

CARRIER PROGRAM COMBINER
DESCRIPTION
CARRIER PROGRAM TRANSMISSION
ANALOG MULTIPLEX TERMINAL EQUIPMENT

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1. GENERAL

1.01 Program combining equipment (Fig. 1) provides a flexible means of connecting signals from a carrier program terminal and an A-type channel bank to the group equipment in an LMX terminal. The program combining circuit (SD-51572) permits placing a program terminal in service or out of service with a minimum of time and effort.

1.02 This section is issued to replace Section 356-800-101 which is cancelled, to add a description of the high frequency program bridge,

to correct errors, and to provide an improved drawing for the carrier program combining circuit.

1.03 A program combiner includes transmit and receive equipment for combining message and program signals into the group band: 60 to 108 kHz.

1.04 The *transmit* equipment receives a message signal from a channel bank and a program signal from a transmit program terminal and combines these signals. The combined signals are connected to a group modulator via the group distribution frame.

1.05 The *receive* equipment receives the combined signals from a group demodulator via the group distribution frame. An amplifier provides two outputs for connection to a receive channel bank and to a receive program terminal.

1.06 Additional equipment available for use with the transmit program equipment includes an alternate use switch and a high frequency program bridge (Fig. 2). The alternate use switch permits changing from the message plus program mode to the message only mode simply by depressing pushbuttons at the program combiner jack field (Fig. 1). The high frequency bridge permits one program signal to be distributed simultaneously to a number of transmit group modulators.

2. FUNCTIONAL DESCRIPTION

A. General

2.01 A transmit program combiner circuit (Fig. 3 and 4) receives a 5-kHz or 8-kHz signal from a transmit program terminal and a message signal from a channel bank, combines these signals, and

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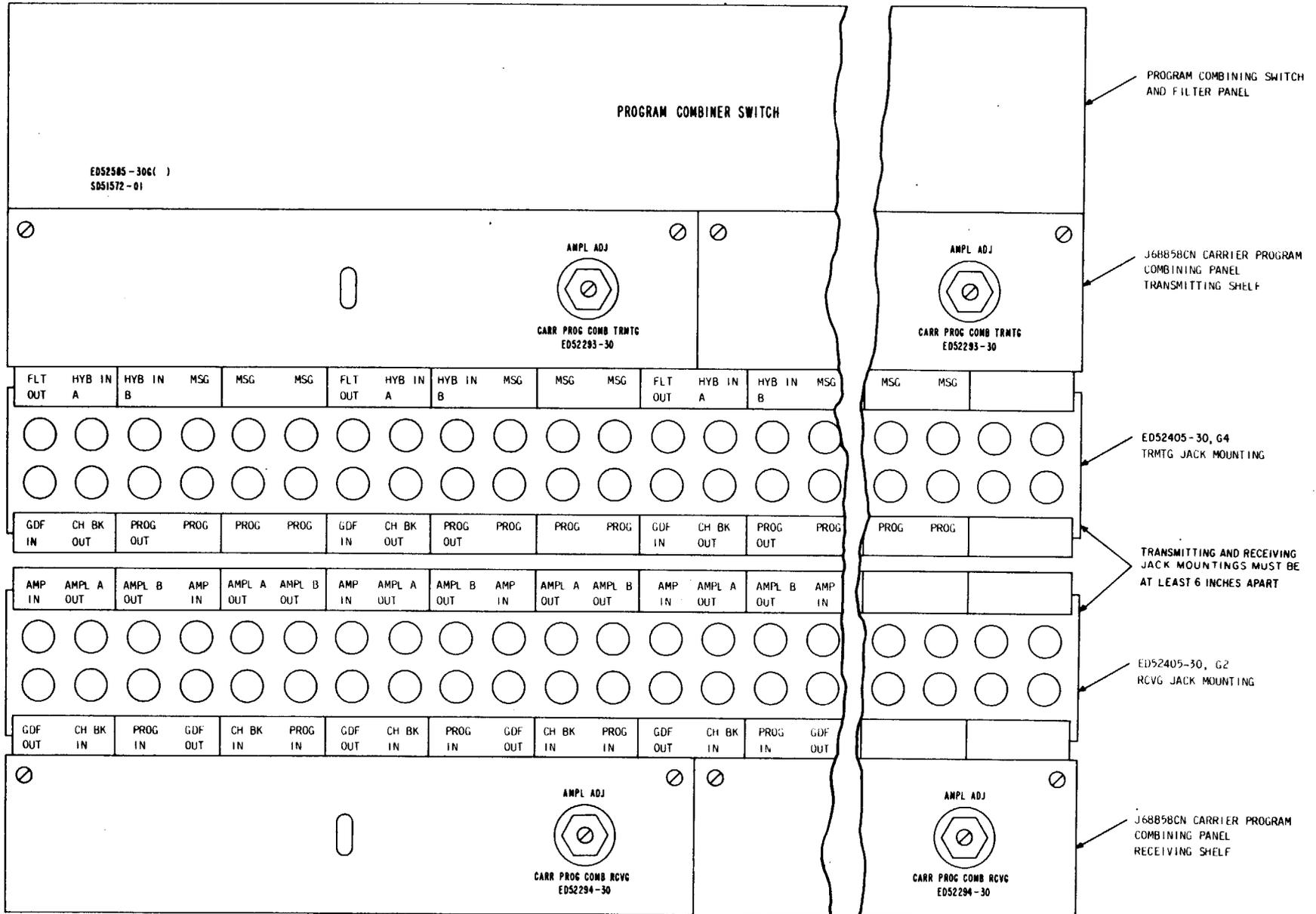


