TYPE L3 CARRIER SYSTEM
LINE CONNECTING ARRANGEMENTS

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1. GENERAL

1.01 This section describes line connecting equipment used in the L3 carrier system to connect L units together or to connect an L unit to terminal equipment. Line switching with arrangements for bridging or dropping facilities (both message and television) is considered to be part of the line connecting facilities. Included is a description of the transmitting line arrangements and supplemental gain and delay equalizers used when television facilities are part of the system.

1.02 This section replaces Issue 1 of Section 359-010-130 and is reissued to update information on line connecting arrangements. Since this reissue incorporates a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Line connecting equipment is used at switching and terminal main repeaters. It includes all the high-frequency line equipment between the pilot hybrid and the transmitting hybrid, and it is used to connect the receiving end of a high-frequency line to the transmitting end of another and/or to connect telephone mastergroup circuits to either the receiving or transmitting terminal equipment.

1.04 The line connecting equipment at a switching main repeater is required to perform two major functions. It must provide:

(a) A through path for line pilots and through circuits.

(b) A means for both dropping circuits for local distribution and inserting circuits for transmission to the next repeater.

At a terminal main repeater, line connecting equipment provides means for dropping circuits for local distribution and inserting circuits for transmission to the next repeater.

1.05 Fig. 1 is a typical block schematic of the line connecting equipment used at two terminals in an all-message system, showing transmitting and receiving mastergroup levels. The L3 carrier high-frequency line which connects the terminals is shown as a simple amplifier having a gain of 30.8 db from the transmitting hybrid at one terminal to the pilot hybrid of the following terminal.

2. LINE SWITCHING

2.01 Line switching, which is part of the line connecting equipment, is described in detail in Section 359-010-125. In case of failure of a regular transmission line, line switching arrangements provide protection by switching to a standby line. The three types of switching arrangements are automatic 2-line, automatic multiline, and automatic expanded multiline switching. In the automatic 2-line switching arrangement, one standby line is required for each regular line. The automatic multiline arrangement allows the use of one standby line in each direction for two to four regular lines in each direction. In the automatic

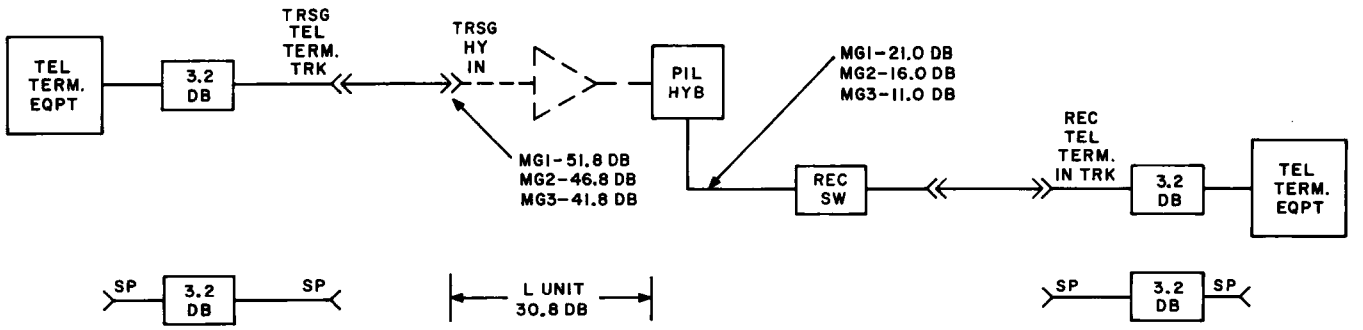


Fig. 1 — Line Connecting Equipment at Terminals — All-Message System

expanded multiline switching arrangement, one standby line in each direction can serve four to eight regular lines in each direction. The operation and synchronization of the switches used for multiline and expanded multiline switching is accomplished by means of switching signals. These switching signals are in the frequency range from 280 to 296 kc and are transmitted between stations over the L3 carrier high-frequency lines in parallel.

3. BRANCHING AND THROUGH LINE ARRANGEMENTS

3.01 Optional equipment is provided at switching main repeaters which permits dropping either message or television facilities or both. Known generally as branching, it includes both bridging and blocking arrangements. Typical arrangements are shown in Fig. 2A and 2C.

3.02 When bridging, an incoming line is split into two branches by a hybrid coil. All frequencies pass into each branch with one leg of the hybrid forming the side branch and the other leg forming the through circuit. Blocking arrangements provide for blocking frequencies that are sent into the line from all or part of Mastergroup 1 (MG 1) so that they will not be transmitted to the next section of the line. Pilot pass filters provide a means for passing pilots that appear in the blocked frequency band. Details of these arrangements are covered in Parts 4 and 5.

3.03 At switching main repeaters when branching is not required, a through line connection is provided as shown in Fig. 2B. This circuit consists of a pad and attenuators that build out the total loss to 30.8 db, a switching signal band elimination filter which blocks switching signals to prevent activation of the following switching sections, and a cable equalizer. The cable equalizer compensates for transmission deviations introduced by the cable used in the connecting circuit, the receiving line switch, and the receiving branching filter. The cable equalizer is adjustable in steps equivalent to 50-foot cable lengths up to a maximum of 300 feet.

3.04 Fig. 2D shows line connecting arrangements at a terminal repeater. The pads serve to maintain correct transmission levels.

3.05 At an equalizing auxiliary repeater, the line connecting equipment provides means for dropping TV circuits only for local transmission. Since TV cannot be properly equalized at this point, this provision is now Manufacture Discontinued.

3.06 Table A provides the frequencies appearing at the input of a terminal or switching main repeater in an all-message or in a

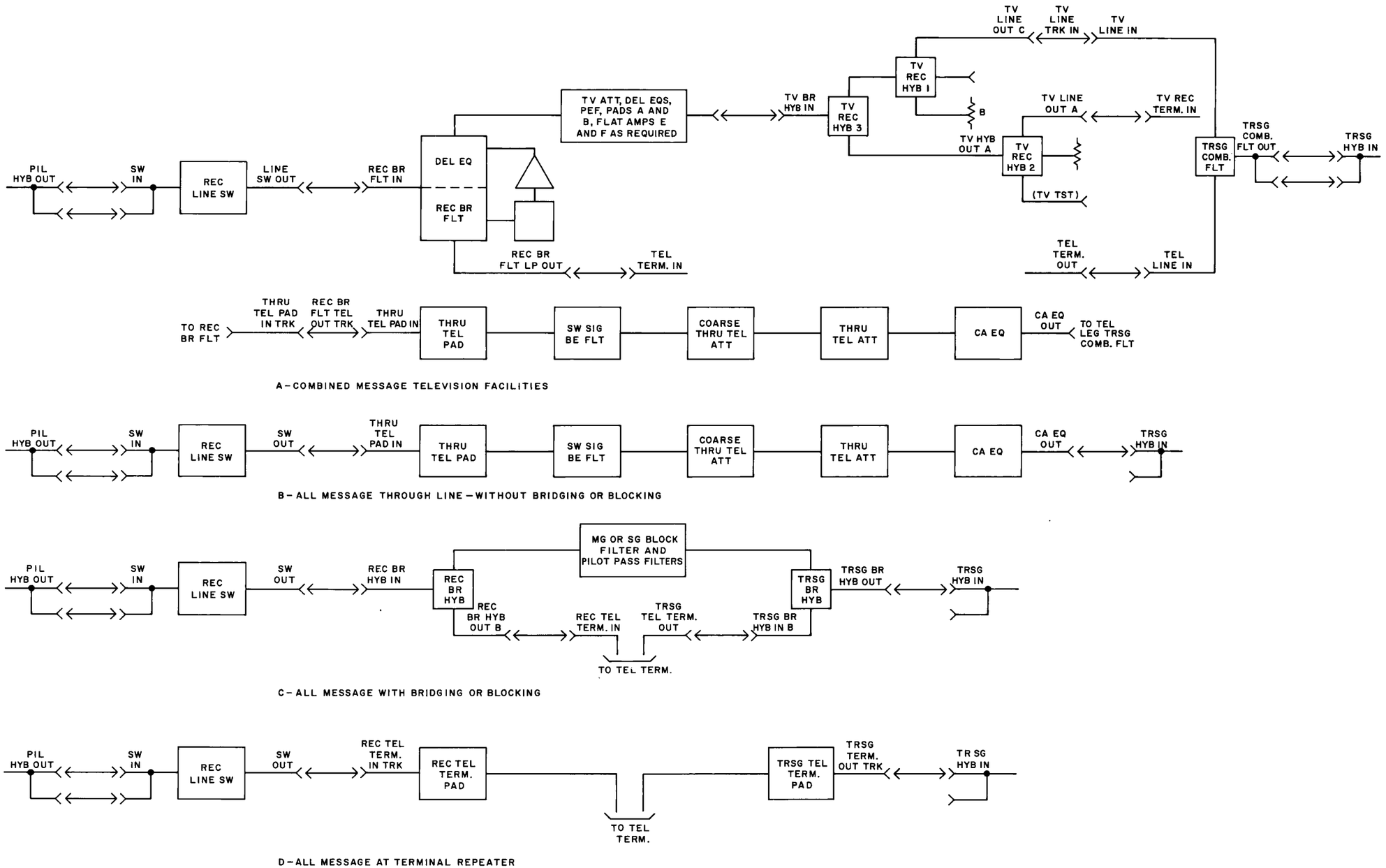


Fig. 2 — Line Connecting Circuits — Block Diagram

system equipped for combined message-television transmission.

