit picture information, it is necessary

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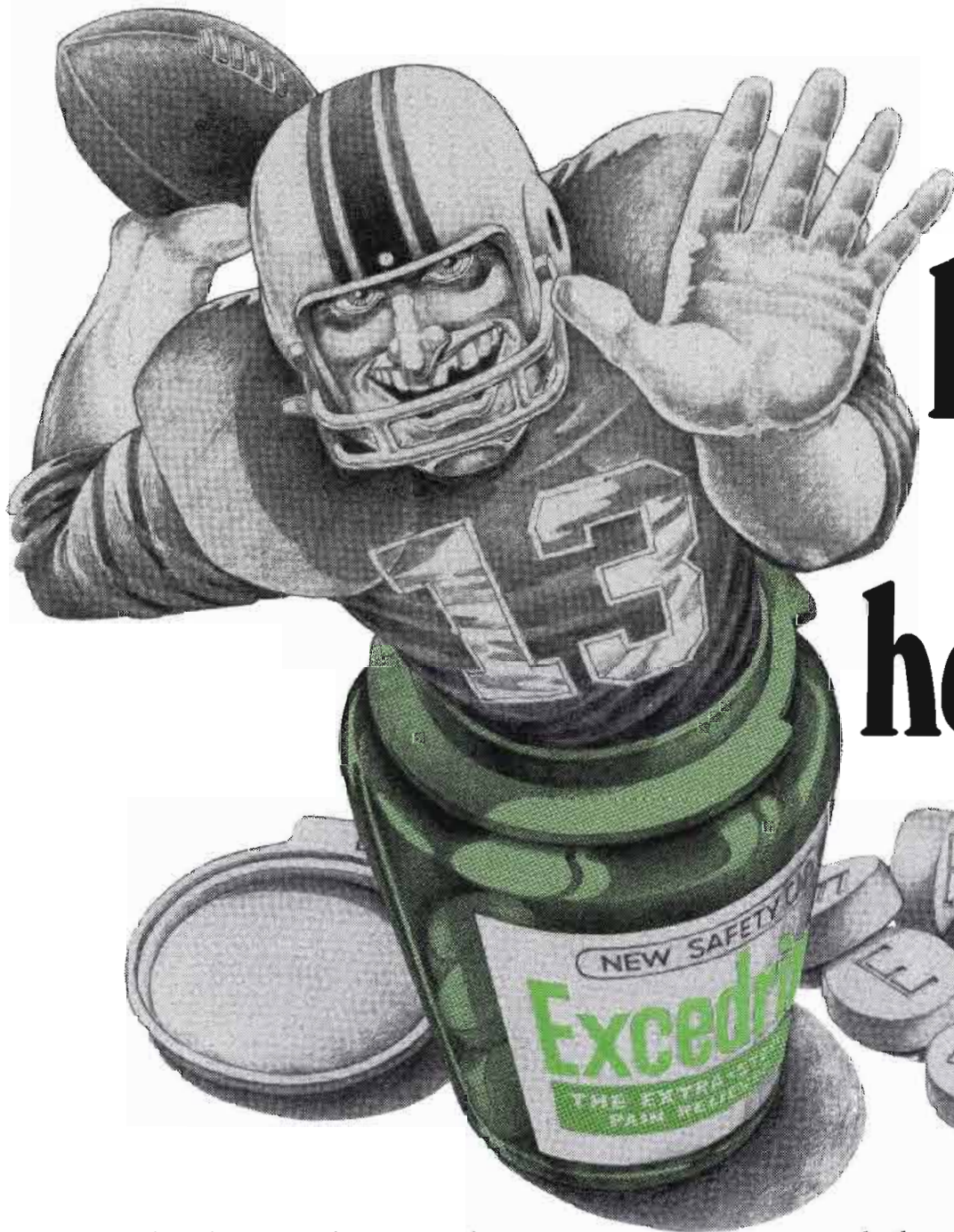
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to place the voice channels in the upper region of the baseband spectrum and devise a means of isolating them from the video.

This has been accomplished quite successfully with a broadband voice-over-video FM subcarrier diplexer, which can in turn be subdivided with voice or program multiplex channels. The FM subcarrier can be made immune to all but the most severe amplitude and phase nonlinearities in the microwave system and provide a 10 to 20 dB noise improvement.

Interference to the video is minimized since the subcarrier presents a constant load to the microwave which is independent of the voice channel load fluctuations. The noise and interference improvement of the FM subcarrier allows it to be transmitted at a level well below the video and, therefore, insures that there is no interference to the video or loss of video signal-to-noise.

Figure 5 shows two SBC 415 program audio and one SBC 424 wideband voice-over-video FM subcarrier diplexers in combination to provide multiple program, voice and data channels on a single STL baseband.

Where a large number of program channels are required and the microwave capacity is limited, the SBC 424 wideband subcarrier can be multiplexed with SBC 502 single sideband program channels. Two subcarriers can be used to carry four program channels by direct modulating a left and right stereo channel on each subcarrier from 0-15 kHz. The TV aural can then be multiplexed from 32-48 kHz on one subcarrier and the AM radio station program from 32-44 kHz on the second subcarrier.

Similar voice-over-video techniques can be used on campus TV cable systems for multi-channel distribution of language lab material, document retrieval, CRT displays, etc.

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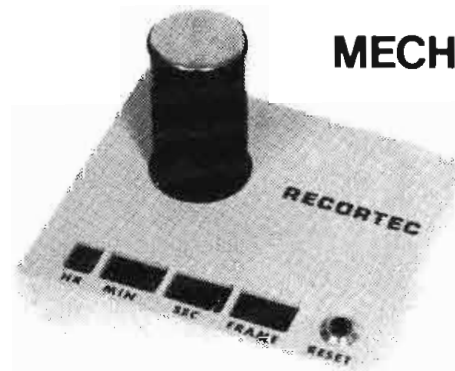
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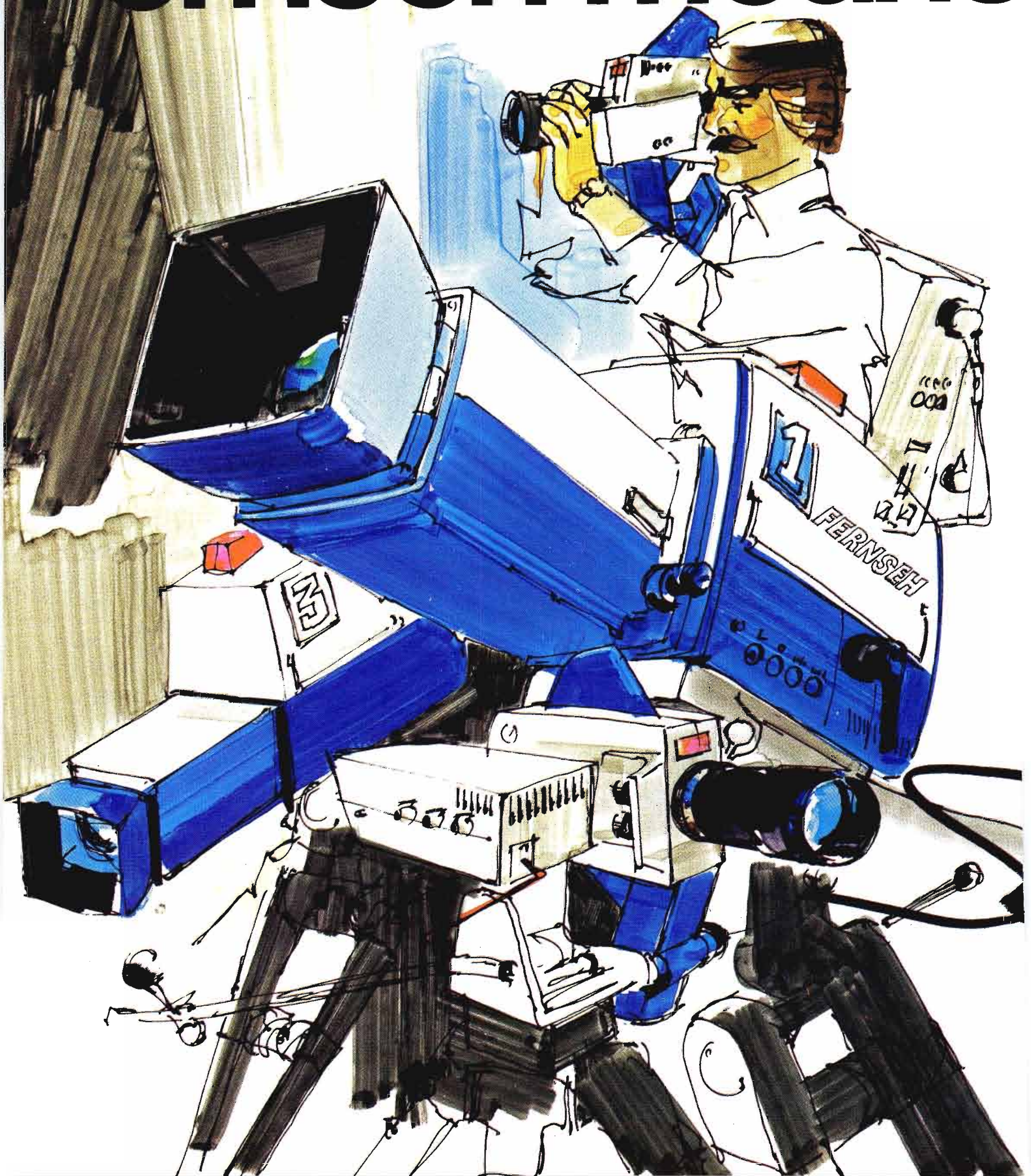
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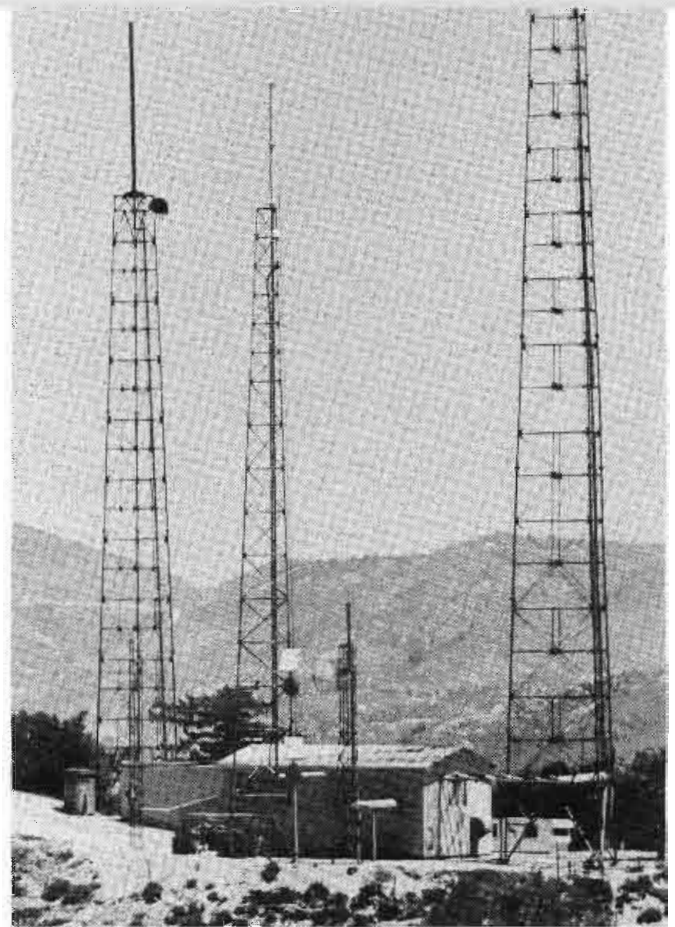
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Optimizing vertical coverage of UHF-TV antennas



Special pattern shaping techniques in the design of television transmitting antennas make possible the efficient coverage of difficult service areas. The antenna described in this article was designed to serve the Los Angeles basin area from Mount Wilson on channel 58. The topography of the Los Angeles basin approximates the shape of an ellipse approximately 25 miles wide and 100 miles long.

Mount Wilson is located on the wide side of the ellipse, and has clear line of site to almost all of the service area. Because of the 5700 foot elevation, the depression angle to such sites as Pasadena, Altadena, La Canada, and other important service areas is 5° to 12° below the horizon. Special pattern shaping techniques are required for coverage of these sites.

Elevation Pattern Requirement

Figure 1 indicates the profile of the service area from Mount Wilson on a 220-degree true azimuth. It is evident that the elevation beam must be shaped to avoid the appearance of nulls in the pattern from the horizon to approximately 13 or 14 degrees below the horizon. It is also apparent that sites located at greater depression angles are progressively closer to the transmitting antenna. Consequently, free space attenuation will be proportionately less.

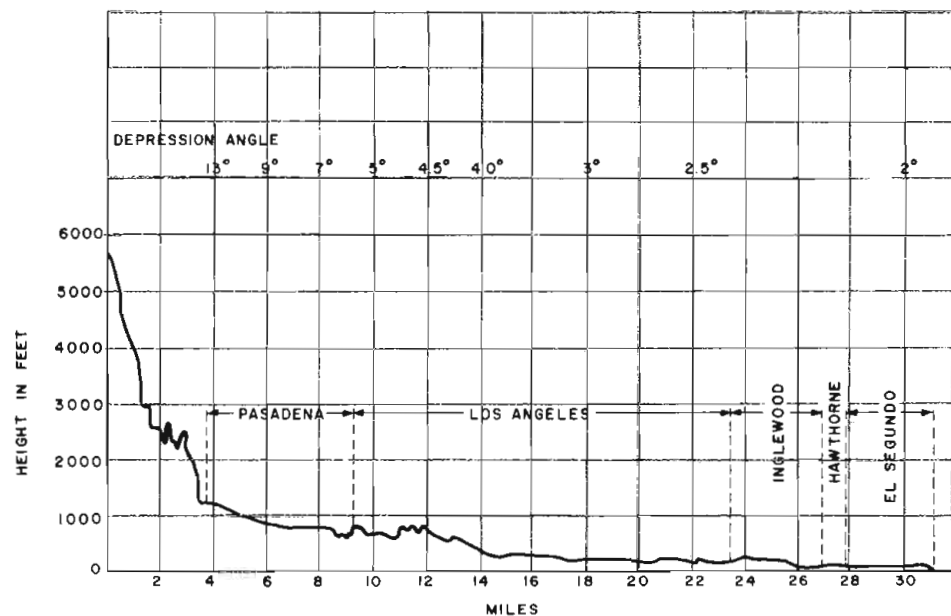


Fig. 1 Profile from Mount Wilson. Azimuth 220 degrees true.

