

TRUNK ORDER OR CIRCUIT ORDER TESTS—TESTING METHODS

CHANNEL NET GAIN

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accurate trunk lineup, and will also enable testboard personnel to converse knowledgeably with carrier test personnel. It is expected that the detailed information required by carrier maintenance personnel will be obtained from the appropriate carrier sections which provide specifics beyond the intended scope of this section.

1.02 This section is reissued to bring the section up to date. Since this issue is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 In order to satisfactorily provide direct distance dialing (DDD), extended area service (EAS), and data-type services such as TWX, WATS, and DATAPHONE®, it is extremely important that the carrier channels be capable of transmitting the frequencies used for data transmission.

2. APPLICATION OF TRUNK ORDER OR CIRCUIT ORDER TESTS

2.01 Channel net gain at 1 kHz should be accurately measured and correctly adjusted in both directions of transmission on all channels of carrier telephone systems. Input and output levels are exact and should be in accordance with the appropriate section for the carrier being tested.

2.02 Standard test frequencies are shown as 1 kHz for loss measurements. The 71G tone generator, as well as the 52-type responders used in the Automatic Transmission Measuring System (ATMS) and Centralized Automatic Reporting On Trunks (CAROT) systems, provide a signal at 1004 Hz. The 4 Hz offset prevents slow-gain variations of ± 0.25 dB at 1 kHz which occur when integral submultiples of the T carrier sampling rate of 8 kHz cause harmonically related tones to fall back in the voice band. The same 8 kHz sampling rate is used in the No. 4 ESS switch.

1. GENERAL

1.01 This section provides methods and requirements for making channel net gain measurements on the various carrier systems. It contains general information which should be of value to trunk testers and control offices in that it will assist in the sectionalization of transmission troubles, provide

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2.03 The 1-kHz tone output of each channel should be adjusted to exactly match the receiving test level by varying the gain-adjusting potentiometer on the channel demodulator amplifier or equivalent control. The level adjustment provided by the gain-adjusting potentiometer normally compensates for gain variations in the receiving terminal equipment.

2.04 The net gain measured between carrier system terminals depends upon the 1-kHz transmission levels used at the voice-frequency (VF) access point at which the channels terminate. The nominal net gain for the various carrier systems is shown in Table A.

TABLE A

NOMINAL CHANNEL NET GAIN VALUES

FACILITY	GAIN	COMMENTS
N, O, and ON Carrier	23 dB	Note 1
A-Type Channel Bank	23 dB	Note 1
D1A,B to D1A,B Channel Bank	12 dB	Note 2
D2 to D2 Channel Bank	23 dB	Note 2
D3 to D3 Channel Bank	10 dB	Note 2
D4 to D4 Channel Bank	12.5 dB	Note 2
D1D to D1D Channel Bank	11.75 dB	Note 2
D1D to D3 Channel Banks	11.75 dB	Note 2
D1D to D4 Channel Banks	13.25 dB	Note 2
D3 to D1D Channel Banks	10 dB	Note 2
D4 to D1D Channel Banks	11 dB	Note 2
D3 to D2 Channel Banks	14.5 dB	Note 2
D4 to D2 Channel Banks	15.5 dB	Note 2
D2 to D3 Channel Banks	18.5 dB	Note 2
D2 to D4 Channel Banks	20 dB	Note 2
D3 to D4 Channel Banks	11.5 dB	Note 2
D4 to D3 Channel Banks	11 dB	Note 2

Note 1: Normally measured from the MOD IN jack (-16 dB TLP input) to the DEMOD OUT jack (+7 dB TLP).

Note 2: For D-type channel banks measuring access varies. For D1, transmit access is via a matching network (0 dB TLP input) to the XMT jack; receive access is via the matching network (+2 D1A,B or +1.5 D1D) from the RCV jack. For D2, transmit access is a FAC IN jack (-16 dB TLP input); receive access is a FAC OUT jack (+7 dB TLP). For D3 and D4 transmit and receive access are at Channel Access Unit 0 dB, XMT and RCV jack.

2.05 Channel net gain measurement on N1, 0, and ON carrier systems with built-in 3.7-kHz signaling should be measured in the "off-hook" condition as outlined in Section 362-305-512. When *thru channel units* are used to interconnect N1, 0, or ON channels, follow the test procedures outlined in Section 362-310-501.

3. CHANNEL NET GAIN MEASUREMENTS

A. General

3.01 Measurements should not be made unless it has been established that initial circuit order, lineup, or routine tests have been completed on the carrier system involved and that the high-frequency line meets its operating requirements. The phrase "high-frequency line" includes line pilots of type K or similar systems and line, group, and supergroup pilots on L-type carrier.

B. Transmission Measurements on N, O, ON, and Type A Channel Banks Terminated in Voice Frequency (VF) Patch Bays

3.02 Channel Net Gain Measurements: As indicated in Fig. 1, channel net gain is measured by patching 1 kHz at -32 dBm into the MOD IN jack at the originating end of the channel being tested. The measured test power at the DEM OUT jack at the terminating end of the channel should be -9 dBm. If the requirement is not met, adjust the GAIN ADJUST potentiometer (REC potentiometer on N, O, and ON carrier) associated with the channel under test to bring the measurement to the exact value of -9 dBm. N, O, and ON carrier systems must meet the

requirements of Section 362-305-512 at E1 and E2 jacks. Normal TLPs at the VF patch bays are:

MOD IN Jack -16 dB TLP

DEM OUT Jack +7 dB TLP

C. Transmission Measurements on T Carrier D1 Channel Banks (D1A, D1B, D1C)

3.03 The T carrier, equipped with D1 channel banks, is aligned by using a matching network which matches the 2500 ohm impedance of the carrier channel units to the 600 ohm impedance of the transmission test sets.

3.04 Channel measurement methods are detailed in Section 365-105-500.

3.05 With connections shown in Fig. 2, a test frequency of 1 kHz is patched into the matching network at -16 dBm. At the terminating end, the channel unit GAIN potentiometer is adjusted to obtain -14.0 dBm on the TMS.

3.06 Normal TLPs for T Carrier equipped with D1 channel banks are shown in Fig. 2.

D. Transmission Measurements on T Carrier D1D Channel Banks

3.07 T Carrier, equipped with D1D channel banks, is the same as T Carrier with other D1 channel banks as previously described in paragraphs 3.03 through 3.06 of this section, except that the facility gain is 11.75 dB rather than 12 dB. Channel measurement methods are detailed in Section 365-116-505.

