

9961E Pulse Link Repeater Subassembly

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1. general description

1.01 The 9961E Pulse Link Repeater subassembly (figure 1) provides conversion between E&M facility signaling (E-lead originate) and E&M loop signaling (E-lead or M-lead originate). The 9961E subassembly can be used to interface equipment that originates on the E lead to other equipment that also originates on the E lead (e.g., two carrier systems that both originate on the E lead). In FCC-registered applications, the 9961E can be used to provide wiring protection for the E and M leads. The 9961E is designed specifically for use on Tellabs' 6461, 6461R, and 6462 Common Signaling Modules and on 6971 and 6972 Common Interface Modules.

1.02 In the event that this Practice section is reissued, the reason for reissue will be stated in this paragraph.

1.03 The 9961E makes electrical and physical connection to the host 6461 or 6461R module by means of male connectors on the 9961E and receptacles on the 6461 or 6461R module's printed circuit board. A standoff mounting near the center of the subassembly adds rigidity.

1.04 The 9961E subassembly can be optioned for either M-lead originate (for use as a pulse-link repeater) or E-lead originate (for use as a wiring protector). In both applications, M-lead current is limited to 100mA.

1.05 When the 9961E subassembly is used on a host 6461R module, a cut-and-terminate output lead controls a CT (cut-and-terminate) relay on the host 6461R. When both the E and M leads are idle, the 9961E energizes the CT relay. The CT relay cuts the receive path and terminates it in both directions, thereby limiting the idle signal power delivered to the network to a level below the FCC-mandated maximum of -55dBm.

1.06 Input power is supplied to the 9961E subassembly via the host module. The 9961E accepts -22 to -56Vdc filtered, ground-referenced input and requires 40mA of current in addition to that required by the host module.

1.07 As stated above, the 9961E plugs into a receptacle on the printed circuit board of the host 6461, 6461R, 6462, 6971, or 6972 module. For

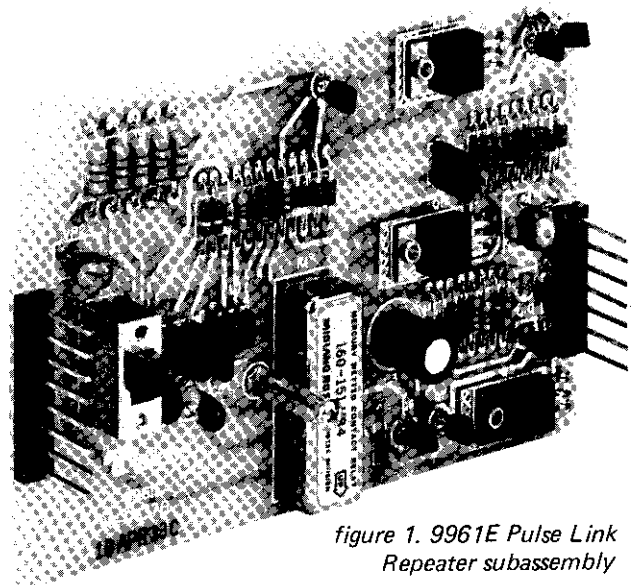


figure 1. 9961E Pulse Link Repeater subassembly

complete information on these modules, refer to their respective Tellabs Practices. For FCC-registered applications, the 9961E is used on a 6461R module, which plugs into one position of a Tellabs 266XR Registered Network Interface System Mounting Assembly. Refer to Practice section 8X266XR for detailed information on FCC-registered applications.

2. application

2.01 The 9961E Pulse Link Repeater subassembly, when used on a 6461, 6461R, 6462, 6971, or 6972 module, provides conversion between E&M facility signaling (E-lead originate) and E&M loop signaling (E-lead or M-lead originate). The 9961E subassembly can be used to interface equipment that originates on the E lead to other equipment that also originates on the E lead (e.g., two carrier systems that both originate on the E lead). In FCC-registered applications, the 9961E can be used to provide wiring protection for the E and M leads.

2.02 When the 9961E is optioned for the M-lead-originate mode (S1 set to the M position), it acts as a Type I E&M pulse link repeater (figure 2). From either direction of transmission, the 9961E accepts an E lead that originates with a ground state and provides an M lead that originates with negative battery.

