QWEST Communications International Inc. Technical Publication

Intelligent Network Channel Terminating Equipment Protocol

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1. General Information

This document describes the QWEST Communications International Inc. protocol used for Intelligent Network Channel Terminating Equipment (INCTE). The providing of status and the interaction between network intelligent equipment or test systems will enhance the operation of the network.

The INCTE is operated with a Menu of commands. The Command Menu is accessed by sending 0# Dual Tone Multi-Frequency (DTMF) command or (2713 Hz, default frequency: same as the loopback frequency used) tone command for greater than 30 seconds to the INCTE. The tone method consists of either a single tone or several tones sent in sequence.

The DTMF command consists of three parts. Each command is comprised of 1) an option or configuration change, 2) a primary number or a possible secondary number, and 3) the execute.

Example: *__643__# (DTMF Command)

*	=	Option or Configuration change
643	=	DTMF numbers assigned to the command
#	=	Execute

The INCTE will not change any existing transmission or signaling parameters unless a complete and recognizable command is received. The INCTE has the ability to secure certain commands from accidental operation. (See the paragraph in Chapter 4 under Subsection 4.1 — Security Feature.)

The INCTE will respond with an Identification Tone upon being placed in the Command Menu mode. All the required signals are defined in this document.

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2. Purpose

The purpose of this document is to describe QWEST Communications International Inc.'s standard protocol to be used with INCTE and other equipment in the loop. Any changes in the document will be stated here.

This document is being reissued to show change in company information. U S WEST is now QWEST.

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3. Intelligent Network Channel Terminating Equipment (INCTE) Response Signals

The INCTE uses response signals to convey information to the remote end pertaining to the unit's status and operation.

3.1 Response Frequencies

Requirement: The INCTE supports the following response frequencies:

RESPONSE	FREQUENCY
Accept	350 Hz (+ 1%)
Reject	750 Hz (+ 1%)
Identification Tone (ID)	1004 Hz (+ 1%)
Error	1350 Hz (+ 1%)
Security Violation	2050 Hz (+ 1%)
Pass (Align)	2804 Hz (+ 1%)
Fail (Align)	404 Hz (+ 1%)

3.2 Accept Signal (350 Hz + 1%)

Requirement: An Accept Signal is a 2-second ascending sweep tone followed by at least 15 seconds of 350 Hz tone. The ascending sweep tone starts at 404 Hz and sweeps up to 2804 Hz in 100 Hz steps. An Accept Signal is a positive response signal generated by intelligent equipment in response to a command received from the distant end. The INCTE sends an Accept Signal if it implements the function requested by a command or is already configured for the function requested by a received command. An INCTE will return an Accept Signal if it can be software configured to provide the function requested by a command. The INCTE will also sense the position of a manually set switch option and respond with an Accept Signal if the switch is set in the position to provide the requested function. The Accept Signal is also used as a positive response to a query command. The Accept Tone will not be a response for milliwatt, cable-flip, or time cable pair open command.

3.3 Reject Signal (750 Hz + 1%)

Requirement: A Reject Signal is a 2-second descending sweep tone followed by at least 15 seconds of 750 Hz tone. The descending sweep tone starts at 2804 Hz and sweeps to 404 Hz in 100 Hz steps. The Reject Signal is a negative response by the INCTE to a command generated by the distant end. If a test command is received by an INCTE, and the parameter is outside a set of prescribed limits, the INCTE responds by sending a Reject Signal. The Reject Signal is also used as a negative response to a query. If a command is received to set an INCTE to a particular function which can only be provided with a manually operated switch and the switch is not in the correct position to supply the requested function, the INCTE will respond with a Reject Signal. The Reject Signal is also sent as an indication that an option switch is set to an inappropriate position. As an example, if a particular INCTE has an option switch used to switch in a signaling board, and it is in the signaling board position, but no signaling board is attached, the INCTE will send a Reject Signal. The Reject Signal is also a negative response to a self-test command.

3.4 Identification Signal (1004 Hz + 1%)

Requirement: An Identification Signal is a single tone of 1004 Hz which will default to Test Level Point (TLP). The INCTE responds with a single identification (ID) tone upon being placed in the Command Menu mode. The level of the transmitted tone will be at TLP unless the INCTE was previously set at Data Level Point (DLP). Any time the command menu is accessed it will apply the ID tone at the previously selected TLP or DLP.

3.5 Error Signal (1350 Hz + 1%)

Requirement: An Error Signal is a 2-second descending sweep tone followed by a 1350 Hz tone until time-out is reached or the unit is returned to the Command mode. The descending sweep tone starts at 2804 Hz and sweeps to 404 Hz in 100 Hz steps. The Error Signal is an INCTE response indicating that a receive DTMF command was out of sequence, unrecognizable or incomplete. The Error Signal also indicates an unsupported command. An unsupported command is in the protocol, but the particular INCTE is not capable of supporting that command. The Error Signal is also used to indicate a failed alignment as described in the paragraph in Chapter 8, Subsection 8.5 titled “Automatic Alignment.”

3.6 Security Violation Signal (2050 Hz + 1%)

Requirement: A Security Violation Signal is a 2-second descending sweep tone followed by at least 15 seconds of 2050 Hz tone. The descending sweep tone starts at 2804 Hz and sweeps to 404 Hz in 100 Hz steps. If a secured command is received, the INCTE responds by sending a Security Violation Signal.

3.7 Pass (Align) Signal (2804 Hz + 1%)

Requirement: A Pass Signal is a 2-second ascending sweep tone followed by at least 15 seconds of 2804 Hz tone. The ascending sweep tone starts at 404 Hz and sweeps to 2804 Hz in 100 Hz steps. The Pass Signal is a positive response sent by the INCTE if equalization of the receive facility to C5 (see Appendix A) parameters is successfully accomplished. This response is used only during the alignment mode.

3.8 Fail (Align) Signal (404 Hz + 1%)

Requirement: A Fail Signal is a 2-second descending sweep tone followed by at least 15 seconds of 404 Hz tone. The descending sweep tone starts at 2804 Hz and sweeps to 404 Hz in 100 Hz steps. The fail signal is a negative response sent by the INCTE if it was unsuccessful in equalizing the receive facility to C5 parameters. This response is only used during the alignment mode.

3.9 Response Time

Requirement: Response Signals are sent within 1.5 seconds of receipt of a command. The response signals also apply to the sub-menu tone commands in Chapter 14.

3.10 Accept, Reject, and Security Violation Signal Duration

Requirement: All response tones with the exception of the ID tone have a 2-second sweep followed by at least 15 seconds of appropriate response tone.

The ascending sweep tone starts at 404 Hz and sweeps to 2804 Hz in 100 Hz steps over a period of 2 seconds, and precedes the Accept Tone (350 Hz) and the Pass Tone (2804 Hz).

The descending sweep tone starts at 2804 Hz and sweeps to 404 Hz in 100 Hz steps over a period of 2 seconds, and precedes the Reject Tone (750 Hz), the Error Tone (1305 Hz), the Security Violation Tone (2050 Hz) and the Fail Tone (404 Hz).

After the INCTE completes the proper response signal, the INCTE sends the Command Menu ID tone. If a command is received by the INCTE while sending these response signals, the INCTE will stop sending the response signal and perform the received command.

3.11 Sub-Menu Acknowledgement Tone

Requirement: The INCTE sends the same frequency as received as an acknowledgement when the Sub-Menu tone has been sent to activate the INCTE. For example, the Query Sub-Menu commands (The third paragraph in Chapter 14):

- 604 Hz is sent toward the INCTE to activate the Sub-Menu.
- The INCTE answers with an Accept Tone (350 Hz).
- The INCTE returns the 604 Hz tone as acknowledgement it is in the Sub-Menu.

- At this time, any of the queries requiring entry through a single tone Sub-Menu may be performed.
- If a second tone is required, for example 2304 Hz in this case, it is sent.
- The INCTE equipment will acknowledge with the same frequency tone (2304 Hz).
- In the second tone menu (2304 Hz), any of the queries needing both tones to activate (604 Hz + 2304 Hz) may be performed by entering only the command tone required.

3.12 Manufacturer and Unit Identification (ID) Command

This tone identifies the manufacturer of the installed INCTE. See Chapter 5, Subsection 5.2.10 titled “DTMF 70# Manufacturer and Unit ID Command” for information on the tones.

3.13 Error Signal Duration

Requirement: The Error Signal is applied by the INCTE until the Command Menu time-out is reached. An exception to the Command Menu time-out is when the Error Signal is applied because of a problem with either remote or automatic alignment. If a problem is encountered with alignment, the Error Signal will not time-out.

3.14 Error Signal Release

Requirement: The Error Signal condition can be escaped by the receipt of a DTMF 01# or a loopback tone (2713 Hz) for greater than 0.9 seconds. Loopback tone returns the INCTE to the idle mode. The Error Signal condition can also be escaped by the receipt of a DTMF 0# or 3104 Hz, which returns the INCTE to the Command Menu.