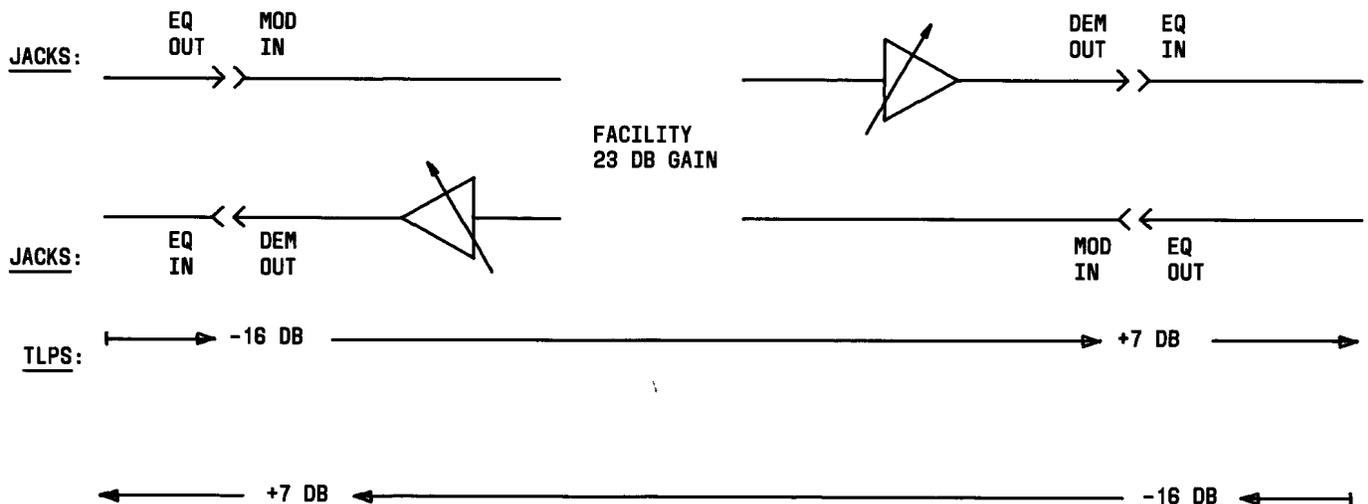


Fig. 1—End-to-End Channel Net Gain at 1 kHz, N, O, ON, and Type A Channel Banks (Two Directions Shown)

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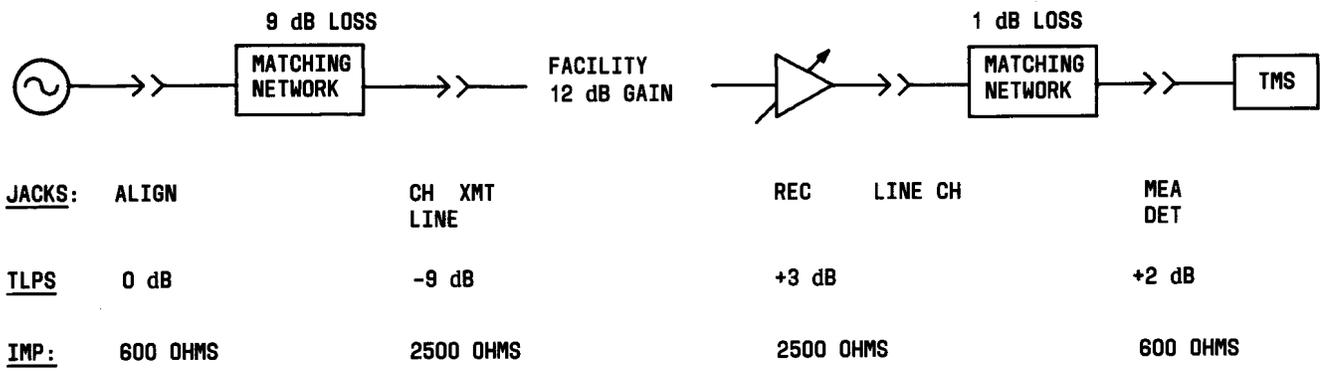


Fig. 2—End-to-End Channel Net Gain at 1 kHz, T Carrier Equipped With D1 Channel Banks (One Direction Shown)

3.08 As shown in Fig. 3, a 1-kHz, -16 dBm signal, is patched into the ALIGN jack of the originating matching network. A 0.25-dB pad is used with D1D and not with other D1s. At the terminating end, the channel unit GAIN potentiometer is adjusted to obtain -14.5 dBm at the TMS.

3.09 If the external 0.25-dB pad is not used, transmission level measurements must take into account the fact that the matching network used to transmit test tone at the originating end has only 9-dB loss which causes the actual power level to be -25 dBm at the -9.25-dB TLP. For this reason the terminating gain adjustment must be set to obtain a -14.25 dBm reading on the TMS.

E. Transmission Measurements on T Carrier D2 Channel Banks

3.10 Jack access to -16-dB and +7-dB TLPs on a 4-wire basis is provided on all channel units. Level measurements can be made on all channels from the 4-wire transmission paths. In addition, all 2-wire channel units, except the E and M 2-wire units, have jack access to the 2-wire (tip and ring) leads of the channel unit.

3.11 Channel unit description is found in Section 365-400-104. Test panel description is found in Section 365-400-108. Installation tests are found in Section 365-400-300. Channel net gain is adjusted per Section 365-404-500, Chart 2, which describes a method for adjusting the receiver gain on an

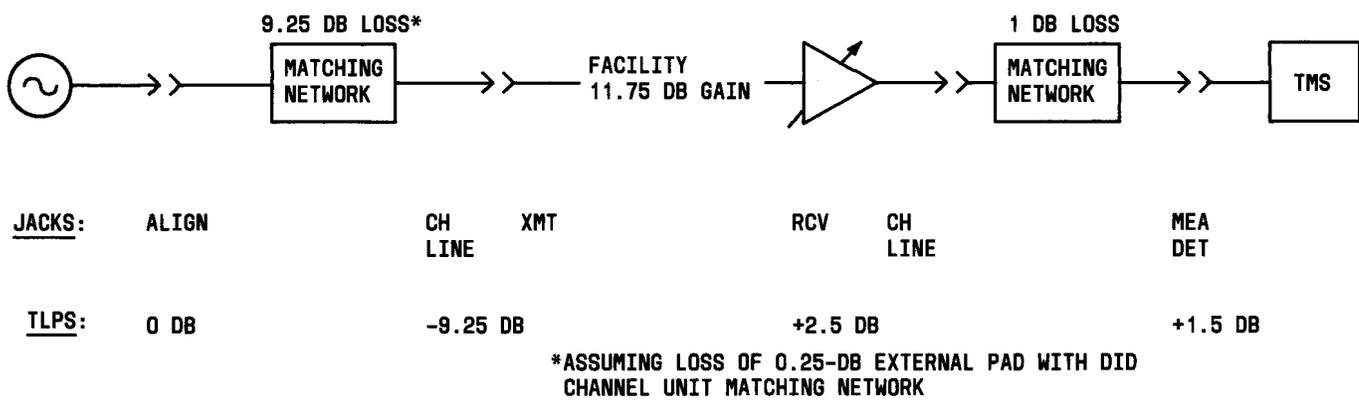


Fig. 3—End-to-End Channel Net Gain at 1 kHz, T Carrier Equipped With DID Channel Banks (One Direction Shown)

end-to-end basis for a single channel when the other channels of the digroup are in service.

