Addendum: 6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater

1. general

1.01 This addendum to practice section 816125G, revision A, is issued to correct the following errors in the practice:

- The tone frequencies sent by the module, as referenced throughout the practice.
- The explanation of MTU TEST operation in paragraph 2.53, where the FOUR-TONE MTU AND TRANSPONDER TEST diagnostic mode is covered in detail.
- Note 2 following paragraph 4.02, which explains how to exit any diagnostic or alignment mode at any time.
- The note in step 4 of table 21, which briefly summarizes MTU TEST operation in the FOUR-TONE MTU AND TRANSPONDER TEST diagnostic mode.
- The **protocol overview flowchart,** section 5 of the practice.
- The *ringing-voltage detection threshold* specification in section 7 of the practice. (Please note that this correction involves the addition of one new specification, *ringing-signal frequency detection range.*)
- The input-current portion of the *input power requirements* specification in section 7 of the practice.

1.02 This addendum section is revised to add the corrected input-current specification.

2. corrections

corrected tone frequencies

2.01 Contrary to what is stated throughout the 6125G practice, the tone frequencies actually sent by the module during alignment and diagnostics are as follows:

- **1013Hz** rather than 1014Hz (in response to CTC tone of 1004Hz).
- **2800Hz** rather than 2804Hz (in response to CTC tone of 2804Hz).
- **413Hz** rather than 414Hz (in response to CTC tone of 404Hz).
- **1819Hz** rather than 1810Hz (in response to CTC tone of 1804Hz).

corrected explanation of MTU TEST operation in paragraph 2.53

2.02 Paragraph 2.53 of the 6125G practice is incorrect with regard to module operation during the MTU TEST portion of the FOUR-TONE MTU AND TRANSPONDER TEST diagnostic mode, as explained in the first half of the paragraph. That part of the paragraph should read as follows:

> 2.53 The FOUR-TONE MTU AND TRANSPONDER TEST diagnostic mode can be used to analyze the facility from a distant location. This mode is entered (from the PROGRAM mode) by sending 804Hz tone or DTMF code #5 to the module. The 6125G responds by entering the MTU TEST portion of the mode, in which the module sends a 4-tone cycle consisting of 413, 1013, 1819, and 2800Hz, with each frequency held for 15 seconds. If #5 was sent, this cycle takes place once, and the module then provides a quiet-line termination for 20 minutes. If 804Hz was sent, the cycle repeats until the 804Hz tone is removed. The module then completes its current 4-tone cycle and provides a quiet-line termination for 20

minutes. As an alternative to the quiet-line termination, the CTC can remove its 804Hz tone and then send 404, 1004, 1804, or 2804Hz tone. Receipt of any of these tones causes the 6125G to enter the TRANSPONDER TEST portion of the mode, in which the module responds to each tone received by generating and returning a corresponding tone: 413, 1013, 1819, or 2800Hz, respectively. If LOCAL....(The remainder of the paragraph in the practice is correct as written.)

corrected note following paragraph 4.02 on exiting alignment and diagnostic modes

2.03 Note 2 following paragraph 4.02 of the 6125G practice is incorrect with regard to returning the module to the PROGRAM mode. The note should read as follows:

> **Note:** *To exit any alignment or diagnostic mode at any time, simply send 2713Hz for 10 seconds to return to idle. In all modes except LOCAL, LOCAL PLUS, AUTO, and LOOPBACK, sending DTMF code ## also returns the 6125G to idle. In all* **diagnostic** *modes except LOOPBACK, sending DTMF code #4 returns the 6125G to the PROGRAM mode.*

corrected note in table 21 summarizing MTU TEST operation

2.04 In table 21 in section 4 of the 6125G practice, the note in step 4 is incorrect with regard to MTU TEST operation of the module. The note should read as follows:

> **Note:** *Four-tone sequence takes place* **once** *if DTMF code #5 is sent or repeats for as long as 804Hz tone is sent. When sequence ceases (either after one cycle following the sending of #5 or upon removal of 804Hz tone), module provides a quiet-line termination and then goes idle.*

corrected protocol overview flowchart

2.05 In the **protocol overview flowchart,** section 5 of the 6125G practice, the module is shown as returning to the PROGRAM mode upon completion of LOCAL, LOCAL PLUS, and AUTO alignment. In reality, the module goes into LOOPBACK upon completion of LOCAL or LOCAL PLUS alignment and goes idle upon completion of AUTO alignment. Therefore, please refer to the corrected **protocol overview flowchart** in this addendum rather than to the erroneous flowchart in the practice.

corrected specifications

2.06 In the **specifications,** section 7 of the 6125G practice, the *ringing-voltage detection threshold* specification under the heading **2wire loop conditions and supervisory limits, FXO operation,** is incorrect. Also, one additional specification is missing. The corrected specification and missing specification should read as follows:

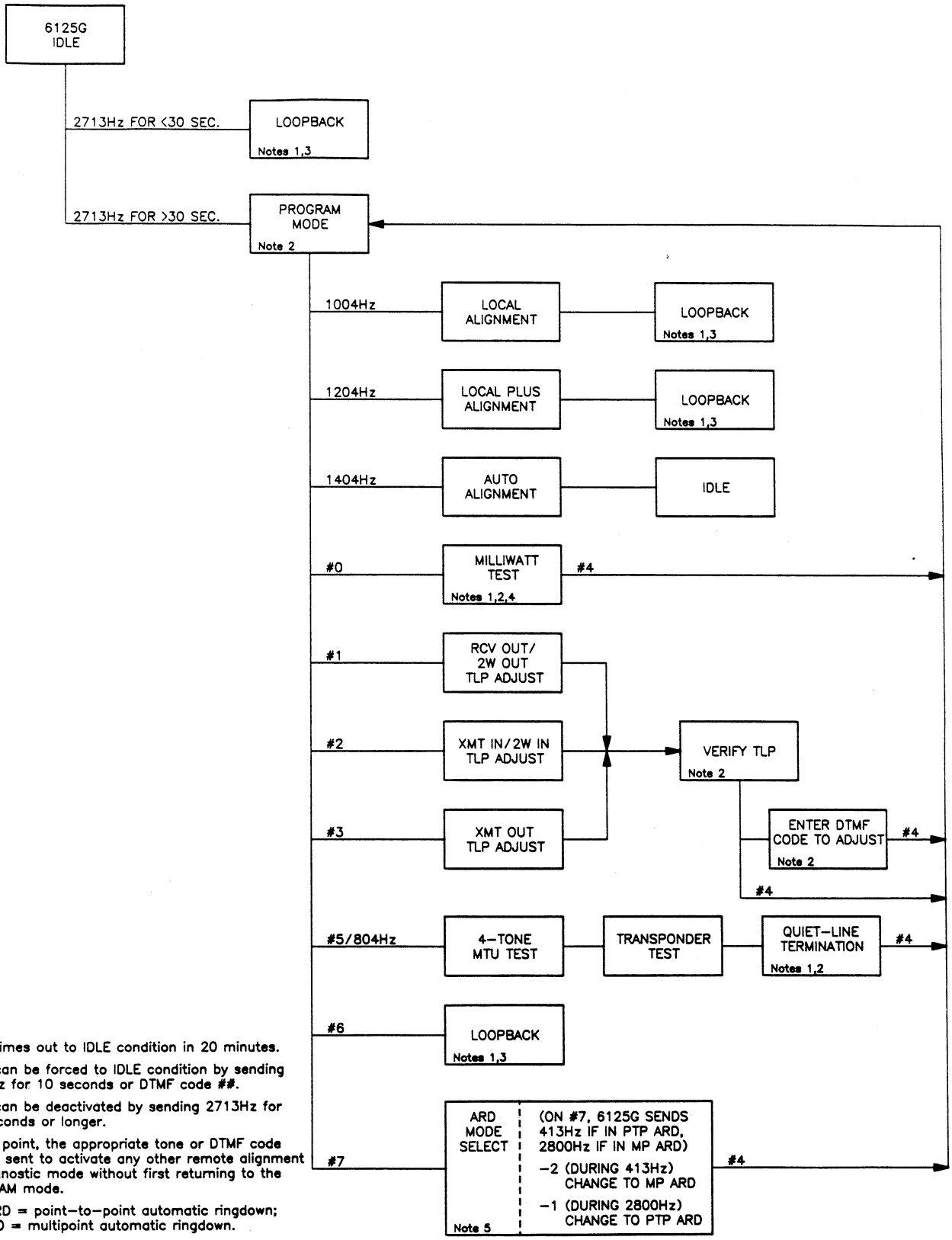
> *ringing-voltage detection threshold*
> **65Vrms**
>
> *ringing-signal frequency detection range*
> **15 to 34Hz**

2.07 Also in the **specifications,** the input-current portion of the *input power requirements* specification is in error. It should read as follows:

> *current: 110mA maximum at idle, 140mA maximum when busy, not including loop current in FXS and ARD operation*

miscellaneous

2.08 Please be aware that the area code for Tellabs headquarters in Lisle, IL, is changed to 708 (formerly 312, as stated in section 8 of the 6125G practice). The headquarters telephone number, however, remains the same: 969-8800. Also, the telephone number for the Tellabs Central Region Office is changed to (708)505-7800 (formerly (312)357-7400).



Note 1: Mode times out to IDLE condition in 20 minutes.

Note 2: Mode can be forced to IDLE condition by sending 2713Hz for 10 seconds or DTMF code ##.

Note 3: Mode can be deactivated by sending 2713Hz for 1.2 seconds or longer.

Note 4: At this point, the appropriate tone or DTMF code can be sent to activate any other remote alignment or diagnostic mode without first returning to the PROGRAM mode.

Note 5: PTP ARD = point-to-point automatic ringdown; MP ARD = multipoint automatic ringdown.

5. protocol overview flowchart

tellabs

6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater

Practice Section 816125G

IMPORTANT NOTE: *In this practice, personnel conducting remote alignment and diagnostics are instructed to send certain DTMF tone codes consisting of two or three digits. Please be aware that in addition to numeric digits 1 through 0, these codes may contain DTMF keypad "digits" * and #.*

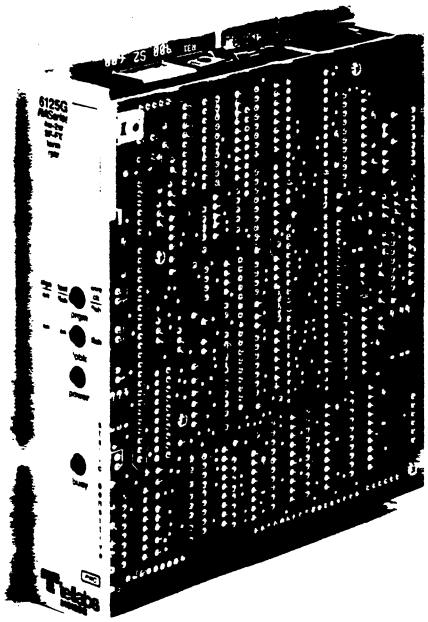


figure 1. 6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater module

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Technical Manual 76.816125G, Revision A, 7/89

1. general description

overview

1.01 The 6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater module (figure 1) provides transmission and signaling interface between a 4wire facility that uses 2600Hz single-frequency (SF) signaling and a 2wire metallic link that uses either foreign-exchange station-end (FXS), foreign-exchange office-end (FXO), or automatic ringdown (ARD) loop signaling.The FXS and FXO signaling modes are normally used at the station-equipment and switching-equipment (office) ends, respectively, of foreign-exchange (FX) and off-premises-station (OPS) circuits. On these circuits and on ARD circuits, the 6125G provides bidirectional signaling conversion, active level control and amplitude equalization in one or both channels (transmit and receive), and impedance matching on the facility side. The primary feature of the 6125G (a Type 10 module) is its remote diagnostic, and troubleshooting capabilities. In remote alignment, both transmission levels and amplitude equalization are set automatically from a remote central test center (CTC). This alignment takes place at transmission level points, or TLP's (0dBm0), referenced to +5dBm.

1.02 In the event that this practice section is revised or reissued, the reason for revision or reissue will be stated in this paragraph.

diagnostic, alignment, and optioning modes

1.03 The 6125G offers a choice of five diagnostic modes and seven alignment and optioning modes. The five **diagnostic modes** are as follows:

- LOOPBACK, which is used to test both the receive and transmit pairs of the facility and the transmission and signaling circuitry of the 6125G. The LOOPBACK mode (2713Hz tone-activated) provides equal-level transmission loopback for circuits with up to 23dB of difference in drop-side receive and transmit transmission levels and times out automatically after 20 minutes if a second 2713Hz tone is not received.

- WIRING CHECK, which allows the installer of the 6125G to quickly and easily verify that all wiring connections are properly made. This is done simply by depressing a front-panel pushbutton and verifying the presence of specific tones. A 1-hour timeout period is provided for this mode, and the timeout period can be overridden remotely by sending 2713Hz tone for 10 seconds.

- FOUR-TONE MTU AND TRANSPONDER TEST, in which the 6125G generates and returns any of four test frequencies —1014, 2804, 414, and/or 1810Hz—in response to tones received from the CTC. The module then provides a quiet-line termination for 20 minutes.

- MILLIWATT TEST, which allows CTC personnel to remotely initiate the transmission of 1014Hz at 0.0dBm from the 6125G. This establishes a benchmark level from which to determine the TLP's at the 6125G's ports.

1.04 The seven **alignment and optioning modes** are as follows:

- LOCAL, which is used when the 6125G's receive level and receive (post-) equalization are to be aligned from a CTC for end-link circuits.

- LOCAL PLUS, which is an enhancement of the LOCAL mode in that it automatically aligns the transmit level and (pre-) equalization in addition to the receive level and equalization for end-link circuits.

- AUTO, which is used to align the receive levels and equalization at both ends of a point-to-point circuit. In this mode, a second 6125G (or equivalent) must be present at the distant end of the facility.

- 2W OUT TLP, which remotely sets the outgoing transmission interface level at the 6125G's terminal-side 2wire port.

- 2W IN TLP, which remotely sets the incoming transmission interface level at the 6125G's terminal-side 2wire port.

- XMT OUT TLP, which remotely sets the outgoing transmission interface level at the 6125G's facility-side transmit output port.

- ARD MODE SELECT, which allows CTC personnel to remotely select either **point-to-point** or **multipoint** automatic ringdown (ARD) operation when the module is switch-optioned for ARD operation.

1.05 Upon completion of the selected alignment mode, the 6125G acknowledges the correct settings of its level and equalization circuitry by sending confirmation tone. If, however, C5 attenuation distortion limits are not met, error tone is sent, and the module defaults to the best possible settings under the circumstances. Thus, less-than-optimum circuit performance and subsequent alignment settings that result in error tone being sent **do not inhibit module operation.**

additional features

1.06 Additional features of the 6125G are summarized below:

- Integral 2600Hz SF tone oscillator.

- Switch-selectable FXS or FXO signaling operation.

- Switch-selectable ARD operation when FXS signaling is selected.

- Switch-selectable loop-start or ground-start operation.

- Interrupted ringing (via integral interrupter circuitry) in ARD operation.

- Minimum-break transmit pulse correction in FXS operation.

- Full precision receive pulse correction in FXO operation.

- Loop-current limiting.

- Alignment performed at 1004, 2804, 404, and 1804Hz.

- Capability of aligning with three tones only (1004, 2804, and 404Hz).

- Alignment and diagnostic modes selected remotely by tone frequency sent to module. Tones used are either of one frequency or standard DTMF tones, depending upon the mode desired.

- Capability of aligning facilities with up to 15dB of 1004Hz loss.
- Capability of providing up to C5 attenuation distortion conditioning.
- Capability of exiting any diagnostic or alignment mode by sending 2713Hz for 10 seconds.
- Automatic entry into LOOPBACK mode after all alignment modes except AUTO, with AUTOMATIC loopback timeout after 20 minutes unless a second 2713Hz tone is sent prior to timeout to force LOOPBACK deactivation.
- Storage of all level and equalization settings indefinitely in nonvolatile memory.
- Security: The 6125G must receive a specific set of tones with precise levels, frequencies, and durations for alignment to take place. the original settings are maintained if, for any reason, alignment is not completed.
- Preset transmission interface TLP's (alterable after remote alignment):

  — 2wire output, −4TLP in FXS or FXO operation and −10TLP in ARD operation.

  — 2wire input, 0TLP.

  — transmit output, +5TLP except in LOCAL PLUS alignment, where the transmit output TLP is varied as needed for a −9 receive TLP at the distant serving CO.
- Receive input and transmit output level ranges: −16 to +7TLP.
- 2wire input and output level range: −16 to +7TLP.
- Automatic adjustment of internal SF tone TLP's.
- Variable slope or bump-type amplitude equalization in the receive path (LOCAL, LOCAL PLUS, and AUTO alignment) and also in the transmit path (LOCAL PLUS alignment only).
- Transformer coupling at all three transmission ports.
- Balanced, switch-selectable 1200, 600, or 150-ohm terminating impedances at the facility-side ports (receive input and transmit output).
- Balanced, switch-selectable 900 or 600-ohm terminating impedance in series with 2.15μF at the terminal-side 2wire port.
- Power-up self-diagnostics with pass/fail indication.
- Manual (local) loopback activation and deactivation capability via a manual loopback lead and a manual loopback ground lead available at the module's card-edge connector.

- Front-panel power-on, loopback, program, and circuit-busy indicator LED's.
- Operation on −44 to −52Vdc input power.
- Type 10 module packaging for mounting in a variety of Tellabs Type 10 Mounting Shelves, which are available in versions for relay-rack (occupying 6 inches of vertical rack space) and apparatus-case installation. The module can also be mounted in a prewired Tellabs 262G-series NCTE/DST Mounting Assembly.

2. application

general

overview

2.01 The 6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater module is used in FX and OPS applications where a 4wire SF signaling facility must interface a 2wire metallic FXS or FXO signaling link. The module is also used in applications where a 4wire SF signaling facility must interface a 2wire metallic ARD signaling link. In FXS applications, the 2wire link (metallic loop) is typically terminated in station equipment or a PBX trunk circuit. In FXO applications, the 2wire link is typically terminated in a PBX line circuit or a CO switch. In ARD applications, the 2wire link is typically terminated in a station telephone set. Typical FXO and FXS applications of the 6125G are shown in figures 2 and 3. In these and other 6125G applications, coordination between field-installation personnel and central-test-center (CTC) personnel is often difficult. Typically, one person must wait for the other person to return or to complete another task before the circuit can be aligned. This waiting time is unproductive and therefore costly. The 6125G allows an installer to finish the physical installation, leave the site, and move on to another installation site without the involvement of CTC personnel. The CTC personnel can then align the circuit at their convenience.

2.02 In addition, because the need for reoptioning and/or realignment sometimes arises on in-service circuits, attention to such circuits is often required after installation. This means dispatching a person to the site. Because of its remote alignment and optioning capabilities, however, the 6125G can either eliminate or greatly reduce the need for subsequent trips to the customer premises, resulting in additional cost savings.

2.03 When used in its intended application, the 6125G provides the necessary signaling conversion, level coordination, amplitude equalization, and impedance matching to interface a 4wire SF signaling facility with a 2wire FXS, FXO, or ARD signaling link. Microprocessor-based alignment circuitry allows the 6125G to be aligned from the distant end of the facility. Furthermore, the 6125G's FOUR-TONE MTU AND TRANSPONDER TEST mode, in conjunction with its remote (tone-activated/deactivated) LOOPBACK circuitry, allows the facility to be checked from the distant location after alignment is completed.

