

# 4420LA RA Series® 4Wire-to-4Wire or 4Wire-to-2Wire Data Station Termination Module

CLEI\* code: DSTNP001

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## 1. General

- 1.1 The 4420LA RA Series 4Wire-to-4Wire or 4Wire-to-2Wire Data Station Termination (DST) module is a Type-10 module that interfaces a 4wire transmission facility with a 4wire or 2wire data modem. The module provides active level control and active amplitude equalization in the receive channel and impedance matching on the facility side. Self alignment and diagnostic capabilities are the module's primary features. In self alignment, both transmission levels and amplitude equalization are automatically set from a remote Special Services Center (SSC). Alignment is performed at Transmission Level Points (TLPs) (0dBm0), or at data level (-13dBm0), depending upon tone frequencies sent from the SSC to initiate remote alignment.

**Caution:** The 4420LA is static sensitive. Observe all precautions for handling static-sensitive devices.

### Reason for Revision

- 1.2 If this practice is revised, the reason for the revision will be stated in this paragraph.

### UL Listed



- 1.3 The 4420LA is UL listed as a telephone equipment accessory when installed in a 263E-1 case, and UL recognized in all other mountings, under Underwriters Laboratories, Inc. (UL) 1459 Standard.

## Diagnostic and Alignment Modes

- 1.4 The 4420LA offers a choice of five diagnostic modes and two alignment modes.

### Diagnostic Modes

- 1.5 **Loopback** tests the 4420LA and the receive and transmit pairs of the facility. Loopback (2713Hz tone activated) provides equal level loopback for circuits with a 16dB difference in drop-side receive and transmit transmission levels. Upon initiation of loopback, the 4420LA provides identification tone (alternating 1014 and 414Hz) for .5 second, nominal, to identify the module as a remote align device. Loopback automatically times out after 20 minutes if a second 2713Hz tone is not received.
- 1.6 **WIRING CHECK** allows quick and easy verification that all wiring connections are correct. This is done via a front panel pushbutton and verification of the presence of specific tones. A 1-hour time-out period is provided for this mode; the time-out period can be remotely overridden by sending 2713Hz for 5 seconds, or by redepressing the front panel pushbutton.
- 1.7 **TEST** performs remote diagnostic tests such as frequency response, idle channel noise, idle channel noise with tone, and impulse noise. Within TEST, two different modes of operation are available:
- **FOUR-TONE mode**, where the 4420LA generates four alignment tones in succession (414, 1014, 1818, and 2814Hz), each for 15 seconds. The module then goes into a quiet-line termination for 20 minutes, where the four-tone sequence can be repeated.
  - **TRANSPONDER mode**, where incoming tone of any frequency from 304 to 4004Hz, nominal, at 100Hz intervals (except 2704Hz) detected at the receive input port causes the module to generate a corresponding TRANSPONDER TEST tone (see paragraphs 2.20 and 2.21). The 4420LA then sends this tone from its transmit output port with the tone level automatically adjusted to +5dBm if TLP alignment is selected, or to -8dBm if data level alignment is selected. If the 4420LA detects no incoming tone at its receive input port, it provides a quiet-line termination for 20 minutes and then goes idle, unless incoming tone is detected again before the 20-minute interval expires. If the 4420LA receives 2713Hz during TRANSPONDER operation, it goes idle after 15 seconds.
- 1.8 **DEMARC QUERY** allows SSC personnel to remotely determine whether the module is switch optioned for 4wire or 2wire terminal (modem) side interface.
- 1.9 **POWER SOURCE QUERY** allows the SSC to check the current power source of the 4420LA (local power or line power).

### Alignment Modes

- 1.10 **LOCAL** is used on end link voice-band analog data circuits, where both ends of the circuit are not under control of the same Local Exchange Carrier (LEC). In this mode, the receive level and receive (post) equalization are aligned from the SSC.
- 1.11 **AUTO** is used on point-to-point voice-band analog data circuits, where the same LEC controls both ends of the circuit. In AUTO, a second 4420LA (or equivalent) must be present at the distant end of the circuit, and the receive level and receive (post) equalization of **both** DST modules are aligned, either remotely from the SSC by sending tones, or locally by depressing the front panel 'align' pushbutton.

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### Acknowledgment Tones

- 1.12 Upon completion of the selected alignment mode, the 4420LA acknowledges the correct settings of its level and equalization circuitry by sending **confirmation tone** (an ascending tone sweep from 314 to 3042Hz). If C5 attenuation distortion limits are not met, **error tone** (a descending tone sweep from 3014 to 314Hz) is sent instead, and the module defaults to the best possible settings under the circumstances. Less than optimum circuit performance and subsequent alignment settings that result in error tone being sent **do not inhibit module operation**.

## Additional Features

1.13 Additional features of the 4420LA are summarized as follows:

- Line-powered capabilities
- Switchable 4wire or 2wire drop-side interface
- Alignment performed at 1004, 2804, 404, and 1804Hz at TLPs or data level
- TLP or data level alignment remotely selected via tone frequency sent to the module
- Alignment and diagnostic modes remotely selected by tone frequency sent to module
- Aligns facilities with up to 15dB of 1004Hz loss
- Provides up to C5 attenuation distortion conditioning
- Exits any diagnostic or alignment mode (except loopback) via 2713Hz sent for 15 seconds
- Incorrect sequence timer that automatically causes the module to revert to its previous alignment settings and then go idle after 5 minutes if proper tones are not received during that time
- Automatic entry into loopback after LOCAL alignment
- Indefinite storage of all level and equalization settings in nonvolatile memory
- Security - the 4420LA must receive a specific set of tones with precise levels, frequencies, and durations for alignment to take place; original settings are maintained if alignment is not completed
- Receive input level range: -10 to +5dBm (TLP) or -23 to -8dBm data level
- Receive output or 2wire output level: -3dBm (TLP) or -16dBm data level
- Transmit input or 2wire input level: +13dBm (TLP) or 0dBm data level
- Transmit output level: +5dBm (TLP) or -8dBm data level
- Fixed 8dB pad in the transmit channel
- Variable slope or bump-type amplitude equalization in the receive path
- Transformer coupling at all transmission ports
- Balanced, switch-selectable 1200-, 600-, or 150-ohm terminating impedances at the facility side ports (receive input and transmit output)
- Fixed, balanced, 600-ohm terminating impedances at the terminal side port(s) (transmit input and receive output, or 2wire)
- Power-up self diagnostics with pass / fail indication
- Integral facility side sealing current source (nominal 20mA) with built-in "ZAP" feature that provides higher current upon initial power-up
- A switch option that conditions the module to supply internally generated sealing current to the facility, to establish a return path (current sink) for sealing current supplied from the distant end of the facility, or to make normal facility side simplex (SX) leads available at the card edge connector
- Manual (local) loopback activation and deactivation capability via manual loopback (MNLB) and manual loopback ground (MLBG) leads available at the card edge connector
- Front panel power, loopback, program, sealing current, transmit data detection, and receive data detection LED indicators
- Local power operation on -22 to -56Vdc or 20 to 30Vac input power (-42 to -56Vdc input power required for use of internal sealing current source)

## 2. Applications

- 2.1 The 4420LA is used where a 4wire or 2wire data station communicates with another data station or a Central Processor Unit (CPU) over a 4wire voice-grade telephone facility. In such applications, an installer can finish the physical installation and move on to another site without SSC personnel involvement, allowing SSC personnel to align the circuit at their convenience.

- 2.2 In addition, because data circuits are much less tolerant of marginal operation than voice circuits, attention to data circuits is often required after installation, which requires dispatching a person to the site. Remote alignment eliminates or greatly reduces the need for subsequent trips to the site.
- 2.3 The 4420LA provides the necessary level coordination, amplitude equalization, and impedance matching to interface a 4wire transmission facility with a 4wire or 2wire data modem. Microprocessor-based alignment circuitry allows the 4420LA to be aligned from the distant end of the facility. The TRANSPONDER TEST mode, in conjunction with its remote (two-tone) loopback circuitry, allows the facility to be checked from the distant location after alignment is completed.
- 2.4 The 4420LA satisfactorily adjusts gain and equalization on virtually any nonloaded, loaded, or mixed cable to meet up to C5 attenuation distortion specifications, and adjusts for as much as 15dB of cable loss at 1004Hz. The receive input level range is -10 to +5TLP or -23 to -8dBm data level, and its transmit output level is fixed at +5TLP or -8dBm data level (see Table 2-1).

Cable Gauge	Maximum Distance for Nonloaded Cable	Maximum Distance for Loaded H88 Cable
22	40Kft	84Kft
24	32Kft	54Kft
26	24Kft	36Kft

**Table 2-1** Cable Gauge / Maximum Distance Chart for Up to C5 Conditioning

### Alignment Tones Returned by 4420LA

- 2.5 Alignment takes place through a "dialogue" of tones at various frequencies sent from the SSC and returned by the 4420LA. Tones returned by the 4420LA are deliberately higher than the nominal standard SSC test tone frequencies so that SSC personnel can easily distinguish them from tones sent to the 4420LA. Specifically, the 4420LA returns tones of 1014, 2814, 414, and 1818Hz in response to SSC tones of 1004, 2804, 404, and 1804Hz, respectively.

**Note:** When the 4420LA is accessed from the SSC for alignment, testing, or troubleshooting, sealing current should be applied to the line as a standard operating procedure. This process ensures that if the 4420LA is powered from the line circuit (not powered at the CPE) at the time of access, the module will still remain operational.

### Acknowledgment Tones Returned by 4420LA

- 2.6 Upon completion of any alignment mode, the 4420LA sends acknowledgment tone, either **confirmation tone** or **error tone**.
- Confirmation tone** is an ascending tone sweep from 314 to 3042Hz (with 3042Hz held for 10 seconds), indicating that attenuation distortion is within C5 limits in accordance with the criteria in Table 2-2. Confirmation tone eliminates a manual check of the frequency response of the facility after alignment.

Frequency	C5 Attenuation Distortion Limits
	LOCAL Alignment
404Hz	-1, +3dB
1004Hz	Reference Level
1804Hz	-.5, +1.5dB
2804Hz	-.5, +1.5dB

**Table 2-2** C5 Attenuation Distortion Limits

- **Error tone** is a descending tone sweep from 3014 to 314Hz (with 314Hz held for 10 seconds), indicating that C5 attenuation distortion limits are not met and that the 4420LA has defaulted to the best possible level and equalization settings under the circumstances. In this case, a manual frequency response check of the facility may be required.

**Note:** **Error tone does not necessarily indicate a circuit or module problem, nor does it inhibit module operation.**

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## Facility Side Interface and Sealing Current

- 2.7 The 4420LA interfaces the 4wire transmission facility via transformers at the receive input and transmit output ports. These transformers can be switch optioned for balanced 1200-, 600-, or 150-ohm terminating impedance. The 1200-ohm option interfaces loaded cable; the 600-ohm option interfaces nonloaded cable or carrier; and the 150-ohm option provides a small amount of slope-type amplitude equalization for nonloaded cable through the deliberate impedance mismatch.
- 2.8 The 4420LA contains an integral 20mA (nominal) sealing current source and a detector on its facility side for when the facility is metallic. An associated option switch affords a choice of three sealing current options:
- **Internal Sealing Current.** When this option is selected, 20mA (nominal) of sealing current flows from the transmit output port (pins 41 and 47) and returns via the receive input port (pins 7 and 13). The sealing current source's ZAP feature provides a greater amount of current when power is initially applied to the module. This ZAP current eliminates oxidation or corrosion at cable splices, solder joints, etc. The front panel 'sealing current' LED lights when the internal source is active and current is flowing.

**Note:** **-42 to -56Vdc input power is required for use of the internal sealing current source.**

- **External Sealing Current** allows the module to sink, i.e., establish a return path for, sealing current supplied from the distant end of the facility. With this option selected, the 'sealing current' LED lights when current is flowing.

