NOKIA

Broadband Systems
D50 Documentation

Volume 4

Provisioning

NOKIA

VOLUME 4   PROVISIONING

Contents

Introduction to D50 Documentation

Introduction D50 documentation provides complete detailed instructions on how to install, test, and commission a D50. This documentation complies with all requirements in Telcordia Technologies Technical Reference documents GR-454 *Generic Requirements for Supplier-Provided Documentation*, and IP-10260 *Standards for Task Oriented Practices (TOPS)*.

Target Audience D50 documentation volumes are written at different levels of detail based on the reader's needs. Below is a list of the various volumes and the intended target audience for each.

Number	Title	Target Audience
Volume 1	General Information	Anyone with a need to understand more about the D50 System and planning requirements.
Volume 2	Installation	Installation and Testing Technicians, and Engineers (Detailed Level Procedures, or DLPs).
Volume 3	Commissioning	Testing Technicians and Engineers (DLPs).
Volume 4	Provisioning	Provisioning Technicians and Engineers (DLPs).
Volume 5	Maintenance and Testing	Maintenance and Testing Technicians and Engineers (DLPs).
Volume 6	Craft Terminal	Testing and Installation Technicians and Engineers (Reference manual for Craft Terminal).

Information Mapping Style All documents are written in Information Mapping style, which presents information in small units or blocks. Each information block is identified by a subject label in the left margin and is separated from the next information block by a horizontal line. Subject labels make it easy for the reader to scan the document and to find information on a specific subject.

Each DLP lists the required equipment and tools to perform the job, and provides step by step instructions (supported by graphics where appropriate) to help the reader perform each task.

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Chapter 1
DMT8a-3 ADSL Provisioning

Introduction

This document describes ADSL provisioning parameters and the operation of the D50 DMT8a-3 line cards. Details are provided on how the DMT8a-3 port adjusts its data rate during the training operational mode.

> **Note:** Additional provisioning information can be located in Appendix A, Provisioning Parameters.

The DMT8a-3 line cards provide eight RADSL (Rate Adaptive Asymmetric DSL) lines using ANSI standard Discrete Multi-Tone (DMT) modulation technique. The cards is compliant to ANSI T1.413 (issue 2) and support both "lite" (G.lite) and "full-rate" (G.dmt) ADSL, provisionable on an individual port basis. Key differences between G.dmt and G.lite are shown in the table below:

Table 1-1: G.lite and G.dmt Differences

	G.lite	**G.dmt**
Splitter required at subscriber?	No	Yes
Transmission rate: Downstream Upstream	up to 1.5 Mbps up to 512 Kbps	up to 8.1 Mbps up to 1024 Kbps
Frequency Spectrum Used Number of Highest Bin Used	25 to 552 kHz 127	25 kHz to 1.1 MHz 256

DMT8a-3 Operational Modes

Each DMT8a-3 line card provides eight ports. DMT8a-3 ports have three basic operational states:

- **Idle Mode.** The DMT8a-3 port transmitter and receiver are "locked" and disabled.
- **Training Mode.** The DMT8a-3 port transmitter and receiver are "unlocked." The DMT8a-3 port is attempting to establish a connection with CPE equipment during the Training mode. Training time is approximately 20 seconds.
- **Data Mode.** The DMT8a-3 port connection is established and payload data is carried.

The signal quality of the ATUR[1] and ATUC channels is determined early in the training process. This is one of the first and most critical steps in the establishment of an ADSL data connection because it determines the data rates that can be supported on a given local loop facility. After the channels are established, their quality, combined with other provisioned settings, determines the actual data rate delivered.

Provisioning Parameters

The following provisioning parameters affect port operation:

Advanced Configuration. This parameter, when set to "Auto," sets the advanced configuration parameters for optimal performance for the selected Operation Mode; this is the recommended setting. When set to "Manual," the advanced configuration parameters must be set manually. The default setting is "Auto."

Maximum and Minimum Fast Path Rates. The DMT8a-3 card provides two methods of transporting data across the ADSL link: **Fast Path** or **Interleaved**. Maximum and minimum data rate parameters are provisioned for both ATUR and ATUC channels in Kbps. When these parameters are set to values other than "0," the Interleaved Path Rate parameters must be set to "0." The range for both the Maximum Rate and the Minimum Rate for ATUR is 64 to 1024 Kbps; the range for both the Maximum Rate and the Minimum Rate for ATUC is 64 to 8128 Kbps. The default setting for Maximum and Minimum for both ATUR and ATUC is "0" (see Maximum and Minimum Interleaved Path rates, below).

Maximum and Minimum Interleaved Path Rates. The DMT8a-3 card provides two methods of transporting data across the ADSL link: **Fast Path** or **Interleaved**. Maximum and minimum Interleaved Path Rate parameters are provisioned for both ATUR and ATUC channels in Kbps. When these parameters are set to values other than "0," the Fast Path Rate parameters must be set to "0." The range for both the Maximum Rate and the Minimum Rate for ATUR is 32 to 1024 Kbps; the default for the maximum setting is 1024, and the default for the minimum setting is 32. The range for both the Maximum Rate and the Minimum Rate for ATUC is 32 to 8128 Kbps; the default for the maximum setting is 8128, and the default for the minimum setting is 32.

The Interleave mode is used to improve burst error performance, and the Fast mode is used for latency sensitive applications. The default system mode is Interleave. This is because the Interleave mode provides a more robust and reliable service under "long reach" conditions.

Interleave Delay. This parameter allows the user to increase or decrease the delay (latency), which increases or decreases the immunity to impulse noise. In general, the lower settings are used for latency-sensitive voice transmissions, and the higher settings are for data. This applies to the Interleaved Path operation only.

Maximum parameters can be set for both ATUC and ATUR. The setting options are 1 mS, 2 mS, 4 mS, 8 mS, 16 mS, 32 mS and 64 mS; the default setting is 16 mS for ATUR, and 32 mS for ATUC.

If the provisioned setting cannot be attained, the parameter is rounded down to the nearest available setting.

Target Noise Margin. This parameter sets the margin used during the Rate Adaptive DSL (RADSL) and Fixed Rate training process. The Target Noise Margin parameter establishes the amount of noise allowed on the line for the channel to operate at

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[1] The terms ADSL Transceiver Unit – Central Office (ATUC) and ADSL Transceiver Unit – Remote (ATUR) are used in DMT ADSL provisioning to describe the DSL port hardware required at both the Central Office and Remote (CPE) ends of the local loop.

10^{-7} BER (Bit Error Rate). A larger margin lowers the rate, but provides greater noise immunity.

- The DMT8a-3 port will train to the maximum data rate supportable on the line, while operating within the provisioned Target Noise Margin parameter, and maintaining the bit error rate at 10^{-7} BER. The actual and provisioned margins should be approximately equal. Any excess channel capacity is used to increase the margin if the port can train to the maximum rate; in this case the actual margin is higher than the provisioned margin.

- Target Noise Margin parameters are provisionable for both ATUR and ATUC. The range is from 0 dB to 16 dB; the default is 6 dB.

RADSL Mode. The DMT8a-3 port supports the following types of RADSL Operation settings for the ATUC channel:

- **None.** Fixed rate training.
- **Startup**. RADSL training at startup. Startup is the default setting.

Selection of fixed rate or RADSL operation and results are displayed in Craft Terminal.

Fixed Rate Training. The DMT8a-3 port trains to the Maximum Rates provisioned for the ATUR and ATUC channels. The port will continue training to the provisioned Fixed Rate until it is successful. An LOS (Loss of Signal) condition is displayed for the port in Craft Terminal until training at the Fixed Rate is successful.

> **Note:** Fixed Rate operation uses the DMT8a-3 parameters that are provisioned for each port.

Rate Adaptive DSL (RADSL) Training. The port measures the quality of the line (allowing for the Noise Margin provisioned for the port) and determines the best RADSL upstream and downstream transmit rates that the line can support during the training process. A Rate Degraded condition is displayed in Craft Terminal if the actual transmit rate is below the provisioned Rate Degraded threshold.

Actual ATUR and ATUC Data Rates are displayed in Craft Terminal.

Operation Mode. This parameter allows the user to set the operational standard for the port. The options are Auto (default), ANSI, G.lite, G.dmt, Alcatel14, ADI, UAWG, and Auto Ansi.

> **Note:** When Auto mode is selected, the system trains to the mode supported by the CPE modem. Refer to the Actuals tab after training is complete to see the actual Operation Mode selected.

FEC (RS Correction). Enables or disables downstream forward error correction (FEC). The default setting is Enable. The default setting for RS Correction timing is 2 mS for the ATUC and 1 mS for the ATUR.

Coding Gain (Auto/Manual). Normal use is "Auto." The default setting is Auto (enabled).

Coding Gain (Manual). Coding gain is the gain due to Trellis coding. Auto coding is normally selected for automatic bit allocation. Range is 0 to 7 dB in 1 dB increments.

Trellis Coding. Enables Trellis Coding, a method of forward error correction in which each signal element is assigned a value based on phase and amplitude to help the receiving modem determine if the element is received in error. Allows the user to meet

performance margin requirements for long loops, or increase the transmission throughput under a specified performance margin; provides increased gain against background and crosstalk noise. Set to Enable or Disable. The default setting is Enable.

Transmit Power Reduction. This ATUC parameter sets the amount to reduce the transmitted power (dB) below the maximum allowed transmit power. The default setting is 0 dB.

Error Retrain Threshold. This ATUC parameter sets the number of near end "errored frames" per second allowed during Data mode before the DMT8a-3 port retrains. The number of Error Retrains are viewed using Craft Terminal. The range is 1 to 60 seconds, and the default is 10; the inactive setting is 0.

FE (Far End) Error Retrain Threshold. This ATUC parameter sets the number of far-end errored frames per second allowed during Data mode before the DMT8a-3 port retrains. The number of FE Error Retrains are viewed using Craft Terminal. The range is 1 to 60 seconds, and the default is 10; the inactive setting is 0.

Rate Degraded Threshold. This is the number of bits per second below the minimum data rate provisioned for the ATUC (downstream) and ATUR (upstream) channels before a Rate Degraded condition is reported to Craft Terminal. If the actual rate is less than or equal to this threshold, a Rate Degraded condition is reported. The default setting is 0.

ACP – This feature is planned for a future release (default is 0).

The following tables provide the ATUR and ATUC Channel Provisioning Parameters.

Table 1-2: ATUR Provisioning Parameters

Parameter	Values	Units	Defaults
Maximum Fast Path Rate[1]	64 – 1024	Kbps	0
Minimum Fast Path Rate	64 – 1024	Kbps	0
Maximum Interleaved Path Rate	32 – 1024	Kbps	1024
Minimum Interleaved Path Rate	32 – 1024	Kbps	32
Target Noise Margin	0 – 16	dB	6
Interleave Delay	1 – 64	mS	16

[1] ATUR Maximum and Minimum Rate values are set in multiples of 32 Kbps.

Table 1-3: ATUC Provisioning Parameters

Parameter	Values	Units	Defaults
Maximum Fast Path Rate[1]	64 – 8128	Kbps	0
Minimum Fast Path Rate[1]	64 – 8128	Kbps	0
Maximum Interleaved Path Rate	32 – 8128	Kbps	8128
Minimum Interleaved Path Rate	32 – 8128	Kbps	32
Target Noise Margin	0 – 16	dB	6
Interleave Delay	1 – 64	mS	32
Error Retrain Threshold	1 – 60	Errors/Sec	10
FE Error Retrain Threshold	1 – 60	Errors/Sec	10

[1] ATUC Maximum and Minimum Rate values are set in multiples of 32 Kbps.

Data Mode   The DMT8a-3 port enters Data mode upon completion of the training process. After the data channel is established, the ATM backplane interface is enabled and payload cells start to flow.

During Data mode the DMT8a-3 port provides actual measurements that result from the training process.

Port Actuals   The DMT8a-3 port can measure channel quality established over the existing telephone copper network (the local loop). The DMT8a-3 port reports actuals for the following operational parameters:

Transmit Rate. The *actual* ATUR and ATUC data rate for the channel; this rate is either fixed or determined by the DMT8a-3 port during the training process. See page 1-3 for more information on the RADSL training process.

Previous Transmit Rate. Recorded upon termination of a successful data transport session; reports the rate according to whether the line is trained or not trained:

- Not Trained – the rate achieved by the most recent successful training.
- Trained – the rate achieved by the most recent successful link-up prior to the current link-up.

Best Transmit Rate. The highest rate the port has linked up at successfully. If it is less than the Transmit Rate after training, the port copies in the Transmit Rate value.

Payload Transmit Rate. The *actual* ATUR and ATUC <u>payload</u> rate for the channel, calculated by subtracting the ATM cell overhead from the Transmit Rate.

Transmit Power. The actual power being transmitted on the channel, measured in dBm.

Noise Margin. The *actual* amount of noise margin measured on the ATUR and ATUC channels. The range is -64.0 dB to +63.5 dB, measured in increments of .5 dB.

Loop Attenuation. The decrease in power of the signal received from the far end over the loop. The range is 0 dB to +63.5 dB, measured increments of .5 dB.

Corrected Errors. The total number of corrected Forward Error Correction (FEC) errors since start-up, or since the last reset.

HEC Errors. The total number of received cells that have Header Error Control (HEC) errors detected in their header.

Training Starts. The total number of times a port has detected the CPE, and attempted to train up with the CPE.

The count will not increment if the CPE is not connected at the other end of the loop. This feature allows the user to determine whether the port cannot train to the CPE, or whether there is no CPE.

Bad Provisioning Status. Provides a short description of the provisioning error. In the case of multiple errors, only one error is displayed; additional errors are displayed as each preceding error is cleared.

The following tables provide details on the ATUR and ATUC performance parameters listed above.

For additional information on actuals, refer to the DMT8a-3 port section in <u>Craft Terminal</u>.

DMT8a-3 Thresholds	The following thresholds are set and viewed using Craft Terminal. The default setting is 0 (zero) or inactive, except where noted:

LOFS Thresholds. Loss of Frame condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The LOFS threshold settings are the number of seconds during which an LOF condition was present. An event is reported to Craft Terminal when the LOFS threshold is crossed.

LOSS Thresholds. Loss of Signal condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The LOSS threshold settings are the number of seconds during which an LOS condition was present. An event is reported to Craft Terminal when the LOSS threshold is crossed.

LPRS Thresholds. Loss of Power condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. LPRS threshold is set to monitor power shutdown signals at the ATUR.

> **Note:** LOF, LOS and LPR conditions are mutually exclusive, and are reported in the following priority:
>
> – If all three conditions are present, LPR is reported.
> – If LOS and LOF are present, LOS is reported.
> – LOF is reported when it is the only condition.

LCDS Thresholds. Loss of Cell Delineation condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. LCDS threshold settings are the number of seconds during which an LCD condition was present. An event is reported to Craft Terminal when the LCDS threshold is crossed.

LOF Retrains. The number of times a port has retrained due to LOF. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the LOF Retrains threshold is crossed.

Error Rate Retrains. The number of times a port has retrained due to excessive Near End errored frames. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. Error Rate Retrains are monitored during all operational modes. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the Error Rate Retrains threshold is crossed.

FE Error Rate Retrains. The number of times a port has retrained due to excessive Far End (FE) errored frames. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. FE Error Rate Retrains are monitored during all operational modes. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the FE Error Rate Retrains threshold is crossed.

Errored Seconds Thresholds. (Near End) Errored Seconds are the cumulative number of seconds the port is in an LOF, LOS, LPR, LCD, or Coding Violation condition. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. Errored Seconds are monitored during all operational modes. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the Errored Seconds threshold is crossed.

FE Errored Seconds Thresholds. Far-End (FE) Errored Seconds are the cumulative number of seconds the port has been in a far-end LOF, LOS, LPR, LCD, or Coding Violation condition. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. FE Errored Seconds are monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the FE Errored Seconds threshold is crossed.

Table 1-4: LOS, LOF, LPR, LCD and Errored Seconds Parameters

Parameter	15-minute Values	Daily Values	Units	Defaults
Loss of Frame (LOF)	1–900	1–86400	Seconds	0
Loss of Signal (LOS)	1–900	1–86400	Seconds	0
Loss of Power (LPR)	1–900	1–86400	Seconds	0
Loss of Cell Delineation (LCD)	1–900	1–86400	Seconds	0
NE and FE Errored Seconds Threshold	1–900	1–86400	Seconds	0

Coding Violation Thresholds. Coding Violation errors are a count of the Cyclic Redundancy Check (CRC) errored frames received for the ATUC unit during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The Coding Violation parameters have thresholds for reporting an event to Craft Terminal.

FE Coding Violations. Far End (FE) Coding Violation errors are a count of the Far-End Block Errors (FEBE) reported by the ATUR to the ATUC during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The FE Coding Violation parameters have thresholds for reporting an event to Craft Terminal.

The following table provides the expected number of ATUC Near and FE Coding Violation (CRC) errors in 15-minute and Daily intervals[2]; they can be used as threshold settings.

> **Note:** The number of expected Coding Violation errors varies based on the data rate. The values in the following table provide guidelines to help establish thresholds.

Table 1-5: ATUC Coding Violation Threshold Settings

Parameters	Threshold Settings based on Data Rates (bps)				Sensitivity to CV Errors
	32000	**64000**	**320000**	**640000**	
Daily Settings	270000	530000	2200000	3500000	Low
	28000	55000	270000	530000	Medium Low
	2800	5600	28000	55000	Medium
	280	560	2800	5600	Medium High
	28	56	280	560	High

Table 1-5: ATUC Coding Violation Threshold Settings (continued)

Parameters	Threshold Settings based on Data Rates (bps)				Sensitivity to CV Errors
	32000	**64000**	**320000**	**640000**	
15-Minute Settings	2800	5500	23000	36000	Low
	290	580	2800	5500	Medium Low
	29	58	290	580	Medium
	3	6	29	58	Medium High
	0	1	3	6	High

Error Alarm Threshold. This ATUC parameter sets the number of near-end errored frames per second allowed during Data mode before an event (alarm) is sent to Craft Terminal.

FE Error Alarm Threshold. This ATUC parameter sets the number of far-end errored frames per second allowed during Data mode before an event (alarm) is sent to Craft Terminal.

Rate Degraded Threshold. This is the number of bits per second below the minimum data rate provisioned for the ATUC (downstream) and ATUR (upstream) channels before a Rate Degraded condition is reported to Craft Terminal. If the actual rate is less than or equal to this threshold, a Rate Degraded condition is reported.

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[2] Coding Violation errors are single bit errors randomly distributed with a mean equal to the Bit Error Rate.

Chapter 2
DMT8a4 ADSL Provisioning

Introduction   This document describes ADSL provisioning parameters and the operation of the D50 DMT8a4 line cards. Details are provided on how the DMT8a4 port adjusts its data rate during the training operational mode.

The DMT8a4 line cards provide eight RADSL (Rate Adaptive Asymmetric DSL) lines using ANSI standard Discrete Multi-Tone (DMT) modulation technique. The cards are compliant with the ANSI T1.413-1998 (Issue 2) and the DSL Forum TR-48 standard for increased loop performance. The DMT8a4 cards support both "lite" ADSL (G.lite, corresponding to the G.992.2 ITU-T ADSL standard) and "full-rate" ADSL (G.dmt, corresponding to the G.992.1 ITU-T ADSL standard). The "lite" and "full rate" ADSL is spectrally compatible as defined in the E1 T1.4 Spectral Compatibility Standard Draft. The DMT8a4 ports are provisionable on an individual port basis. The G.hs (handshake) standard is used during the modem's startup sequences.

Key differences between G.dmt and G.lite are shown in the following table:

Table 1-6: G.lite and G.dmt Differences

	G.lite	**G.dmt**
Splitter required at subscriber?	No	Yes

Transmission rate:
    Downstream
    Upstream
	up to 1536 Kbps
	up to 512 Kbps
		up to 8160 Kbps
		up to 896 Kbps

Frequency Spectrum Used Number of Highest Bin Used	25 to 552 kHz 127	25 kHz to 1.1 MHz 255

Note: Additional provisioning information are available in Appendix A, Provisioning Parameters.

DMT8a4 Operational Modes	Each DMT8a4 line card provides eight ports. DMT8a4 ports have three basic operational states:

Each DMT8a4 line card provides eight ports. DMT8a4 ports have three basic operational states:

- **Idle Mode.** The DMT8a4 port transmitter and receiver are "locked" and disabled.
- **Training Mode.** The DMT8a4 port transmitter and receiver are "unlocked." The DMT8a4 port is attempting to establish a connection with CPE equipment during the Training mode. Training time is approximately 20 seconds.
- **Data Mode.** The DMT8a4 port connection is established and payload data is carried.

The signal quality of the ATUR[1] and ATUC channels is determined early in the training process. This is one of the first and most critical steps in the establishment of an ADSL data connection because it determines the data rates that can be supported on a given local loop facility. After the channels are established, their quality, combined with other provisioned settings, determines the actual data rate delivered.

Provisioning Rate and DMT Parameters

The following provisioning parameters affect port operation:

Maximum and Minimum Fast Path Rates. The DMT8a4 card provides two methods of transporting data across the ADSL link: **Fast Path** or **Interleaved**. When these parameters are set to values other than "0," the Interleaved Path Rate parameters must be set to "0." Maximum and minimum ATUC Fast Path rates are "8160" and "32" Kbps, respectively. Maximum and minimum ATUR Fast Path data rates are "896" and "32" Kbps, respectively. The Fast Path rate fields display a default of "0" since Interleave rates are enabled by default.

Maximum and Minimum Interleaved[2] Path Rates. The DMT8a4 card provides two methods of transporting data across the ADSL link: **Fast Path** or **Interleaved**. Maximum and minimum Interleaved Path Rate parameters are provisioned for both ATUR and ATUC channels in Kbps. When these parameters are set to values other than "0," the Fast Rate parameters must be set to "0." Maximum and minimum ATUC Interleave rates are "8160" and "32" Kbps, respectively. Maximum and minimum ATUR Interleave data rates are "896" and "32" Kbps, respectively. These rates are also the defaults.

The Interleave mode is used to improve burst error performance, and the Fast Path mode is used for latency sensitive applications. The default system mode is **Interleave**. This is because the Interleave mode provides a more robust and reliable service under "long reach" conditions.

Error Retrain Threshold. This ATUC parameter sets the number of near end "errored frames" per second allowed during Data mode before the DMT8a4 port retrains. The number of Error Retrains are viewed using Craft Terminal. The range is 1 to 60 seconds, and the default is "10"; the inactive setting is "0".

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[1] The terms ADSL Transceiver Unit – Central Office (ATUC) and ADSL Transceiver Unit – Remote (ATUR) are used in DMT ADSL provisioning to describe the DSL port hardware required at both the Central Office and Remote (CPE) ends of the local loop.

[2] The DMT8a4 line card also supports speeds up to 10.8 Mbps in 32 Kbps increments in Interleave Mode based on "S=1/2" from the ITU-T G992.1 standard, when used in conjunction with an "S=1/2"-compliant CPE.

Far End Error Retrain Threshold. This ATUC parameter sets the number of far-end errored frames per second allowed during Data mode before the DMT8a4 port retrains. The number of FE Error Retrains are viewed using Craft Terminal. The range is 1 to 60 seconds, and the default is "10"; the inactive setting is "0".

Error Alarm Threshold. This ATUC parameter sets the number of near-end errored frames per second allowed during Data mode before an event (alarm) is sent to Craft Terminal.

Far End Error Alarm Threshold. This ATUC parameter sets the number of far-end errored frames per second allowed during Data mode before an event (alarm) is sent to Craft Terminal.

Rate Degraded Threshold. This is the number of bits per second below the minimum data rate provisioned for the ATUC (downstream) and ATUR (upstream) channels before a Rate Degraded condition is reported to Craft Terminal. If the actual rate is less than or equal to this threshold, a Rate Degraded condition is reported. The default setting is "0".

RADSL Mode. The DMT8a4 port supports the following types of RADSL Operation settings for the ATUC channel:

- **None.** Fixed rate training.
- **Startup**. RADSL training at startup. "Startup" is the default setting.

Selection of fixed rate or RADSL operation and results are displayed in Craft Terminal.

Fixed Rate Training. The DMT8a4 port trains to the Maximum Rates provisioned for the ATUR and ATUC channels. The port will continue training to the provisioned Fixed Rate until it is successful. An LOS (Loss of Signal) condition is displayed for the port in Craft Terminal until training at the Fixed Rate is successful.

> **Note:** Fixed Rate operation uses the DMT8a4 parameters that are provisioned for each port.

Rate Adaptive DSL (RADSL) Training. The port measures the quality of the line (allowing for the Noise Margin provisioned for the port) and determines the best RADSL upstream and downstream transmit rates that the line can support during the training process. A Rate Degraded condition is displayed in Craft Terminal if the actual transmit rate is below the provisioned Rate Degraded threshold.

Actual ATUR and ATUC Data Rates are displayed in Craft Terminal.

ATUC Advanced Configuration. This parameter, when set to **Auto** sets the advanced configuration parameters for optimal performance for the system-selected ATUC Operation Mode. "Auto" is the default and recommended setting. When set to **Manual**, the advanced configuration parameters of **ATUC Operation Mode**, **Bitswap** and **Trellis** must be set manually.

ATUC Operation Mode. This parameter allows the user to set the operational standard for the port. The supported options are "Auto" (default), "G.lite", and "G.dmt".

> **Note:** When "Auto" mode is selected, the system trains to the mode supported by the CPE modem. Refer to the **Actuals** tab after training is complete to see the actual operation mode selected.

Trellis Coding. Enables Trellis Coding, a method of forward error correction in which each signal element is assigned a value based on phase and amplitude to help the receiving modem determine if the element is received in error. Allows the user to meet performance margin requirements for long loops, or increase the transmission throughput under a specified performance margin; provides increased gain against background and crosstalk noise. Set to Enable or Disable. The default setting is "Enable".

Bitswap. This parameter allows you to enable or disable bitswapping. Bitswapping allows you to manage bit allocation during data mode to adapt to changing line conditions to help maintain an acceptable level of noise margin for each bin. Bitswapping does not dynamically change the data rate. Bit allocations are "swapped" from a bin with a degraded margin to one with a high margin.

Target Noise Margin. This parameter sets the margin used during the Rate Adaptive DSL (RADSL) Startup and Fixed Rate training process. The Target Noise Margin parameter establishes the amount of noise allowed on the line for the channel to operate at 10^{-7} BER (Bit Error Rate). A larger margin lowers the rate, but provides greater noise immunity.

- The DMT8a4 port will train to the maximum data rate supportable on the line, while operating within the provisioned Target Noise Margin parameter, and maintaining the bit error rate at 10^{-7} BER. The actual and provisioned margins should be approximately equal. Any excess channel capacity is used to increase the margin if the port can train to the maximum rate; in this case the actual margin is higher than the provisioned margin.

- Target Noise Margin parameters are provisionable for both ATUR and ATUC. The range is from 0 dB to 16 dB; the default is "6 dB".

Transmit Power Reduction. This ATUC parameter sets the amount to reduce the transmitted power (dB) below the maximum allowed transmit power. The default setting is "0 dB".

The following tables provide the ATUR and ATUC Channel Provisioning Parameters.

Table 1-7: ATUR Provisioning Parameters

Parameter	Values	Units	Defaults
Maximum Fast Path Rate[1]	32 – 896	Kbps	0
Minimum Fast Path Rate	32 – 896	Kbps	0
Maximum Interleaved Path Rate	32 – 896	Kbps	896
Minimum Interleaved Path Rate	32 – 896	Kbps	32
Target Noise Margin	0 – 16	dB	6

[1] ATUR Maximum and Minimum Rate values are set in multiples of 32 Kbps.

Table 1-8: ATUC Provisioning Parameters

Parameter	Values	Units	Defaults
Maximum Fast Path Rate[1]	32 – 8160	Kbps	0
Minimum Fast Path Rate[1]	32 – 8160	Kbps	0
Maximum Interleaved Path Rate[2]	32 – 8160	Kbps	8160
Minimum Interleaved Path Rate	32 – 8160	Kbps	32
Target Noise Margin	0 – 16	dB	6
Error Retrain Threshold	1 – 60	Errors/Sec	10
FE Error Retrain Threshold	1 – 60	Errors/Sec	10

[1] ATUC Maximum and Minimum Rate values are set in multiples of 32 Kbps.

[2] The DMT8a4 line card also supports speeds up to 10.8 Mbps in 32 Kbps increments in Interleave Mode based on "S=1/2" from the ITU-T G992.1 standard, when used in conjunction with an "S=1/2"-compliant CPE.

Data Mode   The DMT8a4 port enters Data mode upon completion of the training process. After the data channel is established, the ATM backplane interface is enabled and payload cells start to flow.

During Data mode the DMT8a4 port provides actual measurements that result from the training process.

Provisioning DMT8a4 Thresholds

The following thresholds are set and viewed using Craft Terminal. The default setting is "0" (zero) or inactive, except where noted:

LOF Seconds Thresholds. Loss of Frame condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The LOFS threshold settings are the number of seconds during which an LOF condition was present. An event is reported to Craft Terminal when the LOFS threshold is crossed.

LOS Seconds Thresholds. Loss of Signal condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The LOSS threshold settings are the number of seconds during which an LOS condition was present. An event is reported to Craft Terminal when the LOSS threshold is crossed.

LPR Seconds Thresholds. Loss of Power condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. LPRS threshold is set to monitor power shutdown signals at the ATUR.

> **Note:** LOF, LOS and LPR conditions are mutually exclusive, and are reported in the following priority:
> – If all three conditions are present, LPR is reported.
> – If LOS and LOF are present, LOS is reported.
> – LOF is reported when it is the only condition.

LCD Seconds Thresholds. Loss of Cell Delineation condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. LCDS threshold settings are the number of seconds during which an LCD condition was present. An event is reported to Craft Terminal when the LCDS threshold is crossed.

LOF Retrains. The number of times a port has retrained due to LOF. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the LOF Retrains threshold is crossed.

Error Rate Retrains. The number of times a port has retrained due to excessive Near End errored frames. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. Error Rate Retrains are monitored during all operational modes. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the Error Rate Retrains threshold is crossed.

Far End Error Rate Retrains. The number of times a port has retrained due to excessive Far End (FE) errored frames. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. FE Error Rate Retrains are monitored during all operational modes. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the FE Error Rate Retrains threshold is crossed.

Coding Violation Thresholds. Coding Violation errors are a count of the Cyclic Redundancy Check (CRC) errored frames received for the ATUC unit during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The Coding Violation parameters have thresholds for reporting an event to Craft Terminal.

FE Coding Violations. Far End (FE) Coding Violation errors are a count of the Far-End Block Errors (FEBE) reported by the ATUR to the ATUC during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. The FE Coding Violation parameters have thresholds for reporting an event to Craft Terminal.

The following table provides the expected number of ATUC Near and FE Coding Violation (CRC) errors in 15-minute and Daily intervals[3]; they can be used as threshold settings.

Note: The number of expected Coding Violation errors varies based on the data rate. The values in the following table provide guidelines to help establish thresholds.

Table 1-9: ATUC Coding Violation Threshold Settings

Parameters	Threshold Settings based on Data Rates (bps)				Sensitivity to CV Errors
	32000	**64000**	**320000**	**640000**	
Daily Settings	270000	530000	2200000	3500000	Low
	28000	55000	270000	530000	Medium Low
	2800	5600	28000	55000	Medium
	280	560	2800	5600	Medium High
	28	56	280	560	High
15-Minute Settings	2800	5500	23000	36000	Low
	290	580	2800	5500	Medium Low
	29	58	290	580	Medium
	3	6	29	58	Medium High
	0	1	3	6	High

Errored Seconds Thresholds. (Near End) Errored Seconds are the cumulative number of seconds the port is in an LOF, LOS, LPR, LCD, or Coding Violation condition. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. Errored Seconds are monitored during all operational modes. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the Errored Seconds threshold is crossed.

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[3] Coding Violation errors are single bit errors randomly distributed with a mean equal to the Bit Error Rate.

Far End Errored Seconds Thresholds. Far-End (FE) Errored Seconds are the cumulative number of seconds the port has been in a far-end LOF, LOS, LPR, LCD, or Coding Violation condition. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. FE Errored Seconds are monitored during Data mode. Daily and 15-minute thresholds can be set for the ATUC unit. An event is reported to Craft Terminal when the FE Errored Seconds threshold is crossed.

Table 1-10: LOS, LOF, LPR, LCD and Errored Seconds Parameters

Parameter	15-minute Values	Daily Values	Units	Defaults
Loss of Frame (LOF)	1–900	1–86400	Seconds	0
Loss of Signal (LOS)	1–900	1–86400	Seconds	0
Loss of Power (LPR)	1–900	1–86400	Seconds	0
Loss of Cell Delineation (LCD)	1–900	1–86400	Seconds	0
NE and FE Errored Seconds Threshold	1–900	1–86400	Seconds	0

Error Alarm Threshold. This ATUC parameter sets the number of near-end errored frames per second allowed during Data mode before an event (alarm) is sent to Craft Terminal.

Far End Error Alarm Threshold. This ATUC parameter sets the number of far-end errored frames per second allowed during Data mode before an event (alarm) is sent to Craft Terminal.

Rate Degraded Threshold. This is the number of bits per second below the minimum data rate provisioned for the ATUC (downstream) and ATUR (upstream) channels before a Rate Degraded condition is reported to Craft Terminal. If the actual rate is less than or equal to this threshold, a Rate Degraded condition is reported.

Viewing Port Actuals

The DMT8a4 port can measure channel quality established over the existing telephone copper network (the local loop). The DMT8a4 port reports actuals for the following operational parameters:

Transmit Rate. The *actual* ATUR and ATUC <u>data</u> rate for the channel; this rate is either fixed or determined by the DMT8a4 port during the training process. See page 1-13 for more information on the RADSL training process.

Previous Transmit Rate. Recorded upon termination of a successful data transport session; reports the rate according to whether the line is trained or not trained:

- Not Trained – the rate achieved by the most recent successful training.
- Trained – the rate achieved by the most recent successful link-up prior to the current link-up.

Best Transmit Rate. The highest rate the port has linked up at successfully. If it is less than the Transmit Rate after training, the port copies in the Transmit Rate value.

Payload Transmit Rate. The *actual* ATUR and ATUC <u>payload</u> rate for the channel, calculated by subtracting the ATM cell overhead from the Transmit Rate.

Transmit Power. The actual power being transmitted on the channel, measured in dBm.

Noise Margin. The *actual* amount of noise margin measured on the ATUR and ATUC channels. The range is -64.0 dB to +63.5 dB, measured in increments of .5 dB.

Loop Attenuation. The decrease in power of the signal received from the far end over the loop. The range is 0 dB to +63.5 dB, measured increments of .5 dB.

Maximum Achievable Rate. The maximum transmit rate that is possible on the line. It may be greater than the maximum provisioned rate, or equal to the maximum provisioned rate if the line is not limited.

Best Maximum Achievable Rate. The best of the Maximum Achievable Rates since the card was reset. If it is less than the Maximum Achievable Transmit Rate after training, the port copies the Maximum Achievable Transmit Rate value.

Cells Received. The number of valid, non-idle cells "received" on the line card port from the CPE and sent on to the LSM card since the card was reset.

Cells Transmitted. The number of valid, non-idle cells received from the LSM card and "transmitted" to the CPE since the card was reset.

Operation Mode. The actual operation mode, whether G.dmt or G.lite.

Corrected Errors. The total number of corrected Forward Error Correction (FEC) errors since start-up, or since the last reset.

HEC Errors. The total number of received cells that have Header Error Control (HEC) errors detected in their header.

Training Starts. The total number of times a port has detected the CPE, and attempted to train up with the CPE.

The count will not increment if the CPE is not connected at the other end of the loop. This feature allows the user to determine whether the port cannot train to the CPE, or whether there is no CPE.

Bad Provisioning Status. Provides a short description of the provisioning error. In the case of multiple errors, only one error is displayed; additional errors are displayed as each preceding error is cleared.

S (DMT symbols/RS Codeword). The number of symbols per RS codeword.

For additional information on actuals, refer to the DMT8a4 port section in Craft Terminal.

Chapter 3
SDSL8 Provisioning

Introduction   This document describes the Symmetrical DSL (SDSL) provisioning parameters and operation of the D50 SDSL8 line card. Details are provided on how the SDSL8 port establishes its data rate during the "training" operational mode.

> **Note:** Additional provisioning information can be located in Appendix A, Provisioning Parameters.

The SDSL8 line card uses 2B1Q (2 Binary, 1 Quaternary) line encoding. This is a DSL line encoding technique that uses four variations in amplitude and polarity to represent two bits. The SDSL8 line card uses the entire frequency spectrum for data transmission—unlike the ADSL line cards, which can carry both data and analog voice transmissions. The SDLS8 line card supports a data rate of up to 1.536^1 Mbps (1536 Kbps).

SDSL8 Operational Modes   The SDSL8 line card has eight ports. Each port has three basic operational modes: Idle, Training, and Data. These operational modes are defined as follows:

- **Idle.** The SDSL8 port transmitter and receiver are "locked" or disabled.
- **Training.** The SDSL8 port transmitter and receiver are "unlocked." The port attempts to establish a connection with the CPE.
- **Data.** The SDSL8 port connection to the CPE is established, and payload data is carried.

ATUC and ATUR Terminology   The terms ADSL Transceiver Unit – Central Office (ATUC) and ADSL Transceiver Unit – Remote (ATUR) are used in SDSL provisioning to describe the DSL port hardware required at both the Central Office and Remote (CPE) ends of the local loop.

Signal Quality Measurements   The SDSL8 port has the functionality to measure channel "quality" established over the existing telephone copper network—the "local loop." Actual signal quality parameters provided by the SDSL8 port include:

- **Noise Margin** is the maximum tolerable increase in external noise power allowed on the line for the port to operate at 10^{-7} BER. The Noise Margin is measured in dB—it has a direct effect on the maximum local loop length supported for a provisioned fixed ATUC/ATUR data rate.
- **Loop Attenuation** is the overall signal power attenuation or "decrease in power of the DSL signal" over the local loop. Power Attenuation is expressed in dB.

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[1] Hardware Release 5.0 or earlier SDSL8 line cards support data rates of only up to 1.152 Mbps.

- **Transmit Power** is the power level at which data is being transmitted, measured in dBm.
- **Transmit Rate** is the <u>actual</u> data rate for the ATUC unit, measured in bits per second.

The actual measurements are displayed in Craft Terminal[2].

Other Reported Actuals

Bad Provisioning Status, one of the actuals provided by the SDSL8 port, displays details on specific provisioning problems.

Other actuals include: Payload Transmit Rate, Received Blocks, Transmitted Blocks, Cells Received, Cells Transmitted, and Vendor ID. These actual signal quality parameter measurements are displayed in Craft Terminal[3].

SDSL8 Port Data Rates

Maximum Rate. The ATUC Maximum data rate is provisionable for the SDSL8 card. The setting options are 192, 384, 768, 1152, and 1536 Kbps.

> **Note:** The 1536 Kbps rate is supported by Hardware Rev. 5.0 or later SDSL8 line cards on a D50 system running Software Release 5.0 or later and is available only if the CPE supports it.

The following ATUC data rate selections are used during the SDSL8 port training process based on the provisioned maximum data rate. The SDSL8 port trains to a fixed data rate (192, 384, 768, 1152, or 1536 Kbps) based on the provisioned rate. The SDSL8 port will train down to the next lower fixed data rate if the provisioned rate is <u>less than</u> the next higher data rate. For example: If the user enters a provisioned data rate of 200 Kbps, the SDSL8 port will train down to 192 Kbps. The default setting is 384 Kbps.

Table 1-11: ATUC Provisioned and Actual Data Rates

Provisioned Rates (Kbps)	Actual Rates (Kbps)
0 – 383	192
384 – 767	384
768 – 1151	768
1152 – 1535	1152
1536 and above	1536

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[2]

[3]

The time required for the SDSL8 port to train to its provisioned data rate changes proportionately; approximate training times[4] are as follows:

Table 1-12: Approximate Training Times in the Fixed Mode

Provisioned Rates (Kbps)	Training Time[1] (Seconds)
1536	26
1152	28
768	30
384	42
192	64

[1] This excludes hunt time.

Rate Degraded. The Rate Degraded threshold rate should be set at or below the ATUC provisioned rate. When the actual transmission rate drops below this rate, a Rate Degraded condition is generated in Craft Terminal. The default setting is "0" (zero).

Training Mode   The SDSL8 card supports two training modes:
- Fixed
- AutoBaud Pre-Activation Rate Negotiation

Fixed Training Mode.

In the Fixed mode, the CO (ATUC) is set at the provisioned fixed rate. The CPE enters the "hunting" mode. It attempts to train to each of the 5 fixed rates of 192, 384, 768, 1152, and 1536 Kbps, starting with its base rate[5], until it reaches and can synchronize with the port at the provisioned rate. A Loss of Signal (LOS) condition is displayed during hunting mode. If the CPE cannot train to the provisioned rate, no link is established with the port, and the LOS condition remains.

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[4] SDSL8 port training times will vary depending on the condition of the local copper loop and the CPE device.

[5] The base rate varies among different CPE units.

AutoBaud[6] Pre-Activation Rate Negotiation Training Mode.

The AutoBaud Pre-Activation Rate Negotiation training mode is applicable only to Release 6.0 and above and works only with compatible CPE that supports AutoBaud.

This mode establishes a simple communication channel prior to synchronization between the SDSL8 port and the CPE. This channel is established very fast since it requires only a two-level signal. This initial connection takes about 30 seconds regardless of the provisioned data rate. The port then transmits the provisioned data rate to the CPE over the pre-activation channel. The CPE attempts to train at the provisioned data rate. If successful, the port and the CPE synchronize, and data is transferred at the provisioned rate. If unsuccessful, the ATUC uses the AutoBaud algorithm, estimates the loop quality and decides on the optimal data rate. Autobaud suggests only the rates within the provisioned minimum and maximum range. The optimal data rate is communicated to the CPE over the pre-activation channel for the new training attempt.The AutoBaud algorithm uses only 11 data rates.

The benefits of this mode include accelerated training speeds, direct communication of the provisioned or optimal data rate, automatic detection of the maximum data rate supported on the loop, and negotiation of the best speed within the provisioned data rates.

The following table provides a comparative chart of two sample data rates of 192 and 1536 Kbps in different training modes to illustrate the time efficiency of the AutoBaud Pre-Activation Rate Negotiation mode. The training times are approximate.

