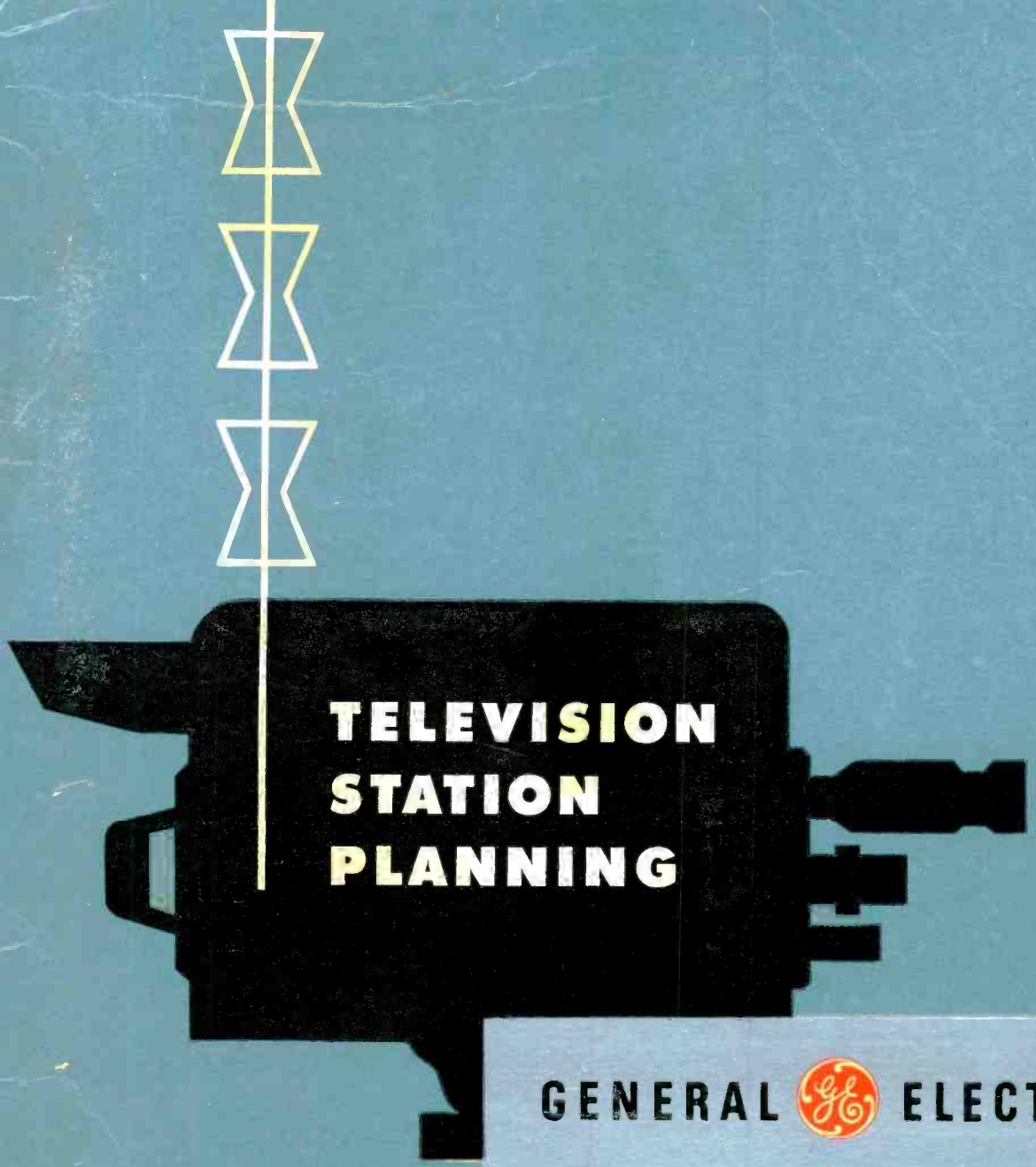


TELEVISION STATION PLANNING

GENERAL ELECTRIC

TELEVISION STATION PLANNING

With television today on the threshold of unprecedented expansion—with UHF and additional VHF channels soon to be claimed by scores of applicants—General Electric's latest television developments deserve your attention. This booklet is concerned with *television systems*, with special attention devoted to discussions of station requirements, basic equipment combinations, and integrated systems.

General Electric's television systems experience spans a quarter century from Dr. E. F. W. Alexanderson's pioneer television transmitter and home receiver first demonstrated on December 16, 1926 to the G-E 12KW UHF Transmitter equipment of today.

A look at some of the G-E *firsts* in television discloses:

First television system—First transmitter, camera, and home receiver employing a mechanical scanning principle pioneered early television development.

First remote pickup—Pioneer G-E equipment at Albany, 15 miles from Schenectady, picked up the image and voice of Governor Alfred E. Smith accepting the Democratic presidential nomination in August 1928.

First transoceanic television—In February 1930 test images were broadcast via the Alexanderson system from studios in Schenectady, N. Y. to station VK2ME in Sydney, Australia. These images were in turn retransmitted from VK2ME and received in Schenectady.

First theater television—In 1930 Dr. Alexanderson produced a picture seven feet square on a screen in the Proctors Theater in Schenectady.

First high power television transmitter (approximately 40KW)—Designed and built by General Electric and operated from the Helderberg Mountains to serve the Albany-Schenectady area.

First visual transmitter for the first commercial television station was built by General Electric for the National Broadcasting Company in New York.

First television network—A G-E receiving and transmitting system was first to relay WNBT telecasts out of New York to the Albany-Schenectady area. First microwave relay system later replaced this early link.

First *high gain* UHF helical antenna—25 to 1 power gain available to broadcasters of the future.

First 12KW UHF Television Transmitter—World's most powerful UHF transmitter.

While this guide has been designed by no means to replace the expert counsel and guidance of your Consulting Engineer, you will find it a handy reference to assist both station managers and engineers in preliminary investigations of their television equipment requirements. General Electric representatives are always happy to provide further information and assistance.

PRICES USED IN THIS GUIDE ARE FOR ESTIMATING PURPOSES ONLY.

GENERAL ELECTRIC

G-E OFFICES ARE AT YOUR SERVICE

For information about either VHF or UHF television equipment call or write to the G-E office nearest you.

ATLANTA 3, GA.
300 Red Rock Bldg.
Cypress 2581

BOSTON 15, MASS.
963 Commonwealth Ave.
Hubbard 2-1800

CHICAGO 54, ILL.
1122 Merchandise Mart
Whitehall 4-3915

CINCINNATI 2, OHIO
215 W. 3rd St.
Parkway 3431

DALLAS 2, TEXAS
901 Ross Ave.
Prospect 4296

HOUSTON, TEXAS
3217 Montrose Ave.
Justin 0657

LOS ANGELES 14, CALIF.
530 West 6th Street
Trinity 3417

NEW YORK 22, N. Y.
570 Lexington Ave.
Plaza 5-1311

PHILADELPHIA 2, PA.
1405 Locust Street
Pennypacker 5-9000

SAN FRANCISCO 6, CAL.
235 Montgomery Street
Douglas 2-3740

ST. LOUIS, MO.
4227 Lindell Blvd.
Lucas 8873

SYRACUSE 2, N. Y.
Onondaga County Savings
Bank
2-3308

WASHINGTON 5, D. C.
777 14th St. N.W.
Executive 3600

Introduction

The purpose of this section is to supply general information on television station planning. Included here are brief discussions of station requirements, basic equipment combinations, and integrated systems.

The material presented will assist in making the best choice of equipment for each installation and is designed to give an over-all awareness of the technical problems involved. More detailed discussions of individual units are given in the equipment sections of this book.

Prices are to be used for estimating purposes only.

GENERAL OUTLINE OF TELEVISION STATION PLANNING SECTION E-202

General

Current station design practice in the industry indicates that there are certain equipment and facility patterns into which the great majority of successful station planning falls. Which pattern will be used is primarily dictated by *network availability*, *population density*, *desired coverage*, *competition from existing stations*, *competition from station which will go on the air in the future*, *available capital for purchase*, *and expansion and ease of operation and maintenance*.

Network availability Has a direct bearing on the system of operation a station will use and, therefore, on the equipment required by the station. Networks may not be available in some sections of the country for several years, and stations so situated will program national shows entirely by kinescope recordings or film. While film facilities are necessary to the network station to produce local revenue and to handle delayed network shows, they are *vital* to the non-network station.

Population density has two important effects on station planning. Because it affects income, it determines return on capital investment, and may make anything but a "bare essentials" installation unreasonable. Low density is also an indication of limited sources of talent for studio programs and remotes, and the purchase of extensive studio equipment may be unwise.

Desired coverage is achieved by choosing the transmitter, antenna, and tower indicated by the surveys conducted by the Consulting Engineer. The value of allowing sufficient leeway in the transmitter building and tower structure for the addition of amplifiers and high-gain antenna systems cannot be overemphasized. A small additional investment at the beginning may eliminate serious or insoluble expansion problems in the future.

Competition from existing stations affects the cost of the system in that the amount of the available audience captured varies with the quality of service rendered. Thus it follows that the facilities purchased should at least be equal to competition.

Competition from stations which will go on the air is exactly the same type of problem, except for the time element. Although a station may conceivably operate on a rudimentary basis while it commands the market, it may be forced to expand somewhat before the second station enters the field.

Available capital for purchase; and expansion is the controlling factor in equipping a station. An inadequately equipped station will fail because it will be unable to provide revenue producing services. An over-equipped station is a similarly poor risk; it will be unable to carry its investment and meet its obligations. There is a *right* equipment list for every station, and taking the steps necessary to provide that list can well determine the success or failure of an operation, especially during the initial development period.

Ease of Operation and Maintenance is the basic factor determining long term operating efficiency and the profit obtainable from operating revenues. Equipment should be selected which fits together properly and provides the smoothest and most versatile performance with the smallest operating staff. The purchase of additional units can sometimes be justified for this reason alone. An adequate maintenance staff and suitable service schedule covering all station equipment will pay off in better performance, lower over-all cost, and less loss of "on-the-air" time.

The following information is presented in three General Groups: The Basic Transmitting System, the Studio System, and the Portable (Remote) Systems.

Basic Transmitting Systems Introduction

The basic transmitting system as defined here, provides all the equipment necessary to switch, monitor, and transmit a television program except the tower and transmission line. It is made up of the transmitter with associated equipment, antenna, diplexer, phasing unit, adapter if required, transmitter, control console, monitoring equipment and accessories. Brief descriptions and applications of these equipments will be covered in five sub sections which will appear in order as:

1. E-202.31—Transmitters & High Power Amplifiers
2. E-202.32—Antennas
3. E-202.33—Antenna-Transmitter Combinations
4. E-202.34—Accessory Equipment
5. E-202.35—Over-all Transmitter Systems

Transmitters and High Power Amplifiers

The television spectrum is covered by three types of transmitters, each of which is particularly adapted for the frequency spectrum segment it serves. The power requirements for these spectra are covered by four transmitters and two high power amplifiers. Complete technical details are given in Section E230, but the tabulation on Chart I will help the reader obtain an over-all understanding of the classification of the various transmitters and amplifiers. The amplifiers are designed to be driven by any standard 5 KW television transmitter.

In many installations, consideration should be given to the possibility of addition of a high power amplifier at a later date. In these cases the transmitter room should be designed large enough to facilitate a later addition of the amplifier cubicles (see Figs. 4 & 5) and an antenna transmission line, and accessories having the power capabilities eventually required should be selected.

The following figures will aid in the layout of the transmitter room.

Figure 1: Installation requirements, diagram for TT-10-A low channel transmitter.

Figure 2: Suggested air duct layout for the TT-6-E high channel transmitter.

Figure 4: Suggested layout of the TF-3-A low channel amplifier.

Figure 5: Suggested layout of the TF-4-A high channel amplifier.

TRANSMITTER CONTROL

Each General Electric transmitter is supplied with a Control Panel. Figure 8 shows a typical transmitter control panel for the television transmitter. Plate On-Off control and required fading and switching facilities for two visual and four aural inputs are provided. A functional line diagram of the Control Panel is given in Figure 8. For "bare essentials" installations, the Control Panel can be used to do all the necessary switching for the station. (See Figure 10 of E202.48.) With the addition of line patching units, additional sources of program material can be handled. The limitations imposed by this kind of operation for anything more than a two-source system, however, make it advisable to recommend more elaborate facilities. Only quick switches and fade-in-fade-outs can be made, and these must be done for both the visual and aural lines since

Chart I

Transmitter Type No.	TT-10-A	Driver TT-10-A or equiv.	TT-6-E	Driver TT-6-E or equiv.	TT-24-A	TT-25-A
Amplifier Type No.		TF-3-A		TF-4-A		
Designation	Low Channel Transmitter	Low Channel Amplifier	High Chan. Transmitter	High Chan. Amplifier	Low Power UHF Trans.	High Power UHF Trans.
Channel	2–6	2–6	7–13	7–13	14–83	14–83
Freq. Range	54 to 88 mc	54 to 88 mc	174 to 216 mc	174 to 216 mc	470 to 890 mc	470 to 890 mc
Visual Power Output	5 KW	35 KW	5 KW	20 KW	100 Watts	12 KW
Aural Power Output	2.5 KW	17.5 KW	2.5 KW	10 KW	50 Watts	6 KW
Output Stage Cooling	Air	Water	Air	Air	Air	Water
Power Input Black Picture	18 KW	Amp. only 120 KW	20.3 KW	Amp. Only 60 KW	3 KW	100 KW

ganged controls are not provided. It must be remembered that the Control Panel is intended to control and feed the Transmitter and is *not* intended to be a program control center.

A third function of the Control Panel is to provide the facility for switching the associated Calibration Monitor to significant check points in the visual section of the transmitter. These points, normally the two line inputs, the modulator input and output, and the demodulator output simplify routine logging and adjustment of levels and provide information on the source of possible abnormal operation.

Since just the control panel alone is supplied with the transmitter, many installations will require additional cabinetry and a monitor in order to "build up" a complete transmitter control console. These additional items are discussed under accessory equipment.

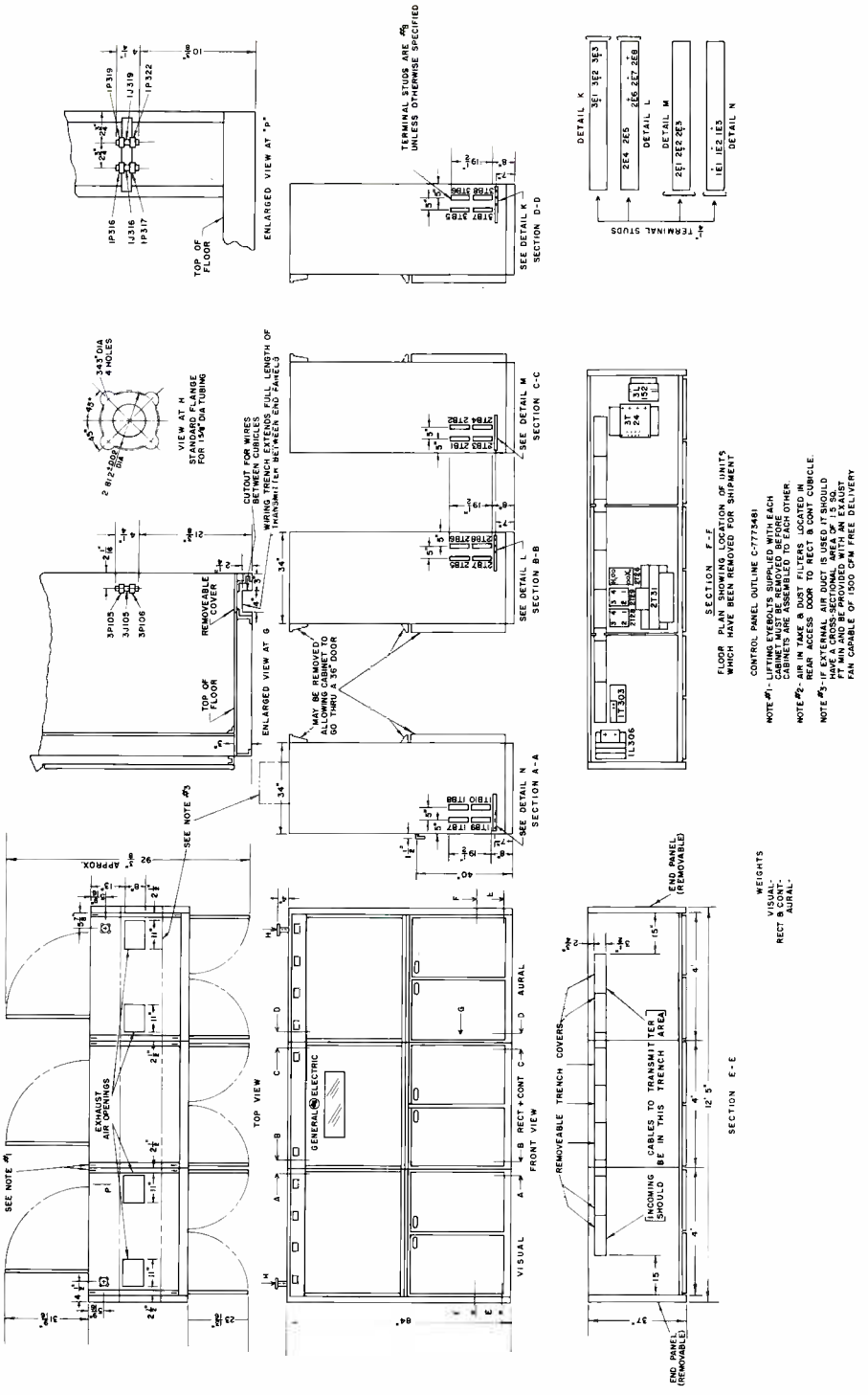


Figure 1

INSTALLATION REQUIREMENTS FOR TT-10-A LOW CHANNEL TRANSMITTER

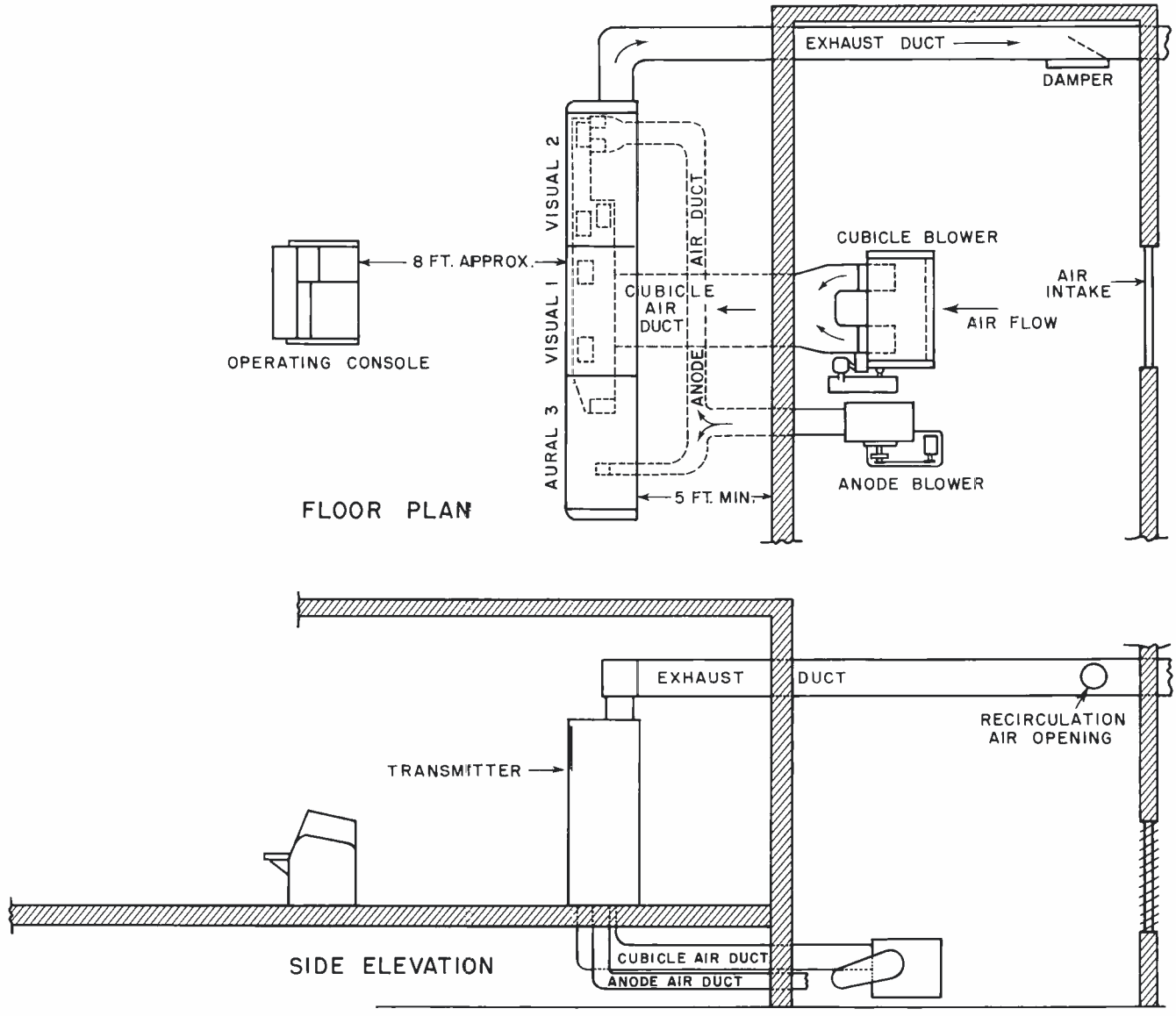


Figure 2

SUGGESTED AIR DUCT LAYOUT FOR THE TT-6-E HIGH CHANNEL TRANSMITTER

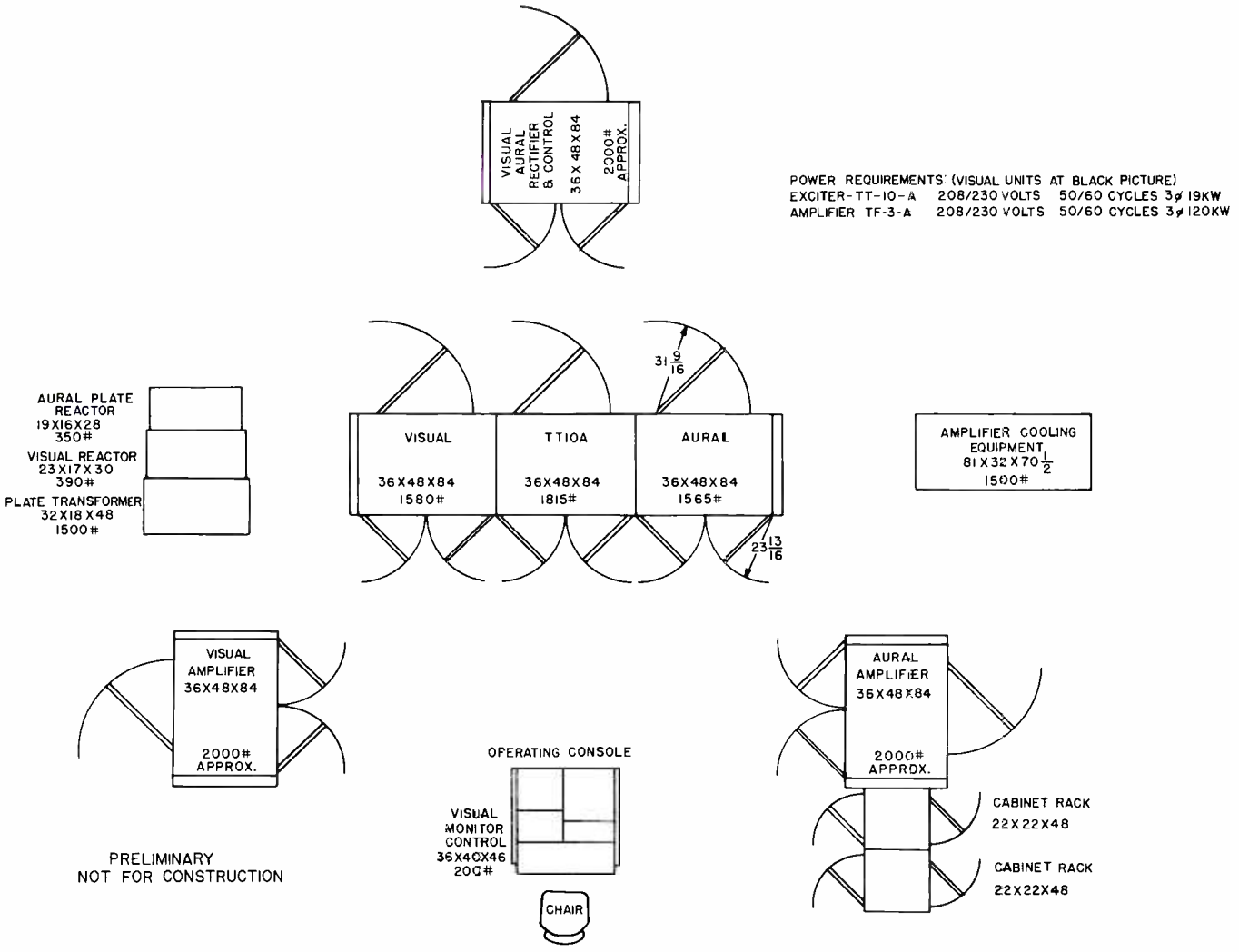


Figure 4

SUGGESTED LAYOUT OF THE TF-3-A LOW CHANNEL 35 KW AMPLIFIER (WITH TYPE TT-10-A 5 KW DRIVER)

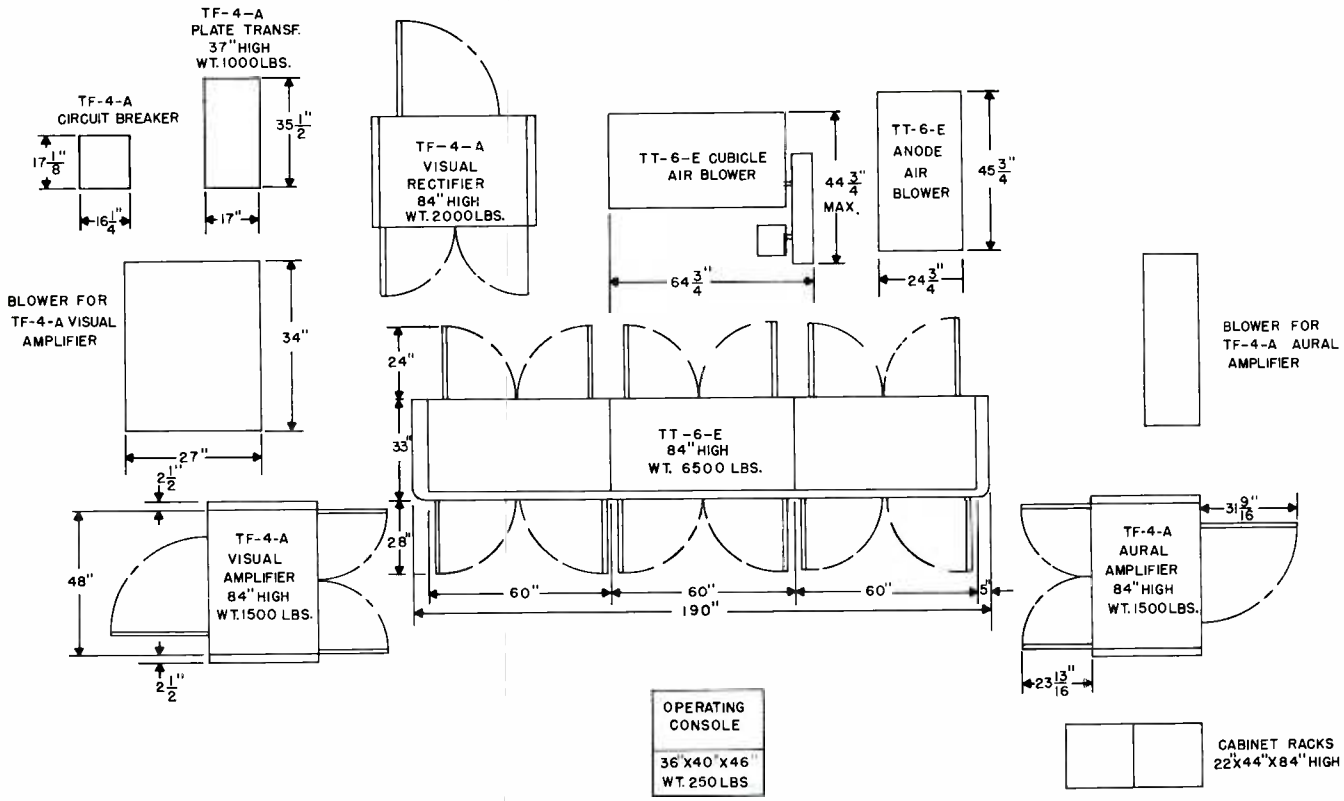
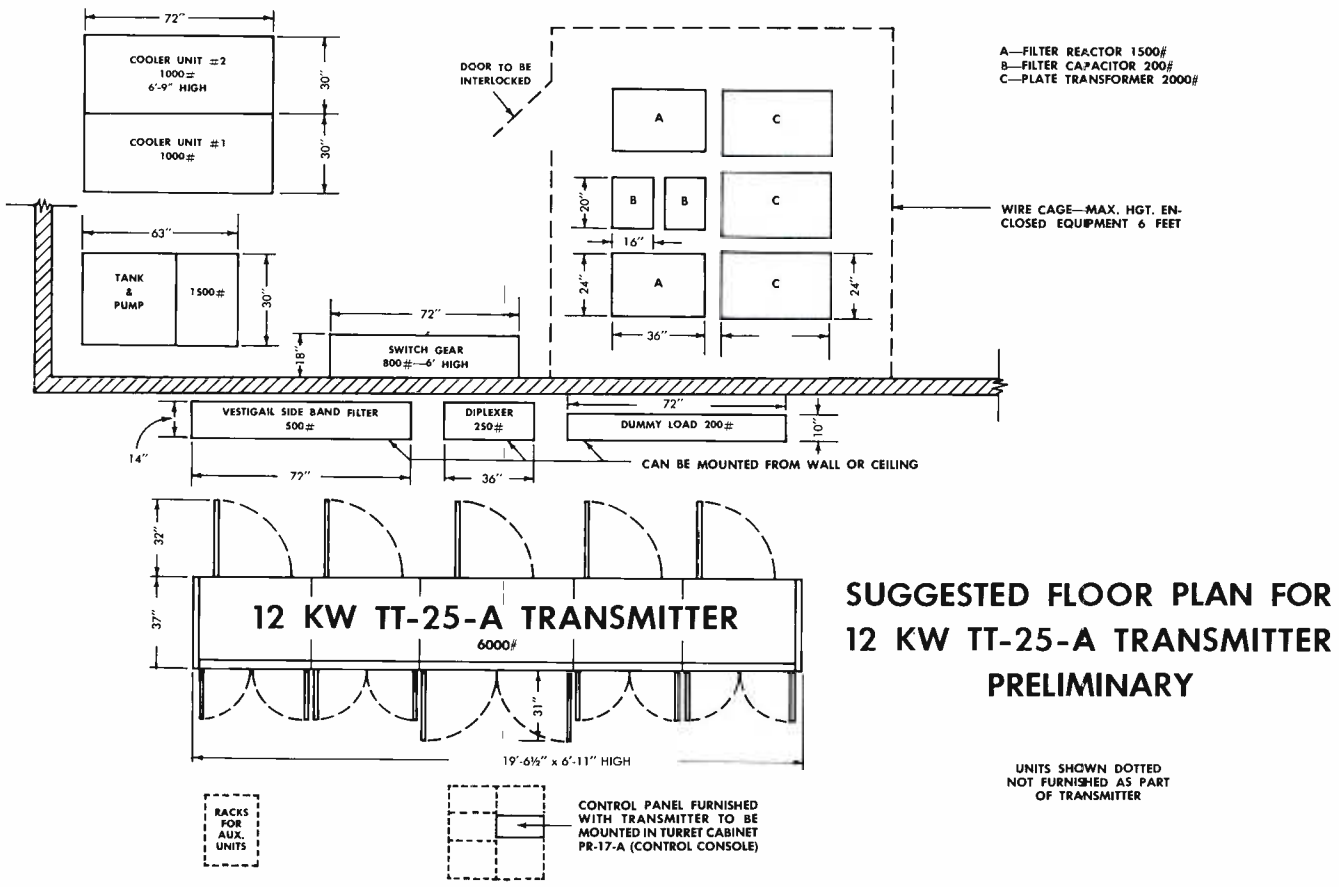