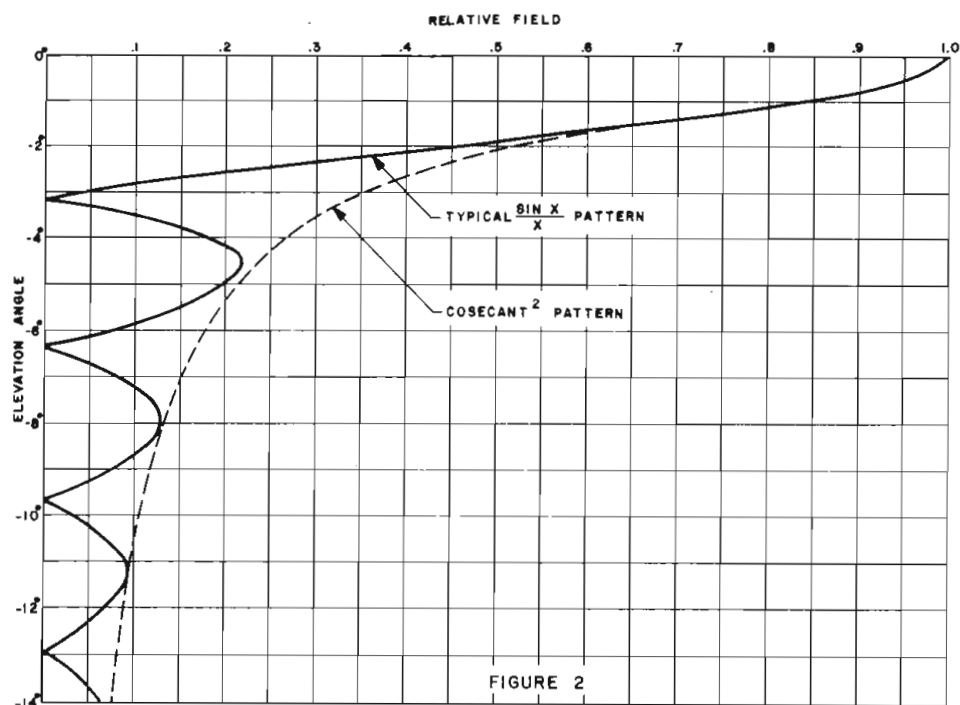


FIGURE 2

The Blue Funk Good Times Rock'n' Roll Band dedicates its latest hit to COASTCOM



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The active Tracking Filter creates a narrow 30 KHz window constantly centered on the carrier of the diplexed FM subcarrier. The Coastcom circuit reduces the noise bandwidth as much as 10:1, and utilizes only the top 35 dB of clean carrier extending above the noise, producing a full fidelity audio signal with a 65 dB S/N ratio.

Because of the Active Tracking Filter, Coastcom's SBC 418 multiplex systems achieve this advanced level of performance at low cost and without the risk of video interference from various digital audio encoding techniques.

The Active Tracking Filter is a Coastcom innovation with enormous problem-solving potential in communications multiplex applications.

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The proper beam-shaping techniques will provide for this difference in free-space attenuation and should be calculated to supply approximately the same received power to each television set regardless of distance and depression angle. Such a pattern shape is realizable and is called the cosecant-squared pattern. By taking the distance between the receive site and the transmitting antenna for each depression angle, the required pattern may be calculated and is shown on Figure 2.

There are, however, some other factors to be considered as well. The requirement placed on the Channel 58 antenna calls for a gain of 15.7 dB over a dipole. The azimuth pattern of this antenna should approximate that of a cardioid and give an azimuth directivity of approximately 2.7 dB. This means that the vertical directivity should be 13 dB over a dipole. To achieve such a gain, a relatively narrow elevation beam must be formed with a half-power beamwidth of approximately 2.75

or 3 degrees. Such a pattern is drawn on Figure 2. Without any beam shaping, the pattern will have several nulls in the area of 0 to -15 degrees depression angle. These nulls must be eliminated in order to provide the proper service at those locations where the nulls would fall.

In addition, an electrical beam tilt of approximately 1-1/2 degrees is indicated from the topography of the terrain. Figure 3 shows such a pattern with 1-1/2 degrees beam tilt with and without the necessary null fill.

The required null fill is calculated in the following manner: For the required null fill, the equation

$$\left[20 \text{ Log } \frac{\sin \left(\frac{\theta}{2} + \epsilon \right)}{\sin \theta} \right]$$

is utilized. In the equation, θ is the half-power beamwidth, ϵ is the beam tilt, and θ is the depression angle. Using this equation, the pattern in Figure 3 is drawn and is utilized as a guide for the required pattern shape.

Beam Tilt

Electrical beam tilt is easily achieved on any line source by designing the antenna with the appropriate phase progression along the antenna array. The design calls for a phase front radiated from the antenna so that it is orthogonal to a straight line drawn between the transmitting antenna location and the point where the peak of the main beam would fall. In other words, the phase front should exhibit an angle of 1.5 degrees with respect to the axis of the antenna.

Null Fill-In

Several techniques may be utilized to eliminate the undesired nulls.

A. Unequal Power Division.

This technique calls for dividing the antenna into two equal lengths and feeding the segments with unequal power. Some common ratios are 30 percent and 70 percent of the available power to the top and bottom segments, respectively, but other ratios may also be utilized.

The disadvantage of this technique is that it only fills in the first null directly adjacent to the main

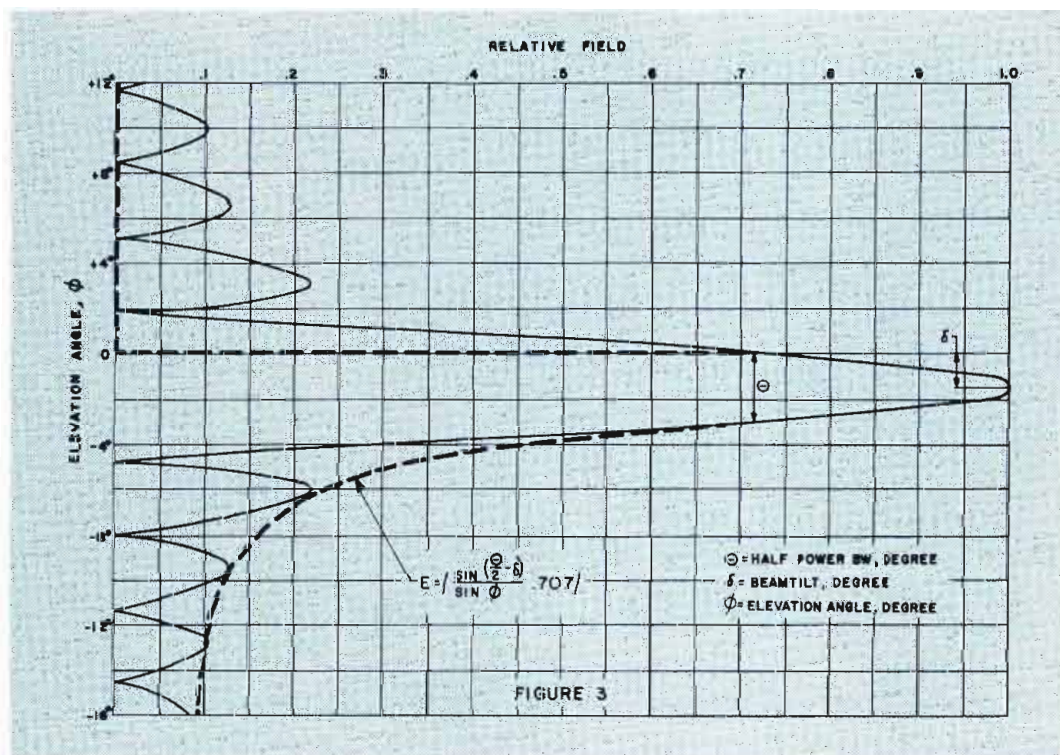


FIGURE 3

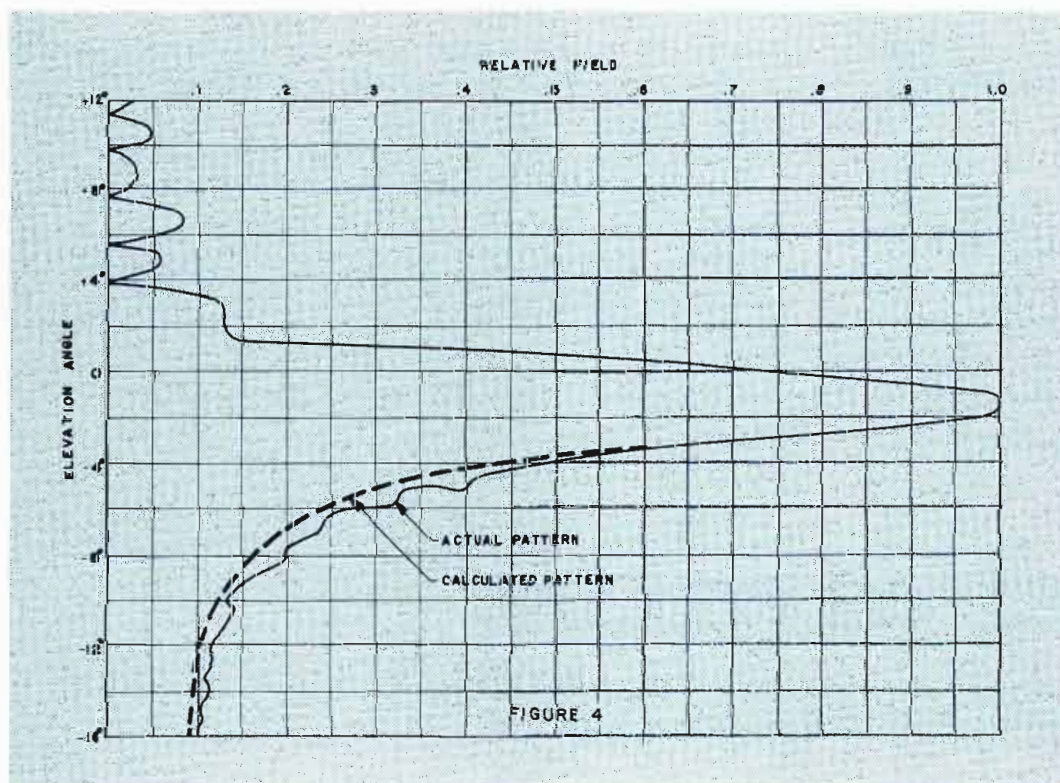


FIGURE 4



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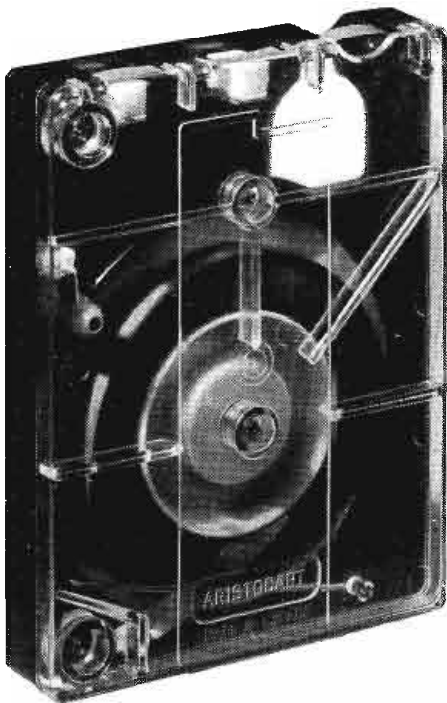
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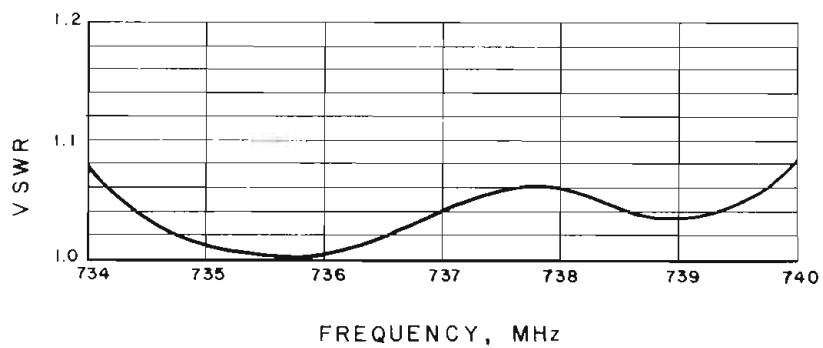


FIGURE 5

beam. Some second null fill-in may be realized by choosing the antenna segments to be unequal in length. This design does not afford a great deal of control and one major disadvantage is that null fill-in will occur, not only below, but also above the horizon therefore wasting energy by radiating it into unwanted directions.

B. Quadratic Phase Error.

A systematically calculated quadratic phase error may be introduced in addition to the linear phase shift required for tilting the main beam. The quadratic phase distribution may be described by the expression:

$$\Delta \frac{\rho^2}{L^2} \sigma$$

where: Δ = the relative phase at the distance l from the array center.

σ = maximum desired phase error at the extremities of the array.

L = center-to-edge length.

ρ = distance to port from center of aperture.

This phase error will cause all nulls appearing in the antenna pattern to be filled in to varying degrees. The amount of null fill-in is proportional to the phase error and is readily controllable.