Table 1-13: Example of Training Times in Different Modes[1]

Training Mode	192 Kbps			1536 Kbps		
	Initiating	Training	Total	Initiating	Training	Total
AutoBaud Pre-Activation Rate Negotiation	30 secs. constant.	64 secs.	94 secs.	30 secs. constant.	26 secs.	56 secs.
Fixed (Hunt)	Variable hunting time.	64 secs.	Depending on the CPE hunting algorithm, up to 15 minutes.	Variable hunting time.	26 secs.	Depending on the CPE hunting algorithm, up to 15 minutes.

[1] This example uses sample data rates.

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[6] 'AutoBaud' is a set of drivers available on SDSL devices to promote inter-operability.

D50 and AutoBaud Pre-Activation Rate Negotiation Compatibility

The AutoBaud Pre-Activation Rate Negotiation training mode works with D50 Release 6.0 and above. It requires an AutoBaud Pre-Activation Rate Negotiation compatible CPE. Differences in the capabilities result in the following situation:

SDSL8 port with AutoBaud incompatible CPE. If an AutoBaud Pre-Activation Rate Negotiation incompatible CPE is connected to an SDSL8 port, the port detects that the CPE is incompatible and reverts to the Fixed mode. In this case, to maintain backward compatibility with older CPE devices, the maximum allowable data rate is 1536 Kbps.The SDSL8 port performs a maximum of 24 consecutive attempts in the Fixed mode. If the training is not successful, the port reverts to the AutoBaud Pre-Activation Rate Negotiation mode.

Data Mode

The SDSL8 port enters Data mode after it has completed the training process and a connection is established with the CPE; the line card software waits for frame acquisition to determine that the data channel is established. Once the data channel is established, the ATM backplane interface is turned on and payload cells start to flow.

During Data mode the SDSL8 port provides:

- "Actual" measurements as a result of the training process.
- Continuous real time measurement of Noise Margin indicating signal quality.

See **Signal Quality Measurements, page 1-21** for detailed information about performance actuals provided by the SDSL8 port.

Threshold Settings

The following thresholds can be set and viewed in Craft Terminal for any SDSL card; an event is reported when a threshold is crossed:

Loss of Frame (LOF) Seconds. The LOF Threshold setting is the number of seconds during which an LOF condition was present. Loss of Frame condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default threshold setting is "0" (zero) or inactive. The LOF thresholds <u>do not</u> affect SDSL port operation.

Loss of Signal (LOS) Seconds. The LOS Threshold setting is the number of seconds during which an LOS condition was present. Loss of Signal condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default threshold setting is "0" (zero) or inactive. The LOS thresholds <u>do not</u> affect SDSL port operation.

Loss of Frame (LOF) Retrains. The LOF Threshold setting is the number of times a port will retrain due to LOF. Loss of Frame condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default threshold setting is "0" (zero) or inactive. An event is reported to Craft Terminal when the LOF Retrains threshold is crossed. The LOS thresholds <u>do not</u> affect SDSL port operation.

Errored Seconds (ES). Errored Seconds is the cumulative number of seconds the port is in an LOF, LOS, or CV condition. Errored Seconds are monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC (Near) and ATUR (Far) units. The default threshold setting is "0" (zero) or inactive. The Errored Seconds thresholds <u>do not</u> affect SDSL port operation.

Coding Violations (CV). The SDSL8 line card counts Coding Violation (CV) Errors for both the ATUC and ATUR units during Data mode. The default threshold setting is "0" (zero) or inactive. The CV thresholds <u>do not</u> affect SDSL port operation.

■ Coding Violation (CV) Threshold—15 min: This parameter is a count of Cyclic Redundancy Check (CRC) errored frames received.

■ Coding Violation (CV) Threshold—Daily: This parameter is a count of Cyclic Redundancy Check (CRC) errored frames received.

The following table provides expected number of Coding Violation errors in 15 minute and Daily intervals.[7] These numbers can be used as threshold settings. The number of expected Coding Violation errors varies on the data rate.

Table 1-14: Coding Violation Threshold Settings

Data Rate (Kbps)	192	384	768	1152	1536	Sensitivity to CV Errors
Daily Settings	163055	326110	652220	978330	1304440	Low
	16560	33120	66241	99361	132481	Medium Low
	1659	3317	6634	9952	13269	Medium
	166	332	664	995	1327	Medium High
	17	33	66	100	133	High
15 Min Settings	1698	3397	6794	10191	13588	Low
	173	345	690	1035	1380	Medium Low
	17	35	69	104	138	Medium High
	2	3	7	10	14	High

SDSL8 Performance Counts

The SDSL8 card counts Performance items during Data mode. The SDSL8 line card maintains fourteen counters for each of these performance items; the count begins when the card powers up:

– Previous Day.

– Current Day.

– Current 15 Minute Interval.

– Previous 15 Minute Intervals (up to eleven Previous 15 Minute Intervals).

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[7] Coding Violation errors are single bit errors randomly distributed with a mean equal to the Bit Error Rate.

The SDSL8 line card counts:

- **LOF Failures** – Loss of Frame errors since line card reset, or since the physical performance monitoring data was cleared.

- **LOS Failures** – Loss of Signal errors since line card reset, or since the physical performance monitoring data was cleared. An LOS condition takes precedence over an LOF condition.

- **Loss of Frame (LOF) Seconds** – The number of seconds in a Loss of Frame (LOF) condition.

- **Loss of Signal (LOS) Seconds** – The number of seconds in a Loss of Signal (LOS) condition.

- **Loss of Frame (LOF) Retrains** – Counts the number of retrains due to Loss of Frame (LOF).

- **Errored Seconds** – The cumulative number of seconds the port is in an LOF, LOS, and CV condition.

- **Coding Violations** – Counts the number of Cyclic Redundancy Check (CRC) errored frames received[8].

- **FE Errored Seconds** – Total number of seconds the far end detected frame CRC errors since line card reset, or since the physical performance monitoring data was cleared.

- **FE Coding Violations** – Coding violations detected by the far end since line card reset, or since the physical performance monitoring data was cleared.

- **Cells Received** – The number of valid, non-idle cells "received" on the line card port from the CPE and sent on to the LSM card.

- **Cells Transmitted** – The number of valid, non-idle cells received from the LSM card and "transmitted" to the CPE.

- **Header Error Control (HEC) Errors** – The number of received cells that have HEC errors detected in their header.

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[8] ATUR Coding Violations are measured in Far End Block Error (FEBE). FEBE is the number of "received" frames that contain an FEBE bit set. The receiver end sets the FEBE when it "receives" a CRC error frame. The FEBE is cleared in the next frame it transmits.

Chapter 4
SDSL8+ Provisioning

Introduction
This document describes the provisioning parameters and operation of the D50 SDSL8+ (Symmetrical DSL) line card. Details are provided on how the SDSL8+ port establishes its data rate during the "training" operational mode.

> **Note:** Additional provisioning information is available in Appendix A, Provisioning Parameters.

As with SDSL8 line cards, SDSL8+ line cards use 2B1Q (2 Binary, 1 Quaternary) line encoding. This is a DSL line encoding technique that uses four variations in amplitude and polarity to represent two bits. Unlike the ADSL line cards which can carry both data and analog voice transmissions, SDSL8+ line cards use the entire frequency spectrum for data transmission.

> **Note:** The SDSL8+ card can be installed only on a Release 6.0 or above D50 system.

SDSL8+ Card Features
In addition to retaining SDSL8 line card functionality, the SDSL8+ card provides the following new feature.

> **Note:** SDSL8+ features are available only with compatible CPE.

Variable data rate range in 8 Kbps increments. The SDSL8+ line card allows provisioning of 273 data rates within a range of 144 to 2320 Kbps in 8 Kbps increments. The default data rate is 384 Kbps. In comparison, the SDSL8 card allows five specific data rates of 192, 384, 768, 1152, and 1536 Kbps.

SDSL8+ Operational Modes
The SDSL8+ card has eight ports. Each port has three basic operational modes: Idle, Training, and Data. These operational modes are defined as follows:

- **Idle.** The SDSL8+ port transmitter and receiver are "locked" or disabled.
- **Training.** The SDSL8+ port transmitter and receiver are "unlocked." The port attempts to establish a connection with the CPE.
- **Data.** The SDSL8+ port connection to the CPE is established, and payload data is carried.

ATUC and ATUR Terminology	The terms ADSL Transceiver Unit – Central Office (ATUC) and ADSL Transceiver Unit – Remote (ATUR) are used in SDSL provisioning to describe the DSL port hardware required at both the Central Office and Remote (CPE) ends of the local loop.

Signal Quality Measurements	The SDSL8+ port has the functionality to measure channel "quality" established over the existing telephone copper network—the "local loop." Actual signal quality parameters provided by the SDSL8+ port include:

- **Noise Margin** is the maximum tolerable increase in external noise power allowed on the line for the port to operate at 10^{-7} BER. The Noise Margin is measured in dB—it has a direct effect on the maximum local loop length supported for a provisioned fixed ATUC/ATUR data rate.

- **Loop Attenuation** is the overall signal power attenuation or "decrease in power of the DSL signal" over the local loop. Power Attenuation is expressed in dB.

- **Transmit Power** is the power level at which data is being transmitted, measured in dBm.

- **Transmit Rate** is the <u>actual</u> data rate for the ATUC unit.

These actual signal quality parameter measurements are displayed in Craft Terminal[1].

Other Reported Actuals	**Bad Provisioning Status**, one of the actuals provided by the SDSL8+ port, displays details on specific provisioning problems. Other actuals include: Payload Transmit Rate, Received Blocks, Transmitted Blocks, Cells Received, Cells Transmitted, and Vendor ID.

SDSL8+ Port Data Rates	**Maximum Rate.** The ATUC Maximum data rate can be provisioned for the SDSL8+ card. The setting options are in the range of 144 to 2320 Kbps in 8 Kbps increments. The SDSL8+ port will train down to the next lower, fixed data rate if the provisioned rate is <u>less than</u> the next higher data rate. For example: if a user enters a provisioned data rate of 195 Kbps, the SDSL8+ port will train down to 192 Kbps. The default setting is 384 Kbps. The time required for an SDSL8+ port to train to its provisioned data rate changes proportionately. Approximate training times[2] for some sample data rates (after the CPE has synchronized with the port at the provisioned data rate) are as follows:

Table 1-15: Approximate Training Times in the Fixed Mode

Provisioned Rates[1] (Kbps)	Training Time[2] (Seconds)
2320	24
1536	26

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[1]

[2] SDSL8+ port training times will vary depending on the condition of the local copper loop and the CPE device.

Table 1-15: Approximate Training Times in the Fixed Mode (continued)

Provisioned Rates[1] (Kbps)	Training Time[2] (Seconds)
1152	28
768	30
384	42
192	64
144	78

[1] This table uses sample data rates.

[2] This excludes hunt time.

Rate Degraded. The Rate Degraded threshold rate should be set at or below the ATUC provisioned rate. When the actual transmission rate drops below this rate, a Rate Degraded condition is generated in Craft Terminal. The default setting is "0" (zero).

Training Mode   The SDSL8+ card supports two training modes: Fixed, and AutoBaud Pre-Activation Rate Negotiation.

Fixed. In the Fixed mode, the ATUC is set at the provisioned fixed rate. The CPE enters the "hunting" mode. It attempts to train to each of the 5 fixed rates of 192, 384, 768, 1152, and 1536 Kbps, starting with its base rate[3], until it reaches and can synchronize with the port at the provisioned rate. A Loss of Signal (LOS) condition is displayed during hunting mode. If the CPE cannot train to the provisioned rate, no link is established with the port, and the LOS condition remains.

AutoBaud[4] Pre-Activation Rate Negotiation. The AutoBaud Pre-Activation Rate Negotiation training mode is available with D50 Release 6.0 and above, and works only with an AutoBaud Pre-Activation Rate Negotiation compatible CPE that supports AutoBaud. This mode establishes a simple communication channel prior to synchronization between the SDSL8+ port and the CPE. This channel is established very fast since it requires only a two-level signal. This initial connection takes about 30 seconds regardless of the provisioned data rate. The port then transmits the provisioned data rate to the CPE over the pre-activation channel. The CPE attempts to train at the provisioned data rate. If successful, the port and the CPE synchronize, and data is transferred at the provisioned rate. If unsuccessful, the ATUC uses the AutoBaud algorithm, estimates the loop quality and decides on the optimal data rate. Autobaud suggests only the rates within the provisioned minimum and maximum range. The optimal data rate is communicated to the CPE over the pre-activation channel for the new training attempt. The AutoBaud algorithm uses only 11 data rates.

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[3] The base rate varies among different CPE units.

[4] 'AutoBaud' is a set of drivers available on SDSL devices to promote inter-operability.

The benefits of this mode include: accelerated training speeds, direct communication of the provisioned or optimal data rate, automatic detection of the maximum data rate supported on the loop, and negotiation of the best speed within the provisioned data rates.

The following table provides a comparative chart of two sample data rates of 192 and 1536 Kbps in different training modes to illustrate the time efficiency of the AutoBaud Pre-Activation Rate Negotiation mode. Training times are approximate.

Table 1-16: Example of Training Times in Different Modes[1]

Training Mode	192 Kbps			1536 Kbps		
	Initiating	Training	Total	Initiating	Training	Total
AutoBaud Pre-Activation Rate Negotiation	30 secs. constant.	64 secs.	94 secs.	30 secs. constant.	26 secs.	56 secs.
Fixed (Hunt)	Variable hunting time.	64 secs.	Depending on the CPE hunting algorithm, up to 15 minutes.	Variable hunting time.	26 secs.	Depending on the CPE hunting algorithm, up to 15 minutes.

[1] This table uses sample data rates.

D50 and AutoBaud Pre-Activation Rate Negotiation Compatibility	The AutoBaud Pre-Activation Rate Negotiation training mode works with D50 Release 6.0 and above. It requires an AutoBaud Pre-Activation Rate Negotiation compatible CPE. Differences in the capabilities result in the following situation:

SDSL8+ port with AutoBaud incompatible CPE. If an AutoBaud Pre-Activation Rate Negotiation incompatible CPE is connected to an SDSL8+ port, the port detects that the CPE is incompatible and reverts to the Fixed mode. In this case, to maintain backward compatibility with older CPE devices, the maximum allowable data rate is 1536 Kbps. The SDSL8+ port performs a maximum of 24 consecutive attempts in the Fixed mode. If the training is not successful, the port reverts to the AutoBaud Pre-Activation Rate Negotiation mode.

Data Mode	The SDSL8+ port enters Data mode after it has completed the training process and a connection is established with the CPE; the line card software waits for frame acquisition to determine that the data channel is established. Once the data channel is established, the ATM backplane interface is turned on and payload cells start to flow.

During Data mode the SDSL8+ port provides:

- "Actual" measurements as a result of the training process.
- Continuous real time measurement of Noise Margin indicating signal quality.

See **Signal Quality Measurements, page 1-30** for detailed information about performance actuals provided by the SDSL8+ port.

Threshold Settings	The following thresholds can be set and viewed in Craft Terminal for any SDSL8+ card; an event is reported when a threshold is crossed:

Loss of Frame (LOF) Seconds. The LOF Threshold setting is the number of seconds during which an LOF condition was present. Loss of Frame condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default threshold setting is "0" (zero) or inactive. The LOF thresholds <u>do not</u> affect SDSL port operation.

Loss of Signal (LOS) Seconds. The LOS Threshold setting is the number of seconds during which an LOS condition was present. Loss of Signal condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default threshold setting is "0" (zero) or inactive. The LOS thresholds <u>do not</u> affect SDSL port operation.

Loss of Frame (LOF) Retrains. The LOF Threshold setting is the number of times a port will retrain due to LOF. Loss of Frame condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default threshold setting is "0" (zero) or inactive. An event is reported to Craft Terminal when the LOF Retrains threshold is crossed. The LOS thresholds <u>do not</u> affect SDSL port operation.

Errored Seconds (ES). Errored Seconds is the cumulative number of seconds the port is in an LOF, LOS, or CV condition. Errored Seconds are monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC (Near) and ATUR (Far) units. The default threshold setting is "0" (zero) or inactive. The Errored Seconds thresholds <u>do not</u> affect SDSL port operation.

Coding Violations (CV) . The SDSL8+ line card counts Coding Violation (CV) Errors for both the ATUC and ATUR units during Data mode. The default threshold setting is "0" (zero) or inactive. The CV thresholds do not affect SDSL port operation.

■ Coding Violation (CV) Threshold—15 min: This parameter is a count of Cyclic Redundancy Check (CRC) errored frames received.

■ Coding Violation (CV) Threshold—Daily: This parameter is a count of Cyclic Redundancy Check (CRC) errored frames received.

The following table provides expected number of Coding Violation errors in 15 minute and Daily intervals[5] for some sample data rates. These numbers can be used as a guideline for threshold settings. The number of expected Coding Violation errors varies on the data rate.

Table 1-17: Sample Coding Violation Threshold Settings

Data Rate (Kbps)	144	192	384	768	1152	1536	2320	Sensitivity to CV Errors
Daily Settings	122291	163055	326110	652220	978330	1304440	1970248	Low
	12420	16560	33120	66241	99361	132481	200102	Medium Low
	1244	1659	3317	6634	9952	13269	20041	Medium
	124	166	332	664	995	1327	2004	Medium High
	12	17	33	66	100	133	200	High
15 Min Settings	1274	1698	3397	6794	10191	13588	20523	Low
	129	173	345	690	1035	1380	2084	Medium Low
	13	17	35	69	104	138	209	Medium High
	1	2	3	7	10	14	21	High

SDSL8+ Performance Counts

The SDSL8+ card counts Performance items during Data mode. The SDSL8+ line card maintains fourteen counters for each of these performance items; the count begins when the card powers up:

– Previous Day.

– Current Day.

– Current 15 Minute Interval.

– Previous 15 Minute Intervals (up to eleven Previous 15 Minute Intervals).

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[5] Coding Violation errors are single bit errors randomly distributed with a mean equal to the Bit Error Rate.

The SDSL8+ line card counts:

- **LOF Failures** – Loss of Frame errors since line card reset, or since the physical performance monitoring data was cleared.
- **LOS Failures** – Loss of Signal errors since line card reset, or since the physical performance monitoring data was cleared. An LOS condition takes precedence over an LOF condition.
- **Loss of Frame (LOF) Seconds** – The number of seconds in a Loss of Frame (LOF) condition.
- **Loss of Signal (LOS) Seconds** – The number of seconds in a Loss of Signal (LOS) condition.
- **Loss of Frame (LOF) Retrains** – Counts the number of retrains due to Loss of Frame (LOF).
- **Errored Seconds** – The cumulative number of seconds the port is in an LOF, LOS, and CV condition.
- **Coding Violations** – Counts the number of Cyclic Redundancy Check (CRC) errored frames received[6].
- **FE Errored Seconds** – Total number of seconds the far end detected frame CRC errors since line card reset, or since the physical performance monitoring data was cleared.
- **FE Coding Violations** – Coding violations detected by the far end since line card reset, or since the physical performance monitoring data was cleared.
- **Cells Received** – The number of valid, non-idle cells "received" on the line card port from the CPE and sent on to the LSM card.
- **Cells Transmitted** – The number of valid, non-idle cells received from the LSM card and "transmitted" to the CPE.
- **Header Error Control (HEC) Errors** – The number of received cells that have HEC errors detected in their header.

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[6] ATUR Coding Violations are measured in Far End Block Error (FEBE). FEBE is the number of "received" frames that contain an FEBE bit set. The receiver end sets the FEBE when it "receives" a CRC error frame. The FEBE is cleared in the next frame it transmits.

Chapter 5
SHDSL8 Provisioning

Introduction

This document describes the provisioning parameters and operation of the D50 SHDSL8 (Single-pair High-speed Digital Subscriber Line) line card. Details are provided on how the SHDSL8 port establishes its data rate during the "training" operational mode.

The SHDSL8 line cards support 8 ports of symmetric bit rate transmission using multi-level Trellis Coded Pulse Amplitude Modulation (TC-PAM) line encoding.

> **Note:** The SHDSL8 line card can be installed only on a Release 8.0 or above D50 system.

> **Note:** Additional provisioning information is available in Appendix A, Provisioning Parameters.

SHDSL8 Card Features

The SHDSL8 line card has the following features.

> **Note:** SHDSL8 features are available only with compatible CPE.

Variable data rate range in 64 Kbps increments. The SHDSL8 line card allows provisioning of variable data rates within a range of 64 to 2304 Kbps in 64 Kbps increments.

Higher speed services over longer distances. The SHDSL8 line card offers the capability to reach more customers with higher speed services than an SDSL line card within a given deployment area, since it is based on 16-level Trellis Coded Pulse Amplitude Modulation (TC-PAM) line encoding technology and is compliant with the ITU G.shdsl[1] standard.

Pair Bonding. The Release 11.0 SHDSL8 line card includes a pair bonding feature which doubles the bandwidth, providing a maximum of 4608 Kbps of symmetric service. (The maximum data rate of a single port is 2304 Kbps.) This pair bonding feature can be enabled or disabled on the line card on demand. By default, it is disabled.

The pair bonding feature bonds an odd port with the next higher even numbered port. For example, you can bond pairs 1 and 2, 3 and 4, 5 and 6, and 7 and 8. Due to hardware limitations, you cannot bond ports 2 and 3, 4 and 5 and 6 and 7.

> **Note:** Release 11.0 supports only a two-port pair bonding configuration.

In the Craft Terminal GUI, a rectangle appears over the ports that are pair bonded to distinguish them from other individual ports. Also, if port 1 is pair bonded, port 2 is grayed out and cannot be provisioned individually. Pair bonding for even ports is disabled in the GUI.

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[1] International Telecommunication Union Recommendation G.991.2.

Provisioning changes made to the odd port are reflected in the even port for all tabs in the Craft Terminal **Port Provisioning** dialog box, except the **ATM PM** tab. ATM PM details are available only for the odd port; no data is available for the even port. Port actuals are available for both the odd and even port, individually, on the **Actuals** tab of the respective port. The **Physical PM** tab displays the information separately for each individual odd or even port. Alarms appear separately for each individual port.

When the odd port is provisioned, the **Status**, **Test**, **Rates**, **DSL Thresholds**, **SHDSL**, **Connection**, and **Queue Manager** tabs display in read-only mode. The other tabs of **ATM PM**, **Physical PM**, **Queue Congestion PM**, and **Actuals** have editing capability.

The default traffic descriptors are applicable to pair-bonded ports as well.

> **Important! When pair bonding is enabled, connections existing on the second port of the pair-bonded ports are lost. To retain those connections, remove them from the second port and add them on the first port before enabling pair-bonding. Procedures on how to add or remove a new connection are provided in Section 3—*Change Order Provisioning*.**

For procedures on how to pair bond SHDSL8 ports in Craft Terminal, see Chapter 2—"Initial Service Provisioning," **Enabling and Provisioning SHDSL Pair-Bonded Ports**, page 2-35 and **Disabling SHDSL Pair-Bonded Ports**, page 2-39.

STUC and STUR Terminology	The terms SDSL Transceiver Unit – Central Office (STUC) and SDSL Transceiver Unit – Remote (STUR) are used in SHDSL8 provisioning to describe the DSL port hardware required at both the Central Office and Remote (CPE) ends of the local loop.
SHDSL8 Operational Modes	The SHDSL8 line card has eight ports. Each port has three basic operational modes: Idle, Training, and Data. These operational modes are defined as follows: ■ **Idle.** The SHDSL8 port transmitter and receiver are "locked" or disabled. ■ **Training.** The SHDSL8 port transmitter and receiver are "unlocked." The port attempts to establish a connection with the CPE. ■ **Data.** The SHDSL8 port connection to the CPE is established, and payload data is carried.
Data Mode	The SHDSL8 port enters Data mode upon completion of the training process. After the data channel is established, the ATM backplane interface is enabled and payload cells start to flow. During Data mode the SHDSL8 port provides actual measurements that result from the training process.
Provisioning SHDSL8 Port Data Rates	The following SHDSL8 parameters affect port training: **Maximum Rate.** The STUC Maximum data rate can be provisioned for the SHDSL8 port in Kilobits per second. The setting options are in the range of 64 to 2304 Kbps in 64 Kbps increments. The SHDSL8 port will train down to the next lower, fixed data rate if the provisioned rate is <u>less than</u> the next higher data rate. Example: If a user enters a provisioned data rate of 195 Kbps, the SHDSL8 port will train down to 192 Kbps.

Minimum Rate. The STUC Minimum data rate should be entered in Kilobits per second for the SHDSL8 port.

Rate Degraded. The Rate Degraded threshold rate should be set at or below the STUC provisioned rate. When the actual transmission rate drops below this rate, a Rate Degraded condition is generated in Craft Terminal. The default setting is "0" (zero).

| Training Mode | The SHDSL8 port supports the following types of RADSL Operation settings for the STUR and STUC channels: |

Training Mode

The SHDSL8 port supports the following types of RADSL Operation settings for the STUR and STUC channels:

- **None.** Fixed rate training.
- **Startup**. RADSL training at startup.

Selection of fixed rate or RADSL operation and results are displayed in Craft Terminal.

Fixed. In the Fixed mode, the STUC is set at the provisioned rate using Maximum and Minimum Rates. Using the G.handshake[2] protocol, the STUC communicates the provisioned data rate to the STUR and they attempt to link at that rate. If the maximum rate is equal to the minimum rate, the CPE attempts to train to that fixed provisioned rate. If unsuccessful, no link is established with the port, training restarts, and the port remains in the LOS condition. If the maximum rate is greater than the minimum rate, the CPE attempts to train to the maximum rate and if unsuccessful, falls back to the minimum provisioned rate.

Startup Rate Adaptive DSL (RADSL) Training. In this mode, the port is set to the provisioned maximum and minimum data rates. Using the G.handshake protocol, the STUC and STUR alternately send line probing signals to evaluate the loop quality. When the STUC and STUR have obtained sufficient information on the loop quality, they each decide the rate that the loop can support. This information is exchanged between the STUC and the STUR using the G.handshake protocol. The STUC and STUR then train at the highest rate that both can support.

If the highest rate the loop can support is greater than the provisioned maximum rate, the STUC and the STUR train at the provisioned maximum rate. If the highest rate the loop can support is lower than the provisioned minimum rate, no link is established, training restarts, and the port remains in the LOS condition. A Rate Degraded condition is displayed in Craft Terminal if the actual transmit rate is below the provisioned Rate Degraded threshold.

The actual data rate is displayed in Craft Terminal.

SHDSL8 Provisioning Parameters

The following SHDSL8 parameters, except Error Alarms, affect port operation:

Target Noise Margin. Target Noise Margin is the difference in dB between noise at which the port will operate at an error rate of 10^{-7} BER and the set noise margin in dB. The noise margin is usually set higher than the noise in dB for a 10^{-7} BER. Target Noise Margin has a direct effect on the maximum local loop length supported for a provisioned fixed STUC/STUR data rate. This is available for both the STUC and the STUR sides of the connection.

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[2] International Telecommunication Union Recommendation G.994.1.

Error Retrain. This STUC parameter sets the number of near-end "errored frames" allowed per second during Data mode before the SHDSL8 port retrains. The inactive Error Retrain threshold setting is "0," the default setting is "0."

FE Error Retrain. This STUC parameter sets the number of far-end "errored frames" allowed per second during Data mode before the SHDSL8 port retrains. The inactive FE Error Retrain threshold setting is "0," the default setting is "0."

Error Alarm. This STUC parameter sets the number of near-end "errored frames" allowed per second during Data mode before an Error Rate Alarm condition is reported to Craft Terminal. The inactive Error Alarm Threshold setting is "0," the default setting is "0." This parameter does not affect port operation.

FE Error Alarm. This STUC parameter sets the number of far-end "errored frames" per second allowed during Data mode before an Error Rate Alarm condition is reported to Craft Terminal. The inactive FE Error Alarm Threshold setting is "0," the default setting is "0." This parameter does not affect port operation.

Advanced Configuration. This parameter, when set to **Auto**, sets the advanced configuration parameters for optimal performance. Auto is the default and recommended setting. When set to **Manual**, the following configuration parameters must be set.

- **Power Backoff**—Select this option to enable/disable downstream power reduction on short loops.
- **Odd/Even Pair Bonding**—Enables or disables pair bonding. The default is "Disabled". For procedures on how to pair bond SHDSL8 ports in Craft Terminal, see Chapter 2—"Initial Service Provisioning," **Enabling and Provisioning SHDSL Pair-Bonded Ports**, page 2-35 and **Disabling SHDSL Pair-Bonded Ports**, page 2-39.
- **TC-PAM 32**—This field is not currently supported.

Operation Mode. Select **Annex A** if the deployment area is North America or **Annex B** for Europe.

STUC ACP 1. This field is for future enhancements.

STUC ACP 2. This field is for future enhancements.

SHDSL8 Thresholds

The following thresholds are set and viewed using Craft Terminal. They do not affect port operation. The default setting is 0 (zero) or inactive, except where noted:

LOFS (Loss of Frame Seconds) Thresholds. Loss of Frame condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the STUC unit. The LOFS threshold settings are the number of seconds during which an LOF condition was present. An event is reported to Craft Terminal when the LOFS threshold is crossed.

LOSS (Loss of Signal Seconds) Thresholds. Loss of Signal condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the STUC unit. The LOS threshold settings are the number of seconds during which an LOS condition was present. An event is reported to Craft Terminal when the LOS threshold is crossed.

LPRS (Loss of Power Seconds) Thresholds. Loss of Power condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the STUC unit. LPR threshold is set to monitor power shutdown signals at the STUR.

> **Note:** LOF, LOS and LPR conditions are mutually exclusive, and are reported in the following priority:
> - If all three conditions are present, LPR is reported.
> - If LOS and LOF are present, LOS is reported.
> - LOF is reported when it is the only condition.

LCD (Loss of Cell Delineation) Seconds Thresholds. Loss of Cell Delineation condition is monitored during Data mode. Daily and 15-minute thresholds can be set for the STUC unit. LCDS threshold settings are the number of seconds during which an LCD condition was present. An event is reported to Craft Terminal when the LCD threshold is crossed.

LOF (Loss of Frame) Retrains. The number of times a port has retrained due to LOF. Daily and 15-minute thresholds can be set for the STUC unit. An event is reported to Craft Terminal when the LOF Retrains threshold is crossed.

Error Rate Retrains. The number of times a port has retrained due to excessive Near End errored frames. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. Error Rate Retrains are monitored during all operational modes. Daily and 15-minute thresholds can be set for the STUC unit. An event is reported to Craft Terminal when the Error Rate Retrains threshold is crossed.

FE (Far End) Error Rate Retrains. The number of times a port has retrained due to excessive Far End (FE) errored frames. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. FE Error Rate Retrains are monitored during all operational modes. Daily and 15-minute thresholds can be set for the STUC unit. An event is reported to Craft Terminal when the FE Error Rate Retrains threshold is crossed.

Coding Violation Thresholds. Coding Violation errors are a count of the Cyclic Redundancy Check (CRC) errored frames received for the STUC unit during Data mode. Daily and 15-minute thresholds can be set for the STUC unit. The Coding Violation parameters have thresholds for reporting an event to Craft Terminal.

FE (Far End) Coding Violations. Far End (FE) Coding Violation errors are a count of the Far-End Block Errors (FEBE) reported by the STUR to the STUC during Data mode. Daily and 15-minute thresholds can be set for the STUC unit. The FE Coding Violation parameters have thresholds for reporting an event to Craft Terminal.

The following table provides the expected number of STUC Near and FE Coding Violation (CRC) errors in 15-minute and Daily intervals[3]; they can be used as threshold settings.

Note: The number of expected Coding Violation errors varies based on the data rate. The values in the following table provide guidelines to help establish thresholds.

Table 1-18: STUC Coding Violation Threshold Settings

Parameters	Threshold Settings based on Data Rates (bps)				Sensitivity to CV Errors
	32000	**64000**	**320000**	**640000**	
Daily Settings	270000	530000	2200000	3500000	Low
	28000	55000	270000	530000	Medium Low
	2800	5600	28000	55000	Medium
	280	560	2800	5600	Medium High
	28	56	280	560	High
15-Minute Settings	2800	5500	23000	36000	Low
	290	580	2800	5500	Medium Low
	29	58	290	580	Medium
	3	6	29	58	Medium High
	0	1	3	6	High

Errored Seconds Thresholds. (Near End) Errored Seconds are the cumulative number of seconds the port is in an LOF, LOS, LPR, LCD, or Coding Violation condition. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. Errored Seconds are monitored during all operational modes. Daily and 15-minute thresholds can be set for the STUC unit. An event is reported to Craft Terminal when the Errored Seconds threshold is crossed.

FE (Far End) Errored Seconds Thresholds. Far-End (FE) Errored Seconds are the cumulative number of seconds the port has been in a far-end LOF, LOS, LPR, LCD, or Coding Violation condition. Coding Violation conditions include CRC (Cyclic Redundancy Check) errors. FE Errored Seconds are monitored during Data mode. Daily and 15-minute thresholds can be set for the STUC unit. An event is reported to Craft Terminal when the FE Errored Seconds threshold is crossed. The values in the following table provide guidelines to establish thresholds.

Table 1-19: LOS, LOF, LPR, LCD and Errored Seconds Parameters

Parameter	15-minute Values	Daily Values	Units	Defaults
Loss of Frame (LOF)	1–900	1–86400	Seconds	0

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[3] Coding Violation errors are single bit errors randomly distributed with a mean equal to the Bit Error Rate.

Table 1-19: LOS, LOF, LPR, LCD and Errored Seconds Parameters (continued)

Parameter	15-minute Values	Daily Values	Units	Defaults
Loss of Signal (LOS)	1–900	1–86400	Seconds	0
Loss of Power (LPR)	1–900	1–86400	Seconds	0
Loss of Cell Delineation (LCD)	1–900	1–86400	Seconds	0
NE and FE Errored Seconds Threshold	1–900	1–86400	Seconds	0

Transmission Status Actuals

The SHDSL8 port has the functionality to measure the transmission quality established over the existing telephone copper network—the "local loop." Actual transmission quality parameters provided by the SHDSL8 port include:

Noise Margin. The level of noise in dB that the loop can tolerate before it impairs the current transfer bit rate. This is available for both the STUC and STUR sides of the connection.

Loop Attenuation. It is the overall signal power attenuation or "decrease in power of the DSL signal" over the local loop expressed in dB. The current measured difference between the transmit power level and the and the received power level at the far end of the loop is displayed in the actuals for both the STUC and STUR sides of the connection.

Transmit Power. The physical transmission power measured. This is available for both the STUC and STUR sides of the connection.

Receiver Gain. The actual gain applied to the received signal as a result of the training process. Receiver Gain is measured in dB, from –99.99 to +99.99 dB. A negative value indicates attenuation. Receiver Gain is measured for both channels.

Transmit Rate. The actual data rate set by training for the port.

Previous Transmit Rate. Recorded upon termination of a successful data transport session; reports the rate according to whether the line is trained or not trained:

- Not Trained – the rate achieved by the most recent successful training.
- Trained – the rate achieved by the most recent successful link-up prior to the current link-up.

Best Transmit Rate. The highest rate the port has linked up at successfully. If it is less than the Transmit Rate after training, the port copies in the Transmit Rate value.

Payload Transmit Rate. The *actual* STUR and STUC payload rate, calculated by subtracting the ATM cell overhead from the Transmit Rate.

Maximum Achievable Rate. The maximum transmit rate that is possible on the line. It may be greater than the maximum provisioned rate, or equal to the maximum provisioned rate if the line is not limited.

Best Maximum Achievable Rate. The best of the Maximum Achievable Rates since the card was reset. If it is less than the Maximum Achievable Transmit Rate after training, the port copies the Maximum Achievable Transmit Rate value.

Received Blocks. The total number of blocks received on the line card port since the card was reset.

Transmitted Blocks. The total number of blocks transmitted on the line card port since the card was reset.

Cells Received. The number of valid, non-idle cells "received" on the line card port from the CPE and sent on to the LSM card since the card was reset.

Cells Transmitted. The number of valid, non-idle cells received from the LSM card and "transmitted" to the CPE since the card was reset.

Operation Mode. The actual operation mode, whether G.shdsl Annex A or G.shdsl Annex B.

Error Actuals

The SHDSL8 card counts the following performance items during Data mode.

> **Note:** Not every performance monitoring counter has a performance monitoring threshold.

LOF (Loss of Frame) Failures. Loss of Frame errors since the line card was reset, or since the physical performance monitoring data was cleared.

LOS (Loss of Signal) Failures. Loss of Signal errors since the line card was reset, or since the physical performance monitoring data was cleared. An LOS condition takes precedence over an LOF condition.

LCD (Loss of Cell Delineations) Failures. A Loss of Cell Delineation failure since the line card was reset, or since the physical performance monitoring data was cleared.

LOF (Loss of Frame) Seconds. The number of seconds in a Loss of Frame (LOF) condition.

LOS (Loss of Signal) Seconds. The number of seconds in a Loss of Signal (LOS) condition.

LCD (Loss of Cell Delineations) Seconds. The number of seconds when a Loss of Cell Delineation condition was present.

LOF (Loss of Frame) Retrains. Counts the number of retrains due to Loss of Frame (LOF).

Errored Seconds. The cumulative number of near end seconds the port is in an LOF, LOS, and CV condition.

FE (Far End) Errored Seconds. The cumulative number of far end seconds the port is in an LOF, LOS, and CV condition on the near end.

Coding Violations. Counts the number of Cyclic Redundancy Check (CRC) errored frames received[4] on the near end.

FE (Far End) Coding Violations. Counts the number of Cyclic Redundancy Check (CRC) errored frames received[5] on the far end.

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[4] ATUR Coding Violations are measured in Far End Block Error (FEBE). FEBE is the number of "received" frames that contain an FEBE bit set. The receiver end sets the FEBE when it "receives" a CRC error frame. The FEBE is cleared in the next frame it transmits.

HEC (Header Error Control) Errors. The number of received cells that have HEC errors detected in their header.

FE HEC (Far End Header Error Control) Errors. The number of received cells that have HEC errors detected in their header on the far end.

Error Retrains. The number of times the port had to retrain on the near end owing to errored frames.

FE (Far End) Error Retrains. The number of times the port had to retrain on the far end owing to errored frames.

LOF (Loss of Frames) Retrains. The number of times the port had to retrain due to loss of frames.

Training Starts. The total number of times a port has detected the CPE, and attempted to train up with the CPE. The count will not increment if the CPE is not connected at the other end of the loop. This feature allows the user to determine whether the port cannot train to the CPE, or whether there is no CPE.

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5   STUR Coding Violations are measured in Far End Block Error (FEBE). FEBE is the number of "received" frames that contain an FEBE bit set. The receiver end sets the FEBE when it "receives" a CRC error frame. The FEBE is cleared in the next frame it transmits.

Chapter 6
DS1 Provisioning

Introduction   This document describes the provisioning parameters and operation of the D50 DS1 quad line card. Details are provided on how the DS1 port establishes its data rate during the "training" operational mode.

DS1 is a high-speed line card capable of delivering 1544 Kbps of data in both directions. It is divided into 24 DS0 data-bearing channels. The DS1 line card provides four DS1 ports in balanced (100Ω) form to connect Frame Relay, Ethernet, and ATM end-users with the ATM backbone over T1 leased line replacement services.

The DS1 line card supports a maximum of 20 virtual connections per port.

> **Note:** If you are upgrading to Release 11, and the sum total of your per port buffer allocation for the three priority queues on DS1 line card is greater than the maximum 1024 cells, a "Provisioning Data Not Found" error message will appear, and you will be required to manually re-provision the queue default settings.

DS1 Card Applications   The DS1 line card provides a T1 ATM-based leased line replacement service for Frame Relay, Ethernet, and ATM services over DS1. By implementing ATM to Frame Relay and ATM to Ethernet interworking, The DS1 line card can interface directly with Frame Relay or Ethernet network equipment. The ATM functionality provides multi-protocol consolidation of voice and data over DS1.   Compared to xDSL technology, the ATM-based T1 service can provide an extensive reach well beyond the Central Office with the use of repeated T1 lines over existing line terminal (Span) systems.

Frame Relay Over ATM   To support Frame Relay services, the DS1 line card provides the FRF.5 and FRF.8 Frame Relay Interworking Functions. Frame Relay connections originate from the far end user equipment and enter the D50 in the Ingress direction. The Frame Relay to ATM interworking function present in the DS1 line card converts Frame Relay frames to ATM cells, and sends the cells through the ATM trunk card to the ATM Network. The reverse occurs in the Egress direction.

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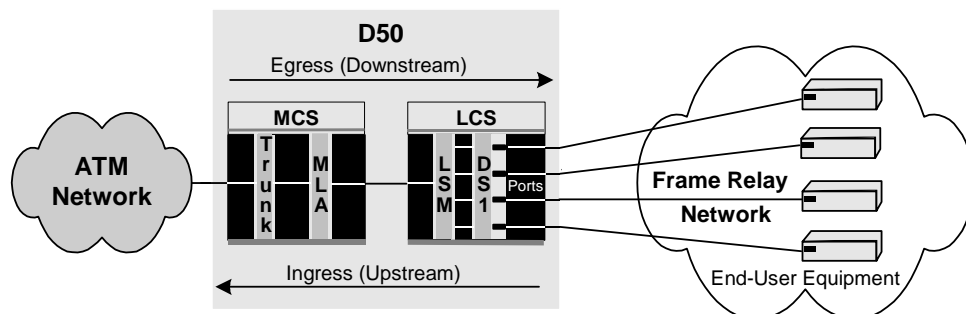
Figure 1-1: DS1 Frame Relay to ATM Functionality

PPP over ATM To support Ethernet, the DS1 line card uses PPP (Point-to-Point Protocol). Ethernet PPP (Point-to-Point Protocol) connections originate from end-user equipment and enter the D50 in the Ingress direction. The PPP to ATM interworking function present in the DS1 line card converts the PPP frames to ATM cells and sends the cells through the ATM trunk card to the ATM network. The reverse occurs in the Egress direction.
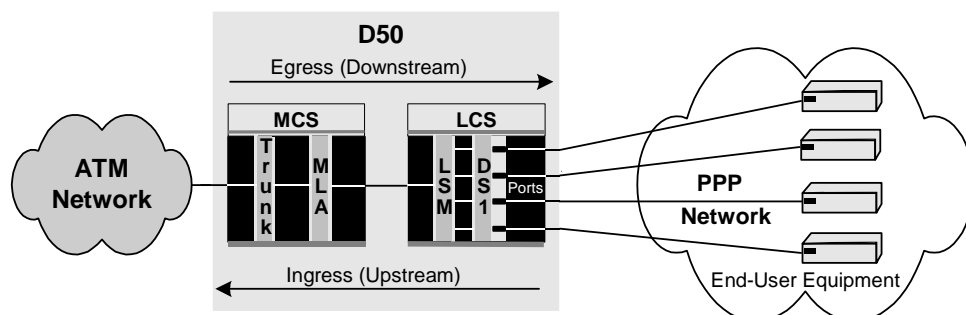
Figure 1-2: DS1 PPP to ATM Functionality

ATM Over DS1 Overview To support ATM over DS1, the DS1 line card forwards consolidated data and voice traffic between the ATM trunk and customer premise. ATM over DS1 connections originate from specialized IAD or CPE equipment. The IAD consolidates traffic from multiple voice and data services into ATM cells for ATM transport over the DS1 line in the ingress direction. The DS1 card sends the ATM cells through the ATM trunk card to the ATM network. The reverse occurs in the egress direction.

