

4408 4Wire Line Termination Module

contents

section 1	description and application	page 1
section 2	installation	page 2
section 3	circuit description	page 3
section 4	block diagram	page 4
section 5	specifications	page 3
section 6	testing and troubleshooting	page 3

1. description and application

1.01 The 4408 4Wire Line Termination module (figure 1) interfaces a 4wire private line with a voice-paging conference arrangement involving up to twenty 4wire station telephone sets and associated loudspeakers. To accomplish this interface, the 4408 provides transformer coupling in both the transmit and receive paths and level coordination (via fixed attenuation) in the transmit path. The 4408 also supplies adjustable sidetone to the 4wire conference telephones.

1.02 This practice section is revised to update the text portion of section 6.

1.03 A typical application of the 4408 module is shown in figure 2. On the facility (line) side of the 4408 is a 4wire line amplifier (e.g., a Tellabs 4001) that provides facility impedance matching, gain, and optional amplitude equalization. On the terminal (drop) side of the 4408 are from 1 to 20 Tellabs 4409 Pickup Relay and Station Circuit Modules, each of which interfaces and provides talk battery to one 4wire station telephone. Each 4409 is also connected to a voice-paging loudspeaker (e.g., a Tellabs 9791) except in cases where two or more station telephones are in close proximity and can share one loudspeaker. At the distant end of the 4wire private line is a 4wire station telephone (with an associated loudspeaker if two-way voice paging is required) or, more commonly, another voice-paging conference arrangement involving two or more 4wire station telephones and associated loudspeakers.

1.04 Going off-hook at any station in the circuit seizes the circuit for broadcasting a message through the loudspeakers at all other stations at both ends of the circuit. When a station goes off-hook in response to a received loudspeaker page, the pickup relays in that station's 4409 module operate to connect the station to the circuit and to mute its associated loudspeaker for as long as the station is off-hook. This type of circuit is commonly referred to as a hoot 'n' holler, yell-down, or junkyard circuit.

1.05 Transformers in the 4408's transmit and receive paths provide 600-ohm impedance on the line side and low impedance on the drop side. This impedance transformation minimizes level changes

