

2600-HZ E1P SINGLE-FREQUENCY SIGNALING UNIT

DESCRIPTION

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1. GENERAL

1.01 This section describes the E1P single-frequency (SF) signaling unit. The E1P SF unit, SD-99779-01, is a component part of the E-type signaling system. It is used at the switching end of a special access circuit.

1.02 This section is reissued to correct information stated in Parts 1 and 2 of the section.

1.03 The E1P SF unit (Fig 1) will function on 4-wire trunk facilities having -16 dBm and +7 dBm voice transmission level points (TLP), such as J, K, L, N, O, and T carrier trunks. The E1P unit should be located near enough to the above TLPs so that the local cabling transmission loss at 2600-Hz does not exceed 3 dB. A and B or E and M lead signaling is used between the SF

unit and the connecting equipment. The E1P SF unit has two modes of operation: (1) ground-start (GS) and (2) loop-start (LS). In the GS mode the unit uses the A and B leads for signaling between the connecting equipment and in the LS mode either the A and B or E and M leads can be used. The LP-GS switch on the face of the unit controls the mode of operation.

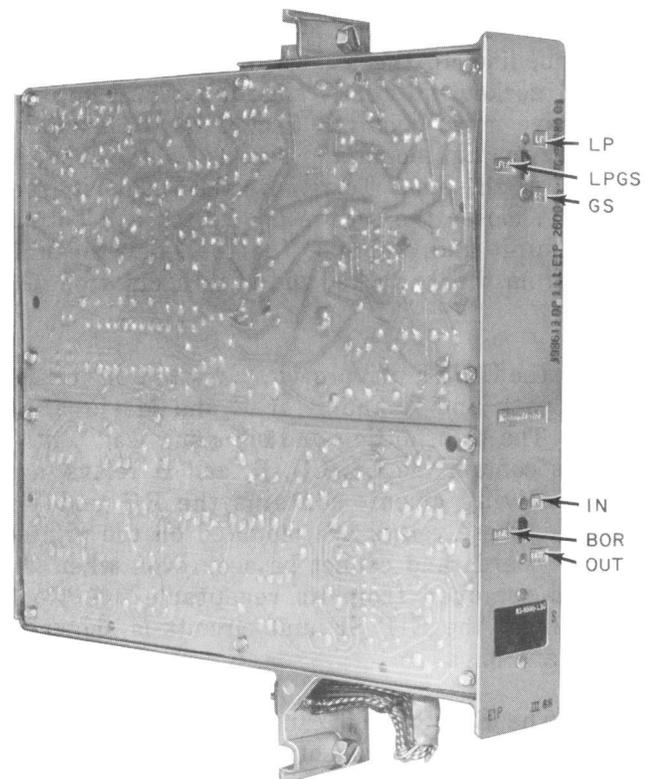


Fig. 1—E1P SF Unit

1.04 Also appearing on the face of the E1P unit is a BOR switch and an S socket. The BOR switch is a 2-position switch which adds resistance in series with the A and B leads when operated to the IN position and removes it in the OUT position. The BOR switch is operated to the IN position if the external loop resistance of

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the A and B leads is less than 520 ohms. The S socket is provided for monitoring and making in-service tests of the E1P unit. The following transmission and signaling ports can be monitored at the S socket: LINE RCV, EQUIP RCV, LINE TRMT, and E and M leads.

1.05 The circuit components of the E1P SF unit are mounted on printed circuit wiring boards, which are bolted to the sides of a die cast aluminum frame with the circuit components on the inside. The overall dimensions of the unit are approximately 11-3/4 inches high by 1-3/4 inches wide by 10 inches deep. All interconnecting wiring is brought out on the P1 connector. The P1 connector on the E1P unit mates with the J1 socket in the signaling unit bay. To place the E1P unit in its in-service position, line up the guides of the P1 connector and J1 socket and gently slide it forward until all pins have made contact. Secure the E1P unit to the bay by tightening the screws on the top and bottom of the unit. To remove the E1P unit from the bay, loosen the screws on the top and bottom of the unit and, using a 725 tool, pry the unit loose from the J1 socket and slide it out from the bay.

1.06 The E1P SF unit provides a 4-wire transmission path and A and B or E and M signaling leads. The transmitting and signaling lead control circuits contain the CS, CO, D, and H relays, and the receiving circuit contains the RG and VG relays. These relays are mounted on the printed wiring boards and cannot be seen even when the unit is removed from its receptacle. A block diagram of the E1P SF unit circuits is shown in Fig. 2 and 3.

1.07 The E1P SF unit can be seized from either the line or equipment side. Its basic functions on a line (station) seizure are to request a dial tone connection and repeat pulsing. On an equipment seizure (switching) its primary function is to convert a ringing signal into a 2600-Hz tone signal for transmission over the line facility.

1.08 The E1P SF unit is the replacement for the E1L, E2L, E1L-A, and E2L-A SF units. For ground start applications where an E-L and E-L-A must be mounted side-by-side and interconnected, a single E1P SF unit with the LP-GS switch operated to GS position will perform the same functions. The E1P SF unit offers many transmission and signaling improvements such as reduced talk-off,

better dial pulse correction, protection against false disconnects due to high voltage tip party tests, prevention of false ringing due to transient office conditions, and allows ringing into a station off-hook condition for certain hotel-motel applications.

1.09 ♦The E1P SF unit offers improved stability over other E-type SF units. This is due to improved circuit design and to the circuit components that are selected for its construction. Environmental changes, such as temperature, aging, etc., have a minimal effect upon this unit.♦

1.10 ♦A 1-type terminating set (or equivalent) with inductors must be connected to the equipment side of the E1P SF unit. If a terminating set, other than a 1-type is used, it must not exceed the range of SX signaling. The terminating set is used to convert from 2-wire to 4-wire speech transmission (or vice versa).♦

2. TRANSMISSION AND SIGNALING PERFORMANCE

A. Transmitting Circuit

2.01 The transmitting circuit consists of a through transmission path and a low and high level 2600-Hz tone gate circuit. The speech path and the 2600-Hz tone gate circuit are switched by means of transfer contacts on the CO relay. Operation of the CO relay connects a 2600-Hz tone gate to the line and opens the speech path. When the CO relay is released, the voice transmission path is cut through and 2600-Hz tone is removed. The transmitting circuit is under control of the A and B lead detector or the M lead (see 2.17, 2.18). The high and low level 2600-Hz tone control is accomplished by diode gates. A major function of the tone gate is to supply high level tone towards the line when the ringing signal is applied to the E1P SF unit from the switching equipment.