Provisioning
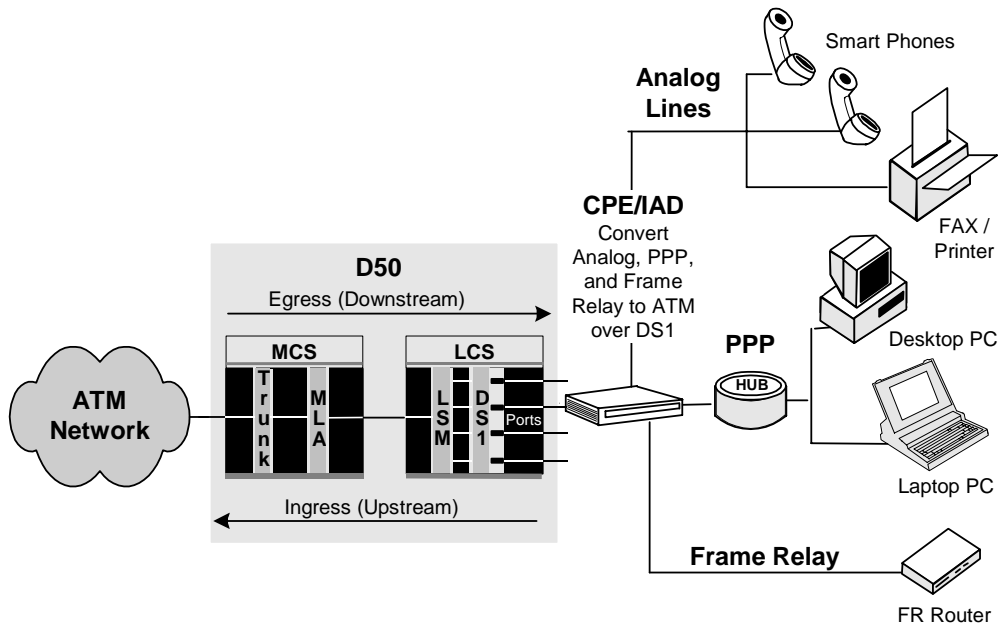
Figure 1-3: ATM over DS1 Functionality

Parameters   The DS1 line card provisioning parameters include:

- DS1 Parameters. Per port provisioning of the DS1 transmission from the far end user equipment to the DS1 line card.

- Interworking Descriptors for Frame Relay, PPP, or ATM over DS1.

- Frame Relay/PPP to ATM Interworking Parameters. Per connection provisioning of the interworking between Frame Relay/PPP frames and ATM cells.

- Thresholds. Setting of thresholds to generate events or alarms in Craft Terminal for purposes of performance data collection.

Provisioning DS1 Parameters

The following parameters must be provisioned for the DS1 port.

Framing Format. Select the framing format type from the following two options:

- **Extended Super Frame (ESF).** This format uses 8000 framing bits per second, of which 2000 framing bits are required for synchronization, which leaves 6000 framing bits available for error detection, CRC (Cyclic Redundancy Check), data link monitoring and maintenance. Using this format, the data payload remains intact and the full 1.536 Mbps bandwidth is available for user data.
- **Super Frame (SF).** This format combines 24 DS0 time slots and a coded framing bit to form a frame. Twelve of these frames are combined to create a super frame.

Transmit Clock Source. Select the timing source from the following two options:

- **Loop.** The DS1 card obtains the timing from the far end user equipment.
- **Internal.** The DS1 card obtains timing from the D50 system. The far end user equipment must be configured for Loop timing if the line card is set to Internal, and vice versa.

Frame Relay to OAM Mapping. This parameter can be set to **Enable** or **Disable** OAM (Operations and Maintenance) AIS (Alarm Indication Signal) generation.

- **Enabled.** When enabled, if the LMI (Local Management Interface) identifies an inactive DLCI (Data Link Connection Identifier) on a port where no data is flowing, an AIS signal is sent to the network (ingress) on the corresponding VCC (Virtual Channel Connection).
- **Disabled.** When disabled, the AIS signal is not sent. The network operator learns about a Frame Relay failure through Craft Terminal, rather than through an AIS. This is the default setting.

Local Management Interface Mode. Select the LMI (Local Management Interface) mode. LMI is a specification for the use of frame-relay products that defines a method of exchanging status information regarding the Frame Relay link and the DLCI (Data Link Connection Identifier).

> **Note:** The following parameters are not specified if the interworking function type is PPP LLC, PPP VCMUX or ATM.

The options are:

> **Note:** Both the line card and the Frame Relay end-user equipment must be provisioned to the same LMI mode.

- **Auto.** The DS1 card automatically detects the type of LMI signal sent.
- **None.** This is the default setting.

  > **Note:** The **LMI Mode** field should be set to **None** when the **FRF.5 One to Many** Frame Relay/ATM Interworking type is used in the Interworking descriptor.

- **OrigLMI.** This option sets the LMI to meet the original LMI specification standard.
- **ANSI (American National Standards Institute).** This option sets the LMI to meet the telecommunications standards in the United States.
- **ITU (International Telecommunications Union).** An international standards group called the International Telecommunications Union. This option sets the LMI to meet the ITU standards.

Line Code and Polarity. Select the Line Code and Polarity type for the DS1 line from the following options:

- **B8ZS (Binary 8-Zero Substitution).** This is a line-coding format in DS1 transmission systems that uses intentional Bipolar Violations (BPVs) to break long strings of zeros in order to maintain ones density in the signal. This is the recommended format.

- **AMI (Alternate Mark Inversion) & Inverted.** AMI is a line-coding format in DS1 transmission systems that reverses the polarity of successive ones in the frame. AMI & Inverted is the same as AMI line-coding except that the polarity of the payload signal is reversed.

- **B8ZS & Inverted.** This is the same as B8ZS line-coding except the polarity of the payload signal is reversed. B8ZS normally maintains ones density. The polarity may need to be reversed if AMI is used anywhere between the near-end and far-end of the data stream.

  Note: If either end is using AMI Inverted, the other end can use either B8ZS Inverted or AMI Inverted.

Line Build Out. Adjusts the build out strength of the signal to compensate for output attenuation in DS1 lines greater than 133 feet. To increase build out, select the appropriate line length from the following five options.

- 0 to 133 ft.
- 133 to 366 ft.
- 266 to 399 ft.
- 399 to 533 ft.
- 533 to 655 ft.

Time Slots. The 24 DS0 channels of the DS1 line. Select the check boxes to indicate that the channel will be used to transmit data through the DS1 line card.

DS1 Thresholds

The following thresholds are set and viewed using Craft Terminal. The default setting is 0 (zero) or inactive, except where noted:

LOFS (Loss of Frame Seconds) Thresholds. Loss of Frame condition is monitored during Data mode. Daily and 15-minute thresholds can be set. The LOFS threshold settings are the number of seconds during which an LOF condition was present. An event is reported to Craft Terminal when the LOFS threshold is crossed.

LOSS (Loss of Signal Seconds) Thresholds. Loss of Signal condition is monitored during Data mode. Daily and 15-minute thresholds can be set. The LOSS threshold settings are the number of seconds during which an LOS condition was present. An event is reported to Craft Terminal when the LOSS threshold is crossed.

LPRS (Loss of Power Seconds) Thresholds. Loss of Power condition is monitored during Data mode. Daily and 15-minute thresholds can be set. LPRS threshold is set to monitor power shutdown signals at the port.An event is reported to Craft Terminal when the LPRS threshold is crossed.

> **Note:** LOF, LOS and LPR conditions are mutually exclusive, and are reported in the following priority:
> – If all three conditions are present, LPR is reported.
> – If LOS and LOF are present, LOS is reported.
> – LOF is reported when it is the only condition.

LMI Fail Seconds Thresholds. LMI Fail Seconds threshold settings are the number of seconds during which an LMI fail condition was present. Daily and 15-minute thresholds can be set. An event is reported to Craft Terminal when the threshold is crossed

LOF (Loss of Frame) Retrains. The number of times a port has retrained due to LOF. Daily and 15-minute thresholds can be set. An event is reported to Craft Terminal when the LOF Retrains threshold is crossed.

Error Rate Retrains. The number of times a port has retrained due to excessive errored frames. Error Rate Retrains are monitored during all operational modes. Daily and 15-minute thresholds can be set. An event is reported to Craft Terminal when the Error Rate Retrains threshold is crossed.

Coding Violation Thresholds. Coding Violation errors are a count of BPV (Bipolar Violations) errors received during Data mode. Daily and 15-minute thresholds can be set. The Coding Violation parameters have thresholds for reporting an event to Craft Terminal.

Errored Seconds Thresholds. Errored Seconds are the cumulative number of seconds the port is in an LOF, LOS, or Coding Violation condition. Errored Seconds are monitored during all operational modes. Daily and 15-minute thresholds can be set. An event is reported to Craft Terminal when the Errored Seconds threshold is crossed.

Severely Errored Seconds (SES). This is the count of seconds containing one or more severe errors. Daily and 15-minute thresholds can be set. An event is reported to Craft Terminal when the SES threshold is crossed.

SEF/AIS Seconds (SAS). This is the count of seconds containing one or more SEF (Severely Errored Frames) defects or AIS (Alarm Indication Signal) defects. Daily and 15-minute thresholds can be set. An event is reported to Craft Terminal when the SAS threshold is crossed.

Unavailable Seconds (UAS). This is the count of one second intervals during which the DS1 card is not available. Daily and 15-minute thresholds can be set. An event is reported to Craft Terminal when the UAS threshold is crossed.

DS1 Actuals   The following actuals are available for the DS1 port.

- **Transmit Rate (kbps):** The actual data rate set by training for the port.
- **LOF Failures:** Loss of Frame failures since line card reset, or since the physical performance monitoring data was cleared.
- **LOS Failures:** Loss of Signal failures since line card reset, or since the physical performance monitoring data was cleared. An LOS condition takes precedence over an LOF condition.
- **DS1 LMI Failures:** LMI failures since the line card reset, or since the physical performance monitoring data was cleared.
- **LOF Seconds:** Loss of Frame error seconds.
- **LOS Seconds:** Loss of Signal error seconds.
- **DS1 LMI Seconds:** Total number of seconds this port detected that the LMI was unavailable.
- **Line ES:** Total number of seconds this port detected frame CRC errors since the line card reset, or since the physical performance monitoring data was cleared.
- **Line CV:** Coding Violation ((BPV and EXZ errors) errors since line card reset, or since the physical performance monitoring data was cleared.
- **Line SES:** Total number of Severely Errored Seconds this port detected frame CRC errors since the line card reset, or since the physical performance monitoring data was cleared.
- **Line UAS:** Total number of seconds the line was unavailable since the line card reset, or since the physical performance monitoring data was cleared.
- **Path CV:** Total number of Coding Violation errors (BPV and EXZ errors) since the line card reset, or since the physical performance monitoring data was cleared.
- **Path ES:** Total number of Errored Seconds since the line card reset, or since the physical performance monitoring data was cleared.
- **Path SES:** Total number of Severely Errored Seconds since the line card reset, or since the physical performance monitoring data was cleared.
- **Path SAS:** Total number of SEF or AIS error counts since the line card reset, or since the physical performance monitoring data was cleared.
- **Path UAS:** Total number of unavailable seconds of the DS1 line since the line card reset, or since the physical performance monitoring data was cleared.
- **Errored Seconds:** Total number of Errored Seconds since line card reset, or since the physical performance monitoring data was cleared.
- **Coding Violation:** Coding Violation errors.
- **Payload Integrity Test (%):** Displays the success rate of the last remote loopback Payload Integrity Test as a percentage.

- **Bad Provisioning Status:** Reports bad provisioning on this resource.
- **Elapsed Time - Current 15 min:** Total number of seconds in the current 15-minute performance monitoring interval.

ATM Performance Management

The following ATM performance management actuals are available:

- **Received Bytes:** The total number of bytes received on the channel since the card reset, or counter reset.
- **Transmitted Bytes:** The total number of bytes transmitted on the channel since the card reset, or counter reset.
- **Errored PDUs:** Number of errored PDUs.

Setting Up DS1 Connections

DS1 connections require the following additional parameters:

DLCI. Data Link Connection Identifier is a 10 bit number in the Frame Relay header. It identifies the virtual circuit number with local significance at the UNI that corresponds to a specific destination. DLCIs are specified at Link A, while VPI/VCI values are specified at the Link Z side. The value for this field must be between 16 and 991.

> **Note:** This parameter is not specified if the interworking function type is PPP LLC, PPP VCMUX or ATM.

LMI Tunneling. When enabled, the LMI information in the Frame Relay packet is transmitted over the connection, instead of being terminated at the DS1 line card. This can be enabled only for the FRF.5 interworking protocol.

> **Note:** This parameter is not specified if the interworking function type is PPP LLC, PPP VCMUX or ATM.

Interworking (IWF) Descriptors. Interworking descriptors define the translation between protocols for Frame Relay frames or PPP frames into ATM cells in the D50. An Interworking descriptor can also be created for ATM over DS1.

Frame Relay Interworking descriptors contain Frame Relay quality of service features such as Committed Burst Size, Excess Burst Size and Committed Information Rate. Interworking descriptors can be created using the D50's Craft Terminal, or by utilizing a customized application.

Each created descriptor has an index number associated with it. "1," "2," "3" and "4" are the pre-defined IWF descriptors. They correspond to FRF8, PPP LLC, PPP VcMux, and ATM respectively. When creating descriptors using the Craft Terminal, numbers are assigned automatically, beginning with "33."

> **Note:** If desired, descriptors with a number between 5 and 32 can be created using an SNMP manager. This allows creation of the same descriptor number for use by all network nodes.

Interworking Descriptors

Interworking descriptors must be specified for all DS1 connections. Interworking descriptors comprise of the following:

Interworking Function Type. This is the protocol conversion type Frame Relay, PPP, and ATM over DS1. Interworking protocols address the issues of traffic management, fragmentation and reassembly, PVC management, and address resolution.

The supported interworking functions types are:

- **PPP LLC** – Point-to-Point Protocol Logical Link Control. On the far end (CPE side), it is treated as PPP over HDLC since a PPP frame does not have a header. On the ATM side, this frame is placed into AAL5 with LLC encapsulation per *RFC 1483 Multiprotocol Encapsulation over AAL5*. The hardware at the far end must support LLC encapsulation for this type interworking type. The default IWF for PPP LLC is "2".

- **PPP VcMux** – Point-to-Point Protocol Virtual Connection Multiplex. On the ATM side, a PPP frame is directly placed into the AAL5 frame without any encapsulation. This type can be used if the hardware at the far end does not support LLC encapsulation. The default IWF for PPP VcMUX is "3".

- **FRF.8** – Frame Relay Forum Standard 8. This is used when the ATM network connects a single Frame Relay network. It describes a one-to-one mapping between Frame Relay and ATM connection per the standard. The default IWF for FRF.8 is "1".

  Note: You cannot configure a PPP connection on a port that has an FRF connection, and vice versa. PPP and FRF connections cannot be used together on the same port.

- **FRF.8 Transparent** – Frame Relay Forum Standard 8. This is used when the ATM network connects a single Frame Relay network. On the Frame Relay side, the Frame Relay header is removed and the payload (with possible encapsulation) is placed unaltered in an AAL5 frame. On the ATM to Frame Relay side, the Frame Relay frame is created by attaching a frame header to the AAL5 payload (with possible encapsulation).

- **FRF.5 One-To-One** – Frame Relay Forum Standard 5. Use when the ATM network connects two Frame Relay networks, where a single Frame Relay connection is mapped to a single ATM connection (one DLCI to one VCI/VPI) per the standard.

- **FRF5 One-To-Many** – Frame Relay Forum Standard 5. Use when the ATM network connects two Frame Relay networks, where multiple Frame Relay connections are mapped to a single ATM connection (many DLCIs to one VCI/VPI) per the standard.

  Note: The **LMI Mode** field should be set to **None** when the **FRF.5 One to Many** Frame Relay/ATM Interworking type is used.

- **FRF PPP VcMUX** – Frame Relay Forum Point-to-Point Protocol Virtual Connection Multiplex. In this case, the PPP frame is placed in the Frame Relay frame with normal encapsulation on the far end (CPE side). On the ATM side, a PPP frame is directly placed into the AAL5 frame without any encapsulation. Use when PPP over Frame Relay traffic is to be forwarded without any encapsulation in the AAL5 frame.

- **ATM** – ATM over DS1 supports transport for ATM-packetized data and voice services per ITU-T G.804 standard (ATM cell mapping onto Plesiochronus Digital Hierarchy). Analog to digital conversion occurs at the external CPE or IAD and is mapped to ATM VC connections at the DS1 line card. Because T1 lines provide guaranteed data rates that are distance independent, AAL5 voice services can be provided with minimal loss of performance. The default IWF for ATM is 4.

  Note: Analog voice and Frame Relay require separate VCC channels from the CPE/IAD because they each use different ATM Adaption Layers and QoS.

Frame Relay Congestion Management. The interworking function supports different modes of operation for Frame Relay Discard Eligibility (DE), ATM Cell Loss Priority (CLP), and Forward Explicit Congestion Notification (FECN) to Explicit Forward Congestion Indication Bit (EFCI) bit mapping.

  Note: The following parameters are not specified if the interworking function type is PPP LLC, PPP VCMUX or ATM.

- **ATM Cell Loss priority to Frame Relay (Egress Direction)**
  - CLP to DE. If one or more cells belonging to the AAL5 frame has the CLP bit set, the DE bit will be set in a corresponding Frame Relay frame.
  - Constant 0 to DE. The CLP bit is set to a constant of "0" for the generated Frame Relay frame.
  - Constant 1 to DE. The CLP bit is set to a constant of "1" for the generated Frame Relay frame.

- **Frame Relay Loss Priority to ATM (Ingress Direction)**
  - DE to CLP. The DE bit value is copied to the CLP bit without alteration. Each ATM cell that is generated as a result of segmenting each Frame Relay frame contains this DE/CLP value.
  - Constant 0 to CLP. The DE bit is set to a constant of "0" for all ATM cells generated as a result of segmentation in the connection regardless of the CLP value.
  - Constant 1 to CLP. The DE bit is set to a constant of "1" for all ATM cells generated as a result of segmentation in the connection regardless of the CLP value.

- **Forward Congestion Indicator Frame Relay to ATM EFCI (Ingress Direction)**
  - FECN to EFCI. The FECN bit is placed into the EFCI bit without alteration.
  - Constant to EFCI. The EFCI bit is provided a constant value of "0."

Frame Relay Service Level Agreement Parameters

The following Frame Relay service level agreement parameters are configured for each connection:

- **Committed Burst Size** – The maximum amount of data (in bits) that the network agrees to transfer under normal conditions during a time interval. The time interval is calculated as Committed Burst Size divided by Committed Information Rate.

- **Excess Burst Size** – The maximum amount of uncommitted data (in bits) in excess of the Committed Burst Size that a Frame Relay network can attempt to deliver during a time interval. This data has a lower probability of delivery than Committed Burst Size and is eligible for discard under circumstances of congestion.

- **Committed Information Rate** – It is the average information capacity of the virtual circuit.

  Note: The Service Level Agreement parameters are not specified if the interworking function type is PPP LLC, PPP VCMUX or ATM.

ATM QoS Traffic Descriptors

Each DS1 connection is configured with ATM QoS traffic descriptors that correspond to the Frame Relay Service Level Agreement (SLA) parameters. The Committed Burst Size, the Excess Burst Size, the Committed Information Rate and the maximum speed of the Frame Relay line are mapped to ATM QoS traffic descriptors.

The following rules should be used to map Frame Relay SLA parameters to equivalent ATM QoS parameters:

- If Committed Burst Size (Bc) and Committed Information Rate (CIR) are defined, the IWF descriptor should be mapped to the ATM VBR-nrt service category. The traffic descriptor type should be *ClpTaggingScrCdvt (VBR.3)*. ATM performance parameters should be calculated as follows. (The acronyms used in the calculations are described in Table 1-20: List of Interworking Acronyms below.)

$$PCR = \frac{AR}{8} * OHA$$

$$SCR = \frac{CIR}{8} * OHB$$

$$MBS = \left[\frac{Bc}{8} * \left(\frac{1}{1 - \frac{CIR}{AR}} \right) + 1 \right] * OHB$$

$$CDVT = \frac{1}{PCR} * 10^7$$

Table 1-20: List of Interworking Acronyms

Acronym	Description
PCR	Peak Cell Rate (Cells/Sec).
AR	Access Line Rate (Bits/Sec) (The number of time slots used on the DS1 interface) X 64,000.
OHA	Overhead Factor for Access Rate (Cells/Byte) = 0.0286. **Note:** Assumes frame size of 64 bytes.
SCR	Sustainable Cell Rate (Cells/Sec).
CIR	Committed Information Rate (Bits/Sec).
OHB	Overhead Factor for Committed/Excess Rate (Cells/Byte) = 0.0312. **Note:** Assumes frame size of 64 bytes.
CDVT	Cell Delay Variance Tolerance (10^{-7} Sec).

■ If Committed Burst Size (Bc) and Committed Information Rate (CIR) are zero, the IWF descriptor should be mapped to the ATM UBR service category. In this case, all traffic is considered as excess capacity data. The traffic descriptor type should be *NoClpNoScrCdvt (UBR.1)*. ATM performance parameters should be calculated as follows. (The acronyms used in the calculations are described in Table 1-20: List of Interworking Acronyms.)

$$PCR = \frac{AR}{8} * OHA$$

$$CDVT = \frac{1}{PCR} * 10^7$$

Note: The standard, "ATM Forum BISDN Inter Carrier Interface (B-ICI) Specification," defines how the mapping should be specified.
To make exact calculations for different frame sizes, use the equations available in Appendix A (A.1.1 Method 1) of this specification.

Chapter 7
IDSL Provisioning

Introduction

This document describes ISDN DSL (IDSL) provisioning parameters and the operation of the D50 IDSL8 line card.

The IDSL8 line card provides eight IDSL lines using 2B1Q (2 Binary, 1 Quaternary) line encoding technique and standard ISDN transceivers with 2B + D (2 Bearer channels plus 1 Data channel) framing. 2B1Q is a DSL line encoding technique that uses four variations in amplitude and polarity to represent two bits. The IDSL8 line card uses the entire frequency spectrum for data transmission—unlike the ADSL line cards that carry both data and analog voice transmissions.

> **Note:** Additional provisioning information can be located in Appendix A, Provisioning Parameters.

Frame Based IDSL8 Line Cards

The D50 is an ATM based multiplexer that uses DSL technology to transport ATM cells between the ATM network and the subscriber. ATM based line cards (DMT8a-3, SDSL8, SDSL8+, and SHDSL8) transport ATM cells from the ATM network all the way through to the subscriber's CPE. The ATM Segmentation and Reassembly (SAR) function is done in the CPE.

The IDSL8 line card translates between frame-based protocols and ATM protocols—and performs the SAR function at the line card. Each IDSL port must be provisioned to support one of six frame-based Interworking Function (IWF) protocols. IWF allows the line card to translate between frame-based incoming "ingress" cells to ATM cells and vice versa.

In the ingress direction (from the CPE to the line card) the IDSL8 line card operates on the incoming frame with an IWF protocol and "segments" the frame into ATM cells. The ATM cells are sent across the Line Card Shelf backplane to the LSM card and onto the ATM network.

In the egress direction (from the ATM network to the line card) the ATM cells are "reassembled" at the line card into a PDU (Protocol Data Unit) and then transformed into frame format—based on the IWF provisioned for the connection—and sent out to the subscriber's CPE.

This frame-based architecture allows IDSL subscribers to use their existing ISDN CPE.

IDSL Provisioning Parameters

There are four IDSL provisioning parameters:

- Channel Mapping.
- IDSL Mode.
- Interworking Function (IWF).
- Network Interworking.

IDSL Channel Mapping Parameters

The IDSL8 line card has eight ports; each port supports three channel mapping parameters. The Channel Mapping parameter must be compatible with the IDSL Mode provisioned for the port. The default Channel Mapping setting is "B1."

Table 1-21: IDSL Channel Mapping Parameters

	Channel Mapping	**Valid with IDSL Modes**
B1	One Bearer channel (default)	All
B2	Two Bearer channels	2B Independent 2B+D Compatible
D	One Data channel	2B+D Compatible

IDSL Mode Parameters

Each IDSL port supports four provisionable IDSL Modes. The Mode determines the data rate supported by the IDSL port. The default Mode setting is "2B+D."

Table 1-22: IDSL Mode Parameters

IDSL Modes	**Data Rates**	**Valid with Channel Mode**
2B+D Bonded (default)	(1) 144 Kbps channel	B1
2B Bonded	(1) 128 Kbps channel	B1
2B Independent	(2) 64 Kbps channels	B1 or B2
2B+D Compatible (ISDN compatible)	(2) 64 Kbps B channels (1) 16 Kbps D channel	B1, B2 or D

IDSL8 Line Card PVC Connections

A Permanent Virtual Connection (PVC) must be established to connect the ATM trunk interface VPI/VCI with the IDSL8 line card port VPI/VPI. Each IDSL PVC must be configured to support one of six frame-based Interworking Function (IWF) protocols to allow translation at the line card between frame-based incoming "ingress" cells to ATM cells and vice versa:

- PPP over HDLC Logical Link Control (LLC) encapsulated.
- PPP over HDLC, Virtual Channel (VC) multiplexed.
- Frame Relay (FRF.8) translated over HDLC (includes PPP over Frame Relay, LLC encapsulated).
- Frame Relay (FRF.5) one-to-one multiplexed over HDLC.

■ Frame Relay (FRF.5) many-to-one multiplexed over HDLC.

■ Frame Relay PPP Virtual Channel (VC) multiplexed only.

PPP over HDLC supports only one PVC connection per port with default system mapping. Frame Relay supports multiple PVC connections with the VPI/VCI on the trunk side mapped to a specified Frame Relay Data Link Connection Identifier (DLCI) on the line card port. The IDSL8 line card supports a total of twenty-four Frame Relay connections, with a maximum of eight connections on a single port.

IDSL IWF Parameters

The IDSL8 line card supports two different types of frame-based IWFs:

■ Point to Point over High-level Data Link Control.

■ Frame Relay.

The default IWF setting is "FRF8."

Table 1-23: Interworking Function Parameters

IWF Type	IWF Function	Definition	PVCs Supported
PPP	**PPPLLC**	PPP over HDLC Logical Link Control (LLC) encapsulated.	1
	PPPVCMux	PPP over HDLC, Virtual Channel (VC) multiplexed.	1
Frame Relay	**FRF8** (default)	Frame Relay (FRF.8) translated over HDLC. Includes PPP over Frame Relay, LLC encapsulated.	1 to 8
	FRF5One	Frame Relay (FRF.5) one-to-one multiplexed over HDLC.	1 to 8
	FRF5Many	Frame Relay (FRF.5) many-to-one multiplexed over HDLC.	1 to 8
	FRF-PPPVC	Frame Relay PPP Virtual Channel (VC) multiplexed only.	1 to 8

Bad Provisioning Condition	A "Bad Provisioning" condition is displayed in Craft Terminal if any of the following provisioning errors are detected:	

- More than one PVC connection on an IDSL port provisioned for PPP.
- An IDSL port provisioned with a mix of PPP and Frame Relay PVC connections.
- More than twenty-four PVC connections per IDSL8 line card.

Network Interworking Parameter

The Network Interworking feature allows one Frame Relay network to pass information to another Frame Relay network over an ATM network.

The default Network Interworking setting is "disable."

IDSL Thresholds

The following thresholds are set and viewed in Craft Terminal; an event is reported when a threshold is crossed:

LOF Thresholds. The LOF threshold settings are the number of seconds during which an LOF condition was present. Loss of Frame condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default LOF threshold settings are "0" (zero) or inactive.

LOF Failures. Loss of Frame errors since line card reset, or since the physical performance monitoring data was cleared.

LOS Failures. Loss of Signal errors since line card reset, or since the physical performance monitoring data was cleared. An LOS condition takes precedence over an LOF condition.

Errored Seconds Thresholds. (Near End) Errored Seconds are the cumulative number of seconds the port is in an LOF condition or had a Coding Violation condition (Cyclic Redundancy Check (CRC) errors). Daily and 15 minute thresholds can be set for the ATUC unit. The default Errored Seconds threshold settings are "0" (zero) or inactive.

FE Errored Seconds Thresholds. Far End (FE) Errored Seconds are the cumulative number of seconds the port is in an LOF condition or had a Coding Violation condition (Cyclic Redundancy Check (CRC) errors). Daily and 15 minute thresholds can be set for the ATUC unit. The default FE Errored Seconds threshold settings are "0" (zero) or inactive.

Table 1-24: LOF and Errored Seconds Parameters

Parameter	15 Minute Values	Daily Values	Units	Defaults
Loss of Frame (LOF)	1 – 900	1 – 86400	Seconds	0
NE and FE Errored Seconds Threshold	1 – 900	1 – 86400	Seconds	0

Coding Violation Thresholds. (Near End) Coding Violation errors are a count of the Cyclic Redundancy Check (CRC) errored frames received for the ATUC unit during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit. The default Coding Violation threshold settings are "0" or inactive.

FE Coding Violations. Far End (FE) Coding Violation errors are a count of the Far End Block Errors (FEBE) reported by the ATUR to the ATUC during Data mode. Daily and 15 min thresholds can be set for the ATUC unit. The default Coding Violation threshold settings are "0" or inactive.

The following table provides the expected number of ATUC Near and FE Coding Violation errors in 15 minute and Daily intervals.[1] These numbers can be used as threshold settings.

Note: The number of expected Coding Violation errors varies based on the data rate. The numbers included in the following table are provided as a guideline to help establish Coding Violation thresholds.

Table 1-25: ATUC Coding Violation Threshold Settings

Parameters	Threshold Settings based on Data Rates (bits per second)		Sensitivity to CV Errors
	128000	**144000**	
Daily Settings	110000	120000	Low
	11000	12000	Medium Low
	1100	1200	Medium
	110	120	Medium High
	11	12	High
15 Min Settings	10600	12000	Low
	1100	1300	Medium Low
	110	130	Medium
	12	13	Medium High
	1	1	High

Error Alarm Threshold. This ATUC parameter sets the number of near end "errored frames" per second allowed before an "event" or alarm is sent to Craft Terminal. The inactive Error Alarm Threshold setting is "0," the default setting is "0."

Rate Degraded Threshold. This is the number of bits per second below the minimum data rate provisioned for the ATUC (Downstream) and ATUR (Upstream) channels before a "Rate Degraded" condition is sent to Craft Terminal. The default setting is "0."

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[1] Coding Violation errors are single bit errors randomly distributed with a mean equal to the Bit Error Rate.

The following thresholds are reported in Craft Terminal for the IDSL port:

- **ATUC LOF Seconds 15 min:** Total number of seconds during which the port detects a Loss of Frame (LOF) condition during the current 15-minute interval.
- **ATUC LOS Seconds 15 min:** Total number of seconds during which the port detects a Loss of Signal (LOS) condition during the current 15-minute interval.
- **ATUC LPR Seconds 15 min:** Total number of seconds during which the port detects a Loss of Power (LPR) condition during the current 15-minute interval.
- **ATUC LCD Seconds 15 min:** Total number of seconds during which the port detects a Loss of Cell Destination (LCD) condition during the current 15-minute interval.
- **ATUC LOF Retrains 15 min:** The number of DSL port retrains (based on LOF) during the current 15-minute interval.
- **ATUC Error Retrains 15 min:** The number of near-end DSL port retrains (based on "errored frames") during the current 15-minute interval.
- **ATUC FE Error Retrains 15 min:** The number of far-end DSL port retrains (based on "errored frames") during the current 15-minute interval.
- **ATUC LOF Seconds daily:** Total number of seconds during which the port detects an LOF condition during the current daily interval.
- **ATUC LOS Seconds daily:** Total number of seconds during which the port detects an LOS condition during the current daily interval.
- **ATUC LPR Seconds daily:** Total number of seconds during which the port detects an LPR condition during the current daily interval.
- **ATUC LCD Seconds daily:** Total number of seconds during which the port detects an LCD condition during the current daily interval.
- **ATUC LOF Retrains daily:** The number of DSL port retrains (based on LOF) during the current daily interval.
- **ATUC Error Retrains daily:** The number of near-end DSL port retrains (based on "errored frames") during the current daily interval.
- **ATUC FE Error Retrains daily:** The number of far-end DSL port retrains during the current daily interval.
- **ATUC NE** and **FE CV (15 min and daily):** The number of Coding Violations.
- **ATUC NE** and **FE ES (15 min and daily):** The number of Errored Seconds.

Chapter 8
ATM Provisioning

Introduction The D50 multiplexer connects two ends of an ATM data pipe. One end is the ATM network interface; the other end is the line card port. The line card port is connected to the subscriber's residence or business—via the existing copper "twisted pair" network—using Digital Subscriber Line (DSL) technology. This data pipe is called a virtual *connection*.

At the ATM network interface, the D50 multiplexer sends and receives ATM cells containing customer "payload." At the subscriber's end of the twisted pair, the NIC or external router/modem extracts the customer "payload" out of the ATM cell format, and reassembles the "payload" back into its original form.

From the perspective of the subscriber or the ATM network backbone, the data goes in one end of the data pipe at the ATM network interface, and comes out the other end at the customer's PC.

> **Note:** Additional provisioning information can be located in Appendix A, Provisioning Parameters.

A PVC Connection ATM supports two types of circuits: Permanent Virtual Circuit (PVC), and Switched Virtual Circuit (SVC). The D50 System supports PVC connections. A PVC is provisioned by the network service provider as part of setting up subscriber service. Once a PVC is established, data goes in one end of the pipe, and comes out the other end.

A PVC consists of the following components:

- A connection ID number.
- A line card Virtual Path Identifier (VPI), Virtual Circuit Identifier (VCI), shelf, slot, and port number. The D50 System refers to the line card VPI/VCI as the "Virtual Link A."
- A trunk VPI/VCI. The D50 System refers to the trunk VPI/VCI as the "Virtual Link Z."

A *connection ID number* is an integer from 1 to 4096, assigned sequentially by the D50 System as each connection is established. When the D50 breaks a connection, that ID number is free. The connection ID number is reused when ID numbers are assigned up to 4096; the counter then starts back at 1.

The line card side (Virtual Link A) of the connection has a VPI/VCI address, as well as the physical address of the Line Card Shelf, slot, and port.

The following service order information is required to provision service:

- A trunk VPI/VCI corresponding to a particular Internet Service Provider's port.
- A subscriber VPI/VCI.
- A Line Card Shelf, slot, and port (or line circuit) that is attached to the customer's cable/pair (twisted pair physical address).

DSL Port Parameters

Associated with the line card port are a series of DSL parameters that control how the line card port sends data over the copper network. DSL provisioning information required from the service order includes maximum and minimum Upstream/ATUC and Downstream/ATUR data rates.

Provisioning with Craft Terminal

Detailed Level Procedures for Provisioning are provided in Section 2—*System and Service Order Provisioning, Chapter 2—"Initial Service Provisioning," page 2-29*.

Chapter 9
DS3 Trunk Provisioning

Introduction

This document describes provisioning parameters and the operation of the D50 DS3 trunk card.

The DS3 trunk card provides the interface for connecting the D50 system to an ATM backbone facility. The DS3 card multiplexes and de-multiplexes up to 12 broadband ATM cell streams from the MLA cards, and sends this payload out over the ATM network. The D50's Master Control Shelf (MCS) can contain two DS3 cards in a 1:1 protection group.

The D50 system supports the following types of DS3 cards:

- **DS3T** – The basic DS3 card; it does not support priority queuing.
- **DS3T2** – The DS3T2 card, which provides support for priority queuing Quality of Service (QoSV4). QoS Provisioning details for this card are available in Chapter 11—"QoSV4 Provisioning," page 1-81.
- **DS3TQ** – The DS3TQ card supports end to end ATM QoS for the different service categories of CBR, VBR-rt, VBR-nrt and UBR. QoS Provisioning details for this card are available in Chapter 12—"ATM QoS Provisioning," page 1-91.

For details, see the description of the DS3 card in the volume titled <u>Craft Terminal</u>.

Note: Additional provisioning information can be located in Appendix A, Provisioning Parameters.

Note: To switch service between the active and standby trunk cards, refer to the volume titled <u>Maintenance and Testing</u>, Section 4—*Appendices*, Appendix A—"Trunk Card Service Switching."

DS3/ATM Interface Specifications

The DS3 trunk card provides the GR499 compliant, metallic DS-3 interface to connect the D50 system to a DS-3 based data network. It also contains the downstream address translation, second level of multiplexing, and timing generation functions for the D50 system. The DS3 terminates the DS-3 formatted ATM data stream to and from the ATM data network. The DS-3 functions of frame formatting, cell delineation and serial to parallel conversion are contained in an ATM physical layer device in the DS3 trunk card.

The Master Control Shelf (MCS) contains two DS3 cards in a 1:1 protection group. Slot 8 in the MCS contains the working card, and slot 7 contains the protection card. The protection card monitors the internal data path to prevent failures.

On the downstream (egress) path, if a cell's VPI/VCI address identifies the cell as user data, the VPI portion of the cell header is replaced with an internal multiplexer address to facilitate routing through the D50 system. A routing tag is also inserted, which is used by the DS3 card to determine the destination for the cell. The DS3 translator checks for OAM cells and processes them based on associated data. The translator supports Alarm Indication Signal (AIS), Remote Defect Indicator (RDI) and loopback Operations And Maintenance (OAM). All other OAM cells are discarded by the address translator.

The input path is multiplexed into twelve 8-bit parallel ports for the MLA (Master Line Card Adapter) card slots and to a queue connected to the upstream data path. The downstream-to-upstream path is used for routing OAM and Embedded Operations Channel (EOC) cells out of the DS3 trunk and for routing test cells to the microprocessor. The MLA ports operate at a 25 MHz rate.

> **Note:** F4 Virtual Connection End to End Endpoint OAM loopback tests are not supported on the trunk side of the OC3TQS, OC3TQM, OC3TQL, and DS3TQ trunk cards.

On the upstream (ingress) path, cells enter the D50 with their final ATM network VPI/VCI addresses. Buffers are located on the individual MLA circuit cards in the upstream path. Flow control feedback is implemented across the interface between the trunk card and the MLA slots. The D50 polls the MLA slot circuit cards for buffer status and implements a service algorithm to ensure fairness. A service interval is provided for each of the 12 MLA ports and the downstream to upstream path. Cells with their test indicator bit set are extracted from the upstream path and placed in a microprocessor port queue. The remainder of the aggregated ATM cell stream is applied directly to the ATM physical layer device.

Fault information is stored in registers in the D50; the DS3 card uses this information for performance monitoring purposes.

The DS3 card uses its internal system clocks and references.The system references are frequency locked to the on-board DS3 carrier TCXO (20-PPM stability) on initial power up. The system references may also be frequency locked to the DS3 frame pulse (if available), or to an external office reference. The DS3 card provides an 8 kHz and a 19.44 MHz system reference. It also provides a 25 MHz bus clock. The bus clock is not locked to the system reference.

> **Important! If installed, the Master Timing Unit (MTU) card(s) provides the 8 kHz timing signal to the DS3 trunk card. The trunk card generates the backup 8 kHz timing signal if the MTU card(s) signal fails. The timing option on the DS3 trunk card must be set to <u>External</u> if MTU cards are used. MTU cards are designed to be used with the DS3TQ, OC3TQS, OC3TQM, and OC3TQL, trunk cards. MTU cards are not designed to work with any other trunk cards. For detailed information about MTU cards, refer to the volume titled <u>Installation</u>, Section 6—*Telco Cabling*, Chapter 6—"MTU Card Installation and Telco Cabling."**

The metallic full-duplex uni-directional DS-3 signals connect to the D50 at the backplane connectors. The DS-3 signal is switched on the backplane to either the main or protect DS3 card. The DS-3 signals enter the DS3 circuit card at the backplane connector. These signals are then applied to a DS3 Line Interface Module that provides the analog line to the digital terminal (DS3 PHY layer device) interface.

For details on the DS3 card user interface, see the volume titled <u>Craft Terminal</u>.

> **Note:** Additional provisioning information can be located in Appendix A, Provisioning Parameters.

Provisioning Parameters

All DS3 provisioning parameters can be set using Craft Terminal[1]. For details on the user interface, see the volume titled <u>Craft Terminal</u>.

The DS-3 signal parameter settings on the DS3 trunk card must match the parameters set on the far-end ATM router or switch. The signal parameters include:

- Line Type.
- Line Timing.
- Cell Scrambling.
- HEC Coset.

The DS3 card interface allows you to set a number of thresholds for BER (Bit Error Rate) performance parameters. The following BER parameters affect port operation, and can be set for both 15-minute and daily intervals:

- Code Violation – Path (CVCP-P).
- SEF/AIS Second – Path (SAS-P).
- Errored Second – Path (ESCP-P).
- Severely Errored Seconds – Path (SESCP-P).
- Unavailable Seconds – Path (UASCP-P).
- Errored Second – Line (ES-L).
- Severely Errored Seconds – PLCP – P (SEFSPLCP-P).
- Errored Second PLCP – Path (ESPLCP-P).
- Unavailable Second PLCP – P (UASPLCP-P).
- Code Violation PLCP – Path (CVPLCP-P).
- Severely Errored Seconds PLCP – P (SESPLCP-P).

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[1]

The following table provides the threshold settings for the DS3 performance parameters. For each parameter the table specifies whether the value is fixed or provisionable.

