Volume

4

Diamond Lane®
Communications

The Speedlink™ System

Provisioning

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Speedlink Documentation

Introduction

Speedlink documentation provides complete detailed instructions on how to install, test, and turn-up a Speedlink System. This documentation complies with all requirements in Bellcore Technical Reference TR-TSY-000454 *Supplier Documentation for Network Elements* and IP 0260 *Standards for Task Oriented Practices (TOPS)* requirements.

Target Audience

Speedlink 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.

VOLUME	TITLE	TARGET AUDIENCE
Volume 1	General	Anyone with a need to understand more about the Speedlink System and planning requirements.
Volume 2	Installation	Installation and Testing Technicians, and Engineers (Detailed Level Procedures)
Volume 3	Acceptance Testing	Testing Technicians and Engineers (Detailed Level Procedures)
Volume 4	Provisioning	Provisioning Technicians and Engineers (Detailed Level Procedures)
Volume 5	Maintenance and Testing	Maintenance and Testing Technicians and Engineers (Detailed Level Procedures)
Volume 6	DiamondView	Network Management Technicians (Tutorial and Reference Manual for DiamondView)
Volume 7	DiamondCraft	Testing and Installation Technicians and Engineers (Tutorial and Reference Manual for DiamondCraft)

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 the document easy for the reader to scan and to find information.

Each Detailed Level Procedure states the required equipment and tools to perform the job, provides step by step instructions, with integrated graphics, to help the reader perform each task.

Chapter
1

SECTION 1 PROVISIONING CONCEPTS

Chapter 1 CAP2 ADSL Provisioning

Introduction

This document describes the DSL provisioning parameters and operation of the Speedlink CAP2 line card. Details are provided on how the CAP2 port adjusts Transmit (Tx) Power, Signal Quality, and Data Rate during the “training” operational mode.

The CAP2 line card provides two Rate Adaptive Asymmetric (RADSL) lines using Carrierless Amplitude Phase (CAP) modulation technique. CAP uses Frequency Division Duplex (FDD) multiplexing to transmit data in the 35 KHz to 1.3 MHz frequency spectrum. Separate bands or “channels” are assigned for Upstream and Downstream data transmission. The Upstream channel rate is 35 KHz up to 191 KHz, the Downstream channel rate is 240 KHz to 1.3 MHz.

Operation of the CAP2 and CAP4 line cards is the same. The difference between the two line cards is the number of lines supported per line card and the way parameters are displayed in DiamondView[1]. Refer to Chapter 2–CAP4 ADSL Provisioning for detailed information regarding the CAP4 line card.

CAP ADSL Operational Modes

A CAP2 line card has two ports, each port has three basic operational modes: Idle, Training, and Data. These operational modes are defined as follows:

- IDLE – The CAP2 port transmitter and receiver are “locked” and disabled.
- TRAINING – The CAP2 port transmitter and receiver are “unlocked”. The CAP2 port is attempting to establish a connection with CPE equipment during the Training Mode. Training time is approximately 20 to 30 seconds depending on the quality of the local loop facility and the time required for the port to determine the best RADSL data rate.

[1] CAP2 provisioning parameters are also displayed in DiamondCraft.

- DATA – The CAP2 port connection is established and payload data is carried.

The signal "quality" of the Upstream and Downstream 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. Once the channels are established, their "quality"—combined with other provisioned settings—determines the actual data rate delivered.

Provisioning Parameters

There are four provisioning parameters that can be established in DiamondView[2] to affect CAP DSL port operation:

- **Transmit Power Reduction –** This parameter can be changed to affect the establishment of the DSL channel. The Transmit (Tx) Power Reduction parameter range is from 0 dB to 15 dB, for both Upstream and Downstream provisioning. The default setting is 0 dB for both channels. See page 5 for more detail on the Transmit Power Reduction parameter.
- **Upstream** and **Downstream Channel Data Rates –** Data rate translates into a baud and constellation setting delivered to the CAP2 port. Baud and constellation settings determine the bit rate of the CAP DSL channel.

  Minimum and Maximum[3] Upstream channel provisioning parameters range from 272 to 1088 Kbps. The default Upstream rate settings are: minimum = 272 Kbps, maximum = 1088 Kbps.

  Minimum and Maximum[4] Downstream channel provisioning parameters range from 640 to 6272 Kbps. The default Downstream rate settings are: minimum = 640 Kbps, maximum = 2560 Kbps.

  See page 7 for more detail on Upstream and Downstream Channel Data Rates.
- **Margin –** This parameter sets the noise Margin used during the Rate Adaptive DSL (RADSL) training process. The larger the Margin number, the lower the rate, but the greater the noise immunity achieved for a line of a given quality. The Margin parameter range is from -3 dB to +9 dB, for both Upstream and Downstream provisioning. The default setting is 6 dB for both channels.

  See page 7 for more detail on the Margin parameter.
- **Retrain Threshold –** This parameter determines the amount of "errored frames" allowed during Data Mode before the CAP DSL port retrains. The

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[2] Provisioning parameters can also be established using DiamondCraft.
[3] The CAP2 port will not exceed the provisioned upstream maximum rate.
[4] The CAP2 port will not exceed the provisioned downstream maximum rate.

Retrain Threshold parameter range is from 10^{-4} BER to 10^{-7} BER (Bit Error Rate). The default setting is 6 or 10^{-6} BER for both channels.

See page 12 for more detail on Retrain Threshold Setting.

Upstream and Downstream Channel Provisioning Parameters tables:

Table 1: Upstream Provisioning Parameters

Parameter	Values	Units	Defaults	Notes
Maximum Rate	272 - 1088	Kbps	1088	
Minimum Rate	272 - 1088	Kbps	272	
Transmit Power Reduction	0-15	dB	0	
Margin	-3 - +9	dB	6	
Retrain Threshold	4 - 7	BER	6	10^{-4} - 10^{-7}

Table 2: Downstream Provisioning Parameters

Parameter	Values	Units	Defaults	Notes
Maximum Rate	640 - 6272	Kbps	2560	
Minimum Rate	640 - 6272	Kbps	640	
Transmit Power Reduction	0-15	dB	0	
Margin	-3 - +9	dB	6	
Retrain Threshold	4 - 7	BER	6	10^{-4} - 10^{-7}

Channel Signal Quality Measurements

The CAP2 port has the functionality to measure channel “quality” established over the existing telephone copper network—the “local loop”. Average Signal Quality is the measurement used by the CAP2 port to measure channel quality. Other parameters provided by the CAP2 port about its operation are: Current Rate, Receiver Gain, Signal Quality, and Transmit Power.

- Current Rate is the actual Upstream and Downstream data rate for the channel. This rate is either fixed or determined by the CAP2 port during the training process. See page page 9 for more information on the RADSL training process.
- Receiver Gain is the 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.
- Signal Quality is a dynamic measurement. It is sampled continuously on the Upstream Channel during Data Mode operation.

- Average Signal Quality (ASQ) is the measured quality of the signal received over the local loop during the training process. ASQ is measured in dB, from 0 to +99.99 dB. ASQ is affected by the Transmit (Tx) Power of the transmitted signal, noise, plus the length and quality of the local loop. The higher the ASQ number the better the quality of the channel. For example: An ASQ in the low forties is excellent and indicates a loop with very little attenuation or noise.
- Transmit Power is the power level of the signal being transmitted by the transceiver at either end. Transmit Power is measured in dB, from 0 to +99.99 dB.

Table 3: Upstream Performance Actuals

Parameter	Range	Units	Notes
Current Rate	90 - 1088	Kbps	Result of Startup Training
Receiver Gain	-99.99 to +99.99	dB	Result of Startup Training
Average Signal Quality	0 to +99.99	dB	Result of Startup Training
Transmit Power	0 to +99.99	dB	Result of Startup Training
Signal Quality	0 to +99.99	dB	Dynamic -Changes during Data Mode

Table 4: Downstream Performance Actuals

Parameter	Range	Units	Notes
Current Rate	640 - 6272	Kbps	Result of Startup Training
Baud Rate	340, 680, 952	baud	Result of Startup Training
Receiver Gain	-99.99 to +99.99	dB	Result of Startup Training
Average Signal Quality	0 to +99.99	dB	Result of Startup Training
Transmit Power	0 to +99.99	dB	Result of Startup Training

All of these actual measurements are displayed in DiamondView's Advanced DSL Parameters window.

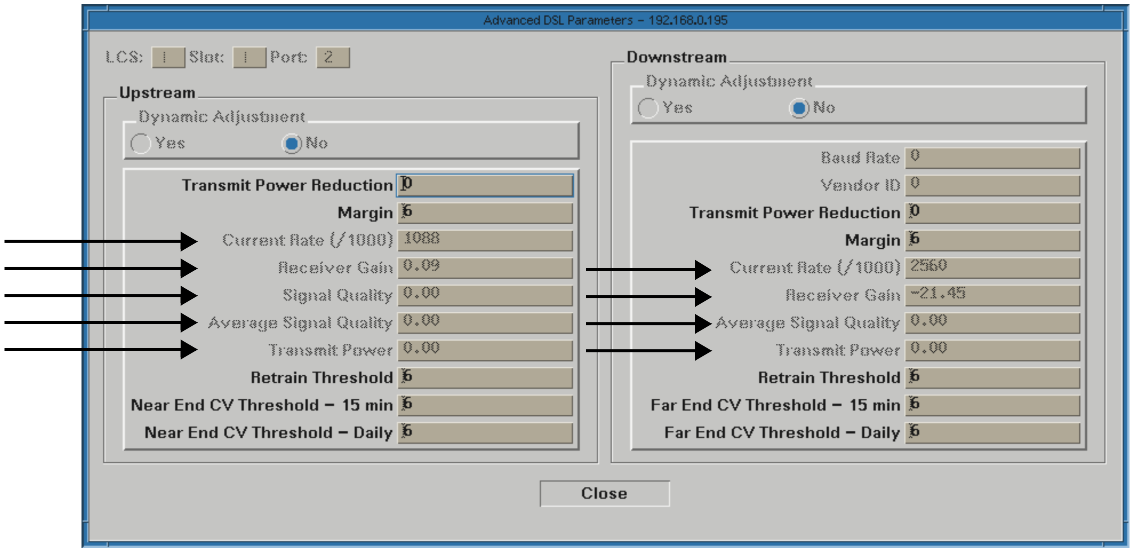

Figure 1: DiamondView—Advanced DSL Parameters Window

Transmit Power Reduction Setting

The quality of DSL channels is mainly determined by the characteristics of the local loop facility—and is beyond the control of the network service provider. However, the service provider can provision the "Transmit Power Reduction" parameter to affect Average Signal Quality and modify the performance of the CAP DSL channel.

The Transmit Power Reduction parameter limits the maximum power of a channel's transmit signal. It instructs the CAP DSL port to limit the full transmit power level by the Transmit Power Reduction amount.

Transmit Power Limit = Full Tx Power Level - Transmit Power Reduction setting

During the training process, the CAP DSL transceiver determines the Upstream and Downstream transmit power levels it will use. Once the transceiver determines the transmit power level, it looks at the Transmit Power Reduction setting, compares it to the value listed in the table below, and selects the lower of the two transmit power levels.

Table 5: Upstream and Downstream Transmit Power Reduction Settings and Baud Rates

Tx Power Reduction Setting	Upstream	Downstream		
	136 Baud	340 Baud	680 Baud	952 Baud
	Tx Power Limit	Tx Power Limit	Tx Power Limit	Tx Power Limit
0	12.9 dB	21.7 dB	21.9 dB	22.2 dB
3	9.9 dB	18.7 dB	18.9 dB	19.2 dB
6	6.9 dB	15.7 dB	15.9 dB	16.2 dB
9	3.9 dB	12.7 dB	12.9 dB	13.2 dB
12	0.9 dB	9.7 dB	9.9 dB	10.2 dB
15	-2.10 dB	6.7 dB	6.9 dB	7.2 dB

The Transmit Power Reduction setting can be used to “balance” the ASQ between the Downstream and Upstream channels. When the Transmit Power of an Upstream or Downstream channel is reduced—by increasing the Transmit Power Reduction parameter—the ASQ is reduced on that channel and increased on the opposite channel. For example: Decreasing the Transmit Power Reduction setting on the Downstream channel increases the power of the Downstream channel transmit signal, and increases the ASQ.

Basically, lower the Transmit Power Reduction setting on the channel to increase the channel’s ASQ. This will decrease the ASQ on the other channel.

Table 6: Downstream Transmit Power Reduction Setting Impacts

DOWNSTREAM Transmit Power Reduction Setting[a]	Actual DOWNSTREAM Transmit Power	DOWNSTREAM ASQ	UPSTREAM ASQ
Decrease	Increased	Increased	Decreased
Increase	Decreased	Decreased	Increased

[a] Release 3.0 supports Transmit Power Reduction Settings of 0 to 15 dB.

Table 7: Upstream Transmit Power Reduction Setting Impacts

UPSTREAM Transmit Power Reduction Setting	Actual UPSTREAM Transmit Power	UPSTREAM ASQ	DOWNSTREAM ASQ
Decrease	Increased	Increased	Decreased
Increase	Decreased	Decreased	Increased

The other intended purpose of the Transmit Power Reduction parameter is to reduce the amount of “transmitted power” at the Central Office, thereby reducing the “interference” or “crosstalk” with other circuits in the local loop. The greater the transmit power on a channel, the greater the potential for interference on the local loop.

Upstream and Downstream Transmit Power Reduction settings are provisioned in DiamondView’s Advanced DSL Parameters window.

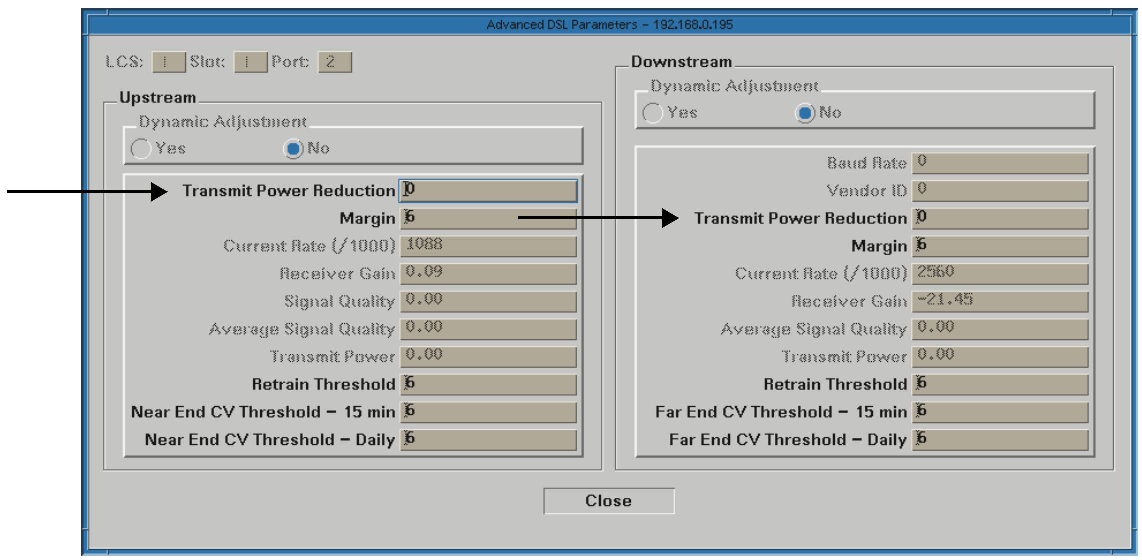

Figure 2: DiamondView—Advanced DSL Parameters Window

CAP DSL Port Data Rates and Margin

There are three parameters that affect the CAP DSL port operation and data rates. these are: Minimum and Maximum Data Rates, and Margin.