2.04 The 6125G can satisfactorily adjust the gain and equalization on virtually any cable—nonloaded, loaded, or mixed—to meet up to C5 attenuation distortion specifications. The 6125G can adjust for as much

as 15dB of cable loss at 1004Hz. For up to C5 conditioning, a cable-gauge/maximum-distant chart (table 1) is provided below. The 6125G's receive input, transmit output, and 2wire input and output level ranges are −16 to +7TLP except for the transmit output port in the LOCAL PLUS mode, whose output level range is −9 to +5TLP.

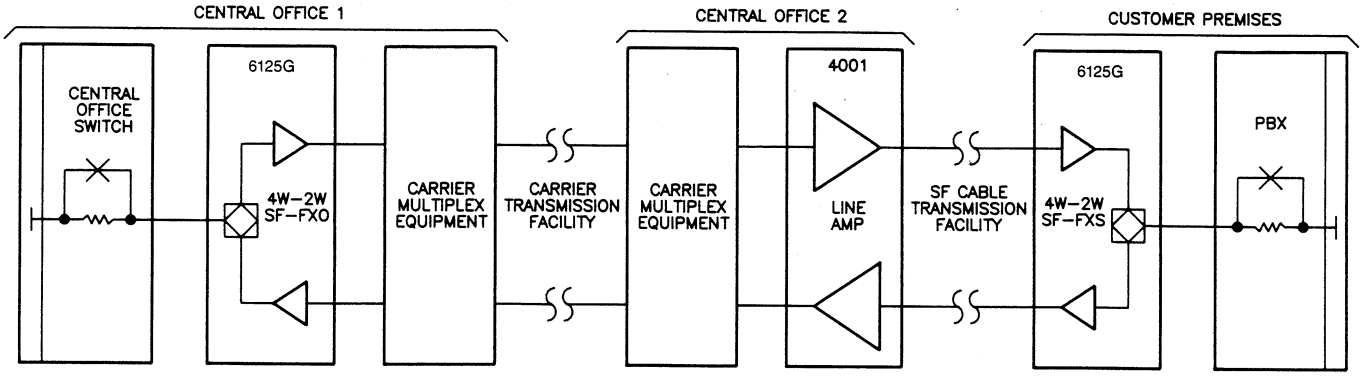


figure 2. Typical foreign-exchange (FX) application of 6125G

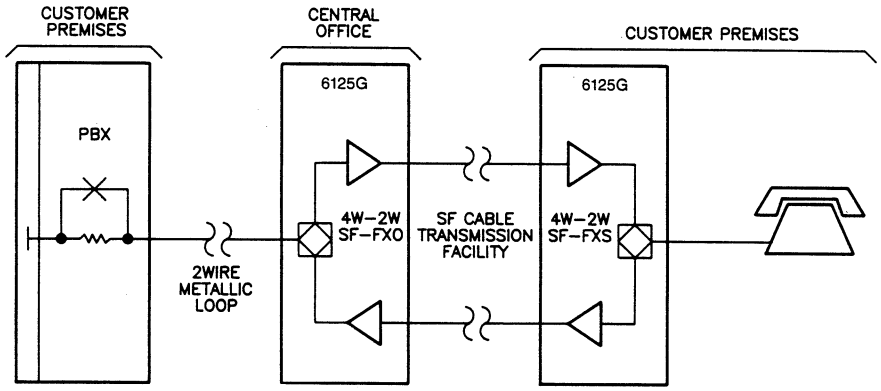


figure 3. Typical off-premises-station (OPS) application of 6125G

cable gauge	max. distance for nonloaded cable	max. distance for loaded H88 cable
19	54kft	150kft
22	40kft	84kft
24	32kft	54kft
26	24kft	36kft

table 1. Maximum cable lengths for 6125G remote alignment to meet up to C5 attenuation distortion specifications in receive path

2.05 In most applications, the access point from which tones are transmitted toward the 6125G has a flat frequency response in normal circuit operation. The module's LOCAL and LOCAL PLUS alignment processes are, in fact, based upon this assumption. If the frequency response of the access point is not flat, alignment can still be performed, but the levels of the tones transmitted toward the 6125G must be properly adjusted to compensate for actual circuit roll-off at the access point.

alignment tones returned by 6125G

2.06 Alignment of the 6125G takes place through a "dialogue" of tones at various frequencies sent from the CTC and returned by the 6125G, as listed below.

when the CTC sends tone of...	the 6125G returns tone of...
1004Hz	1014Hz
2804Hz	2804Hz
404Hz	414Hz
1804Hz	1810Hz

acknowledgement tones returned by 6125G

2.07 Upon completion of alignment, the 6125G sends acknowledgement tone, which can be either of two types:

- **Confirmation tone,** an ascending sweep of tones from 300 to 3000Hz (with 3000Hz tone held for 15 seconds), indicates that attenuation distortion is within C5 limits in accordance with the criteria in table 1. Thus, confirmation tone can eliminate the need to manually check the frequency response of the facility after alignment.

- **Error tone,** a descending sweep of tones from 3000 to 300Hz (with 300Hz tone held for 15 seconds), indicates that C5 attenuation distortion limits are not met and that the 6125G has defaulted to the best possible level and equalization settings under the particular circumstances. In this case, a manual frequency-response check of the facility may be in order. Please be aware, however, that error tone does not necessarily indicate that the circuit is defective.

Note: *In the TLP-adjustment modes and the MILLIWATT TEST diagnostic mode, the 6125G sends the ascending-sweep portion of confirmation tone upon receipt and acceptance of a valid DTMF code.*

4wire facility-side interface

2.08 The 6125G interfaces the 4wire transmission facility via transformers at the receive input and transmit output ports. These transformers can be switch-optioned for any of the following balanced terminating impedances:

- **1200** ohms for interface with **loaded cable**.
- **600** ohms for interface with **nonloaded cable or carrier**.
- **150** ohms to provide a small amount of **slope-type amplitude equalization for nonloaded cable** through the deliberate impedance mismatch.

2wire terminal-side interface

2.09 On its 2wire terminal side, the 6125G interfaces the 2wire loop via an integral magnetic hybrid that provides a switch-selectable choice of two terminating impedances in series with 2.15μF of capacitance:

- **900** ohms for interface with **loaded cable, 900-ohm equipment, or switched networks** accessing loaded or nonloaded cable.
- **600** ohms for interface with **nonloaded cable, station equipment, or other 600-ohm equipment**.

SF signaling, FXS operation

supervisory states, loop start

2.10 The 6125G module accommodates a conventional loop-start supervisory format. In loop-start operation, detection of incoming SF tone activates ringing toward the station or PBX trunk circuit. Loop current is supplied to the station-side loop or trunk through matched resistances in the module's internal A and B leads.

supervisory states, ground start

2.11 In ground-start operation, just as in loop-start, the 6125G module accommodates a conventional supervisory format. Whenever incoming SF tone is detected, the 2wire tip-lead path is opened to ground, except during ringing. Presence of SF tone at the 4wire receive port indicates that the associated office-end circuit is idle (2wire tip lead open), and local ringing is initiated by receipt of SF tone amplitude-modulated by a ringing frequency of 18 to 33Hz. Outgoing seizure is initiated in ground-start operation by application of ground to the 2wire ring lead, which causes transmission of SF tone to cease.

loop-current limiting and supervisory limits

2.12 An internal loop-current limiter on the 6125G limits current to less than approximately 35mA on short loops. With long loops, at least 16mA of current must be drawn from the battery feed to guarantee proper operation. In ground-start operation, the module senses application of ground to the 2wire ring lead to initiate seizure toward the distant end. The ring-ground sensor in the 6125G can sense application of this ground through external resistance of up to 1000 ohms on the 2wire ring lead.

ring trip and ring-trip range

2.13 The 6125G provides for removal of local ringing when the station or PBX trunk responds to incoming seizure. For proper operation of the ring-trip circuit, the external ringing source must be referenced to a potential of −44 to −52Vdc. The 6125G can reliably detect ring trip at up to 1500 ohms of external loop resistance with −48Vdc biased ringing.

signaling-tone states

2.14 Signaling-tone states for the 6125G are consistent with the conventional F-signaling formats of FXS and station-end OPS service. These states are listed in tables 2 and 3 for loop-start and ground-start operation, respectively.

local loop condition	SF tone	
	receive	transmit
idle	off	on
ringing	on	on
off-hook	off	off
dialing	off	off-on-off

table 2. Loop-start signaling-tone states

local loop condition	SF tone	
	receive	transmit
idle	on	on
seizure from CO	off	on
ringing	off-on-off	on
busy	off	off
CO release	on	off until detection of incoming SF tone, then on
idle	on	on
local seizure	on	off
CO seizure acknowledgement	off	off
dialing	off	off-on-off
busy	off	off
local station disconnect first	off	on
CO release	on	on
idle	on	on

table 3. Ground-start signaling-tone states

incoming SF tone detection

2.15 The 6125G is designed to interface the receive path on the facility (4wire) side at any TLP from −16 to +7. Idle-state SF tone is received at a level of −20dBm0. A higher level of −8dBm0 is received during break portions of dial pulses and for about 400ms at the beginning of each tone interval. The SF tone detector in the module reliably detects tone levels from 0 to −27dBm0, provided that the SF tone energy is at least 6dB above the level of all other signals simultaneously present at the 4wire receive port. The SF tone detector is actually a signal-to-guard ratio comparator that compares energy in a narrow band of frequencies centered at the SF tone frequency with energy in the entire voice band. This detection arrangement aids significantly in prevention of talk-off, but it places an upper bound on allowable circuit noise. In general, received noise in excess of 49dBrnC0 may interfere with detection of low-level signaling tones.

2.16 The 6125G's SF tone detector is designed to ignore momentary losses of SF tone during periods of otherwise continuous receipt of tone and to ignore momentary tone bursts to prevent false signaling. Within approximately 17ms of detection of incoming SF tone, a band-elimination filter (BEF) is inserted into the receive transmission path to prevent propagation of SF tone beyond the module. An internal timing circuit ensures that the BEF remains inserted during dial pulsing and during momentary losses of tone continuity.

outgoing SF tone transmission

2.17 The 6125G is designed to interface the transmit path on the facility (4wire) side at any TLP from +7 to −16. During the idle state, the module transmits SF tone at −20dBm0. During dial pulsing and also for the first 400ms each time it applies tone to the facility, the module transmits SF tone at a higher level of −8dBm0. This momentarily increased tone level aids in detection of supervisory-state changes and incoming dial pulsing at the distant (office) end of the circuit.

delay circuit and transmit pulse correction

2.18 The 6125G contains a delay circuit in the loop-current sensor that delays detection of on-hook-to-off-hook and off-hook-to-on-hook transitions by about 40ms to prevent false detection of short transients typically associated with station loops. A minimum-break pulse corrector in the transmit path ensures a 45ms minimum break duration and a 25ms minimum make duration during dialing, regardless of input break or pulsing rate. The minimum-break pulse corrector has no effect on pulsing breaks longer than 50ms.

transmit path cut

2.19 To prevent speech and transient energy from interfering with detection of SF signaling tone at the distant (office) end of the circuit, the voice path through the transmit portion of the 6125G module is cut (opened) during dialing and whenever SF tone is transmitted. The path cut is inserted shortly after any interruption of local loop current and approximately 13ms before any transmission of SF tone. The path cut is removed approximately 125ms after transmission of SF tone ceases.

SF signaling, ARD operation

2.20 The 6125G module, when appropriately switch-optioned, can be used at opposite ends of a circuit to provide loop-start or ground-start automatic ringdown (ARD) operation. In ARD operation, the module's supervisory states, loop-current and supervisory limits, SF tone detection and transmission, and transmit-path-cut insertion and removal are essentially identical to those in FXS operation. Two different modes of ARD operation are available, as selected via DTMF tones sent to the

module (see paragraph 2.50). These modes are **point-to-point** ARD and **multipoint** ARD. Operation in the two modes is as follows:

- **In point-to-point ARD,** two 6125G's are used at opposite ends of a faility. Each module sends SF tone when idle (on-hook). When one station telephone goes off-hook, the associated 6125G stops sending SF tone. Upon detection of loss of incoming SF tone, the distant-end 6125G activates local-station ringing at that end. This ringing is interrupted at a 2-second-on, 4-second-off rate by an integral interrupter circuit in the 6125G. In addition, the distant-end 6125G returns ringback tone toward the calling end of the circuit. The ringback tone ceases when the called station goes off-hook.

- **In multipoint ARD,** two or more 6125G's are used at multiple ARD points on a circuit. (For applications involving three or more ARD points, the various facilities must be bridged at a central location.) During the idle (on-hook) condition, the 6125G modules **do not send** SF tone. When one station telephone goes off-hook, the associated 6125G sends a 2-second burst of SF tone, after which ringing toward the distant station(s) is activated for 30 seconds at a nominal 2-second-on, 4-second-off rate. Upon detection of the 2-second SF tone burst from the calling 6125G, the other 6125G(s) on the circuit return ringback tone **for 1 second only.** One or more of the called stations can go off-hook and be connected to the call.

Note: *For proper ARD operation, both 6125G's on a point-to-point circuit must be optioned for point-to-point ARD and all 6125G's on a multipoint circuit must be optioned for multipoint ARD.*

SF signaling, FXO operation

supervisory states, loop start

2.21 The 6125G module accommodates a conventional loop-start supervisory format. When the distant (station) end is idle (on-hook), the associated foreign-exchange station-end (FXS) signaling unit transmits SF tone. Receipt of this tone by the 6125G holds the 2wire loop open toward the local switching equipment. When the office end is idle, the 6125G does not transmit SF tone. **On calls from the office end to the station end,** receipt of ringing voltage from the local switching equipment causes the 6125G to transmit SF tone. Receipt of this tone by the FXS signaling unit initiates ringing toward the station or PBX circuit. **On calls from the station end to the office end,** a station-end off-hook condition causes the FXS unit to cease SF tone transmission. The 6125G, upon detecting this loss of incoming tone, closes the 2wire loop toward the local switching equipment. Incoming SF tone pulses indicate dialing.

supervisory states, ground start

2.22 In ground-start operation, just as in loop-start, the 6125G module accommodates a conventional supervisory format. When the station end is idle, the associated FXS signaling unit transmits SF tone. Receipt of this tone by the 6125G holds the 2wire loop open toward the local switching equipment. Similarly, when the office end is idle, the 6125G transmits SF tone. Receipt of this tone by the distant FXS signaling unit holds the tip lead open toward the PBX trunk circuit at that end. **On calls from the office end to the station end,** the local switching equipment grounds the tip lead, causing the 6125G to remove outgoing SF tone. Subsequent receipt of ringing voltage from the local switching equipment causes the 6125G to transmit high-level SF tone amplitude-modulated at 20Hz. Receipt of this tone by the FXS signaling unit causes that unit to close the tip lead to ground and to apply ringing toward the PBX trunk circuit. When the PBX answers, the FXS unit ceases SF tone transmission. Upon detecting this loss of incoming tone, the 6125G closes the 2wire loop to trip ringing and establishes the connection. **On calls from the station end to the office end,** the distant PBX grounds the ring side of the line, cutting off the SF tone being received by the 6125G. This removal of SF tone grounds the ring side of the 2wire path toward the local switching equipment. The switching equipment returns ground on the tip side, and the 6125G ceases SF tone transmission. This loss of SF tone at the station end closes the tip side to ground toward the PBX, completing the loop. Dialing can commence at this time.

loop-current and supervisory range

2.23 When the distant station is off-hook, the 6125G provides a path for loop-current flow by providing a loop closure toward the local switching equipment. Supervisory limits in applications involving the 6125G depend upon the sensitivity of the local switching equipment.

signaling-tone states

2.24 Signaling-tone states for the 6125G are consistent with the conventional F-signaling formats for FXO and office-end OPS service. These states are listed in tables 4 and 5 for loop-start and ground-start operation, respectively.

local loop condition	SF tone	
	receive	transmit
idle	on	off
ringing	on	on
off-hook	off	off
dialing	off-on-off	off

table 4. Loop-start signaling-tone states

local loop condition	SF tone	
	receive	transmit
idle	on	on
incoming seizure (ground applied to ring lead at station)	off	on
seizure acknowledgement (switch grounds local tip lead)	off	off
dialing	off-on-off	off
busy	off	off
station on-hook	on	off
CO release	on	on
outgoing seizure (switch grounds local tip lead)	on	off
ringing	on	on-off-on at 20Hz rate
station answer	off	off
CO release (forward disconnect)	off until FXS signaling unit opens tip lead, then on	on
idle	on	on

table 5. Ground-start signaling-tone states

incoming SF tone detection

2.25 Incoming SF tone detection in FXO operation is identical to that in FXS operation, as described in paragraphs 2.15 and 2.16 of this practice.

outgoing SF tone transmission

2.26 Outgoing SF tone transmission in FXO operation is similar to that in FXS operation. The 6125G interfaces the facility-side transmit path at any TLP from +7 to −16. When idle, the module transmits SF tone at −20dBm0. For the first 400ms each time it applies tone to the facility, the module transmits SF tone at −8dBm0. The momentarily higher tone level aids in detection of signaling-state and supervisory-state changes at the distant (station) end of the circuit.

receive pulse correction

2.27 The 6125G contains an integral precision pulse corrector in its SF receive section. To ensure optimum pulsing toward the local termination, this pulse corrector corrects incoming pulsing (SF tone bursts) at 8 to 12 pulses per second to provide outgoing dial pulsing at 58±4 percent break. The pulse corrector ignores incoming tone bursts shorter than approximately 30ms.

transmit path cut

2.28 To prevent speech and transient energy from interfering with detection of SF signaling tone at the distant (station) end of the circuit, the transmit voice path through the 6125G is cut (opened) whenever SF tone is transmitted or received.

power and ringing

power

2.29 The 6125G operates on filtered input potentials between −44 and −52Vdc. The positive side of the dc power supply must be connected to earth ground. In ground-start FXS applications, ground-start operation of the station-end equipment (e.g., PBX or telephone set) requires a low-resistance ground that is common with the ground of the module. Maximum current required is 125mA, not including loop current in FXS (or ARD) operation.

ringing, FXS operation

2.30 In FXS operation, the 6125G's ringing circuitry operates with any ringing frequency between 16 and 35Hz, but (as mentioned previously) the ringing generator must be referenced to (or superimposed upon) a potential of −44 to −52Vdc for reliable operation of the ring-trip detector. In the ground-start mode, the 6125G responds to any ringing frequency (modulated SF tone) between 18 and 33Hz.

ringing, FXO operation

2.31 In FXO operation, the 6125G's ringing detector senses incoming ringing (from the local switching equipment) across the tip and ring leads. Both superimposed and grounded ringing schemes can be accommodated. The 6125G can sense any ringing frequency from 16 to 35Hz, and the module's ringing-voltage sensing threshold is 65Vrms nominal.

remote alignment, optioning, and diagnostics

PROGRAM mode

2.32 Before remote alignment, optioning, or diagnostics can be initiated, the 6125G must be placed in the PROGRAM mode. This is done by sending 2713Hz tone to the module for at least 30 seconds. During any remote alignment, optioning, or diagnostic mode, the 6125G can be returned to the PROGRAM mode by sending DTMF code #4 and can be returned to idle by sending 2713Hz tone for 10 seconds. Furthermore, in all modes except LOCAL, LOCAL PLUS, AUTO, and LOOPBACK, the 6125G can be returned to idle by sending DTMF code ##. If no activity occurs on the circuit for 5 continuous minutes in the PROGRAM mode, the 6125G goes idle.

preset transmission interface levels

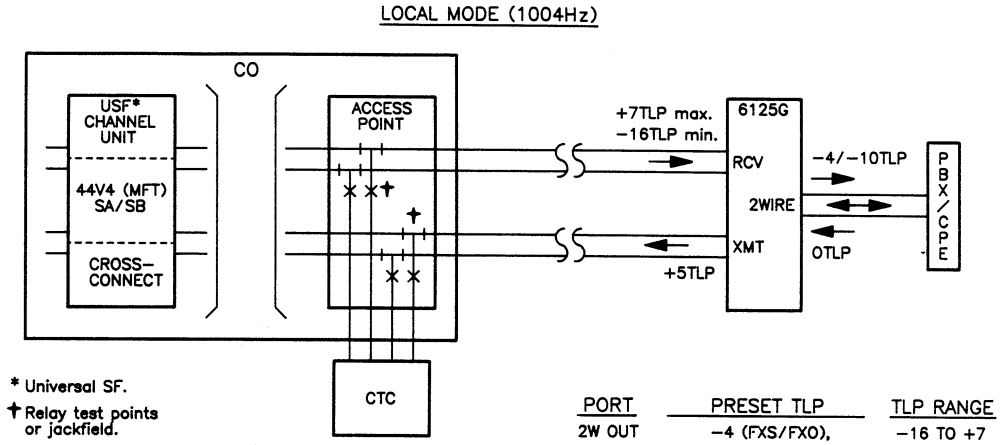
2.33 The 6125G's transmission interface levels are preset automatically during alignment as follows:

- 2wire output: −4TLP in FXS or FXO operation, −10TLP in ARD operation.
- 2wire input: 0TLP.
- 4wire transmit output: +5TLP except in the LOCAL PLUS mode, in which the 4wire transmit output TLP is varied as needed to achieve a −9 receive TLP at the distant CO.