The major disadvantage of this system is that, as a result of the quadratic phase error, the main beam will be somewhat broadened and the antenna gain will be reduced in proportion to the phase error. Another major disadvantage is that this is a symmetrical error, thereby producing null fill-in not only below, but also above the horizon where null fill-in is not required. As in the first case, power will be radiated above the horizon where it does no good and will be wasted.

C. Asymmetrical Pattern.

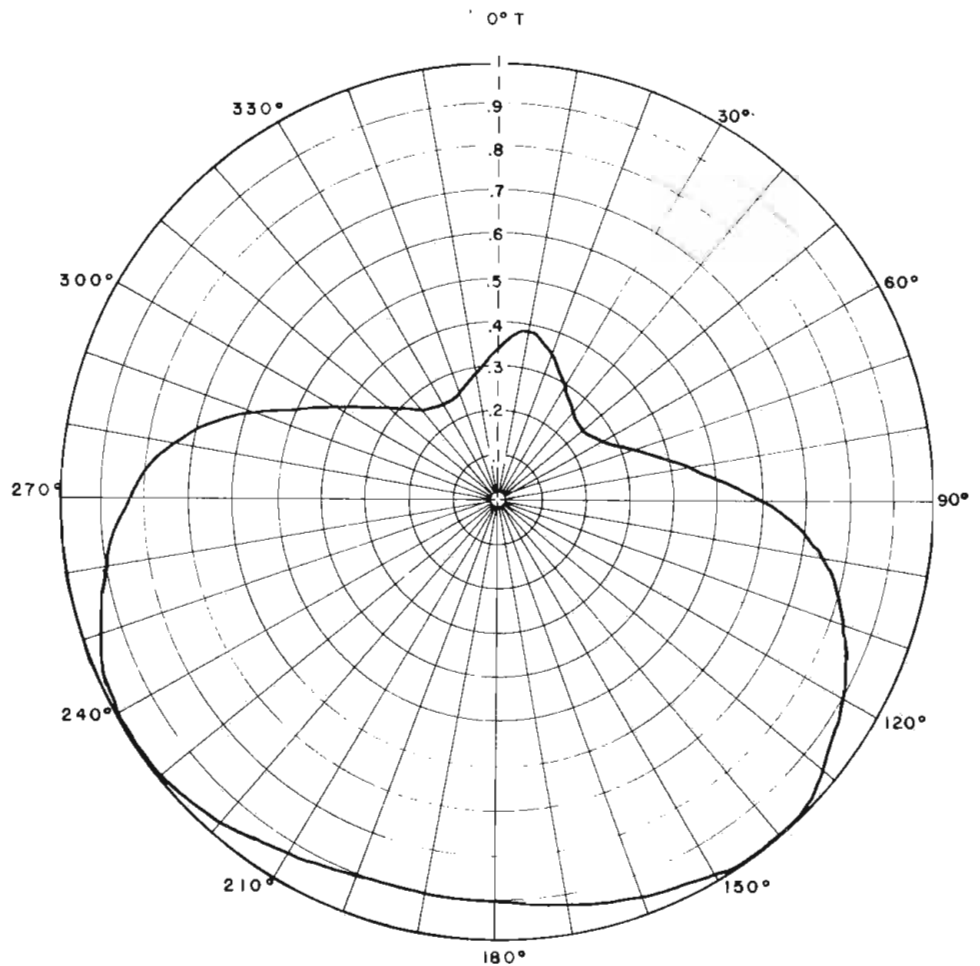
The above two techniques are extensively used in television antenna design, since they are relatively simple. Not only are they simple in the theoretical sense, but also in physical realization. Phasing is accomplished by means of feeder-line length control and to solve the unequal power-division problem, a simple two-way power divider is constructed. To achieve the maximum possible gain while retaining the coverage required below the horizon, an asymmetrical pattern is required. This pattern would be characterized by a low level of radiation above the horizon, so that energy would not be radiated into unwanted directions and would follow a cosecant-squared curve below the horizon in the service area.

A more precise control on parameters is required to achieve this asymmetrical antenna pattern. The design method utilized an iteration technique but instead of the procedure of calculating the pattern of a hypothetical antenna, and changing parameters until the results are satisfactory, the required antenna pattern is used as input and the size and current distribution for a given antenna pattern are calculated. The method is called pattern synthesis, and the procedure begins with specifying the required antenna pattern.

The broken line in Figure 3 indicates the desired pattern shape for this particular antenna. At elevation angles above the horizon, the radiation pattern is depressed in order to conserve energy. From the required beamwidth, it is easy to estimate the antenna size which, for the specific case under discussion, is approximately 20 radiating elements located approximately 1 wavelength apart. Utilizing this number 20, strategically located

data points are selected on the desired antenna pattern and from these points the required phase and amplitude information for each radiating element is calculated. With this information, the actual antenna pattern of such an array is calculated by a computer to visualize and predict the entire beam of the antenna. For all 20 data points, the calculated and desired patterns will coincide. For other points there are some deviations between the desired smooth pattern and the one that the antenna would actually produce. In order to get a perfect match between the desired and actual patterns, an infinite number of radiators would be necessary. This is not possible, so the designer must compromise between what is achievable, with the given antenna size, and what would be optimum for the given situation.

The next design consideration is the practicality of the calculated phase and current distribution along the antenna. In some cases,

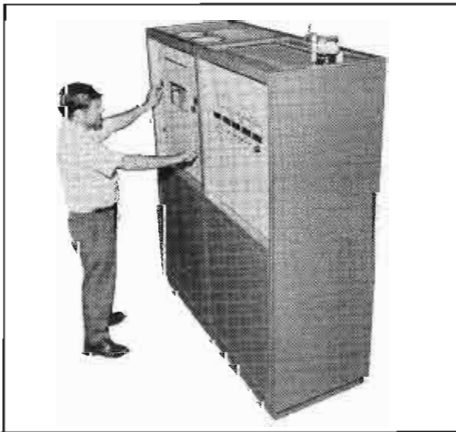


HORIZONTAL PATTERN

FIGURE 6

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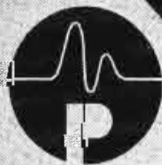
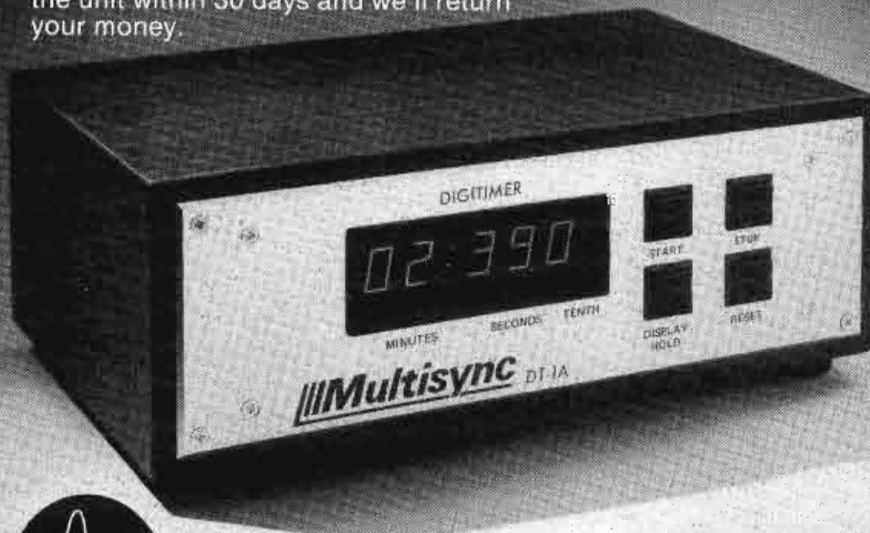
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the required phase and amplitude distribution is extremely difficult to realize. The designer must estimate the practically achievable phase and current distribution and try for the best compromise between that dictated by theory and achievable in practice. After the estimate has been made, information again is fed into the computer and the pattern of this physically realizable antenna array is calculated and compared to the desired pattern.

Several iterations may be needed before an acceptable compromise is found. This is analogous to producing a required wave form with the utilization of sine waves of various amplitude, phase, and harmonic distribution. The number of radiating elements would be analogous to the number of harmonics present, etc. To approximate, for example, a square wave, a great number of harmonics are necessary. The greater the number of harmonics present, the more faithful approximation of a square wave is possible. This is one reason why Andrew had decided to utilize

a design approach that calls for a seemingly large number of individual radiating elements.

Design

The actual design of this antenna consisted of three phases:

Phase I

Phase I was the theoretical phase during which, by the pattern synthesis technique and use of a computer, the antenna design was finalized. Phase and amplitude distribution to all radiating elements were calculated and checked to confirm that the desired parameters could be achieved in the practical sense. In order to establish tolerances, the patterns of this antenna array were calculated with various degrees of phase and amplitude error. In this manner, the required degree of accuracy with which these important antenna parameters had to be held, was predicted.

Phase II

In order to double-check the calculations, a four-to-one scale model of this antenna was constructed. The patterns of the scale model were recorded and examined very carefully for any undesired perturbation, possible design errors, constructional difficulties, and the effect of the radome on antenna impedance and pattern characteristics, etc. The scale model also served in establishing tuning procedures and methods and gathering information about the antenna impedance. The effects of the supporting structure and the top, middle, and bottom supporting steel plates were also examined from both the impedance and radiation patterns points of view.

Phase III

After the design information had been gathered, the actual antenna construction began. Scaling of all the physical antenna parameters, from the four-to-one to the full-size model, had been carefully examined for pitfalls. Conductivity and dielectric constant of antenna materials cannot be easily scaled.

The full-size antenna was subdivided into three segments; two eight-slot traveling-wave arrays and four-slot standing-wave array. The four-slot standing-wave array acts as the load for the traveling-wave portion of the antenna. In this

manner, all the power is radiated, and none is wasted by simply heating a load. Once the antenna segments were constructed, the phase and amplitude distribution of each slot on each antenna section was measured with a vector voltmeter. Both phase and amplitude parameters can be brought well within tolerances by a slight tuning on each radiating element.

After the radiating elements had been adjusted within specifications, the entire antenna assembly was moved to the pattern range and elevation patterns were recorded to confirm that the desired radiation pattern had been met. Pattern tests proved the antenna to be acceptable without any modifications whatsoever. The theoretical versus actual pattern match was better than $\pm 1\text{dB}$ at all elevation angles of interest. The specifications had been exceeded in all cases as is shown in Figure 4.

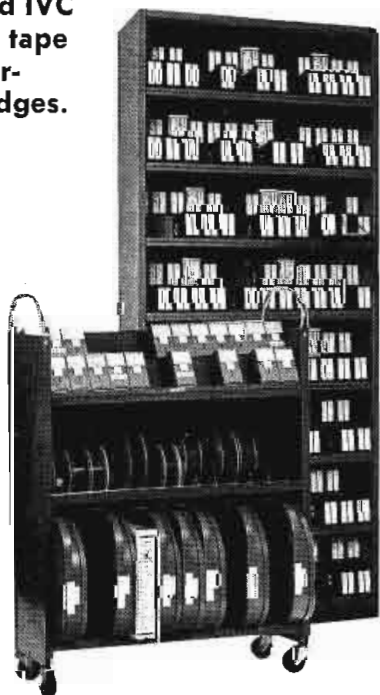
Environmental Protection

The Channel 58 antenna is entirely enclosed in a 12-inch diameter, 28-foot long fiberglass radome. The radome serves a dual function. First, it protects the antenna from the elements, keeps moisture out, and keeps ice and snow from accumulating on the radiating elements, etc. Secondly, the radome functions as a structural member. It provides mechanical support for the entire antenna assembly. The antenna floats inside the radome and the entire radiating section is supported by the bottom plate attached to the radome.