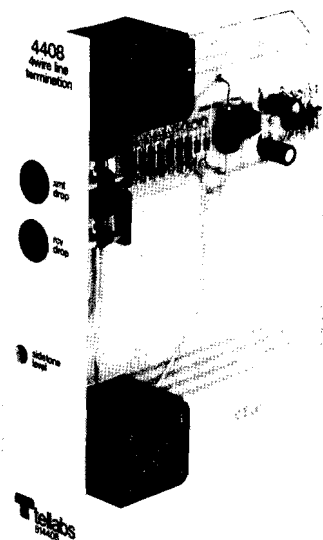


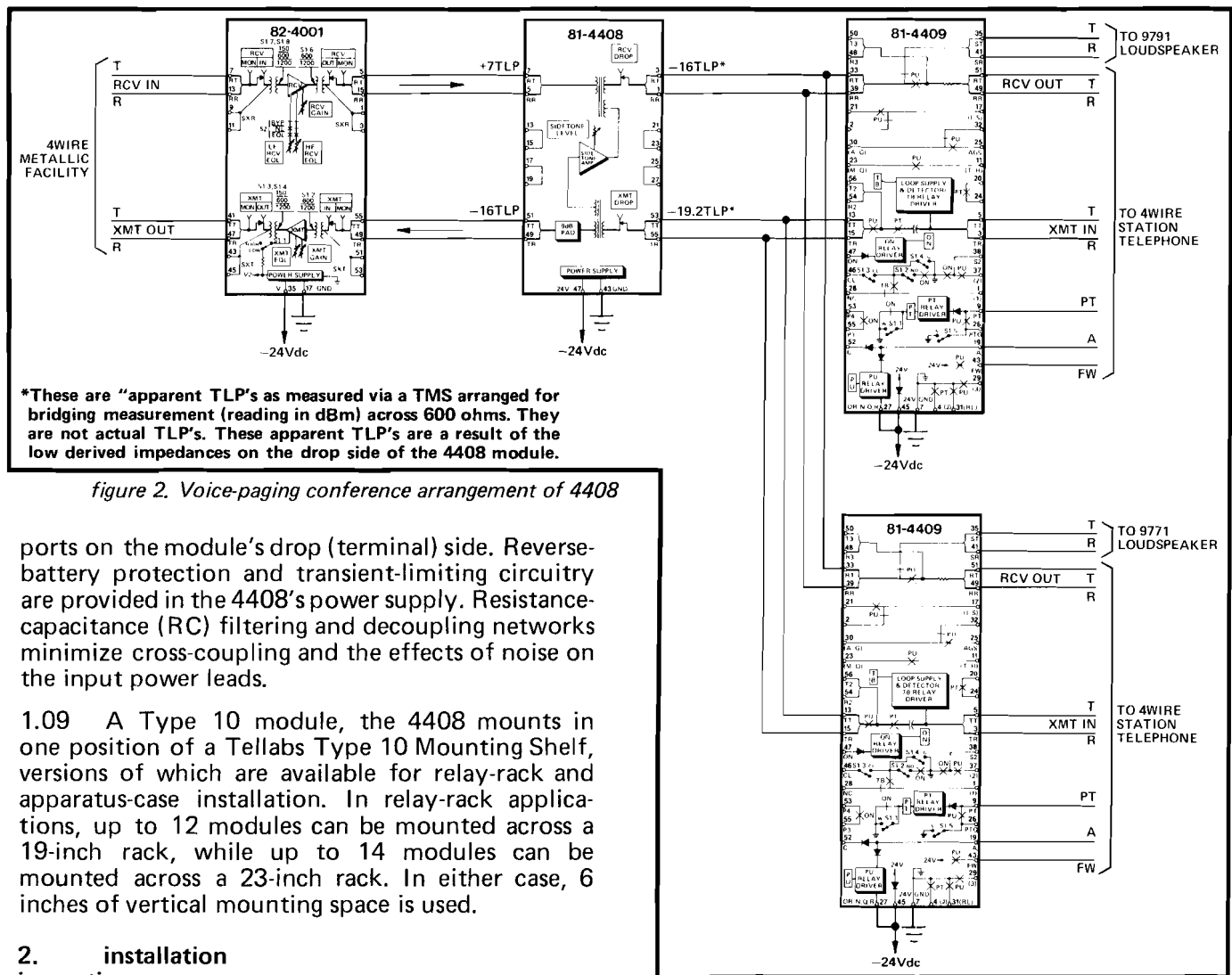
figure 1. 4408 4Wire Line Termination Module

caused by conference stations going on-hook and off-hook. In addition, the transformers provide insertion loss for coordinating standard -16 transmit and +7 receive transmission level points (TLP's) on the 4408's line side with the required drop-side levels. The receive-path transformer provides 23dB of insertion loss, which is the exact amount required. The transmit-path transformer provides 7dB of insertion loss. To obtain the required 16dB of transmit insertion loss, a 9dB pad is used.

1.06 The 4408's sidetone amplifier allows the user of each 4wire station telephone to hear his or her own voice (at a low level) through the receiver of the same telephone, just as he or she would with a conventional 2wire telephone. The sidetone amplifier also makes conferencing possible by allowing each station on the 4408's drop side to communicate with all other drop-side stations as well as with the stations at the distant end of the circuit. Sidetone-path loss (transmit drop to receive drop) at 1000Hz is continuously adjustable from 13 to greater than 60dB by means of a front-panel control.

1.07 Also located on the 4408's front panel are two drop-side opening jacks, one in the transmit channel and the other in the receive channel, for isolated-module measurement of transmit-drop, receive-drop, and sidetone levels.

1.08 An integral power supply in the 4408 permits operation on -21 to -28Vdc filtered, ground-referenced input. Maximum current requirements range from 3mA at idle to 10mA when active (at -24Vdc). Surge protection is provided at both



ports on the module's drop (terminal) side. Reverse-battery protection and transient-limiting circuitry are provided in the 4408's power supply. Resistance-capacitance (RC) filtering and decoupling networks minimize cross-coupling and the effects of noise on the input power leads.

1.09 A Type 10 module, the 4408 mounts in one position of a Tellabs Type 10 Mounting Shelf, versions of which are available for relay-rack and apparatus-case installation. In relay-rack applications, up to 12 modules can be mounted across a 19-inch rack, while up to 14 modules can be mounted across a 23-inch rack. In either case, 6 inches of vertical mounting space is used.