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4. Intelligent Network Channel Terminating Equipment (INCTE) Security

4.1 Security Feature

Requirement: The INCTE secures certain commands from accidental activation by preventing access to the command in the Command Menu (see Subsection 4.3 titled "Commands Secured by INCTE"). Access to these commands can be accomplished only by disabling security. Security is disabled by issuing a Turn Security Off Command (DTMF 03# or 2004 Hz tone). Every INCTE that has the security feature and utilizes a DTMF receiver must also use the tone equivalent method (2004 Hz) for the 03# command.

COMMAND	FUNCTION
03#	Turn Security Off
2004 Hz	Turn Security Off

4.2 Command Response

Requirement: If a secured command is received by the INCTE, it will respond by sending a Security Violation Signal. For example, if a 1004 Hz tone is received by the INCTE while in the Command Menu, the INCTE will not start the alignment procedure if security is in place and responds by sending a Security Violation Signal. Any command in the command menu not listed as "secured" is considered "unsecured" and can be used without sending the DTMF 03# or 2004 Hz.

4.3 Commands Secured by INCTE

Requirement: The following commands shall have the security feature. Security will be placed on any future commands that change the transmission or signaling characteristics of the INCTE. All tone equivalent commands for the DTMF commands listed below are also secured.

DTMF	TONE	FUNCTION
20#	704 + 1204 Hz	Factory Defaults
22#	1804 Hz	Start Automatic Alignment
23#	704 + 1304 Hz	Transmission Defaults
31#	904 + 504 Hz	Transfer to Terminate and Leave
36#	1404 Hz	Transfer to Wire Check Mode
42(NN)#	704 + 1104 + X Hz	Loopback Frequency Selection
48(N)#	N/A	Time-out Duration
*410#	504 + 1304 Hz	Default Levels
*4101#	504 + 1104 Hz	Special Level Set
*440#	504 + 304 Hz	Set Facility Impedance 150 ?
*441#	504 + 404 Hz	Set Facility Impedance 600 ?
*442#	504 + 604 Hz	Set Facility Impedance 1200 ?
*445#	504 + 704 Hz	Sealing Current Sink
*446#	504 + 804 Hz	Sealing Current Source
*447#	504 + 904 Hz	Sealing Current Off
*448#	504 + 1204 Hz	2W Customer Side Operation
*449#	504 + 1404 Hz	4W Customer Side Operation
*643#	704 + 804 Hz	Receive Equalizer Toggle
*645#	2204 Hz	Roll Off Toggle (3 dB)
N/A	1004 Hz	Start Alignment

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5. General Housekeeping Commands

5.1 Housekeeping Features

Requirement: The INCTE has housekeeping commands which assist the user in provisioning, aligning, testing the signaling, and using the transmission testing features of the INCTE.

DTMF	TONE	FUNCTION
*#	3004 Hz	Cancel Command
0#	3104 Hz	Go to Command Menu
01#	Loopback	Return to Idle Mode
12#	604 + 404 Hz	Self Test
20#	704 + 1204 Hz	Factory Default†
21#	704 + 604 Hz	Gain/Equalization Default
23#	704 + 1304 Hz	Transmission Default†
48(N)#	N/A	Change Time-out Duration
70#	704 + 904 Hz	Manufacturer and Unit ID
*643#	704 + 804 Hz	Receive Equalizer Toggle†
*645#	2204 Hz	Roll Off Toggle†
500#	704 + 1004 Hz	Configuration Status Command

† These commands have the security feature.

5.2 Housekeeping Commands

5.2.1 Command Menu Access

Requirement: To enter the main Command Menu, a loopback tone (2713 Hz) is sent to the INCTE for greater than 30 seconds. When the INCTE has accessed the Command Menu, it responds by sending back a 1004 Hz ID tone. Once the unit is in the Command Menu, the operator may use either DTMF or single tones to send commands to the INCTE.

5.2.2 DTMF *# Cancel Command

Requirement: This command causes a command to be canceled if sent during a command. The INCTE returns to the Command Menu and sends the ID tone upon receiving the cancel command. The cancel command is effective only if sent before the execute command.

The Tone Command is 3004 Hz.

5.2.3 DTMF 0# Go To Command Mode

Requirement: This command will cause the INCTE to go to the Command Menu mode if the INCTE is in any mode other than the idle mode, Terminate and Leave mode, or the Wiring Test mode. The INCTE sends the ID tone upon entering the Command Menu mode. The 0# command can also be issued by sending 3104 Hz for greater than 5 seconds. The 3104 Hz tone is effective in all modes except the Idle mode or Transporter mode.

5.2.4 DTMF 01# Return To Idle Mode

Requirement: This command causes the INCTE to enter the idle mode if the INCTE is in any mode other than the Wiring Test mode. Idle mode can also be accessed by sending loopback tone (2713 Hz) for greater than 0.9 seconds.

5.2.5 DTMF 12# Self-Test Command

Requirement: The INCTE performs a self-test and responds with either an Accept response signal or a Reject response signal as follows:

- If the INCTE successfully completes the self-test, the INCTE sends an Accept Signal (350 Hz).
- If the INCTE fails the self-test, the INCTE sends a Reject Signal (750 Hz).
- If the INCTE successfully completes the self-test, but an option switch is incorrectly set making the INCTE inoperative, the INCTE sends a Reject Signal (750 Hz).
- If the INCTE successfully completes the self test, but a software selectable option is incorrectly set making the INCTE inoperable, the INCTE sends a Reject Signal (750 Hz).

The INCTE performs a power-up test when power is supplied. The INCTE must not send a response signal of any kind even if the power-up test fails. The response signals are strictly responses to commands and will not be generated unless a command is received. The INCTE must have all operating parameters stored in nonvolatile memory. This is required to restore operation after a power outage.

The Tone Command is 604 + 404 Hz.

5.2.6 DTMF 20# Factory Default

Requirement: This command resets the INCTE to the Factory Default settings and overrides previously set positions. The DTMF 20# command sets the:

- Drop to 4-Wire (4W)
- Facility Impedance to 600 ohms
- Sealing Current to Sink

- INCTE to the Transmission Default positions.

The Tone Command is 704 + 1204 Hz.

5.2.7 DTMF 21# Default Receive Gain/Equalization

Requirement: If the unit was used in another circuit configuration where the receive gain was set excessively high or low and the receive equalization was set extremely high, the unit may not respond to alignment tones or some DTMF commands when used in a new circuit. This command causes the INCTE receive gain and equalization to return to a predetermined value so the unit may be aligned or receive DTMF commands. The default gain and equalization is vendor specific. The receive gain and equalizer settings in place before the DTMF 21# was received are stored in memory. If an alignment is not performed before leaving the Command Menu, the gain and equalizer settings stored in memory will be reapplied upon exiting the Menu mode.

The Tone Command is 704 + 604 Hz.

5.2.8 DTMF 23# Transmission Default

Requirement: The INCTE resets to the Transmission Defaults. Issuing a DTMF 23# command sets the receive gain/equalizer to default, enables the receive equalizer, disables the 3 dB roll off, and sets the INCTE to default levels. This command overrides previously set positions.

The Tone Command is 704 + 1304 Hz.

5.2.9 DTMF 48(N)# Time-out Duration Command

Requirement: In all modes except Idle and Equal Level Loopback, a time-out returns the INCTE to idle if no activity is detected during this period. No activity means no stimulus such as a single-tone or DTMF command has been received. The default 5-minute period can be changed to any integer (N) between 2 minutes and 65,000 minutes with the DTMF command 48(N)#. The time-out will be restored to 5 minutes when the INCTE is transferred to idle.

A tone equivalent command is not available.

5.2.10 DTMF 70# Manufacturer and Unit ID Command

Requirement: Because the QWEST Communications International Inc. INCTE protocol is universal for every vendor, a means is needed to identify the manufacturer and the model or list number of the INCTE. The INCTE sends a 4-Tone sequence identifying the manufacturer and unit. Each tone of the sequence lasts 10 seconds. Usable tones are from 204 Hz to 1104 Hz in 100 Hz steps. The first two digits indicate the name of the manufacturer. The third and fourth digits indicate the list number or vintage of the INCTE. The first two numbers can be obtained from QWEST Communications International Inc. Product Selection by calling 303-896-5922. The third and fourth digits are vendor specific and will be assigned by the vendor. The vendor shall disclose the assignment of the third and fourth digits in the literature for the individual INCTE. The Accept Response Signal is not required.

The Tone Command is 704 + 904 Hz.

204 Hz = 2	604 Hz = 6	1004 Hz = 1
304 Hz = 3	704 Hz = 7	1104 Hz = 0
404 Hz = 4	804 Hz = 8	
504 Hz = 5	904 Hz = 9	

Do not use the same frequency twice in a row in the four numbers used for the ID code. Example: 2278 must be sent as 204 Hz, 704 Hz, 204 Hz, 804 Hz.

5.2.11 DTMF *643# Receive Equalizer Toggle

Requirement: This command toggles the receive equalizer in or out of the receive side of the INCTE. The command sets the receive equalizer to a flat response or inserts the equalizing capabilities of the INCTE.