Figure 5

SUGGESTED LAYOUT OF THE TF-4-A HIGH CHANNEL 20 KW AMPLIFIER (WITH TYPE TT-6-E 5 KW DRIVER)



SUGGESTED FLOOR PLAN FOR 12 KW TT-25-A TRANSMITTER PRELIMINARY

UNITS SHOWN DOTTED
NOT FURNISHED AS PART
OF TRANSMITTER

Figure 7

SUGGESTED LAYOUT OF THE TT-25-A UHF 12 KW TRANSMITTER

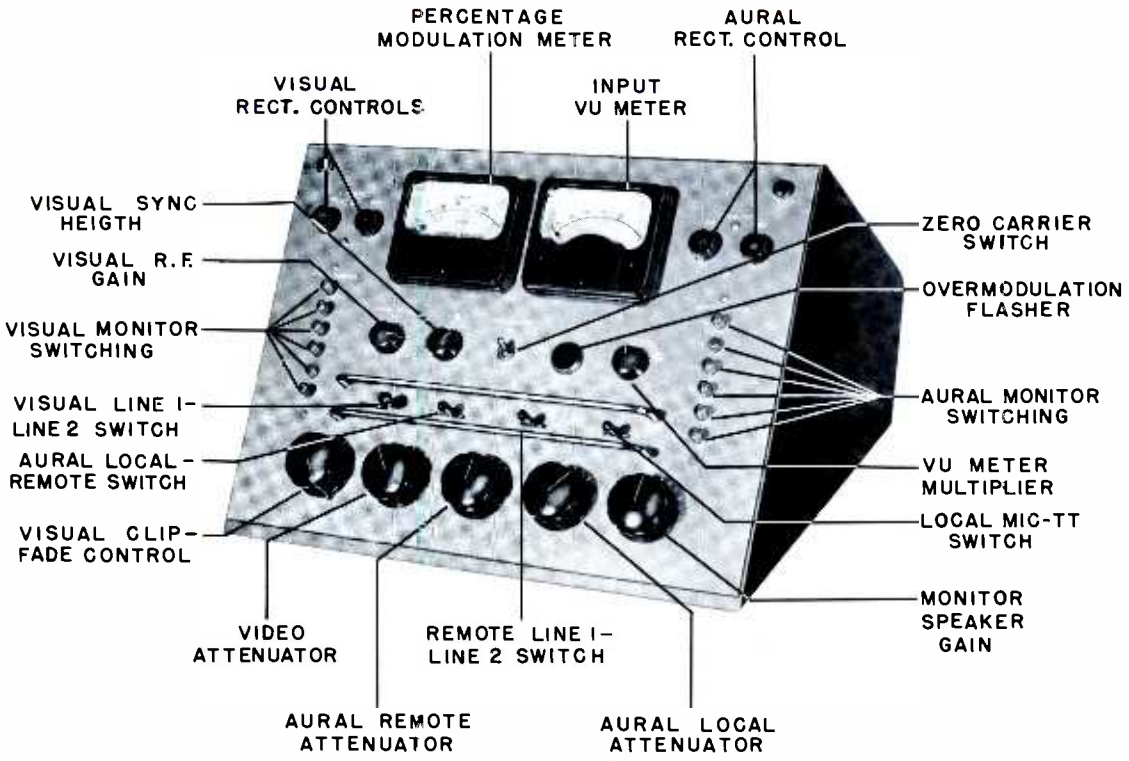


Figure 8a

TRANSMITTER CONTROL PANEL

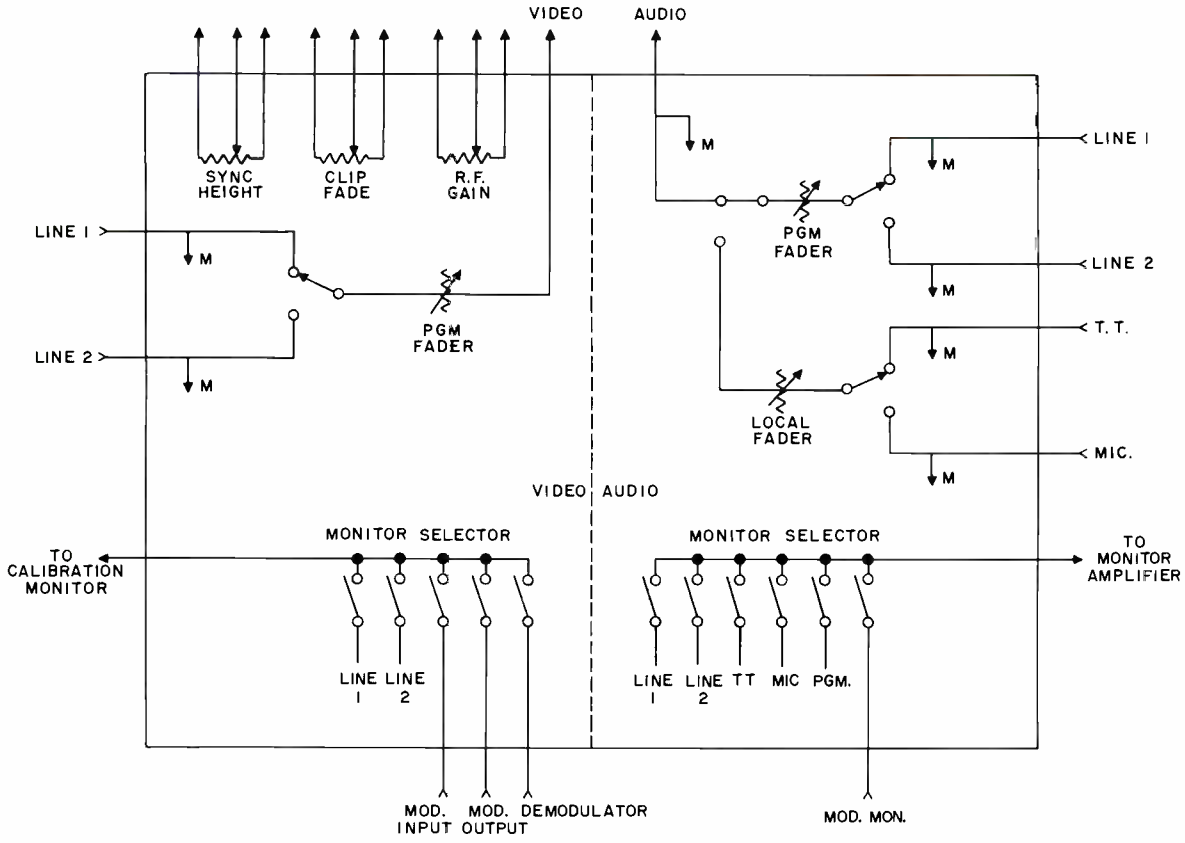


Figure 8b

TRANSMITTER CONTROL PANEL

Antennas and Associated Equipment

VHF ANTENNAS

The proper specification of an antenna for a VHF station is almost wholly an economic one. Although range bears little relation to radiated power at television frequencies, *coverage* is invariably affected. It is important to understand the difference between range and coverage—the difference between providing a good signal at ideal points in the market area and providing a *strong, usable* signal at every point in that area. Increased power may not appreciably extend the signal horizon, but it will greatly improve the service to the fringe of the pattern and to those urban areas which present interference problems.

Stations located in the same city will compete for every receiver in the area, stations in adjacent cities for rural areas that lie between them. Fully as important as program quality is picture quality.

Somewhere along the line of planning the station, the customer, his consulting engineer, and the General Electric Representative must justify the increased cost of high radiated power against the expected increase in receivers served. Consideration of terrain, population distribution, types of buildings in metropolitan areas, etc., is necessary. In addition, the relative advantages of high-gain antennas must be balanced against those of high-power transmitter amplifiers.

Figures 9 and 10 give an over-all picture of the VHF antennas available at the present time.

The high-gain antenna with the low-power transmitter has obvious advantages over the use of the low-gain antenna and high-power transmitter. It is relatively inexpensive in first cost, has no operating cost except for sleet-melters, is comparatively low in maintenance expense, and is rarely a source of outages. The disadvantages of a high-gain antenna, especially on the lower channels, are higher installation cost and increased tower expense to support the weight and shear forces.

In the VHF channels the familiar "batwing" antenna has nearly universal acceptance. The practice has been to recommend three or five bays on Channels 2 through 6 where good coverage can be realized on low power and six or twelve bays on Channels 7 through 13 where higher power is needed to provide adequate coverage.

UHF ANTENNAS

The helical UHF antenna provides high gain with great simplicity. It is sold with the G-E transmitter as part of a complete system but can be recommended advantageously for use with transmitters of other manufacture.

The problem of adequate coverage on UHF channels seems to dictate the recommendation of maximum radiated power in every installation except the most rural. If transmission line loss is adequately low the four-bay antenna with a gain of twenty and the G-E 12KW transmitter approach the 200KW ERP now allowed by the Federal Communications Commission.

The approach outlined for VHF antennas is generally applicable to UHF installation planning, but it should be pointed out to the customer that the difficulty of achieving adequate coverage is increased and that he may expect somewhat higher costs in order to reach his market.

UHF antennas are available from one to five bays. The gain of each bay is 5 for all channels.

ASSOCIATED EQUIPMENT

Dehydrator

The purpose of this unit is to keep the lines pressurized with dry air so as to assure that no moisture will collect. It consists of a compressor and a silica gel chamber. A low pressure, about 3 lbs. per sq. in., is all that is necessary. The size of the unit depends upon the length and diameter of the lines and is usually given in line manufacturers' catalogs.

Deicing Equipment

The VHF equipment consists of calrod heating units inserted in the vertical side of each batwing nearest the mast. There are three sizes and power consumptions used to accommodate the three batwing sizes, these being 750, 500, 250 watts per batwing for the corresponding groups of channels 2–3, 4–6, and 7–13. The elements can be connected so that they may be fed from most of the standard distribution systems. The UHF antenna is heated by passing a heavy current through the helix conductor.

Deicing Control

This unit, by use of two thermo-switches, turns the heating elements on through the icing range of approximately 35° F to 26° F keeping it off for all other temperatures. There are several types depending upon the voltage distribution system used. These are explained in more detail in Section #E240 of this book.

Diplexers

At the present time two types of diplexers are offered for the VHF channels. These are the bridge type which requires two antenna feed lines and the slot type that requires only one antenna feed line and a dual feed adapter. Before choosing the diplexer the relative advantages of each should be weighed. The most important consideration is which one is the best economically. To determine this the graphs on Fig. 11 may be used.

Other items to consider are:

(1) When using a bridge diplexer, two feed lines are needed; thus half the aural and visual power appears in each line. This may mean that a smaller diameter line could be used with a bridge diplexer.

(2) The visual loss in the slot diplexer is about 0.04% while the visual loss in the bridge diplexer is 0.1%.

(3) The aural loss in the bridge diplexer is 0.25% while the aural loss in the slot diplexer is 6.3% channels 2–6 and 8.1% channels 7–13.

(4) The bridge diplexer can be used only with turnstiled antennas while the slot diplexer may be used with single feed directional antennas as well as turnstiled antennas with the addition of an adapter.

(5) If large line is required to reduce attenuation, the reduced wind load on the tower resulting from use of a single line may be an important factor.

Dual to Single Line Adapters

This is essentially an extended "Y" connector, permitting adapting the standard dual-feed antenna to single-feed. A matcher is included in the input line to rematch the paralleled 50-ohm lines to 50 ohms. In normal use a standard 20-foot phasing section must be added between one branch outlet and one antenna input; a standard 20-foot piece of line must be added in the other branch. Variations in spacing of the two antenna lines may be handled by the addition of two 45° swivel elbows in each branch. The input and output of the adapter is 3⅛" flanged 50 ohms.

Phasing Section

A portion of the 20 feet of phaser is an impedance-compensated dielectrically loaded line. The phase shift per unit length in the dielectric section is greater than in the regular air line. By making the loaded section the proper length, the added phase shift over an equal length of air line may be made 90° (or other value if desired). Two sizes of phasing section are made: 1⅝" phaser for low power applications and 3⅛" for high power applications. When a bridge diplexer is used, the phasing section should usually be located close to the transmitter. When a slot diplexer is used, the phasing section is located up next to the antenna just above the dual to single line adapter.

Transmission Line

The four general sizes of transmission lines that are in common use today are 6⅛, 3⅛, 1⅝, and ⅞". The factors that influence the choice are power handling capacity and allowable loss. The larger the line the higher the power rating and lower the loss. Efficiency and power ratings of VHF and UHF lines are given in Figures #12, #13, #14, and #15.

FREQUENCY CHANGES

Antennas:

The VHF-TV antennas are broken into three basic sizes, covering a certain frequency range.

These are:

Channels 2–3

Channels 4–6 incl.

Channels 7–13 incl.

If the frequency change is from one channel range to another, a new antenna is required.

A frequency change remaining within a channel range can be accommodated by rematching the antenna.

The 3-bay low-channel (2–6) antennas contain no special matchers. The only change required is in the bay to mast spacing. This may be done on the tower by installing new spacer plates under the batwing mounting feet.

All other antennas have special matching. A thorough job of rematching requires that the antenna be removed from the tower to permit accurate work to be done by trained personnel. In some cases removal of the antenna may be considered unfeasible or too expensive.

The addition of adjustable slug matchers at the antenna inputs might be considered. The VSWR would be measured at the tower base, and the matchers adjusted by trial and error until acceptable values of VSWR were obtained. The adjustable matchers would then be replaced by fixed matchers having slugs placed at the locations determined by the adjustable matchers.

The minor mismatches occurring in the various branches of the antenna will not deteriorate picture quality because of the short time delays involved.

Another possibility is the addition of a network at the tower top to absorb all reflected power. If the VSWR is initially not too high, especially near the carriers, such an expedient has possibilities.

Accessories:

The phasing section will require modification to give 90° phasing at the new channel. Instructions for doing this are included in the customer's antenna instruction book. In some cases additional phasing material will be required, especially when going from a higher to a lower channel. This material may be ordered from the factory.

The bridge diplexer must be returned to the factory for readjustments or recutting. Modification of the slot type is not too feasible, and a new unit is recommended.

CHANGES TO HIGH POWER

Antennas:

The antenna power ratings are given under the antenna specifications. The ratings are given in terms of peak visual ERP for ready comparison to the FCC's proposed 100 KW low channel and 200 KW high channel ERP.

A new antenna may be the simplest answer in most cases when a higher power-capacity antenna is required, especially if the former antenna can be sold to another station. Alternatively, it may be possible to modify the feed system. Whether to make such modification with the antenna on the tower or on the ground takes careful consideration. Quite often modification on the tower appears attractive economically, but the factors of workmanship under difficult conditions and lack of inspection and test by qualified personnel must be held against modification on the tower.

Accessories:

The diplexer, if the bridge type, may have its rating doubled by the addition of a small 100-CFM blower to provide internal forced-air cooling. If desired, or in the case of new stations, a high-power bridge or slot-type diplexer may or should be used.

The phasing unit may require replacement with a 3-⅛" size.

Type Number	*No. of Bays*	*Channel*	*Average Gain*	*Input Power Rating KW*	*E.R.P. Rating KW*	*Max. E.R.P. Obtainable using 35 KW Amp.*	*Max. E.R.P. Obtainable using 20 KW Amp.*	*Max. E.R.P. Obtainable 5 KW Transmitter*
TY-12-C	3	2–3	3.6	21.5	78	78		18
TY-26-C	3	2–3	3.6 *	50 *	180 *	126 *		18 *
TY-13-C	3	4–6	3.9	19	74	74		19
TY-27-C	3	4–6	3.9 *	45 *	160 *	136 *		19 *
TY-12-E	5	2–3	5.6	25	140	140		28
TY-13-E	5	4–6	5.8	20.5	120	120		29
TY-13-F	6	4–6	6.6	20.5	135	135		33
TY-14-F	6	7–9	6.6	13.4	88		88	33
TY-14-F	6	10–13	7.0	12.6	88		88	35
TY-28-F	6	7–9	6.6 *	46 *	304 *		132 *	33 *
TY-28-F	6	10–13	7.0 *	44 *	308 *		140 *	35 *
TY-14-H	12	7–9	12.5	6.7	84		84	62
TY-28-H	12	7–9	12.5 *	26 *	325 *		250 *	62 *
TY-14-H	12	10–13	13.2	6.3	83		83	66
TY-28-H	12	10–13	13.2 *	24 *	318 *		264 *	66 *

* Tentative data.

Fig. 9. *ANTENNA POWER RATINGS* (Assuming zero transmission line and diplexer loss)

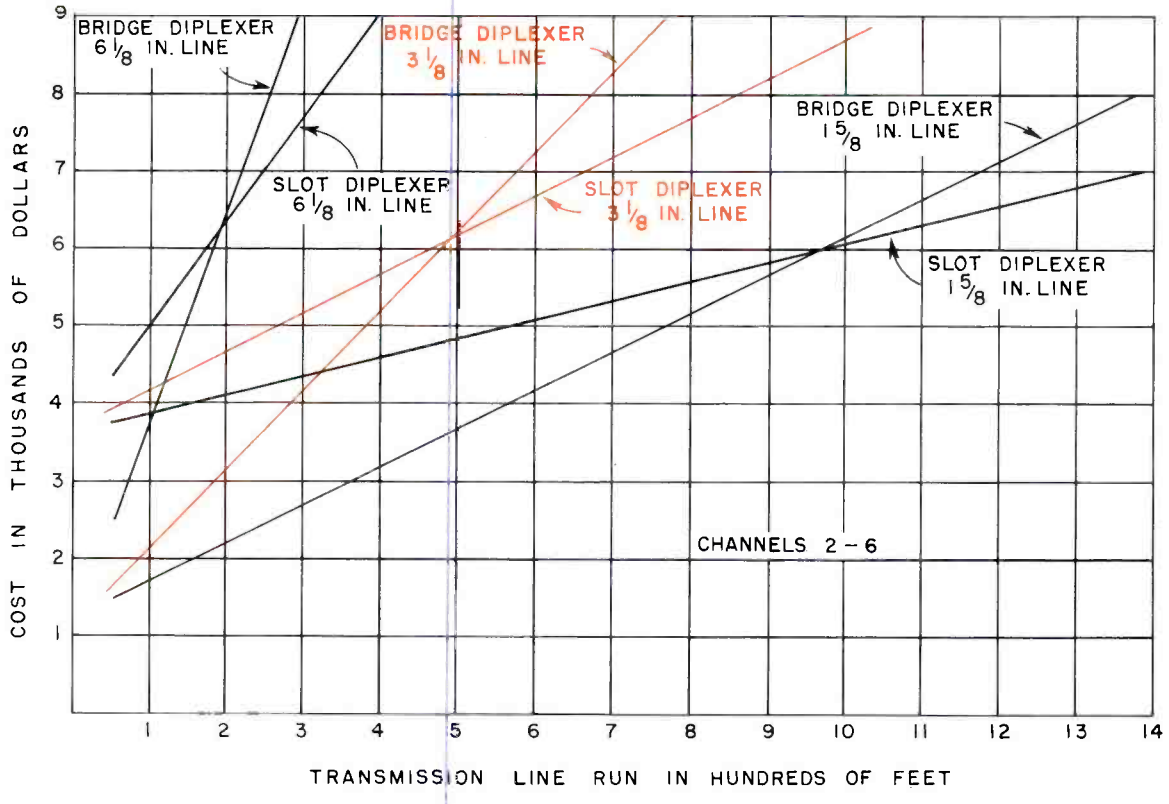
ANTENNA GAINS

Channel	*No. of Bays*	*1*	*2*	*3*	*4*	*5*	*6*	*12*
2				3.4	4.4	5.4	6.3	
3				3.8	4.8	5.9	6.8	
4				3.4	4.3	5.3	6.2	
5				4.0	5.2	6.3	7.3	
6				4.2	5.1	6.2	7.1	
7				3.4			6.4	12.1
8				3.6			6.6	12.5
9				3.7			6.8	12.8
10				3.9			6.9	13.0
11				3.9			7.0	13.2
12				3.9			7.1	13.3
13				3.9			7.2	13.3
14–83		5	10	15	20	25		

Diplexers

Type	*Des.*	*VSWR Aural*	*Visual*	*Chan. 2–6 Rating KW*	*Chan. 7–13 Rating KW*	*Loss*	
						Aural	*Visual*
PY-16-A/B/C	Bridge	1.2	1.1	50	50	.25%	.1%
PY-14/15-A	Slot	1.25	1.1 to 3.5 mc 1.25 at 4 mc	40	20 or 50	6.3% 2–6 8.1% 7–13	0.04%

Fig. 10



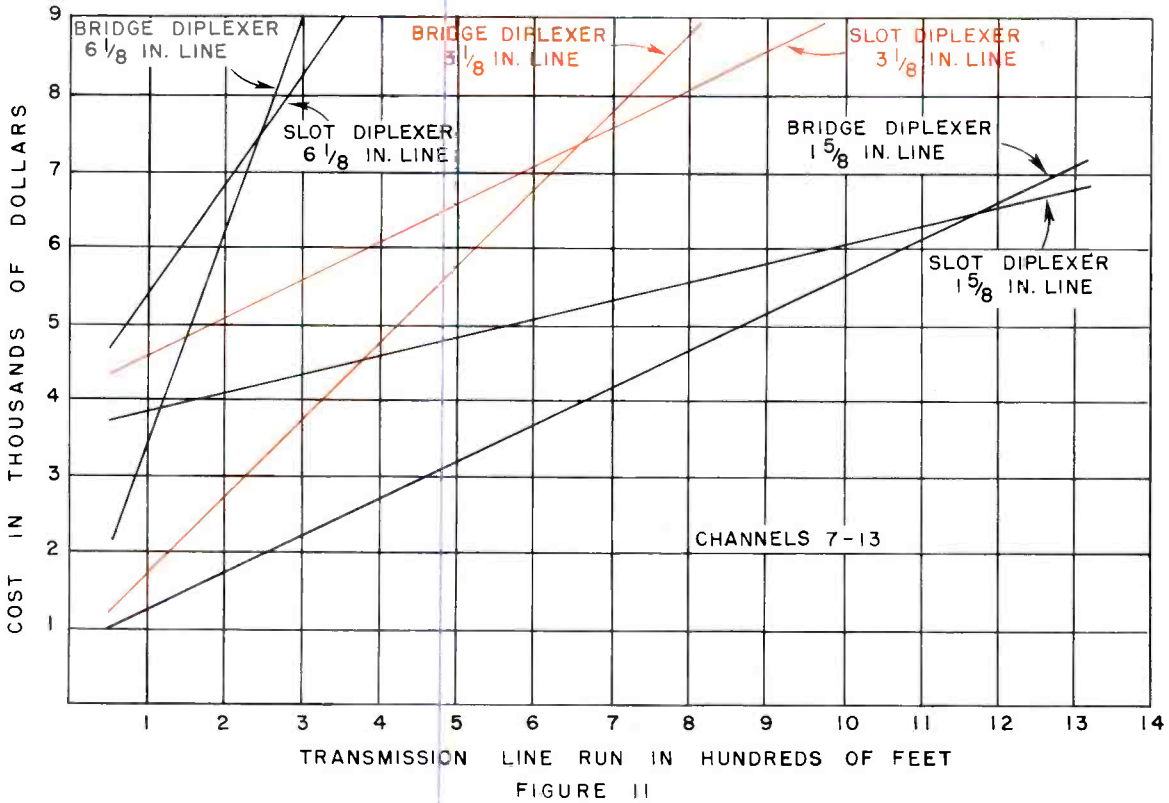


FIGURE 11

COST OF SLOT DIPLEXER WITH ADAPTOR AND SINGLE TRANSMISSION LINE OR COST OF BRIDGE DIPLEXER AND DUAL TRANSMISSION LINE VERSUS LENGTH OF TRANSMISSION LINE RUN

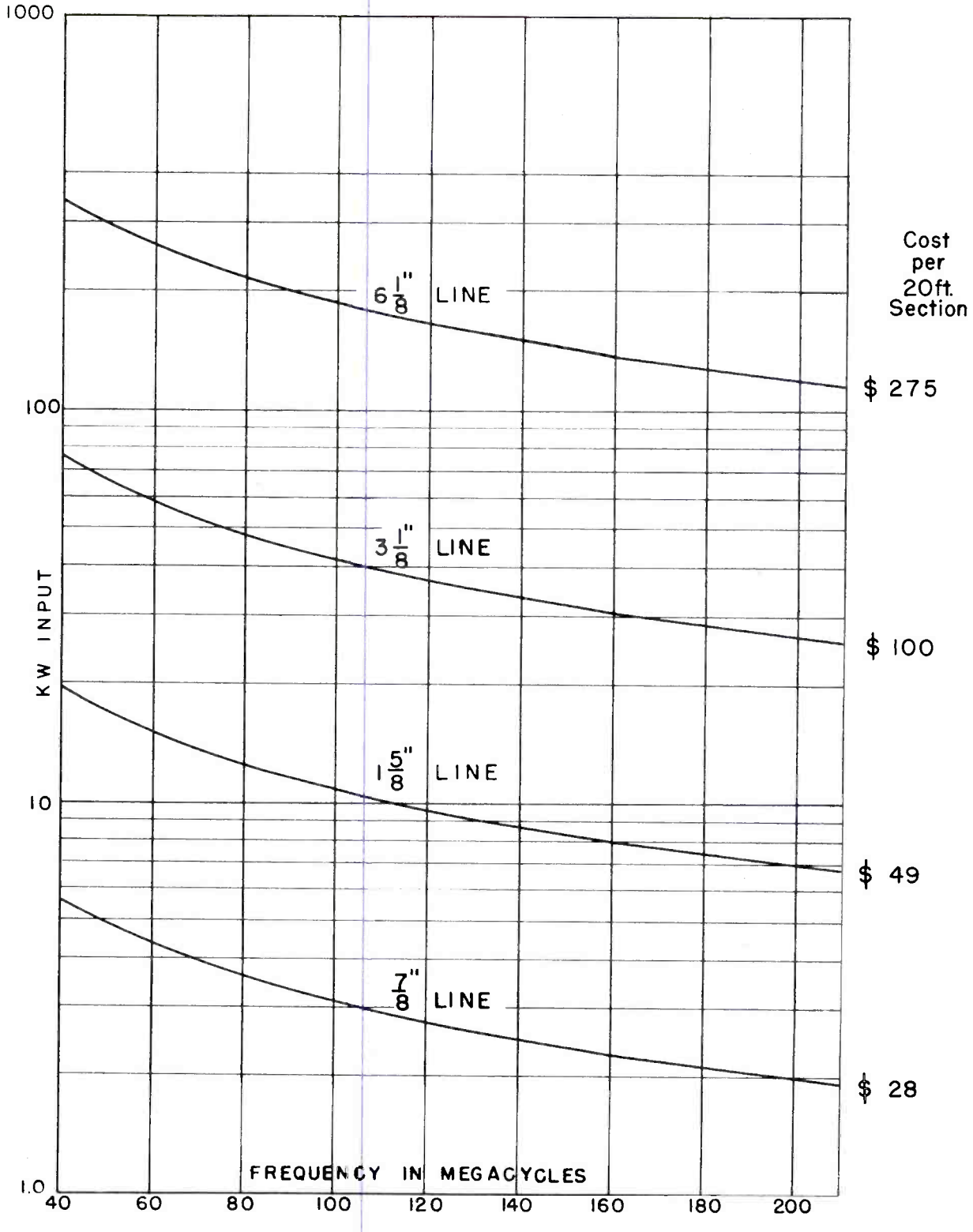


Figure 12

V.H.F. POWER RATING RMA STANDARD 51½ OHM COAXIAL TRANSMISSION LINE (ALSIMAG BEADS)