3.12 Each direction of transmission on a D2 channel has a transmitting and receiving amplifier. As shown in Fig. 4, the end-to-end gain is 23-dB. The input level to the FAC IN jack is -16-dBm. The output level at the FAC OUT jack is +7-dBm.

3.13 Each channel in the D2 bank is equipped with two gain controls which are used for adjusting the end-to-end channel net gain from 4-wire jack to 4-wire jack. One gain control is used for adjusting the transmitting level, and another gain control is used for adjusting the receiving level.

Caution: *Another method of terminal lineup, which loops digroups (24 channels) and is designed to be used during initial lineup or before the digroup is released for service, is provided. This method loops the transmit circuit to the receive circuit for all 24 channels in the digroup. Once service has been established, this 24-channel looping method should not be used unless the entire 24-channel group is removed from service.*

3.14 The receiver gain is first adjusted at the terminating terminal without assistance from the originating terminal. The receiving amplifier is adjusted to +7 dBm. Next the transmitting amplifier gain at the originating terminal is adjusted with the assistance of the terminating terminal. The transmitting amplifier is adjusted to +7 dBm at the receiving terminal FAC OUT jack. Channel units are equipped with 4-wire transmission jacks for making level, transmission, noise, and crosstalk measurements.

3.15 Normal 1-kHz test levels when D2 banks transmit to D2 banks are shown in Fig. 4.

F. Transmission Measurements on T Carrier D3 and D4 Channel Banks

3.16 The D3 and D4 channel banks use the channel access unit (CAU) which provides for 0-dBm transmit and receive power, to measure channel net gain. The CAU is built into the maintenance and hot-spare shelf in D3. D4 uses a portable CAU. The CAU contains an internal oscillator which generates a 0 dBm, 1.02-kHz tone connected as shown in Fig. 5 and Fig. 6.

3.17 A description of the CAU as used in D3 is given in Section 365-150-100 along with a general description of the D3 channel bank. A

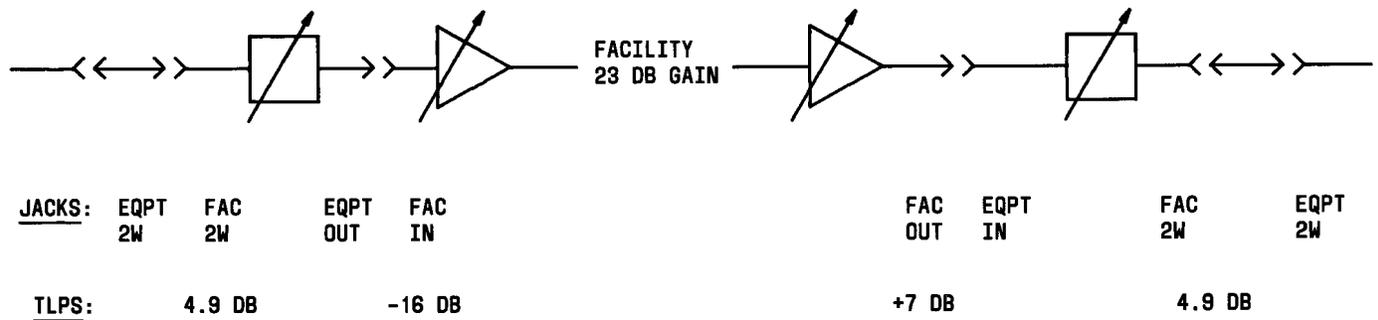


Fig. 4—End-to-End Channel Net Gain at 1 kHz, T Carrier Equipped With D2 Channel Banks (One Direction Shown)

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description of the D4 channel unit and the CAU as used in the portable test set is given in Section 365-170-101.

3.18 Referring to Fig. 5, the output level at the RCV jack of the D3 channel unit is +2.5 dB. The channel gain between terminals is 10 dB. The receiving circuit of the CAU has a built-in 2.5-dB loss to permit a simple 0 ± 0.25 -dBm meter reading at the receiving terminal.

3.19 Referring to Fig. 6, the output level at the TST jack of the D4 channel unit is +4 dB. The channel net gain between terminals is 12.5 dB.

3.20 There are no channel gain adjustments on D3 or D4 channel banks. The receive power read on the CAU must be 0 ± 0.25 dBm to meet requirements. Channel units which fail to meet requirements are replaced.

G. Transmission Measurements on T Carrier D3 or D4 Channel Banks Associated With D1D, D2, D3, or D4 Channel Banks

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3.21 D3 or D4 channel banks used in conjunction with D1D, D2, D3, or D4 channel banks are considered ready for service after single-end tests have been completed. When a D3 or D4 channel bank is used with a different but compatible bank, channel bank adapters are required to preserve the channel number identity at both ends.

3.22 Section 365-150-502 provides initial circuit order tests when D3 channel banks are used with D3, D2, or D1D channel banks. Single-end tests and adjustments for the channel banks are the same as described in Sections C through F.

D1D BANKS ASSOCIATED WITH D3 OR D4 BANKS

Channel Net Gain - D1D Bank Transmitting to a D3 or D4 Bank

3.23 As shown in Fig. 7 and 8, a 1-kHz signal at -16 dBm is patched into the transmitting D1D channel bank matching network. When the NET LOSS keys of the matching network are in the vertical position, and the 0.25-dB pad described in 3.09 is connected between the milliwatt jack and the input jack of the matching network, the output of the network is -25.25 dBm.