As Mount Wilson is relatively high, ice formation and snowfall

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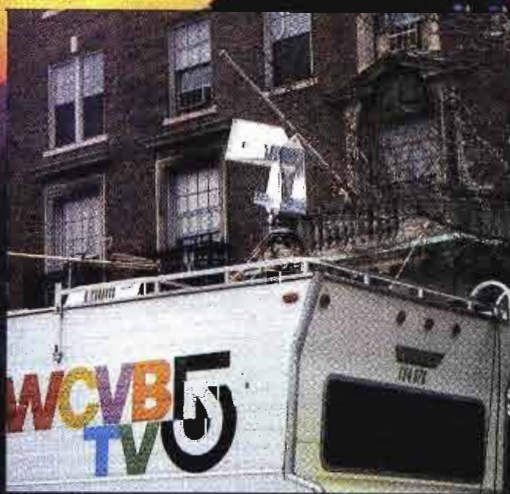
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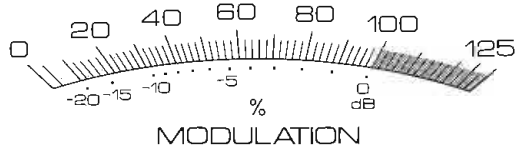
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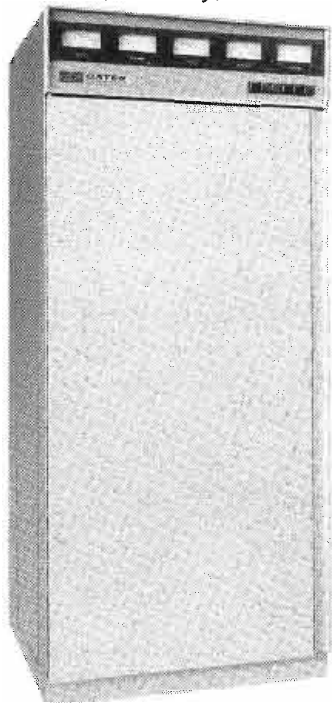
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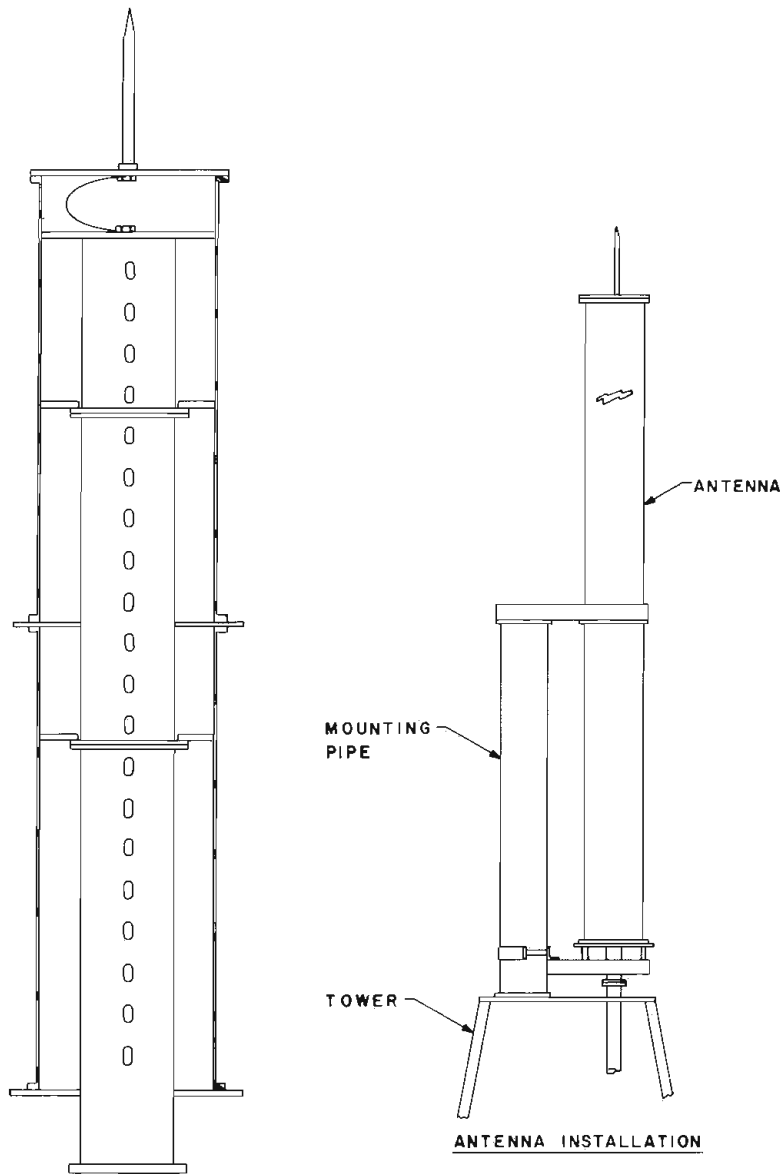


FIGURE 7

are common, even though the mountain is in Southern California. The problem of de-icing this antenna was very carefully considered and has been achieved in a unique way. The radome is tubular in appearance with a smooth outside surface, and the surface is painted with special paint that serves to reduce friction and prevent the adherence of water. Consequently, water runs off quite readily, and snowflakes have a tendency to slide off the radome. Another factor is the radome material.

The type of fiberglass, and the thickness used, were chosen to provide some heating of the radome by RF loss. The loss is very small (much less than 1/10 of 1 dB), but is sufficient to heat the radome 10 to 15 degrees over ambient. Much of the heat is lost by convection through the outer surface of the radome, but sufficient temperature difference remains to enhance ice and snow shedding.

The second heat producing mechanism is the I^2R losses in the unit itself. The radiating section of this antenna consists of approximately 26 feet of 6-1/8-inch coaxial line with slots, coupling devices, etc. Due to simple RF heating of these components, a total loss of about .1 dB occurs. This amounts to approximately 600-800 watts of heating power which contributes to elevating the antenna temperature over ambient. As the radome surrounds the entire antenna assembly, the heat, produced by loss in the radiating segment, conducts through the radome material and serves to heat the radome surface.

This de-icing method was put to an excellent test. The top of Mount Wilson has had, during the winter of 73-74, possibly the worst snow and ice conditions in 15 years. According to reports, the Channel 58 antenna had been affected to only a very slight degree, as far as VSWR is concerned, and visual

inspection of the antenna revealed only a minor accumulation of snow on the radome. This is contrasted with conditions on nearby antennas which were heavily iced and snow packed, and exhibited a corresponding change in mismatch due to de-tuning of the antenna elements by ice and snow deposits.

Summary

The Channel 58 antenna has a gain of 15.7 dB over a dipole. This, in conjunction with the 55 kW transmitter used in the system, provides an effective radiated power of approximately 2 million Watts. The antenna provides a smooth pattern coverage from the horizon down to the -15 degrees depression angle, which is more than sufficient to serve even the closest inhabited areas under Mount Wilson. The coverage area of the azimuth pattern shape extends roughly to San Bernardino, Riverside, Newport Beach, Santa Monica, the San Fernando Valley, with provision made for a small backlobe which allows a CATV system to pick up Channel 58 broadcasts in the Lancaster area.

The antenna was designed to handle 55 kW of transmit power and utilizes a 6-1/8-inch coaxial input with a 75-Ohm input impedance. The input VSWR is better than 1.1 and ranges from 1.07 to 1.05 over the 6-MHz Channel 58 frequency range. Physically, the antenna is approximately 28 feet long and 12 inches in diameter, weighing approximately 550 pounds.

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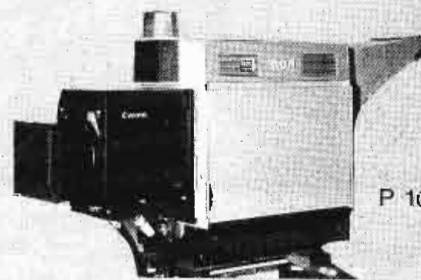
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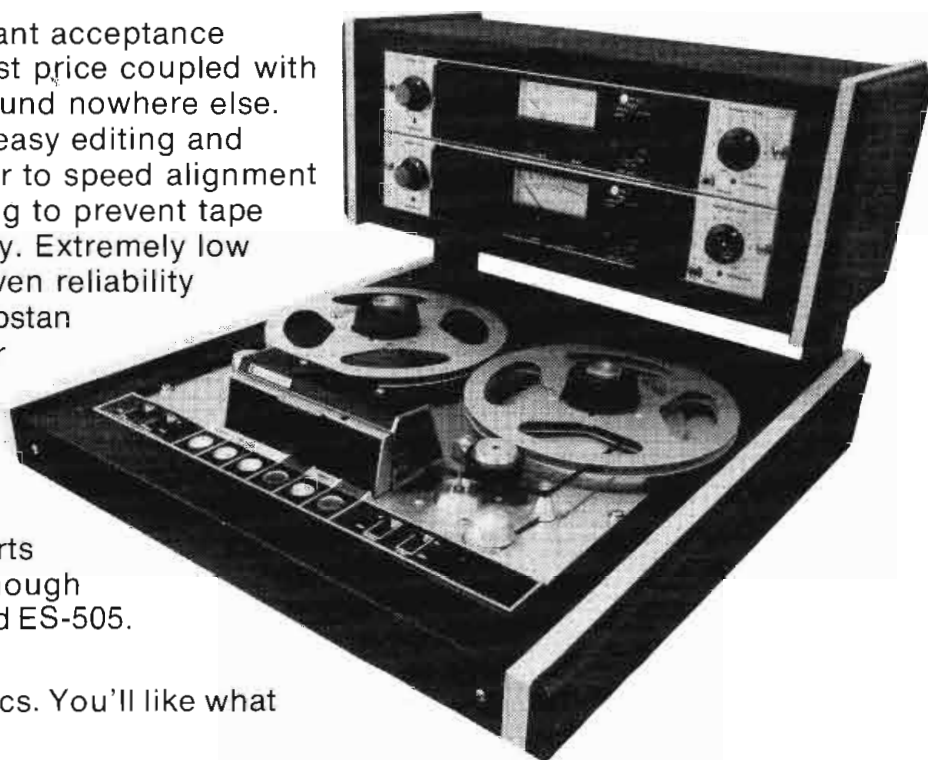
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The audio engineer as a professional

By Todd A. Boettcher

All too frequently, as audio engineers, we are caught up in the hum-drum world of routine, especially when fulfilling daily broadcast requirements. What we fail to recognize is that, with just a little extra effort, we can realize the goal of being truly “professional” audio engineers.

What do I mean by this? Webster defines “professional” as someone “conforming to the technical or ethical standards of a profession or an occupation regarded as such.” This means that, as audio engineers, we must have the practical working knowledge necessary to use the tools of our trade: micro-

phones, mixers, turntables, tape recorders, etc. That should be taken for granted. We’ve all had some training to provide us with the engineering basics and most of us have had enough practical experience to get the job done right without too much lost time.

But Webster continues: a professional is “one who engages in anything professionally.” Thus, to be truly professional, a professional attitude about our work is mandatory. Sure, we can get by doing in-house production and even some commercial production by just going through the motions. Is that what you really want, though? I think not.

To be really effective, you need the unbending desire to give your all to every production session, and to show your client, whether outside commercial agency or in-house promotion assistant, that you will give them the best product they could find anywhere. Make it a standard operating procedure to show your willingness to do more than is expected of you.

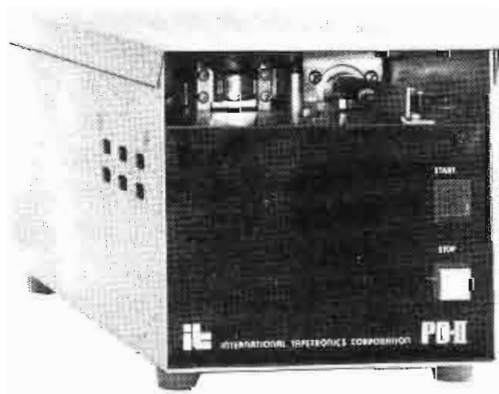
In essence, we are combining the Biblical golden rule “Do unto others as you would have them do unto you” with Dale Carnegie’s book **How to Win Friends and Influence People**. You may chuckle to yourself at first, but this psychology pays rich dividends. With a

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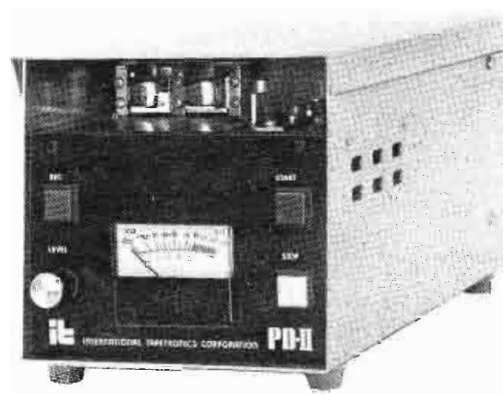
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friendly and willing attitude, you can learn much more quickly what the client **really** wants. The session will go more smoothly, and chances are that the outside client will remember this pleasant atmosphere and will want to return for future sessions. This is rewarding to you as the audio engineer, in that the client recognizes your professionalism. It's rewarding to your station because your professionalism is increasing the station's revenue.

If you can establish a friendly, helpful, understanding philosophy of life, your associates, fellow workers and clients will value their time with you. Tact, diplomacy and protocol are words usually associated with the higher levels of government, but it is just as important for us all to practice them in our daily contacts with clients. Keeping the production area neat and clean is a courtesy to your client. It doesn't take much to empty an ashtray or remove discarded soda bottles before the next client enters. Put yourself into the

client's shoes. What kind of an impression would your facility make? Good, I hope!

I can't stress enough how very important it is to have adequate pre-session coordination with the client. Is multi-track needed? Variable speed? Fifteen dubs to go at the end of the session? (Now is the time to make sure there is an adequate supply of raw tape on hand.) What about the talent? One or two voices for a talk-over, or a live band with chorus? It's a lot easier to know ahead of time so that adequate equipment and materials are available at session time. Provide a place for the client to prepare himself before session time: a desk with a telephone extension, a coat rack, some paper and pencils. Unless it's a live music session, the client will probably need access to the station's music library. He should have a place where he can audition records for music beds and sound effects. The more services you can offer the client, the more likely he is to

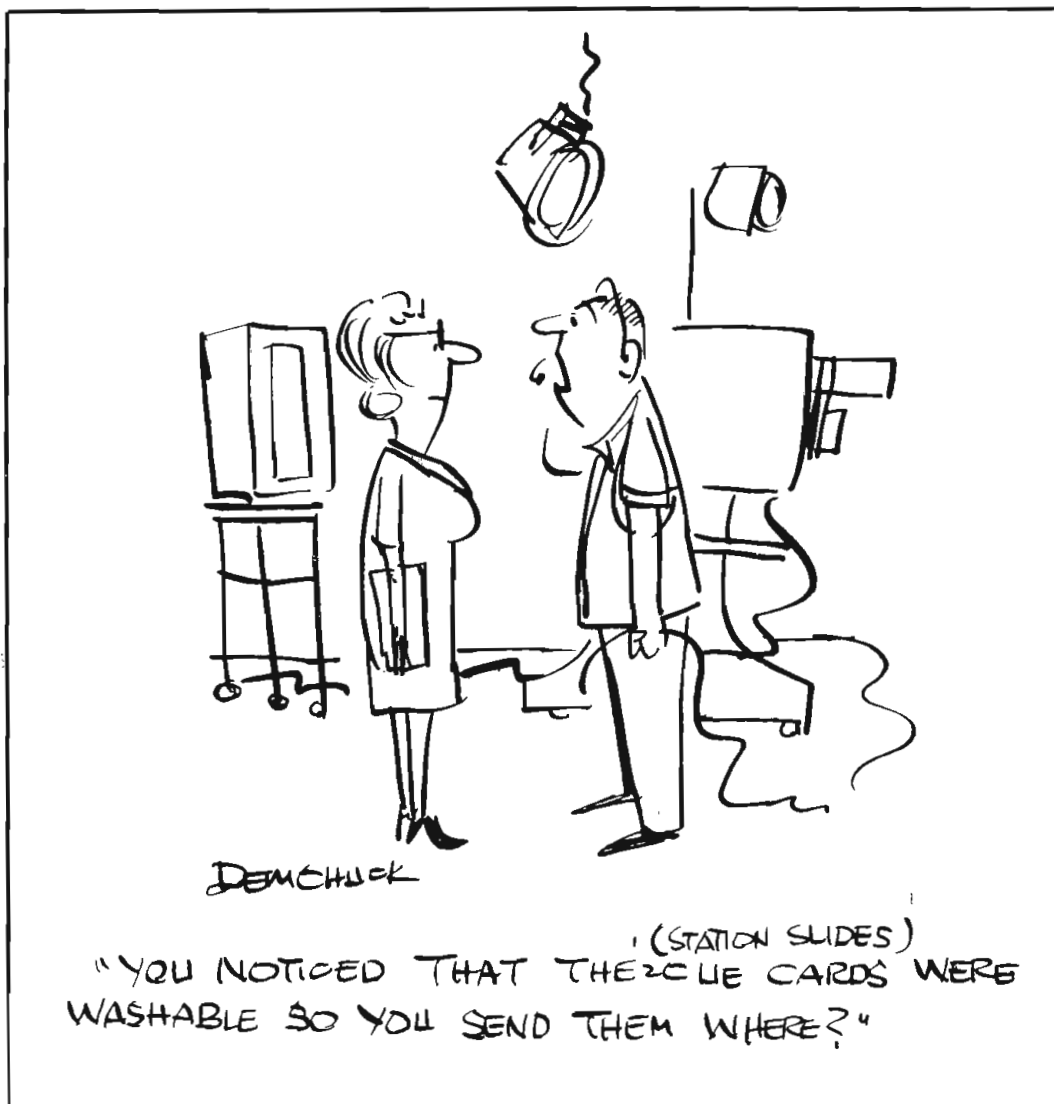
return for future sessions.