TABLE A

RECEIVING MASTERGROUP FREQUENCIES

MASTERGROUP	SUPERGROUP	FREQUENCY (KC)
1	112 through 118 125 through 128	312 through 3084
2	213 through 218 225 through 228	3164 through 5684
3	313 through 318 325 through 328	5764 through 8284
TV FREQUENCIES		
MASTERGROUP		FREQUENCY (KC)
2		3640 through 8340
3		

3.07 Fig. 3 is a graphic presentation of the frequency spectrum of an L system showing the relation of the pilots to the mastergroup. In a combined telephone-television system, the frequency band of 3640 to 8340 kc (normally used by MG 2 and MG 3) is used for the television portion of the signal and the 7266- and 8320-kc pilots appear therein. Pilot pass filters provide a transmission path, when needed, for the 308-, 556-, 2064-, and 3096-kc pilots appearing in MG 1, to the succeeding L sections.

3.08 The LMX-2 terminal equipment delivers and receives the mastergroup frequency bands normally required for the L3 coaxial system. Frequency translations in formation of the supergroup and mastergroup bands differ in the LMX-2 system and the LMX-1 system. However, in either case the line connecting arrangements may be used to block, drop, and bypass signals as described herein.

4. BRIDGING

A. General

4.01 Bridging arrangements are provided at switching main repeaters in an all-message system where facilities are required to bridge MG 1, or MG 1, 2, and 3. In a combined message-television system, provisions are made for bridging MG 1 and, in some instances, television. Fig. 4 is a typical block schematic of the circuits used in each case.

B. Operation

4.02 In Fig. 4, signals from the receiving branching filter in a combined system and from the receiving switch in an all-message system are transmitted to the REC BR HY, the ***bridging point*** of the receive circuit. The REC TEL TERM equipment connected to one leg of the REC BR HY selects the portion of the frequency band to be dropped. Since these frequencies in the dropped portion of the band travel over the portion of the line beyond the dropping point, this portion of the frequency spectrum ***cannot*** be used for transmission beyond the dropping point except perhaps where two appearances of these same frequencies are required, such as for program or possibly telegraph. The second leg of the REC BR HY is the through path, going to the switching signal band elimination filter, which prevents passage of switching signal frequencies to the next repeater, and thence through the attenuators and through telephone pad which are used to maintain correct transmission levels in the through path.

4.03 The cable equalizer in this arrangement compensates for transmission deviations of the cabling used in the connecting circuit, the receiving and transmitting branching hybrids, and the receiving line switch.

4.04 The transmitting branching hybrid permits connection of two simultaneous inputs to the high-frequency line, one being the through circuit from the cable equalizer. The second input may be used for insertion of circuits from a local source if frequency space is available for usage.

4.05 In case of failure of any part of the line connecting equipment, an emergency through path has been provided at a switching main repeater in an all-message system or in a combined system. In either case, connection is made between the receiving switch of the switching circuit and the band-elimination filter, as indicated in Fig. 4. Branch pass pads have been

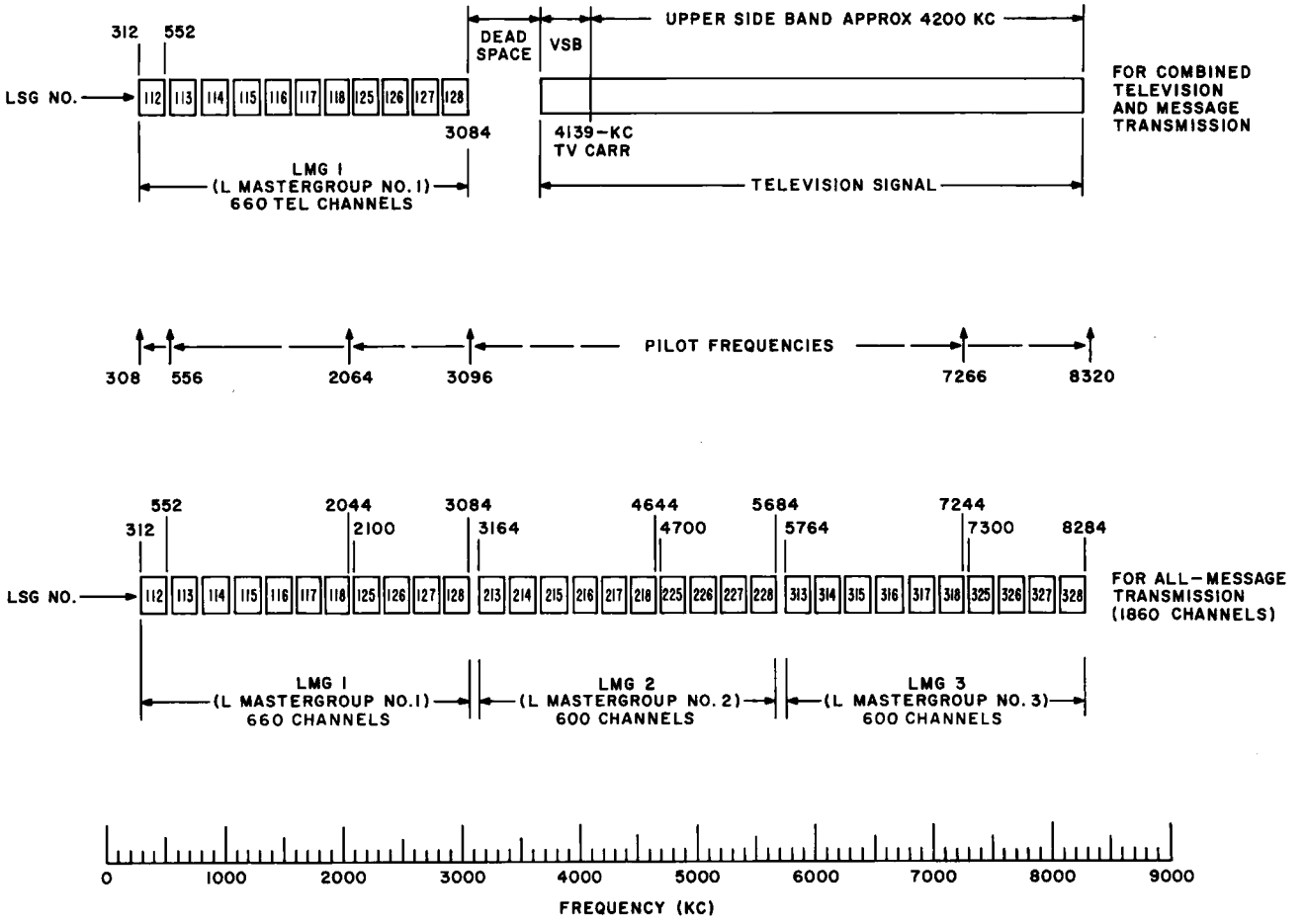


Fig. 3 — Line Frequency Allocations for Systems Used for Combined Message-Television Transmission and for All-Message Transmission

provided to maintain the proper transmission level whenever the regular equipment is bypassed. The band-elimination filter prevents passage of switching signals to the next repeater. In case of failure in either the cable equalizer or the transmitting branch hybrid, an emergency path between the THRU TEL PAD OUT jack and the TRSG HY MAIN REP TRANS circuit has been provided as shown.

5. BLOCKING ARRANGEMENTS

A. General

5.01 At a switching main repeater, it is sometimes necessary to block all or a part of a receive mastergroup for local usage while allowing the remaining portion of the frequency band to be transmitted beyond the point at which the dropping occurred. Provisions are available for dropping receive Mastergroup 1, Submastergroup 1 (SG 112 through 118), or Submastergroup 2 (SG 125 through 128) in an all-message or in a combined system. In each case, common equipment in addition to the receiving branching hybrid is required.