After alignment, these preset TLP's can be changed if needed as described in paragraphs 2.43 through 2.49 except for the transmit output TLP in the LOCAL PLUS mode.

LOCAL alignment mode

2.34 The LOCAL alignment mode is activated (when the 6125G is in the PROGRAM mode) by sending 1004Hz tone. In the LOCAL alignment mode (see figure 4), the 6125G adjusts its receive level-control circuit and equalizer and its transmit preset-TLP control circuit in response to tones sent from a CTC. The 6125G, in turn, transmits tones so that the CTC can align its end of the facility. Upon completion of LOCAL alignment, the 6125G calculates the frequency response of the receive channel, sends acknowledgement tone, and then goes into LOOP-BACK. If desired, CTC personnel can calculate the module's actual 2wire output level at each alignment frequency by first recording the levels of the tones generated by the 6125G during alignment, then recording the levels of the tones sent by the CTC and looped back by the 6125G, and finally performing the simple subtractions indicated in the LOCAL alignment mode procedure table in section 3 of this practice.



PORT	PRESET TLP	TLP RANGE
2W OUT	-4 (FXS/FXO), -10 (ARD)	-16 TO +7
2W IN	0	-16 TO +7
XMT OUT	+5	-16 TO +7

figure 4. LOCAL mode application

LOCAL PLUS alignment mode

2.35 **Background.** Transmit-channel pre-equalization is not a widely accepted circuit design method due to the possibility of crosstalk induction on adjacent cable pairs. This can occur when pre-equalization creates abnormally high signal levels on one cable pair relative to an adjacent pair. When pre-equalization-induced crosstalk does occur, its main causes are typically found to be incorrect circuit engineering and/or equipment misalignment. The 6125G, however, eliminates these concerns because the maximum signal level that can be applied to the transmit pair at any frequency between 1004Hz and 2804Hz is +5TLP.

2.36 **Operation.** The LOCAL PLUS mode (see figures 5 and 6) closely resembles the LOCAL mode of operation. In the LOCAL PLUS mode, however, the 6125G adjusts not only the receive and transmit levels and receive equalization but also the transmit equalization. This mode is activated (when the module is in the PROGRAM mode) by sending 1204Hz tone. In the LOCAL PLUS mode, the module's transmit and receive level-coordination circuits are adjusted based on a +5 transmit TLP and a −9 receive TLP at the serving CO. Accordingly, the 6125G's transmit output level is varied to maintain a −9 receive TLP at the CO for all frequencies from 404 to 2804Hz. This places limita-

tions on the length of cable that can be served by the 6125G (see paragraph 2.38). The module's transmit (pre-) equalizer is designed to provide up to C5 attenuation distortion conditioning on circuits with up to 14dB of loss at 2804Hz. Because attenuation increases as frequency increases, 2804Hz loss is, in most cases, greater than 1804Hz and 404Hz loss. Therefore, the module's transmit output level "pivots" around the 2804Hz level required to maintain the −9 CO receive TLP. On circuits with more than 14dB of 2804Hz loss, the 6125G's transmit output level at 1004Hz is increased to maintain the required −9 CO receive TLP and the module's transmit equalization slope is decreased so as not to exceed the maximum allowable output level of +5TLP. On circuits with more than 13dB of 1kHz ICL, equalization and gain are held constant; thus, the CO receive level decreases as loop length increases. Upon completion of LOCAL PLUS alignment, the 6125G calculates the frequency response of the receive channel, sends acknowledgement tone, and then goes into LOOPBACK.

Note: *The 6125G's LOCAL PLUS transmit (pre-) equalization settings are based upon receive-channel measurements. If the transmit and receive cable pairs interfacing the module are not "symmetrical," i.e., if the cable pairs exhibit significantly different electrical characteristics and therefore have significantly different frequency-response curves, circuit misalignment can occur. In such instances, the use of the 6125G's LOCAL mode in conjunction with a post-equalizer at the CO is recommended.*

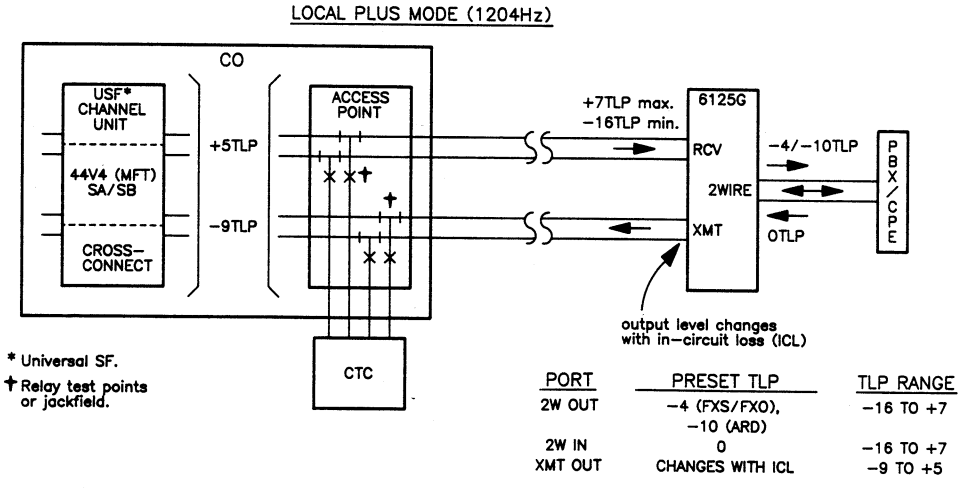


figure 5. LOCAL PLUS mode application

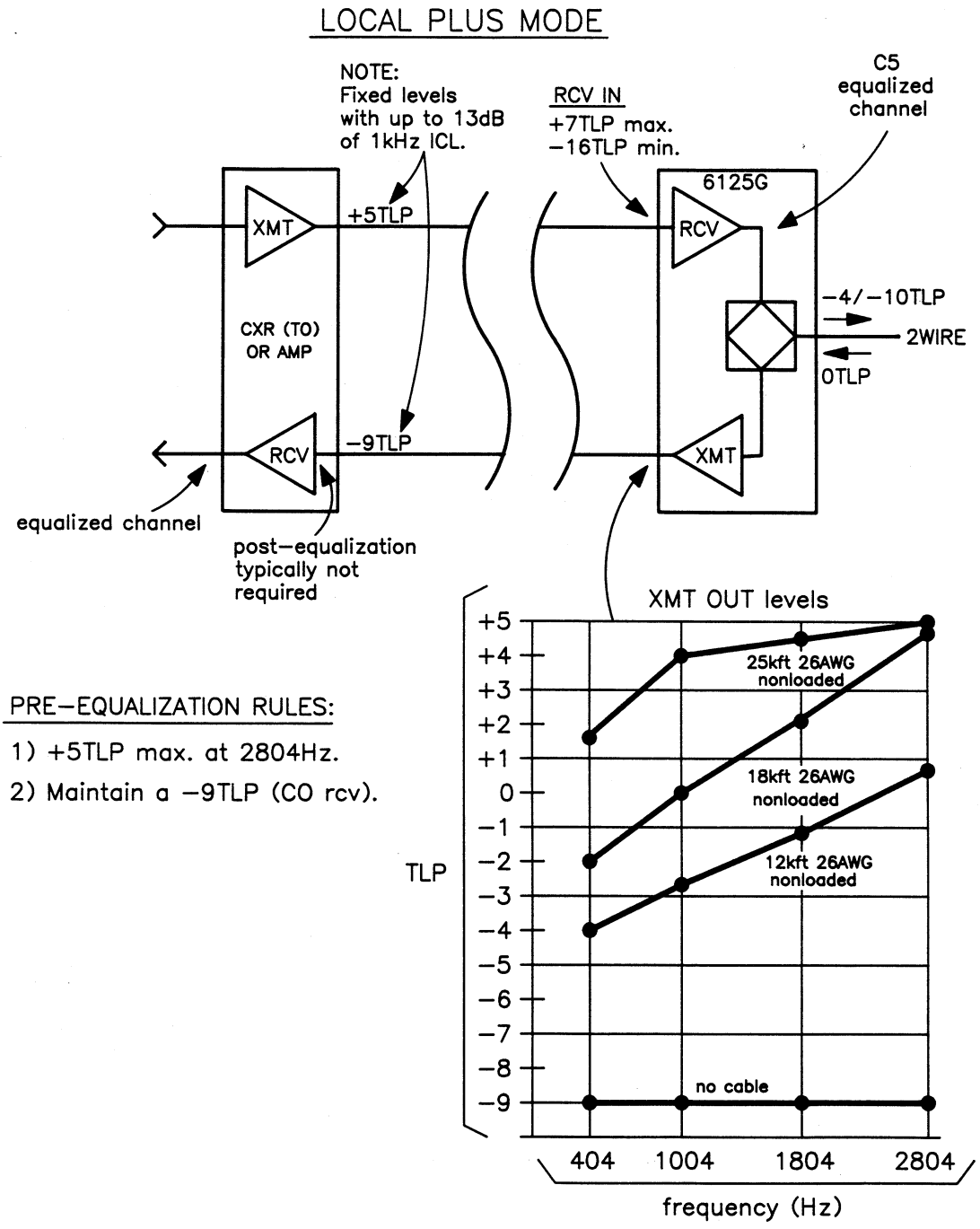


figure 6. LOCAL PLUS design criteria

2.37 Central-office TLP's other than +5 transmit and −9 receive can also be accommodated in the LOCAL PLUS mode. To eliminate CO equipment, the 6125G can be used to coordinate levels that directly interface interoffice carrier or interexchange carrier (IXC). Table 6 lists, in 1dB increments, those CO TLP's that can be accommodated and maximum cable-loss limits for each pair of TLP's. Interpolation can be used, if necessary, to calculate levels between these increments. When other than a +5TLP is sent from the CO, the 6125G automatically adjusts the CO receive TLP as indicated in table 6.

CO xmt TLP	CO rcv TLP	max. cable loss at 2804Hz (dB)
+5*	−9*	14
+4	−8	13
+3	−7	12
+2	−6	11
+1	−5	10
0	−4	9
−1	−3	8
−2	−2	7
−3	−1	6
−4	0	5
−5	+1	4
−6	+2	3
−7	+3	2
−8	+4	1
−9	+5	0

*Normal CO TLP's.

table 6. CO TLP's that can be accommodated in LOCAL PLUS mode

2.38 **Circuit Design Criteria.** Using the 6125G's LOCAL PLUS mode can simplify circuit design and reduce equipment costs. In the past, a circuit designer had to calculate (or measure at the time of circuit turn-up) the amounts of gain and post-equalization to be provided by the equipment at the CO. Today, because the LOCAL PLUS mode provides fixed CO interface levels, gain calculations are simplified. Furthermore, because the circuit is pre-equalized by the 6125G, post-equalization is typically not required at the CO and, therefore, the need for equalization slope calculations is often eliminated. As a result, transmission-only (TO) channel units or line amplifiers without equalization can be used at the CO, thereby reducing equipment costs. Also, because the CO transmit and receive data levels are fixed (i.e., not variable) when LOCAL PLUS alignment is used, the CO equipment requires no alignment and its levels can be preset. Cable-gauge/maximum-distance charts (tables 7 and 8) are provided below to calculate the range of the 6125G's transmit (pre-) equalizer. Please note that the cable length and 1004Hz loss figures in tables 7 and 8 are typical and that up to C5 attenuation distortion conditioning can be met on these cables. If, however, cable loss at 2804Hz exceeds 13dB, additional (i.e., post-) equalization is required at the CO. In

such cases, because the CO post-equalizer's frequency response must complement that of the 6125G's transmit (pre-) equalizer, circuit design becomes complex. For this reason, in applications where circuit losses are greater than those listed in tables 7 and 8 **and** where C5 attenuation distortion conditioning is required, use of the LOCAL PLUS mode is not recommended.

nonloaded cable length	gauge	1004Hz loss	2804Hz loss
34.2kf	19	6.7dB	14dB
25.0kf	22	7.3dB	14dB
20.5kf	24	7.8dB	14dB
16.5kf	26	8.4dB	14dB

table 7. Maximum nonloaded cable lengths for 6125G's transmit (pre-) equalizer to meet C5 attenuation distortion specifications (LOCAL PLUS mode only)

H88 loaded cable length	gauge	1004Hz loss	2804Hz loss
138kf	19	11.6dB	14dB
78kf	22	12.0dB	14dB
54kf	24	12.6dB	14dB
36kf	26	12.7dB	14dB

table 8. Maximum H88 loaded cable lengths for 6125G's transmit (pre-) equalizer to meet C5 attenuation distortion specifications (LOCAL PLUS mode only)

AUTO alignment mode

2.39 **Overview.** In the AUTO mode (figures 7 and 8), the 6125G acts as the **master** module and directs the receive-level and receive- (post-) equalization alignment process for both ends of the facility. The distant end of the circuit must be terminated either with a 6125G or with an equivalent unit that aligns at TLP's. It makes no difference which end of the circuit is selected as the master. Alignment is initiated either by depressing the front-panel *wiring check* pushbutton on the 6125G for 5 seconds minimum or by transmitting the proper tones toward the 6125G from the CTC. After alignment is initiated, the 6125G assumes control of the alignment process. The master 6125G, when in the AUTO mode, transmits the necessary tones to the far-end, or **slave**, unit to put that unit into its alignment mode. The master and slave units then send tones back and forth until both ends of the circuit are aligned. In this mode, the 2wire output TLP returns to its preset value of −4 (FXS or FXO operation) or −10 (ARD operation), the 2wire input TLP returns to its preset value of 0, and the 4wire transmit output TLP is adjusted to +5. After aligning at the last frequency, the slave unit goes into loopback. The master unit then checks the round-trip frequency response of the facility, after which it removes the slave unit from loopback, sends acknowledgement tone, and then goes idle.

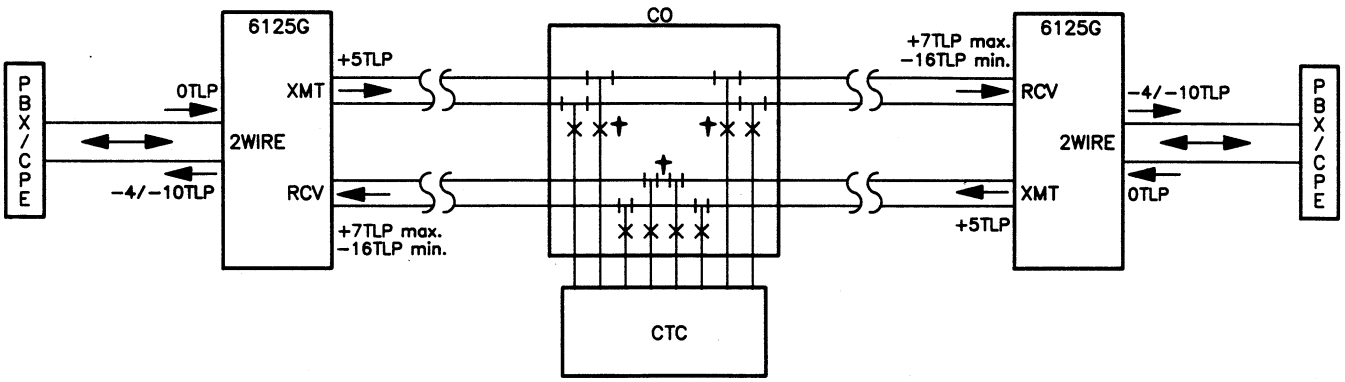
2.40 **Local Activation of AUTO Mode.** When the AUTO mode (or any other alignment mode) is activated remotely, i.e., from the CTC, local visible indications of the success or failure of the alignment process in meeting the established conditioning limits are not provided. (With no personnel present to view the 6125G's LED's, such indications are simply not needed.) With local activation of the AUTO mode via the module's *wiring check* pushbutton, however, local visible indications of circuit alignment status are necessary, especially if installation personnel are to be spared the bother of carrying test equipment to the module site. Therefore, when the 6125G's *wiring check* pushbutton is depressed, either of two LED indications is given:

- If alignment takes place, the *prgm* and *lpbk* LED's light steadily during alignment and extinguish when alignment is completed.
- If alignment is attempted but cannot be completed, the *prgm* and *lpbk* LED's light steadily during alignment (or attempted alignment). The *prgm* LED then flashes, and the *lpbk* LED remains lighted steadily. These LED states continue until any of three actions occurs:
  - — Another operating mode is selected.
  - — The *wiring check* pushbutton is redepressed.
  - — Power is removed.

2.41 Conditions that cause failure of locally initiated AUTO-mode alignment are as follows:

- No slave module is present.
- The slave module is not an RA Series (or equivalent) unit.
- The tone dialogue between the slave module and the 6125G is not completed.

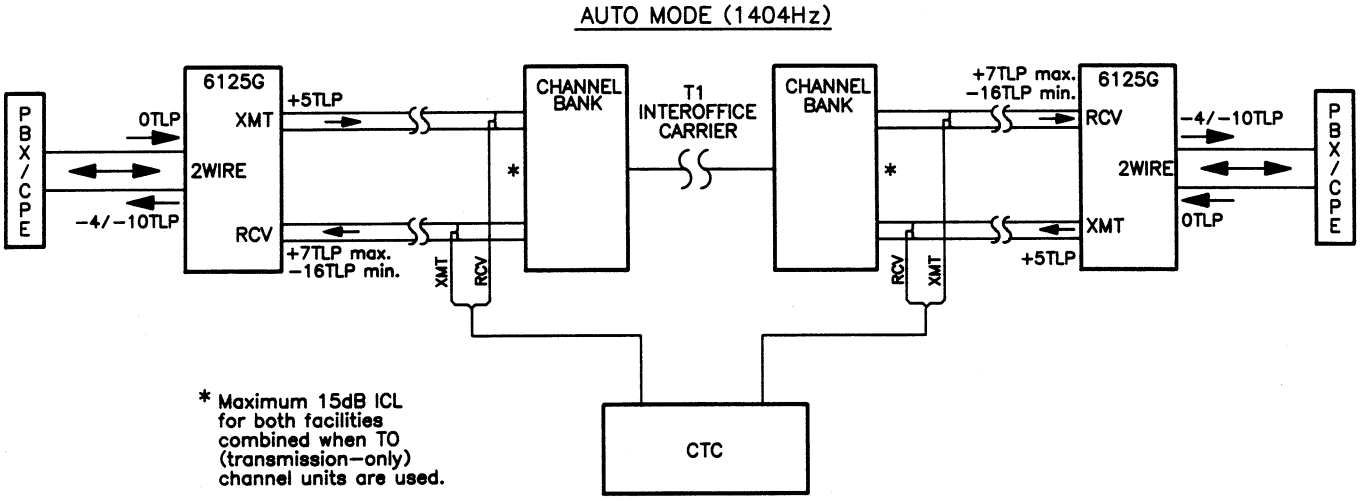
Please note, however, that no visible indication is given for a conditioning failure, i.e., when C5 conditioning limits cannot be met.