Minimum and Maximum Data Rates

The Minimum and Maximum Data Rate parameters determine whether a CAP2 port is set for Fixed Rate or Rate Adaptive DSL (RADSL) “training” mode.

Minimum and Maximum Data Rate parameters are provisioned for both Upstream and Downstream channels in Kbps. See the tables on page 3 for valid data rates.

A CAP2 port is provisioned for Fixed Rate operation by setting the Minimum and Maximum Data Rate parameters at the same rate.

When the Minimum and Maximum Data Rate parameters are not equal (the maximum rate is higher than the minimum rate) on the Upstream or Downstream channel, the channel is provisioned for RADSL operation.

Minimum and Maximum Data Rates are provisioned independently for the Upstream and Downstream channels using DiamondView's Line Card Shelf Port Details window.

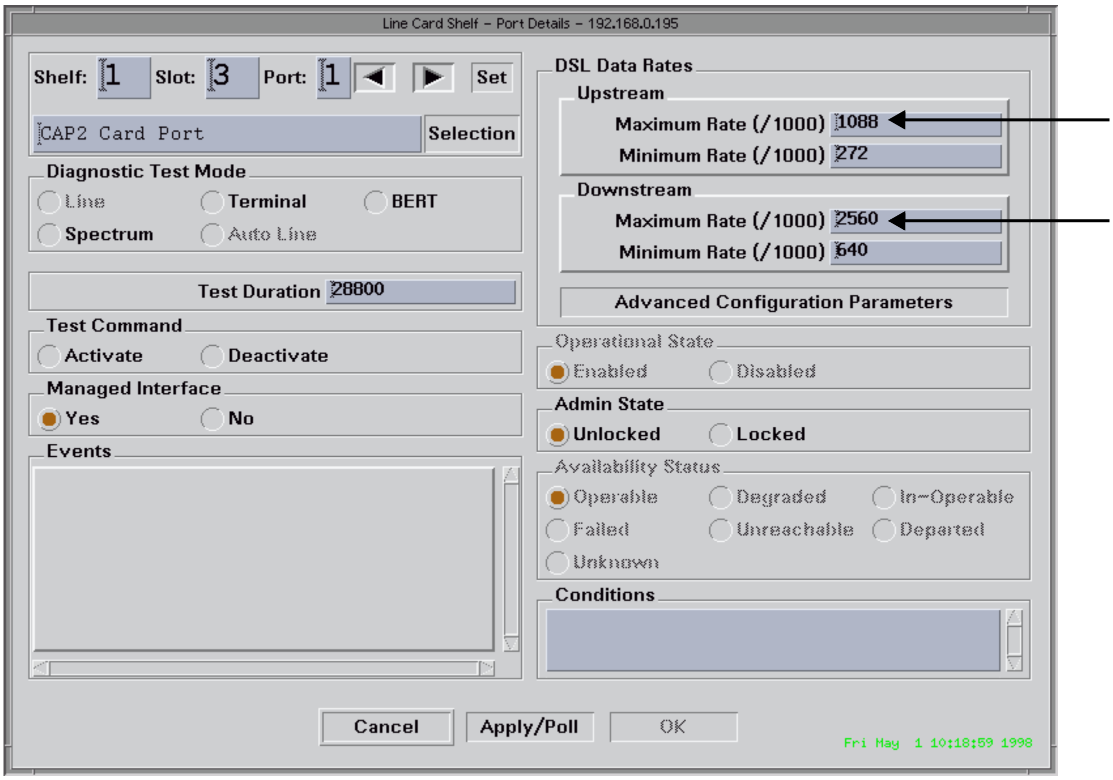

Figure 3: DiamondView—Line Card Shelf Port Details Window

Margin

The Margin parameter indicates the desired noise "margin" used during the RADSL training process. This parameter is only used during RADSL operation, it is not used during Fixed Rate operation. Margin is measured in dB, from -3 to +9 dB; the default Margin setting is 6 dB.

The provisioned Margin parameter is subtracted from the measured Average Signal Quality. This parameter establishes the amount of noise or “margin” of noise allowed on the line for the channel to operate at 10^{-7} BER. The Margin provisioned for the DSL port has a direct affect on the maximum data rate that is established during the training process. Therefore, the greater the provisioned Margin, the lower the maximum data rate established, but the greater the noise immunity for the line.

The Upstream and Downstream Margin parameters are provisioned in DiamondView’s Advanced DSL Parameters window.

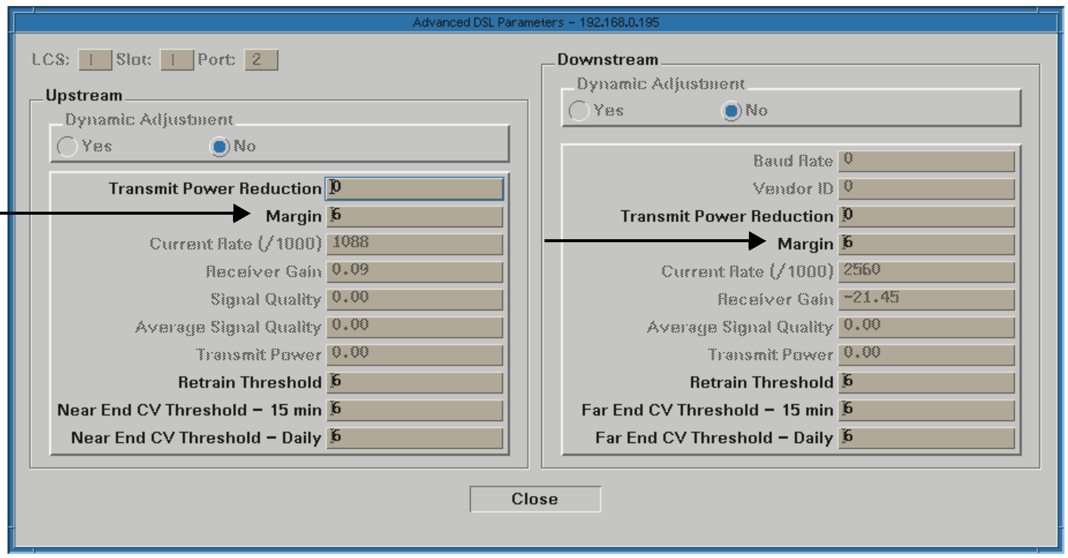

Figure 4: DiamondView—Advanced DSL Parameters Window

Training Mode

Fixed Rate Training

The CAP2 port trains to the Fixed Rate provisioned for the Upstream and Downstream channels. The port will continue training to the provisioned Fixed Rate until it is successful. A Loss of Signal (LOS) condition is displayed for the port via DiamondView[5] until training at the Fixed Rate is successful.

Rate Adaptive DSL (RADSL) Training

The DSL port measures the quality of the line—allowing for the Margin parameter provisioned for the port—and determines the best RADSL data rate that the line can support during the training process. The maximum data rate provisioned for the

[5] Conditions are also displayed in DiamondCraft.

Downstream channel determines the baud rate used by the DSL port. Release 3.0 performs full RADSL training across all baud rates.

The DSL port measures the Signal to Noise Ratio (SNR) of a line during the training process. Upstream and Downstream channel receivers measure and record the ASQ for the line's received signal. This value is used to determine the constellation used to provide the maximum data rate provisioned for the port.

A "Rate Degraded" condition is displayed in DiamondView[6] if the actual data rate is below the CAP DSL port's provisioned minimum data rate.

The following Downstream Baud Rate and Constellation selections are used during the CAP port training process based on the maximum data rate provisioned for the Downstream channel. The CAP2 port selects the constellation that will deliver the highest data rate equal to or less than the provisioned rate.

Table 8: Downstream Baud and Constellation Selections

Provisioned Downstream Minimum to Maximum Data Rate (Kbps)	Actual Downstream Data Rate (Kbps)	Constellation	Baud
0 – 959	640	8	340
960-1279	960	16	340
1280-1599	1280	64	340
1600-1919	1600	32	340
1920	1920	128	340
1921-2239	1920[a]	16	680
2240-2559	2240	256	340
2560-2687	2560	256U	340
2688-3199	2688	16	952
3200-4479	3200	64	680
4480	3200	256	680
4481-5119	4480[b]	64	952
5120-6271	5120	256U	680
6272-12000	6272	256	952

[a] Data rates of 1920 and 4480 can be achieved with two different combinations of Baud and Constellation. The higher Baud rate can be "forced" by provisioning the port for a data rate higher than the Actual data rate required.

[b] See previous footnote.

[6] Conditions are also displayed in DiamondCraft.

The following Upstream Baud Rate and Constellation selections are used during the CAP port training process based on the maximum data rate provisioned for the Upstream channel. The CAP2 port selects the constellation that will deliver the highest data rate equal to or less than the provisioned rate.

Table 9: Upstream Baud and Constellation Selections

Provisioned Upstream Minimum to Maximum Data Rate (Kbps)	Actual Upstream Data Rate (Kbps)	Constellation	Baud
0 – 407	272	8	136
408-543	408	16	136
544-679	544	32	136
680-815	680	64	136
816-951	816	128	136
952-1087	952	256	136
1088-12000	1088	256U	136

Actual Upstream and Downstream Data Rates are displayed in DiamondView's Advanced DSL Parameters window.

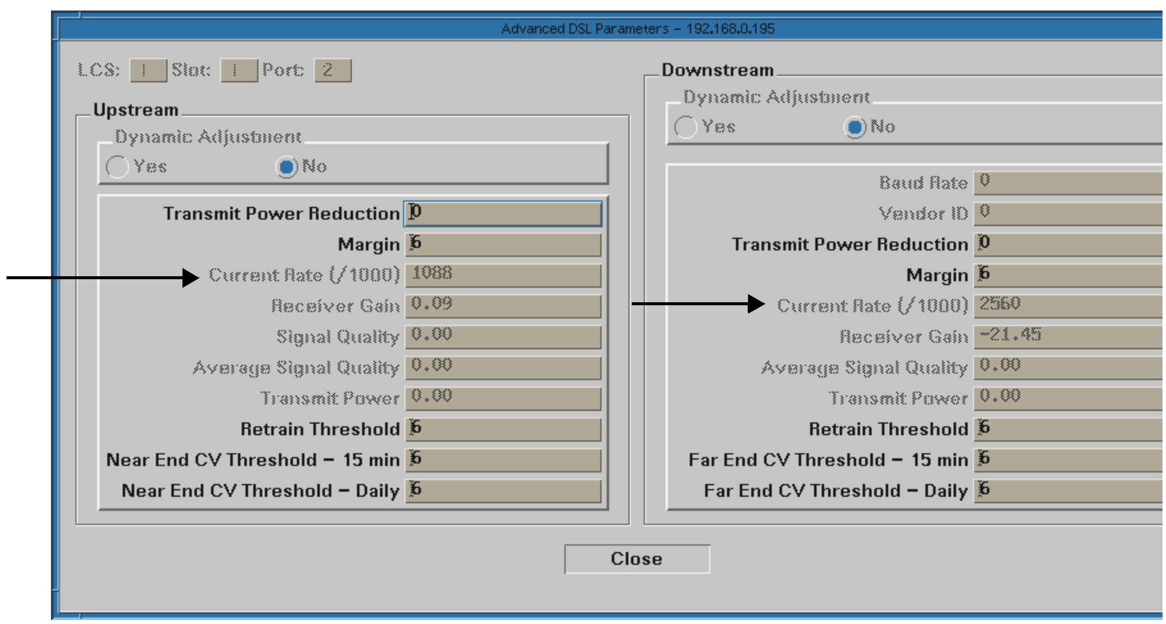

Figure 5: DiamondView—Advanced DSL Parameters Window

Data Mode

Framing

The CAP DSL port enters Data Mode after it has completed the training process and a connection is established with CPE equipment. 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 CAP2 DSL port provides:

- “Actual” measurements as a result of the training process.
- Continuous real time measurement of the signal quality.

See pages pages 3 through 5 for detailed information about performance actuals provided by the CAP2 DSL port.

Retrain Threshold Setting

Framing errors are monitored during Data Mode. The greater the Retrain Threshold setting the more sensitive the CAP DSL port is to framing errors.

The Retrain Threshold parameter range is from 10^{-4} BER to 10^{-7} BER. The default setting is 6 or 10^{-6} BER for both channels.

Provisioned Retrain Threshold setting percentages are:

Table 10: Retrain Threshold Settings

Threshold Settings	Sensitivity to Errors
4 BER (High)	Low
5 BER (Medium High)	Medium Low
6 BER (Medium Low)	Medium Low
7 BER (Low)	High

The CAP DSL port restarts the training process (“retrains”) if the amount of “errored” frames exceeds the provisioned Retrain Threshold.

The CAP DSL port's Retrain Count is monitored via DiamondView's DSL Performance window.

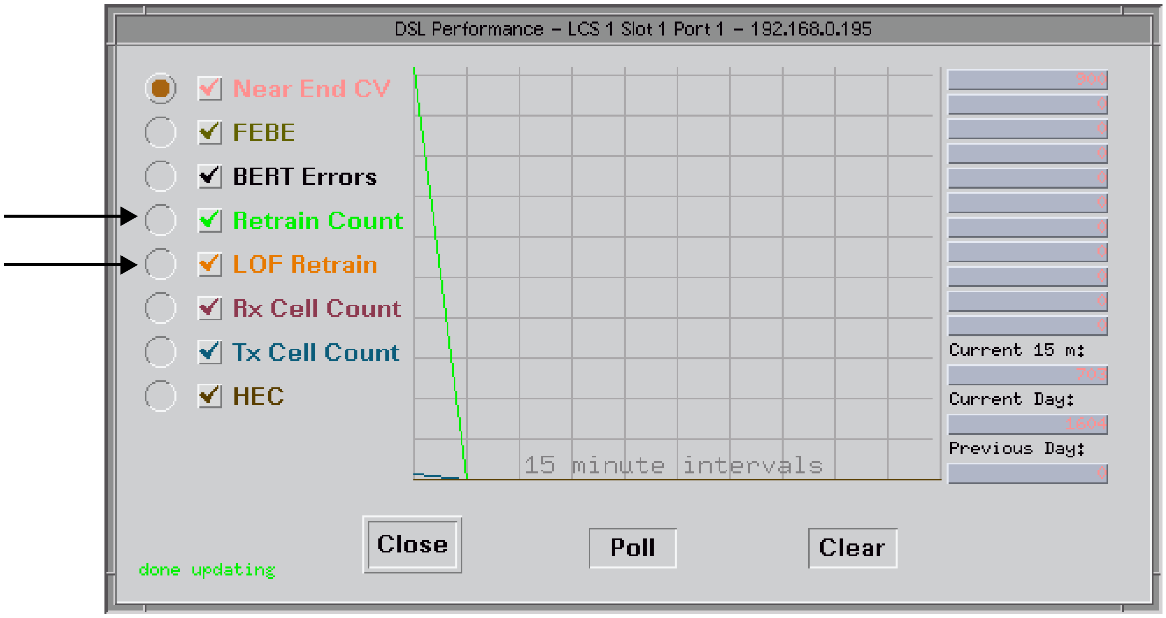

Figure 6: DiamondView—DSL Performance Window

Loss of Frame (LOF) Retrain

The CAP DSL port also monitors the frame indicator bit to determine if a Loss of Frame (LOF) condition exists. The port retrains if it detects an LOF condition. The LOF Retrain Count is monitored via DiamondView's DSL Performance window, see the above example.