3.24 The receiving D3 channel unit RCV jack is patched to the CAU. The power level at the D3 RCV jack is -13.5 dBm. The receiving D4 channel unit TST jack is patched to the CAU in the portable test set. The level at the D4 TST jack is -12 dBm. In both D3 and D4, the CAU is designed so that the level meter will read 0 dBm with the proper channel net gain. There are no channel gain adjustments when D1D banks transmit to D3 or D4 banks. On channels which fail, replace the D3 or D4 channel unit and retest. If the trouble persists, replace the D1D channel unit and retest. If trouble is still not cleared, follow single-end test procedures per Section 365-150-501

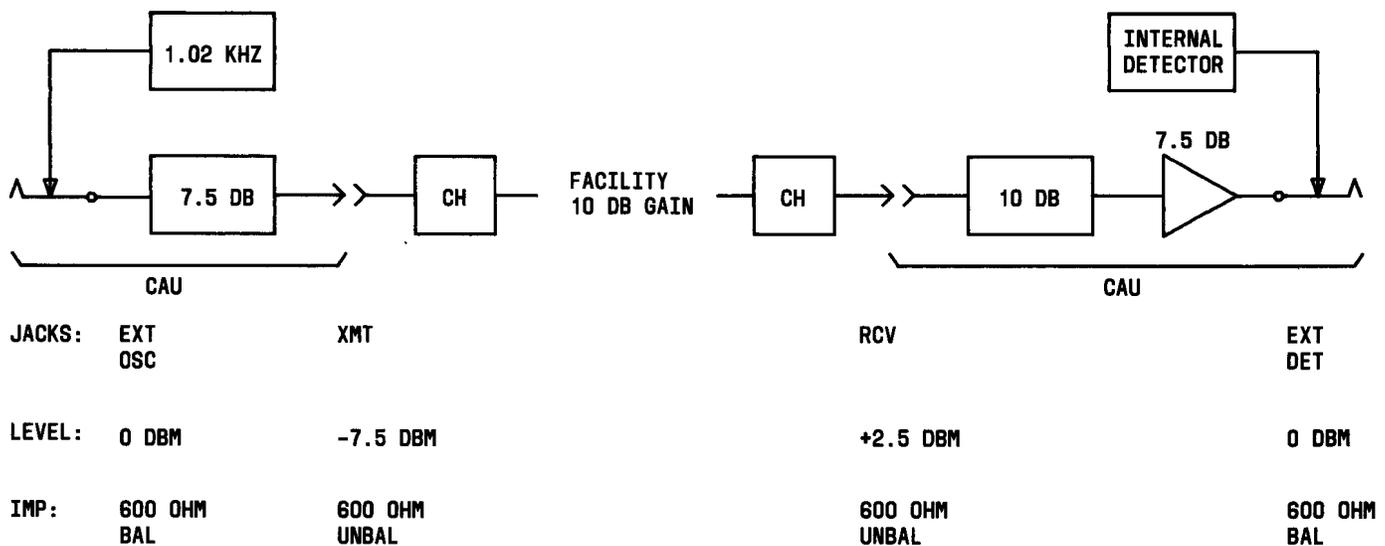
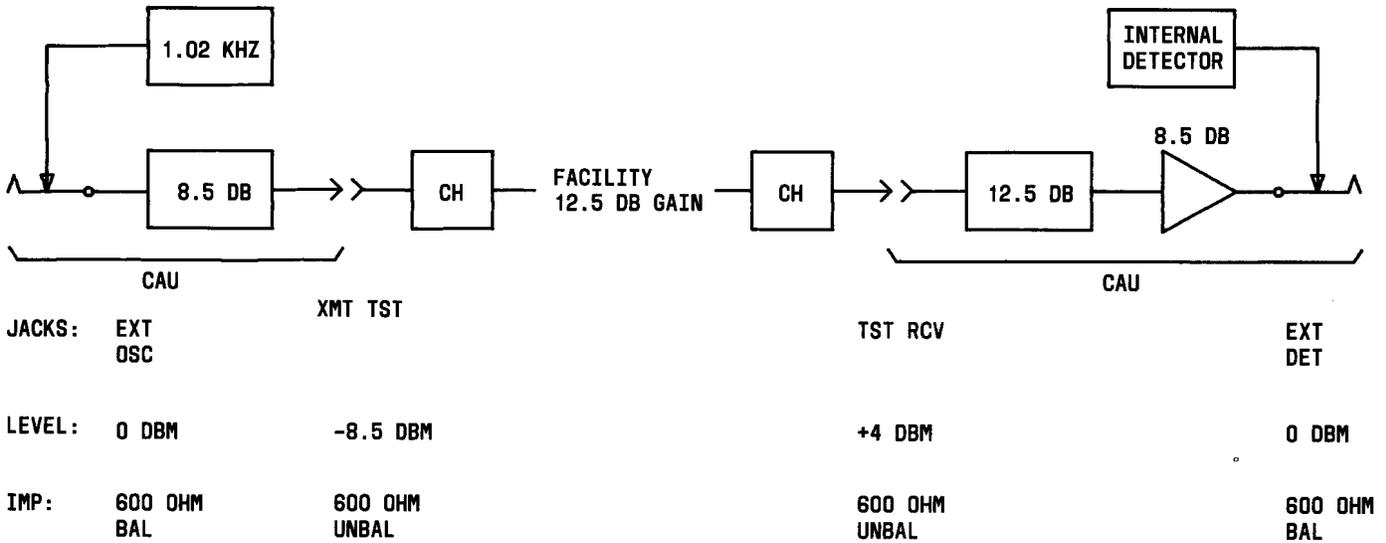
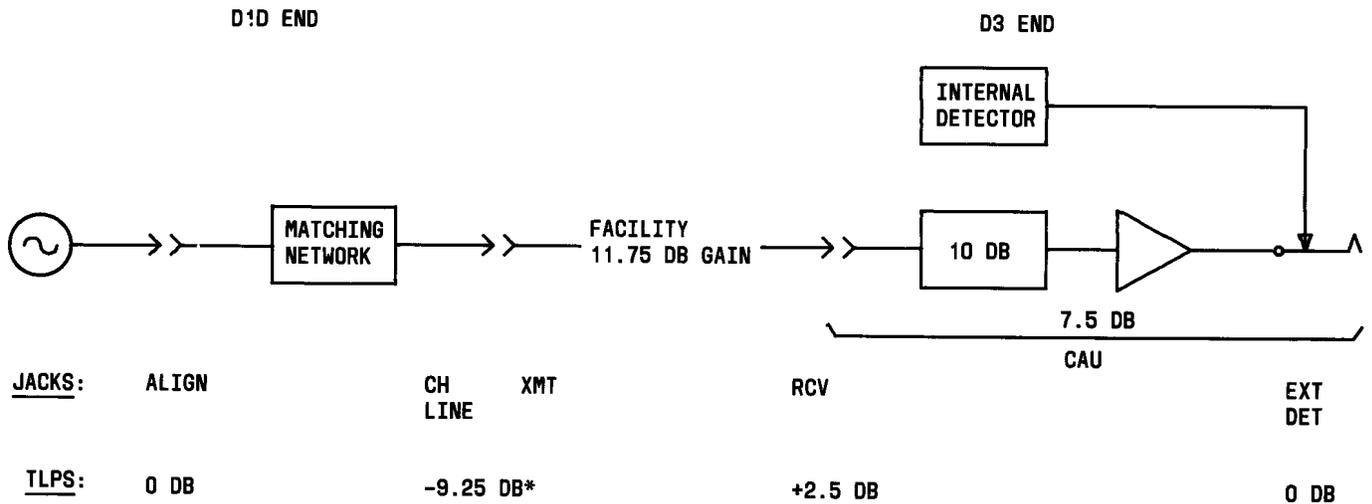