Fig. 1—Carrier Program Combiner Equipment

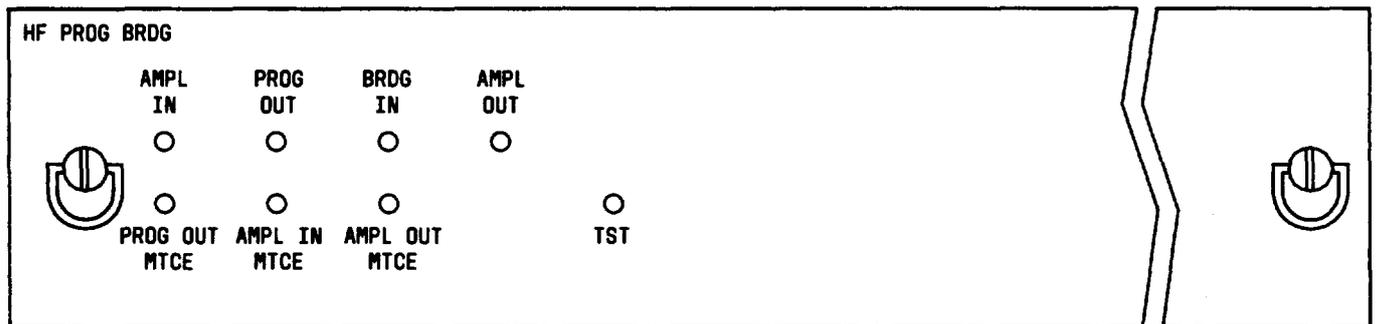


Fig. 2—High Frequency Program Bridge

provides an output to an LMX transmit group. Each program combiner includes an amplifier with two outputs which differ in level by 8 dB. Only the high-level amplifier output is used in transmit combining modules.

2.02 A high frequency program bridge (Fig. 5) is used to connect a program signal to several transmit program combining circuits.

2.03 A receive program combiner circuit (Fig. 6) receives the output of an LMX receive group and provides outputs to a receive channel bank and to a receive program terminal. Both amplifier outputs are used in the receive combining module.

B. Transmit Circuits

2.04 Each transmit circuit includes a transmit combining module ED-52293, which is provided in three group numbers. A group 1 module is used for 5-kHz or 8-kHz program combining where program combiner switch and filter panel ED-52585 is not used. A group 2 module is used for 5-kHz

program combining where switch and filter panel ED-52585 is used. A group 3 module is used in conjunction with a high frequency program bridge.

Group 1 Transmit Combining Module

2.05 The transmit circuit with a group 1 module is shown in Fig. 3. This circuit requires physical removal of transmit channels 6 and 7 from the channel bank for a 5-kHz program, or removal of channels 6 through 8 for an 8-kHz program. Figure 7 shows the frequency allocations for the 5-kHz and 8-kHz program signals.