Of course, having clients return for future sessions also depends on your technical competence and creativity. When a client enters your production facility, he assumes that you know how to operate all your equipment and that all your equipment is operating. Don't disappoint him or all your good intentions won't count!

What about those live music sessions? Do you like music? What kind of training do you have to qualify you to adequately do a music pickup? Have you had any formal music education? Basic music appreciation? Can you read or even follow a musical score? An engineer who can read a score can be an invaluable asset to the session producer. You will be better able to anticipate level changes and orchestration changes, possibly saving several takes through your expanded professional abilities. This means money, because lost takes can mean extra musicians' wages.

Music is created by playing musical instruments. Can you recognize the wide variety of instruments used by looking at them or by listening to them? More importantly, do you understand how the different instruments produce their sounds, so that you will have some logical starting point for microphone placement? Do you understand the concepts of musical balance and harmony? This is essential if you want to be an effective mixing engineer. Just as importantly even for experienced mixing engineers, do you know how the instruments, bands, orchestras, groups or vocalists sound **live**? If you are used to only listening through microphones and monitor speakers, how can you effectively use EQ or produce a natural musical balance?

Formal audio education in the United States has been quite limited compared to other electronic specializations until recently. Other than covering the basics of sound and providing a basic understanding of what microphones, mixing consoles, turntables and tape recorders are supposed to do, anything further was picked up by the students' own initiative.



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Fortunately, this is changing. The state of the audio art is becoming sophisticated to the point that formal programs for audio engineers are necessary. Yet, we are still far behind Europe in providing a truly comprehensive formal program for training "professional" audio engineers. Started in Germany in 1946 (after the suggestion by composer Arnold Schoenberg) and since spreading throughout Europe, the Tonmeister (sound master) program provides an integrated four-year music and engineering course culminating in the degree of Bachelor of Music (Tonmeister).¹ In this major, music and sound engineering courses compliment each other. The result is a well-rounded graduate with practical as well as theoretical experience.

Just as a good working rapport is necessary with the client, so is it necessary with the talent. Inexperienced talent will welcome your moral support and encouragement, as long as it is given diplomatically. Although the talent is working for the session producer (your client), you may be able to offer suggestions at times that will help the session continue to a successful completion. Experienced talent will appreciate your technical abilities to the extent that an errorless engineering performance will mean a quicker completion of the session. Some tactful flattery may be an icebreaker, but talent is more concerned that the final recorded product is representative of their abilities. Regardless of their experience or abilities, talent should always be given full attention during takes, so that they will **desire** to perform well for your session.

In conclusion, when a client walks into your production session, he **expects** you to be technically proficient. He **expects** that you will be able to provide him with a quality product with essentially no production problems and no lost time. This is basic, and should be the regular result of your education and experience. What the client and talent deserve, but don't always get in modern business, is professionalism—ours. Just as important as our technical capabilities are tact, diplomacy, kindness, going beyond the call of duty, having an

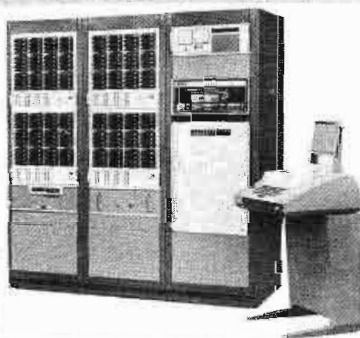
active interest in the session, and old-fashioned common courtesy. The client and talent should always be treated like VIP's, regardless of your personal feelings toward them or your personal moodiness. Remember, when they are working with you, **You** represent the production facility, **You** represent the station, **You** represent the station management, and **Your** capabilities and attitudes will determine

whether they come back again. Speaking financially, we all want a portion of the advertising revenue pie. A friendly greeting and a "professional" attitude may just give your station a little extra dessert!

1 "What Is A Tonmeister" by John Borwick, db - **The Sound Engineering Magazine**, Vol. 7, No. 10, pp. 26-28 (October, 1973)

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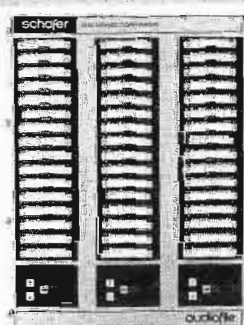
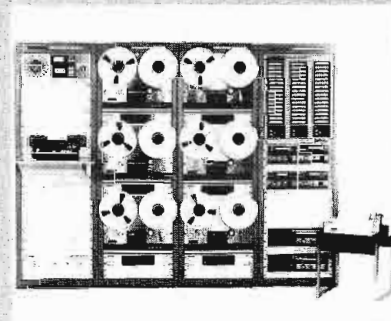
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Pictured is the Schafer 903 time-oriented MOS Memory system with 24 hour (or up to 7 days) advance programming capability. More features are standard equipment on the 903 than on any other comparably priced system. Automatic Memory loading and Verified Encoded Logging are available, too.

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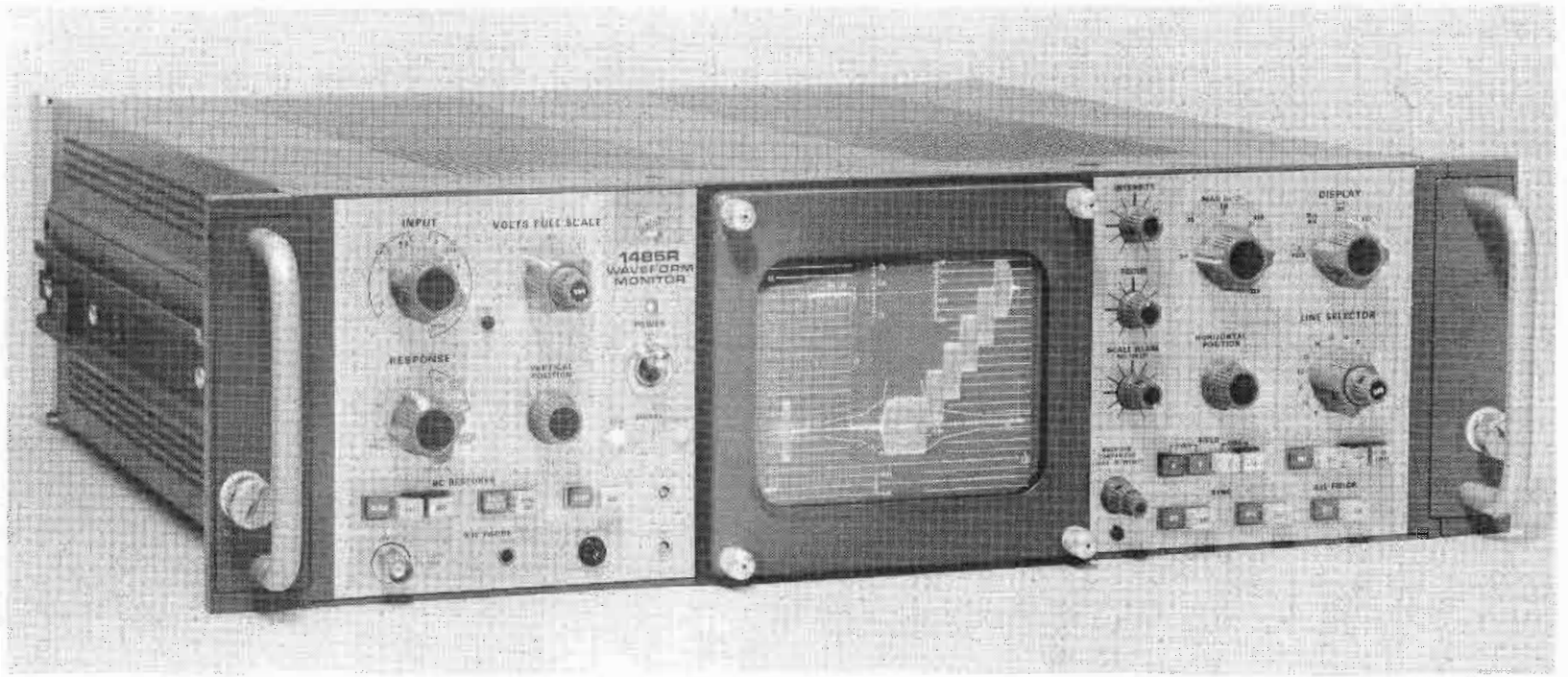
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For More Details Circle (34) on Reply Card



A special report on the 1480 waveform monitor

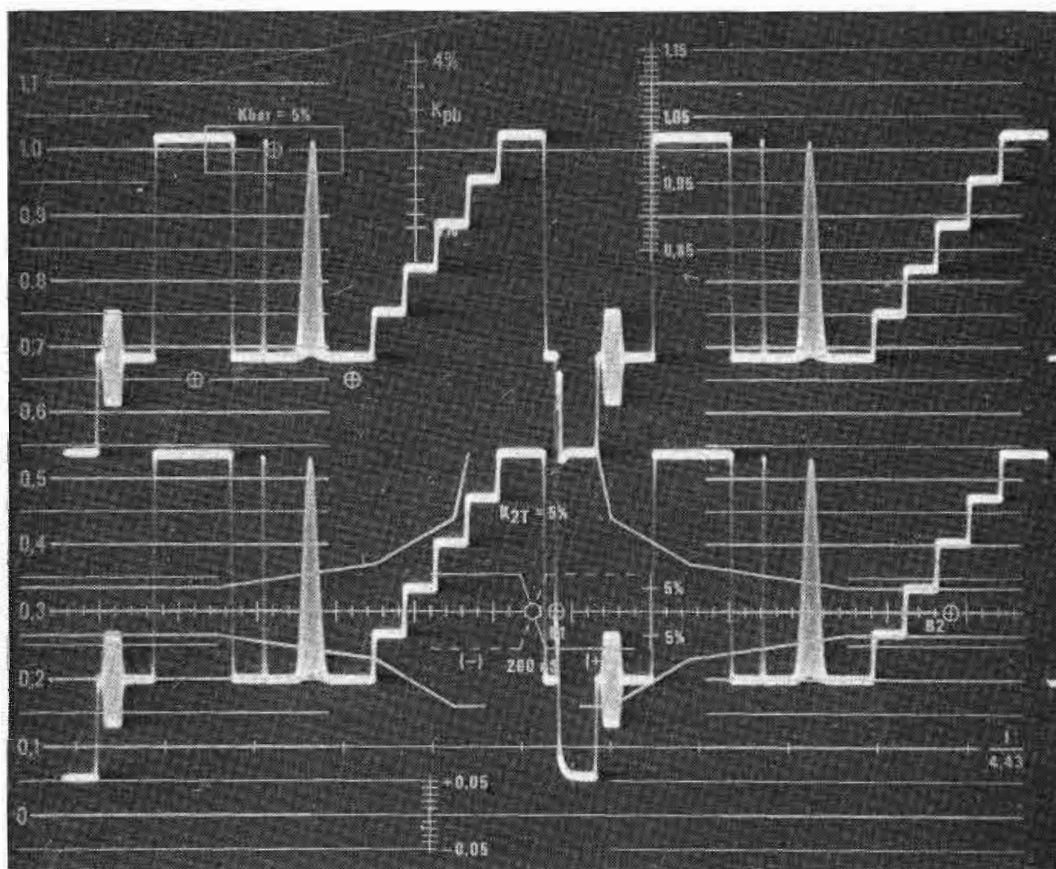


Fig. 1 In this photo the sensitivity has been reduced below normal operating values to show how offset places the top of one display on the same level as the bottom of another display of the same signal. Since the top and bottom line up, the signal equals the offset standard.

TEKTRONIX has developed a new waveform monitor, and we think it significant enough to be included in an early edition for introduction to the industry. For further information, refer to our New Products section.

The Editor

The 1480's are all new, with new amplitude measuring accuracy and many unique operating modes that enable you to work more precisely and accurately. But before going further let's get a question out of the way now. Are the 1480's replacements for the 529? Yes, where you used a 529 (or 527), one of the 1480 Series will slide in and you're ready to operate. But these new monitors are quite a bit more than just a replacement.