**Note:** **This option must be selected if the module is to operate on line power.**

- **SX Leads** makes facility side SX leads available at the card edge connector and is selected when sealing current is not required, e.g., when the facility is nonmetallic, or when sealing current is to be applied to the facility from a local source external to the module, in which case the 'sealing current' LED **does not light** when current is flowing.

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## Terminal Side Interface

- 2.9 The terminal side of the 4420LA can be switch optioned to interface a 4wire or a 2wire data modem. In the 4wire mode, the terminal side ports (receive output and transmit input) interface the 4wire link via transformers that provide fixed, balanced, 600-ohm terminating impedance at both ports. In the 2wire mode, the transmit input port becomes the bidirectional 2wire port, and the receive output port becomes nonfunctional. Thus, in 2wire operation, the 2wire port interfaces the 2wire link via a transformer that provides fixed, balanced, 600-ohm terminating impedance. On the module side of this transformer, a hybrid provides the necessary 4wire-to-2wire conversion.

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## PROGRAM Mode

- 2.10 Before remote alignment or diagnostics can be initiated, the 4420LA must be placed in this mode by sending 2713Hz to the module for at least 30 seconds. The 4420LA responds by returning 1014Hz at +5TLP, indicating that it is **ready for alignment at TLPs**. If alignment at data level is desired instead, the SSC then sends 2804Hz tone to the module for 3 seconds,

minimum. The 4420LA responds by returning 1014Hz at -8dBm, indicating that it is **ready for alignment at data level**. SSC personnel can return to the TLP PROGRAM mode by removing and then reapplying 2804Hz.

## LOCAL Alignment Mode

- 2.11 In this mode (see Figures 2-1 and 2-2), the 4420LA adjusts its receive equalizer and receive level control circuit in response to tones sent from the SSC. The 4420LA, in turn, sends tones so that the SSC can align its end of the facility. Upon completion of LOCAL alignment, the 4420LA calculates the frequency response of the receive channel, sends acknowledgment tone, and then goes into loopback. When in the LOCAL mode, the 4420LA can be returned to IDLE by sending 2713Hz for 15 seconds, minimum.

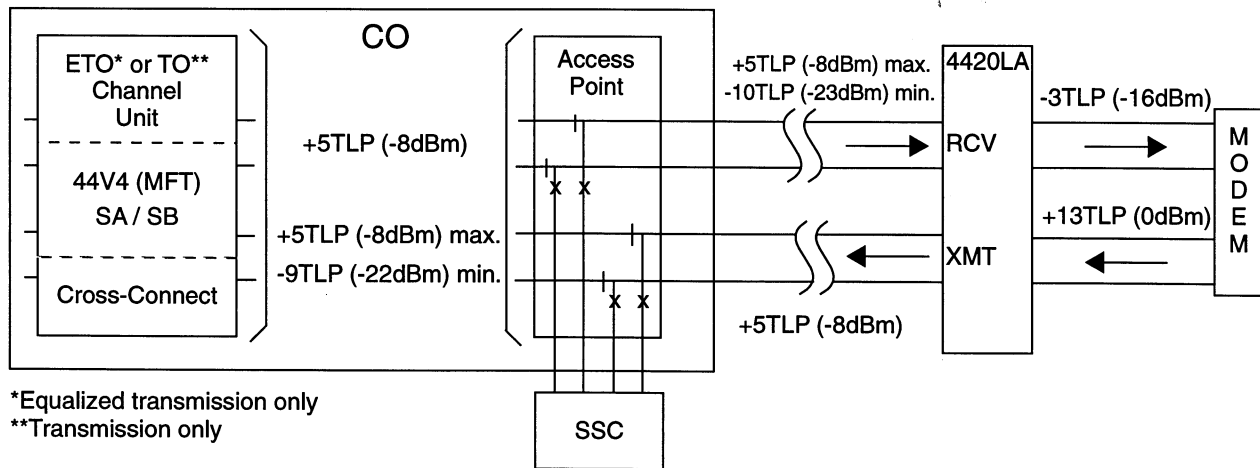
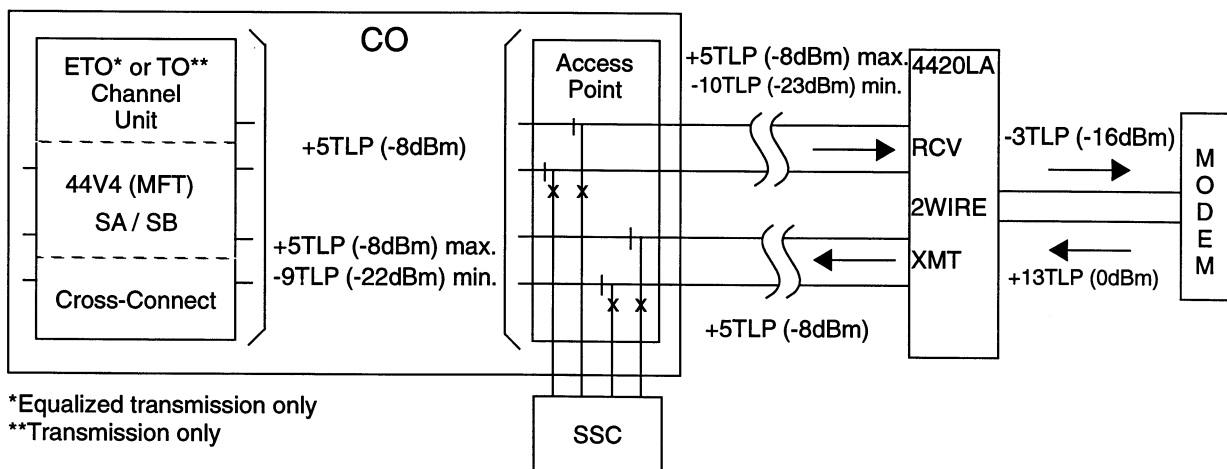


Figure 2-1 LOCAL Mode Application, 4Wire-to-4Wire Operation



**Note:** The 2wire modem side interface levels shown here also apply to AUTO mode (Figures 2-3 and 2-4) and TEST mode (Figure 2-5) applications when 4wire-to-2wire operation is selected.

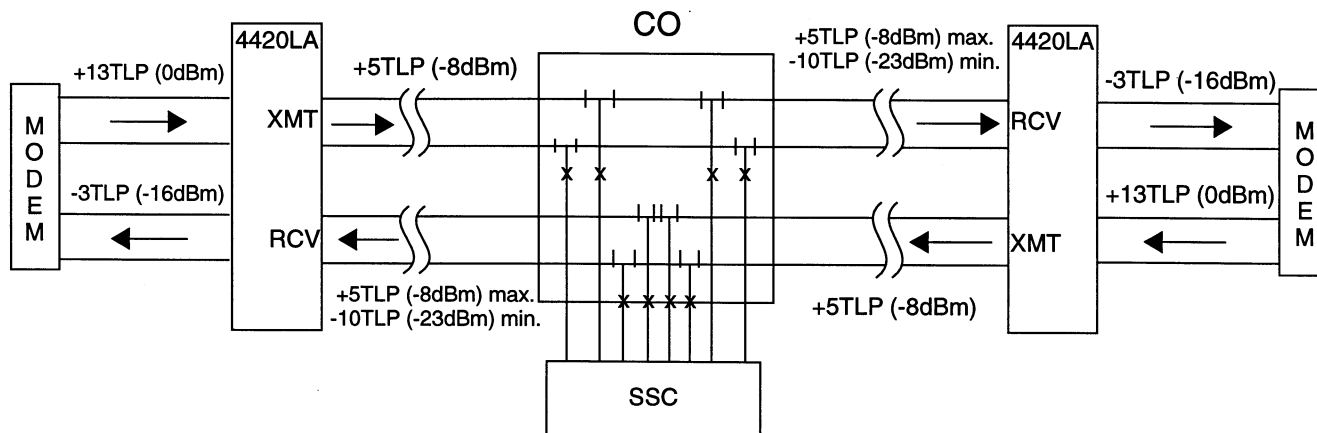
Figure 2-2 LOCAL Mode Application, 4Wire-to-2Wire Operation

## AUTO Alignment Mode

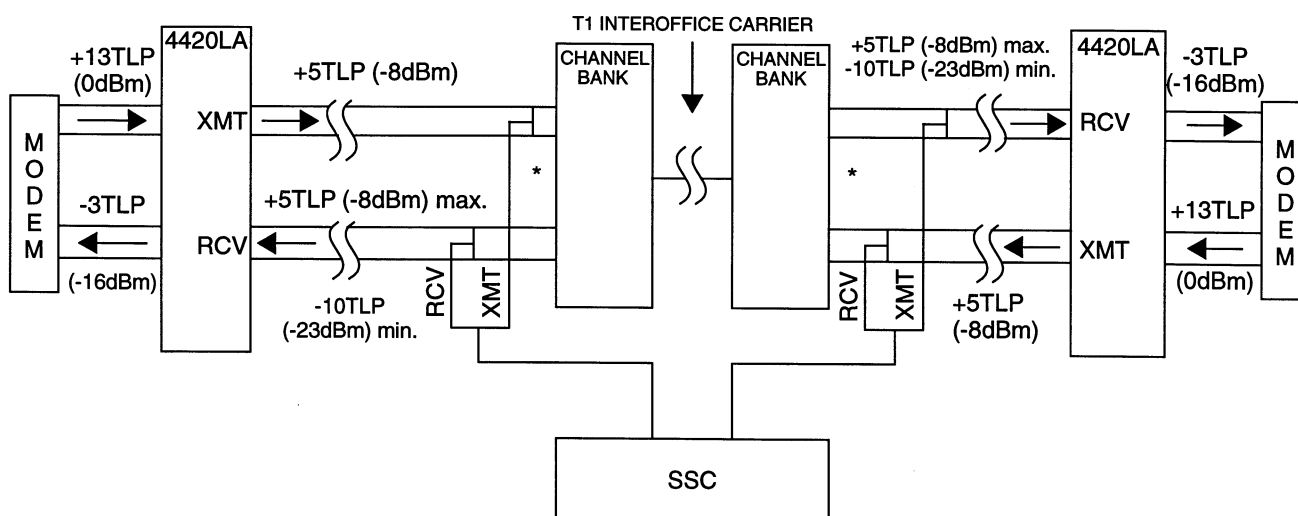
- 2.12 In this mode (see Figures 2-3 and 2-4), the 4420LA acts as the master DST unit and directs the receive level and receive (post) equalization alignment process for both ends of the facility. **Note that, if manually activated, alignment takes place at TLP only.** The distant end of the circuit must be terminated with a 4420LA or equivalent. The distant end DST unit can align at either three or four tones. It makes no difference which end of the circuit is selected

as master. Alignment is initiated by depressing the 'align' pushbutton, or by sending the proper tones to the 4420LA from the SSC. After alignment is initiated, the 4420LA assumes control of the alignment process.

- 2.13 The master 4420LA, when in the AUTO mode, sends the necessary tones to the far-end unit to put it into its LOCAL alignment mode. The master and far-end units then send tones back and forth until both ends of the circuit are aligned. (If the far-end DST aligns at three tones, the master DST also aligns at three tones.) After aligning at the last frequency, the far-end unit goes into loopback. The master unit measures the acknowledgment tone sent by the far end, and then removes the far-end unit from loopback. As the master, if the far-end unit acknowledges with error tone, the master also responds with error tone.
- 2.14 After removing the far-end unit from loopback, the master unit sends acknowledgment tone and then goes idle.



**Figure 2-3 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

**Figure 2-4 AUTO Mode Application With CO Equipment**

- 2.15 Conditions that cause failure of the AUTO alignment mode are as follows:
- The DST at the distant end of the circuit is not an RA Series (or equivalent) unit.
  - Tone dialogue between the SSC and 4420LA is not completed.