2.03 When the 9961E is optioned for the E-lead-originate mode (S1 set to the E position), it acts as a coupler between an M-lead-originate trunk circuit and an E-lead-originate carrier circuit (figure 3). Normally, when an M-lead-originate circuit interfaces an E-lead-originate circuit, the E and M

leads from one circuit are directly connected to the E and M leads (respectively) of the other circuit. This is achieved by setting the *NORM/BYP* switch option on the host module to the *BYP* position; a 9961E subassembly is not required. However, in applications where power supply isolation and wiring protection are required to satisfy FCC regulations (e.g., connecting non-FCC-registered carrier equipment to the public switched network), the 9961E mounted on a 6461R Common Signaling Module provides a fully registered E&M-lead interface.

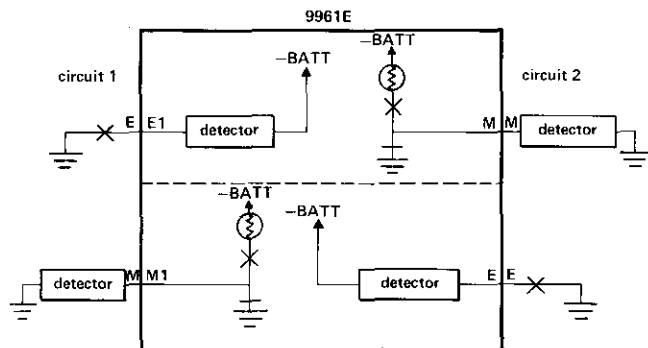


figure 2. 9961E subassembly arranged for M-lead originate

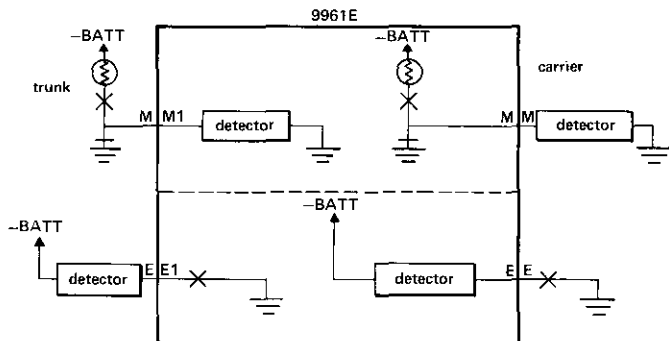


figure 3. 9961E subassembly arranged for E-lead originate

2.04 The 6461R-9961E combination can accommodate the registered facility interface codes listed in table 1.

registered facility interface code	facility transmission interface	E&M signaling interface	option switch S1 position
TL11E	2wire	E-lead originate	E
TL11M	2wire	M-lead originate	M
TL31E	4wire	E-lead originate	E
TL31M	4wire	M-lead originate	M

table 1. Facility codes served by 6461R-9961E combination

2.05 When the 9961E subassembly is used on a 6461R module, a cut-and-terminate output lead controls a CT (cut-and-terminate) relay on the host 6461R. When both the E and M leads are idle, the 9961E energizes the 6461R's CT relay. The CT relay cuts the receive path and terminates it in both directions, thereby limiting the idle signal power delivered to the network to a level below the FCC-mandated maximum of -55dBm. The

timing of the cut-and-terminate function is such that the receive path remains cut during dialing.

2.06 The 9961E's M-lead drivers are current-limited by thermistors. Under normal operating conditions, M-lead battery is supplied through a 65-ohm resistance. If the M-lead current exceeds 100mA, the associated M-lead driver replaces the 65-ohm resistance with a 5-kilohm resistance, thereby producing a foldback of M-lead current. Maximum E-lead current drawn by the 9961E is 15mA at -52Vdc nominal input supply voltage.

3. installation

inspection

3.01 The 9961E Pulse Link Repeater subassembly should be visually inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the subassembly should be visually inspected again prior to installation.

mounting and connections

3.02 The 9961E subassembly makes physical and electrical connection to the host module via seven-pin connector *P1* and eight-pin connector *P2* located on the component side of the subassembly. Connector *P1* on the 9961E plugs into receptacle *J1* on the host module, and connector *P2* plugs into receptacle *J2*. The subassembly is further secured to the host module's printed circuit board by a standoff mounting. Connections to the subassembly and their corresponding pinouts on the host module are listed in table 2.