Table 1-26: Performance Parameter BERs

Acronym	Parameter	Daily Interval	15 minute Interval
CVCP-P	Code Violation-Path: Count of CP-bit parity errors occurring in the accumulation period. For values, see Table 1-27: CVCP-P Provisionable Thresholds, page 1-71.	3820 Provisionable	382 Provisionable
ESCP-P	Errored Second-Path: Count of seconds containing one or more CP-bit parity errors, one or more SEF defects, or one or more AIS defects.	250 Fixed Value	25 Fixed Value
SESCP-P	Severely Errored Second-Path: Count of seconds containing more than 44 (equates to a BER of 10-6) CP-bit parity errors, one or more SEF defects, or one or more AIS defects.	40 Fixed Value	4 Fixed Value
SAS-P	SEF/AIS Second-Path: Count of seconds containing one or more SEF defects or one or more AIS defects.	8 Fixed Value	2 Fixed Value
UASCP-P	Unavailable Second-Path: Count of one second intervals during which the DS3 path is unavailable.	10 Fixed Value	10 Fixed Value
ES-L	Errored Second-Line: Count of seconds containing one or more BPVs (which are not part of a zero substitution code), one or more Excessive Zeros (EXZ), or one or more LOS defects.	250 Fixed Value	25 Fixed Value
CVPLCP-P	Code Violation PLCP: Count of BIP-8 code errors in the accumulation period. For values, see Table 1-28: CVPLCP-P Provisionable Thresholds, page 1-72.	3584 Provisionable	359 Provisionable

Table 1-26: Performance Parameter BERs (continued)

Acronym	Parameter	Daily Interval	15 minute Interval
ESPLCP-P	Errored Second PLCP: Count of seconds containing one or more BIP-8 coding errors, or one or more SEF defects.	250	25
SESPLCP-P	Severely Errored Second PLCP: Count of seconds containing more than 4 (equates to a BER of 10-7) BIP-8 coding errors, or one or more SEF defects.	40 Fixed Value	4 Fixed Value
SEFSPLCP-P	Severely Errored Framing Second PLCP: Count of seconds containing one or more SEF defects. A SEF defect is declared when an error in the A1 octet and an error in the A2 octet of a framing octet pair or two consecutive invalid or non-sequential Path Overhead Identifier octets are detected.	8 Fixed Value	2 Fixed Value
UASPLCP-P	Unavailable Second PLCP: Count of one second intervals during which the DS3 PLCP path is unavailable.	10	10

The following tables provide the provisionable values for the CVCP-P and CVPLCP-P parameters.

Table 1-27: CVCP-P Provisionable Thresholds

BER	Daily Interval	15 minute Interval
10^{-10}	382	38
10^{-9}	3820 (default)	382 (default)
10^{-8}	38196	3820
10^{-7}	381799	38180
10^{-6}	3801881	380188

Table 1-28: CVPLCP-P Provisionable Thresholds

BER	Daily Interval	15 minute Interval
10^{-10}	358	36
10^{-9}	3584 (default)	359 (default)
10^{-8}	35830	3583
10^{-7}	358132	35813
10^{-6}	3564673	356467

Chapter 10
OC3 Trunk Provisioning

Introduction

This document describes provisioning parameters and the operation of the D50 OC3 trunk card.

The D50 supports the following types of OC3 cards:

- **OC3T** – The basic OC3 card, does not support priority queuing Quality of Service (QoSV4).
- **OC3T2, OC3T2M, OC3T2L** – These cards provide support for priority queuing Quality of Service (QoSV4). QoS provisioning details for this card are available in Chapter 11—"QoSV4 Provisioning," page 1-81.
- **OC3TQS, OC3TQM, OC3TQL** – The OC3TQ card supports end to end ATM QoS for the different service categories of CBR, VBR-rt, VBR-nrt, UBR, and UBR+. QoS provisioning details for this card are available in Chapter 12—"ATM QoS Provisioning," page 1-91.

For details, see the description of the OC3 card in the volume titled <u>Craft Terminal</u>.

Note: To switch service between the active and standby trunk cards, refer to the volume titled <u>Maintenance and Testing</u>, Section 4—*Appendices*, Appendix A—"Trunk Card Service Switching."

OC3/ATM Interface Specifications

The OC3 trunk card provides a GR-253 compliant SONET (Synchronous Optical Network) interface for connecting the D50 system to an OC3-based data network. It also provides egress address translation, second level multiplexing, and timing resources. The OC3 trunk card terminates the OC3-formatted ATM data stream to and from the ATM data network.

The Master Control Shelf (MCS) contains two OC3 cards in a 1:1 protection group. For D50 systems, slot 8 in the MCS contains the working card, and slot 7 contains the protection card.

If a cell's VPI/VCI address identifies the cell as user data, the VPI portion of the cell header is replaced with an internal multiplexer address to facilitate routing through the D50 system. A routing tag is also inserted, which is used by the OC3 card to determine the destination for the cell. The OC3 translator checks for OAM cells and processes them based on associated data. The translator supports Alarm Indication Signal (AIS), Remote Defect Indicator (RDI) and loopback Operations and Maintenance (OAM).

Upstream data is multiplexed into twelve 8-bit parallel ports for the MLA (Master Line Card Adapter) card slots and to a queue connected to the ingress data path. The downstream-to-upstream path is used for routing OAM and Embedded Operations

Channel (EOC) cells out of the OC3 trunk and for routing test cells to the microprocessor. The MLA ports operate at a 25 MHz rate.

> **Note:** F4 Virtual Connection End to End Endpoint OAM loopback tests are not supported on the trunk side of the OC3TQS, OC3TQM, OC3TQL,and DS3TQ trunk cards.

Fault information is stored in registers in the multiplexer; this information is used by the OC3 card for performance monitoring purposes.

The OC3 card obtains timing from its internal system clocks and references. The system references are frequency locked to the on-board OC3 carrier TCXO (20-PPM stability) on initial power up. The system references may also be frequency locked to the OC3 frame pulse (if available), or to an external office reference. The OC3 card provides an 8 kHz and a 19.44 MHz system reference. It also provides a 25 MHz bus clock. The bus clock is not locked to the system reference.

> **Important! If installed, the Master Timing Unit (MTU) card(s) provides the 8 kHz timing signal to the OC3 trunk card. The trunk card generates the backup 8 kHz timing signal if the MTU card(s) signal fails. The timing option on the OC3 trunk card must be set to <u>External</u> if MTU cards are used. MTU cards are designed to be used with the OC3TQS, OC3TQM, OC3TQL, and DS3TQ trunk cards. MTU cards are not designed to work with any other trunk cards. For detailed information about MTU cards, refer to the volume titled Installation, Section 6—*Telco Cabling*, Chapter 6—"MTU Card Installation and Telco Cabling."**

For details on the OC3 card user interface, see the volume titled <u>Craft Terminal</u>.

> **Note:** Additional provisioning information can be located in Appendix A, Provisioning Parameters.

Provisioning Parameters	All OC3 provisioning parameters can be set using Craft Terminal[1]. For details on the user interface, see the volume titled <u>Craft Terminal</u>.

The OC3 facility parameter settings on the OC3 trunk card must match the parameters set on the far-end ATM router or switch. The signal parameters include:

- Facility Type.
- Timing.

The OC3 card interface allows the user to set a number of thresholds for near- and far-end performance parameters. The following parameters affect port operation, and can be set for both 15-minute and daily intervals:

Section Thresholds. These include SEFS (Severely Errored Seconds).

Line Thresholds. These include the following thresholds:

- ES (Errored Seconds).
- SES (Severely Errored Seconds).
- CV (Coding Violations).
- UAS (Line Unavailable Seconds).

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[1]

Path Thresholds. These include the same thresholds as for the multiplexer section.

Note: The parameters listed above are for OC3 trunk SONET facilities. When working with STM1 trunk SDH facilities, the equivalent parameters are as follows:

– Section Thresholds = Regenerator Section (RS) Thresholds.

– Line Thresholds = Multiplexer Section (MS) Thresholds.

– Path Thresholds = High Order (HO) Path Thresholds.

For details on setting these thresholds, see Table 1-29: Near SONET Performance Parameters, page 1-75, and Table 1-30: Far SONET Performance Parameters, page 1-77.

The near-end performance parameters (for daily and 15-minute intervals), their descriptions, and default counts are described in the table below:

Table 1-29: Near SONET Performance Parameters

Acronym	Meaning	Daily Interval	15 Minute Interval
SECTION			
SEFS	**Section Severely Errored Framing Second**: Count of seconds containing one or more Severely Errored Framing (SEF) defect (defined as a time at which the incoming signal has a minimum of four consecutive errored framing patterns). A SEF defect is terminated upon detecting two successive error-free framing patterns.	0 – 65535 Default setting is 0 (inactive)	0 – 900 Default setting is 0 (inactive)
LINE			
ES	**Line Errored Second**: Count of seconds containing one or more Line Layer BIP errors or an AIS-L defect was present.	0 – 65535 Default setting is 0 (inactive)	0 – 900 Default setting is 0 (inactive)
SES	**Line Severely Errored Second**: Count of seconds containing 2,500 or more Line Layer BIP errors or an AIS-L defect was present.	0 – 65535 Default setting is 0 (inactive)	0 – 900 Default setting is 0 (inactive)

Table 1-29: Near SONET Performance Parameters (continued)

Acronym	Meaning	Daily Interval	15 Minute Interval
CV	**Line Code Violation-Path**: Count of BIP errors (using B2 byte) occurring in the accumulation period. Up to 8XN BIP errors can be detected per STS-N frame, with each error incrementing the CV-L current second register.	0 – 1,048,575 Default setting is 0 (inactive)	0 – 16383 Default setting is 0 (inactive)
UAS	**Line Unavailable Second**: Count of one second intervals during which the Line is unavailable. The Line is unavailable at the onset of 10 contiguous SES-Ls. The 10 SES-Ls are included in unavailable time and so since it is not known until the tenth second that unavailable time started ten seconds ago the counts for all the parameters must be adjusted back to what they were ten seconds ago. Once unavailable the Line becomes available at the onset of 10 contiguous seconds with no SES-Ls. The ten seconds with no SES-Ls are excluded from available time so the counts of the parameters do not need to be adjusted.	0 – 65535 Default setting is 0 (inactive)	0 – 900 Default setting is 0 (inactive)
PATH			
ES	**Path Errored Second**: Count of seconds containing one or more Path Layer BIP errors or an AIS-P or LOP-P defect was present.	0 – 65535 Default setting is 200	0 – 900 Default setting is 20
SES	**Path Severely Errored Second**: Count of seconds containing 2,400 or more Line Layer BIP errors or an AIS-P or LOP-P defect was present.	0 – 65535 Default setting is 7	0 – 900 Default setting is 3

Table 1-29: Near SONET Performance Parameters (continued)

Acronym	Meaning	Daily Interval	15 Minute Interval
CV	**Path Code Violation**: Count of BIP errors (using B3 byte) occurring in the accumulation period. Up to 8 BIP errors can be detected per frame, with each error incrementing the CV-P current second register.	0 – 1,048,575 Default setting is 250	0 – 16383 Default setting is 25
UAS	**Path Unavailable Second**: Count of one second intervals during which the Path is unavailable. The Path is unavailable at the onset of 10 contiguous SES-Ps. The 10 SES-Ps are included in unavailable time and so since it is not known until the tenth second that unavailable time started ten seconds ago the counts for all the parameters must be adjusted back to what they were ten seconds ago. Once unavailable the Path becomes available at the onset of 10 contiguous seconds with no SES-Ps. The ten seconds with no SES-Ps are excluded from available time so the counts of the parameters do not need to be adjusted.	0 – 65535 Default setting is 10	0 – 900 Default setting is 10

The far-end performance parameters (for daily and 15-minute intervals), their descriptions, and default counts are described in the table below:

Table 1-30: Far SONET Performance Parameters

Acronym	Meaning	Daily Interval	15 Minute Interval
LINE			
ES	**Line Errored Second**: Count of seconds containing one or more Line Layer BIP errors was reported by the far-end LTE (using the REI-L indication) or an RDI-L defect was present.	0 – 65535 Default setting is 0 (inactive)	0 – 900 Default setting is 0 (inactive)

Table 1-30: Far SONET Performance Parameters (continued)

Acronym	Meaning	Daily Interval	15 Minute Interval
SES	**Line Severely Errored Second**: Count of seconds containing 2,500 or more Line Layer BIP errors reported by the far-end LTE (using the REI-L indication) or an RDI-L defect was present.	0 – 65535 Default setting is 0 (inactive)	0 – 900 Default setting is 0 (inactive)
CV	**Line Code Violation-Path**: Count of BIP errors (using REI-L indication in the Line Overhead) detected by the far-end LTE. Up to 8XN BIP errors can be indicated by the REI-L, with each error incrementing the CV-LFE current second register.	0 – 1,048,575 Default setting is 0 (inactive)	0 – 16383 Default setting is 0 (inactive)
UAS	**Line Unavailable Second**: Count of one second intervals during which the OC3 Line is unavailable at the far-end. The far-end Line is unavailable at the onset of 10 contiguous SES-LFEs. The 10 SES-LFEs are included in unavailable time and so since it is not known until the tenth second that unavailable time started ten seconds ago the counts for all the parameters must be adjusted back to what they were ten seconds ago. Once unavailable the Line becomes available at the onset of 10 contiguous seconds with no SES-LFEs. The ten seconds with no SES-LFEs are excluded from available time so the counts of the parameters do not need to be adjusted.	0 – 65535 Default setting is 0 (inactive)	0 – 900 Default setting is 0 (inactive)

Table 1-30: Far SONET Performance Parameters (continued)

Acronym	Meaning	Daily Interval	15 Minute Interval
PATH			
ES	**Path Errored Second**: Count of seconds containing one or more Path Layer BIP errors was reported by the far-end PTE (using the REI-P indication) or an RDI-P defect was present.	0 – 65535 Default setting is 200	0 – 900 Default setting is 20
SES	**Path Severely Errored Second**: Count of seconds containing 2400 or more Path Layer BIP errors reported by the far-end PTE (using the REI-P indication) or an RDI-P defect was present.	0 – 65535 Default setting is 7	0 – 900 Default setting is 3
CV	**Path Code Violation-Path**: Count of BIP errors (using REI-P indication in the Path Overhead) detected by the far-end PTE. Up to 8 BIP errors can be indicated by the REI-P, with each error incrementing the CV-PFE current second register.	0 – 1,048,575 Default setting is 250	0 – 16383 Default setting is 25

Table 1-30: Far SONET Performance Parameters (continued)

Acronym	Meaning	Daily Interval	15 Minute Interval
UAS	**Path Unavailable Second**: Count of one second intervals during which the Path is unavailable at the far-end. The Path is unavailable at the onset of 10 contiguous SES-PFEs. The 10 SES-PFEs are included in unavailable time and so since it is not known until the tenth second that unavailable time started ten seconds ago the counts for all the parameters must be adjusted back to what they were ten seconds ago. Once unavailable the Line becomes available at the onset of 10 contiguous seconds with no SES-PFEs. The ten seconds with no SES-PFEs are excluded from available time so the counts of the parameters do not need to be adjusted.	0 – 65535 Default setting is 10	0 – 900 Default setting is 10

Chapter 11
QoSV4 Provisioning

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Introduction This document describes priority queuing of QoS Version 4 (QoSV4) provisioning parameters for the D50 cards. Various QoS features can be provisioned at the port level for the following cards:

- MCS cards
    - Trunk – DS3T2, OC3T2, OC3T2M, OC3T2L.
    - MLA – MLA2, MLA2S, MLA2L, MLAT1 (IMUX), MLAT3.
    - Broadband tributary – OC3L, DS3L.
- LCS cards
    - LSM – LSMT1 (IMUX), LSMT3, LSM2, LSM2S, LSM2L.
    - Line – DMT8a-3, DMT8a4, SDSL8, SDSL8+, SHDSL8, DS1, IDSL.

Not all priority queuing QoS parameters are provisionable for all the card types listed.

Note: QoSV4 priority queuing features are not provisionable for the LSM2 card versions.

Release 11.0 supports a maximum QoS buffer capacity of 1024 cells per port for all line cards.

Note: If you are upgrading to Release 11, and the sum total of your per port buffer allocation for the three priority queues on two-port and four-port line card is greater than the maximum 1024 cells, a "Provisioning Data Not Found" error message will appear, and you will be required to manually re-provision the queue default settings.

The following sections describe the QoSV4 features and note which features are provisionable for each card type. Additional provisioning information can be located in Appendix A, Provisioning Parameters.

Note: Craft Terminal refers toMLA2, MLA2S, MLA2L cards as MLA2, and LSM2, LSM2S, LSM2L cards as LSM2.

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Starvation Cycles The Starvation Cycles parameters are used to prevent bandwidth starvation for Low and Medium priority queues. The user can specify the number of starvation cycles in both the ingress (upstream) and egress (downstream) directions. The starvation cycle values are applied to all line cards in the LCS.

The Starvation Cycle works by allocating priority service to Low priority or Medium priority queues once per provisioned starvation cycles. In this way, additional bandwidth is allocated to low-priority or medium-priority traffic at the end of the provisioned starvation cycle, as shown in the following figure.

Starvation Cycles

Que: Low ▼

Ingress: 5

Bandwidth priority to
Low Priority Queue

Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	
High Priority	High Priority	High Priority	High Priority	High Priority	Low Priority
Medium Priority	Medium Priority	Medium Priority	Medium Priority	Medium Priority	High Priority
Low Priority	Low Priority	Low Priority	Low Priority	Low Priority	Medium Priority

Repeat Starvation Cycles

Figure 1-4: Starvation Cycles

As shown in Figure 1-4, service to low-priority and medium-priority traffic is allocated as a specified percentage of the total bandwidth available. The percentage for each queue is calculated as one divided by the value of queue plus one [1/(starvation cycles + 1)]. If field values are assigned to both medium priority and low priority queues, then both queues receive a percentage of the total bandwidth, though neither queue can receive more than 33% of the total bandwidth.

If l $\neq$ 0 and m $\neq$ 0

$$BW_{low} = \frac{1}{1+l} * BW_{total}$$

$$BW_{med} = \frac{1}{1+m} * BW_{total}$$

Example: If l = 9 and m = 4, then BW_{low} = 10% of total bandwidth available for low priority traffic and BW_{med} = 20% of total bandwidth available for medium priority traffic.

Variables

Low Priority Starvation Cycle = l
Medium Priority Starvation = m
Low Priority Bandwidth = BW_{low}
Medium Priority Bandwidth = $PriBW_{med}$
Total bandwidth = BW_{total}

Figure 1-5: Equations for Calculating Low and Medium Priority Bandwidth

Starvation Cycle Range. The following table lists starvation cycle ranges for the LSM and MLA cards.

Note: If the value for the **Starvation Cycle** field is set to 0 (zero), starvation cycling is disabled.

Table 1-31: Starvation Cycle Range

Card	Direction	Cycle Range
MLA	Egress	0 – 63
	Ingress	0 – 63
LSM	Egress	0 – 15
	Ingress	0 – 63

Provisioning Starvation Cycles by Card Type. The following table shows for which direction(s) the Starvation Cycles are provisionable for each card type ("n/p" means the starvation cycle is "not provisionable" for the specified direction):

Table 1-32: Provisionable Starvation Cycle Directions

Card Type	Direction Low Priority		Direction Medium Priority	
	Ingress	**Egress**	**Ingress**	**Egress**
Line Cards	n/p	n/p	n/p	n/p
LSM2/LSM2S/LSM2L	n/p	**YES**	n/p	**YES**
LSMT1 (IMUX)	**YES**	**YES**	**YES**	**YES**
LSMT3	**YES**	**YES**	**YES**	**YES**
MLA2/MLA2S/MLA2L	**YES**	**YES**	**YES**	n/p
MLAT1 (IMUX)	**YES**	**YES**	**YES**	n/p
MLAT3	**YES**	**YES**	**YES**	n/p
OC3L, DS3L	**YES**	**YES**	**YES**	n/p
Trunk Cards[1]	**YES**	n/p	**YES**	n/p

[1] This is not applicable to the DS3T and OC3T cards.

QoSV4 features are provisionable in Craft Terminal. Refer to the volume titled Craft Terminal for more information.

Queue Management Parameters

The queue management parameters allow you to provision the QoS buffers to control congestion in the QoS buffers. The user can specify which queue to view as follows:

- Priority: low, medium, or high.
- Direction: ingress or egress.

The following table shows which queues (by Priority and Direction) are provisionable on each card ("n/p" means the Priority or Direction is "not provisionable"):

Table 1-33: Priority/Direction – Queue Management Parameters

Card Type	Priority	Direction	
		Egress	Ingress
Line Cards	**YES**	n/p	**YES**
LSM2/LSM2S/LSM2L	n/p	n/p	n/p
LSMT1 (IMUX)	**YES**	n/p	**YES**
LSMT3	**YES**	n/p	**YES**
MLA2/MLA2S/MLA2L	**YES**	**YES**	**YES**
MLAT1 (IMUX)	**YES**	**YES**	**YES**
MLAT3	**YES**	**YES**	**YES**
OC3L, DS3L	**YES**	**YES**	**YES**
Trunk Cards	n/p	n/p	

The following EPD/PPD (Early Packet Discard/Partial Packet Discard) and EFCI (Explicit Forward Congestion Indicator) parameters can be provisioned for low and medium priority queues:

- **EPD Enable**. This parameter enables/disables EPD for the port. Once the queue congestion threshold is reached, EPD is used to reduce the number of cells transmitted by dropping partial packets. A partial packet results if a cell is dropped from a packet for any reason. The EPD transmits only intact packets, based on the thresholds set on this tab. This option should be enabled if the queue will be carrying connections supporting ATM Adaptation Layer (AAL) Type 5; otherwise it should be disabled.

  EPD can also be provisioned at the connection level. If a queue will be carrying a combination of AAL5 and other protocols, EPD should be enabled at the port level, and enabled for the individual connections that will be carrying AAL5 traffic exclusively, and disabled for those connections not carrying AAL5 data.

- **EFCI Enable.** This parameter enables/disables EFCI for the port.

Thresholds can be specified for each of these parameters, including:

- **PPD** – specifies the threshold above which partial packets will be discarded. If any cell in the packet is dropped for any reason, subsequent cells associated with the packet are dropped. The default is 95.0 (95%).
- **EPD Onset** – specifies the threshold above which partial packets will be discarded. A packet that is being transmitted when this threshold is reached will be transmitted in its entirety. The default is 75.0 (75%).
- **EPD Abate** – specifies the threshold below which packets will be transmitted. The default is 65.0 (65%).
- **EFCI** – specifies the threshold above which EFCI will be applied to packets. The default is 65.0 (65%).

Changing the Queue Size

You can view and change the queue size for any of the three buffers. However, this is a data affecting action and is NOT recommended. If you do choose to change the queue size, use the following guidelines. The total buffering available for all three queues is 64K (except for line cards; refer to Table 1-34: Card Queue Sizes, page 1-85).

The default sizes for the three queues use the entire 64K of available buffering, so increasing the size of one queue requires that you decrease the size of another by at least the same number of cells to make the required buffering available; you should provision the decrease in size first, otherwise a provisioning error will occur. If the total size of all three queues exceeds 64K, the system will display a condition message, but will continue to use the queue sizes as provisioned.

Note: Line card queues are actually located on the LSM card, not on the line card. However, provisioning a queue size associated with a line card is done at the line card port level, using Craft Terminal. Queue sizes are shown in the following table:

Table 1-34: Card Queue Sizes

Card Type	Ingress Size (total cells)	Egress Size (total cells)	Priority Sizes (Defaults)
MLA2/MLA2S/ MLA2L	64511	64511	Low = 45067 Med = 19316 High = 128
MLAT1 (IMUX), MLAT3	64511	64511	Low = 45067 Med = 19316 High = 128
OC3L, DS3L	64511	64511	Low = 45067 Med = 19316 High = 128

Table 1-34: Card Queue Sizes (continued)

Card Type	Ingress Size (total cells)	Egress Size (total cells)	Priority Sizes (Defaults)

LSM2/LSM2S/LSM2L	(none)	8192 per line card:
		■ 4-port line cards = 1024 per port:
		  − Low = 694
		  − Med = 298
		  − High = 32
		■ 8-port line cards = 1024 per port:
		  − Low = 694
		  − Med = 298
		  − High = 32
			(see Ingress and Egress columns)

LSMT1 (IMUX), LSMT3	Low = 45067
	Med = 19316
	High = 128
		8192 per line card:
		■ 4-port line cards = 1024 per port:
		  − Low = 694
		  − Med = 298
		  − High = 32
		■ 8-port line cards = 1024 per port:
		  − Low = 694
		  − Med = 298
		  − High = 32
			(see Ingress and Egress columns)

Line cards (Quad, Octal)	(none)	(managed by the LSM; see LSM above)	(see LSM above)
Trunk cards	(none)	(none)	(none)

Queue Congestion Parameters

The queue congestion parameters allow you to set options for monitoring the queues. Queues can be specified by Priority (low, medium, or high) and Direction (ingress or egress).

The following table shows which queues (by Priority and Direction) are <u>provisionable</u> on each card ("n/p" means the Priority or Direction is "not provisionable"):

Table 1-35: Provisioning: Queue Congestion Parameters

Card Type	Priority	Direction	
		Egress	Ingress
Line Cards	**YES**	n/p	**YES**
LSM2/LSM2S/LSM2L	n/p	n/p	n/p
LSMT1 (IMUX)	**YES**	n/p	**YES**
LSMT3	**YES**	n/p	**YES**
MLA2/MLA2S/MLA2L	**YES**	**YES**	**YES**
MLAT1 (IMUX)	**YES**	**YES**	**YES**
MLAT3	**YES**	**YES**	**YES**
OC3L, DS3L	**YES**	**YES**	**YES**
Trunk Cards	n/p	n/p	

Use the Congestion Measurement parameters to enable or disable congestion measurement. You can also specify a weight factor between .001 and 1.000. The default is 0.300. (The **weight factor** is used to smooth data samples; a value of "1" means that no weighting is applied to the current sample to calculate the measure of congestion.)

The Levels and Reporting Periods parameters allow you to provision thresholds for the following parameters:

- **Severe level** – level at which an alarm will be reported if the level stays above the specified Abate level for the specified number of Active report seconds. The default is 90%.
- **Abate level** – level below which an alarm will clear if the level stays below the specified Abate level for the specified number of Clear report seconds. The default is 70%.
- **Intermediate level** – level at which a threshold report will be generated. Only one report will be generated per five-minute interval. The default is 40%.

- **Active report** – time in seconds before an alarm is reported if:
  - the level exceeds the specified Severe level, and
  - the level stays above the specified Abate level for the specified number of Active report seconds.
    The default is 30 seconds.
- **Clear report** – time in seconds before an alarm clears if the level stays below the specified Abate level. The default is 30 seconds.

Queue Congestion Performance Monitoring

The queue congestion Performance Monitoring (PM) parameters allow you to specify reporting information on congestion for each of the three queues (low, medium, and high) in both directions (egress and ingress). Up to 12 five-minute bins of performance data (Craft Terminal only) can be viewed. The data in Bin number 1 always contains the data for the current interval; Bin number 2 contains the data for the previous interval, and so on. The selected bin will contain the maximum and minimum smoothed values which occurred in that five-minute period.

The following table shows which queues (by Priority and Direction) are <u>provisionable</u> on each card ("n/p" means the Priority or Direction is "not provisionable"):

Table 1-36: Provisioning: Queue Congestion PM Parameters

Card Type	Priority	Direction	
		Egress	Ingress
Line Cards	**YES**	n/p	**YES**
LSM2/LSM2S/LSM2L	n/p	n/p	n/p
LSMT1 (IMUX)	**YES**	n/p	**YES**
LSMT3	**YES**	n/p	**YES**
MLA2/MLA2S/MLA2L	**YES**	**YES**	**YES**
MLAT1 (IMUX)	**YES**	**YES**	**YES**
MLAT3	**YES**	**YES**	**YES**
OC3L, DS3L	**YES**	**YES**	**YES**
Trunk Cards	n/p	n/p	

**MLAT1
Congestion
Monitoring**

The MLAT1 card supports two alternative methods of congestion monitoring for the DS-1 IMUX group, based on the queue priority type (low, medium, and high):

- The <u>medium</u> and <u>low</u> priority queues monitor the queue buffer depth of the IMUX port. A congestion alarm is generated when queue capacity exceeds the **Severe Level %** capacity of the queue buffer. See the preceding section **Queue Congestion Performance Monitoring**, page 1-88 for more information.

- The <u>high</u> priority queue monitors congestion for the total bandwidth utilization of all active DS-1 links in the IMUX group. Bandwidth utilization threshold is a percentage of total bandwidth on all MLA/LSM links in the MLAT1 IMUX group. When congestion PM monitoring is enabled for the high priority queue, bandwidth utilization monitoring is activated. A utilization alarm is generated when the congestion level exceeds the **Severe Level %** bandwidth utilization threshold for a set period of time (in seconds). The utilization alarm is configurable in both the ingress and egress direction.

The following Queue management parameters on the MLA card determine the bandwidth conditions for generating and clearing the utilization alarm:

- **Severe Level** – specifies the percentage of total bandwidth at which the utilization alarm is generated. When bandwidth utilization exceeds this threshold for a set period of time, the alarm occurs. The default is 90 (90%).

- **Abate Level** – specifies the percentage of total bandwidth at which the utilization alarm is cancelled. When bandwidth utilization drops below this threshold for a specified period of time, the alarm clears. The default is 70 (70%).

- **Active Report** – specifies the length of time (in seconds) that bandwidth must exceed the **Severe Level** threshold before the utilization alarm is generated. The default is 30 seconds

- **Clear Report** – specifies the length of time (in seconds) that bandwidth must drop below the **Abate Level** threshold before the utilization alarm is cancelled. The default is 30 seconds.

Chapter 12
ATM QoS Provisioning

Introduction
ATM Quality of Service (QoS) is supported on all versions of the OC3TQ[1] and DS3TQ trunk cards and the MCP and works optimally on an OC3 interface between the MLA and LSM. ATM QoS includes all the standard features per the ATM Forum Traffic Management Specification Version 4.0 with the exception of Available Bit Rate (ABR) service category support.

ATM QoS enables network and service providers to provide service differentiation over the network over individual DSL lines. Examples of service differentiation include voice, video, circuit emulation, high-priority business data, and consumer Internet access.

This document describes ATM QoS provisioning parameters for the D50 cards.

QoS Hardware and Software Compatibilities
The following table shows the different trunk and MLA cards and the system software required for QoSV4 Priority Queuing and ATM QoS features.

Table 1-37: QoS Hardware and Software Compatibilities

	QoSV4 Priority Queuing		ATM QoS[1]	
	Hardware	**Software**	**Hardware**	**Software**
D50 Trunk Cards	DS3T2, OC3T2, OC3T2M, OC3T2L	Release 5.1	DS3TQ, OC3TQL, OC3TQM, OC3TQS	Release 6.0, 8.0, 9.0, 9.1, 10.0, and 11.0
ATM-based MLA Cards	MLA2, MLA2S, MLA2L, MLAT3, MLAT1	Release 5.1	MLA2, MLA2S, MLA2L, MLAT3, MLAT1	Release 6.0, 8.0, 9.0, 9.1, 10.0, and 11.0

[1] ATM QoS supports CBR, VBR-nrt, VBR-rt, UBR, and UBR+.

Features
ATM QoS provides the following features:
- Provisionable service categories per Virtual Connection.
- Upstream Traffic policing per Virtual Connection.

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[1] Includes OC3TQS, OC3TQM, OC3TQL

- Traffic shaping per Virtual Connection.

- Provisionable queuing per Virtual Connection.

- Connection Admission and Control (CAC) alarms for the trunk card and individual Virtual Connections.

- Backward compatibility with QoSV4.

- Performance Monitoring per Virtual Connection.

- Provisionable EPD/PPD and EFCI for Congestion Control and Avoidance.

  Note: Priority queuing starvation cycles are not applicable to a D50 system supporting ATM QoS.

Multiple Service Categories

ATM QoS provides the following four[2] service categories:

- **Constant Bit Rate (CBR)** is used by connections that request a static amount of bandwidth to be continuously available during the connection life-time. Examples are real time video, audio, circuit emulation services, and audio-video distribution such as TV, Pay-per-view, distance learning. CBR services provide connectivity up to a peak cell rate with an upper bound of cell delay variation tolerance. The source may emit cells at, or below the negotiated peak cell rate at any time for any duration and the QoS commitments still pertain.

- **Variable Bit Rate real-time (VBR-rt)** service category supports applications requiring variable bandwidth with tight bounds on delay. Cells are generated at arbitrary time intervals and delivered with bounded cell delay variation and cell loss ratio. Examples are variable bit rate CODECs, aggregated voice with silence removal, video conferencing and loop emulation services with AAL2.

- **Variable Bit Rate non-real-time (VBR-nrt)** service category supports applications requiring variable bandwidth with less stringent limits on delay as in the case of transaction processing. Cells are generated at arbitrary time intervals and delivered with bounded cell delay variation and cell loss ratio.

- **Unspecified Bit Rate (UBR, UBR+)** is intended for applications that do not require a fixed bandwidth or fixed interval of transmission, and are highly tolerant of delay and loss. Examples are file transfer, e-mail, and LANs.

  – **UBR**. In the case of UBR, there is no explicit commitment from the network provider regarding capacity or throughput. No objective is specified for the QoS parameters and the only traffic parameter is PCR.

  – **UBR+**. Introduced with D50 Release 8.0, UBR+ allows operators to provide a UBR service that is better than best effort. UBR+ guarantees a minimum cell throughput, has EPD/PPD congestion control support, and allows the connection to burst to the Peak Cell Rate. The traffic parameters used for UBR+ are PCR and MCR.

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[2] Available Bit Rate (ABR,) although displayed in the Craft Terminal GUI, is not available in this release.

The following figure shows the bandwidth occupied by various service categories in a network circuit.
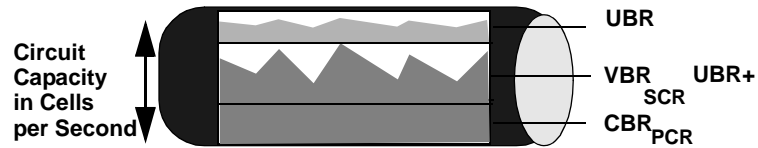
Figure 1-6: CBR, VBR, UBR, and UBR+

ATM Performance Parameters

The following QoS and traffic parameters are used in this chapter to describe ATM performance.

CLR (Cell Loss Ratio). A QoS parameter that gives the ratio of the lost cells to the total number of transmitted cells on a given VCC in cells per second. This is preset for the Connection Admission Control algorithm to be 10^{-7} for VBR-rt and VBR-nrt.

CTD (Cell Transfer Delay). A QoS parameter that measures the maximum or worst-case time for a cell to be transferred from its source to its destination over a virtual connection. It is the sum of buffering, propagation, processing and queuing delays. The maximum CTD is 0xFFFFFF.

CDV (Cell Delay Variance). A QoS parameter that measures the peak-to-peak cell delay through the network; it is the difference between the worst case delay as determined by the CTD and the best case delay or fixed delay achievable on the virtual connection. It is a very important parameter for time-sensitive service categories such as CBR and VBR-rt and it provides a measure of how closely cells are spaced in a VCC. CDV is usually introduced due to cell multiplexing, buffering or the insertion of OAM cells. Provision the CDV value to be approximately equal to the inverse of the PCR.

CDVT (Cell Delay Variance Tolerance). It specifies in tenths of microseconds the acceptable tolerance to cell-by-cell variations of the CDV (jitter). The CDVT is typically very low for CBR and VBR-rt connections, a bit higher for VBR-nrt connections and very high for UBR connections. This is provisionable for each virtual connection.

PCR (Peak Cell Rate).

A traffic parameter in cells per second that characterizes the maximum source transmission rate. The fraction 1/PCR represents the time between two cells over a given virtual connection. PCR is assigned to all service categories. It can only be set at a speed lower than the port connection speed.

Table 1-38: Mapping Data Rates to ATM Peak Cell Rates

Data Rates[1] (Kbps)	Peak Cell Rate Cells/Sec.
192	453
384	906
768	1812
1152	2717
1536	3623
2320	5472

[1] One ATM cell equals 424 bits.

SCR (Sustainable Cell Rate).
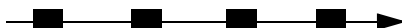
An ATM traffic parameter in cells per second that characterizes a bursty source and specifies a maximum average rate at which cells can be sent over a given ATM virtual connection.

Burst Tolerance.

Burst Tolerance is the maximum length of time that a connection can send at the Peak Cell Rate. The parameter measures how long a connection may exceed the Sustained Cell Rate.

MBS (Maximum Burst Size).

A traffic parameter that specifies the maximum number of cells in a burst that can be transmitted at the peak rate assuming that, at the beginning of the burst, the receiving buffers are empty.

CLP (Cell Loss Priority). A 1-bit field in the ATM cell header that corresponds to the loss priority of a cell. CLP=0 cells are a higher priority than CLP=1 cells. Lower priority (CLP=1) cells can be discarded under a congestion situation. CLP=0+1 refers to an aggregate cell stream.

The following figure illustrates PCR, SCR, and MBS in a sample ATM traffic stream. It also shows that non-conforming cells are tagged to be discarded in the event of network congestion.
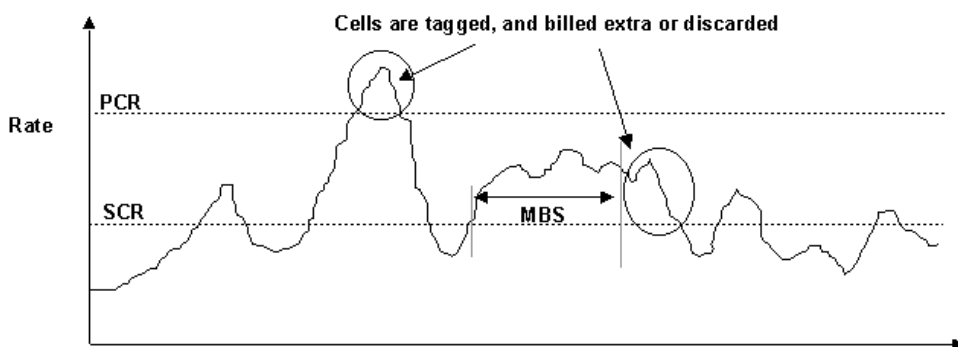
Figure 1-7: PCR, SCR, and MBS

Traffic Descriptor Types, Traffic Parameters, and Connections

PCR, SCR, MBS, and CDVT are traffic parameters that measure the inter-cell arrival time for resource allocation. Based on these traffic parameters, seven, basic, pre-defined traffic descriptor types corresponding to seven traffic contracts are available for different categories of service.

Table 1-39: Traffic Descriptor Types (Templates)

QoS Service Category	Traffic Descriptor Type	Traffic Parameters		Description
CBR	ClpTransparent NoScr (CBR.1)	Parameter 1	PCR in cells/second for CLP[1]=0+1 traffic.	Traffic conformance is based on the CLP-transparent model with no SCR. In a CLP-transparent model, the network disregards the CLP bit.
		Parameter 2	CDVT in tenths of microseconds.	
		Parameters 3, 4 and 5	Not used.	
VBR	ClpTransparent Scr (VBR.1)	Parameter 1	PCR in cells/second for CLP=0+1.	Traffic conformance is based on the CLP-transparent model with SCR. In a CLP-transparent model, the network disregards the CLP bit.
		Parameter 2	SCR CLP=0+1.	
		Parameter 3	MBS in cells.	
		Parameter 4	CDVT in tenths of microseconds.	
		Parameter 5	Not used.	

Table 1-39: Traffic Descriptor Types (Templates) (continued)

QoS Service Category	Traffic Descriptor Type	Traffic Parameters		Description
VBR	ClpNoTagging ScrCdvt (VBR.2)	Parameter 1	PCR in cells/second for CLP=0+1.	Traffic conformance is based on CLP with SCR without tagging.
		Parameter 2	SCR in cells/second for CLP=0 traffic.	
		Parameter 3	MBS in cells.	
		Parameter 4	CDVT in tenths of microseconds.	
		Parameter 5	Not used.	
VBR	ClpTaggingScr Cdvt (VBR.3)	Parameter 1	PCR in cells/second for CLP=0+1.	Traffic conformance is based on CLP with SCR and tagging.
		Parameter 2	SCR in cells/second for CLP=0 traffic, excess tagged[2] as CLP=1.	
		Parameter 3	MBS in cells.	
		Parameter 4	CDVT in tenths of microseconds.	
		Parameter 5	Not used.	
UBR[3]	NoClpNoScrCdvt (UBR.1)	Parameter 1	PCR in cells/second for CLP=0+1 traffic.	Traffic conformance is based on no CLP and no SCR.
		Parameter 2	CDVT in tenths of microseconds.	
		Parameters 3, 4 and 5	Not used.	
UBR	NoClpTaggingNo Scr (UBR.2)	Parameter 1	PCR in cells/second for CLP=0+1 traffic.	Traffic conformance is based on no CLP with tagging and no SCR.
		Parameter 2	CDVT in tenths of microseconds.	
		Parameters 3, 4 and 5	Not used.	

Table 1-39: Traffic Descriptor Types (Templates) (continued)

QoS Service Category	Traffic Descriptor Type	Traffic Parameters		Description
UBR+	ClpNoTagging Mcr	Parameter 1	PCR in cells/second for CLP=0+1 traffic.	Traffic conformance is based on CLP with no tagging and MCR.
		Parameter 2	CDVT in tenths of microseconds.	
		Parameter 3	MCR in cells/second.	
		Parameters 4 and 5	Not used.	

[1] CLP=0 cells are a higher priority than CLP=1 cells. Lower priority (CLP=1) cells can be discarded under a congestion situation. CLP=0+1 refers to an aggregate cell stream.

[2] Tagging is a process of setting the CLP bit of cells entering an ATM network to 1 because they do not conform to the subscribed traffic descriptor. These marked cells can be dropped based on the network congestion.

[3] UBR is titled "Low" in the Craft Terminal GUI.

Traffic Profiles/Traffic Descriptors

The traffic descriptor types listed in the previous table (Table 1-39: Traffic Descriptor Types (Templates)) function as templates. Based on these templates, **traffic profiles** (known as **traffic descriptors** in the GUI) can be created when the user requires a different set of characteristics other than those pre-defined.

Creating Traffic Profiles/Traffic Descriptors. Traffic profiles/traffic descriptors can be created by assigning specific values to the parameters of the default traffic descriptor types in Craft Terminal. Each profile is assigned an index number by the system for identification purposes. The indices of 1 to 32 are reserved by the system; indices from 1 to 10 are pre-defined (see the following table).

Note: The New Traffic Descriptor dialog box in Craft Terminal enables users to create traffic profiles/traffic descriptors. For details, see volume titled <u>Craft Terminal</u>.

The ten default traffic profiles/traffic descriptors are available in the following table:

Table 1-40: Pre-defined Traffic Profiles/Traffic Descriptors

Index	Service Category	Traffic Descriptor Type	Performance Parameters				Congestion Control Features	
			PCR	CDVT	SCR	MBS	Tagging	Frame Discard
1.	CBR	CBR.1	X	X				
2.	VBR-rt	VBR.1	X	X	X	X		
3.	VBR-rt	VBR.1	X	X	X	X		X
4.	VBR-nrt	VBR.2	X	X	X	X		
5.	VBR-nrt	VBR.3	X	X	X	X	X	
6.	VBR-nrt	VBR.3	X	X	X	X	X	X
7[1].	VBR-nrt	VBR.1	X	X	X	X		
8.	UBR	UBR.1	X	X				
9.	UBR	UBR.1	X	X				X
10.	UBR	UBR.2	X	X			X	

[1] Used for In-Band Management Channel.