2.02 The transmission path through the E1P SF unit transmitting circuit is via input tip and ring leads from the equipment side, through break contacts of the CO relay, and out on the tip and ring leads towards the line. When 2600-Hz tone is being transmitted, the CO relay is operated and the transmission path is cut and terminated with 600 ohms.

2.03 Envelope delay distortion is present in the transmitting and receiving paths of the E1P unit. The amount present in the transmit path is

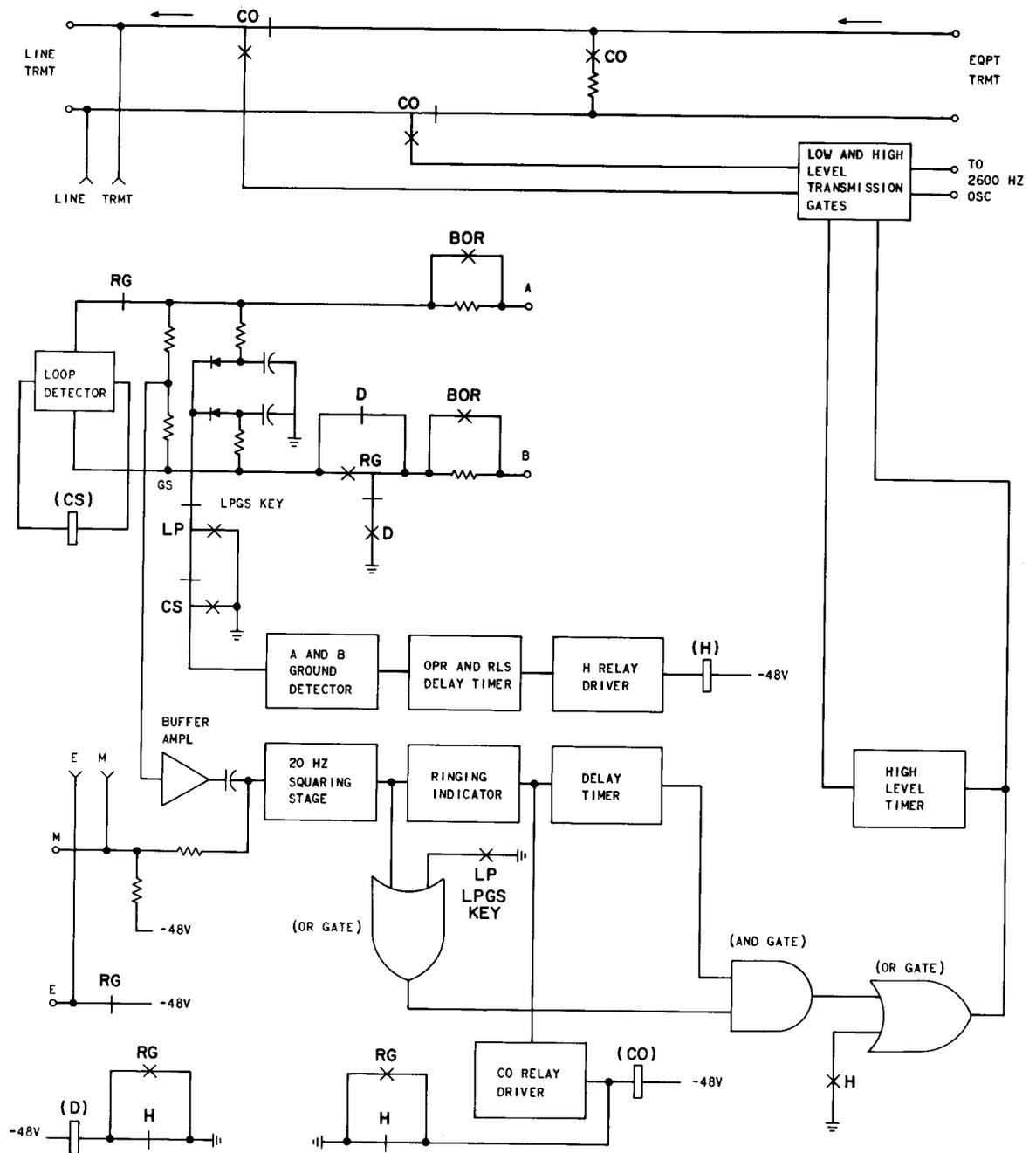


Fig. 2—Transmit and Signaling Lead Circuits

so small that it can be considered to be negligible. Fig. 4 shows the envelope distortion of the transmission paths.

2.04 The insertion loss at frequencies in the voice range is about 0.1 dB at 1000-Hz. Fig. 5 shows the transmit path loss for frequencies

between 100- and 5000-Hz. This loss would normally not be shown on circuit layout records.

B. Receiving Circuit

2.05 The receiving circuit consists of a transmission path, signal and guard detector circuits, a dc comparator, and RG and VG relay control circuits.

