

RADIO
CKT

5-KHZ AND 8-KHZ PROGRAM CHANNEL UNITS
DESCRIPTION, INSTALLATION, AND TESTS
D4 CHANNEL BANKS
DIGITAL TRANSMISSION SYSTEMS

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|--|------|--|
| 1. GENERAL | 1 | 1.01 This section provides a general description of the D4 program channel units (PGCUs). This section also includes instructions for application of options, attenuators, and equalization networks as well as installation tests. |
| 2. PHYSICAL DESCRIPTION | 1 | |
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| 4. INSTALLATION CONSIDERATIONS AND RESTRICTIONS | 3 | 1.02 Whenever this section is reissued, the reason for reissue will be stated in this paragraph. |
| 5. SERVICE LIMITATIONS | 4 | 1.03 The D4 program channel units are used to provide temporary or permanent service for series 6004, 6005 (5-kHz bandwidth) and series 6006, 6007 (8-kHz bandwidth) programming. Such service includes remote-main studio links, secondary studio links, and network access links. PGCUs may also be used to equip studio-transmitter links (AM broadcasting only, since FM and TV links require 15-kHz bandwidth). The channel units provide one-way service without signaling or control circuits. Transmit units contain circuitry to equalize nonloaded cable. If more equalization is required, it must be provided with external equipment (see Section 320-145-500). |
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| CHART 5—IDLE CIRCUIT NOISE TEST | 9 | 1.04 PGCUs for D4 applications are completely compatible with available D3 program channel units. However, the D4 units provide some features unavailable in D3 PGCUs. |
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| 7. MAINTENANCE/TROUBLE TESTS | 13 | 2. PHYSICAL DESCRIPTION |
| CHART 7—TRANSMIT END CHANNEL DROP | 14 | 2.01 Each D4 program channel unit is approximately 1-3/8 inches wide, 4-7/16 inches high, and 9-7/8 inches deep, and physically occupies one channel unit slot in a D4 channel bank. However, the extended bandwidth of the PGCUs requires multiple sampling which electrically preempts additional channel unit slots. To ensure that the |
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preempted channels are not interfered with, blank channel units are inserted in these locations. One blank channel unit is supplied with the 5-kHz PGCUs, and two blank channel units are supplied with the 8-kHz PGCUs. Each blank channel unit consists of a faceplate attached to a fiber board upon which condensed instructions for program service are printed (Tables A and B).

2.02 All D4 PGCUs have 600/150 ohm input impedance options which are selected by socket-and-plug combinations labeled IMP on the circuit boards. Attenuation controls in the PGCUs are of the slide-switch type and may be used to select 0 through 15 dB of attenuation. Equalization controls on the 5- and 8-kHz transmit units (labeled EQL on the circuit board) and the distortion compensation controls on the 5-kHz units (labeled COMP) are also of the socket-and-plug type. The distortion compensation control on the 8-kHz PGCUs is a 3-position rotary switch and is not labeled (except for switch position designations A, B, and C).

2.03 Special card jacks (labeled TST) on the faceplates of the program channel units provide access to the transmit path and the equalization test point in the transmit units and to the receive path in the receive units. A P6AC test cord is required to access the equalization test point. A P6AD cord is required to access the transmit path or the receive path.

3. FUNCTIONAL DESCRIPTION

A. Transmit Circuit Operation

3.01 Figure 1 shows a simplified transmit unit diagram. The PGCUs have a 600- and 150-ohm balanced, transformer-coupled T and R input, and accept a program test input level in the range of +1 to -14 dBm (+9 to -6 VU). (See *Note*.) An input slide attenuator allows the input level within this range to be reduced 15 dB in 1-dB steps in order to obtain the standard program level at the transmit TST jack. This level optimizes the signal-to-noise ratio and allows instantaneous 10-dB program peaks that approach the +3 dBm₀ overload point of the D4 bank. The input attenuator is coupled to a controlled 0- or 24-dB attenuator circuit which allows the PGCUs to bypass the control of the D4 trunk processing unit (TPU) during the yellow alarm condition. This bypassing is necessary

to reduce program service interruption, which is intolerable to the broadcaster.

Note: The input level range shown in VU (volume units) is for program test tone applications where a +8 VU point is a reference point similar to the 0 dB TLP common to telephone practice.

3.02 An audio equalizer circuit is connected between the level attenuator and the controlled attenuator circuit. A bridging test point is provided to enable equalization measurements to be made without interruption of the signal. The equalizer is designed for up to 3.75 miles of 26-gauge nonloaded cable. Local cables with mixed gauges may require external equalization.

3.03 The controlled attenuator is enabled by the "logic controlled" voltage supply -48SP. During TPU operation (initiated at the sending end bank), the bank transmits a yellow alarm code (second bit in each coded channel sample is suppressed to zero). Since digit 2 has a coding weight of 24 dB, the controlled attenuator compensates for this effect by inserting 24 dB of attenuation into the transmitted signal, thereby preventing major distortion that would result from a signal 24 dB too large. Processing of nonprogram channels occurs normally since they are not affected by the transmit PGCUs control circuitry.

3.04 Following the attenuator control circuit is a preemphasis amplifier which boosts high frequency gain (18.5-dB range) to reduce the effect of quantization noise at high frequencies. The transmit TST jack bridges the preemphasis amplifier to a program filter (for flat 5-kHz or 8-kHz response) which feeds the transmit gate through an analog delay circuit. The delay circuit reduces in-band distortion by inserting segments of delay in the audio signal. This compensates for the nonuniform sampling which is caused by the time gap required in the D4 format for the framing pulse. The compensation is adjustable and must be correctly set per Table C. The transmit gate and its associated logic circuitry connect to the D4 bank common equipment and provide the double sampling rate required for the 5-kHz PGCUs or triple sampling for the 8-kHz PGCUs.

B. Receive Circuit Operation

3.05 Refer to Fig. 2. The receive PGCU connects to the D4 channel bank common equipment through receiving logic circuits which provide a double sampling rate for the 5-kHz PGCU or a triple rate for the 8-kHz PGCU. This circuitry also delays appropriate sampling pulses to compensate for unequal sampling intervals (caused by the time gap for the framing pulse required in the D4 format). The compensation is adjustable and must be correctly set per Table C. Enabled by the logic gates is a program filter which reconstructs the audio signal from the received samples. The receive TST jack bridges the reconstructed audio to the de-emphasis amplifier which compensates for the transmit unit pre-emphasis and thereby enhances the signal-to-quantizing-noise ratio when measured with a program weighted noise meter. The de-emphasis amplifier is coupled to a 0- to 15-dB output attenuator which provides program test output levels to the T and R leads of +1 to -14 dBm (see *Note*, paragraph 3.01) at the 600- or 150-ohm transformer-coupled output.

4. INSTALLATION CONSIDERATIONS AND RESTRICTIONS

D4/T CARRIER FAILURE RATE RESTRICTIONS

4.01 The D4/T carrier system selected for PGCU installation should not have a history of excessive TPU operations (alarm rates) or have a history of excessive errors. Guidelines for typical and exceptional T1 alarm rates are contained in EL 3791 (GL 75-10-207). Error rate objectives for program service via T carrier have not yet been established; however, in the interim, higher quality lines may be selected using the procedures in Section 365-228-500.