2.06 The group 1 module includes a 2.4-dB pad, a 3.2-dB hybrid, an adjustable amplifier, and a low-pass filter network.

2.07 The message signal enters from the channel bank at a transmission level of -37.4 dBTL. The program signal enters from the program terminal at a transmission level 8.6 dB below the message transmission level. The program signal passes through the 2.4-dB pad and combines with

the message signal in the 3.2-dB hybrid transformer. The program signal is 11 dB below the message signal at the hybrid output.

2.08 The amplifier has a nominal gain of 38 dB and an adjustment range of ± 4 dB from nominal. The amplifier is adjusted for 0-dB overall combiner gain in the message path which results in an overall 2.4-dB loss in the program path, due to the 2.4-dB pad.

2.09 The low-pass filter network consists of a resistive pad and a low-pass filter. The pad provides the proper loss and the filter attenuates interference above 108 kHz.

Group 2 Transmit Combining Module

2.10 The transmit circuit with a group 2 module is shown in Fig. 4. This circuit is used with a switch and filter panel which includes a band-elimination filter, a hybrid, and an alternate-use switch. The filter suppresses signals in the band used by the 5-kHz program signal, so transmit channel equipment need not be removed from the channel bank. Switching between the message only and the message plus program modes is accomplished by depressing pushbuttons to operate relays.

2.11 The group 2 module includes a hybrid with one input terminated, an adjustable amplifier, and a low-pass filter network.

2.12 The message signal enters from the channel bank at a transmission level of -37.4 dBTL. After passing through the switch relay, the message signal enters the hybrid transformer which provides a 3.2-dB loss. The amplifier provides a nominal gain of 38 dB and can be adjusted ± 4 dB to achieve an overall gain of 0 dB in the message path, including the filter.

2.13 The low-pass filter network has a 7.7-dB pad which attenuates the message signal. The low-pass filter suppresses interference above 108 kHz.

2.14 The band elimination filter suppresses signals in the frequency band needed for the program signal. The hybrid, which is a part of the band elimination filter unit, combines the message and program signals, and the switch relay routes the combined signal to the group distribution frame.

The input and output levels are the same for both the group 1 and group 2 arrangements.

2.15 The group 2 arrangement can be switched in or out of service by operation of nonlocking pushbutton keys. Four control keys and two status lamps are used with this arrangement. Up to two additional lamp sets may be used for remote status indicators. The keys control the switch relay for placing the program combiner circuit in or out of service. Accidental operation of the switch relay is prevented by a special wiring arrangement of the control keys. Two keys designated PROG must be pressed simultaneously to place the program combiner in service. This action also lights the status lamp designated PROG, indicating that the circuit is in the program combining status. When the two control keys designated MSG are pressed, the program combiner is switched out of service and the MSG lamp lights.