† Relay test points or jackfield.

PORT	PRESET TLP	TLP RANGE
2W OUT	−4 (FXS/FXO), −10 (ARD)	−16 to +7
2W IN	0	−16 to +7
XMT OUT	+5	−16 to +7

figure 7. AUTO-mode application without CO equipment



* Maximum 15dB ICL for both facilities combined when TO (transmission–only) channel units are used.

Maximum 15dB ICL for each facility when ETO (equalized transmission–only) channel units are used.

PORT	PRESET TLP	TLP RANGE
2W OUT	−4 (FXS/FXO), −10 (ARD)	−16 TO +7
2W IN	0	−16 TO +7
XMT OUT	+5	−16 TO +7

figure 8. AUTO-mode application with CO equipment

MILLIWATT TEST diagnostic mode

2.42 The MILLWATT TEST diagnostic mode allows personnel to establish a benchmark (reference) level and, from that benchmark, determine the TLP's at the 6125G's ports. The MILLIWATT TEST mode also allows CTC personnel to measure 1014Hz facility (cable) loss, if desired. This mode is activated (from the PROGRAM mode) by sending DTMF code #0 to the module. The 6125G responds with an ascending tone sweep from 300 to 3000Hz, after which the module sends 1014Hz tone continuously at a level of 0.0dBm (at the module). This sending of 1014Hz tone indicates that the module is awaiting further instruction. At this time, CTC personnel can do the following:

- Activate any of the three TLP alignment modes (see paragraphs 2.43 through 2.49).
- Activate any other remote alignment or diagnostic mode without returning to the PROGRAM mode first.
- Return the 6125G to the PROGRAM mode by sending DTMF code #4. (This causes the 6125G to send 1014Hz tone at +5TLP rather than at 0.0dBm.)
- Return the 6125G to idle by sending 2713Hz tone for 10 seconds or DTMF code ##.

If none of these actions is taken, the module automatically returns to idle upon expiration of a 20-minute timeout interval.

2W OUT TLP, 2W IN TLP, and XMT OUT TLP alignment modes

2.43 The 2W OUT TLP, 2W IN TLP, and XMT OUT TLP alignment modes are used after LOCAL, LOCAL PLUS, or AUTO alignment to set the 6125G's 2wire output interface TLP, 2wire input interface TLP, and 4wire transmit output interface TLP, respectively. Each of these modes is activated by sending a specific DTMF code toward the module as described below. The 6125G responds by returning the ascending-sweep portion of confirmation tone if the desired mode was successfully activated or by returning error tone if not. Upon receipt of the ascending tone sweep, CTC personnel can select the desired interface TLP (−16 to +7) for the port being addressed by sending additional DTMF digits as described below.

2.44 **TLP Verification.** After the desired TLP adjustment mode is successfully activated and the ascending tone sweep from the 6125G ceases, the module sends (from its transmit output port) 1014Hz tone. This tone is sent at the current TLP for the specific port addressed via the DTMF code sent from the CTC. This allows CTC personnel to conveniently verify whether the TLP is correct or requires adjustment. If adjustment is required, CTC personnel can proceed as described in paragraphs 2.45 through 2.49.

2.45 **Activating 2W OUT TLP Mode.** The 2W OUT TLP mode is used to set the 6125G's 2wire output interface TLP to ensure proper levels outgoing to the customer-premises equipment from the module. This mode is activated by sending DTMF code #1 to the 6125G.

2.46 **Activating 2W IN TLP Mode.** The 2W IN TLP mode is used to set the 6125G's 2wire input interface TLP to ensure proper levels incoming to the module from the customer-premises equipment. This mode is activated by sending DTMF code #2 to the 6125G.

2.47 **Activating XMT OUT TLP Mode.** The XMT OUT TLP mode is used **after LOCAL or AUTO alignment only** to set the 6125G's 4wire transmit output interface TLP to ensure proper levels outgoing to the facility from the module This mode is activated by sending DTMF code #3 to the 6125G.

2.48 **Setting Interface TLP's.** Upon successful activation of any of the above modes, the 6125G responds by sending the ascending-sweep portion of confirmation tone. This tone sweep can be cut off prior to its timing out by sending the next tone in the TLP-setting sequence, as described later in this paragraph. If, however, the desired TLP mode is not successfully activated, the 6125G sends error tone, which cannot be cut off prior to its timing out. Upon successful activation of the desired TLP mode and receipt of the ascending tone sweep, CTC personnel then select the desired interface TLP as follows for the port being addressed:

Note: *The port addressing described above is summarized as follows:*

port	DTMF code
2wire port, output TLP	#1
2wire port, input TLP	#2
transmit output port	#3

- For a **positive** TLP, CTC personnel send DTMF code *XXX to the 6125G. In this code, *=+ (positive), X=0 through 9, and a decimal point is assumed at the left of the rightmost X. Thus, to select a +1.4TLP, for example, CTC personnel would send DTMF code *014.

- For a **negative TLP,** CTC personnel send DTMF code XXX to the 6125G. In this code, the lack of a * indicates negative, X=0 through 9, and a decimal point is assumed at the left of the rightmost X. Thus, to select a −12.7TLP, for example, CTC personnel would send DTMF code 127.

2.49 If the TLP setting is successfully completed, the 6125G sends the ascending-sweep portion of confirmation tone, which indicates that the module is ready for additional commands. If not (e.g., if an invalid level such as *080 is received), the module sends error tone. If this occurs, CTC personnel must resend both the TLP mode selection code (#1, #2, or #3) and the proper TLP-setting code (*XXX or XXX) as explained above.

ARD MODE SELECT optioning mode

2.50 The ARD MODE SELECT optioning mode is selected (from the PROGRAM mode) by sending DTMF code #7 to the module. The module responds by returning 414Hz tone if it is currently in the point-to-point ARD mode or 2804Hz if it is currently in the multipoint ARD mode (see paragraph 2.20). (If the module is not correctly switch-optioned for ARD operation, it returns error tone.) During receipt of the 414 or 2804Hz, CTC personnel can do any of the following:

- If 414Hz (indicating point-to-point ARD) or 2804Hz (indicating multipoint ARD) is being received and **no change** in the module's current ARD mode is desired, CTC personnel need only exit ARD MODE SELECT to lock in the desired ARD mode. This can be done either by sending DTMF code #4 to return to the PROGRAM mode or by sending DTMF code ## or 2713Hz for 10 seconds to return to idle.

- If 414Hz (indicating point-to-point ARD) is being received and multipoint ARD is desired, CTC personnel can change to multipoint ARD by sending DTMF digit 2. The 6125G can then be returned to the PROGRAM mode or to idle as described above.

- If 2804Hz (indicating multipoint ARD) is being received and point-to-point ARD is desired,, CTC personnel can change to point-to-point ARD by sending DTMF digit 1. The 6125G can then be returned to the PROGRAM mode or to idle as described above. .

remote LOOPBACK diagnostic mode

2.51 In the the LOCAL and LOCAL PLUS alignment modes, the 6125G completes the alignment sequence by going into equal-level LOOPBACK. The LOOPBACK mode facilitates the checking of both the 6125G and the facility. LOOPBACK can also be activated when the 6125G is in the PROGRAM mode simply by transmitting 2713Hz tone to the module for 2.0 seconds (nominal). LOOPBACK occurs upon removal of the tone. The LOOPBACK mode is deactivated either automatically after 20 minutes or by transmitting 2713Hz tone for 0.9 second (nominal) prior to expiration of the 20-minute timeout period. Removing this tone is not necessary for LOOPBACK deactivation.

2.52 In addition to equal-level **transmission loopback**, the 6125G's LOOPBACK mode provides **signaling loopback** as well. Signaling loopback allows the module's SF tone detector, band-elimination filter (BEF), SF tone oscillator, and transmit-path-cut circuitry to be tested remotely. Normally, a 6125G in LOOPBACK repeats all SF signaling states that it receives (tone in results in tone out, no tone in results in no tone out). Thus, the aforementioned signaling circuitry can be tested simply by placing the module into LOOPBACK and sending continuous 2600Hz SF tone at −20dBm0 from the CTC. If its signaling circuitry is operating properly, the 6125G returns 2600Hz SF tone at −8dBm0 (high level) for approximately 400ms and at −20dBm0 (low level) thereafter.

Note: *If SF tones shorter than 50ms (but long enough for detection) are sent to a 6125G in LOOPBACK, the tones looped back by the module are lengthened to 50±4ms by the module's minimum-break transmit pulse-correction circuitry. Please be aware, however, that the 25ms minimum-make transmit pulse correction provided in normal module operation* **does not take place during LOOPBACK.**

FOUR-TONE MTU AND TRANSPONDER TEST diagnostic mode

2.53 The FOUR-TONE MTU AND TRANSPONDER TEST diagnostic mode can be used to analyze the facility from a distant location. This mode is entered (from the PROGRAM mode) by sending 804Hz tone or DTMF code #5 to the module. The 6125G responds by entering the MTU TEST portion of the mode, in which the module sends 414, 1014, 1810, and 2804Hz tones, each for 15 seconds. This sequence continues for 20 cycles (20 minutes). During this time, the CTC can remove its 804Hz tone and send no additional tone. Removal of the 804Hz tone causes the 6125G to complete its current 4-tone cycle and then provide a quiet-line termination for 20 minutes. As an alternative, the CTC can remove its 804Hz tone and then send 404, 1004, 1804, or 2804Hz tone. Receipt of this tone causes the 6125G to enter the TRANSPONDER TEST portion of the mode, in which the module responds to each tone received by generating and returning a corresponding tone: 414, 1014, 1810, or 2804Hz, respectively. If LOCAL or AUTO-mode alignment was previously completed, the tones are transmitted at a fixed +5TLP. If LOCAL PLUS alignment was previously completed, the tones are transmitted at their equalized output levels. This means that the four tones are always transmitted as if tones were being inserted into the module's 2wire port at the current TLP for that port. In the FOUR-TONE MTU AND TRANSPONDER TEST mode, if the 6125G detects no tone at its receive input port, it provides a quiet-line termination for 20 minutes, during which time the CTC can either send DTMF code #4 to return the 6125G to the PROGRAM mode or send 2713Hz tone for 10 seconds or DTMF code ## to return the module to idle. Upon expiration of the 20-minute quiet-line termination, the 6125G goes idle. By subtracting measurements made during LOOPBACK from MTU or TRANSPONDER TEST measurements (please note that MTU and TRANSPONDER TEST measurements are transmit-channel-only), receive-channel characteristics can be determined.

WIRING CHECK diagnostic mode

2.54 The WIRING CHECK diagnostic mode allows the installer of the 6125G to quickly and easily verify that the wiring connections between the outside-plant distribution cable termination point (within the building) and the 6125G and also between the customer's network interface and the 6125G are properly made. When the front-panel *wiring check* pushbutton on the 6125G is depressed for less than 5 seconds and then released, continuous 1014Hz tone is transmitted from the module's 4wire receive port, interrupted 1014Hz tone is transmitted from the module's 4wire transmit port, and amplitude-modulated 1014Hz tone is transmitted from the module's 2wire port. Depressing the *wiring check* pushbutton a second time terminates the WIRING CHECK mode. If the 6125G is accidentally left in the WIRING CHECK mode, the mode times out after one hour. Prior to expiration of the 1-hour timeout interval, the CTC can force termination of the WIRING CHECK mode by sending 2713Hz tone for 10 seconds.

manual (local) loopback

2.55 In addition to the 2713Hz-tone (remote) LOOPBACK activation and deactivation described above, the 6125G provides for manual (local) loopback activation and deactivation as well. The module is placed into loopback manually at its site of installation simply by connecting its manual loopback (MNLB) lead (pin 1 or 18) to its manual loopback ground (MLBG) lead (pin 21). Loopback is maintained until the MNLB-MLBG connection is removed. Please note that manually activated loopback **cannot** be deactivated by sending 2713Hz tone.

3. installation tasks at module site

inspection

3.01 The 6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater should be visually inspected upon arrival to determine 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

3.02 The 6125G mounts in one position of a Tellabs Type 10 Mounting Shelf or in a Tellabs 262G-series Network Channel Terminating Equipment/Data Station Termination (NCTE/DST) Mounting Assembly. The module plugs physically and electrically into a 56-pin connector at the rear of its shelf or assembly position.

installer connections

3.03 Before making any connections to the mounting shelf, case, or assembly, 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.

3.04 Table 9 lists all external connections to the 6125G. All connections to non-prewired mountings are made via wire-wrapping to the 56-pin connector at the rear of the module's shelf, case, or assembly position. Pin numbers are found on the body of the connector.

connect:	to pin:
4WIRE RECEIVE IN TIP	7
4WIRE RECEIVE IN RING	13
4WIRE TRANSMIT OUT TIP	41
4WIRE TRANSMIT OUT RING	47
2WIRE TIP	55
2WIRE RING	49
4WIRE RECEIVE SX (simplex)	9 and 11
4WIRE TRANSMIT SX (simplex)	43
RING GEN (ringing generator, FXS/ARD only)	45 and 46
MNLB (manual loopback)	1 and 18
MLBG (manual loopback ground)	21
−BATT (−44 to −52Vdc filtered input)	35
GND (ground)	17

table 9. External connections to 6125G

switch options

3.05 Five option switches must be set before the 6125G is placed into service. One is a three-position slide switch; the others are two-position slide switches. Locations of these switches on the module's printed circuit board are shown in figure 9. Instructions for setting the switches are given in table 10.

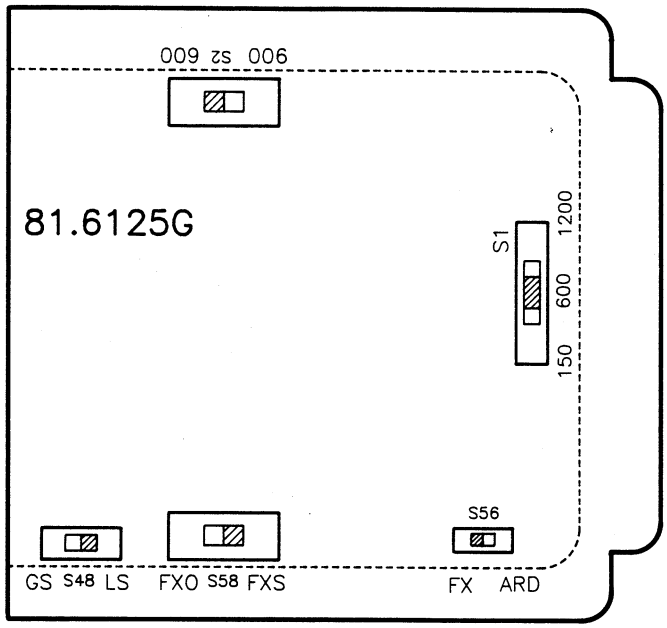


figure 9. 6125G option switch locations

option	switch	selection	settings	checklist
terminating, impedance, 4wire receive input and 4wire transmit output ports (facility side)	S1	1200 ohms (for loaded cable)	1200	
		600 ohms (for nonloaded cable or carrier)	600	
		150 ohms (extra slope equalization for nonloaded cable)	150	
terminating impedance, 2wire port (terminal side)	S2	900 ohms plus 2.15μF (for loaded cable or 900-ohm equipment)	900	
		600 ohms plus 2.15μF (for nonloaded cable or 600-ohm equipment)	600	
FXS or FXO signaling operation	S58	FXS signaling (required in both FXS and ARD applications)	FXS	
		FXO signaling	FXO	
FX or ARD operation (with FXS signaling selected*)	S56*	FX operation (FXS and OPS applications)	FX	
		ARD operation (ARD applications only)	ARD	
loop-start or ground-start supervision	S48	loop-start supervision	LS	
		ground-start supervision	GS	
*Please note that switch *S56* is **nonfunctional** when switch *S58* is set to the *FXO* position.				

table 10. 6125G switch option summary and checklist

power verification

3.06 Verify the presence of input power to the 6125G as follows:

A. Apply power to the 6125G.

B. Verify that the module's front-panel LED's flash for a few seconds, indicating that self-diagnostics are being performed.

C. Then verify that the *power* LED is lit steadily and that the *prgm* and *lpbk* LED's are both off.

D. If, after 15 seconds, the *power* LED is still flashing, remove the module from the shelf, reinsert it into the shelf, and wait another 15 seconds.

E. If the *power* LED is still flashing, the module should be considered defective and returned to Tellabs as directed in section 8 of this practice.

wiring check

Caution: *Depressing the* wiring check *pushbutton during normal operation inhibits transmission through the module.*

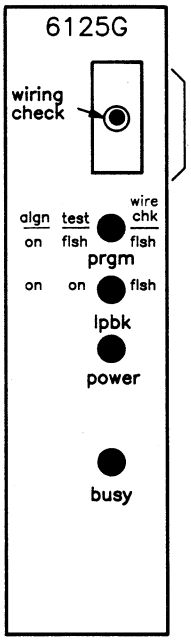
3.07 To perform the WIRING CHECK procedure, proceed as follows:

A. If a plastic window (see figure 10) is installed over the 6125G's front-panel *wiring check* pushbutton, use a small screwdriver or similar tool to remove the plastic cover and expose the pushbutton.

B. Using a small screwdriver or similar tool, depress the *wiring check* pushbutton for less than 5 seconds.

C. Using a transmission measuring set (TMS) or a hand-test telephone set, verify that continuous 1014Hz tone is present on the receive pair (from the facility) at the incoming-cable termination point and that interrupted 1014Hz tone is present on the transmit pair (to the facility) at the incoming-cable termination point. Then verify that amplitude-modulated (louder, softer, louder, etc.) 1014Hz tone is present on the 2wire pair at the network interface. Also verify that the module's *lpbk* and *prgm* LED's are flashing simultaneously (see figure 10).

D. Depress the *wiring check* pushbutton again to terminate the WIRING CHECK mode. Verify that the *lpbk* and *prgm* LED's are off. The 6125G is now ready for alignment. Unless AUTO-mode alignment is to be initiated locally via the module's *wiring check* pushbutton, replace the plastic window over the module's front-panel pushbutton at this time by snapping it into place.



Note: *Pushbutton is shown with the protective plastic window removed. In normal module operation, the plastic window should always be in place over the pushbuttons to prevent accidental changing of the operating mode.*

figure 10. 6125G front-panel controls and indicators

local initiation of AUTO-mode alignment (optional)

3.08 If AUTO-mode alignment is to be initiated at the 6125G's installation site, perform the AUTO-mode alignment initiation procedure in table 11 while referring as needed to figure 11, a flowchart showing the end-to-end AUTO alignment process.