The INCTE retains in memory the receive equalizer settings if the INCTE is toggled to the equalizer disable configuration and reinserts the equalizer settings when the receive equalizer is toggled to the equalizer enable configuration.

The status of the equalizer can be queried with query command 643#. The INCTE responds with an Accept Signal (350 Hz) if the equalizer is enabled and a Reject Signal (750 Hz) if the equalizer is disabled. If the receive equalizer has been disabled, the alignment procedure is modified to require only a 1004 Hz tone instead of the normal 3-Tone or 4-Tone alignment.

The Tone Command is 704 + 804 Hz.

The command can also be reset by either the Transmission Default command or the Facility Default command.

5.2.12 DTMF *645# 3 dB Roll Off Toggle

Requirement: This command causes the receive equalizer in the INCTE to toggle between full equalization of the receive side or 3 dB of attenuation distortion at 2804 Hz. When enabled, the inserted roll off will be "visible" in the loopback.

The INCTE will normally attempt to equalize the receive side, using 3- or 4-Tone alignment, to meet C5 conditioning (full equalization) requirements or better. If the INCTE receives a *645# command, it will insert 3 dB of attenuation distortion at the higher frequencies after alignment.

A 645# is a query to find out if the INCTE has been toggled to full equalization or has added 3 dB of attenuation distortion to the high end. The INCTE responds with an Accept Tone (350 Hz) if the roll off is turned on and a Reject Tone (750 Hz) if the roll off is turned off. Roll Off disabled is the factory default.

The Tone Command is a 2204 Hz tone for greater than 5 seconds while in the Command Menu mode.

5.2.13 DTMF 500# Configuration Status

Requirement: This command indicates the INCTE's transmission and signaling configuration. The INCTE responds with three consecutive tones (in sequence), each lasting 15 seconds.

VOICE	SIGNALING	SIGNAL
4W to 4W	None	404 + 1404 + 604 Hz
4W to 2W	None	404 + 1304 + 604 Hz
4W to 4W	DX to E&M, DX-1, Type I	604 + 1404 + 604 Hz
4W to 4W	DX to E&M, DX-1, Type II	604 + 1304 + 604 Hz
4W to 4W	DX to E&M, DX-1, Type III	604 + 1204 + 604 Hz
4W to 4W	DX to E&M, DX-2, Type I	604 + 1104 + 604 Hz
4W to 4W	DX to E&M, DX-2, Type II	604 + 1004 + 604 Hz
4W to 4W	DX to E&M, DX-2, Type III	604 + 904 + 604 Hz
4W to 2W	DX to E&M, M lead Org., Type I	804 + 1404 + 804 Hz
4W to 2W	DX to E&M, M lead Org., Type II	804 + 1304 + 804 Hz
4W to 2W	DX to E&M, M lead Org., Type III	804 + 1204 + 804 Hz
4W to 2W	DX to E&M, E lead Org., Type I	804 + 1104 + 804 Hz
4W to 2W	DX to E&M, E lead Org., Type II	804 + 1004 + 804 Hz
4W to 2W	DX to E&M, E lead Org., Type III	804 + 904 + 804 Hz
4W to 4W	SF to E&M, M lead Org., Type I	904 + 504 + 904 Hz
4W to 4W	SF to E&M, M lead Org., Type II	904 + 404 + 904 Hz
4W to 4W	SF to E&M, M lead Org., Type III	904 + 304 + 904 Hz
4W to 4W	SF to PLR, E lead Org., Type I	1004 + 1404 + 1004 Hz
4W to 4W	SF to PLR, E lead Org., Type II	1004 + 704 + 1004 Hz
4W to 4W	SF to PLR, E lead Org., Type III	1004 + 604 + 1004 Hz
4W to 2W	SF to E&M, E lead Org., Type I	1004 + 504 + 1004 Hz
4W to 2W	SF to E&M, E lead Org., Type II	1004 + 404 + 1004 Hz
4W to 2W	SF to E&M, E lead Org., Type III	1004 + 304 + 1004 Hz
4W to 2W	SF to PLR, E lead Org., Type I	1104 + 504 + 1104 Hz
4W to 2W	SF to PLR, E lead Org., Type II	1104 + 404 + 1104 Hz
4W to 2W	SF to PLR, E lead Org, Type III	1104 + 304 + 1104 Hz
4W to 2W	SF to Open End, Loop Start	1204 + 404 + 1204 Hz
4W to 2W	SF to Open End, GRD. Start	1204 + 304 + 1204 Hz
4W to 2W	SF to Closed End, Loop Start	1304 + 404 + 1304 Hz
4W to 2W	SF to Closed End, GRD. Start	1304 + 304 + 1304 Hz
4W to 4W	Simplex continuity	1404 + 404 + 1404 Hz
4W to 2W	Simplex continuity	1404 + 304 + 1404 Hz

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6. Intelligent Network Channel Terminating Equipment (INCTE) Setup Commands

6.1 Setup Features

Requirement: INCTE setup commands invoke a particular circuit configuration. These commands are the initial setup options done before aligning and placing the INCTE in service.

DTMF	TONE	FUNCTION
*440#	504 + 304 Hz	Set Facility Impedance 150 ? †
*441#	504 + 404 Hz	Set Facility Impedance 600 ? †
*442#	504 + 604 Hz	Set Facility Impedance 1200 ? †
*445#	504 + 704 Hz	Sealing Current Sink †
*446#	504 + 804 Hz	Sealing Current Source †
*447#	504 + 904 Hz	Sealing Current Off †
642#	704 + 504 Hz	Sealing Current Test
*448#	504 + 1204 Hz	2W Customer Side Operation †
*449#	504 + 1404 Hz	4W Customer Side Operation †
*51(N)#	N/A	Simplex Normal/Reverse †
*513#	1204 Hz	Simplex Toggle †
*5(NN)#	N/A	Set Signaling Options †

†These commands have the security feature.

6.2 Intelligent Network Channel Terminating Equipment (INCTE) Command Response

Requirement: The INCTE responds with the following response signals upon receipt of a command. If the INCTE is already switch selected to perform the function, is hard wired to perform the function, or can perform the function under software control from a command received from the distant end, it responds with an Accept Signal. If the INCTE has a switch selectable option and the switch is not in the position required to perform the function requested, the INCTE returns a Reject Signal. If the INCTE is not capable of performing a requested function because it does not have the ability, either through software, hard wiring, option switch, etc., it returns an Error Signal. If the INCTE receives a command which is secured, and security is in place, the INCTE responds with a Security Violation Signal.

6.3 Intelligent Network Channel Terminating Equipment (INCTE) Impedance/Operation Commands

6.3.1 DTMF *44(N)# Set Facility Impedance

Requirement: The INCTE is capable of line (facility) impedances of 150 ohms, 600 ohms, and 1200 ohms. A sensor device is required if the INCTE has a manual switch selectable option.

DTMF	FREQUENCY	IMPEDANCE
*440#	504 + 304 Hz	Set Facility Impedance 150 ?
*441#	504 + 404 Hz	Set Facility Impedance 600 ?
*442#	504 + 604 Hz	Set Facility Impedance 1200 ?

6.3.2 DTMF *445# Sealing Current Sink

Requirement: The INCTE loops the transmit and receive repeat coil simplex leads together so that the INCTE can sink sealing current. The INCTE senses sealing current flow when battery and ground are applied from the distant end.

The Tone Command is 504 + 704 Hz.

6.3.3 DTMF *446# Sealing Current Source

Requirement: The INCTE supplies current battery and ground to the transmit and receive simplex leads. The INCTE senses sealing current flow when a simplex loop is applied from the distant end.

The Tone Command is 504 + 804 Hz.

6.3.4 DTMF *447# Sealing Current Off

Requirement: The INCTE opens the simplex leads to prevent the flow of current when battery and ground are applied from the distant end.

The Tone Command is 504 + 904 Hz.

6.3.5 DTMF 642# Sealing Current Test

Requirement: The INCTE checks if sealing current is flowing. If sealing current is flowing, the INCTE responds with an Accept Signal. If sealing current is not flowing, the INCTE responds with a Reject Signal.

The Tone Command is 704 + 504 Hz.

6.3.6 DTMF *448# 2-Wire Customer Side Operation

Requirement: This command configures the customer side for 2-Wire operation. The INCTE has configuration ability for either 600 or 900 ohm operation when in the 2-Wire mode. The Receive Out Level (ROL) and Transmit In Level (TIL) should not change when selecting either 4-Wire or 2-Wire operation. The INCTE should also automatically compensate the ROL and TIL for the 600 or 900 ohm operation when switching between the two impedances.

The Tone Command is 504 + 1204 Hz.

6.3.7 DTMF *449# 4-Wire Customer Side Operation

Requirement: This command configures the drop side for 4-Wire operation. The impedance of the customer side will always be 600 ohms when in the 4-Wire mode.

The Tone Command is 504 + 1404 Hz.

6.3.8 DTMF *51(N)# Simplex Normal/Reversed Toggle

The Simplex leads are set to normal or reverse with the following commands.