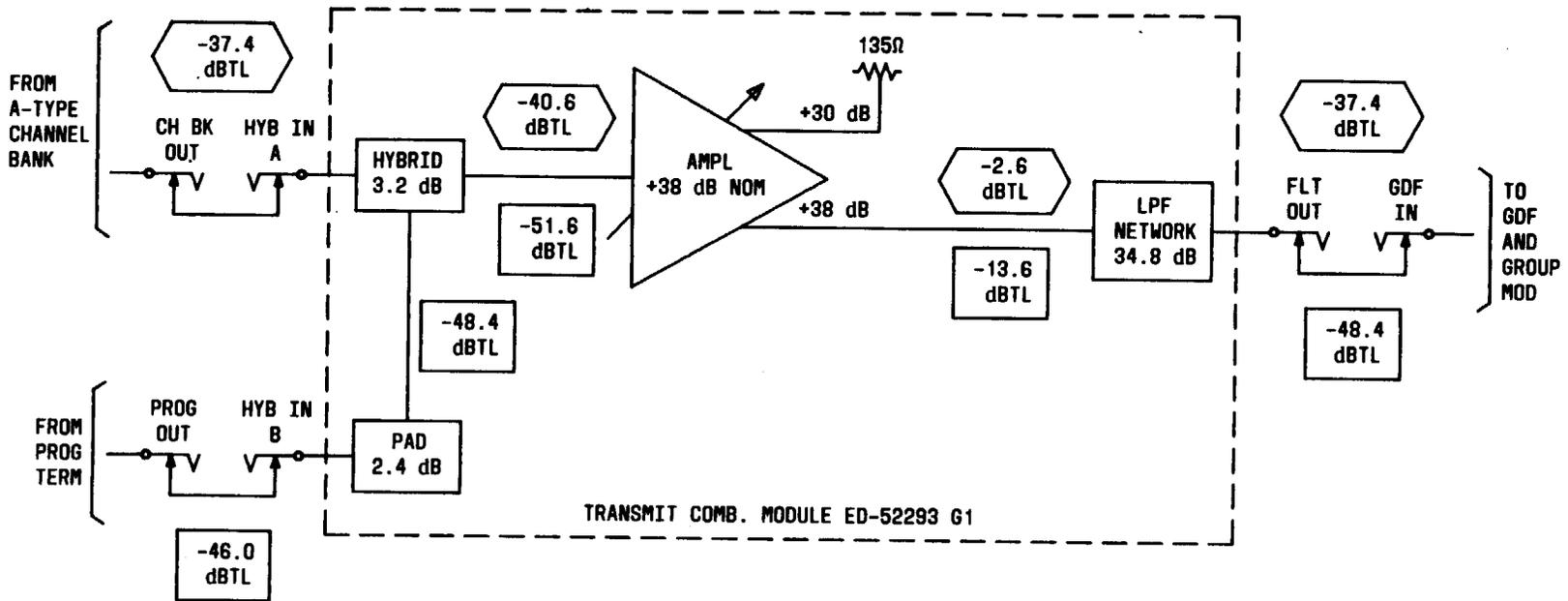
2.16 Remote control operation of the switch relay is possible with the dual relay, which controls the switch relay. The remote control dual relay may be wired to function on signals from Centralized Status Alarm and Control System (CSACS), Surveillance and Control of Transmission Systems (SCOTS), or a similar system. The status lamps indicate the status of the circuit when switched by local or remote control. The switch relay and the remote control dual relay are in the switch and filter panel. The control keys and local status lamps are in the group 4 transmit jack mounting designed for use with the switch and filter panel.

Group 3 Transmit Combining Module

2.17 A group 3 module is used with a high frequency program bridge as shown in Fig. 5. This module includes a hybrid with one input terminated and an adjustable amplifier.

High Frequency Program Bridge

2.18 The high frequency program bridge (Fig. 5) receives the signal from a transmit program terminal and provides ten outputs. One output tap connects to the TST jack on the front panel. Any of the other nine output taps can be connected to an LMX transmit group, or can be connected to another high frequency program bridge located up to 1200 cable feet away.



LEGEND

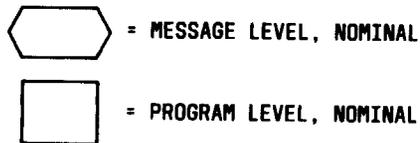


Fig. 3—Transmit Carrier Program Combiner Circuit Without Program Combiner Switch Panel