**Note:** Used in a point-to-point configuration where the slave position is sourcing line power to the master at the distant end (no local power is available at the distant end or local power has failed), alignment is not possible. This is because the slave position removes line power while performing AUTO alignment; thus, the distant end loses its power source and alignment cannot be completed.

### Local Activation of AUTO Mode

- 2.16 When AUTO, or any other alignment mode, is remotely activated (from the SSC), local visible indications of the success or failure of the alignment process are not provided. With local activation of the AUTO mode via the 'align' pushbutton, however, local visible indications of circuit alignment status are necessary, especially if installation personnel aren't carrying test equipment to the module site. Therefore, when the 'align' pushbutton is depressed, either of two LED indications is given:
- The front panel 'program' and 'loopback' LEDs light steadily during successful alignment and extinguish when alignment is completed.
  - If alignment cannot be completed, the 'program' and 'loopback' LEDs light steadily during the attempted alignment. The 'program' LED then flashes, and the 'loopback' LED remains steadily lit. These LED states continue until: (1) another operating mode is selected, e.g., 2713Hz is sent for 15 seconds to reset to IDLE, (2) the 'align' pushbutton is redepressed, or (3) power is removed.

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### Remote Loopback Diagnostic Mode

- 2.17 This mode facilitates the testing of both the 4420LA and the facility. Loopback can be activated when the 4420LA is not in any of its alignment modes by sending 2713Hz to the 4420LA for 2 seconds (nominal). Loopback occurs upon removal of the tone. Upon initiation of loopback, the 4420LA generates and sends **identification tone**, which consists of alternating 1014 and 414Hz, for .5 second, nominal. The loopback mode is deactivated automatically after 20 minutes, or by sending 2713Hz for .9 second (nominal) prior to expiration of the 20-minute time-out period. Removing this tone is not necessary for loopback deactivation. When loopback is deactivated, the module goes idle.

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### TEST Diagnostic Mode

- 2.18 This mode (see Figure 2-5) analyzes the facility from a distant location. After entering the TEST mode, the 4420LA provides a quiet-line termination for 20 minutes, at which time SSC personnel can perform noise measurements. Also during the quiet-line termination, SSC personnel can send 404Hz to initiate FOUR-TONE operation, or send any other tone from 304 to 4004Hz to initiate TRANSPONDER operation.
- 2.19 In FOUR-TONE operation, the 4420LA generates and sends four alignment tones (414, 1014, 1818, and 2814Hz) in succession, each for 15 seconds. This sequence can be repeated by removing and reapplying 404Hz tone from the SSC.
- 2.20 In TRANSPONDER operation, tone of any frequency from 304 to 4004Hz, nominal, at 100Hz intervals (except 2704Hz) sent to the 4420LA and detected at its receive input port causes the module to generate a corresponding TRANSPONDER TEST tone that is within 1 percent of 314Hz, 414Hz, etc. (through 4014Hz), depending upon the tone frequency received (see Table 2-3). This tone is then sent from the transmit output port with the tone level automatically adjusted to +5dBm (TLP alignment) or to -8dBm (data level alignment).
- 2.21 In TRANSPONDER operation, if the 4420LA detects no tone at its receive input port, it provides a quiet-line termination for 20 minutes, sends confirmation tone, and then goes idle, unless incoming tone is detected again before the 20-minute interval expires. If the 4420LA receives 2713Hz during TRANSPONDER operation, it goes idle after 15 seconds.



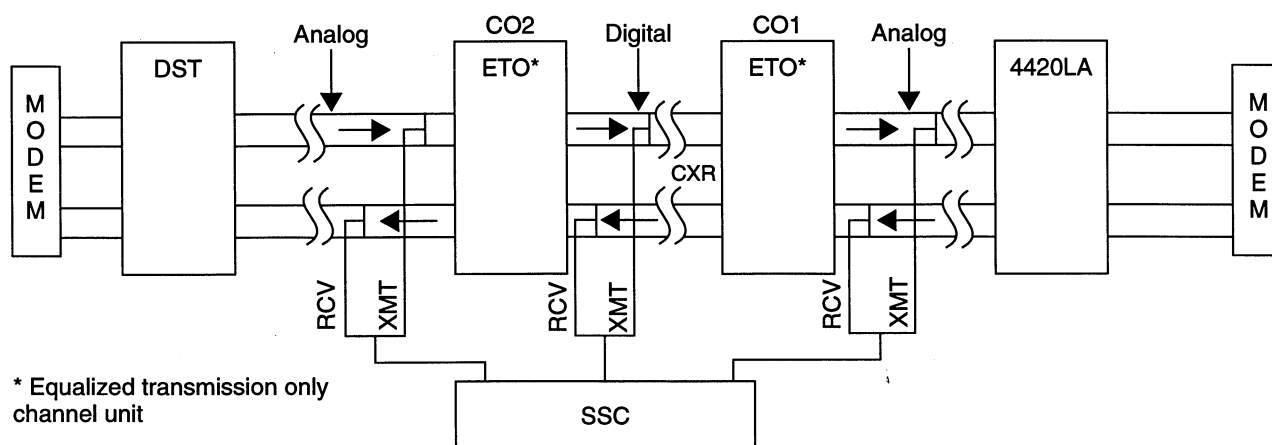


Figure 2-5 TEST Mode Application

Nominal Frequency Sent by SSC	TRANSPONDER TEST Frequency Generated and Returned by 4420LA	Nominal Frequency Sent by SSC	TRANSPONDER TEST Frequency Generated and Returned by 4420LA
304Hz	314Hz	2204Hz	2214Hz
404Hz	414Hz	2304Hz	2314Hz
504Hz	514Hz	2404Hz	2414Hz
604Hz	614Hz	2504Hz	2514Hz
704Hz	714Hz	2604Hz	2614Hz
804Hz	814Hz	2704Hz*	None
904Hz	914Hz	2804Hz	2814Hz
1004Hz	1014Hz	2904Hz	2914Hz
1104Hz	1114Hz	3004Hz	3014Hz
1204Hz	1214Hz	3104Hz	3114Hz
1304Hz	1314Hz	3204Hz	3214Hz
1404Hz	1414Hz	3304Hz	3314Hz
1504Hz	1514Hz	3404Hz	3414Hz
1604Hz	1614Hz	3504Hz	3514Hz
1704Hz	1714Hz	3604Hz	3614Hz
1804Hz	1818Hz	3704Hz	3714Hz
1904Hz	1914Hz	3804Hz	3814Hz
2004Hz	2014Hz	3904Hz	3914Hz
2104Hz	2114Hz	4004Hz	4014Hz
*2713Hz sent from the SSC returns the module to IDLE.			

Table 2-3 TRANSPONDER TEST Tone Frequencies

### DEMARC QUERY Diagnostic Mode

- 2.22 This mode allows SSC personnel to verify whether the 4420LA is switch optioned for 4wire or 2wire terminal (modem) side interface. Within 3 seconds after it enters this mode, the module determines the setting of the modem side interface switch. It then sends 2814Hz for 3 seconds if 4wire interface is selected, or 414Hz for 3 seconds if 2wire interface is selected. The 4420LA then enters the PROGRAM mode.

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### WIRING CHECK Diagnostic Mode

- 2.23 This mode allows quick and easy verification that wiring connections between the outside-plant distribution cable termination point (within the building) and the 4420LA, and also between the customer's network interface and the 4420LA, are correct.
- 2.24 The WIRING CHECK mode detects an open cable or a reversed cable pair before the installer leaves the site. When the front panel 'wiring check' pushbutton is depressed in 4wire-to-wire operation, continuous 1014Hz is sent from the receive input and output ports, while interrupted 1014Hz is sent from the transmit input and output ports.
- 2.25 When the 'wiring check' pushbutton is depressed in 4wire-to-2wire operation, continuous 1014Hz is sent from the receive input port, interrupted 1014Hz is sent from the transmit output port, and amplitude modulated 1014Hz is sent from the 2wire port. Depressing the 'wiring check' pushbutton a second time terminates the WIRING CHECK mode. If the 4420LA is accidentally left in the WIRING CHECK mode, the mode times out after one hour. Prior to expiration of the 1-hour time-out interval, the SSC can force termination of the WIRING CHECK mode by sending 2713Hz for up to 5 seconds.

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### POWER SOURCE QUERY Diagnostic Mode

- 2.26 This is a status query mode that allows the SSC to determine the source of the module's operating power (local or line). To query the power status, first enter the PROGRAM mode. Once in the PROGRAM mode, the DST provides a 1014Hz response. Sending the 4420LA a 904Hz tone puts you into the power query mode. If the module is powered locally at the customer premises, the 4420LA responds with 2814Hz tone for 3 seconds. If the module is powered via the line power source, the module responds with 414Hz tone for 3 seconds. After the local / line status tone is sent, the module automatically exits the query mode and is returned to the PROGRAM mode, as noted by a return to 1014Hz tone.

**Note:** To use line power operation, the module must be optioned for external sealing current.

## 3. Installation

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### Inspection

- 3.1 Visually inspect the 4420LA upon its arrival to determine possible damage incurred during shipment. If damage is noted, immediately file a claim with the carrier. If the module is stored, reinspect it prior to installation.

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### Mounting

- 3.2 The 4420LA mounts in one position of a Tellabs Type-10 Mounting Shelf, 263E-series DST Mounting Assembly, or prewired mountings having standard NCTE pinouts.

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### Connections

- 3.3 Before making any connections to the mounting shelf, case, or assembly, ensure that power is **off** and modules are **removed**. Modules should be powered only **after** they are properly optioned and **after** wiring is completed.

- 3.4 Table 3-1 lists external connections to the 4420LA. All connections to non-prewired mountings are made via wire wrapping to the 56-pin connector at the rear of the shelf, case, or assembly position. Pin numbers are found on the body of the connector.

### Factory Alignment Settings

- 3.5 The 4420LA is shipped from Tellabs configured for the following alignment settings:

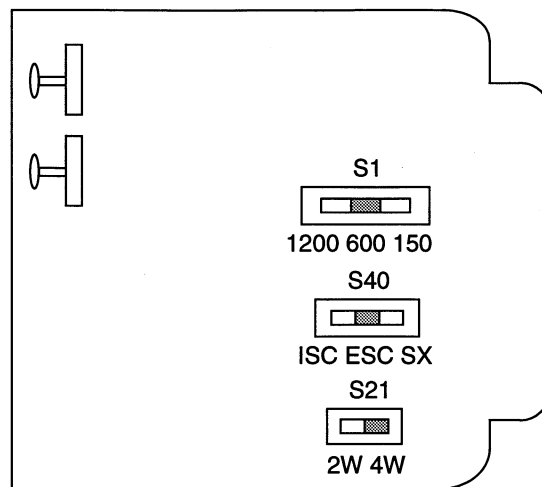
- TLP / DLP alignment status: TLP alignment
- Receive channel loss: 8dB
- Receive channel equalization: flat (no equalization)
- Transmit channel loss: 8dB

Connect:	To Pin:
<b>Facility:</b>	
XMT OUT TIP (TT)	41
XMT OUT RING (TR)	47
RCV IN TIP (RT)	7
RCV IN RING (RR)	13
RCV IN SX (simplex)	9 and 11
XMT OUT SX (simplex)	43
<b>Modem:</b>	
DATA XMT TIP (DTT, XMT IN) or 2WIRE TIP	55
DATA XMT RING (DTR, XMT IN) or 2WIRE RING	49
DATA RCV TIP (DRT, RCV OUT)	5
DATA RCV RING (DRR, RCV OUT)	15
TEK5 (data set disable)	21
TEK6 (data set disable)	23
<b>Loopback:</b>	
MNLB	1
MLBG	19
<b>Power:</b>	
-BATT / AC1 (-22 to -56Vdc filtered input* or 20 to 30Vac input)	35
GND / AC2 (ground or 20 to 30Vac input)	17
*If internal sealing current source is to be used, input voltage must be -42 to -56Vdc.	