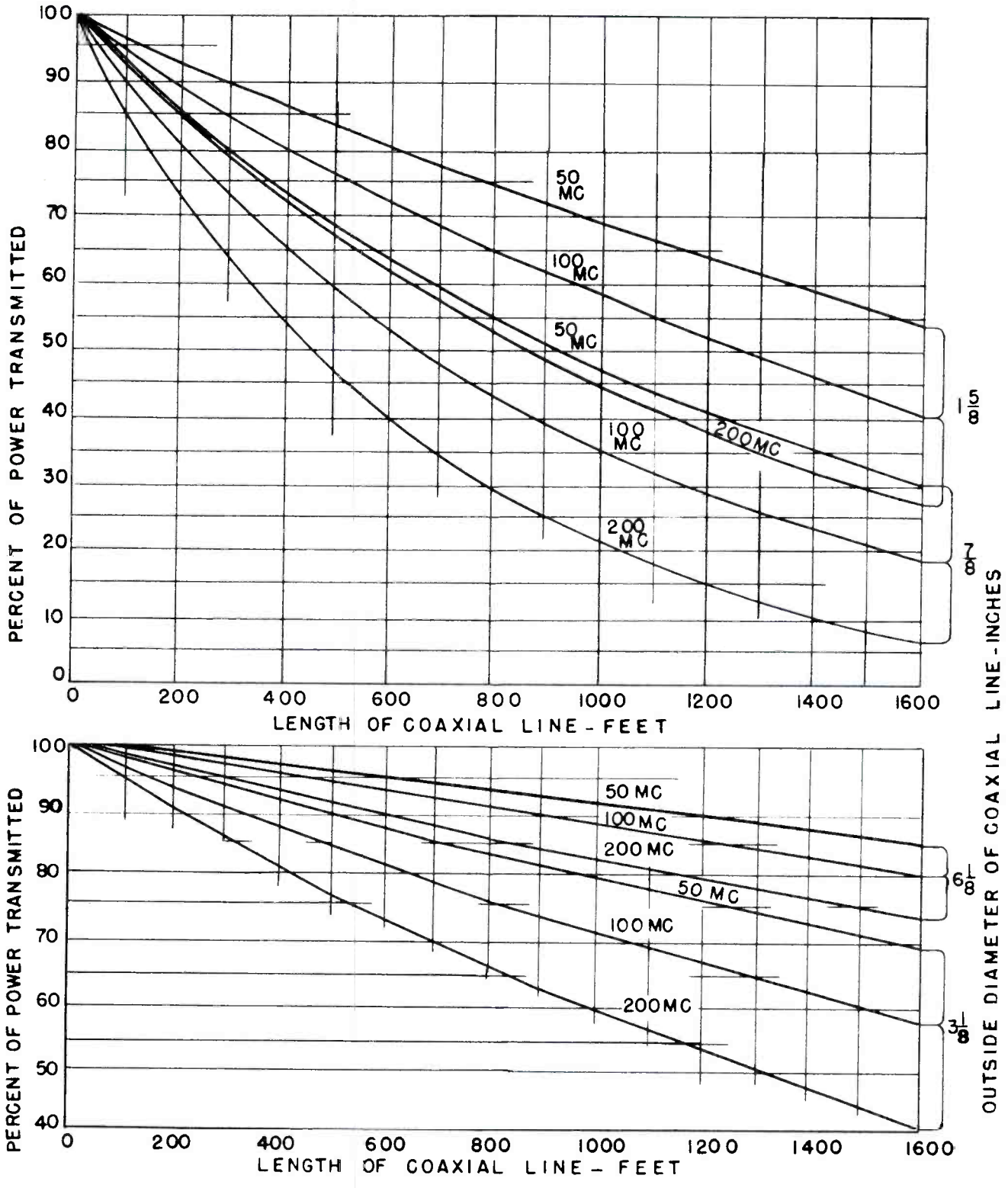


Figure 13

VHF TRANSMISSION LINE EFFICIENCY

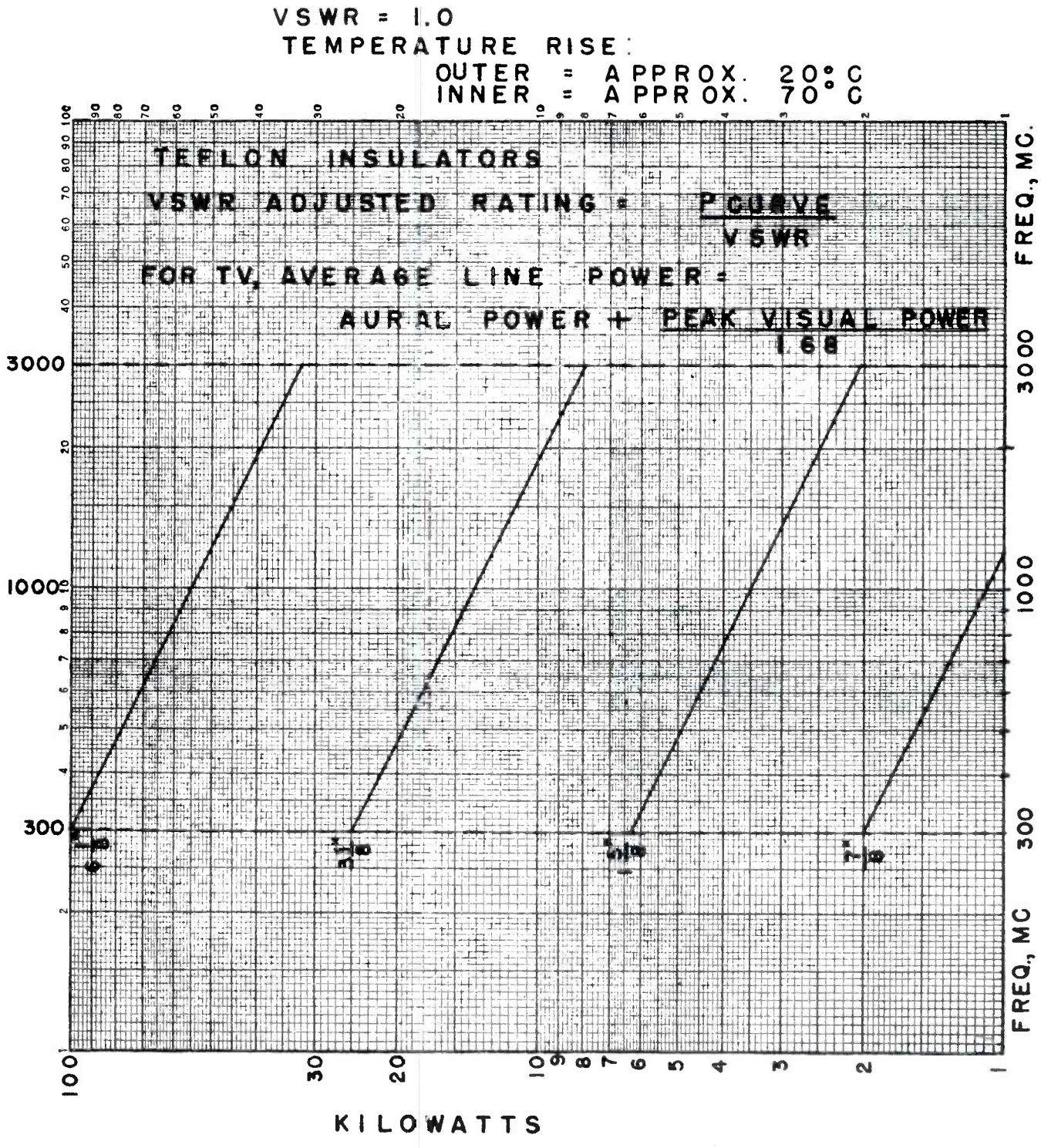


Figure 14

APPROXIMATE UHF POWER RATING NOMINAL 50 OHM AIR-DIELECTRIC COAXIAL TRANSMISSION LINE

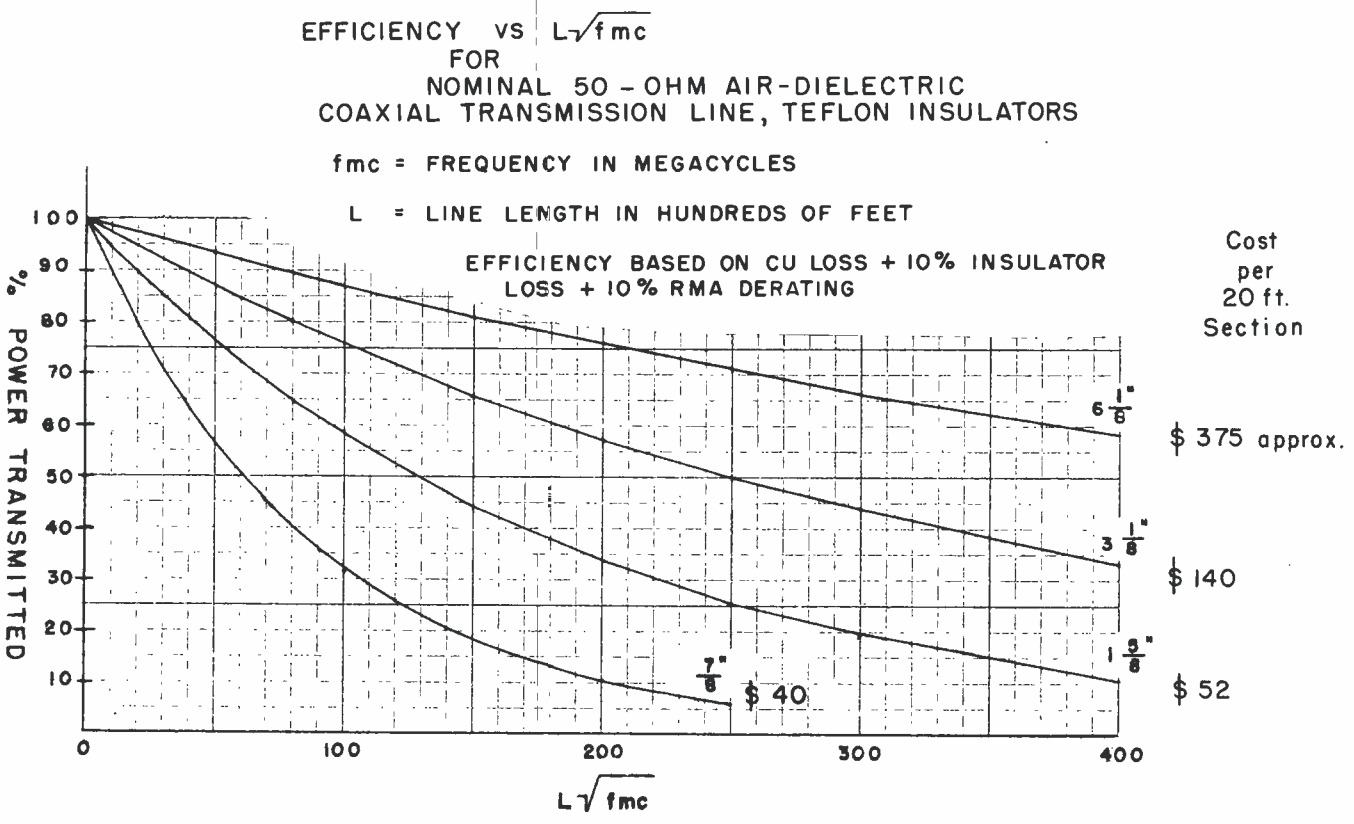
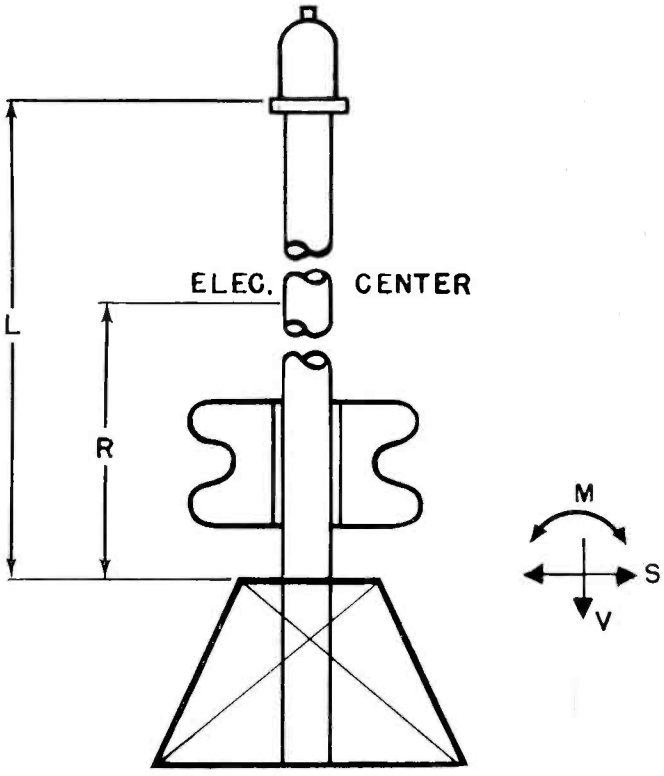


Figure 15
UHF LINE EFFICIENCY

Section E202.32-9
Broadcast Equipment Data Book
April 1, 1952

ANTENNA SPECIFICATION SUMMARY

BAT WING TYPE TV ANTENNAS



Note: Antennas are designed to withstand 50 lbs. per sq. ft. wind pressure with wind blowing at 45° angle to all radiators.

Loads indicated in the table are for 30 lbs. per sq. ft. wind pressure with shape factor included, since most towers are designed for this pressure.

50 lbs. per sq. ft. (150 mph)
30 lbs. per sq. ft. (115 mph)

KEY TO SYMBOLS

M—Moment in foot-lbs. at tower top or base

S—Shear in lbs. above tower top or base.

V—Max. vertical load in lbs. including everything furnished for a complete antenna.

P—Max. power input in kw. Peak visual power—for total average, multiply by 1.1

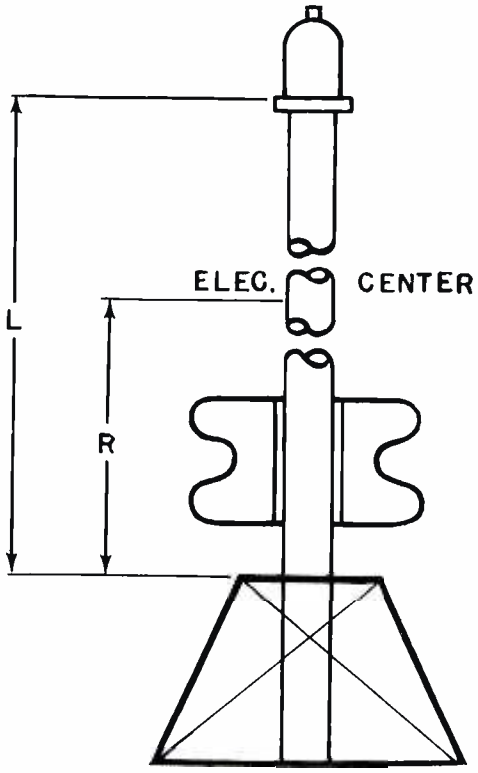
FSF—Free space field in millivolts per meter at one mile for 1 kw input

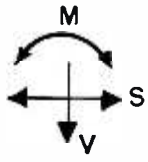
Important: for VHF antennas of six or more bays, it is important that tower deflection be held to a minimum of 1° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. per sq. ft. wind loading.

Table 1A Bat Wing Antennas

Channel	Freq. Range Mc	Type No.	P	Gain	FSF	M	S	V	R	L
					3 BAY					
2	54—60	TY-26-C	50	3.4	250	42200	1870	4600	25.00	49.00
3	60—66	TY-26-C	50	3.8	270	42200	1870	4600	25.00	49.00
4	66—72	TY-27-C	45	3.4	250	26900	1390	3500	20.33	40.00
5	76—82	TY-27-C	45	4.0	270	↓	↓	↓	↓	↓
6	82—88	TY-27-C	45	4.2	280	↓	↓	↓	↓	↓
7	174—180	TY-14-C		3.4	250	5400	515	1000	10.00	19.00
8	180—186	↓		3.6	260	↓	↓	↓	↓	↓
9	186—192	↓		3.7	260	↓	↓	↓	↓	↓
10	192—198	↓		3.9	270	↓	↓	↓	↓	↓
11	198—204	↓		3.9	270	↓	↓	↓	↓	↓
12	204—210	↓		3.9	270	↓	↓	↓	↓	↓
13	210—216	↓		3.7	270	↓	↓	↓	↓	↓
					4 BAY					
2	54—60	TY-12-D		4.4	290	68150	2200	9000	33.92	67.00
3	60—66	TY-12-D		4.8	300	68150	2200	9000	33.92	67.00
4	66—72	TY-13-D	20	4.3	380	49920	1992	4550	27.80	55.00
5	76—82	TY-13-D	20	5.2	310	↓	↓	↓	↓	↓
6	82—88	TY-13-D	20	5.1	310	↓	↓	↓	↓	↓
					5 BAY					
2	54—60	TY-12-E	25	5.4	320	120650	3260	11500	42.75	84.00
3	60—66	TY-12-E	25	5.9	340	120650	3260	11500	42.75	84.00
4	66—72	TY-13-E	20.5	5.3	320	79200	2560	8250	34.83	69.00
5	76—82	TY-13-E	20.5	6.3	340	↓	↓	↓	↓	↓
6	82—88	TY-13-E	20.5	6.2	340	↓	↓	↓	↓	↓

BAT WING TYPE TV ANTENNAS





KEY TO SYMBOLS

M—Moment in foot-lbs. at tower top or base

S—Shear in lbs. above tower top or base.

V—Max. vertical load in lbs. including everything furnished for a complete antenna.

P—Max. power input in kw. Peak visual power—for total average, multiply by 1.1

FSF—Free space field in millivolts per meter at one mile for 1 kw input

Note: Antennas are designed to withstand 50 lbs. per sq. ft. wind pressure with wind blowing at 45° angle to all radiators.

Loads indicated in the table are for 30 lbs. per sq. ft. wind pressure with shape factor included, since most towers are designed for this pressure.

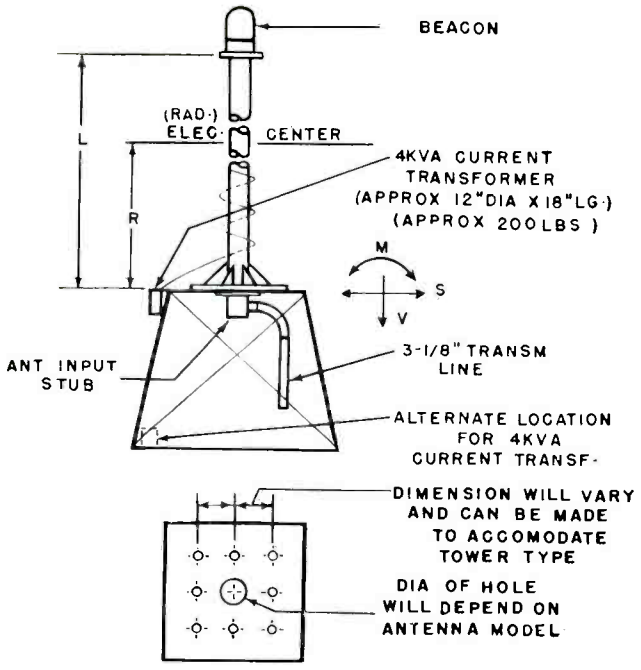
50 lbs. per sq. ft. (150 mph)
30 lbs. per sq. ft. (115 mph)

Important: for VHF antennas of six or more bays, it is important that tower deflection be held to a minimum of 1° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. per sq. ft. wind loading.

Table 1B Bat Wing Antennas

Channel	Freq. Range Mc	Type No.	P	Gain	FSF	M	S	V	R	L
				6 BAY						
2	54—60	TY-12-F		6.3	340	187300	4100	18000	51.21	100.00
3	60—66	TY-12-F		6.8	350	187300	4100	18000	51.21	100.00
4	66—72	TY-27-F	35	6.2	340	122600	3400	10500	41.88	83.00
5	76— 82	↓	35	7.3	370	↓	↓	↓	↓	↓
6	82—88	↓	35	7.1	370	↓	↓	↓	↓	↓
7	174—180	TY-28-F	46	6.4	350	22400	1300	2650	19.03	37.00
8	180—186	↓	46	6.6	350	↓	↓	↓	↓	↓
9	186—192	↓	46	6.8	360	↓	↓	↓	↓	↓
10	192—198	↓	44	6.9	360	↓	↓	↓	↓	↓
11	198—204	↓	44	7.0	360	↓	↓	↓	↓	↓
12	204—210	↓	44	7.1	370	↓	↓	↓	↓	↓
13	210—216	↓	44	7.2	370	↓	↓	↓	↓	↓
				12 BAY						
7	174—180	TY-28-H	26	12.1	470	90830	2864	8500	37.67	74.00
8	180—186	↓	26	12.5	480	↓	↓	↓	↓	↓
9	186—192	↓	26	12.8	490	↓	↓	↓	↓	↓
10	192—198	↓	24	13.0	490	↓	↓	↓	↓	↓
11	198—204	↓	24	13.2	500	↓	↓	↓	↓	↓
12	204—210	↓	24	13.3	500	↓	↓	↓	↓	↓
13	210—216	↓	24	13.3	500	↓	↓	↓	↓	↓

HELICAL TV ANTENNAS



PLAN OF TOWER TOP

Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S—Shear in lbs.
V—Vertical load in lbs.
G—Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

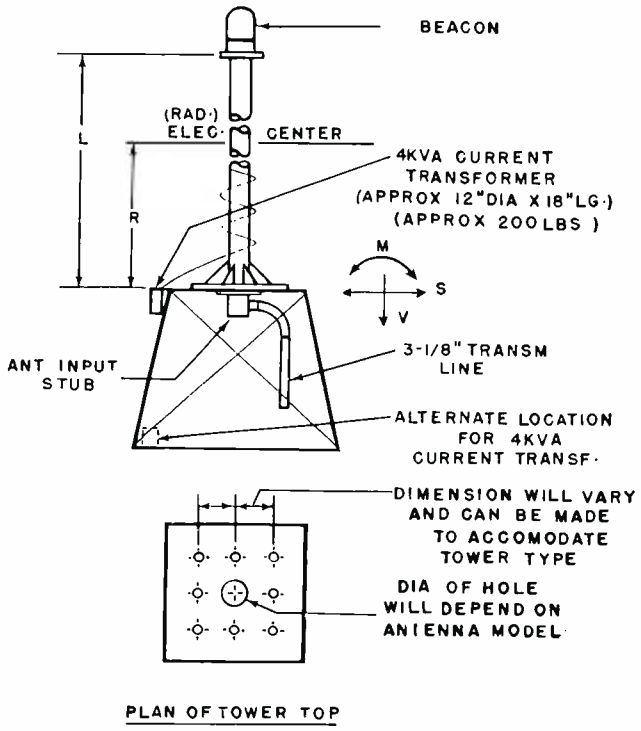
Table 2A Helical Antennas

One Bay

POWER GAIN = 5.0 for channels 14–83.
FREE SPACE FIELD = 308 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
7	174—180								
8	180—186								
9	186—192								
10	192—198								
11	198—204								
12	204—210								
13	210—216								
14	470—476	TY-21-A		2070	270	1400	6.43	12.40	10¾ x ½
15	476—482	TY-21-A		2070	270	1400	6.34	12.12	↓
16	482—488	TY-21-A		2070	270	1400	6.25	12.05	↓
17	488—494	TY-21-B		1850	255	1220	6.18	11.91	10 x ½
18	494—500	↓		↓	↓	↓	6.12	11.80	↓
19	500—506	↓		↓	↓	↓	6.07	11.69	↓
20	506—512	↓		↓	↓	↓	6.01	11.58	↓
21	512—518	↓		↓	↓	↓	5.96	11.46	↓
22	518—524	↓		↓	↓	↓	5.90	11.35	↓
23	524—530	↓		↓	↓	↓	5.85	11.24	↓
24	530—536	↓		↓	↓	↓	5.79	11.13	↓
25	536—542	TY-21-C		1640	210	1090	5.74	11.03	8⅝ x ½
26	542—548	↓		↓	↓	↓	5.69	10.94	↓
27	548—554	↓		↓	↓	↓	5.65	10.85	↓
28	554—560	↓		↓	↓	↓	5.60	10.76	↓
29	560—566	↓		↓	↓	↓	5.56	10.66	↓
30	566—572	↓		↓	↓	↓	5.51	10.57	↓
31	572—578	↓		↓	↓	↓	5.47	10.48	↓
32	578—584	↓		↓	↓	↓	5.42	10.39	↓
33	584—590	TY-21-D		1260	200	956	5.17	10.02	7¾ x ½
34	590—596	↓		↓	↓	↓	5.13	9.94	↓
35	596—602	↓		↓	↓	↓	5.09	9.86	↓
36	602—608	↓		↓	↓	↓	5.05	9.78	↓
37	608—614	↓		↓	↓	↓	5.01	9.70	↓
38	614—620	↓		↓	↓	↓	4.98	9.62	↓
39	620—626	↓		↓	↓	↓	4.94	9.54	↓
40	626—632	↓		↓	↓	↓	4.90	9.46	↓
41	632—638	↓		↓	↓	↓	4.86	9.38	↓
42	638—644	↓		↓	↓	↓	4.82	9.30	↓
43	644—650	↓		↓	↓	↓	4.78	9.22	↓
44	650—656	TY-21-E		940	160	770	4.75	9.17	6⅝ x .432
45	656—662	↓		↓	↓	↓	4.72	9.11	↓
46	662—668	↓		↓	↓	↓	4.69	9.05	↓
47	668—674	↓		↓	↓	↓	4.66	8.98	↓
48	674—680	↓		↓	↓	↓	4.63	8.92	↓

HELICAL TV ANTENNAS



PLAN OF TOWER TOP

Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S Shear in lbs.
V—Vertical load in lbs.
G—Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

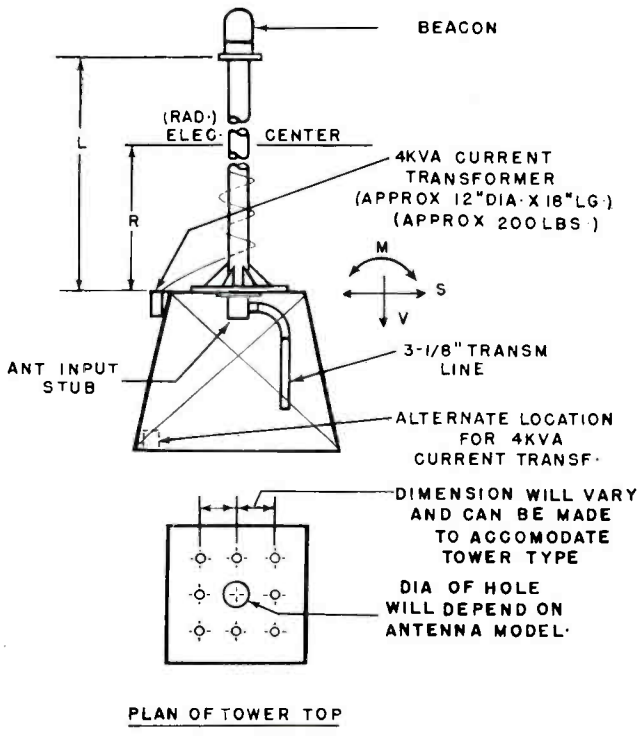
Table 2A Helical Antennas (Cont.)

One Bay

POWER GAIN = 5.0 for channels 14–83.
FREE SPACE FIELD = 308 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
49	680—686	TY-21-E		940	160	770	4.60	8.86	6⅝ x .432
50	686—692						4.57	8.80	
51	692—698						4.53	8.73	
52	698—704						4.50	8.67	
53	704—710						4.47	8.61	
54	710—716						4.44	8.55	
55	716—722						4.41	8.48	
56	722—728	↓		↓	↓	↓	4.38	8.42	↓
57	728—734	TY-21-F		700	130	635	4.10	8.20	5 9/16 x .375
58	734—740						4.08	8.15	
59	740—746						4.05	8.10	
60	746—752						4.02	8.05	
61	752—758						4.00	8.00	
62	758—764						3.97	7.95	
63	764—770						3.95	7.90	
64	770—776						3.92	7.85	
65	776—782						3.90	7.80	
66	782—788						3.87	7.75	
67	788—794						3.85	7.70	
68	794—800	↓		↓	↓	↓	3.82	7.65	↓
69	800—806	TY-21-H		600	120	585	3.81	7.62	5 x .375
70	806—812						3.79	7.58	
71	812—818						3.77	7.54	
72	818—824						3.75	7.50	
73	824—830						3.73	7.45	
74	830—836						3.71	7.41	
75	836—842						3.69	7.37	
76	842—848						3.67	7.33	
77	848—854						3.64	7.29	
78	854—860						3.62	7.25	
79	860—866						3.60	7.21	
80	866—872						3.58	7.16	
81	872—878						3.56	7.12	
82	878—884						3.56	7.08	
83	884—890	↓		↓	↓	↓	3.52	7.04	↓

HELICAL TV ANTENNAS



Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S—Shear in lbs.
V—Vertical load in lbs.
G—Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

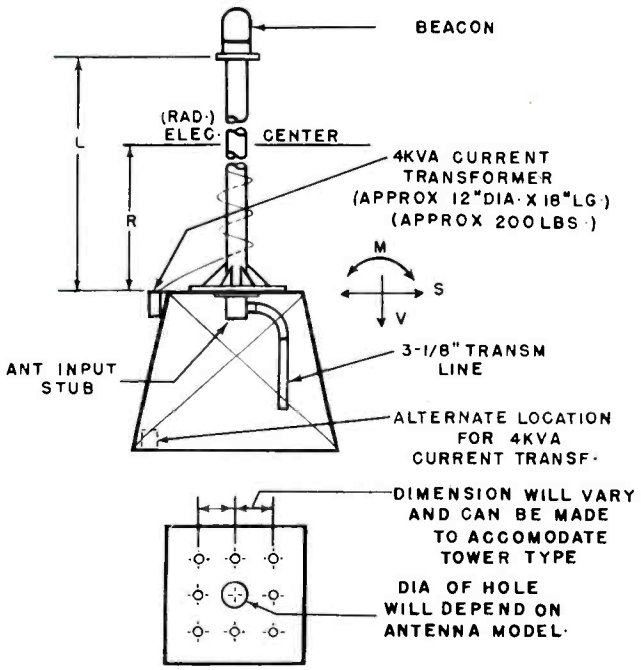
Table 2B Helical Antennas

Two Bay

POWER GAIN = 10.0 for channels 14–83
FREE SPACE FIELD = 435 millivolts per meter at one mile for 1 kw input channels 14–83

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
7	174—180								
8	180—186								
9	186—192								
10	192—198								
11	198—204								
12	204—210								
13	210—216								
14	470—476	TY-22-A		6180	485	2220	11.65	22.85	10¾ x ½
15	476—482	TY-22-A		6180	485	2220	11.48	22.30	↓
16	482—488	TY-22-A		6180	485	2220	11.30	22.15	
17	488—494	TY-22-B		5500	450	1950	11.16	21.87	
18	494—500	↓		↓	↓	↓	11.05	21.65	
19	500—506						10.94	21.43	
20	506—512						10.83	21.20	
21	512—518						10.71	20.98	
22	518—524						10.60	20.76	
23	524—530						10.49	20.53	
24	530—536	↓		↓	↓	↓	10.38	20.31	↓
25	536—542	TY-22-C		4150	365	1772	10.28	20.11	8⅜ x ½
26	542—548						10.19	19.93	
27	548—554						10.10	19.74	
28	554—560						10.01	19.56	
29	560—566						9.91	19.38	
30	566—572						9.82	19.20	
31	572—578						9.73	19.01	
32	578—584	↓		↓	↓	↓	9.64	18.83	↓
33	584—590	TY-22-D		3520	335	1450	9.35	18.37	7¾ x ½
34	590—596						9.27	18.21	
35	596—602						9.19	18.05	
36	602—608						9.11	17.89	
37	608—614						9.03	17.73	
38	614—620						8.95	17.57	
39	620—626						8.87	17.41	
40	626—632						8.79	17.25	
41	632—638						8.71	17.09	
42	638—644						8.63	16.93	
43	644—650	↓		↓	↓	↓	8.55	16.77	↓
44	650—656	TY-22-E		2500	260	1180	8.50	16.67	6⅝ x .432
45	656—662						8.44	16.55	
46	662—668						8.38	16.42	
47	668—674						8.31	16.30	
48	674—680	↓		↓	↓	↓	8.25	16.17	↓

HELICAL TV ANTENNAS



PLAN OF TOWER TOP

Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S—Shear in lbs.
V—Vertical load in lbs.
G—Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

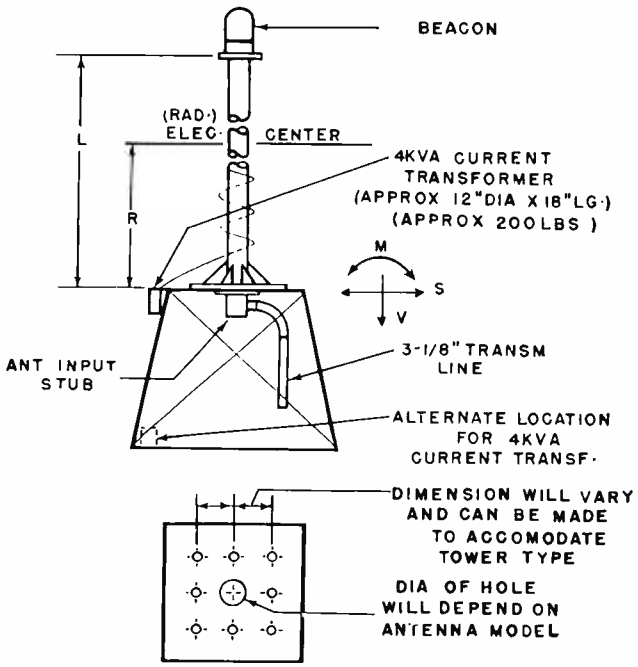
Table 2B Helical Antennas (Cont.)