UBR+ does not have default traffic descriptors associated with it.

Using Traffic Profiles/Traffic Descriptors. Traffic profiles/traffic descriptors can be applied to unlimited, individual connections.

Rules for Traffic Profiles/Traffic Descriptors. The following rules apply:
- A traffic profile/traffic descriptor must exist before a connection can be created.
- A traffic profile/traffic descriptor cannot be deleted unless all the associated connections are deleted.
- A traffic profile/traffic descriptor cannot be modified, once created.
- An existing connection can be moved from one traffic profile/traffic descriptor to the other by first deleting the connection and then re-creating it and associating it with the desired traffic profile/traffic descriptor.
- The same traffic profile/traffic descriptor should be assigned to both the Receive and Transmit directions when adding a new connection. For instance, if "1" is the index number of the traffic profile/traffic descriptor selected in the Receive field of the New Connection dialog box in Craft Terminal, "1" should also be selected in the Transmit field of the same dialog box. For details, see volume titled Craft Terminal.

Traffic Descriptor for In-Band Management

A traffic descriptor is required in order to provision In-Band Management. In the Craft Terminal GUI, the In-Band Management fields are available in the System Initialization dialog box.

A Release 9.0 system with ATM QoS trunk cards supports a bandwidth capacity of 512 Kbps for In-band Management. With non-ATM QoS trunk cards, a bandwidth configuration of 128 Kbps is supported for In-band Management.

The default traffic descriptor numbered 7 is available for the 512 Kbps In-Band channel. This default traffic descriptor cannot be modified. However, if there is a need for a different set of characteristics, any traffic descriptor that satisfies the bandwidth capacity of 512 Kbps of the In-Band channel can be used.

> **Note:** Additional information on the In-Band channel is available in the volume titled Craft Terminal.

Traffic Descriptor for UBR+

UBR+ does not have a default traffic descriptor associated with it. However, one can easily be created in Craft Terminal using the following parameters:

Table 1-41: UBR+ Traffic Descriptor

Field	Value
Descriptor Type	ClpNoTaggingMcr
Service Category	UBR
Parameters	PCR (Param 1)
	CDVT (Param 2)
	MCR (Param 3)
Frame Discard	Yes/No

Maximum and Minimum Values for ATM QoS Parameters

The following table provides the maximum and minimum provisionable values per connection for ATM QoS parameters.

Table 1-42: Maximum and Minimum Values

ATM QoS Parameter	Minimum	Maximum
PCR (Cells/Sec)	1.4	354,000
CDVT	700 nanoseconds	1 second
SCR (Cells/Sec)	1.4	17,700
MCR (Cells/Sec)	1.4	17,700
MBS (Cells)	1	1,000,000

Traffic Policing

Once a virtual connection is established, active processes monitor and enforce the rules embodied in the traffic contract. This is called traffic policing.

Note: Traffic policing is applicable only in the upstream (ingress) direction. Downstream traffic policing has been disabled on the trunk card since this function is performed by the ATM switch.

Traffic policing is carried out by a process component called the **Usage Parameter Control (UPC)**, resident in the OC3TQ trunk cards.

Generic Cell Rate Algorithm (Dual Leaky Bucket)

The UPC tags or discards errant cells based on the Generic Cell Rate Algorithm, also known as the Dual Leaky Bucket algorithm. The Generic Cell Rate Algorithm (GCRA) provides a method to explain how an ATM switch measures the bandwidth conformance of each CBR, VBR, and UBR connection. It is a flow control algorithm where cells are monitored to check whether they comply with the established connection parameters.

The "dual leaky bucket" analogy conceptually describes the traffic policing and shaping performed by the complex Generic Cell Rate Algorithm. In Figure 1-8: Generic Cell Rate Algorithm (Dual Leaky Bucket), there is a burst of cells entering the network from the ATM Customer Premises Equipment. The leak out of the first bucket represents the Peak Cell Rate. Cells may enter at above the Peak Cell Rate, and the tolerance for this is represented by CDVT, which is the depth of the first bucket. Cells are discarded when the bucket fills. This is true for all types of connections: CBR, VBR-rt, VBR-nrt, UBR, UBR+.

For VBR connections, cells then enter the second bucket. The leak out of the second bucket represents the Sustainable Cell Rate, and the depth of the bucket is the Burst Tolerance, which is the maximum length of time a connection can send cells at the Peak Cell Rate. Cells overflowing from the second bucket are either tagged or discarded.
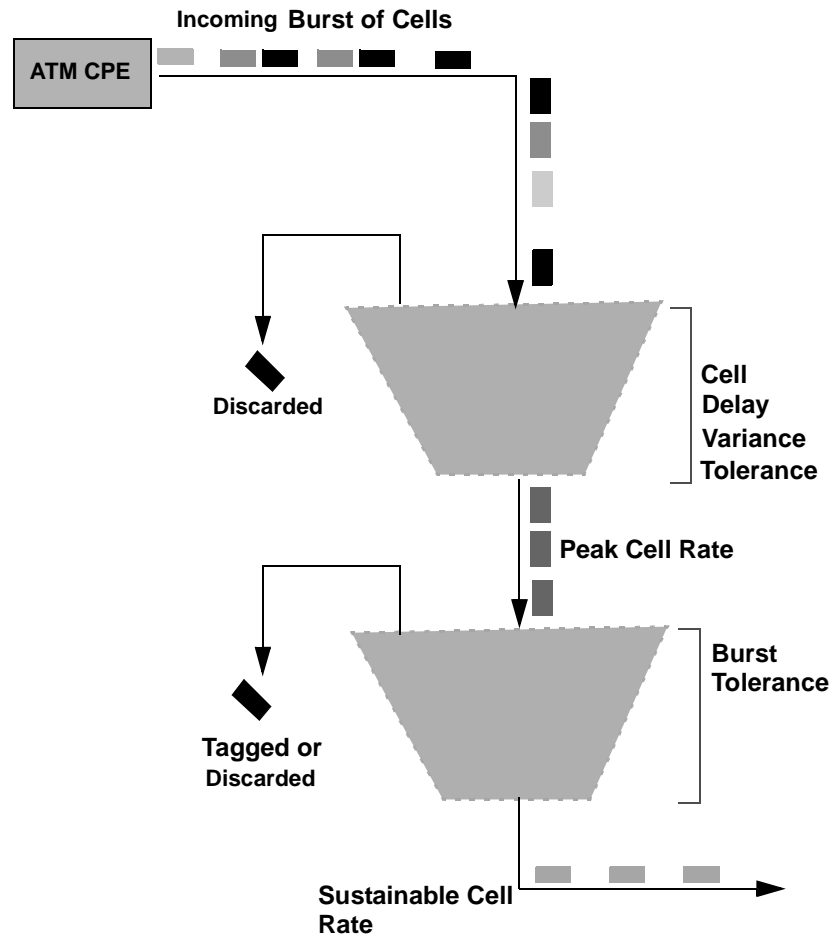
Figure 1-8: Generic Cell Rate Algorithm (Dual Leaky Bucket)

Traffic Shaping	ATM QoS includes a feature called traffic shaping that uses cell scheduling algorithms to distribute available bandwidth to UBR and VBR-nrt connections. Traffic shaping also smooths the cell stream, eliminates peaks and cell jitters, helps reduce burst lengths, and maintains cell sequence integrity.

Congestion Control and Avoidance

Release 8.0 enhanced the Congestion Control and Avoidance (CCA) functionality provided with earlier releases. As before, CCA parameters can be configured and enabled at the queue level for all connection types; in addition, since Release 8.0, they can be enabled/disabled at the traffic descriptor level for AAL5 type of connections.

The following parameters can be provisioned for low and medium priority queues:

Early Packet Discard (EPD)/Partial Packet Discard (PPD) Enable. Early Packet Discard (also called Frame Discard) can be enabled on a traffic descriptor basis for AAL5 type of connections, both upstream and downstream, for VBR and UBR service categories. When the provisioned threshold is reached, EPD stops all new incoming packets (a Protocol Data Unit comprising a series of ATM cells) and makes an intelligent choice of dropping all cells in a packet instead of randomly dropping cells from many packets.

EPD determines the packet boundaries by examining the Service Data Unit Identifier (SDUI) in the Payload Type (PT) field of the ATM cell header.
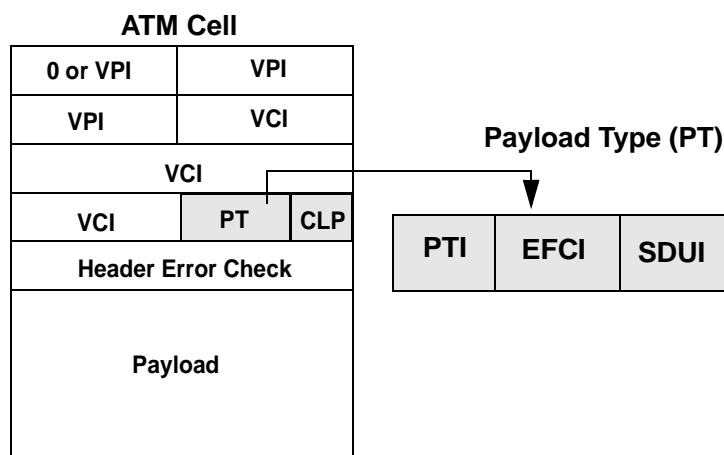
Figure 1-9: Three Bits in the Payload Type Field of the ATM Cell Header

If some of the cells in a packet have passed through the network before congestion occurred, PPD is implemented. PPD drops cells in a frame beginning at an arbitrary point.

Explicit Forward Congestion Indicator (EFCI) Enable. This parameter can be enabled to assist congestion avoidance and recovery on both upstream and downstream traffic on a traffic descriptor basis for AAL5 type of connections. In this case, the EFCI bit in the ATM cell header is set to 1.

> **Note:** A connection failure may result if EPD is enabled for types of connections other than AAL5.

Thresholds can be specified for each of these parameters, including:

- **PPD** – specifies the threshold above which partial packets (Protocol Data Units, or PDUs) will be discarded. The default is 95.0 (95%).
- **EPD Onset** – specifies the threshold above which PDUs will be discarded. A PDU that is being transmitted when this threshold is reached will be transmitted in its entirety, and any subsequent PDUs will be discarded. The default is 75.0 (75%).
- **EPD Abate** – specifies the threshold below which PDUs will be transmitted. The default is 65.0 (65%).
- **EFCI** – specifies the threshold above which EFCI will be applied to PDUs. The default is 65.0 (65%).

Connection Admission and Control (CAC)

The Connection Admission and Control (CAC) determines whether there is sufficient bandwidth to establish new connections at the required QoS, by subtracting bandwidth in use from maximum bandwidth. When CAC is enabled, the network does not accept new connection requests when it cannot provide the requested QoS. CAC alarms are system generated and cannot be configured. They are viewed on Craft Terminal.

For each connection request, the CAC evaluates the bandwidth request based on the following information obtained from the traffic contract:

- Values of parameters in the source traffic descriptor.
- Requested and acceptable values of each QoS parameter and the requested QoS category.
- CDVT value.
- Requested conformance definition.

CAC reserves bandwidth for each QoS as follows:

- For CBR connections, CAC reserves bandwidth for Peak Cell Rate (PCR)
- For VBR connections, CAC reserves bandwidth for Sustained Cell Rate (SCR)
- For UBR connections, no bandwidth is reserved.

The following parameter enables or disables CAC:

Enable ATM CAC. By default CAC is disabled. When CAC is disabled, the D50 allows oversubscription of maximum bandwidth. In oversubscription, connections can be provisioned in excess of maximum bandwidth on the assumption that not all connections will be in service at the same time or transmit at their maximum rate all the time (for example, VBR transmits data in bursts). Therefore, if carefully planned based on connection bandwidth requirements and subscriber use rates, oversubscription can provide high utilization of D50 transmission capacity.

Performance Monitoring

The performance monitoring function maintains a count of total cells sent to the network by the OC3TQ and DS3TQ trunk cards and those received by the MLA to be delivered to the CPE. Systems released prior to Release 6.0 are supported by monitoring the cells received and sent at the MLA. For Release 6.0 and later versions, performance monitoring is carried out per connection on the system and consists of:

- Transmitted CLP = 0 Cells.
- Transmitted CLP = 0 + 1 Cells.
- Received CLP = 0 Cells.
- Received CLP = 0 + 1 Cells.

(CLP=0 cells are a higher priority than CLP=1 cells. CLP=0+1 refers to an aggregate cell stream.)

Fault Management

Operations and Maintenance (F4 and F5) fault management functions such as standard loopback (end-to-end or segment), both source and respond, continuity checks, plus AIS and RDI alarms are supported on the OC3TQ and DS3TQ trunk cards. OAM feature includes OAM Performance Management that provides for the collection of ATM PM information on a per connection basis.

> **Note:** F4 Virtual Connection End to End Endpoint OAM loopback tests are not supported on the trunk side of the OC3TQS, OC3TQM, OC3TQL, and DS3TQ trunk cards.

Queues

The D50 guarantees a service category to and from the ATM network for each Permanent Virtual Circuit (PVC). However, if subscriber traffic exceeds the rate[3] of the connection between the Line Card Shelf (LCS) to the Master Control Shelf (MCS), the D50 allocates bandwidth through a priority queuing mechanism. Each of the service categories is mapped to a different priority queue for bandwidth allocation within the D50. They are based on the mapping structure described below in **Backward Compatibility with QoSV4 and Non-QoS**.

At the trunk card, "per VC queuing" (Priority Queuing) is supported – each virtual connection has a separate buffer. The total buffer size is 1536K cells, which includes the upstream and downstream directions together.

In the ingress (upstream) direction, for DS-3 and 4xDS-1connections only, the LSM cards have queue sizes of 64K cells. The default sizes for the queues are:

- High – 128 cells
- Medium – 19316 cells
- Low – 45067 cells

Note: For OC-3 MLA-LSM connections, there are no priority queues on the LSM cards in the upstream direction.

Low priority connections have the largest queue size because in the event of congestion, High priority connections would be the first to flow through the system, followed by Medium priority, and then Low priority. The Low priority queue size

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[3] D50 MCS to LCS interfaces include OC-3, DS-3, and 4xDS-1 rates.

needs to be the largest since these connections will most likely have to wait for sufficient bandwidth to flow through the system.

Note: In the downstream direction, for OC-3, DS-3 and 4xDS-1 connections, the queue sizes are provisionable at the line card port level but the queues are actually held at the LSM cards.
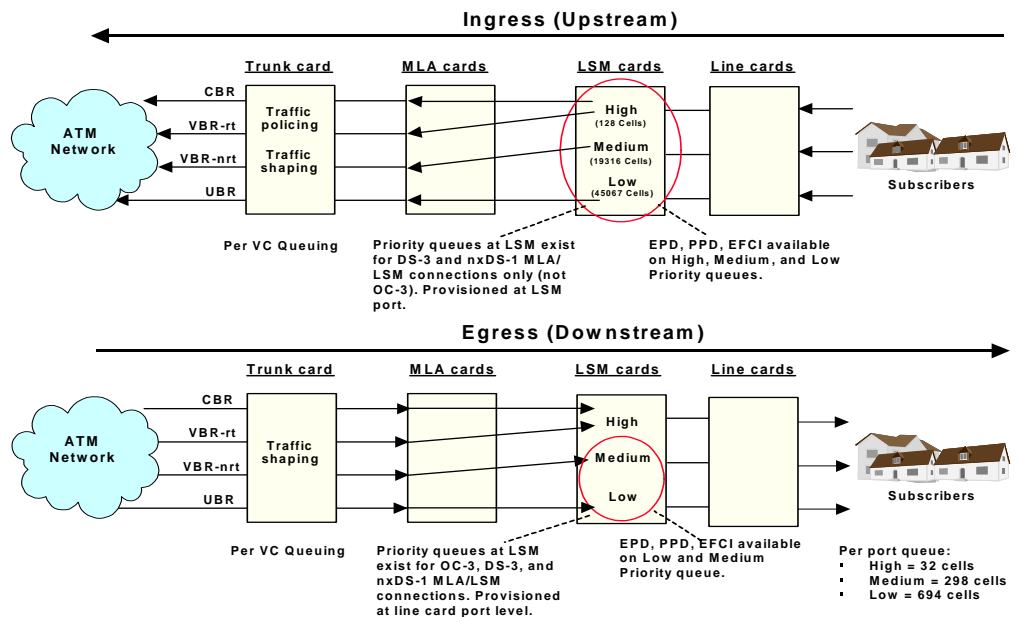
Figure 1-10: Priority Queuing in a D50 ATM QoS Implementation

Selected priority queues on the LSM cards utilize the congestion control features as described in **Congestion Control and Avoidance**, page 1-102.

OC-3 MLA-LSM interfaces do not have priority queues at the LSM card in the upstream direction. For DS-3 and 4xDS-1 connections, priority queues (High, Medium and Low) are held at the LSM card and EPD, PPD and EFCI are used to manage all three queues.

In the downstream direction, all MLA-LSM interface types, OC-3, DS-3, and 4xDS-1 have queues at the LSM card. EPD, PPD and EFCI are used for the Low and Medium priority queues.

CBR Connection Maximum Rates

The maximum rate of a CBR connection must be set at 5% of the trunk or MLA/LSM interface rate, whichever is lower as PCR, in cells per second. At a rate greater than 5%, the connection may drop cells. The following table provides the maximum interface rates in bits per second.

Table 1-43: Maximum Interface Rates

Trunk/Broadband Tributary/MLA/LSM Card	Interface Rate (bps)
OC3TQ/OC3L	149,760,000
DS3TQ/DS3L	40,704,000 (PLCP) 44,736,000 (ATM Direct Mapping)
MLA2/LSM2	149,618,000
MLAT3/LSMT3	40,562,000 (PLCP) 44,594,000 (ATM Direct Mapping)
MLAT1/LSMT1	6,002,000

.

**ATM QoS
Scheduling**

Excess bandwidth is calculated as the trunk interface rate less the committed bandwidth.

Example: If the trunk interface rate is 150 Mbps and the committed bandwidth is 120 Mbps, 30 Mbps is the excess bandwidth. The 30 Mbps is equally allocated among the categories of VBR-rt, VBR-nrt + UBR+, and UBR. The excess bandwidth allocated to each service category is then equally shared by each connection. The following table provides some sample data on allocation of excess bandwidth per service category.

Table 1-44: Excess Bandwidth Allocation

Service Category	Sample Number of Connections	Committed Bandwidth	Excess Bandwidth per Service Category	Excess Bandwidth per Connection
CBR	50	PCR	0	0
VBR-rt	200	Between SCR and PCR	Total Excess Bandwidth/3 = 10 Total Weight = 1 x 200	10/200 = 50 Kbps
VBR-nrt	200	Between SCR and PCR	Total Excess Bandwidth/3 = 10 Total Weight = 1 x 200 + 0.5 x 50 = 225	VBR-nrt: 10/225 = 44.4 Kbps UBR+: 44.4/2 Kbps = 22.2 Kbps
UBR+	50	Between MCR and PCR		
UBR	500	0	Total Excess Bandwidth/3 = 10 Total Weight = 1 x 500	10/500 = 20 Kbps
TOTAL	**1000**	**120 Mbps**	**30 Mbps**	

**Provisionable
Queuing per
Connection**

Per virtual connection queuing enables the network to independently hold the cells of a connection without impacting other connections.

Backward Compatibility with QoSV4 and Non-QoS

ATM QoS is backward compatible with QoSV4 priority queuing and provides the mapping structure shown in the following table.

Table 1-45: Mapping Priority Queues to Service Categories

QoSV4 Priority Queues	ATM QoS Service Categories
High Priority	CBR VBR-rt
Medium Priority	VBR-nrt UBR+
Low Priority	UBR

ATM QoS treats all traffic as UBR for systems that do not support QoS.

Additional information on priority queuing QoSV4 is provided in Section 1—*Provisioning Concepts*, Chapter 11—"QoSV4 Provisioning."

Chapter 13
VC Cross-Connection Provisioning

Introduction Virtual Circuit (VC) cross-connection is a Release 8.0 feature (continued into Release 11.0) on the OC3TQ, and DS3TQ trunk cards. It allows the broadband tributary cards to function as trunk cards for virtual connections to and from line cards, broadband tributary cards, and trunk cards. The trunk card acts as a *switch* instead of a multiplexer for VC cross-connections.

Business Applications Some of the business applications of the VC cross-connection feature are discussed as follows:

As an alternative to trunk routing. The VC cross-connection feature provides an alternative to trunk card routing.

Example: Customers using multiple D50s in their network can balance the traffic load on two D50s by routing connections from one D50 to another. In the Ingress direction, connections exit from the broadband tributary card of the first D50 and enter the broadband tributary card of the second D50, to the trunk card and out to the ATM network.

Voice Traffic. Voice traffic from an Integrated Access Device is routed to a Voice Gateway through a broadband tributary card in the D50.

Streaming Audio/Video Solutions. Here, broadband tributary cards are utilized as network interfaces to offer the extra capacity desired to allow streaming media connections to subscribers from the D50.

Types Release 11.0 supports four types of VC cross-connections in addition to trunk card routing.
- Line Card to Broadband Tributary Card.
- Broadband Tributary Card to Broadband Tributary Card.
- Broadband Tributary Card to Trunk Card.
- Line Card to Trunk Card. (Line Card to Trunk Card is a standard connection that is documented elsewhere in this volume.)

The cross-connection types are discussed in the following pages of this chapter.

Trunk Card Routing

Prior to Release 8.0, all traffic was carried from the line card connections to the MLA cards, then to the trunk card and out to the ATM network in the ingress direction. The reverse path was followed in the egress direction.

Beginning with Release 8.0, in addition to routing connections through the trunk card, three other types of connections can be provisioned to route through the broadband tributary cards as seen in the following pages.

The following figure shows regular traffic flow through the trunk card. It is provided in order to highlight the difference between regular trunk routing and VC cross-connections.
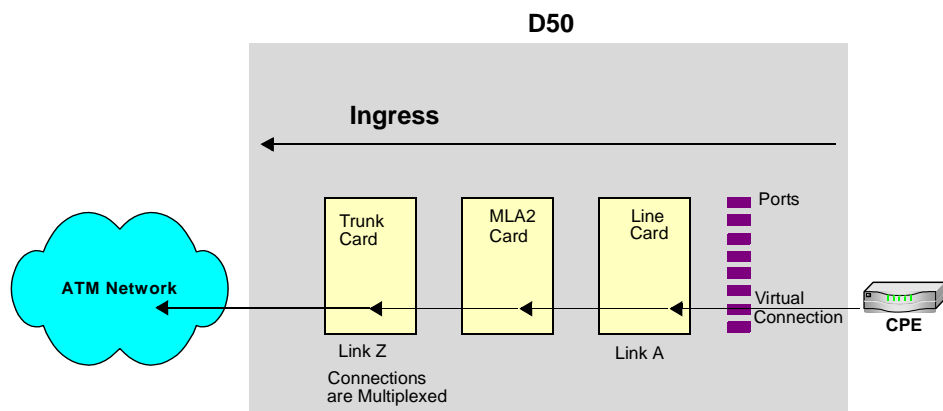
Figure 1-11: Line Card to MLA Card to Trunk Card

Line Card to Broadband Tributary Card

In this type of VC cross-connection, traffic from a line card connection is switched to the trunk card through the MLA2 card. The trunk card switches the traffic to a broadband tributary card connection and the broadband tributary card switches it out to the ATM network in the ingress direction. The reverse path is followed in the egress direction. The **line card** is provisioned as **Link A** and the **broadband tributary card** is **Link Z**. The following figure illustrates this configuration.

D50

Ingress

Broadband Tributary Card

OC3TQ/ DS3TQ Trunk Cards

MLA2 Card

Line Card

Ports

ATM Network

Virtual Connection

CPE

Link Z

Connection Switched to the Broadband Tributary Card

Link A
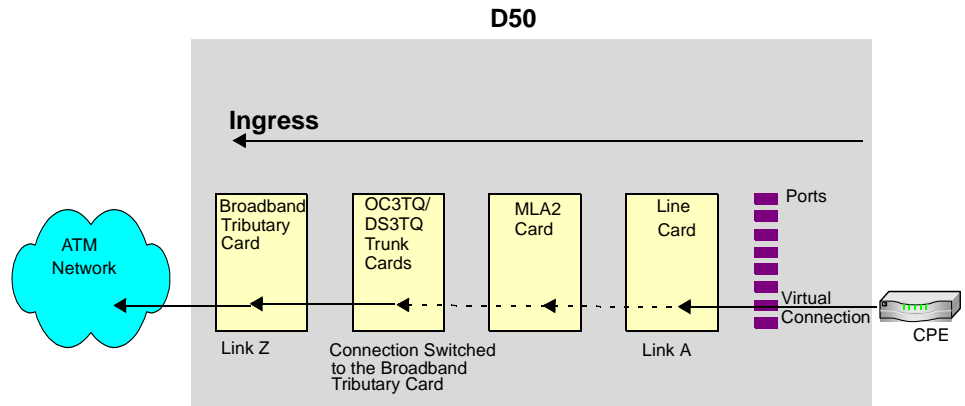
Figure 1-12: Line Card to Broadband Tributary Card

Broadband Tributary Card to Broadband Tributary Card

In this type of VC cross-connection, traffic from an ATM router switches through a broadband tributary card connection to another broadband tributary card connection and out to the ATM network in the ingress direction. The reverse path is followed in the egress direction. The **broadband tributary card** nearest to the ATM network is **Link Z**, and the one closer to the ATM router is **Link A**. The following figure illustrates this configuration.

D50

Ingress

Broadband Tributary Card

Broadband Tributary Card

ATM Network

Virtual Connection

Router

Link Z

Connections are Switched

Link A
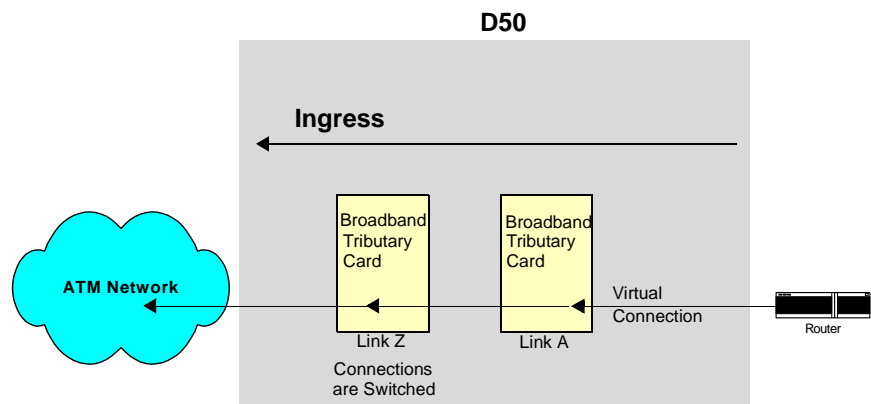
Figure 1-13: Broadband Tributary Card to Broadband Tributary Card

Broadband Tributary Card to Trunk Card

In this type of VC cross-connection, traffic from an ATM router switches through a broadband tributary card connection to the trunk card and out to the ATM network in the ingress direction. The reverse path is followed in the egress direction. The **trunk card** is **Link Z**, and the **broadband tributary card** is **Link A**.The following figure illustrates this configuration.
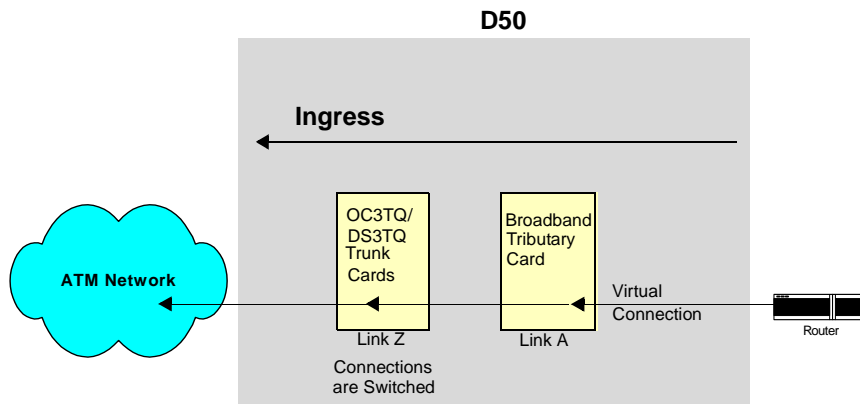
Figure 1-14: Broadband Tributary Card to Trunk Card

Provisioning Parameters

VC cross-connections are provisioned exactly like the regular line card to trunk card connections using Craft Terminal with one exception. Prior to Release 8.0, Link Z was preset to the trunk card. Beginning with Release 8.0, to facilitate VC cross-connections, Link Z can either be a trunk card or a broadband tributary card. The parameters for setting up these connections are:

Link A. Link A is either a line card or a broadband tributary card. See Figures 1-2 through 1-4 in this chapter to determine the Link A of each type of VC cross-connection.

Link Z. Link Z is either a trunk card or a broadband tributary card. See Figures 1-2 through 1-4 in this chapter to determine the Link Z of each type of VC cross-connection.

Link A/Z VCI/VPI Values. VPI and VCI specify the ATM circuit address for each end of the connection. The VPI (Virtual Path Identifier) identifies the route to be used by the ATM cell. A virtual path may include multiple virtual channels. The VCI (Virtual Circuit Identifier) identifies the specific virtual channel to which the cell belongs. The VPI and VCI are translated at each ATM switch and are unique only for a given physical link.

VC Topology. VC Topology specifies the direction in which the PVC sends data:

- Duplex. Transmits data in both directions through this port.
- Simplex AZ. Transmits data up from the port only.
- Simplex ZA. Transmits data down to the port only.

Administration State. This specifies whether the connection is available for service. Unlocked makes the connection usable if there are no other conditions blocking its use. Locked makes the connection unavailable for service. The administration state should be set to Locked when configuring or deleting a connection.

Traffic Descriptor. A traffic descriptor must be provisioned for each VC cross-connection. You can select from a set of default traffic descriptors or create traffic descriptor profiles based on the default traffic descriptor types. For more information on how to create and use traffic descriptors, refer to Chapter 12—"ATM QoS Provisioning," page 1-91.

The Craft Terminal New Connection dialog box shows the provisioning parameters.
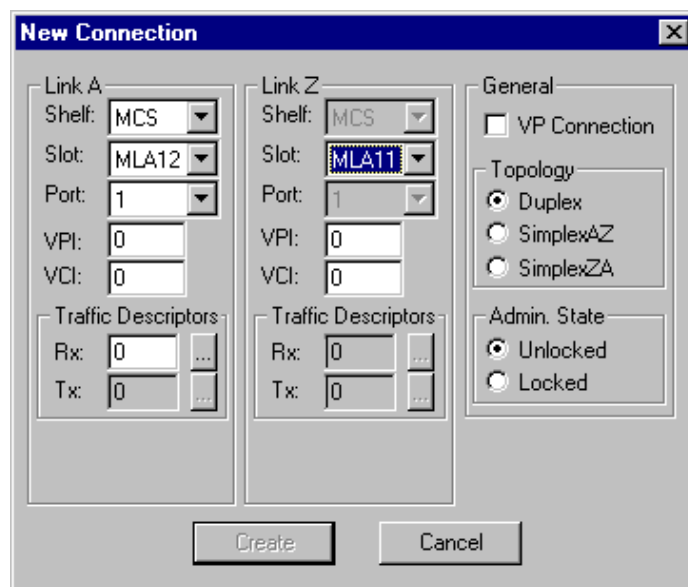
Figure 1-15: Craft Terminal New Connection Dialog Box

SECTION 2 SYSTEM AND SERVICE ORDER PROVISIONING

Contents

Chapter 1
Using Craft Terminal for Commissioning

Introduction   Craft Terminal is a stand-alone craft interface application. It is used for initial installation of a D50 multiplexer, to complete initial test and commissioning procedures, to set up communications with a management system, and for on-site diagnosis of a hardware or local network problem. Craft Terminal communicates directly with the D50 multiplexer through a serial port or Ethernet connection using Point-to-Point Protocol (PPP). It operates on a PC laptop or desktop, using either the Windows NT or the Windows 2000 operating system.
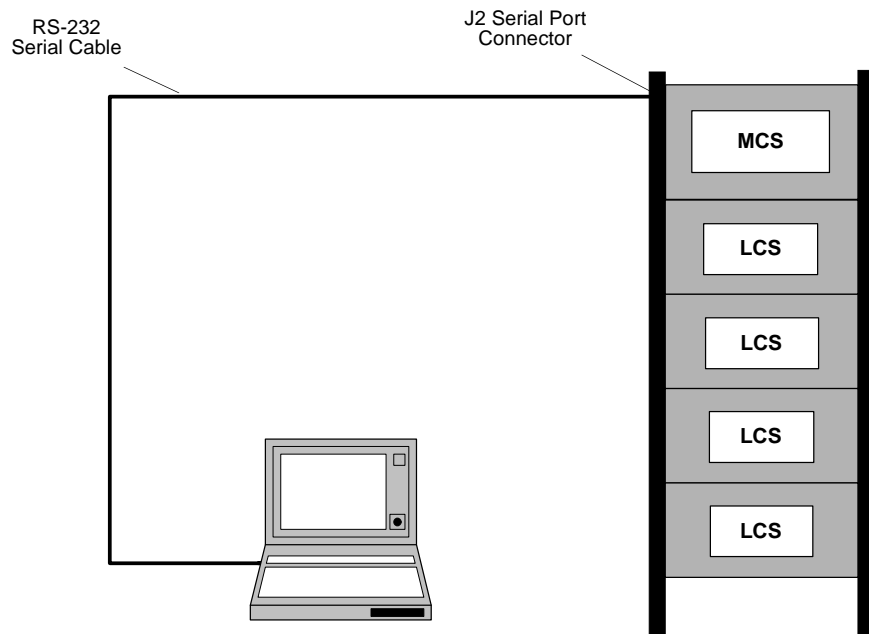
Figure 2-1: Craft Terminal Serial Port Connection to the D50

For the Craft Terminal direct Ethernet connection to the MCS, refer to Section 5—*Commissioning*, Chapter 3—"Craft Terminal Direct Ethernet Connection" in the volume titled <u>Commissioning</u>.

Provisioning Parameters   Initial provisioning parameters for each card type are described in this chapter beginning in the section titled **NMP and MCP Cards—Unlock/Check Conditions**, page 2-15.

Craft Terminal Reference Documents	This procedure assumes you have reviewed the volume titled <u>Craft Terminal</u>. Refer to this manual as necessary while completing this procedure.
Craft Terminal Online Help	Craft Terminal has Windows NT or Windows 2000 and Craft Terminal application help available via the Help menu.

Required Equipment and IP Information

To begin this task you must have the following equipment and tools:

- A laptop PC to support Windows NT or Windows 2000, Simple Network Management Protocol (SNMP), Remote Access Service (RAS), and Craft Terminal software.
- A standard straight through serial port cable with a 9-pin RS-232-C (DB-9) male connector on one end—to connect directly to the D50 multiplexer[1]—and a 9-pin or 25-pin RS-232-C (DB-9) female connector on the other end—to match the serial port connector on your PC. Refer to Figure 2-2: DB-9 Connector Pin-outs, page 2-3.
- Contact the local Network Administrator to get D50 IP Address information for the Craft Terminal In-Band and 10Base-T Ethernet connections:
  - IP Address, for example: 192.168.1.4.
  - IP Mask, for example: 255.255.255.0.
  - Gateway, for example: 192.168.1.251. (Gateway information may not be required.)
  - VPI/VCI (In-Band only), for example: 40, 70.

Set up PC Interface with the D50

Follow these steps to set up Craft Terminal on your PC and connect to the D50:

Note: The serial port connection, described below, must be used to establish initial communication with the D50.

Table 2-1: Set Up PC Interface with the D50

STEP	PROCEDURE
1	Install Windows NT or Windows 2000[1] according to the manufacturer's instructions.
2	Install and configure Windows support services: Serial Port, Modem, Remote Access Services (RAS), Simple Network Management Protocol (SNMP), and Dial-up Networking following the instructions in the volume titled <u>Craft Terminal</u>, Section 1—*Overview and Installation*, Chapter 1—"Craft Terminal Overview."

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[1] If your D50 has a male J2 serial port connector, you will need to connect a gender changer device between the serial cable and the D50, or use a serial cable with two female ends.

Table 2-1: Set Up PC Interface with the D50 (continued)
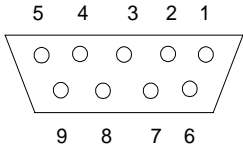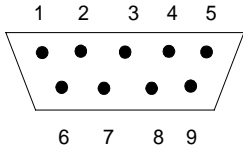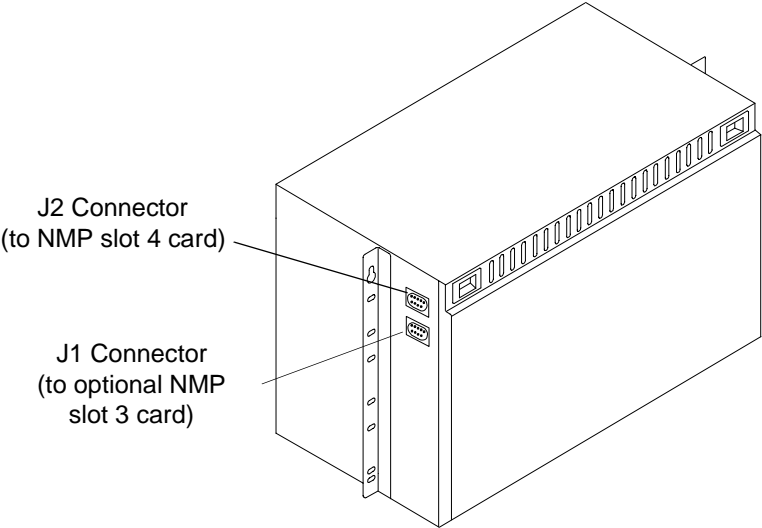
STEP	PROCEDURE
3	Install Craft Terminal software following the instructions in the volume titled <u>Craft Terminal</u>, Section 1—*Overview and Installation*, Chapter 6—"Installing/Removing Craft Terminal Software." **Important! Windows NT service packs that were previously installed will need to be reinstalled at this point.**
4	Connect the serial port cable to your PC's 9-pin or 25-pin serial port connector. 5 4 3 2 1 ○ ○ ○ ○ ○ ○ ○ ○ ○ 9 8 7 6 Female (to PC or laptop) 1 2 3 4 5 ● ● ● ● ● ● ● ● ● 6 7 8 9 Male (to D50) Figure 2-2: DB-9 Connector Pin-outs

Table 2-1: Set Up PC Interface with the D50 (continued)

STEP	PROCEDURE
5	Connect the other end of the serial port cable to the J2 serial port connector on the left side of the D50's MCS.
	The D50 has two 9-pin serial ports located on the back of the Master Control Shelf Alarm Board—the J2 port connects to the Network Management Processor slot 4 card, the J1 port connects to the *optional* NMP slot 3 card[2]. These serial ports are accessed through serial port connectors on the left side of the MCS assembly.
	J2 Connector (to NMP slot 4 card) J1 Connector (to optional NMP slot 3 card) Figure 2-3: MCS Serial Ports
6	Continue to the next procedure: **Establish Communication with the D50**.

[1] As of Release 8.0, Windows 2000 can be used for the Craft Terminal application.

[2] Planned for future release.

Establish Communication with the D50

Follow these steps to establish communication with the D50:

Table 2-2: Establish Communication with the D50
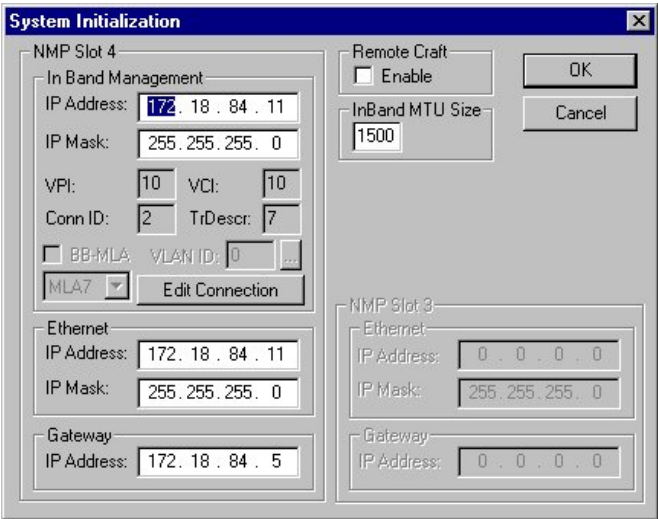
STEP	PROCEDURE
1	To start the Craft Terminal application: ■ From the Task bar, click the **Start** button. ■ Select **Programs** ⇒ **Nokia** ⇒ **D50CraftTerminal.** or if you have installed the Craft Terminal icon on your desktop: ■ Double-click the **Craft Terminal** icon.
2	Craft Terminal displays the Connection Dialog box: ■ Choose **Serial Cable**. ■ Click **OK**. After a few moments, Craft Terminal displays the Main screen and the System window.
3	In the Main menu bar: ■ Select **Tools** ⇒ **Initialize System...** . Craft Terminal displays the System Initialization dialog box. Figure 2-4: System Initialization Dialog Box
4	The Remote Craft field enables Remote Craft Access for connecting Craft Terminal directly to the D50 RAM. The default setting is disabled; to enable Remote Craft Access, click the Enable check box.

Table 2-2: Establish Communication with the D50 (continued)

STEP	PROCEDURE
5	The InBand MTU Size field (for Maximum Transmission Unit) enables configuration of the channel size. The default setting is 1500 bytes (the range is 68 to 1500 bytes). **Do not change this setting unless instructed to do so by your network administrator.** **Note:** Craft Terminal may momentarily display a "0" in the InBand MTU Size field, before the default value of 1500 is displayed.
6	The System Initialization dialog box is also used for setting up the Ethernet or In-Band Management connection between the D50 and Craft Terminal or a management system. Are you setting up an Ethernet connection, or the In-Band Management connection? ■ If you are setting up an Ethernet connection, continue to Step 7. ■ If you are setting up the In-Band Management connection, skip to Step 8. **Note:** Both the Ethernet connection and the In-Band Management connection can be set up on the same D50.
7	To set up the Ethernet connection information on the NMP card: ■ In the Ethernet dialog box (near the bottom of the window), enter the IP Address and IP Mask information. ■ In the Gateway dialog box, enter the Gateway IP Address information (if required). ■ Click **OK**. **Important! The IP Address must be established via Craft Terminal so a management system can communicate with the D50 over a TCP/IP data network.** To set up cabling for Craft Terminal 10Base-T connections, refer to the volume titled <u>Installation</u>, Section 7—*Ethernet and Alarm Board Cabling*, Chapter 1—"Craft Terminal Ethernet Cabling." Skip to Step 11.

