

# Managing Cisco 90i. IDSL Channel Units and Subscriber Loops

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Managing the Cisco 90i IDSL Channel Unit and its associated subscriber loops is a process of managing the channel units, ports, and connections for each D4 channel bank in the network. The Cisco 90 Series DSL Management Agent provides a single convenient, scalable Simple Network Management Protocol (SNMP) management interface to monitor and control thousands of Cisco 90i IDSL Channel Units. This chapter provides information on the following subjects:

- Cisco 90 Series DSL Management Agent SNMP MIB
- Verifying Network Connectivity
- Managing Cisco 90i IDSL Channel Units
- Managing Subscriber Loops

## Cisco 90 Series DSL Management Agent SNMP MIB

All management functionality for the Cisco 90i IDSL Channel Units and their associated subscriber loops is provided through the Cisco 90 Series DSL Management Agent SNMP Management Information Base (MIB). (See the appendix “Cisco 90 Series MIB” for information on how to obtain the Cisco 90 Series MIB.)

The MIB provides managed objects and information to perform operational tasks including:

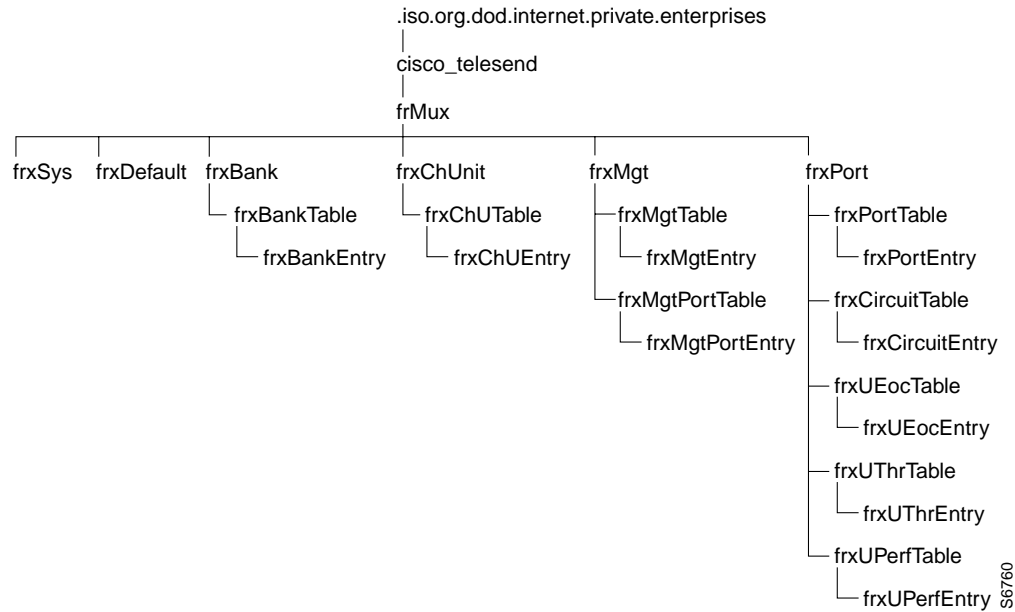
- Discover D4 channel banks containing Cisco 90i IDSL Channel Units available to be managed
- Configure global default settings for newly-installed Cisco 90i IDSL Channel Units
- Configure Cisco 90i IDSL Channel Unit settings, retrieve channel unit inventory information and performance/error statistics
- Configure settings, monitor status, and retrieve performance/error statistics for each subscriber port
- Configure settings, monitor status, and retrieve performance statistics for each subscriber permanent virtual circuit (PVC)
- Perform diagnostic tests on individual subscriber ports (such as BERT) and configure loopbacks
- Perform diagnostic tests and loopbacks, and retrieve performance/error statistics on each downstream segment of the subscriber loop (Bellcore TR-TSY-000829 compliant)

## Cisco 90 Series DSL Management Agent SNMP MIB Structure

The Cisco 90 Series DSL Management Agent SNMP MIB is partitioned into several logical groups of managed objects and tables. These groups and tables are organized to distinguish between information and functionality associated with physical and logical entities such as channel units, ports, and PVCs. Many tables are hierarchically indexed, meaning that one or more indexes are used to access items and subitems that are related to one another. For example, a table having information about subscriber ports is indexed first by channel bank number, then by channel unit slot, and finally by the port number. In this way, all objects managed through the agent can be individually and uniquely referenced.

Figure 5-1 graphically represents the basic structure of the MIB. The information and functionality of each group or table of the MIB is described briefly in the following sections. The complete Cisco 90 Series DSL Management Agent SNMP MIB is provided in the appendix “Cisco 90 Series MIB,” following this chapter. Examples of how to use each group or table in actual operations is covered in more detail later in the chapter.

**Figure 5-1 Cisco 90 Series DSL Management Agent MIB Structure**



### frxSys Group

The frxSys group consists exclusively of administrative information, operational status, and configurable parameters for the Cisco 90 Series DSL Management Agent.

Administrative information includes the description, type, and version of the Cisco 90 Series DSL Management Agent.

Additionally, SNMP managers can view and modify strings containing a customer-defined descriptive name, the person to contact regarding this device, and where the device is located.

The operational status information objects are useful in determining what connectivity the agent has to the rest of the network. Several objects are present in this table to help troubleshoot connectivity and protocol problems between the agent and the Frame Relay port to which it is connected.

The SNMP manager can configure the agent's real-time clock, and also define whether or not an SNMP trap is generated to the appropriate manager(s) when a performance monitoring threshold is crossed.

## frxDefault Group

The frxDefault group controls whether settings in the frxDefault group may be downloaded to the channel unit and what values to download when you install a new Cisco 90i IDSL Channel Unit or any time you press the Download Config pushbutton on the channel unit faceplate.

For example, the first three objects in the frxDefault group (frxDefaultEnable, frxDefaultTrap, and frxDConfigSrc), control what actions are taken when the channel unit Download Config pushbutton is pressed:

- frxDefaultEnable—If this object is enabled, the parameters stored in the frxDefault group are automatically downloaded to the channel unit and applied. If disabled, the frxDefault group parameters are not downloaded.
- frxDefaultTrap—If this object is enabled, the agent automatically generates an SNMP trap of type frxDownloadTrap to any SNMP managers defined by the user to receive the trap in the agent configuration. If disabled, no trap is generated. The functionality provided by this option allows a higher level manager to apply a special set of configuration parameters on a case-by-case basis to the channel units. This is useful if most channel units are to use the default settings, but one or more may need an altered set of parameters. This object is not mutually exclusive from the frxDefaultEnable object in that both can be enabled or not at the same time. If both are enabled, the default settings are applied from the frxDefault group and the trap is also sent, allowing the SNMP manager to override the defaults.
- frxDConfigSrc—This object defines the default method the channel unit should use to acquire the settings for subscriber port data rate and protocol (Frame Relay or PPP). The user has the option of specifying whether the parameters are obtained from SNMP (the default) or from the Annex D LMI protocol. The LMI approach is not normally recommended; however, it may be necessary in cases where configuration using SNMP is not desirable.