**Table 3-1 External Connections to the 4420LA**

### Option Switches

- 3.6 Three option switches must be set before the 4420LA is placed into service; one 2-position slide switch ('S21'), and two 3-position slide switches ('S1' and 'S40'). Switch locations on the printed circuit board are shown in Figure 3-1, and instructions for setting the switches follow (paragraphs 3.7 through 3.9).



Note: When shipped from Tellabs, the option switches are factory set, as shown here, to 600, ESC, and 4W.

**Figure 3-1 Option Switch Locations**

- 3.7 Terminal (Modem) Side 4Wire or 2Wire Interface.** 'S21' selects either a 4wire or 2wire interface on the terminal (modem) side. Set this switch as follows:
- For a 4wire modem side interface, set it to the *4W* position.
  - For a 2wire modem side interface, set it to the *2W* position.
- 3.8 Facility Side Terminating Impedances.** Terminating impedances at the facility side ports (receive input and transmit output) are selected as follows via 'S1':
- For 1200 ohms (required for interface with loaded cable), set 'S1' to the *1200* position.
  - For 600 ohms (required for interface with nonloaded cable or carrier), set 'S1' to the *600* position.
  - For 150 ohms (provides a small amount of slope equalization for nonloaded cable through the deliberate impedance mismatch), set 'S1' to the *150* position.
- 3.9 Sealing Current / SX-Lead Options.** 'S40' selects any of three sealing current / SX-lead options on the facility side. Set this switch as follows:
- If sealing current is to be supplied to a metallic facility from the internal 20mA (nominal) source, i.e., if the distant CO is configured to sink sealing current, set 'S40' to the Internal Sealing Current (*ISC*) position.

**Note:** This option requires -42 to -56Vdc input power to the module.

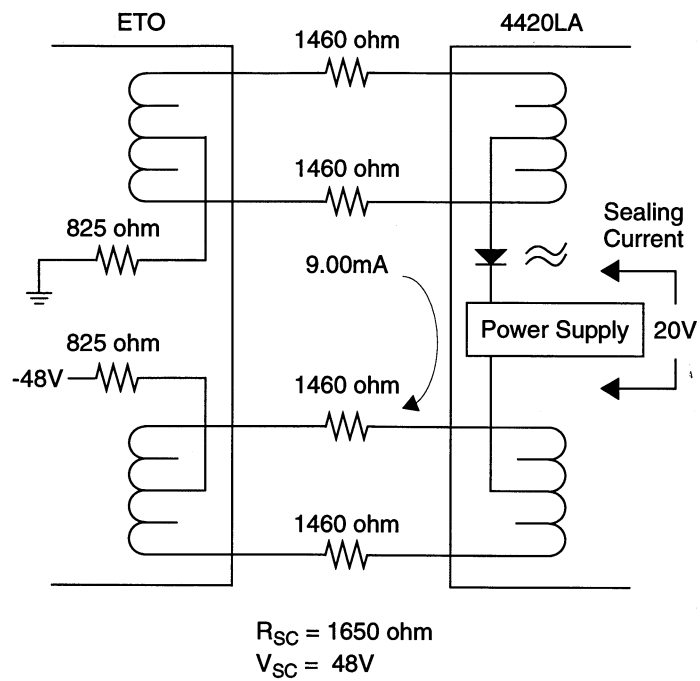
- If a sealing current sink (return path) is required for sealing current supplied from the distant CO, i.e., if the CO is configured to source sealing current, set 'S40' to the External Sealing Current (*ESC*) position.

**Note:** 'S40' must be optioned for *ESC* in order to line power the 4420LA.

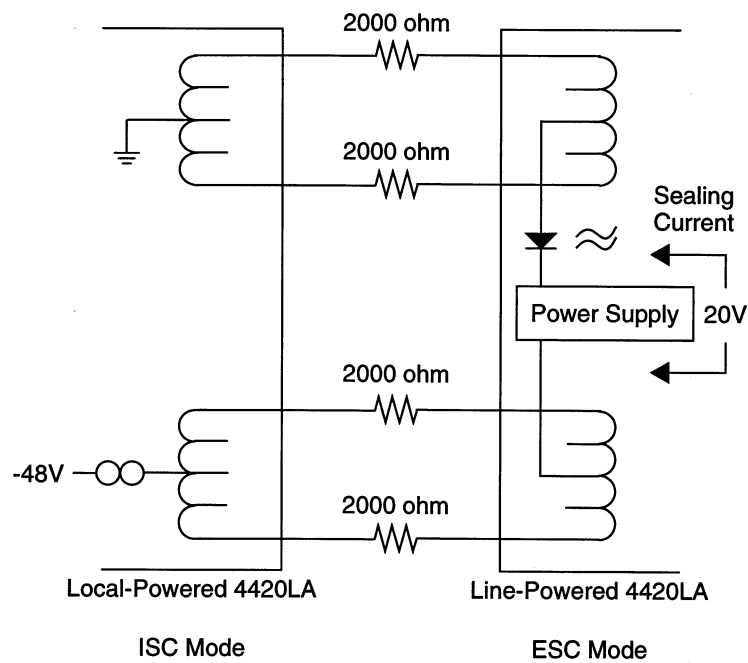
- If card edge connector access to the facility side SX leads is desired, or if a sealing current source or sink is not required, e.g., because the facility is nonmetallic, set 'S40' to the *SX* position.

## Maximum Loop Length - Line Power

- 3.10** To calculate the maximum allowable loop resistance for line powering, determine the voltage and resistance of the sealing current source ( $V_{SC}$  and  $R_{SC}$ ) and use the equation shown below Figure 3-3 to calculate loop resistance. Figures 3-2 and 3-3 show the maximum resistance for each application.



**Figure 3-2 An ETO Powering a 4420LA**



**Figure 3-3 A 4420LA Powering Another 4420LA**

$$R_L = \frac{V_{SC} - 20}{.009} - R_{SC}$$

- 3.11 Figure 3-2 shows that the allowed loop resistance of the sealing current path between a typical ETO ( $V_{SC} = 48V$ ,  $R_{SC} = 1650$  ohms) and a 4420LA is a 1460-ohm loop ( $R_L = 1460$  ohms).
  - 3.12 Figure 3-3 shows that when one 4420LA powers another 4420LA, the maximum line resistance of 2000 ohms is allowed.
- 

### Power Verification

- 3.13 Apply power to the 4420LA; verify that the 'program' and 'loopback' LEDs alternate for a few seconds, indicating that self-diagnostics are being performed. If the module is using local power, verify that the front panel 'power' LED lights steadily, that the 'sealing current' LED lights (if sealing current is being used), and that the 'program' and 'loopback' LEDs are both off. If the module is line powered, verify that the 'program' and 'loopback' LEDs are off, the 'sealing current' LED is lit, and the 'power' LED is off. If after 15 seconds the LEDs are not lit as indicated, the module should be considered defective and returned to Tellabs, as directed in Section 8.
- 

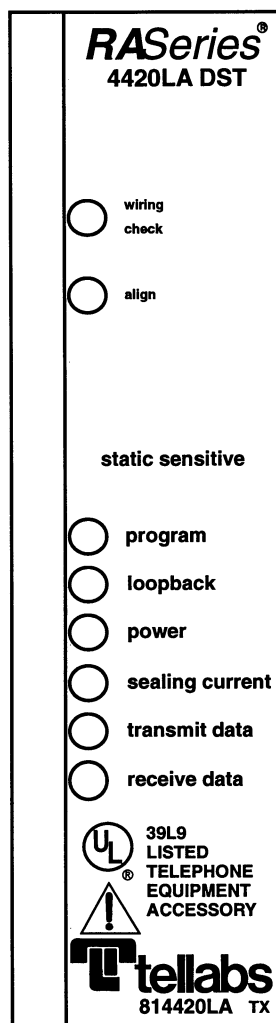
### WIRING CHECK

---

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

---

- 3.14 To perform the WIRING CHECK procedure, proceed as follows (refer to Figure 3-4):



This symbol is intended to alert the user to the presence of important operating and maintenance instructions in the literature.

**Figure 3-4 Front Panel Control and LED Indicators**

1. Using a small screwdriver or similar tool, depress the 'wiring check' pushbutton. Then proceed to step 2 for 4wire-to-4wire operation, or step 3 for 4wire-to-2wire operation.
2. If 4wire-to-4wire operation is selected, use a Transmission Measuring Set (TMS) or a hand-test telephone set to verify that continuous 1014Hz is present on the receive pair (from the facility) at the incoming cable termination point, and that interrupted 1014Hz is present on the transmit pair (to the facility) at the incoming cable termination point. Then verify that continuous 1014Hz is present on the receive pair (to the modem) at the network interface and that interrupted 1014Hz is present on the transmit pair (from the modem) at the network interface. Also verify that the 'loopback' and 'program' LEDs are flashing simultaneously.
1. If 4wire-to-2wire operation is selected, verify that continuous 1014Hz is present on the receive pair (from the facility) at the incoming cable termination point, and that interrupted 1014Hz 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 is present on the 2wire pair (to / from the modem) at the network interface. Also verify that the 'loopback' and 'program' LEDs are flashing simultaneously.
2. Depress the 'wiring check' pushbutton again to terminate the WIRING CHECK mode. Verify that the 'loopback' and 'program' LEDs are off. The 4420LA is now ready for alignment.

```

sequenceDiagram
    participant Slave as 4420LA (Slave)
    participant Master as 4420LA (Master)

    Note over Slave, Master: Enter PROGRAM mode
    Master->>Slave: Send 2713Hz
    Slave->>Master: Receive 2713Hz for 30 seconds
    Slave->>Master: Send 1014Hz
    Master->>Slave: Receive 1014Hz

    Note over Slave, Master: Set mode of operation
    Master->>Slave: Send 1014Hz
    Slave->>Master: Receive 1014Hz
    Slave->>Master: Send 2814Hz
    Master->>Slave: Receive 2814Hz
    Master->>Slave: Send 2814Hz
    Slave->>Master: Receive 2814Hz
    Slave->>Master: Send 414Hz
    Master->>Slave: Receive 414Hz
    Master->>Slave: Send 414Hz
    Slave->>Master: Receive 414Hz
    Slave->>Master: Send 1818Hz
    Master->>Slave: Receive 1818Hz
    Master->>Slave: Send 1818Hz
    Slave->>Master: Receive 1818Hz; adjust gain and equalization

    Note over Slave, Master: Automatic alignment
    Master->>Slave: Adjust gain and equalization

    Note over Slave, Master: Slave performs internal RCV OUT level testing
    Slave->>Master: Send acknowledgment tone
    Master->>Slave: Measure acknowledgment tone from slave

    Note over Slave, Master: Loopback
    Master->>Slave: Send 1014Hz
    Slave->>Master: Loopback activated

    Note over Slave, Master: Removal of distant end from loopback
    Master->>Slave: Send 2713Hz
    Slave->>Master: Loopback deactivated (circuit idle)

    Note over Slave, Master: IDLE
    Master->>Master: Send acknowledgment tone
    Master->>Master: Circuit idle
    Note over Master: IDLE
  
```

The diagram illustrates the communication sequence between a 4420LA (Slave) and a 4420LA (Master). The process begins with the Master sending a 2713Hz signal to the Slave, which receives it for 30 seconds. The Slave then sends a 1014Hz signal to the Master, which receives it. This is followed by a series of frequency exchanges: 1014Hz, 2814Hz, 414Hz, and 1818Hz, each sent by the Slave and received by the Master, and then sent by the Master and received by the Slave. After the 1818Hz exchange, the Slave adjusts gain and equalization. The Master then adjusts gain and equalization. The Slave sends an acknowledgment tone, which the Master measures. The Master then sends a 1014Hz signal, and the Slave activates loopback. The Master then sends a 2713Hz signal, and the Slave deactivates loopback (circuit idle). The Master then sends an acknowledgment tone and the circuit goes idle. The Slave also goes idle.