Caution: Connector *J1* on the 6461, 6462, 6971, and 6972 modules is a six-pin female connector; plug *P1* on the 9961E subassembly is a seven-pin male connector. Therefore, when mounting the 9961E subassembly on the 6461, 6462, 6971, or 6972 module, there will be an extra pin on *P1* that does not plug into *J1*. Ensure that this extra pin is at the top of *J1*, that is, toward the top of the host module.

lead designation	9961E connector pin	6461/6461R/6462 host module edge-connector pin
E LEAD (carrier)	P1-5	25
M LEAD (carrier)	P1-4	21
E1 LEAD (fac/trunk)	P2-1	3
M1 LEAD (fac/trunk)	P2-2	22
CT (cut-and-terminate)	P1-7	—
A	P2-8	9 (6461 only)
B	P2-7	7 (6461 only)
A1	P2-6	—
B1	P2-5	—
-22 to -56Vdc input	P1-6	39
GND (ground)	P1-1	1
unused	P1-2	—
unused	P1-3	—
unused	P2-3	—
unused	P2-4	—

table 2. Connections to 9961E subassembly via host module

options

3.03 No alignment of the 9961E subassembly is required. Before the subassembly is placed into service, however, one option switch must be set. The location of this switch on the subassembly is shown in figure 4.

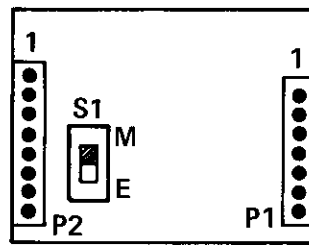


figure 4. Option switch location

3.04 Option switch *S1* selects either the E-lead-originate or M-lead-originate mode. Set *S1* to the *E* position for E-lead-originate (for use as a wiring protector). Set *S1* to the *M* position for M-lead-originate (for use as a pulse link repeater).

4. circuit description

4.01 This circuit description is intended to familiarize you with the 9961E Pulse Link Repeater subassembly for engineering and application purposes only. Attempts to troubleshoot the 9961E internally are not recommended (and are prohibited by FCC regulations in FCC-registered applications). Troubleshooting procedures should be limited to those prescribed in section 7 of this Practice. Refer to the block diagram, section 5 of this Practice, as an aid in understanding the circuit description.

carrier interface

4.02 The 9961E interfaces the carrier equipment with M-lead-originate E&M circuitry. The *M-lead driver* is a solid-state switch that provides negative-

battery and ground M-lead states toward the carrier equipment. A ground on the E lead from the carrier is detected by relay *K1*. Simultaneous idle states on the E and M leads are detected by the *CT-relay driver*, which operates the CT relay on the host module.

facility or trunk interface

4.03 The *E/M-lead detector* is an opto-coupled device that is switched via *S1* to a ground reference for M-lead detection or to negative battery for E-lead detection. The *E/M-lead detector* output controls the *M-lead driver* and *CT-relay driver*. The contacts of relay *K1* are reconfigured by *S1* to provide E-lead open and ground states (E-lead originate) or M-lead battery and ground states (M-lead originate).