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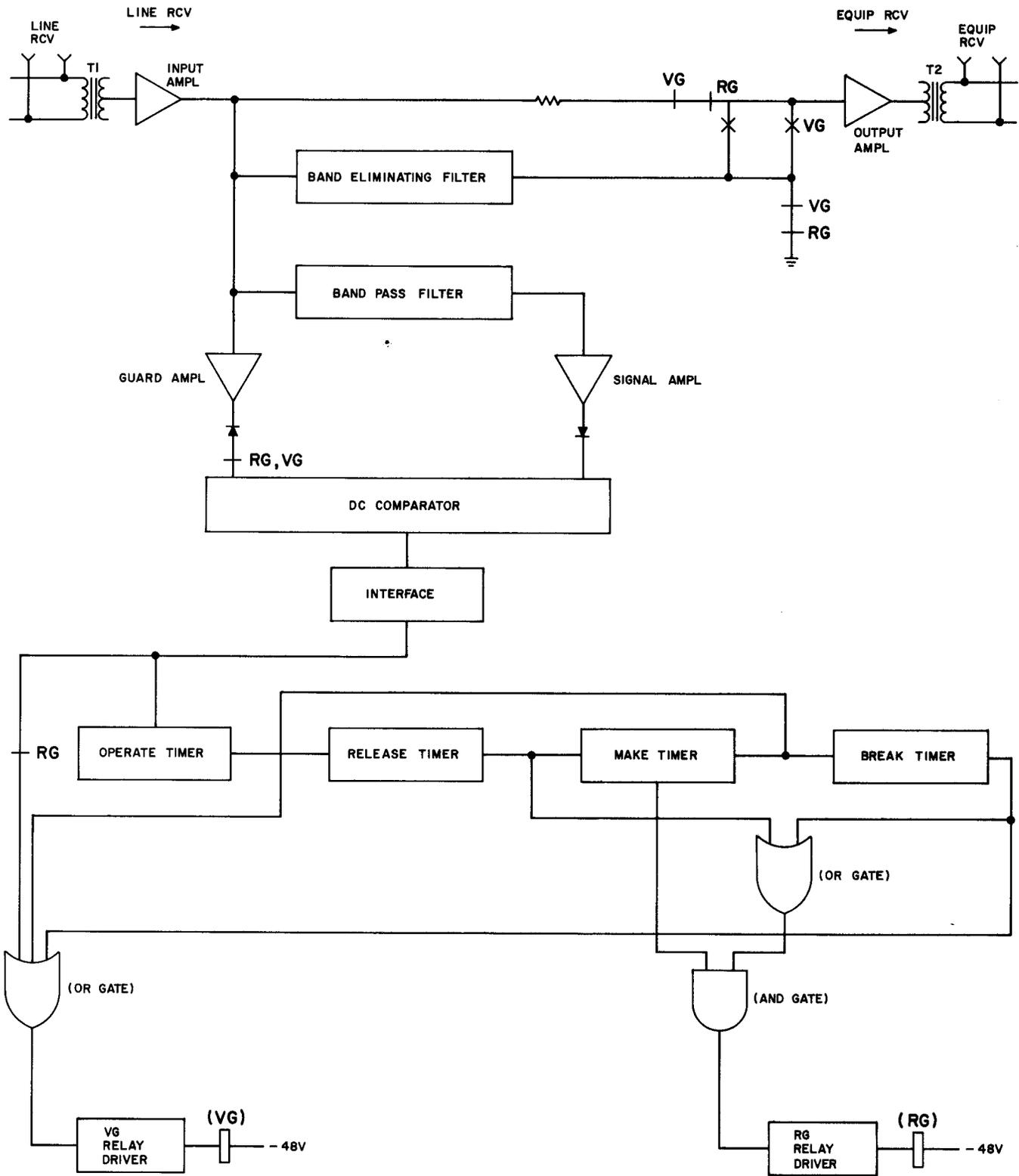