CHANNEL UNIT PREEMPTION

A. 5-kHz Service

4.02 If a combination of D3 and D4 banks is used for program service, the 5-kHz PGCUs may be installed in any or all channel unit slots 2 through 11. Table C lists the channel slots, which must be vacant to prevent interference (due to the double sampling of the 5-kHz units). If only D4 banks are used, the 5-kHz PGCUs may be installed in any channel unit slot 1 through 24. Table D lists the channel slots which must be vacant in D4-only applications. For example, if a

5-kHz PGCU is installed in slot 2, slot 14 must be vacant. If it is installed in slot 17, slot 5 must be vacant.

B. 8-kHz Service

4.03 If a combination of D3 and D4 banks is used for program service, the 8-kHz PGCUs may be installed in any or all of channel unit slots 2 through 7. Table C lists the channel slots which must be vacant to prevent interference (due to the triple sampling of the 8-kHz units). If only D4 banks are used, the 8-kHz PGCUs may be installed in any channel unit slot 1 through 24. Table D lists the channel slots which must be vacant in D4-only applications. For example, if an 8-kHz PGCU is installed in slot 7, slots 15 and 23 must be vacant. If it is installed in slot 19, slots 3 and 11 must be vacant.

C. Combined 5- and 8-kHz Service

4.04 When 5- and 8-kHz transmit units are installed in the same channel bank, they should *never* be installed *exactly* four slots apart or distortion and interference will occur in both program circuits. The receive units would naturally follow this four-slot restriction.

D. Blank Units

4.05 For channels preempted by program sampling, blank units (supplied along with each PGCU and providing program precautionary and installation information) should be installed in the vacant slots. If preempted channel units are not removed (or are inadvertently reinstalled), interference in both the program and message channels will result.

TANDEM OPERATION

4.06 Only D3 and D4 banks are PGCU compatible and only these banks may be used to terminate T systems in tandem (ie, D3 or D4 banks connected back-to-back at the tandem point). In each D3 or D4 bank, the receiving PGCUs must be installed in the channel slots coinciding with those of the transmitting units. Operation using T-systems in tandem is not recommended for other than part-time or occasional service, and even then should be limited to one tandem point to prevent noise and distortion difficulties.

4.07 For tandem D4-to-D4 operation, the tandem connection should be made a -6 VU point by setting the receive PGCU attenuator to 15 dB and the transmit PGCU attenuator to 0 dB. Both units should be optioned for 600 ohms impedance. All equalization should be removed on the transmit PGCU.

SERVICE PROTECTION

4.08 In order to prevent plant personnel from accidentally monitoring or otherwise disturbing working PGCUs, they should be treated with the same restrictions and cautions as special service circuits (Section 460-110-100). ***In no case should the channel bank be looped before patching the program channel(s) to another suitable circuit.***

5. SERVICE LIMITATIONS

5.01 PGCUs are not used for establishing FM or TV-aural studio-transmitter links because they do not meet FCC bandwidth requirements for that service. Furthermore, when PGCUs are used to provide an AM studio-transmitter link, extra care should be taken to maintain the transmission requirements (based on FCC requirements) specified in this document.

5.02 Controlled distortion will occur on a program channel during TPU operation initiated by the program sending D4 bank; therefore, program channels should not be assigned to T lines which historically experience excessive hits, especially those which cause TPU operation. Consequently, program channels should not be assigned to channel banks which have a history of trouble reports (noise, distortion, crosstalk, etc).

5.03 Program channel units are not recommended for use in banks containing data port channel

units unless the paired metallic extensions of each service can be physically separated. The data pairs may crosstalk into the program pairs. For further information, refer to Section 880-601-115.

5.04 Even though the D4/T program channel meets the test requirements of this section which relate to digital conditioning, the channel may not meet customer expectations which are based upon years of experience with analog facilities. This may be a result of using measurement techniques not directly applicable to digital facilities, as explained in paragraphs 7.02, 7.03, and 7.04.

6. INITIAL INSTALLATION TESTS

6.01 Program channels should be treated as channels added to an operating bank. During initial bank turnup, the standard D4 channels are tested on a looped terminal basis, and the program channels are tested end-to-end (since separate transmit and receive channel units prevent looped program testing). The nonstandard transmit and receive TST jack testing levels for the PGCUs require that an external oscillator and detector be used with the D3/D4 portable test set when it is used for tests other than the carrier test.

6.02 Input and output line impedances should be in accord with the circuit layout. Jack access (at the D4 channel unit extender or at other program connecting equipment within the office) may be used for tests instead of the T and R appearances at the DF. Allowances must be made for any additional attenuation or amplification introduced in the central office and for any equalization implemented in the transmit PGCU.

6.03 The initial installation tests in Charts 1 through 6 must be performed in the sequence indicated.

CHART 1

RECEIVE ATTENUATOR ADJUSTMENT

The attenuation value for the receiving PGCU is selected on a prescription basis according to the desired output line level (indicated on office record cards). The attenuator is set by operating the appropriate sliders so that the sum of the digits exposed (0 through 15) equals the desired attenuation value (in dB).

CHART 1 (Contd)

APPARATUS:

1—J98726 MF Channel Unit Extender

| STEP | PROCEDURE |
|------|--|
| 1 | Insert receiving PGCU in channel unit extender and insert extender in desired channel slot. |
| 2 | Refer to Table E. Find desired output line level (as indicated on office record cards) and corresponding attenuator setting. |
| 3 | Operate the appropriate sliders on the attenuator so that the sum of the digits exposed equals the value found in Table E. |

CHART 2**CARRIER TEST**

The following carrier test procedures quickly verify that the PGCUs have proper transmission over the carrier, that preempted channel units have been correctly removed, and that the jack levels shown on Fig. 1 and 2 are correct.

APPARATUS:

1—J98718AL D3/D4 Portable Test Set (PTS) equipped with J98718AJ Channel Access Unit (CAU)

1—P6AD Patch Cord (embossed VOICE)

2—3P6A Patch Cords

1—J98726 MF Channel Unit Extender (optional)

| STEP | PROCEDURE |
|------|---|
| 1 | On the CAU portions of the portable test sets, set the controls as follows: |

CHART 2 (Contd)

| STEP | PROCEDURE | |
|------|---|------------|
| | CONTROL | POSITION |
| | REJ FLT | OUT |
| | SEND LEVEL DB | OFF |
| | TEST | CAL |
| | Requirement: Meters on CAUs must indicate within the raised black index. | |
| 2 | At the transmitting office, make the test connections shown in Fig. 3, and set the controls on the CAU as follows: | |
| | CONTROL | POSITION |
| | REJ FLT | OUT |
| | SEND | LEVEL DB 0 |
| | TEST | CHAN LINE |
| 3 | At the receiving office, make the test connections shown in Fig. 3, and set the controls on the CAU as follows: | |
| | CONTROL | POSITION |
| | REJ FLT | OUT |
| | SEND LEVEL DB | OFF |
| | TEST | CHAN LINE |
| | Requirements: The CAU meter on the receive end must indicate within green-black-green area, and tone must be heard as VOL control is adjusted clockwise. | |
| 4 | Disconnect the test arrangements at both offices, and proceed to Chart 3. | |