Fig. 5—End-to-End Channel Net Gain at 1.02 kHz, T Carrier Equipped With D3 Channel Banks (One Direction Shown—Both Directions are the Same)



NOTE: CAU CONSISTS OF CAU AND D4 TEST CIRCUIT BUILT INTO THE D3/D4 PORTABLE TEST SET

Fig. 6—End-to-End Channel Net Gain at 1.02 kHz, T Carrier Equipped With D4 Channel Banks (One Direction Shown—Both Directions are the Same)



* ASSUMING USE OF 0.25-DB EXTERNAL PAD ON D1D CHANNEL UNIT MATCHING NETWORK

Fig. 7—End-to-End Channel Net Gain at 1 kHz, T Carrier D1D Channel Bank Transmitting to D3 Channel Bank (Opposite Direction Shown in Fig. 9)

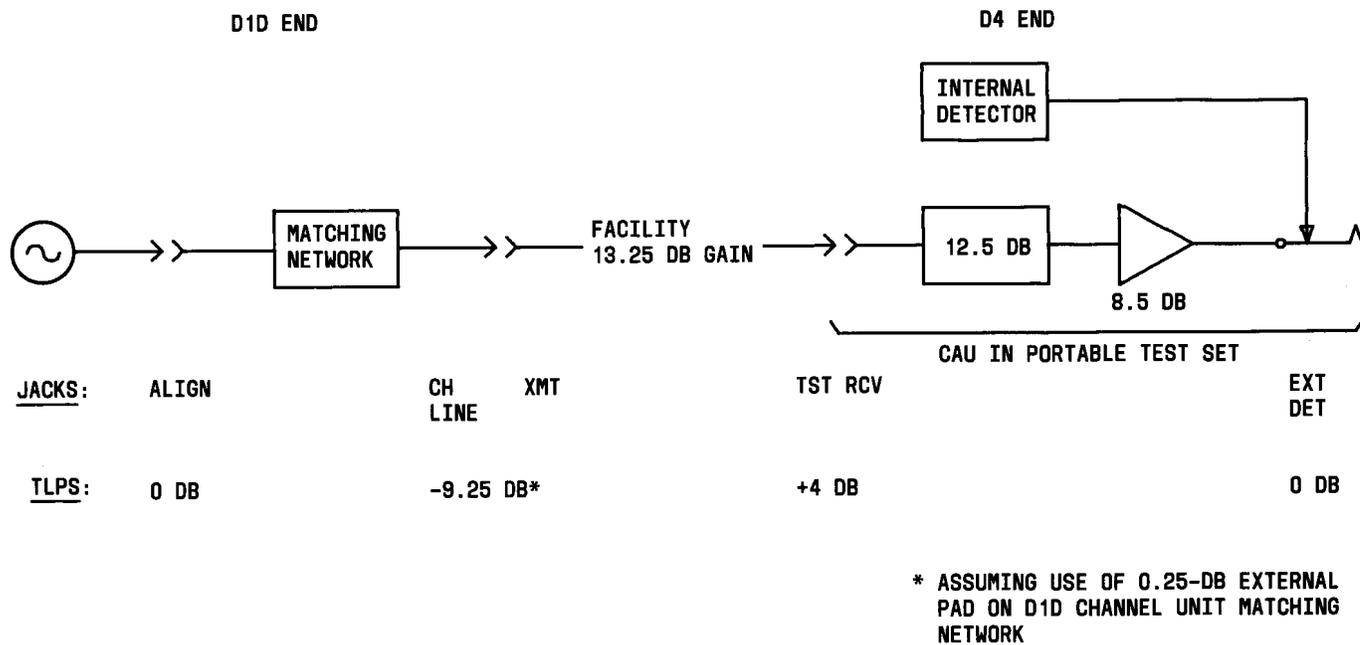


Fig. 8—End-to-End Channel Net Gain at 1 kHz, T Carrier D1D Channel Bank Transmitting to a D4 Channel Bank (Opposite Direction Shown in Fig. 10)

for D3, Section 365-170-000 for D4, and Section 365-116-500 for D1D.

Channel Net Gain — D3 or D4 Bank Transmitting To a D1D Bank

3.25 As shown in Fig. 9 and 10, the transmitting D3 or D4 channel bank is patched to the CAU. The CAU contains an internal oscillator which generates a 0-dBm, 1.02-kHz tone which is attenuated to -7.5 dBm on D3 and -8.5 dBm on D4. This signal is input to the XMT jack on D3 or the TST jack on D4. The receiving D1D RCV jack is patched to the matching network CH LINE jack. The matching network DET jack is patched to the TMS. With the proper channel net gain, the TMS should read +1.5 dBm. If this adjustment cannot be made, replace the D3 or D4 channel unit and retest. If the TMS does not read +1.5 dBm, attempt adjustment of the D1D channel unit receive gain control to obtain the +1.5 dBm. If trouble still exists, replace the D1D channel unit and readjust.

D2 BANKS ASSOCIATED WITH D3 OR D4 BANKS

Channel Net Gain - D3 or D4 Banks Transmitting To a D2 Bank

3.26 As shown in Fig. 11 and 12, the transmitting D3 or D4 CAU is patched to the channel XMT jack (TST jack on D4). On D3, the level of the 1.02-kHz test signal entering the XMT jack is -7.5 dBm. On D4, the level entering the TST jack is -8.5 dBm. The TMS at the receiving D2 channel should measure +7 dBm at the FAC OUT jack. If the output level is not +7 dBm, attempt adjustment of the D2 gain control per Section 365-404-500. If trouble persists, replace the D3 and D4 channel banks and retest. If this does not clear the trouble, replace the D2 channel unit and proceed per Section 365-410-500.