5.02 Fig. 5 is a simplified block diagram of a combined system having MG 1 blocked and dropping television. The overall diagram shows that frequencies originating in each branch of the system are combined for transmission over an L unit. At the switching main repeater the received frequencies are treated separately. MG 1

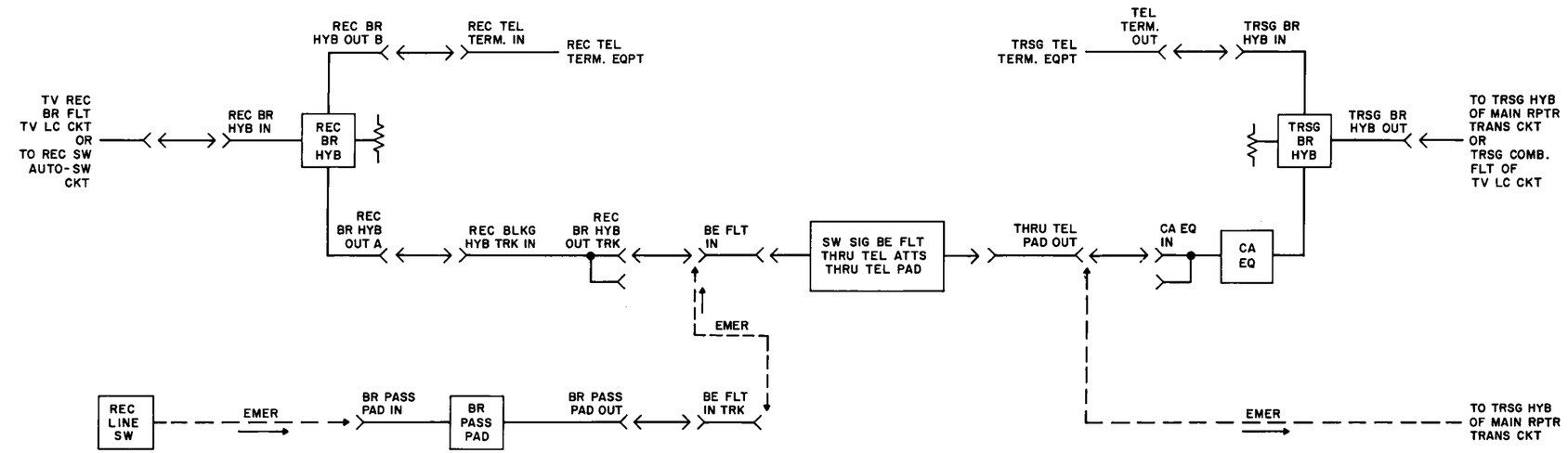


Fig. 4 — Bridging All-Message or Combined System

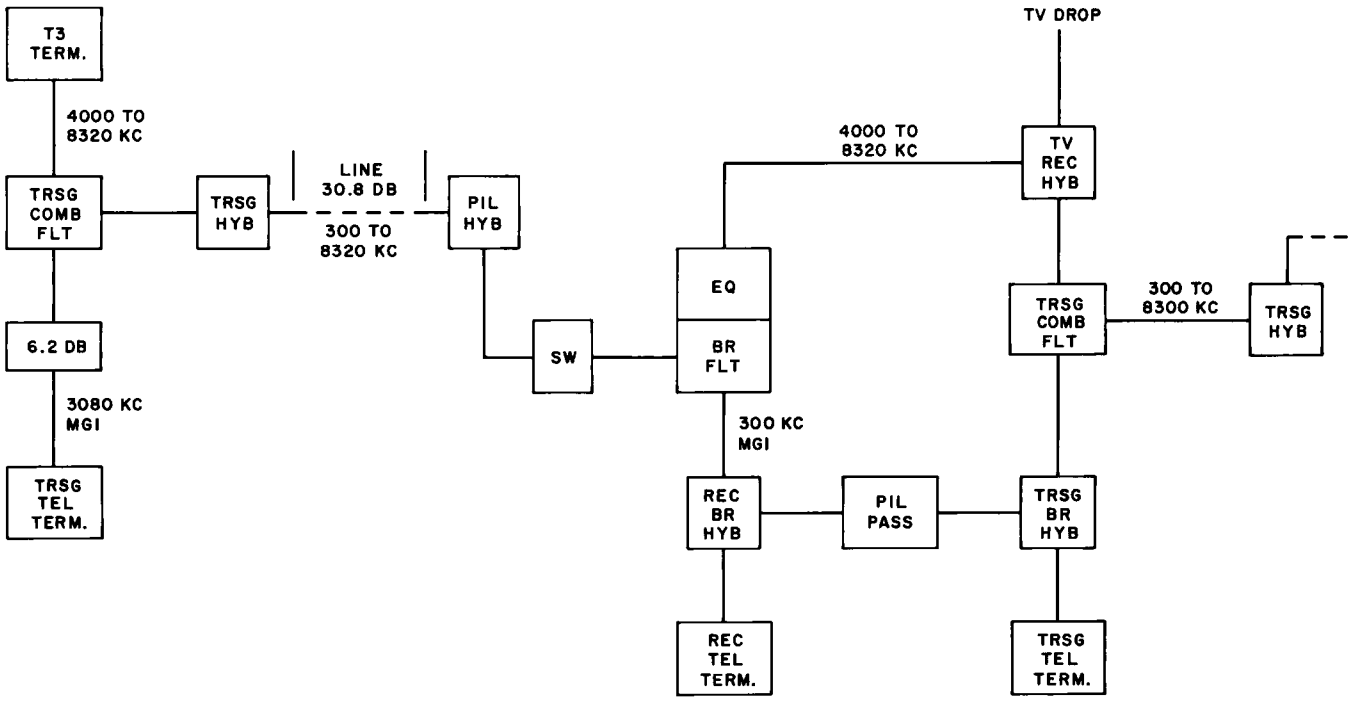


Fig. 5 — Television Dropping and Mastergroup 1 Blocked at Switching Main Repeaters — Block Diagram

frequencies are blocked and the television is dropped. The telephone and television are again combined and may be split after transmission over the succeeding L unit. No television transmission may originate at a switching main repeater unless 7266- and 8320-kc pilots are resupplied, in which case the repeater assumes features of a terminal repeater.

5.03 Arrangements for blocking MG 1 or SG 112 through 118 in an all-message system are shown in Fig. 6. In case of failure of the line connecting equipment normally carrying the signals between the receive branching hybrid and the cable equalizer, an emergency path between the two points is provided. This emergency path contains a switching signal band-elimination filter which eliminates switching signals, a blocking pass pad, and blocking pass attenuators for maintaining correct transmission levels.

5.04 Most of the equipment necessary for blocking MG 1 or SG 112 through 118 is common, the differences consisting mainly of the blocking filters and the pilot pass filters required. In an all-message system, the high-pass filter is used to block all of MG 1 or only a part of it (SG 112 through 118). In a combined message-television system, television is blocked by the receiving branching filter, which allows MG 1 frequencies to pass. In either case, any pilot 3096 kc or below which is blocked by filters is passed by the pilot pass filters.

B. Blocking Mastergroup 1 — All-Message System

5.05 At switching main repeaters, the MG 1 blocking filter suppresses the transmission of all MG 1 frequencies, including the 308-, 556-, 2064-, and 3096-kc pilots, to the through path and allows transmission of the remainder of the frequency band to the following repeater section.

5.06 The mastergroup blocking circuit shown in Fig. 6 consists of a receiving branching hybrid which splits the incoming path into two branches. One branch goes to the telephone terminal and the second goes to the receiving blocking hybrid, which further divides the transmission path. One output leg from the receiving blocking hybrid is connected to the MG 1 blocking filter and to the distribution network. The distribution

network contains an adjustable pad which permits fine adjustment of transmission levels of the signals passed by the blocking filters.

5.07 The second output is connected through the individual pads of the distribution network to the pilot pass filters. The individual pads permit fine adjustment of transmission levels at each of the pilots.

5.08 Four pilot pass filters, 308, 556, 2064, and 3096 kc, permit through transmission of those pilots which are blocked by the MG 1 blocking filter. The pilot pass filters provide shunt paths around the blocking filter so that the loss at the pilots is 15 db, as is the passband of the blocking filter. The 35-db composite characteristic loss in the 280- through 296-kc band prevents the passing of the switching signals which are used for the control of the multiline switching circuit. The 7266- and 8320-kc pilots do not require pilot passing filters, as they are not blocked by the mastergroup or supergroup blocking filters. The loss in the pilot passband is adjustable to close tolerances at the pilot pass frequencies. The pad improves the impedance matching between the filters and the blocking hybrid. Fig. 7 shows the composite loss characteristics of the blocking and pilot pass filters.

5.09 An oven supply, which is a part of this circuit, furnishes power for operation of ovens located in the 2064- and 3096-kc filters, thereby lessening the filter loss-frequency variations as the ambient temperature varies. The cable equalizer performs the same function described in 4.03 and also compensates for transmission deviations of the receiving and transmitting branching hybrids. A transmitting branching hybrid permits simultaneous connection to the high-frequency line of the through circuit from the cable equalizer and a new mastergroup from a local terminal through the TRSG TEL TERM OUT jack.