CHART 3

CIRCUIT LOSS AND FREQUENCY RESPONSE TEST

APPARATUS:

- 1—Hewlett-Packard 3551A Transmission Test Set or any equivalent oscillator with minimum frequency range of 10 kHz and less than -46 dB total harmonic distortion

CHART 3 (Contd)

APPARATUS (Contd):

- 1—J94021A Transmission Measuring Set or equivalent measuring set with a minimum frequency response of 10 kHz
 - 1—J98726MF Channel Unit Extender (optional)
-

STEP**PROCEDURE**

-
- 1 Set the IMP options on the transmit and receive PGCUs to 600 ohms, and set the distortion compensation switches according to Table B.
 - 2 Temporarily set the transmit PGCU attenuator to 15 dB (sum of the digits exposed equals 15).
 - 3 At the transmitting end, set the controls on the oscillator portion of the HP 3551A as follows:

| CONTROL | POSITION |
|------------------------|-----------------|
| FUNCTION | SEND |
| SEND-FREQUENCY | 200-6K |
| DISPLAY & MONITOR-SEND | FREQ |

- 4 Rotate the frequency selection knob until the display indicates 1.020 kHz.
- 5 Depress the DISPLAY & MONITOR—SEND—LEVEL button.
- 6 Adjust the LEVEL control until the display indicates -10 dBm.
- 7 Connect the HP 3551A to the channel unit T and R leads at the DF (or via the TR LINE jack on the channel unit extender)
- 8 At the receiving end, connect the J94021A TMS (or the detector portion of an equivalent TMS) to the channel unit T and R leads at the DF (or via the TR LINE jack on a channel unit extender) and record the meter indication of received power.

Requirement: The meter reading must equal +5 dBm decreased by the sum of channel unit attenuator settings at both ends ± 0.5 dB.

Example: If the transmit attenuator is set to 15 and the receive attenuator is set to 1, the indicated received power shall be -11 dBm (+5 dBm—[15 + 1] = -11 dBm) ± 0.5 dBm.

CHART 3 (Contd)

STEP

PROCEDURE

- 9 At the transmitting end, maintain a -10 dBm power level and send the following test frequencies:

50 Hz, 3020 Hz, and 5020 Hz for 5-kHz PGCU

50 Hz, 3020 Hz, 5020 Hz, and 8020 Hz for 8-kHz PGCU

Requirement: The receiving end power measurement must agree within ± 0.5 dB of the 1020-Hz power measurement of Step 8.

- 10 At the transmitting end, maintain a -10 dBm power level and send either a 6200-Hz tone (for a 5-kHz PGCU) or a 9400-Hz tone (for an 8-kHz PGCU).

Requirement: The receiving end power measurement must drop 1 to 5 dB below the 1020-Hz power measurement to Step 8.

Note: Failure to meet frequency response requirements may result from one of the following:

- (a) The attenuator in the transmit PGCU is improperly set and is overdriving the preemphasis amplifier. This can be checked with the Channel Drop Test in Chart 7.
 - (b) The test tone level is too large and is overdriving the preemphasis amplifier (applied level should not exceed 0 dBm for a +8 VU point)
 - (c) The frequency response characteristics of the measuring set may be insufficient. This can be resolved by checking the measuring set specifications or by connecting an oscillator directly to the measuring set input and sending the required frequencies.
- 11 Remove the test connections at the receiving end. Without removing the test connections at the transmitting end, proceed to Chart 4.

CHART 4

UNWEIGHTED SIGNAL/DISTORTION TEST

The procedures in this chart measure total distortion, including that from quantizing, spurious responses, and the harmonics present. A repeating coil must be used to reduce the effect of longitudinal noise on the unbalanced analyzer input.

CHART 4 (Contd)

APPARATUS:

- 1—Hewlett-Packard 334A Distortion Analyzer (with externally-connected 600-ohm carbon terminating resistor and 111C repeating coil) or an equivalent analyzer capable of measuring total harmonic distortion by rejecting test tone and measuring the remaining combined distortion components.
- 1—Hewlett-Packard 3551A Transmission Test Set or equivalent oscillator with frequency range up to 10 kHz and less than -46 dB total harmonic distortion.

| STEP | PROCEDURE |
|------|--|
| 1 | Check that the IMP options on the transmit and receive PGCUs are set to 600 ohms. |
| 2 | At the transmitting end, set the HP 3551A oscillator section (or equivalent) to send a 1020 Hz tone at 0 dBm. |
| 3 | At the receiving end, connect the HP 334A distortion analyzer (with 111C repeating coil and 600-ohm termination) to the T and R pair (at the DF or at the T/R LINE on the channel unit extender) as shown in Fig. 4. |
| 4 | Adjust the analyzer to measure the received test tone level and record the indication. |
| 5 | Adjust the analyzer to reject the test tone and measure the distortion level. |
| | Requirement: Test tone level (Step 4) minus distortion level (Step 5) must be 35 dB or (numerically) greater. |
| | Note: If the requirement is not met, verify that the VF oscillator's signal-to-distortion ratio is greater than 46 dB. This is accomplished by measuring the oscillator output directly with a distortion analyzer. Failure may also be influenced by the characteristics of the D4 bank. Substitution of another D4 bank may provide sufficient improvement. |
| 6 | Remove all test connectors at both ends and proceed to Chart 5. |

CHART 5**IDLE CIRCUIT NOISE TEST**

This procedure will determine if the desired channel meets the program noise requirements.

APPARATUS:

- 1—J98718AL D3/D4 Portable Test Set (PTS) equipped with J98718AJ Channel Access Unit (CAU)

CHART 5 (Contd)

APPARATUS (Contd):

- 1—J94003C Noise Measuring Set (NMS) with 497B program weighting network or equivalent noise measuring set having program weighting, 600-ohm impedance, and damped response
- 1—J98726MF Channel Unit Extender (optional)
- 1—600 ohm Carbon Resistor
- 1—3P6D Patch Cord

STEP

PROCEDURE

Note: The following tests should be made for at least 10 minutes during the office busy hour.

- 1 See Fig. 4. At the transmitting end, terminate the T and R pair (at the DF or at the T/R LINE jack on the channel unit extender) with a 600-ohm resistor.
- 2 At the receive end, set the controls on the 3C NMS as follows to check calibration:

| CONTROL | SETTING |
|-----------|------------|
| WTG | PROGRAM |
| DBRN | 85 |
| FUNCTION | NM 600/900 |
| NORM-DAMP | DAMP |

- 3 Using a 3P6D cord, patch from the top 310 jack on the NMS to the EXT DETR jack on the CAU portion of the D3/D4 portable test set.
- 4a On the CAU, set the controls as follows:

| CONTROL | SETTING |
|---------------|---------|
| REJ FLT | OUT |
| TEST | CAL |
| SEND LEVEL DB | OFF |

Requirement: NMS DBRN meter must indicate 5 (corresponding to 90 ± 0.2 dB_{rn}).