Two Bay

POWER GAIN = 10.0 for channels 14–83
FREE SPACE FIELD = 435 millivolts per meter at one mile for 1 kw input channels 14–83

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
49	680—686	TY-22-E		2500	260	1180	8.19	16.05	$6\frac{8}{8}$ x .432
50	686—692						8.13	15.92	
51	692—698						8.06	15.80	
52	698—704						8.00	15.67	
53	704—710						7.94	15.55	
54	710—716						7.88	15.42	
55	716—722						7.81	15.30	
56	772—728						7.75	15.17	
57	728—734	TY-22-F		1920	220	915	7.45	14.90	$5\frac{9}{16}$ x .375
58	734—740						7.40	14.80	
59	740—746						7.35	14.70	
60	746—752						7.30	14.60	
61	752—758						7.25	14.50	
62	758—764						7.20	14.40	
63	764—770						7.15	14.30	
64	770—776						7.10	14.20	
65	776—782						7.05	14.10	
66	782—788						7.00	14.00	
67	788—794						6.95	13.90	
68	794—800						6.90	13.80	
69	800—806	TY-22-H		1550	190	855	6.87	13.74	5 x .375
70	806—812						6.83	13.66	
71	812—818						6.79	13.58	
72	818—824						6.75	13.49	
73	824—830						6.70	13.41	
74	830—836						6.66	13.33	
75	836—842						6.62	13.24	
76	842—848						6.58	13.16	
77	848—854						6.54	13.08	
78	854—860						6.50	12.99	
79	860—866						6.46	12.91	
80	866—872						6.41	12.83	
81	872—878						6.37	12.75	
82	878—884						6.33	12.66	
83	884—890						6.29	12.58	

HELICAL TV ANTENNAS



Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M– Moment in foot-lbs.

S - Shear in lbs.

V – Vertical load in lbs.

G– Outside diameter of mast at pole butt.

P– Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

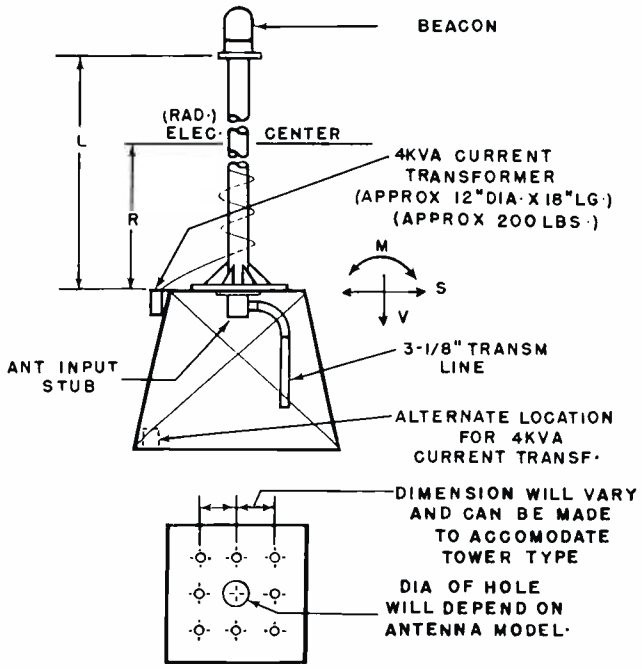
Table 2C Helical

Three Bay

POWER GAIN = 15.0 for channels 14–83.
FREE SPACE FIELD = 533 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
7	174—180								
8	180—186								
9	186—192								
10	192—198								
11	198—204								
12	204—210								
13	210—216								
14	470—476	TY-23-A		12600	700	3000	16.88	33.30	10¾ x ½
15	476—482	TY-23-A		12600	700	3000	16.61	32.79	
16	482—488	TY-23-A		12600	700	3000	16.35	32.25	
17	488—494	TY-23-B		11200	650	2850	16.14	31.83	10 x ½
18	494—500	↓		↓	↓	↓	15.97	31.49	
19	500—506	↓		↓	↓	↓	15.80	31.16	
20	506—512	↓		↓	↓	↓	15.64	30.82	
21	512—518	↓		↓	↓	↓	15.47.	30.49	
22	518—524	↓		↓	↓	↓	15.30	30.16	
23	524—530	↓		↓	↓	↓	15.14	29.82	
24	530—536	↓		↓	↓	↓	14.97	29.49	
25	536—542	TY-23-C		8200	515	2300	14.82	29.19	8⅝ x ½
26	542—548	↓		↓	↓	↓	14.75	28.97	
27	548—554	↓		↓	↓	↓	14.69	28.76	
28	554—560	↓		↓	↓	↓	14.62	28.54	
29	560—566	↓		↓	↓	↓	14.56	28.32	
30	566—572	↓		↓	↓	↓	14.49	28.10	
31	572—578	↓		↓	↓	↓	14.13	27.90	
32	578—584	↓		↓	↓	↓	14.36	27.67	
33	584—590	TY-23-D		6800	470	2010	13.52	26.72	7¾ x ½
34	590—596	↓		↓	↓	↓	13.40	26.48	
35	596—602	↓		↓	↓	↓	13.28	26.24	
36	602—608	↓		↓	↓	↓	13.16	25.99	
37	608—614	↓		↓	↓	↓	13.04	25.75	
38	614—620	↓		↓	↓	↓	12.92	25.52	
39	620—626	↓		↓	↓	↓	12.81	25.28	
40	626—632	↓		↓	↓	↓	12.69	25.04	
41	632—638	↓		↓	↓	↓	12.57	24.80	
42	638—644	↓		↓	↓	↓	12.45	24.56	
43	644—650	↓		↓	↓	↓	12.33	24.32	
44	650—656	TY-23-E		4820	360	1540	12.25	24.17	6⅝ x .432
45	656—662	↓		↓	↓	↓	12.16	24.00	
46	662—668	↓		↓	↓	↓	12.05	23.79	
47	668—674	↓		↓	↓	↓	11.96	23.61	
48	674—680	↓		↓	↓	↓	11.87	23.42	

HELICAL TV ANTENNAS



PLAN OF TOWER TOP

Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.

S—Shear in lbs.

V—Vertical load in lbs.

G -Outside diameter of mast at pole butt.

P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

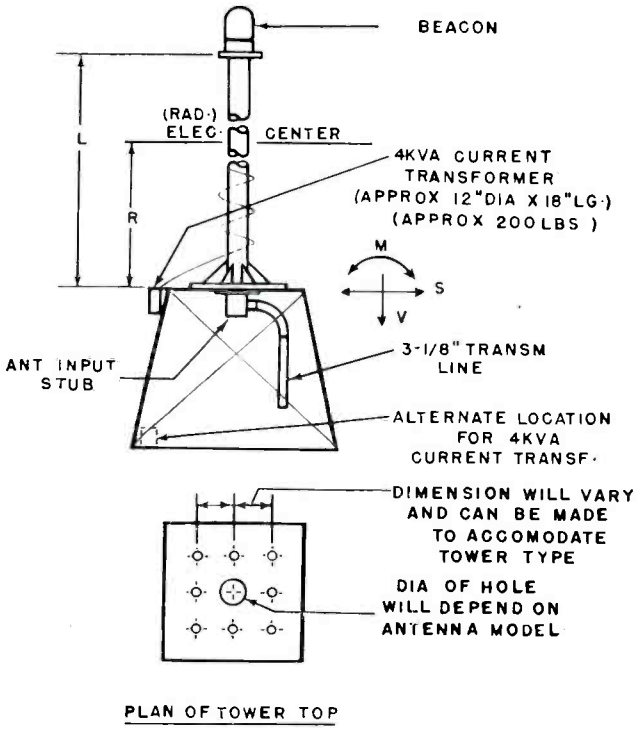
Table 2C Helical (Cont.)

Three Bay

POWER GAIN = 15.0 for channels 14–83.
FREE SPACE FIELD = 533 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
49	680—686	TY-23-E		4820	360	1540	11.78	23.25	6⅝ x .432
50	686—692						11.68	23.04	
51	692—698						11.59	22.86	
52	698—704						11.50	22.67	
53	704—710						11.40	22.48	
54	710—716						11.31	22.29	
55	716—722						11.22	22.09	
56	722—728						11.13	21.92	
57	728—734	TY-23-F		3600	300	1210	10.80	21.60	5 9/16 x .375
58	734—740						10.72	21.45	
59	740—746						10.65	21.30	
60	746—752						10.57	21.15	
61	752—758						10.50	21.00	
62	758—764						10.42	20.85	
63	764—770						10.35	20.70	
64	770—776						10.27	20.55	
65	776—782						10.19	20.40	
66	782—788						10.12	20.25	
67	788—794						10.04	20.10	
68	794—800						9.97	19.95	
69	800—806	TY-23-H		2940	260	1110	9.93	19.86	5 x .375
70	806—812						9.87	19.75	
71	812—818						9.80	19.61	
72	818—824						9.74	19.49	
73	824—830						9.68	19.36	
74	830—836						9.62	19.24	
75	836—842						9.56	19.11	
76	842—848						9.49	18.99	
77	848—854						9.43	18.87	
78	854—860						9.37	18.74	
79	860—866						9.31	18.62	
80	866—872						9.25	18.49	
81	872—878						9.18	18.37	
82	878—884						6.12	18.24	
83	884—890						9.06	18.12	

HELICAL TV ANTENNAS



Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S—Shear in lbs.
V—Vertical load in lbs.
G—Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

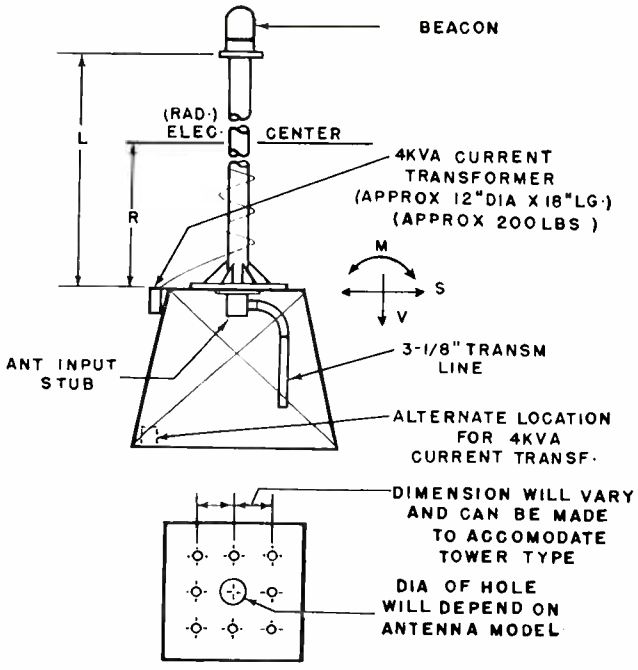
Table 2D Helical

Four Bay

POWER GAIN = 20.0 for channels 14–83.
FREE SPACE FIELD = 615 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	Mast Size
7	174—180								
8	180—186								
9	186—192								
10	192—198								
11	198—204								
12	204—210								
13	210—216								
14	470—476	TY-24-A		21300	910	3800	22.10	43.75	10¾ x ½
15	476—482	TY-24-A		21300	910	3800	21.75	43.05	
16	482—488	TY-24-A		21300	910	3800	21.40	42.35	
17	488—494	TY-24-B		18750	845	3350	21.12	41.79	10 x ½
18	494—500	↓	↓	↓	↓	↓	21.04	41.35	↓
19	500—506	↓	↓	↓	↓	↓	20.96	40.91	↓
20	506—512	↓	↓	↓	↓	↓	20.88	40.45	↓
21	512—518	↓	↓	↓	↓	↓	20.80	40.01	↓
22	518—524	↓	↓	↓	↓	↓	20.72	39.56	↓
23	524—530	↓	↓	↓	↓	↓	20.64	39.12	↓
24	530—536	↓	↓	↓	↓	↓	20.56	38.67	↓
25	536—542	TY-24-C	↓	13700	670	2890	19.36	38.27	8⅜ x ½
26	542—548	↓	↓	↓	↓	↓	19.18	37.91	↓
27	548—554	↓	↓	↓	↓	↓	18.00	37.54	↓
28	554—560	↓	↓	↓	↓	↓	18.81	37.17	↓
29	560—566	↓	↓	↓	↓	↓	18.63	36.81	↓
30	566—572	↓	↓	↓	↓	↓	18.44	36.44	↓
31	512—578	↓	↓	↓	↓	↓	18.26	36.08	↓
32	578—584	↓	↓	↓	↓	↓	18.08	35.71	↓
33	584—590	TY-24-D	↓	11500	610	2500	17.70	35.07	7¾ x ½
34	590—596	↓	↓	↓	↓	↓	17.54	34.75	↓
35	596—602	↓	↓	↓	↓	↓	17.38	34.43	↓
36	602—608	↓	↓	↓	↓	↓	17.22	34.11	↓
37	608—614	↓	↓	↓	↓	↓	17.06	33.79	↓
38	614—620	↓	↓	↓	↓	↓	16.90	33.47	↓
39	620—626	↓	↓	↓	↓	↓	16.74	33.15	↓
40	626—632	↓	↓	↓	↓	↓	16.58	32.83	↓
41	632—638	↓	↓	↓	↓	↓	16.42	32.51	↓
42	638—644	↓	↓	↓	↓	↓	16.26	32.19	↓
43	644—650	↓	↓	↓	↓	↓	16.10	31.87	↓
44	650—656	TY-24-E	↓	7900	460	1950	16.00	31.67	6⅜ x .432
45	656—662	↓	↓	↓	↓	↓	15.88	31.42	↓
46	662—668	↓	↓	↓	↓	↓	15.75	31.17	↓
47	668—674	↓	↓	↓	↓	↓	15.63	30.92	↓
48	674—680	↓	↓	↓	↓	↓	15.50	30.67	↓

HELICAL TV ANTENNAS



Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S—Shear in lbs.
V—Vertical load in lbs.
G—Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

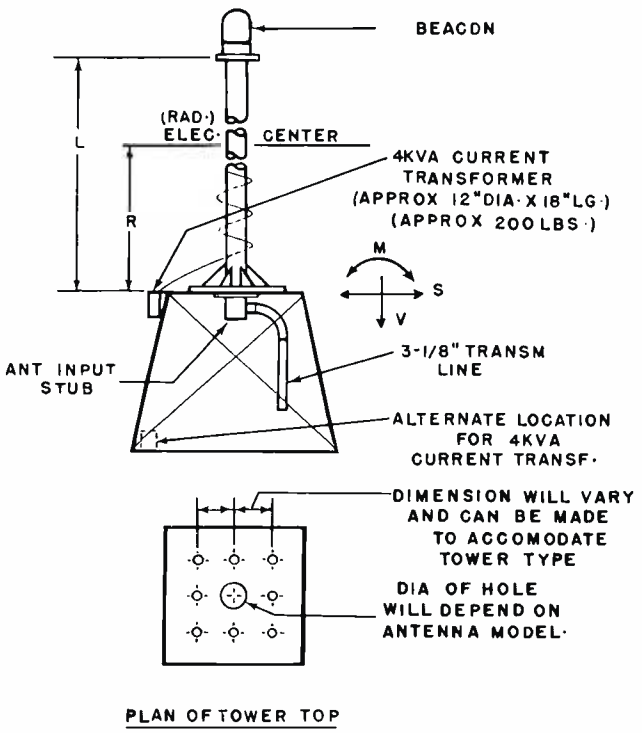
Table 2D Helical (Cont.)

Four Bay

POWER GAIN = 20.0 for channels 14–83.
FREE SPACE FIELD = 615 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
49	680—686	TY-24-E		7900	460	1950	15.38	30.42	$6\frac{5}{8}$ x .432
50	686—692						15.25	30.17	
51	692—698						15.13	29.92	
52	698—704						15.00	29.67	
53	704—710						14.88	29.42	
54	710—716						14.75	29.17	
55	716—722						14.63	28.92	
56	722—728						14.50	28.67	
57	728—734	TY-24-F		5870	380	1460	14.15	28.30	$5\frac{9}{16}$ x .375
58	734—740						14.05	28.10	
59	740—746						13.95	27.90	
60	746—752						13.85	27.70	
61	752—758						13.75	27.50	
62	758—764						13.65	27.30	
53	764—770						13.55	27.10	
64	770—776						13.45	26.90	
65	776—782						13.35	26.70	
66	782—788						13.25	26.50	
67	788—794						13.15	26.30	
68	794—800						13.05	26.10	
69	800—806	TY-24-H		4700	330	1350	12.99	25.98	5 x .375
70	806—812	TY-24-H		4700	330	1350	12.87	25.74	
71	812—818						12.75	25.51	
72	818—824						12.63	25.27	
73	824—830						12.52	25.04	
74	830—836						12.40	24.80	
75	836—842						12.28	24.56	
76	842—848						12.16	24.38	
77	848—854						12.04	24.08	
78	854—860						11.92	23.85	
79	860—866						11.80	23.61	
80	866—872						11.69	23.37	
81	872—878						11.57	23.13	
82	878—884						11.45	22.90	
83	884—890						11.33	22.66	

HELICAL TV ANTENNAS



PLAN OF TOWER TOP

Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S—Shear in lbs.
V—Vertical load in lbs.
G —Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of $\frac{3}{8}$° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

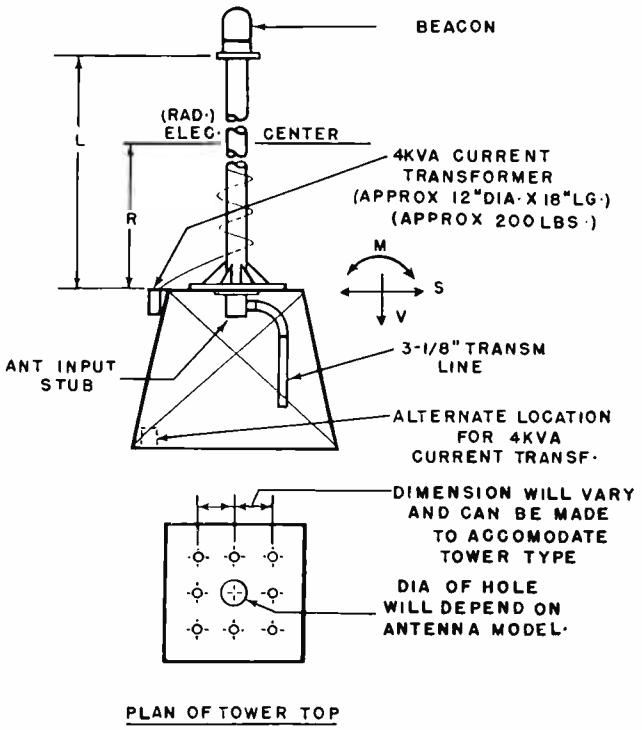
Table 2E Helical

Five Bay

POWER GAIN = 25.0 for channels 14–83.
FREE SPACE FIELD = 688 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
7	174—180								
8	180—186								
9	186—192								
10	192—198								
11	198—204								
12	204—210								
13	210—216								
14	470—476	TY-25-A		31800	1120	4505	27.33	54.20	10¾ x ½
15	476—482	TY-25-A		31800	1120	4505	26.89	53.33	
16	482—488	TY-25-A		31800	1120	4505	26.45	52.45	
17	488—494	TY-25-B		27200	1000	4125	26.10	51.75	10 x ½
18	494—500	↓		↓	↓	↓	25.82	51.19	
19	500—506						25.54	50.64	
20	506—512						25.26	50.08	
21	512—518						24.99	49.52	
22	518—524						24.71	48.97	
23	524—530						24.43	48.41	
24	530—536	↓		↓	↓	↓	24.15	47.85	
25	536—542	TY-25-C		20500	820	3505	23.90	47.35	8⅝ x ½
26	542—548						23.67	46.89	
27	548—554						23.44	46.44	
28	554—560						23.21	45.98	
29	560—566						22.99	45.52	
30	566—572						22.76	45.06	
31	572—578						22.53	44.61	
32	578—584	↓		↓	↓	↓	22.30	44.15	
33	584—590	TY-25-D		16100	700	3060	21.87	43.42	7¾ x ½
34	590—596						21.68	43.02	
35	596—602						21.48	42.62	
36	602—608						21.28	42.22	
37	608—614						21.08	41.82	
38	614—620						20.88	41.42	
39	620—626						20.68	41.02	
40	626—632						20.48	40.62	
41	632—638						20.28	40.22	
42	638—644						20.08	39.82	
43	644—650	↓		↓	↓	↓	19.88	39.42	
44	650—656	TY-25-E		11750	560	2515	19.75	39.17	6⅝ x .432
45	656—662						19.60	38.86	
46	662—668						19.44	38.54	
47	668—674						19.28	38.13	
48	674—680	↓		↓	↓	↓	19.13	37.92	

HELICAL TV ANTENNAS



PLAN OF TOWER TOP

Tower fabricator shall consult G.E. Co. for bolt spacing and clearances required at antenna top.

Note: All antennas are designed for 50 lbs. per sq. ft. wind pressure or a max. angular deflection of the tangent at electrical center not to exceed 1° for 30 lbs. per sq. ft. wind pressure. Loads indicated in table are for 30 lbs. per sq. ft. wind with shape factor included, since most towers are designed for this pressure.

KEY TO SYMBOLS

M—Moment in foot-lbs.
S—Shear in lbs.
V—Vertical load in lbs.
G—Outside diameter of mast at pole butt.
P—Max. power input in kw peak visual power—for total average multiply by 1.1

All antennas are bolted to tower top and a hole must be provided in tower top to permit bolting antenna input stub to antenna base plate.

Important: U.H.F. T.V. antennas of 3 or more bays operate with 2° to 3° beam. It is of extreme importance that tower deflection beheld to a minimum of 3/8° angle between vertical and tan. to elastic line at tower top as maximum allowable for 30 lbs. sq. ft. wind loading.

50 lbs. per sq. ft. is result of 150 mph wind.
30 lbs. per sq. ft. is result of 115 mph wind.

Table 2E Helical (Cont.)

Five Bay

POWER GAIN = 25.0 for channels 14–83.
FREE SPACE FIELD = 688 millivolts per meter at one mile for 1 kw input channels 14–83.

Channel	Freq. Range Mc	Type No.	P	M	S	V	R	L	G
49	680—686	TY-25-E		11750	560	2515	18.97	37.61	6⅝ x .432
50	686—692						18.82	37.29	
51	692—698						18.76	36.98	
52	698—704						18.50	36.67	
53	704—710						18.35	36.36	
54	710—716						18.19	36.05	
55	716—722						18.04	35.73	
56	722—728						17.88	35.42	
57	728—734	TY-25-F		8550	460	1900	17.50	35.00	5 9/16 x .375
58	734—740						17.37	34.75	
59	740—746						17.25	34.50	
60	746—752						17.12	34.25	
61	752—758						17.00	34.00	
62	758—764						16.87	33.75	
63	764—770						16.75	33.50	
64	770—776						16.62	33.25	
65	776—782						16.50	33.00	
66	782—788						16.37	32.75	
67	788—794						16.25	32.50	
68	794—800						16.12	32.25	.750
69	800—806	TY-25-H		6940	400	1735	16.05	32.10	5 x .375
70	806—812						15.95	31.82	
71	812—818						15.84	31.54	
72	818—824						15.74	31.27	
73	824—830						15.64	30.99	
74	830—836						15.53	30.71	
75	836—842						15.43	30.43	
76	842—848						15.32	30.15	
77	848—854						15.22	29.87	
78	854—860						15.12	29.59	
79	860—866						15.01	29.31	
80	866—872						14.91	29.04	
81	872—878						14.81	28.76	
82	878—884						14.70	28.48	
83	884—890						14.60	28.20	

Antenna-Transmitter Combinations

Four charts are given to assist in selecting the proper transmitter-antenna combination to obtain a specified effective-radiated-power. A convenient bar chart covers virtually all the possible combinations of the transmitting systems in each of the three general channel groups. Thus three bar charts in addition to a separate chart for the 100 watt UHF transmitter cover all the combinations now available.

Figures 16, 17, 18, and 19 are bar charts indicating the maximum effective-radiated-power obtainable from various combinations of transmitters, amplifiers and antennas. The height of the black bars gives the ERP obtainable with the indicated transmitter and various antennas which are given at the top of the column. The height of the red bars gives the ERP's obtainable with the indicated transmitter-amplifier-antenna combinations. A horizontal line across each VHF chart represents the maximum ERP allowable by the F.C.C. and the cross-hatched red above this line indicates the power available to absorb transmission line and diplexer power loss, since all bars are calculated on the basis of zero transmission line and diplexer loss. Diplexer losses and curves for transmission losses are given in Section E-202.-32. The antenna gains used on the VHF charts are not exact, but are average gains over the low or high channels. The exact gain for each antenna is given in Figure 10, Section E-202.32.

