COAXIAL CABLE TELEVISION TRANSMISSION SYSTEMS
RF TYPE
GENERAL DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section replaces Issue 1, and is reissued to include information on thermal equalizers, thermal gain control units, automatic slope equalization and new wires used. It has been changed to include the latest equipment and system usage.

1.02 This section describes coaxial cable television transmission systems using radio-frequency carriers in the VHF television broadcast band (channels 2 through 13, 54 to 212 megacycles), the subVHF band (25 to 51 megacycles) or a combination of both.

1.03 These systems differ from baseband video systems, such as A2 or A2A, in that the video is used to modulate an rf carrier. Transmission is by means of the rf carrier, rather than the video. At the receiving end, it is necessary to demodulate the signal; that is, remove the video information from the carrier.

1.04 The transmission and distribution systems described are designed to provide essentially flat transmission of each channel in the system. Such systems are used to distribute off-the-air TV signals from a common antenna, as in a community antenna system, or to distribute closed-circuit television signals for educational, industrial, business or entertainment purposes.

1.05 In community antenna systems it is not contemplated that the Telephone Company would own or operate the antennas or the associated towers. The Telephone Company would provide the head end amplifiers and converters and the channels from the head end of the system to the premises of the ultimate user.

1.06 The subscriber's drop terminates in a grounded fitting on his premises. This fitting is considered the point of demarcation, and transmission levels are specified at this point.

1.07 A system of the type discussed provides for accepting either off-the-air standard rf picture and sound carriers or baseband video and audio signals. Modulators are provided by the Telephone Company to convert the baseband signals to rf carriers. In either case, it is expected that the signal delivered to the customer will be at rf. The acceptance of an rf signal from the customer may be justified if the customer's camera equipment is arranged to deliver an rf signal.

**Reprinted to comply with modified final judgment.

1.08 There may be special instances where the customer desires delivery of baseband signals. This can be accomplished by providing a suitable tuner of the type approved for off-the-air service.

1.09 The reasons for transmitting signals in the subVHF range are that the cable attenuations are lower in this range and the return losses of splices and cable may be considerably higher than in the VHF range. In areas where it is desired to deliver TV signals in the high VHF range to the receiving television sets in schools, for example, it would in general, be cheaper to transmit them at subVHF frequencies through the feeder system and convert them at the input to the distribution systems rather than to use a high VHF feeder system with its much closer spacing of line amplifiers. In order to use the subVHF region for the transmission of TV signals, the video and audio signals would be modulated on carrier frequencies appearing in this range and converted at the receiving point to channel frequencies in the low or high VHF range. For educational TV, two general transmission systems are considered, one carrying only low VHF signals and the other a combination of subVHF and low VHF signals.

1.10 The systems described employ components immediately available from various manufacturers in the community antenna field. These components are combined with Western Electric CA-1878 3/8″ air dielectric coaxial cable and B, C, or D triaxial solid dielectric cable.

1.11 The coaxial cable transmission system described here is generally suitable for systems where the maximum distance from picture source to the most distant subscriber does not require more than about 35 line amplifiers in tandem. This might cover a system whose extremities from a centrally located "head end" or transmitting point does not exceed about 30 miles. As discussed later, the limitation of the number of amplifiers operated in tandem is imposed by noise and cross-modulation considerations.

2. DEFINITIONS

2.01 Before proceeding to a discussion of systems, it may be helpful to define a number of terms which will be used freely.

*(1) **Head End*** — That end of the system at which the signals are injected, as illustrated in Figs. 1A and 1B.

*(2) **System Impedance*** — The system impedance is 75 ohms, unbalanced.

*(3) **System Levels*** — The standard reference for measurements of system signal levels is one millivolt rms (0 dbmv) across 75 ohms, and all system signal levels should be measured in rms millivolts across 75 ohms or in decibels above and below the standard reference level of 1 millivolt rms across 75 ohms (0 dbmv). On most of the sketches included in this section, system levels are indicated by two numbers separated by a slant line, the level at the lowest channel frequency being shown as the "numerator" of the "fraction" and the level at highest channel as the "denominator" (e.g., +10/+3). Losses and gains in various components of the system are shown in the same manner. Levels are usually indicated above the diagram lines while losses and gains are indicated below.

*(4) **Primary Feeder*** — That portion of the system illustrated in Fig. 2 which is concerned primarily with transmission of the signal from the head end to the areas in which it is to be distributed. It employs CA-1878 Western Electric 0.375″ air dielectric coaxial cable with polyethylene jacket exclusively and contains the necessary line amplifiers, equalization, automatic level controls (ALC) and → automatic slope equalization (ASE) to provide the required carrier level for all channels. As shown in Fig. 2, it may contain directional couplers for deriving additional primary or secondary feeders.

*(5) **Secondary Feeder*** — That portion of the system which, as illustrated in Fig. 2, is concerned with transmitting the signal from primary feeders to distribution areas. It has, in addition to the necessary line amplifiers and equalizers required to maintain the desired signal levels, bridging amplifiers connected in it to derive the "side" or distribution legs. It will usually employ CA-1878 coaxial cable exclusively and may contain passive splitters or directional couplers for