Have you ever had to turn the lights down or shade a CRT with your hand to see a particular VIT Signal? That is not necessary with the new 1480 Series because the CRT is bright. So bright that one VIT Signal, selected out of four fields, can be seen with ease even in a well-lighted area. This solution to VITS display problems required the

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TV's newest "spectacular" will be premiered by CMX Systems in Hollywood and New York in a few days.

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design of a new, and very high light-output, cathode-ray-tube with fine spot size. But the bright CRT is just one of the unique features of the 1480 Series.

In recognition of the need for more accuracy the 1480's provide several advanced measurement modes. In these modes the 1480's gives the engineer the capacity to make amplitude measurements with accuracy approaching 0.2 percent. In one mode, a precision display offset is used. A proven video measurement technique, offsetting displays with an amplitude standard, is an easy-to-use method that achieves accuracy by eliminating parallax and transfer errors. Transfer errors are eliminated because the engineer compares his signal to a precise one Volt standard rather than to graticule calibration.

Measurements made with comparison techniques also have a high order of consistency and repeatability. When the signal precisely matches the standard, the signal amplitude will be determined to the value and accuracy of the offset. The tolerance of the internal calibration signal used as the standard is 0.2 percent.

Resolving Power

Resolving power is an important factor in achieving very accurate

amplitude measurement results. The 1480's provide great resolving power through calibrated five times expansion of the vertical display. Expansion not only means that signal and standard comparison is more precise, it means that the difference (errors) between signal and standard are of the order of one millivolt and are easier to see and to measure.

Use of the greater resolution of the five times expansion is facilitated by a vernier position control. With this control any portion of a standard amplitude signal can be positioned on screen and then examined in detail. Zero point two percent amplitude standard, 5X expansion, offset comparison; and fine CRT spot size.

Waveform Overlay

Another feature is the accurate comparison technique. **TEKTRONIX** calls this technique overlay or sweep foldback. The 1480's can actually overlay a later segment of a display on the earlier segment of a display on the earlier segment. Superimposing waveforms over other waveforms allows exact comparison of levels. With overlay, the elements of complex vertical interval test signals can be compared. Add the extra resolving power of five times vertical expansion with

precision offset, and the overlay mode reaches it's full potential.

Many television measurements require the filtering of some components from the composite signal. For example, luminance signal rejection by 3.58 MHz or 4.43 MHz filters for differential gain measurements. A selection of filters is provided in the 1480's; including low pass, IRE, and a new one for staircase linearity measurements called differentiated staircase.

These selectable filters, five altogether, sometimes are not enough for a specialized or unique measurement requiring a special filter. Insert that filter between the auxiliary video output and auxiliary input provided. This function allows the addition of any filter, or other devices, without breaking into the program line. The auxiliary video input and output are buffered by amplifiers to provide a precise 75 Ohm source and load.

Another use of the auxiliary mode is to determine Chrominance-Luminance Gain and Delay inequalities with the convenient **TEKTRONIX 1478** Calibrated Chrominance Level Corrector. Again this measurement can be switched in any time without the inconvenience of disconnecting the program line.

The overlay mode allows overlay

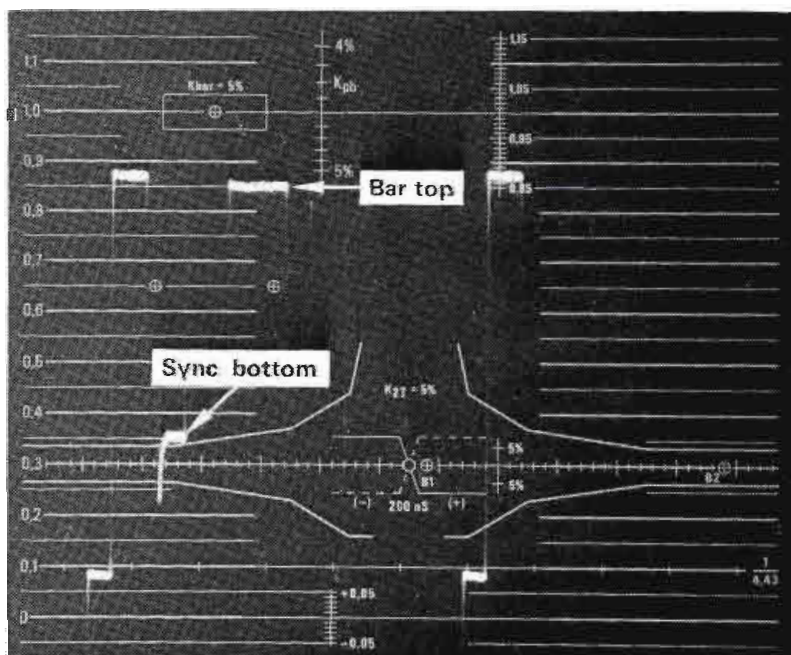


Fig. 2 In this photo, scale factor is expanded 5 times to 0.2 Volts full scale. Offset used with 5X expansion provides resolving power plus comparison accuracy. The signal shown is 10 percent high.

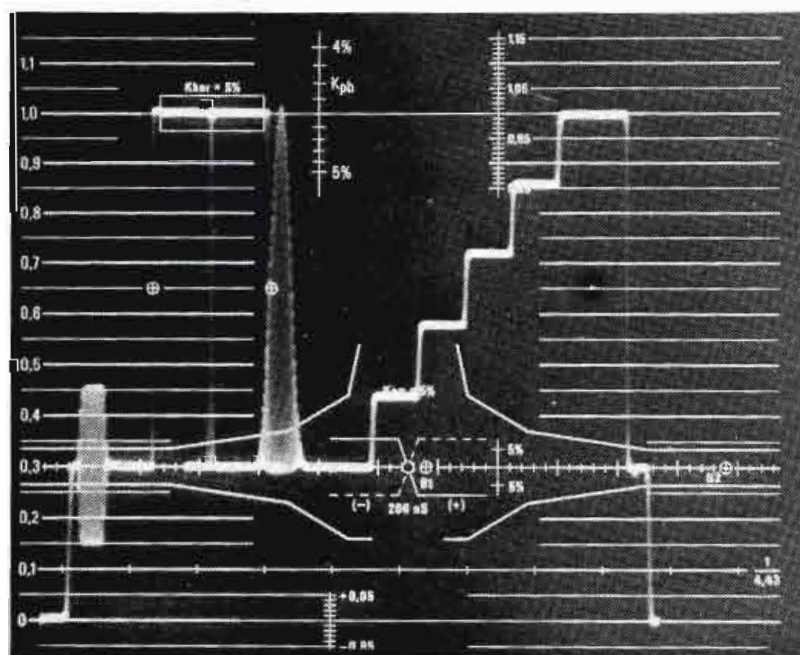


Fig. 3 Pulse and bar overlaid for precise comparison. Expansion can be used for more resolution. Offset and overlay techniques are fully detailed in TV application notes.

Silent Partners



the illustration is shown with optional extras

Now that the FCC have approved the use of a 25 microsecond characteristic on Dolby transmission, more and more FM stations will be taking advantage of this ruling to effect even better quality for their listeners.

Obviously now, more than ever, source quality is of paramount importance and in tape the Revox/Dolby B is the obvious answer.

Already most manufacturers of automated programming equipment have come to rely on Revox—such prestigious names as Schafer Electronics Corporation, CCA, Gates Division of Harris-Intertype, Sparta Electronics Corporation, IGM/NTI and SMC Systems Marketing Incorporated (Sonomag) all employ Revox tape recorders as an integral part of their installations.

If your application depends on ultra-reliable, high performance and outstanding signal to noise, shouldn't you be using Revox too?

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As for the headphones, they are in a class by themselves. The

heart of the DT48 is a heat-formed aluminum membrane to which a moving coil is attached. This assembly is mounted within a housing machined from solid aluminum which also contains a high powered magnet held in a machine-cut thread. The back cover is engineered to such tolerance that a perfect hermetic seal results. By whatever criteria headphones are measured . . . extended response, low distortion, sensitivity, dynamics, the DT48 is so clearly superior to all the rest that you will be able to critically monitor and evaluate your recording quality and balance better than ever before.

In fact, the DT48 is designated by the German Standards Bureau as the preferred audiometric standard.

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Beyer DT48

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of waveforms for exact comparison ...one of the advances in timebase functions incorporated in the 1480's. Also included is the introduction of digital selection of field and line as well as a number of other improvements in making measurements related to assuring positive identification of displayed information. For example, when selecting line 18 of field 2, it is certain that what you will see is line 18, field 2. Digital techniques will not allow an incorrect selection.

Variable line selection of other lines is provided for full field signal analysis. The new 15-line mode is provided for working with quadruplex VTR's. In all line selection modes a line intensifying strobe is provided with video for picture monitor displays. A second line strobe output is provided to strobe 520 Series Vectorscopes, etc. Two field displays on the 1480 are also intensified to help locate the line or lines selected.

With Quad Machines

With the new 15-line mode, the 1480's are well suited to examine head-by-head the performance of a quadruplex video tape recorder. Timebase instability, jitter, distorted sync pulses, missing sync pulses, and field time distortions can be displayed and measured without the conflicting pattern of signals from other heads. In addition the line strobe output from the 1480 is useful in selecting just the signal from any one head for measurements on a TEKTRONIX 520 Series Vectorscope. That makes it possible to measure chrominance phasing, differential phase and differential gain and video signal to noise ratio.

In transmitter applications, any field rate phase modulation that can cause hue shift. For example, right after vertical blanking can be seen on a TEKTRONIX Vectorscope. Again the line strobe is used to select the vector or vectors of interest.

Graticules

Graticules? Two of them are provided. One, internal and illuminated, is used for most applications. An internal graticule is ex-

ternal and can be easily changed, a feature useful for special applications. The external graticule is illuminated by a separate system with a control that turns the internal one off — getting it out of sight so only the external one can be seen. A selection of optional external graticules will be made available for 625/60 and 525/60 standards.

While we worked on factors affecting display, we added new focus and brightness controls that automatically compensate when changing display rates. Switch from two field to a faster timebase, intensity and focus are automatically reset to an optimum level. That makes this monitor convenient to use, since CRT controls do not need readjustment in normal operations.

Other improvements include slow DC Restoration which will display any hum present or a new mode (fast) to filter out hum so that measurements can be made more accurately. Also selectable are backporch or sync tip DC Restoration. Also a DC coupled input mode is provided for measuring diode demodulator output, and other applications.

Probe Option

Did you ever want to use the special abilities of a waveform monitor in a high impedance or where loop-thru is inconvenient? The 1480's make convenient high impedance probing available with a Probe Option. This Option provides an input that accepts most TEKTRONIX probes.

As a part of this option, a probe compensation waveform test point is provided. A ten-times amplifier keeps full screen sensitivities at 1.0 V, 0.5 V, and 0.2 V while using attenuator probes. Without probe the ten-times amplifier can be used to achieve sensitivities as high as 20 millivolts full screen for special applications such as measuring noise and residual subcarrier.

The sweep is three times faster than the 529; in 0.1 microseconds per division is the fastest sweep. Fast enough and bright enough (remember the bright CRT) to examine T pulses even in the vertical interval. The 1480's are calibra-

ted in microseconds with a basic percent timebase accuracy. Two percent when using the multiplier. The greatest range of magnification is 50 x with steps of 10, 5, 2 and 1 times provided with calibration in time and magnification value. The sync recognized has a new automatic frequency control mode for the display of noise caused jitter. (Use a direct mode when you want to see a noisy signal stably displayed).

There are always some questions

that only an examination of the monitor in operation will answer. But TEKTRONIX does have application notes to help apply the 1480's to station needs. Other details about the 1480's are presented in the remainder of this section and in the characteristics section.

The 1480's have: RGB and YRGB parade inputs for CCU applications — Tone wheel sync option for replacement of 529 (s) provided in RCA VTR bridges —

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External sync inputs A and B are slaved to follow the signal input switch, sync input A only operation can be used instead of slaving — remote control operation. Like the TEKTRONIX 650 Series Color Monitors ground closure logic is provided for most front panel switches, the manual will tell you how to do the cabling required — an external input is provided for the X-Axis drive in lieu of timebase (a suggested application swept

signal test).

The 1485C and 1485R Multi-standard Monitors represent all eight monitors in the 1480 Series. The differences between the monitors are essentially confined to the lines selected for vertical interval examination and in the field selection modes. Multi-standard monitors recognize the signal automatically and indicate that standard with front panel indicators.

NEW PRODUCTS

Recorder/Splice Finder Cart Machine

The introduction of three new products from **Ampro Corporation** to take place at the National Radio Broadcaster's conference and Exposition was announced by Alex Meyer, President of Ampro. These products are:

- Twelve channel versions of existing rotary and slide fader consoles.
- A totally new dual stereo console with two full stereo capable output channels. This model, available in rotary fader 6, 8, 10 and 12 channel versions, can serve as a simulcast console, i.e. a mono channel for AM, stereo for FM simply by strapping the appropriate output.
- A complete range of automatic tape cartridge recorder/reproducers incorporating a special splice finder circuit. This feature, switchable on/off, is exclusive with Ampro.

In addition, Ampro will also display its complete line of 6, 8 and 10 channel consoles and Automatic Tape Cartridge Recorder/Reproducers.

For More Details Circle (54) on Reply Card

Waveform Monitor

This is the new **TekTronix 1480** monitor described in an article in this issue. This new unit gives the engineer the capacity to make amplitude measurements with accuracy approaching 0.2 percent. In one mode, a precision display offset is used. Transfer errors are virtually eliminated,

because the user compares his signal to precise one Volt standard rather than a graticule calibration.

The unit uses waveform overlay as a comparison technique. The 1480 can overlay a later segment of a display on an earlier segment of an earlier display. This feature allows exact comparison levels.

Also included is the introduction of digital selection of field and line as well as a number of other improvements in making measurements related to assuring positive identification of displayed information. For further information, see the waveform article in this issue and circle the number below on the Reader Service Card.