Fig. 3—Receiving Circuit

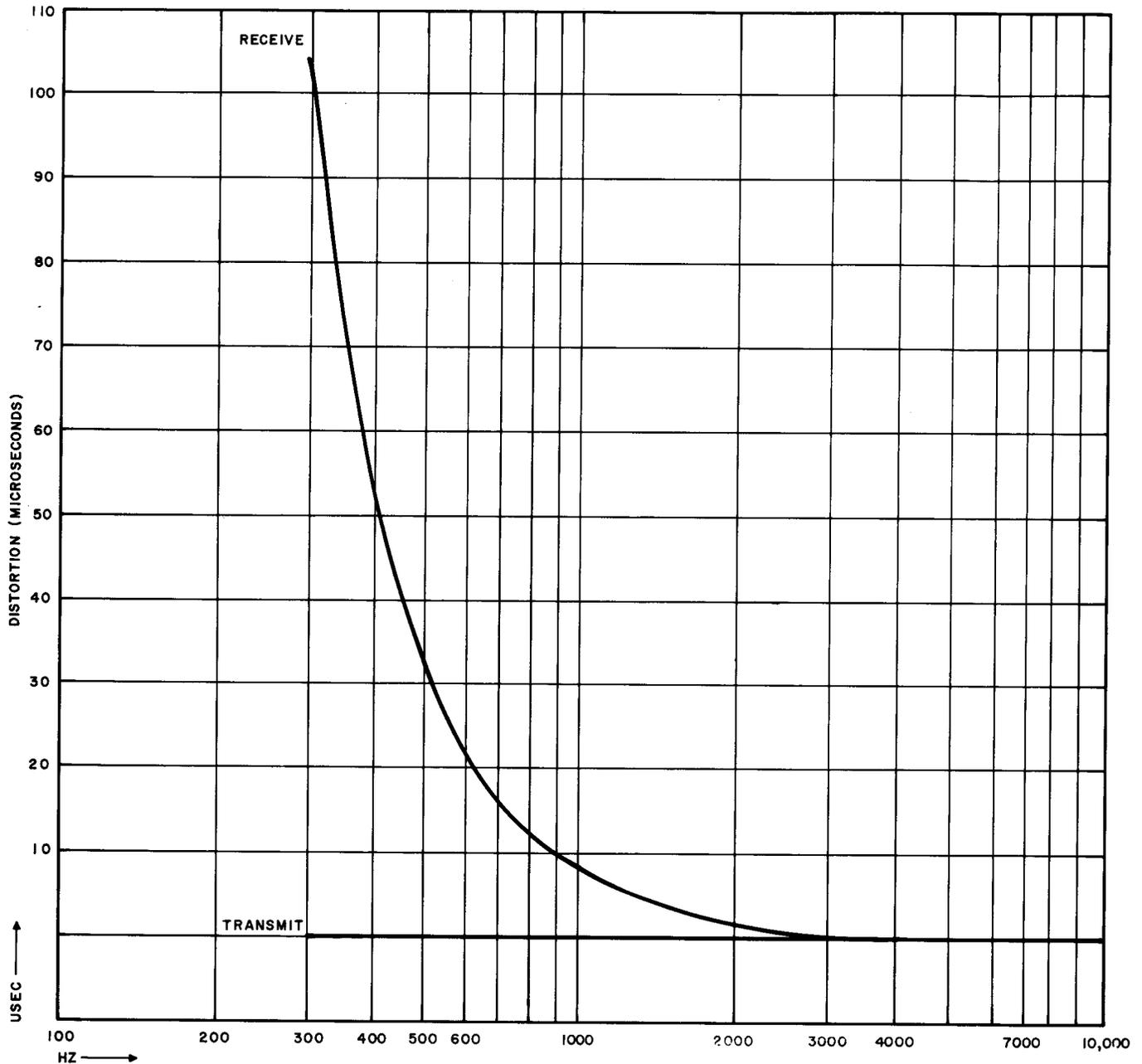


Fig. 4—Envelope Delay Distortion

The primary functions of the receiving circuit are: (1) upon station seizure request a dial tone connection, (2) convert 2600-Hz tone pulses into dc signals, (3) provide pulse correction to incoming tone pulses, and (4) provide a voice transmission path.

2.06 The transmission path through the receive circuit (Fig. 3) is via input transformer T1,

an input buffer amplifier, a 2 dB pad, an output amplifier, and output transformer T2. A switched band-elimination filter is also provided in the receiving circuits transmission path.

2.07 The band-elimination filter is switched into the receive speech path whenever 2600-Hz signaling tone is being received. It prevents

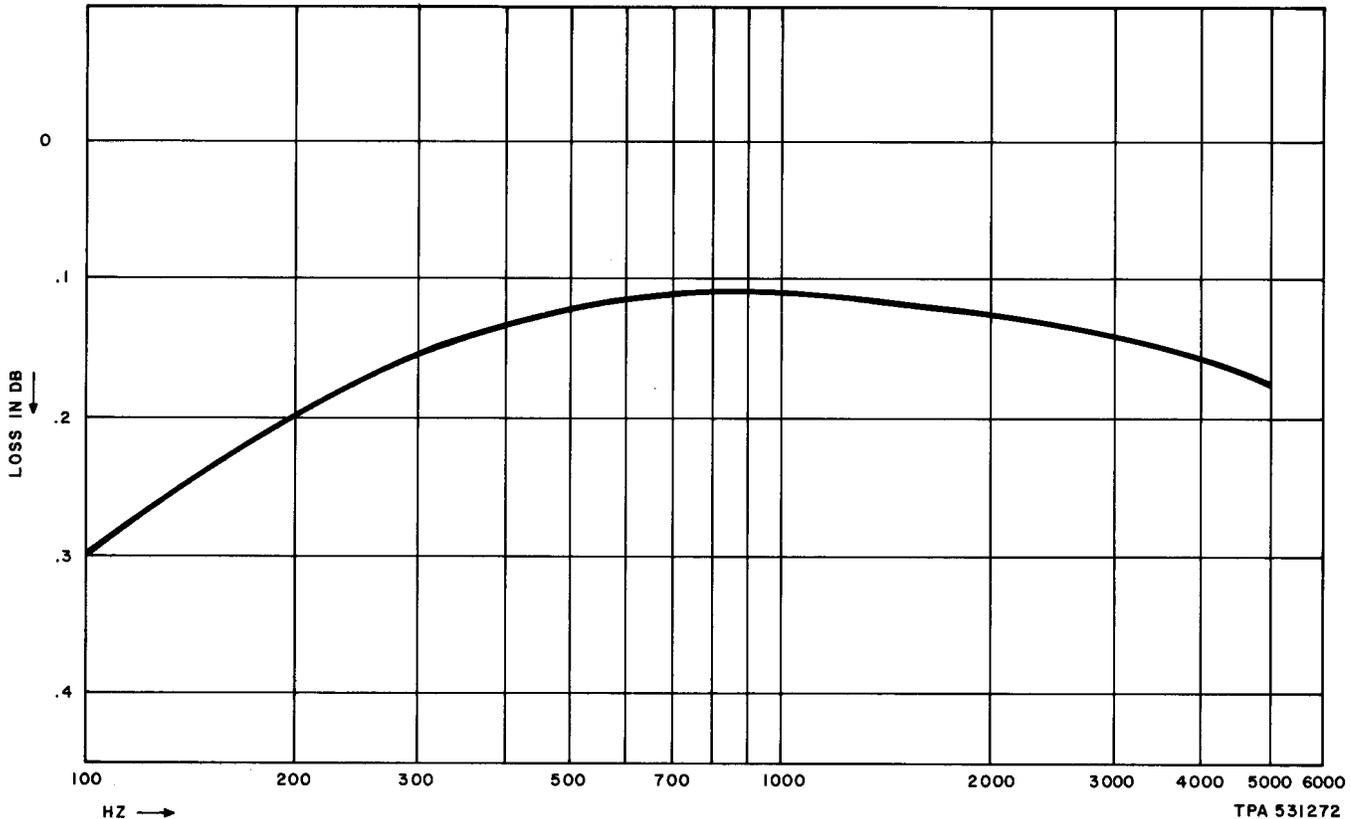


Fig. 5—Transmit Circuit Insertion Loss

2600-Hz tone signals from being passed on to subsequent signaling links and affecting call progress or annoying a terminating customer. The voice transmission performance of the receive paths is shown in Fig. 6 and 7 with the filter in and out of the circuit.

2.08 Voice frequencies entering the LINE RCV port are passed through the receive circuit with no insertion loss (excluding 2600-Hz tone when signaling). The voice frequencies are dropped 2 dB before passing to the input buffer amplifier. The 2 dB drop guards the input amplifier against peak voice currents. The input buffer amplifier is of the emitter-follower transistor configuration. It serves as an impedance buffer. The voice frequencies from the input buffer amplifier pass through the band-elimination filter or through a resistor circuit. In either case they are dropped another 7 dB before entering an output amplifier. The output amplifier is of the hybrid feedback variety. It provides the receive circuit with 9 dB of gain with an output impedance of 600 ohms.