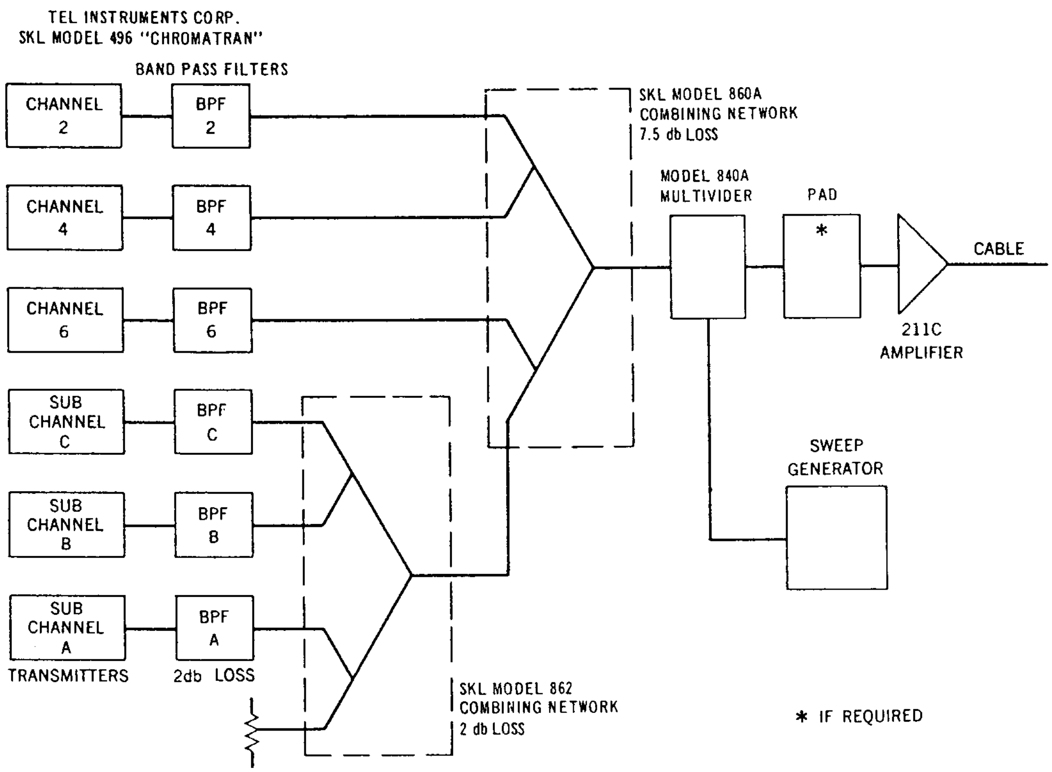


Fig. 1A — Typical Head End for Closed Circuit Television System

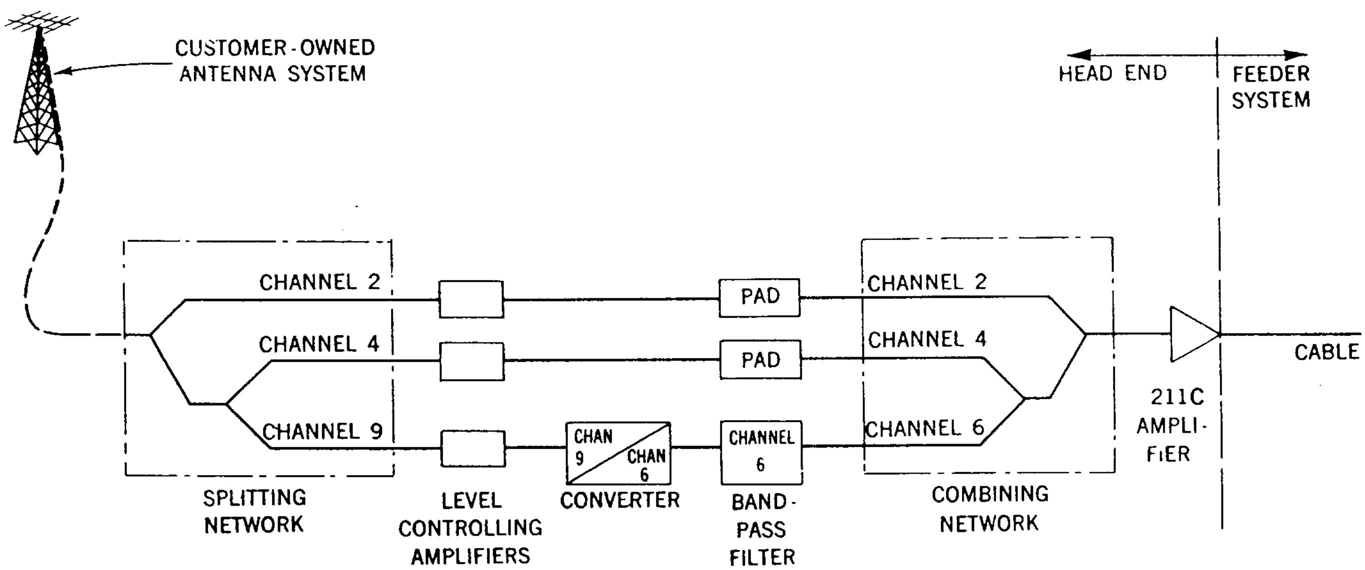


Fig. 1B — Typical Head End for CATV System

deriving additional secondary feeders. In an educational TV system, the distinction between primary and secondary feeders largely disappears since a branch to a school may be required anywhere in the feeder system.

(6) Distribution Cable System — This is the cable to which the subscriber's drops are directly connected. This will employ double-shielded solid center conductor cable such as B, C or D triaxial cable. It may also contain directional couplers for deriving additional distribution cable branches.

(7) Line Extension Amplifier — An amplifier placed in a distribution cable leg in order to extend its length and to correct to some degree for cable slope.

(8) Receiving Distribution System — That portion of the system, usually within a building or confined to a relatively small geographical area, which distributes the TV signals to the individual receivers. The signals may be in sublow VHF, low VHF, high VHF or combinations of these. In the case of public buildings, the receiving distribution system may be Telephone Company or subscriber owned.

(9) Subscriber Drop — A coaxial or triaxial wire connected to the TV transmission system and supplying TV signals to individual subscribers or buildings. It may end in a grounded fitting at the subscriber's premises.

(10) TV Distribution Company — An organization, such as a community antenna company or entertainment TV company, which is engaged in the provision of TV signals to an area.

(11) CATV System — Community antenna television system, a cable network to provide for the distribution of off-the-air television signals.

3. TRANSMISSION NETWORK

(A) Primary Feeders

3.01 The primary feeder is that portion of the system which is concerned with transmission of the signal from the head end to the areas in which it is to be distributed. Fig. 2 illustrates a representative feeder system. Primary feeders, as indicated, start at the head end of the system and transport the signals to the areas through which they are to be carried by secondary feeders or distribution cables. No devices are therefore required in them for deriving side distribution legs. Except for special cases, the line amplifiers can be located at very nearly optimum distances apart without the need to locate them advantageously with respect to particular streets or alleys down which distribution cables are required to run. Generally, the amplifiers are located to take advantage of their maximum gain so that overloading will not take place at lowest temperature when the cable attenuation is low and so that the input levels will not drop below permissible signal-to-noise ratio minimums when ambient temperatures and cable attenuations are high.

3.02 In an educational system, illustrated by Fig. 3, the distinction between primary feeders and secondary feeders largely disappears. The feeder cable transports the signal from the various transmitting points past the receiving points so that school or other building receiving distribution systems may be connected at any point along the feeder. Since transmission impairments in the feeder will affect the entire system beyond, it is important to keep them to a minimum. Individual drops, generally, are not derived from feeders. The method of deriving branch feeders and distribution systems will be covered later.

3.03 Ambient temperatures may be high in the summertime and low in the winter with consequent rather large attenuation swings. There is a change in cable slope with temperature. The difference in attenuation for the lowest frequency and for the highest is greater at high temperatures as shown in Fig. 9. Due to this difference in slope, a "twist" in levels takes place with temperature change which becomes serious in a system with a number of amplifiers in tandem. Assuming a zero difference in levels for the highest and lowest channels at a median temperature, the levels depart from each other in opposite directions as the temperature rises or diminishes. This

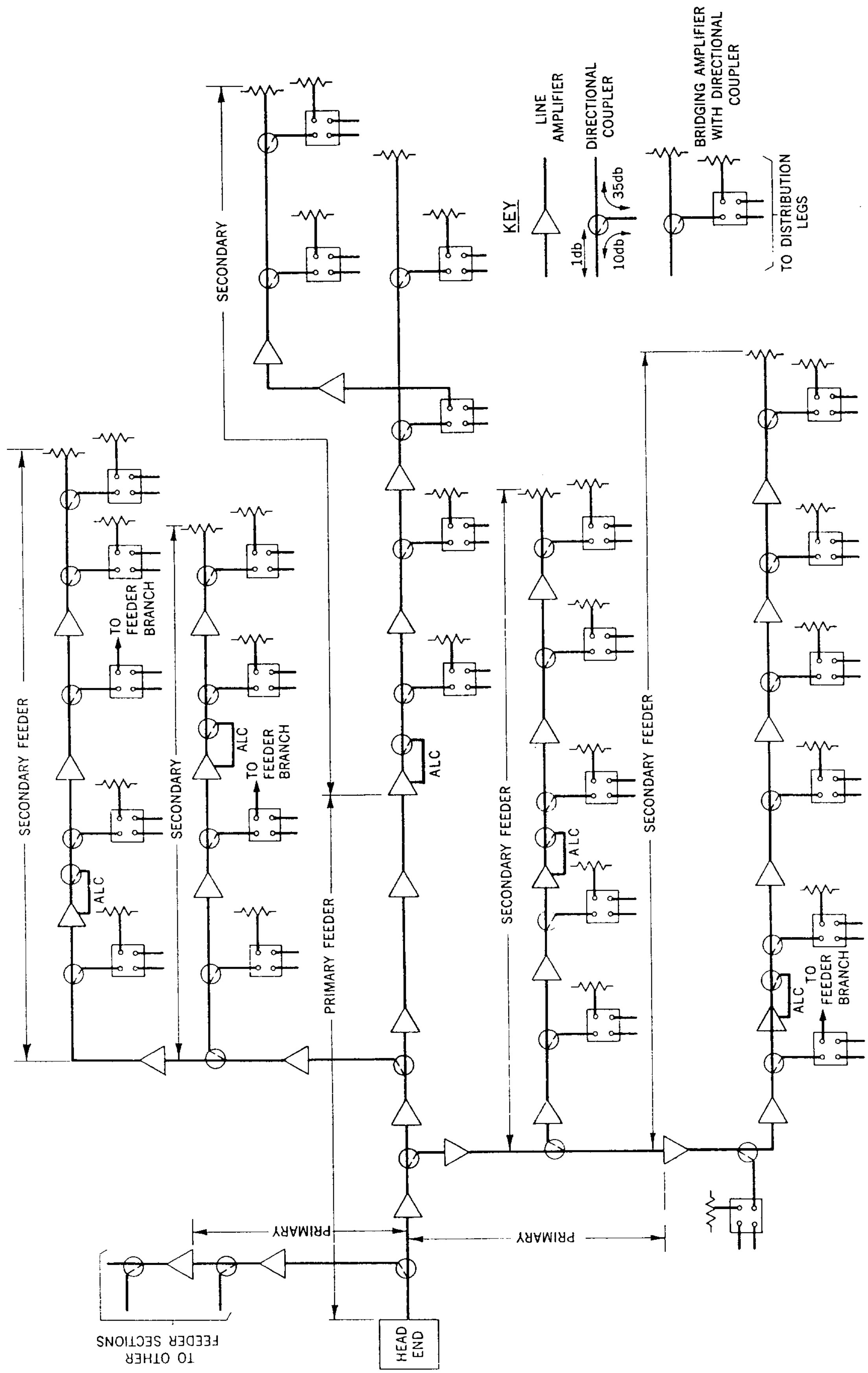


Fig. 2 — Representative Feeder System

difference in level becomes cumulatively greater as the system length increases. Thermal gain control units and thermal equalizers are used to counteract this characteristic. These thermal units not only tend to compensate for level changes, but also give slope correction which fairly well tracks the cable characteristics during these varying conditions. Normally, in aerial cable sections a thermal equalizer is used with each amplifier, and two thermal gain control units are included in an ALC section. Buried cable systems may not use any thermal equalizers and ordinarily would use only one thermal gain control in an ALC section.