The remaining objects in the frxDefault group are the parameters that are actually to be applied to the channel unit when the Download Config pushbutton is activated and the frxDefaultEnable object is enabled.

The frxDMgtT391, frxDMgtT392, frxDMgtN391, frxDMgtN392, and frxDMgtN393 objects define the respective default Annex D LMI communications parameters for the link between the subscribers and the channel units when Frame Relay protocol is used on the subscriber loops. The same objects also define those parameters for the link between the channel units and the service provider Frame Relay network.

The frxDPortSpeed and frxDPortProtocol objects define the default subscriber port speed (56, 64, 128, or 144 kbps) and port protocol (Frame Relay or PPP) to be applied.

The frxDCKtCIR, frxDCKtBc, and frxDCKtBe objects control the default settings for the PVCs between the subscriber CPE and the channel unit subscriber port. These objects define the Frame Relay committed information rate (CIR), committed burst size (Bc) and excess burst size (Be) parameters for all PVCs on the channel unit, respectively. These parameters can be overridden for each individual PVC, if desired.

### frxBank Group

The frxBank group contains a dynamically populated table, frxBankTable, which contains a list of all D4 channel banks the agent has discovered and is managing. Banks are only discovered if they contain at least one Cisco 90i IDSL Channel Unit and a management PVC has been provisioned between the agent and the bank, as described in the chapter “Installing D4 Channel Banks and Cisco 90i IDSL Channel Units.” Empty banks are not discovered nor are banks containing channel units other than the Cisco 90i IDSL Channel Unit. Entries will only be present for banks that exist; there are no empty entries in this table. Users may not add, delete, or modify any information in this table.

Each table entry consists of two objects:

- frxBankIndex—When the management PVC between the agent and a channel bank is created, each end of the PVC has a Frame Relay DLCI value associated with it. For the main agent, the DLCI at the channel bank end always has the value 31 (the value is always 30 for the optional standby agent). The DLCI value at the agent end of the PVC is user-assigned. The DLCI value assigned by the user at the agent end of the PVC is exactly the same as the frxBankIndex value that will be used for this bank in the frxBankTable. For example, if the PVC DLCI assigned by the user at the agent end of the management PVC is 99, a corresponding bank entry will appear in the frxBankTable with a frxBankIndex of 99. It is highly recommended that the same user-defined DLCI values be used on both the main and standby agents to maintain consistency between the two agents.
- frxBankType—Identifies the type of bank discovered for each entry. The only supported bank type is D4.

### frxChUnit Group

The frxChUnit group contains a dynamically populated table, frxChUTable, which contains a list of all Cisco 90i IDSL Channel Units the agent has discovered and is managing. Cisco 90i IDSL Channel Units are automatically discovered when they are installed in channel banks linked to the agent with a management PVC. An entry for each channel unit is automatically added to this table when a channel unit is discovered. Channel units that are removed from service are automatically removed from the table. The frxChUTable is indexed first by the frxBankIndex and second by the frxChUIndex, which corresponds to the physical slot number of the channel bank the channel unit is installed in. Several parameters for each channel unit can be monitored or configured through the frxChUTable:

- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Represents the physical slot in the channel bank where the channel unit is installed.
- frxChUType—Identifies what model of channel unit is installed.
- frxChUVersion—Identifies the version of the channel unit firmware.
- frxSigProtocol—Specifies the type of in-band signaling used for subscriber Frame Relay connections. Only Annex D signaling is supported.
- frxConfigSrc—Defines the method the channel unit should use to acquire the settings for subscriber port data rate and protocol (Frame Relay or PPP). Both SNMP and Annex D are supported options.
- frxDLCIAdLen—Defines the number of bytes in the DLCI address. Only 2-byte address lengths are currently supported.

The frxChUTable also contains several performance and error statistics counter objects to monitor the health and operation of the channel units. Each counter only counts data for traffic destined for or sent from subscriber ports on a particular channel unit.

- frxNetInOctets—Number of octets destined for subscriber ports on this channel unit that were received from the service provider Frame Relay network.
- frxNetOutOctets—Number of octets from subscriber ports on this channel unit that were transmitted to the service provider Frame Relay network.
- frxNetBadFrames—Number of frames received from the service provider Frame Relay network destined for a subscriber port on this channel unit that were discarded because of errors. The type of errors can be determined from the following parameters.
- frxNetHDLCEs—Number of errored seconds that have occurred because of HDLC abort codes received for frames from the service provider Frame Relay network destined for a subscriber port on this channel unit.
- frxNetCRCEs—Number of errored seconds that have occurred because of CRC errors for frames from the service provider Frame Relay network destined for a subscriber port on this channel unit.
- frxNetLinkEs—Number of errored seconds that have occurred because of non-integral byte errors for frames from the service provider Frame Relay network destined for a subscriber port on this channel unit.
- frxNetFrShEs—Number of errored seconds that have occurred because of short frame errors for frames from the service provider Frame Relay network destined for a subscriber port on this channel unit.
- frxNetFrLgEs—Number of errored seconds that have occurred because of long frame errors for frames from the service provider Frame Relay network destined for a subscriber port on this channel unit.
- frxNetPPPEs—Number of errored seconds that have occurred because of RFC-1973 frame header errors for frames from the service provider Frame Relay network destined for a subscriber port on this channel unit.
- frxNetBufEs—Number of errored seconds that have occurred because of a frame from the service provider Frame Relay network destined for a subscriber port on this channel unit being discarded because of insufficient buffer space.

## frxMgt Group

The frxMgt group contains two tables, frxMgtTable and frxMgtPortTable, which allow the monitoring and configuration of channel unit and port Annex D management parameters, respectively.

### frxMgtTable

The frxMgtTable allows you to monitor and configure Annex D management protocol between the D4 digroup and the Frame Relay switch. These parameters apply specifically to the link between the D4 channel bank and the service provider Frame Relay network. The frxMgtTable is indexed first by the frxBankIndex and second by the frxChUIndex, which corresponds to the physical slot number of the channel bank the channel unit is installed in.

- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Corresponds to the physical slot in the channel bank where the channel unit is installed.

- frxPortsInSvc—Number of ports currently in service on the channel unit. A port is considered in service if it has one or more assigned PVCs as reported by the Annex D protocol from the Frame Relay switch.
- frxMgtT391, frxMgtT392, frxMgtN391, frxMgtN392, and frxMgtN392—Define the respective Annex D LMI communications parameters for the link between the channel units and the service provider Frame Relay network and for the link between the channel unit and the subscribers when Frame Relay protocol is used on the subscriber loops. These parameters must be set to identical values for all channel units in a digroup.

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**Note** Because all channel units in a D4 digroup are monitoring the same Annex D protocol between the D4 T1 and the Frame Relay switch, the values for frxNetLinkErrors, frxNetProtErrors, frxNetChInactive, and frxNetChStatus should be (approximately) equal in all channel units. These parameters can be read from any channel unit in the digroup.

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- frxNetLinkErrors—Number of signaling link reliability errors that have occurred between the channel unit and the service provider Frame Relay network. Signaling link reliability errors are characterized by the failure of a channel unit to receive a reply to an Annex D poll from the service provider Frame Relay network.
- frxNetProtErrors—Number of signaling protocol errors that have occurred between the channel unit and the service provider Frame Relay network. Signaling protocol errors are characterized by invalid formatting or sequence numbers in a message received by a channel unit in a reply to an Annex D poll from the service provider Frame Relay network.
- frxNetChInactive—Number of times the Annex D signaling channel between the channel unit and the service provider Frame Relay network was declared inactive.
- frxNetChStatus—Indicates the current status (active or inactive) of the Annex D signaling channel between the channel unit and the service provider Frame Relay network.

#### frxMgtPortTable

The frxMgtPortTable allows you to monitor subscriber port Annex D management parameters. These parameters apply specifically to the link between the channel unit subscriber port and the subscriber CPE. Annex D LMI is only in use when the subscriber port protocol is set to be Frame Relay. These parameters are not applicable when the subscriber port protocol is defined to be PPP. The frxMgtPortTable is indexed by:

- 1 frxBankIndex
- 2 frxChUIndex (which corresponds to the physical slot number of the channel bank the channel unit is installed in)
- 3 frxPortIndex (the subscriber port number on the channel unit)

These indexes are described below:

- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Represents the physical slot in the channel bank of the the channel unit.
- frxPortIndex—Represents the subscriber port on the channel unit and has a range of 0 to 3 to address each of the four ports.

- frxPortLinkErrors—Number of signaling link reliability errors that have occurred between the channel unit and subscriber. Signaling link reliability errors are characterized by the failure of a channel unit to receive an Annex D poll from the subscriber in the provisioned time (frxMgtT392).
- frxPortProtErrors—Number of signaling protocol errors that have occurred between the channel unit and the subscriber. Signaling protocol errors are characterized by invalid formatting or sequence numbers in an Annex D poll received by a channel unit from the subscriber.
- frxPortInactive—Number of times the Annex D signaling channel between the channel unit and the subscriber was declared inactive.

## frxPort Group

The frxPort group contains five tables:

- 1 frxPortTable
- 2 frxCircuitTable
- 3 frxUEocTable
- 4 frxUThrTable, and
- 5 frxUPerfTable

These tables are described below:

- frxPortTable—Configure and monitor parameters for individual subscriber ports on a channel unit.
- frxCircuitTable—Configure and monitor parameters for PVCs on a particular subscriber port.
- frxUEocTable—Allow diagnostic tests to be executed for subscriber ports and downstream devices (for example, BRITE cards) using the IDSL embedded operations channel (EOC).
- frxUThrTable—Provides the registers defined by Bellcore TR-TSY-000829 for U-interface performance monitoring thresholds and alarms for subscriber loops and any downstream devices.
- frxUPerfTable—Provides the registers defined by Bellcore TR-TSY-000829 for U-interface performance statistics for subscriber loops and any downstream devices.

## frxPortTable

The frxPortTable allows subscriber ports on the Cisco 90i IDSL Channel Unit to be configured and monitored by an SNMP manager. The frxPortTable is indexed as follows:

- 1 frxBankIndex
- 2 frxChUIndex (which corresponds to the physical slot number of the channel bank the channel unit is installed in)
- 3 frxPortIndex (the subscriber port number on the channel unit)

These indexes are described below:

- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Represents the physical slot in the channel bank of the channel unit.
- frxPortIndex—Represents the subscriber port on the channel unit and has a range of 0 to 3 to address each of the four ports.
- frxPortSpeed—Sets the subscriber loop data rate to 56, 64, 128, or 144 kbps.
- frxPortProtocol—Sets the subscriber loop protocol to Frame Relay or PPP.
- frxDSLStatus—Reflects the operational status of the subscriber loop.
- frxPVCAssigned—Number of PVCs assigned to a subscriber loop as determined by Annex D.
- frxLastChange—Time elapsed since the last change of synchronization status on the subscriber loop, measured in 0.01-sec increments.
- frxBrite—Number of downstream BRITE cards detected.
- frxDSLInOctets—Number of octets received from the subscriber loop.
- frxDSLOutOctets—Number of octets transmitted to the subscriber loop.
- frxT1InOctets—Number of octets received from the service provider Frame Relay network destined for this subscriber port.
- frxT1OutOctets—Number of octets transmitted to the service provider Frame Relay network from this subscriber port.
- frxDSLBadFrames—Number of bad frames received from this subscriber loop that were discarded. The reason for discarding the frames can be determined from the following parameters.
- frxDSLHDLCEs—Number of errored seconds that have occurred because of HDLC abort codes received for frames received from this subscriber loop.
- frxDSLRCREs—Number of errored seconds that have occurred because of CRC errors for frames received from this subscriber loop.
- frxDSLLEs—Number of errored seconds that have occurred because of non-integral byte errors for frames received from this subscriber loop.
- frxDSLFrShEs—Number of errored seconds that have occurred because of short frame errors for frames received from this subscriber loop.
- frxDSLFrLgEs—Number of errored seconds that have occurred because of long frame errors for frames received from this subscriber loop.
- frxDSL DLCIEs—Number of errored seconds that have occurred because of illegal DLCI errors for frames received from this subscriber loop.