2.09 The harmonic distortion of input signals passing through the receive circuit is given in Fig. 8. Most of the distortion is second harmonic. Signals entering the receive circuit below +5 dBm have a total harmonic distortion of less than 55 dB. Internal noise of the receive circuit which includes battery noise is less than 20 dBmC0.

2.10 The E1P SF unit provides high return loss and longitudinal balance characteristics. At frequencies between 250 and 4000-Hz, the return loss at the LINE RCV or the EQUIP RCV ports against 600 ohms is a minimum of 30 dB. At frequencies between 200 and 3000-Hz, longitudinal balance at the input is a minimum of 65 dB and at the output is at least 60 dB.

2.11 The approximate delay distortion of the receive circuit in the voice frequency range is shown in Fig. 4.

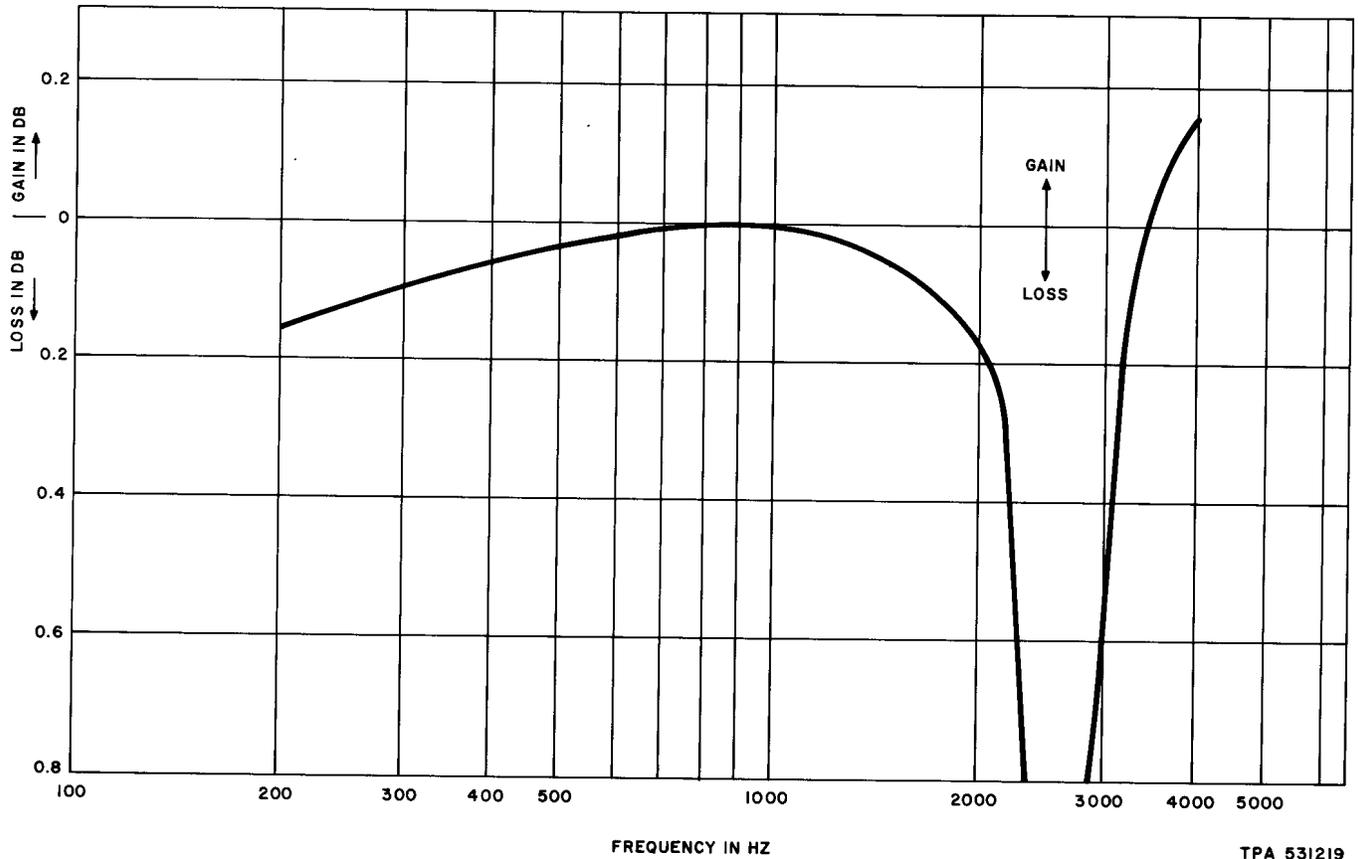


Fig. 6—Receive Circuit Insertion Loss With Band Elimination Filter In

2.12 The SF receiving circuit of the E1P unit has pulse correcting features. It will accept 2600-Hz tone pulses in the range of 7.5 to 12.5 pps with the following input percent break limitations:

PPS	INPUT % BREAK RANGE
7.5	26-88
10.0	35-85
12.5	44-81

The response of the receiving circuit to incoming tone pulses under actual in-service conditions is often poorer than the preceding figures indicate due to transient noise introduced by line and equipment facilities. Noise exceeding 65 dBrc at the LINE RCV port may prevent satisfactory performance of the receiving circuit.

2.13 Pulse correction is obtained by four timing circuits: an operate, a release, a make, and a break timer. The operate timer guards the receiving circuit against false tones or tones of less than 30 milliseconds. The release timer provides the circuit with a holdover feature which guards against interruptions due to impulse noise. The make and break timers provide the pulse correction. The pulse corrector output drives the RG relay. The VG relay operates in response to steady 2600-Hz being received and remains operated while pulses are being applied. The combination of both RG and VG relay contacts controls the insertion of the band elimination filter as described in 2.07.