C. Blocking Submastergroup 1 (SG 112 through 118) — All-Message System

5.10 Blocking of Submastergroup 1 (SG 112 through 118) in Fig. 6 is substantially the same as for blocking MG 1. The blocking filter used in this instance blocks Supergroups 112 through 118, and the pilot pass filters for the 308-, 556-, and 2064-kc pilots permit the transmission of the pilots which are blocked by the (Supergroups 112 through 118) blocking filter. No pilot pass filter is required for the 3096-kc pilot as it is not in the band of frequencies that is blocked. A 1-db pad is used in tandem with the supergroup blocking filter to maintain correct transmission levels.

D. Mastergroup Blocking — Combined System

5.11 The circuit used for blocking MG 1 in a combined system is shown in Fig. 8A. The signals from the high-frequency line are received at the receive branching filter, which serves to separate the MG 1 frequencies from the remainder of the received signals. The television portion of the received signals passes to the television branch of the circuit, and MG 1 frequencies pass through the low-pass portion of the receive branching filter to the receive branching hybrid. Output leg B of the receive branching hybrid is connected to the telephone terminal equipment. Leg A allows MG 1 frequencies to pass through the distribution network to the pilot pass filters, which pass only the required pilot frequencies 308, 556, 2064, and 3096 kc. The pilots then pass through a pad and cable equalizer to the transmitting branching hybrid. A second input at the transmitting branching hybrid allows injection of new MG 1 frequencies for transmission. From the output of the hybrid, telephone signals and pilots pass to the transmitting combining filter, where they are combined with TV signals for transmission over the line.

E. Supergroups 112 through 118 Blocking — Combined System

5.12 Supergroups 112 through 118 blocking in a combined message-television system, shown in Fig. 8B, differs only slightly from that in the all-message system discussed in 5.10. In this instance, no pad is required in tandem with the blocking filter. The blocking pass pad used in the emergency path gives approximately 1.1-db higher output level than that of the blocking pass pad used in the all-message system to compensate for loss of the transmitting combining filter.

5.13 As shown in Fig. 8B, blocking of SG 112 through 118 in a combined message-television system may be accomplished by using a

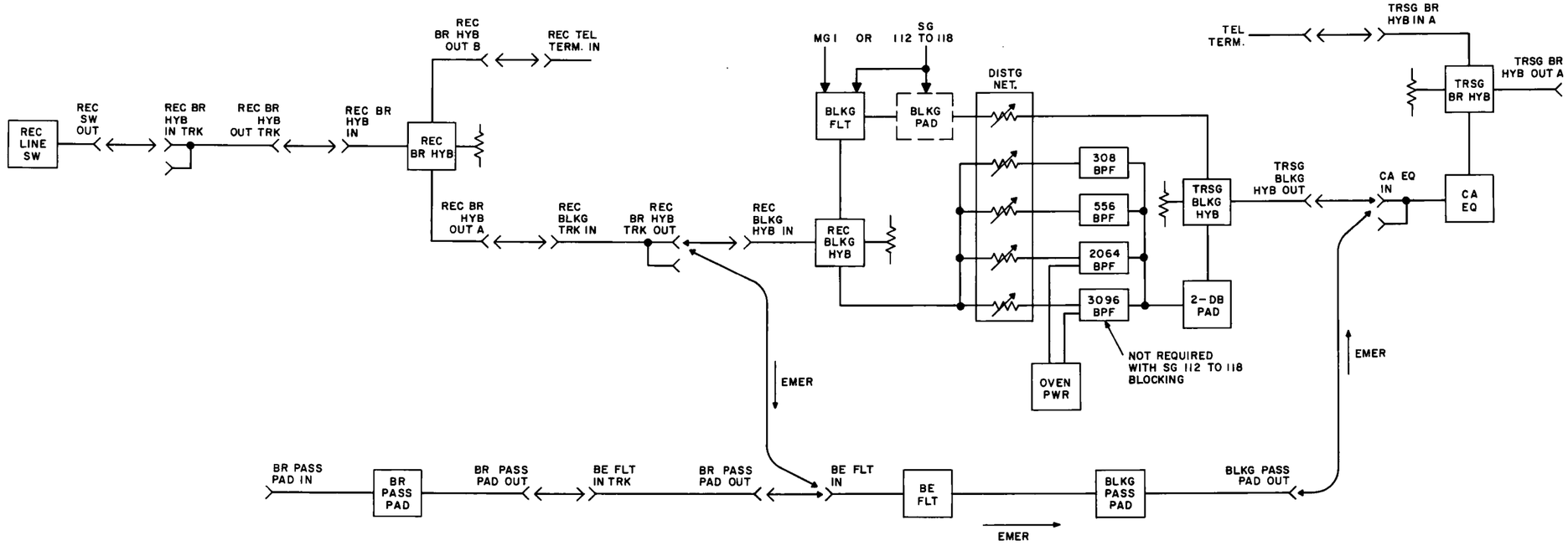


Fig. 6 — Mastergroup 1 and Submastergroup 1 (SG 112 through 118) All-Message — Blocking

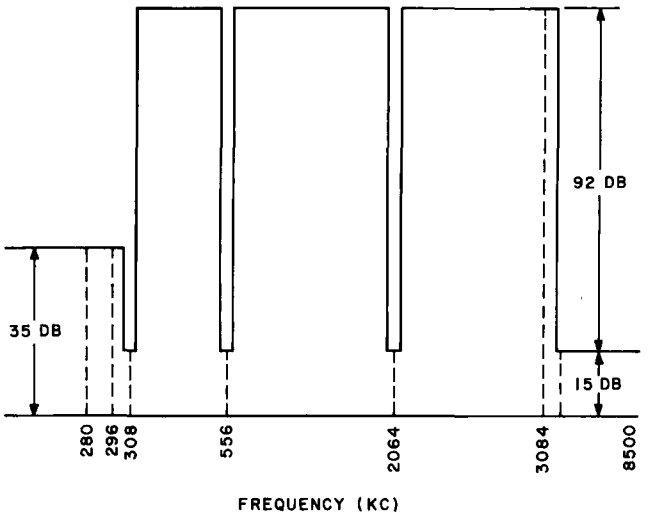


Fig. 7 — Composite Loss Characteristics — Blocking and Pilot Pass Filters

suitable (SG 112 through 118) blocking filter and eliminating the 3096-kc pilot pass filter since the 3096-kc pilot is not in the band of frequencies being blocked.

F. Blocking Circuit — Dropping Submastergroup 2 of Mastergroup 1 — All-Message System

5.14 In Fig. 9, MG 1, MG 2, and MG 3 frequencies leaving the pilot hybrid coil in an all-message system pass through the REC BR HY to the telephone terminal equipment, which rejects all frequencies except those in SMG 2 (2100 to 3084 kc) of MG 1 which are being dropped. The same mastergroup frequencies pass to the receiving blocking hybrid, which divides the circuit into two primary branches. The first primary branch passes into the TEL BR FLT used to divide the branches into two secondary branches. In the secondary branch connected to equalizer EQ1, the 2100-LP filter limits the passed frequency to about 300 to 2100 kc. Three pilots, 308, 556, and 2064 kc, are included in this range. The 300 through 2100 fine and coarse attenuators adjust the loss to a critical value at 2064 kc. No individual adjustment for the 556-kc pilot is provided. The switching signal band-elimination filter is included in this circuit to prevent passage of switching signals. The secondary branch connected to equalizer EQ2 contains a 3100-kc high-pass filter which passes the frequencies above 3100 kc. The secondary branches are combined at the combining filter. Equalizers EQ1 and EQ2 equalize the gain characteristic of the branching and combining filters. The combination of the two secondary branches blocks the portion of the frequency band between 2100 and 3100 kc. The 3096-kc pilot, which is within the blocked band, is passed by means of a second primary branch starting at the receiving blocking hybrid. This branch passes through the 3096 control of the distributing network, where the loss is adjusted in the narrow band of the 3096-kc pass filter. The 300-2100 FINE and COARSE controls, the controls in the distributing network, and fixed pads A and B make the losses equal through the three paths.

5.15 The loss of the passed 3100- to 8320-kc band is adjusted by means of the 3100-8500 control in the distributing network to make the overall loss of the circuit 30.8 db at the 7266-kc pilot. With respect to MG 3, transmission decreases in MG 2 by 0.7 db toward the lower end; that is, the lower five supergroups in SMG 2 have greater loss than does MG 3, as indicated in Table B. If this blocking is used in tandem, the loss in the supergroup will be down this amount at each block.

TABLE B

TRANSMISSION DECREASE IN MASTERGROUP 2 (SG 1 THROUGH 5)

SUPERGROUP	AMOUNT OF LOSS GREATER THAN MG 3 (DB)
1	0.7
2	0.5
3	0.3
4	0.2
5	0.1

5.16 The cable equalizer, if properly set during installation, limits the difference between 7266- and 8320-kc pilot powers. The 300 through 2100 fine and 200 through 2100 coarse attenuators in the 2100 low-pass path are adjusted to set the loss at 2064 kc correctly. The 308-kc equalizer has a bump shape and can be used to adjust 308 kc after adjustment of the 2064-kc attenuator.