Table 2-2: Establish Communication with the D50 (continued)

STEP	PROCEDURE
8	**Important! Before you can set up the In-Band Management connection, you must verify with the Network Administrator that the ATM network router or switch has been set up and provisioned as follows**[1] (refer to the volume titled <u>Installation</u>, Section 7—*Ethernet and Alarm Board Cabling*, **Chapter 1—"Craft Terminal Ethernet Cabling," Figure 7-2: In-Band Management Connection to the D50**): ■ The VPI/VCI information matches the In-Band settings to be entered through Craft Terminal. ■ The VPI/VCI bandwidth configuration does not exceed a maximum of <u>128</u> Kbps with DS3T, DS3T2, OC3T, and OC3T2 trunk cards. ■ The VPI/VCI bandwidth configuration does not exceed a maximum of <u>512</u> Kbps with DS3TQ, OC3TQS, OC3TQM, and OC3TQL trunk cards. Proceed to one of the following steps according to the In-Band Management connection you are setting up: **Note:** Only one In-Band Management connection can be supported on a D50 system; to set up a different In-Band Management connection, the existing connection must first be deleted. ■ For a connection on a <u>broadband tributary card</u>, continue to Step 9. ■ For a connection on a <u>trunk card</u>, skip to Step 10.

Table 2-2: Establish Communication with the D50 (continued)

STEP	PROCEDURE
9	(For a <u>broadband tributary card</u>) In the NMP Slot 4 In Band Management box: ■ Enter the IP Address, IP Mask, VPI, and VCI information. ■ Select the BB-MLA option. ■ In the drop-down menu, select the slot supporting the broadband card. ■ The Traffic Descriptor (TD) field default setting is 7; this traffic descriptor has been preset for In-Band Management. To select a different existing option, or to create new options, refer to the next procedure, **Traffic Descriptor Selection and Creation**, page 2-10. To view the TrDescr values, refer to **View the TrDescr Values**, page 2-14. ■ In the Gateway dialog box, enter the Gateway IP Address information (if required). ■ In the In Band Management dialog box, click the **Create Connection** button. The system assigns a connection ID number and displays it in the Connection ID (Conn ID) field. **Note:** The **Create Connection** button becomes the **Edit Connection** button. You can click it to display the Connection window for the new connection, to check the status of the connection and to lock and unlock the connection's Administration State. Clicking the **Edit Connection** button closes the System Initialization dialog box. To re-open it, select **Tools** ⇒ **Initialize System...** . ■ Click **OK**. Skip to Step 11.

Table 2-2: Establish Communication with the D50 (continued)

STEP	PROCEDURE
10	(For a <u>trunk card:</u>) In the NMP Slot 4 In Band Management box: ■ Enter the IP Address, IP Mask, VPI, and VCI information. ■ The Traffic Descriptor (TD) field default setting is 7; this traffic descriptor has been preset for In-Band Management. To select a different existing option, or to create new options, refer to the next procedure, **Traffic Descriptor Selection and Creation**, page 2-10. To view the TrDescr values, refer to **View the TrDescr Values**, page 2-14. ■ In the Gateway dialog box, enter the Gateway IP Address information (if required). ■ In the In Band Management dialog box, click the **Create Connection** button. The system assigns a connection ID number and displays it in the Connection ID (Conn ID) field. **Note:** The **Create Connection** button becomes the **Edit Connection** button. You can click it to display the Connection window for the new connection, to check the status of the connection and to lock and unlock the connection's Administration State. Clicking the **Edit Connection** button closes the System Initialization dialog box. To re-open it, select **Tools ⇒ Initialize System...** . ■ Click **OK**. Continue to Step 11.
11	Craft Terminal displays the System window. ■ Click the **System** tab page, if it is not displayed. ■ In the MCP Synchronization box, click the **Yes** option button, if it is not selected. ■ Click the **SAVE**[2] button to permanently save IP Address and In Band Management information in the D50 Master Control Shelf (MCS) backplane PROM. ■ Click **Yes** in the Craft Application dialog box that appears, stating that the procedure may take several minutes. The System dialog box may be left open.
12	The **Establish Communication with the D50** procedure is complete. Continue to the procedure titled **NMP and MCP Cards—Unlock/Check Conditions**, page 2-15, to begin unlocking the cards in the MCS and LCS.

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[1] The In-Band Management connection dialog box is not active until the ATM network router or switch set-up and provisioning are complete.

[2] The SAVE command saves all transactions in the MIB, in case the NMP or MCP cards fail or in case of a system power failure. Use the SAVE command periodically during your Craft Terminal session.

Traffic Descriptor Selection and Creation

Important! Consult your network administrator before selecting or creating traffic descriptors.

The default traffic descriptor for the In-Band Management connection is 7.

- To <u>select a different existing traffic descriptor</u>, refer to Table 2-3: Select a Different Traffic Descriptor, below.
- To <u>create a new traffic descriptor</u>, refer to Table 2-4: Create a New Traffic Descriptor, page 2-12.

Follow these steps to <u>select a different existing traffic descriptor</u> for the In-Band Management connection[2]:

Table 2-3: Select a Different Traffic Descriptor

STEP	PROCEDURE
1	Before selecting a different existing traffic descriptor, the System Initialization dialog box must be closed. If the System Initialization dialog box is open, do one of the following: ■ Click **Cancel** to close the dialog box without saving any unsaved In Band Management information. ■ Click **OK** to save any unsaved In Band Management information and to close the dialog box. **Note:** When you re-open the System Initialization dialog box after clicking **OK**, you must re-enter the VPI and VCI information.
2	In the Main menu bar, select **Tools ⇒ Traffic Descriptors...** .
3	The Traffic Descriptors window is displayed, listing all existing traffic descriptors. ■ Traffic descriptor ID numbers are displayed in the Index column. ■ Descriptors 1 through 10 are the preset options; descriptor 7 is the default option for In-Band Management. ■ Additional user-created descriptors are automatically numbered in the order they are created, beginning with 33.
4	Determine the ID number of the traffic descriptor you need from the Index column, then click **Close**.
5	In the Main menu bar, select **Tools ⇒ Initialize System...** to display the System Initialization dialog box.
6	In the In Band Management dialog area, enter the descriptor ID number in the Traffic Descriptor (TrDescr) box.
7	Re-enter the VPI and VCI information, and the IP Address and IP Mask information if necessary.

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[2] For additional information on setting up the In-Band Management connection, refer to the previous procedure, **Establish Communication with the D50**, page 2-5.

Table 2-3: Select a Different Traffic Descriptor (continued)

STEP	PROCEDURE
8	Click the **Create Connection** button. The system assigns a connection ID number and displays it in the Connection ID (Conn ID) field. **Note:** After the connection is created, the TrDescr field is no longer displayed. To view the TrDescr values, refer to **View the TrDescr Values**, page 2-14. **Note:** The **Create Connection** button becomes the **Edit Connection** button. You can click it to display the Connection window for the new connection, to check the status of the connection and to lock and unlock the connection's Administration State. Clicking the **Edit Connection** button closes the System Initialization dialog box. To re-open it, select **Tools ⇒ Initialize System...** .
9	Click **OK**.
10	The **Traffic Descriptor Selection and Creation** procedure is complete. Refer to the previous procedure, **Establish Communication with the D50**, page 2-5, to continue setting up the In-Band Management connection.

Follow these steps to <u>create a new traffic descriptor</u> for the In-Band Management connection[3]:

Table 2-4: Create a New Traffic Descriptor

STEP	PROCEDURE
1	Before creating a new traffic descriptor, the System Initialization dialog box must be closed. If the System Initialization dialog box is open, do one of the following: ■ Click **Cancel** to close the dialog box without saving any unsaved In Band Management information. ■ Click **OK** to save any unsaved In Band Management information and to close the dialog box. **Note:** When you re-open the System Initialization dialog box after clicking **OK**, you must re-enter the VPI and VCI information.
2	In the Main menu bar, select **Tools ⇒ Traffic Descriptors...** .
3	In the Traffic Descriptors window, click **New** to display the New Traffic Descriptor dialog box.
4	Set the following settings as required (for details, refer to Section 1—*Provisioning Concepts*, Chapter 12—"ATM QoS Provisioning"): ■ Descriptor Type (default is NoClpNoScr). ■ Service Category (default is CBR). ■ Frame Discard (default is True). ■ Param1: (default is 0). ■ Param2: (default is 0). ■ Param3: (default is 0). ■ Param4: (default is 0). ■ Param5: (default is 0). **Note:** The combined size of all traffic descriptors cannot exceed the bandwidth limit of: – 128 Kbps in a system with DS3T, DS3T2, OC3T, or OC3T2 trunk cards, or – 512 Kbps in a system with DS3TQ, OC3TQS, OC3TQM, and OC3TQL trunk cards.
5	Click **Create**. A window appears showing the ID number for the new traffic descriptor.

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[3] For additional information on setting up the In-Band Management connection, refer to the procedure titled **Establish Communication with the D50**, page 2-5.

Table 2-4: Create a New Traffic Descriptor (continued)

STEP	PROCEDURE
6	Click **OK**. The new traffic descriptor appears in the Traffic Descriptors window. The ID number is shown in the Index column.
7	Click **Close**.
8	In the Main menu bar, select **Tools** ⇒ **Initialize System...** to display the System Initialization dialog box.
9	In the In Band Management dialog area, enter the ID number of the new traffic descriptor in the Traffic Descriptor (TrDescr) box.
10	Re-enter the VPI and VCI information, and the IP Address and IP Mask information if necessary.
11	Click the **Create Connection** button. The system assigns a connection ID number and displays it in the Connection ID (Conn ID) field. **Note:** After the connection is created, the TrDescr field is no longer displayed. To view the TrDescr values, refer to **View the TrDescr Values**, page 2-14. **Note:** The **Create Connection** button becomes the **Edit Connection** button. You can click it to display the Connection window for the new connection, to check the status of the connection and to lock and unlock the connection's Administration State. Clicking the **Edit Connection** button closes the System Initialization dialog box. To re-open it, select **Tools** ⇒ **Initialize System...** .
12	Click **OK**.
13	The **Traffic Descriptor Selection and Creation** procedure is complete. Refer to the previous procedure, **Establish Communication with the D50**, page 2-5, to continue setting up the In-Band Management connection.

View the TrDescr Values

After a connection is created in the D50 via Craft Terminal, the System Initialization window in Craft Terminal no longer displays the TrDescr field. Follow these steps to view the TrDescr values:

Table 2-5: View the TrDescr Values

STEP	PROCEDURE
1	In the Main menu bar, select **Tools ⇒ Initialize System...** to display the System Initialization dialog box.
2	Click the **Edit Connection** button to display the Connection window.
3	Select the Connection tab, and click **Show Z** to display the Connection Link window.
4	Select the Link Config tab. The read-only Traffic Descriptors fields (Receive and Transmit) are displayed in the lower left of the window.

NMP and MCP Cards—Unlock/ Check Conditions

Follow these steps to "unlock" the Administration State and check the operational conditions of Master Control Shelf NMP and standby MCP[4] cards:

Table 2-6: NMP and MCP Cards—Unlock/Check Conditions

STEP	PROCEDURE
1	Display the Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting **Rack**.
2	Display the Master Control Shelf (MCS) locator by clicking **View** in the Main toolbar and selecting MCS. **Note:** The MCS locator does not display Master Control Shelf slots 1 and 2. The first slot in the MCS locator is Master Control Shelf slot 3. It reads "NMP." References to slot numbers will be according to their actual location in the Master Control Shelf.
3	In the MCS equipment locator, click the NMP card in slot 4[1] to display the NMP slot 4 object view window. **Note:** To see all the items in the object view window, you may need to drag it into view, or move or close other opened windows.
4	Click the **Status** tab in the NMP window to view the NMP's Administration State.
5	Click the **Unlocked** option button in the Administration State box to "unlock" the NMP card.
6	Click the **Save** button in the System window to save all changes to the MIB.
7	Click the **Refresh** 🔃 icon in the toolbar to "refresh" the data in the Conditions list dialog box. **Note:** Craft Terminal automatically refreshes the data in the Conditions list dialog box. The Refresh icon forces a "refresh" command; this is an optional step.
8	The Conditions dialog box shows the Operational State and Availability Status for the NMP card. Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions," Table 6-19: NMP & MCP Conditions & Recommended Actions in the volume titled <u>Commissioning</u>. Follow the Recommended Action listed for the condition. You may now close the NMP object view window or leave it open.

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[4] The active MCP card comes up "unlocked."

Table 2-6: NMP and MCP Cards—Unlock/Check Conditions (continued)

STEP	PROCEDURE
9	Repeat Steps 3 though 8 to "unlock" the Administration State and check conditions for the standby MCP card. (The active MCP card comes up "unlocked.")
10	The **NMP and MCP Cards—Unlock/Check Conditions** procedure is complete. Continue to the next procedure: **Trunk and Broadband Cards/Ports— Unlock/Check Conditions**.

[1] NMP slot 4 is the main NMP card; NMP slot 3 is an optional card planned for a future release.

Trunk and Broadband Cards/Ports— Unlock/Check Conditions

Follow these steps to "unlock" the Administration State and to check the operational conditions and default configuration for Master Control Shelf DS3 trunk (DS3T, DS3T2, and DS3TQ) cards and ports, OC3 trunk (OC3T, OC3T2, OC3T2L, OC3T2M, OC3TQS, OC3TQM, and OC3TQL) cards and ports, and DS3L and OC3L broadband tributary cards and ports:

Table 2-7: Trunk/Broadband Cards/Ports—Unlock/Check Conditions

STEP	PROCEDURE
1	Click the first trunk card (slot 7[1]) or the first broadband tributary card in the Equipment Locator to open the card object view window. **Note:** The MCS locator does not display Master Control Shelf slots 1 and 2. The first slot in the MCS locator is Master Control Shelf slot 3. It reads "NMP." References to slot numbers will be according to their actual location in the Master Control Shelf. **Note:** To see all the items in the object view window, you may need to drag it into view, or move or close other opened windows.
2	Click the **Status** tab to view the card Administration State.
3	Click the **Unlocked** option button in the Administration State box to "unlock" the card.
4	Click the **Save** button in the System window to save all changes to the MIB.
5	Click the **Refresh**[2] ⬚ icon in the toolbar to "refresh" the data in the Conditions list dialog box.

Table 2-7: Trunk/Broadband Cards/Ports—Unlock/Check Conditions

STEP	PROCEDURE
6	The Conditions list box shows the Operational State and Availability Status for the card. Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions" in the volume titled <u>Commissioning</u>; see the sections for trunk and broadband tributary cards. Follow the Recommended Action listed for the condition.
7	Ports are depicted in the Equipment Locator as small circle ports on the cards. Click the port on the first trunk or broadband tributary card.
8	Continue to the next steps according to the card type you are unlocking: ■ For a DS3 trunk or DS3L broadband tributary card, click the DS3T tab and continue to Step 9. ■ For an OC3 trunk or OC3L broadband tributary card, click the OC3T tab and skip to Step 10.

Table 2-7: Trunk/Broadband Cards/Ports—Unlock/Check Conditions

STEP	PROCEDURE
9	For a DS3 trunk or DS3L broadband tributary card, verify or change the configuration settings according to your network configuration:

Note: Default settings are in bold.

- Addressing Mode: **NNI** is preset for the DS3 trunk card; **UNI** is preset for the DS3L card.
- Cell Scrambling: click the Disable or **Enable** option button.
- HEC Coset: click the Disable or **Enable** option button.
- Starvation Cycles: set these for Ingress and Egress for the DS3L card, and Ingress for the DS3 trunk card (except for the DS3T card).
- Line Build Out: click the **Low** or High option button.

Note: The DS3 trunk and DS3L broadband tributary Line Interface Units (LIU) support two levels of line build out (this is the length of the coax cable from the MCS backplane to the Central Office DSx3 panel):
- Low = Coax cables shorter than 50 feet (default).
- High = Coax cables between 50 and 450 feet.

Line build out is not applicable to the OC3 trunk or OC3L broadband tributary cards.

- Line Type: click the setting you need: Direct Mapping CBit, Direct Mapping M23, **PLCP CBit**, or PLCP M23.
- Timing: click the **Loop** (DS3 trunk default), Loop PLCP, **Internal** (DS3L default), Internal PLCP, or External option button.

Note: If your system has an MTU card and two DS3TQ trunk cards installed, the Timing option must be set to External for both trunk cards.

Click **Apply Changes**.

Important! The Cell Scrambling, HEC Coset, and Line Type settings must match those at the other end of the DS3 connection (ATM network equipment).

Refer to the volume titled <u>Craft Terminal</u> for more information on the DS3T tab page.

Skip to Step 11.

Table 2-7: Trunk/Broadband Cards/Ports—Unlock/Check Conditions

STEP	PROCEDURE
10	For an OC3 trunk or OC3L broadband tributary card, verify or change the configuration settings according to your network configuration:
	Note: Default settings are in bold.
	■ Addressing Mode: **UNI** is preset for the OC3L cards; **NNI** is preset for the OC3 trunk card.
	■ Facility Type: **SONET** is the OC3 trunk default; **SDH** is the OC3L default.
	■ Timing Option: click the **Loop** (OC3 trunk default), **Internal** (OC3L default), or **External** option button.
	Note: If your system has an MTU card and two OC3TQ trunk cards installed, the Timing option must be set to External for both trunk cards.
	■ S1 Sync Status: enter a value (1 through **15**) in the Transmit dialog box (OC3 trunk cards only).
	■ Starvation Cycles: set these for Ingress and Egress for the OC3L card, and Ingress for the OC3 trunk card (except for the OC3T card.
	■ Path RDI (OC3 trunk cards) or HP RDI (OC3L card):
	– Mode: click the **Default** option button (OC3 trunk cards only).
	– Loss of Cell Delineation: click the Enable or **Disable** option button.
	– Payload Label Mismatch: click the Enable or **Disable** option button.
	– Trace Identifier Mismatch: click the Enable or **Disable** option button (OC3 trunk cards only).
	Click **Apply Changes**.
	Important! The ATM switch or router must be configured with the same facility type as the D50 (SONET or SDH).
	Refer to the volume titled <u>Craft Terminal</u> for more information on the OC3T tab page.
11	Click the **Status** tab to view the port's Administration State.
12	Click the **Unlocked** option button in the Administration State box to "unlock" the port.
13	Click the **Save** button in the System window to save all changes to the MIB.
14	Click the **Refresh** icon in the toolbar to "refresh" the data in the Conditions list box.

Table 2-7: Trunk/Broadband Cards/Ports—Unlock/Check Conditions

STEP	PROCEDURE
15	The Conditions list box shows the Operational State and Availability Status for the port.
	Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions" in the volume titled <u>Commissioning</u>; see the section for trunk and broadband tributary cards. Follow the Recommended Action listed for the condition.
	You may now close the object view windows or leave them open.
16	Repeat Steps 1 though 15 to "unlock" the Administration State and check the configuration settings and conditions for the slot 8 (standby) trunk card and port, and for additional broadband tributary cards and ports.
17	The **Trunk and Broadband Cards/Ports— Unlock/Check Conditions** procedure is complete.
	Continue to the next procedure: **MLA Cards and Ports— Unlock/Check Conditions**.

[1] The first unlocked trunk card becomes the active trunk card; in this case, the trunk card in slot 7.

[2] Craft Terminal automatically refreshes the data in the Conditions list dialog box. The Refresh icon forces a "refresh" command; this is an optional step.

MLA Cards and Ports— Unlock/Check Conditions

Follow these steps to "unlock" the Administration State and to check the operational conditions for all Master Control Shelf MLA cards and ports:

Table 2-8: MLA Cards and Ports—Unlock/Check Conditions

STEP	PROCEDURE
1	To unlock the MLA card:
	■ Click the MLA card to bring up the card object view window.
	Note: To see all the items in an object view window, you may need to drag it into view, or move or close other opened windows.
	■ Click the **Status** tab to view the card's Administration State.
	■ Click **Unlocked** in the Administration State box.
	Note: The card changes from black to dark blue after it is unlocked.
2	Click the **Save** button in the System window to save all changes to the MIB.
3	Click the **Refresh**[1] icon in the toolbar to "refresh" the data in the Conditions list box.

Table 2-8: MLA Cards and Ports—Unlock/Check Conditions (continued)

STEP	PROCEDURE
4	The Conditions list box shows the Operational State and Availability Status for the MLA card. Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions," Table 6-22: MLA Conditions & Recommended Actions in the volume titled <u>Commissioning</u>. Follow the Recommended Action listed for the condition.
5	Ports are depicted in the Equipment Locator as small circle ports on the cards. Click the port on the first MLA card to bring up the port object view window. **Note:** For the MLAT1 card, clicking the port displays 5 additional ports: the IMUX port and four T1 ports; configuration settings must be set individually for each port. Click a port to bring up its object view window.

Table 2-8: MLA Cards and Ports—Unlock/Check Conditions (continued)

STEP	PROCEDURE
6	Verify the configuration settings as follows: **Note:** Default settings are in bold. For <u>MLA2</u>, <u>MLA2L</u>, or <u>MLA2S</u> card ports: ■ Click the <u>OC3T tab</u>, and verify: – Facility Type: click the **SONET** option button (not SDH). – Timing Option: leave the **Internal** option button selected. – Starvation Cycles: set these for Ingress and Egress. For <u>MLAT1</u> card ports: ■ Click the <u>DS1 tab</u>, and verify: – Line Type (IMUX port only): select **ESF** or SF. – Transmit Clock Source (IMUX port only): leave the **Internal** option button selected. – Starvation Cycles (IMUX port only): set these for Ingress and Egress. – Line Build Out (non-IMUX ports only): leave the setting at **100** or enter a different setting as required. For <u>MLAT3</u> card ports: ■ Click the <u>DS3T tab</u>, and verify: – Addressing Mode: the default **NNI** is preset. – Cell Scrambling: select Disable or **Enable**. – HEC Coset: select Disable or **Enable**. – Starvation Cycles: set these for Ingress and Egress. – Line Build Out: select **Low** or High. – Line Type: select Direct Mapping CBit, Direct Mapping M23, **PLCP CBit**, or PLCP M23. – Timing: select Loop or **Internal**. Click **Apply Changes**. **Important! The settings for the MLA card must match those for the corresponding LSM card. See the following section, LSM Card and Port— Unlock/Check Conditions, page 2-23.** Refer to the volume titled <u>Craft Terminal</u> for more information on the MLA port tab pages, including Quality of Service (QoS) provisioning.
7	Click the **Status** tab to view the port's Administration State.
8	Click the **Unlocked** option button in the Administration State box to "unlock" the port.
9	Click the **Save** button in the System window to save all changes to the MIB.

Table 2-8: MLA Cards and Ports—Unlock/Check Conditions (continued)

STEP	PROCEDURE
10	Click the **Refresh** icon in the Tools menu to "refresh" the data in the Conditions list box.
11	The Conditions list box shows the Operational State and Availability Status for the MLA port. Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions," Table 6-22: MLA Conditions & Recommended Actions in the volume titled <u>Commissioning</u>. Follow the Recommended Action listed for the condition.
12	For <u>MLAT1</u> cards only: repeat Steps 5 through 11 for each port on the card.
13	You may now close both MLA object view windows or leave them open.
14	Repeat Steps 1 though 13 for each installed MLA card.
15	The **MLA Cards and Ports— Unlock/Check Conditions** procedure is complete. Continue to the next procedure: **LSM Card and Port— Unlock/Check Conditions**.

[1] Craft Terminal automatically refreshes the data in the Conditions list box. The Refresh icon forces a "refresh" command; this is an optional step.

LSM Card and Port— Unlock/Check Conditions

Follow these steps to "unlock" the Administration State and to check the operational conditions for the Line Card Shelf LSM card and port:

Table 2-9: LSM Card and Port—Unlock/Check Conditions

STEP	PROCEDURE
1	Display the LCS1 Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting LCS1, or by right-clicking the LCS in the rack locator graphic. **Note:** To see all the items in an object view window, you may need to drag it into view, or move or close other opened windows.
2	To unlock the LSM card: ■ Click the LSM card to bring up the card object view window. ■ Click the **Status** tab to view the card's Administration State. ■ Click **Unlocked** in the Administration State box. **Note:** The card changes from black to dark blue after it is unlocked.

Table 2-9: LSM Card and Port—Unlock/Check Conditions (continued)

STEP	PROCEDURE
3	Click the **Save** button in the System window to save all changes to the MIB.
4	Click the **Refresh**[1] icon in the toolbar to "refresh" the data in the Conditions list box.
5	The Conditions list box shows the Operational State and Availability Status for the LSM card. Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions," Table 6-23: LSM Conditions & Recommended Actions in the volume titled <u>Commissioning</u>. Follow the Recommended Action listed for the condition.
6	Ports are depicted in the Equipment Locator as small circle ports on the cards. Click the port on the LSM card to bring up the port object view window. **Note:** For the LSMT1 card, clicking the port displays 5 additional ports: the IMUX port and four T1 ports; configuration settings must be set individually for each port. Click a port to bring up its object view window.

Table 2-9: LSM Card and Port—Unlock/Check Conditions (continued)

STEP	PROCEDURE

7	Verify the configuration settings as follows:
	
	Note: Default settings are in bold.
	
	For <u>LSM2</u>, <u>LSM2S,</u> or <u>LSM2L</u> card ports:
	■ Click the <u>OC3T tab</u>, and verify:
	   – Facility Type: click the **SONET** option button (not SDH).
	   – Timing Option: click the Internal option button (not **Loop**).
	   – Loss of Cell Delineation: select **Disable** or Enable.
	   – Payload Label Mismatch: select **Disable** or Enable.
	
	For <u>LSMT1</u> card ports:
	■ Click the <u>DS1 tab</u>, and verify:
	   – Line Type (IMUX port only): select **ESF** or SF.
	   – Transmit Clock Source (IMUX port only): click the Internal option button (not **Loop**).
	   – Starvation Cycles (IMUX port only): set for Ingress.
	   – Line Build Out (non-IMUX ports only): leave the setting at **100** or enter a different setting as required.
	
	For <u>LSMT3</u> card ports:
	■ Click the <u>DS3T tab</u>, and verify:
	   – Addressing Mode: the default **NNI** is preset.
	   – Cell Scrambling: select Disable or **Enable**.
	   – HEC Coset: select Disable or **Enable**.
	   – Starvation Cycles: set these for Ingress and Egress.
	   – Line Build Out: select **Low** or High.
	   – Line Type: select Direct Mapping CBit, Direct Mapping M23, **PLCP CBit**, or PLCP M23.
	   – Timing: select **Loop**, Internal, or Internal PLCP.
	
	Click **Apply Changes**.
	
	Important! The settings for the LSM card must match those for the corresponding MLA card. See the previous section, MLA Cards and Ports— Unlock/Check Conditions, page 2-20.
	
	Refer to the volume titled <u>Craft Terminal</u> for more information on the LSM port tab pages, including Quality of Service (QoS) provisioning.

8	Click the **Status** tab to view the port's Administration State.
9	Click the **Unlocked** option button in the Administration State box to "unlock" the port.
10	Click the **Save** button in the System window to save all changes to the MIB.

Table 2-9: LSM Card and Port—Unlock/Check Conditions (continued)

STEP	PROCEDURE
11	Click the **Refresh** icon in the toolbar to "refresh" the data in the Conditions list box.
12	The Conditions list box shows the Operational State and Availability Status for the LSM port. Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions," Table 6-23: LSM Conditions & Recommended Actionsin the volume titled <u>Commissioning</u>. Follow the Recommended Action listed for the condition.
13	For <u>LSMT1</u> cards only: repeat Steps 6 through 12 for each port on the card.
14	You may now close both LSM object view windows or leave them open.
15	Repeat Steps 1 through 14 for each LCS in the rack locator.
16	The **LSM Card and Port— Unlock/Check Conditions** procedure is complete. Continue to the next procedure: **Line Cards—Unlock/Check Conditions**.

[1] Craft Terminal automatically refreshes the data in the Conditions list box. The Refresh icon forces a "refresh" command; this is an optional step.

Line Cards—Unlock/ Check Conditions

Follow these steps to "unlock" the Administration State and to check the operational conditions for line cards:

Table 2-10: Line Cards—Unlock/Check Conditions

STEP	PROCEDURE
1	Display the LCS1 Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting LCS1, or by right-clicking the LCS in the rack locator graphic. **Note:** To see all the items in the object view window, you may need to drag it into view, or move or close other opened windows.
2	Click the line card in the LCS1 equipment locator to open the line card dialog window. **Note:** Line cards appear "black" at initial start-up.
3	Click the **Status** tab to view the line card Administration State.

Table 2-10: Line Cards—Unlock/Check Conditions (continued)

STEP	PROCEDURE
4	Click the **Unlocked** option button in the Administration State box to "unlock" the card. **Note:** Line cards change color from black to dark blue after they are "unlocked."
5	Click the **Save** button in the System window to save all changes to the MIB.
6	Click the **Refresh**[1] 🖹 icon in the toolbar to "refresh" the data in the Conditions list box.
7	The Conditions list box shows the Operational State and Availability Status for the line card. Refer to Section 6—*Appendices*, Appendix F—"Conditions and Recommended Actions," Table 6-24: Line Card Conditions & Recommended Actions in the volume titled <u>Commissioning</u>. Follow the Recommended Action listed for the condition. You may now close the line card object view window or leave it open.
8	Repeat Steps 2 through 6 to "unlock" the Administration State and check the condition of each line card in the LCS.
9	Ports are depicted in the Equipment Locator as small circle ports on the cards. Clicking the port on a line card displays Ports 1–4 for quad cards and Ports 1–8 for octal cards. **Note:** A black line card port indicates a "locked" Administration State. The line card port turns green once the port is unlocked and "synched up" with end user equipment (CPE). **Important! Do not unlock a line card port until it is provisioned and connected to CPE, or an "alarm" condition will be generated.**

Table 2-10: Line Cards—Unlock/Check Conditions (continued)

STEP	PROCEDURE
10	Are there additional Line Card Shelves? ■ If YES, repeat all the steps from the previous section (**LSM Card and Port— Unlock/Check Conditions**, page 2-23) and this section for each LCS. ■ If NO, the Line Cards—Unlock/Check Conditions procedure is complete.
11	The **Line Cards—Unlock/Check Conditions** procedure is complete. **Important!** Be sure to replace the MCS top screen and replace and close MCS and LCS front and back panels after completion of all procedures in the volumes titled <u>Installation</u> and <u>Commissioning</u>, to ensure proper air flow through the D50.

[1] Craft Terminal automatically refreshes the data in the Conditions list box. The Refresh icon forces a "refresh" command; this is an optional step.

Chapter 2
Initial Service Provisioning

Introduction   The D50 is ready for provisioning after completion of Initial Commissioning procedures (refer to Chapter 1—"Using Craft Terminal for Commissioning," page 2-1).

This chapter provides procedures for how to:

- Create a Permanent Virtual Circuit (PVC) to connect a subscriber to an ATM Network Service Provider and unlock the line card port to provide service.
- Create a PVC for the DS3L or OC3L broadband tributary cards.
- Enabling and provisioning SHDSL pair-bonding.
- Disabling SHDSL pair-bonding.

Required Information   To begin this task you will need the following information from the service order:

- Line Card Shelf, line card, and port.
  Note: For broadband tributary cards: the Master Control Shelf and DS3L or OC3L cards.
- Subscriber's VPI/VCI address.
- Traffic Descriptor. For additional information on traffic descriptor types and profiles, refer to Section 1—*Provisioning Concepts*, Chapter 12—"ATM QoS Provisioning."
- Frame Relay to ATM Inter-working Descriptor and other Frame Relay parameters DLCI and LMI Tunneling for the DS1 card. Additional information is available in the Section 1—*Provisioning Concepts*, Chapter 6—"DS1 Provisioning," **Setting Up DS1 Connections**, page 1-54.
- ATM network interface VPI/VCI.
- Minimum and maximum data rates.
- VC Topology, to set the direction.
  Note: Rates are not applicable to the DS3L or OC3L cards.
  Note: There may be multiple PVCs defined for a single subscriber's loop.

Provision DSL/ATM Service

Follow these steps to provision a line card and port, and to unlock the port to provide service as specified on the service order. If you are provisioning a pair-bonded SHDSL port,

<center>Table 2-11: Provision DSL/ATM Service</center>

STEP	PROCEDURE
1	Display the LCS Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting the LCS for the line card specified in the service order. **Note:** To see all the items in an object view window, you may need to drag it into view, or move or close other opened windows. **Note:** For tool bar descriptions and object naming conventions, refer to the volume titled <u>Craft Terminal</u>, Section 2—*Craft Terminal User Interface*, Chapter 1—"General Description of the User Interface."
2	Click the line card icon for the line card specified on the service order to display the **Provisioning Card** dialog box. ■ On the **Status** tab in the **Administration State** group box, select **Unlocked**. ■ Exit the dialog box by clicking the **X** button on the far right of the title bar.
3	Click the port icon on the line card icon. In the port selection drop-down list that appears, click the port icon specified on the service order to display the **Provisioning Port** dialog box.
4	Are you provisioning ISDN for an IDSL8 card(s)? ■ If YES, skip to Step 6. ■ In NO, continue to Step 5.
5	For a non-IDSL8 card, click the **Rates** tab. Set the values for the parameters specified on the service order: – Maximum and minimum data rates. – Mode. – Thresholds. – Rate Degraded. ■ Click **Apply Changes** to commit the changes and keep the dialog box open. **Note:** The **Rates** tab is not available on the DS1 card. Skip to Step 7.
6	For an IDSL8 card, click the IDSL tab and do the following: ■ Set the values for the parameters specified on the service order. ■ Click **Apply** to commit the changes and keep the dialog box open.

Table 2-11: Provision DSL/ATM Service (continued)

STEP	PROCEDURE
7	Click the **DSL Thresholds** tab (**Error Thresholds** tab for DS1) and perform the following: ■ Set the values for the parameters specified on the service order. ■ Click **Apply Changes**. **Note:** For detailed information on threshold settings, refer to the specific chapters in this volume for each line card.
8	To create a new connection: ■ Click the **Connection** tab in the **Provisioning Port** dialog box. ■ Click **New Connection** to display the **New Connection** dialog box. This dialog box is used to establish the Permanent Virtual Circuit (PVC) on the subscriber's service order.
9	The LCS number, slot number, and port number are logical cue address mapping values for Virtual Link A (the subscriber's side); the active trunk card in the D50 multiplexer is the logical cue address for Virtual Link Z (the ATM network interface). Enter manually or select (from the drop-down list boxes) the following information from the subscriber's service order: ■ VPI/VCI for Link A, for example: 0, 38. ■ VPI/VCI for Link Z, for example, 10, 71. ■ Traffic Descriptor. ■ Frame Relay/ATM Interworking Descriptor, DLCI, and LMI Tunneling for the DS1 card. ■ VC Topology, to set the direction. **Note:** Refer to the volume titled <u>Craft Terminal</u> for more details on these parameters.
10	Click **Create**. The **Provisioning Connection** dialog box appears. Exit the **Provisioning Connection** dialog box by clicking the **X** on the top corner of the title bar. The connection is listed in the **Connection** tab. The ID column indicates the system-assigned ID of this connection. **Note:** Expand the dialog width to read the column titles by dragging the sides of the dialog to the left and right. Individual columns can also be resized.

Table 2-11: Provision DSL/ATM Service (continued)

STEP	PROCEDURE
11	To unlock the connection: ■ Select the connection ID number on the **Connection** tab, then click **Open Connection** to display the **Provisioning Connection** dialog box. ■ Click the **Status** tab. ■ For the **Administration State**, select **Unlocked**. ■ Exit the dialog box by clicking the **X** button on the far right of the title bar.
12	Repeat Steps 8 – 11 for each ATM virtual <u>connection</u> specified on the service order for this line card port.
13	Are there DS3L or OC3L broadband tributary cards to provision? ■ If YES, skip to the next procedure: Table 2-12: Provision Broadband Tributary Card. ■ If NO, continue to Step 14.
14	To save the changes to the MIB, do the following: ■ Click the **File** menu in the menu bar ■ Click **Save**.
15	The Provision DSL/ATM Service procedure is complete. **Important! Do not unlock the <u>port</u> until the subscriber's end user equipment is installed and ready for service. An alarm condition is generated when the line card port is unlocked before the end user equipment is installed.**

Provision DS3L or OC3L Broadband Tributary Card

Broadband tributary cards provide a standard ATM UNI/NNI interface that supports provisionable VPI/VCI mappings to the D50 trunk card, allowing ATM cells to be aggregated from standard ATM network equipment.

If testing and commissioning procedures were not completed, follow the steps to initialize the broadband tributary cards as outlined in Section 2—*Commissioning*, Chapter 1—"Using Craft Terminal for Commissioning," **Trunk and Broadband Cards/Ports— Unlock/Check Conditions**, page 2-16, prior to starting the provisioning steps outlined below.

Follow these steps to provision a broadband tributary card, and to unlock the port to provide service as specified on the service order.

Table 2-12: Provision Broadband Tributary Card

STEP	PROCEDURE
1	Display the MCS Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting the MCS from the list.
2	Click the broadband tributary card icon the MCS Equipment Locator group graphic for the card specified on the service order. The **Provisioning Card** dialog box appears. ■ On the **Status** tab, for card **Administration State**, select **Unlocked**. ■ Exit the **Provisioning Card** dialog box by clicking the **X** button in the top corner of the title bar.
3	Click the port object on the broadband tributary card icon to display the Port list. Click the required port icon from the Port list for the port specified on the service order. The **Port Provisioning** dialog box opens.
4	Click the **DS3T** tab for the DS3L card or the **OC3T** tab for OC3L card and do the following: ■ Set the values for the parameters specified on the service order. ■ Click **Apply Changes**.
5	Click the **DS3 Thresholds** tab for the DS3L card or the **OC3 Thresholds** tab for OC3L card and do the following: ■ Set the values for the parameters specified on the service order. ■ Click **Apply Changes**.
6	To create a new connection: ■ Click the **Connection** tab in the **Provisioning Port** dialog box. ■ Click **New Connection** to display the **New Connection** dialog box. This dialog box is used to establish the Permanent Virtual Circuit (PVC) on the subscriber's service order.

Table 2-12: Provision Broadband Tributary Card (continued)

STEP	PROCEDURE
7	The MCS number, slot number, and port number are logical cue address mapping values for Virtual Link A (the subscriber's side); the active trunk card in the D50 multiplexer is the logical cue address for Virtual Link Z (the ATM network interface). Enter manually or select (from the drop-down list boxes) the following information from the subscriber's service order: ■ VPI/VCI for Link A, for example: 0,38. ■ VPI/VCI for Link Z, for example: 10,71. ■ Traffic Descriptor. ■ VC Topology, to set the direction.
16	Click **Create**. The **Provisioning Connection** dialog box appears. Exit the **Provisioning Connection** dialog box by clicking the **X** on the top corner of the title bar. The connection is listed in the **Connection** tab. The ID column indicates the system-assigned ID of this connection. **Note:** Expand the dialog width to read the column titles by dragging the sides of the dialog to the left and right. Individual columns can also be resized.
17	To unlock the connection: ■ Select the connection ID number on the **Connection** tab, then click **Open Connection** to display the **Provisioning Connection** dialog box. ■ Click the **Status** tab. ■ For the **Administration State**, select **Unlocked**. ■ Exit the dialog box by clicking the **X** button on the far right of the title bar.
8	To save the changes to the MIB, do the following: ■ Click the **File** menu in the menu bar ■ Click **Save**.
9	The Provision Service for broadband tributary card procedure is complete. **Important! Do not unlock the port until the subscriber's end user equipment (or the embedded network equipment or network elements to be linked) is installed and ready for service. An alarm condition is generated when the line card port is unlocked before the end user equipment is installed.**

Enabling and Provisioning SHDSL Pair-Bonded Ports

The Release 11.0 SHDSL8 line card includes a pair bonding feature which doubles the bandwidth, providing a maximum of 4608 Kbps of symmetric service. (The maximum data rate of a single port is 2304 Kbps.) This pair bonding feature can be enabled or disabled on the line card on demand. By default, it is disabled.

The pair bonding feature bonds an odd port with the next higher even numbered port. For example, you can bond pairs 1 and 2, 3 and 4, 5 and 6, and 7 and 8. Due to hardware limitations, you cannot bond ports 2 and 3, 4 and 5 and 6 and 7.

> **Note:** Release 11.0 supports only a two-port pair bonding configuration.

In the Craft Terminal GUI, a rectangle appears over the ports that are pair bonded to distinguish them from other individual ports. Also, if port 1 is pair bonded, port 2 is grayed out and cannot be provisioned individually. Pair bonding for even ports is disabled in the GUI.

Provisioning changes made to the odd port are reflected in the even port for all tabs in the Craft Terminal **Port Provisioning** dialog box, except the **ATM PM** tab. ATM PM details are available only for the odd port; no data is available for the even port. Port actuals are available for both the odd and even port, individually, on the **Actuals** tab of the respective port. The **Physical PM** tab displays the information separately for each individual odd or even port. Alarms appear separately for each individual port.

When the odd port is provisioned, the **Status**, **Test**, **Rates**, **DSL Thresholds**, **SHDSL**, **Connection**, and **Queue Manager** tabs display in read-only mode. The other tabs of **ATM PM**, **Physical PM**, **Queue Congestion PM**, and **Actuals** have editing capability.

The default traffic descriptors are applicable to pair-bonded ports as well.

The following procedure table explains how to enable and provision pair bonding for a certain selected odd port. It assumes that the physical connections between the CPE equipment and the SHDSL card have been made correctly prior to enabling the pair-bonded ports.

> **Important!** As a pre-requisite to the following procedure, at the customer's end, the CPE must be configured to a *4 wire* mode.

Table 2-13: Enabling and Provisioning SHDSL Pair-Bonded Ports

STEP	PROCEDURE
1	Display the LCS Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting the LCS for the line card specified in the service order. **Note:** To see all the items in an object view window, you may need to drag it into view, or move or close other opened windows. **Note:** For tool bar descriptions and object naming conventions, refer to the volume titled <u>Craft Terminal</u>, Section 2—*Craft Terminal User Interface*, Chapter 1—"General Description of the User Interface."