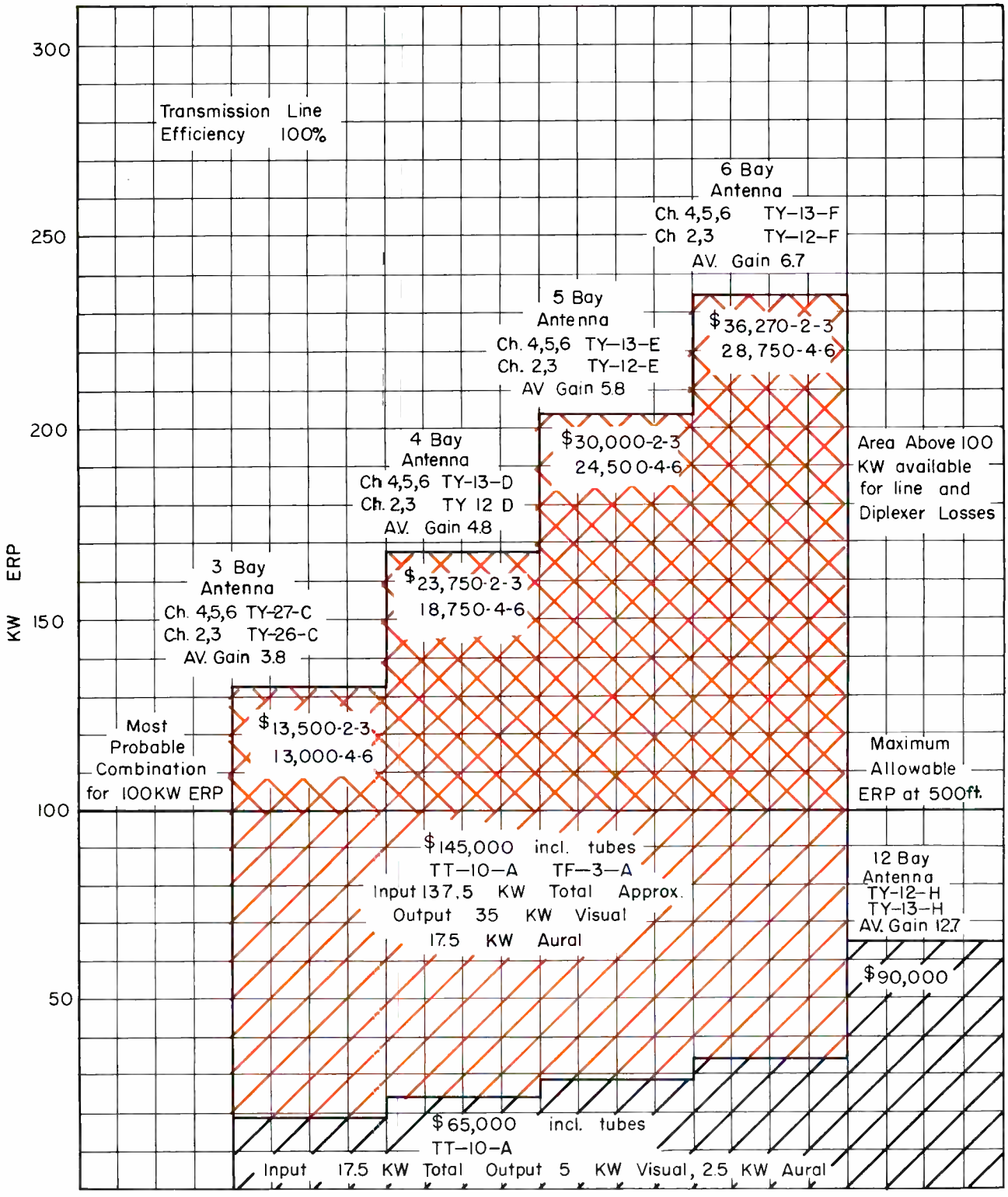


Figure 16

E.R.P. VS. TRANSMITTER-ANTENNA COMBINATIONS FOR VHF CHANNELS 2-6

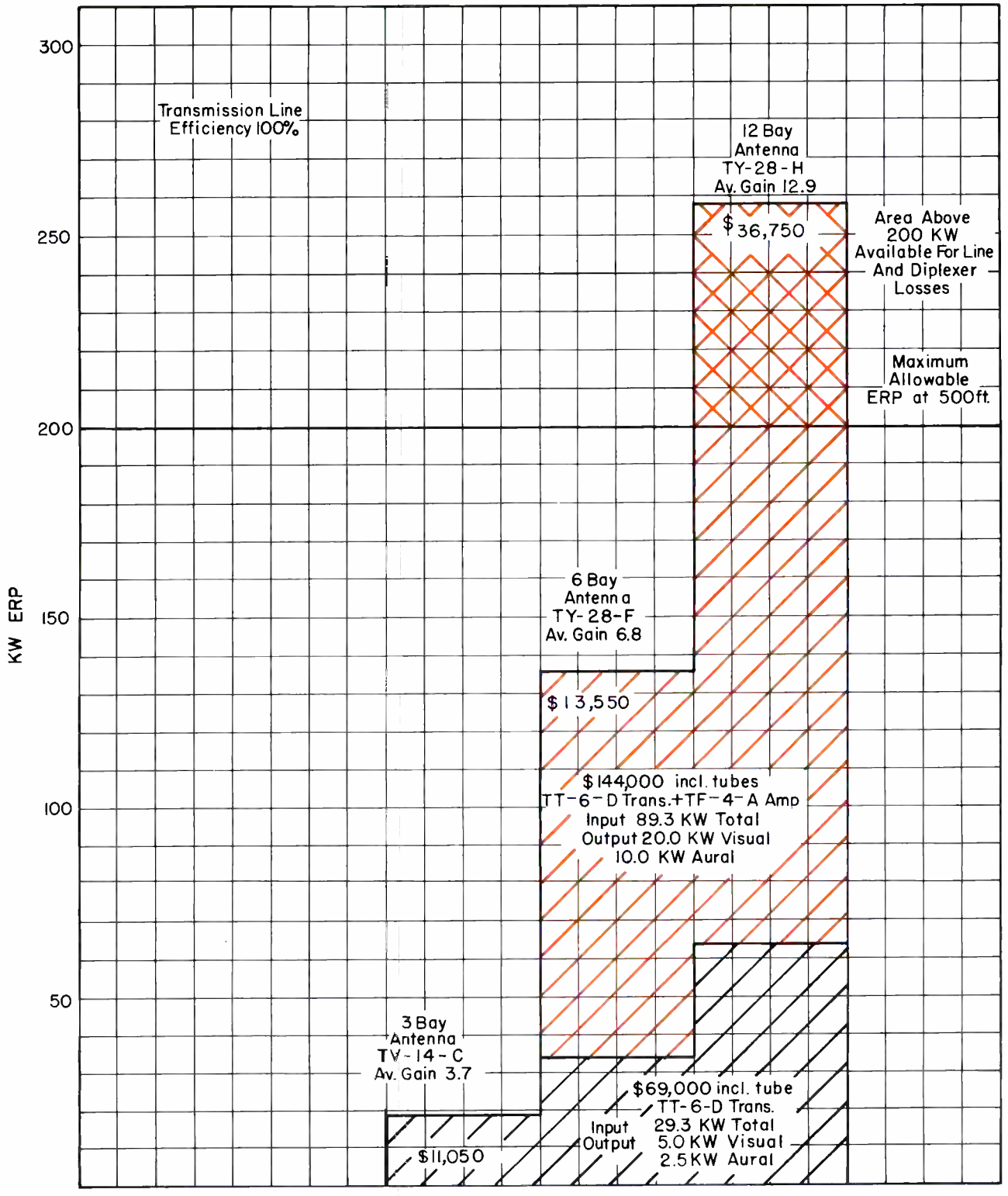


Figure 17

E.R.P. VS. TRANSMITTER-ANTENNA COMBINATIONS FOR VHF CHANNELS 7–13

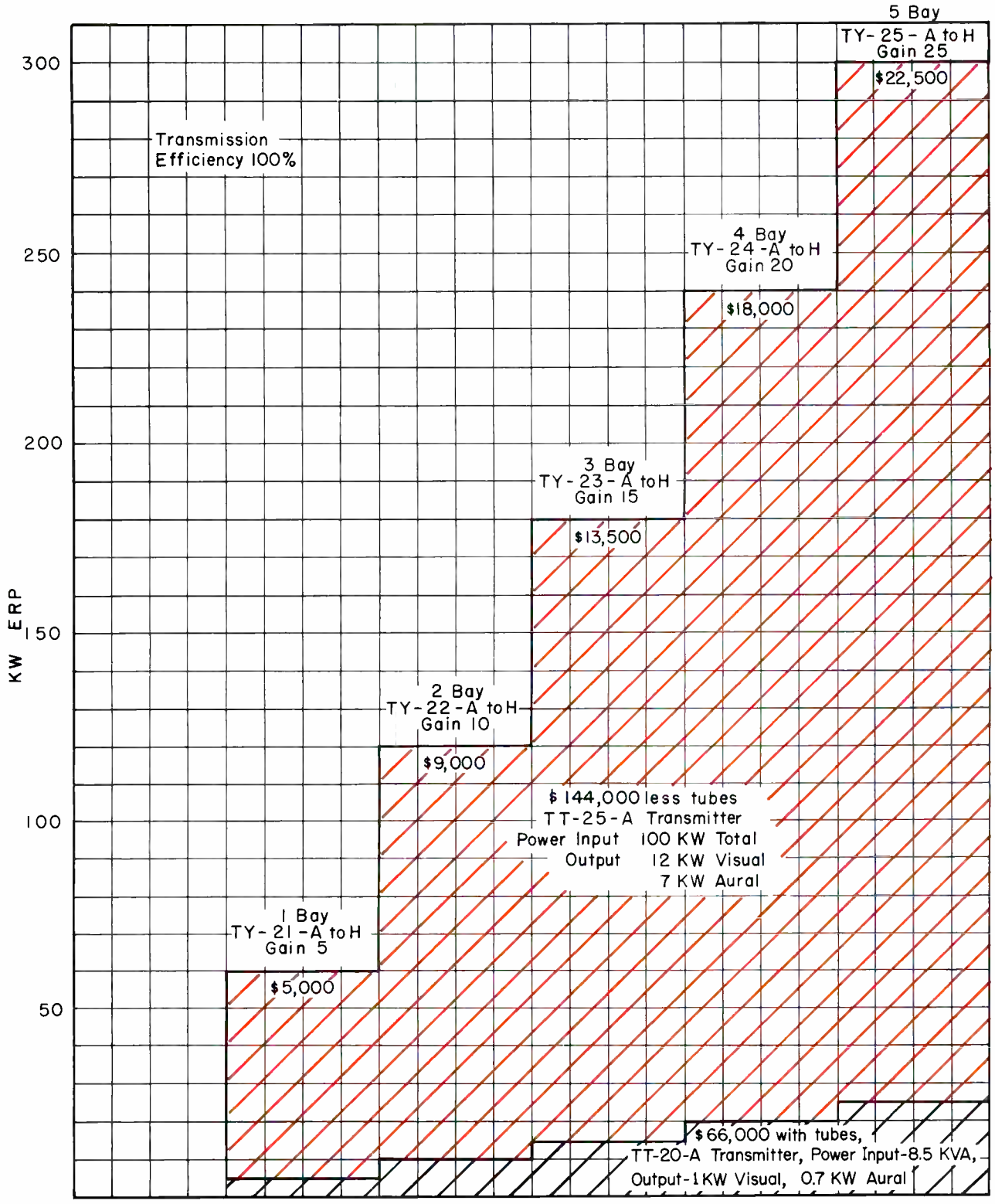


Figure 18

E.R.P. VS. 1 KW AND 12 KW TRANSMITTER-ANTENNA COMBINATIONS FOR UHF CHANNELS 14–83

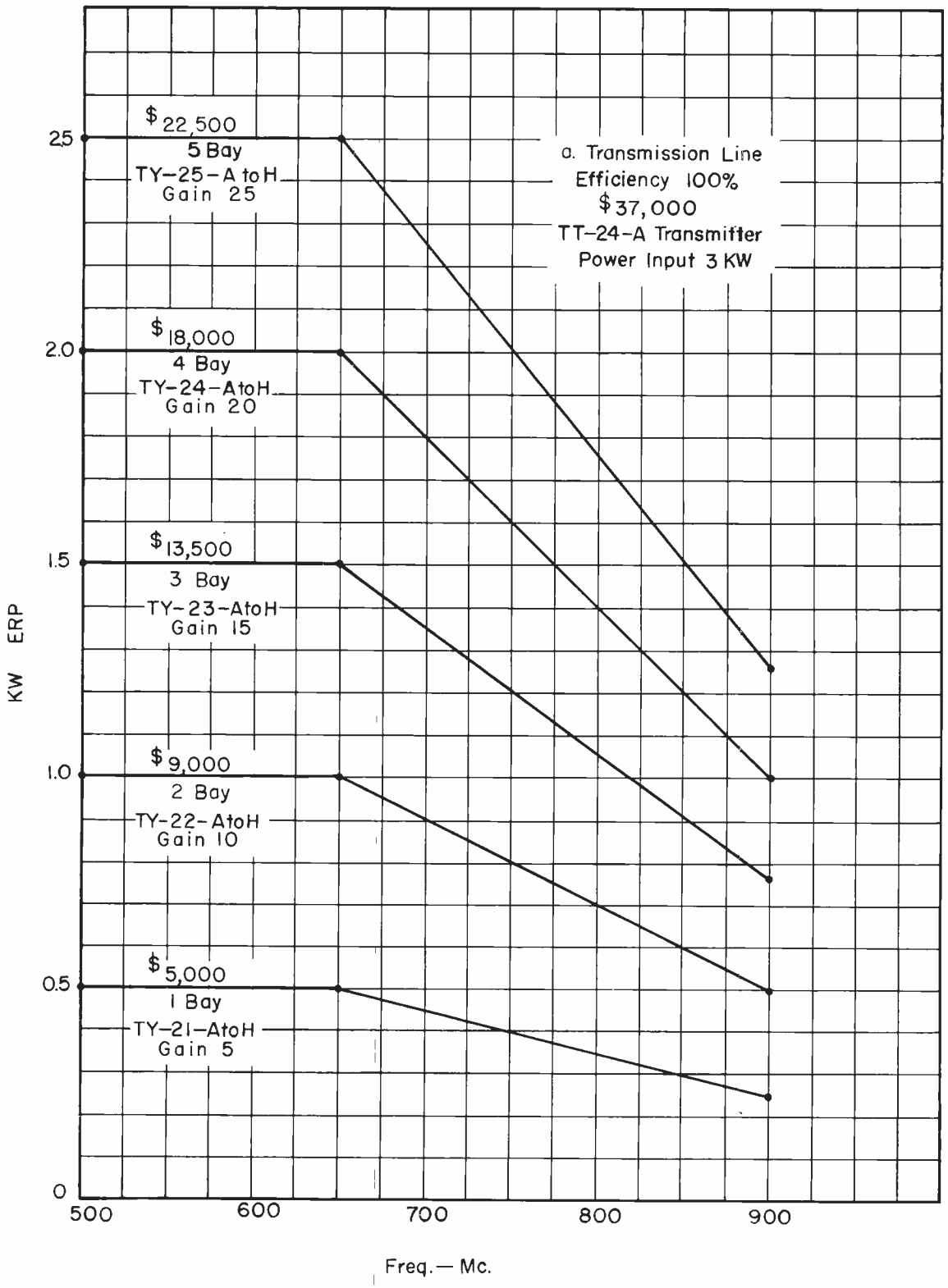


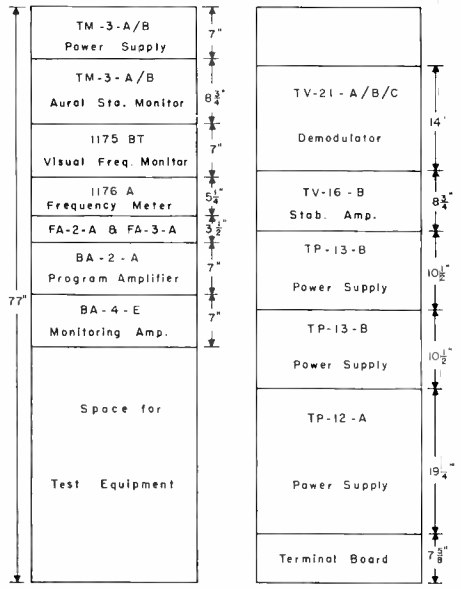
Figure 19

E.R.P. VS. 100 WATT TRANSMITTER-ANTENNA COMBINATIONS FOR UHF CHANNELS 14-83

Accessory Equipment

A minimum amount of accessory equipment is required at every transmitter installation in order to properly feed, test and monitor the transmitter. The units such as visual and aural frequency monitors, demodulators, audio amplifiers, and patching facilities are standard 19" rack-mounted equipments. Their space requirements appear in Chart II below:

Chart II



RACK-MOUNTED ACCESSORIES

The TM-3-A/B Aural station monitor takes some R.F. from a sampling loop in the aural VHF transmitter and demodulates it giving a continuous monitoring source of what is actually being broadcast. This audio also appears on a VU meter so that a reading of percentage modulation is obtained. In addition to this function it compares the transmitter frequency with that of a self-contained stable crystal oscillator. The difference between the two appears on a meter which continuously indicates the frequency deviation of the transmitter.

The 1175BT visual frequency monitor and 1176AT frequency meter compares the r-f output of the visual transmitter with a self-contained stable oscillator to give a frequency deviation indication of the VHF visual transmitter.

The TV-21-A/B/C demodulator is effectively a very high quality fixed tuned TV receiver that allows monitoring of the visual transmitter picture when its output is fed into a picture and waveform monitor such as a TM-8-A. The local oscillator of the demodulator may be keyed to produce a zero carrier reference line on a waveform monitor which makes it possible to measure the depth of modulation of the visual transmitter. The r-f input for the demodulator is picked up by a probe in the transmission line between the transmitter and diplexer and fed to the demodulator by co-ax.

The GR1183-T visual-aural frequency monitor provides visual and aural frequency deviation readings and aural modulation percentage reading for the UHF television transmitter.

The BA-2-A program amplifier is needed to amplify and control the audio level into the transmitter. If overmodulation protection is desired, a BA-5-A limiting amplifier may be used in place of the BA-2-A.

The BA-4-E monitoring amplifier is needed to feed the monitor speaker.

The TP-12-A power supply is required to supply power to the TM-8-A calibration monitor.

The TP-13-A power supplies are required to supply power to the TV-16-B Stabilizing Amplifier and the demodulator.

The TV-16-B Stabilizing Amplifier is used to set levels and clean up the video signal coming into the transmitter installation from the studio or remote.

OTHER ACCESSORIES

The TT-10-A low channel transmitter is completely self-contained and thus requires no external cooling equipment.

The TF-3-A 35-KW low channel amplifier, in addition to its three main aural and visual cubicles, requires an external water cooler and one external plate transformer. A suggested layout is given in Fig. 4 of Section E202.31.

The TT-6-E high channel transmitter requires an external low pressure cubicle blower for cubicle cooling and a high pressure anode blower for tube cooling. A suggested layout is given on Fig. 3 of Section E202.31.

The TF-4-A 20-KW high channel, in addition to its three main aural and visual cubicles, requires the following external equipment: one plate transformer, one reactor, and an external cooling blower. A suggested layout is given in Fig. 5 of Section E202.31.

The TT-25-A high power UHF transmitter requires an external water cooler, two external chokes and three external plate transformers. A suggested layout is given in Fig. 7 of Section E202.31.

All television transmitters are supplied with a transmitter control panel. In order to "build up" a complete transmitter control console, as shown in Fig. 20, the following equipment is needed in addition to the control panel:

1 calibration monitor TM-8-A to monitor the video signal

1 console cabinet PR-10-A to house the monitor

1 base cabinet PR-16-A to support the turret cabinet

1 turret cabinet PR-17-A to house the transmitter control panel

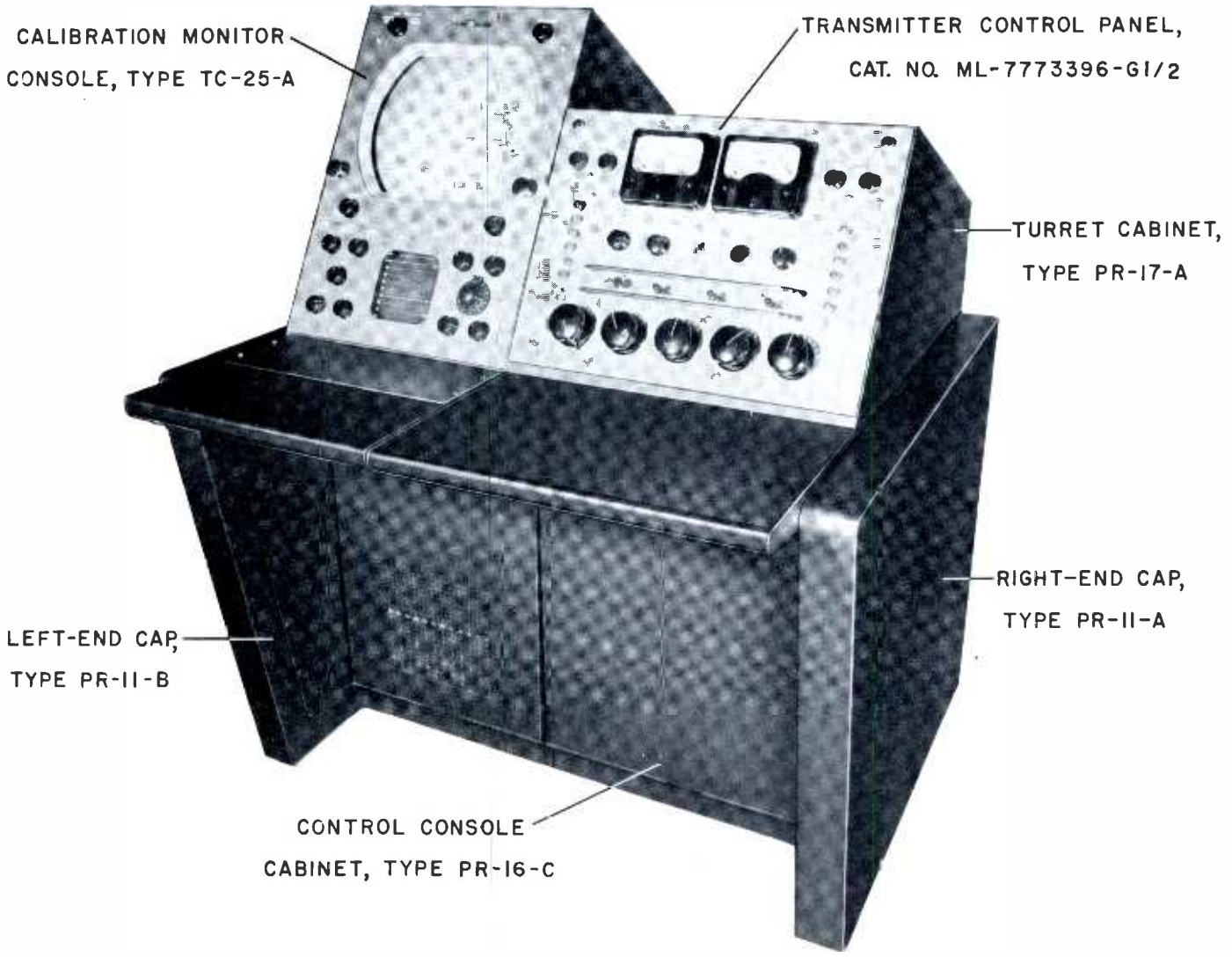


Figure 20
TRANSMITTER CONTROL CONSOLE

Over-all Transmitting Systems

Block diagrams showing all the essential equipment for a basic transmitting system are given on Figures 24 and 25. Figures 21, 22, and 23 are convenient checkoff lists for these systems. An approximate price of the over-all transmitting system may be obtained by taking the price of the applicable antenna and transmitter from the bar charts, Figures 16, 17, and 18 in Section E202.33 and adding this price to that of the proper monitoring and accessory equipment list. The total price does not include the cost of the tower, transmission line with hangers, tower lighting equipment and deicing equipment.

Description	*Type No.*	*Price*	*Equipment Needed*			
			Channels 2–3		*Channels 4–6*	
			With Slot Diplexer	*With Bridge Diplexer*	*With Slot Diplexer*	*With Bridge Diplexer*
Visual Frequency Meter	GR1176A	$285.00	1	1	1	1
Visual Frequency Monitor	GR1175BT	410.00	1	1	1	1
Aural Frequency Monitor	TM-3-A	1780.00	1	1	1	1
Demodulator	TV-21-A	2150.00	1	1	1	1
Bridge Diplexer	PY-16-A	1350.00		1		
Bridge Diplexer	PY-16-B	1050.00				1
Slot Diplexer	PY-14-A	3500.00	1		1	
Adapter	PY-13-A	600.00	1		1	
Phasing Unit	PY-5-C	425.00	1	1	1	1
Program Amplifier	BA-2-A	195.00	1	1	1	1
Monitor Amplifier	BA-4-E	180.00	1	1	1	1
Monitor Speaker	FS-1-A	175.00	1	1	1	1
Audio Jack Strip	FA-2-A	45.00	1	1	1	1
Single Jack Panel	FA-3-A	9.50	1	1	1	1
2′ Patch Cords	FA-7-A	9.00	8	8	8	8
Stabilizing Amp.	TV-16-B	720.00	1	1	1	1
Calibration Monitor	TM-8-A	2450.00	1	1	1	1
Power Supplies	TP-13-A	360.00	2	2	2	2
Power Supply	TP-12-A	850.00	1	1	1	1
Cabinet Racks	PR-1-A	210.00	2	2	2	2
Monitor Cabinet	PR-10-A	440.00	1	1	1	1
Base Cabinet	PR-16-A	310.00	1	1	1	1
Turret Cabinet	PR-17-A	130.00	1	1	1	1
End Cap (Left)	PR-11-A	60.00	1	1	1	1
End Cap (Right)	PR-11-B	60.00	1	1	1	1
Cabinet Rack Front Door	PR-3-A	60.00	1	1	1	1
Term. Board Mtg. Frame	PR-4-A	9.00	2	2	2	2
Wiring Duct Assembly	PR-5-A	17.00	1	1	1	1
Cable Strap	PR-80A	8.50	1	1	1	1
Dummy Load (5 KW)	TX-4-A	1000.00	1	1	1	1
TOTAL PRICE OF MONITORING EQUIPMENT AND ACCESSORIES			$17,090.00	$14,340.00	$17,090.00	$14,040.00

Fig. 21 *MONITORING EQUIPMENT AND ACCESSORIES FOR VHF CHANNELS 2-6*

Description	*Type No.*	*Price*	*Equipment Needed Channels 7–13*	
			With Slot Diplexer	*With Bridge Diplexer*
Visual Frequency Meter	GR1176A	$285.00	1	1
Visual Frequency Monitor	GR1175BT	410.00	1	1
Aural Frequency Monitor	TM-3-B	2190.00	1	1
Demodulator	TV-21-B	2150.00	1	1
Bridge Diplexer	PY-16-C	750.00		1
Slot Diplexer	PY-15-A	3000.00	1	
Adapter	PY-13-B	600.00	1	
Phasing Unit	PY-5-D	425.00	1	1
Program Amplifier	BA-2-A	195.00	1	1
Monitor Amplifier	BA-4-E	180.00	1	1
Monitor Speaker	FS-1-A	175.00	1	1
Audio Jack Strip	FA-2-A	45.00	1	1
Single Jack Panel	FA-3-A	9.50	1	1
2′ Patch Cords	FA-7-A	9.00	8	8
Stabilizing Amplifier	TV-16-B	720.00	1	1
Calibration Monitor	TM-8-A	2450.00	1	1
Power Supplies	TP-13-A	360.00	2	2
Power Supply	TP-12-A	850.00	1	1
Cabinet Racks	PR-1-A	210.00	2	2
Monitor Cabinet	PR-10-A	440.00	1	1
Base Cabinet	PR-16-A	310.00	1	1
Turret Cabinet	PR-17-A	130.00	1	1
End Cap (left)	PR-11-A	60.00	1	1
End Cap (right)	PR-11-B	60.00	1	1
Cabinet Rack Front Door	PR-3-A	60.00	1	1
Term. Board Mtg. Frame	PR-4-A	9.00	2	2
Wiring Duct Assembly	PR-5-A	17.00	1	1
Cable Strap	PR-8-A	8.50	1	1
Dummy Load (5 KW)	TX-4-A	1000.00	1	1
TOTAL PRICE OF MONITORING EQUIPMENT AND ACCESSORIES			$17,000.00	$14,150.00

Fig. 22 *MONITORING EQUIPMENT AND ACCESSORIES FOR VHF CHANNELS 7-13*

Description	*Type No.*	*Price*	*Equipment Needed Channels 14–83*
			Using Slot Diplexer
Visual-Aural Frequency Monitor	GR-1183-T	*	1
Demodulator (Visual Mod. Monitor)	TV-21-C	*	1
Slot Diplexer	*	*	1
Program Amplifier	BA-2-A	$195.00	1
Monitor Amplifier	BA-4-E	180.00	1
Monitor Speaker	FS-1-A	175.00	1
Audio Jack Strip	FA-2-A	45.00	1
Single Jack Panel	FA-3-A	9.50	1
2′ Patch Cords	FA-7-A	9.00	8
Stabilizing Amplifier	TV-16-B	720.00	1
Calibration Monitor	TM-8-A	2450.00	1
Power Supplies	TP-13-A	360.00	2
Power Supply	TP-12-A	850.00	1
Cabinet Racks	PR-1-A	210.00	2
Monitor Cabinet	PR-10-A	440.00	1
Base Cabinet	PR-16-A	310.00	1
Turret Cabinet	PR-17-A	130.00	1
End Cap (left)	PR-11-A	60.00	1
End Cap (right)	PR-11-B	60.00	1
Cabinet Rack Front Door	PR-3-A	60.00	1
Term. Board Mtg. Frame	PR-4-A	9.00	2
Wiring Duct Assembly	PR-5-A	17.00	1
Cable Strap	PR-8-A	8.50	1
Dummy Load	*	*	1
TOTAL PRICE OF MONITORING EQUIPMENT AND ACCESSORIES			$16,000 (approximately)

* On Application.