Channel Net Gain—D2 Bank Transmitting to a D3 or D4 Bank

3.27 As shown in Fig. 13 and 14, 1 kHz at -16 dBm is patched into the transmitting D2 channel bank FAC IN jack. The level at the receiving D3 or D4 channel is measured by patching

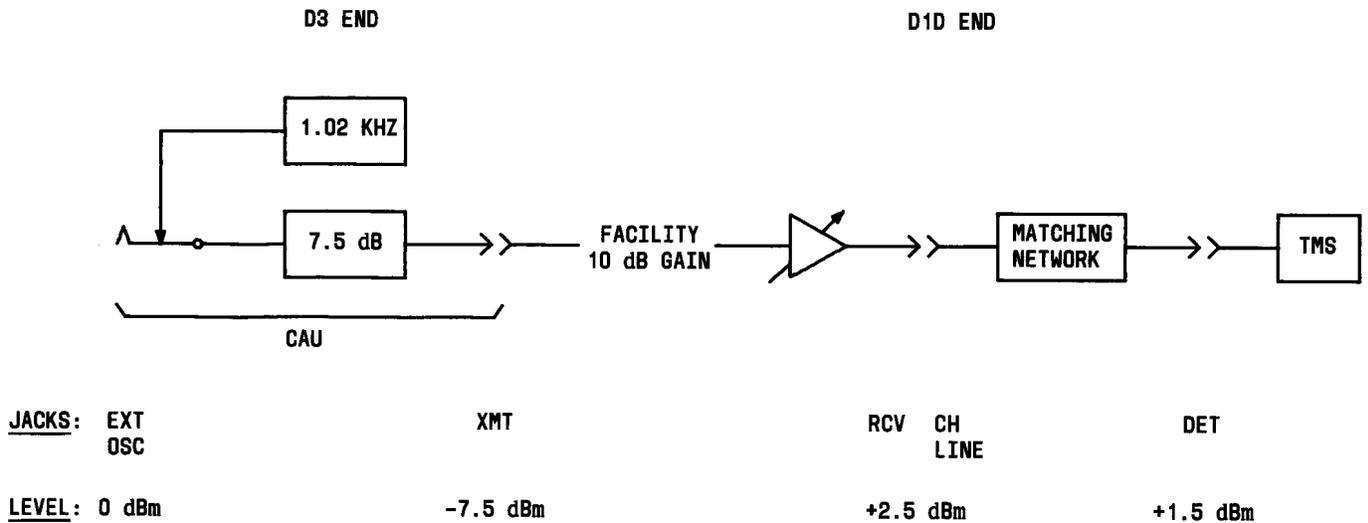


Fig. 9—End-to-End Channel Net Gain at 1.02 kHz, T Carrier D3 Channel Bank Transmitting to a D1D Channel Bank (Opposite Direction Shown in Fig. 7)

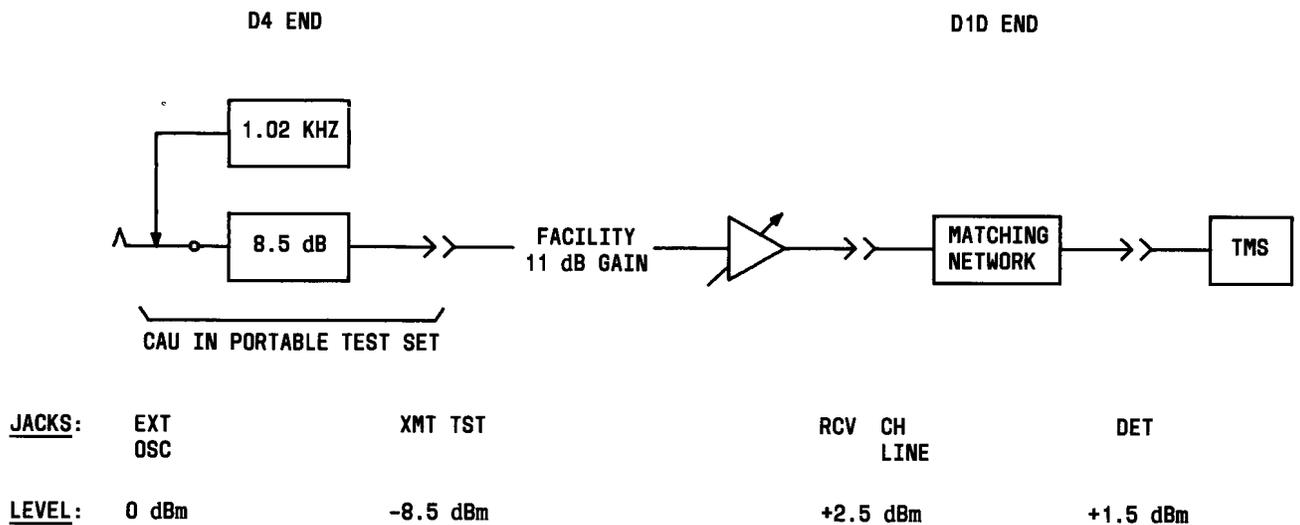


Fig. 10—End-to-End Channel Net Gain at 1.02 kHz, T Carrier D4 Channel Bank Transmitting to a D1D Channel Bank (Opposite Direction Shown in Fig. 8)

the CAU to the channel RCV jack on D3 or to the channel TST jack on D4. The level will be at the required +2.5 dBm when the level meter on the CAU reads 0 dBm. If the channel net gain requirement is not met, attempt adjustment of

the D2 transmit gain control per Section 365-410-500. If the trouble persists replace the D3 or D4 channel unit and retest. If this does not clear the trouble, replace the D2 channel unit and test per Section 365-410-500.