3.04 Seasonal as well as day-to-night temperature swings in some locations may be so marked that rather violent level changes are quite likely to take place. Since the thermal equalizers and gain control units do not exactly follow the changes in the cable, automatic slope control is used at every second ALC station to keep the transmission system slope within proper limits.

3.05 Because of its low cost and superior transmission characteristics, Western Electric CA-1878 cable is used in all feeders except where placing conditions require a cable with great resistance to physical damage. Its attenuation at various frequencies and temperatures will determine the line amplifier locations.

(B) Secondary Feeders

3.06 A secondary feeder system is that portion of the total system which is concerned with transmitting the signal from primary feeders to distribution areas. Distribution legs are derived from directional couplers in the secondary feeder. Adequate levels to the distribution legs are maintained by means of multioutput distribution amplifiers. Except for closer line amplifier spacings due to the insertion loss of the directional couplers, the methods of equalization and level considerations in a secondary feeder are the same as for primary feeders. The need to locate the amplifiers more carefully with respect to the streets or alleys down which distribution legs are to be run will also affect these spacings. The permissible cable lengths given are approximate and engineering layouts based upon these values are usually modified in accordance with the requirements of the particular neighborhoods and customer densities to be served. The type of cable used for secondary feeders is Western Electric CA-1878. Fig. 4 illustrates a typical secondary feeder system.

(C) Distribution Cable Systems

3.07 The primary objective of the design of a distribution cable system is to deliver a signal to the subscriber's service drop of sufficient magnitude that the signal levels at the subscriber's grounding block will not be less than about 0 dbmv, nor more than about 10 dbmv. It is also desirable that there will not be more than 2 dbmv difference in the levels for adjacent channels. The objective is accomplished by the use of suitable cable together with appropriately located tap-off devices to which the service drops are connected.

3.08 Fig. 5 illustrates a typical distribution cable design using B, C or D triaxial cable, drop connectors and coaxial or triaxial wire service drops. The approximate attenuations of the distribution cable and the service drop are shown in the table in Fig. 5. The service drops are considered to be 125 feet in length which is the mean between the shortest expected length of about 50 feet and the longest length about 200 feet. The attenuation of a 125-foot service drop at 54-88 mc (75°F) would be approximately 3.1/4.0 db. The treatment of extra long drops is discussed later.

3.09 The drop terminates in a grounding block on the subscriber's premises. This is the point of demarcation between the Telephone Company's responsibility and that of the subscriber.

3.10 In arriving at the permissible length of a particular distribution leg, some estimate has to be made as to what the number and distribution of subscriber's drops will be. The distribution cable loss plus the through-loss of the drop connectors will determine the permissible length of the distribution leg. Fig. 5 assumes an average distribution of drops

NOTES:

1. FOR SIMPLICITY, DETAILS OF SWITCHING, HEAD END, ETC., NOT SHOWN. EACH CASE SHOULD BE ENGINEERED TO SATISFY LOCAL CONDITIONS.
2. PADS SHOWN WITH BAND ELIMINATION FILTERS MUST EQUAL FLAT LOSS OF BEF.
3. PROVIDE ONE BEF AT ORIGINATING POINT FOR EACH ORIGINATED CHANNEL.
4. CHANNEL USED AS PILOT CAN NOT BE ORIGINATED REMOTELY.
5. ALL UNUSED PORTIONS OF THE RF BAND MUST BE BLOCKED AT THE SAME POINT AS THE PILOT BEF.

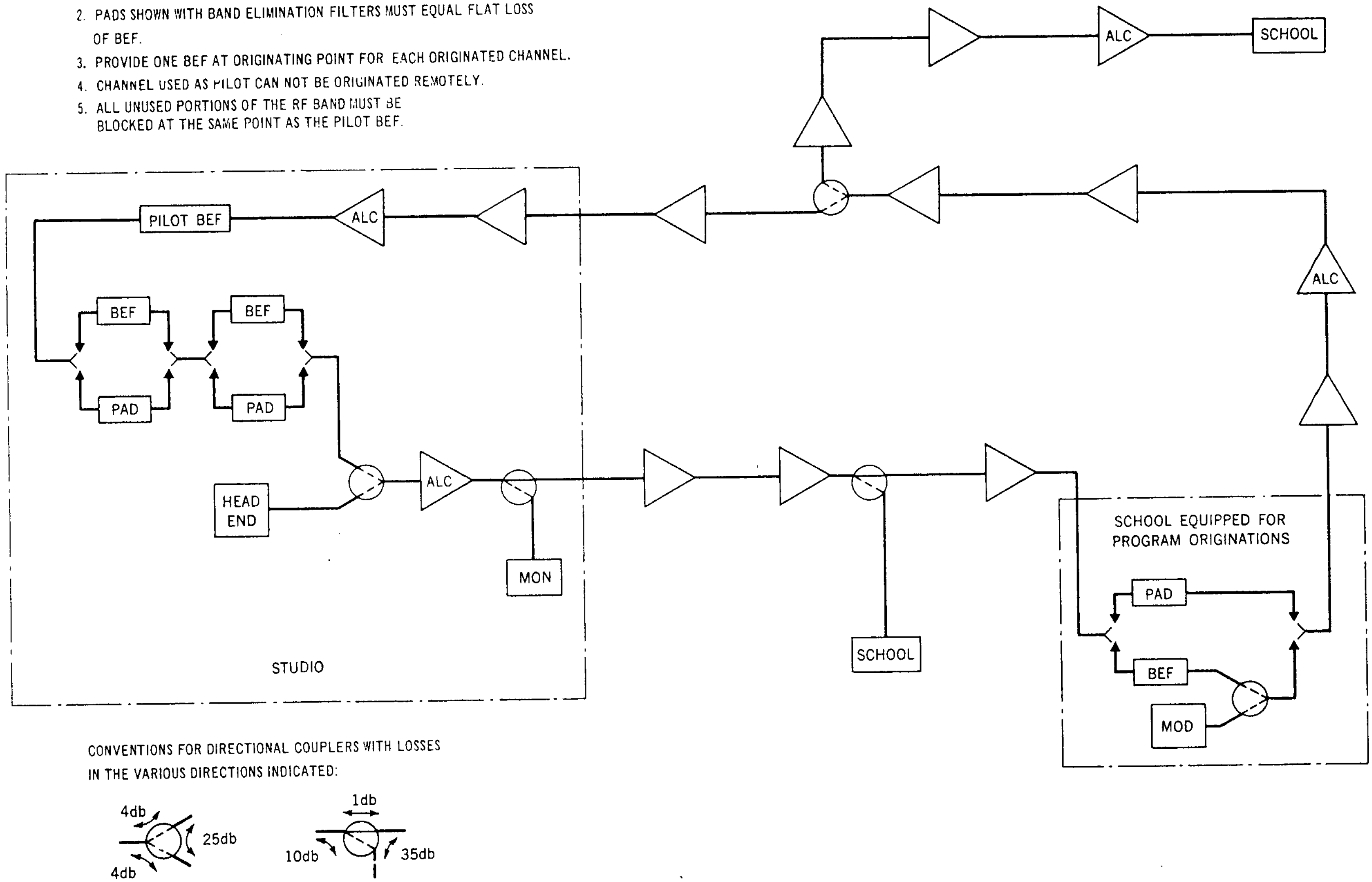
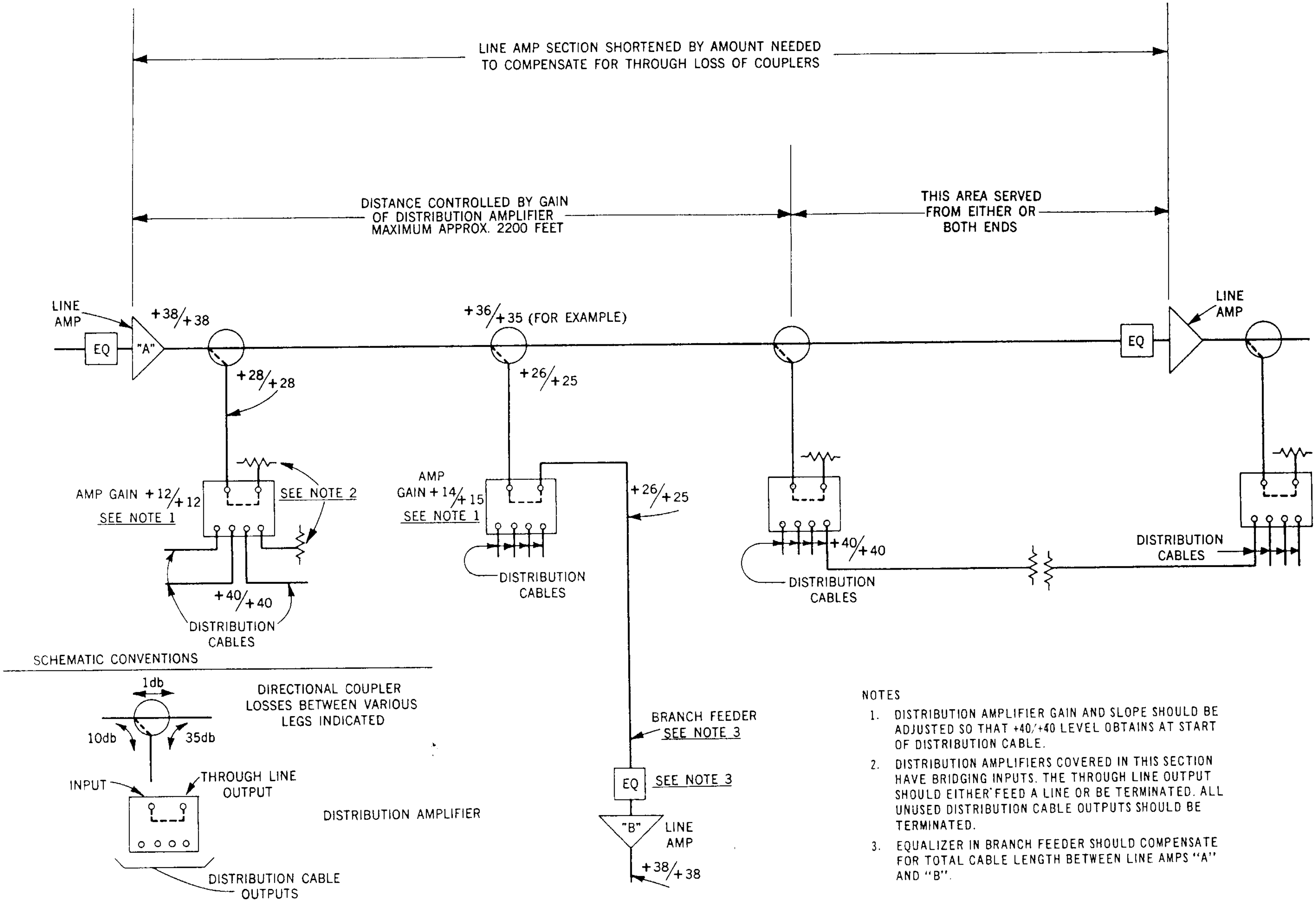