Fig. 23 *MONITORING EQUIPMENT AND ACCESSORIES FOR UHF CHANNELS 14-83*

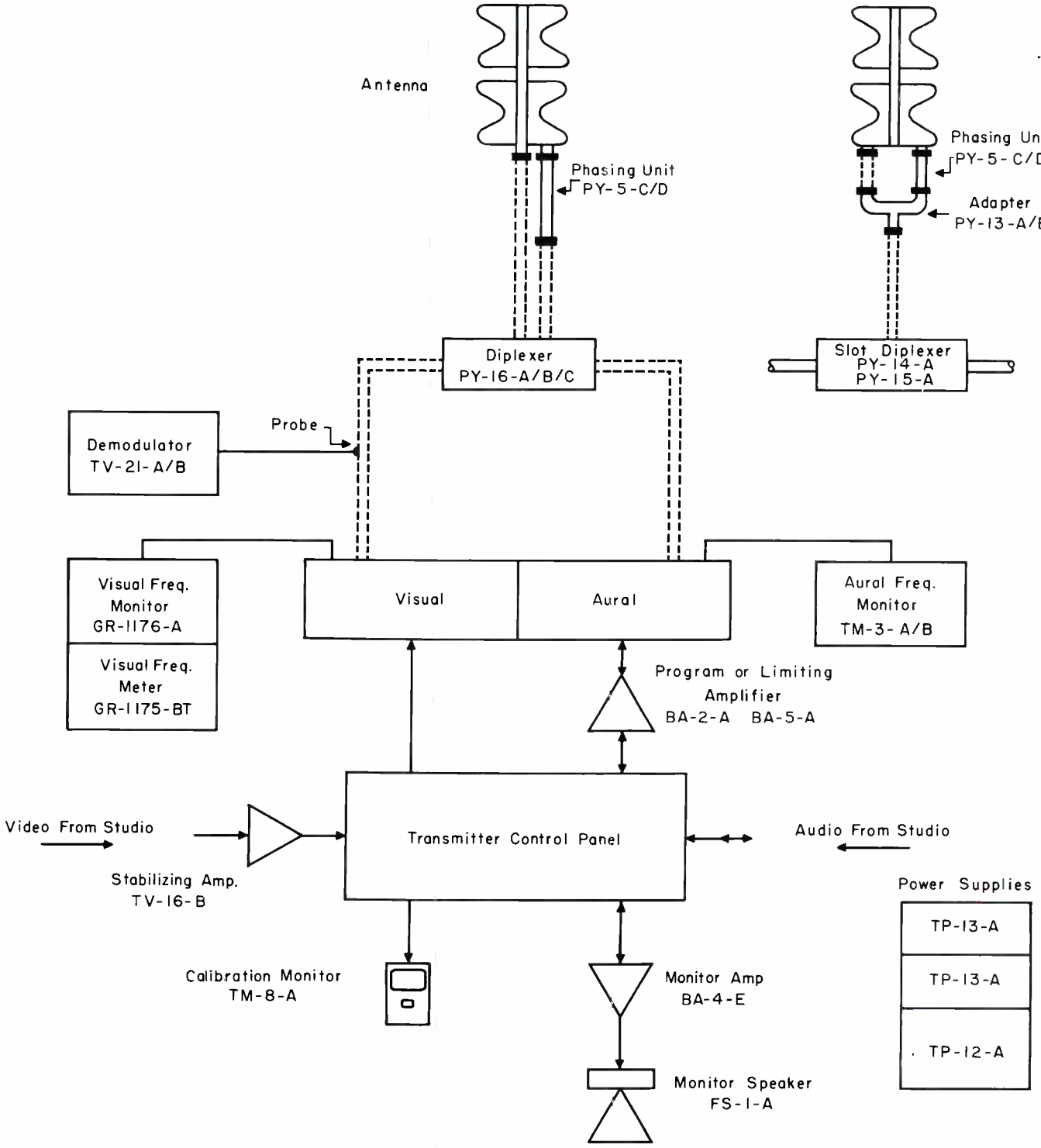


Figure 24

BASIC TRANSMITTING SYSTEM FOR VHF CHANNELS 2–13

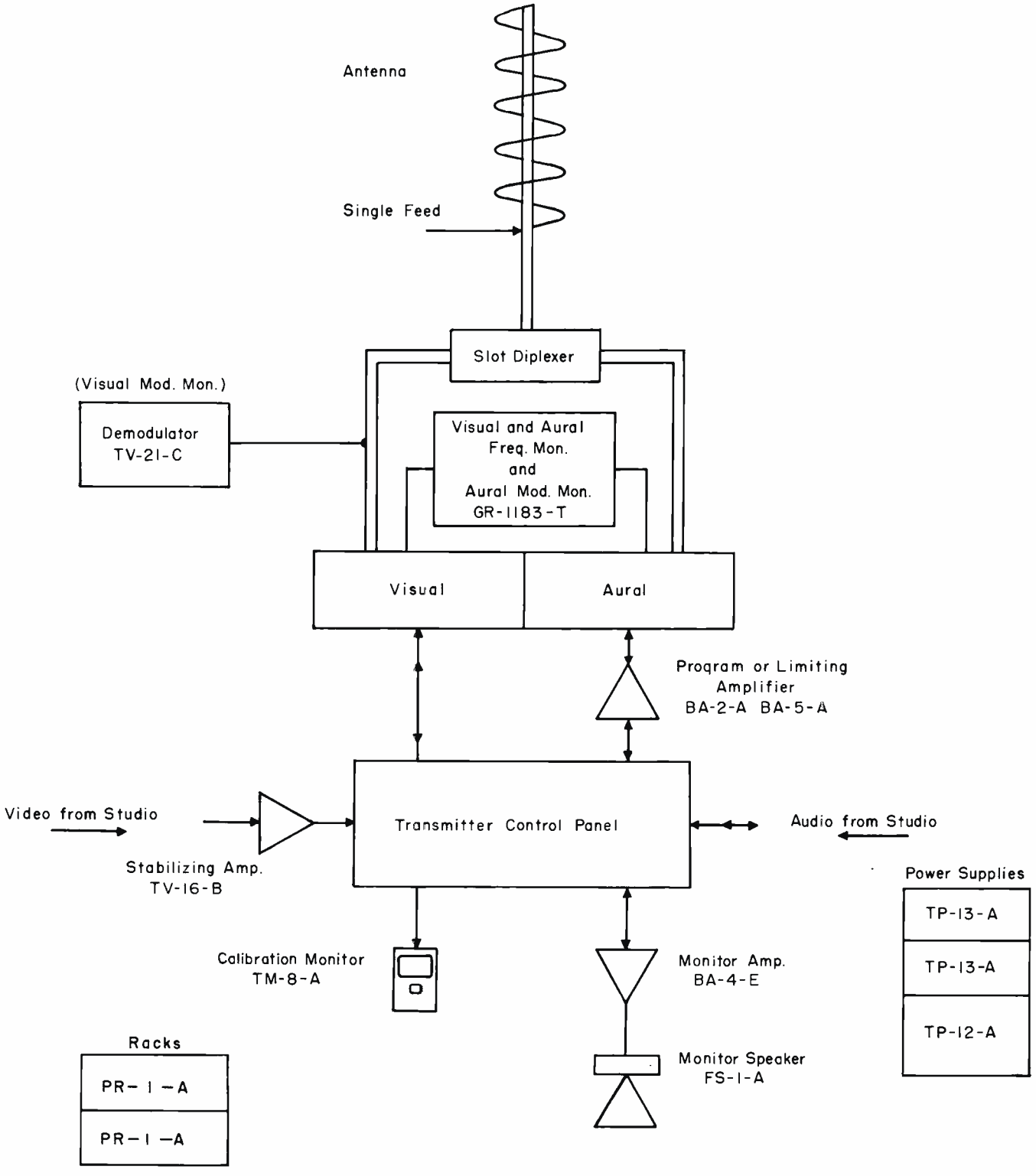


Figure 25

BASIC TRANSMITTING SYSTEM FOR UHF CHANNELS 14–83

Studio Systems Introduction

The Studio System described here contains essentially all the equipment needed to produce a station's programs and present them to the Basic Transmitting System for broadcast. In many stations, particularly small ones, the Studio System and Transmitting System are combined in the same building and sometimes in the same room. In such a case the two systems tend to lose individual identity; but still the components can be classified functionally and placed in either one system or the other.

For the sake of presenting the Studio System in an easily followed form, it is broken down as follows:

SECTION E202.41
Studio Video System

Consists of Picture Signal Sources, plus the Mixing and Switching equipment necessary to combine Sources to produce a program; its function is "program building."

SECTION E202.42
Special Effects Video Equipment

Covers specialized amplifiers which add interest to the program techniques; operationally this equipment is very closely integrated with the Studio Video Equipment.

SECTION E202.43
Synchronizing System

Generally includes equipment for generating and distributing sync signals.

SECTION E202.44
Projection Equipment

Includes all equipment used to produce optically transcribed picture material. This equipment also is operationally a part of the Studio Video System.

SECTION E202.45
Studio Audio Equipment

Consists of Audio Signal Sources, plus the Mixing and Switching equipment necessary to combine Sources to produce the audio portion of a program.

SECTION E202.46
Intercom System

Intercom here denotes "Television Studio Communication" and includes both interphone (telephone) and ordinary intercom (mike, speaker) facilities, as well as any other intra-studio communications.

SECTION E202.47
Master Control System

The function of Master Control is to combine complete shows to make up the day's program schedule, in other words, "Program Selecting." Master control in some cases involves custom-built equipment; however, many "building-blocks" are available and are here shown in several sample combinations.

SECTION E202.48
Sample Systems Section

Sample System #1

Near minimum; all switching done at transmitter.

Sample System #2

Electronic Video Mixing of four non-composite inputs and switching of three composite inputs.

Sample System #3

Electronic Video Mixing of six non-composite inputs and switching of three composite inputs.

Sample System #4

Electronic Video Mixing of nine non-composite inputs and switching of three composite inputs.

Unit Specification summary.

Studio Video System

The terms small, medium, and large which have been used to define classes of television stations have proved both unrealistic and inadequate. Like most generalizations they have no meaning when applied to specific problems. More recently we have learned to talk in the language of functions: network, non-network, program building, program selecting, etc., as well as operational techniques, mixing and switching. This enables a more precise estimation to be made of facilities for operation and the equipment needs for a particular installation.

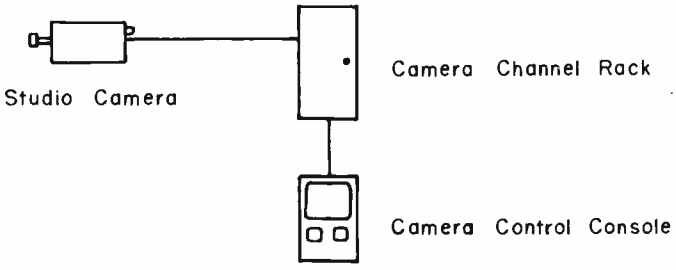
The type and amount of Studio Video equipment required to fulfill customer's individual needs is largely determined by the following points:

1. What are the sources of program material the station intends to present?
2. What switching and mixing techniques are desired to fit the sources of program material together to make up a show?
3. Is duplication of equipment desired to obtain a flexible operation?
4. Is duplication of equipment desired in order to minimize off-the-air time?

PROGRAM SOURCES

In order to discuss point #1 further, the available sources of program material and the equipment needed to produce it must first be listed.

STUDIO CAMERA CHANNEL, PE-8-A

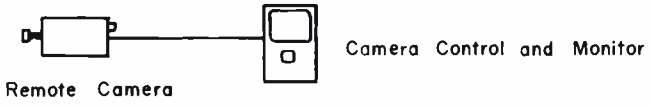


Details in Section E-210.20

Used to produce Local Live Shows.

For example: Local talent shows drawing on station and area talent for participants. This type of equipment is also used at network origination points to telecast live talent programs.

REMOTE (Portable) CAMERA CHANNELS, Type TA-124-A



Details in Section E-235

Used to televise live program material taking place outside the studio.

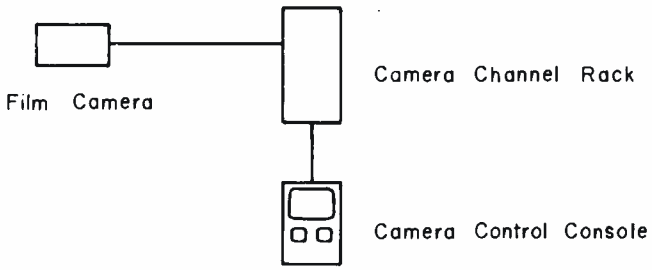
For example: Boxing from the Local Arena, Baseball, Ice Shows, etc.

The equipment is very similar in nature to the Studio Camera Channel, but is designed to be more easily transported and set up in different locations. The studio monitor cathode ray tubes are larger, and the studio camera controls are more convenient to operate.

Since studio and remote channels are similar some stations may want to double up and make the remote camera channels serve also in producing the local live shows.

When used as remote cameras along with remote switchers, a truck, etc., a fairly complete system results. This system is discussed in Section E-202.50 of this book.

FILM CAMERA CHANNEL, Type PE-5-A



Details in Section E-210.26

Used to produce transcribed program material.

For example: Slide station identification and commercials, 16 mm commercials, television recordings, feature films, etc.

MONOSCOPE CAMERA, Type PH-3-A

Details in Section E-210.27

Single rack mounted unit to produce a complete Fixed Test Pattern signal.

NETWORK

Details in Section E-210.10

Usually a Stabilizing Amplifier is used to clean up and control network and remote feeds. The type of program material obtainable from these sources is varied and may originally have been produced using all of the above equipment. For our purposes these sources will be grouped together and called NETWORK and treated as though each were a single unit source of Program Material.

SWITCHING AND MIXING METHODS

The second point (#2) that affects the complexity of a system is the switching and mixing method desired to turn sources of program material to programs and program schedules.

Below is a list of the methods most commonly used.

Switching Methods

Used in Program Building

(Non-composite switching in Studio Control Rooms)

1. Switching	Instantaneous exchange from one picture to another.
2. Fading	Simply fading one non-composite completely out, and another in.
3. Lap-dissolving	Fading one video source down but bringing the next in before the first has completely faded. In the middle of the changeover the two video sources will be mixed together.
4. Super-imposing	Mixing two or more video signals together.

Used in Program Selecting

(Composite switching in Studio Control Rooms where program selecting is occasionally required)

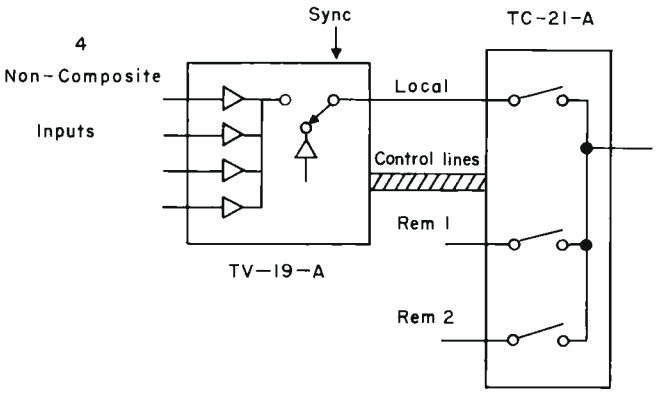
5. Switching	Switching from one composite signal to another.
6. Clip fading	Taking a composite signal and fading only the video portion, preserving the sync. This special type of fading can be done only in the Stabilizing Amplifier and Transmitter Modulator. The reason for this is that the video must first be separated from the sync and then faded. The G.E. Visual Modulator is the only one in the industry that will do this.

If a simple instantaneous switch from one video source to another is all that is desired, it can be done very inexpensively by a row of switches on a panel. The next step in smoothing out a program is the introduction of laps, fades, and superimpositions. This is taken care of by the TV-19-A or TV-39-A. Addition of special effects such as montage, wipe, etc. is the latest step taken by the industry today to add interest to telecasts.

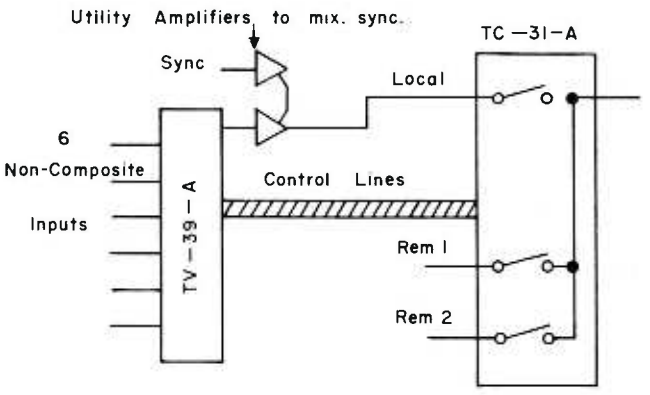
General Functions of Switching Units

1. To change from one picture to another by various methods.
2. Provide means for monitoring different points in the system.
3. Send information to the cameras indicating which camera is on the air.
4. Contain remote controls for various units such as stabilizing amplifiers.
5. Contain remote start and stop controls for projectors.
6. Limited (Intercom) facilities.
7. Special controls that must be convenient to the operator.

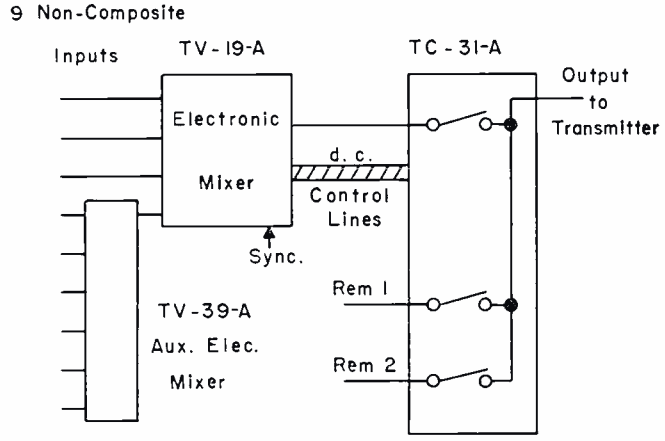
The basic unit now being built to handle small installations is the TV-19-A Electronic Mixer and its Control Unit, the TC-21-A. These are pictured below:



These units handle four non-composite inputs such as Film and Studio Cameras and three composite signals, one of them "local." The exchange or non-composite signal sources can be accomplished by two operations. First select the type of transfer to be accomplished; slow or fast, lap or fade, or instantaneous, or manual. Then push the button which will place the desired channel on the air. In some operations more than the four non-composite inputs will be needed. The combination shown below is available to handle six non-composite inputs and three composite inputs:



Further expansion of this same block-building system accommodates nine non-composite inputs and three composite inputs.



DUPLICATION OF EQUIPMENT FOR FLEXIBILITY

Point #3 affecting the complexity of the system is Duplication of Equipment in order to obtain program flexibility.

In most cases at least two Studio Channels are planned for. With two or more cameras, lenses can be changed and camera positions varied while a program is on the air. One camera limits program flexibility since changing lenses and refocusing on the air is considered impractical.

Two Film Camera Channels are desirable in order that each picture can be pre-adjusted before going on the air. If one Film Camera channel is used, the change from one picture to another must be done optically while on the air; hence picture differences must be adjusted while on the air.

Use of a Monoscope Camera makes it possible to release Film Channels for rehearsal and maintenance during Test Pattern. A Monoscope Camera placed at a remote transmitter site will release an entire downtown studio during Test Pattern Time.

DUPLICATION OF EQUIPMENT FOR MINIMIZING LOST "AIR-TIME"

Point #4 increases the size of the system by duplicating equipment in order that off-the-air time can be cut to a minimum.

In spite of a constant effort in behalf of engineering departments throughout the industry to increase the dependability of equipment, there is always the chance of a breakdown. Locating a tube failure among the hundreds of tubes used may take precious minutes. To guard against this "off-the-air time," duplicate equipment may be advisable. Equipment duplication is found in many stations especially in the synchronization equipment, since it is the heart of the whole studio.

Otherwise duplications are as follows:

1. Since Power Supplies are connected through plugs, a spare unit may be substituted by means of a Portable patching cable.
2. Cue Monitor Switching Systems can be connected through a patch panel so that in emergencies they can feed the program to the output line.
3. Extra utility and stabilizing amplifiers can be conveniently located in the patching field for quick substitution. A spare line amplifier can be permanently bridged across the Program line making necessary only a single patching operation to substitute it in case of failure.
4. Spare camera cables are a near must.

Special Effects Systems

At this time the following three equipments will be considered as special effects: Montage Amplifier, TV-35-A with Control Panel TC-34-A; Electronic Pointer TV-34-B with a "joy stick" control box; and the Sync Lock TV-30-A with its Control Panel TC-35-A. The manner in which these units fit into an over-all video system is illustrated by Figure 12 where the special effects equipment is shown in red.

The montage/wipe amplifier and control panel permits making wipes when going from one non-composite picture source to another. The kind of wipe is determined by the direction the division between the two parts of the picture moves and by the shape of this division. The most common wipes are:

1. Vertical
2. Horizontal
3. Combination

This amplifier also will produce montage pictures; that is, when one picture may be inserted into another and no parts of the two pictures are superimposed. The shape of the inserted area is determined by a third picture or keying signal.

The electronic pointer, TV-34-A, is a unit that develops a rectangular marker which can be moved to any point in the picture. The marker is approximately $\frac{7}{16}$" high by $\frac{7}{64}$" wide on a 12" tube, and its position is controlled by a "joy stick" control. It is useful in drawing particular attention to a certain part of a picture.

The TV-30-A sync lock is discussed in Synchronizing Systems, Section 202.43.

Synchronizing Systems

SYNC GENERATORS

Every television studio requires a synchronizing generator to supply the proper sync signals for the video equipment and provide "super sync" and blanking for the composite video output of the studio. If the sync generator fails, practically all of the studio video equipment becomes inoperative; therefore it is advisable to have two sync generators if at all possible. When two are used a TC-16-B Switching Unit should be installed. This unit allows the four pulse outputs of the spare sync generator to be switched into the television system.

SYNC GENERATOR SWITCHING UNITS

At the present time some G-E stations equipped with one old type sync generator, PH-A-1, may desire to acquire a new PG-2-B and keep the old one as a spare. Some of these installations require as many as nine different sync signals. In order to switch this many pulses, three parallel-connected type TC-16-B switching units are required. A type TC-16-A switching unit capable of switching as many as twenty pulses may also be used.

For installations that require six different sync pulses, two regular TC-16-B's are required, or one TC-16-B can be modified by the user to switch two additional pulses by adding a video relay and six female amphenol jacks in accordance with information available from G.E. Field Engineering.

TV-30-A SYNC LOCK

The sync lock contains horizontal frequency control circuits and vertical phase correction circuits which provide automatic synchronization of a local sync generator with a remote sync signal. A TV-16-B Stabilizing Amplifier or equivalent is required to provide "skimmed" remote sync for the sync lock. This stabilizing amplifier also provides a non-composite remote picture.

When the local pulse generator is locked to the remote sync, the remote non-composite picture will be exactly in phase with a local non-composite; therefore these two pictures may be mixed, lapped, faded, etc., just as if they were both from local studio cameras. The sync lock may be used with a GE PG-2-B, or an RCA TG-1-A sync generator. When used with the RCA unit, an a-c regulating transformer or separate bias supply for the Sync Lock is required.

When the local sync generator is locked to a remote, the remote sync can be completely removed by the stabilizing amplifier and local sync inserted on the remote signal, therefore providing the remote signal with good, clean sync before it is sent to the transmitter.

Locking the local sync generator to a network show is especially advantageous and provides smooth insertion of local commercials and station identifications as long as there is no loss of network sync. During station breaks on the network, the sync may be changed or it may even be eliminated a few seconds while going from one network or program to another. On these occasions a slaved sync generator will drop out of speed. When network sync is restored it will relock instantly on horizontal, and local pictures will appear phased vertically with only a slight hum bar rolling upward to the top of the picture. If composite switching is used within the network show, a slow vertical "roll" up to two seconds will occur at each switch while the local sync generator searches for vertical lock again. In this case too it will relock instantly in horizontal. Since the locked sync generator will not follow a change in sync as rapidly as a receiver will, a network composite switch may cause more noticeable receiver "roll" when the sync generator is slaved than when it is not.

A sync lock control panel TC-35-A is shown in figure 2. This panel contains sync height, black clip, remote gain and composite—non-composite controls for two stabilizing amplifiers, as well as sync lock on-off switch, front porch width control, sync selector and a remote switch for the pulse generator switching unit. The panel also provides seven push buttons for video monitoring purposes. This panel serves as a remote line control for two video lines. It may be desirable to associate it with corresponding audio line equalizers and attenuators in adjacent panels to give complete remote line control in one place.

By adding another sync generator switching unit to the system shown in Fig. 2 it is possible to arrange the connections so that stabilizing amplifier and sync lock controls can be preset on the spare sync generator before actually being used in a slave operation.

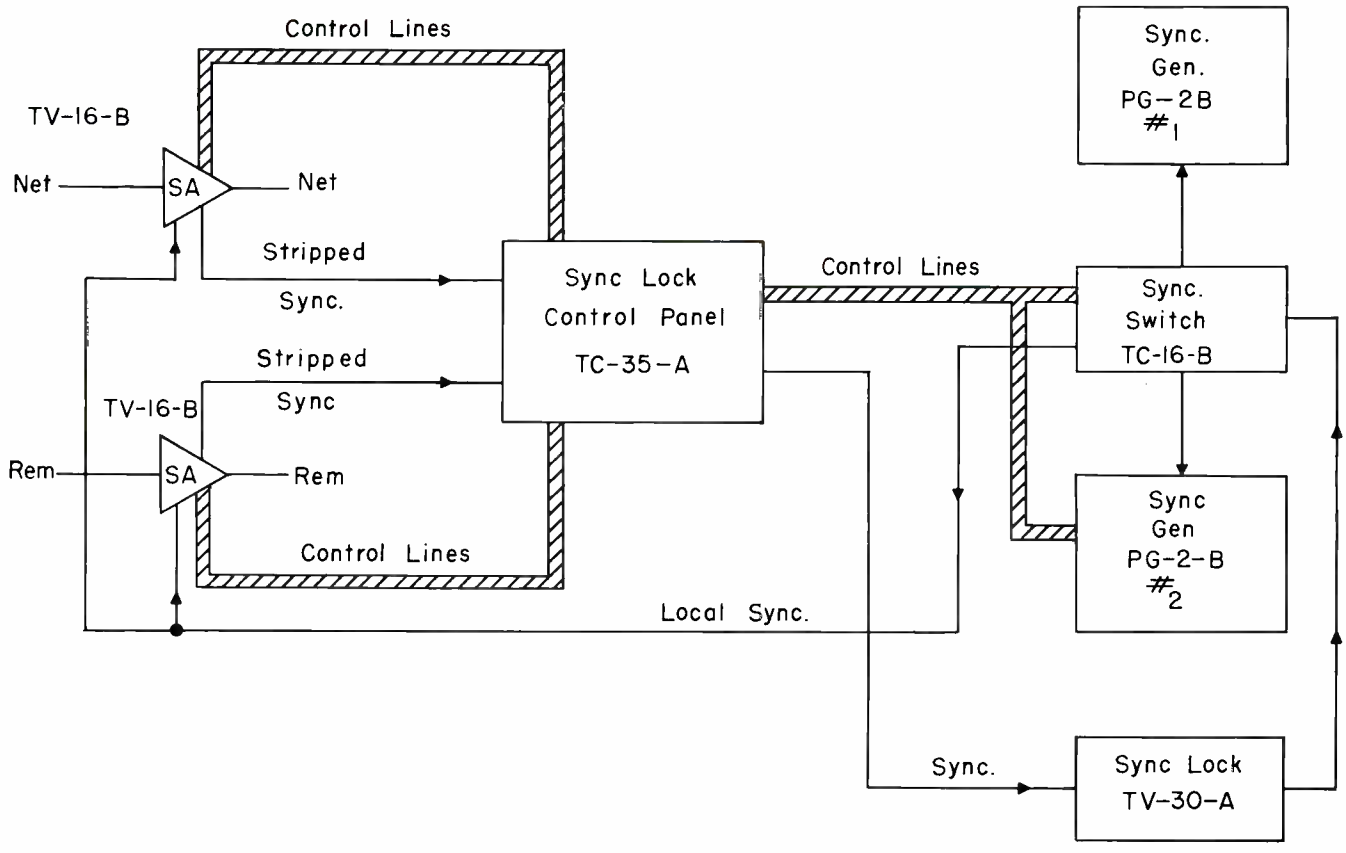


Figure 2
SYNC-LOCK CONTROL SYSTEM

Projector Systems

The heart of most studio video systems is the film camera and its associated projection equipment. It is important because it is used for the production of most of the commercials.

Types of projection equipment available are the 16-mm movie projector, 35-mm movie projector and the slide projector. Typical arrangements of these equipments in a film room are given on Figure 3. A station should have at least two 16-mm projectors and a slide projector in order to program smoothly and safely. In arrangements such as A & B of Figure 3, a mirror changeover is used in order to provide multiple inputs to the film camera. Drawing C of Figure 3 shows an "in line" arrangement with a fire wall between the cameras and projectors. This layout does not require mirror changeovers but the cameras have to be moved often between projectors.

The PF-5-A 16-mm Projector is supplied with a remote control selector which has provision for one local and five remote control positions. Video switching panels such as the TC-31-A, TC-22-A and TC-21-A have two sets of three push buttons to control two projectors remotely. One button will turn the synchrolite on, one turns the projector motor on, and a third will turn the synchrolite and the motor off. These buttons are inoperative until the projectionist gives remote control of the projector to the remote location. If the station uses a sync lock with its sync generator a model 4TV32A2 slaving kit must be used with each PF-2-B projector. The PF-5-A always operates from vertical sync with the projector motor receiving a-c power from the synchrolite. This keeps the projector "pull-down" in the proper phase with the sync generator at all times. Shutter type 16 mm projectors with incandescent light sources are available but are not adaptable to slaving operation.

The PF-1-A 35-mm projector is a standard theater projector with a modified intermittent and a synchrolite used as its light source. It is supplied with a high quality audio pre-amp mounted in its base. Although the synchrolite is a "cold" light source and is far less a fire hazard than other projectors, some local and state laws require that the 35-mm projector be enclosed in a fireproof room isolated from the other projection equipment. The 35-mm projector cannot be slaved from the synchrolite.

The PF-3-C and PF-4-A slide projectors are each, in effect, two projectors in one. Two slides may be superimposed, dissolved and lapped by means of a mechanical fader. The slides may be either transparent or opaque and are 3¼" x 4". Accessory kits are available which permit the use of 35-mm slides, strip film, moving news tape, etc.

Studio Audio Systems

The heart of the studio audio system is the BC-11-A Audio Console. This console is extremely flexible with sufficient inputs for television use. The console contains nine mixers and may use up to seven pre-amplifiers, two booster amplifiers, two program amplifiers, and two monitoring amplifiers. A typical combination, Model 4BC11A4 includes four pre-amplifiers, two booster amplifiers, one program amplifier, and one monitor amplifier, plus a power supply. This gives a single channel console with a sub-master control. For emergency use the monitor output may be used for a program output. If a dual channel console is desired, a second program amplifier, power supply, and VU meter may be added. Studio Turn-Table feed may be provided by adding a second monitoring amplifier. Relay interlock control is available by the addition of an FA-45-A relay chassis. All amplifiers, power supplies, and the relay chassis are plug-in type. The power supplies are mounted externally to the BC-11-A, usually in the rack or in the control desk.

A typical audio layout for a TV studio is given in simplified form on Figure 4. In addition to the BC-11-A Console, other equipment, such as studio mikes, announce microphones, turntables, speakers, cue amplifiers, patch panels, etc., are required to fit the stations' needs.

In some small installations, a turret mounted four-input amplifier, BA-14-A, may suffice. An example of its use is given in Figure 10 of E202.48. For remote broadcasts a BA-6-B, portable version of the same amplifier, is available. This provides high-level mixing for four inputs, a monitoring output, built-in tone for remote cue, output level control, etc.