Table 2-13: Enabling and Provisioning SHDSL Pair-Bonded Ports

STEP	PROCEDURE
2	Click the line card icon for the line card specified on the service order to display the **Provisioning Card** dialog box. ■ On the **Status** tab in the **Administration State** group box, select **Unlocked**. ■ Exit the dialog box by clicking the **X** button on the far right of the title bar.
3	Click the port icon on the line card icon. In the port selection drop-down list that appears, click the odd port that you need to pair bond. The **Provisioning Port** dialog box appears.
4	On the **Status** tab, click **Locked** in the **Administration State** group box to lock the port.
5	Click the **SHDSL** tab.
6	From the **STUC Advanced Config** drop-down list box, select **Manual**.
7	In the **Odd/Even Pair Bonding** group box that is now activated, do the following: ■ Click **Enable**. ■ Click **Apply Changes**. When you click the Ports icon on the SHDSL8 card, you will now see a rectangle around the pair bonded ports indicating that the pair of ports is bonded. **Important! When pair bonding is enabled, connections existing on the second port of the pair-bonded ports will not carry data. To place those connections in use, remove them from the second port and add them on the first port before enabling pair-bonding. Procedures on how to add or remove a new connection are provided in Section 3—*Change Order Provisioning*.** This completes the procedure to enable pair bonding on an odd and even port. The following steps explain how to provision the ports.

Table 2-13: Enabling and Provisioning SHDSL Pair-Bonded Ports

STEP	PROCEDURE
8	Click the **Rates** tab. Set the values for the parameters specified on the service order: – Maximum and minimum data rates. The default maximum rate is 2304 Kbps and the default minimum rate is 1152 Kbps. (The actual rate of the bonded port will be double the Kbps values you enter in these fields.) – Mode. – Thresholds. – Rate Degraded. ■ Click **Apply Changes** to commit the changes and keep the dialog box open. **Note:** The values entered on the **Rates** tab of this odd port are reflected in the **Rates** tab of the even port.
9	Click the **DSL Thresholds** tab and perform the following: ■ Set the values for the parameters specified on the service order. ■ Click **Apply Changes**. **Note:** For detailed information on threshold settings, refer to the specific chapters in this volume for each line card. **Note:** The values entered on the DSL Thresholds tab of this odd port are reflected in the DSL Thresholds tab of the even port.
10	To create a new connection: ■ Click the **Connection** tab. ■ Click **New Connection** to display the **New Connection** dialog box. This dialog box is used to establish the Permanent Virtual Circuit (PVC) on the subscriber's service order. **Note:** Connections cannot be created on the even port. **Important! When pair bonding is enabled, connections existing on the second port of the pair-bonded ports will not carry data. To place those connections in use, remove them from the second port and add them on the first port before enabling pair-bonding. Procedures on how to add or remove a new connection are provided in Section 3—*Change Order Provisioning*.**

Table 2-13: Enabling and Provisioning SHDSL Pair-Bonded Ports

STEP	PROCEDURE
11	The LCS number, slot number, and port number are logical cue address mapping values for Virtual Link A (the subscriber's side); the active trunk card in the D50 multiplexer is the logical cue address for Virtual Link Z (the ATM network interface). Enter manually or select (from the drop-down list boxes) the following information from the subscriber's service order: ■ VPI/VCI for Link A, for example: 0, 38. ■ VPI/VCI for Link Z, for example, 10, 71. ■ Traffic Descriptor. ■ VC Topology, to set the direction. **Note:** Refer to the volume titled <u>Craft Terminal</u> for more details on these parameters.
12	Click **Create**. The **Provisioning Connection** dialog box appears. Exit the **Provisioning Connection** dialog box by clicking the **X** on the top corner of the title bar. The connection is listed in the **Connection** tab. The ID column indicates the system-assigned ID of this connection. **Note:** Expand the dialog width to read the column titles by dragging the sides of the dialog to the left and right. Individual columns can also be resized.
13	To unlock the connection: ■ Select the connection ID number on the **Connection** tab, then click **Open Connection** to display the **Provisioning Connection** dialog box. ■ Click the **Status** tab. ■ For the **Administration State**, select **Unlocked**. ■ Exit the dialog box by clicking the **X** button on the far right of the title bar.
14	Repeat Steps 10 – 13 for each ATM virtual <u>connection</u> specified on the service order for this line card port.

Table 2-13: Enabling and Provisioning SHDSL Pair-Bonded Ports

STEP	PROCEDURE
15	On the **Status** tab, click **Unlocked** in the **Administration State** group box to unlock the port.
16	To save the changes to the MIB, do the following: ■ Click the **File** menu in the menu bar ■ Click **Save**. **Important! Do not unlock the <u>port</u> until the subscriber's end user equipment is installed and ready for service. An alarm condition is generated when the line card port is unlocked before the end user equipment is installed.**

Disabling SHDSL Pair-Bonded Ports

The following table explains how to disable pair bonding on a certain selected pair of ports on the SHDSL line card.

Table 2-14: Disabling Pair Bonding on SHDSL8 Ports

Step	Procedure
1	Click the ports icon on the SHDSL8 line card.
2	Click the odd port icon from the pair bonded rectangle icon. The **Port Provisioning** dialog box opens. **Important! At this point, at the customer's end, revert the CPE to a 2 wire mode. (The port must be in an Unlocked state for this step.)**
3	On the **Status** tab, click **Locked** in the **Administration State** group box to lock the port.
4	Click the **SHDSL** tab.
5	In the **Odd/Even Pair Bonding** group box that is now activated, click **Disable**.
6	Click **Apply Changes** and exit the dialog box. When you click the Ports icon on the SHDSL8 card, you will now see that there is no rectangle around the previously pair bonded ports indicating that the pair of ports are now ready to be provisioned individually.

SECTION 3 CHANGE ORDER PROVISIONING

Contents

List of Tables

Chapter 1
Add PVC

Introduction   Each line card port can have up to eight Permanent Virtual Circuits (PVCs). This procedure describes how to add a PVC to a line card port that is already providing service.

Craft Terminal is used to communicate with the D50. Details about installing Craft Terminal and establishing communications with the D50 are in the volume titled <u>Craft Terminal</u>. Refer to this document as required while completing these procedures.

Required Information   To begin this task, you will need the following information from the change order:

- Line Card Shelf, line card, and port
- Traffic Descriptor. Additional information on traffic descriptor types and profiles is available in Section 1—*Provisioning Concepts*, Chapter 12—"ATM QoS Provisioning."
- Frame Relay to ATM Inter-working Descriptor, DLCI, and LMI Tunneling for the DS1 card. Additional information is available in the Section 1—*Provisioning Concepts*, Chapter 6—"DS1 Provisioning," **Setting Up DS1 Connections**, page 1-54.
- Subscriber's VPI/VCI address
- ATM network interface VPI/VCI

Note: There may be multiple PVCs defined for a single subscriber's loop.

Add PVC   Follow these steps using Craft Terminal to add a PVC from the D50 graphical window:

Table 3-1: Add PVC

STEP	PROCEDURE
1	Display the LCS Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting the LCS for the line card specified in the service order. **Note:** To see all the items in an object view window, you may need to drag it into view, or move or close other opened windows. For tool bar descriptions and object naming conventions, refer to the volume titled <u>Craft Terminal</u>, Section 2—*Craft Terminal User Interface*, Chapter 1—"General Description of the User Interface."
2	Click the port object on the line card icon to display the Port list. Click the required port icon from the Port list for the port specified on the service order. The **Port Provisioning** dialog box opens.

Table 3-1: Add PVC (continued)

STEP	PROCEDURE
3	Click the **Connection** tab.
4	Click the **New Connection** button to open the **New Connection** dialog box.
5	The LCS number, slot number, and port numbers are the default values for Link A (the subscriber's side); the active trunk card is the default for Link Z (the ATM network interface).
	Enter the following information from the change order:
	■ the VPI/VCI for Link A, for example: 0, 38.
	■ the VPI/VCI for Link Z, for example, 10, 71.
	■ Traffic Descriptor.
	■ Frame Relay to ATM Inter-working Descriptor, DLCI, and LMI Tunneling for the DS1 card. Additional information is available in the Section 1—*Provisioning Concepts*, Chapter 6—"DS1 Provisioning," **Setting Up DS1 Connections**, page 1-54.
	■ the VC Connection Topology, to set the direction.
	Note: Refer to the volume titled <u>Craft Terminal</u> for more details on these parameters.
6	In the **Admin State** group box, click **Unlocked** to unlock the connection or **Locked** to lock it until it is ready to be placed into service.
7	Click **Create**. The **Provisioning Connection** dialog box appears. Exit the **Provisioning Connection** dialog box by clicking the **X** on the top corner of the title bar. The connection is listed in the **Connection** tab. The ID column indicates the system-assigned ID of this connection.
8	Repeat Steps 1 through 7 for each additional PVC on the change order.

Chapter 2
Delete PVC

Introduction   This procedure describes how to delete a Permanent Virtual Circuit (PVC) from a line card port.

Craft Terminal is used to communicate with the D50. Details about installing Craft Terminal and establishing communications with the D50 are included in the volume titled <u>Craft Terminal</u>. Refer to this document as required while completing these procedures.

Required Information   To begin this task you will need the following information from the change order:
- Line Card Shelf, line card, and port of the PVC to be deleted.
- Virtual Link A VPI/VCI of the PVC to be deleted.

   Note: There may be multiple PVCs defined for a single subscriber's loop. A change order may delete one, some, or all of the PVCs defined for that loop.

Delete PVC   Follow these steps using Craft Terminal to delete a PVC from the D50 graphical window:

Table 3-2: Delete PVC

STEP	PROCEDURE
1	Display the LCS Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting the LCS for the line card specified in the service order. **Note:** To see all the items in an object view window, you may need to drag it into view, or move or close other opened windows.
2	Click the port object on the line card icon to display the Port list. Click the required port icon from the Port list for the port specified on the service order. The **Port Provisioning** dialog box opens.
3	Click the **Connection** tab.
4	Select the connection to be deleted and click **Open Connection** to display the **Provisioning Connection** dialog box.
5	To lock the PVC: ■ Click the **Status** tab. ■ Click **Locked** in the **Admin State** group box.

Table 3-2: Delete PVC (continued)

STEP	PROCEDURE
6	Click the **Delete** button.
7	A confirmation message appears as follows: This will remove the object from the system and close any related windows. Continue? Click **OK**.
8	Repeat Steps 1 to 7 to delete additional PVCs on the ports indicated in the change order.
9	Exit the **Port Provisioning** dialog box by clicking **X** in the top right corner of the title bar.

Chapter 3
Changing Data Rates

Introduction
This procedure describes how to change the maximum and minimum data rates associated with a line card port. Data rates are associated with DSL provisioning for the port, not a PVC.

Craft Terminal is used to communicate with the D50. Details about installing Craft Terminal and establishing communications with the D50 are in the volume titled <u>Craft Terminal</u>. Refer to this document as required while completing these procedures.

Required Information
To begin this task you will need the following information from the change order:
- Line Card Shelf, line card, and port.
- New Maximum and Minimum data rates.

Changing Data Rates
Follow these steps using Craft Terminal to change a port's maximum and minimum data rates from the D50 graphical window:

> **Important! It may take as long as 30 seconds for the line card to resynchronize with the subscriber's equipment; the subscriber's data service is down during this time.**

Table 3-3: Changing Data Rates

STEP	PROCEDURE
1	Display the LCS Equipment Locator group graphic by clicking **View** in the Main toolbar and selecting the LCS for the line card specified in the service order. **Note:** To see all the items in an object view window, you may need to drag it into view, or move or close other opened windows. For tool bar descriptions and object naming conventions, refer to the volume titled <u>Craft Terminal</u>, Section 2—*Craft Terminal User Interface*, Chapter 1—"General Description of the User Interface."
2	Click the port object on the line card icon to display the Port list. Click the required port icon from the Port list for the port specified on the service order. The **Port Provisioning** dialog box opens.

Table 3-3: Changing Data Rates (continued)

STEP	PROCEDURE
3	In this dialog box, do the following: ■ Click the **Rates** tab. ■ Set the new maximum and minimum data rates for both the ATUC (upstream) and ATUR (downstream) channels (if applicable), as specified in the change order. ■ Click **Apply Changes**.
4	The Changing Data Rates procedure is complete.

SECTION 4 APPENDICES

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Appendix A
Provisioning Parameters

D50 Provisioning Parameters

Appendix A provides provisioning parameters for all D50 line cards at the port level: DMT8a-3, DMT8a4, SDSL8, SDSL8+, SHDSL8, DS1, and IDSL. The provisioning tables list parameter data by tabs within individual dialog boxes as they appear to the user in Craft Terminal. In addition to providing default values and range values where applicable, the tables also provide cross-references to pages within this volume, to assist the reader in locating additional provisioning information.

Provisioning parameters for DS3 and OC3 trunk cards, broadband interface (MLA and LSM) cards, broadband tributary cards (DS3L and OC3L), and ATM connections are also provided in this appendix.

Table 4-1: DSL Provisioning Parameters

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Status Tab														
Administration State	–	Locked	–	Locked	–	Locked	–	Locked	–	Locked		Locked	–	Locked
Managed Interface	–	No	–	No	–	No	–	No	–	No		No	–	No
Rates Tab[1]														
Data Rate, Max[2] (ATUC or STUC)	–	N/A	1-2, 1-5	0 Kbps (Range 32 to 8128 Kbps)	1-12	0 Kbps (Range 32 to 8160 Kbps)	1-22	384 Kbps (Range 192 to 1536 Kbps)	1-30	384 Kbps (Range 144 to 2320 Kbps)		2304 Kbps (Range 64 to 2304 Kbps)	–	N/A
Data Rate, Min[3] (ATUC or STUC)	–	N/A	1-2, 1-5	0 Kbps (Range 32 to 8128 Kbps)	1-12	0 Kbps (Range 32 to 8160 Kbps)	1-22	384 Kbps (Range 192 to 1536 Kbps) (Read-only)	1-30	384 Kbps (Range 144 to 2320 Kbps) (Read-only)		64 Kbps (Range 64 to 2304 Kbps)	–	0 Kbps
Data Rate, Max[4] (ATUR or STUR)	–	N/A	1-2, 1-5	0 Kbps (Range 32 to 1024 Kbps)	1-12	0 Kbps (Range 32 to 896 Kbps)	1-22	384 Kbps (Read-only)	1-30	384 Kbps (Range 144 to 2320 Kbps) (Read-only)	–	N/A	–	N/A
Data Rate, Min[5] (ATUR or STUR)	–	N/A	1-2, 1-5	0 Kbps (Range 32 to 1024 Kbps)	1-12	0 Kbps (Range 32 to 896 Kbps)	1-22	384 Kbps (Range 192 to 1536 Kbps) (Read-only)	1-30	384 Kbps (Range 144 to 2320 Kbps) (Read-only)	–	N/A	–	N/A
Interleave Rate, Max (ATUC)	–	N/A	1-2, 1-5	8128 Kbps (Range 32 to 8128 Kbps)	1-12	8160[6] Kbps (Range 32 to 8160 Kbps)	–	N/A	–	N/A	–	N/A	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Interleave Rate, Min (ATUC)	–	N/A	1-2, 1-5	32 Kbps (Range 32 to 8128 Kbps)	1-12	32 Kbps (Range 32 to 8160 Kbps)	–	N/A	–	N/A	–	N/A	–	N/A
Interleave Rate, Max (ATUR)	–	N/A	1-2, 1-5	1024 Kbps (Range 32 to 1024 Kbps)	1-12	896 Kbps (Range 32 to 896 Kbps)	–	N/A	–	N/A	–	N/A	–	N/A
Interleave Rate, Min (ATUR)	–	N/A	1-2, 1-5	32 Kbps (Range 32 to 1024 Kbps)	1-12	32 Kbps (Range 32 to 896 Kbps)	–	N/A	–	N/A	–	N/A	–	N/A
Interleave Delay (ATUC)	–	N/A	1-2, 1-5	32 ms (Setting Options: 1, 2, 4, 8, 16, 32, 64)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Interleave Delay (ATUR)	–	N/A	1-2, 1-5	16 ms (Setting Options: 1, 2, 4, 8, 16, 32, 64)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
RADSL Mode[7] (ATUC or STUC)	–	N/A	1-3	Startup	1-13	Startup	–	none (Default value = "Fixed")	–	none (Default value = "Fixed")	1-39	Startup	–	N/A
Error Retrain Near (ATUC or STUC), (Unit = Errors/Sec)	–	N/A	1-4, 1-5	10 (Range 1 – 60)	1-12	10 (Range 1 – 60)	–	N/A	–	N/A	1-40, 1-45	10 (Range 1 – 60)	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Error Alarm Near (ATUC or STUC), (Unit = Errors/Sec)	–	N/A	1-9	0	1-12	0	–	N/A	–	N/A	1-40	0	–	N/A
Error Retrain Far (ATUC or STUC)	–	N/A	1-4, 1-5	10 (Range 1 – 60)	1-12	10 (Range 1 – 60)	–	N/A	–	N/A	1-40	10 (Range 1 – 60)	–	N/A
Error Alarm Far (ATUC or STUC)	–	N/A	1-9	0	1-12	0	–	N/A	–	N/A	1-40	0	–	N/A
Rate Degraded (ATUC or STUC)	–	N/A	1-9	0	1-13	0	–	0	–	0	1-39, 1-39	0	–	N/A
Rate Degraded (ATUR or STUR)	–	N/A	1-9	0	1-13	0	–	0	–	0	–	N/A	–	N/A
DS1 Tab														
Framing Format	1-50	ESF	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Transmit Clock Source	1-50	Loop	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
LMI Mode	1-50	None	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Line Code & Polarity	1-38	B8ZS	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Line Build Out	1-50	0-133 ft	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
DS0 Time Slots	1-50	24	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
FR to OAM Mapping		Disable	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
DMT Tab													–	
Fast Retrain	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Forward Error Correction (ATUC)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Trellis[8]	–	N/A	1-3	Enable	1-14	Enable	–	N/A	–	N/A	–	N/A	–	N/A
Bitswap	–	N/A		Disable		Disable	–	N/A	–	N/A	–	N/A	–	N/A
ATUC Advanced Config	–	N/A	N/A	Auto	N/A	Auto	–	N/A	–	N/A	–	N/A	–	N/A
ATUC Operation Mode	–	N/A	1-3	Auto	1-13	Auto	–	N/A	–	N/A	–	N/A	–	N/A
Coding Gain[9]	–	N/A	1-3	'Auto'	–	N/A'	–	N/A	–	N/A	–	N/A	–	N/A
Gain (dB)[9]	–	N/A	1-3	3	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
RS Correction[9]	–	N/A	1-3	Enable	–	Disable	–	N/A	–	N/A	–	N/A	–	N/A
ATUC Time[9]	–	N/A	1-3	1 ms	–	1 ms (Read-only)	–	N/A	–	N/A	–	N/A	–	N/A
ATUR Time[9]	–	N/A	1-3	1 ms	–	250 ms (Read-only)	–	N/A	–	N/A	–	N/A	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Target Noise Margin[9] **(ATUC)**	–	N/A	1-2 1-5	6 dB (Range 0 – 16 dB)	1-14	6 dB (Range 0 – 16 dB)	–	N/A	–	N/A	–	N/A	–	N/A
Target Noise Margin[9] **(ATUR)**	–	N/A	1-2 1-5	6 dB (Range 0 – 16 dB)	1-14	6 dB (Range 0 – 16 dB)	–	N/A	–	N/A	–	N/A	–	N/A
Transmit Power Reduction[10] **(ATUC)**	–	N/A	1-4	0 dB	1-15	0 dB	–	N/A	–	N/A	–	N/A	–	N/A
ACP[11] **(ATUC)**	–	N/A	–	0	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Advanced Tab[12]														
Target Noise Margin (ATUC)	–	N/A	–	6 dB (Range 0 – 16 dB)	–	6 dB (Range 0 – 16 dB)	–	N/A	–	N/A	–	N/A	–	N/A
Target Noise Margin (ATUR)	–	N/A	–	6 dB (Range 0 – 16 dB)	–	6 dB (Range 0 – 16 dB)	–	N/A	–	N/A	–	N/A	–	N/A
TX Power Reduction (ATUC) (In Craft Terminal Only)	–	N/A	–	0 dB	–	0 dB	–	N/A	–	N/A	–	N/A	–	N/A
ACP[11] **(ATUC) (In Craft Terminal Only)**	–	N/A	–	0	–	0	–	N/A	–	N/A	–	N/A	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
DSL Thresholds Tab														
LOF Seconds 15 min. (ATUC)	–	N/A	1-6, 1-8	0 (Range 1–900)	1-16	0 (Range 1–900)	1-25	0	1-33	0	1-40	0	1-62	0 (Range 1–900)
LOS Seconds 15 min. (ATUC)	–	N/A	1-6, 1-8	0 (Range 1–900)	1-16	0 (Range 1–900)	1-25	0	1-33	0	1-40	0	1-62	0 (Range 1–900)
LPR Seconds 15 min. (ATUC)	–	N/A	1-7, 1-8	0 (Range 1–900)	1-16	0 (Range 1–900)	–	0 (Read-only)	–	0 (Read-only)	1-41	0	–	0 (Read-only)
LCD Seconds 15 min. (ATUC)	–	NA	1-7, 1-8	0 (Range 1–900)	1-16	0 (Range 1–900)	–	0 (Read-only)	–	0 (Read-only)	1-41	0	–	0 (Read-only)
LOF Retrains 15 min. (ATUC)	–	N/A	1-7,	0	1-16	0	1-25	0	1-33	0	1-41	0	–	0
Error Rate Retrains 15 min. (ATUC)	–	N/A	1-7	0	1-16	0	–	0 (Read-only)	–	0 (Read-only)	1-41	0	–	0 (Read-only)
FE Error Rate Retrains 15 min. (ATUC)	–	N/A	1-7	0	1-16	0	–	0 (Read-only)	–	0 (Read-only)	1-41	0	–	0 (Read-only)
LOF Seconds Daily (ATUC)	–	N/A	1-6, 1-8	0 (Range 1–86400)	1-16	0 (Range 1–86400)	1-25	0	1-33	0	1-40	0	1-62	0 (Range 1–86400)
LOS Seconds Daily (ATUC)	–	N/A	1-6, 1-8	0 (Range 1–86400)	1-16	0 (Range 1–86400)	1-25	0	1-33	0	1-40	0	–	0

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
LPR Seconds Daily (ATUC)	–	N/A	1-7, 1-8	0 (Range 1–86400)	1-16	0 (Range 1–86400)	–	0 (Read-only)	–	0 (Range 1–86400)	1-41	0	–	0 (Read-only)
LCD Seconds Daily (ATUC)	–	N/A	1-7, 1-8	0 (Range 1–86400)	1-16	0 (Range 1–86400)	–	0 (Read-only)	–	0 (Range 1–86400)	1-41	0	–	0 (Read-only)
LOF Retrains Daily (ATUC)	–	N/A	1-7	0	1-16	0	1-25	0	1-33	0	1-41	0	–	0
Error Rate Retrains Daily (ATUC)	–	N/A	1-7	0	1-16	0	–	0 (Read-only)	–	0 (Read-only)	1-41	0	–	0 (Read-only)
FE Error Rate Retrains Daily (ATUC)	–	N/A	1-4 1-7	10 (Range 1-60)	1-16	10 (Range 1-60)	–	0 (Read-only)	–	0 (Read-only)	1-41	0	–	0 (Read-only)
Coding Violations NE, 15 min.	–	N/A	1-8	0	1-16	0	1-26	0	1-34	0	1-41	0	1-62	0
Coding Violations NE, Daily	–	N/A	1-8	0	1-16	0	1-26	0	1-34	0	1-41	0	1-62	0
Coding Violations FE, 15 min.	–	N/A	1-8	0	1-16	0	1-26	0	1-34	0	1-41	0	1-63	0
Coding Violations FE, Daily	–	N/A	1-8	0	1-16	0	1-26	0	1-34	0	1-41	0	1-63	0
Errored Seconds NE, 15 min.	–	N/A	1-8	0 (Range 1–900)	1-17	0 (Range 1–900)	1-25	0	1-33	0	1-42	0	1-62	0 (Range 1–900)

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Errored Seconds NE, Daily	–	N/A	1-8	0 (Range 1–86400)	1-17	0 (Range 1–86400)	1-25	0	1-33	0	1-42	0	1-62	0 (Range 1–86400)
Errored Seconds FE, 15 min.	–	N/A	1-8	0 (Range 1–900)	1-18	0 (Range 1–900)	1-25	0	1-33	0	1-42	0	1-62	0 (Range 1–900)
Errored Seconds FE, Daily	–	N/A	1-8	0 (Range 1–86400)	1-18	0 (Range 1–86400)	1-25	0	1-33	0	1-42	0	1-62	0 (Range 1–86400)
Error Thresholds Tab														
LOF Seconds 15 min. (ATUC)	1-51	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
LOS Seconds 15 min. (ATUC)	1-51	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
LMI Fail/Seconds 15 min. (ATUC)	1-52	0 (Range 1–900	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
LOF Seconds Daily (ATUC)	1-51	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
LOS Seconds Daily (ATUC)	1-51	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
LMI Fail/Seconds Daily (ATUC)	1-52	0 (Range 1–86400)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Errored Seconds Line NE, 15 min (ATUC)	1-52	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Severely Errored Seconds (SES) Line NE, 15 min (ATUC)	1-52	0 (Range 1–900	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Unavail Sec (UAS) Line NE, 15 min (ATUC)	1-53	0 (Range 1-900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Coding Violation Line NE, Daily (ATUC)	1-52	0	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Errored Seconds Line NE, Daily (ATUC)	1-52	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Severely Errored Seconds (SES) Line NE, Daily (ATUC)	1-52	0 (Range1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Unavail Sec (UAS) Line NE, Daily (ATUC)	1-53	0 (Range1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Coding Violation Path NE, 15 min. (ATUC)	1-52	0	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Errored Seconds Path NE, 15 min (ATUC)	1-52	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Severely Errored Seconds (SES) Path NE, 15 min (ATUC)	1-52	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
SEF/AIS Sec (SAS) Path NE, 15 min (ATUC)	1-53	0	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Unavail Sec (UAS) Path NE, 15 min (ATUC)	1-53	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Coding Violation Path NE, Daily (ATUC)	1-52	0	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Errored Seconds Path NE, Daily (ATUC)	1-52	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Severely Errored Seconds (SES) Path NE, Daily (ATUC)	1-52	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
SEF/AIS Sec (SAS) Path NE, Daily (ATUC)	1-53	0	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
Unavail Sec (UAS) Path NE, Daily (ATUC)	1-53	0 (Range 1–900)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A
SHDSL Tab														
Odd/Even Pair Bonding	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-40	Disable	–	N/A
Power Back-off	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-40	Enable	–	N/A
TC-PAM 32	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-40	Disable	–	N/A
STUC Advanced Config	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-40	Auto	–	N/A
STUC Opera-tion Mode	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-40	AnnexB	–	N/A
STUC ACP 1	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-40	0	–	N/A
STUC ACP 2	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-40	0	–	N/A

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
IDSL Tab														
IDSL Mode	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A		N/A	1-60	2B Plus D Bonded
Test Mode	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A		N/A	–	Terminal
Test Duration (Seconds)	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A		N/A	–	28800
Element Address	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	0 = CPE default (1 – 6 to address intermediate equipment units)

Table 4-1: DSL Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SHDSL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values
Channels Tab														
PVC VCI	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-60	Channel 1 default is 16, all others are 0
Mapping	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-60	B1
Inter-working Function	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-61	FRF.8
Network Interworking	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	–	N/A	1-62	Disable

[1] Tab name is IDSL for IDSL8 card.

[2] Field name is ATUC Fast Rate Max for DMT8a-3 and DMT8a4 line cards.

[3] Field name is ATUC Fast Rate Min for DMT8a-3 and DMT8a4 line cards.

[4] Field name is ATUR Fast Rate Max for DMT8a-3 and DMT8a4 line cards.

[5] Field name is ATUR Fast Rate Min for DMT8a-3 and DMT8a4 line cards.

[6] The DMT8a4 line card also supports speeds up to 10.8 Mbps in 32 Kbps increments in Interleave Mode based on "S=1/2" from the ITU-T G992.1 standard, when used in conjunction with an "S=1/2"-compliant CPE.

[7] For SDSL – referred to as "Startup Mode."

[8] Field name is Trellis for DMT8a-3 and DMT8a4 card.

[9] Used for DMT8a-3 and DMT8a4 ports only. Editable only when the ATUC Operation Mode is Manual.

[10] Used for DMT8a-3 and DMT8a4 ports only on DMT Tab.

[11] This field is planned for future use.

[12] Tab name is DMT for DMT8a-3 and DMT8a4 card.s

QoS Queue Provisioning Parameters

Table 4-2: QoS Queue Provisioning Parameters

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SDHL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Default Values	Vol. 4 Page #'s	Default Values
Queue Manager Tab														
EPD/PPD Enable	1-84	Enable	1-84	Enable	1-84	Enable	1-84	Enable	1-84	Enable	1-84	Enable	1-84	Enable
EPD Onset Threshold	1-85, 1-103	75%	1-85, 1-103	75%	1-85, 1-103	75%	1-85, 1-103	75%	1-85, 1-103	75%	1-85, 1-103	75%	1-85, 1-103	75%
EPD Abate Threshold	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%
PPD Threshold	1-85, 1-103	95%	1-85, 1-103	95%	1-85, 1-103	95%	1-85, 1-103	95%	1-85, 1-103	95%	1-85, 1-103	95%	1-85, 1-103	95%
EFCI Enable	1-84, 1-103	Enable	1-84, 1-103	Enable	1-84, 1-103	Enable	1-84, 1-103	Enable	1-84, 1-103	Enable	1-84, 1-103	Enable	1-84, 1-103	Enable
EFCI Threshold	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%	1-85, 1-103	65%
Priority	1-84, 1-108	'Low' = default. Options: • Low • Medium • High	1-84, 1-108	'Low' = default. Options: • Low • Medium • High	1-84, 1-108	'Low' = default. Options: • Low • Medium • High	1-84, 1-108	'Low' = default. Options: • Low • Medium • High	1-84, 1-108	'Low' = default. Options: • Low • Medium • High	1-84, 1-108	'Low' = default. Options: • Low • Medium • High	1-84, 1-108	'Low' = default. Options: • Low • Medium • High
Direction	1-84	Egress (Read-only)	1-84	Egress (Read-only)	1-84	Egress (Read-only)	1-84	Egress (Read-only)	1-84	Egress (Read-only)	1-84	Egress (Read-only)	1-84	Egress (Read-only)
Queue Size	–	694	–	694	–	694	–	694	–	694	–	694	–	694
Congestion Measurement Enable	1-87	(Enable off)	1-87	(Enable off)	1-87	(Enable off)	1-87	(Enable off)	1-87	(Enable off)	1-87	(Enable off)	1-87	(Enable off)

Table 4-2: QoS Queue Provisioning Parameters (continued)

	DS1		DMT8a-3		DMT8a4		SDSL8		SDSL8+		SDHL8		IDSL	
	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Default Values	Vol. 4 Page #'s	Vol. 4 Page #'s	Default Values	Default Values	Vol. 4 Page #'s	Default Values
Weight Factor	1-87	0.300 (Range .001 to 1.000)	1-87	0.300 (Range .001 to 1.000)	1-87	0.300 (Range .001 to 1.000)	1-87	0.300 (Range .001 to 1.000)	1-87	0.300 (Range .001 to 1.000)	1-87	0.300 (Range .001 to 1.000)	1-87	0.300 (Range .001 to 1.000)
Severe Lvl (%)	1-87	90%	1-87	90%	1-87	90%	1-87	90%	1-87	90%	1-87	90%	1-87	90%
Abate Lvl (%)	1-87	70%	1-87	70%	1-87	70%	1-87	70%	1-87	70%	1-87	70%	1-87	70%
Intermed Lvl (%)	1-87	40%	1-87	40%	1-87	40%	1-87	40%	1-87	40%	1-87	40%	1-87	40%
Active Rpt. (Seconds)	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds
Clear Rpt. (Seconds)	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds	1-88	30 seconds
Queue Congestion Tab														
Priority	1-87, 1-108	'Low' = default Options: • Low • Medium • High	1-87, 1-108	'Low' = default. Options: • Low • Medium • High	1-87, 1-108	'Low' = default. Options: • Low • Medium • High	1-87, 1-108	'Low' = default. Options: • Low • Medium • High	1-87, 1-108	'Low' = default. Options: • Low • Medium • High	1-87, 1-108	'Low' = default. Options: • Low • Medium • High	1-87, 1-108	'Low' = default. Options: • Low • Medium • High
Direction	1-87	Egress (Read-only)	1-87	Egress (Read-only)	1-87	Egress (Read-only)	1-87	Egress (Read-only)	1-87	Egress (Read-only)	1-87	Egress (Read-only)	1-87	Egress (Read-only)

Table 4-3: DS3 Provisioning Parameters – DS3T Tab[1]

Parameter	Values	Default
Addressing Mode	• NNI • UNI	• NNI = DS3 trunks, MLAT3, and LSMT3 cards. • UNI = DS3L card. (Not provisionable; preset to default.)
Cell Scrambling	• Cell Scrambling Disable • Cell Scrambling Enable	Cell Scrambling Enable
HEC Coset	• HEC Coset Disable • HEC Coset Enable	HEC Coset Enable
Starvation Cycle – Ingress[2]	• 0 – (no bandwidth guaranteed for low-priority traffic) • 1 – 63 for low-priority and medium-priority traffic • 1 – 15 for low-priority and medium priority traffic	0
Starvation Cycle – Egress[2]	• 0 – (no bandwidth guaranteed for low-priority traffic) • 1 – 63 for low-priority traffic	0
Line Build Out	• Build Out Low • Build Out High	Build Out Low

Table 4-3: DS3 Provisioning Parameters – DS3T Tab[1] (continued)

Parameter	Values	Default
Line Type	• Direct Mapping CBit • PLCP CBit • Direct Mapping M23 • PLCP M23	PLCP CBit
Timing	• Loop • Internal • External[3] • Loop PLCP 8 kHz • Internal PLCP 8 kHz	• Loop = DS3 trunks and LSMT3 cards. • Internal = MLAT3 and DS3L cards.

[1] Pertains to all DS3 trunk cards (DS3T, DS3T2, DS3TQ), and MLAT3, LSMT3, and DS3L cards.
[2] Priority queuing starvation cycles are not applicable to a D50 supporting ATM QoS.
[3] Pertains only to DS3TQ trunk cards that utilize one or two Master Timing Unit (MTU) cards to extract an external timing signal.

Table 4-4: DS3 Provisioning Parameters – DS3 Thresholds Tab[1]

Parameter	Daily Interval Values	15 Minute Interval Values	Associated BER
CVCP-P	382 3820 38196 381799 3801881	38 382 3820 38180 380188	10^{-10} 10^{-9} (**9** = default) 10^{-8} 10^{-7} 10^{-6}
CVPLCP-P	358 3584 35830 358132 3564673	38 382 3820 38180 380188	10^{-10} 10^{-9} (**9** = default) 10^{-8} 10^{-7} 10^{-6}
BERT Signal Degrade Condition (Set for DS3T2 card.)	N/A	N/A	6 = default (Range 6 – 9)

[1] Pertains to all DS3 trunk cards (DS3T, DS3T2, DS3TQ), and MLAT3, LSMT3, and DS3L cards.

Table 4-5: OC3 Provisioning Parameters – OC3T Tab[1]

Parameter	Values	Default
Addressing Mode	• NNI • UNI	• NNI = OC3 trunks, MLA2 and LSM2 cards. • UNI = OC3L card. (Not provisionable; preset to default.)
Facility Type	• SONET • SDH	• Use SONETSONET for the D50. • Use SDH for the D50e.
Timing Option	• Loop • Internal • External[2]	• Loop = OC3 trunk card and LSM2 cards. • Internal = All MLA cards and OC3L cards.
S1 Sync Status – Transmit	1 to 15 bits	15 (Provisionable for trunk card, read-only for others.)
S1 Sync Status – Received	–	0 (Read-only)
Starvation Cycle – Ingress	• 0 – (no bandwidth guaranteed for low-priority traffic) • 1 – 63 for low-priority and medium-priority traffic • 1 – 15 for low-priority and medium priority traffic	0
Starvation Cycle – Egress	• 0 – (no bandwidth guaranteed for low-priority traffic) • 1 – 63 for low-priority traffic	0
Path RDI Mode ("HP RDI Mode" for all LSM/MLA cards and OC3L cards)	• Default • Auxiliary • Enhanced	Default (Provisionable for trunk card, read-only for others.)

Table 4-5: OC3 Provisioning Parameters – OC3T Tab[1] (continued)

Parameter	Values	Default
Loss of Cell Delineation	• Enabled • Disabled	Disabled
Payload Label Mismatch	• Enabled • Disabled	Disabled
Trace Identifier Mismatch	• Enabled • Disabled	Disabled (Provisionable for trunk card, read-only for others.)

[1] Pertains to all OC3 trunk cards (OC3T, OC3T2, OC3TQL, OC3TQM, OC3TQS), LSM2 (LSM2S, LSM2L) / MLA2 (MLA2S, MLA2L), and OC3L cards.

[2] Pertains only to OC3TQL, OC3TQS, and OCSTQM trunk cards that utilize one or two Master Timing Unit (MTU) cards to extract an external timing signal.

Table 4-6: OC3 Provisioning Parameters – OC3 Thresholds Tab[1]

Parameter	Daily Interval Values	15 Minute Interval Values
Section or RS		
Severely Errored Framing Seconds	Range 0 – 65535 Default = 0 (inactive)	Range 0 – 900 Default = 0 (inactive)
Line or MS		
Line Code Violations	Range 0 – 1048575 Default = 0 (inactive)	Range 0 – 16383 Default = 0 (inactive)
Line Errored Seconds	Range 0 – 65535 Default = 0 (inactive)	Range 0 – 900 Default = 0 (inactive)
Line Severely Errored Seconds	Range 0 – 65535 Default = 0 (inactive)	Range 0 – 900 Default = 0 (inactive)
Line Unavailable Seconds	Range 0 – 65535 Default = 10	Range 0 – 900 Default = 10
Path or HP		
Path Code Violations	Range 0 – 1048575 Default = 250	Range 0 – 16383 Default = 25
Path Errored Seconds	Range 0 – 65535 Default = 200	Range 0 – 900 Default = 20
Path Severely Errored Seconds	Range 0 – 65535 Default = 7	Range 0 – 900 Default = 3
Path Unavailable Seconds	Range 0 – 65535 Default = 10	Range 0 – 900 Default = 10
BERT	**Values**	**Default**
BERT Signal Degrade Condition (Set for OC3T2 card.)	6 – 9	6
BERT Signal Fail Condition		3 (Applicable to trunk card only.)

[1] Also pertains to LSM2 (LSM2S, LSM2L) /MLA2 (MLA2S, MLA2L), and OC3L cards.

Table 4-7: New Connection Dialog Box

Parameter	Values	Default
Link A Shelf	LCS1 through LCS12	(Dependent on line card selection.)
Link A Slot	LC1 through LC24 and LSM	(Dependent on line card selection.)
Link A Port	• 1 – 4 (for four-port line cards) • 1 – 8 (for eight-port line cards)	(Dependent on port selection.)
Link A VPI	(Per service order)	0
Link A VCI	(Per service order)	0
Link A Traffic Descriptor Rx		0
Link A Traffic Descriptor Tx		(Read-only)
Link Z Shelf	MCS (Read-only)	(Read-only information)
Link Z Slot	Trunk (Read-only)	(Read-only information)
Link Z Port	(Read-only)	(Read-only information)
Link Z VPI	(Per service order)	0
Link Z VCI	(Per service order)	0
Link Z Traffic Descriptor Rx		(Read-only)
Link Z Traffic Descriptor Tx		(Read-only)
VP Connection	• Select • Deselect	Deselect
Topology	• Duplex • SimplexAZ • SimplexZA	Duplex
Administration State	• Unlocked • Locked	Unlocked
FR/ATM Descriptor		1 (For the DS1 card only.)

Table 4-7: New Connection Dialog Box (continued)

Parameter	Values	Default
LMI Tunneling		– (For the DS1 card only.)
Link A DLCI	(Per service order)	(For the DS1 card only.)
Link Z DLCI	(Per service order)	(For the DS1 card only.)

MLAT1 Provisioning Parameters

Table 4-8: MLAT1 Provisioning Parameters – DS1 Tab

Parameter	Values	Default
ATUC Line Type	• ESF • SF	ESF (IMUX port only)
ATUC Transmit Clock Source	• Loop • Internal • cesAdaptive • cesSrts	MLAT1 = Internal (IMUX port only)
Starvation Cycles – Ingress	• 0 – (no bandwidth guaranteed for low-priority traffic) • 1 – 63 for low-priority and medium-priority traffic • 1 – 15 for low-priority and medium priority traffic	0
Starvation Cycles – Egress	• 0 – (no bandwidth guaranteed for low-priority traffic) • 1 – 63 for low-priority traffic	0
Line Build Out – Cable Length (feet)		100 (Non-IMUX port only)

Table 4-9: MLAT1 Provisioning Parameters – DSL Thresholds Tab

Parameter	Values	Default
ATUC LOF Seconds 15 Min.	1 – 900	0 (Both IMUX and non-IMUX ports.)
ATUC LOF Seconds Daily	1 – 86400	0 (Both IMUX and non-IMUX ports.)
ATUC LOS Seconds 15 Min.	1 – 900	0 (Both IMUX and non-IMUX ports.)
ATUC LOS Seconds Daily	1 – 86400	0 (Both IMUX and non-IMUX ports.)
ATUC LCD Seconds 15 Min.	1 – 900	0 (Non-IMUX port only)
ATUC LCD Seconds Daily	1 – 86400	0 (Non-IMUX port only.)
15 Min and Daily values: ATUC LPR Seconds ATUC LOF Retrains ATUC Error Retrains ATUC FE Error Retrains	–	0 (Both IMUX and non-IMUX ports. Read-only.)

Table 4-10: MLAT1 – DSL Frame Thresholds Tab[1]

Parameter	15 Minute Interval Values	Daily Interval Values
Line Near		
Line Coding Violations (CV)	Range 0 – 16383 Default = 0 (inactive) (Read-only for IMUX ports.)	Range 0 – 1048575 Default = 0 (inactive) (Read-only for IMUX ports.)
Line Errored Seconds (ES)	Range 0 – 900 Default = 0 (inactive) (Read-only for IMUX ports.)	Range 0 – 65535 Default = 0 (inactive) (Read-only for IMUX ports.)
Line Severely Errored Seconds (SES)	Range 0 – 900 Default = 0 (inactive) (Read-only for IMUX ports.)	Range 0 – 65535 Default = 0 (inactive) (Read-only for IMUX ports.)
Line SEF/AIS Seconds (SAS)	–	–
Line Unavailable Seconds (UAS)	Range 0 – 900 Default = 0 (Read-only for IMUX ports.)	Range 0 – 65535 Default = 0 (Read-only for IMUX ports.)
Path Near		
Path Coding Violations (CV)	Range 0 – 16383 Default = 0 (inactive) (Read-only for IMUX ports.)	Range 0 – 1048575 Default = 0 (inactive) (Read-only for IMUX ports.)