Near End Coding Violation Errors

The CAP DSL line card counts Near End Coding Violation (CV) Errors for the "Upstream" channel during Data Mode. The Near End Coding Violation parameters have "thresholds" for reporting of an event to DiamondView's System Events window. These thresholds do not affect CAP DSL port operation.

The CAP2 line card maintains fourteen counters for Near End Coding Violations. The count begins when the line card powers up. The counters are:

Previous Day

Current Day

Current 15 Minute Interval

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

Near End Coding Violation (CV) Threshold—15 min

An event is reported to DiamondView when the Current 15 Minute Near End CV counter exceeds this threshold. This parameter is a count of Cyclic Redundancy Check (CRC) errored frames received. The Near End CV Threshold parameter is measured in Bit Error Rate (BER) and the range is from 10^{-5} to 10^{-9} BER; the default setting is 6 or 10^{-6} BER. The greater the Near End CV Threshold parameter setting, the more sensitive it is to framing errors.

Near End Coding Violation (CV) Threshold—Daily

An event is reported to DiamondView when the Daily Near End CV counter exceeds this threshold. This parameter is a count of Cyclic Redundancy Check (CRC) errored frames received. The Near End CV Threshold parameter is measured in Bit Error Rate (BER) and the range is from 10^{-5} to 10^{-9} BER; the default setting is 6 or 10^{-6} BER. The greater the Near End CV Threshold parameter setting, the more sensitive it is to framing errors.

Table 11: Near End Code Violation Upstream Provisioning Parameters

Parameter	Values	Units	Defaults	Notes
Near End CV Threshold – Daily	5 - 9	BER	6	10^{-5} - 10^{-9}
Near End CV Threshold – 15 min	5 - 9	BER	6	10^{-5} - 10^{-9}

Table 12: Near End Code Violation Downstream Provisioning Parameters

Parameter	Values	Units	Defaults	Notes
Far End CV Threshold – Daily	5 - 9	BER	6	10^{-5} - 10^{-9} (Release 3.0 monitors FEBE.)
Far End CV Threshold – 15 min	5 - 9	BER	6	10^{-5} - 10^{-9} (Release 3.0 monitors FEBE.)

Table 13: Coding Violation Threshold Settings

CV Threshold Settings in BER	Sensitivity to Framing Errors
5 (High)	Low
6 (Medium High)	Medium Low
7 (Medium)	Medium
8 (Medium Low)	Medium High
9 (Low)	High

Near End Coding Violation threshold settings for 15 minute and Daily counters are provisioned in DiamondView's Advanced DSL Parameters window:

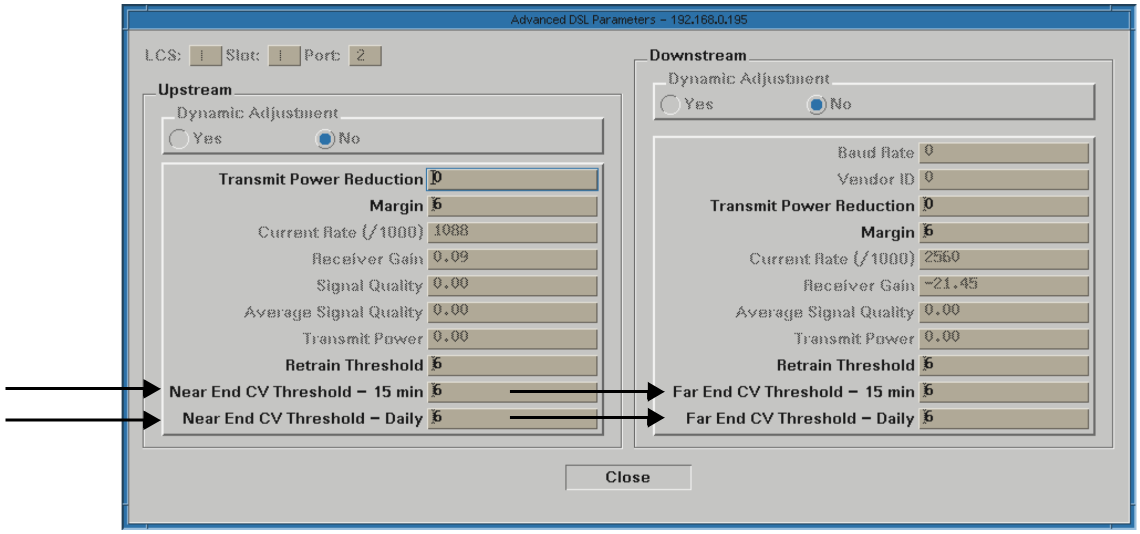

Figure 7: DiamondView—Advanced DSL Parameter Window

Near End Coding Violations are monitored via DiamondView's DSL Performance Monitoring window.

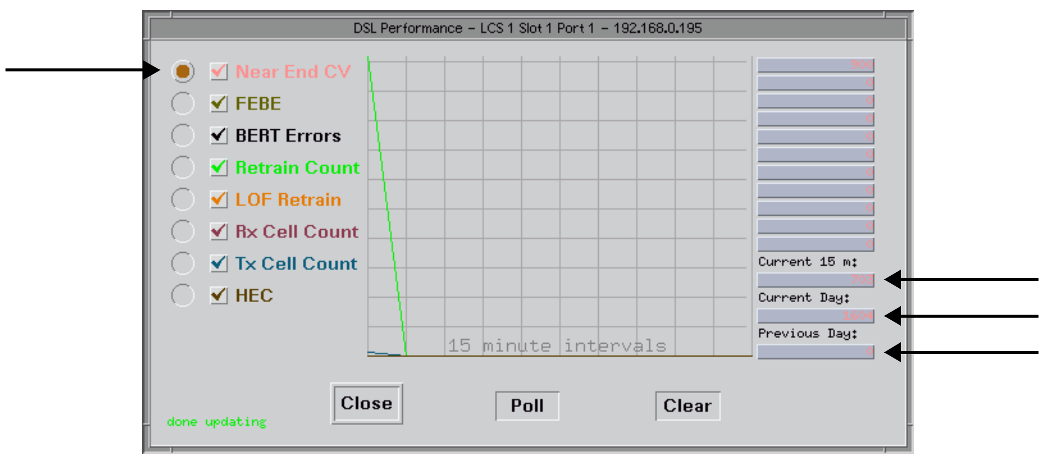

Figure 8: DiamondView—DSL Performance Window

Additional DSL Performance Counts

The CAP2 line card counts five additional DSL Performance items during Data Mode. It maintains fourteen counters for each of these performance items. The count begins when the line card powers up:

Previous Day

Current Day

Current 15 Minute Interval

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

The CAP2 line card counts:

Far End Block Error (FEBE) The number of "received" frames that contain a Far End Block Error (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.

NOTE: FEBE is used against Far End Coding Violation (15 minute and Daily) threshold settings—provisioned for the "Downstream" channel in the Advanced DSL Parameters window—in Release 3.0.

Bit Error Rate Test (BERT) The number of received errors during a BER Test.

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

Rx Cell Count The number of valid, non-idle cells "received" on the line card port from the CPE and sent onto the LSM2 card.

Tx Cell Count The number of valid, non-idle cells received from the LSM2 card and "transmitted" to the CPE.

Each of these DSL Performance items is monitored via DiamondView's DSL Performance Monitoring window.

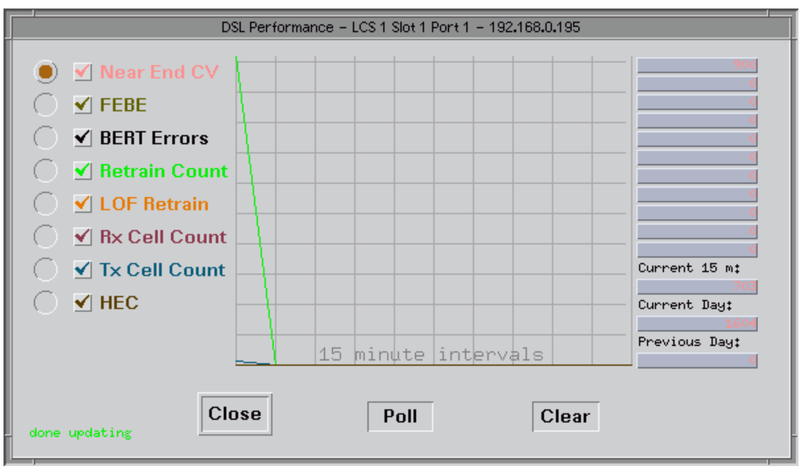

Figure 9: DiamondView—DSL Performance Window

Chapter
2

SECTION 1 PROVISIONING CONCEPTS

Chapter 2 CAP4 ADSL Provisioning

Introduction

This document describes the DSL provisioning parameters and operation of the Speedlink CAP4 line card. Details are provided on how the CAP4 port adjusts Transmit (Tx) Power and Data Rate during the "training" operational mode.

The CAP4 line card provides four Rate Adaptive Asymmetric (RADSL) DSL lines using Carrierless Amplitude Phase (CAP) modulation technique. CAP uses Frequency Division Duplex (FDD) multiplexing to transmit data in the 35 KHz to 1.3 MHz frequency spectrum. Separate bands or "channels" are assigned for upstream and downstream data transmission. The upstream channel rate is 35 KHz to 191 KHz, the downstream channel rate is 240 KHz to 1.3 MHz.

Operation of the CAP2 and CAP4 line cards is the same. The difference between the two line cards is the number of lines supported per line card—and the way parameters are provisioned and displayed in DiamondView[1]. Refer to Chapter 1–"CAP2 ADSL Provisioning" for detailed information regarding the CAP2 line card.

CAP DSL Operational Modes

A CAP4 line card has four ports, each port has three basic operational modes: Idle, Training, and Data. These operational modes are defined as follows:

- IDLE – The CAP4 port transmitter and receiver are "locked" and disabled.
- TRAINING – The CAP4 port transmitter and receiver are "unlocked". The CAP4 port is attempting to establish a connection with CPE equipment during the Training Mode. Training time is approximately 20 to 30 seconds depending on the quality of the local loop facility and the time required for the port to determine the best RADSL data rate.

[1] CAP4 provisioning parameters are also displayed in DiamondCraft.

- DATA – The CAP4 port connection is established and payload data is carried.

The signal "quality" of the ATUR and ATUC channels[2] 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. Once the channels are established, their "quality"—combined with other provisioned settings—determines the actual data rate delivered.

Provisioning Parameters

There are six provisioning parameters that can be established in DiamondView[3] to affect CAP DSL port operation:

- **Signal/Noise Margin** – This parameter sets the "margin" used during the Rate Adaptive DSL (RADSL) training process, it is not used during Fixed Rate operation.

  The Signal/Noise Margin parameter establishes the amount of noise or "margin" of noise allowed on the line for the channel to operate at 10^{-7} BER. The larger the margin number, the lower the rate, but the greater the noise immunity achieved for a line of a given quality. The Signal/Noise Margin parameter range is from -3 dB to +9 dB, for both ATUR and ATUC provisioning.

  ATUR and ATUC Signal/Noise Margin parameters are provisioned in DiamondView's CAP Advanced Configuration Parameters window. The Signal/Noise Margin default setting is "6" dB for both channels.

- **Transmit Power Reduction** – This parameter can be changed to affect the establishment of the DSL channel. The Transmit (Tx) Power Reduction parameter range is from 0 dB to 15 dB, for both ATUR and ATUC provisioning. The default setting is "0" dB for both channels. See page 22 for more detail on the Transmit Power Reduction parameter.

- **Interleave Depth** – Interleave is a coding technique that provides a more error-free connection with increased noise protection—but with increased latency. The Interleave Depth parameter defines the size of the interleave blocks processed in bytes. The larger the Interleave Depth setting—the greater the noise protection—and therefore increased latency.

  The maximum or long Interleave Depth setting is 56 bytes. A short Interleave Depth setting is 55 bytes or less (5, 9, 12 bytes depending on the baud rate used by the DSL port). The default ATUC setting is "9" bytes.

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[2] The terms ADSL Transceiver Unit – Central Office (ATUC) and ADSL Transceiver Unit – Remote (ATUR) are used in CAP4 ADSL provisioning to describe the DSL port hardware required at both the Central Office and Remote (CPE) ends of the local loop.

[3] Provisioning parameters can also be established using DiamondCraft.

- **ATUR** and **ATUC Data Rates –** Data rate translates into a baud and constellation setting delivered to the CAP4 port. Baud and constellation settings determine the bit rate of the CAP DSL channel.

  Maximum[4] ATUR channel provisioning parameters range is from 90 to 1088 Kb/s. The default ATUR rate setting is 1088 Kb/s.

  Maximum[5] ATUC channel provisioning parameters range from 640 to 7168 Kb/s. The default ATUC rate setting is 7168 Kb/s.

  See page 21 for more detail on ATUR and ATUC Channel Data Rates.

- **Error Retrain Threshold –** This ATUC parameter sets the number of near end "errored frames" per second allowed during Data mode before the CAP DSL port retrains. The number of Error Retrains are viewed on DiamondView's CAP Performance Actuals window. The default Error Retrain Threshold setting is "10".
- **FE Error Retrain Threshold** - This ATUC parameter sets the number of far end "errored frames" per second allowed during Data mode before the CAP DSL port retrains. The number of FE Error Retrains are viewed on DiamondView's CAP Performance Actuals window. The default FE Error Retrain Threshold setting is "10".

ATUR and ATUC Channel Provisioning Parameters tables:

Table 14: ATUR Provisioning Parameters

Parameter	Values	Units	Defaults
Signal/Noise Margin	-3 - +9	dB	6
Transmit Power Reduction	0-15	dB	0
Maximum Rate	90 - 1088	Kb/s	1088

Table 15: ATUC Provisioning Parameters

Parameter	Values	Units	Defaults
Signal/Noise Margin	-3 - +9	dB	6
Transmit Power Reduction	0-15	dB	0
Interleave Depth	5 - 56	Bytes	9
Maximum Rate	640 - 7168	Kb/s	7168
Error Retrain Threshold	1 - 70	Errors/Sec	10
FE Error Retrain Threshold	1- 70	Errors/Sec	10

[4] The CAP4 port will not exceed the provisioned ATUR maximum rate.
[5] The CAP4 port will not exceed the provisioned ATUC maximum rate.

Suggested Error Retrain and FE Error Retrain Threshold settings are listed below:

Table 16: ATUC Error Retrain Threshold Settings

Sensitivity to Errors	Threshold Settings
Low	92
Medium	11
High	1

NOTE: The above Error Retrain Threshold settings use 1088 kb/s data rate as the baseline. The CAP DSL port automatically selects the threshold based on the provisioned threshold weighted by the actual data rate.