6. specifications*E-lead signaling states*

idle: open, 75 kilohms minimum allowable resistance to ground

busy: ground, 2 kilohms maximum series resistance to ground

M-lead signaling states

idle: ground, 100mA maximum sourcing current

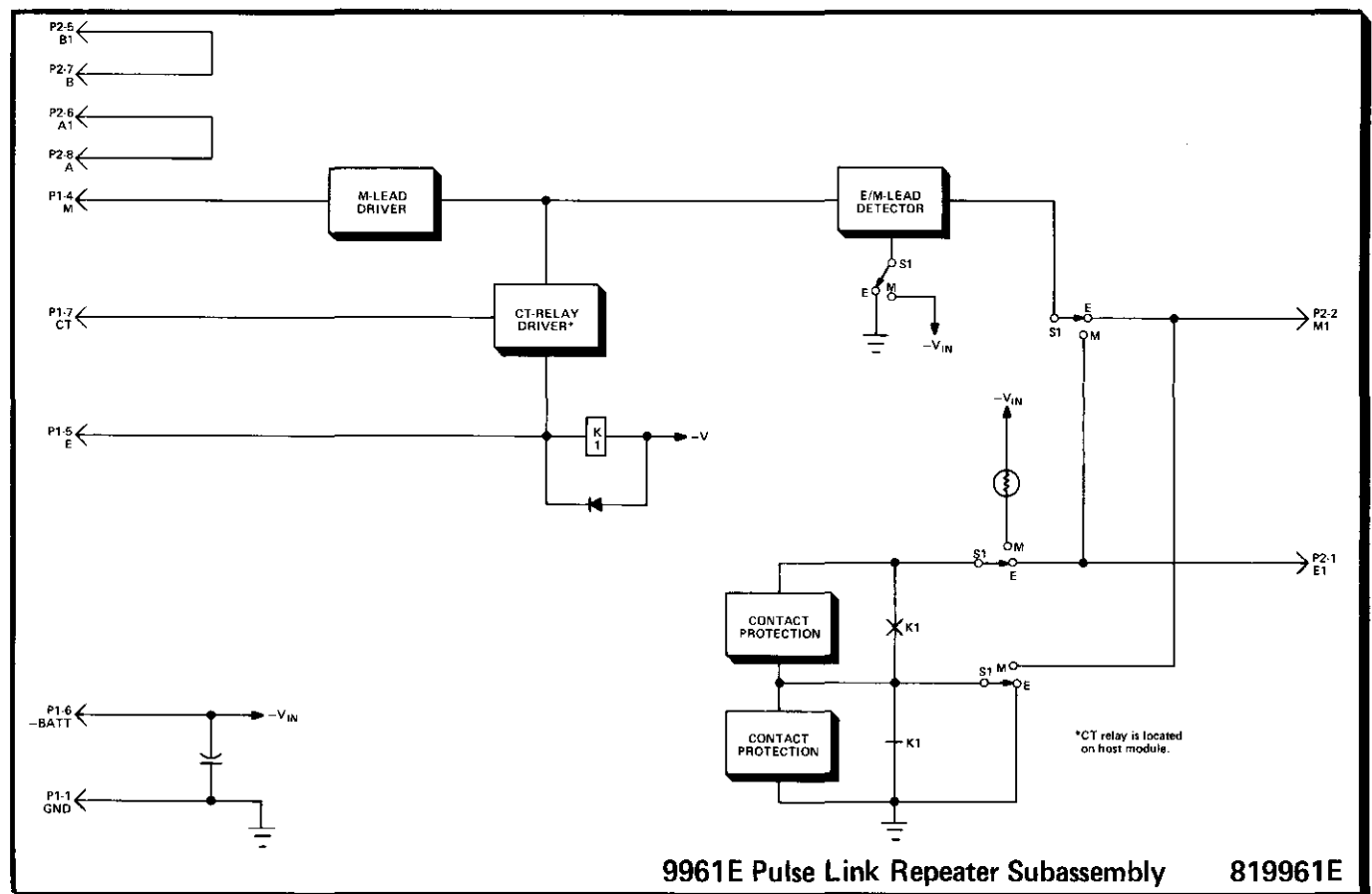
busy: negative battery, 100mA maximum sinking current

E1-lead signaling states

- *E-lead originate (S1 set to E position)*

idle: open, greater than 10 megohms resistance to ground

busy: ground, 500mA maximum noninductive load or 100mA maximum inductive load; 60Vdc maximum



9961E Pulse Link Repeater Subassembly

819961E

5. block diagram

- *M-lead originate (S1 set to M position)*
idle: open, 30 kilohms minimum allowable resistance to ground
busy: ground, 1 kilohm maximum series resistance to ground

M1-lead signaling states

- *E-lead originate (S1 set to E position)*
idle: ground, 30 kilohms maximum allowable resistance to ground
busy: negative battery, 1 kilohm maximum series resistance to battery
- *M-lead originate (S1 set to M position)*
idle: ground, 500mA maximum noninductive load or 100mA inductive load; 60Vdc maximum
busy: negative battery, 100mA maximum sinking current

pulse distortion

2 percent maximum

cut-and-terminate timing

attack: 20 milliseconds maximum

release: 120 milliseconds minimum

power requirements

voltage: -22 to -56Vdc, filtered, ground referenced

current: 40mA maximum at -52Vdc

operating environment

20° to 130° F (-7 to 54° C), humidity to 95% (no condensation)

dimensions

4.1 inches (10.4cm) high

1.2 inches (3.0cm) wide

5.1 inches (13.0cm) deep

weight

approximately 4 ounces (113g)

mounting

mounts on printed circuit board of the Tellabs 6461, 6461R, 6462, 6971, and 6972 modules via two male connectors on the 9961E and two receptacles on the host module

7. testing and troubleshooting

7.01 The *troubleshooting guide* in this section may be used to assist in the installation, testing, or troubleshooting of the 9961E Pulse Link Repeater subassembly. The *guide* is intended as an aid in the localization of trouble to a specific module or subassembly. If a unit is suspected of being defective, a new one should be substituted and the test conducted again. If the substitute unit operates correctly, the original unit should be considered defective and returned to Tellabs for repair or replacement. We strongly recommend that no internal (component-level) testing or repairs be attempted on the 9961E subassembly. Unauthorized testing or repairs may void the subassembly's warranty.