CHART 5 (Contd)

| STEP | PROCEDURE |
|------|---|
| | <p>Note: If the requirement cannot be met, proceed to step 4b; otherwise, proceed to Step 5.</p> |
| 4b | Calibrate the NMS or replace the battery (as necessary) according to Section 103-611-101 (primary calibration paragraphs). |
| 5 | Connect the NMS to the receiving PGCU T and R pair (at the DF or at the T/R LINE jack on the channel unit extender). |
| | <p>Requirement: Less than 37 dBrn minus the receive attenuator setting.</p> <p>Note: This requirement is equivalent to overall program requirement of less than 36 dBrn with program weighting at a +8 VU point. If this requirement cannot be met, it may be possible to select another channel slot or D4 bank with lower idle circuit noise.</p> |
| 6 | Using the NMS monitoring receiver, adjust for an on-scale meter indication and listen for noise and crosstalk. |
| | <p>Requirement: No voice (intelligible words or syllables) or other program-degrading transients should be heard.</p> |
| 7 | Remove all test connections and proceed to Chart 6. |

CHART 6
EQUALIZER AND TRANSMIT ATTENUATOR ADJUSTMENT

The procedures in this chart will ensure that the input to the preemphasis circuit will have a flat frequency response at the proper level.

APPARATUS:

- 1—Hewlett-Packard 3551A Transmission Test Set or equivalent transmission measuring set (TMS) with a minimum frequency response of 10 kHz

Note: The TMS used must have a bridging input and jacks that accept both 310- and banana-type plug connections. These must be in parallel to enable adapting the unbalanced P6AC cord connections to the balanced TMS connections via the strap shown in Fig. 5.

- 1—P6AC Signaling Patch Cord

- 1—J98726MF Channel Unit Extender

CHART 6 (Contd)

| STEP | PROCEDURE |
|-------------------------------------|--|
| 8 | <p>tone is applied at the +8 VU point at the broadcaster sending location. If necessary, adjust the transmit attenuator to obtain a reading of -14 ± 0.5 dBm.</p> <p>Note: The impedance at the receiving PGCU should be set to 600 ohms unless the 150-ohm option is required to match a 150-ohm equalizing termination at the broadcaster receiving location.</p> <p>Remove all test connections and make final DF connections (applying service protection per paragraph 4.08) to both the sending and receiving metallic broadcast facilities. Visually check to ensure that the required PGCU options are in place and that the required blank units are installed.</p> |
| 7. MAINTENANCE/TROUBLE TESTS | |
| 7.01 | <p>No routine maintenance is required for D4 program channel units. Section 320-135-300 details the overall program circuit routines and maintenance. In the event of reported program trouble, ensure that the program service is patched to another suitable circuit or turned down before the installation tests of this document are performed to identify the trouble. <i>In no case should the channel bank be looped before patching or turning down the program channel(s).</i></p> |
| 7.02 | <p>Failure of the carrier test indicates problems in either the T-carrier line, channel bank common equipment, or PGCU. Failure of noise and distortion tests directly relates to the type of trouble reported (noise, distortion, crosstalk, etc). A report of excessive distortion (particularly by the customer) may be an indication of incorrect attenuator adjustment in the transmit PGCU, which may be checked by the channel drop tests.</p> |
| 7.03 | <p>A report of excessive harmonic or total harmonic distortion may result from an incorrect measurement with an analyzer such as the HP 334A. Such an analyzer indicates quantizing</p> |
| | <p>distortion and spurious responses in addition to harmonics. Harmonic distortion objectives can be met by measuring individual harmonics with a 4A frequency analyzer or HP 302A wave analyzer, and then combining the harmonic measurements to derive the total harmonic distortion.</p> |
| | <p>7.04 The customer may report excessive noise as a result of a measurement of "noise in the presence of signal." This is the D4 quantizing noise which is greater than idle circuit noise (steady noise without tone), and is not considered to be a significant impairment to program quality.</p> |
| | <p>7.05 Failure of the circuit loss test accompanied by a successful carrier test indicates problems on the channel unit drop side at either or both ends of the system. This can be resolved by alternately replacing channel units to see if the trouble clears, or by performing the following channel drop tests (normally performed with the metallic facility disconnected at the DF). The channel drop tests require that the transmit and receive PGCU attenuation settings be those prescribed for service and that the PGCU IMP controls are optioned for 600 ohms.</p> |

CHART 7

TRANSMIT END CHANNEL DROP

APPARATUS:

- 1—Hewlett-Packard 3551A Transmission Test Set or equivalent with minimum oscillator frequency range of 10 kHz and less than -46 dB total harmonic distortion
- 1—J98718AL D3/D4 Portable Test Set (PTS) equipped with J98718AJ Channel Access Unit (CAU)
- 1—J94021A Transmission Measuring Set (TMS) or equivalent with minimum frequency response of 10 kHz
- 1—P6AD Voice Patch Cord
- 1—3P6D Patch Cord
- 1—3P6A Patch Cord

STEP

PROCEDURE

Note: This procedure should be performed with the program metallic facility disconnected at the DF (or use channel unit extender in which the path is automatically disconnected when the LINE jack is used).

- 1 Verify that the distortion compensation switch has been set according to Table B.
- 2 At the transmitting end, connect a 600 ohm, 1020 Hz oscillator (oscillator portion of HP3551A or equivalent) to the PGCU T and R appearances at the DF (or at the T/R LINE jack on a channel unit extender) as shown in Fig. 6.

Note: The transmit PGCU should have the IMP option set to 600 ohms for this test.

- 3 Condition the oscillator to send a power level consistent with the level (from office records) expected at the DF.
- 4 Set the controls on the CAU portion of the D3/D4 portable test set as follows:

| CONTROL | POSITION |
|---------------|-----------|
| REJ FLT | OUT |
| SEND LEVEL DB | 0 |
| TEST | CHAN DROP |

CHART 7 (Contd)

| STEP | PROCEDURE |
|------|---|
| 5 | Connect the CAU to the PGCU as shown in Fig. 6. |
| 6 | Connect the J94021A TMS (or the detector of an equivalent TMS) to the CAU as shown in Fig. 6 and observe the power indication. Requirement: -15 ± 0.5 dBm on the TMS. |
| 7 | Disconnect all test equipment and return the IMP option to the original setting if it was changed for this test. Reconnect any program connections removed to facilitate testing. |

CHART 8
RECEIVE END CHANNEL DROP

APPARATUS:

- 1—Hewlett-Packard 3551A Transmission Test Set, or equivalent, with minimum oscillator frequency range of 10 kHz, and less than -46 dB total harmonic distortion
 - 1—J98718AL D3/D4 Portable Test Set equipped with J98718AJ Channel Access Unit (CAU)
 - 1—J94021A Transmission Measuring Set (TMS), or equivalent, with minimum frequency response of 10 kHz
 - 1—P6AD Voice Patch Cord
 - 1—3P6D Patch Cord
 - 1—3P6A Patch Cord
-

| STEP | PROCEDURE | | | | | | | | |
|----------------|--|---------|----------|---------|-----|----------------|---|------|-----------|
| 1 | Verify that the distortion compensation switch has been set according to Table B. | | | | | | | | |
| 2 | At the receive end, set the controls on the CAU portion of the D3/D4 portable test set as follows: | | | | | | | | |
| | <table border="0"> <thead> <tr> <th data-bbox="370 1696 464 1724">CONTROL</th> <th data-bbox="699 1696 794 1724">POSITION</th> </tr> </thead> <tbody> <tr> <td data-bbox="370 1755 493 1782">REJ FLT</td> <td data-bbox="716 1755 776 1782">OUT</td> </tr> <tr> <td data-bbox="370 1803 626 1831">CAU SEND LEVEL</td> <td data-bbox="716 1803 732 1831">0</td> </tr> <tr> <td data-bbox="370 1852 444 1879">TEST</td> <td data-bbox="716 1852 889 1879">CHAN DROP</td> </tr> </tbody> </table> | CONTROL | POSITION | REJ FLT | OUT | CAU SEND LEVEL | 0 | TEST | CHAN DROP |
| CONTROL | POSITION | | | | | | | | |
| REJ FLT | OUT | | | | | | | | |
| CAU SEND LEVEL | 0 | | | | | | | | |
| TEST | CHAN DROP | | | | | | | | |

CHART 8 (Contd)

| STEP | PROCEDURE |
|--|---|
| 3 | Connect an oscillator (the oscillator portion of the HP 3551A or equivalent) to the CAU as shown in Fig. 6. |
| 4 | Set the oscillator to -15 dBm at 1020 Hz. |
| 5 | Connect the J94021A TMS (or the detector or an equivalent TMS) to the receive PGCU T and R appearances at the DF (or at the T/R LINE jack on a channel unit extender) as shown in Fig. 6. |
| Note: The receive PGCU IMP control should be optioned for 600 ohms for this test. | |
| Requirement: Power (in dBm) within ± 0.5 dBm of the test power level (level from the office records at receive end DF must be known in order to determine if measured test power level is correct). | |
| Note: Channel drop tests may be extended to include the metallic facility serving the customer. If this is the case, a 1020 Hz, 0 dBm tone applied at the broadcaster sending location +8 VU point should produce a -15 ± 0.5 dBm level when the TST jack of the transmit PGCU is coupled through the CAU to a TMS. Likewise, a 1020 Hz, -15 dBm tone applied at the CAU EXT OSC jack and coupled to the TEST jack of the receive PGCU should produce at test power level equivalent (± 0.5 dBm) to the required receiving level at the T and R appearances (+1 to -14 dBm) minus the metallic facility loss to the customer receiving location. | |
| 6 | Remove all test equipment from the program circuit, and reconnect any program connections or options removed to facilitate testing. |

| 8. REFERENCES AND DRAWINGS | SECTION | TITLE |
|----------------------------|-------------|---|
| | 880-601-115 | Digital Data System Local Loops Engineering Guidelines |
| 320-145-500 | 460-110-100 | Special Safeguard Measures (SSM) and Special Service Protection (SSP) |
| 365-228-500 | 365-170-000 | D4 Channel Bank—TOP |
| | 365-170-101 | D4 Channel Bank—Description |

| | | | |
|----------------|--------------------------------|----------------|--------------------------------|
| DRAWING | TITLE | CD- & SD-3C320 | 8-kHz Transmitting Unit (PG8T) |
| CD- & SD-3C318 | 5-kHz Transmitting Unit (PG5T) | CD- & SD-3C321 | 8-kHz Receiving Unit (PG8R) |
| CD- & SD-3C319 | 5-kHz Receiving Unit (PG5R) | CD- & SD-3C304 | D4 Bank Application |

TABLE A

CONDENSED INSTALLATION INSTRUCTIONS

| | Channel slots allowed for program. | | For each equipped channel, preempted channel N greater must be vacant. Equip these with blank units provided with each PGCU. |
|--------------------|------------------------------------|---------|--|
| | D4 → D3 D3 → D4 | D4 → D4 | |
| PG5T or PG5R | Ch2-11 | Ch1-24 | N = +12 |
| PG8T or PG8R | Ch2-7 | Ch1-24 | N = +8 AND N = +16 |

Not Allowed: PG5T and PG8T or PG5R and PG8R exactly four slots apart

TABLE B

CONDENSED INSTALLATION INSTRUCTIONS

| CHANNEL SLOT | DISTORTION COMPENSATION SETTINGS | | | | | |
|--------------|----------------------------------|------|-------|------|-------------|------|
| | LIU-1, 2, 3, 4 | | LIU-1 | | LIU-2, 3, 4 | |
| | PG5T | PG5R | PG8T | PG8R | PG8T | PG8R |
| 1 | B | B | C | C | C | C |
| 2 | A | B | C | A | A | C |
| 3 | A | B | A | A | A | C |
| 4 | A | B | A | A | A | C |
| 5 | A | B | B | A | A | C |
| 6 | A | B | C | B | A | C |
| 7 | A | B | C | C | A | C |
| 8 | A | B | A | C | A | C |
| 9 | A | B | A | A | A | A |
| 10 | A | B | B | A | B | A |
| 11 | A | B | B | B | B | A |
| 12 | A | B | B | B | B | A |
| 13 | A | A | B | C | B | A |
| 14 | B | A | B | A | B | A |
| 15 | B | A | A | A | B | A |
| 16 | B | A | B | A | B | A |
| 17 | B | A | B | B | B | B |
| 18 | B | A | C | B | C | B |
| 19 | B | A | C | C | C | B |
| 20 | B | A | A | C | C | B |
| 21 | B | A | A | A | C | B |
| 22 | B | A | B | B | C | B |
| 23 | B | A | B | B | C | B |
| 24 | B | A | C | B | C | B |

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TABLE C

PREEMPTED CHANNELS FOR D3-TO-D4 OR D4-TO-D3 APPLICATION

| 5 kHz PGCU SLOT* | SLOT WHICH MUST BE VACANT FOR 5 kHz SERVICE† | 8 kHz PGCU SLOT* | SLOTS WHICH MUST BE VACANT FOR 8 kHz SERVICE† |
|------------------------|--|------------------------|---|
| 2 | 14 | 2 | 10, 18 |
| 3 | 15 | 3 | 11, 19 |
| 4 | 16 | 4 | 12, 20 |
| 5 | 17 | 5 | 13, 21 |
| 6 | 18 | 6 | 14, 22 |
| 7 | 19 | 7 | 15, 23 |
| 8 | 20 | | |
| 9 | 21 | | |
| 10 | 22 | | |
| 11 | 23 | | |

*When D3 and D4 banks are used together, only the channels shown may be used for program service.