For More Details Circle (55) on Reply Card

Turntable Preamp

Broadcast Electronics, Inc. announces the introduction of a new Spotmaster® turntable pre-amplifier designed for the most discriminating broadcaster and sound man. Designated as the Model BE TMS, this pre-amp provides complete mono, stereo and dual channel capabilities. Its versatility is enhanced by a phase reversal switch on one channel that allows five modes of operation—mono in/mono out, stereo in/mono out, stereo in/stereo out, dual channel mono in/dual channel mono out, and single channel mono in/dual channel mono out.

The BE TMS has an output level switchable between -10, 0 and +8 dBm into a nominal 600 Ohm load. Transformer coupled output is available as an option. Gain of the pre-amp

is 54 dB at 1 kHz and frequency response is ± 2 dB, 30 Hz to 15 kHz (RIAA) NAB. Also featured are channel separation better than 50 dB and distortion less than 0.5% at +8 dBm.

Spotmaster's BE TMS has front panel controls for power, left and right channel gain, mono/stereo selection and right channel phase reversal.

For More Details Circle (56) on Reply Card

Portable Video Delay Unit

To meet the needs of TV broadcast engineers for timing studios, for special event programmes, and for connecting up outside broadcast units, **Matthey** has introduced the UN180 portable video delay unit.

This adjustable unit covers the range 10ns to 165ns. High reliability switches allow adjustment in 5ns steps throughout the range and a fine trim of ± 4 ns is provided by a screw adjustment.

Examination of a pulse and bar waveform will show minimal distortion after passing through the UN180.

Where space requires cable attachment via BNC connectors to be at the back of the unit, the UN180 may be ordered as "rear mounted".

For More Details Circle (57) on Reply Card

Pro Tape Recorder

A new compact professional tape recorder, said to be less than one-half the size and one-third the weight of larger, more expensive professional recorders, has been announced by **Otari Corporation**.

Designated the MX-5050 Mini-Pro, the new machine is believed to contain many professional features not found in this price range, while maintaining performance specifications comparable to full size professional recorders.

Among its professional features are synchronous reproduce, front panel edit control (which allows both spilling and rocking), IC digital control system with motion sensing, adjustable cueing control for audible monitoring in fast forward and rewind, optional DC capstan servo system, 15 and 7½ ips tape speeds (easily convertible to 7½ and 3 3/4), front adjustable bias, record lockout, capstan location on non-oxide side of tape, and a built in test and cue oscillator.

For More Details Circle (58) on Reply Card

Cartridge Player Equipment

At the NAFMB convention this year, **Control Design Corporation** will introduce an 80-event sequential programmer. This unit is capable of expansion to 36 audio sources.

In addition, they will show production models of this multiple cartridge player which was shown in prototype at the NAB.

The company also will introduce a new line of automatic tape cartridge machines that employ a totally new concept in head placement that is exclusive with Control Design.

For More Details Circle (59) on Reply Card

TV Audio Console

A new, 16-input Robins/Fairchild TV audio console, with three sub-master mixing channels and two program mixing/output channels, has been announced by **Fairchild Sound Equipment Corp.**, subsidiary of Robins Industries Corp.

Although specifically designed as a state-of-the-art television audio production or air console, the new Robins/Fairchild unit, Model 1632, is readily usable in AM and FM monaural broadcasting.

A future-expansion capability is integral to the design, with add-on units available to provide as many as



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Exciting things are happening in the reel-to-reel market. And it's all caused by a new machine called the ITC 850 Series. Here is the result of a long series of consultations with broadcasters to determine what they most desired in a reel-to-reel machine. Then we added a few innovations of our own. Truly, the 850 Series is equipment designed specifically with the professional broadcaster in mind. Some 850 features: motion sensing, multi-function edit mode, super quiet operation, automatic tape lifters, TTL logic circuitry, capability of handling dissimilar size reels... and more too numerous to mention here. If you're in the market for something new and vastly improved in reel-to-reel, a **collect** call to us will reveal an interesting story that you may have been waiting to hear. Make the real move to reel-to-reel... ITC. Collect number 309-828-1381.



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This came about because Stanton's engineers, who were deeply involved in the development of Stanton's superb discrete 4-channel cartridge, 780/4DQ, achieved certain intricate refinements and sophisticated new techniques that were equally applicable to stereo cartridge design and construction.

Each 681 Triple-E is guaranteed to meet its specifications within exacting limits, and each one boasts the most meaningful warranty possible: an individual calibration test result is packed with each unit.

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All Stanton cartridges are designed for use with all two and four-channel matrix derived compatible systems.

For More Details Circle (62) on Reply Card

24 or 32 input channels, handling up to 128 sources.

Model 1632 uses all solid-state IC-Op Amp electronics on plug-in PC boards for reliable, continuous operation and easiest possible servicing. It has an aluminum cabinet that maximizes shielding and minimizes the possibility of external interference.

The Model 1632 can readily and economically be customized by the addition of such optional equipment as the Robins/Fairchild "Lumiten" attenuators; limiters or compressors and equalizers on mic inputs; Clare-Pendar switches; dual power supplies with automatic changeover, and colored Formica operating surfaces.

For More Details Circle (60) on Reply Card

**4-Channel
Programmer**

A new version of the successful Quadra Que 1 programmer that features automatic tone comparison has been introduced by **Spindler & Sauppe, Inc.**, manufacturers of multi-image control equipment and professional slide projectors.

The Quadra Que 1 Model 2021

features a computer-oriented phase-lock loop design that incorporates an integrated circuit chip containing an oscillator in each of the four channels. This oscillator produces a continuous tone in both the record and playback modes. This signal is compared to the incoming tone of the tape recorder in the system, and automatically locks onto it much in the way that automatic frequency control is accomplished in radio.

Since the frequency range of the tone can be controlled, a broad frequency variation can be accommodated. Thus, the unit is virtually immune to wow and flutter, tape speed variations and dropouts, splices or other spurious effects.

For More Details Circle (61) on Reply Card

**Lighting
Equipment**

Berkey Colortran, a division of Berkey Photo, Inc., announces its latest product development: The Berkey Beam.

Designed for theatrical applications,
(Continued on page 52)

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BROADCAST ENGINEERING

Globecasting

SECAM At The Asian Games

The French color television process, SECAM, is being used for the first time at a major international sports event outside of France to originate the Asian Games held in Tehran between September 1-16.

Under the competent direction of Mr. Milani-Nia, Technical Director for National Iranian Radio and Television (NIRT), with the assistance of Mr. Bernard Gensous of the ORTF, and Mr. David Lambert of Ampex Corporation, a huge complex of TV equipment (under a lease/purchase plan) has been assembled in Tehran and set up in time for the inaugural ceremony on September 1st.

Major color camera coverage at the venues came from six Thomson/CSF mobile vehicles and one Fernseh GMBH unit. Of the 33 color cameras at the Asian Games, 26 were the latest model Thomson TTV-1515, similar to those bought

recently by CBS TV Network of New York. In addition, the ORTF had several prototype portable cameras using two plumbicons.

Five NIRT mobile vans covered some of the venues in monochrome. There were 25 black and white cameras all together between the mobile vans and the studios. Vans were moved from one venue to another as the need arose and cameras were repositioned.

The main TV installations were at the Aryamehr Sports Center's Press building. For live programming and unilateral commentary there were two fully equipped color studios and 14 "oftube" positions. Television recordings were made on twenty-five Ampex VR-1200 type VTR's and edited with an ACR-25 cassette machine. Four HS-100 slow motion disc recorders are located at the main venues for time manipulation purposes.

Terminal equipment includes SECAM/PAL transcoders to provide an output for countries requiring PAL tapes. Several of the VTR's have multi-standard equipment, permitting recording in both standards. All VTR's can operate on SECAM. Distribution of eleven program channels to SECAM color receivers around the Press Center was done on VHF with up converters at each receiver to set the channel to the desired program line. Excellent color pictures were available at any desired terminal in the building for press or monitoring purposes.

Notwithstanding the fact the NIRT presently operates only a monochrome television service, they were able to mount a huge and successful effort to assemble and train over 700 Iranian technical and production personnel who operated this large installation.

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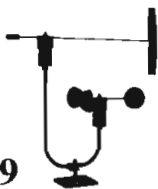


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For More Details Circle (42) on Reply Card

(Continued from page 50)

the Berkey Beam represents a significant design innovation in theatrical lighting equipment in 30 years. The Berkey Beam is a variable spread ellipsoidal reflector framing spot light. A rack and pinion zoom focus mechanism provides a continuously variable beam angle from 24° to 43° with soft and hard edge control. A 1000 Watt Tungsten Halogen lamp in a unique optical train develops 140,000 beam candlepower. An offset radical shutter design provides 60° angular rotation anywhere in the gate, with up to 120 degrees total angular rotation between blades.

Lenses are fabricated of low expansion Borosilicate glass and supported by shock absorbing silicon rubber mounts.

A joy stick control permits rapid optical alignment. Color frames are secured by a safety latch. A pattern slot is standard and a new precision socket assures proper lamp positioning. The Berkey Beam is 26" long, 14.5" wide, 27" from top to bottom, and weighs 34 lbs.

For More Details Circle (64) on Reply Card

Line Transformers

Shure Brothers Inc., Evanston, Illinois, has added two new models to its A95 Series of line transformers. These new line transformers make it possible to connect a high impedance microphone to a low impedance amplifier input.

The new Model A95D features a male professional 3-pin audio connector with a 1/4" phone jack; the Model A95FD has a female connector with a similar phone jack. Neither unit requires wiring or soldering and, thus, can be connected easily and quickly.

For More Details Circle (65) on Reply Card

Vertical Interval Switcher

Video Concepts, Inc. has introduced the SEI Vertical Interval Switcher/Special Effects Generator for use in CCTV, CATV, small studio and mobile van operations.

The SEI is a 4-input, 3-buss Effects/

SMPTE Conference Ready For November

Chairmen of committees that will make all the non-program arrangements for the upcoming SMPTE Toronto Conference have been announced by SMPTE Conference Vice-President, Harry Teitelbaum, Hollywood Film Co.

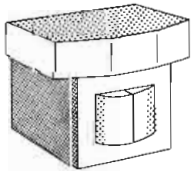
The Conference is set for the Four Seasons Sheraton Hotel, November 10-15, 1974.

According to Teitelbaum, Alex MacGregor, O.E.C.A., has been appointed Local Arrangements Chairman with overall responsibility for Conference arrangements.

The SMPTE Conference will feature a full week of sessions on the technical aspects of motion pictures and television. Session topics include Television Systems, Photo Instrumentation, Films for Television, Motion Picture Systems, Small Format, Theater Design and Projection, Satellites in Broadcasting, Cable Television, Television and Film in Education, Laboratory Practices, and Sound Recording and Reproduction.

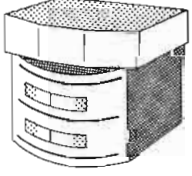
A 78-booth exhibition of professional motion picture and television equipment will run concurrently with the technical sessions.

For information on the technical sessions and the equipment exhibit, please write to SMPTE, c/o Conference Coordinator, 862 Scarsdale Ave., Scarsdale, N.Y. 10583.



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Dissolve switcher and teleproduction center. The three busses are arranged so that the output of the effects amplifier always enters into one of the inputs of the dissolve amplifier. The other input of the dissolve amplifier is taken from the third, or program buss which operates in a vertical interval manner. Thus a dissolve can be made between the program buss and the output of the Special Effects Generator. In addition, a fifth push-button is provided on each buss so that the output may be either faded, wiped or switched to black.

Additional features include six effects between A and B buss, matting with variable gray scale, external and internal keying (B buss), effects preview. The SEI is available with or without built-in 2:1 sync, in black and white, or color.

The SEI Vertical Interval Switcher is 4 3/4 inches high, 9 inches wide and 6 inches deep. It may be ordered either in a free standing, walnut grained cabinet with canted panel, or for rack mount. List price starts at \$995.00.

For More Details Circle (66) on Reply Card

Color Receiver/Monitor

The new **Shintron** Model 909 Chromatic Color Receiver/Monitor is a 9" diagonal general purpose utility monitor/receiver. It is capable of either displaying off-the-air signal of UHF and VHF, or a live source through its BNC or UHF connector.

Compact and portable, the Model 909 Chromatic Monitor/Receiver can be used desk-top or rackmounted when combined with Model 9091 rack adaptor. Power requirements are 115 V 60 Hz or 12 V DC.

The unit comes packed with such standard accessories as an earphone, UHF antenna, AC cord, DC cord with cigarette lighter plug and smoked acrylic screen for glare reduction.

For More Details Circle (67) on Reply Card

Stereo Synthesizer

Orban/Parasound announces the availability of a new model Stereo Synthesizer. The Orban/Parasound Stereo Synthesizer, Model 245E has been designed to take any mono signal and create lifelike pseudo-stereo. Unlike many other techniques, the patented Orban/Parasound stereo synthesis technique causes no change in spectral balance, does not blur the

transient definition, and adds not the slightest audible noise or distortion to the mono original. The stereo output sums back to the original mono for total/stereo compatibility.

The O/P Stereo Synthesizer creates a stereo effect by dividing the mono source signal into five frequency bands. Three of these bands are placed in one stereo output channel; the remaining two are placed in the other channel. The filters are synthesized so that the sum of the two output channels is identical to the mono input.

In addition, the sum of the powers in the left and right output channels is equal to the power in the mono input signal, guaranteeing that the stereo will have the same perceived frequency balance as the mono source.

For More Details Circle (68) on Reply Card

FM Antenna

Two new 1000 Watt per bay, circularly and horizontally polarized, FM broadcast antennas have been introduced by **Phelps Dodge Communications Company**.

Designated Cat. Nos. CP-1000 and HP-1000, the two new antennas are designed to fill the void which currently exists between an educational series rated at 200 Watts per bay and the standard antenna series rated at 5000 Watts per bay. Cat. Nos. CP-1000 and HP-1000 are parallel fed so that a two bay antenna is rated at 2kW, a three bay at 3kW, etc.