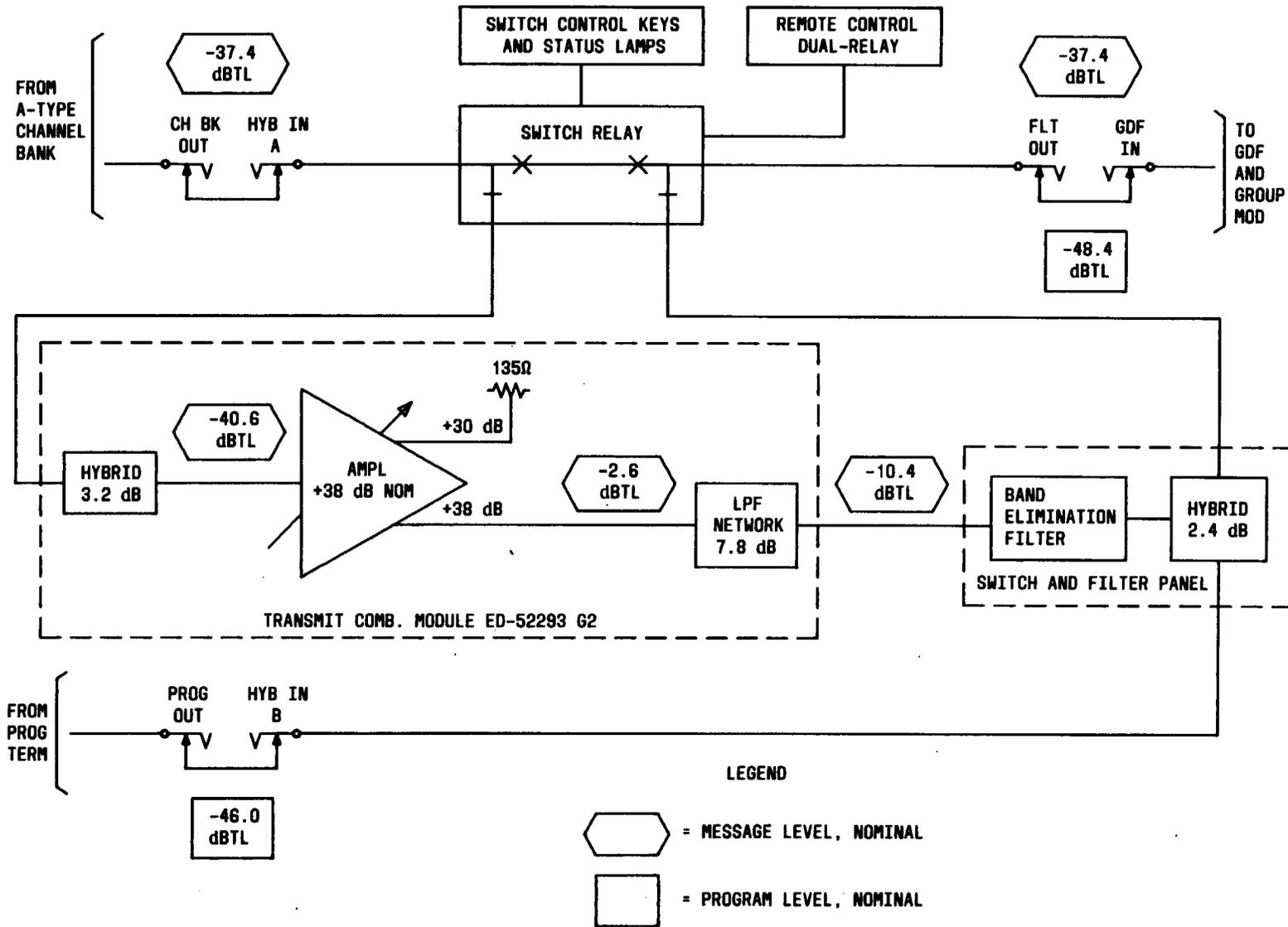


Fig. 4—Transmit Carrier Program Combiner Circuit With Program Combiner Switch Panel