N	SIMPLEX NORMAL / REVERSE / TOGGLE COMMAND
1	Simplex Signaling Normal
2	Simplex Signaling Reversed
3	Simplex Toggle*

*The command DTMF *513# can also be issued with the 1204 Hz tone.

6.3.9 DTMF *5(NN)# Set Signaling Options Command

NN	SET SIGNALING OPTION COMMAND
20	None
21	DX to E&M, DX 1, Type I
22	DX to E&M, DX 1, Type II
23	DX to E&M, DX 1, Type III
24	DX to E&M, DX 2, Type I
25	DX to E&M, DX 2, Type II
26	DX to E&M, DX 2, Type III
51	SF to E&M, Cust. originate : M Lead, Type I
52	SF to E&M, Cust. originate : M Lead, Type II
53	SF to E&M, Cust. originate : M Lead, Type III
54	SF to E&M, Cust. originate : E Lead, Type I
55	SF to E&M, Cust. originate : E Lead, Type II
56	SF to E&M, Cust. originate : E Lead, Type III
41	SF to Open End, Loop Start
42	SF to Open End, Ground Start
43	SF to Closed End, Loop Start
44	SF to Closed End, Ground Start
60	Simplex Continuity, Open End, Loop Start
61	Simplex Continuity, Open End, Ground Start
62	Simplex Continuity, Closed End, Loop Start
63	Simplex Continuity, Closed End, Ground Start

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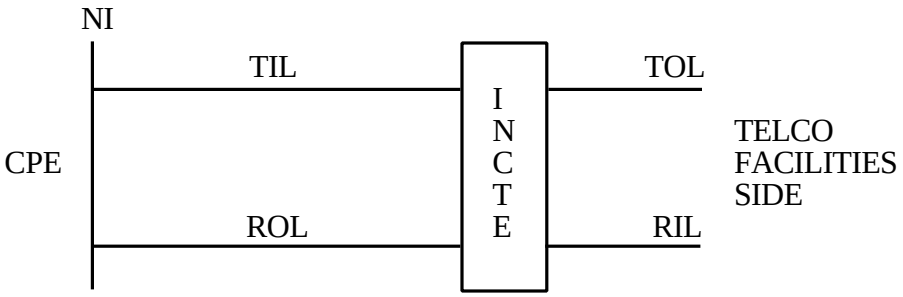
7. Set Levels



RIL Receive In Level

ROL Receive Out Level

TIL Transmit In Level

TOL Transmit Out Level

DTMF	TONE	FUNCTION
*410#	504 + 1304 Hz	Default Level Set†
*4101#	504 + 1104 Hz	Special Level Set†

†These commands have the security feature.

7.1 DTMF *410# Default Levels

Requirement: This command is used when setting the default levels of the ROL, TIL, and TOL. The INCTE default levels are shown in the table below.

The Tone Command is 504 + 1304 Hz.

	ID TONE AT TLP	ID TONE AT DLP
ROL	-3.0	-16.0
TIL	+13.0	0.0
TOL	+5.0	-8.0

7.2 DTMF *4101# Special Level Set

Requirement: This command is a special level command, which sets the ROL to 0.0 dB DLP, the TIL to 0.0 dB DLP, and the TOL to -8.0 dB DLP. When Special Level Set is selected, the INCTE must default to DLP level. Any attempt to toggle to TLP (41# or 2804 Hz) or to set communicate at TLP (411# or 1304 Hz) will be rejected and a Reject response returned.

The Tone Command is 504 + 1104 Hz.

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8. Alignment

8.1 Alignment Functions

DTMF	TONE	FUNCTION
41#	2804 Hz	Toggle Communicate at DLP/TLP
411#	1304 Hz	Communicate at TLP Command
412#	1104 Hz	Communicate at DLP Command
22#	1804 Hz	Originate Automatic Alignment†

†These commands have the security feature.

8.2 Alignment Rules

8.2.1 Alignment - Method of Entry

Requirement: A 1004 Hz tone starts the alignment procedure. Note that this command may be secured and security should be toggled off before entering this command.

8.2.2 Alignment - Method of Exit

Requirement: DTMF 0# or a 3104 Hz tone aborts to the Menu mode. DTMF 01# or a loopback tone (2713 Hz) for greater than 0.9 seconds will abort to the idle mode. The INCTE automatically exits to the loopback mode after completing a successful alignment; it exits to the Error Signal response (1350 Hz) after an unsuccessful alignment.

8.2.3 Alignment - Timing Requirements

Requirement: The INCTE will time-out to idle mode if a tone or command is not received from the distant end within 5 minutes. The INCTE must process the 1004 Hz tone within 60 seconds of receipt and must process the 2804 Hz, 404 Hz, and the 1804 Hz within 10 seconds of receipt.

8.2.4 Alignment - Frequency Requirements

Requirement: During transmit, the frequency of the transmitted signal must not vary beyond + 1%, while the signal is being transmitted and the power in that signal shall not vary beyond + 0.1 dB. During receive, the INCTE must be able to recognize a received frequency with a + 1% tolerance. The INCTE will not continue the alignment process if the received alignment tone changes in frequency by more than 100 Hz prior to the INCTE changing to the next alignment frequency.

8.2.5 Alignment - Response Signals

Requirement: The alignment procedure uses the following response signals. These signals are preceded by the appropriate 2 seconds of ascending or descending stair-step response followed by 15 seconds of appropriate response tone.

- PASS (2804 Hz) - The Pass Signal is an ascending stair-step response indicating a successful alignment.
- FAIL (404 Hz) - The Fail Signal is a descending stair-step response indicating that the INCTE can align the receive amplifier/equalizer to the best of its ability, but the equalized tones are not successfully equalized.
- ERROR (1350 Hz) - The Error Signal is a descending stair-step response indicating that a received alignment tone changed in frequency by more than + 100 Hz prior to the INCTE changing to the next frequency, or that the alignment procedure was stopped, failed, or terminated in some way and the INCTE reverted to the original settings before alignment began. The INCTE will not implement new alignment settings if an Error Signal must be sent. Instead, the INCTE will retain the gain/loss and equalizer settings that were in place before the alignment began. An Error Signal sent as a result of an alignment problem will not time-out using the normal 5-minute Command Menu time-out. Instead, the operator must reset the INCTE by sending either DTMF 0# or a tone (3104 Hz) to enter the Command Menu, or DTMF 01# or the tone equivalent to place the INCTE in idle mode. If Automatic Alignment (AA) was originated by depressing the AA push-button, the AA push-button may be depressed a second time to terminate the Error Signal and return the INCTE to the idle mode.
- SECURITY (2050 Hz) - The Security Signal is a descending stair-step response indicating that the security feature of the INCTE is enabled. The alignment procedure requires that the security be disabled by using the DTMF 03# (or equivalent command).

8.2.6 Alignment - Special Requirements

Requirement: Security must be turned off before the INCTE can accept alignment. The INCTE can be aligned at DLP or TLP with the same result. The alignment sequence of 1004 Hz, 2804 Hz, 404 Hz, and 1804 Hz is used for 4-Tone alignment. The INCTE will halt alignment if the receive requirements are exceeded. The INCTE can perform either a 1-Tone, 3-Tone, or 4-Tone alignment. The 1804 Hz is used only with the 4-Tone alignment. The INCTE may only use 1004 Hz (1-Tone) if the receive equalizer has been disabled.

The INCTE will not permanently change the receive equalizer gain settings until the complete 1-Tone, 3-Tone, or 4-Tone alignment sequence is completed. If the alignment procedure is stopped, fails, or is terminated in any way during the alignment procedure, the INCTE will revert to the settings which were in place before the alignment began and the unit will send an Error Signal (1350 Hz). Once the alignment process is completed, the new gain and equalizer settings will take effect.

8.3 Alignment Commands

8.3.1 DTMF 41# Communicate at TLP/DLP Toggle

Requirement: This command causes the INCTE to toggle between TLP and DLP.

The tone Command is 2804 Hz.

8.3.2 DTMF 411# Communicate at TLP Command

Requirement: This command causes the INCTE to send the ID tone, transmission testing tones, etc. at TLP. This command also allows the INCTE to be aligned at TLP. If the unit is conditioned for special level set, a Reject response will be generated.

The Tone Command is 1304 Hz for greater than 5 seconds.

8.3.3 DTMF 412# Communicate at DLP Command

Requirement: This command causes the INCTE to send the ID tone, transmission testing tones, etc. at DLP. This command also allows the INCTE to be aligned at DLP.

The Tone Command is 1104 Hz for greater than 5 seconds.

8.4 Manual Alignment

8.4.1 Manual Alignment Sequence

Requirement: The alignment procedure or algorithm follows the sequence below. The term "Distant End" can be replaced by Switched Maintenance Access Connector (SMAS), Channel Access Unit, Equipment Extender, Special Service Center, Advanced Digital Terminal System (ADTS), remote end, etc. The unit must be capable of C2 and C5 conditioning.