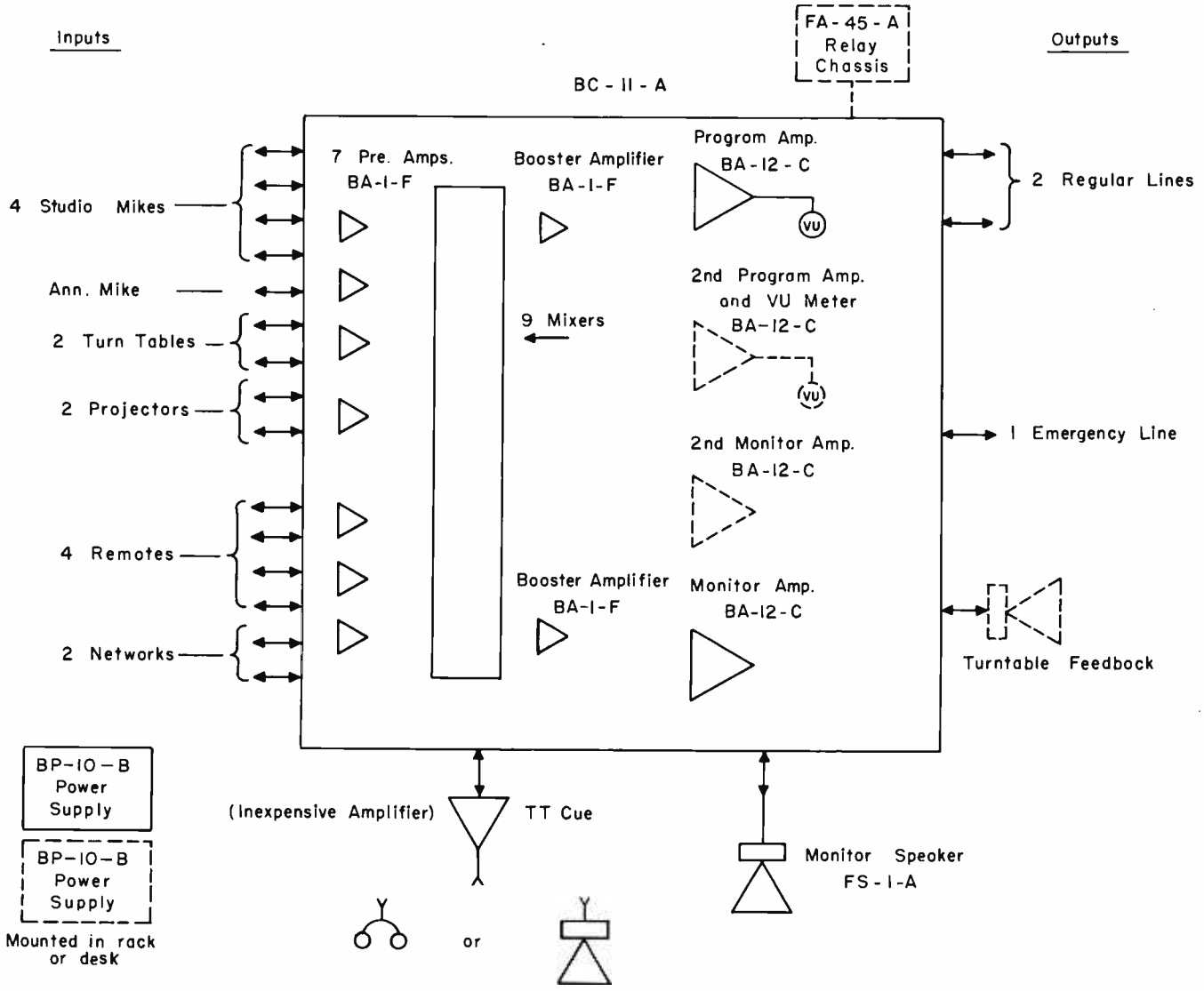


Figure 4

TYPICAL AUDIO LAYOUT USING A BC-11-A

Intercom Systems

Intercom equipment provides constant communication among operating personnel during the course of a television rehearsal or show, and among maintenance and set-up crews during off-the-air time. Using intercom equipment, the program director or co-ordinator can maintain instantaneous contact with cameraman, stage manager, projectionists, engineers and other important operating personnel.

Each studio camera channel is provided with a two-way communication system between the camera, rack, and console. By means of a switch it can be isolated for private communication during line up, or connected to the over-all studio intercom system during programming.

It has been found that most stations choose to build their own intercom systems from inexpensive amplifiers, speakers, etc., or buy commercial interoffice interphone, since excellent quality is not necessary. The TC-21-A panel has four switches marked "utility," and the TC-22-A has six switches, which may be used in an intercom system.

Figure 5 depicts a general intercom system which may be used as a guide in laying out a system. Decisions as to the number of amplifiers and speakers can be made by crossing out those channels not required in the proposed operation. To minimize confusion, interconnecting lines have been left out and like numbers should be connected.

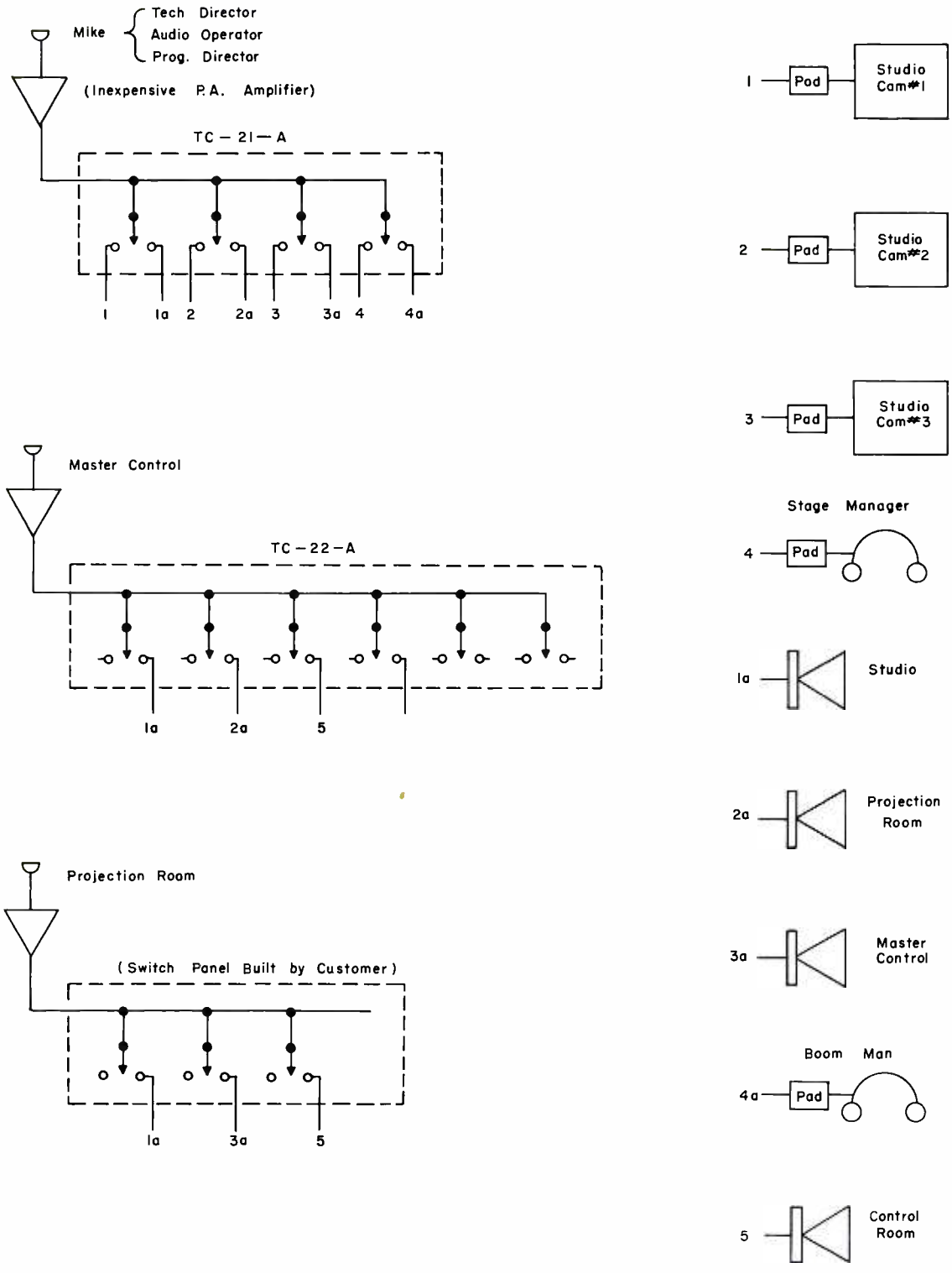


Figure 5
GENERAL INTERCOM SYSTEM

Master Control System

In general, studio control is the system for combining non-composite video sources to build a program. Master Control combines complete programs, as composite video, to make up the scheduled broadcast for the day. In many stations the need for a separate Master Control setup is not great enough to warrant the additional expense, therefore this function, as described above, is handled to a limited extent in the Studio Control Systems, as indicated by including limited composite switching on the TC-21-A or TC-31-A panels.

Since Master control systems follow no set pattern and vary greatly in the number of inputs and outputs handled, no one complete unit can be made to cover the field.

There are, however, several units which when used as "building-blocks" can to a large extent fulfill most station requirements. These blocks are discussed individually and finally shown combined in one sample combination.

General Functions of Master Control Equipment

1. "Program Selection." This can be done on a direct switch basis or on a Pre-Set—Operate basis.
2. Monitoring of all incoming and outgoing lines.
3. Control of incoming and outgoing lines.
4. Communication with the sources of its inputs, such as, Studios, Remotes, Tel Co, etc.
5. Originating Film Programs from the ProjectionEquipment through a group of equipment similar to that used in the studios—thus the common name "Studio X."
6. Production, control, and distribution of sync signals.
7. Control of slaving operations.

TC-22-A Master Control Panel

This unit was designed to incorporate as many of the general functions of master control as possible on one panel, and is intended for a medium size Master Control System.

By referring to Fig. 6, note that it has:

1. Switching and monitoring facilities to handle 7 video and 8 audio inputs on a direct switch or "clip-fade" basis.
2. Switching intended for talkback facilities.
3. Controls for two stabilizing amplifiers.
4. Limited Dual Outputs (when using Audio and Video isolation Amplifiers).
5. Controls for two projectors.

Other units such as the BC-14-A Console Amplifier, TC-21-A, TV-19-A Non-composite Video Switcher, can be added along with the TC-22-A to increase the functions of the master control system, however, the number of inputs and outputs handled by the panel itself are not easily expanded.

TC-36-A Master Control (Preset Panel)

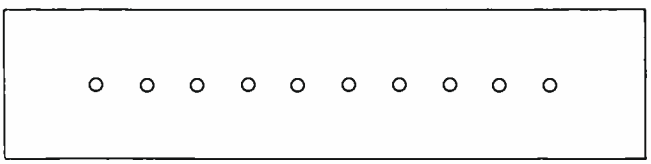
The TC-36-A is intended to operate in conjunction with a TK-1-A Relay Strip for video preselect and switching. The Audio is preselected and switched directly on the panel. One TC-36-A will provide one video and one audio output. These panels can be added up side by side to increase the number of outputs.

The reason this is called a preset panel is that dual busses are used, one of which is "on the air" and the other available for preset. For example, assume that Video A-Bus (in Figure 7) is on the air. The program to come up next is preset on Video B-Bus and when the time comes, it is placed "on the air" by pushing the operate button.

If the system has more than one output, with the corresponding number of TC-36-A Panels, the operate function of each panel may be delegated to any one of them, thus accomplishing a simultaneous change of all the outputs, both audio and video, at the same time, with one operation. Here the value of preset really becomes evident. Since most of the switching is done at 15 minute intervals, plenty of time is available within these intervals to preset, check, and otherwise get set. This results in a substantial reduction of errors.

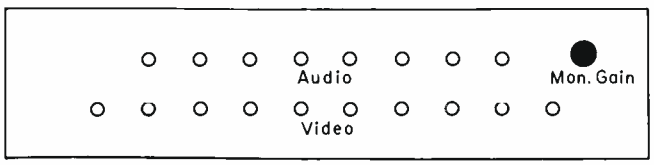
The function of the "Operate Button" can also be delegated to the leaving for taking studio so that more accurate cueing can easily be done.

Monitor Selector Panel TC-28-A



This panel mounts in either a PR-10-A or PR-16-A (using only one-half of opening) and is used to select inputs to a monitor for preview and cueing purposes. The video can be switched either directly or the panel used to control a TK-1-A relay chassis first which in turn switches the video, this latter permits all the actual control to be done in one room. A sample of its use is shown in Fig. 8.

Master Monitor Selector Panel TC-29-A



Same as TC-28-A except audio selector switch also included.

Figure 8 shows one possible equipment arrangement for master control using the "building blocks" just discussed. Here only eight inputs and two outputs are shown, however, expansion from here is accomplished by using more TK-1-A relay strips in parallel to increase the number of outputs and in series to increase the number of inputs. The control panels for handling increased number of inputs would probably be custom built.

Program preview and monitoring is handled by another TK-1-A relay strip controlled by either a TC-28-A monitor selector panel or TC-29-A master monitor selector panel.

"Studio X" is really another group of control equipment the same as found in a studio control room. Among its many uses are:

1. Handling remote or network as non-composite when M. C. is slaved.
2. Fading and lapping between studios.
3. Handling film in the late evening when the studios may be shut down.

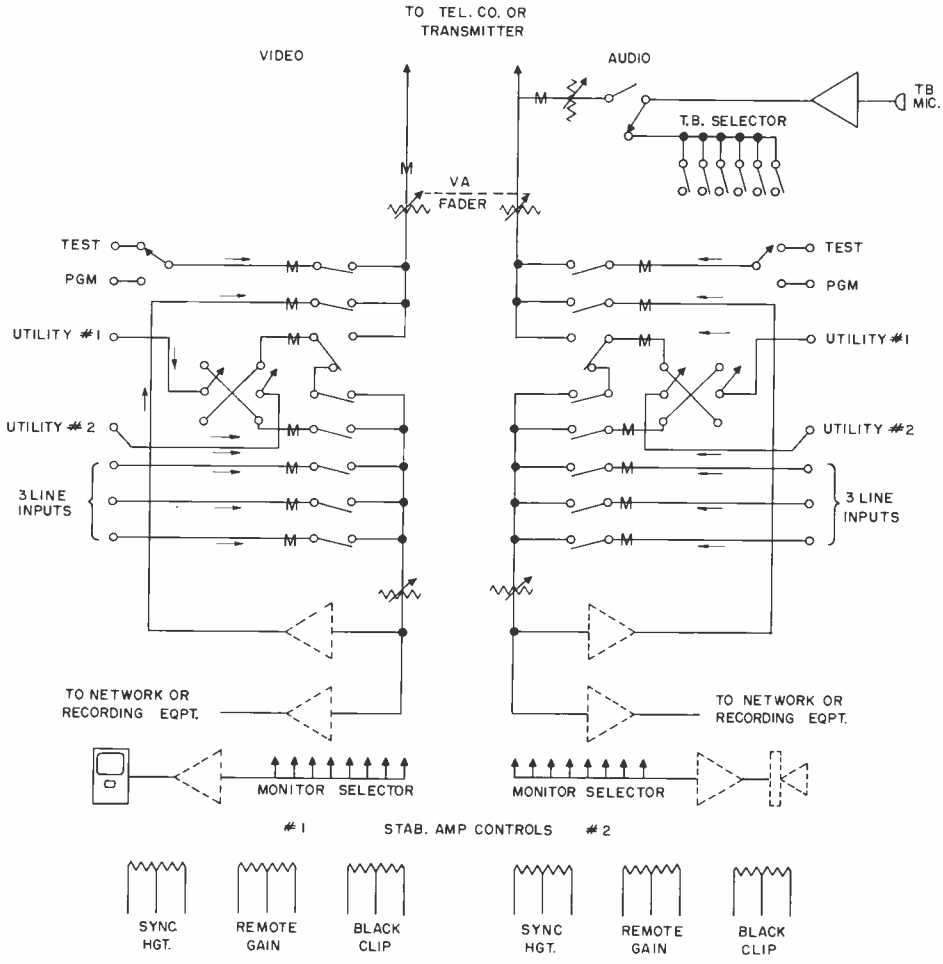


Figure 6a

LINE DIAGRAM OF TC-22-A

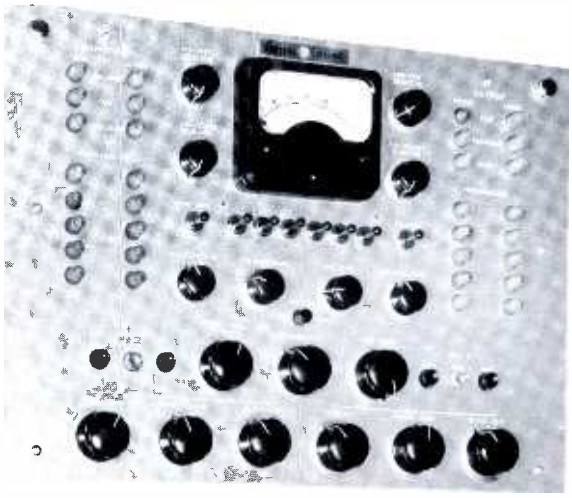


Figure 6b

TC-22-A MASTER CONTROL PANEL

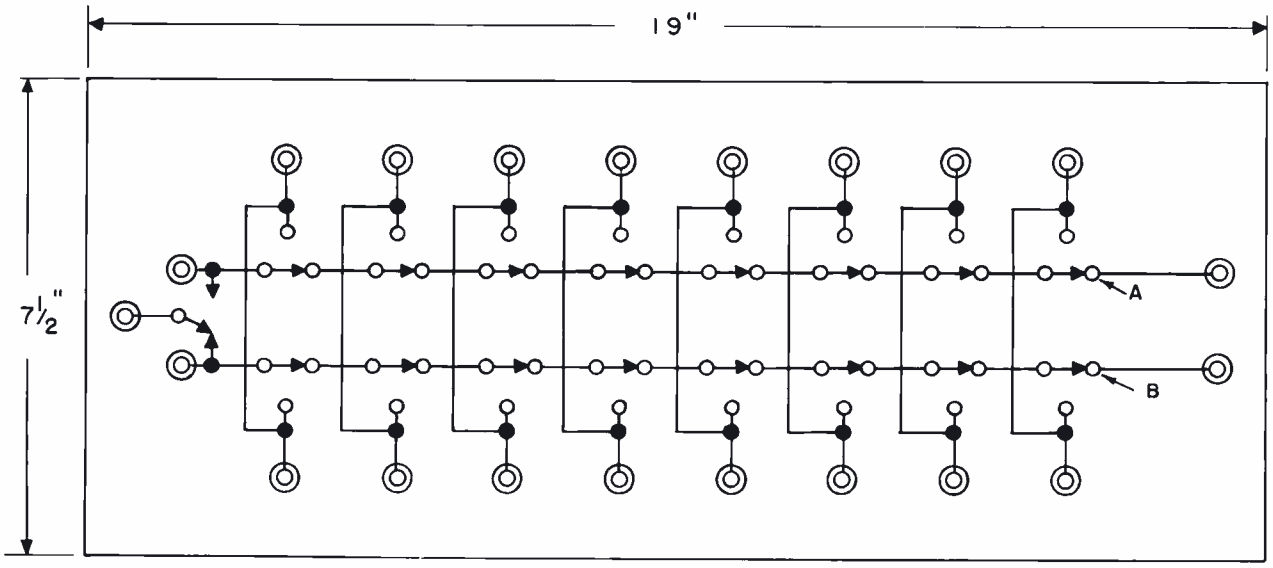


Figure 7a

TK-1-A RELAY STRIP

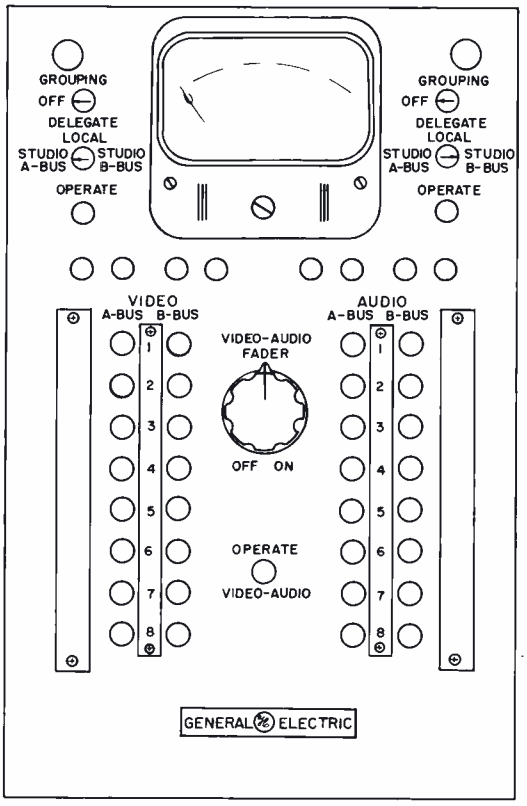


Figure 7b

TC-36-A MASTER CONTROL PANEL

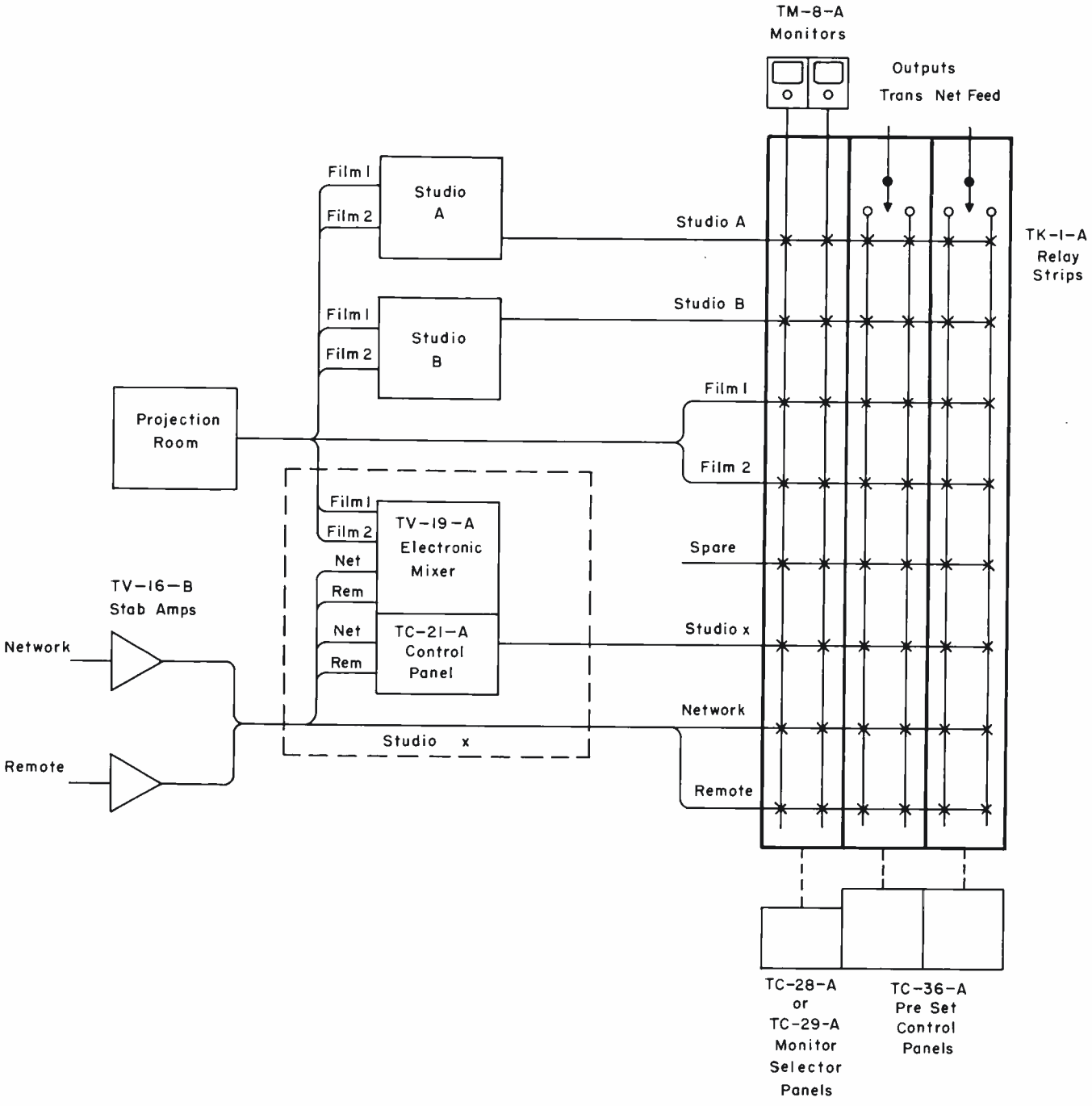


Figure 8
SAMPLE MASTER CONTROL SYSTEM

Sample Systems Section

Four sample studio video systems and an equipment checkoff list for each system are included in this section. Also the total approximate cost of each system is given. Every television station will incorporate its own individual needs and desires in making up its studio video equipment lists and the four systems given here may be used as a guide and a check for this purpose.

Sample system #1 (figure 9) is a near minimum installation with all switching done at the transmitter. Sample systems #2, #3, and #4 incorporate switching of three (3) composite inputs and 4, 6, or 9 non-composite inputs respectively. Sample system #4 also includes special effects equipment.

Figure #14 is a unit specification table. Two of the more important uses of this table are in determining the number of racks required to house the studio equipment (each rack contains forty-four (44) rack units, one rack unit equals 1¾") and determining the number of power supplies needed to supply this equipment.