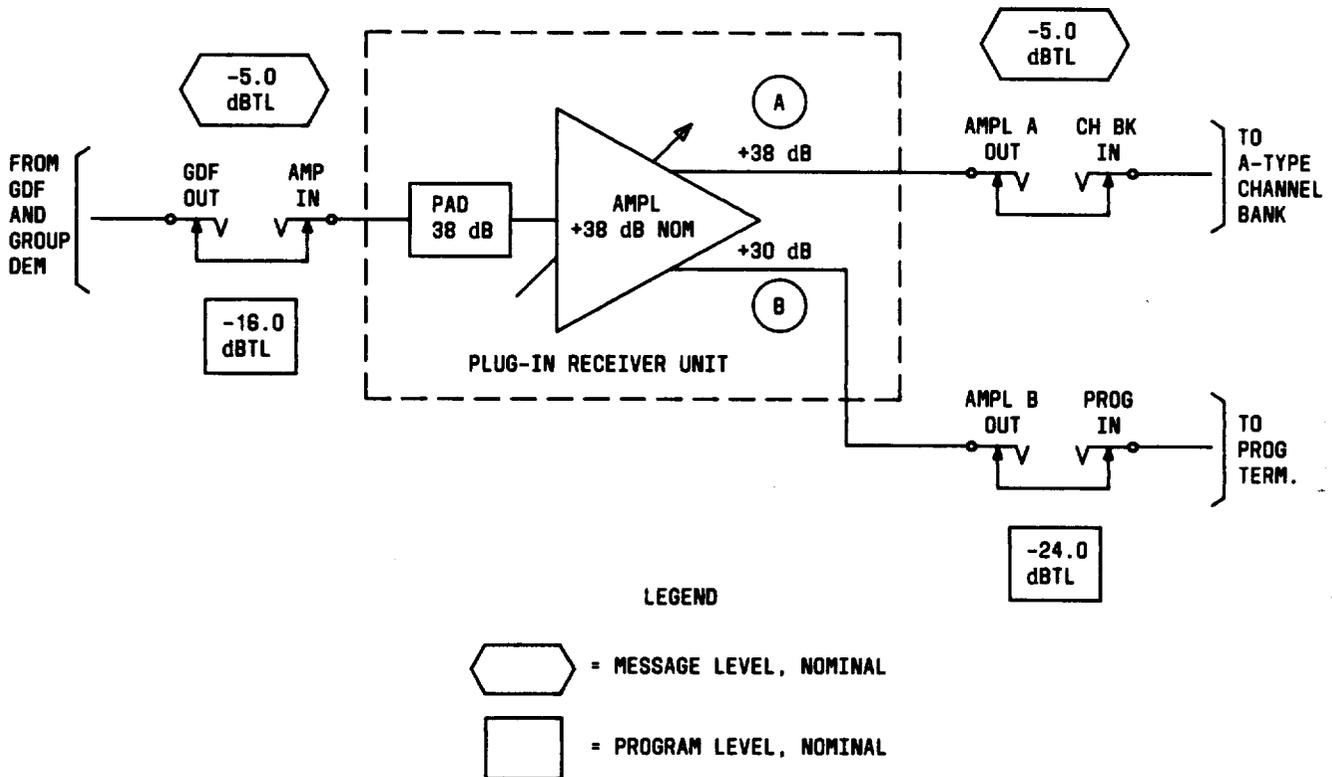


Fig. 6—Receive Carrier Program Combiner Circuit

2.19 The bridge can contain high-level and/or low-level output taps. A low-level tap is used for up to 100 feet of cable; a high-level tap is used for up to 1200 feet of cable. The bridge is provided in various list numbers to include all combinations of high-level and low-level outputs. Each amplifier used with a high frequency program bridge is part of a group 3 transmit program combining module.

2.20 A bridge can be used for connecting 5-kHz, 8-kHz, or 15-kHz program signals to a number of LMX transmit groups. Frequency allocations for these program signals are shown in Fig. 7 and 8. Options for 15-kHz program signals in the group band are:

- (1) one monaural channel and six voice channels
- (2) two monaural channels
- (3) one pair of stereo channels.

The frequency allocations for 15-kHz stereo program signals are shown in Fig. 8. The channel A and B program signals, program pilots at 16.8 kHz in each channel, the 104.08-kHz group pilot, and cueing channels Q1 and Q2 occupy the entire group band from 60 to 108 kHz.

C. Receive Circuit

2.21 The receive circuit includes a receive combining module ED-52294 which contains a 38-dB pad and an adjustable amplifier providing two outputs as shown in Fig. 6. The receive circuit does not separate the program signal from other signals in the group band. Both amplifier output signals contain the same information. The proper information is extracted from each signal in the receive program terminal and in the receive channel bank.

3. EQUIPMENT DESCRIPTION

A. General

3.01 Carrier program combining equipment is shown in Fig. 1 and 2. This equipment includes transmit and receive combining panels, transmit and receive jack mountings, switch and filter panel, and high frequency program bridge.

3.02 Program circuit jacks are provided in the transmit and receive jack mountings and in the high frequency bridge panel. These jacks are dual-through jacks which permit patching, to replace defective equipment, and access for testing. The signal path is broken when a plug is inserted into any jack.

B. Switch and Filter Panel

3.03 Switch and filter panel ED-52585 contains four wire-wrap terminal strips, four wire-spring relays, and a band elimination filter. This panel is provided only for a 5-kHz program combiner circuit.