DISTANT END	INCTE END
Send Loopback tone (2713 Hz) for greater than 2.5 seconds + DTMF 0# - or - Send Loopback tone (2713 Hz) for greater than 30 seconds.	The INCTE will enter the Command Menu and return the ID Response Signal (1004 Hz).
Disable security by sending DTMF 03# or 2004 Hz for greater than 5 Seconds.	The INCTE will respond with an Accept Signal (350 Hz).
Choose Communication Level: Send 411# (1304 Hz) for TLP - or - Send 412# (1104 Hz) for DLP - or - Send 41# (2804 Hz) for TLP/DLP Toggle.	The INCTE will respond with an Accept Signal (350 Hz).
Choose Alignment Options: Send DTMF 23# (704+1304 Hz) for Transmission Defaults - or - Send DTMF 20# (704+1204 Hz) for Factory Defaults - or - Manually select Equalizer (*643#) and 3 dB Roll-off (*645#) options.	The INCTE will respond with the appropriate Response Signal then send ID tone (1004 Hz).
Start Alignment: Process the received ID tone and send 1004 Hz to the INCTE.	For 1-Tone Alignment: If the receiver equalizer is disabled, store or process the received tone within 60 seconds, complete alignment, and send the appropriate Response Signal. For 3-Tone or 4-Tone Alignment: If the receiver equalizer is enabled, store or process the received level within 60 seconds and output a 2804 Hz tone.
Store or process the received 2804 Hz level and upon completion, return 2804 Hz tone to the INCTE.	Upon receipt of 2804 Hz tone, store or process the received level within 10 seconds and output a 404 Hz tone.
Store or process the received 404 Hz level and upon completion, return 404 Hz tone to the INCTE.	Upon receipt of 404 Hz tone, store or process the received level within 10 seconds and output a 1804 Hz tone.
If 3-Tone Alignment: Store or process the 1804 Hz level, send 1004 Hz tone to the INCTE to terminate 3-Tone Alignment.	Accept the 1004 Hz tone and within 10 Seconds send the appropriate Response Signal (Pass / Fail / Error).
If 4-Tone Alignment: Store or process the received 1804 Hz level and upon completion, return 1804 Hz tone to the INCTE.	Accept the 1804 Hz tone and within 10 seconds send the appropriate Response Signal (Pass / Fail / Error).
Complete Alignment.	Implement the new Gain and Equalizer Settings and enter the Loopback Mode.

8.5 Automatic Alignment

8.5.1 Automatic Alignment Rules

Requirement: The Automatic Alignment (AA) mode originates self-alignment of the INCTE and aligns the distant end intelligent equipment. The Automatic Alignment is performed using the 4-Tone method and at TLP. The Automatic Alignment mode can be started three ways: the DTMF method, the single-tone method, and the push-button method. All three methods are identical except for the command or method to place the INCTE into the Automatic Alignment mode.

The originating end performs a loopback test after the 4-Tone alignment is complete to verify that the circuit meets requirements. If the limits of Automatic Alignment are met, the originating INCTE returns to idle mode. If the limits are not met, the originating end repeats the Automatic Alignment process a second time. If the second attempt still does not meet requirements, the INCTE responds with an Error Signal (1350 Hz) which will not time-out. The INCTE shall implement new receive settings even if an Error Signal must be sent. The originating end places the remote end in the idle mode after Automatic Alignment is complete.

The INCTE must be compatible with other plugs used in QWEST Communications International Inc.

8.6 Automatic Alignment Sequence

Requirement: The originating end must be capable of placing the remote end in Command Menu mode and controlling the following Automatic Alignment sequence.

- Send 2713 Hz tone for greater than 30 seconds to set the remote end INCTE into Loopback.
- Disable security by sending 2004 Hz for greater than 5 seconds.
- Send 704 Hz for greater than 5 seconds followed by 1304 Hz for greater than 5 seconds to set the remote INCTE to Transmission Defaults.
- Send 3104 Hz for greater than 5 seconds to return the remote INCTE to Command Mode.
- Toggle the slave unit to TLP by sending 2804 Hz for greater than 5 seconds.
- Perform a 4-Tone alignment as described earlier.
- Perform a loopback test after the 4-Tone alignment is complete and verify that the circuit meets the C5 (see Appendix A) attenuation distortion requirements.
- Place the remote end in idle mode after the Automatic Alignment is complete.

8.7 DTMF Method and Single Tone Method

Requirement: The Automatic Alignment mode can be started using the DTMF method or the Single Tone method. The INCTE chosen to be the originating end is first placed in the Command Menu mode. The INCTE is then sent a DTMF 22# (DTMF method) or an 1804 Hz tone (Single Tone method). The INCTE, upon receipt of the 22# or 1804 Hz, enters the Originating Automatic Alignment mode and starts the automatic alignment sequence.

8.8 Push-Button Method

Requirement: The push-button method of Automatic Alignment (AA) is started by depressing the AA push-button on the faceplate of the INCTE for more than 1 second. This puts the INCTE in the Originating Automatic Alignment (AA) mode and starts the automatic alignment sequence. The INCTE AA push-button is usable only within the first 5 minutes after power is applied to the INCTE. The INCTE has a timer, which will disable the AA push-button after 5 minutes. If the AA push-button is depressed and Automatic Alignment is to be terminated, the push-button may be depressed a second time to terminate Automatic Alignment.

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9. Loopback Signals & Loopback Paths

DTMF	TONE	FUNCTION
33#	304 Hz	Place INCTE in Equal Level Loopback.
42(NN)#	704 + 1104 + XXXX Hz	Change Loopback Frequency.†

†The 42(NN)# command has the security feature.

9.1 Equal Level Loopback

Requirement: If the loopback frequency is sent for more than 2.5 seconds but less than 30 seconds while the INCTE is in idle mode, the INCTE enters the Equal Level Loopback mode. The Equal Level Loopback mode can also be entered by sending a DTMF 33# command or a 304 Hz tone greater than 5 seconds while in the Command Menu mode. Equal Level Loopback will time-out in 20 minutes and return the INCTE to idle mode. Sending the loopback frequency for greater than 0.9 seconds after entering the Command Menu returns the INCTE to the idle mode. The DTMF 01# command will also cause the INCTE to leave Equal Level Loopback and return to idle mode. Sending the DTMF 0# command or 3104 Hz tone while in Equal Level Loopback causes the INCTE to go to Command Menu mode. The loopback tone operates the loopback function of the INCTE at TLP or DLP. Equal Level Loopback is also entered after an alignment is complete. See Chapter 8 for details.

9.2 Change Loopback Frequency

Requirement: The INCTE can select seven different loopback or control frequencies. The factory default will always be 2713 Hz. The DTMF 42(NN)# command or its tone equivalent of 704 + 1104 + XXXX Hz selects the loopback or control frequency. The DTMF command must be sent twice for the frequency to change. If the command is sent only once and the INCTE is placed back in idle mode, the first DTMF 42(NN)# command is ignored. The command must be sent two more times after entering the Command Menu mode for the frequency to change.

The INCTE provides 6 different loopback frequencies other than 2713 Hz. The new loopback frequency becomes effective immediately upon executing the DTMF command twice.

DTMF 42(NN)#	NEW LOOPBACK FREQUENCY
NN = 15	1513 Hz
NN = 16	1613 Hz
NN = 17	1713 Hz
NN = 19	1913 Hz
NN = 24	2413 Hz
NN = 25	2513 Hz
NN = 27	2713 Hz

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10. Queries

Most commands have a query mode, which allows the user to find specific options installed in the INCTE or query the status of a function of the INCTE. Most of the DTMF query commands have an equivalent tone method.

The following commands are query commands:

DTMF	TONE	FUNCTION
410#	604 + 2304 + 904 Hz	Default Level Query
440#	604 + 2304 + 404 Hz	Facility Side 150 ?
441#	604 + 2304 + 504 Hz	Facility Side 600 ?
442#	604 + 2304 + 604 Hz	Facility Side 1200 ?
445#	604 + 804 Hz	Sealing Current Sink
446#	604 + 904 Hz	Sealing Current Source
447#	604 + 1004 Hz	Sealing Current Off
448#	604 + 504 Hz	2W Customer Side Operation
449#	604 + 704 Hz	4W Customer Side Operation
643#	604 + 2304 + 304 Hz	Receive Equalizer Query
645#	604 + 2304 + 804 Hz	3 dB Roll Off Query

10.1 Query Responses

Requirement: If the query command sent to the INCTE is applicable to the operation, the INCTE responds with an Accept Signal (350 Hz). If the INCTE is incapable of the operation, it responds with an Error Signal (1350 Hz). If the INCTE has an option switch which is set opposite to the query or the query is false, the INCTE responds with a Reject Signal (750 Hz).

10.2 Query Commands

10.2.1 DTMF 410# Default Level Query

Requirement: This command verifies the status of the Default Level or Special Level setting of the INCTE. If the INCTE is set for Default Levels, the INCTE responds with an Accept Signal. Otherwise, the INCTE sends a Reject Signal indicating that the INCTE is currently set for Special Levels.

The Tone Command is 604 + 2304 + 904 Hz.