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## Manual (Local) Loopback

- 3.16 In addition to 2713Hz tone loopback activation and deactivation, the 4420LA provides for manual (local) loopback activation and deactivation. The module is manually placed into loopback at the installation site by connecting its MNLB lead (pin 1) to its MLBG lead (pin 19) via an external switch or key. Loopback is maintained until the MNLB-MLBG connection is removed. Manual loopback **cannot** be deactivated by sending 2713Hz to the module.

## LED Indications

- 3.17 The six front panel LEDs indicate circuit status. Observe the LEDs (see Figure 3-4) while referring to Table 3-2, which lists LED functions and their respective status indications.

Operating Mode / Status	Front Panel LEDs					
	program (red)	loopback (red)	power (green)	sealing current (yellow)	transmit data (green)	receive data (green)
normal	off	off	on (local power) off (line power)	on or off (local power)* on (line power)	**	**
program	on	on	on (local power) off (line power)	off (local power)* on (line power)	**	**
loopback	off	on	on (local power) off (line power)	off (local power)* on (line power)	**	**
WIRING CHECK	flashing	flashing	on (local power) off (line power)	on or off (local power)* on (line power)	**	**
TEST	flashing	on	on (local power) off (line power)	off (local power)* on (line power)	**	**
self-test	alternates with 'loopback'	alternates with 'program'	on (local power) off (line power)	on or off (local power)* on (line power)	**	**
unsuccessful alignment, locally initiated AUTO mode	flashing	on	on (local power) off (line power)	on or off (local power)* on (line power)	**	**

\*In local power operation only, sealing current LED indication is independent of all other LED indications and depends solely upon whether or not sealing current is flowing.  
 \*\*\*transmit data' and 'receive data' LEDs can be off in any mode, depending upon whether tone is being sent or received by the module.

**Table 3-2 Front Panel LED Mode and Status Indicators**

## 4. Tone-Activated Alignment and Diagnostics

- 4.1 Before tone activated alignment or diagnostics are initiated, the required operating mode must be determined. If LOCAL alignment is chosen, the choice of alignment at TLPs or data level must also be made. Tone-activated alignment and diagnostics can be initiated locally at the module site or remotely from the SSC.

### Notes:

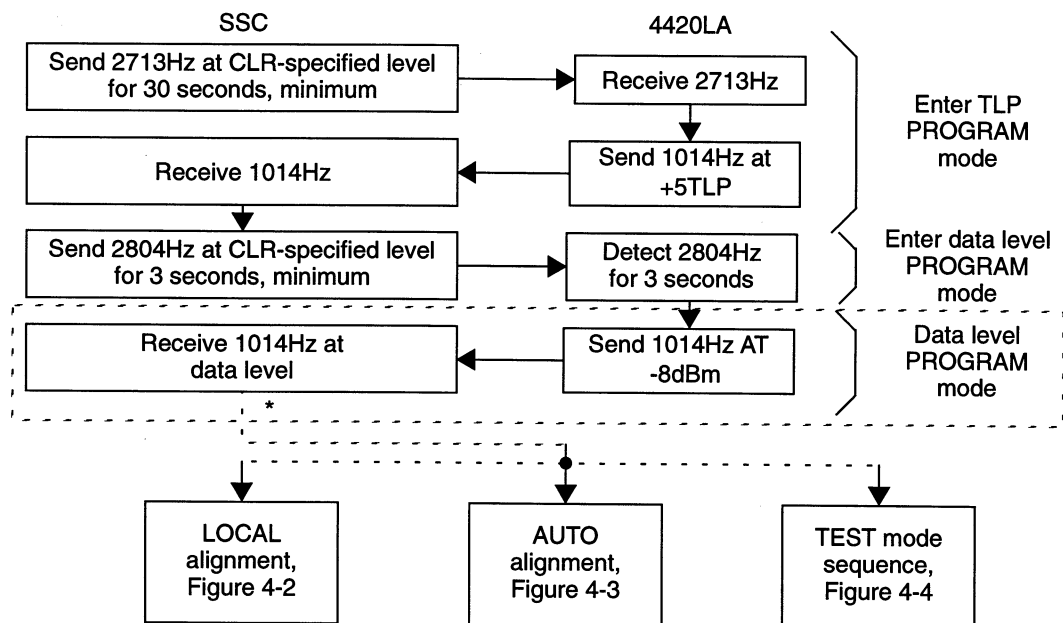
1. Although tone-activated alignment can be initiated from any point in the circuit (if the point of access has a flat frequency response), all text and procedural flow-charts that follow later in this section are based upon the assumption that the access point is at the local end office interfacing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

2. All alignment and diagnostic procedures in this section are based upon the assumption that the 4wire facility is split (metallic path broken) at the access point. This isolates the end link being aligned or tested from the rest of the circuit. A split 4wire facility is essential when the 4420LA is optioned for 4wire-to-2wire operation, because if the 2wire port is not terminated, tones sent to the 4420LA are looped through the 4wire-to-2wire hybrid and back to the network. If this happens and the 4wire facility is not split, the tones are passed on to the distant end of the circuit, where they can cause problems.

### Tone-Activated Loopback

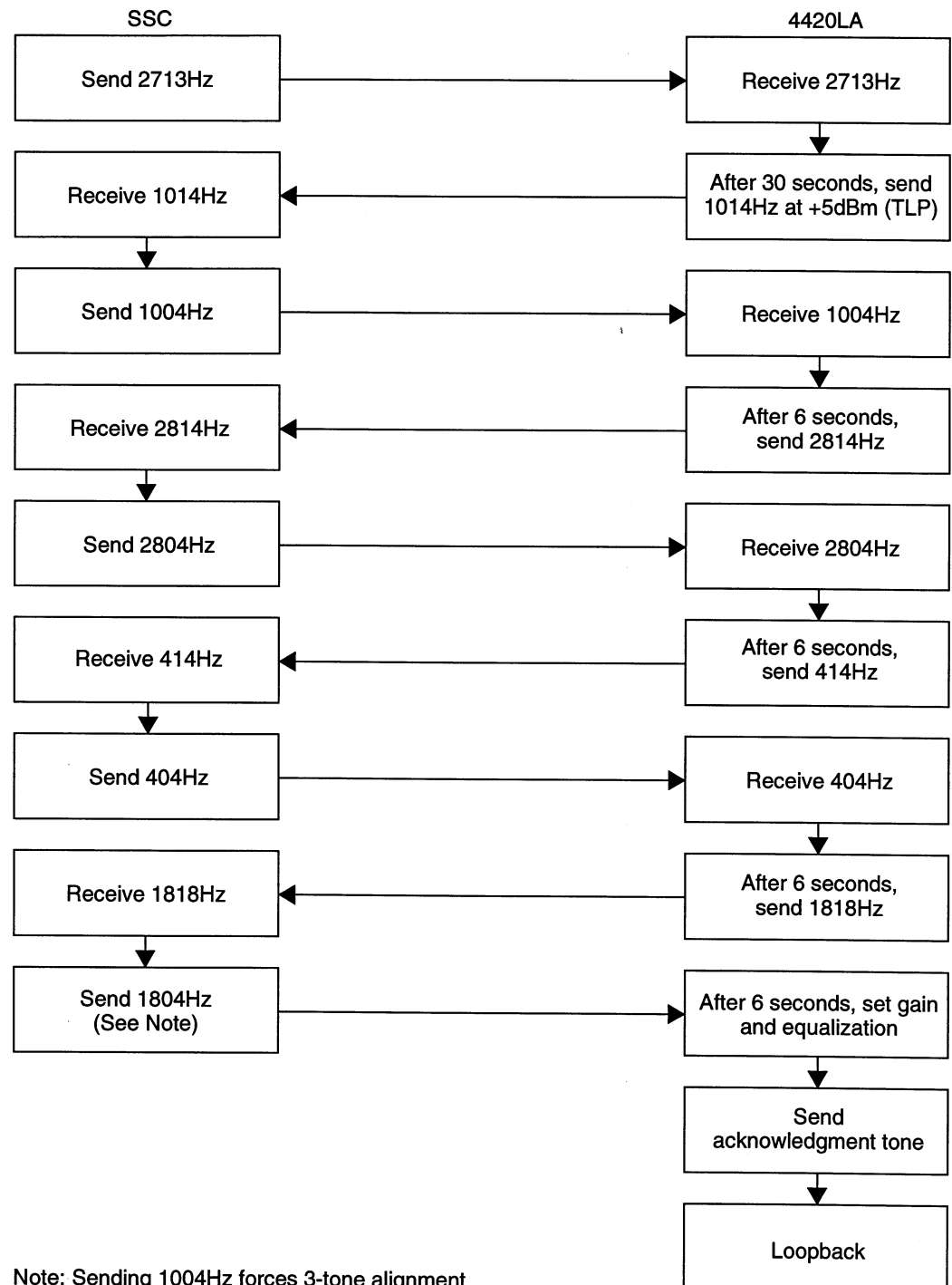
- 4.2 The 4420LA can be placed into loopback by sending 2713Hz to the module for at least 2 (but no more than 30) seconds and then removing the tone. Upon initiation of loopback, the 4420LA returns **identification tone**, which is alternating 1014 and 414Hz, for .5 second, nominal. Loopback is deactivated by sending a second 2713Hz for at least .9 second. Removal of the second tone is not necessary for loopback deactivation.
- 4.3 While performing alignment or diagnostic procedures, refer to the function sequence flowcharts, Figures 4-1 through 4-6.

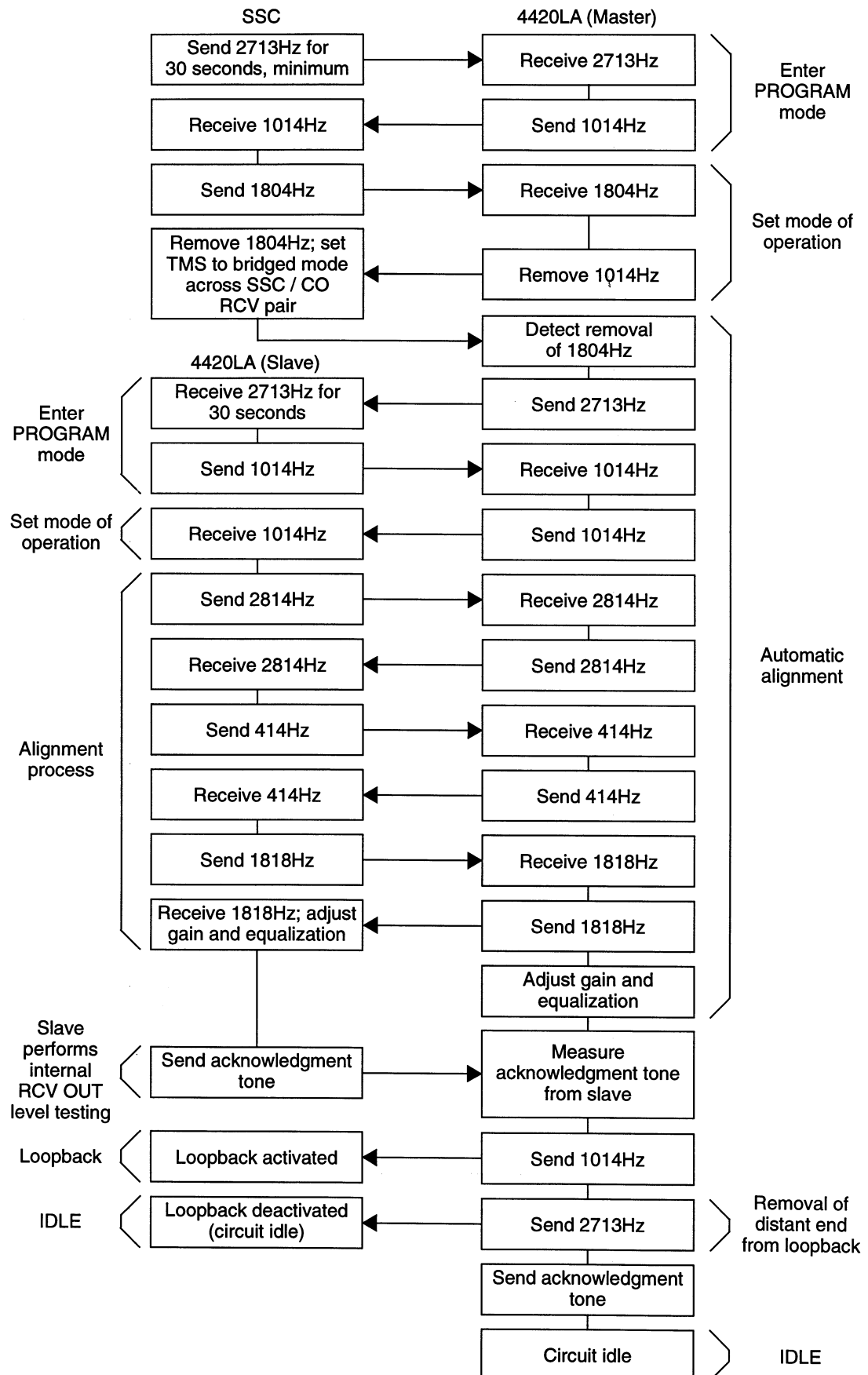
**Note:** To exit any alignment or diagnostic mode at any time, send 2713Hz to the 4420LA for 15 seconds.