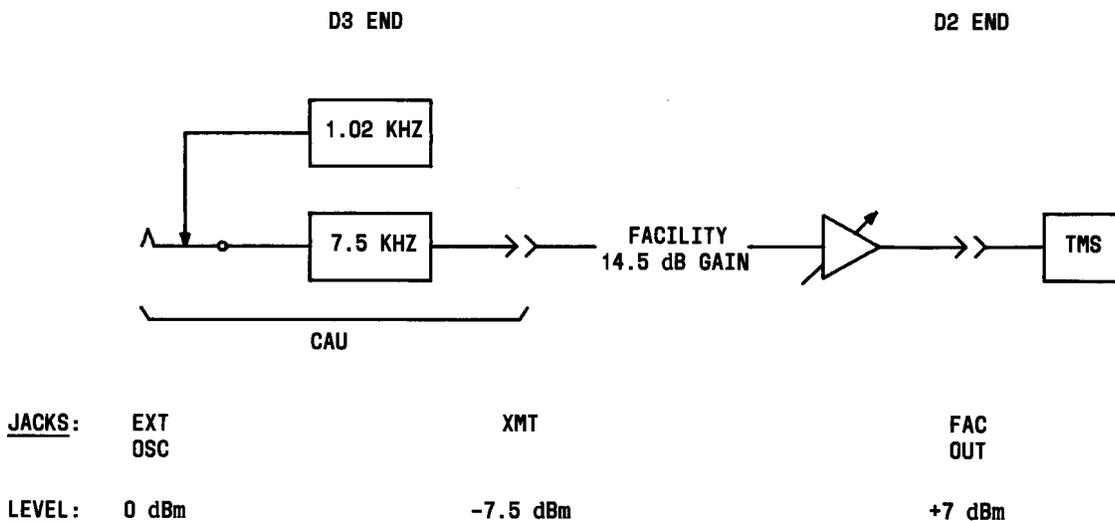


Fig. 11—End-to-End Channel Net Gain at 1.02 kHz, T Carrier D3 Channel Bank Transmitting to a D2 Channel Bank (Opposite Direction Shown in Fig. 13)

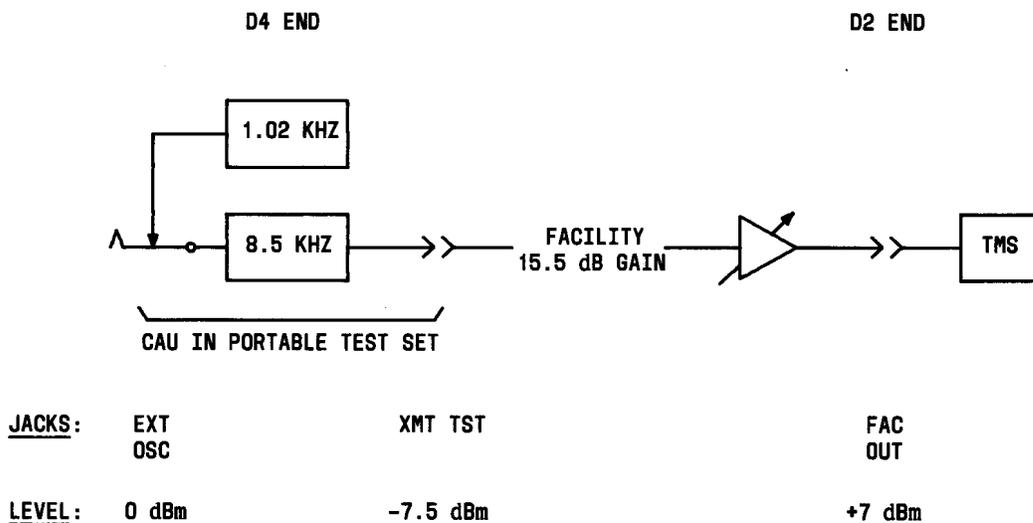


Fig. 12—End-to-End Channel Net Gain at 1.02 kHz, T Carrier D4 Channel Bank Transmitting to a D2 Channel Bank (Opposite Direction Shown in Fig. 14)

D3 BANKS ASSOCIATED WITH D4 BANKS

Channel Net Gain - D3 Bank Transmitting to a D4 Bank

3.28 As shown in Fig. 15, the transmitting D3 channel bank is patched to the CAU. The CAU contains an internal oscillator which generates a 0 dBm, 1.02 kHz tone which is attenuated to

-7.5 dBm. This signal is input to the XMT jack on the D3 channel unit. The receiving D4 channel unit TST jack is patched to the CAU in the D4 portable test set. The level at the D4 TST jack is +4 dBm. The CAU is designed so that the level meter will read 0 dBm with the proper channel net gain. There are no channel gain adjustments when D3 banks transmit to D4 banks. On channels which fail channel net gain tests, replace first one

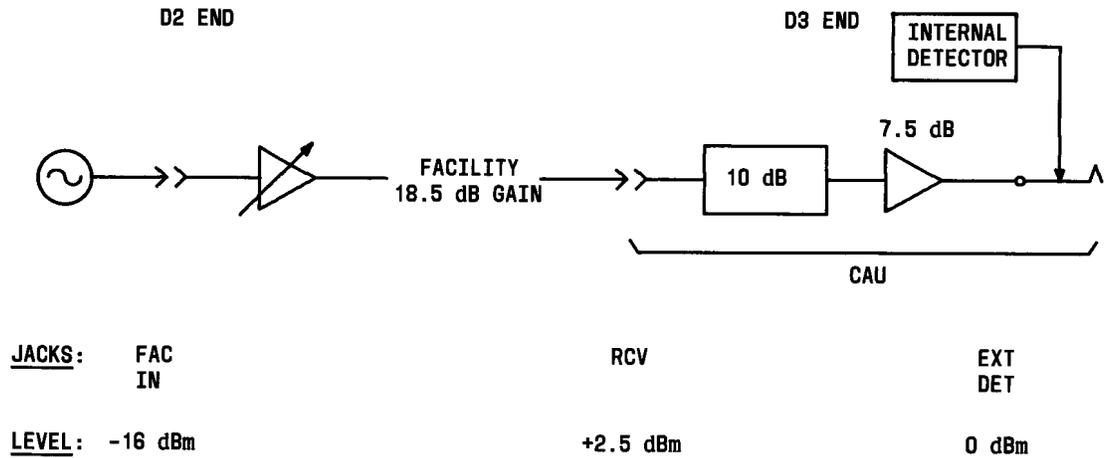


Fig. 13—End-to-End Channel Net Gain at 1 kHz, T Carrier D2 Channel Bank Transmitting to a D3 Channel Bank (Opposite Direction Shown in Fig. 11)