†Blank units should be installed in vacant slots

TABLE D

PREEMPTED CHANNELS FOR D4-TO-D4 APPLICATIONS

| PGCU SLOT* | SLOT WHICH MUST BE VACANT FOR 5 kHz SERVICE† | SLOTS WHICH MUST BE VACANT FOR 8 kHz SERVICE† |
|---------------|--|---|
| 1 | 13 | 9, 17 |
| 2 | 14 | 10, 18 |
| 3 | 15 | 11, 19 |
| 4 | 16 | 12, 20 |
| 5 | 17 | 13, 21 |
| 6 | 18 | 14, 22 |
| 7 | 19 | 15, 23 |
| 8 | 20 | 16, 24 |
| 9 | 21 | 17, 1 |
| 10 | 22 | 18, 2 |
| 11 | 23 | 19, 3 |
| 12 | 24 | 20, 4 |
| 13 | 1 | 21, 5 |
| 14 | 2 | 22, 6 |
| 15 | 3 | 23, 7 |
| 16 | 4 | 24, 8 |
| 17 | 5 | 1, 9 |
| 18 | 6 | 2, 10 |
| 19 | 7 | 3, 11 |
| 20 | 8 | 4, 12 |
| 21 | 9 | 5, 13 |
| 22 | 10 | 6, 14 |
| 23 | 11 | 7, 15 |
| 24 | 12 | 8, 16 |

*When only D4 banks are used, any channel may be used for program service.

†Blank units should be installed in vacant slots.

TABLE E

RECEIVE PGCU ATTENUATOR SELECTION

| DESIRED TEST TONE OUTPUT LEVEL (dBm) | RECEIVE ATTENUATOR SETTING (dB) |
|---|------------------------------------|
| +1 | 0 |
| 0 | 1 |
| -1 | 2 |
| -2 | 3 |
| -3 | 4 |
| -4 | 5 |
| -5 | 6 |
| -6 | 7 |
| -7 | 8 |
| -8 | 9 |
| -9 | 10 |
| -10 | 11 |
| -11 | 12 |
| -12 | 13 |
| -13 | 14 |
| -14 | 15 |

TABLE F

EQUALIZER ADJUSTMENT

| RECEIVED LEVEL OF 1 kHz TEST TONE AT TRANSMIT UNIT TST JACK (dBm) | RECEIVED LEVEL OF 5 kHz TEST TONE AT TRANSMIT UNIT TST JACK (dB) | DIFFERENCE BETWEEN 5 kHz AND 1 kHz RECEIVED LEVELS (dB) | EQUALIZER SETTING |
|--|---|--|----------------------|
| 0 | 0 | 0 | 0 |
| -.5 | -1.2 | .7 | 1 |
| -1.1 | -2.8 | 1.7 | 2 |
| -1.6 | -4.5 | 2.9 | 3 |
| -2.1 | -6.0 | 3.9 | 4 |
| -2.6 | -7.5 | 4.9 | 5 |
| -3.1 | -8.6 | 5.5 | 6 |
| -3.6 | -9.8 | 6.2 | 7 |
| -4.0 | -10.6 | 6.6 | 8 |
| -4.4 | -11.6 | 7.2 | 9 |
| -4.9 | -12.3 | 7.4 | 10 |
| -5.3 | -13.2 | 7.9 | 11 |
| -5.7 | -13.8 | 8.1 | 12 |
| -6.1 | -14.5 | 8.4 | 13 |
| -6.4 | -15.1 | 8.7 | 14 |
| -6.8 | -15.7 | 8.9 | 15 |
| -7.2 | -16.2 | 9.0 | 16 |
| -7.5 | -16.8 | 9.3 | 17 |
| -7.8 | -17.2 | 9.4 | 18 |
| -8.1 | -17.8 | 9.7 | 19 |
| -8.4 | -18.1 | 9.7 | 20 |
| -8.7 | -18.6 | 9.9 | 21 |
| -9.0 | -19.0 | 10.0 | 22 |
| -9.3 | -19.5 | 10.2 | 23 |
| -9.6 | -19.7 | 10.1 | 24 |
| -9.8 | -20.1 | 10.3 | 25 |
| -10.1 | -20.4 | 10.3 | 26 |
| -10.3 | -20.8 | 10.5 | 27 |
| -10.6 | -21.0 | 10.4 | 28 |
| -10.8 | -21.4 | 10.6 | 29 |
| -11.0 | -21.7 | 10.7 | 30 |
| -11.3 | -21.9 | 10.6 | 31 |

AT XMIT END

Send 1000 = 4.4

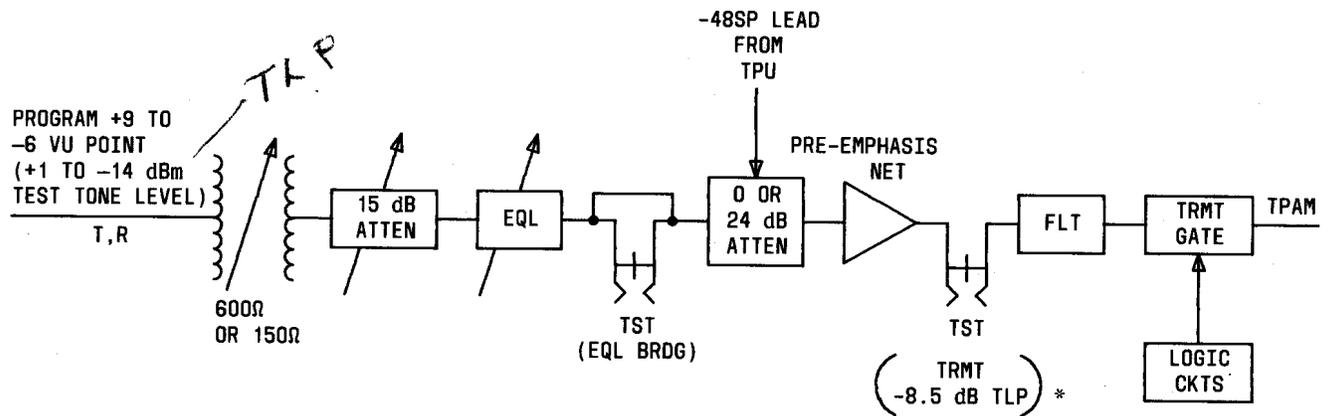
5000 = 11.6

DIFFERENCE 7.2

↑ 7.2 = 9 EQUALIZER = 16

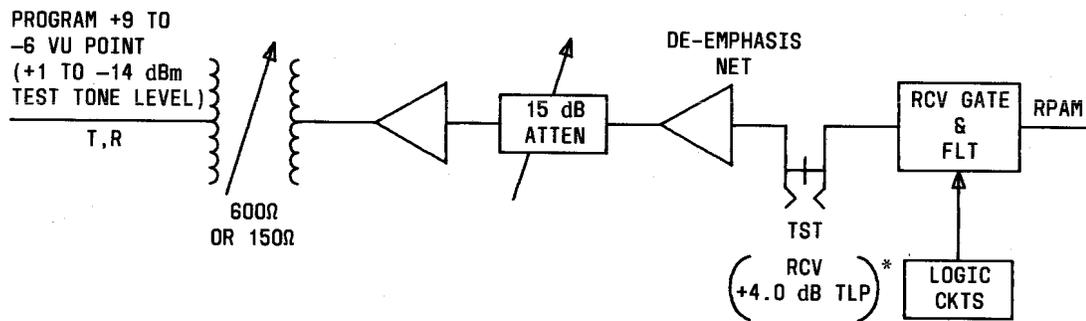
XMIT TLP = -14.0

REC TLP = -11.0



* THE TRANSMISSION LEVEL AT THIS POINT WILL BE -8.5 dBm ONLY FOR THE CARRIER TEST. WHEN PROPER 1020 Hz TEST TONE LEVELS ARE USED, THE LEVEL AT THIS POINT IS -23.5 dBm (-15.0 dBm AT THE D3/D4 PORTABLE TEST SET EXTERNAL DETECTOR JACK)