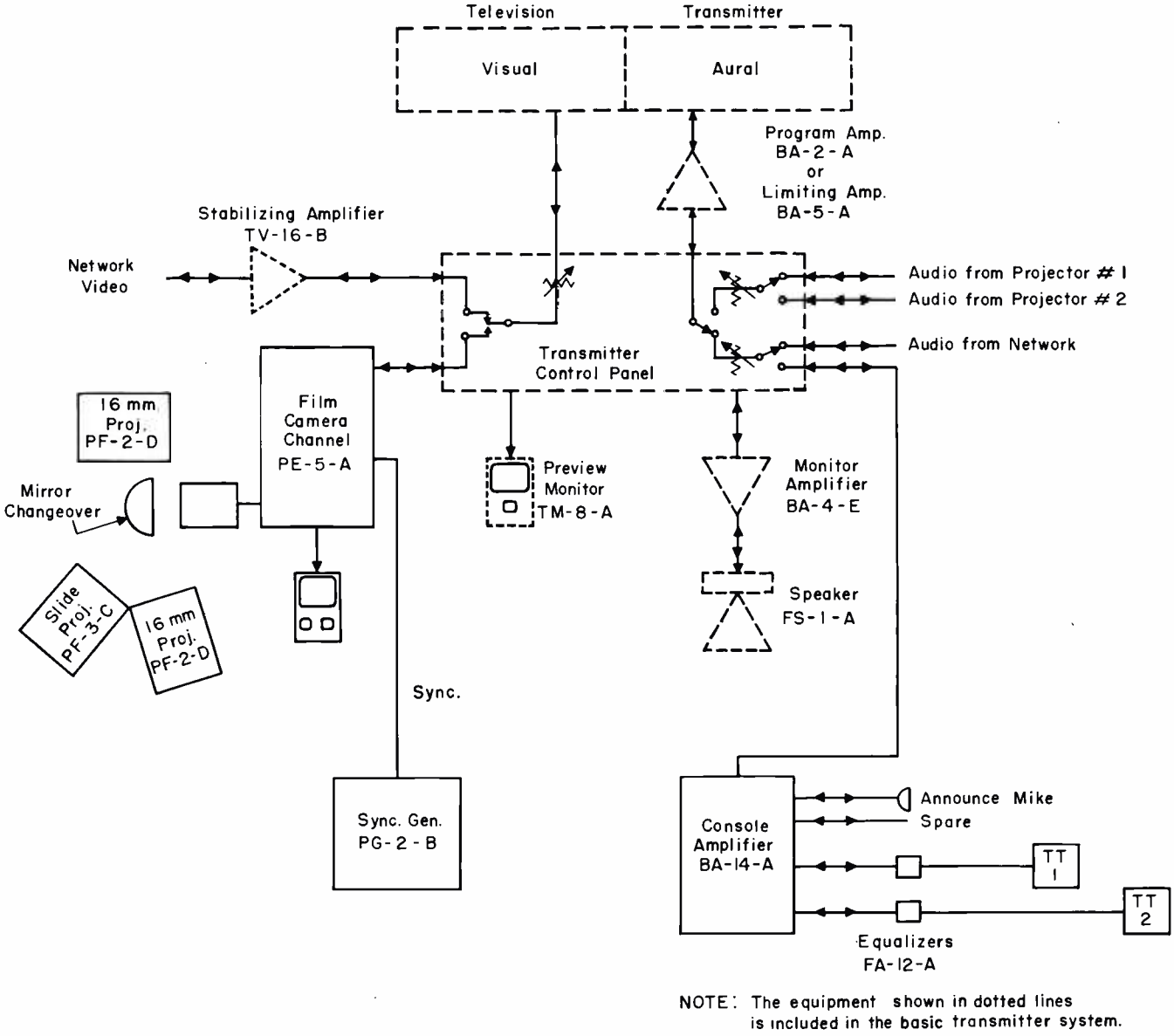


Figure 9

SAMPLE SYSTEM #1

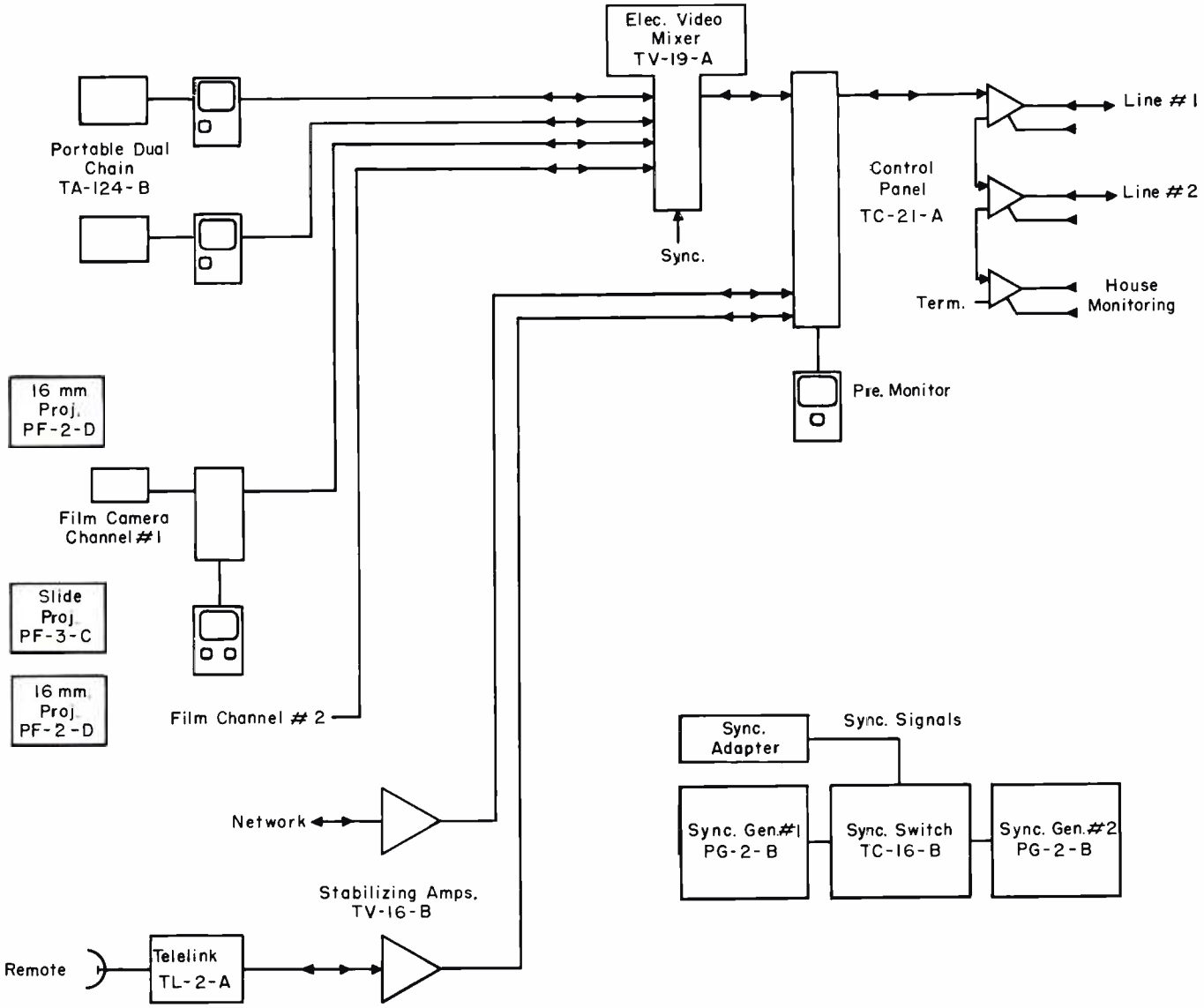


Figure 10
SAMPLE SYSTEM #2

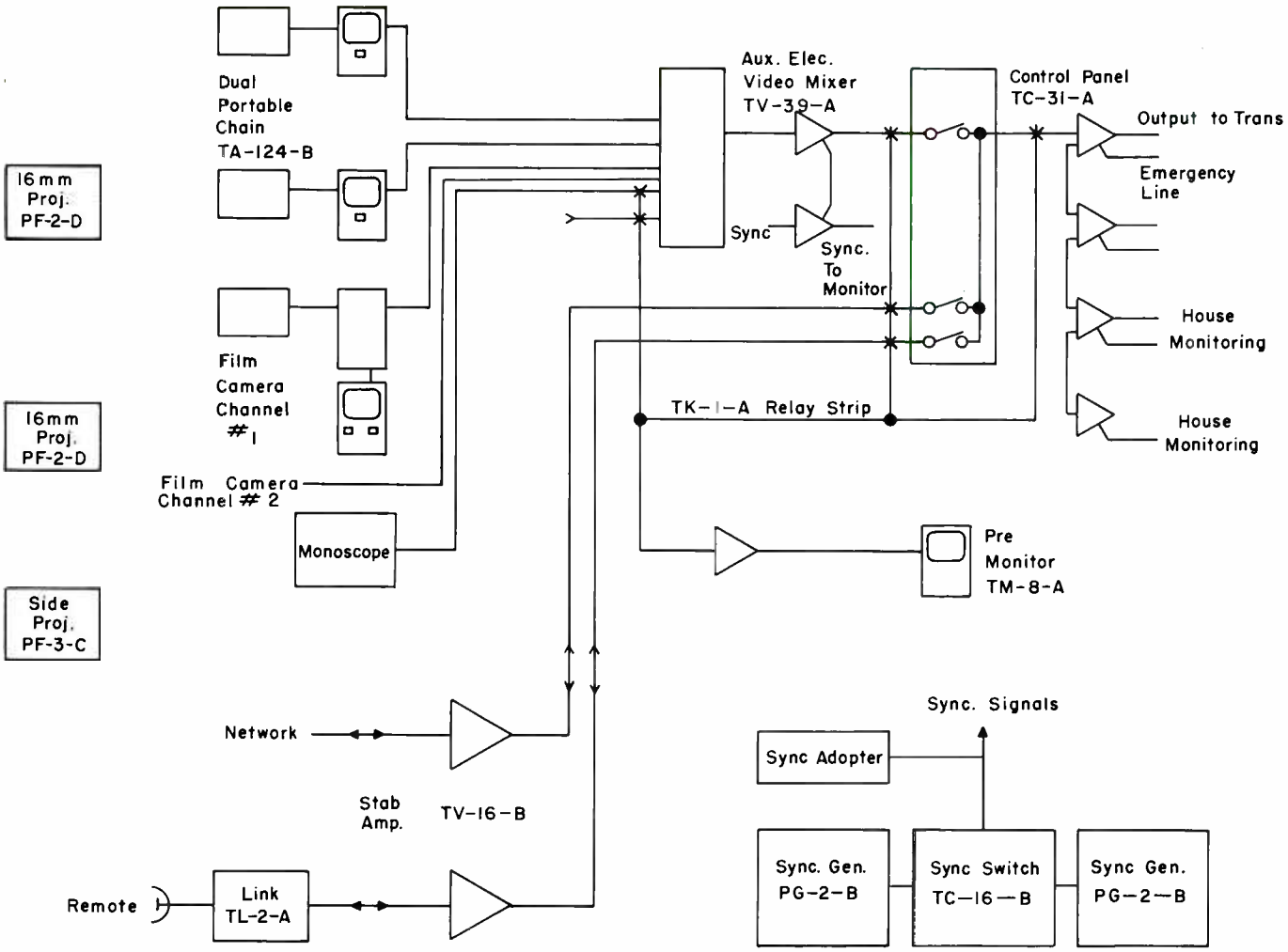


Figure 11

SAMPLE SYSTEM #3

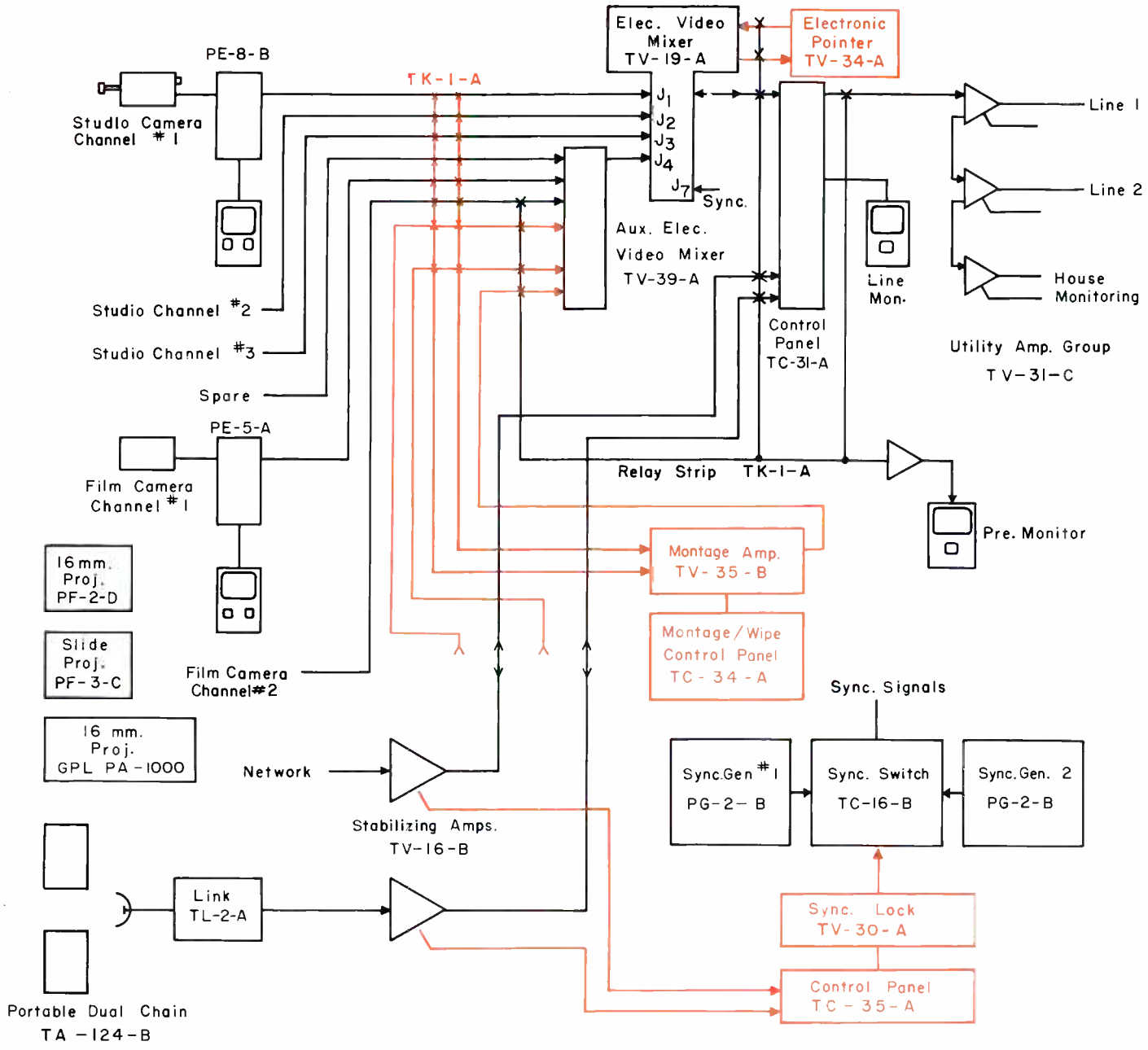


Figure 12

SAMPLE SYSTEM #4

	Individual Selling Price	*Quantity required for Sample Systems*			
		#1	#2	#3	#4
Picture Generating Equipment					
Studio Camera Channel PE-8-B	$15,800.00	0	0	0	3
One Man Dolly PD-5-A	1,885.00	0	0	0	2
Two Man Dolly PD-1-A	3,400.00	0	0	0	1
Film Channel PE-5-A	11,150.00	1	2	2	2
Monoscope Camera PH-3-A	2,900.00	0	0	1	0
Flying Spot Scanner—Philco FFS2	6,950.00	0	0	0	0
Portable Equipment					
Dual Chain	34,399.00	0	1	1	1
Triple Chain	47,725.00	0	0	0	0
Remote Truck	16,500.00	0	0	0	1
Projection Equipment					
16 mm Synchro-lite Projector PF-2-D (Eastman Head)	7,850.00	2	2	2	2
16 mm Incandescent Projector (G.P.L. PA-100)	4,300.00	0	0	0	0
35 mm Synchro-lite PF-1-A	14,400.00	0	0	0	0
Slide Projector PF-3-C	2,750.00	1	1	1	1
Mirror Change-Over TV-15-A	510.00	1	1	1	1
Sync Equipment					
Sync Generator PG-2-B	3,150.00	1	2	2	2
Sync Switch TC-16-B	290.00	0	1	1	1
Sync Distribution Amplifier TV-26-A	450.00	0	0	0	0
Sync Lock TV-30-A	720.00	0	0	0	1
Sync Lock Panel TC-35-A	395.00	0	0	0	1
Studio—Video—Switching Equipment					
Studio Switching Combination TC-30-A including: Program Switching Panel TC-21-A, Electronic Mixer TV-19-A, Calibration Monitor TM-8-A, Cabinet PR-10-A	6,090.00	0	1	0	0
Studio Switching Combination including: Program Switching Panel TC-31-A, Auxiliary Mixer TV-39-A, Relay Chassis TK-1-A	3,890.00	0	0	1	0
Studio Switching Combination including: Program Switching Panel TC-31-A, Electronic Mixer TV-19-A, Auxiliary Mixer TV-39-A, Relay Chassis TK-1-A	5,500.00	0	0	0	1
Monitoring Equipment					
Calibration Monitor TM-8-A	2,450.00	0	0	1	2
Dual Monitor TM-9-A	2,780.00	0	0	0	0
Picture Monitor TM-10-A	1,450.00	0	0	0	0
Special Effects					
Montage/Wipe Amplifier TV-35-B	1,450.00	0	0	0	1
Montage/Wipe Control Panel TC-34-A	290.00	0	0	0	1
Electronic Pointer TV-34-A	1,100.00	0	0	0	0
General Purpose Equipment					
Stabilizing Amplifier TV-16-B	720.00	0	2	2	2
Utility Amplifier Group TV-31-A	648.00	0	1	1	0
Utility Amplifier Group TV-31-C	798.00	0	0	1	1
Power Supply TP-12-B	850.00	1	3	3	4
Sync Adapter 5177-A	495.00	0	1	1	0
Power Supply TP-13-B	360.00	0	0	0	2
24 Volt Power Supply TP-4-A	290.00	0	1	1	1
TV Output Switching (Video and Audio)					
M-C Panel TC-22-A	1,600.00	0	0	0	0
TV Preset Panel TC-36-A	1,160.00	0	0	0	0
Video Relay Chassis TK-1-A	600.00	0	0	1	1
Lumiline Outlet Assembly	56.00	1	3	3	5
Blower Assembly 7485321-1	68.00	1	3	3	5

	Individual Selling Price	*Quantity required for Sample Systems*			
		#1	#2	#3	#4
Cabinetry					
Cabinet Rack PR-1-A (Without Accessories)	$210.00	1	3	3	5
Rack Front Door PR-3-A	60.00	1	3	3	5
Terminal Board Mounting PR-4-A	9.00	1	3	3	5
Wiring Duct PR-5-A	17.00	0	1	1	1
Power Terminal Board 7118	2.50	1	3	3	5
Monitor Cabinet PR-10-A (For Calibration or Dual Monitors)	440.00	0	0	1	2
Monitor Cabinet PR-10-B (For Picture Monitor)	410.00	0	0	0	0
End Cap (Right) PR-11-A	60.00	0	0	0	0
End Cap (Left) PR-11-B	60.00	0	0	0	0
Monitor Cabinet Spacer PR-15-A	42.50	0	0	0	0
Base Cabinet PR-16-A	310.00	1	0	0	0
Base Cabinet PR-16-B	310.00	0	0	1	1
Turret Cabinet PR-17-A	130.00	0	0	0	0
Desk Unit PR-18-A	390.00	0	1	1	1
Video Patching Equipment					
Jack Strip PV-1-A	17.50	1	1	1	2
Dual Connector Plug PV-2-A	14.50	6	20	20	40
Video (single) Jack PV-12-A	4.90	12	40	40	80
Card Holder Kit PV-14-B	12.00	1	1	1	2
Video Patch Cord (2 ft.) PV-2-B	14.50	1	4	6	8
Studio Audio Switching & Mixing Equipment					
Console Amplifier BC-14-A (Turret Mounted 4-Mixer Portable Amplifiers)	965.00	1	0	0	0
Audio Console BC-11-A (9-Mixer Console with Plug-In Amplifiers)	2,150.00	0	1	1	1
Audio Amplifiers					
Two-Stage Pre-Amplifier BA-1-D	82.50	0	0	0	0
Plug-In Pre-Amplifier BA-1-F	110.00	0	0	0	0
Program Amplifier BA-2-A	195.00	0	0	0	0
Equalized Transcription Pre-Amp. BA-3-A	150.00	0	0	0	0
Monitoring Amplifier BA-4-E	180.00	0	0	0	0
Limiting Amplifier BA-5-A	980.00	0	0	0	0
Portable Amplifier BA-6-B	655.00	0	1	1	1
Utility Input Amplifier BA-10-A	75.00	0	0	0	0
Plug-In Prog/Mon. Amplifier BA-12-C	125.00	0	0	0	0
Plug-In Shelf FA-23-A	31.50	0	1	1	1
Audio Accessories					
Jack Strip FA-2-A	51.50	0	3	3	3
Monitor Speaker FS-1-A	175.00	0	1	1	1
Wall Speaker FS-2-A	29.50	0	0	0	0
Single Jack Panel FA-3-A	9.50	0	0	0	0
Double Jack Panel FA-3-B	12.00	0	0	0	0
Triple Jack Panel FA-3-C	14.00	0	1	1	1
Patch Cord (2 ft.) FA-7-A	9.00	0	8	8	8
Patch Cord (4 ft.) FA-7-B	9.50	0	0	0	0
Patch Cord (6 ft.) FA-7-C	9.75	0	0	0	0
Transcription Arm, Cartridge & Equalizer	115.87	2	2	2	2
Turn Table (Presto 64A)	495.00	2	2	2	2
Microwave Equipment					
ST Broadcast System BL-2-A	3,950.00	0	0	0	0
ST Telelink Equipment—2000 MC TL-1-A	15,000.00	0	0	0	0
Intercity Telelink Equip.—2000 MC TL-1-B	15,500.00	0	0	0	0
Portable Telelink Equip.—2000 MC TL-2-A	15,500.00	0	1	1	1

TOTAL COST OF SAMPLE SYSTEM

#1	#2	#3	#4
$38,320.00	$115,930.00	$121,260.00	$198,560.00

Figure 13

STUDIO EQUIPMENT LIST

VIDEO UNIT SPECIFICATION SUMMARY

Figure 14

Type	Unit	Instruction Book E.B.I.	Inputs			Outputs			Purpose	Physical Size	Rack Units
			Signal	D.C.	A.C.	Signal	D.C.	A.C.			
PE-5-A	Film Channel	3175	H drive neg. V drive neg. Blanking neg.		208/120 3φ ac 1900 watts	1 volt video 4 volt video			To produce picture video from recorded sources.	Over-all rack dimensions Height 83⅓ in. Width 22 in. Depth 22¼ in.	Rack included
PE-8-B	Studio Channel	3158	H drive neg. V drive neg. Blanking neg.		120 volts 1φ ac 1600 watts	1 volt video 4 volt video			To produce picture video from studio subjects.	As above	Rack included
PF-1-A	35mm Projector	2000	± V drive		110/117/120 volts 1φ 500 watts 208 volts 3φ 640 watts	10 dbm audio 600/-150 ohms			To project 35mm film.	Height 73 in. Width 20 in. Length 72 in.	
PF-3-C	Slide Projector	3103			115 volts 1φ 1000 watts max.				Used for titles, I.-D.'s, news, time tape, spots, etc.	Height 50 in. Length 31¼ in. Width 30 in.	
PF-5-A	16 mm Projector	3113	± V drive		110/117/120 volts 1φ 600 watts	14 dbm audio 600/-150 ohms			To project 16mm film.	Height 65 ft. with 4000 ft. reel Width 25.5 in. Length 28 in. Weight 500 lbs.	
PG-2-B	Sync. Generator	3125		275 volts 375 ma		± H drive ± V drive ± Sync. ± Blanking			To produce all R. T. M. A. Sync, Blanking and Driving signals needed for a T.V. System.	Height 28 in. Width 19 in.	16
PH-3-A	Monoscope	3191	H drive neg. V drive neg. Blank neg. Sync. neg.	275 volts 275 ma	110/117/125 volts 65 watts	Same as TV-17-B			Used to produce a fixed pattern with minimum amount of equipment.	Height 17½ in. Width 19 in.	10
TC-16-B	Sync. Gen. Switch	3181	8 coax 12 dc leads	275 volts 20 ma		4 coax 6 dc leads			To switch either of two Sync. Generators into System.	Height 5¼ in. Width 19 in.	3
TM-8-A	Calibration Monitor	3165	Same as TM-9-A	275 volts 800 ma	110/117/125 volts 1φ 160 watts				To be used to monitor video where accurate measurements are to be made.	Height 20¼ in. Width 15 in. Depth 20 in.	
TM-9-A	Dual Waveform	3164	.15 to 1.5 volts non-comp video 3 to 8 volts Sync. neg. .15 to 1.5 volts ref. sig.	275 volts 650 ma	110/117/125 volts 1φ 160 watts	−20 dbm audio 600/150 ohms			Monitoring of film and studio channels.	Height 20¼ in. Width 15 in. Depth 20 in.	

VIDEO UNIT SPECIFICATION SUMMARY

Figure 14 (cont'd)

Type	Unit	Instruction Book E.B.I.	Inputs			Outputs			Purpose	Physical Size	Rack Units
			Signal	D.C.	A.C.	Signal	D.C.	A.C.			
TM-10-A	Picture Monitor	3166	Same as TM-9-A except no ref. sig.	275 volts 450 ma	110/117/ 125 volts 1φ 100 watts				Wherever a picture is to be produced.	Height 14 7/16 in. Width 15 in. Depth 20 in.	
TP-12-B	Power Supply	3142			110/117/ 125 volts 1φ 650 watts		275-300/-6 volts 900 ma		To supply power to units.	Height 19¼ in. Width 19 in.	11
TP-13-B	Power Supply	3179			110/117/ 125 volts 1φ 250 watts		400 volts or 275 volts 300 ma		To supply power to units.	Height 10½ in. Width 19 in.	6
TV-16-B	Stab. Amp.	3143	3-5 volts sync. neg. app. 1 volt blanking neg.			4 volts skimmed sync. neg. plus same as TV-17-B			To control and fix up external signals coming into studio or transmitter.	Height 8¾ in. Width 19 in.	5
			.15 video .02 Sync	275 volts 250 ma	110/117/ 125 volts 77 watts						
			3 video .45 Sync								
TV-17-B	Utility Amplifier	3145	2.5 volts maximum	250-300 volts 70 ma −5 volts 15 ma	6.3 volts 1.75 amps	1.4 volts video 1.4 volts video (Monitor) 2.0 volts video 1/5 or 2/5 of above (Monitor)		Gain .6 to 2.5 Gain .9 to 4.0	To serve as isolation or, when grouped, as a distribution amp.	Fits in mounting for Utility amp. groups	
TV-19-A	Electronic Video Mixer	3169	(4) 1 volt video 3-8 volts sync. neg.	275 volts 220 ma	110/117/ 120 volts 1φ 50 watts	Same as TV-17-B plus 1.0 volt non-comp and 0.2 volt non-comp			To electronically change from one picture source to another by switches, laps, fades, etc.	Height 10½ in. Width 19 in.	6
TV-21-A/B	Demodulator	3126	.2 v RMS R.F.	275 volts 250 ma	110/117/ 125 volts 1φ 250 watts	1.0 volt waveform 1.0 volt picture			To provide monitoring of the transmitter output.	Height 14 in. Width 19 in.	8
TV-26-A	Sync Distribution Amplifier	3197	3-8 volts H drive neg. V drive neg. Blanking neg. Sync. neg.	275 volts 265 ma	110/117/ 125 volts 55 watts	2 neg. H drive 2 neg. V drive 2 neg. Blanking 4 neg. Sync.			To provide multiple buffered outputs.	Height 10½ in. Width 19 in.	6
TV-30-A	Sync. Lock	3180	H drive neg. Sync. neg. Skimmed Sync. from Remotes	275 volts 105 ma	120 volts 30 watts	H afc to sync. gen. V coincidence pulse			To lock the local P. G. to another sync. source.	Height 8¾ in. Width 19 in.	5
TV-31-A	Utility Amp. Group	3168	Contains (3) TV-17-B amps	Contains own Power Supply	110/117/ 120 volts 1φ 200 watts	See TV-17-B			Group of 3 TV-17-B amps. Utility	Height 10½ in. Width 19 in.	6
TV-31-C	Utility Amp. Group	3178	Contains (4) TV-17-B amps	275 volts 280 ma	110/117/ 120 volts 1φ 60 watts	See TV-17-B			Group of 4 TV-17-B Utility amps.	Height 10½ in. Width 19 in.	6

VIDEO UNIT SPECIFICATION SUMMARY

Figure 14 (cont'd)

Type	Unit	Instruction Book E.B.I.	Inputs			Outputs			Purpose	Physical Size	Rack Units
			Signal	D.C.	A.C.	Signal	D.C.	A.C.			
TV-34-A	Electronic Pointer		.5 to 2 volts Video Sync. neg. 3-8 volts	275 volts 225 ma	110/117/125 volts 1ϕ 40 watts				To place a manually movable pointer, black or white, in a picture.	Height 7 in. Width 19 in.	4
TV-35-B	Montage/Wipe Amp.	3199	(3) 1 volt non-comp	275 volts 300 ma	110/117/120 volts 1ϕ 80 watts	Same as TV-17-B			Special video effects.	Height 14 in. Width 19 in.	8
TV-39-A TC-31-A	(Auxiliary) Electronic Video	3182	3-8 volts Sync. neg. (6) 1 volt video non-comp.	275 volts 150 ma	110/117/125 volts 40 watts	1.0 volt non-composite picture sig. 1.0 volt monitor output			To increase the number of electronically controllable non-composite picture signal inputs to the TV-19-A to 9-14-19-24, by using 1 2 3 or 4 TV-39's, respectively. Anything over 9 inputs will require a custom built control panel.	Height 7 in. Width 19 in.	4

Portable (Remote) Systems
General Considerations

In order for a station to pick up "remotes" the following equipment is recommended:

1. Dual, triple, or quadruple remote camera chain.
2. Remote truck.
3. Microwave Link.
4. Accessory equipment such as radio communication, audio equipment, monitors, etc.

The type TA-124-B Remote Chain is made up of from one to four cameras (each with a camera control monitor, power supply, and pick up auxiliary), a sync generator and an electronic switcher with a mixer amplifier and power supply. Output of the chain is a 2-volt composite picture. The number of cameras and the length of the camera cables required will be determined by the type of remote programs the station plans to cover.

The 17-foot remote truck is especially designed to use with the TA-124-B remote chain. This truck contains shock mounted brackets for the camera control equipment, cable reels, storage closets, a variac for adjusting line voltages, blowers for hot or fresh air, seats and table for the program director and operators. A layout of the truck is given in Figure 1.

In order to transmit the programs to the station, a microwave link such as the TL-2-A portable link is needed. Often the transmitting parabola may be mounted on the roof of the truck where it can be readily set up and adjusted. In some cases line-of-sight to the receiver will not be obtainable from the truck roof top, and the antenna and transmitter will have to be mounted on a tower, high building or equivalent. For these cases a control cable which goes between the transmitter and the control equipment is available up to a length of 50 feet.

It is desirable to have the microwave receiver at the station's studio location in order to simplify programming, but often this is not possible because line-of-sight cannot be obtained. Therefore, the microwave receiver may be installed at the transmitter site which is usually at a much higher elevation. Here switching between remotes and studio programs can be done with the transmitter control console.

A BA-6-B type portable amplifier with microphones and a monitor speaker will usually satisfy the audio needs of a remote. Telephone lines are generally used for sending the audio portion of the program to the transmitter.

Some kind of communication between the remote truck and the studio or transmitter is essential, as well as an aid to programming it is needed to "line up" the microwave link. For this purpose either telephone lines or radio communication in the 30 to 50 mc or 152 mc band may be used.

The power requirements of the remote truck are about 4000 VA for a dual chain. An additional camera will require 1500 more VA. In most cases power is available at the remote locations, but if it is not, a portable generator is needed. This may be of about 5 to 10-KVA capacity, mounted on wheels so that it may be pulled behind the truck. The generator should have a voltage regulation of less than ten per cent and frequency stability of ± 2 cycles. If it is planned to use floodlights on remotes, a larger generator will be needed.

Sometimes in the case of a small station, the remote cameras are also used for programs in the studio. If this is being considered, one point to be investigated thoroughly is the difficulty of moving the equipment between the studio and truck to meet tight program schedules. If the equipment has to be moved back and forth often, its reliability will be decreased and its need for maintenance increased. Some small installations which do several remotes and few studio shows have overcome this problem by leaving the camera control equipment and power supplies in the truck at all times and arranging their studio so that studio show may be run from the truck.

When the remote camera equipment is used in the studio on a permanent or semi-permanent basis, it is usually desirable to use type 5177-A sync adapter. This unit makes it possible to operate the portable chain on the studio pulse generator, and a studio video source such as a film camera may be fed into the portable mixer-switcher to be mixed and switched in the same manner as a portable camera chain.

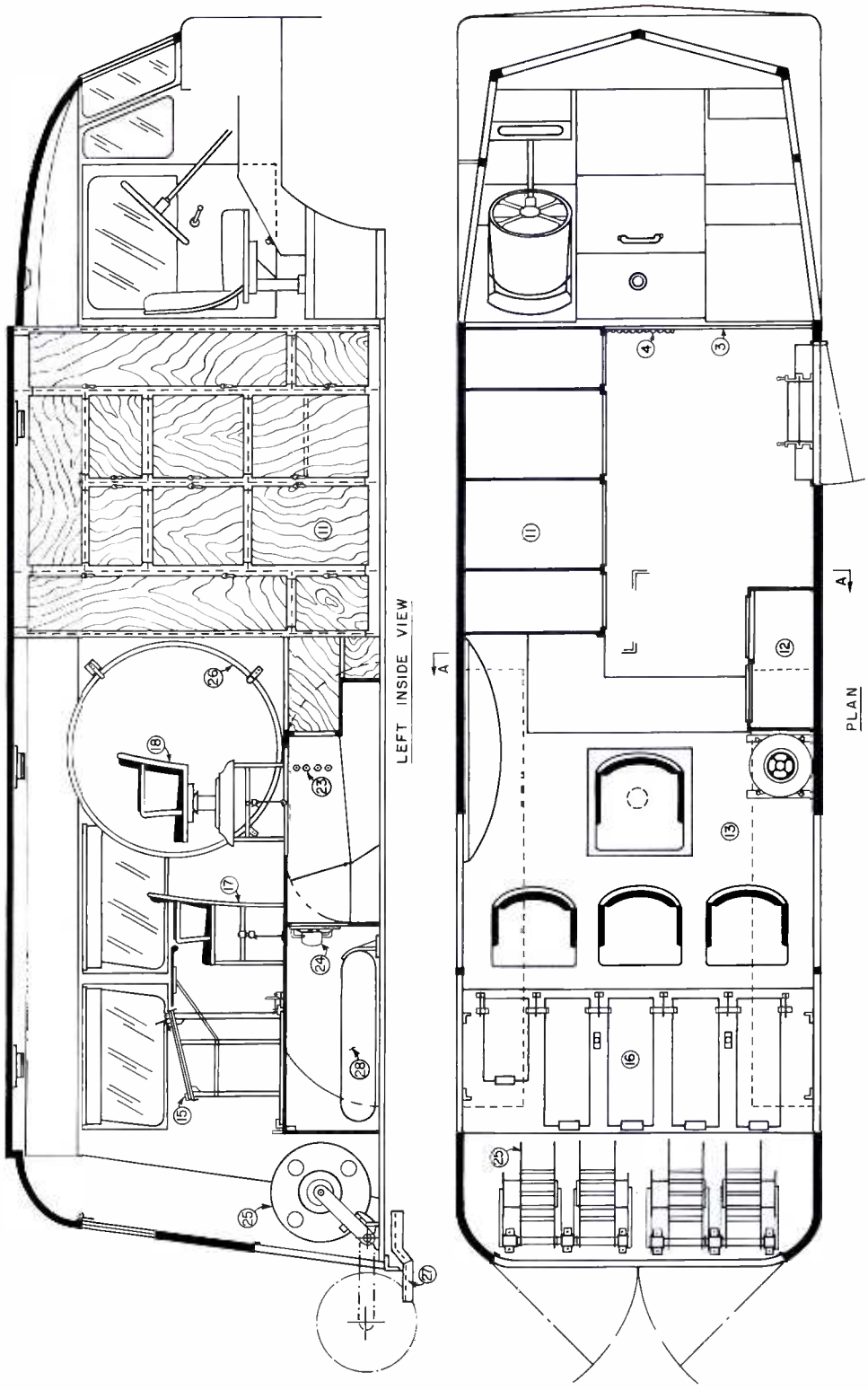


Figure 1