Fig. 3 — Typical Round Robin Educational System Application Schematic



NOTES

1. DISTRIBUTION AMPLIFIER GAIN AND SLOPE SHOULD BE ADJUSTED SO THAT +40/+40 LEVEL OBTAINS AT START OF DISTRIBUTION CABLE.
2. DISTRIBUTION AMPLIFIERS COVERED IN THIS SECTION HAVE BRIDGING INPUTS. THE THROUGH LINE OUTPUT SHOULD EITHER FEED A LINE OR BE TERMINATED. ALL UNUSED DISTRIBUTION CABLE OUTPUTS SHOULD BE TERMINATED.
3. EQUALIZER IN BRANCH FEEDER SHOULD COMPENSATE FOR TOTAL CABLE LENGTH BETWEEN LINE AMPS "A" AND "B".

Fig. 4 — Secondary Feeder Layout

NOTES

1. CONNECTOR INSERTS SHOULD BE ASSIGNED TO SUBSCRIBERS IN ACCORDANCE WITH THE DISTANCE OF THE CONNECTOR FROM THE BRIDGING AMPLIFIER OR LINE EXTENSION AMPLIFIER AS SHOWN ON THIS FIGURE. THESE DISTANCES APPLY TO:
   a. A MAIN DISTRIBUTION LEG IMMEDIATELY FOLLOWING THE BRIDGING AMPLIFIER
   b. A MAIN OR BRANCH DISTRIBUTION LEG IMMEDIATELY FOLLOWING A LINE EXTENSION AMPLIFIER.
2. ASSUMED DROP DENSITY – 4 PER 100 FEET
   ASSUMED SERVICE DROP LENGTH–125 FEET
3. FOR OTHER SUBSCRIBER DENSITIES AND OTHER DROP LENGTHS THE LEVELS WILL VARY SOMEWHAT FROM THOSE SHOWN.

TABLE OF THROUGH LOSSES IN CONNECTORS

CONNECTOR INSERT CODE NO.	INDIVIDUAL THRU LOSS CH.2	INDIVIDUAL THRU LOSS CH.6	DISTANCE	QUAN.	TOTAL THRU LOSS CH.2	TOTAL THRU LOSS CH.6
PI-4A	.01	.02	100′	4	.04	.08
PI-4	.01	.03	300′	12	.12	.36
PI-3	.03	.06	300′	12	.36	.72
PI-2A	.05	0.11	200′	8	.40	.88
PI-1A	0.11	0.24	100′	4	.44	.96
			1000′	40	1.36	3.00