10.2.2 DTMF 440# Facility Side 150 Ohms

Requirement: This command verifies the impedance setting of the facility side of the INCTE. If the facility side of the INCTE is set to 150 ohms, the INCTE sends an Accept Signal. Otherwise, the INCTE sends a Reject Signal.

The Tone Command is 604 + 2304 + 404 Hz.

10.2.3 DTMF 441# Facility Side 600 Ohms

Requirement: This command verifies the impedance setting of the facility side of the INCTE. If the facility side of the INCTE is set to 600 ohms, the INCTE sends an Accept Signal. Otherwise, the INCTE sends a Reject Signal.

The Tone Command is 604 + 2304 + 504 Hz.

10.2.4 DTMF 442# Facility Side 1200 Ohms

Requirement: This command verifies the impedance setting of the facility side of the INCTE. If the facility side of the INCTE is set to 1200 ohms, the INCTE sends an Accept Signal. Otherwise, the INCTE sends a Reject Signal.

The Tone Command is 604 + 2304 + 604 Hz.

10.2.5 DTMF 445# Sealing Current Sink

Requirement: This command verifies that the INCTE is set to Sealing Current Sink. The INCTE will respond with an Accept Signal if the query is true; otherwise, the INCTE will respond with a Reject Signal.

The Tone Command is 604 + 804 Hz.

10.2.6 DTMF 446# Sealing Current Source

Requirement: This command verifies that the INCTE is set to Sealing Current Source. The INCTE responds with an Accept Signal if the query is true; otherwise, the INCTE sends a Reject Signal.

The Tone Command is 604 + 904 Hz.

10.2.7 DTMF 447# Sealing Current Off

Requirement: This command verifies that the INCTE is set to Sealing Current Off. The INCTE responds with an Accept Signal if the query is true; otherwise, the INCTE will respond with a Reject Signal.

The Tone Command is 604 + 1004 Hz.

10.2.8 DTMF 448# 2-Wire Customer Side Operation

Requirement: This command verifies that the customer side of the INCTE is set to 2-Wire (2W) operation. The INCTE responds with an Accept Signal if the query is true; otherwise, the INCTE sends a Reject Signal.

The Tone Command is 604 + 504 Hz.

10.2.9 DTMF 449# 4-Wire Customer Side Operation

Requirement: This command verifies that the customer side of the INCTE is set to 4-Wire (4W) operation. The INCTE responds with an Accept Signal if the query is true; otherwise, the INCTE sends a Reject Signal.

The Tone Command is 604 + 704 Hz.

10.2.10 DTMF 643# Receive Equalizer Query

Requirement: This command checks the position of the receive equalizer. If the equalizer is enabled, the INCTE will respond with an Accept Signal. If the equalizer is disabled, the INCTE responds with a Reject Signal. If the INCTE is not capable of removing the receive equalizer (disabling the equalizer), the INCTE responds with an Error Signal.

The Tone Command is 604 + 2304 + 304 Hz.

10.2.11 DTMF 645# 3 dB Roll Off Query

Requirement: This command verifies that the INCTE has been toggled to full equalization or 3 dB of attenuation distortion at 2804 Hz. If the INCTE is set to insert a 3 dB Roll Off, the INCTE responds with an Accept Signal indicating that the Roll Off is enabled.

The Tone Command is 604 + 2304 + 804 Hz.

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11. Transmission Testing Features

Testing features can be accessed on the INCTE through DTMF or the frequencies listed below.

DTMF	TONE	FUNCTION
30#	904 + 1004 Hz	Milliwatt Test
31#	904 + 504 Hz	Terminate and Leave †
32#	404 Hz	Access Transmission Response Mode
35#	804 Hz	4-Tone Slope
640#	904 + 304 Hz	Cable Flip Command
646#	904 + 804 Hz	Timed Cable Pair Open
641#	904 + 604 Hz	Terminate 2W
644#	904 + 704 Hz	Short 2W

† The Terminate and Leave command has the security feature.

11.1 DTMF 30# Milliwatt Test

Requirement: This command causes the INCTE to send a 1004 Hz at a 0.0 dBm level at the transmit out port. The level of output shall always be 0.0 dBm and default to a 600 ohm termination. This command will execute without delay and will not send an Accept Signal. To exit this command, use DTMF 0# or 3104 Hz to return to the Command Menu or use DTMF 01# or the loopback tone to return to idle mode.

The Tone Command is 904 + 1004 Hz.

11.2 DTMF 31# Terminate and Leave Command

Requirement: This command leaves the INCTE in a Terminate and Leave state until it is released by loopback tone for greater than 0.9 seconds. While in Terminate and Leave, it is imperative that the INCTE not recognize foreign tone equivalent or any other commands in the Universal Command Menu except loopback tone. The Terminate and Leave mode was designed to take a circuit out of service and in this mode it can possibly receive foreign DTMF, frequency tones, and voice band data signals from the distant end. These foreign signals do not cause the INCTE to change modes or respond with any response signals.

The Tone Command is 904 + 504 Hz.

11.3 DTMF 32# Access Transmission Response Mode

Requirement: This command permits using the INCTE as a signal generator to align office equipment, make a frequency sweep of the transmit facility, perform a transmission analysis of a circuit, etc. The INCTE always sends tones at 0.0 dBm0 TOL at TLP or -13.0 dBm0 TOL at DLP.

While in the Transmission Response mode, none of the tone commands are recognized by the INCTE except loopback tone. The Transmission Response mode can be escaped by sending loopback tone for greater than 0.9 seconds which returns the INCTE to idle mode; sending DTMF 0# (not its tone equivalent) which returns the INCTE to the Menu mode; or letting the INCTE time-out.

The Tone Command is 404 Hz for greater than 5 seconds.

11.4 Select Transponder Frequency - Received Tone Method

Requirement: The frequency of the tone received by the INCTE determines the frequency of the tone generated, rounded to the nearest 104 Hz, (i.e., 1035 Hz is rounded to 1004 Hz). The range of operation is from 304 Hz to 3204 Hz, (except for the 2650 through 2749 Hz band, which is restricted). If the INCTE receives a tone within the restricted band, the INCTE either returns to idle mode, if the frequency received is in the loopback frequency band, or responds with a quiet termination (see Appendix A), if the received tone is outside the loopback frequency band. If no tone is received, the INCTE provides a quiet termination.

11.5 Select Transponder Frequency - DTMF Method

Requirement: Tones generated by the INCTE can also be set via DTMF signals. The Transmission Response Sub-Menu is entered by sending a DTMF 32#, after which the INCTE returns a quiet termination. Then, any frequency may be selected via DTMF (NN)# commands listed below. The send level can be changed using command 41# TLP/DLP toggle, 411# for TLP, or 412# for DLP. These commands must be sent before entering Transmission Test mode. The INCTE will not recognize these commands while in Transmission Response mode. The frequency of the transmitted tones is +1% from the listed frequencies; output level is within +0.2 dB of the previously selected TOL.

NN#	FREQUENCY	NN#	FREQUENCY	NN#	FREQUENCY
00	Quiet Termination	12	1204 Hz	22	2204 Hz
03	304 Hz	13	1304 Hz	23	2304 Hz
04	404 Hz	14	1404 Hz	24	2404 Hz
05	504 Hz	15	1504 Hz	25	2504 Hz
06	604 Hz	16	1604 Hz	26	2604 Hz
07	704 Hz	17	1704 Hz	27	2704 Hz
08	804 Hz	18	1804 Hz	28	2804 Hz
09	904 Hz	19	1904 Hz	29	2904 Hz
10	1004 Hz	20	2004 Hz	30	3004 Hz
11	1104 Hz	21	2104 Hz	31	3104 Hz

11.6 DTMF 35# 4-Tone Slope Mode

Requirement: The 4-Tone Slope mode allows the facility to be analyzed from the distant end. Upon receipt of the command or 804 Hz tone, the INCTE does not respond with an Accept Signal but directly enters the 4-Tone Slope mode. The INCTE sends a series of four alignment tones of known frequency and level, then provides a quiet termination. The four tones in sequence are: 1004 Hz, 404 Hz, 1804 Hz, and 2804 Hz. Each tone is transmitted for 10 seconds at the TLP or DLP previously selected. If the TLP/DLP needs to be changed, it must be selected before entering 4-Tone Slope mode.

After completing the 4-Tone Slope sequence and while in the quiet termination mode, the INCTE will respond to a new 4-Tone Slope command. While in the 4-Tone mode, if the unit receives DTMF 0# (the tone equivalent has no effect), the INCTE returns to Command Menu. The unit returns to idle mode upon receipt of DTMF 01# or loopback tone for more than 0.9 seconds.

The Tone Command is 804 Hz for greater than 5 seconds.

11.7 DTMF 640# Cable Flip Toggle Command

Requirement: This command operates a relay in the INCTE which reverses the transmit and receive cable facilities. Factory default (normal) is Transmit on pins 41 and 47 and Receive on pins 7 and 13. This command permits toggling between normal and reversed. It will execute without delay and will not initiate an Accept response. This command causes only a temporary reversal: the cable flip returns to normal when exiting Command Menu or when Command Menu time-out is reached.