Fig. 1—Transmit PGCU Transmission Path



* THE TRANSMISSION LEVEL AT THIS POINT WILL BE +4.0 dBm ONLY FOR THE CARRIER TEST. WHEN PROPER 1020 Hz PROGRAM TEST TONE LEVELS ARE USED, THE LEVEL AT THIS POINT IS -11 dBm (-15.0 dBm AT THE D3/D4 PORTABLE TEST SET EXTERNAL DETECTOR JACK)

Fig. 2—Receive PGCU Transmission Path

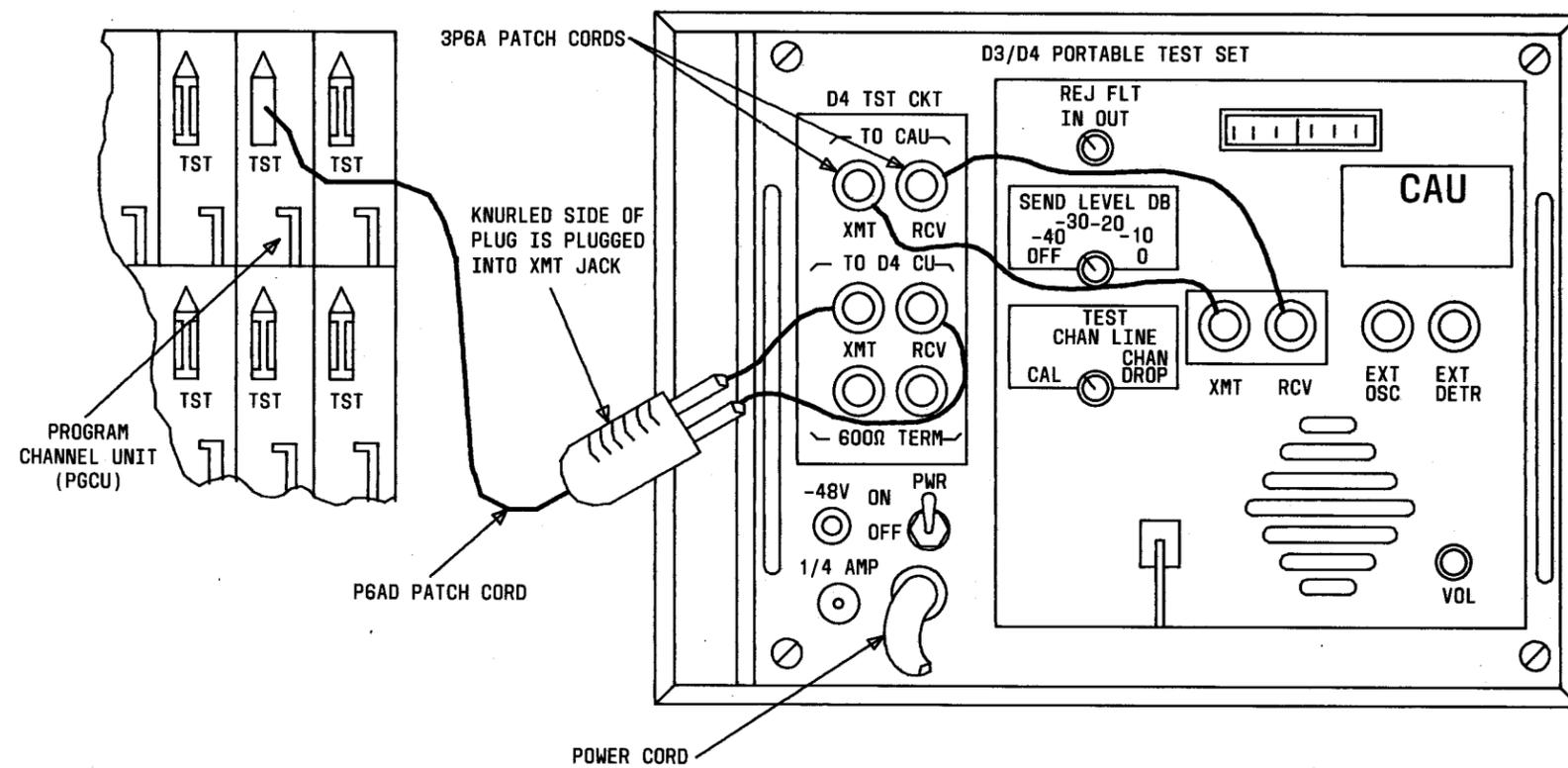


Fig. 3—Test Connections

TRANSMIT TLP = -14.0
 REC TLP = -11.0

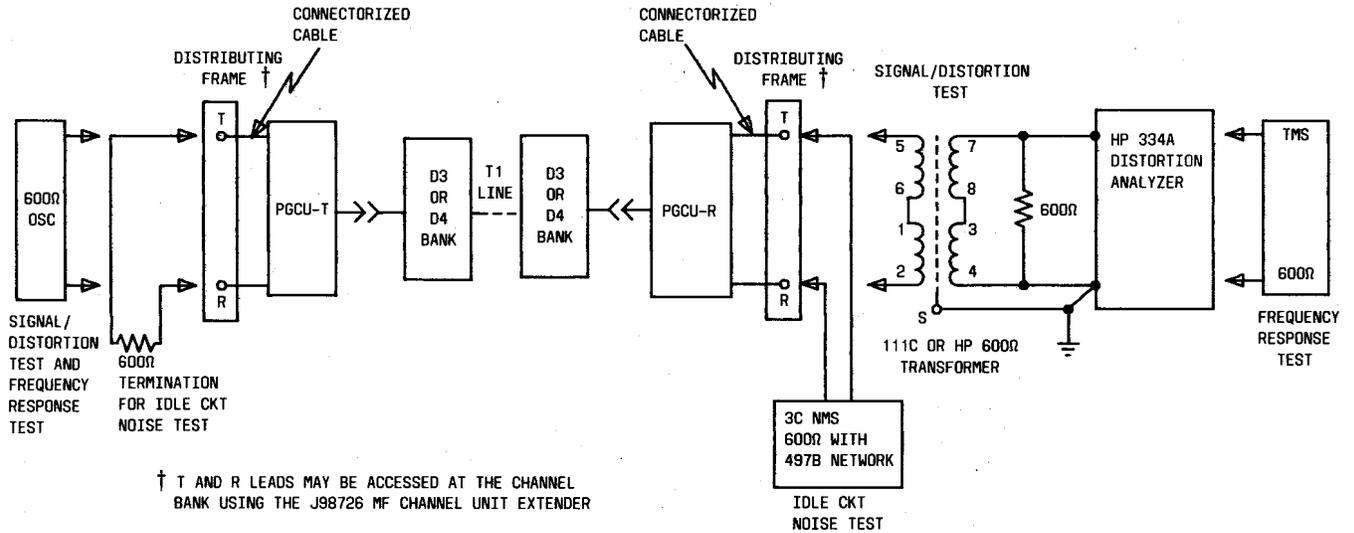


Fig. 4—End-to-End Tests

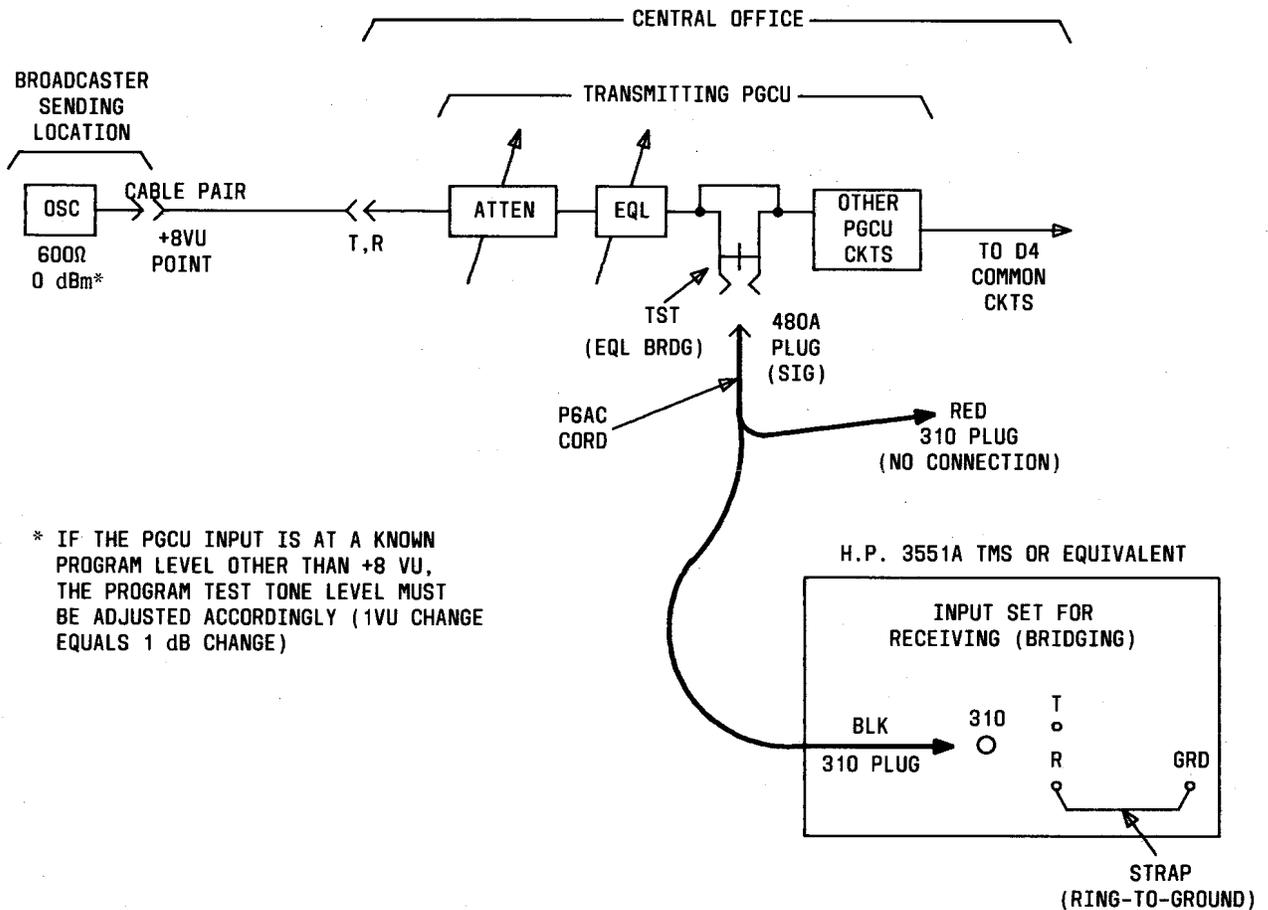