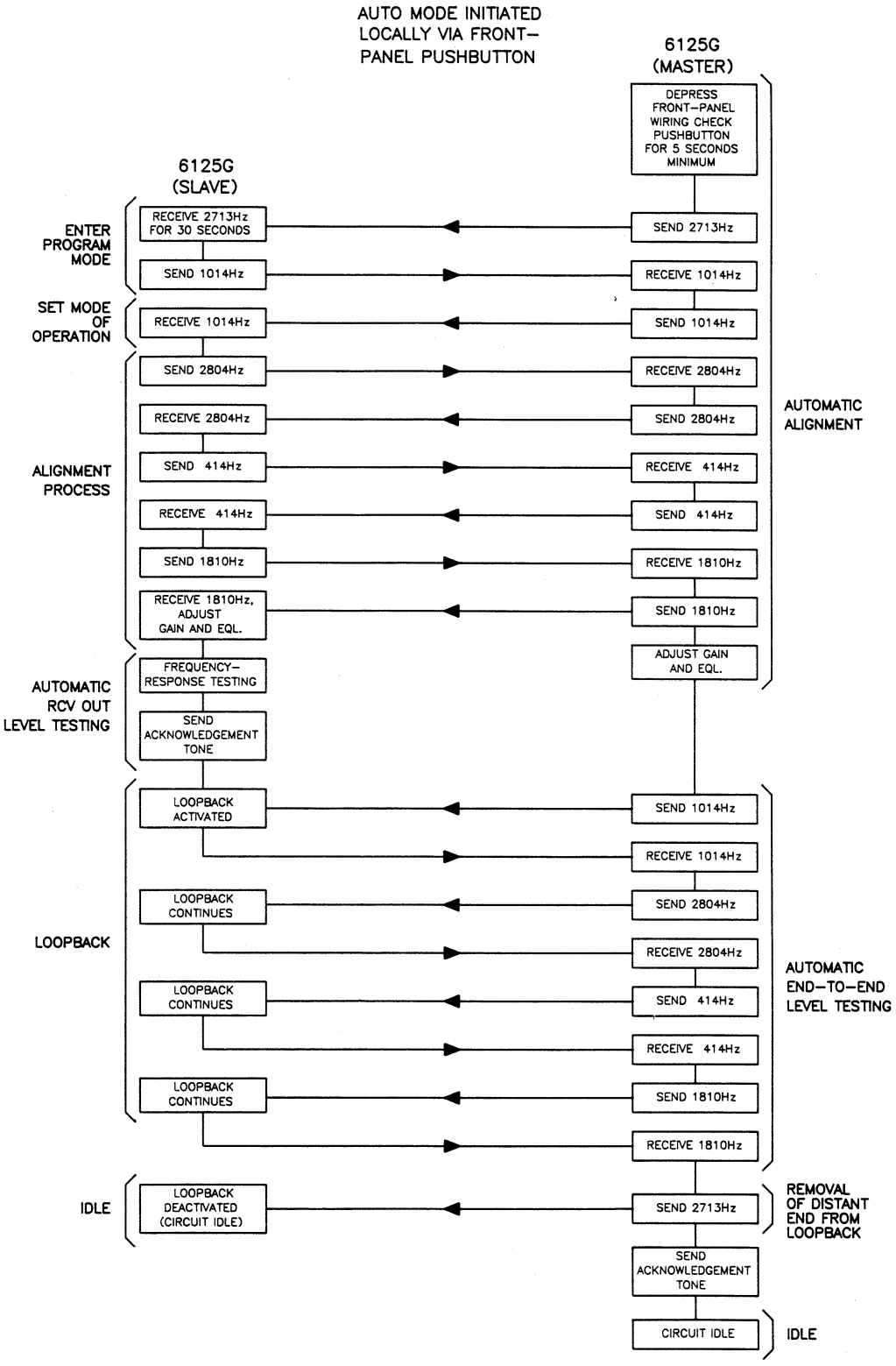


figure 11. Alignment flowchart for AUTO mode initiated locally via front-panel pushbutton

	step	operation
OPTIONAL	1*	Remove 6125G's front-panel plastic window to expose *wiring check* pushbutton.*
	2	Arrange receive portion of transmission measuring set (TMS) for bridged measurement, and connect it to transmit output tip and ring (pins 41 and 47).
	3*	Depress 6125G's front-panel *wiring check* pushbutton for 5 seconds minimum.*
OPTIONAL	4	Monitor 2713Hz being sent from master 6125G.
	5	After 35 seconds, monitor 1014Hz being sent from master 6125G.
	6	After 15 seconds, monitor 2804Hz being sent from master 6125G.
	7	After 10 seconds, monitor 414Hz being sent from master 6125G.
	8	After 10 seconds, monitor 1810Hz being sent from master 6125G.
	9	After 15 seconds, monitor 1014Hz being sent from master 6125G.
	10	After 10 seconds, monitor 2804Hz being sent from master 6125G.
	11	After 10 seconds, monitor 414Hz being sent from master 6125G.
	12	After 10 seconds, monitor 1810Hz being sent from master 6125G.
	13	After 5 seconds, monitor 2713Hz being sent from master 6125G.
	14	After 10 seconds, monitor acknowledgement tone being sent from master 6125G for 20 seconds. Upon cessation of acknowledgement tone, 6125G goes idle.
	15	Verify that 6125G's front-panel *prgm* and *align* LED's are unlighted. Then replace plastic window on module's front panel.
* Alignment can be initiated from either end of the circuit. The 6125G whose *wiring check* pushbutton is depressed becomes the master, and the 6125G at the opposite end of the circuit becomes the slave.		

table 11. AUTO alignment mode procedure for local initiation of alignment via front-panel pushbutton

LED indications on module

3.09 Four LED's on the 6125G's front panel indicate circuit status. If necessary, the installer should observe the LED's while referring to tables 12 and 13, which list the functions of the LED's and their respective mode and status indications.

function	color	designation
program	red	*prgm*
loopback	red	*lpbk*
power on	green	*power*
circuit busy	red	*busy*

table 12. Front-panel indicator LED's

operating mode/status	front-panel LED's			
	power	prgm	lpbk	busy
normal operation	on	off	off	on or off*
alignment occurring or PROGRAM mode	on	on	on	off
LOOPBACK mode	on	off	on	off
WIRING CHECK mode	on	flashing	flashing	off
FOUR-TONE MTU AND TRANSPONDER TEST or quiet-line termination	on	flashing	on	off
self-test	flashing	flashing	flashing	off
self-test failure	flashing	off	off	on or off
*Depending upon busy (seized)/idle status of circuit.				

table 13. Mode and status indications via front-panel LED's

4. alignment tasks at CTC

initiating desired remote alignment or diagnostic mode

4.01 Before initiating 6125G remote alignment or diagnostics, CTC personnel must determine what alignment mode is required—LOCAL, LOCAL PLUS, or AUTO. Upon completion of any of these modes, CTC personnel may need to adjust the module's transmission interface levels (if the preset ones are incorrect for the particular application) via the 2W OUT TLP, 2W IN TLP, and XMT OUT TLP modes. If ARD operation is to be used on the circuit, the ARD MODE SELECT optioning mode is then used to select either point-to-point or multipoint ringdown. Finally, remote diagnostics—LOOPBACK, FOUR-TONE MTU AND TRANSPONDER TEST, and MILLIWATT TEST—are performed to verify proper circuit performance.

Note 1: *Remote alignment can be performed from any point in the circuit (if the point of access has a flat frequency response). However, all text and all procedural flowcharts that follow later in this section are based upon the assumption that the access point is at the local end-office interfacing the end-link metallic facility. If remote alignment is to be performed or circuit frequency response is to be checked from a location other than the metallic access point, be certain that alignment-tone and/or test-tone levels are properly adjusted to compensate for frequency-response roll-off at that location in the circuit.*

Note 2: *All alignment and diagnostic procedures in this section are based upon the additional assumption that the 4wire facility is split (metallic path broken) at the access point. This iso-*

lates the end-link being aligned or tested from the rest of the circuit. A split 4wire facility is essential, for if the 2wire port is not terminated, tones sent to the 6125G are looped through the module's 4wire-to-2wire hybrid and back toward the network. If this occurs and the 4wire facility is not split, the tones are passed on toward the distant end of the circuit, where they can cause problems.

4.02 Table 14 is a quick-reference guide for locating the desired alignment or diagnostic procedure. Table 15 is an overview reference table that lists tone frequencies and/or DTMF codes used to select and activate (from the PROGRAM mode) the 6125G's various remote alignment and diagnostic modes. Tables 16 through 21 provide step-by-step procedures for initiating the 6125G's remote alignment and diagnostic modes. Figures 12 through 17, respectively, are corresponding flowcharts showing the end-to-end alignment and diagnostic processes. Select the desired mode in table 14; then perform the procedure in the appropriate table while referring as needed to the corresponding flowchart. If LOCAL or LOCAL PLUS alignment is used, see paragraph 4.04 for an additional optional procedure associated with the LOCAL and LOCAL PLUS modes only.

Note 1: *When any remote alignment mode is activated, please remember that the module's 2wire output, 2wire input, and transmit output TLP's are preset to −4 or −10 (FXS/FXO or ARD), 0, and +5TLP, respectively, except for the transmit output TLP in the LOCAL PLUS mode, which can range from −9 to +5. If different TLP's are required, see figure 15 and table 19 for the appropriate procedure.*

Note 2: *To exit any alignment or diagnostic mode at any time, simply send DTMF code #4 to return to the PROGRAM mode or send 2713Hz tone for 10 seconds to return to idle. In all modes except LOCAL, LOCAL PLUS, AUTO, and LOOPBACK, sending DTMF code ## also returns the 6125G to idle.*

alignment, optioning, or diagnostic mode	procedure flowchart		procedure table	
	figure no.	page	table no.	page
AUTO, activated locally via pushbutton*	11	33	11	34
LOCAL**	12	39	16	40
LOCAL PLUS**	13	41	17	42
AUTO, activated remotely from CTC	14	43-44	18	44
MILLIWATT TEST and TLP alignment	15	45	19	46
ARD MODE SELECT	16	47	20	48
FOUR-TONE MTU AND TRANSPONDER TEST	17	49	21	50

* Figure 11 and table 11 are located in section 3 of this practice.
** An additional procedure for optional adjustment of receive-channel frequency response upon completion of LOCAL or LOCAL PLUS alignment is described in paragraph 4.04. Its procedure table is table 23 on page 51.

table 14. Quick-reference guide for locating desired alignment, optioning, or diagnostic mode

remote alignment or diagnostic mode	from PROGRAM mode, send tone frequency:	from PROGRAM mode, send DTMF code:
MILLIWATT TEST	—	#0
2W OUT TLP	—	#1
2W IN TLP	—	#2
XMT OUT TLP	—	#3
return to PROGRAM mode	—	#4
FOUR-TONE MTU AND TRANSPONDER TEST	804Hz	#5
LOOPBACK	—	#6
ARD MODE SELECT	—	#7
LOCAL	1004Hz	—
LOCAL PLUS	1204Hz	—
AUTO	1404Hz	—

table 15. Mode-selection overview table

optional determination of receive-channel frequency response (LOCAL or LOCAL PLUS mode)

4.03 If confirmation tone is returned by the 6125G upon completion of alignment, it can be safely assumed that the circuit's frequency response is within C5 attenuation distortion limits at the four alignment frequencies, as listed in table 22. Error tone, on the other hand, indicates that the circuit's frequency response does not meet C5 attenuation distortion limits. Please be aware, however, that error tone does not necessarily mean that a particular circuit's alignment requirements are not met. It may therefore be necessary to determine the actual frequency response of the circuit. (In some cases, standard operating procedures may dictate that this be done regardless of whether confirmation or error tone was returned.) Tables 16 and 17 (LOCAL and LOCAL PLUS alignment) each provide a simple procedure for calculating receive-channel attenuation distortion, if required.

	C5 attenuation distortion limits	
frequency	LOCAL alignment	AUTO alignment (2x C5 limits)
404Hz	−1, +3dB	−2, +6dB
1004Hz	reference level	reference level
1804Hz	−0.5, +1.5dB	−1, +3dB
2804Hz	−0.5, +1.5dB	−1, +3dB

table 22. C5 attenuation distortion limits

optional adjustment of receive-channel frequency response (LOCAL or LOCAL PLUS mode)

4.04 For most facilities, the 6125G provides successful alignment within C5 attenuation distortion limits upon the very first alignment attempt. If error tone is returned but C5 conditioning is not required, receive-channel attenuation distortion should be calculated as directed in tables 16 and 17 (LOCAL and LOCAL PLUS alignment) to verify that the circuit meets the required conditioning limits. If error tone is returned and C5 conditioning is required, the circuit's frequency response can often be manually adjusted at the CTC so that a second 6125G alignment attempt is successful at meeting C5 attenuation distortion limits. This second alignment is performed by using the original CTC transmit TLP plus or minus a calculated response correction at each alignment frequency. If the 6125G's levels are too high after the first alignment attempt (i.e., if the module is inserting too much gain), a new alignment TLP (the original TLP raised by the appropriate calculated amount) will cause the 6125G to insert less gain. Similarly, if the 6125G's levels are too low after the first alignment attempt (i.e., if the module is not inserting enough gain), a new alignment TLP (the original TLP lowered by the appropriate calculated amount) will cause the 6125G to insert more gain. Table 23 contains a step-by-step procedure for making the calculations required for this receive-channel frequency-response adjustment.

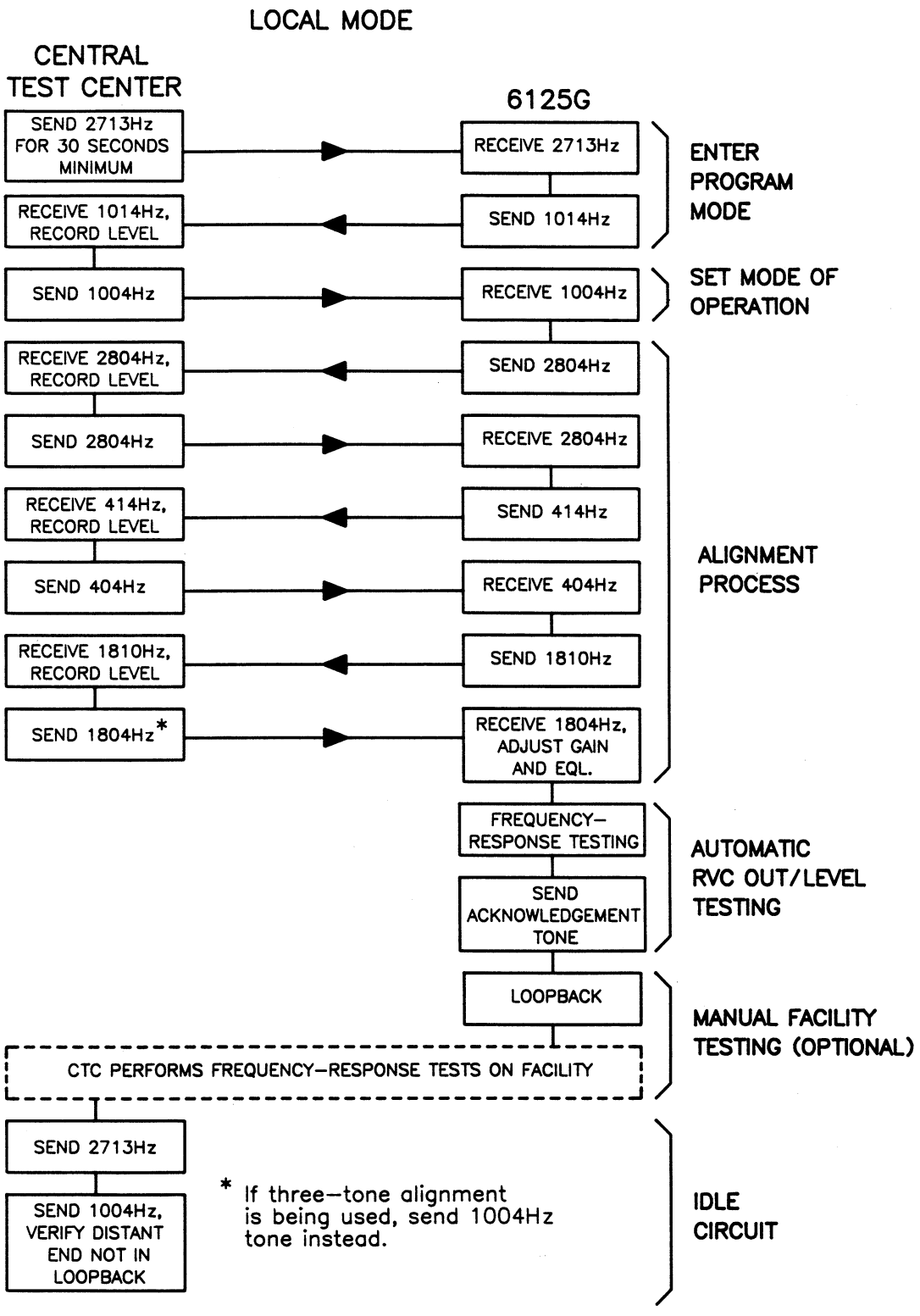


figure 12. Alignment flowchart for LOCAL mode

step	operation
1	Send 2713Hz at TLP specified on circuit layout record (CLR) for 30 seconds minimum while monitoring receive.
2	Receive 1014Hz. Verify frequency and measure level. Record level in column A (see below).
3	Send 1004Hz at CLR-specified level.
4	Within 10 seconds, receive 2804Hz. Verify frequency and measure level. Record level in column A.
5	Send 2804Hz at CLR-specified level.
6	Within 10 seconds, receive 414Hz. Verify frequency and measure level. Record level in column A.
7	Send 404Hz at CLR-specified level.
8	Within 10 seconds, receive 1810Hz. Verify frequency and measure level. Record level in column A. Proceed either to step 8A (if three-tone alignment is being used) or to step 9 (if four-tone alignment is being used).
8A (FOR THREE-TONE ALIGNMENT ONLY)	Send 1004Hz at CLR-specified level.
8B (FOR THREE-TONE ALIGNMENT ONLY)	Within 15 seconds, receive acknowledgement tone for 20 seconds. Remove and then resend 1004Hz to cut off acknowledgement tone. Upon cessation of acknowledgement tone, 6125G goes into LOOP-BACK. Proceed to step 11.
9	Send 1804Hz at CLR-specified level.
10	Within 10 seconds, receive acknowledgement tone for 20 seconds. Send 1004Hz to cut off acknowledgement tone. Upon cessation of acknowledgement tone, 6125G goes into LOOPBACK.
11	Send 1004Hz at CLR-specified level. Record level of looped 1004Hz in column B.
12	Send 2804Hz at CLR-specified level. Record level of looped 2804Hz in column B.
13	Send 404Hz at CLR-specified level. Record level of looped 404Hz in column B.
14	Send 1804Hz at CLR-specified level. Record level of looped 1804Hz in column B.
15	Calculate receive-channel attenuation distortion as directed in column C.
16	Send 2713Hz at CLR-specified level (release LOOPBACK).