The Tone Command is 904 + 304 Hz.

11.8 DTMF 646# Timed Cable Pair Open

Requirement: This command causes the transmit and receive pairs to be opened at the line side of the INCTE to facilitate remote Direct Current (DC) testing. The command will execute without delay and will not send an Accept response. This option automatically restores normal operation after 60 seconds.

The Tone Command is 904 + 804 Hz.

11.9 DTMF 641# Terminate 2-Wire

Requirement: This command checks the loss across the 2-Wire (2W) path of the hybrid in the INCTE. The 2W termination can be removed by sending 0# to return to the command mode (command 01#) or by sending loopback tone for greater than 0.9 seconds.

The Tone Command is 904 + 604 Hz.

11.10 DTMF 644# Short 2-Wire

Requirement: This command places a direct metallic short across the 2W port of the hybrid.

The Tone Command is 904 + 704 Hz.

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12. Signaling Test Commands

Requirement: A Signaling Test mode allows the distant end to command the INCTE to apply selected signaling states to the Facility Side or to measure a signaling parameter. The Signaling Test mode is entered from the Command Menu mode by sending DTMF commands. A busy condition and Voice Frequency (VF) termination towards the customer is maintained at all times.

Since Data Station Termination (DST) does not implement signaling, those Signaling Test commands should be ignored, and the INCTE should respond by sending Error Response tone.

12.1 DTMF 6(NN)# Signaling Test Command

The signaling commands and tests assist the distant end in checking the performance of the INCTE and the cable facilities. The INCTE is capable of sending only one signaling state or command response at a time.

NN	SIGNALING TEST COMMAND
03	Send Battery and Ground
04	Send Ring Ground and Open Loop
05	Send Ringing (20 Hz, 2 seconds on, 4 seconds off : Negative superimposed with tip ground)
08	Remove Repeat Signaling mode
09	Remove Constant Pulses
10	Check Loop Current (INCTE must condition circuit toward facility before performing this test, i.e. furnish battery and ground, loop closures, etc.)
11	Send On-Hook or Open Loop
12	Send Off-Hook or Closed Loop
13	Send Constant Pulses at 61% Break and 10 PPS
14	Repeat signaling mode. This causes INCTE to send any received signaling state back toward originating end
15	Check for loop closure
16	Check for tip ground
17	Check pulsing
18	Send battery and open
19	Check for ring ground
20	Check for ringing (INCTE will send a loop open during this test)

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13. Wiring Check Mode

13.1 4-Wire to 4-Wire (4W to 4W) Operation

Requirement: This Wire Check mode shall be capable of sending a constant 1014 Hz tone on the RIL and ROL and an interrupted (30 Interruptions Per Minute [IPM] minimum) 1014 Hz tone on the TIL and TOL.

13.2 4-Wire to 2-Wire (4W to 2W) Operation

Requirement: This mode shall be capable of sending a constant 1014 Hz tone on the receive input port, a 1014 Hz interrupted (30 IPM) tone on the transmit port, and a 1014 Hz continuous, amplitude modulated tone on the 2W port.

13.3 DTMF 36# Wire Check Mode

Requirement: This command activates the INCTE Wire Check mode remotely.

The Tone Command is 1404 Hz for greater than 5 seconds.

13.4 Local Wire Check

Requirement: The Wire Check push-button is depressed on the INCTE. The function can only be activated within the first 5 minutes after power is applied to the INCTE.

13.5 Removing the Wire Check Tones

The Wire Check mode can be removed remotely by sending 2713 Hz for greater than 0.9 seconds or, locally by depressing the wire check push-button a second time. This places the INCTE in idle mode.

The Wire Check mode will time-out after 60 minutes, if not deactivated; and return the INCTE to idle mode.

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14. List of Commands and Assigned Tones

The operator may use either DTMF or single tones to send commands to the INCTE. This section lists the tone command equivalents of the DTMF commands described throughout this document. When using the tone method, each tone must be applied for a minimum of 5 seconds.

14.1 Command Menu Commands

Requirement: The following is a list of tones assigned to each of the commands available from the Command Menu. If the INCTE has a DTMF receiver, it will be able to recognize and perform either the DTMF or the single tone command.

COMMAND MENU MODE

304 Hz	Transfer to Equal Level Loopback Mode (DTMF 33#)
404 Hz	Transmission Response Mode (DTMF 32[NN]#)
504 Hz	Enter Setup Mode Sub-Menu
604 Hz	Enter Query Mode Sub-Menu
704 Hz	Enter Housekeeping Mode Sub-Menu
804 Hz	Enter 4-Tone Slope Mode (DTMF 35#)
904 Hz	Enter Transmission Testing Mode Sub-Menu
1004 Hz	First Tone of Alignment Sequence†
1104 Hz	Communicate at DLP (DTMF 412#)
1204 Hz	Toggle Simplex Leads (DTMF *513#)
1304 Hz	Communicate at TLP (DTMF 411#)
1404 Hz	Transfer to Wiring Check† (DTMF 36#)
1513 Hz	Assigned for Loopback frequency option
1613 Hz	Assigned for Loopback frequency option
1713 Hz	Assigned for Loopback frequency option
1804 Hz	Start Automatic Alignment† (DTMF 22#)
1913 Hz	Assigned for Loopback frequency option
2004 Hz	Turn Security Off (DTMF 03#)
2204 Hz	Toggle 3 dB Roll Off† (DTMF *645#)
2413 Hz	Assigned for Loopback frequency option
2513 Hz	Assigned for Loopback frequency option
2604 Hz	Single Frequency (SF) Signaling
2713 Hz	Assigned Loopback frequency
2804 Hz	Toggle between Communicate at TLP or DLP (DTMF 41#)
2908 Hz	Reserved for other INCTE units
3004 Hz	Cancel and return to Command Menu (DTMF*#)
3104 Hz	Go to Command Menu (DTMF 0#)

†These commands have the security feature.

14.2 Sub-Menus

14.2.1 Sub-Menu Mode

Requirement: The Command Menu has four sub-menus which send detailed commands to the INCTE. Sub-menus are accessed by sending a sub-menu tone to the INCTE after entering the main Command Menu. The sub-menus and their tones are: 504 Hz for the Setup Sub-Menu, 604 Hz for the Query Sub-Menu, 704 Hz for the Housekeeping Sub-Menu, and 904 Hz for the Transmission Testing Sub-Menu.

14.2.2 Sub-Menu Response

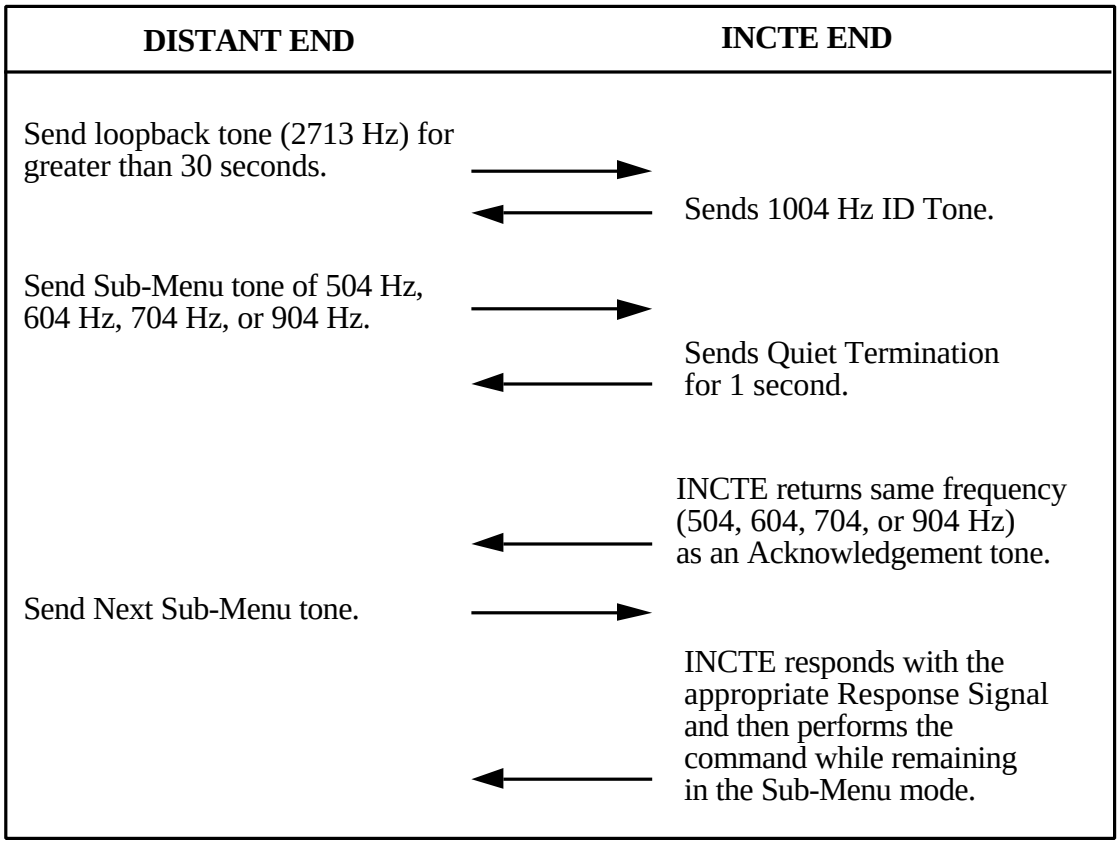
Requirement: The INCTE, upon recognition of a tone, responds with the appropriate response signal (Accept, Reject) only if that tone is the last tone or only tone in a sequence. If that tone is the first sub-menu tone (504 Hz, 604 Hz, 704 Hz, or 904 Hz), the INCTE responds with a tone of the same frequency as the received sub-menu tone. This response is called Sub-Menu Acknowledgement tone. Upon recognition of a sub-menu tone, the INCTE will remove the existing transmitted tone, apply a quiet termination for 1 second, then apply the Sub-Menu Acknowledgement tone. After an Accept or Reject response, the INCTE will stay in the sub-menu and return the acknowledgment tone instead of an ID tone.