ATTENUATION

CABLE	ATT/100′ @ 75° (55.25 AND 83.25 MC)
TRIAXIAL DISTRIBUTION CABLE	1.4/1.8
TRIAXIAL SERVICE DROP	2.5/3.2

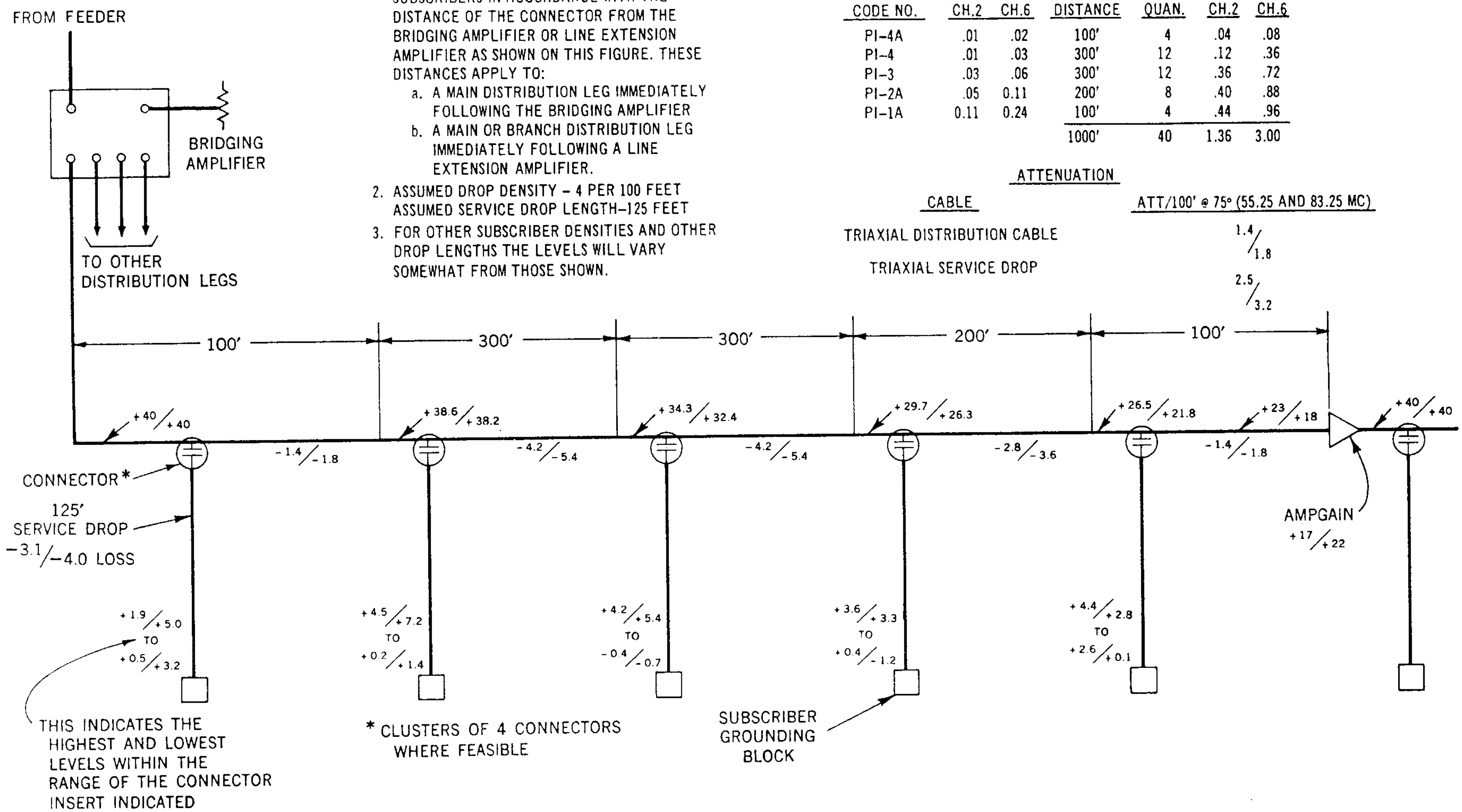


Fig. 5 — Typical Distribution Cable with Drops

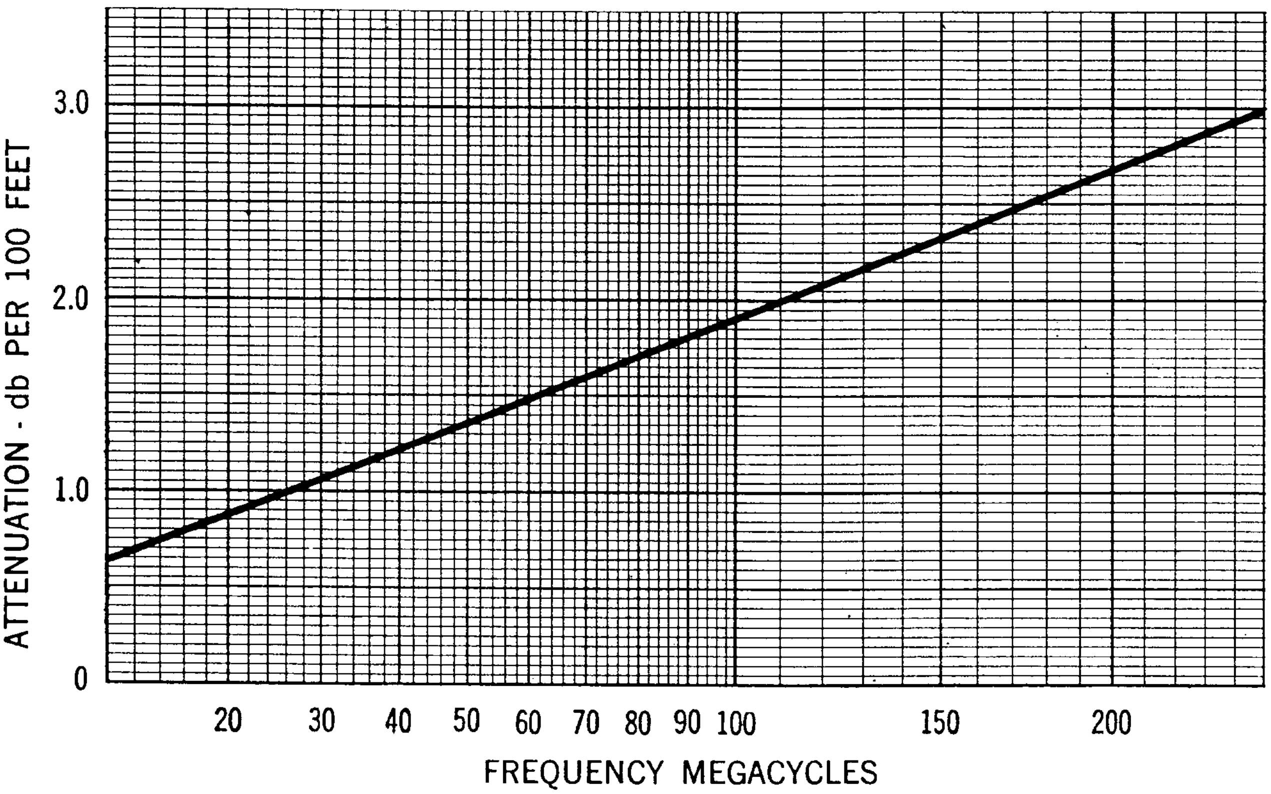


Fig. 6 — Attenuation (75° F) AT-7775 Cable (B, C and D Types)

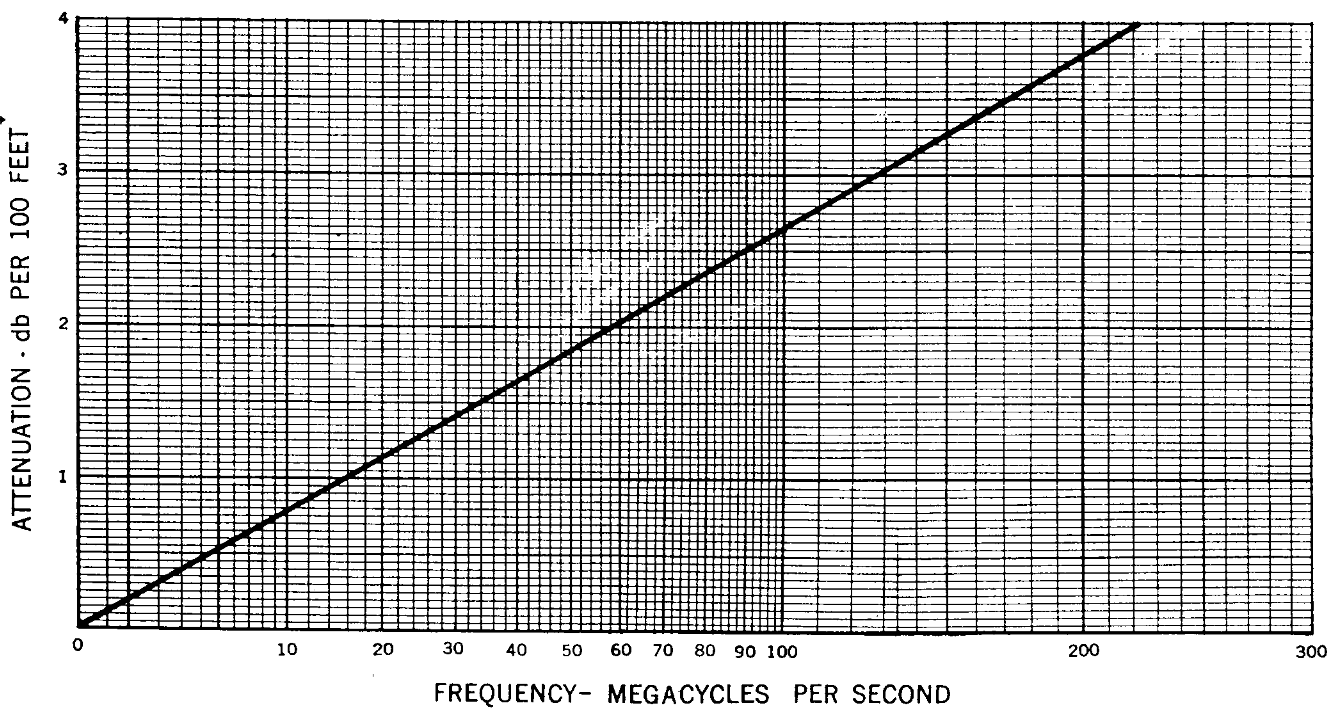


Fig. 7 — Attenuation (72° F) Characteristics of CA-3049 and CA-3050 Cables

of four per 100 feet and that the connectors may be arranged in clusters of four, each having the same code number insert. Under the conditions assumed in Fig. 5 the distribution leg can be about 1000 feet in length without a line extension amplifier. It will accommodate about forty subscribers. If a line extension amplifier is used, the length of the distribution leg can be doubled. However, because the distortions produced by line extension amplifiers are high, the use of more than one of these amplifiers in the same distribution leg is not desirable. While there will, of course, be areas where the density of subscribers would be greater or less than assumed here, permitting slightly shorter or longer distribution legs and a somewhat different distribution of drop connector inserts, the 1000-foot length and distribution of drop connector inserts shown in Fig. 5 are usually accepted as standard for the sake of simplicity in subscriber assignment.