2. installation inspection

2.01 The 4408 4Wire Line Termination module 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 module should be visually inspected again prior to installation.

mounting

2.02 The 4408 module mounts in one position of the Tellabs Type 10 Mounting Shelf, which is available in configurations for relay-rack and apparatus-case installation. The module plugs physically and electrically into a 56-pin connector at the rear of its module position in the Type 10 Shelf.

installer connections

2.03 Before making any connections to the mounting shelf, make sure that power is **off** and modules are **removed**. Modules should be put into place only **after** they are properly optioned and **after** wiring is completed.

2.04 Table 1 lists external connections to the 4408 module. All connections are made via wire wrapping to the 56-pin connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the connector.

connect:

to pin:

TT1 (line transmit output tip)	51
TR1 (line transmit output ring)	49
RT1 (line receive input tip)	7
RR1 (line receive input ring)	5
TT (drop transmit input tip)	53
TR (drop transmit input ring)	55
RT (drop receive output tip)	3
RR (drop receive output ring)	1
-24Vdc (nominal -24Vdc filtered input)	47
GND (ground)	43
internal jumper	13 to 15
internal jumper	17 to 19
internal jumper	21 to 23
internal jumper	25 to 27

table 1. External connections to 4408

optioning and alignment (sidetone level)

2.05 The 4408 module contains no option switches and therefore requires no optioning. Alignment of the 4408 consists simply of adjusting the sidetone level. To obtain the commonly preferred sidetone level, proceed as follows:

A. Arrange the transmit portion of a transmission measuring set for 1000Hz tone output at

0dBm into 600 ohms. Connect this signal to the 4408's *xmt drop* jack.

B. Arrange the receive portion of the TMS for 600-ohm terminated measurement and connect it to the 4408's *rcv drop* jack.

C. Adjust the *sidetone level* control until a TMS reading of -16dBm is achieved.

Note: To completely disable the *sidetone amplifier* so that no *sidetone* is present, adjust the *sidetone level* control fully counterclockwise.

3. circuit description

3.01 This circuit description is intended to familiarize you with the 4408 4Wire Line Termination module for engineering and application purposes only. Attempts to troubleshoot the 4408 internally are not recommended and may void your warranty. Troubleshooting procedures should be limited to those prescribed in section 6 of this Practice. Please refer to the associated functional block diagram, section 4 of this Practice, as an aid in understanding this circuit description.

3.02 Two transformers, one in the 4408's transmit path and the other in the receive path, lower the impedances on the module's drop side from those on the line side. In the transmit channel, line-side impedance is 600 ohms while drop-side impedance is 35 ohms. In the receive channel, line-side impedance is 600 ohms while drop-side impedance is 4 ohms.

3.03 The 4408's two transformers also provide level coordination through attenuation that results from the impedance transformations in the transmit and receive paths. The receive-path transformer attenuates the receive input level by the required 23dB. The transmit-path transformer attenuates the transmit input level by 7dB. Thus, to achieve the required 16dB of transmit-path attenuation, a *9dB pad* is used.

3.04 The 4408's *sidetone amplifier* is an operational amplifier that not only provides gain but also derives a voice transmission path between the module's transmit and receive paths. The amount of gain provided is adjusted via a front-panel *sidetone level* potentiometer.

3.05 The *power supply* in the 4408 is a series voltage regulator that uses a zener diode between input battery and ground to limit high-level supply transients to a safe level. A series diode in the input battery lead protects the circuit against reversed input power connections, and electrolytic capacitors provide filtering and decoupling.

5. specifications

receive channel

impedance, line side (rcv in port)
600 ohms, balanced

impedance, drop side (rcv out port)

4 ohms, balanced

frequency response

$\pm 1\text{dB}$, 300 to 4000Hz, re 1000Hz

insertion loss

$23 \pm 1\text{dB}$ at 1000Hz, measured with 600-ohm termination on both line and drop sides

transmit channel

impedance, line side (xmt out port)

600 ohms, balanced

impedance, drop side (xmt in port)

35 ohms, balanced

frequency response

$\pm 1\text{dB}$, 300 to 4000Hz, re 1000Hz

insertion loss

16dB at 1000Hz, measured with 600-ohm termination on both line and drop sides

common specifications

sidetone frequency

300 to 4000Hz

sidetone-path loss (transmit drop to receive drop)