NOTE: The CAP DSL port restarts the training process (retrains) if the amount of "errored" frames exceeds the provisioned Error Retrain Threshold. The numbers included in the preceding table are provided as a guideline to help establish Error Retrain thresholds.

Training Mode

The CAP4 port supports two types of RADSL Operation settings for the ATUR and ATUC channels:

- **None** = Fixed Rate Training
- **Startup** = RADSL Training.

RADSL operation is established for the CAP4 port in DiamondView's CAP Port Details window.

Fixed Rate Training

The CAP4 port trains to the Fixed Rate provisioned for the ATUR and ATUC channels. The port will attempt operation at the provisioned Fixed Rate until it is successful. A Loss of Signal (LOS) condition is displayed for the port via DiamondView[6] until training at the Fixed Rate is successful.

Rate Adaptive DSL (RADSL) Training

The DSL port measures the quality of the line—allowing for the Signal Noise/ Margin parameter provisioned for the port—and determines the best RADSL data rate that the line can support during the training process. The maximum data rate provisioned for the ATUC channel determines the baud rate used by the DSL port. Release 3.0 performs full RADSL training across all baud rates.

6 Conditions are also displayed in DiamondCraft.

The DSL port measures the Signal to Noise Ratio (Current Noise Margin) of a line during the training process. ATUR and ATUC channel receivers measure and record the Startup Average Signal Quality (ASQ) for the line's received signal. This value is used to determine the constellation to provide the maximum data rate possible for the port.

A "Rate Degraded" condition is displayed in DiamondView[7] if the actual data rate is below the provisioned Rate Degraded Threshold.

The following ATUR Baud Rate and Constellation selections are used during the CAP port training process based on the maximum data rate provisioned for the ATUR channel. The CAP4 port selects the constellation that will deliver the highest data rate equal to or less than the provisioned rate.

Table 17: ATUR Baud and Constellation Selections

Provisioned ATUR Minimum to Maximum Data Rate (Kb/s)	ATUR Transmit Rate (Kb/s)	Constellation	Baud
0 – 407	272	8	136
408-543	408	16	136
544-679	544	32	136
680-815	680	64	136
816-951	816	128	136
952-1087	952	256	136
1088-12000	1088	256U	136

The following ATUC Baud Rate and Constellation selections are used during the CAP port training process based on the maximum data rate provisioned for the ATUC channel. The CAP4 port selects the constellation that will deliver the highest data rate equal to or less than the provisioned rate.

Table 18: ATUC Baud and Constellation Selections

Provisioned ATUC Maximum Data Rate (Kb/s)	ATUC Transmit Rate (Kb/s)	Constellation	Baud
0 – 959	640	8	340
960-1279	960	16	340
1280-1599	1280	64	340
1600-1919	1600	32	340

[7] Conditions are also displayed in DiamondCraft.

Table 18: ATUC Baud and Constellation Selections (continued)

Provisioned ATUC Maximum Data Rate (Kb/s)	ATUC Transmit Rate (Kb/s)	Constellation	Baud
1920	1920	128	340
1921-2239	1920[a]	16	680
2240-2559	2240	256	340
2560-2687	2560	256U	340
2688-3199	2688	16	952
3200-4479	3200	64	680
4480	3200	256	680
4481-5119	4480[b]	64	952
5120-6271	5120	256U	680
6272-7167	6272	256	952
7168-12000	6272	256	952

[a] Data rates of 1920 and 4480 can be achieved with two different combinations of Baud and Constellation. The higher Baud rate can be “forced” by provisioning the port for a data rate higher than the transmit rate required.

[b] See previous footnote.

Actual ATUR and ATUC Transmit Rates are displayed in DiamondView’s CAP Physical & Channels Actuals window.

Transmit Power Reduction Setting

The quality of DSL channels is mainly determined by the characteristics of the local loop facility—and is beyond the control of the network service provider. However, the service provider can provision the “Transmit Power Reduction” parameter to affect Average Signal Quality and modify the performance of the CAP DSL channel.

The Transmit Power Reduction parameter limits the maximum power of a channel’s transmit signal. It instructs the CAP DSL port to limit the full transmit power level by the Transmit Power Reduction amount.

Transmit Power Limit = Full Tx Power Level - Transmit Power Reduction setting

During the training process, the CAP DSL transceiver determines the ATUR and ATUC transmit power levels it will use. Once the transceiver determines the transmit power level, it looks at the Transmit Power Reduction setting, compares it to the value listed in the table below, and selects the lower of the two transmit power levels.

Table 19: ATUR and ATUC Transmit Power Reduction Settings and Baud Rates

Tx Power Reduction Setting	ATUR	ATUC		
	136 Baud	340 Baud	680 Baud	952 Baud
	Tx Power Limit	Tx Power Limit	Tx Power Limit	Tx Power Limit
0	12.9 dB	21.7 dB	21.9 dB	22.2 dB
3	9.9 dB	18.7 dB	18.9 dB	19.2 dB
6	6.9 dB	15.7 dB	15.9 dB	16.2 dB
9	3.9 dB	12.7 dB	12.9 dB	13.2 dB
12	0.9 dB	9.7 dB	9.9 dB	10.2 dB
15	-2.10 dB	6.7 dB	6.9 dB	7.2 dB

The Transmit Power Reduction setting can be used to “balance” the ASQ between the ATUC and ATUR channels. When the Transmit Power of an ATUR or ATUC channel is reduced—by increasing the Transmit Power Reduction parameter—the ASQ is reduced on that channel and increased on the opposite channel. For example: Decreasing the Transmit Power Reduction setting on the ATUC channel increases the power of the ATUC channel transmit signal, and increases the ASQ.

Basically, lower the Transmit Power Reduction setting on the channel to increase the channel’s ASQ. This will decrease the ASQ on the other channel.

Table 20: ATUC Transmit Power Reduction Setting Impacts

ATUC Transmit Power Reduction Setting[a]	Actual ATUC Transmit Power	ATUC ASQ	ATUR ASQ
Decrease	Increased	Increased	Decreased
Increase	Decreased	Decreased	Increased

[a] Release 3.0 supports Transmit Power Reduction Settings of 0 to 15 dB.

Table 21: ATUR Transmit Power Reduction Setting Impacts

ATUR Transmit Power Reduction Setting	Actual ATUR Transmit Power	ATUR ASQ	ATUC ASQ
Decrease	Increased	Increased	Decreased
Increase	Decreased	Decreased	Increased

The other intended purpose of the Transmit Power Reduction parameter is to reduce the amount of “transmitted power” at the Central Office, thereby reducing the “interference” or “crosstalk” with other circuits in the local loop. The greater the transmit power on a channel, the greater the potential for interference on the local loop.

ATUR and ATUC Transmit Power Reduction settings are provisioned in DiamondView’s CAP Advanced Configuration Parameters window.

Data Mode

The CAP DSL port enters Data Mode after it has completed the training process and a connection is established with CPE equipment. 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 enabled and payload cells start to flow.

During Data Mode the CAP4 DSL port provides:

- “Actual” measurements as a result of the training process.
- Continuous real time measurement of Signal Quality.

See pages 24 through 26 for detailed information about performance actuals provided by the CAP4 DSL port.

Channel Signal Quality Measurements

The CAP4 port has the functionality to measure channel “quality” established over the existing telephone copper network—the “local loop”. Startup Average Signal Quality and Current Signal Quality are the measurements used by the CAP4 port to measure channel quality. Other parameters provided by the CAP4 port about its operation are: Current Noise Margin, Receiver Gain, Transmit Rate, Interleave Depth, Power Attenuation, and Transmit Power.

- Current Noise Margin is the actual amount of noise or “margin” of noise measured on the ATUR and ATUC channels. Current Noise Margin is measured in dB.

- Startup Average Signal Quality (ASQ) is the measured quality of the signal received over the local loop during the training process. ASQ is measured in dB, from 0 to +99.99 dB. ASQ is affected by the Transmit (Tx) Power of the transmitted signal, noise, plus the length and quality of the local loop. The higher the ASQ number the better the quality of the channel. For example: An ASQ in the low forties is excellent and indicates a loop with very little attenuation or noise. ASQ is measured for both channels.
- Current Signal Quality is a dynamic measurement. It is sampled continuously on the ATUC Channel during Data Mode operation.
- Receiver Gain is the 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 is the actual ATUR and ATUC data rate for the channel. This rate is either fixed or determined by the CAP4 port during the training process. Transmit Rate is measured in Kb/s. See page 20 for more information on the RADSL training process.
- Interleave Depth is the actual size of the interleave blocks processed in bytes. The larger the Interleave Depth—the greater the noise protection—and therefore increased latency. Interleave Depth is measured for the ATUC channel.
- Power Attenuation is the decrease in power of the signal received over the ATUR and ATUC channels. Loop Attenuation is measured in dB
- Transmit Power is the power level of the signal being transmitted by the ATUC transceiver. Transmit Power is measured in dB, from 0 to +99.99 dB.

Table 22: ATUR Performance Actuals

Parameter	Range	Units	Notes
Current Noise Margin	0 to +99.99	dB	Result of Startup Training
Startup Average Signal Quality	-99.99 to +99.99	dB	Result of Startup Training
Receiver Gain	-99.99 to +99.99	dB	Result of Startup Training
Transmit Rate	90 - 1088	Kb/s	Result of Startup Training
Power Attenuation	0 to +99.99	dB	Result of Startup Training
Transmit Power	0 to +99.99	dB	Result of Startup Training

Table 23: ATUC Performance Actuals

Parameter	Range	Units	Notes
Current Noise Margin	0 to +99.99	dB	Result of Startup Training
Startup Average Signal Quality	0 to +99.99	dB	Result of Startup Training
Current Signal Quality	0 to +99.99	dB	Dynamic -Changes during Data Mode
Receiver Gain	-99.99 to +99.99	dB	Result of Startup Training
Transmit Rate	640 - 7168	Kb/s	Result of Startup Training
Interleave Depth	5 - 56	Bytes	Result of Startup Training
Current Baud	340, 680, 952	baud	Result of Startup Training
Power Attenuation	-99.99 to +99.99	dB	Result of Startup Training
Transmit Power	0 to +99.99	dB	Result of Startup Training

Other CAP4 Thresholds

The following thresholds are set using DiamondView's CAP Advanced Configuration Parameters window:

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 DiamondView when the LOF threshold is crossed. LOF Seconds and Failures are viewed on DiamondView's CAP Performance Actuals and CAP Performance monitoring windows. The default threshold settings are "0" (zero) or inactive.

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 DiamondView when the LOS threshold is crossed. LOS Seconds and Failures are viewed on DiamondView's CAP Performance Actuals and CAP Performance monitoring windows. The default threshold settings are "0" (zero) or inactive.

LPRS Thresholds Loss of Power (LPR) 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 shut down" signals at the ATUR. LPR Seconds and Failures are viewed on DiamondView's CAP Performance Actuals and CAP Performance monitoring windows. The default threshold settings are "0" (zero) or inactive.

NOTE: LOF, LOS and LPR conditions/events are mutually exclusive; for example: 1) If all three conditions are present, LPR is reported. 2) If LOS and LOF are present, LOS is reported. 3) LOF is reported when it is the only condition.

Errored Seconds Thresholds (Near End) Errored Seconds are the cumulative number of seconds the port is in an LOF, LOS, LPR condition or had a Coding Violation condition (Cyclic Redundancy Check (CRC) 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 DiamondView when the Errored Seconds threshold is crossed. Errored Seconds are viewed on DiamondView’s CAP Performance Actuals and CAP Performance monitoring windows. The default threshold settings are “0” (zero) or inactive.

FE Errored Seconds Thresholds Far End (FE) Errored Seconds are the cumulative number of seconds the port received a Far End Block Error (FEBE) indicator bit. 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 DiamondView when the FE Errored Seconds threshold is crossed. FE Errored Seconds are viewed on DiamondView’s CAP Performance Actuals and CAP Performance monitoring windows. The default threshold settings are “0” (zero) or inactive.

Table 24: LOS, LOF, LPR 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
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 of an event to DiamondView’s System Events window. Coding Violations are viewed on DiamondView’s CAP Performance Actuals and CAP Performance monitoring windows.

FE Coding Violations Far End (FE) Coding Violation errors are a count of the Far End Block Errors (FEBE) indicator bits reported by the ATUR to the ATUC during Data mode. Daily and 15 min thresholds can be set for the ATUC unit. The FE Coding Violation parameters have "thresholds" for reporting of an event to DiamondView's System Events window. FE Coding Violations are viewed on DiamondView's CAP Performance Actuals and CAP Performance monitoring windows.

The following table provides the expected number of ATUC Near and FE Coding Violation (CRC) errors in 15 minute and Daily intervals.[8] These numbers can be used as threshold settings. The default Coding Violation threshold setting is "0" or inactive.

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 25: ATUC Coding Violation Threshold Settings

Parameters	Threshold Settings based on Data Rates (bits per sec.)				Sensitivity to CV Errors
	272000	544000	816000	1088000	
Daily Settings	1990000	3970000	5960000	7950000	Low
	231000	462000	693000	924000	Medium Low
	23000	47000	70000	94000	Medium
	2400	4700	7000	9400	Medium High
	240	470	700	940	High
15 Min Settings	21000	41000	62000	83000	Low
	2400	4800	7200	9600	Medium Low
	240	490	730	980	Medium
	24	49	73	98	Medium High
	2	5	7	10	High

Error Alarm Threshold This ATUC parameter sets the number of near end "errored frames" per second allowed during Data mode before an Error Rate Alarm condition is sent to DiamondView. The inactive Error Alarm Threshold setting is "0", the default setting is "0".

FE Error Alarm Threshold This ATUC parameter sets the number of far end "errored frames" per second allowed during Data mode before an Error Rate Alarm

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

condition is sent to DiamondView. The inactive FE Error Alarm Threshold setting is “0”, the default setting is “0”.

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

Additional CAP ADSL Performance Counts

The following DSL performance counts are displayed in DiamondView’s CAP Performance monitoring window:

Bit Error Rate Test (BERT) The number of received errors during a BER Test.

Rx Cell Count The number of valid, non-idle cells “received” on the line card port from the CPE and sent onto the LSM2 card.

Tx Cell Count The number of valid, non-idle cells received from the LSM2 card and “transmitted” to the CPE.

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

Chapter
3

SECTION 1 PROVISIONING CONCEPTS

Chapter 3 DMT ADSL Provisioning

Introduction

This document describes ADSL provisioning parameters and the operation of the Speedlink DMT4 line card. Details are provided on how the DMT4 port adjusts its data rate during the “training” operational mode.

The DMT4 line card provides four Rate Adaptive Asymmetric DSL lines using ANSI standard Discrete Multi-Tone (DMT) modulation technique. DMT 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 or bins, each with 4 KHz bandwidth. Each band is independently modulated.

DMT DSL Operational Modes

A DMT4 line card has four ports, each port has three basic operational states: Idle, Training, and Data. These states are defined as follows:

- IDLE - The DMT4 port transmitter and receiver are “locked” and disabled.
- TRAINING - The DMT4 port transmitter and receiver are “unlocked”. The DMT4 port is attempting to establish a connection with CPE equipment during the training mode. Training time is approximately 20 seconds.
- DATA - The DMT4 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. Once the channels are established, their

[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.

"quality"—combined with other provisioned settings—determines the actual data rate delivered.