There is no independent adjustment at 556 kc, but requirements on the filter limit deviations at that frequency.

5.17 The circuit is thus arranged to provide essentially flat and adjustable transmission of all pilots except 556 and 8320 kc. The cable equalizer is not adjustable in service, so there is no independent control over 8320 kc. The entire transmission band, with the exception of SMG 2, reaches the succeeding switching section. SMG 2, with independent message channels connected, may be transmitted into the succeeding switching section.

G. Blocking Circuit — Dropping Submastergroup 2 of Mastergroup 1 — Combined Message-Television System

5.18 Fig. 10 shows the circuit for dropping SMG 2 in a combined message-television system. In this circuit the REC BR FLT splits the received frequency band, with MG 1 passing into the telephone portion of the line connecting equipment and MG 2 and MG 3 bands going to the television portion of the line connecting equipment. At the REC BR HY the telephone portion is split into two paths. One, the through path, is split into two circuits at the TEL BR FLT. The low-pass filter (224D) passes only frequencies up to 2100 kc (SMG 1) and rejects those from 2100 to 3084 kc (SMG 2), which are dropped at the REC TEL TERM. A switching signal band-elimination filter is included in the low-pass path to prevent passage of switching signals between 280 and 296 kc used in operation of the multiline switching circuit.

5.19 Provisions for passing the 3096-kc pilot, which is rejected by the low-pass filter, are made in the second path, which contains a 3096-kc bandpass filter. A 3096-kc pilot adjustment provided in the DISTG NET, whose loss, coupled with the loss of the 3096-kc bandpass filter and the fixed pad in this branch, gives the branch a nominal loss approximately the same as that of the low-pass branch of the circuit. This gives a nominal 30.8-db loss from the pilot hybrid out to the transmitting hybrid in, through both branches of the circuit.

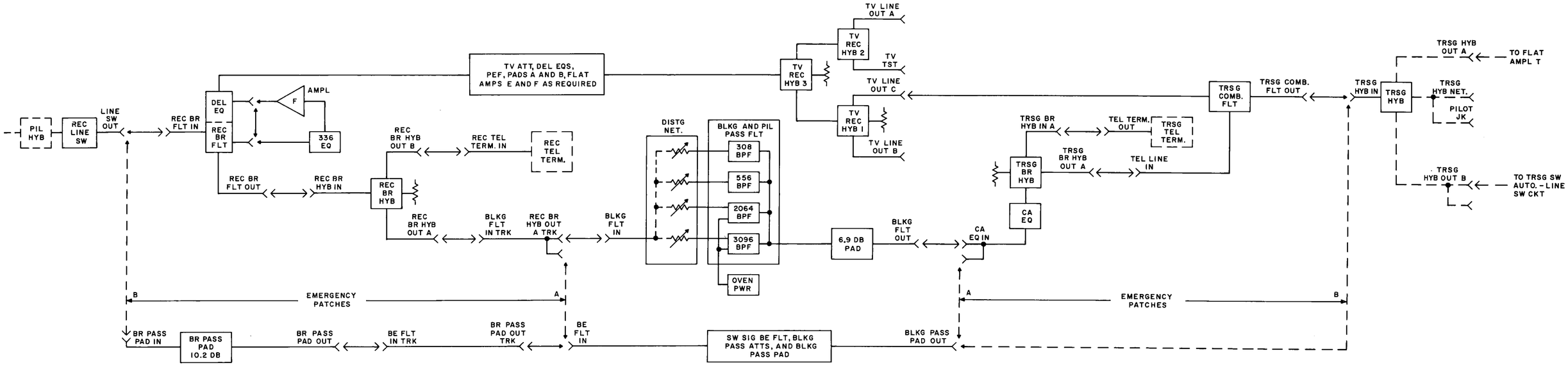
5.20 The 2100 low-pass filter which passes the 308-, 556-, and 2064-kc pilots has a built-in tolerance between these pilots, with the 2064-kc pilot adjusted by the 300-2100 FINE and COARSE controls to give a nominal 30.8-db overall loss. The 308-kc equalizer has a narrow peak loss centered at 308 kc and is continuously adjustable over a range of ± 1 db. This control is used to make the loss at 308 kc equal to that at 2064 kc. No supplementary adjustment is provided for the 556-kc pilot.

5.21 Thus, the circuit blocks SMG 2 frequencies only, passing the remaining frequencies. The 308-, 2064-, and 3096-kc pilots have individual adjustment, and the 556-kc pilot is controlled by the characteristics of the various filters. The 7266- and 8320-kc pilots are controlled by the single TV ATT in the TV line connecting equipment. SMG 2 frequencies from independent message channels may be transmitted over the succeeding section.

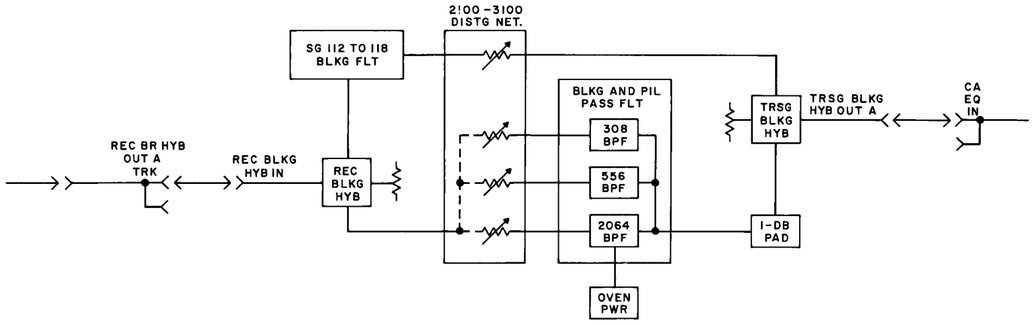
6. EMERGENCY RESTORATION

6.01 In the all-message and combined message-television circuits shown in Fig. 6, 8, and 10, provisions for restoration of through television and through message and blocked message are made by emergency patches A or B. The through path made with patch A contains a switching signal band-elimination filter which rejects switching signals, and blocking pass attenuators and a blocking pass pad which are adjusted to set the total loss from the pilot hybrid out to the transmitting hybrid in to 30.8 db. This path bypasses the blocking equipment, and telephone operation can continue only on a bridged basis. When it is necessary to restore between the pilot hybrid out and the transmitting hybrid in, emergency patch B is used. This circuit includes a branching pass pad and is connected in tandem with the switching signals band-elimination filter, blocking pass attenuators, and a blocking pass pad used with emergency path A. The branching pass pad has sufficient loss to compensate for other normal circuit elements removed, so that the circuit can be adjusted to 30.8-db loss between the pilot hybrid out and the transmitting hybrid in. This circuit restores all through circuits and disables all dropped circuits, both message and television.

6.02 Line connecting equipment for interconnection of standby lines at a switching main repeater in an all-message or a combined message television system provides for making a



A - MASTERGROUP 1 BLOCKING



B - SUPERGROUP 112 TO 118 BLOCKING

Fig. 8 — Mastergroup 1 and Submastergroup 1 (SG 112 through 118) Blocking in Combined System at Switching Main Repeater

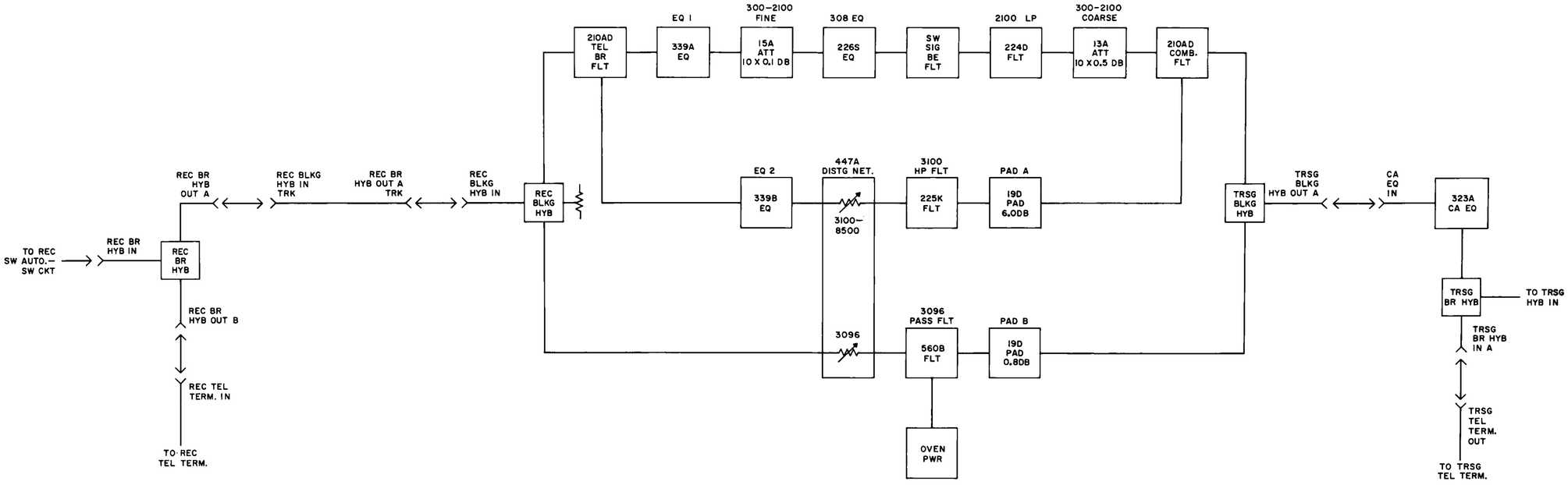


Fig. 9 — Blocking Circuit — Dropping Submastergroup 2 of Mastergroup 1 — All-Message System