- frxTxBuf—Number of octets in the transmit buffer of this subscriber port destined for the service provider Frame Relay network.
- frxRxBuf—Number of octets in the receive buffer of this subscriber port from the service provider Frame Relay network.
- frxPortNetEs—Number of errored seconds that have occurred because of frames transmitted from the service provider Frame Relay network to this subscriber loop being discarded.

## frxCircuitTable

The frxCircuitTable allows configuration and monitoring of all Frame Relay PVCs linking subscriber ports to subscriber CPE. The frxCircuitTable is indexed as follows:

- 1 frxBankIndex
- 2 frxChUIndex (which corresponds to the physical slot number of the channel bank the channel unit is installed in)
- 3 frxPortIndex (the subscriber port number on the channel unit)
- 4 frxPvcIndex (the DLCI of the PVC)

These indexes are described below:

- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Represents the physical slot in the channel bank of the channel unit.
- frxPortIndex—Represents the subscriber port on the channel unit and has a range of 0 to 3 to address each of the four ports.
- frxPvcIndex—DLCI of the PVC between the subscriber port and the subscriber CPE. These DLCI's fall in the range of 16 to 23.
- frxCktCIR—Committed information rate (CIR) of the PVC, in bits per second.
- frxCktBc—Committed burst size (Bc) of the PVC, in bits per second.
- frxCktBe—Excess burst size (Be) of the PVC, in bits per second.
- frxFarEndOpStat—Status (active or inactive) of the far end of the PVC, across the service provider Frame Relay network, as determined by Annex D.
- frxCktInOctets—Number of octets received on this PVC from the subscriber loop destined for the service provider Frame Relay network.
- frxCktOutOctets—Number of octets transmitted to the subscriber loop on this PVC from the service provider Frame Relay network.
- frxCktInFrames—Number of frames received on this PVC from the subscriber loop destined for the service provider Frame Relay network.
- frxCktOutFrames—Number of frames transmitted to the subscriber loop on this PVC from the service provider Frame Relay network.
- frxCktDiscards—Number of frames from the subscriber loop on this PVC destined for the service provider Frame Relay network that were discarded because of congestion.

## frxUEocTable

The frxUEocTable table uses IDSL Embedded Operations Channel (EOC) functions to diagnose and sectionalize problems on the subscriber loop. The frxUEocTable is indexed first by the frxBankIndex and second by the frxChUIndex, which corresponds to the physical slot number of the channel bank the channel unit is installed in.

- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Represents the physical slot in the channel bank of the channel unit.
- frxTestPort—Indicates which subscriber port to test. Only one port on a given channel unit may be tested at a time.
- frxTestType—Indicates the type of test to perform. Tests include loopbacks, block error rate tests (BERT) and injection of corrupt CRC values.
- frxLoopLoc—For tests that include loopbacks, this object defines the location of the loop. Loops can be set at the subscriber port, on downstream BRITE cards, or at the subscriber NT1.
- frxLoopCh—Controls which channels are looped when a loopback is initiated. Either B channel can be individually looped or all channels (2B+D) can be looped simultaneously.
- frxStartTest—Allows the selected test to be started and stopped using the currently defined test parameters.
- frxBertRst—Allows the bit error rate counter object (frxBertBE) to be reset to zero. After using the reset option, this object is automatically returned to the normal state to continue recording new bit errors.
- frxBertBE—Number of block errors measured on the current BERT test.
- frxBertTestTime—Elapsed time, in 0.01second increments, of the current BERT test.
- frxTestInProg—Test status of the subscriber port. The port may either have a test in progress or be in normal operation mode.

See the section “Managing Subscriber Loops” later in this chapter for test procedures using this table.

#### frxUThrTable

The frxUThrTable table allows U-interface performance monitoring thresholds and alarms for each subscriber loop and any downstream BRITE cards. The objects in this table are defined by the Bellcore TR-TSY-000829 specification. The table is indexed as follows:

- 1 frxBankIndex
- 2 frxChUIndex (which corresponds to the physical slot number of the channel bank the channel unit is installed in)
- 3 frxPortIndex (the subscriber port number on the channel unit)
- 4 frxPAddrIndex (the location of the device on the subscriber loop)

The indexes are described below:

- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Represents the physical slot in the channel bank of the channel unit.
- frxPortIndex—Represents the subscriber port on the channel unit and has a range of 0 to 3 to address each of the four ports.
- frxPAddrIndex—Represents the location of the device on the subscriber loop. Options include the subscriber port and any downstream BRITE cards.
- frxChEsTh—Number of current hour errored seconds that must be exceeded before an error condition should be raised. If the threshold is exceeded, the actions taken are conditional based upon the configuration of other MIB objects. If the corresponding bit in the frxAlertMask register is set to 0, the corresponding bit in the frxThCond register is set. In addition, if the frxUPerfTrapEnable object is also enabled, an SNMP trap of type frxUPerfTrap is generated.

- **frxCdEsTh**—Number of current day errored seconds that must be exceeded before an error condition should be raised. If the threshold is exceeded, the actions taken are conditional based upon the configuration of other MIB objects. If the corresponding bit in the **frxAlertMask** register is set to 0, the corresponding bit in the **frxThCond** register is set. In addition, if the **frxUPerfTrapEnable** object is also enabled, an SNMP trap of type **frxUPerfTrap** is generated.
- **frxChSesTh**—Number of current hour severely errored seconds that must be exceeded before an error condition should be raised. If the threshold is exceeded, the actions taken are conditional based upon the configuration of other MIB objects. If the corresponding bit in the **frxAlertMask** register is set to 0, the corresponding bit in the **frxThCond** register is set. In addition, if the **frxUPerfTrapEnable** object is also enabled, an SNMP trap of type **frxUPerfTrap** is generated.
- **frxCdSesTh**—Number of current day severely errored seconds that must be exceeded before an error condition should be raised. If the threshold is exceeded, the actions taken are conditional based on the configuration of other MIB objects. If the corresponding bit in the **frxAlertMask** register is set to 0, the corresponding bit in the **frxThCond** register is set. In addition, if the **frxUPerfTrapEnable** object is also enabled, an SNMP trap of type **frxUPerfTrap** is generated.
- **frxAlertMask**—8-bit binary mask that defines what alerts are to be raised or masked. When a particular bit position is set to 0, the corresponding alert is raised (not masked) in **frxThCond** if the appropriate threshold is exceeded. When a particular bit position is set to 1, the corresponding alert is not raised (masked) in **frxThCond** and the corresponding threshold crossing is ignored.