			C
			B minus A
	A	B	receive-channel attenuation distortion (dB) (toward station)
frequencies	alignment level	loopback level	
1004 and 1014Hz			
2804 and 2804Hz			
404 and 414Hz			
1804 and 1810Hz			

table 16. LOCAL alignment mode procedure

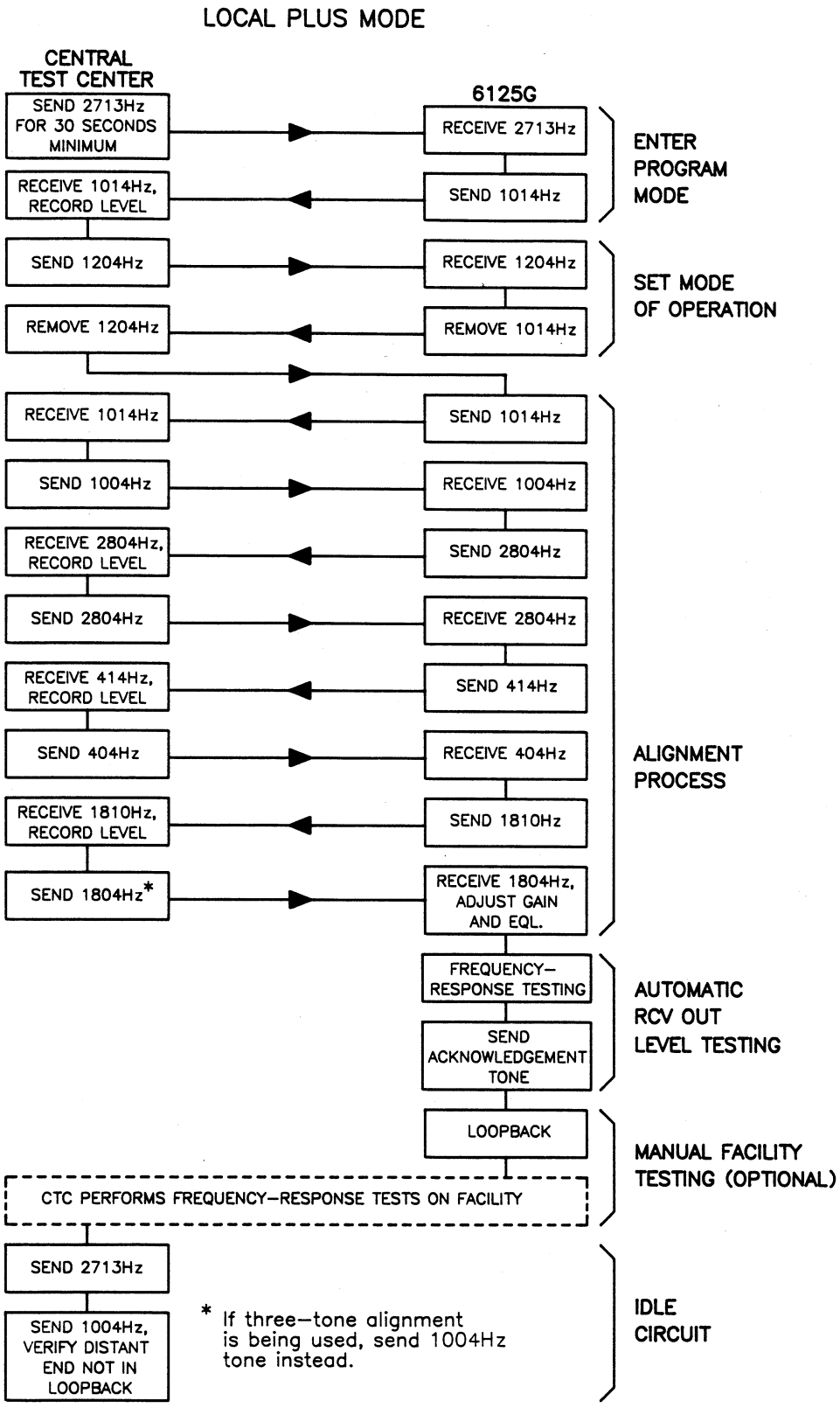
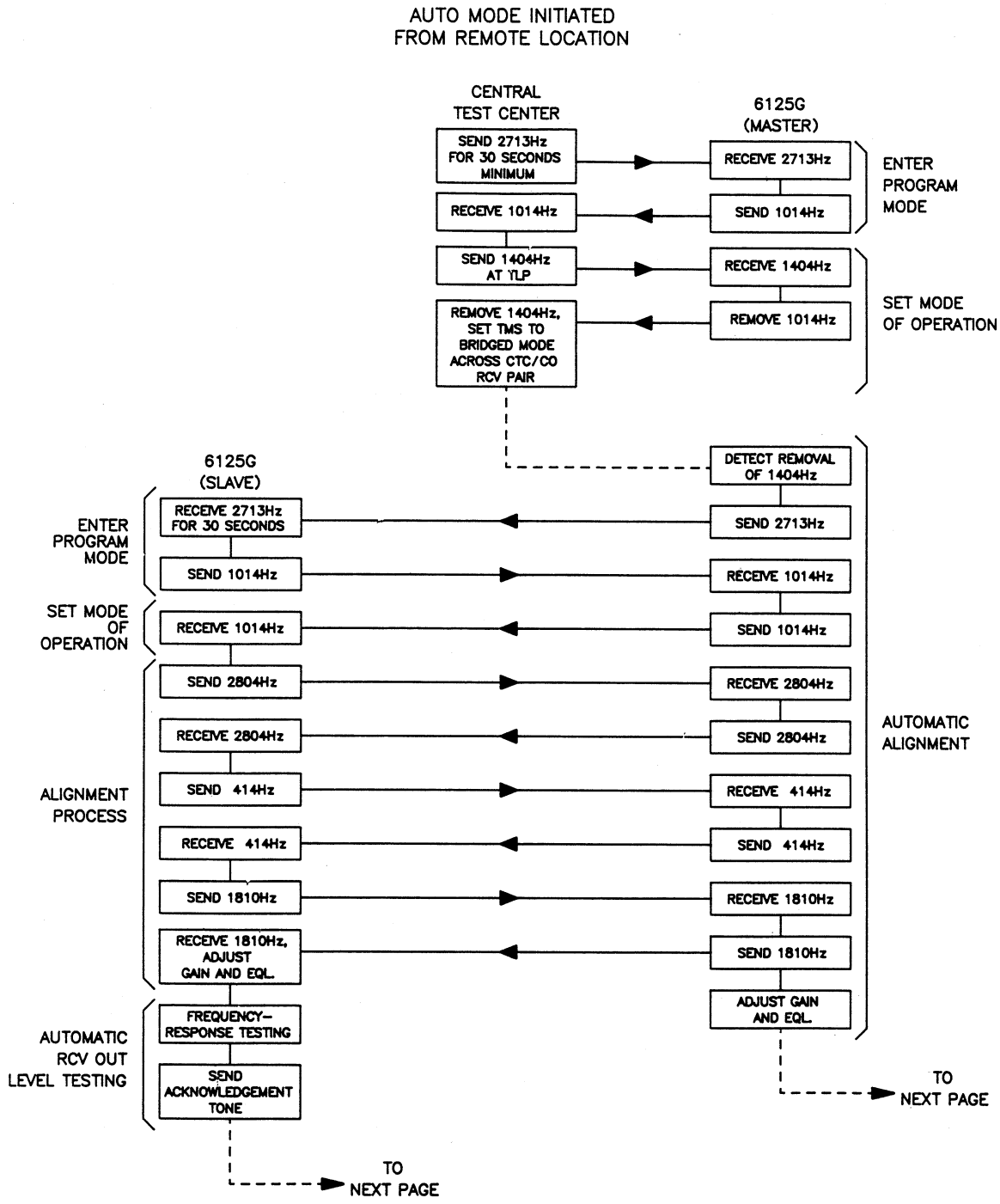


figure 13. Alignment flowchart for LOCAL PLUS mode

step	operation
1	Send 2713Hz at TLP specified on circuit layout record (CLR) for 30 seconds minimum while monitoring receive.
2	Receive 1014Hz. Verify frequency and measure level. Record level in column A (see below).
3	Send 1204Hz at CLR-specified level.
4	Within 15 seconds, incoming 1014Hz removed. Measure frequency to verify absence of 1014Hz.
5	Remove 1204Hz. (As an alternative, change frequency being sent to 1004Hz and skip to step 8.)
6	Receive 1014Hz. Measure frequency to verify presence of 1014Hz.
7	Send 1004Hz at CLR-specified level.
8	Within 15 seconds, receive 2804Hz. Verify frequency and measure level. Record level in column A.
9	Send 2804Hz at CLR-specified level.
10	Within 10 seconds, receive 414Hz. Verify frequency and measure level. Record level in column A.
11	Send 404Hz at CLR-specified level.
12	Within 10 seconds, receive 1810Hz. Verify frequency and measure level. Record level in column A. Proceed either to step 12A (if three-tone alignment is being used) or to step 13 (if four-tone alignment is being used).
12A (FOR THREE-TONE ALIGNMENT ONLY)	Send 1004Hz at CLR-specified level.
12B (FOR THREE-TONE ALIGNMENT ONLY)	Within 15 seconds, receive acknowledgement tone for 20 seconds. Remove and then resend 1004Hz to cut off acknowledgement tone. Upon cessation of acknowledgement tone, 6125G goes into LOOPBACK. Proceed to step 15.
13	Send 1804Hz at CLR-specified level.
14	Within 10 seconds, receive acknowledgement tone for 20 seconds. Send 1004Hz to cut off acknowledgement tone. Upon cessation of acknowledgement tone, 6125G goes into LOOPBACK.
15	Send 1004Hz at CLR-specified level. Record level of looped 1004Hz in column B.
16	Send 2804Hz at CLR-specified level. Record level of looped 2804Hz in column B.
17	Send 404Hz at CLR-specified level. Record level of looped 404Hz in column B.
18	Send 1804Hz at CLR-specified level. Record level of looped 1804Hz in column B.
19	Calculate receive-channel attenuation distortion as directed in column C. Also calculate amounts of additional post-equalization required at serving CO by subtracting B from D. Record the results in column E.
20	Send 2713Hz at CLR-specified level (release LOOPBACK).

	A	B	C	D		E
			B minus A			D minus B
frequencies	alignment level	loopback level	receive-channel attenuation distortion (toward station)	reference level: standard	reference level: other	additional post-eql. required (dB)
1004 and 1014Hz				-9dBm		
2804 and 2804Hz				-9dBm		
404 and 414Hz				-9dBm		
1804 and 1810Hz				-9dBm		

table 17. LOCAL PLUS alignment mode procedure


AUTO MODE INITIATED
FROM REMOTE LOCATION
CENTRAL
TEST CENTER
6125G
(MASTER)
SEND 2713Hz
FOR 30 SECONDS
MINIMUM
RECEIVE 2713Hz
ENTER
PROGRAM
MODE
RECEIVE 1014Hz
SEND 1014Hz
SEND 1404Hz
AT TLP
RECEIVE 1404Hz
SET MODE
OF OPERATION
REMOVE 1404Hz,
SET TMS TO
BRIDGED MODE
ACROSS CTC/CO
RCV PAIR
REMOVE 1014Hz
DETECT REMOVAL
OF 1404Hz
6125G
(SLAVE)
RECEIVE 2713Hz
FOR 30 SECONDS
SEND 2713Hz
ENTER
PROGRAM
MODE
SEND 1014Hz
RECEIVE 1014Hz
SET MODE
OF
OPERATION
RECEIVE 1014Hz
SEND 1014Hz
SEND 2804Hz
RECEIVE 2804Hz
RECEIVE 2804Hz
SEND 2804Hz
AUTOMATIC
ALIGNMENT
SEND 414Hz
RECEIVE 414Hz
ALIGNMENT
PROCESS
RECEIVE 414Hz
SEND 414Hz
SEND 1810Hz
RECEIVE 1810Hz
RECEIVE 1810Hz,
ADJUST
GAIN AND EQL.
SEND 1810Hz
ADJUST GAIN
AND EQL.
FREQUENCY-
RESPONSE TESTING
AUTOMATIC
RCV OUT
LEVEL TESTING
SEND
ACKNOWLEDGEMENT
TONE
TO
NEXT PAGE
TO
NEXT PAGE

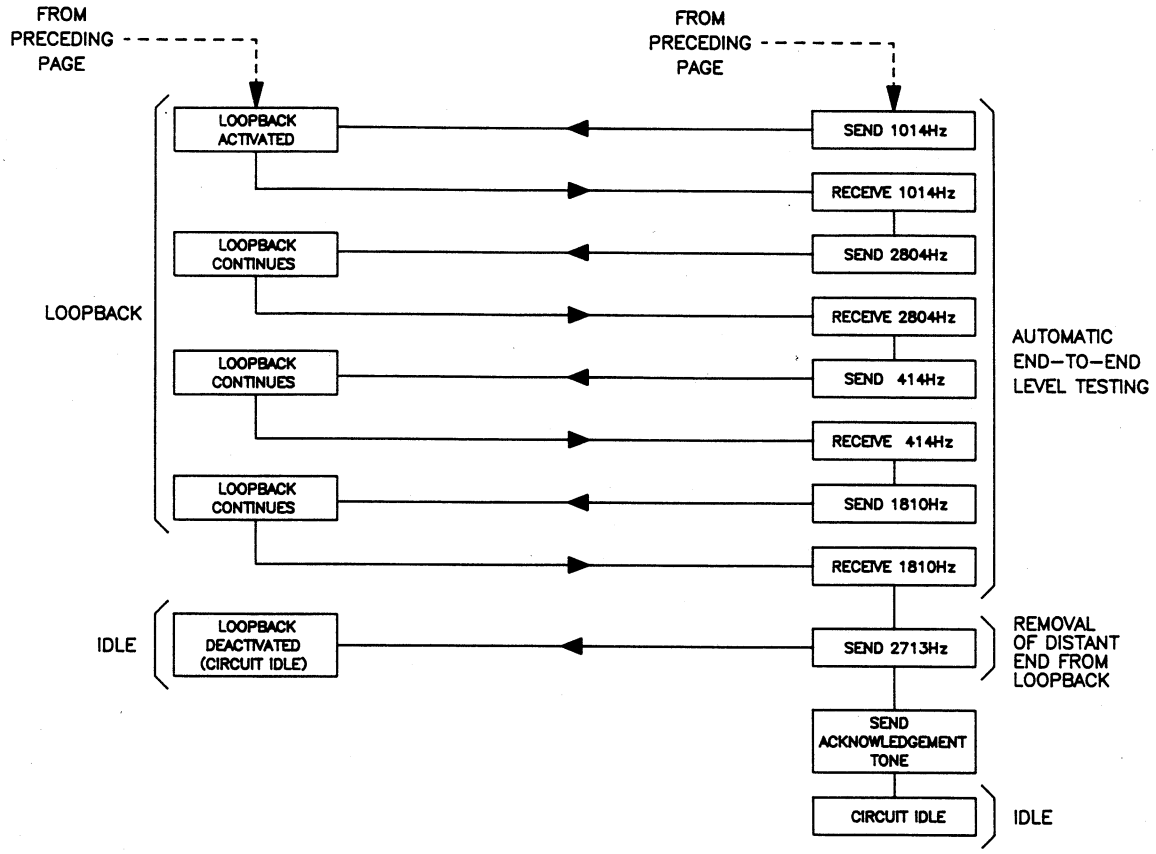


figure 14. Alignment flowchart for AUTO mode initiated remotely from CTC

	step	operation
	1	Send 2713Hz at TLP specified on circuit layout record (CLR) for 30 seconds minimum while monitoring receive.
	2	Receive 1014Hz from master 6125G. Measure frequency to verify presence of 1014Hz.
	3	Send 1404Hz at CLR-specified TLP.
	4	Within 15 seconds, 1014Hz removed. Measure frequency to verify absence of 1014Hz.
	5	Remove 1404Hz. AT THIS POINT, MANDATORY CTC INVOLVEMENT IN AUTO-MODE ALIGNMENT IS COMPLETED. If CTC monitoring of alignment frequencies is desired, arrange TMS (rcv portion) for bridged measurement and proceed to step 6.
OPTIONAL	6	Monitor 2713Hz being sent from master 6125G.
	7	After 35 seconds, monitor 1014Hz being sent from master 6125G.
	8	After 15 seconds, monitor 2804Hz being sent from master 6125G.
	9	After 10 seconds, monitor 414Hz being sent from master 6125G.
	10	After 10 seconds, monitor 1810Hz being sent from master 6125G.
	11	After 15 seconds, monitor 1014Hz being sent from master 6125G.
	12	After 10 seconds, monitor 2804Hz being sent from master 6125G.
	13	After 10 seconds, monitor 414Hz being sent from master 6125G.
	14	After 10 seconds, monitor 1810Hz being sent from master 6125G.
	15	After 5 seconds, monitor 2713Hz being sent from master 6125G.
	16	After 10 seconds, monitor acknowledgement tone being sent from master 6125G for 20 seconds. Upon cessation of acknowledgement tone, 6125G goes idle.

table 18. AUTO alignment mode procedure for remote initiation of alignment from CTC

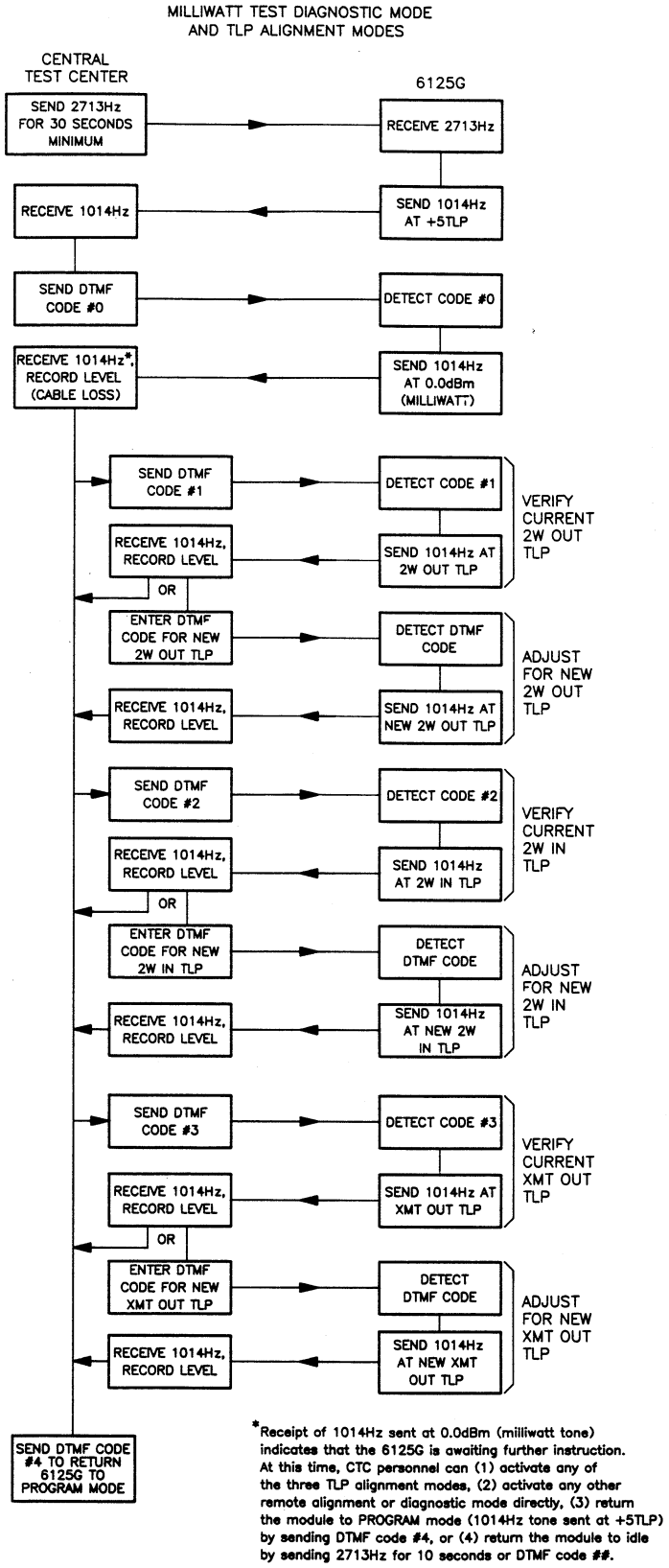


figure 15. Flowchart for MILLIWATT TEST diagnostic mode and TLP alignment modes

	step	operation
	1	Send 2713Hz at TLP specified on circuit layout record (CLR) for 30 seconds minimum while monitoring receive.
	2	Receive 1014Hz (sent from module at +5TLP).
	3	Send DMTF code #0 for 0dBm (milliwatt) tone.
	4	Receive ascending tone sweep followed by 1014Hz (see note 1 at bottom of table). Record 1014Hz level in column C. This level represents the amount of cable loss. For calculation purposes, do not include a minus sign in column C.
	5	Send DTMF code #1.
	6	Receive ascending tone sweep followed by 1014Hz (see note 1). Record 1014Hz level in the #1 2WIRE OUT row of column A.
OPTIONAL	7	If a different interface 2WIRE OUT TLP is required, enter new TLP via DTMF code as directed in note 2 below.
OPTIONAL	8	Receive ascending tone sweep followed by 1014Hz (see note 1). Record 1014Hz level in the #1 2WIRE OUT row of column B.
	9	Send DTMF code #2.
	10	Receive ascending tone sweep followed by 1014Hz (see note 1). Record 1014Hz level in the #2 2WIRE IN row of column A.
OPTIONAL	11	If a different interface 2WIRE IN TLP is required, enter new TLP via DTMF code as directed in note 2 below.
OPTIONAL	12	Receive ascending tone sweep followed by 1014Hz (see note 1). Record 1014Hz level in the #2 2WIRE IN row of column B.
	13	Send DTMF code #3.
	14	Receive ascending tone sweep followed by 1014Hz (see note 1). Record 1014Hz level in the #3 XMT OUT row of column A.
OPTIONAL	15	If a different interface XMT OUT TLP is required, enter new TLP via DTMF code as directed in note 2 below.
OPTIONAL	16	Receive ascending tone sweep followed by 1014Hz (see note 1). Record this level in the #3 XMT OUT row of column B.
	17	Calculate actual TLP by adding column A or B (if readjusted) to column C and recording the sum in column D.