13dB to greater than 60dB at 1000Hz, continuously adjustable via front-panel control

echo return loss

20dB minimum

input voltage

-21 to -28Vdc , filtered, ground referenced

input current

3mA maximum at idle, 10mA maximum when active, both at -24Vdc input

operating environment

20° to 130°F (-7° to $+54^\circ\text{C}$), humidity to 95% (no condensation)

dimensions

5.58 inches (14.17cm) high

1.42 inches (3.61cm) wide

5.96 inches (15.14cm) deep

weight

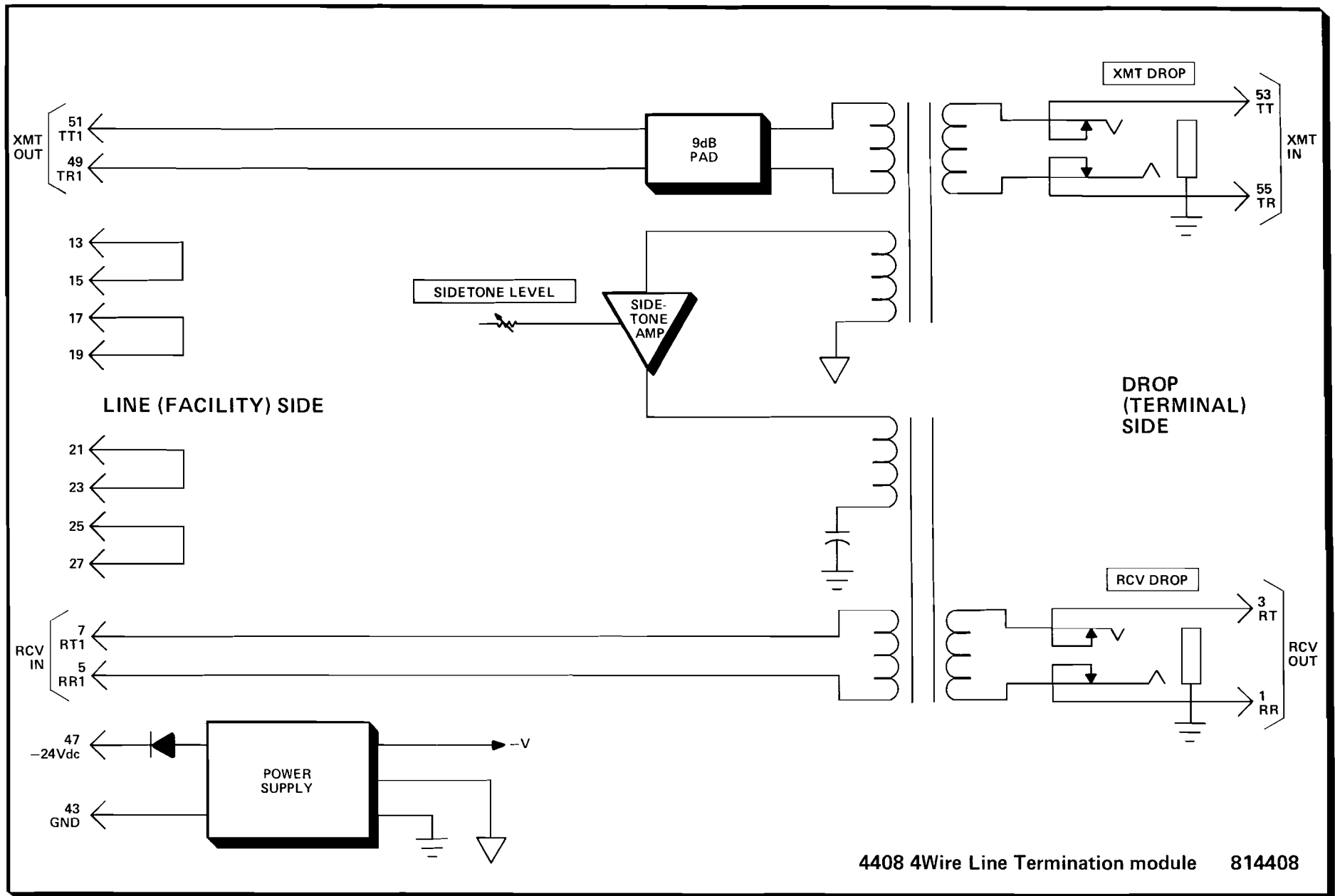
8 ounces (227 grams)