The bit positions are mapped as follows:

Bit Position	Description
1	Current Day Severely Errored Seconds Receive
2	Current Day Severely Errored Seconds Transmit
4	Current Day Errored Seconds Receive
8	Current Day Errored Seconds Receive
16	Current Hour Severely Errored Seconds Receive
32	Current Hour Severely Errored Seconds Transmit
64	Current Hour Errored Seconds Receive
128	Current Hour Errored Seconds Transmit

- **frxThCond**—Current alarm threshold conditions that have been raised because of a threshold having been exceeded. A 0 in a particular bit position signifies the threshold condition has not been exceeded and the alert not raised. A 1 in a particular bit position indicates the threshold condition has been exceeded and the alert raised.

The bit positions are mapped as follows:

Bit Position	Description
1	Current Day Severely Errored Seconds Receive
2	Current Day Severely Errored Seconds Transmit
4	Current Day Errored Seconds Receive
8	Current Day Errored Seconds Receive
16	Current Hour Severely Errored Seconds Receive
32	Current Hour Severely Errored Seconds Transmit
64	Current Hour Errored Seconds Receive
128	Current Hour Errored Seconds Transmit

## frxUPerfTable

The frxUPerfTable table contains the U-interface performance monitoring statistics for each subscriber loop and any downstream BRITE cards. The objects in this table are defined by the Bellcore TR-TSY-000829 specification. The table is indexed as follows:

- 1 frxBankIndex
- 2 frxChUIndex (which corresponds to the physical slot number of the channel bank the channel unit is installed in (1 to 24))
- 3 frxPortIndex (the subscriber port number on the channel unit (0, 1, 2, or 3))
- 4 frxPAddrIndex (the location of the device on the subscriber loop)

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**Note** These errors are measured using the ISDN physical frame level CRC and have no relationship to errors in the Frame Relay or PPP frames that ride on top of this link.

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- frxBankIndex—Represents the channel bank the channel unit is installed in.
- frxChUIndex—Represents the physical slot in the channel bank of the channel unit.
- frxPortIndex—Represents the subscriber port on the channel unit and has a range of 0 to 3 to address each of the four ports.
- frxPAddrIndex—Represents the location of the device on the subscriber loop. Options include the subscriber port and any downstream BRITE cards.
- frxResetPM—Resets the counters associated with the specified device.
- frxPMtype—Indicates whether the specified device is performing segmented or path performance monitoring, as defined in Bellcore document TR-NWT-000397.
- frxChEsTx—Number of physical link layer errored seconds in the current hour measured for data transmitted from the service provider Frame Relay network to the subscriber port. Errored seconds are seconds in which one or more block errors occur.
- frxChEsRx—Number of physical link layer errored seconds in the current hour measured for data received from the subscriber port destined for the service provider Frame Relay network.
- frxPhEsTx—Previous Hour Errored Seconds - Transmit direction.
- frxPhEsRx—Previous Hour Errored Seconds - Receive direction.
- frxH2EsTx—Errored Seconds 2 hours ago - Transmit direction.
- frxH2EsRx—Errored Seconds 2 hours ago - Receive direction.
- frxH3EsTx—Errored Seconds 3 hours ago - Transmit direction.
- frxH3EsRx—Errored Seconds 3 hours ago - Receive direction.
- frxH4EsTx—Errored Seconds 4 hours ago - Transmit direction.
- frxH4EsRx—Errored Seconds 4 hours ago - Receive direction.
- frxH5EsTx—Errored Seconds 5 hours ago - Transmit direction.
- frxH5EsRx—Errored Seconds 5 hours ago - Receive direction.
- frxH6EsTx—Errored Seconds 6 hours ago - Transmit direction.
- frxH6EsRx—Errored Seconds 6 hours ago - Receive direction.

- frxH7EsTx—Errored Seconds 7 hours ago - Transmit direction.
- frxH7EsRx—Errored Seconds 7 hours ago - Receive direction.
- frxH8EsTx—Errored Seconds 8 hours ago - Transmit direction.
- frxH8EsRx—Errored Seconds 8 hours ago - Receive direction.
- frxCdEsTx—Current Day Errored Seconds - Transmit direction.
- frxCdEsRx—Current Day Errored Seconds - Receive direction.
- frxPdEsTx—Previous Day Errored Seconds - Transmit direction.
- frxPdEsRx—Previous Day Errored Seconds - Receive direction.
- frxChSesTx—Number of physical link layer severely errored seconds in the current hour measured for data transmitted from the service provider Frame Relay network to the subscriber port. Severely errored seconds are seconds in which three or more block errors occur.
- frxChSesRx—Number of physical link layer severely errored seconds in the current hour measured for data received from the subscriber port destined for the service provider Frame Relay network.
- frxPhSesTx—Previous Hour Severely Errored Seconds - Transmit direction.
- frxPhSesRx—Previous Hour Severely Errored Seconds - Receive direction.
- frxCdSesTx—Current Day Severely Errored Seconds - Transmit direction.
- frxCdSesRx—Current Day Severely Errored Seconds - Receive direction.
- frxPdSesTx—Previous Day Severely Errored Seconds - Transmit direction.
- frxPdSesRx—Previous Day Severely Errored Seconds - Receive direction.
- frxChBeTx—Number of block errors in the current hour measured for data transmitted from the service provider Frame Relay network to the subscriber port. Block errors are 12-millisecond time periods in which a physical link level error occurs. These errors are not the same as Frame Relay level errors.
- frxChBeRx—Number of block errors in the current hour measured for data received from the subscriber port destined for the service provider Frame Relay network.
- frxPhBeTx—Previous Hour Block Errors - Transmit direction.
- frxPhBeRx—Previous Hour Block Errors - Receive direction.