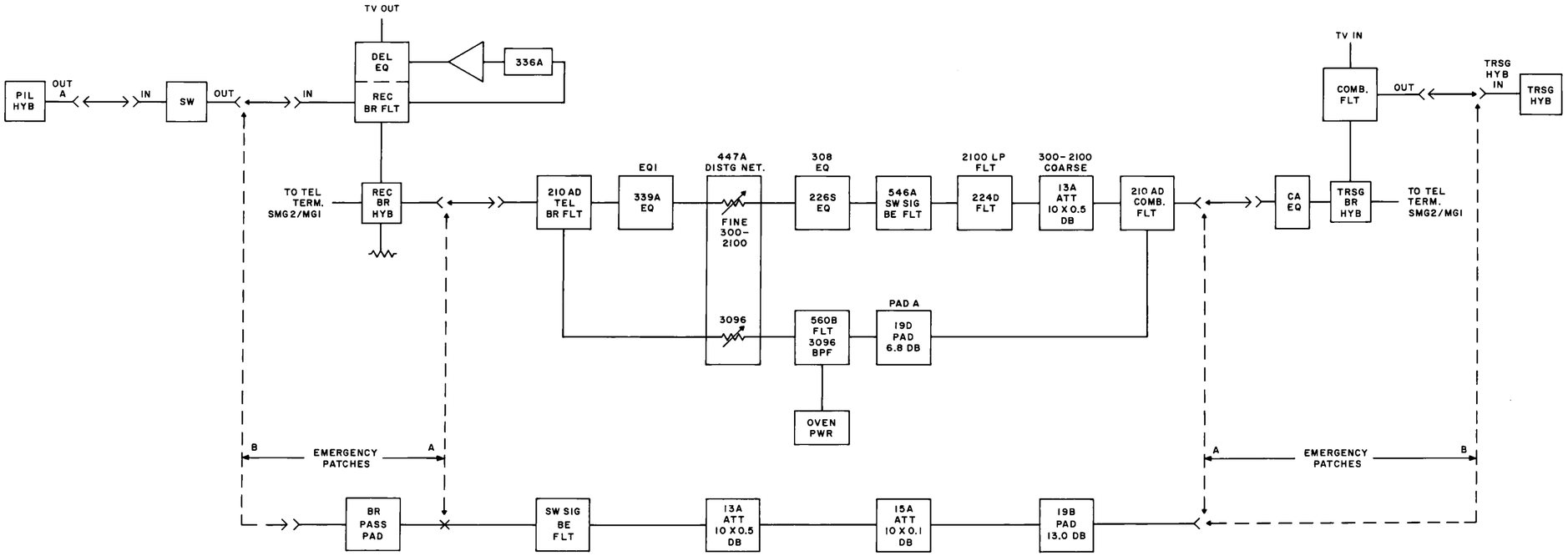


Fig. 10 — Blocking Circuit — Dropping Submastergroup 2 of Mastergroup 1 — Combined Message-Television System

connection between the pilot hybrid of the receiving circuit and the transmitting hybrid of the main repeater. The standby line pad shown in Fig. 11A has a loss of approximately 30.8 db which serves to maintain correct transmission levels. Fig. 11B shows through line used at a switching main repeater in an all-message system when bridging or blocking is not required. Fig. 11C shows the through telephone circuit used in a combined system for passing telephone band in regular line without bridging or blocking, or in a standby line having delay distortion equalization.

7. EQUALIZATION

A. 336A Gain and Delay Equalizer

7.01 In long circuits, supplementary adjustable mop-up gain and delay equalization is required at approximately 400-mile intervals. The 336A gain and delay equalizer, used in the television branch of the line connecting circuit, provides a part of the necessary supplementary equalization at switching main and terminal points equipped for television.

B. 326A, 327A, and 327B Equalizers

7.02 The 326A, 327A, and 327B equalizers are transmission delay distortion equalizers in the receiving branching filters, and are used to equalize delay distortion of the television band of 3.5 to 8.5 mc. They also serve to separate the telephone and television portions of the received frequency spectrum.

8. TELEVISION BRIDGING

A. General

8.01 At a dropping point, the combined telephone and television signals are passed from the receive line switch shown in Fig. 12 to the receive branch filter, at which point they divide. Low-pass and high-pass filters, which are a part of the receive branch filter, select the signals to be passed to each branch of the circuit. The low-pass filter selects the telephone or MG 1 band of frequencies, and the television or MG 2 and 3 signals are selected by the high-pass filters. When more than one of these filter-equalizer