7.02 If a situation arises that is not covered in the *troubleshooting guide*, contact Tellabs Customer Service at your Tellabs Regional Office or at our Lisle, Illinois, or Mississauga, Ontario, Headquarters. Telephone numbers are as follows:

US central region: (312) 969-8800

US northeast region: (412) 787-7860

US southeast region: (305) 645-5888

US western region: (702) 827-3400

Lisle Headquarters: (312) 969-8800

Mississauga Headquarters: (416) 624-0052

7.03 If a 9961E is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is more expedient, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

7.04 To obtain a replacement 9961E subassembly, notify Tellabs via letter (see addresses below, telephone (see numbers above), or twx (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X9961E part number that indicates the issue of the subassembly in question. Upon notification, we shall ship a replacement 9961E to you. If the subassembly in question is in warranty, the replacement will be shipped at no charge. Pack the defective 9961E in the replacement subassembly's carton, sign the packing slip included with the replacement, and enclose it with the defective subassembly (this is your return authorization). Affix the preaddressed label provided with the replacement subassembly, to the carton being returned, and ship the subassembly prepaid to Tellabs.

repair and return

7.05 Return the defective 9961E subassembly, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs Incorporated

4951 Indiana Avenue

Lisle, Illinois 60532

In Canada: Tellabs Communications Canada, Ltd.

1200 Aerowood Drive, Unit 39

Mississauga, Ontario, Canada L4W 2S7

Enclose an explanation of the subassembly's malfunction. Follow your company's standard procedure with regard to administrative paperwork. Tellabs will repair the subassembly and ship it back to you. If the subassembly is in warranty, no invoice will be issued.

troubleshooting guide

trouble condition	steps toward solution
carrier cannot seize facility	<p>1. Connect VOM between pins 25 (+) and 39 (–) on the host module's card-edge connector. The measured voltage should be greater than 15Vdc. If it is not, verify: maximum E-lead series resistance not exceeded <input type="checkbox"/>; common ground between carrier and module <input type="checkbox"/>; common ground between carrier and module <input type="checkbox"/>; and wiring between carrier and module <input type="checkbox"/>.</p> <p>9961E optioned for M-lead originate</p> <p>2. If the voltage measured in step 1 is greater than 15Vdc, connect VOM between pins 22 (+) and 39 (–). The measured voltage should be less than 5Vdc. If it is, verify: wiring to facility equipment <input type="checkbox"/>; no faulty facility equipment <input type="checkbox"/>; and common ground between facility equipment and module <input type="checkbox"/>. If the measured voltage is greater than 5Vdc, proceed to step 3.</p> <p>3. Maintain VOM connections as in step 2. Remove the facility M1 lead from pin 22. If the measured voltage is now less than 5Vdc, verify that no shorts exist in facility wiring or equipment <input type="checkbox"/>. If the measured voltage is still greater than 5Vdc, replace 9961E and retest <input type="checkbox"/>.</p> <p>9961E optioned for E-lead originate</p> <p>4. If the voltage measured in step 1 is greater than 15Vdc, connect VOM between pins 3 (–) and 1 (+). The measured voltage should be less than 0.5Vdc. If it is, verify: wiring to facility equipment <input type="checkbox"/>; and common ground between facility equipment and module <input type="checkbox"/>. If the measured voltage is greater than 0.5Vdc, replace 9961E and retest <input type="checkbox"/>.</p>
facility permanently seized	<p>1. Remove the host module from its mounting-shelf position. If the facility is still seized, verify facility wiring and equipment <input type="checkbox"/>. If the facility is not seized after removing the host module, proceed to step 2.</p> <p>2. Reinstall the host module in its shelf position. Connect VOM between pins 25 (+) and 39 (–) on the host module's card-edge connector. The measured voltage should be less than 2.5Vdc. If it is not, verify that no leakage to ground exists in carrier wiring or equipment <input type="checkbox"/>. If the measured voltage is less than 2.5Vdc, verify 9961E optioning <input type="checkbox"/>. If the optioning is correct, replace 9961E and retest <input type="checkbox"/>.</p>
facility cannot seize carrier	<p>9961E optioned for M-lead originate</p> <p>1. Connect VOM between pins 3 (+) and 39 (–) on the host module's card-edge connector. The measured voltage should be greater than 17Vdc. If it is not, verify: maximum E1-lead series resistance not exceeded <input type="checkbox"/>; common ground between facility and module <input type="checkbox"/>; and wiring between facility and module <input type="checkbox"/>. If the measured voltage is greater than 17Vdc, proceed to step 3.</p> <p>9961E optioned for E-lead originate</p> <p>2. Connect VOM between pins 22 (–) and 1 (+) on the host module's card-edge connector. The measured voltage should be greater than 17Vdc. If it is not, verify: maximum M1-lead series resistance not exceeded <input type="checkbox"/>; common ground between facility and module <input type="checkbox"/>; and wiring between facility and module <input type="checkbox"/>.</p> <p>3. Connect VOM between pins 21 (+) and 39 (–). The measured voltage should be less than 9Vdc. If it is, verify: wiring to carrier equipment <input type="checkbox"/>; no faulty carrier equipment <input type="checkbox"/>; and common ground between carrier equipment and ground <input type="checkbox"/>. If the measured voltage is greater than 9Vdc, proceed to step 4.</p> <p>4. Maintain VOM connections as in step 3. Remove the carrier M lead from pin 21. If the measured voltage is now less than 9Vdc, verify that no shorts exist in carrier wiring or equipment <input type="checkbox"/>. If the measured voltage is still greater than 9Vdc, replace 9961E and retest <input type="checkbox"/>.</p>