## Traps

The following traps are generated by the Cisco 90 Series DSL Management Agent:

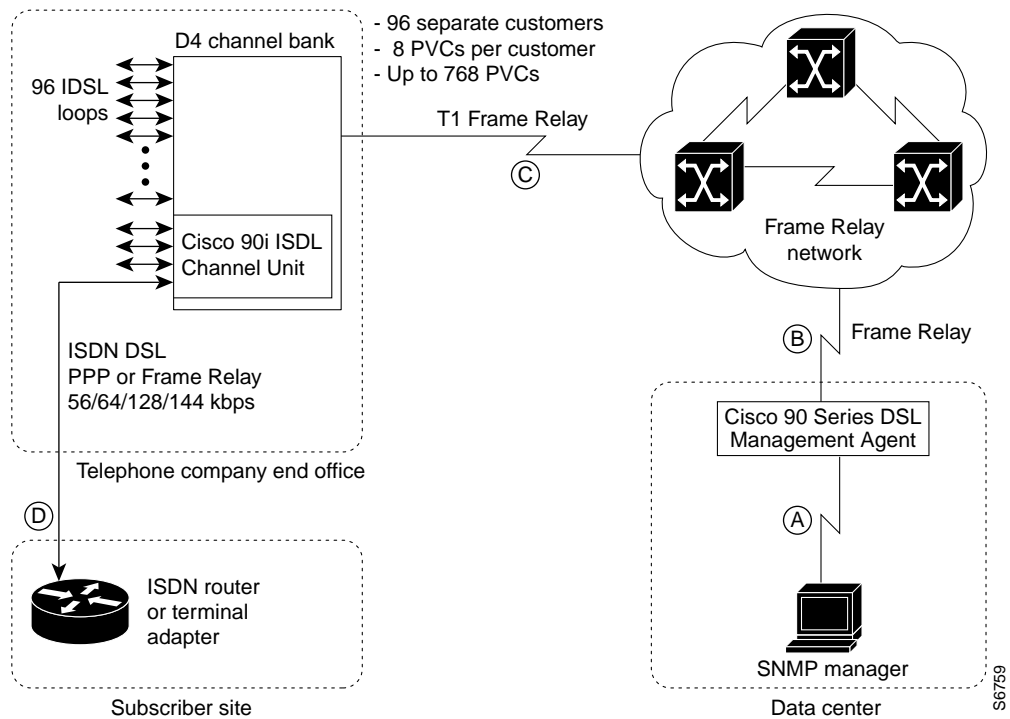
- frxDownloadTrap—Generated when the Download Config pushbutton is depressed on a Cisco 90i IDSL Channel Unit faceplate. The trap is generated only if the frxDefaultTrap object is enabled. The trap includes variables that identify which channel bank and slot the channel unit is located in.
- frxUPerfTrap—Generated when a performance monitoring threshold on a channel unit or downstream device is exceeded. This trap is generated only if the corresponding bit is clear (0) in the frxAlertMask object and the frxUPerfTrapEnable object is enabled. When the trap is generated, it will not be generated again until all error conditions on the associated subscriber port are cleared or masked.

- frxInsertChUTrap—Generated when a Cisco 90i IDSL Channel Unit is inserted into a D4 channel bank digroup slot, and is subsequently discovered by the Cisco 90 Series DSL Management Agent. It can take up to five minutes for the channel unit to be discovered by the Cisco 90 Series DSL Management Agent. The trap includes variables that identify which channel bank and slot the channel unit is located in.
- frxRemoveChUTrap—Generated when a Cisco 90i IDSL Channel Unit is removed from a D4 channel bank digroup slot, and is subsequently discovered removed by the Cisco 90 Series DSL Management Agent. It can take up to five minutes for the channel unit to be discovered removed by the Cisco 90 Series DSL Management Agent. The trap includes variables that identify which channel bank and slot the channel unit was located in.
- frxDConfigFailed—Generated when the Download Config pushbutton is depressed on a Cisco 90i IDSL Channel Unit faceplate, and the data configuration download to the Channel Unit fails. The trap includes variables that identify which channel bank and slot the channel unit is located in.

## Verifying Network Connectivity

The Cisco 90 Series DSL Management Agent is a useful tool for verifying each step of the connectivity between the agent and a particular channel unit, and also the connectivity between a subscriber and a remote service network. This section describes how to use the agent's MIB objects to verify each segment of network connectivity. Figure 5-2 depicts the logical segments of a typical network application of the Cisco 90i IDSL Channel Unit.

**Figure 5-2 Typical Network Application of the Cisco 90i IDSL Channel Unit**



## Manager-to-Agent Connectivity

Connectivity between an SNMP manager station and the Cisco 90 Series DSL Management Agent, shown as the “A” link in Figure 5-2, is critical and should be verified before any other connectivity. Take the following steps to verify connectivity:

- Step 1** Verify TCP/IP connectivity between the manager and the agent by using the Ping utility on the manager and specifying the IP address of the agent. If no response is received from this test, ensure that the agent has power, is connected to the TCP/IP network, and that the agent’s IP address, subnet mask, and default gateway (if any) is set correctly.
- Step 2** Using any SNMP MIB browser with the Cisco 90 Series DSL Management Agent MIB loaded, access any of the objects in the frxSys table (such as frxSysDescr). If an appropriate value is returned for the object, SNMP access is available. If the request fails or a timeout occurs, verify that the SNMP parameters are set correctly at the Cisco 90 Series DSL Management Agent and SNMP manager.

## Agent-to-Network Connectivity

Several objects are available in the MIB to verify connectivity between the Cisco 90 Series DSL Management Agent and the service provider’s Frame Relay network, shown as link “B” on Figure 5-2. These objects can be used to verify that the link between the agent and the Frame Relay switch it is connected to is operating properly. Take the following steps to verify connectivity:

- Step 1** Monitor the frxAgtChStatus object. If the object is in the active state, the link is active. If the state of the object is inactive, the link is not active and there is no connectivity to the Frame Relay network. In this case, the Frame Relay link parameters required for the link defined earlier in this guide should be verified. Consult the Frame Relay network administrator to further troubleshoot this link.
- Step 2** Monitor the frxAgtChInactive object to determine how many times the link has failed because of Annex D signaling problems. Also monitor the frxAgtLinkErrors and frxAgtProtErrors objects to determine how many link and protocol signaling errors have occurred between the agent and the switch. Verify that neither of these objects is incrementing. The results of these tests will aid in resolving any configuration problems or inconsistencies on this link. Consult the Frame Relay network administrator to further troubleshoot this link.

## Channel Bank-to-Network Connectivity

There are many ways to verify the connectivity between a particular channel bank and the service provider Frame Relay network, shown as link “C” in Figure 5-2. Only the most direct mechanisms for validating this connectivity are provided in this section. Take the following steps to verify connectivity:

- Step 1** Using the bank number as a table index, verify that an entry exists in the frxBankTable table for this bank.  
  
If an entry does exist, you have connectivity.  
  
If an entry does not exist, the management PVC for this bank may not exist or might be misconfigured. Consult the Frame Relay network administrator to further troubleshoot this link.
- Step 2** From the Frame Relay switch network management console, verify that the Annex D protocol is active on the port connected to the channel bank.