	A	B	C	D
	initial TLP received	**new (adjusted) TLP received**	**cable loss**	**actual TLP**
#1 2WIRE OUT				
#2 2WIRE IN				
#3 XMT OUT				

Note 1: If error tone is heard, an invalid DTMF code was entered. Therefore, make another attempt at entering a valid DTMF code.

Note 2: Enter the new TLP as follows:

- For a **positive** TLP, enter DTMF code *XXX. In this code, * = + (positive), X = 0 through 9, and a decimal point is assumed at the left of the rightmost X. For example, DTMF code *014 selects a +1.4TLP.
- For a **negative** TLP, enter DTMF code XXX. In this code, the lack of a * indicates negative, X = 0 through 9, and a decimal point is assumed at the left of the rightmost X. For example, DTMF code 127 selects a −12.7TLP.

table 19. MILLIWATT TEST and TLP ADJUST procedure

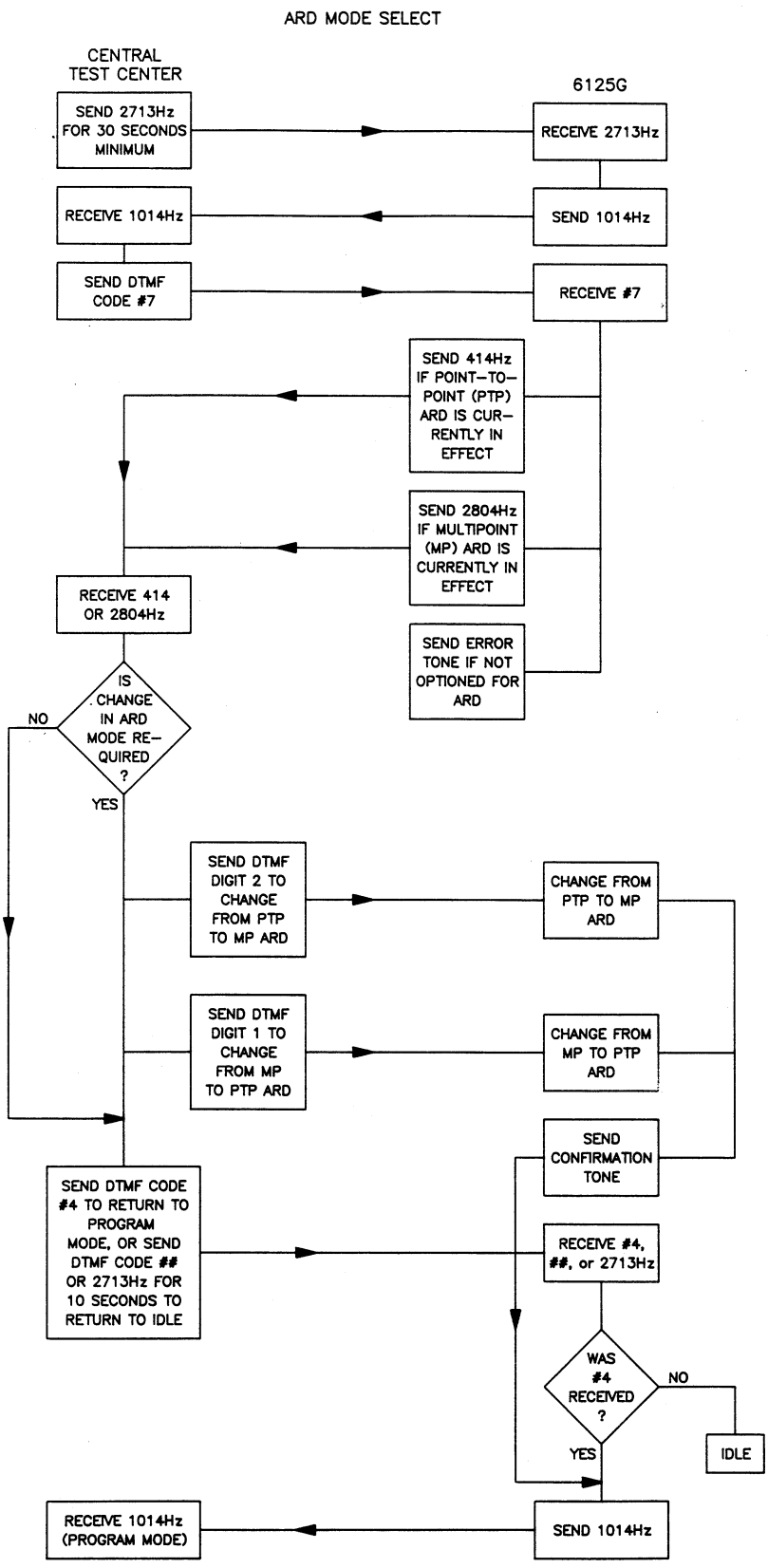


figure 16. ARD MODE SELECT flowchart

step	operation
1	Send 2713Hz at TLP specified on circuit layout record (CLR) for 30 seconds minimum while monitoring receive.
2	Receive 1014Hz. Verify frequency.
3	Send DTMF code #7.
4	Receive 414Hz if 6125G is currently in **point-to-point ARD** mode or 2804Hz if 6125G is currently in **multipoint ARD** mode. (Receive error tone if 6125G is not correctly switch-optioned [by installer] for ARD operation.) Proceed to step 5A, 5B, or 5C as desired.
5A	IF 414Hz (indicating point-to-point ARD) is being received and multipoint ARD is desired, send DTMF digit 2 and proceed to step 6.
5B	If 2804Hz (indicating multipoint ARD) is being received and point-to-point ARD is desired, send DTMF digit 1 and proceed to step 6.
5C	If either 414Hz (indicating point-to-point ARD) or 2804Hz (indicating multipoint ARD) is being received and **no change** in 6125G's current ARD mode is desired, proceed directly to step 6.
6	Either send DTMF code #4 to return 6125G to PROGRAM mode, or send DTMF code ## or 2713Hz for 10 seconds to return 6125G to idle.

table 20. ARD MODE SELECT optioning mode procedure

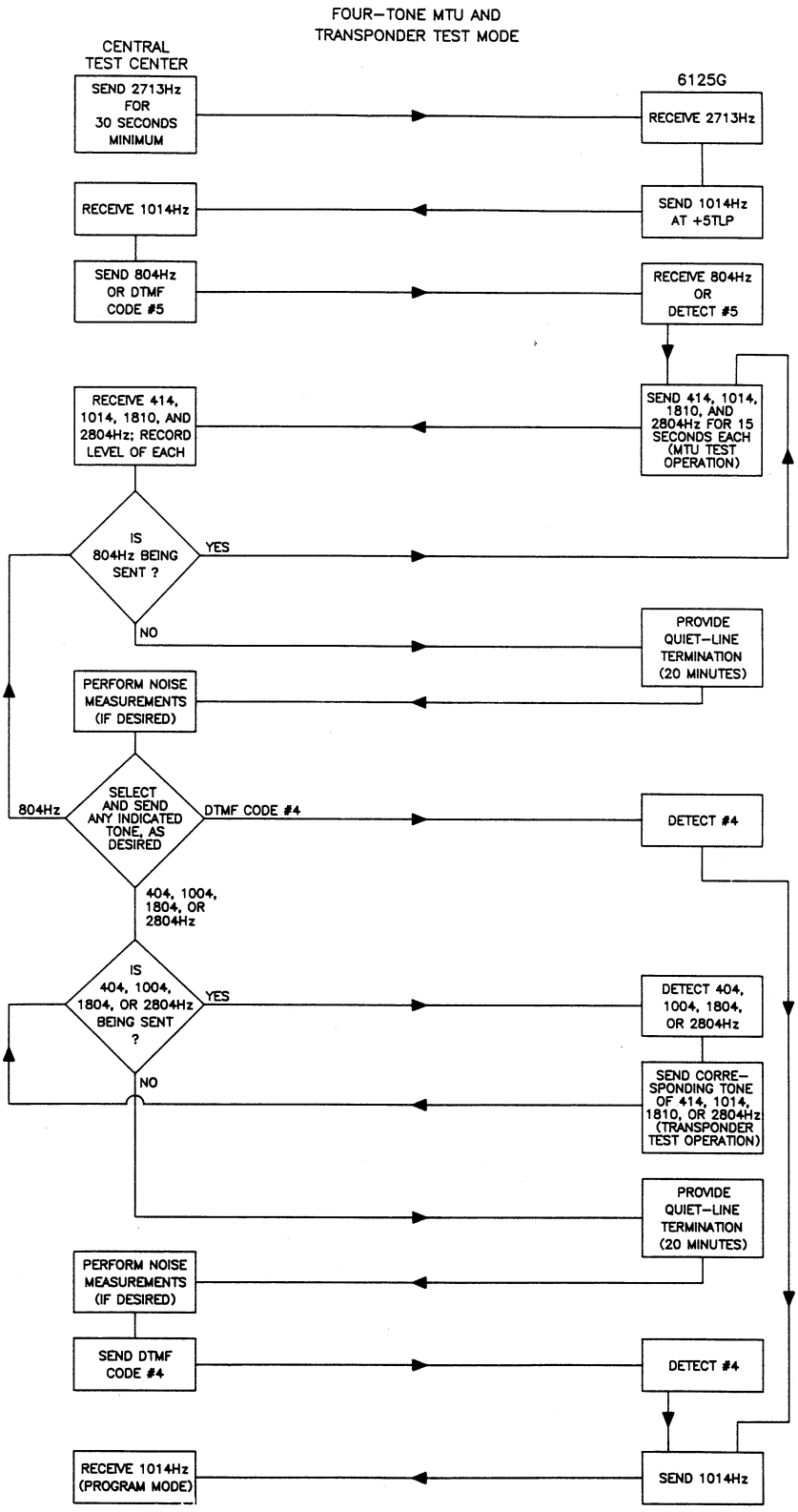


figure 17. Flowchart for FOUR-TONE MTU AND TRANSPONDER TEST diagnostic mode

step	operation
1	Send 2713Hz at TLP specified on circuit layout record (CLR) for 30 seconds minimum while monitoring receive.
2	Receive 1014Hz (sent from 6125G at +5TLP). Verify frequency.
3	Send 804Hz at CLR-specified TLP or DTMF code #5.
4	Receive 414, 1014, 1810, and 2804Hz, each for 15 seconds (MTU TEST operation). Record received levels in column A below. ***Note:*** *Four-tone sequence continues for 20 complete cycles (20 minutes); module then provides a quiet-line termination for 20 minutes and goes idle. To place module in quiet-line termination* ***before*** *20 complete 4-tone cycles elapse, remove 804Hz. Module completes 4-tone cycle in progress and then provides the quiet-line termination.*
5	With module providing quiet-line termination, perform noise measurements (if desired).
6	If TRANSPONDER TEST operation is desired, proceed to step 7A, 8A, 9A, or 10A. Otherwise, proceed to step 11.
7A	Send 404Hz at CLR-specified TLP.
7B	Receive 414Hz (sent from 6125G at current XMT OUT TLP). Verify frequency and measure level. Record level in column B below.
8A	Send 1004Hz at CLR-specified TLP.
8B	Receive 1014Hz (sent from 6125G at current XMT OUT TLP). Verify frequency and measure level. Record level in column B below.
9A	Send 1804Hz at CLR-specified TLP.
9B	Receive 1810Hz (sent from 6125G at current XMT OUT TLP). Verify frequency and measure level. Record level in column B below.
10A	Send 2804Hz at CLR-specified TLP.
10B	Receive 2804Hz (sent from 6125G at current XMT OUT TLP). Verify frequency and measure level. Record level in column B below.
11	To return to quiet-line termination, remove tone being sent. To send another tone, return to step 7A, 8A, or 9A as desired. Otherwise, proceed to step 12.
12	Send DTMF code #4.
13	Receive 1014Hz (PROGRAM mode).

	A	B
frequency	**MTU TEST level**	**TRANSPONDER TEST level**
404 and 414Hz		
1004 and 1014Hz		
1804 and 1810Hz		
2804 and 2804Hz		

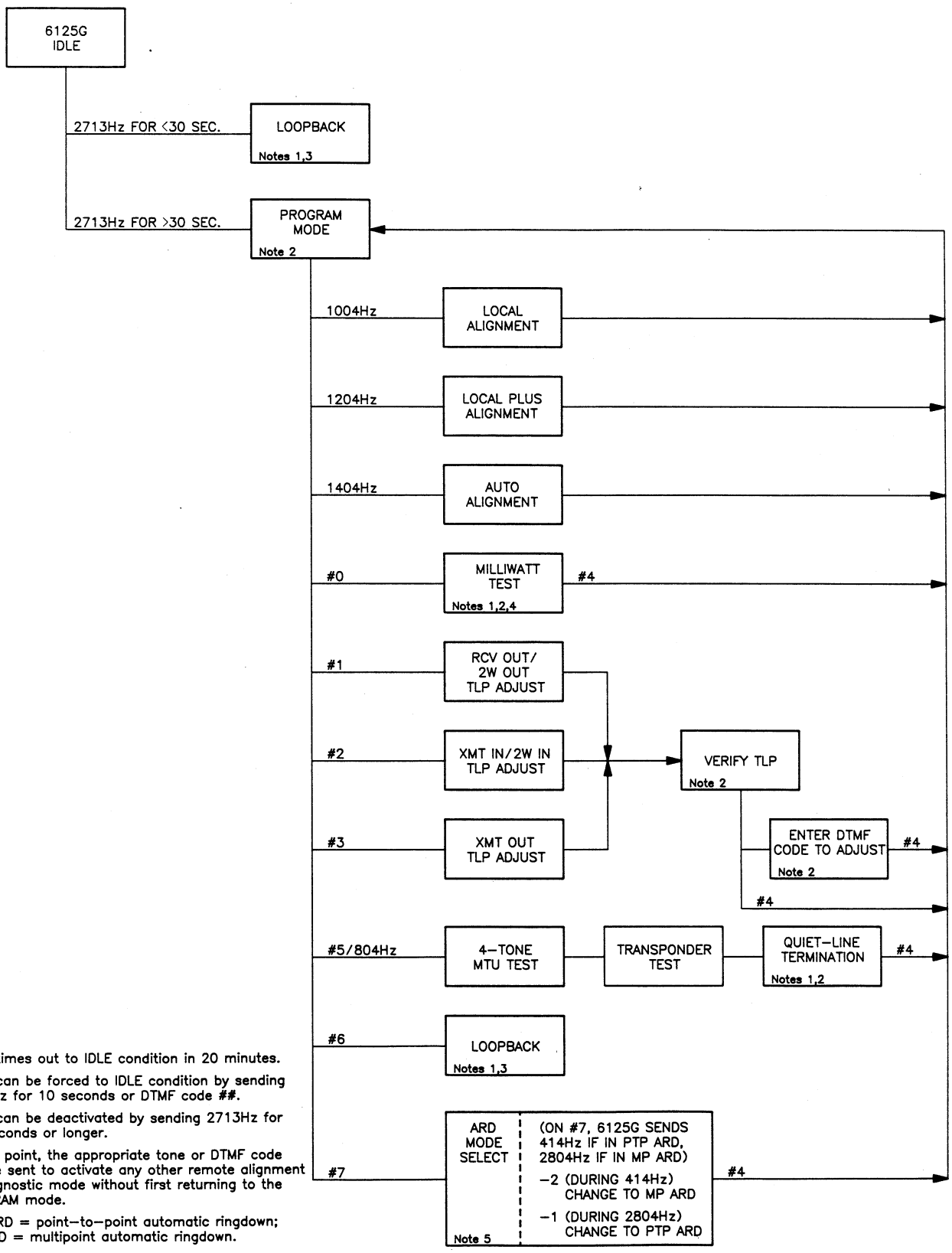
table 21. FOUR-TONE MTU and TRANSPONDER TEST diagnostic mode procedure

step	operation
1	Obtain (from circuit records) the attenuation distortion specification for the circuit, and record the values in column A below.
2	Fill in column B with the receive-channel attenuation distortion values listed in column C of table 16 or 17 (LOCAL or LOCAL PLUS alignment).
3	**For 1004Hz only**, if the current frequency-response value in column B is positive, add the same **negative** value to it to obtain a sum of 0 (zero), and enter 0 in the top row of column C below. If the 1004Hz frequency-response value in column B is negative, add the same **positive** value to it to obtain a sum of 0, and enter 0 in the top row of column C below.
4	To the 2804, 404, and 1804Hz frequency-response values in column B, add the same negative or positive value added to the 1004Hz value in column B. Record the results in the second through fourth rows of column C below.
5	Because 1004Hz is the reference frequency, enter a 0 in the top row of column D. For 2804, 404, and 1804Hz, determine whether the value in column C is **outside of** the respective frequency-response specification in column A. If so, determine the difference and record the **absolute value** of the difference (i.e., the amount of the difference between A and C without a positive or negative sign) in column D.
6	Fill in column E with the CO transmit TLP's used in the initial alignment attempt.
7	For each frequency with a value recorded in column D, compare the value in column C with the value in column A. If the value in column C is greater than that in column A, add the value in column D to the value in column E and record the sum in column F. If the value in column C is less than that in column A, subtract the value in column D from the value in column E, and record the difference in column F.
8	Using the new CO transmit TLP's in column F, realign the circuit by reinitiating LOCAL or LOCAL PLUS alignment as directed in table 16 or 17.