2.14 A minimum interval of 35 milliseconds of 2600-Hz tone is required to operate the E1P SF unit receiver (within the 7.5 and 12.5 pps limit). To recycle the pulse corrector properly, a minimum interval of 15 milliseconds is required between pulses. The approximate amount of pulse correction

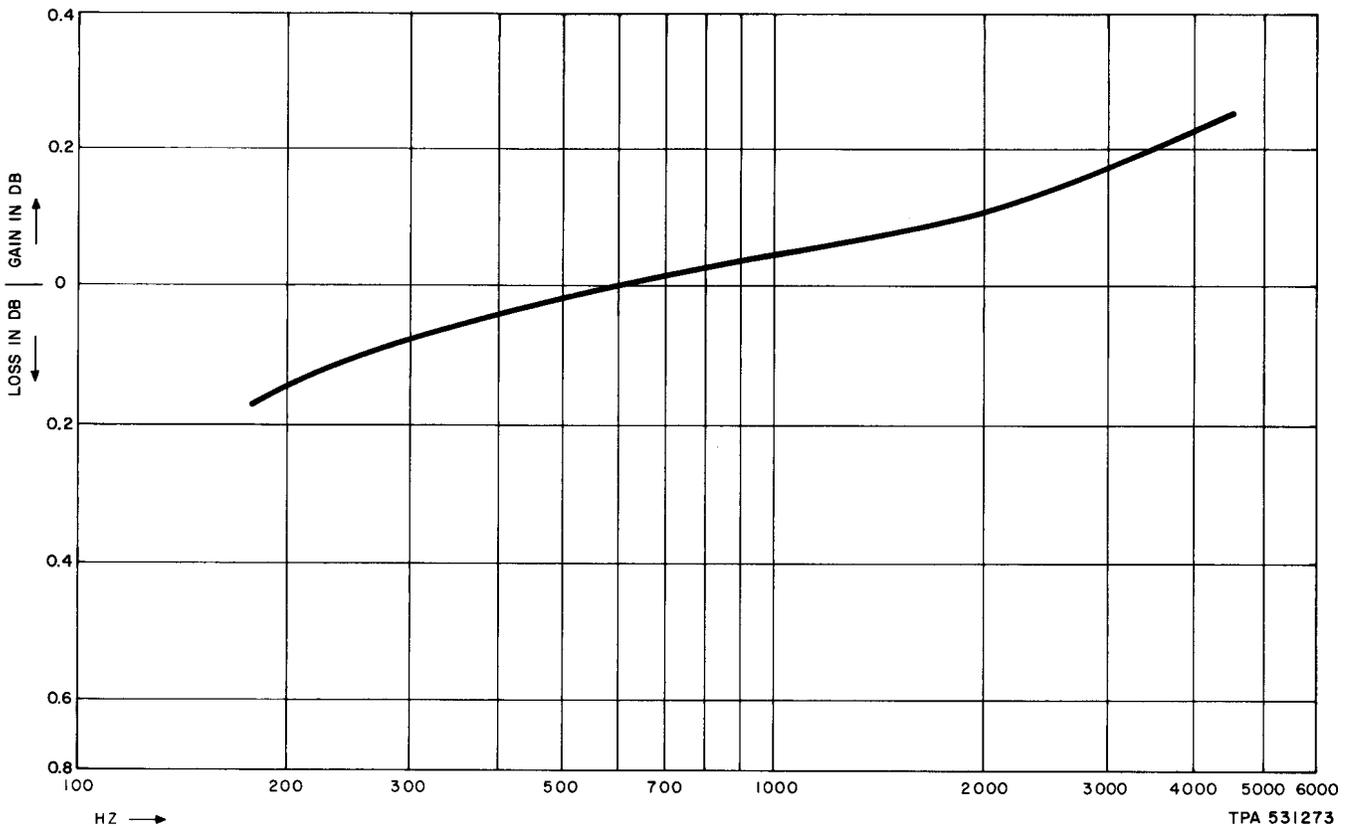


Fig. 7—Receive Circuit Insertion Loss With Band Elimination Filter Out

realized between the input and output of the receiving circuit is shown in Fig. 9.

2.15 All ac signals are directed through a guard amplifier, rectified, and presented to the dc comparator. 2600-Hz tone signals are directed through a band-pass filter to the signal amplifier, rectified, and presented to the dc comparator. The dc comparator is preset to function only if the power ratio between the two inputs (signal amplifier/guard amplifier) is at least 10dB. The normal level of the 2600-Hz tone at the LINE RCV port is -13 dBm for the station on-hook condition and -1 dBm during pulsing. The dc comparator controls the RG and VG relays.¶

C. Signaling Lead Circuits

2.16 The E1P SF unit can pass signaling to and from the equipment side (switching) via the A and B or E and M leads. If ground-start applications are required, the A and B leads must

be used. Either the A and B or E and M leads can be used for loop-start applications. The signaling lead detector and 20-Hz ringing circuits are shown in Fig. 2.

2.17 The A and B lead circuit consists of contacts of the BOR and LP-GS slider switches, an A and B lead ground detector circuit, operate and release delay timers, an H relay control circuit, and a 20-Hz ringing and CO relay circuit. A loop detector and CS relay is provided for loop control following a ground-start sequence. On calls originating at the switching equipment, the functions of the A and B lead circuit are: (1) recognize a seizure by the switching equipment, (2) convert 20-Hz ringing into 2600-Hz tone signals (ground-start applications provide 2600-Hz interrupted at 20 pps and loop-start applications provide steady 2600-Hz tone for ringing), and (3) Supervise, and pass on to the switching equipment, an answered call condition. For calls originating at the station end, the functions of the A and B lead circuit are to