Some commands use a second sub-menu tone to enter command parameters. The INCTE will respond with the same frequency as the second sub-menu tone sent after the quiet termination for 1 second. The INCTE will immediately start looking for the next tone in the sequence. If a tone is not sent, the INCTE will continue to wait for a tone until the normal 5-minute time-out is reached.

14.2.4 Sub-Menu Access

Requirement: The INCTE follows the flowchart below to access and execute sub-menu commands.

SUB-MENU FLOWCHART



14.2.5 Exiting a Sub-Menu

Requirement: Sending a 3004 Hz tone during a command sequence for greater than 5 seconds is interpreted by the INCTE as a Cancel Command (same as a DTMF *#), and the INCTE returns to Command Menu.

14.2.6 Sub-Menu Command Restrictions

Requirement: The usable command tones in a sub-menu are restricted to the following frequencies: 304, 404, 504, 604, 704, 804, 904, 1004, 1104, 1204, 1304, 1404 and 2304 Hz. Each tone must be applied for a minimum of 5 seconds.

14.2.7 Setup Sub-Menu (504 Hz)

Requirement: Sending 504 Hz tone while in the Command Menu causes the INCTE to enter Setup Sub-Menu. The 504 Hz tone need not be present once access is gained. To exit this sub-menu and return to the main Command Menu, send 3104 Hz or DTMF 0#. The following is a list of tones assigned to each command in the Setup Sub-Menu.

SETUP SUB-MENU COMMANDS

504 + 304 Hz	Set Facility Impedance to 150 ? † (DTMF *440#)
504 + 404 Hz	Set Facility Impedance to 600 ? † (DTMF *441#)
504 + 604 Hz	Set Facility Impedance to 1200 ? † (DTMF *442#)
504 + 704 Hz	Sealing Current Sink † (DTMF *445#)
504 + 804 Hz	Sealing Current Source † (DTMF *446#)
504 + 904 Hz	Sealing Current Off † (DTMF *447#)
504 + 1104 Hz	Custom Level Set † (DTMF *4101#)
504 + 1204 Hz	2W Customer Side Operation † (DTMF *448#)
504 + 1304 Hz	Default Levels † (DTMF *410#)
504 + 1404 Hz	4W Customer Side Operation † (DTMF *449#)

† These commands have the security feature.

14.2.8 Query Sub-Menu (604 Hz)

Requirement: Sending 604 Hz tone while in the Command Menu causes the INCTE to enter Query Sub-Menu. The 604 Hz tone need not be present once access is gained. To exit this sub-menu and return to the main Command Menu, send 3104 Hz or DTMF 0#. The following is a list of tones assigned to each command in the Query Sub-Menu.

QUERY SUB-MENU COMMANDS

604 + 404 Hz	Self Test (DTMF 12#)
604 + 504 Hz	Query 2W Customer Side Operation (DTMF 448#)
604 + 704 Hz	Query 4W Customer Side Operation (DTMF 449#)
604 + 804 Hz	Query Sealing Current Sink (DTMF 445#)
604 + 904 Hz	Query Sealing Current Source (DTMF 446#)
604 + 1004 Hz	Query Sealing Current Off (DTMF 447#)
604 + 2304 + 304 Hz	Query Receive Equalizer Enable/Disable (DTMF 643#)
604 + 2304 + 404 Hz	Query Facility Impedance 150 ? (DTMF 440#)
604 + 2304 + 504 Hz	Query Facility Impedance 600 ? (DTMF 441#)
604 + 2304 + 604 Hz	Query Facility Impedance 1200 ? (DTMF 442#)
604 + 2304 + 804 Hz	Query 3 dB Roll Off (DTMF 645#)
604 + 2304 + 904 Hz	Default Level Query (DTMF 410#)

14.2.9 Housekeeping Sub-Menu (704 Hz)

Requirement: Sending 704 Hz tone while in the Command Menu causes the INCTE to enter the Housekeeping Sub-Menu. The 704 Hz tone need not be present once access is gained. To exit this sub-menu and return to the main Command Menu, send 3104 Hz or DTMF 0#. The following is a list of tones assigned to each command in the Housekeeping Sub-Menu.

HOUSEKEEPING SUB-MENU COMMANDS

704 + 504 Hz	Sealing Current Test (DTMF 642#)
704 + 604 Hz	Change to Default Gain and Equalization (DTMF 21#)
704 + 804 Hz	Receive Equalizer Toggle† (DTMF *643#)
704 + 904 Hz	Manufacturer and Unit ID (DTMF 70#)
704 + 1104 + 1513 Hz	Change Loopback Frequency to 1513 Hz† (DTMF 4215#)
704 + 1104 + 1613 Hz	Change Loopback Frequency to 1613 Hz† (DTMF 4216#)
704 + 1104 + 1713 Hz	Change Loopback Frequency to 1713 Hz† (DTMF 4217#)
704 + 1104 + 1913 Hz	Change Loopback Frequency to 1913 Hz† (DTMF 4219#)
704 + 1104 + 2413 Hz	Change Loopback Frequency to 2413 Hz† (DTMF 4224#)
704 + 1104 + 2513 Hz	Change Loopback Frequency to 2513 Hz† (DTMF 4225#)
704 + 1104 + 2713 Hz	Change Loopback Frequency to 2713 Hz† (DTMF 4227#)
704 + 1204 Hz	Restore Factory Defaults† (DTMF 20#)
704 + 1304 Hz	Restore Transmission Defaults† (DTMF 23#)

1104 Hz is the Sub-Menu tone for loopback frequency change (DTMF 42[NN]#). The last tone of the sequence is the frequency of the desired loopback.

†These commands have the security feature.

14.2.10 Transmission Testing Sub-Menu (904 Hz)

Requirement: Sending 904 Hz tone while in the Command Menu causes the INCTE to enter the Transmission Testing Sub-Menu. The 904 Hz tone need not be present once access is gained. To exit this sub-menu and return to the main Command Menu, send 3104 Hz or DTMF 0#. The following is a list of tones assigned to each command in the Transmission Testing Sub-Menu.

TRANSMISSION TESTING SUB-MENU COMMANDS

904 + 304 Hz	Cable Flip (DTMF 640#)
904 + 504 Hz	Transfer to Terminate and Leave mode† (DTMF 31#)
904 + 604 Hz	Terminate 2W for Echo Path Loss (EPL) Testing (DTMF 641#)
904 + 704 Hz	Short 2W for EPL Testing (DTMF 644#)
904 + 804 Hz	Timed Cable Pair Open (DTMF 646#)
904 + 1004 Hz	1004 Hz Milliwatt Tone (DTMF 30#)

†These commands have the security feature.

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15. Acronyms

The following terms are defined as used in this test plan. More definitions are contained in Bellcore Technical Reference SR-TSV-002275, "Notes on the BOC Intra-LATA Networks," Issue 1, March 1991.

2W	Two-Wire
4W	Four-Wire
AA	Automatic Alignment
CAU	D3/D4 Carrier Channel Access Unit
Closed End	Non-switched or Telephone Set end of circuit
CPE	Customer Provided Equipment
dB	Decibel
DLP	Data Level Point
DST	Data Station Termination (same as INCTE)
DTMF	Dual Tone Multi-Frequency
DX	Duplex Signaling System
E&M	Universal signaling scheme using a separate signaling path for each direction.
EPL	Echo Path Loss
GS	Ground Start Operation
Hz	Hertz
ICXR	Intelligent Carrier
ID	Identification
INCTE	Intelligent Network Channel Terminating Equipment
IPM	Interruptions Per Minute
LS	Loop Start Operation
N/A	Not Available
NI	Network Interface
Open End	Switched or Central Office end of circuit
P/AR	Peak to Average Ratio
PLR	Pulse Link Repeater
ROL	Receive Out Level

SF	Single Frequency signaling (2604 Hz)
SMAS	Switched Maintenance Access Connector
SSC	Special Service Center
SX	Simplex Leads
TIL	Transmit In Level
TLP	Test Level Point
TOL	Transmit Out Level
VF	Voice Frequency

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