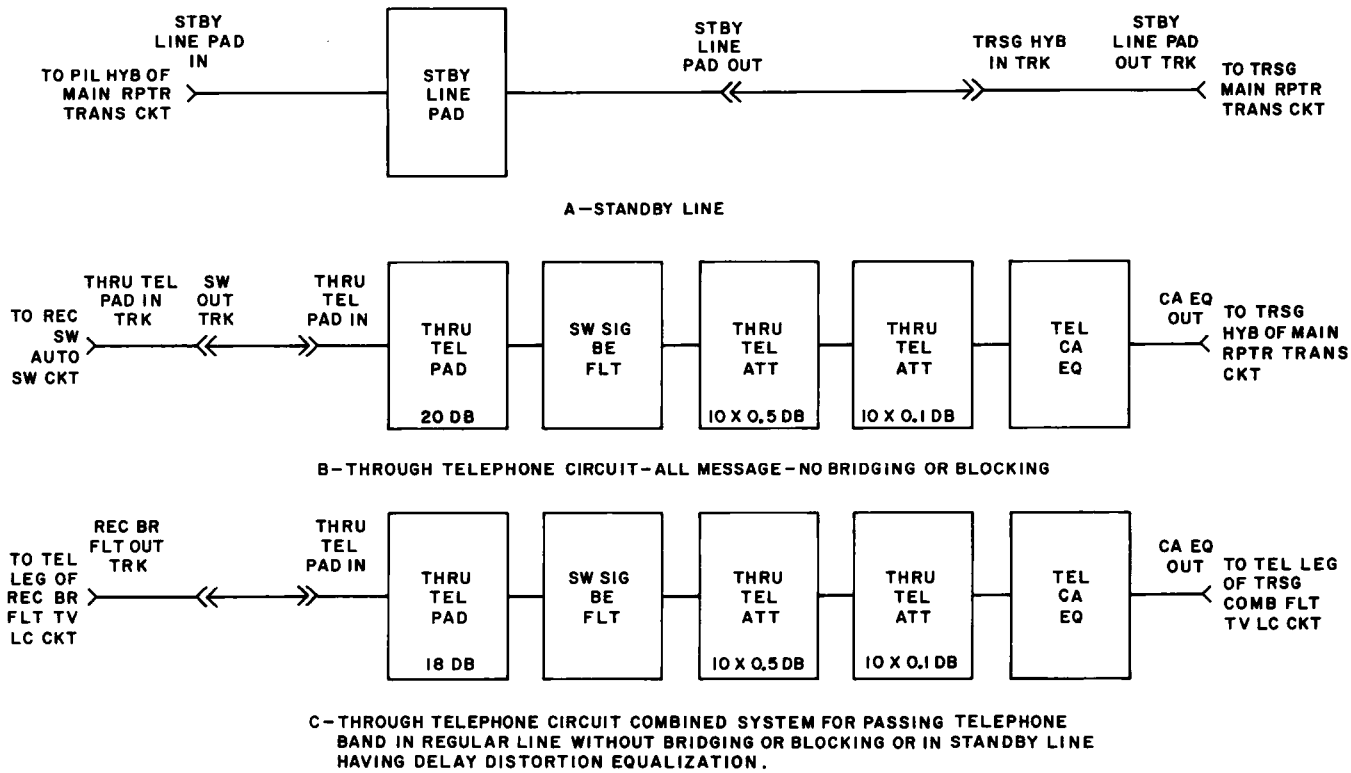


Fig. 11 — Through Line Connections

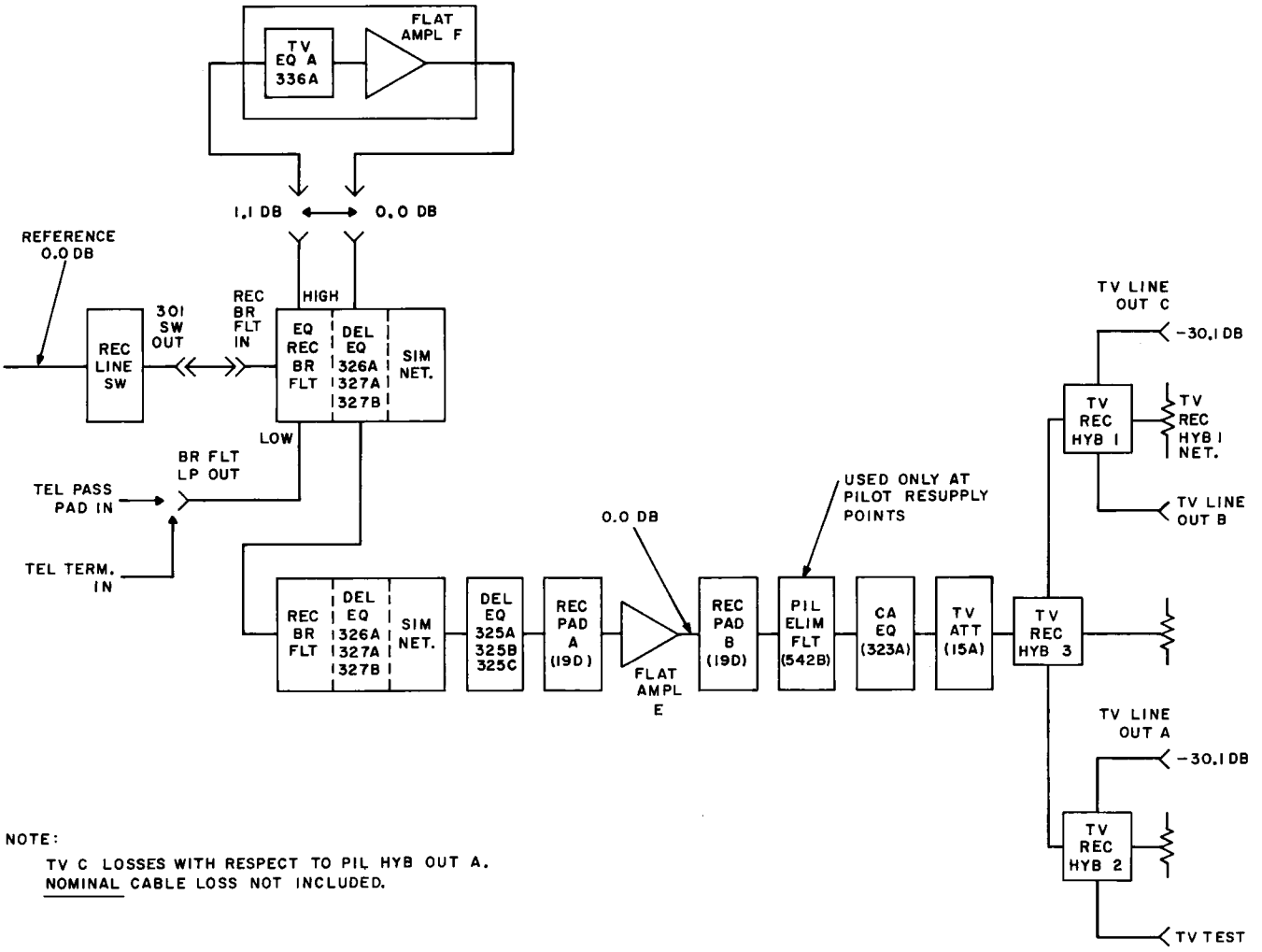


Fig. 12 — Typical Line Connecting Circuit of Combined Message-Television Signals — Block Diagram

simulating-net combinations are connected in tandem, the low-pass sections of all except the first combination are terminated in 75 ohms.

B. Delay Equalization

8.02 Equalization, in addition to that provided by the receive branch filter, is provided by a number of fixed delay equalizers used in various combinations to equalize the delay distortion of the television portion of a switching section. The combinations required depend on the number of repeater sections and the number of intermediate equalizing repeaters used. The equalizers in the receive branch filter also equalize for the delay distortion introduced by the receiving branch filter and the transmitting combining filter. Since only one transmitting combining filter is required per switching section, simulating networks are provided in the receiving branch filter to supply the delay of the missing transmitting combining filters when more than one fixed delay equalizer is used. An adjustable 336A gain and delay equalizer and flat amplifier F (Fig. 12), which compensates for the flat loss of the equalizer, are used when additional equalization is required.

C. Television Receive Pads

8.03 Two television receive pads (Fig. 12) are provided to maintain correct transmission levels. Their loss is determined by the transmis-

sion loss introduced by the fixed delay equalizers, the pilot elimination filters, and any other equipment used in the connecting circuit. TV REC PAD B in Fig. 12 is required only when flat amplifier E is used. TV REC PAD A is of such a value that the unmodulated TV carrier input to flat amplifier E is —34 db. The additional loss required to maintain proper transmission level at the output of the receiving circuit is provided by the TV REC PAD B.

D. Cable Equalizer

8.04 The cable equalizer, an unbalanced equalizer intended for use between 75-ohm impedances, compensates for transmission deviations introduced by the cable used in the connecting circuit, the television receiving hybrid coil, and the receiving line switch. The bottom cover is removable, permitting manual adjustment by strapping in equivalent steps of 50 feet to a maximum of 300 feet of cable length.

E. Pilot Elimination Filter

8.05 Line pilots, which are used to control operation of regulators, are introduced into the transmitting hybrid at terminal main repeaters. The 7266- and 8320-kc pilots are not suppressed in any all-message system; therefore, provisions for bypassing them are not required. The 7266- and 8320-kc signals may be blocked in the TV terminal, which may accommodate the pilot elimination filter. The pilot elimination filter must be used in line connecting equipment only at pilot resupply points. One complete or two modified 1/2 filters are needed when television is connected at line frequency. Some terminal main repeaters have the pilot elimination filters in the line connecting equipment; others have them in the T3-R3 television terminal. At all switching main repeaters, the pilot elimination filters are in the bridged television terminal. When TV carrier is connected between L3 terminal repeaters, the pilot elimination filters must be in the line connecting equipment.

8.06 The pilot elimination filter in Fig. 12 suppresses the 7266- and 8320-kc pilots received with the television signals from the preceding switching section and is used at a terminal repeater only. When pilots are suppressed by a pilot elimination filter, they must be resupplied in the following transmitting hybrid.

F. Television Attenuator

8.07 The television attenuator in Fig. 12 compensates for small variations in the receive equipment losses, thus assuring correct pilot transmission levels at the receiving hybrid. The attenuator consists essentially of a 12-position rotary selector switch and resistors assembled in a metal can, and it provides a loss range of 0 to 1.0 db in 0.1-db steps when used between 75-ohm impedances.

G. Television Receive Hybrid

8.08 Television receiving hybrid arrangements provide for either two or four outputs, depending on the number of receiving hybrids used (Fig. 13). Provisions are made for dropping television signals as well as for through transmission of the television signal. A single receiving hybrid has two outputs, one of which is terminated in the TV LINE OUT jack for connection to the through line or terminal equipment at the end of a line. The single hybrid is used only when TV is not dropped or at the end of a system (terminal repeater) where only one TV circuit is required. The multihybrid receiving circuit is used when TV is dropped and has three hybrids with a maximum of four outputs, three of which are used for television transmission with the fourth output generally used as a TV test point. The transmitting combining filter may be patched to one of the outputs of the receiving hybrid when provision of a through transmission path for the television signal is desired.