troubleshooting guide continued on page 6

troubleshooting guide

trouble condition	steps toward solution
carrier permanently seized	<ol style="list-style-type: none"> 1. Remove the host module from its mounting-shelf position. If the carrier is still seized, verify carrier wiring and equipment <input type="checkbox"/>. If the carrier is not seized after removing the host module, reinstall the host module in its shelf position and proceed to step 2 for M-lead originate or step 3 for E-lead originate. <p>9961E optioned for M-lead originate</p> <ol style="list-style-type: none"> 2. Connect VOM between pins 3 (+) and 39 (–). The measured voltage should be less than 7Vdc. If it is not, verify that no leakage to ground exists in facility wiring or equipment <input type="checkbox"/>. If the measured voltage is less than 7Vdc, proceed to step 4. <p>9961E optioned for E-lead originate</p> <ol style="list-style-type: none"> 3. Connect VOM between pins 22 (–) and 1 (+). The measured voltage should be less than 7Vdc. If it is not, verify that no leakage to negative battery exists in facility wiring or equipment <input type="checkbox"/>. If the measured voltage is less than 7Vdc, proceed to step 4. 4. Connect VOM between pins 21 (–) and 1 (+). The measured voltage should be less than 2Vdc. If it is, verify that no shorts exist in carrier wiring or equipment <input type="checkbox"/>. If the measured voltage is greater than 2Vdc, remove the carrier M lead from pin 21. If the measured voltage is now less than 2Vdc, verify that no shorts exist in carrier wiring or equipment. If the measured voltage is still greater than 2Vdc, replace 9961E and retest <input type="checkbox"/>.
voice cannot be heard on receive transmission path	<ol style="list-style-type: none"> 1. Verify that the carrier and facility can be seized and released as described for the first four trouble conditions in this troubleshooting guide <input type="checkbox"/>. 2. Temporarily remove the facility connections from pins 41 and 43 on the host module's backplane. Connect the transmit portion of a transmission measuring set (TMS) arranged to send 1000Hz test tone at 0dBm to pins 41 and 43. Temporarily remove the carrier connections from pins 42 and 44. Connect the receive portion of the TMS arranged for appropriately terminated measurement to the host module's front-panel <i>rcv</i> test points. Set the front-panel <i>rcv</i> attenuator switches for 0dB loss. The measured level should be approximately –4.5dB. If it is, verify wiring to facility and carrier <input type="checkbox"/>. If the measured level is less than –4.5dB, replace 9961E and retest <input type="checkbox"/>. 3. If the measured level is still less than –4.5dB after replacing the 9961E, replace the host module and retest <input type="checkbox"/>.

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