mounting

relay rack or apparatus case via one position of Tellabs Type 10 Mounting Shelf

6. testing and troubleshooting

6.01 The **testing guide checklist** in this section may be used to assist in the installation, testing, or troubleshooting of the 4408 4Wire Line Termination module. The checklist is intended as an aid in the localization of trouble to this specific equipment. If the equipment is suspected of being defective, substitute new equipment (if possible) and conduct the test again. If the substitute operates correctly, the original should be considered defective and returned to Tellabs for repair or replacement as directed below. We strongly recommend that no internal (component-level) testing or repairs be attempted on the equipment. Unauthorized testing or repairs



4. block diagram

testing guide checklist

Note: The tests in this checklist verify operation of the 4408 independently of associated equipment in the circuit (e.g., line amp and 4409 modules). Therefore, if the 4408 passes these tests but the circuit still does not operate properly, the associated equipment must be checked.

test	test procedure	normal result	if normal conditions are not met, verify:
transmit-path transmission continuity	Arrange transmit portion of transmission measuring set (TMS) for 1000Hz tone output at 0dBm into 600 ohms. Connect this signal to 4408's <i>xmt drop</i> jack. Temporarily disconnect line-side line amp from circuit. Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to 4408's transmit output port (pins 51 and 49).	TMS indicates -16dBm <input type="checkbox"/> .	Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Replace module and retest <input type="checkbox"/> .
receive-path transmission continuity	Arrange transmit portion of TMS as directed for preceding test. With line-side line amp still disconnected, connect this signal to 4408's receive input port (pins 7 and 5). Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to 4408's <i>rcv drop</i> jack.	TMS indicates -23dBm <input type="checkbox"/> .	Same as above <input type="checkbox"/> .
sidetone	Reconnect line-side amp to circuit. Arrange transmit portion of TMS as directed for preceding tests. Connect this signal to 4408's <i>xmt drop</i> jack. Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to 4408's <i>rcv drop</i> jack.	With <i>sidetone level</i> control adjusted as directed in section 2 of this Practice, TMS indicates -16dBm <input type="checkbox"/> . With <i>sidetone level</i> control fully clockwise, TMS indicates -13dBm <input type="checkbox"/> . With <i>sidetone level</i> control fully counterclockwise, TMS indicates -60dBm or lower <input type="checkbox"/> .	Same as above <input type="checkbox"/> .

testing guide checklist

Note: The tests in this checklist verify operation of the 4408 independently of associated equipment in the circuit (e.g., line amp and 4409 modules). Therefore, if the 4408 passes these tests but the circuit still does not operate properly, the associated equipment must be checked.

test	test procedure	normal result	if normal conditions are not met, verify:
transmit-path transmission continuity	Arrange transmit portion of transmission measuring set (TMS) for 1000Hz tone output at 0dBm into 600 ohms. Connect this signal to 4408's <i>xmt drop</i> jack. Temporarily disconnect line-side line amp from circuit. Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to 4408's transmit output port (pins 51 and 49).	TMS indicates -16dBm <input type="checkbox"/> .	Power <input type="checkbox"/> . Wiring <input type="checkbox"/> . Replace module and retest <input type="checkbox"/> .
receive-path transmission continuity	Arrange transmit portion of TMS as directed for preceding test. With line-side line amp still disconnected, connect this signal to 4408's receive input port (pins 7 and 5). Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to 4408's <i>rcv drop</i> jack.	TMS indicates -23dBm <input type="checkbox"/> .	Same as above <input type="checkbox"/> .
sidetone	Reconnect line-side amp to circuit. Arrange transmit portion of TMS as directed for preceding tests. Connect this signal to 4408's <i>xmt drop</i> jack. Arrange receive portion of TMS for 600-ohm terminated measurement and connect it to 4408's <i>rcv drop</i> jack.	With <i>sidetone level</i> control adjusted as directed in section 2 of this Practice, TMS indicates -16 dBm <input type="checkbox"/> . With <i>sidetone level</i> control fully clockwise, TMS indicates -13dBm <input type="checkbox"/> . With <i>sidetone level</i> control fully counterclockwise, TMS indicates -60dBm or lower <input type="checkbox"/> .	Same as above <input type="checkbox"/> .