Provisioning Parameters

There are four provisioning parameters that can be established in DiamondView's DMT Port and Details window and Advanced Configuration window[2] to affect DMT ADSL port operation:

- **ATUR** and **ATUC Channel Data Rates**

  Minimum and Maximum Data Rate parameters are provisioned for both ATUR and ATUC channels in Kb/s. The minimum ATUR data rate is 32 Kb/s, the maximum date rate is 640 Kb/s. The minimum ATUC data rate is 32 Kb/s, the maximum data rate is 8000 Kb/s.

- **Signal/Noise Margin –** This parameter sets the "margin" used during the Rate Adaptive DSL (RADSL) and Fixed Rate training process. The Signal/Noise Margin parameter establishes the amount of noise or "margin" of noise allowed on the line for the channel to operate at 10^{-7} BER. The larger the margin number, the lower the rate, but the greater the noise immunity achieved for a line of a given quality. The Signal/Noise Margin parameter range is from 0 dB to 15 dB, for both ATUR and ATUC provisioning.

  The DMT port will train to the maximum data rate supportable on the line at the provisioned Signal/Noise Margin parameter and operating at 10^{-7} BER. The actual and provisioned margin should be about equal. Any excess channel capacity is used to increase the margin if the port is able to train to the maximum rate. In this case the actual margin is higher than provisioned margin.

  ATUR and ATUC Signal/Noise Margin parameters are provisioned in DiamondView's DMT Advanced Configuration Parameters window. The Signal/Noise Margin default setting is 6 dB for both channels.

- **Error Retrain Threshold –** This ATUC parameter sets the number of near end "errored frames" per second allowed during Data mode before the DMT DSL port retrains. The number of Error Retrains are viewed on DiamondView's DMT Performance Actuals window. The inactive Error Retrain Threshold setting is "0", the default setting is "10".

- **FE Error Retrain Threshold** - This ATUC parameter sets the number of far end "errored frames" per second allowed during Data mode before the DMT DSL port retrains. The number of FE Error Retrains are viewed on DiamondView's DMT Performance Actuals window. The inactive FE Error Retrain Threshold setting is "0", the default setting is "10".

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[2] Provisioning parameters can also be established using DiamondCraft.

ATUR and ATUC Channel Provisioning Parameters tables:

Table 26: ATUR Provisioning Parameters

Parameter	Values	Units	Defaults
Maximum Rate[a]	32 - 640	Kb/s	640
Minimum Rate[b]	32 - 640	Kb/s	32
Signal/Noise Margin	0 - 15	dB	6

[a] ATUR Maximum Rate values are set in multiples of 32 Kb/s.
[b] ATUR Minimum Rate values are set in multiples of 32 Kb/s.

Table 27: ATUC Provisioning Parameters

Parameter	Values	Units	Defaults
Maximum Rate[a]	32 - 8000	Kb/s	8000
Minimum Rate[b]	32 - 8000	Kb/s	32
Signal/Noise Margin	0 - 15	dB	6
Error Retrain Threshold	1 - 60	Errors/Sec	10
FE Error Retrain Threshold	1- 60	Errors/Sec	10

[a] ATUC Maximum Rate values are set in multiples of 32 Kb/s
[b] ATUC Minimum Rate values are set in multiples of 32 Kb/s

Suggested Error Retrain and FE Error Retrain Threshold settings are listed below:

Table 28: ATUC Error Retrain Threshold Settings

Sensitivity to Errors	Threshold Settings based on Data Rates (bits per sec.)			
	32000	64000	320000	640000
Low	3	6	25	40
Medium	0	1	3	6
High	0	0	0	1

NOTE: The DMT DSL port restarts the training process (retrains) if the amount of "errored" frames exceeds the provisioned Error Retrain Threshold. The numbers included in the preceding table are provided as a guideline to help establish Error Retrain thresholds.

Training Mode

The DMT4 port supports two types of RADSL Operation settings for the ATUR and ATUC channels:

- **None** = Fixed rate training.
- **Startup** = Rate Adaptive (RADSL) training at startup.

RADSL operation is established for the DMT4 port in DiamondView's DMT Port Details window.

Fixed Rate Training

The DMT4 port trains to the Fixed Rates provisioned for the ATUR and ATUC channels. The port will continue training to the provisioned Fixed Rate until it is successful. A "Loss of Signal" (LOS) condition is displayed for the port via DiamondView[3] until training at the Fixed Rate is successful.

NOTE: Fixed Rate operation uses the DMT parameters provisioned for the port.

Rate Adaptive DSL (RADSL) Training

The DSL port measures the quality of the line—allowing for the Signal/Noise Margin parameter 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 DiamondView[4] if the actual transmit rate is below the DSL port's provisioned minimum rate.

NOTE: RADSL operation automatically selects the best parameter settings for the port— based on the condition of the line during the training process. RADSL operation overrides provisioned parameters except for: Maximum Data Rate, Signal/Noise Margin, Interleave Depth and Forward Error Correction.

Actual ATUR and ATUC Data Rates are displayed in DiamondView's DMT Performance Actuals window.

Data Mode

The DMT DSL port enters Data mode after it has completed the training process and a connection is established with CPE equipment. 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 enabled and payload cells start to flow.

[3] Conditions are also displayed in DiamondCraft.

[4] Conditions are also displayed in DiamondCraft.

During Data mode the DMT4 DSL port provides:

- “Actual” measurements as a result of the training process.
- Continuous real time measurement of Transmit Rate, Maximum Achievable Rate, Current Noise Margin and Power Attenuation indicating signal quality.

Channel Signal Quality Measurements

The DMT4 port has the functionality to measure channel “quality” established over the existing telephone copper network—the “local loop”. Parameters provided by the DMT4 port about its operation are: Transmit Rate, Maximum Achievable Rate, Current Noise Margin, and Power Attenuation.

- Transmit Rate is the actual ATUR and ATUC data rate for the channel. This rate is either fixed or determined by the DMT4 port during the training process. Transmit Rate is measured in Kb/s. See page 34 for more information on the RADSL training process.
- Maximum Achievable Rate is the maximum transmit rate for the ATUR and ATUC channels supportable on the line at the selected margin and at a 10^{-7} BER. Maximum Achievable Rate is measured in Kb/s.
- Current Noise Margin is the actual amount of noise or “margin” of noise measured for on the ATUR and ATUC channels. Current Noise Margin is measured in dB.
- Power Attenuation is the decrease in power of the signal received over the ATUR and ATUC channels. Power Attenuation is measured in dB.

Table 29: ATUR Performance Actuals

Parameter	Range	Units	Notes
Transmit Rate[a]	32 - 640	Kb/s	Result of Startup Training
Maximum Achievable Rate	32 - 640	Kb/s	ATUR Maximum Achievable Rate can exceed 640 Kb/s.
Current Noise Margin	-64.0 to +63.5	dB	Current Noise Margin is measured in increments of .5 dB.
Power Attenuation	0 to +63.5	dB	Power Attenuation is measured in increments of .5 dB.

[a] ATUR Transmit Rate values are in multiples of 32 Kb/s.

Table 30: ATUC Performance Actuals

Parameter	Range	Units	Notes
Transmit Rate[a]	32 - 8000	Kb/s	Result of Startup Training

Table 30: ATUC Performance Actuals (continued)

Parameter	Range	Units	Notes
Maximum Achievable Rate	32 - 8000	baud	ATUC Maximum Achievable Rate can exceed 8000 Kb/s.
Current Noise Margin	-64.0 to +63.5	dB	Current Noise Margin is measured in increments of .5 dB.
Power Attenuation	0 to +63.5	dB	Power Attenuation is measured in increments of .5 dB.

[a] ATUC Transmit Rate values are in multiples of 32 Kb/s.

All of these actual measurements are displayed in DiamondView's DMT Physical and Channel Actuals window.

Other DMT Provisioning Parameters

The following parameters are set using DiamondView's DMT Advanced Configuration Parameters window:

Bitswap When the Bitswap feature is enabled, the DMT port will change bit allocation during the data mode to adapt to changing conditions on the line. The goal is to maintain an acceptable level of noise "margin" for each bin if possible. Bitswapping does not dynamically change the data rate during the data mode—instead bit allocations are "swapped" from a bin or tone that has a degraded margin to another that has a high margin.

The default Bitswap setting is "disable".

Check Bytes The number of Check Bytes per Codeword, used with RA Fast Path Margin and Interleave Path coding.

The default Check Bytes setting is "12" bytes.

The relationship between Check Bytes and Symbols per Codeword settings is defined in the following table:

Table 31: Check Bytes and Symbols per Codeword

Check Bytes		Symbols per Codeword
An even number from 0 to 20.	0, 2, 4, 6, 8, 10, 12 14, 16, 18 or 20	1

Table 31: Check Bytes and Symbols per Codeword

Check Bytes		Symbols per Codeword
An even number less than 20, and a integer multiple of Symbols per Codeword.	0, 2, 4, 6, 8, 10, 12 14, 16, or 18	2
	4, 8, 12 or 16	4
	8 or 16	8

Constant Margin Improvement The DMT port provides two margin adjustment modes for RADSL operation—regular mode and Constant Margin Improvement. In regular mode the number of parity bytes is selected to provide a 6 dB coding gain corresponding to a margin improvement of 6 dB. The DMT port uses coding gain to reduce the required margin on a line; therefore, allowing a higher data rate.

When Constant Margin Improvement is enabled, the DMT DSL port will identify when coding gain is less effective and will automatically reduce the data rate to provide an effective margin improvement.

The default Constant Margin Improvement setting is “enable”.

Forward Error Correction (FEC) A data transmission technique where redundant bits generated at the transmit end are used at the receiver to detect, locate and correct any transmission errors—before delivery to the data communication link. FEC avoids retransmission of information by the transmitter. FEC is enabled in conjunction with Interleave to provide a more error-free connection, but with increased latency. FEC and Interleave should be disabled if latency is not tolerable—such as video-on-demand. However, if latency is tolerable —as in most internet applications—then FEC and Interleave should be enabled.

The default Forward Error Correction setting is “enable”.

Frequency Domain Equalization (FDQ)[5] The FDQ parameter changes DMT port operation from Time Domain signal processing to Frequency Domain Equalization processing.

The default FDQ setting is “enable”.

Interleave Depth Interleave is a coding technique when combined with FEC coding—will provide a more error-free connection with increased noise protection—but with increased latency. The Interleave Depth parameter defines the size of the interleave blocks processed in bytes. The larger the Interleave Depth setting—the greater the noise protection—and therefore increased latency.

5 FDQ is planned for a future release.

The default ATUR Interleave Depth setting is “8” bytes, the default ATUC Interleave Depth setting is “32” bytes. The Interleave Depth setting must be a power of 2, the maximum is 64 bytes. Please refer to Table 34 on page 40 for Interleave Depth settings.

Interleave Path Interleave combined with FEC coding will provide a more error-free connection, but with increased latency. Interleave and FEC should be disabled if latency is not tolerable—such as video-on-demand. However, if latency is tolerable —as in most internet applications—then the Interleave and FEC should be enabled. The PGA Cutback Offset should be set to 0 dB if the Interleave is enabled.

The default Interleave Path setting is “enable”.

Maximum Power Spectral Density (PSD) The Maximum PSD parameter limits the transmit power on the ATUC channel to prevent interference with other data services in the same cable sheath. Selecting the correct Maximum PSD setting is dependent on the noise tolerance of these other data services. Increasing the transmit power on the ATUC channel can also cause interference on the receive signal. The maximum power parameter setting is -36 dBm/Hz.

The default PSD setting is -40 dBm/Hz.

Programmable Gain Amplifier (PGA) Cutback Offset The PGA boosts the received signal gain.

The default PGA Cutback Offset setting is “0” dB.

Rate Adaptive (RA) Fast Path Margin The DMT4 port can support either Interleave Path or RA Fast Path Margin. RA Fast Path Margin decreases latency but offers less protection against noise. Interleave Path must be disabled if RA Fast Path Margin is enabled.

The default RA Fast Path Margin setting is “enable”.

Symbols per Codeword This is a FEC encoding technique that uses specific symbols to provide error protection. Codeword length given in symbols per codeword is used in combination with RA Fast Path Margin.

The default Symbols per Codeword setting is “1” symbol per codeword.

Trellis Coding Modulation[6] (TCM) Trellis coding is a modem modulation technique used to predict the best fit between the incoming signals and possible combinations of amplitude and phase changes. The default TCM setting is “enable”.

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6 TCM is planned for a future release.

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Table 32: Other ATUR Provisioning Parameters

Parameter	Values	Units	Defaults
Check Bytes	Refer to Table 34 on page 40.	Bytes	12
Forward Error Correction (FEC)	Enable/Disable	N/A	Enable
Interleave Depth	2 - 64	Bytes	8
Interleave Path	Enable/Disable	N/A	Enable
Symbols per Codeword	Refer to Table 34 on page 40.	Codeword Length	1

Table 33: Other ATUC Provisioning Parameters

Parameter	Values	Units	Defaults
BitSwap	Enable/Disable	N/A	Disable
Check Bytes	Refer to Table 34 on page 40.	Bytes	12
Constant Margin Improvement	Enable/Disable	N/A	Enable
Forward Error Correction (FEC)	Enable/Disable	N/A	Enable
Frequency Domain Equalization (FDQ)[a]	Enable/Disable	N/A	Enable
Interleave Depth	2 - 64	Bytes	32
Interleave Path	Enable/Disable	N/A	Enable
Max. Power Spectral Density (PSD)	-50 to -36[b]	dBm/Hz	-40 dBm/Hz
Programmable Gain Amplifier (PGA) Cutback Offset	0 - 7	dB	0
Rate Adaptive (RA) Fast Path Margin	Enable/Disable	N/A	Enable
Symbols per Codeword	Refer to Table 34 on page 40.	Codeword Length	1
Trellis Coding Modulation (TCM)[c]	Enable/Disable	N/A	Enable

[a] FDQ planned for future release.

[b] The minus is assumed, enter the number only; for example: 36.

[c] TCM planned for future release.

The relationship between Symbols per Codeword and Interleave Depth is defined in the following table.

Table 34: Symbols per Codeword and Interleave Depth

Symbols per Codeword	Interleave Depth
1	64
2	32
4	16
8	8
16	4
32	2

DMT Thresholds

The following thresholds are set using DiamondView's DMT Advanced Configuration Parameters window:

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 DiamondView when the LOF threshold is crossed. LOF Seconds and Failures are viewed on DiamondView's DMT Performance Actuals and DMT Performance Monitoring windows. The default threshold settings are "0" (zero) or inactive.

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 DiamondView when the LOS threshold is crossed. LOS Seconds and Failures are viewed on DiamondView's DMT Performance Actuals and DMT Performance Monitoring windows. The default threshold settings are "0" (zero) or inactive.

LPRS Thresholds Loss of Power (LPR) 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 shut down" signals at the ATUR. LPR Seconds and Failures are viewed on DiamondView's DMT Performance Actuals and DMT Performance Monitoring windows. The default threshold settings are "0" (zero) or inactive.

NOTE: LOF, LOS and LPR conditions/events are mutually exclusive; for example: 1) If all three conditions are present, LPR is reported. 2) If LOS and LOF are present, LOS is reported. 3) LOF is reported when it is the only condition.

LCDS Thresholds Loss of (ATM) Cell Delineation (LCD) 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 DiamondView when the LCD threshold is crossed. LCD Seconds and Failures are viewed on DiamondView’s DMT Performance Actuals and DMT Performance Monitoring windows. The default threshold settings are “0” (zero) or inactive.