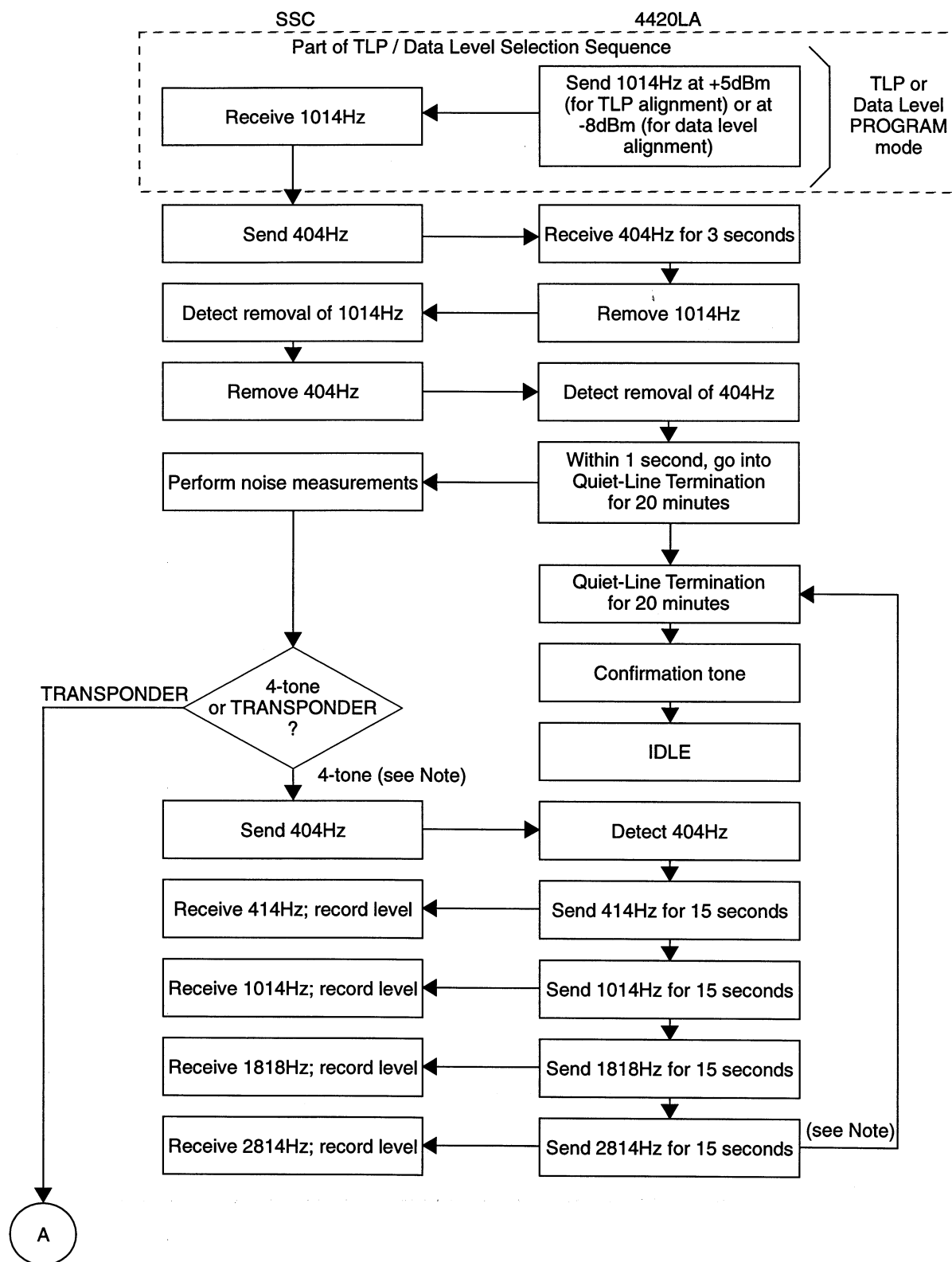
\*At this point, the 4420LA can be returned to the TLP PROGRAM mode by removing and then reapplying 2804Hz.

**Figure 4-1** TLP / Data Level Selection Sequence

**Figure 4-2** LOCAL Alignment Mode



**Figure 4-3** *AUTO Alignment Mode*



Note: 404Hz must be removed and then reapplied to restart the 4-tone sequence.

Figure 4-4 TEST (FOUR-TONE and TRANSPONDER) Mode (Page 1 of 2)

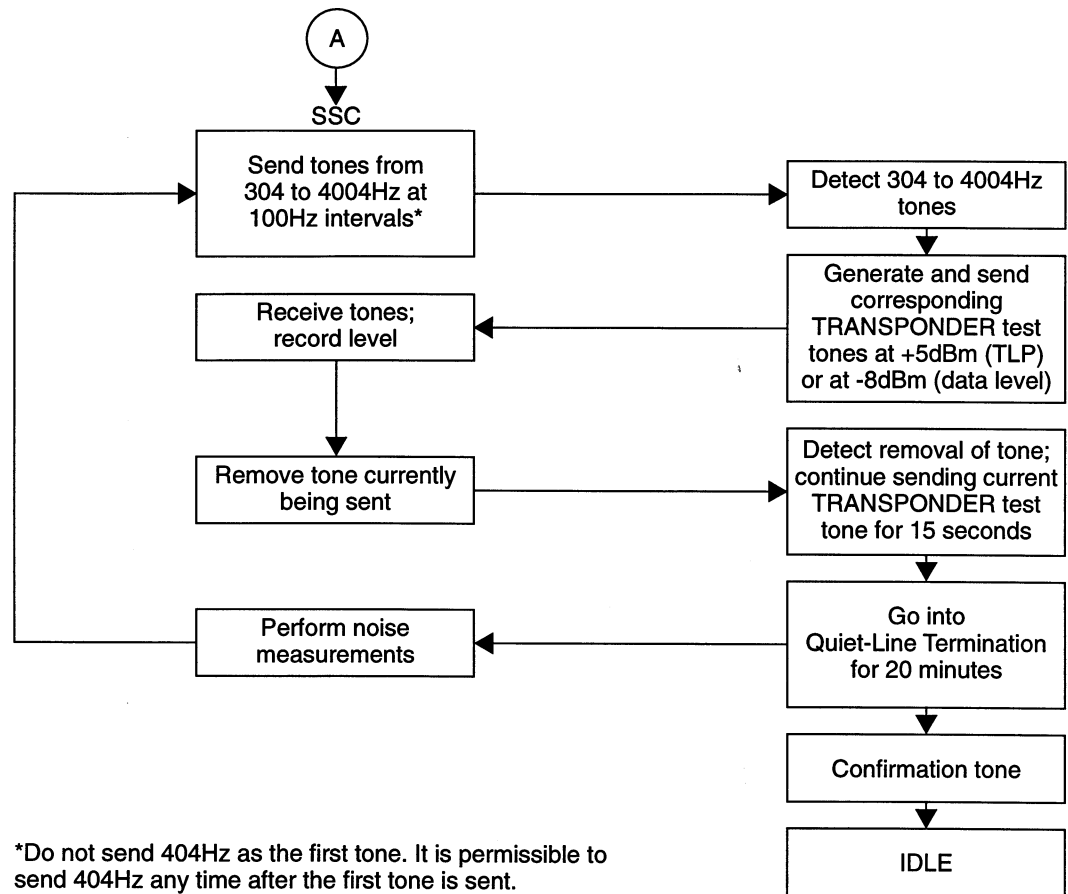


Figure 4-4 TEST (FOUR-TONE and TRANSPONDER) Mode (Page 2 of 2)