9. TRANSMITTING LINE ARRANGEMENTS

9.01 The transmitting portion of the line connecting equipment in Fig. 14 provides facilities for bringing the television and the telephone portion of the high-frequency spectrum together at a common point for transmission over the L3 carrier line. Television signals leaving the television transmitting terminal are adjusted to the proper transmission level ahead of the TV transmitting hybrid by the TV transmitting pad. Telephone and television signals are connected to the 550A transmitting combining filter, which is provided for introducing the two systems into the L3 carrier line without mutual interference between noise and modulation products. The filter, an unbalanced bandpass, contains two units, one passing a low-frequency band for the telephone

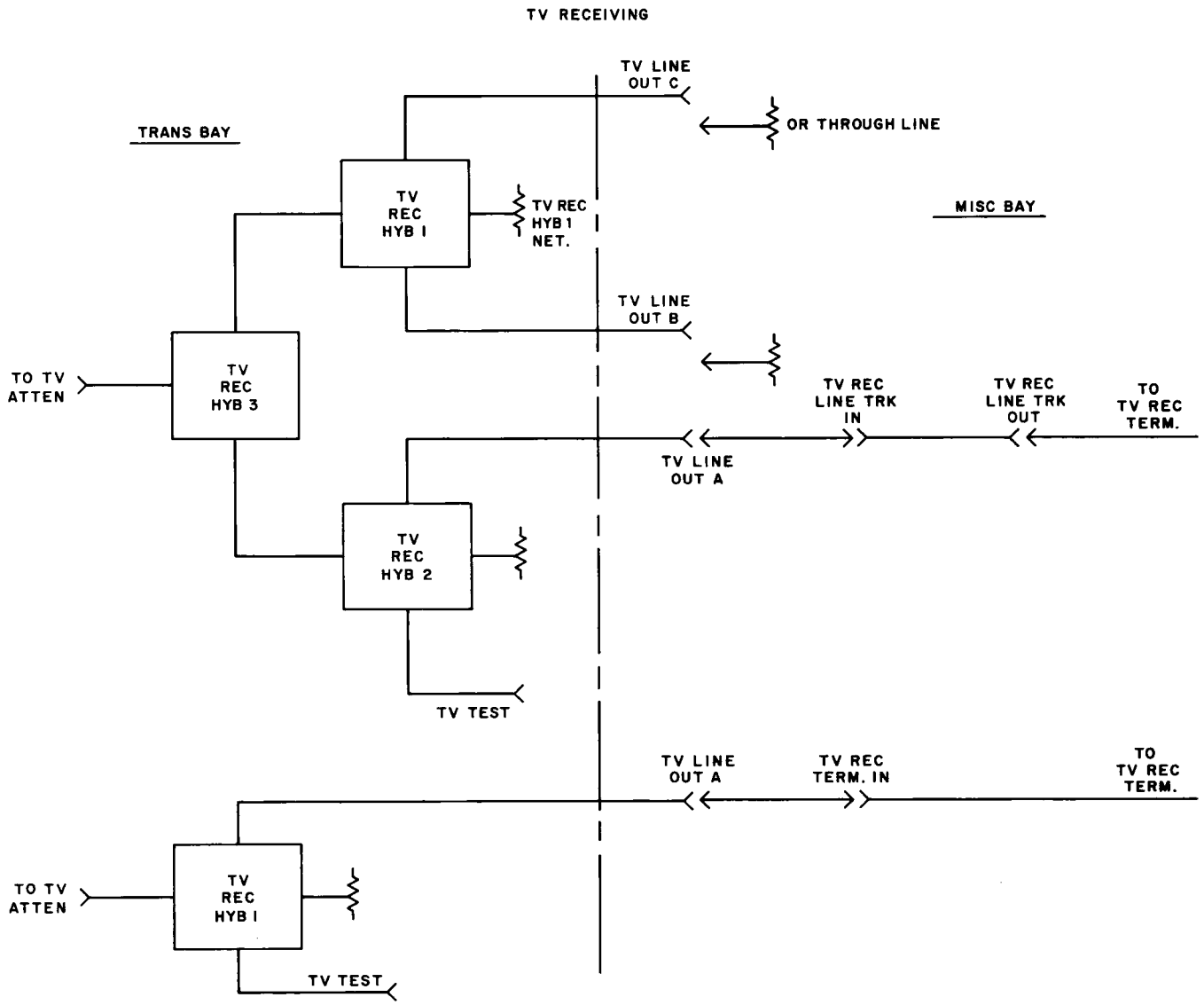


Fig. 13 — Receive Hybrid Arrangements for Television — Block Diagram

frequencies, and the other passing the high-frequency band for television transmission. The low-frequency unit passes frequencies from 0 to 3500 kc and suppresses frequencies above 3500 kc by at least 38 db. The high-frequency unit transmits those frequencies from 3500 to 8500 kc and suppresses frequencies below 3100 kc by at least 27.5 db at 1.0 mc and 29.0 db at 3.0 mc.

9.02 The transmission path of the combined signal, Fig. 14, is through the TRSG COMB FLT, the COMB FLT OUT, and TRSG HY IN jacks to the TRSG HY. Provisions are made for the insertion of pilots at the proper level, at the TRSG HY NET jack, replacing those which have been suppressed by any pilot elimination filters in the TV path.

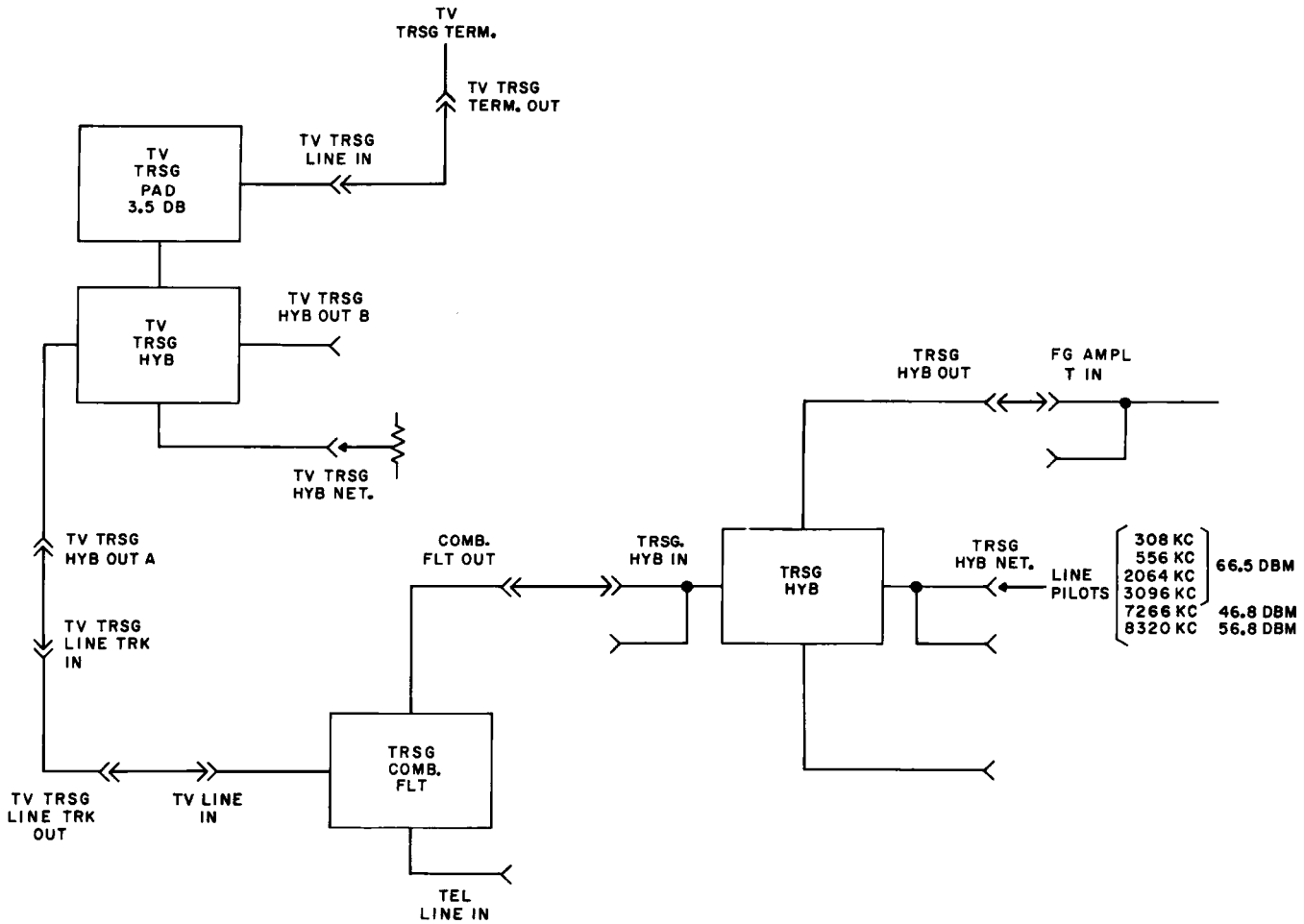


Fig. 14 — Transmitting Combining Circuits — Block Schematic

10. REFERENCES

10.01 The following SD drawings provide additional information.

SD-42024-01 — Application Schematic — T3 Television Terminal

SD-52025-01 — Application Schematic — R3 Television Terminal

SD-59543-01 — Application Schematic — Master and Submastergroup Circuits

SD-59608-01 — Application Schematic — Switching and Terminal Main Repeater Transmission Circuit

SD-59630-01 — Application Schematic — Telephone Line Connecting Circuit

SD-59634-01 — Application Schematic — Automatic Line Switching Circuit

SD-59638-01 — Application Schematic — Switching and Terminal Main Repeater Transmission Circuit — Power Fed from Cable

SD-59659-01 — Application Schematic — TV Line Connecting Circuit

SD-59660-01 — Application Schematic — Dropping Circuit for Television at an Equalizing Auxiliary Repeater