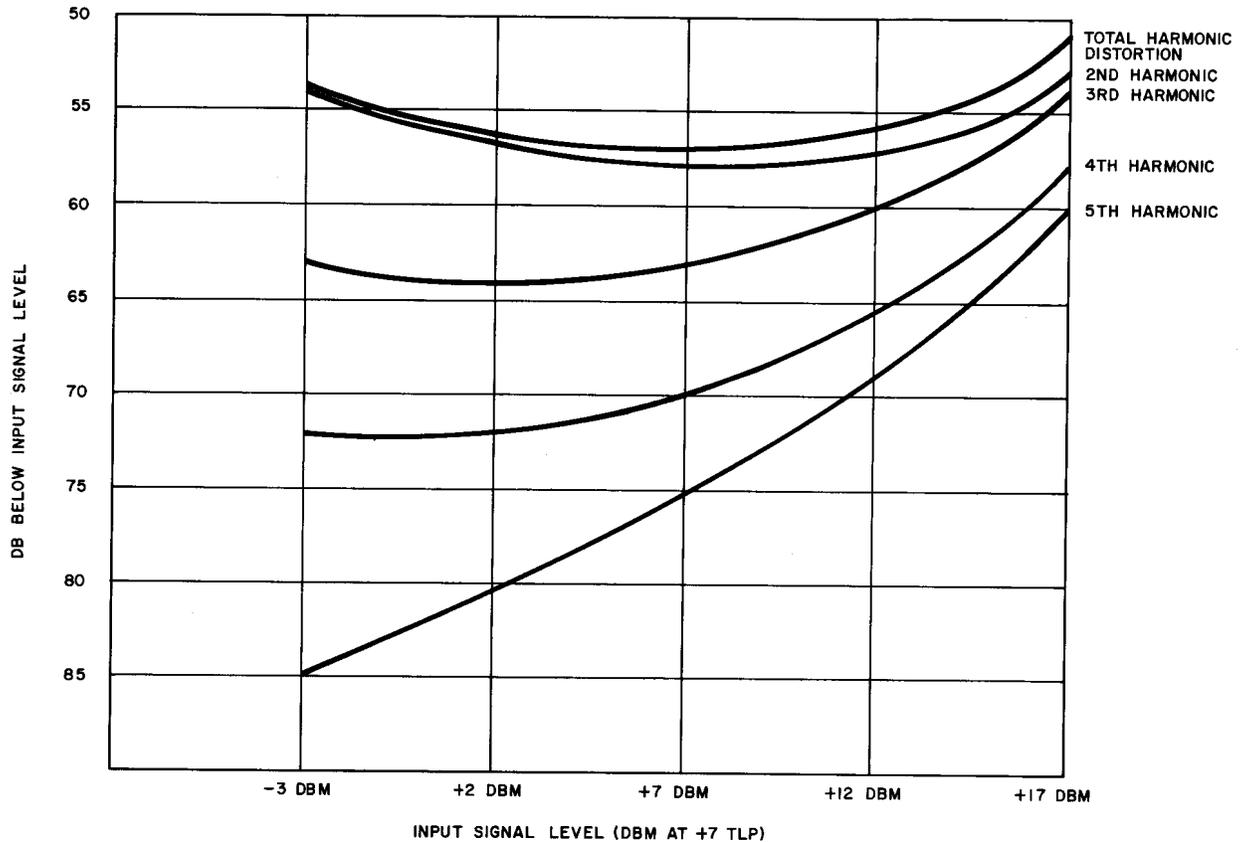


Fig. 8—Receive Circuit Harmonic Distortion

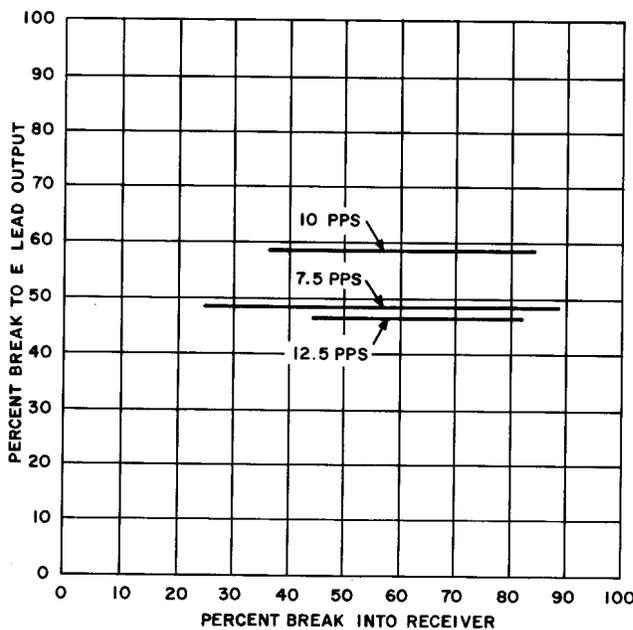


Fig. 9—Receiver Pulse Correction

reflect a station off-hook condition, repeat dial pulses, and supervise an answered call.

2.18 If E and M lead control is utilized on calls originating at the switching equipment side, the E and M lead functions are to convert a grounded M lead condition (ringing signal) into a 2600-Hz tone signal and to trip the ringing upon station answer by grounding the E lead towards the switching equipment. For calls originating at the station end, the E lead is grounded to request a dial tone connection and respond to incoming 2600-Hz tone pulses by pulsing the E lead.

3. OPERATIONAL PRINCIPLES

3.01 Table A shows the condition of the 2600-Hz tone in either the loop-start or ground-start modes of operation and under various circuit conditions. A typical application diagram showing an E1P SF unit at the switching end of a trunk and an E1R SF unit at the station end is shown

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in Fig. 10. It may be helpful to refer to Table A and Fig. 2, 3, and 10 for discussion that follows.

A. A and B Lead—Ground-Start

3.02 On station originated calls, the station removes the receiver off-hook to start the action. A receiver off-hook condition causes the idle 2600-Hz tone to be removed towards the E1P SF unit. The removal of the incoming tone causes the E1P unit to ground the B lead. Ground on the B lead is a request to the switching equipment to make a dial tone connection. Once a dial tone connection has been established, the switching equipment returns a ground on the A lead. The A and B lead ground detector responds to the ground and removes the 2600-Hz tone toward the station. The transmission path is cut through by the SF units at both ends of the circuit and dial tone can be heard at the station end. Dial pulses generated by the station are passed through pulse correcting