3.04 Sufficient relays and terminal strips are provided in the panel to serve two program combiner circuits, if required. A second band elimination filter is required when the second circuit is to be served. This second filter mounts on top of the first band elimination filter in the panel.

3.05 The top and rear covers of the panel may be removed to gain access to the units in the panel. Signal leads and relay control leads may be routed through openings in each side of the panel. The panel is mounted miscellaneously in available bay space. There are no controls or indicators on the panel.

C. Carrier Program Combiner Panel

3.06 A carrier program combiner panel J68858CN is equipped with two transmit combining modules ED-52293 or with two receive combining modules ED-52294. A panel containing transmit modules must be mounted at least six inches from a panel containing receive modules to prevent crosstalk.

3.07 Each module has an 8-pin plug mounted on the rear for making battery and transmission connections via mating connectors on the shelf. This plug-in arrangement permits direct replacement of a defective module with a spare unit. The modules are held in the shelf assembly with screws through the front panel. Each module has a front-panel control, designated AMPL ADJ, for adjusting the overall gain of the combining circuit.

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3.08 The group 2 transmit combining module is designed to be used with the switch and filter panel. The group 1 transmit combining module and associated shelf assembly can be used with the switch and filter panel but requires modifications to prevent overloads if a group 2 or modified group 1 module is accidentally inserted into an unmodified group 1 shelf assembly.

3.09 Three changes must be made to modify a group 1 module:

- (1) The wiring arrangement to the 8-pin plug terminals on the rear of the unit must be changed.
- (2) One of the inputs to the 3.2-dB hybrid transformer must be terminated with a 135-ohm resistor because only one input is needed in the modified circuit.
- (3) The resistive pad in the low-pass filter network must be modified to permit sufficient gain in the transmitting program combiner unit to account for the loss of the band elimination filter.

D. Jack Mountings

3.10 Jack mounting ED-52405 is provided in three group numbers. A group 4 transmit jack mounting is provided when the switch and filter panel is provided. Otherwise, a group 1 transmit jack mounting is provided at the transmit end of a program circuit. A group 2 receive jack mounting is provided at the receive end of a program circuit.

3.11 The control keys and status lamps for the switch and filter panel, when provided, are mounted in labeled spaces in the group 4 transmit jack mounting.

E. High Frequency Program Bridge

3.12 A high frequency program bridge NJ01365A (Fig. 5) includes a distribution bus which provides ten output taps. One tap connects to the TST jack on the front panel. The other nine output taps permit distribution of a carrier program signal to a number of LMX transmit groups. Use of a high frequency program bridge minimizes the number of program terminals required. A card mounted inside the panel provides spaces for