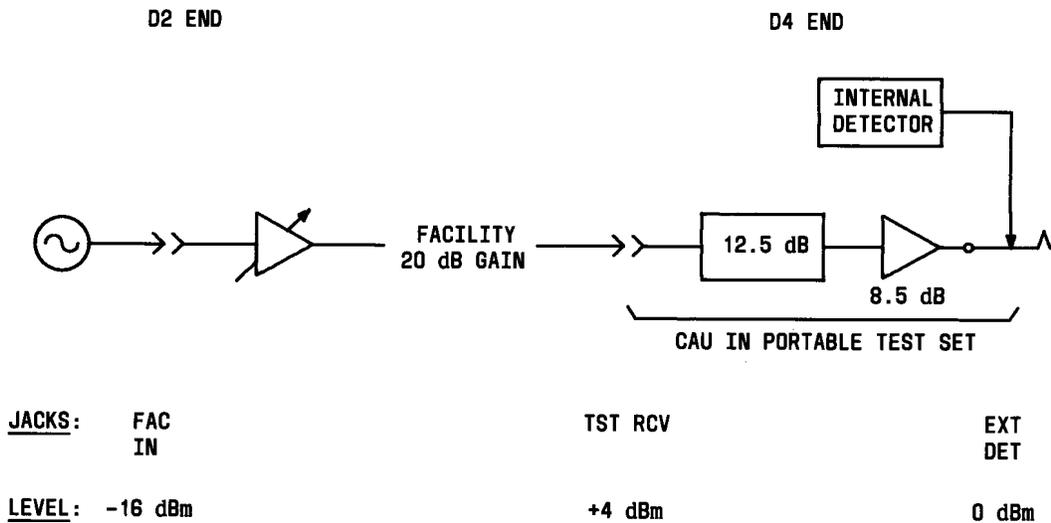


Fig. 14—End-to-End Channel Net Gain at 1 kHz, T Carrier D2 Channel Bank Transmitting to a D4 Channel Bank (Opposite Direction Shown in Fig. 12)

channel unit and retest. If the trouble persists, replace the other channel unit and retest. If the trouble still exists, perform single-end tests per Section 365-150-505 for D3 and Section 365-170-000 for D4.

Channel Net Gain—D4 Bank Transmitting to A D3 Bank

3.29 As shown in Fig. 16, the transmitting D4 channel bank is patched to the CAU contained

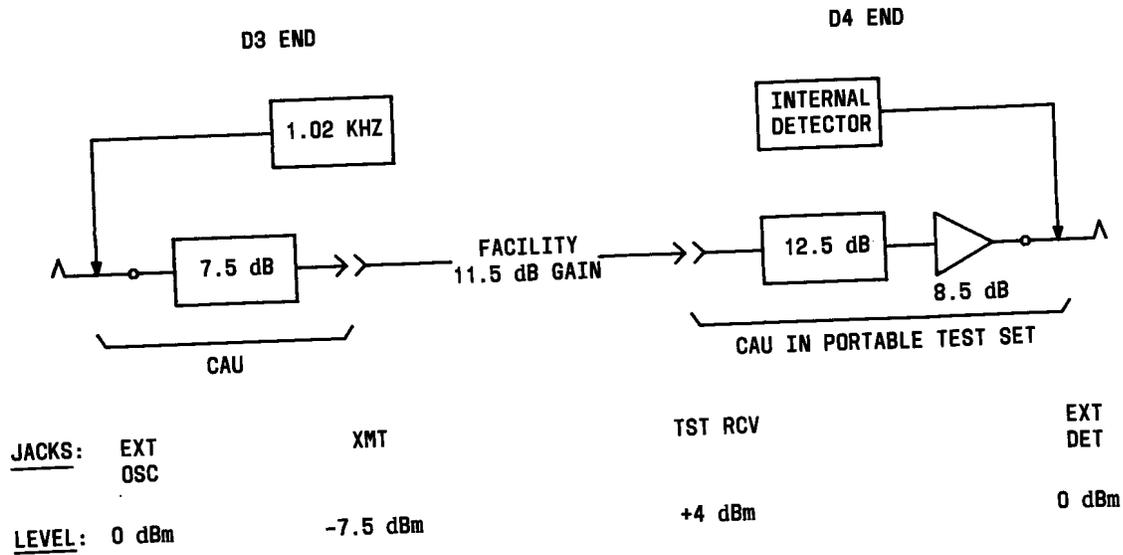


Fig. 15—End-to-End Channel Net Gain at 1.02 kHz, T Carrier D3 Channel Bank Transmitting to a D4 Channel Bank (Opposite Direction Shown in Fig. 16)

in the portable test set. The CAU contains an internal oscillator which generates a 0 dBm, 1.02 kHz tone attenuated to -8.5 dBm. This signal is input to the TST jack on the D4 channel unit. The receiving D3 channel unit RCV jack is patched to the CAU. The level at the RCV jack is +2.5 dBm. The CAU is designed so that the level meter will read 0 dBm with the proper channel net gain.

There are no channel gain adjustments when D4 banks transmit to D3 banks. On channels which fail channel net gain tests, replace first one channel unit and retest. If the trouble persists, replace the other channel unit and retest. If the trouble still exists, perform single-end tests per Section 365-150-505 for D3 and Section 365-170-000 for D4.

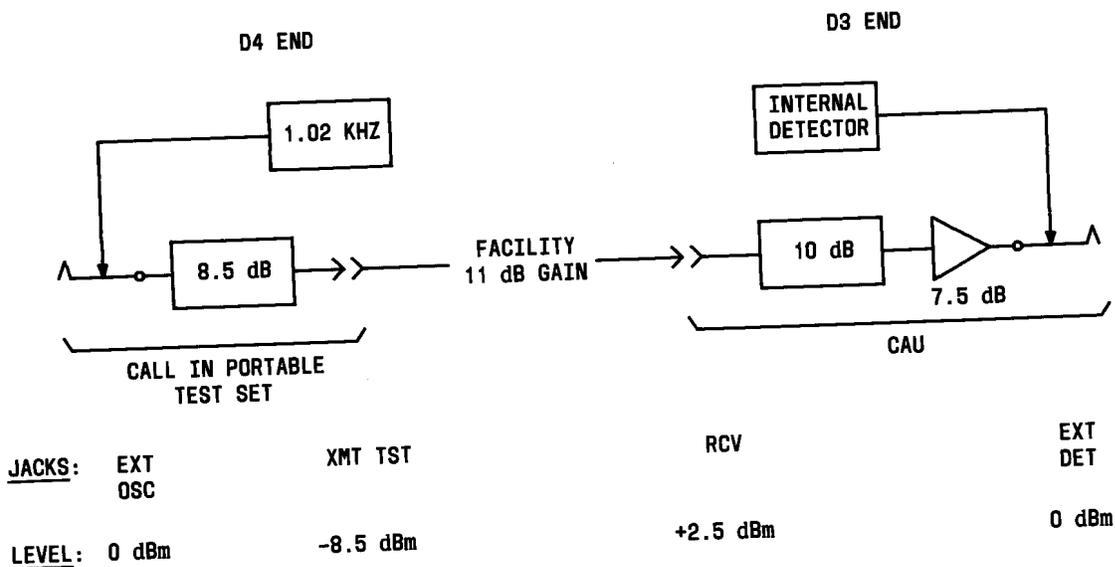


Fig. 16—End-to-End Channel Net Gain at 1.02 kHz, T Carrier D4 Channel Bank Transmitting to a D3 Channel Bank (Opposite Direction Shown in Fig. 15)