Cable and Wire

3.11 B triaxial cable is a solid polyethylene dielectric cable similar to RG11/U cable except that the center conductor is solid copper-steel and there are two braided shields insulated from each other. B, C and D cables, (AT-7775), are identical electrically and differ only in the method of support. The B cable must be placed in rings, lashed or blocked, whereas the C and D cables are furnished spiralled around a steel or plastic jacketed steel wire for support. The attenuation of these cables is shown in Fig. 6 and in the table included as part of Fig. 5.

3.12 B, C, and D coaxial (AT-7776) and B, C, and D triaxial (AT-7783) wires are available for use as service drops. B coaxial wire is similar to RG59/U cable; B triaxial wire is similar except for a second braided shield insulated from the first. The C and D versions of the wires are electrically the same as the B but are furnished with a supporting steel wire, galvanized for the C and plastic jacketed for the D.

3.13 CA-3049 and CA-3050 are solid polyethylene dielectric coaxial cables suitable for outdoor and indoor wiring where a high quality flexible coaxial is required. These cables have a 20-gauge copper center conductor and two layers of closely woven tinned copper braid for shielding. The CA-3049 cable is made with light-resistant black polyethylene outer jacket, while the CA-3050 cable has a noncontaminating, flame resisting, PVC jacket of olive gray color for indoor use. The attenuation of these cables is shown in Fig. 7. The electrical characteristics of both cables are the same.

Drop Connectors

3.14 The drop connector is of the type known to the CATV trade as a pressure tap. It consists of a metal detail which clamps onto the distribution cable and makes contact with the cable shield by points which puncture the outer covering. The detail contains a tapped hole perpendicular to the axis of the cable. A tool can be screwed into the hole which will cut through the cable's jacket and shield and remove these much as one would plug a watermelon. Into this same hole, a connector insert can be screwed. The insert is a coaxial structure. The center conductor starts with a sharp point which can pierce the dielectric in the distribution cable and make contact with its center conductor. In series with the point is a small capacitor the size of which controls the loss to the drop. As shown in Fig. 5, various inserts are used depending on the level available at the different distances along the cable.

3.15 The recommended drop connector is the Intercontinental Electronics (formerly Westbury Electronics) PT-2A pressure tap-off. In its present form the unit provides for two drops but, in order to obtain optimum return loss, the second output is not used except as described later. The unused output is closed with an Intercontinental Electronics seal cap. Inserts numbered from 1A through 4A are supplied which provide different losses to the drops.

Line Extension Amplifiers

3.16 Fig. 5 also shows the method of using a line extension amplifier in a distribution leg. The assignment of connector inserts to subscribers beyond the line extension amplifier is in accordance with the distances shown in Fig. 5. Only one line extension amplifier is inserted between a bridging amplifier and any subscriber because of its high distortion compared to line amplifiers.

3.17 Because of the locations of these amplifiers and the difficulty of gaining access to the components, tube replacements and other maintenance operations should be performed on suspected defective units only in the maintenance center or equivalent location.

Branch Distribution Leg

3.18 A directional coupler may be inserted in a distribution cable to derive a branch distribution feeder as shown in Fig. 8. The only limitation on its location is that distance A plus distance B should not be over 500 feet in order to maintain sufficient levels in the branch. This limitation exists because of the 10 db side loss of the coupler. The branch can be extended by the use of a line extension amplifier but only if not preceded by a similar amplifier as previously discussed under ***Line Extension Amplifiers.*** If the gain of amplifiers in tandem is required, a line amplifier of the type used in primary feeders is used, preferably as the first, since their reliability is higher and distortions lower. Limiting line extension amplifiers to the tag ends of circuits will affect fewer viewers than if they appeared earlier.

3.19 As long as only one branch distribution feeder is derived on a given distribution cable, the assignment of drops on the main cable may be done as shown in Fig. 5. However, if more than one branch is provided, the 1 db through-loss of the coupler becomes more important and each case should be considered on its own merits.

4. EQUALIZATION

4.01 The attenuation of CA-1878 cable is shown graphically in Fig. 9 for various cable temperatures. The equalization scheme for this cable provides an essentially flat gain-frequency characteristic over the usable signal spectrum.

4.02 The thermal equalizers do the major part of the equalization in aerial cable systems. Figs. 10 and 11 show the characteristics of two