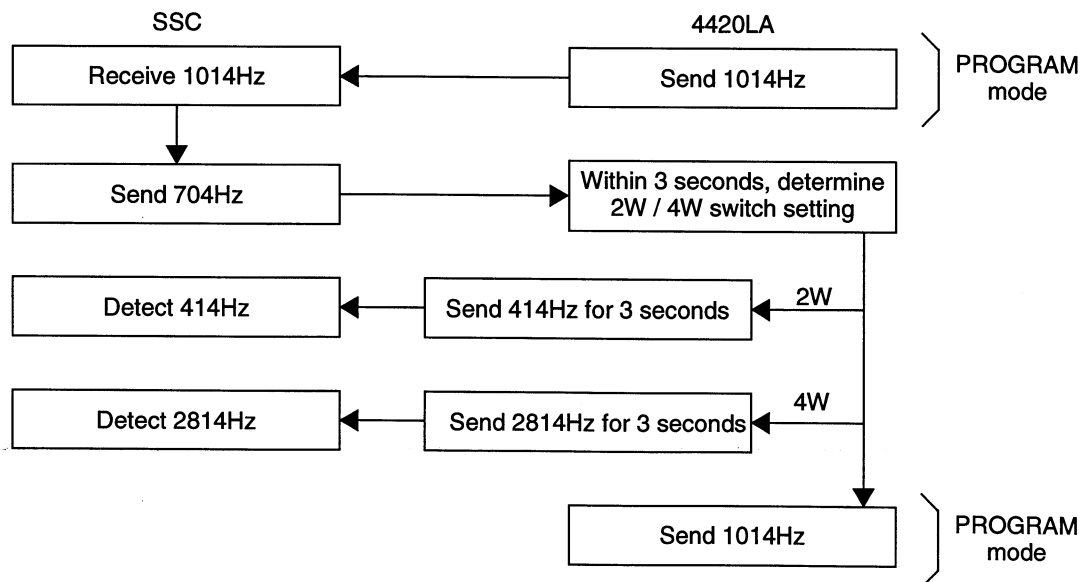


Figure 4-5 DEMARC QUERY Mode

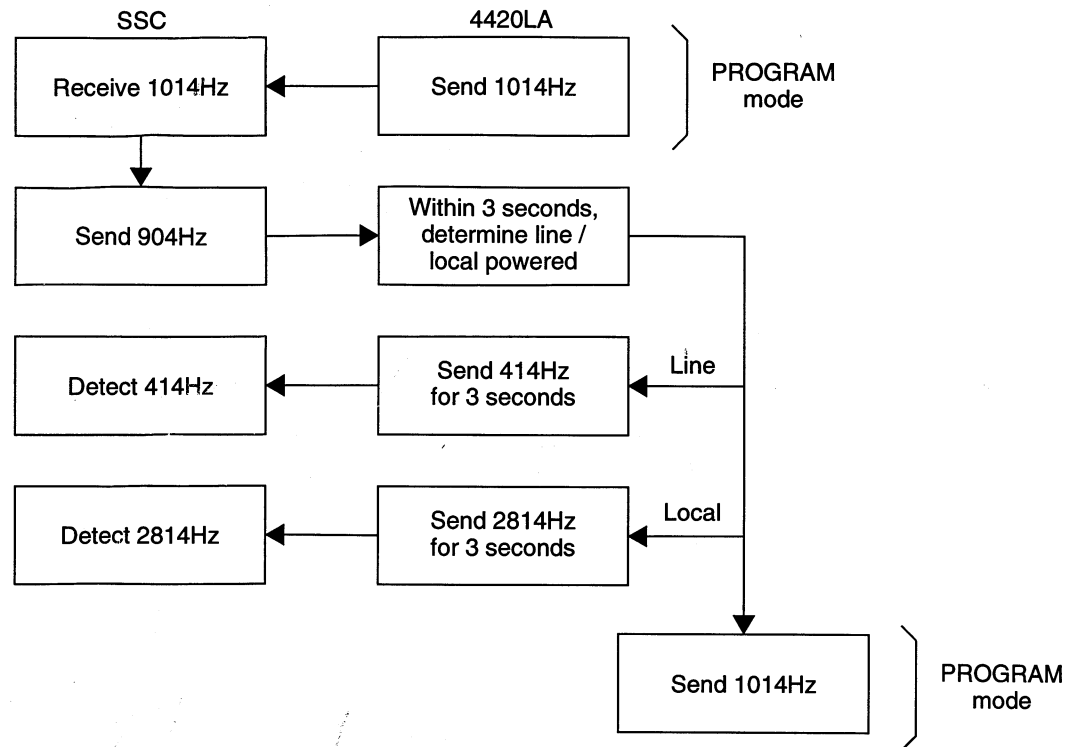


Figure 4-6 POWER SOURCE QUERY Mode

#### Optional Determination of Receive Channel Frequency Response (LOCAL Mode)

- 4.4 If confirmation tone is returned by the 4420LA upon completion of alignment, the circuit's frequency response is within C5 attenuation distortion limits (refer back to Table 2-2). Error tone, however, indicates that the circuit's frequency response does not meet C5 attenuation distortion limits. However, error tone does not necessarily mean that a particular circuit's alignment requirements are not met. Therefore, it may be necessary to determine 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.)

#### Optional Adjustment of Receive Channel Frequency Response (LOCAL Mode)

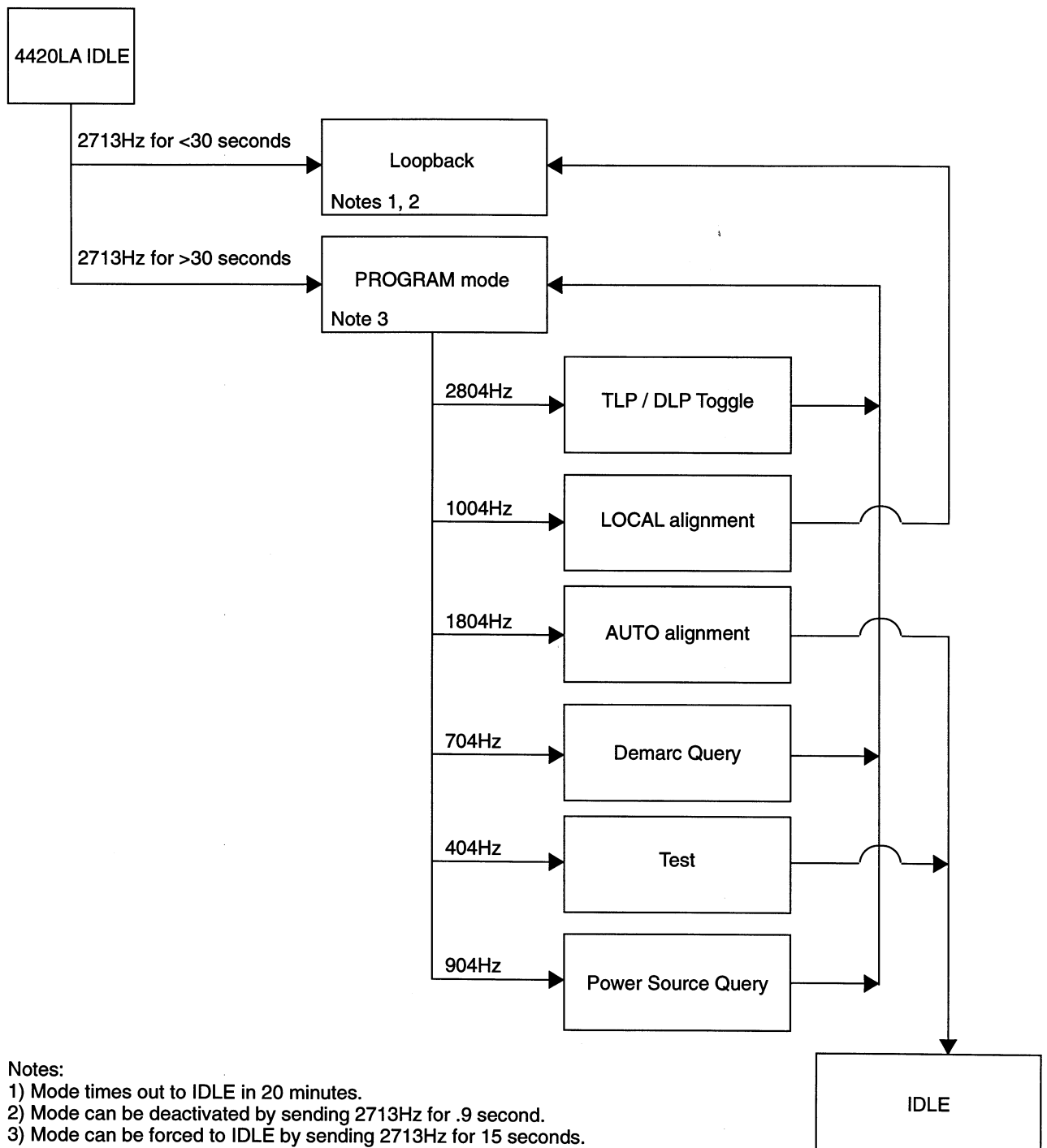
- 4.5 For most facilities, the 4420LA provides successful alignment within C5 attenuation distortion limits upon the first alignment attempt. If error tone is returned but C5 conditioning is not required, receive channel attenuation distortion should be calculated to verify that the circuit meets the required conditioning limits. If error tone is returned and C5 conditioning is required, the circuit's frequency response can be manually adjusted at the SSC so that a second 4420LA alignment attempt is successful at meeting C5 attenuation distortion limits.
- 4.6 This second alignment is performed by using the original serving CO transmit TLP, plus or minus a calculated response correction at each alignment frequency. If the levels are too high after the first alignment attempt (the module is inserting too much gain), a new alignment TLP (the original TLP raised by the appropriate calculated amount) causes the 4420LA to insert less gain.
- 4.7 Similarly, if the levels are too low after the first alignment attempt, (not inserting enough gain), a new alignment TLP (the original TLP lowered by the appropriate calculated amount) causes the 4420LA to insert more gain. Table 4-1 contains a step-by-step procedure for making the required calculations for this receive channel frequency response adjustment.

Step	Operation					
1	Obtain (from circuit records) the attenuation distortion specification for the circuit; record the values in Column A.					
2	Fill in Column B with the receive channel attenuation distortion values.					
3	<b>For 1004Hz tone only.</b> If the current frequency response value in Column B is positive, add the same <b>negative</b> value to it to obtain a sum of 0 (zero), and enter 0 in the top row of Column C. If the 1004Hz frequency response value in Column B is negative, add the same <b>positive</b> value to it to obtain a sum of 0, and enter 0 in the top row of Column C.					
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.					
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 <b>outside</b> of the respective frequency response specification in Column A. If so, determine the difference and record the <b>absolute value</b> 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 TLPs or data levels 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 TLPs or data levels in Column F, realign the circuit by reinitiating LOCAL alignment.					
Frequency	A	B	C	D	E	F
	Frequency Response Specification	Current RCV Channel Frequency Response	Current RCV Channel Frequency Response re 1004Hz	Amount by Which Value in Column C is Outside of Specification	CO XMT TLPs or Data Levels Used in First Alignment Attempt	New CO XMT TLPs or Data Levels for Second Alignment Attempt
1004Hz	Reference		0	0		
2804Hz	+ □ , - □ dB					
404Hz	+ □ , - □ dB					
1804Hz	+ □ , - □ dB					

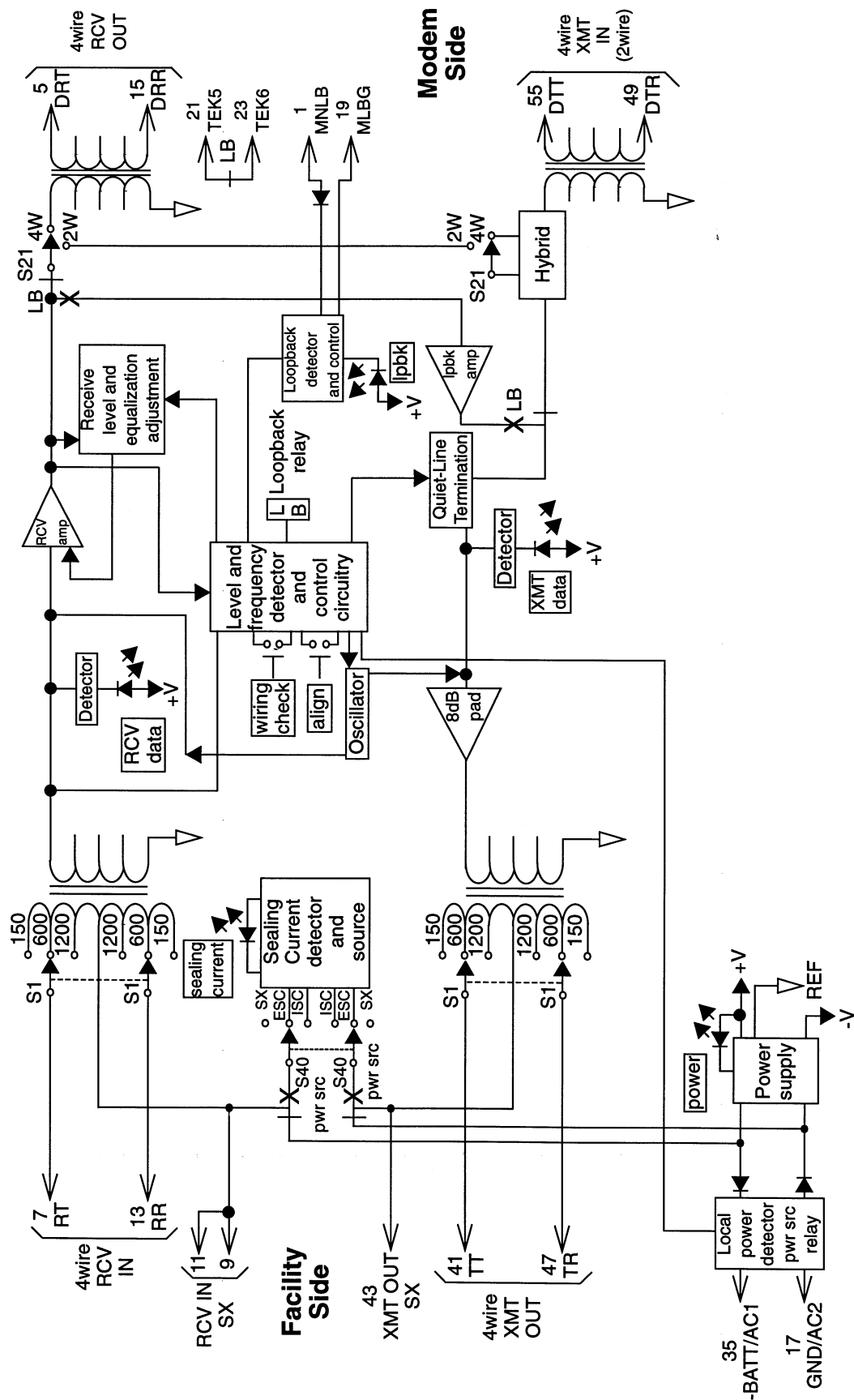
Table 4-1 Optional Adjustment of Receive Channel Frequency Response Upon Completion of LOCAL Alignment



## 5. Protocol Overview Flowchart



## 6. Block Diagram



## 7. Specifications

### Transmission

**Note:** The 4420LA meets transmission, UL 1459 power cross, and lightning-surge protection criteria as specified in BellCore Technical Reference TR-TSY-000007, Voice Frequency Network Channel Terminating Equipment - Metallic Facilities.