**Step 3** Select the channel bank and an installed channel unit in the bank to perform the test. Using the appropriate bank index and slot number as table indexes, monitor the frxNetChStatus object. If the object is in the active state, the link is active. If the state of the object is inactive, the link is not active and there is no connectivity between the D4 channel bank and the Frame Relay network.

Normally, this parameter will always be active if it is accessible because the Frame Relay switch would not allow connectivity if it believed the Annex D link was inactive. Consult the Frame Relay network administrator to further troubleshoot this link.

**Step 4** Using the bank number and slot number as table indexes, monitor the frxNetChInactive object to determine how many times the link has failed because of Annex D signaling problems. Also monitor the frxNetLinkErrors and frxNetProtErrors object to determine how many link and protocol signaling errors have occurred between the agent and the switch. Verify that neither of these objects is incrementing. The results of these tests will aid in resolving any configuration problems or inconsistencies on this link. Consult the Frame Relay network administrator to further troubleshoot this link.

## Channel Unit-to-Subscriber Connectivity

There are many ways to verify the connectivity between a particular subscriber port and the subscriber, shown as link “D” in Figure 5-2. Only the most direct mechanisms for validating this connectivity are provided in this section. Take the following steps to verify connectivity:

**Step 1** Select the channel bank, channel unit, subscriber port, and PVC to perform the test. Using the appropriate bank index, slot number, port number, and PVC DLCI as table indexes, monitor the frxDSLStatus object in the frxPortTable table. If the object is in the loop down state, the loop is down. If the state of the object is dslSyncOnly, the subscriber port has achieved physical connectivity with a downstream BRITE card, if any, or the subscriber NT1. If the state of the object is loopUpInactive, the link is active, but Annex D is not. This state is only possible for DSLs using the Frame Relay protocol. If the state of the object is loopUp, the loop is completely up and Annex D is active, if this is a Frame Relay link.

**Step 2** Using the frxEOTable, run a loopback and BERT test to the NT1 and verify that there are zero BERT errors. Follow the test procedure in the next section.

## Subscriber-to-Remote Network Connectivity

To determine the state of connectivity, as reported by Annex D, from the subscriber to the remote network where the subscriber traffic is terminated, select the channel bank, channel unit, and subscriber port to perform the test. Using the appropriate bank index, slot number, and port number as table indexes, monitor the frxFarEndOpStatus object in the frxCircuitTable table.

If the object is in the active state, the PVC is active and should allow traffic to flow. If the state of the object is inactive, the PVC may not be active and traffic flow may be impacted.



## Managing Cisco 90i IDSL Channel Units

You typically perform the day-to-day management of the Cisco 90i IDSL Channel Units with an SNMP manager application that is more user-friendly than the generic procedures described in this section. Refer to the specific instructions provided with the SNMP manager to perform the tasks described below.

### Channel Bank Management

D4 channel banks are managed using your SNMP manager through the `frxBankTable` indexed by the `frxBankIndex` and `frxBankType`.

#### Determining Which Channel Banks Are Installed

The dynamically-populated table, `frxBankTable`, contains a list of all D4 channel banks the agent has discovered and is currently managing. Banks are discovered only if they contain at least one Cisco 90i IDSL Channel Unit and a management PVC has been provisioned between the agent and the bank. Empty banks are not discovered nor are banks containing channel units other than Cisco 90i IDSL Channel Units. Entries will be present only for banks that exist; there are no empty entries in this table. Each table entry consists of two objects, `frxBankIndex` and `frxBankType`.

### Channel Unit Management

Cisco 90i IDSL Channel Units are managed using your SNMP manager through the `frxChUTable` indexed by the `frxBankIndex` and the `frxChUIndex`.

#### Determining Which Channel Units Are Installed

You can determine which channel units are installed in a channel bank, and therefore how many channel units can be managed within a specific channel bank.

For most managers or MIB browsers, you can retrieve the `frxChUTable` for the specific bank. There will be one entry in the table for each channel unit installed in the bank. The `frxChUIndex` column in the table that is returned will be in the range of 1 to 24, and indicates the slots in the digroup that currently have channel units installed.

For MIB browsers not capable of retrieving entire tables (or subsets of tables), you can determine which channel units are installed by retrieving the `frxChUIndex` variable indexed by the bank number and using a wildcard for the `frxChUIndex`.

#### Displaying Information About Specific Channel Units

After becoming familiar with the information in the previous section “Determining Which Channel Units Are Installed,” you know what channel units are installed in the shelf. The index numbers can then be used to obtain information about a specific channel unit. The following information specific to the channel unit is displayed:

- Channel unit identification and global information
- Traffic to and from the backplane

This information is obtained by using the `frxChUTable` object.

Use the frxChUTable to access a specific channel bank unit. Information that is provided using frxChUTable includes:

- Information about the channel unit, such as type and revision
- In octets
- Out octets
- Bad frames received and dropped
- Causes for bad frames dropped

These statistics indicate the overall health of the network interface relative to the specific channel unit that has been selected. For additional information on the frxChUTable, refer to the appendix “Cisco 90 Series MIB.”

## Port Management

Using the frxPortTable described in this section, you can manage ports on Cisco 90i IDSL channel units.

### frxPortTable

You can manage the ports on a channel unit using the frxPortTable object, which contains the port-specific configuration and traffic statistics for each subscriber loop overall. There is one row (frxPortEntry) for each port on each channel unit in every channel bank.

frxPortTable is indexed by:

- FRX channel bank digroup number (frxBankIndex)
- Channel unit number (1 to 24) (frxChUIndex)
- Port number (0 to 3) (frxPortIndex)

The inside row of the table (frxPortEntry) reports statistics about the health of the port such as:

- In octets
- Out octets
- Errored seconds
- Number of PVCs assigned to the port
- Link status—Whether the physical link is up or down

The following are port parameters that can be written using the frxPortEntry:

- Configured port speed
- Protocol (PPP or Frame Relay)
- Any BRITE cards located on this subscriber line

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**Note** This table is also used to configure subscribers and to read subscriber statistics. See the section “Managing Subscriber Loops” later in this chapter for more information on configuring subscribers.

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## Permanent Virtual Circuit Management

Permanent virtual circuits (PVCs) are managed using the frxCircuitTable.