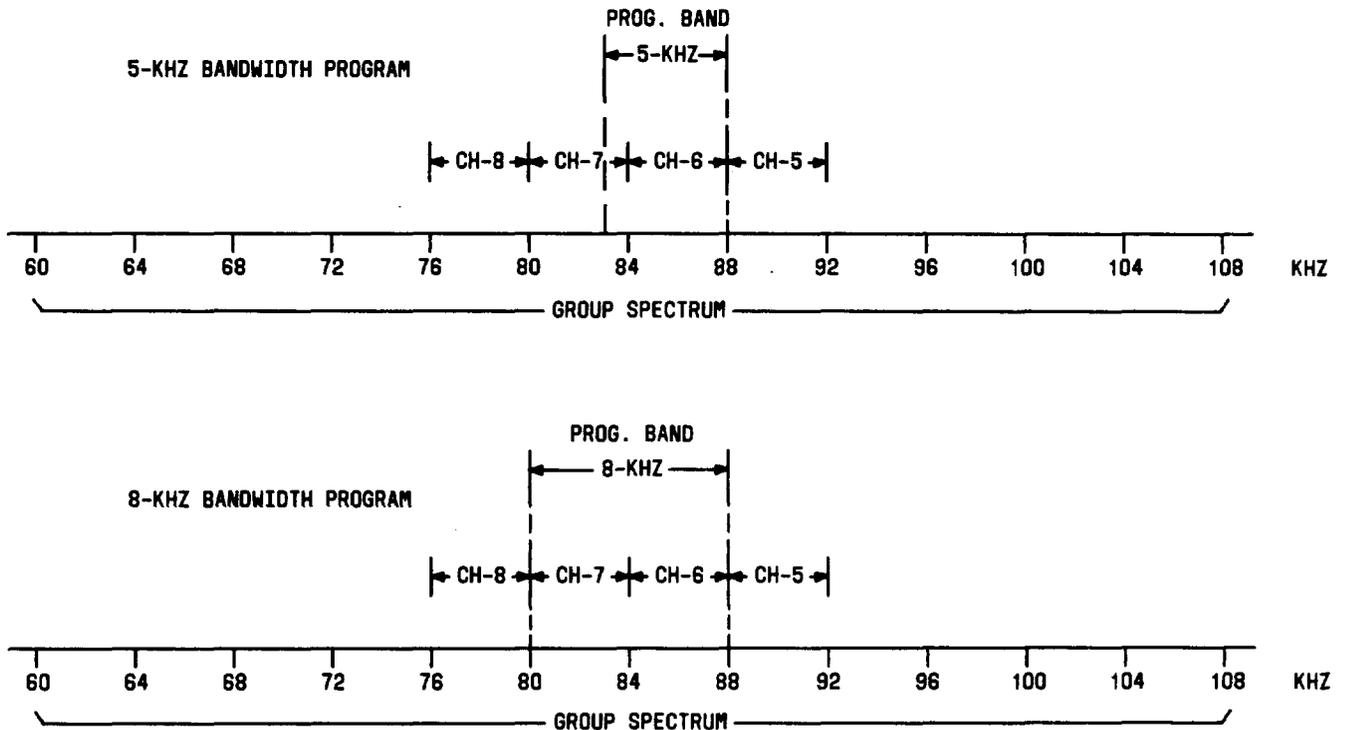


Fig. 7—Locations of Program Signals in Group Spectrum

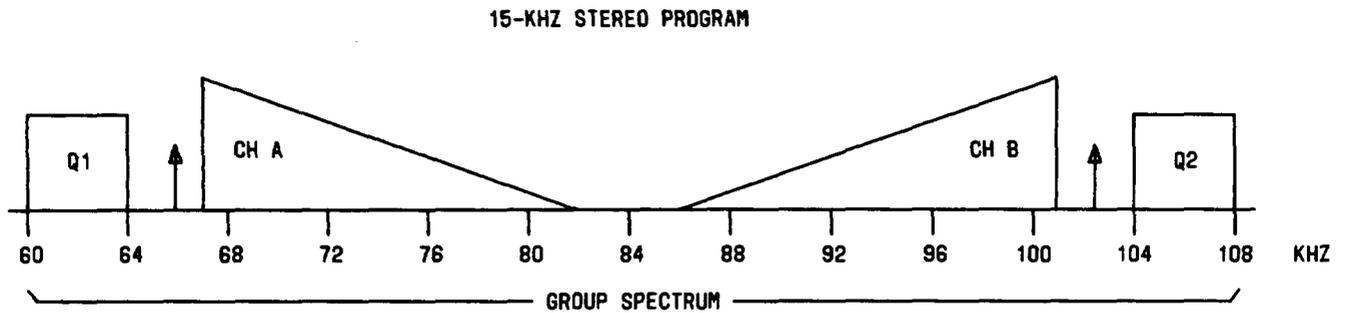


Fig. 8—Frequency Allocations for 15-kHz Stereo Program Signals

recording the distribution bus tap assignments. A cable pad is required for each high-level output, so cable loss plus pad loss will result in the proper program signal level at the HYB IN B jack of the program combiner.

4. REFERENCES

4.01 The following reference material provides additional information.

Bell System Practices

356-017-501 Carrier Program Combiner Patching Procedures and Tests

Schematic Drawings

SD-51572-01 Carrier Program Combiner Circuit

SD-59090-03 A1 and C1 Carrier Program Terminals

Equipment Drawings

ED-52293-30 Transmit Program Combiner Module

ED-52294-30 Receive Program Combiner Module

ED-52405-30 Program Combiner Jack Mounting

ED-52585-30 Program Combiner Switch and Filter Panel

J68858CN Carrier Program Combiner Panel

NJ01365A High Frequency Program Bridge Panel