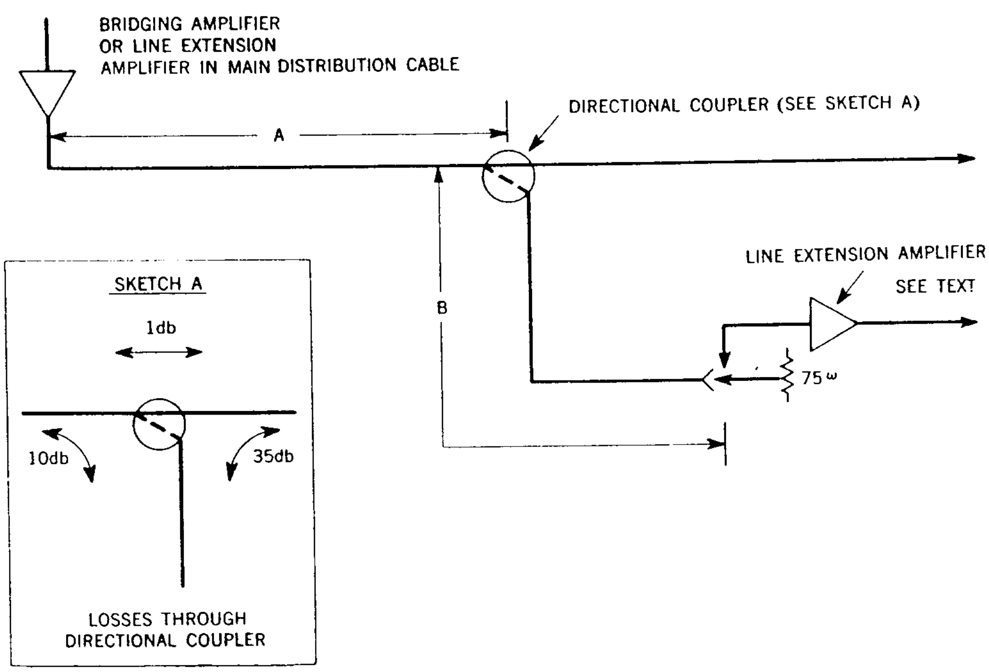


Fig. 8 — Branch Distribution Feeders

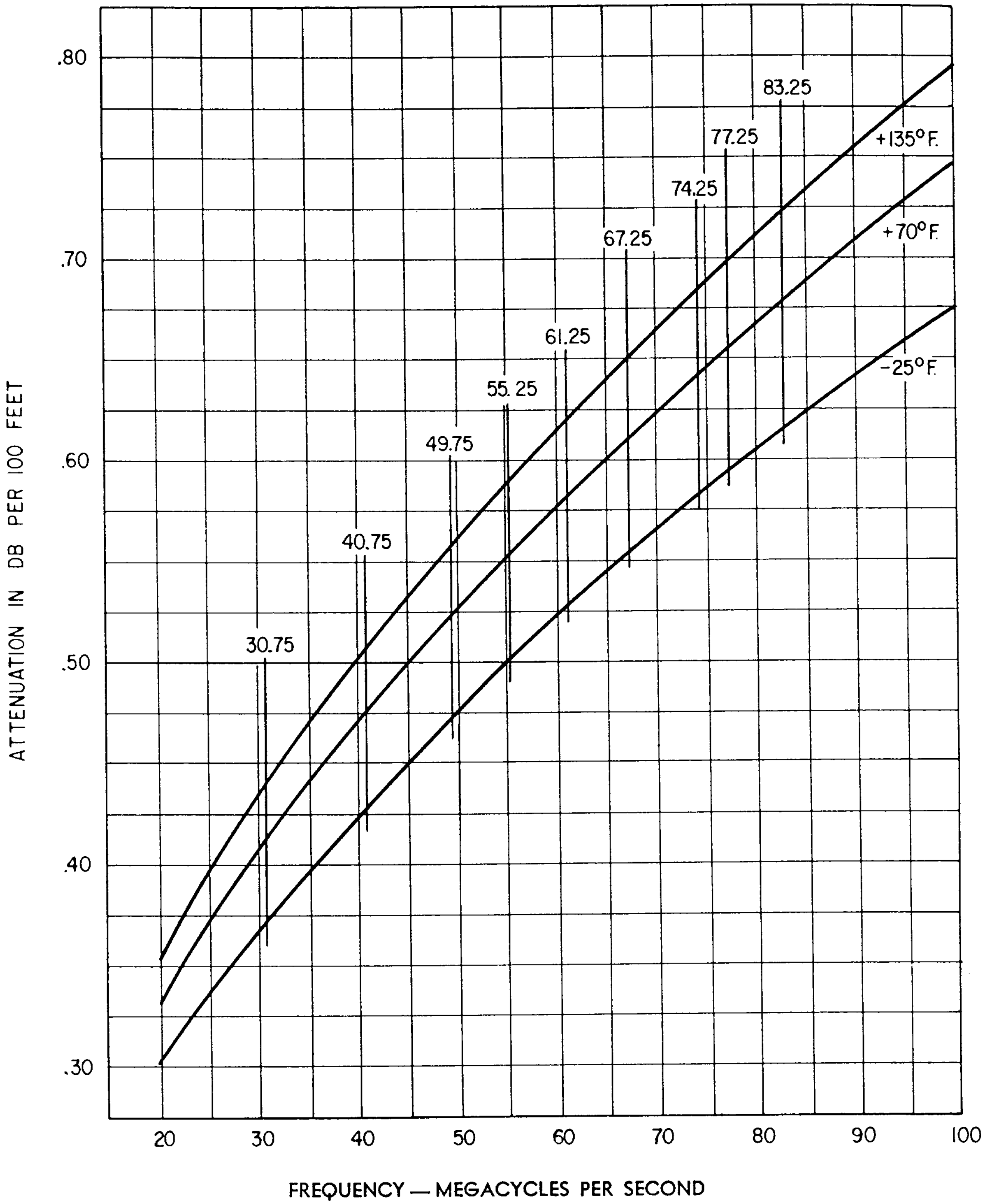


Fig. 9 — CA-1878 Cable Attenuation

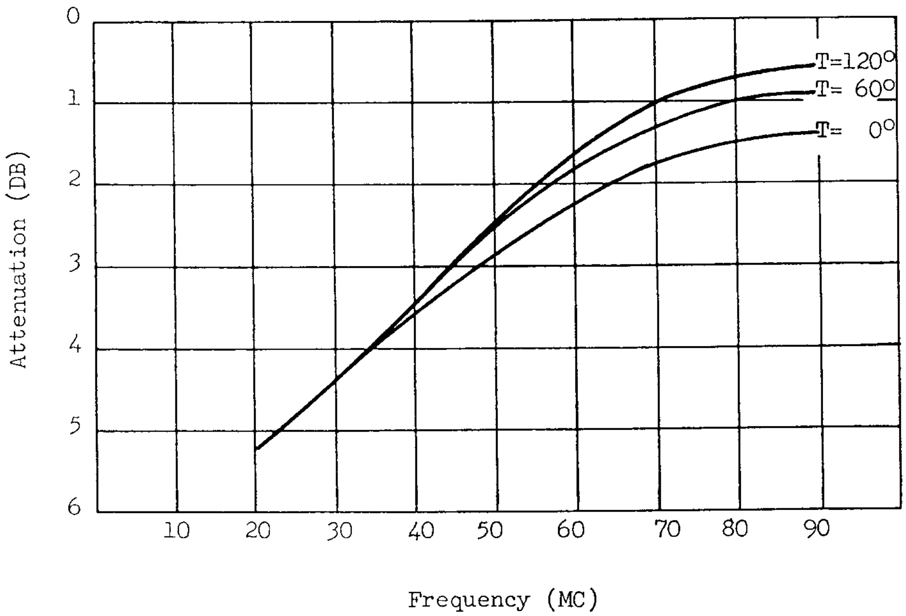


Fig. 10 — SKL 488 Thermal Equalizer

Spencer-Kennedy Laboratories (SKL) thermal equalizers.

4.03 Buried cable systems and automatic slope control stations use fixed slope equalizers. Fig. 12 shows the attenuation characteristics of two SKL fixed slope equalizers which are in common use. Since the characteristics of the equalizers are averages of several, the values are approximate, as is the corrective slope for a specific amplifier. The automatic slope equalizer (more fully explained under Part 6 — *COMPONENTS)* is inserted at specified locations to minimize the changes in slope that tend to develop with temperature changes.

4.04 Because the equalization provided by these components does not exactly match the attenuation of the CA-1878 cable, there will be a systematic buildup of peaks and valleys in the gain-frequency characteristic of the system. These peaks and valleys can be removed through the use of mop-up equalizers. The number of mop-up equalizers required is a function of the number of amplifier sections rather than their combined length because the corrections are primarily for deviations in the amplifiers.

5. TEST EQUIPMENT

5.01 The following test equipment is required for line-up and maintenance of rf transmission systems of the type described in this section:

Field Strength Meter, Jerrold Model 704B
*Adapter, K Channel, for Jerrold 704B Field Strength Meter
Sweep Generator, Jerrold Model 601
Attenuator, Jerrold Model A72
Detector, Jerrold Model D86
Oscilloscope, Du Mont Model 304A
Receiver, Conrac, Model AV-12A, B, or C
Marker Generator
Volt-Ohm-Milliammeter, KS-14510, List 1
Tube Tester, KS-15750, List 1

*Required for subchannel measurements

6. COMPONENTS

6.01 The line facilities, exclusive of the cable, are all manufactured by suppliers in the community antenna field. Practices have been prepared as an aid in the maintenance

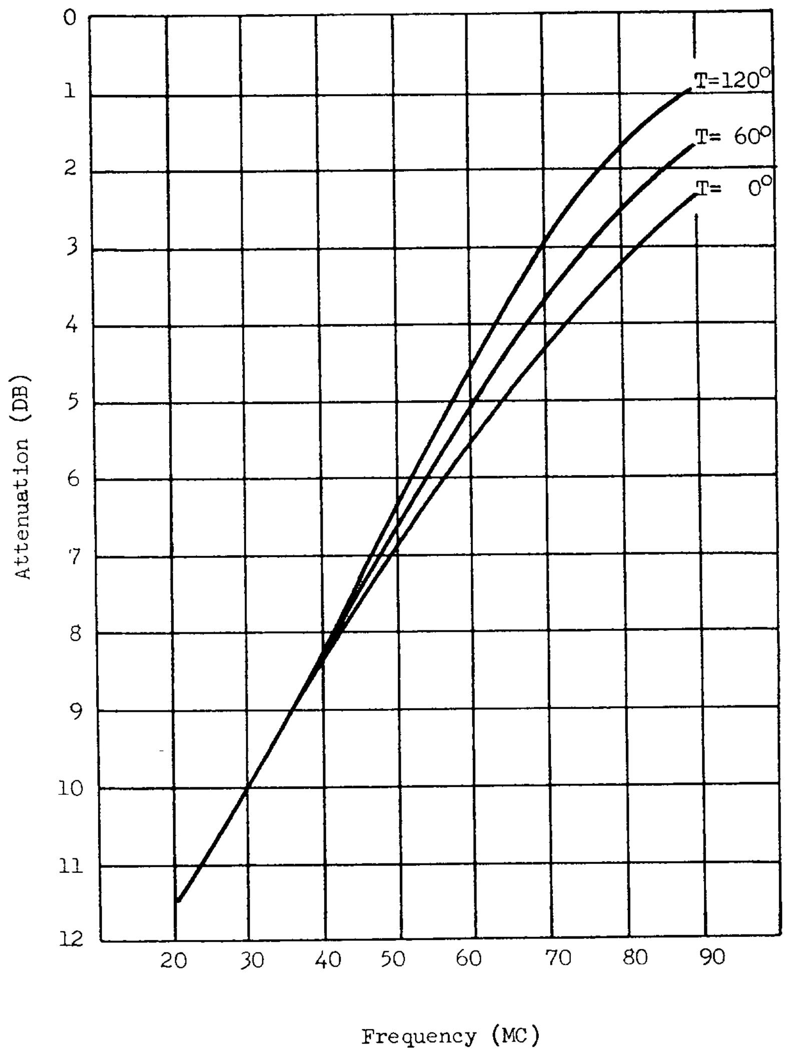


Fig. 11 — SKL 479 Thermal Equalizer

of certain of these units. Available Practices are listed in the *REFERENCE* section of this practice. A brief description of each component is given here.