### frxCircuitTable

The frxCircuitTable contains control information and statistics for each permanent virtual circuit in the system. This table is indexed as follows:

- FRX channel bank digroup number (frxBankIndex)
- Channel unit number (1 to 24) (frxChUIndex)
- Port number (0 to 3) (frxPortIndex)
- Circuit DLCI number (16 to 23) (frxPVCIndex)

The frxCircuitTable is also used when configuring subscribers, because:

- It contains PVC configuration that must match the Frame Relay switch PVC configuration, such as CIR, Bc, and Be.
- It contains statistics about throughput on the PVC.
- It can be used to determine the far end operational status for specific PVCs.

## Managing Subscriber Loops

Managing subscriber loops can be divided into three basic operations:

- Configuring Subscriber Loops
- Monitoring Subscriber Loop Statistics
- Troubleshooting Subscriber Problems

This section explains how to manage your subscribers through the MIB using whatever SNMP manager you prefer.

## Configuring Subscriber Loops

You configure subscriber loops by performing the following procedure:

- Step 1** Configure port speed and protocol on the channel unit using the frxPortTable. As an example, on a Cisco 90i IDSL Channel Unit, you can set the port speed to 56, 64, 128, or 144 kbps.
- Step 2** Select the protocol to be either PPP or Frame Relay. If you are using Frame Relay protocol on the port, the Frame Relay LMI signaling configuration of the CPE must be ANSI T1.617 Annex D.
- Step 3** Determine what PVC parameters have been configured for the subscriber from the Frame Relay switch configuration. Use the frxCircuitTable to verify that the PVC configuration CIR, Bc, and Be parameters are equivalent to those configured for the Frame Relay switch.

## Monitoring Subscriber Loop Statistics

Monitoring subscriber loops is done on several different levels.

- **Monitor network connection**

Read the statistics in the frxChUTable and entry to monitor the network T1 connection. Use the following objects to obtain the information:

- frxChUTable—Allows visibility to the traffic and errors occurring on the network connection for this channel unit.
- frxMgtTable—Allows visibility into the Annex D protocol status on the network connection.

- **Port-specific monitoring**

Use the following objects to obtain specific port statistics that relate to subscribers:

- frxPortTable—Allows visibility into the overall port (subscriber) traffic, buffer depths, errors, synchronization status, and BRITE cards seen on the subscriber loop.
- frxMgtPortTable—Allows visibility into the Annex D protocol state and statistics for subscribers using the Frame Relay protocol.
- frxPerfTable—Allows visibility into into the layer 1 (ISDN) loop performance (errored seconds, severely errored seconds, and so on). If BRITE cards are present, statistics on each segment of the loop are available.

- **PVC-specific monitoring**

Use the following objects to display statistics on a given PVC:

- frxCircuitTable—Allows visibility into the traffic and errors on each PVC on the subscriber loop.

## Configuring Alerts

Alerts allow you to set the system to notify you, using an SNMP trap, whenever certain threshold levels have been exceeded. An alert occurs whenever a threshold is exceeded, which in turn may be configured to generate a trap that is sent to the manager. Alerts can be configured for:

- Number of errored seconds (ES) in the current hour
- Number of errored seconds (ES) in the current day
- Number of severely errored seconds (SES) in the current hour
- Number of severely errored seconds (SES) in the current day

If BRITE cards are present in the loop, you can set alert thresholds separately for each segment of the loop. Although there are separate alerts for each direction of transmission (network to subscriber and subscriber to network), the thresholds must be the same for both directions. It is recommended that alerts be left at their factory default values.

You set alert thresholds using the frxUThrTable. The table is indexed by bank, channel unit, port (0 to n), and interface address. Interface addresses range from 1 to 7, with BRITE cards using addresses 1 through 6, and the local interface using 7. The BRITE cards are numbered in order of appearance on the network (the closest BRITE card is number 1, the second closest is number 2, and so on).

To set up thresholds for the loop segment connected to the Cisco 90i IDSL Channel Unit (the local interface), use `interface address=7`. To enable automatic generation of an SNMP trap when an alert occurs, you must globally enable this trap by setting `frxUPerfTrapEnable` to “enable” in the `frxSys` table. You can mark individual thresholds using the `frxAlertMask` variable. The `frxThCond` variable indicates which threshold crossing caused the alert.

If an alert is generated, a single trap per channel unit may be sent to the SNMP manager based on the configuration of the `frxUPerfTrapEnable` object. The SNMP manager then needs to determine the cause of the trap by reading the `frxThCond` byte for the channel unit and its BRITE cards.

It must then write to the `frxThCond` register to clear the alert bits. A new trap will not be generated until all alerts on the channel unit and its BRITE cards have been masked or fixed and cleared.

## Troubleshooting Subscriber Problems

Troubleshooting subscriber problems is performed by using `frxUEocTable`. The embedded operations channel (EOC) table (`frxUEocTable`) is used to diagnose problems with the subscriber loop. This table contains an entry for each of the channel units in the system. This table is indexed by the channel bank digroup number (`frxBankIndex`), and the channel unit number (1 to 24) (`frxChUIndex`).

Each channel unit has a built-in test set. While multiple tests can be run simultaneously on different channel units, only one test at a time can be run on a given channel unit.

The test set is indexed by channel bank (`frxBankIndex`) and channel unit (`frxChUIndex`). The table and its elements are used to set up the testing context, to start and stop the test, and to monitor the test results. Before starting the test, make sure the following are set:

- The port that will be tested
- The type of test:
  - Loopback with BERT—Most common test. A loopback is created at the specified downstream location and a bit error rate test (BERT) is run.
  - BERT only—Runs a downstream BERT test (does not put up a loopback).
  - Loopback only—Puts up a loopback at a downstream location (no BERT).
  - Corrupt CRC test—Causes the specified location to generate bad CRCs on the DSL. This refers to ISDN layer 1 CRCs, not Frame Relay/PPP CRCs.
  - All port loopback—All four subscriber ports are locally looped back at the channel unit. Normally not used.
- Location (for loopback and corrupt CRC tests)—Loopbacks can be configured to occur locally, at the CPE, or if applicable, at the intermediate points (such as at BRITE cards). The location parameter is also used to select where the corrupt CRC is generated.
- Channels to loop—Used to specify which channels (B1, B2, or all channels) are looped back for loopback-only test. This should be set for all channels (B1, B2, and D channels).

When the above parameters are set, the test can be started. To start and stop the testing, set the `frxStartTest` element to `startTest (2)` or `stopTest (1)`. The test parameters described above can be changed only while the test is stopped.

Use the `frxTestInProg` element to see if a test is in progress. For BERT tests, you can monitor errors by reading `frxBertBE` and test time by reading `frxBertTestTime`.