Errored Seconds Thresholds (Near End) Errored Seconds are the cumulative number of seconds the port is in an LOF, LOS, LPR, LCD condition or had a Coding Violation condition (Cyclic Redundancy Check (CRC) 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 DiamondView when the Errored Seconds threshold is crossed. Errored Seconds are viewed on DiamondView’s DMT Performance Actuals and DMT Performance Monitoring windows. The default threshold settings are “0” (zero) or inactive.

FE Errored Seconds Thresholds Far End (FE) Errored Seconds are the cumulative number of seconds the port has had a far end Coding Violation condition (Cyclic Redundancy Check (CRC) 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 DiamondView when the FE Errored Seconds threshold is crossed. FE Errored Seconds are viewed on DiamondView’s DMT Performance Actuals and DMT Performance Monitoring windows. The default threshold settings are “0” (zero) or inactive.

Table 35: 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

Table 35: LOS, LOF, LPR, LCD and Errored Seconds Parameters

Parameter	15 Minute Values	Daily Values	Units	Defaults
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 of an event to DiamondView’s System Events window. Coding Violations are viewed on DiamondView’s DMT Performance Actuals and DMT Performance Monitoring windows.

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 FE Coding Violation parameters have “thresholds” for reporting of an event to DiamondView’s System Events window. Coding Violations are viewed on DiamondView’s DMT Performance Actuals and DMT Performance Monitoring windows.

The following table provides the expected number of ATUC Near and FE Coding Violation (CRC) errors in 15 minute and Daily intervals.[7] These numbers can be used as threshold settings. The default Coding Violation threshold setting is “0” or inactive.

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 36: ATUC Coding Violation Threshold Settings

Parameters	Threshold Settings based on Data Rates (bits per sec.)				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

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

Table 36: ATUC Coding Violation Threshold Settings

Parameters	Threshold Settings based on Data Rates (bits per sec.)				Sensitivity to CV Errors
	32000	64000	320000	640000	
15 Min 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" or alarm is sent to DiamondView. The inactive Error Alarm Threshold setting is "0", the default setting is "0".

FE Error Alarm Threshold This ATUC parameter sets the number of far end "errored frames" per second allowed during Data mode before and "event" or alarm is sent to DiamondView. The inactive FE 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 DiamondView. The default setting is "0".

Margin Deficit Bitswap Threshold The DMT port will dynamically change bit allocation during the data mode to adapt to changing conditions on the line. The goal is to maintain an acceptable level of noise "margin" for each bin if possible. Bitswapping does not dynamically change the data rate during the data mode—instead bit allocations are "swapped" from a bin or tone that has a degraded margin to another that has a high margin.

Bit allocation is reduced for a bin when the actual noise margin is below the provisioned Signal/Noise Margin by the amount set as the Margin Deficit Bitswap threshold.

An event is reported to DiamondView when the Margin Deficit Bitswap threshold is crossed. The Margin Deficit Bitswap threshold can be set for the ATUC channel, the default threshold setting is 6 dB.

Margin Excess Bitswap Threshold Bit allocation is increased for a bin when the actual noise margin is exceeds the provisioned Signal/Noise Margin by the amount set as the Margin Excess Bitswap threshold.

An event is reported to DiamondView when the Margin Excess Bitswap threshold is crossed. The Margin Excess Bitswap threshold can be set for the ATUC channel, the default threshold setting is 6 dB.

Chapter

4

SECTION 1 PROVISIONING CONCEPTS

Chapter 4 SDSL Provisioning

Introduction

This document describes the Symmetrical DSL (SDSL) provisioning parameters and operation of the Speedlink SDSL8 line card. Details are provided on how the SDSL port adjusts its data rate during the “training” operational mode.

The SDSL8 line card uses 2B1Q (2 Binary, 1 Quaternary) line encoding technique. 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 CAP2 line card, which can carry both data and analog voice transmissions.

An SDSL8 line card has eight ports, each port has three basic operational modes: Idle, Training and Data. These operational modes are defined as follows:

SDSL Operational Modes

- IDLE – The SDSL8 port transmitter and receiver are “locked” and disabled.
- TRAINING – The SDSL8 port transmitter and receiver are “unlocked”. The SDSL8 port is attempting to establish a connection with CPE equipment during the Training Mode.
- DATA – The SDSL8 port connection 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.

There are two provisioning parameters that can be set in DiamondView[1] to affect SDSL port operation:

Provisioning Parameters

- ATUC and ATUR Data Rates—Minimum and Maximum[2] provisioning parameters are 192, 384, 768, and 1152 Kbps. The default ATUC and ATUR rate settings are: minimum = 384 Kbps, maximum = 384 Kbps.
- Error Retrain Threshold – this parameter determines the amount of "errored frames" allowed during Data Mode before the SDSL port retrains. The Error Retrain Threshold parameter range is from 10^{-4} BER to 10^{-7} BER (Bit Error Rate). The default setting is 6 or 10^{-6} BER[3] for ATUC and ATUR units.

Signal Quality Measurements

The SDSL port has the functionality to measure channel "quality" established over the existing telephone copper network—the "local loop". Actuals provided by the SDSL port about its operation are: Transmit Rate, Noise Margin, and Power Attenuation.

- **Transmit Rate** is the actual data rate for the ATUC unit.
- **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 affect on the maximum local loop length supported for a provisioned fixed ATUC/ATUR data rate.
- **Power Attenuation** is the overall signal power attenuation or "decrease in power signal" over the local loop. Power Attenuation is expressed in dB.

These actual measurements are displayed in DiamondView's Advanced DSL Parameters window shown on the following page.

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1 Provisioning parameters can also be established using DiamondCraft.
2 The SDSL8 port will not exceed the provisioned ATUC/ATUR maximum rate.
3 The Error Retrain Threshold is fixed at the default setting of 6 or 10^{-6} BER in Release 3.0.

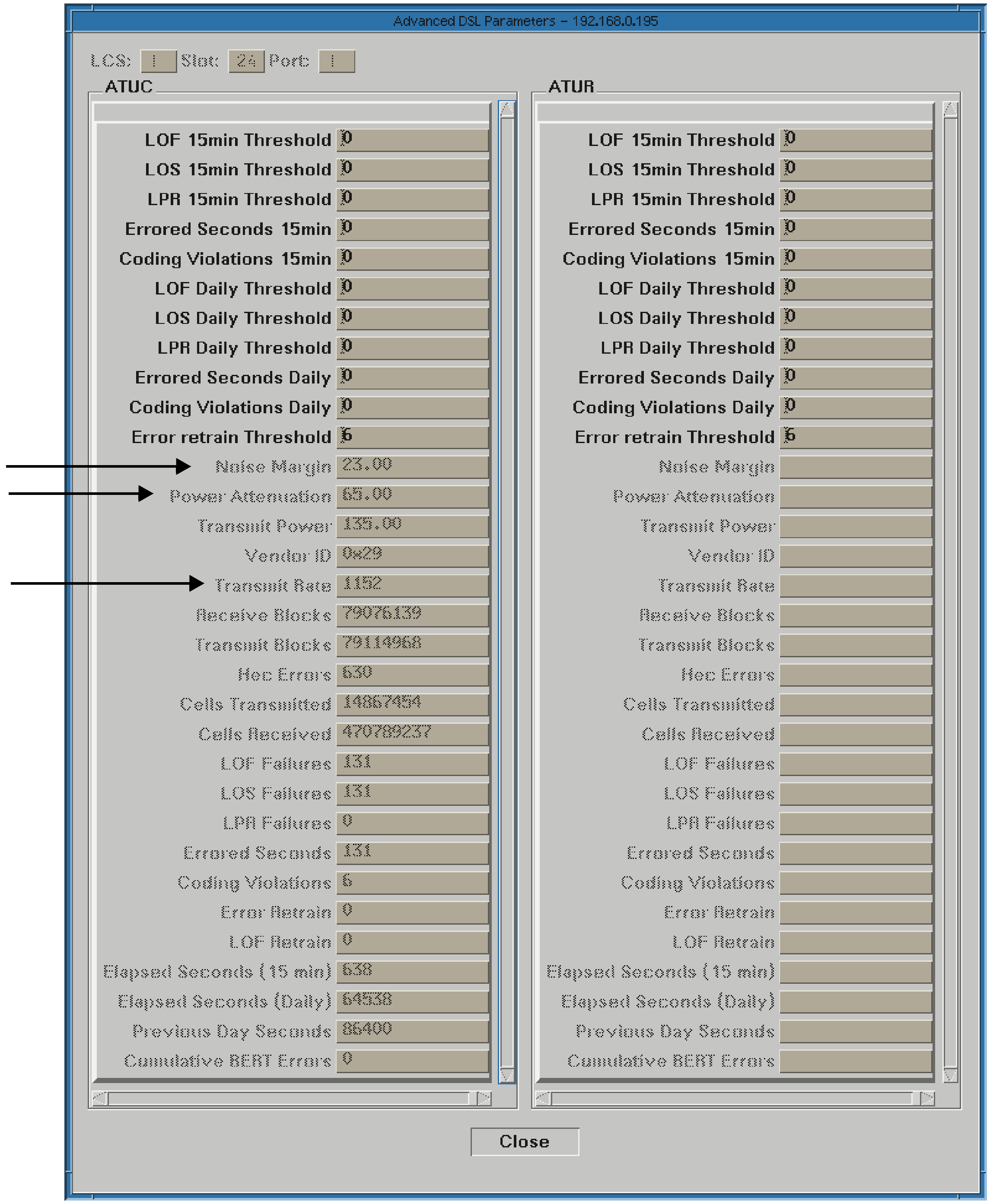

Figure 10: DiamondView—Advanced DSL Parameters

SDSL Port Data Rates

There are three parameters that affect the SDSL DSL port operation and data rates. These are: Minimum and Maximum Data Rates, and Noise Margin.

Minimum and Maximum Data Rates

The SDSL port operates only at a fixed rate “training” mode. Minimum and Maximum Data Rate parameters are provisioned for both ATUC and ATUR units in Kbps. The ATUC maximum data rate entered in DiamondView’s SDSL Port Details window automatically sets the same “fixed” rate in the ATUC minimum data rate and ATUR maximum and minimum data rate fields. See the table on page 48 for valid data rates.

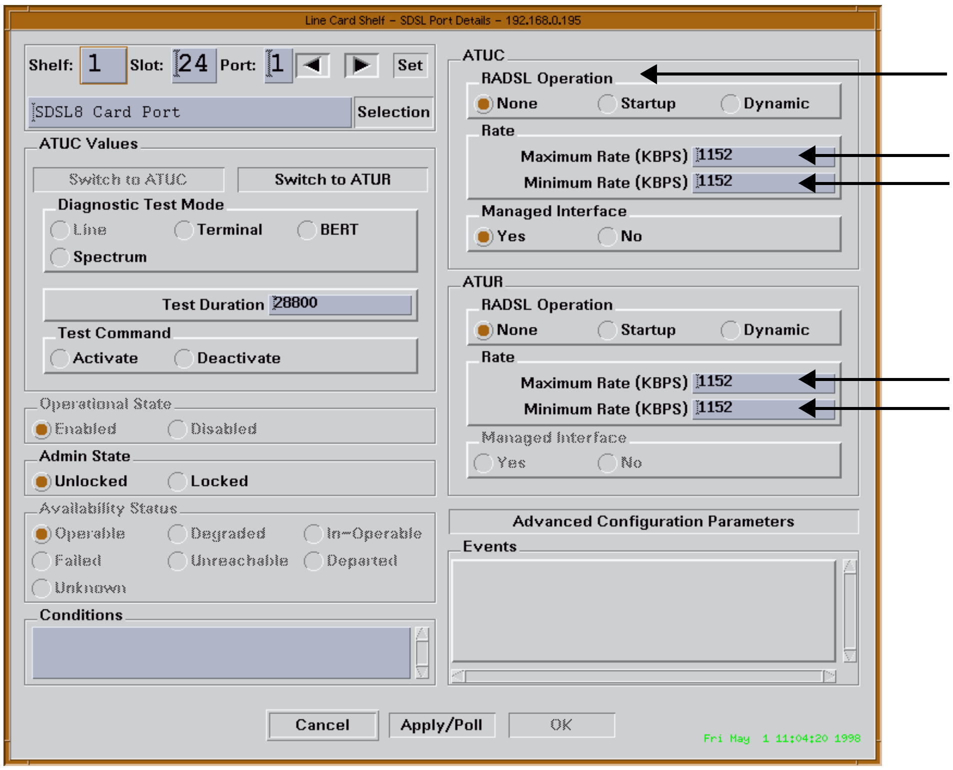

Figure 11: DiamondView—Line Card shelf SDSL Ports Detail Window

Training Mode

Fixed Rate Training

The SDSL8 port trains to the fixed rate provisioned for the ATUC and ATUR. The port will continue training to the provisioned fixed rate until it is successful. A Loss of Signal (LOS) condition is displayed for the port via DiamondView until training at the fixed rate is successful.

The following ATUC and ATUR data rate selections are used during the SDSL port training process based on the maximum data rate provisioned for the ATUC unit. The SDSL8 port trains to a fixed data rate (192, 384, 768,1152 Kbps) based on the provisioned rate. The SDSL port will train down to the next lower fixed data rate if the provisioned rate is less than the next higher data rate. For example: If the user enters a provisioned data rate of 200 Kbps, the SDSL port will train down to 192 Kbps.

Table 37: ATUC and ATUR Provisioned and Actual Data Rates

Provisioned ATUC/ATUR Data Rates (Kbps)	Actual ATUC/ATUR Data Rate (Kbps)
0 – 383	192
384-767	384
768-1151	768
1152-12000	1152

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

- 1152 Kbps 20 seconds.
- 768 Kbps 30 seconds.
- 384 Kbps 60 seconds.
- 192 Kbps 120 seconds.

Actual ATUC and ATUR Transmit Data Rates are displayed in DiamondView's Advanced DSL Parameters window, see page page 47.

Data Mode

The SDSL port enters Data Mode after it has completed the training process and a connection is established with CPE equipment. 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 SDSL port provides:

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

See page 46 for detailed information about performance actuals provided by the SDSL port.

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

LOF Threshold Setting

Loss of Frame condition is monitored during Data Mode. Daily and 15 minute thresholds can be set for the ATUC unit.

ATUC Loss of Frame threshold is entered in the DiamondView Advanced DSL Parameters window, see page page 52. The LOF Threshold setting is the number of seconds during which an LOF condition was present. An event is reported to DiamondView when the LOF threshold is crossed. LOF Seconds (LOFS) are viewed on DiamondView's System Events window. The default threshold setting is "0" (zero) or inactive. The LOF thresholds do not affect SDSL port operation.

LOS Threshold Settings

Loss of Signal condition is monitored during Data Mode. Daily and 15 minute thresholds can be set for the ATUC unit.

ATUC Loss of Signal threshold is entered in the DiamondView Advanced DSL Parameters window, see page page 52. The LOS Threshold setting is the number of seconds during which an LOS condition was present. An event is reported to DiamondView when the LOS threshold is crossed. LOS Seconds (LOSS) are viewed on DiamondView's System Events window. The default threshold setting is "0" (zero) or inactive. The LOS thresholds do not affect SDSL port operation.