Input and Output Levels	<ul style="list-style-type: none"> <li>• RCV IN level range: -10 to +5dBm (TLP) or -23 to -8dBm data level</li> <li>• 2wire OUT / RCV OUT level: -3dBm (TLP) or -16dBm data level</li> <li>• 2wire IN / XMT IN level: +13dBm (TLP) or 0dBm data level</li> <li>• XMT OUT level: +5dBm (TLP) or -8dBm data level</li> </ul>
Acknowledgment Tones	<ul style="list-style-type: none"> <li>• Confirmation tone: ascending sweep of frequencies, starting at 314 and ending at 3042Hz, with 3042Hz held for 10 seconds (total duration 13 seconds)</li> <li>• Error tone: descending sweep of frequencies, starting at 3014 and ending at 314Hz, with 314Hz held for 10 seconds (total duration 13 seconds)</li> </ul>
WIRING CHECK Tones, 4wire-4wire Operation	<ul style="list-style-type: none"> <li>• Receive input and output: 1014Hz continuous</li> <li>• Transmit input and output: 1014Hz interrupted</li> </ul>
WIRING CHECK Tones, 4wire-2wire Operation	<ul style="list-style-type: none"> <li>• Receive input: 1014Hz continuous</li> <li>• Transmit output: 1014Hz interrupted</li> <li>• 2wire: 1014Hz continuous, amplitude modulated</li> </ul>
Identification Tone for Remote Loopback	<ul style="list-style-type: none"> <li>• Alternating 1014 and 414Hz for .5 second, nominal</li> </ul>
Input Detector Threshold, TRANSPONDER TEST Mode	<ul style="list-style-type: none"> <li>• -35dBm, nominal</li> </ul>
Terminating Impedances	<ul style="list-style-type: none"> <li>• RCV IN and XMT OUT ports: 1200, 600, or 150 ohms, balanced, switch selectable</li> <li>• RCV OUT and XMT IN ports (4wire-4wire operation): 600 ohms, fixed, balanced</li> <li>• 2wire port (4wire-2wire operation: 600 ohms, fixed, balanced)</li> </ul>

### Loopback

**Note:** The 4420LA meets Bell Pub 43004 specifications for loopback.

Loopback Path Gain	<ul style="list-style-type: none"> <li>• Equal level, 16dB fixed</li> </ul>
Tone Loopback Frequency	<ul style="list-style-type: none"> <li>• Module must loop back at <math>2713 \pm 7\text{Hz}</math>, but not outside of <math>2713 \pm 37\text{Hz}</math></li> </ul>
Operating Timings for Two-tone Loopback	<ul style="list-style-type: none"> <li>• Operate: 2713Hz for <math>2 \pm .4</math> seconds, loopback upon removal of tone</li> <li>• Release: 2713Hz for <math>.9 \pm .3</math> seconds, release during tone, or automatic release after time-out period of <math>20 \pm 1</math> minutes</li> </ul>

### Common

Internal Sealing Current Source	<ul style="list-style-type: none"> <li>• 20mA nominal output when module is powered from nominal -48Vdc input power</li> <li>• Integral ZAP feature provides higher current upon initial sealing current activation</li> </ul>
Input Power Requirements	<ul style="list-style-type: none"> <li>• Voltage: nominal -22 to -56Vdc, filtered, ground referenced, or 20 to 30Vac</li> <li>• Current: 100mA<sub>dc</sub>, maximum</li> <li>• Line power: 180mW maximum power consumption, with 20V minimum at the module</li> </ul>
Operating Environment	<ul style="list-style-type: none"> <li>• 32° to +122° F (0° to +50° C), humidity to 95%, (no condensation)</li> </ul>
Storage Environment	<ul style="list-style-type: none"> <li>• -58° to 185° F (-50° to +85° C), humidity to 95%, (no condensation)</li> </ul>
Dimensions	<ul style="list-style-type: none"> <li>• 5.58 inches (14.17cm) high</li> <li>• 1.42 inches (3.61cm) wide</li> <li>• 5.96 inches (15.14cm) deep</li> </ul>
Weight	<ul style="list-style-type: none"> <li>• 9.7 ounces (302 grams)</li> </ul>
Mounting	<ul style="list-style-type: none"> <li>• Mounts in one position of a Tellabs Type-10 Mounting shelf, or prewired mountings having standard NCTE pinouts</li> </ul>

## 8. Troubleshooting, Technical Assistance, Repair and Return

- 8.1 These troubleshooting guides may be used to assist in the installation, testing, or troubleshooting of the 4420LA and will 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 (see paragraph 8.3). 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.

### Troubleshooting Guide for Use at SSC

Trouble Condition	Possible Cause (Check Before Assuming Module is Defective)
4420LA cannot be placed into remote loopback.	Incorrect tone loopback frequency and / or level, or 4420LA is in an alignment mode. Send 2713Hz at CLR-specified level to 4420LA for at least 15 seconds to return module to IDLE; remove and resend 2713Hz at CO XMT level for at least 3 seconds before removing 2713Hz again. If 4420LA does not go into loopback, raise CO XMT level 5dB and try again. If this fails, assume module is defective and return it to Tellabs.
Tone is present on CO receive pair.	Module is in an alignment mode if 1014, 2814, 414, or 1818Hz are present, or in WIRING CHECK mode if interrupted 1014Hz is present. Send 2713Hz at CLR-specified level to 4420LA for at least 15 seconds to return module to IDLE. If 4402A does not go idle, raise CO XMT level 5dB and try again. If this fails, assume module is defective and return it to Tellabs.
Loopback frequency response check is out of tolerance.	Test TLPs at CO are incorrect due to lack of equalization at CO, e.g., a TO channel unit is being used instead of an ETO channel unit, or a cross-connect is being used instead of conditioning equipment. As a result, roll-off that is not compensated for exists at CO test access point. A. If AUTO alignment was used, circuit is probably aligned correctly but CO test tone levels must be corrected to compensate for roll-off of incoming facility. Use TEST mode to access distant end of circuit, and determine CO receive TLPs for all four alignment frequencies. Return 4420LA to loopback and, using new CO receive level, retest circuit. B. If LOCAL alignment was used, circuit is probably misaligned. If possible, realign circuit via AUTO mode. Otherwise, use TEST mode to access distant end of circuit, and determine CO receive levels for all four alignment frequencies. Using these new levels, realign circuit via LOCAL mode.

### Troubleshooting Guide for Use at Installation Site

<b>Trouble Condition</b>	<b>Possible Cause (Check Before Assuming Module is Defective)</b>
The 'power' LED continues to flash (or does not light) after 15 seconds with power applied.	Module has failed power-up diagnostics. Remove power, then reapply power. If the 4420LA fails power-up diagnostics again, assume module is defective and return it to Tellabs.
The 'loopback' LED is on.	1. Module is in remote loopback. Apply 2713Hz at receive input port (pins 7 and 13) for at least 5 seconds (or have 2713Hz at CLR-specified level sent to 4420LA for at least 5 seconds) to return module to IDLE. If this fails, see possible cause 2. 2. Module is in manual loopback. Remove connection between MNLB lead (pin 1) and MLBG lead (pin 19). If this fails to remove 4420LA from loopback, assume module is defective and return it to Tellabs.
The 'program' LED is flashing and 'loopback' LED is on.	Module is in TEST mode. Apply 2713Hz at receive input port (pins 7 and 13) for at least 15 seconds (or have 2713Hz at CLR-specified level sent to 4420LA for at least 15 seconds) to return module to IDLE.
The 'program' and 'loopback' LEDs are on.	Module is either in PROGRAM mode or in an alignment mode. Apply 2713Hz at receive input port (pins 7 and 13) for at least 15 seconds (or have 2713Hz at CLR-specified level sent to 4420LA for at least 15 seconds) to return module to IDLE.
The 'program' and 'loopback' LEDs are flashing.	Module is in WIRING CHECK mode. Depress 'wiring check' pushbutton to return module to IDLE.

### Technical Assistance

8.2 Contact Tellabs Technical Assistance as follows:

<b>Location</b>	<b>Telephone</b>	<b>FAX</b>
Tellabs Pty Ltd., North Rocks, NSW, <b>Australia</b>	+61.2.890.1918	+61.2.890.1817
Tellabs SA, Brussels, <b>Belgium</b>	+32-2-646-5380	+32-2-646-6811
Tellabs <b>Canada</b> Ltd., Mississauga, Ontario	416 / 858-2058	416 / 858-0418
Tellabs International, Inc., <b>Dubai, U.A.E.</b>	+971-4-373250	+971-4-376526
Tellabs U.K. Ltd., Buckinghamshire, <b>England</b>	+44-628-660345	+44-628-667735
Tellabs H.K. Ltd., <b>Hong Kong</b>	+852-866-2983	+852-866-2965
Tellabs, Ltd., County Clare, <b>Ireland</b>	+353-61-471433	+353-61-471000 / 472004
Tellabs Ltd., Dublin, <b>Ireland</b>	+353-1-676-6333	+353-1-676-2646
Tellabs S.A. DE C. V., <b>Mexico</b>	525-282-1107, -1432, -1050, or -0981	525-282-0218
Tellabs, N.Z. Ltd., Wellington, <b>New Zealand</b>	+64-4-495-2130	+64-4-495-2133
Tellabs International, Inc. Seoul, <b>South Korea</b>	+82-2-589-0667 or -0668	+82-2-589-0669
Tellabs International, Inc., Stockholm, <b>Sweden</b>	+46-8-678-4040	+46-8-678-4041
Tellabs Turkey A.S., Ankara, <b>Turkiye</b>	+90-4-467-4330	+90-4-467-6664
<b>USA and Puerto Rico</b>	(800) 443-5555*	708 / 512-7097
*All other <b>Caribbean</b> and <b>South American</b> locations, or if the toll-free number is busy, telephone 708 / 969-8800		

**Repair and Return**

- 8.3 If equipment needs repair, contact Tellabs' Product Services Department with the equipment's model and issue numbers and warranty date code. You will be issued a Material Return Authorization (MRA) number and instructions on how and where to return the equipment.

Location	Telephone	FAX
Tellabs <b>Canada</b> Ltd., Mississauga, Ontario	416 / 858-2058	416 / 858-0418
Tellabs, Ltd., County Clare, <b>Ireland</b>	+353-61-471433	+353-61-471000 / 472004
Tellabs Operations, Inc., <b>Lisle, IL USA</b>	(800) 443-5555 (USA and Puerto Rico only) 708 / 969-8800 (other International)	708 / 852-7346 (both)

- 8.4 Repair service includes an attempt to remove any permanent markings made by customers on Tellabs equipment. If equipment must be marked, it should be done with nonpermanent materials and in a manner consistent with the correct handling of electrostatically sensitive devices.