(A) Modulator

6.02 This unit is sometimes called the transmitter. One is used for each channel at the originating point for that channel. It performs the same function as the transmitter at a television station. At its input, normal audio and video signals are received, and, at its output, the unit transmits a radio-frequency signal containing those signals in the same relationship as in an off-the-air signal. This output signal is fed into the transmission network. The audio signal is a frequency-modulated signal with ±25 kc deviation being 100% modulation. The video signal is the standard amplitude-modulated signal. Depending upon the type of modulator, this AM signal may be a double sideband signal, or a vestigial sideband signal.

> *Note:* When a normal television channel is developed by a modulator, the sound carrier is 4.5 megacycles ***higher*** in frequency than the picture carrier. If, however, the modulator produces a subVHF channel directly, without using a converter, the sound carrier

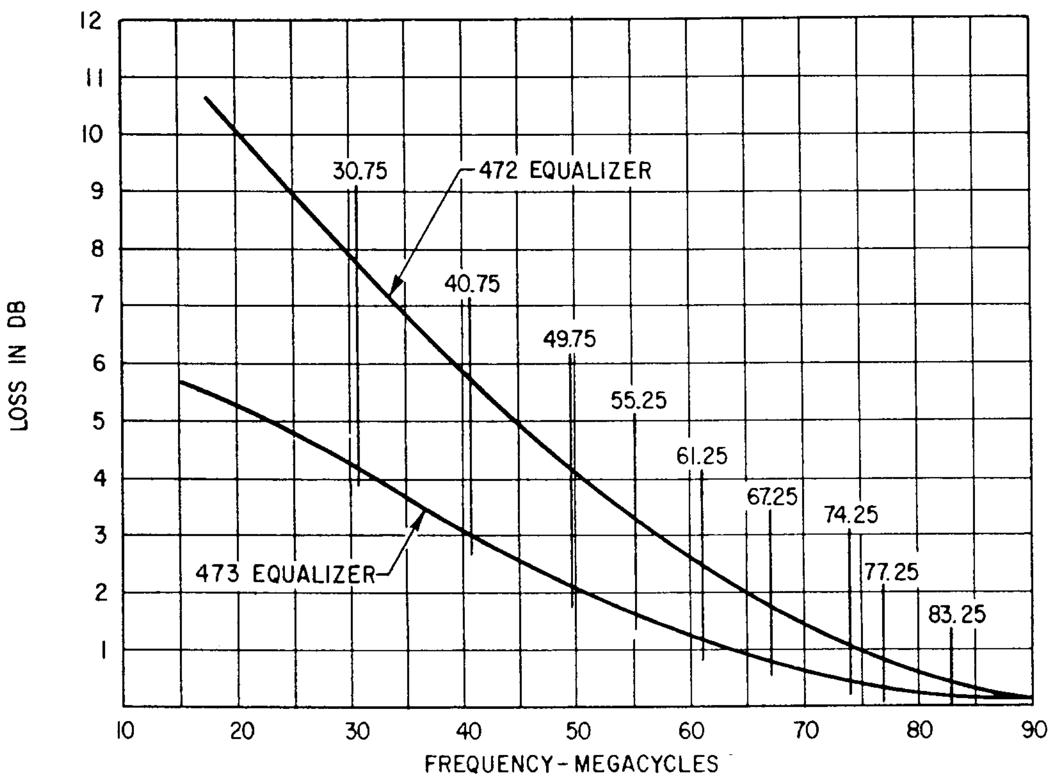


Fig. 12 — SKL Fixed Equalizer Characteristics

is 4.5 megacycles *lower* in frequency than the picture carrier. This is done so that the relationships of the sound and picture, in the second case, will be correct after the carrier passes through a converter with its normal transposition of frequencies.

6.03 The audio input impedance is 600 ohms, balanced, or high-impedance, unbalanced. The video input impedance is 75 ohms.

(B) Pilot Carrier Generator

6.04 The pilot carriers are fixed frequency, constant level radio-frequency signals for the control of the automatic level control (ALC) and automatic slope equalization (ASE) actions in a coaxial cable transmission system. Picture carriers at the highest and lowest frequencies used normally will serve as the pilot carriers. They are located at the head end of the system, and can be used for subVHF, lowVHF or wideband applications.

(C) Amplifiers

6.05 One of the amplifiers available is a chain-type amplifier. In this type amplifier, the tubes in the various stages are placed essentially in parallel, and the loss of one tube may not completely disable the amplifier. If a tube were to go short-circuited, it would kill the signal. However, most common tube troubles, as an open filament, will result in a small reduction of the amplifier's gain or a slight worsening of its frequency response.

(D) Automatic Level Control Unit

6.06 This unit operates in conjunction with an amplifier, a directional coupler, and a pilot carrier bandpass network to maintain a constant signal level at the output of the controlled amplifier in a coaxial cable television transmission system using rf carriers. Factors such as temperature, humidity, line voltage variations, and the aging of components normally affect the average amplitude of the transmitted radio-frequency carriers. However, these variations are kept at a minimum when the system is equipped with the recommended number of automatic level control units. Every fifth line amplifier is so equipped. ← The section of transmission line between automatic level control stations is called an automatic level control section.

(E) Automatic Slope Equalizer Unit

6.07 This unit is used to compensate for the differences in cable 'tilt' caused by changes in temperature. It operates by comparing the levels of two signals, one at each end of the frequency band involved, and adjusting the gain of a variable amplifier, the adjustment in gain not being the same at all frequencies. An example of typical carriers involved: 77.25 megacycles, and 31.75 megacycles. By the use of this equipment, together with thermal gain control units and thermal equalizers, seasonal level readjusting can be eliminated.

6.08 Every other automatic level control station usually is equipped with an automatic slope equalizer. Thus, ten line amplifiers make ← up an automatic slope equalizer section.

(F) Automatic Alarm Unit

6.09 This unit is a transistorized device which monitors the bias-control voltage in an automatic level control station, causing a switch to close when this voltage overtakes a preset threshold. The closed contact energizes an externally connected alarm network to give warning that the bias-control voltage has dropped near or below minimum specified values. Its action can be visualized as that of a voltmeter, constantly measuring the bias-control voltage. When the voltage changes beyond a preset point, contacts in the voltmeter close a circuit, giving the alarm.

(G) Subchannel Converter

6.10 This unit will convert a composite television signal from one VHF television channel to one subchannel, or perform the reverse. By converting a relatively high-frequency signal (the high-band VHF television channel frequencies range upward from 174 megacycles) to a lower frequency (the subchannels range from 26 to 51 megacycles in frequency), it is possible to transmit on cable much greater distances than if the signal wasn't converted, using the same number of amplifiers in each case, since the cable attenuation decreases with frequency. Modulators develop subchannel frequencies without the aid of converters. However, the converter is necessary at the receiving end to make the signal available to the receiver.

7. REFERENCES

7.01 The following Practices are available to aid in the initial installation, line-up, and continuing maintenance of the equipment units involved in these systems.

SECTION	DESCRIPTION
318-500-300	Coaxial Cable Television Transmission Systems — RF Type Periodic Tests and Test Intervals
318-500-500	General
318-500-510	Calibration of Test Equipment
318-500-521	SKL Model 211C Amplifier ←
318-500-530	SKL Model 448 Pilot Carrier Generator
318-500-540	SKL Model 459 Subchannel Converter
318-500-550	SKL Model 474 Automatic Slope Equalizer
318-500-560	SKL Model 830 Automatic Level Control Unit
318-500-570	SKL Model 831 Automatic Alarm Unit
318-500-580	TIC Model 2123A-KS Chromatran
318-500-591	Over-All Line-Up Procedures ←