Loss of Power Signal Threshold

Loss of Power Signal (LPRS) threshold is set to monitor "power shut down" signals at the ATUR.

Errored Seconds

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 and ATUR units.

ATUC Error Seconds threshold is entered in the DiamondView Advanced DSL Parameters window, see page page 52. An event is reported to DiamondView when the Errored Seconds threshold is crossed. Errored Seconds are viewed on DiamondView's System Events window. The default threshold setting is "0" (zero) or inactive. The Errored Seconds thresholds do not affect SDSL port operation.

Coding Violation Thresholds

The SDSL line card counts Coding Violation (CV) Errors for both the ATUC and ATUR units during Data Mode. The Coding Violation parameters have "thresholds" for reporting of an event to DiamondView's System Events window.

The default threshold setting is “0” (zero) or inactive. The CV thresholds do not affect SDSL port operation.

Coding Violation (CV) Threshold—15 min

An event or “trap” is reported to DiamondView when the Current 15 Minute CV counter exceeds this threshold. This parameter is a count of Cyclic Redundancy Check (CRC) errored frames received.

Coding Violation (CV) Threshold—Daily

An event is reported to DiamondView when the Daily CV counter exceeds this threshold. 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] These numbers can be used as threshold settings. The number of expected Coding Violation errors varies on the data rate.

Table 38: Coding Violation Threshold Settings

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

LOF, LOS, LPR, Errored Seconds, and Coding Violation threshold settings for ATUC 15 minute and Daily counters are provisioned in DiamondView’s Advanced DSL Parameters window. Only Errored Seconds and Coding Violations thresholds can be provisioned for the ATUR.

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

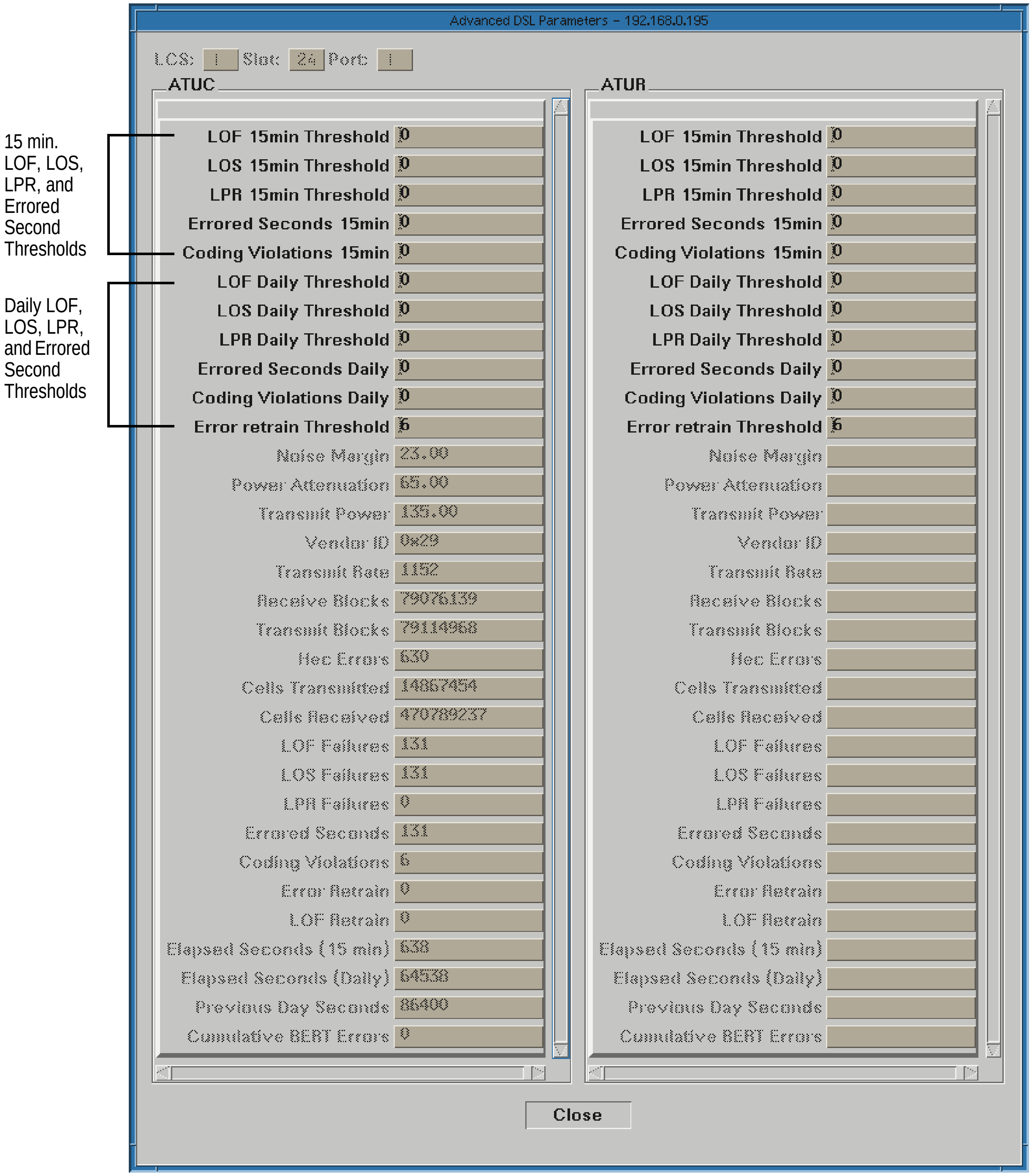

Figure 12: DiamondView—Advanced DSL Parameter Window

SDSL performance counts are monitored via DiamondView's DSL Performance Monitoring window.

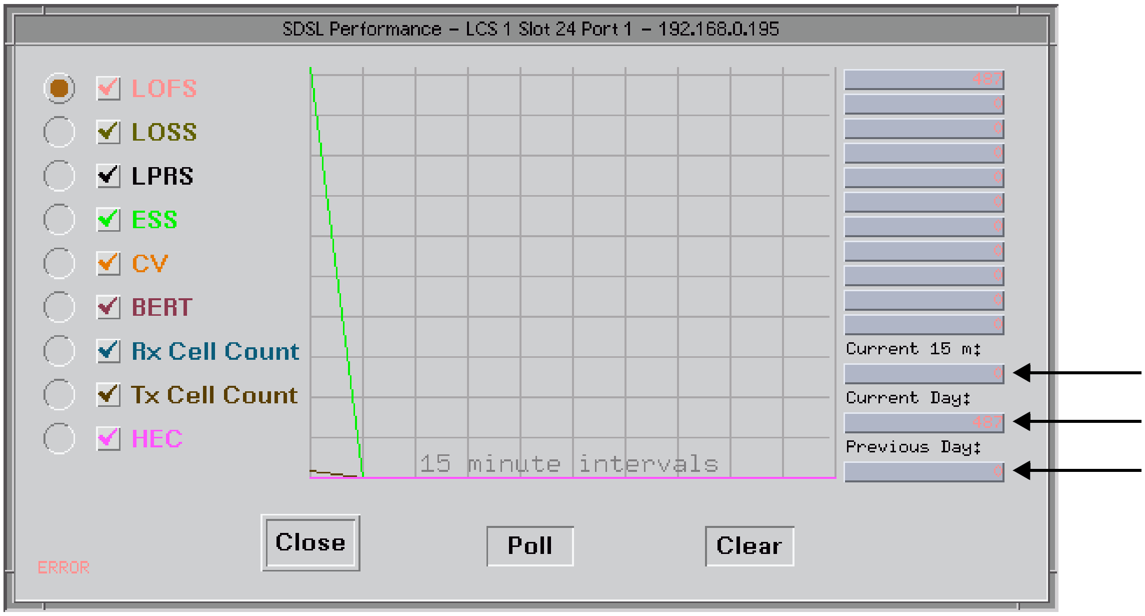

Figure 13: DiamondView—SDSL Performance Window

SDSL Performance Counts

The line card counts SDSL Performance (LOFS, LOSS, ESS, CV, BERT, Rx Cell Count, Tx Cell Count and HEC) items during Data Mode. The SDSL8 line card maintains fourteen counters for each of these performance items, the count begins when the line card powers up:

Previous Day

Current Day

Current 15 Minute Interval

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

The SDSL8 line card counts:

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

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

Loss of Power Signal (LPRS) The number of power shutdown (Loss of Power Signals) at the ATUR.

Errored Seconds (ESS) The cumulative number of seconds the port is in an LOF, LOS, and CV condition.

Coding Violations (CV) Counts the number of Cyclic Redundancy Check (CRC) errored frames received[6].

Bit Error Rate Test (BERT) The number of received errors during a BER Test.

Rx Cell Count The number of valid, non-idle cells “received” on the line card port from the CPE and sent on to the LSM2 card.

Tx Cell Count The number of valid, non-idle cells received from the LSM2 card and “transmitted” to the CPE.

Header Error Control (HEC) 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

SECTION 1 PROVISIONING CONCEPTS

Chapter 5 IDSL Provisioning

Introduction

This document describes ISDN DSL (IDSL) provisioning parameters and the operation of the Speedlink 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.

Frame Based IDSL8 Line Cards

The Speedlink is an ATM based multiplexer that uses DSL technology to transport ATM cells between the ATM network and the subscriber. ATM based line cards (CAP2, CAP4, DMT4, and SDSL8) 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 subscriber's to use their existing ISDN CPE.

IDSL Provisioning Parameters

There are four IDSL provisioning parameters that are established in DiamondView's[1] IDSL Port Details window:

- 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 39: 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 40: IDSL Mode Parameters

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

[1] IDSL provisioning parameters can also be established using DiamondCraft.

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 maximum of eight Frame Relay connections per port, a total of twenty-four connections per card.

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 41: 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

Table 41: Interworking Function Parameters

IWF Type	IWF Function	Definition	PVCs Supported
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 DiamondView[2] if any of the following provisioning errors are detected:

- More than one PVC connection on an IDSL port provisioned for PPP.
- A 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 using DiamondView’s IDSL Advanced Configuration Parameters window:

LOF Thresholds Loss of Frame condition is monitored during Data mode. Daily and 15 minute thresholds can be set for the ATUC unit.

The LOF threshold settings are the number of seconds during which an LOF condition was present. An event is reported to DiamondView when the LOF threshold is crossed. LOF Seconds and Failures are viewed on DiamondView’s IDSL Performance Actuals and IDSL Performance Monitoring windows. The default LOF threshold settings are “0” (zero) or inactive.

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

[2] Conditions are also displayed in DiamondCraft.

condition (Cyclic Redundancy Check (CRC) errors). Daily and 15 minute thresholds can be set for the ATUC unit.

An event is reported to DiamondView when the Errored Seconds threshold is crossed. Errored Seconds are viewed on DiamondView's IDSL Performance Actuals and IDSL Performance Monitoring windows. 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.

An event is reported to DiamondView when the Errored Seconds threshold is crossed. FE Errored Seconds are viewed on DiamondView's IDSL Performance Actuals and IDSL Performance Monitoring windows. The default FE Errored Seconds threshold settings are "0" (zero) or inactive.

Table 42: 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 Coding Violation parameters have "thresholds" for reporting of an event to DiamondView's System Events window. Coding Violations are viewed on DiamondView's IDSL Performance Actuals and IDSL Performance Monitoring windows.

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 FE Coding Violation parameters have "thresholds" for reporting of an event to DiamondView's System Events window. Coding Violations are viewed on DiamondView's IDSL Performance Actuals and IDSL Performance Monitoring windows.

The following table provides the expected number of ATUC Near and FE Coding Violation errors in 15 minute and Daily intervals.[3] These numbers can be used as threshold settings. The default Coding Violation threshold settings are “0” or inactive.

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 43: 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 DiamondView. 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 DiamondView. The default setting is “0”.

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

Chapter 6

SECTION 1 PROVISIONING CONCEPTS

Chapter 6 ATM Provisioning

Introduction

The Speedlink 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 Speedlink 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.

A PVC Connection

ATM supports two types of circuits: Permanent Virtual Circuit (PVC), and Switched Virtual Circuit (SVC). Release 3.0 of the Speedlink 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 Speedlink System refers to the line card VPI/VCI as the "Virtual Link A".

- A trunk VPI/VCI. The Speedlink 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 Speedlink System as each connection is established. When the Speedlink 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. See Chapters 1-5 for detailed information on these parameters. DSL provisioning information required from the service order includes maximum and minimum Upstream/ATUC and Downstream/ATUR data rates.

Provisioning with DiamondView

Provisioning Detailed Level Procedures are provided in Chapter 8—“Initial Service Provisioning,” beginning on page 69.

Chapter 7

SECTION 2 SYSTEM AND SERVICE ORDER PROVISIONING

Chapter 7 Initial Turn-Up

Introduction

After a Speedlink System is installed it must be initialized to carry service. Initializing the Speedlink System consists of two procedures:

- "Initialize MCS Cards" (starting on page 64) configures the Master Control Shelf cards.
- "Provision DSL Service" (Chapter 8—Initial Service Provisioning, starting on page 70) sets up the line cards to carry service.

There are numerous provisioning options available for set-up in the Speedlink System to meet subscriber service requirements. This procedure explains each option; some are mandatory and are required for providing service, others are optional and specific to the installation site equipment and subscriber requirements.

DiamondView Installation & Reference Documents

The DiamondView Element Management System is used to communicate with the Speedlink System. Details about installing DiamondView and establishing communications with the Speedlink are in Volume 6—*DiamondView Software*. Read and refer to this document as required while completing these procedures.

Initialize MCS Cards

The Speedlink System boots up for the first time with all the Master Control Shelf cards (except the active MCP) and Line Card Shelf cards locked. Volume 3—*Acceptance Testing*, Chapter 7—"Using DiamondCraft for Test and Turn-up" provides the procedures required to unlock cards and ready the Speedlink System to provide service. If these procedures were previously completed, skip to Chapter 8— "Initial Service Provisioning." If these procedures were not completed, follow these steps to initialize Master Control Shelf cards using DiamondView:

Table 44: Initialize MCS Cards

STEP	PROCEDURE
1	Double left-click the Master Control Shelf (MCS) graphic in the Speedlink Multiplexer graphical window. This opens the Master Control Shelf graphical 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.
2	Right-click the active trunk card in the Master Control Shelf graphical window. This brings up the Master Control Shelf card dialog window for the trunk card. In this window: ▪ Click the **Unlocked** option button in the trunk card Admin State to "unlock" the trunk card. ▪ Click **Apply/Poll**.
3	Is the trunk card a DS3T card, or an OC3T card? ▪ If it is a DS3T card, continue to STEP 4. ▪ If it is an OC3T card, skip to STEP 9.
4	For a DS3T card, click the **Protection…** button near the bottom of the Master Control Shelf dialog window. This brings up the Protection dialog window. In this window: ▪ Set **Switching Mode** as specified on the service order: either Uni-Directional or Bi-Directional. ▪ Set the Admin State to **Unlocked**. ▪ Click **OK**.
5	Click **OK** in the Master Control Shelf dialog window.