Table 4-10: MLAT1 – DSL Frame Thresholds Tab[1] (continued)

Parameter	15 Minute Interval Values	Daily Interval Values
Path Errored Seconds (ES)	Range 0 – 900 Default = 0 (inactive) (Read-only for IMUX ports.)	Range 0 – 65535 Default = 0 (inactive) (Read-only for IMUX ports.)
Path Severely Errored Seconds (SES)	Range 0 – 900 Default = 0 (inactive) (Read-only for IMUX ports.)	Range 0 – 65535 Default = 0 (inactive) (Read-only for IMUX ports.)
Path SEF/AIS Seconds (SAS)	Range 0 – 900 Default = 0 (inactive) (Read-only for IMUX ports.)	Range 0 – 65535 Default = 0 (inactive) (Read-only for IMUX ports.)
Path Unavailable Seconds (UAS)	Range 0 – 900 Default = 0 (Read-only for IMUX ports.)	Range 0 – 65535 Default = 0 (Read-only for IMUX ports.)
DLCC Near		
DLCC Near Coding Violations (CV)	Range 0 – 16383 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)	Range 0 – 1048575 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)
DLCC Near Errored Seconds (ES)	Range 0 – 900 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)	Range 0 – 65535 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)

Table 4-10: MLAT1 – DSL Frame Thresholds Tab[1] (continued)

Parameter	15 Minute Interval Values	Daily Interval Values
DLCC Far		
DLCC Far Coding Violations (CV)	Range 0 – 16383 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)	Range 0 – 1048575 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)
DLCC Far Errored Seconds (ES)	Range 0 – 900 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)	Range 0 – 65535 Default = 0 (inactive) (For both IMUX and non-IMUX ports.)

[1] Pertains to MLAT1 and LSMT1 cards.

Appendix B
Visual Indicators – Craft Terminal

Visual Indicators   The following table describes how an object's appearance is altered in Craft Terminal, based on possible state and condition changes.

Table 4-11: Visual Indicators

Color	State	The Object is...				Port, Card or Both
		Installed	Configured	Unlocked	Operable	
Green	Enabled, Operable	Yes	Yes	Yes	Yes	Port only. In data mode (CPE is connected and it has synchronized with the port)
Red	Alarmed, Inoperable	Could be either	Yes	No	No	Both card and port.
Yellow	Loss of Signal	Could be either	Yes	Yes	No	Port only.
Black	Disabled, Inoperable, Locked	Could be either	Yes	No	No	Both card and port. In this case, the card is configured, but it may not have been installed or it may have been locked.
Gray	Not Configured	Could be either	No	No	No	Card only.
Orange	Rate Degraded	Yes	Yes	Yes	Yes	Port only.
Dark Blue	Configured, Unlocked	Yes	Yes	Yes	Yes	Card only.
Light Blue	Configured, Unequipped	No	Yes	Yes	No	Card only.

10BaseT. A 10 Mbps Ethernet network that uses unshielded twisted pair cable in a star topology with a central hub.

2B1Q (Two Binary, One Quaternary). A line encoding technique used in ISDN BRI, IDSL and SDSL. It is a four-level PAM (Pulse Amplitude Modulation) technique, which maps two bits of data into one quaternary symbol, with each symbol comprising one of four variations in amplitude and polarity over a circuit.

AAL (ATM Adaptation Layer). ATM Adaptation Layer is located above ATM and converts non-ATM bit streams into ATM cells. The AAL protocol supports higher-layer service requirements.

ADSL (Asymmetric Digital Subscriber Line). Asymmetrical data signals for Internet access that share twisted pairs with POTS and that use modern signal modulation techniques to accomplish the data communications task. The downstream rates are much faster than the upstream rates.

AIS (Alarm Indication Signal). A downstream signal in a digital network that replaces the normal traffic signal when a maintenance alarm indication has been activated (indicating an upstream failure detection – error or alarm on the network). It is used in the OSI network management model.

Alarm. A signal used to indicate that an abnormality, a fault, or a failure has been detected. Alarms may be distinguished by type and by the severity of the event that caused the alarm.

ANSI (American National Standards Institute). Founded in 1918, ANSI is a U.S. voluntary standards setting board.

API (Application Programming Interface). Software that an application program uses to request and carry out lower-level services performed by an operating system.

ASCII (American Standard Code for Information Interchange). A computer coding method for converting alphanumeric and punctuation characters and control codes into digital (binary) form.

ATM (Asynchronous Transfer Mode). A multiplexed information transfer and switching process (cell-switched technology) in which data is organized into fixed length (53 octet) cells and transmitted according to each application's requirement. ATM is generally deployed in enterprise networks, which often connect LANs over wide areas that require large amounts of data to be transported over great distances.

Attenuation. Attenuation is the loss of signal strength over distance. Attenuation is measured in decibels.

ATUC (ADSL Transmission Unit – Central Office). Special electronics located in the Central Office to support a high rate of data transmission over UTP copper wires. This is the "downstream" direction. Works in conjunction with ATUR (see below).

ATUR (ADSL Transmission Unit – Remote). Special electronics located at the customer's premises to support a high rate of data transmission over UTP copper wires. This is the "upstream" direction. Works in conjunction with ATUC (see above).

AutoBaud. A set of drivers available on SDSL devices to promote inter-operability.

Auxiliary Common Systems Interface Panel (CSIP). Each Auxiliary CSIP connects and distributes Central Office power to up to four Line Card Shelves (LCSs). Auxiliary CSIPs are required for D50's with over five LCSs.

AWG (American Wire Gauge). A standard classification for measuring non-ferrous conductors such as copper wire.

Backbone. The part of a network that carries the heaviest traffic. It is one basis for the design of an overall network service. For example, the D50 operates on an ATM backbone.

Bandwidth. The capacity of a communications channel. For digital communications, bandwidth is usually measured in bits per second.

BER (Bit Error Rate). A measurement of transmission quality expressed as a ratio (ratio of error bits to the total number of bits transmitted – erroneous bits per million). The BER indicates how many bits are incorrectly transmitted in a given bit stream. The BER depends on the type and length of transmission.

BNC (Bayonett Neill Concelman). A bayonet-locking cabling interconnection standard, used in thin coaxial cable Ethernet applications.

BPS (Bits Per Second). A measurement of transmission speed – number of bits transmitted each second.

Bridge. A communications device used to interconnect networks or network nodes with a common set of higher level protocols.

Broadband. A communications method in which multiple channels are formed by dividing the transmission medium on a shared communications path. Generally describes communications above 1.5 Mbps.

Burst. A short flow of packets, often followed by idle periods where there is no transmission activity.

CAC (Connection Admission Control). Procedures carried out by an ATM network at connection set-up to determine whether a requested virtual connection can be supported or should be rejected.

CAM (Complimentary Analysis Module). A Nokia Broadband Systems product. A card that is used to provide the pathway to perform continuity testing from the LCS to the MDF when using a Low Pass Filter Shelf (LPFS8). Plugs into the LPFS8 backplane in the same manner as a Low Pass Filter card. Works with the PAM (Pair Analysis Module) card.

CAP (Competitive Access Provider). An alternative competitive local exchange carrier.

CBR (Constant or Continuous Bit Rate). An ATM service category that supports a constant or guaranteed rate to transport services such as video or voice as well as circuit emulation requiring rigorous timing control and performance parameters.

CCA (Congestion Control and Avoidance). A resource and traffic management mechanism to correct, avoid and/or prevent excessive situations such as buffer overflow or insufficient bandwidth that can cause the network to collapse.

CDV (Cell Delay Variance). A component of Cell Transfer Delay, induced by buffering and scheduling.

CDVT (Cell Delay Variance Tolerance). Specifies the acceptable tolerance to cell-by-cell variations of the CDV (jitter).

CE. Products sold into the European Economic Community since January 1996 are required to carry the CE Mark. The CE Mark represents that the product meets all Electromagnetic Compatibility Directives.

Cell. The smallest data component in an ATM stream. The ATM Cell has a 5-byte header and contains 48 bytes of payload.

CEV (Controlled Environment Vault). An environmentally conditioned room for housing optical and electronic equipment.

Channel. A point-to-point link in a communications system.

Circuit. A transmission path for sending and receiving data and/or voice between two points in a telecommunications system.

Circuit Emulation. A virtual circuit service offered to end users where the characteristics of an actual, digital bit-stream line (for example, video traffic) are emulated.

CLEC (Competitive Local Exchange Carrier). These carriers compete with the local exchange service to provide telephone service to customers who may choose voice and/or data services. Additionally, a CLEC may lease existing lines or provide their own local loop.

CLEI (Common Language Equipment Identifier) Codes. Assigned to all telecommunications equipment that may be installed in a RBOC facility (or other facilities if required). The codes are assigned by Bellcore (now SAIC).

Client/Server Model. In the client-server model, the *server* program offers a service reachable over the network (or within a stand-alone system). A server receives a request, performs the service, and returns the result to the requester. The *client* program sends a request to the server and waits for a response.

CLP (Cell Loss Priority). A 1-bit field in the ATM cell header that corresponds to the loss priority of a cell. Lower priority (CLP=1) cells can be discarded under a congestion situation.

CLR (Cell Loss Ratio). A QoS parameter that gives the ratio of the lost cells to the total number of transmitted cells on a given VCC in cells per second.

CMIP (Common Management Information Protocol). An OSI network management/service interface protocol created and standardized by ISO. Based on the basic data storage concept in which management information is collected and stored for subsequent retrieval by a management application. Provides for the transmission of event notifications and the transmission of operations directed toward managed objects.

CO (Central Office). Houses the Local Exchange switch that terminates individual local telephone subscriber lines for switching and connection to the public network (locally and long distance).

Coding Violation (CV). A violation detected in the coding of a signal.

Common Systems Interface Panel (CSIP) Alarm Board. All D50 alarm connections are made at the CSIP Alarm Board; Central Office visual, audible, remote Bay Alarm and remote input alarms. The Alarm Board has LEDs to display D50 alarm status.

Common Systems Interface Panel (CSIP) Power and Distribution Board. The CSIP Power and Distribution Board is located in the Master Control Shelf (MCS). Central Office power is terminated at the CSIP and is distributed to the MCS and up to four Line Card Shelves (LCSs).

CORBA (Common Object Resource Broker Architecture). An Object Request Broker (ORB) standard developed by the Object Management Group (OMG). It is an object-oriented technology which provides a scalable, open platform for both service provider and large enterprise network environments.

COT (Central Office Terminal or Termination). The termination of a local loop facility. Located at the Central Office facility. See Digital Loop Carrier for further information about how this is used.

CPE (Customer Premises Equipment). Refers to telephone and related equipment located on the customer's premises (office or home).

Craft Terminal (DiamondCraft®). Craft Terminal, previously known as DiamondCraft, is the D50's stand-alone craft interface application. It communicates directly with a D50 through a serial port connection using Point-to Point Protocol (PPP) or an Ethernet connection.

CRC (Cyclical Redundancy Checking). A data error-detecting mathematical process designed to ensure that errors don't occur undetected in a block of data. Systems using CRC will request that data be retransmitted if errors are detected.

Cross-connect. A connection between two or more elements of a telecommunications system.

CTD (Cell Transfer Delay). A QoS parameter that measures the maximum or worst-case time for a cell to be transferred from its source to its destination over a virtual connection. It is the sum of buffering, propagation, processing and queuing delays.

D50 Multiplexer. The D50 Multiplexer is classified as a Digital Subscriber Line Access Multiplexer (DSLAM). The D50 Multiplexer uses Digital Subscriber Line

(DSL) and Asynchronous Transfer Mode (ATM) technologies to deliver high speed data rates over the existing copper network.

D50 RAM (Remote Access Module). The D50 RAM is a small, versatile DSL remote line card shelf supporting up to three 8-port D50 line cards, one Line Card Shelf Multiplexer card, and three low pass filter cards, for up to 24 lines. It is equivalent to a small LCS.

Data Rate. The rate at which a channel carries data – measured in bits per second.

dB (Decibel). The decibel is a unit used to measure the power of sound or voltage. It is expressed as the ratio of two values. In telephony, the decibel (a logarithmic measurement) is used as a measure of relative power between circuits or transmission level points. As a reference: a change in level of 1 dB is barely perceptible under ideal conditions; however, increases or reductions of 3 dB result in doubling or halving, respectively, the power in a circuit. The corresponding figure for doubling or halving voltage is 6 dB.

DLC (Digital Loop Carrier). Network transmission equipment used to provide a pair gain function. DLC equipment is deployed in situations in which the cost of the equipment is more than offset by the savings in copper distribution accomplished by eliminating need for as many copper pairs. Digital loop carrier systems consist of two parts—a Central Office Terminal (COT) and a Remote Terminal. The COT provides the multiplexing/demultiplexing function of individual voice signals to the composite multiplexed signal at the interface between the switching equipment and the DLC. The Remote Terminal provides the multiplexing/demultiplexing function at the interface between the individual subscriber pairs and the DLC equipment.

DMT (Discrete Multi-Tone). Modulation technique which uses Frequency Division Duplex multiplexing to transmit data in the 35 kHz to 1.1 MHz frequency spectrum. It divides the frequency range into 256 discrete bands, each with 4 kHz bandwidth. Each band is independently modulated.

Downstream. The communications path going <u>from</u> the CO or DSLAM <u>to</u> the client/end user.

DS1 (Digital Signal Level One). 1.544 Mbps digital signal.

DS3 (Digital Signal Level Three). 44.736 Mbps digital signal – equivalent of 28 T-1 channels (also referred to as T-3).

DS3L. A DS3 rate broadband tributary card that provides a standard ATM UNI/NNI interface that supports provisionable VPI/VCI mappings to the D50 trunk card, allowing ATM cells to be aggregated from standard ATM network equipment.

DSL (Digital Subscriber Line). The generic name for a family of digital services provided by the local telephone companies to their local subscribers. The high speeds of transmission (up to 8 Mbps) are accomplished over the existing twisted pair copper wires.

DSLAM (Digital Subscriber Line Access Multiplexer). An ATM access mux/concentrator that grooms traffic from multiple low rate lines into a high rate trunk (DS1, DS3, OC3, OC12).

Duplex. Simultaneous, two-way independent transmission of data. Both ends of the communication can send and receive data at the same time. Also referred to as full-duplex.

EFCI (Explicit Forward Congestion Indication). A field in the ATM cell header indicating congestion or impending congestion. When EFCI is set, it indicates that a network element is either in a congested state or there is a potential congested state problem. The ATM end-system receiving cells with EFCI set can use this indication to adaptively decrease the cell rate of the connection to avoid congestion.

Egress. Outgoing direction to a network or network device. The term refers to data being sent out of a device or system, as opposed to information being sent into a network or network device (ingress).

EMI (Electromagnetic Interference). Unwanted electrical noise from an external source that can interfere with transmissions over copper cables.

EML (Element Management Layer). A layer representing the management and monitoring of components, at their lowest level, in a telecommunications network. In short, an abstraction of the functions provided by systems that manage each network element on an individual basis.

EMS (Element Management Systems). Software used to manage and monitor components of a telecommunication system at the lower levels of the Telecommunications Management Network.

EOC (Embedded Operations Channel). A control and signaling channel used for operations, administration and maintenance of the transmission line.

EPD (Early Packet Discard). A congestion control technique that selectively drops all but the last ATM cell in a Classical IP over ATM packet.

Error Rate. The ratio of incorrect elements sent to the total number of elements transmitted.

ES (Errored Seconds). The number of seconds in which at least one coding violation was detected.

ESD (Electrostatic Discharge). Transfer of an electrostatic charge on a surface through a conductive path to ground.

ETSI (European Telecommunications Standards Institute). ETSI is the European counterpart to ANSI, the American National Standards Institute. ETSI was founded in 1988.

Fault. Performance degradation that impacts the ability of the network element from properly performing.

FEBE (Far End Block Error). FEBE is used to monitor bit error performance of a communication link. An indication returned to the source that the far-end receiver has detected one or more errors in its received signal from the source.

FEC (Forward Error Correction). A transmission method in which extra bits or characters transmitted with the payload so that transmission errors can be corrected on the receiving end without forcing a retransmission.

FM (Fault Management). A data collection and reporting mechanism for component fault analysis.

Frame. In Time Division Multiplexing (TDM), a frame is one complete cycle of events. The frame consists of a fixed-size block of bits, which contains one (or more) time slots for each channel, plus synchronization and other overhead bits.

Frame Relay. Frame Relay is a packet mode switching interface defined by the ITU-T. Frame relay is provided on fractional T-1 or full T-carrier system carriers.

FRF. Frame Relay Forum.

FRF.5. Frame Relay/ATM PVC Network Interworking Implementation Agreement. FRF.5 provides the standard for ATM to become a high speed backbone for Frame Relay PVCs.

FRF.8. Frame Relay/ATM PVC Network Interworking Implementation Agreement. FRF.8 provides the standard for Frame Relay PVCs and ATM PVCs to communicate.

GFC (Generic Flow Control). A four bit field in the ATM header which can be used to provide local functions (e.g. flow control). The GFC is used to ensure that all nodes obtain access to the transmission medium. It can also be used to prioritize transmissions by data type.

GUI (Graphical User Interface). Generic name for the computer interface that presents graphics (icons) and characters. The GUI permits users to directly manipulate graphical objects displayed on the monitor.

HDLC (High Level Data Link Control). An ITU-TSS link layer protocol standard for point-to-point and multi-point communications. HDLC includes functions for link establishment, sequencing, flow control and error recovery.

HDSL (High bit rate Digital Subscriber Line). HDSL provides a T1 on two copper wire pairs (without the loop engineering and repeaters required for a standard T1 system).

HEC (Header Error Control). An 8-bit field (the last byte) of the ATM-cell header, whose purpose is to allow a receiver to detect, and possibly correct, transmission errors in the cell header. It is used for checking integrity only.

HTML (Hyper Text Markup Language). HTML is the software programming language used to create World Wide Web pages.

IAD (Integrated Access Device). An integrated-access device that can multiplex voice and data on one line.

IDF (Intermediate Distribution Frame). A metal rack designed to connect cables and located in an equipment room or closet. Consists of bits and pieces that provide the connection between inter-building cabling and the intra-building cabling (i.e. between the Main Distribution Frame (MDF) and individual phone wiring).

IDSL (ISDN Digital Subscriber Line). Delivers speeds up to 128/144 Kbps on copper loops as long as 18,000 feet. Dedicated service for data communications applications only. 2B1Q interface. In most cases, users can use their existing ISDN CPE equipment.

IEEE (Institute of Electrical and Electronics Engineers). An international engineering organization that defines standards related to networking and other areas.

IETF (Internet Engineering Task Force). One of two technical engineering bodies of the Internet Architecture Board. The IETF is responsible for solving short-term engineering needs and standards of the Internet.

ILEC (Incumbent Local Exchange Carrier). The local carrier that is (typically) the primary carrier for local calls in a given area. ILECs are telephone companies that were part of the Bell System.

In-Band. Using the same circuit to transport both the information (e.g., data or voice) along with the signaling information.

Ingress. Incoming direction to a network or network device. The term refers to data being sent into a network element or system, as opposed to information being sent out (egress).

Interleave. A process or technique that reduces the number of undetected error bursts and improves burst error performance. Interleave mode provides the most robust service and more reliable service under long reach conditions for DSL service that supports the Interleave process.

Inverse Multiplexer (IMUX). A device that combines multiple links (usually T1s or E1s) a single shared digital channel. Circuits can be added and dropped without losing ATM cells.

IP (Internet Protocol). A component of the TCP/IP protocol suite. IP operates at Layer 3 of the OSI Reference model.

ISDN (Integrated Services Digital Network). ISDN is a digital telecommunications standard for transmitting digital voice, data and video on the same transmission facility. ISDN has two basic access interfaces; BRI (Basic Rate Interface) and PRI (Primary Rate Interface). Both interfaces provide circuit-switched access to public networks. BRI provides a throughput of 144 Kbps and PRI has a throughput of up to 2 Mbps.

ISO (International Standards Organization). The International Standards Organization is an international organization founded in 1946 to facilitate the development of international data communication standards.

ISP (Internet Service Provider). A vendor who provides access to the Internet and the World Wide Web.

ISU (Integrated Services Unit). A digital device that consists of a CSU (Channel Service Unit) and DSU (Digital Service Unit).

ITU (International Telecommunications Union). An organization established by the United Nations. The ITU sets telecommunications standards and allocates frequencies to various uses worldwide.

IWF (Interworking Function). A function used on an interface between networks which use dissimilar technologies.

IXC (Interexchange Carrier). Long distance carrier such as AT&T, MCI WorldCom, Sprint, and some smaller carriers.

Java. A programming language developed by Sun Microsystems® for platform independent, object-oriented application development.

JDBC (Java DataBase Connectivity). A Java based driver which provides a database independent interface between a Java application or applet and the database. It provides a Java API on one side and an SQL interface on the other.

JDK (Java Developer's Kit). A (platform specific) development environment for creating Java based applications and applets.

Kbps (Kilo Bits Per Second). A measurement of transmission speed – one thousand bits transmitted each second.

kHz (Kilohertz). A unit of frequency equal to one thousand (1,000) cycles per second (Hz).

LAN (Local Area Network). A privately owned and administered network for data communications, usually within a building or campus environment, used to connect computers and peripheral devices. Communication is typically accomplished by broadcasting on a connectionless basis over a shared medium.

Latency. The amount of time between the moment a device generates a request for data and the instant at which the requested channel is available for transmission.

Leaky Bucket Algorithm. Officially called the Generic Cell Rate Algorithm. A method of explaining by means of a hole in a bucket, how an ATM switch measures the PCR and SCR conformance of each CBR and VBR connection.

Line Card. A line card serves as the interface between a line and a communications device.

Line Card Shelf (LCS). The D50 is made up of one Master Control Shelf and up to twelve Line Card Shelves. Each LCS has 24 mounting slots for line cards, one slot for a Line Card Shelf Multiplexer (LSM) card, and one slot for an optional LSM card for Remote Line Card Shelf protection group application.

Line Card Shelf Multiplexer (LSM) card. The LSM card communicates with the Master Line Card Adapter (MLA) card. The LSM multiplexes and demultiplexes ATM cell streams for up to 24 line cards in a Line Card Shelf.

Link A. The virtual connection path between the D50 and the CPE (or line card) side of the network.

Link Z. The virtual connection path between the D50 and the ATM side of the network.

LISP (Local Internet Service Provider). See ISP (Internet Service Provider).

Local Loop. The twisted pair cable connecting the subscriber to the Central Office.

LOF (Loss of Frame). A condition that can occur in digital transmissions when the receiving equipment loses frame alignment data (used to determine channel assignments and channel boundaries).

Loopback. Type of diagnostic test in which the transmitted signal is returned to the sending device after passing through a data communications link or network. The returned signal is then evaluated (either by a technician or diagnostic equipment) to get some sense of the condition of the line. Typically used in troubleshooting a data circuit or network.

LOS (Loss of Signal). An alarm sent by the receiving end to indicate that the transmission signal has been lost.

Low Pass Filter Shelf (LPFS8). Data plus voice frequency signals are received from the customer at the Low Pass Filter Shelf. The LPF8 card "splits" the low frequency voice signal from the high frequency ADSL signal. The voice signal is sent to the voice switch unimpeded; the data signal is received by the line card.

Master Control Processor (MCP) card. The MCP card is the central control and communications path for the D50; it stores program and provisioning database information. The D50 has two MCP cards in a 1:1 protection group.

Master Control Shelf (MCS). The MCS contains the central control and communication functions for the D50 and serves as the ATM network interface.

Master Line Card Adapter (MLA) card. Each MLA card provides the broadband interface to one Line Card Shelf. There are up to twelve MLA cards in a Master Control Shelf providing the broadband interface for up to twelve Line Card Shelves and up to 288 line cards.

Mbps (Mega Bits Per Second). A measurement of transmission speed – one million bits transmitted each second.

MBS (Maximum Burst Size). An ATM traffic parameter that specifies the maximum number of cells in a burst that can be transmitted at the peak rate assuming that, at the beginning of the burst, the receiving buffers are empty.

MDF (Main Distribution Frame). A wiring arrangement which connects the telephone/data lines coming from outside on one side and the internal lines on the other.

MDU (Multiple Dwelling Unit). Refers to high-rise apartment buildings or sometimes office buildings. Newer MDUs are often being built with fiber optic cables and other equipment (such as DSLAMs) installed so the occupants have easy access to high-speed data services.

MHz (Megahertz). A unit of frequency equal to one million (1,000,000) cycles per second (Hz).

MIB (Management Information Base). The MIB contains all the provisioning information for the D50 Multiplexer. (The MIB contains data available to a network management program. The network manager queries the MIB.)

MTBF (Mean Time Between Failure). Reliability metric for electronic equipment that represents the average amount of time (expected or predicted) between breakdowns.

Multi-mode Fiber. Fiber whose core diameter is larger than single mode fiber, which allows many modes of light to propagate down the multiple fiber optic paths. Each of these paths has a slightly different length, depending upon how often the light

bounces off the reflective boundary of the core region. Multi-mode fiber is used for short-distance data links.

Multiplexer. Equipment that aggregates two or more channels onto a single transmission channel.

MUX. Abbreviation for Multiplexer.

NE (Network Element). Processor controlled entities of the telecommunications network that primarily provide switching and transport network functions and contain network operations functions.

NEBS (Network Equipment Building System). NEBS is the Network Equipment Building System specification authored by Bellcore. NEBS compliance is required by many carrier customers; the D50 shipping today is already NEBS-compliant.

Network Management Processor (NMP) card. The NMP card controls the D50's network management interfaces and provides the protocol support for communication for D50 Craft Terminal.

NIC (Network Interface Card). An electronic circuitry board that usually fits into an expansion slot of a PC whose purpose is to connect to a Local Area Network. A NIC is designed to comply with both a specific LAN Medium Access Control procedure (CSMA/CD for Ethernet) and a specific physical medium (e.g. twisted pair wire, coax, or multi-mode fiber). Associated with the NIC is a unique address called the MAC address. It works with the network software and computer operating system to transmit and receive messages on the network.

NID (Network Interface Device). The Nokia Broadband Systems' NID ADSL Splitter divides the ADSL and POTS signals and works in conjunction with the router at the subscriber end. The splitter installs on the outside of a home or building, and is enclosed in a weatherproof wall mount enclosure. It features primary lighting and AC power fault protection, and is a passive device, requiring no power or management from the Central Office or subscriber.

NISP (National Internet Service Provider). See ISP (Internet Service Provider).

NNI (Network Node Interface). An Asynchronous Transfer Mode (ATM) interface between two public network pieces of equipment (contrast that to UNI, which stands for User Network Interface).

Node. Connection point in a network.

Noise. Unwanted electronic signals or disturbance that degrades line performance.

OAM (Operations And Maintenance). A group of network management functions that provide network fault indication, performance information, and data diagnosis functions.

OC-1 (Optical Carrier Level-1). A SONET line rate of 51.840 Mbps. Direct electrical-to-optical mapping of the STS signal with frame synchronous scrambling.

OC-12. SONET channel of 622.08 Mbps.

OC-3 (Optical Carrier Level-3). A SONET line rate of 155.520 Mbps. 3 x OC-1. Direct electrical-to-optical mapping of the STS signal with frame synchronous scrambling.

OC3L. A OC3 rate broadband tributary card that provides a standard ATM UNI/NNI interface that supports provisionable VPI/VCI mappings to the D50 trunk card, allowing ATM cells to be aggregated from standard ATM network equipment.

ODF (Optical Distribution Frame). Connection and distribution point for fiber optic cables. It is similar, in function, to an MDF for copper wires.

Optical Cross-Connect Panel. A cross-connect unit used for circuit administration and built from modular cabinets. It provides for the connection of individual optical fibers with optical fiber patch cords.

Oracle8®. An Object Relational Database Management System developed by Oracle.

ORB (Object Request Broker). An object-oriented system consisting of middleware which manages message traffic between application software and computer/software platforms.

OSI (Open System Interconnection Reference Model). An internationally accepted set of standards for communication between various systems manufactured by different vendors. The OSI Reference Model is a seven-layer model developed by the ISO (International Standardization Organization) to describe how to connect any combination of devices to communicate.

OSS (Operations Support System). A management operations center system which supports the daily operation of a telecommunications network.

Packet. A block or group of data organized in such a way as to be treated as a single unit within a communication network. It consists of the data (payload) and its control information.

Pair Bonding. This SHDSL feature enables the user to bond 2 ports to effectively double the maximum single-port bandwidth of 2.3 Mbps to provide up to 4.6 Mbps of symmetrical service.

PAM (Pair Analysis Module) card. A Nokia Broadband Systems' product. The PAM card plugs into the LCS backplane just like a line card and is used to test continuity of cable pair wiring from the LCS to the MDF. The PAM card is powered by AA batteries or -48V Central Office battery. The D50 does not have to be powered up to use the PAM card.

Payload. The data being transmitted, less its control and error-correction information.

PCI (Peripheral Component Interconnect). Bus of an Intel PC. PCI transfers data between the PC's main microprocessor and peripherals at up to 132 Mbps.

PCR (Peak Cell Rate). Specifies an upper bound on the rate at which traffic can be submitted to an ATM connection. Enforcement of this bound allows the network to allocate sufficient resources to ensure that the network performance objectives can be achieved.

PDF (Portable Document Format). File format of documents that can be viewed with Adobe Acrobat® Reader. PDF files are widely used to view files on the Internet.

PDU (Protocol Data Unit). In data communication protocols, a unit of data created by a given protocol layer at one place and logically transferred to the same layer at another place called a peer. This is the OSI terminology for "packet."

PLCP (Physical Layer Convergence Protocol). The part of the physical layer that adapts the transmission facility to handle DQDB (Distributed Queue Dual Bus) functions as defined in IEEE 802.6-1990.

PM (Performance Monitoring). A data collection and reporting mechanism for Quality of Service analysis.

PNNI (Private Network-to-Network Interface). PNNI is a standard of the ATM Forum that provides a multilevel hierarchical routing model for scalability in large and complex networks using ATM switches from multiple vendors.

POP (Point-of-Presence). The physical place within a LATA (Local Access and Transport Area; the long distance carrier's local office) where the IEC (Inter-Exchange Carrier) provides services to the LEC (Local Exchange Carrier), and perhaps directly to end-users.

POTS (Plain Old Telephone Service). A term used to describe analog, voice-only basic telephone service. All POTS lines work on loop start signaling.

PPP (Point-to-Point Protocol). A layer 2 protocol (relative to the OSI reference model) that allows a computer to use TCP/IP with a standard telephone line and a high-speed modem.

Profile. A set of pre-defined configuration variables which can be applied to one or more objects (of the same type) during the provisioning process. The use of profiles decreases configuration time and increases accuracy.

PSD (Power Spectral Density). PSD is the total power in the specified bandwidth divided by the specified bandwidth. PSD is measured in watts per hertz.

PSTN (Public Switched Telephone Network). Refers to the worldwide telephone system accessible to anyone with a telephone.

PTT (Post Telephone & Telegraph administration). The PTTs, usually controlled by their governments, provide telephone and telecommunications services in most countries outside of the USA.

PVC (Permanent Virtual Circuit). A permanent association between two DTEs (Data Terminal Equipment) established by configuration (established administratively via a service order process). A PVC uses a fixed logical channel to maintain a connection between the DTEs. After a PVC is defined, it requires no setup operation before data is sent and no disconnect operation after. The concept of a PVC is included in Networks supporting X.25, Frame Relay and ATM.

QoS (Quality of Service). In ATM networks, a set of parameters for describing a transmission. These parameters include values such as allowable cell loss ratio. The parameters apply to virtual channel connections and virtual path connections.

RADSL (Rate Adaptive Digital Subscriber Line). Transmission technology that supports both asymmetric and symmetric applications on a single twisted pair telephone line. Transmission rates are dynamically adjusted as the performance of the loop varies during a session.

RBOC (Regional Bell Operating Company). These are the major local service providers in the USA today. In 1984 ATT was broken up into 7 RBOCs. Today,

because of mergers, there are 4 RBOCs: BellSouth, Bell Atlantic, SBC Communications, and US WEST (recently merged with Qwest Communications).

Redundancy. This refers to various designs that provide a backup system (or part of a system) in case of a failure. As an example, the D50 has redundant power input terminals so that if one power source fails the backup source can continue to provide power to the system.

Reed-Solomon. A coding technique used to handle Forward Error Correction (FEC).

Remote Line Card Shelf (RLCS). An RLCS allows customers served over long loops — beyond 5.5 kilometers from the Central Office — access to DSL service. The RLCS is located remotely from the Central Office in an outside cabinet and connected to the Central Office Master Control Shelf via fiber optic, coax or copper cable extensions.

Remote Low Pass Filter (RLPF). The RLPF is a remote passive low pass filter "splitter" device. It splits the high frequency ADSL data signal from the voice signal at the customer end just like the Low Pass Filter card in the Central Office. There are two types of RLPF − a retrofit RLPF available in a standard Network Interface Device housing and a stand-alone RLPF.

RFC (Request for Comments). In the Internet community, a series of documents that contain protocol and model descriptions, experimental results, and reviews. All Internet standard protocols are written up as RFCs.

SCR (Sustainable Cell Rate). An ATM traffic parameter in cells per second that characterizes a bursty source and specifies a maximum average rate at which cells can be sent over a given ATM virtual connection.

SDH (Synchronous Digital Hierarchy). SDH is a high-speed, fiber-optic system, which provides an interface and mechanism for optical transmission of digital information. At the interface, signals are converted from electrical to optical form (and back to electrical form at the destination). SDH is an ETSI standard and is used in most of the world outside North America, where SONET is used. Transmission rates range from 155.520 Mbps to 9.953 Gbps.

SDSL (Symmetric Digital Subscriber Line). Also referred to as Single-Line Digital Subscriber Line, SDSL supports symmetrical T1 transmissions. It uses a single copper-pair wire and has a maximum operating range of 10,000 feet. It is capable of accommodating applications that require identical downstream and upstream speeds, such as video conferencing.

Serial Port. A hardware input/output port in which only one pin is available for data transmission in a given direction − bits are transmitted in sequence (one bit at a time). The wiring for a port is associated with a particular physical interface (i.e., RS-232). A serial port is most commonly used for a modem or a mouse.

Service Provider. A service provider is an organization or individual that provides telephone access to a network or to another service, such as the Internet.

SHDSL (Single line high bit rate DSL). Nokia octal line card supporting 8 ports of symmetric bit-rate transmission using multi-level Trellis Coded Pulse Amplitude Modulation (TC PAM).

Simplex. Simplex communication means that data can only be sent in one direction at a time. Also referred to as half-duplex.

Single Mode Fiber. Single mode fiber only provides one path for light pulses to travel through the fiber optic cable. There is very little loss of light pulses transmitted on single mode fiber. Therefore single mode fiber can be used for much longer distances than multi-mode fiber.

Smart Jack. According to the Newton's Telecom Dictionary, a "Smart Jack" is an industry term for a device that tests the integrity of T-1 circuits remotely from the central office. Installed on the customer premises in the form of a semi-intelligent demarcation point, a Smart Jack is completely passive until activated by code.

SNMP (Simple Network Management Protocol). The network management protocol used within TCP/IP-based internets. Defines the protocol for managers (clients) to communicate with agents (servers). The agent interfaces directly with the networking layers on the monitored network device to obtain the network management information. An agent is installed on every network device that will be managed or monitored. A client is an application program that is installed at the network operations center. It communicates with the SNMP agents to collect information in the form of MIB variables. SNMP is a request/reply protocol that uses the operations of Set or Get on data items in an agent's MIB.

SNR (Signal-to-Noise Ratio). In transmission, SNR is the ratio between the signal and noise levels at a given point, usually at the receiving end of the transmission. The SNR value is generally expressed in decibels (dB). The SNR can be used to determine how long a cable segment can be before the signal loss is unacceptably high. The SNR also helps determine whether a particular type of cable is appropriate for the intended use.

SONET (Synchronous Optical NETwork). SONET is a high-speed, fiber-optic system, which provides an interface and mechanism for optical transmission of digital information. At the interface, signals are converted from electrical to optical form (and back to electrical form at the destination). SONET is an ANSI standard. Transmission rates range from 51.84 Mbps to 13.22 Gbps.

Splitter. A device used in DSL to split the incoming bit stream into voice and data.

Subnet. A physically independent network segment. A subnet usually identifies all of the nodes in one geographical area or building. Nodes on a subnet can share a single network address.

SVC (Switched Virtual Circuit). A virtual connection set up on demand via a signal protocol connection, established for a specific communications session and then terminated after the session is over. This is in contrast to a permanent virtual circuit (PVC), which is a connection that is always established.

T1. DS1 rate electrical signal (two pair). T1 is suited for voice, data and image transmissions. T1 has a bandwidth of 1.544 Mbps, which comes from two dozen 64 Kbps channels, together with one 8 Kbps framing channel.

Tagging. The marking of a non-conforming cell that can be later discarded along its route through the ATM network if severe congestion conditions are experienced or the cell is still in violation of the traffic contract.

TCM (Trellis Coding Modulation). A method of forward error correction in which each signal element is assigned a value based on phase and amplitude to help the receiving modem determine if the element is received in error. Allows the user to meet performance margin requirements for long loops, or increase the transmission throughput under a specified performance margin; provides increased gain against background and crosstalk noise.

TCP/IP (Transmission Control Protocol / Internet Protocol). TCP/IP is a common suite of several networking protocols developed for use on the Internet.

Telnet. Telnet is the terminal-remote host protocol developed for ARPAnet in 1974. On the Internet, it is a service program that allows you to connect to other computers at another site permitting you to interact with applications as if by a local terminal.

Threshold. Level or value of a particular signal where an event or alarm will be generated.

TMN (Telecommunications Management Network). Reference model for telecommunications network management.

Transmission rates. The speed at which data is transmitted, measured in bits per second (bps).

Table 4-11: Transmission Rates

DS level	E level	OC level	STM equivalents	Line bit rate
DS-0				64 Kbps
DS-1 (T-1)				1.544 Mbps
	E-1			2.048 Mbps
DS-2				6.312 Mbps
	E-2			8.448 Mbps
	E-3			34.368 Mbps
DS-3 (T-3)				44.736 Mbps
		OC-1		51.840 Mbps
		OC-3	STM-1	155.52 Mbps
		OC-9		466.56 Mbps
		OC-12	STM-4	622.08 Mbps
		OC-18		933.12 Mbps
		OC-24	STM-8	1.244 Gbps
		OC-36	STM-12	1.866 Gbps
		OC-48	STM-16	2.488 Gbps

Table 4-11: Transmission Rates (continued)

DS level	E level	OC level	STM equivalents	Line bit rate
		OC-96		4.976 Gbps
		OC-192		9.953 Gbps

- **DS.** Digital Signal hierarchy: standard signals used in the U.S. telecommunications industry.
- **E.** Standard signals used in the European telecommunications industry.
- **OC.** Optical Carrier; a SONET optical signal.
- **STM.** Synchronous Transport Module; depends on information occurring in regular and fixed patterns with respect to a reference such as a frame pattern.

Trap. A method used to isolate an abnormal condition or operation.

Trunk. A communication circuit or link that interconnects two entities, usually switching systems.

Trunk Card. An interface card used to connect a D50 multiplexer to the ATM backbone facility.

Tunneling. Refers to the encapsulation of a protocol within another protocol format that provides a datalink or path. Tunneling can be used as part of a private secure network via the Internet.

Twisted Pair. The term used to describe common copper telephone wire. The two wires are called Tip and Ring. Also called Unshielded Twisted Pair (UTP).

UBR (Unspecified Bit Rate). In ATM networks, a UBR connection transmits at variable rates. With UBR, specific bandwidth allocation is not guaranteed.

UBR+. Unspecified Bit Rate with minimum cell rate guarantee that allows a connection to burst up to peak cell rate.

UNI (User Network Interface). In ATM networks, one of three levels of interface.   A UNI specification which defines Layer 1 and Layer 2 protocols required for CPE and carrier equipment to interoperate. UNI specifications provide physical media and line rate implementation options.

UNIX. A multi-task, multi-user operating system developed by Ken Thompson of AT&T Bell Labs. UNIX is a registered trademark of Santa Cruz Operations.

UPC. The traffic control entity that monitors and enforces a virtual circuit's conformance with the source's traffic contract and parameters.

Upstream. Description of the communications path coming <u>from</u> the client/end user <u>to</u> the CO or DSLAM.

USB (Universal Serial Bus). The Universal Serial Bus is used in newer PCs. The bus is 12 Mbps and designed to be "plug and play." It supports multiple PC peripherals, including Nokia D50-compatible CPE with USB.

VBR (Variable Bit Rate). In ATM networks, a VBR connection transmits in bursts, at variable speeds.

VC Topology. Used in the Nokia D50's Craft Terminal software to set the direction and mode of communication for duplex, simplex egress, and simplex ingress PVC connections.

VCI (Virtual Channel Identifier). An identifier (value) in an ATM cell that identifies the data of one Virtual Channel connection from the data of another connection.

VDSL (Very-high-speed Digital Subscriber Line). VDSL provides DSL service at a data rate in excess of 10 Mbps (up to 52 Mbps). VDSL has a maximum operating range from 1,000 feet to 4,500 feet on 24-gauge wire.

VF. Voice Frequency – In telephony, the usable voice-frequency band ranges from approximately 300 Hz to 3400 Hz. Also, the bandwidth allocated for a single voice-frequency transmission channel is usually 4 kHz.

VoDSL (Voice over Digital Subscriber Line). An end-to-end voice transport technique integrating voice and data over DSL using special gateways that are designed to connect packetized voice traffic to Class 5 circuit switches.

VoIP (Voice over Internet Protocol). A technique for transmitting voice information in digital form in packets rather than the circuit-switch protocol of the public switched telephone network.

VPI (Virtual Path Identifier). An identifier (value) in an ATM cell that identifies the data of one Virtual Path connection from the data of another connection.

WAN (Wide Area Network). A WAN is a network of computers and related communications equipment whose elements may be in dispersed sites with distances great enough to require common carrier provided communication lines.

xDSL (all forms of Digital Subscriber Lines). The "x" represents the various types of digital subscriber lines: ADSL, RADSL, SDSL, HDSL, SHDSL, IDSL, or VDSL.

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