		B	C	D	E	F
	A		current rcv-channel frequency response re 1004Hz	amount by which value in column C is outside of specification	CO xmt TLP's used in first alignment attempt	new CO xmt TLP's for second alignment attempt
frequency	frequency-response specification	current rcv-channel frequency response				
1004Hz	reference		0	0		
2804Hz	+ ,– dB					
404Hz	+ ,– dB					
1804Hz	+ ,– dB					

table 23. Optional adjustment of receive-channel frequency adjustment upon completion of LOCAL or LOCAL PLUS alignment

5. protocol overview flowchart



Note 1: Mode times out to IDLE condition in 20 minutes.

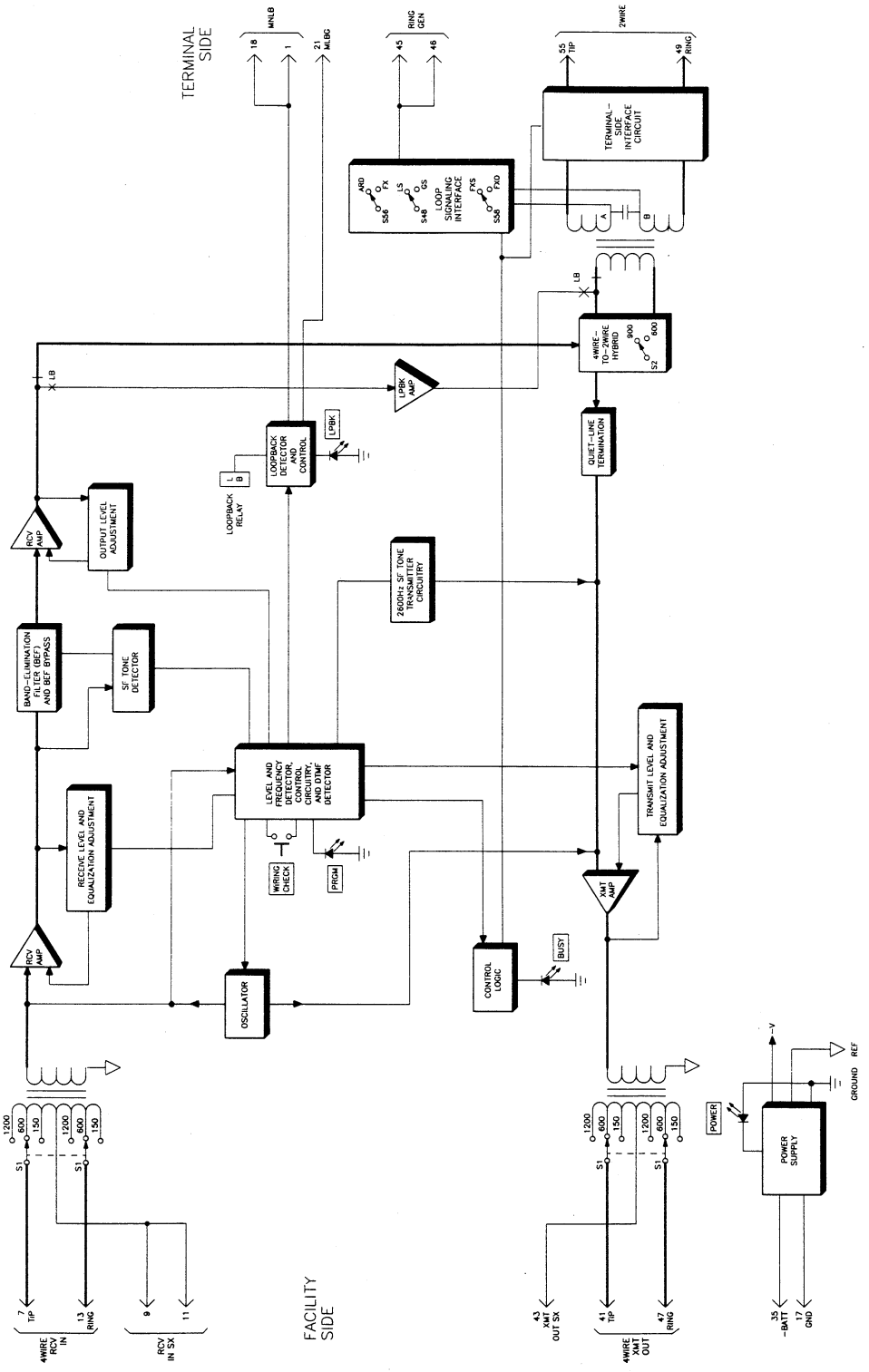
Note 2: Mode can be forced to IDLE condition by sending 2713Hz for 10 seconds or DTMF code ##.

Note 3: Mode can be deactivated by sending 2713Hz for 1.2 seconds or longer.

Note 4: At this point, the appropriate tone or DTMF code can be sent to activate any other remote alignment or diagnostic mode without first returning to the PROGRAM mode.

Note 5: PTP ARD = point-to-point automatic ringdown; MP ARD = multipoint automatic ringdown.

6. block diagram



6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater 816125G

7. specifications

Note: *The 6125G meets power-cross and lightning-surge-protection (facility side) criteria specified in GTE Publication ND-83-215.*

transmission

input and output levels	−16 to +7TLP at all three ports (4wire receive, 4wire transmit, and 2wire) except for 4wire transmit port in LOCAL PLUS mode, whose output level range is −9 to +5TLP
acknowledgement tones	confirmation tone: ascending sweep of frequencies starting at 300Hz and ending at 3000Hz, with the 3000Hz tone held for 15 seconds error tone: descending sweep of frequencies starting at 3000Hz and ending at 300Hz, with the 300Hz tone held for 15 seconds
wiring check tones	4wire receive: 1014Hz continuous 4wire transmit: 1014Hz interrupted 2wire: 1014Hz continuous, amplitude-modulated
terminating impedances	4wire rcv and 4wire xmt ports: 1200, 600, or 150 ohms, balanced, switch-selectable 2wire port: 900 or 600 ohms, balanced, switch-selectable, in series with 2.15μF
transmit and receive output-level accuracy	±0.5dB (nominal)

SF transmit section, common specifications

internal SF tone oscillator frequency and stability	2600±5Hz for life of unit
SF tone levels	low (idle) level: −20dBm0±1dB high level: −8dBm0±2dB
high-level timing	high-level tone is transmitted for 400±100ms when tone switches from off to on

SF transmit section, FXS operation

outgoing SF tone states	see table 2 (loop start) and table 3 (ground start) in section 2 of this practice
pulsing characteristics	• input breaks and makes shorter then 10ms are not recognized • input breaks between 34ms and 50ms are transmitted as 45ms minimum tone bursts • input makes between 18ms and 25ms are repeated as 25ms minimum silent (no tone) intervals • input breaks longer than 50ms are transmitted as tone bursts equal in duration to the input break duration ±4ms • input makes longer than 25ms are repeated as silent (no tone) intervals equal in duration to the input make duration ±4ms

SF transmit section, FXO operation

outgoing SF tone states	see table 4 (loop start) and table 5 (ground start) in section 2 of this practice
SF tone modulation, ground start	20±3Hz during ringing

SF receive section, common

SF tone detection	frequency: 2600±15Hz range: 0 to −27dBm0
SF tone rejection threshold	−37dBm0
signal-to-guard ratio for signal detection	6dB minimum

SF receive section, FXS operation

incoming SF tone states	see table 2 (loop start) and table 3 (ground start) in section 2 of this practice

SF receive section, FXO operation

incoming SF tone states	see table 4 (loop start) and table 5 (ground start) in section 2 of this practice

dial pulse characteristics, SF to loop (input pulses shorter than 30ms are ignored)

pulse rate	**input break**	**output break**
8pps	50 to 75%	58±4%
10pps	50 to 75%	58±4%
12pps	54 to 75%	58±4%

2wire loop conditions and supervisory limits, FXS operation

maximum loop resistance	1500 ohms with −48Vdc input battery
maximum loop current, 0-ohm loop	33±7mA with −48Vdc input battery
SF ringing-signal detection range, ground start	18 to 33Hz
ring-ground sensitivity	1000 ohms
ring-trip range	1500 ohms

2wire loop conditions and supervisory limits, FXO operation

maximum loop resistance	1500 ohms with −48Vdc input battery
maximum loop-current, 0-ohm loop	33±7mA with −48Vdc input battery
ringing-voltage detection threshold	16 to 35Hz

external ringing supply requirements, FXS operation

frequency	16 to 35Hz
bias	must be referenced to negative battery supply
level	130Vac maximum

loopback

loopback-path gain	equal-level, automatically set
tone-loopback frequency	module must loop back at 2713 ±7Hz; module must not loop back outside of 2713 ±37Hz
operating timings for two-tone loopback	operate: 2713Hz for 2.0 ±0.4 seconds, loopback upon removal of tone release: 2713Hz for 0.9 ±0.3 seconds, release during tone, or automatic release after timeout period of 20 ±1 minutes

common

input power requirements	voltage: −44 to −52Vdc, filtered, ground-referenced current: 95mA maximum at idle, 125mA maximum when busy, not including loop current in FXS and ARD operation
operating environment	32° to 122°F (0° to 50°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	15.9 ounces (451 grams)
mounting	relay rack or apparatus case via one position of a Tellabs Type 10 Mounting Shelf; can also be mounted in a Tellabs 262G-series NCTE/DST Mounting Assembly

8. testing and troubleshooting

using troubleshooting guides

8.01 The **troubleshooting guides** in this section may be used to assist in the installation, testing, or troubleshooting of the 6125G RA Series 4Wire-to-2Wire SF-to-FXS/FXO/ARD Terminal Repeater module. The guides are 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 may void its warranty. Also, if the equipment is part of a registered system, unauthorized repairs will result in noncompliance with Parts 15 and/or 68 of the FCC Rules and Regulations.

Note: *Although repair service always includes an attempt to remove any permanent markings made by customers on Tellabs equipment, the success of such attempts cannot be guaranteed. Therefore, if equipment must be marked* **defective** *or* **bad**, *we recommend that it be done on a piece of tape or on a removable stick-on label.*

technical assistance via telephone

8.02 If a situation arises that is not covered in the **troubleshooting guides**, contact Tellabs Customer Service as follows:

USA customers: Contact your Tellabs Regional Office listed below.

region	telephone	office location
US Northeast	(203)798-0506	Danbury, CT
US Capital	(703)478-0468	Washington, DC
US Central	(312)357-7400	Chicago, IL
US Southeast	(407)834-8311	Orlando, FL
US Southwest	(214)869-4114	Dallas, TX
US Western	(714)850-1300	Orange County, CA

Canadian customers: Contact our Canadian headquarters in Mississauga, Ontario. Telephone (416)624-0052.

International customers: Contact your Tellabs distributor.

selecting correct product service procedure

8.03 If equipment is diagnosed as defective or if in-service equipment needs repair, follow the **product return procedure** in paragraph 8.04 in all cases except those where a critical service outage exists (e.g., where a system or a critical circuit is down and no spares are available). In critical situations, or if you wish to return equipment for reasons other than repair, follow the **product replacement procedure** in paragraph 8.05.

product return procedure (for repair)

8.04 To return equipment for repair, first contact Tellabs Product Services (see addresses and numbers below) to obtain a Material Return Authorization (MRA). A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the repair transaction). The service representative will then give you an MRA number that identifies your particular transaction. After you obtain the MRA number, send the equipment prepaid to Tellabs (attn: Product Services).

in the USA:
Tellabs, Inc.
4951 Indiana Avenue
Lisle, Illinois 60532
telephone (312) 969-8800

in Canada:
Tellabs Communications Canada, Ltd.
2433 Meadowvale Boulevard
Mississauga, Ontario, Canada L5N 5S2
telephone (416) 858-2058

Enclose an explanation of the malfunction, your company's name and address, the name of a person to contact for further information, and the purchase order number for the transaction. Be sure to write the MRA number clearly on the outside of the carton being returned. Tellabs will inspect, repair, and retest the equipment so that it meets its original performance specifications and then ship the equipment back to you. If the equipment is in warranty, no invoice will be issued. Should you need to contact Tellabs regarding the status of a repair,

call or write the Product Services department at our Lisle or Mississauga headquarters as directed above.

product replacement procedure

8.05 For critical service outages, Tellabs offers a choice of two replacement services (if the product is in replacement stock) in lieu of the 15-day repair and return service described above. These are **overnight express service** (at extra cost) anywhere in the USA and **five-day expedited delivery** (at no extra cost) anywhere in the USA and Canada. To obtain replacement equipment via either of these services, contact your Tellabs Regional Office in the USA or our Canadian headquarters in Mississauga, Ontario, for details, costs (if applicable), and instructions. Telephone numbers are given in paragraph 8.02. A service representative will request key data (your company's name and address, the equipment's model and issue numbers and warranty date code, and the purchase order number for the replacement transaction). Tellabs will then ship the replacement to you in accordance with the replacement service you request. An invoice in the amount of the replacement's current price plus any applicable service charges will be issued after the replacement is shipped. When you receive the replacement, pack the equipment to be returned in the replacement's carton, sign and enclose the packing list, affix to the carton the preaddressed label provided, and ship the carton prepaid to Tellabs at our USA or Canadian headquarters. The defective equipment must be received within 30 days of the replacement's ship date. When we receive the defective equipment, a credit will be issued, leaving a balance due on the replacement's invoice that reflects only the express service and/or out-of-warranty charges, if any. Returns received more than 30 days after the replacement's ship date **will not be accepted for credit** but instead will be returned to you, thereby rendering the replacement's invoice due and payable. Please note that OEM, modified, and manufacture-discontinued equipment is not available via overnight express service.

troubleshooting guide for use at 6125G installation site

trouble condition	possible cause (check before assuming module is defective)
front-panel *power* LED on 6125G continues to flash after 15 seconds with power applied	1. Module has failed power-up diagnostics. Remove power; then reapply power once again. If 6125G fails power-up diagnostics a second time, assume module is defective and return it to Tellabs.
WIRING CHECK tones incorrect or not present	1. Module is improperly wired. Check all installer connections. 2. *Wiring check* pushbutton was not depressed fully. Redepress pushbutton firmly and hold depressed momentarily. 3. Module is defective. Replace and retest if possible before returning module to Tellabs.
front-panel *lpbk* LED is on	1. Module is in remote LOOPBACK. Therefore, request CTC to send 2713Hz tone at CLR-specified level to 6125G for at least 2 seconds to return module to idle. If this fails, see possible cause 2. 2. Module is in *manual* loopback. Therefore, remove connection between MNLB lead (pin 1 or 18) and MLBG lead (pin 21). If this fails to remove 6125G from loopback, assume module is defective and return it to Tellabs.
front-panel *prgm* LED is flashing and *lpbk* LED is on	1. Module is in FOUR-TONE MTU and TRANSPONDER TEST mode. Request CTC to send 2713Hz tone at CLR-specified level for at least 15 seconds to return module to idle.
front-panel *prgm* and *lpbk* LED's are on	1. Module is either in PROGRAM mode or in an alignment mode. Therefore, request CTC to send 2713Hz tone at CLR-specified level for at least 15 seconds to return module to idle.
front-panel *prgm* and *lpbk* LED's are flashing	1. Module is in WIRING CHECK mode. Therefore, depress *wiring check* pushbutton to return module to idle.

Note: *Consult companion 6125G* ***troubleshooting guide for use at CTC*** *for trouble conditions related to signaling and supervisory operation and improper switch-optioning.*

troubleshooting guide for use at CTC

trouble condition	possible cause (check before assuming module is defective)
6125G cannot be placed into LOOPBACK	1. Incorrect tone-loopback frequency and/or level, or 6125G is in an alignment or other diagnostic mode. Therefore, send 2713Hz tone at CLR-specified level to 6125G for at least 15 seconds to return module to idle. Then remove and resend 2713Hz tone at CO xmt level for at least 3 seconds before removing 2713Hz tone once again. If 6125G does not go into LOOPBACK, raise CO xmt level 5dB and try one more time. If this fails, assume module is defective and return it to Tellabs.
tone is present on CO receive pair	1. Module is in a remote alignment mode (if 1014, 2804, 414, or 1810Hz tone is present), in PROGRAM mode (if 1014Hz tone is present), or in WIRING CHECK mode (if interrupted 1014Hz tone is present). Therefore, send 2713Hz tone at CLR-specified level to 6125G for at least 15 seconds to return module to idle. If module fails to go idle, raise CO xmt level 5dB and try one more time. If this fails, assume module is defective and return it to Tellabs.
6125G will not accept TLP adjustment	1. TLP value entered is invalid (must be between −16 and +7TLP). 2. TLP value entered is not in correct format. See paragraphs 2.13 through 2.49 or table 19 for instructions and examples.
Note 1: *If you are unsure of what mode the 6125G is in, send either 2713Hz tone for 15 seconds to return the module to idle. Remove the 2713Hz tone; then resend it for at least 35 seconds. The module should respond by returning 1014Hz tone, indicating that it is in the PROGRAM mode. At this time, LOCAL alignment or any remote diagnostic mode can be selected.*	
Note 2: *The following trouble conditions are related to the 6125G's signaling and supervisory operation and may occur at a variety of locations on the circuit.*	
no local-station ringing (FXS/ARD)	1. Switches *S48 (LS/GS)* and/or *S58 (FXS/FXO)* improperly set. 2. Local ring generator improperly wired or defective. 3. Facility-side impedance switch *(S1)* improperly set. 4. No incoming SF tone (check facility and distant-end equipment). 5. Excessive ringing load on 2wire loop.
no local ring trip (FXS/ARD)	1. Ring generator not superimposed on module's negative input battery. 2. Excessive loop resistance.
false local ring trip (FXS/ARD)	1. Excessive capacitive loading on 2wire loop (e.g., too many telephone sets). 2. Excessive resistive leakage on 2wire loop.
no off-hook detection (i.e., cannot draw dial tone) (FXS)	1. Excessive 2wire loop resistance (in which case outgoing SF tone may not be removed when local station goes off-hook). 2. Switch *S48 (LS/GS)* improperly set.
cannot dial (FXS)	1. Excessive 2wire loop resistance (see preceding problem, cause 1). 2. Switch *S48 (LS/GS)* improperly set.
incorrect signaling states (FXS)	1. Switches *S48 (LS/GS)* and/or *S15 (FXS/ARD)* improperly set. 2. Improper incoming SF signaling tones at 4wire receive port.
improper or no signaling in one or both directions (FXO)	1. Switches *S48 (LS/GS)* and/or *S58 (FXS/FXO)* improperly set. 2. Improper level and/or frequency of incoming SF tone. 3. Improper level and/or frequency of outgoing SF tone.
Note 3: *A variety of trouble conditions other than those listed above can be caused by incorrect impedance option switch settings on the 6125G. Listed below, by switch number and function, are the trouble conditions that result from wrong switch settings.*	

switch	function	trouble conditions resulting from incorrect settings
S1	facility-side terminating impedances	1. Improper transmission level(s), resulting in improper frequency response. ***Note:*** *Because the 6125G is a remote-alignment device, it may actually compensate for an impedance mismatch under certain circumstances.*
S2	terminal-side terminating impedance	1. Improper transmission level(s), resulting in improper frequency response. 2. Unacceptably low transhybrid loss.