The radiating elements of the two new FM broadcast antennas are fabricated of 1 inch O.D. by .065 inch wall stainless steel tubing. All elements are fed with 1/2 inch - 50 Ohm corrugated copper transmission line. These lines are in turn fed from a single 7/8 inch - 50 EIA flanged power divider and matching transformer.

For More Details Circle (69) on Reply Card

Equalizer

A new low-cost modular equalizer developed by **Automated Processes, Inc.**, 80 Marcus Drive, Melville, N.Y. 11746, has been announced.

The Model 553 Equalizer is suitable for a wide variety of applications in broadcasting, recording, film mixing, and sound reinforcement installations. The shelving type low and high frequency families of curves produce overall balance changes in the musical spectrum, while the 3 kHz mid-fre-

quency peaking curves specifically affect the "presence" range of the music and dialogue.

The high, mid, and low frequency controls are continuously variable with up to 15 dBm of boost or cut. There is a silent In/Out switch with LED indicator, and transformer isolated output to a maximum of +24 dBm. Power requirement is ± 15 VDC @ 30 mA, and the dimensions (1 1/2" X 5 1/4" X 6" deep) permit interchangeability with other equalizers in the Automated Processes line.

For More Details Circle (70) on Reply Card

Soft Key Effects Unit

TV broadcasters can purchase **Chromatech Jr.**, a simplified version of **Technicolor's** Chromatech effects system. Chromatech Jr. is a soft keying device which simply and economically upgrades the color keying capability of switchers by replacing the hard (on-off) keying of standard chromakeyers with proportional keying.

With only three simple operating controls, Chromatech, Jr. can be used in live broadcasting applications without the need for pre-show alignment and setup. It provides natural looking pictures without objectionable outlines and halos around foreground subjects. It is built for 19" switcher rack mounting and includes a 3 1/2" square, panel mountable remote controller. Its DC control circuits allow the remote controller to be installed at any distance from the Chromatech



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Jr. main chassis.

Chromatech Jr. operates by accepting two input sources of composite or non-composite NTSC video with standard synchronizing signals that are common to both video sources. The color keying signal that causes transitions between foreground and background is RGB video, provided by the foreground video source. Chromatech Jr. can be preset to gate on any desired backdrop by means of a hue control located on the remote controller.

For More Details Circle (71) on Reply Card

Subcarrier System

Compact size, excellent audio performance and versatility characterize the new Series "8" Subcarrier System was introduced by **Moseley Associates, Inc.**, at the 1974 NAB Convention. The Series "8" consists of the Model SCG-8 Subcarrier Generator and Model SCD-8 Subcarrier Demodulator.

The Model SCG-8 Subcarrier Generator is well suited to SCA applications. With an adjustable output and built-in power supply, it may be interfaced to all direct FM exciters. The generator and demodulator are tailored as to audio response and deviation based upon carrier frequency and intended applications.

Front-panel metering is provided on both the generator and demodulator. Either automatic muting with adjustable time delay or manual carrier control is included on the SCG-8 Subcarrier Generator. Further, automatic audio output muting in the demodulator is activated should a carrier not be present.

Only 1 3/4" (44.5 cm) of standard 19" (484 cm) rack space is occupied by the SCG-8 or SCD-8. Full mechanical shielding and filtering of all signal and power lines prevent RF interference from affecting operation. Access is gained by removal of the top cover.

For More Details Circle (72) on Reply Card

Solid State Dual Timer

A dual electronic timer in the form of a monolithic integrated circuit has been designed and developed by **Signetics Corp.** for a wide range of uses, including replacement of time delay relays.

The uses of the dual timer, which is called NE/SE556, are limited only by the imagination of the user. The single timer, the 555, is being used in automobiles, home appliances, indus-

trial control systems, and sophisticated electronic equipment...such as data systems...for simple time delay, time sequencing, pulse generation, missing-pulse detection, frequency division, pulse-width modulation, and pulse-position modulation, just to name a few. One NE/SE556 will replace two 555 timers, too.

Both halves of the NE/SE556 dual timer can operate independently as well as together. They will produce fully controllable time delays between one microsecond (or, "one-millionth of a second") and one hour. Timing is adjustable over a ratio of ten to one. The dual timer can also be connected to run free, in which case each half can be set to oscillate at any frequency between 300 kilohertz and less than one pulse per hour (or, "3.6 millihertz").

Duty cycles are adjustable from 50 percent down to 0.01 percent.

For More Details Circle (73) on Reply Card

200MHz Portable Scope

A new portable oscilloscope, Model 1710B from Hewlett-Packard, has two channels with deflection factors to 5 mV/cm, sweep speeds to 1 ns/cm, and frequency response to 200 MHz. Its primary application will be in servicing computers which use ECL 10K or Schottky TTL logic. It will also be valuable in wideband analog work.

The 1710B is especially well suited for computer field service where timing measurements are critical. Calibrated sweeps are accurate to 3%, and even better, 2%, in the 100 ns/cm to 20 ms/cm range. This accuracy is specified over the full 10 cm of horizontal deflection. A X10 magnifier increases the maximum sweep speed to 1 ns/cm. Differential time measurements are accurate to 1% for most applications.

For More Details Circle (74) on Reply Card

Noise Generator

The new NVU-1 Noise Generator from **Vitek** has an instantaneous bandwidth which covers the VHF and UHF frequency range with a power density of -15 dBmV/MHz across 75 ohms. When used with a spectrum analyzer, swept frequency measurements of amplifiers, filters, head ends or complete CATV systems may be made.

For More Details Circle (75) on Reply Card

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WANTED: All surplus broadcast equipment especially clean A.M. & F.M. transmitters, contractors, capacitors. Surpluss Equipment Sales. 2 Thorncliffe Pk. Dr. Unit 28 Toronto 17, Ont; Canada 1-73-tf

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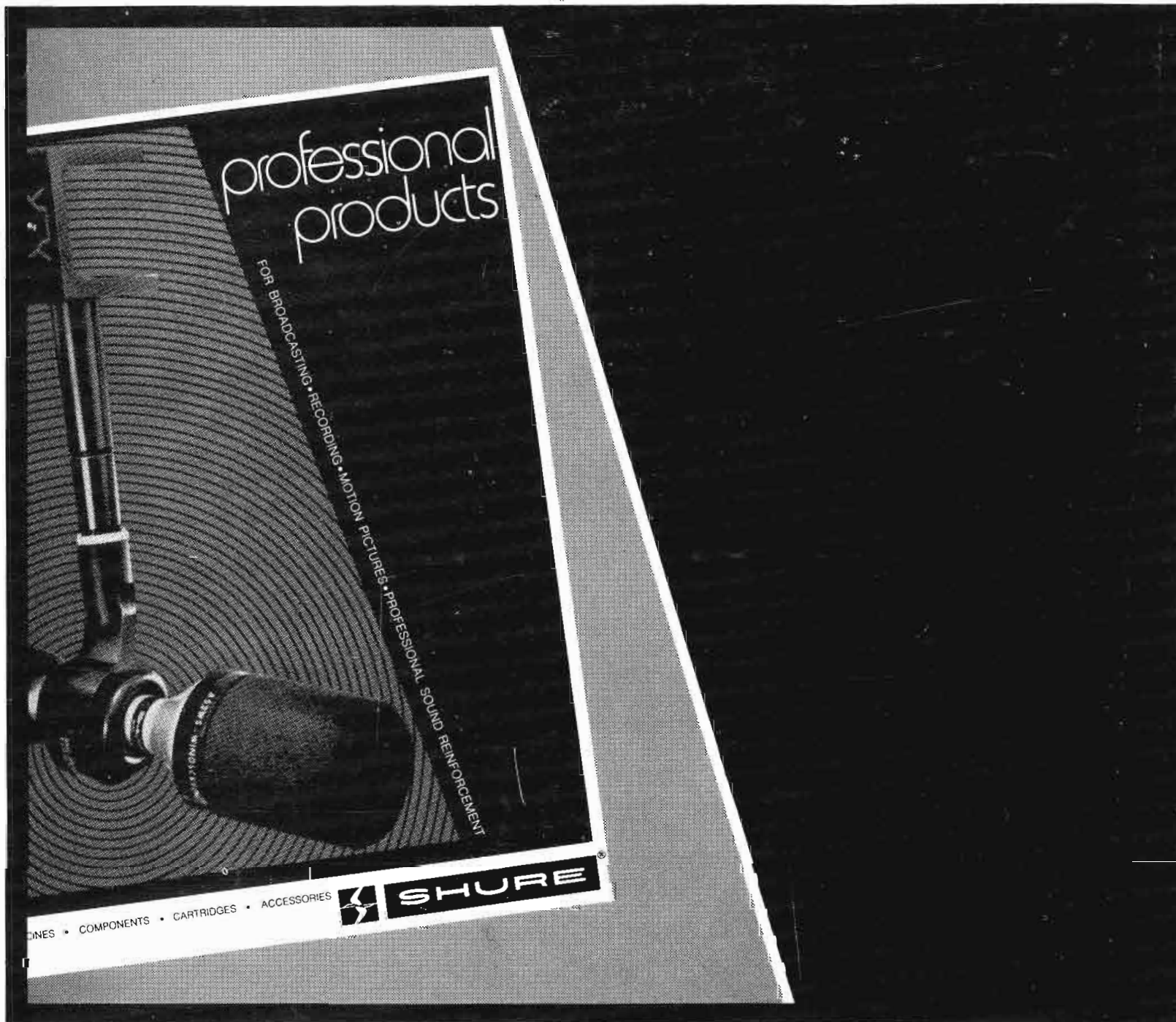
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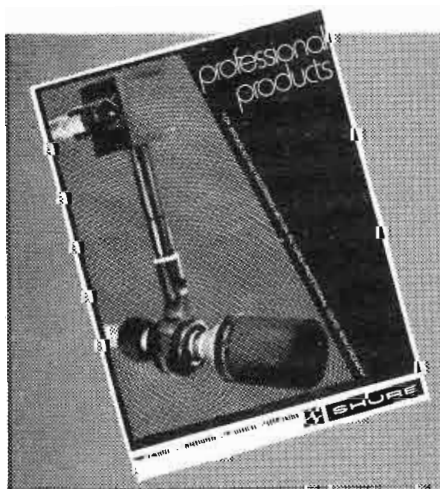
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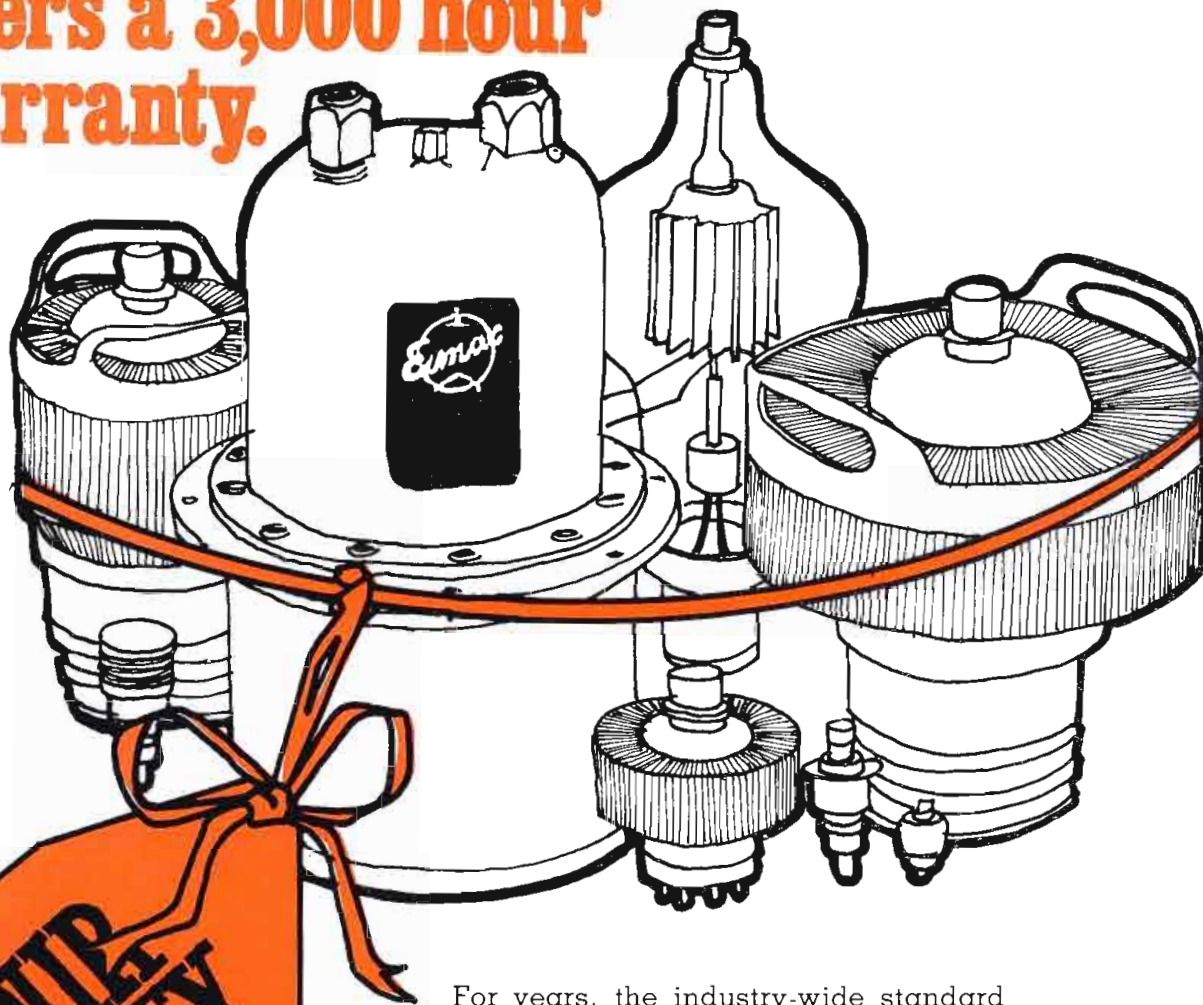
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