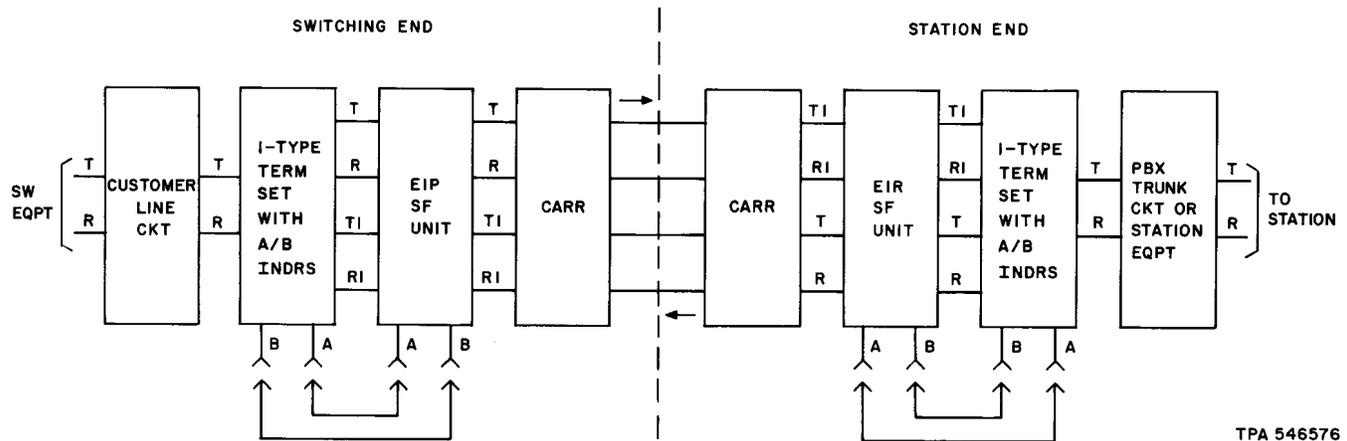
circuits at the E1P SF unit and control the operate and release of the RG relay. The RG relay contacts repeat the pulses on a loop closure basis over the A and B leads to the switching equipment.

3.03 On calls originating from the switching equipment, the A lead into the E1P SF unit is grounded by the switching equipment as an indication of a seizure. The grounded A lead causes idle 2600-Hz to be removed toward the station. In 4 seconds or less, the switching equipment applies 20-Hz ringing to the B lead. The 20-Hz ringing is converted to dc pulses and the dc pulses control a 2600-Hz tone gate. The result is -24 dBm 2600-Hz tone, interrupted at 20 pps, transmitted toward the station as a ringing signal. When the call is answered at the station 2600-Hz tone is removed from the line toward the E1P SF unit. Absence of the incoming tone releases the normally operated RG relay and causes the A and B lead loop to be closed and ringing to be

TABLE A

	MODE OF OPERATION	CONDITION OF TRUNK	CONDITION OF 2600-HZ TONE	
			TRANSMIT	RECEIVE
E1P ORIGINATING CALL	LOOP START	IDLE	OFF	ON
		SEIZURE	OFF	ON
		RINGING	ON	ON
		TALKING	OFF	OFF
	GROUND START	IDLE	ON	ON
		SEIZURE	OFF	ON
		RINGING	ON*	ON
		TALKING	OFF	OFF
E1P TERMINATING CALL	LOOP START	IDLE	OFF	ON
		SEIZURE	OFF	OFF
		PULSING	OFF	ON-OFF
		TALKING	OFF	OFF
	GROUND START	IDLE	ON	ON
		SEIZURE	ON	OFF
		PULSING	ON	ON-OFF
		TALKING	OFF	OFF

*2600-HZ Tone is interrupted at 20 pps rate (ground-start mode only) during the interval in which ringing is being applied.



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Fig. 10—Typical Application Diagram of E1P SF Unit

tripped. The transmission path is also cut through when the station end goes off-hook.

B. A and B Lead—Loop-Start

3.04 The station causes 2600-Hz tone to be removed towards the E1P SF unit when it goes off-hook. The removal of the tone causes the RG relay to release and close the A and B lead loop. The closed loop causes the switching equipment to establish a dial tone connection and dial tone can be heard at the station. The pulsing is the same as previously described in 3.02.

3.05 When a call is originated at the switching end, the circuit receives 20-Hz ringing over the B lead which causes steady 2600-Hz tone to be transmitted toward the line during the ringing cycle. Answer at the station end causes the 2600-Hz tone to be removed toward the E1P SF unit causing the release of the RG relay and A and B lead loop closure. The closed loop over the A and B leads trips the ringing. The RG relay releasing also cuts through the transmission path.

C. E and M Lead—Loop-Start

3.06 When idle 2600-Hz tone is removed towards the E1P SF unit on a station-originated call, it causes the RG relay to release, grounding the E lead. The switching equipment responds to the ground and establishes a dial tone connection. Pulsing is the same as described in 3.02 except

the output is pulsing on the E lead instead of the A and B leads.

3.07 On calls originated at the switching equipment, the M lead is grounded as a ringing signal. The grounded M lead causes 2600-Hz tone at -24 dBm to be transmitted toward the station during the ringing interval. Between ringing intervals, the M lead ground is removed. The station, upon answering the call, causes 2600-Hz tone to be removed toward the E1P SF unit and the RG relay is released. The E lead is grounded to trip the ringing and the transmission path is cut through.

D. High and Low Level Tone Gate

3.08 A tone gate circuit is provided to control the level of the 2600-Hz tone. When the E1P SF unit is idle, the 2600-Hz tone sent toward the station (ground-start applications only) is at -36 dBm at the -16 TLP transmit port. This is low level 2600-Hz tone. During the ringing cycle (all applications) the 2600-Hz is raised 12 dB in level (high level tone) to -24 dBm. The high level tone insures a more reliable inband signal.

E. TOUCH-TONE Operation

3.09 The E1P SF unit can be used for applications using TOUCH-TONE signals. The E1P SF unit operation is the same as that described in 3.02, 3.04, and 3.06 with the exception that there is no pulsing. Once the E1P unit is seized and the RG relay released, the transmission path is cut through

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and the TOUCH-TONE signals pass through it to the switching equipment.

4. MAINTENANCE

4.01 There are no field adjustments to be made on the E1P SF units with the exception of the LP-GS and BOR switches. The circuit layout record (or equivalent) indicates the position of these switches. If the E1P unit does not meet circuit requirements, it should be replaced. Defective

units should be returned to Western Electric Company.

4.02 The E-type signaling test extender (SD-99384-01) can be used to gain access to the transmission and signaling ports of the E1P SF unit. The E1P unit is removed from its in-service position and placed in a receptacle located on the test extender. The test extender provides for terminated measurements and can be used to isolate trouble conditions. Section 179-313-101 provides a description of the test extender.