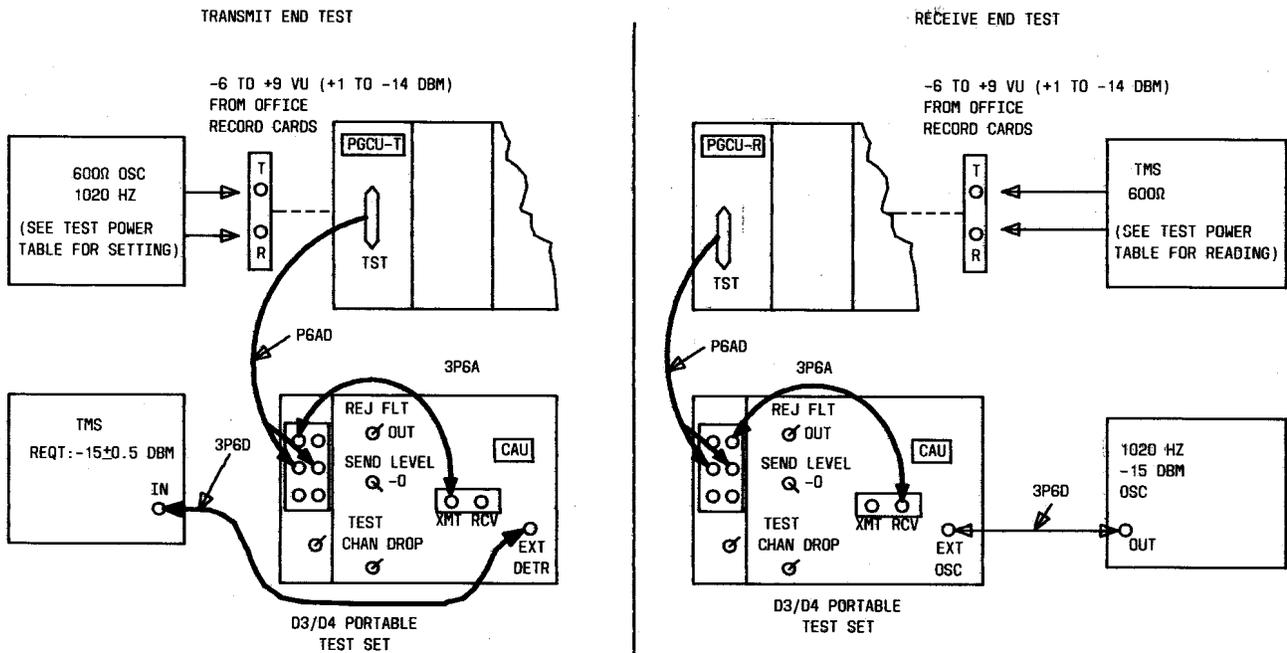


Fig. 5—Equalizer Test Point Connections



| | | | | | | | | | | | | | | | | |
|----------------------------------|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|----|
| VU AT TRANSMIT OR RECEIVE END | -6 | -5 | -4 | -3 | -2 | -1 | 0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 |
| T&R DBM TEST POWER | -14 | -13 | -12 | -11 | -10 | -9 | -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 | 0 | +1 |

Fig. 6—Channel Drop Test Connections