Table 44: Initialize MCS Cards (continued)

STEP	PROCEDURE
6	In the Master Control Shelf graphical window: ▪ Right-click the port **LED** on the active DS3T card graphic to bring up the MCS graphical window for the DS3T port. The port **LED** is the bottom LED on the card graphic. ▪ Left-click the **Line…** button near the bottom of the window to bring up the DS3 Line Parameters dialog window. Set the DS3 configuration parameters: ▪ Line Type option to Direct Mapping CBit, Direct Mapping M23, **PLCP CBit**, or PLCP M23. ▪ Line Timing option to **Loop**. ▪ Line Build Out option to **Low** or High. ▪ Cell Scrambling option to **Enable** or Disable. ▪ Hec Coset to **Enable**. ▪ Click **OK**. NOTE: Default settings are in bold. IMPORTANT: It is critical that the Line Type, Cell Scrambling, and Hec Coset settings match the corresponding settings at the other end of the DS3T connection (the network router or ATM switch).
7	In the Master Control Shelf dialog window: ▪ Left-click the **Thresholds…** button near the bottom left of the window. This brings up the Thresholds dialog window for the DS3T port. ▪ Set the DS3 performance threshold values as specified on the service order. ▪ Click **OK**. ▪ Click **OK** in the Master Control Shelf dialog window.
8	If a standby DS3T card is installed, repeat Steps 2-7 for the standby card. Skip to STEP 14.

Table 44: Initialize MCS Cards (continued)

STEP	PROCEDURE
9	For an OC3T card, click the **Protection…** button near the bottom of the Master Control Shelf dialog window. This brings up the Protection dialog window. In this window: ▪ Set **Switching Mode** as specified on the service order: either Uni-Directional or Bi-Directional. ▪ Set the Admin State to **Unlocked**. ▪ Click **OK**.
10	Click **OK** in the Master Control Shelf dialog window.
11	In the Master Control Shelf graphical window: ▪ Right-click the port **LED** on the active OC3T card graphic to bring up the MCS graphical window for the OC3T port. The port **LED** is the bottom LED on the card graphic. ▪ Left-click the **Configure…** button near the bottom of the window to bring up the OC3 Configuration Parameters dialog window. Set the OC3 parameters: ▪ Facility Type: **SONET** or sdh. ▪ Disable RDI on Loss of Cell option to Enable or **Disable**. ▪ Disable RDI on Label Mismatch option to Enable or **Disable**. ▪ Disable RDI on Trace Mismatch option to Enable or **Disable**. ▪ Timing option to **Loop** or Internal. ▪ Error Rates for Signal Fail (default = **3**) and Signal Degrade (default = **6**) as specified on the service order. ▪ Click **OK**. **NOTE:** Default settings are in bold. **IMPORTANT:** It is critical that the Facility Type setting matches the corresponding setting at the other end of the OC3T connection (the network router or ATM switch).
12	

Table 44: Initialize MCS Cards (continued)

STEP	PROCEDURE
13	In the Master Control Shelf dialog window: ▪ Left-click the **Thresholds…** button near the bottom left of the window. This brings up the Thresholds dialog window for the OC3T port. ▪ Set the OC3 performance threshold values as specified on the service order. ▪ Click **OK**. ▪ Click **OK** in the Master Control Shelf dialog window.
14	If a standby OC3T is installed, repeat Steps 2-12 for the standby card. Continue to STEP 14.
15	Right-click the MLA card graphic in the Master Control Shelf graphical window to bring up the Master Control Shelf dialog window for the MLA card. In this window: ▪ Set the Admin State to **Unlocked**. ▪ Click **OK**.
16	Repeat STEP 14 for each MLA card.
17	Right-click the NMP card graphic in the Master Control Shelf graphical window to bring up the Master Control Shelf dialog window for the NMP card. In this window: ▪ Set the Admin State to **Unlocked**. ▪ Click **OK**.
18	Right-click the standby MCP card graphic in the Master Control Shelf graphical window to bring up the Master Control Shelf dialog window for the MCP card. In this window: ▪ Set the Admin State to **Unlocked**. ▪ Click **OK**.

Table 44: Initialize MCS Cards (continued)

STEP	PROCEDURE
19	The Initialize Master Control Shelf Cards procedure is complete. **NOTE:** To close the Master Control Shelf graphical window, click the top left corner of the box, and select **Close**. Do not select **Exit** under the **File** menu option; this step will exit you out of DiamondView. Continue to Chapter 8—“Initial Service Provisioning,” on page 69.

Chapter
8

SECTION 2 SYSTEM AND SERVICE ORDER PROVISIONING

Chapter 8 Initial Service Provisioning

Introduction

The Speedlink System is ready for provisioning after completion of Initial Turn-up procedures. This procedure creates Permanent Virtual Circuits (PVCs) to connect a subscriber to an ATM Network Service Provider, and unlocks the line cards to provide service.

Required Information

To begin this task you will need the following information from the service order:

- Line Card Shelf, line card, and port
- Subscriber’s VPI/VCI address
- ATM network interface VPI/VCI
- Minimum and maximum data rates
- Bit error rates to force retraining of the line

NOTE: There may be multiple PVCs defined for a single subscriber’s loop.

Provision DSL Service

Follow these steps to provision line cards and line card ports and unlock them to provide service as specified on the service order. From the Speedlink Multiplexer graphical window:

Table 45: Provision DSL Service

STEP	PROCEDURE
1	Are you provisioning ISDN for an IDSL8 card(s)? ▪ If YES, skip these procedures and go to the next section, "Provision IDSL Service" on page 73. ▪ In NO, continue to STEP 2.
2	Double left-click the Line Card Shelf graphic that corresponds to the subscriber loop specified on the service order. This brings up the Line Card Shelf graphical 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.
3	Right-click the line card specified on the service order to bring up the Line Card Shelf dialog window.
4	Click the **Port (x)...**[a] button in the LCS dialog window to bring up the Line Card Shelf—Port Details dialog window.
5	Set the **Maximum** and **Minimum** data rates specified on the service order for both channels: **Upstream** and **Downstream** for CAP2 and CAP4 cards, **ATUC** and **ATUR** for DMT4 and SDSL8 cards.
6	Click the **Advanced Configuration Parameters** button to display: ▪ for CAP2 and SDSL8 cards: the Advanced DSL Parameters dialog window. ▪ for CAP4 cards: the CAP Advanced Configuration Parameters dialog window. ▪ for DMT4 cards: the DMT Advanced Configuration Parameters dialog window. Refer to Chapters 1-4 for detailed information on advanced configuration settings.

Table 45: Provision DSL Service (continued)

STEP	PROCEDURE
7	Set the thresholds for both channels (**Upstream**/**Downstream** for CAP2 and CAP4 cards, **ATUC**/**ATUR** for DMT4 and SDSL8 cards) as specified on the service order. **NOTE:** Use the scroll bar to access all parameters.
8	Click **Close**.
9	Click **OK** in the Line Card Shelf—Port Details dialog window.
10	In the Line Card Shelf dialog window: Click the **(xx) Conn…** button for the port specified on the service order to bring up the Connections—LCS (x) Slot (x) Port (x) dialog window. This dialog window is used to establish the Permanent Virtual Circuit (PVC) on the subscriber's service order.
11	The LCS number, slot number, and port number become the default values for Virtual Link A (the subscriber's side). The subscriber's service order provides the following information: ▪ Enter the VPI/VCI for Virtual Link A. ▪ Enter the VPI/VCI for Virtual Link Z (the ATM network interface). ▪ Click the **Add** button.
12	Click the **Edit Connection…** button to bring up the Connection Details dialog window: ▪ Set the **Topology** radio button to **Duplex**. ▪ Set the **Administrative State** to **Unlocked**. ▪ Click **OK**.
13	Click **OK** in the Connections—LCS (x) Slot (x) Port (x) dialog window.
14	Click **Close** in the Line Card Shelf dialog window: **IMPORTANT:** Unlock the card only, to complete initial provisioning of the line card. Do not "unlock" the line card ports 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.

Table 45: Provision DSL Service (continued)

STEP	PROCEDURE
15	The Provision DSL Service procedure is complete. **NOTE:** To close the Line Card Shelf graphical window, click the top left corner of the box, and select **Close**. <u>Do not</u> select **Exit** under the **File** menu option; this step will exit you out of DiamondView.

[a] The "x" represents the position number of the LCS, slot, or port indicated on the service order.

Provision IDSL Service

Follow these steps to provision IDSL8 line cards and ports and unlock them to provide service as specified on the service order. From the Speedlink Multiplexer graphical window:

Table 46: Provision IDSL Service

STEP	PROCEDURE
1	Double left-click the Line Card Shelf graphic that corresponds to the subscriber loop specified on the service order. This brings up the Line Card Shelf graphical 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.
2	Right-click the IDSL8 line card specified on the service order to bring up the Line Card Shelf dialog window.
3	In the Line Card Shelf dialog window, click the **Port (x)...** button to bring up the Line Card Shelf—IDSL Port Details dialog window.
4	Click the **Unlocked** option button for the Administrative State. Change channel and mode options from the default settings if required on the service order.
5	Set the following parameters as specified on the service order: ▪ Channel Mapping: **B1**, B2, or D. ▪ Inter-Working Options: Enable or **Disable**. ▪ Inter-Working Function: PPP LLC, PPP VCMux, **FRF8**, FRF5 One, FRF5 Many, or FR-PPP VC. ▪ IDSL Mode: **2B + D Bonded**, 2B Bonded, 2B Independent, or 2B + D Compatible. Refer to Chapter 5—“IDSL Provisioning” for detailed information on provisioning parameters. **NOTE:** Default settings are in bold.
6	Click the **Advanced Configuration Parameters** button to display the IDSL Advanced Configuration Parameters dialog window.
7	Set ATUC thresholds as specified on the service order. **NOTE:** Use the scroll bar to access all parameters.

Table 46: Provision IDSL Service (continued)

STEP	PROCEDURE
8	Click **Close**.
9	Click **OK** in the Line Card Shelf—IDSL Port Details dialog window.
10	In the Line Card Shelf dialog window: Click the Port (x) **(xx) Conn…** button to bring up the Connections—LCS (x) Slot (x) Port (x) dialog window. This dialog window is used to establish the Permanent Virtual Circuit (PVC) on the subscriber's service order.
11	The LCS number, slot number, and port number become the default values for Virtual Link A (the subscriber's side). The subscriber's service order provides the following information: ▪ Enter the VPI/VCI for Virtual Link A. ▪ Enter the VPI/VCI for Virtual Link Z (the ATM network interface). ▪ Click the **Add** button.
12	Click the **Edit Connection…** button to bring up the Connection Details dialog window: ▪ Set the **Topology** radio button to **Duplex**. ▪ Set the **Administrative State** to **Unlocked**. ▪ Click **OK**.
13	Click **OK** in the Connections—LCS (x) Slot (x) Port (x) dialog window.
14	Click **Close** in the Line Card Shelf dialog window: **IMPORTANT:** Unlock the card only to complete initial provisioning of the line card. Do not "unlock" the line card ports 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.
15	The Provision IDSL Service procedure is complete. **NOTE:** To close the Line Card Shelf graphical window, click the top left corner of the box, and select **Close**. Do not select **Exit** under the **File** menu option; this step will exit you out of DiamondView.

Chapter 9

SECTION 3 CHANGE ORDER PROVISIONING

Chapter 9 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 DSL service.

The DiamondView Element Management System is used to communicate with the Speedlink System. Details about installing DiamondView and establishing communications with the Speedlink are in Volume 6—*DiamondView Software*. 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
- 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 to add a PVC. From the Speedlink Multiplexer graphical window:

Table 47: Add PVC

STEP	PROCEDURE
1	Double left-click the Line Card Shelf graphic that corresponds to the subscriber loop specified on the change order. This brings up the Line Card Shelf graphical 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.
2	Right-click the line card in the slot specified on the change order. This brings up the Line Card Shelf dialog window.
3	Click the **(xx) Conn...**[a] button for the port specified in the change order to bring up the Connections—LCS (x) Slot (x) Port (x) dialog window.
4	The LCS number, slot number, and port number become the default values for Virtual Link A (the subscriber's side). The subscriber's change order provides the following information: ▪ Enter the VPI/VCI for Virtual Link A. ▪ Enter the VPI/VCI for Virtual Link Z (the ATM network interface). ▪ Click the **Add** button.
5	Click the **Edit Connection…** button to bring up the Connection Details dialog window: ▪ Set the **Topology** radio button to **Duplex**. ▪ Set the **Administrative State** to **Unlocked**. ▪ Click **OK**.
6	Click **OK** in the Connections—LCS (x) Slot (x) Port (x) dialog window.
7	Click **Close** in the Line Card Shelf dialog window.
8	The Add PVC procedure is complete. **NOTE:** To close the Line Card Shelf graphical window, click the top left corner of the box, and select **Close**. Do not select **Exit** under the **File** menu option; this step will exit you out of DiamondView.

[a] The "x" represents the position number of the LCS, slot, or port indicated on the change order.

Chapter 10

SECTION 3 CHANGE ORDER PROVISIONING

Chapter 10 Delete PVC

Introduction

This procedure describes how to delete a Permanent Virtual Circuit (PVC) from a line card port.

The DiamondView Element Management System is used to communicate with the Speedlink System. Details about installing DiamondView and establishing communications with the Speedlink are included in Volume 6—*DiamondView Software*. 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 to delete a PVC. From the Speedlink Multiplexer graphical window:

Table 48: Delete PVC

STEP	PROCEDURE
1	Double left-click the Line Card Shelf graphic that corresponds to the subscriber loop specified on the change order. This brings up the Line Card Shelf graphical 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.
2	Right-click the line card that corresponds to the subscriber loop specified on the change order. This brings up the Line Card Shelf dialog window.
3	Click the **(xx) Conn...**[a] button for the port specified in the change order to bring up the Connections—LCS (x) Slot (x) Port (x) dialog window. The Connections dialog window has a list box that shows all the PVCs carried on this port.
4	Select the PVC specified by the change order.
5	Click **Edit Connection...** to bring up the Connection Details dialog window. ▪ Set the Administrative State to **Locked**. ▪ Click **OK**.
6	Click **Delete** in the Connections—LCS (x) Slot (x) Port (x) dialog window.
7	Does the change order specify any other PVCs to be deleted? ▪ If YES, repeat Steps 4-6 for each PVC to be deleted. ▪ If NO, go to STEP 8.
8	Click **OK** in the Connections dialog window.

Table 48: Delete PVC (continued)

STEP	PROCEDURE
9	Look in the **Port (x)…** box on the right side of the Line Card Shelf dialog window for this port. Are there connections still carried on this port? ▪ If YES, go to STEP 10. ▪ If NO, click the **Lock** button for this port, and continue to STEP 10.
10	Click **Close** in the Line Card Shelf dialog window.
11	The Delete PVC procedure is complete. **NOTE:** To close the Line Card Shelf graphical window, click the top left corner of the box, and select **Close**. Do not select **Exit** under the **File** menu option; this step will exit you out of DiamondView.

[a] The “x” represents the position number of the LCS, slot, or port you have selected.

Chapter

11

SECTION 3 CHANGE ORDER PROVISIONING

Chapter 11 Changing Data Rates

Introduction

This procedure describes how to change the minimum and maximum data rates associated with a line card port. Data rates are associated with a *port*, not a PVC.

The DiamondView Element Management System is used to communicate with the Speedlink System. Details about installing DiamondView and establishing communications with the Speedlink are in Volume 6—*DiamondView Software*. Read and 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 Minimum and Maximum data rates

Changing Data Rates

Follow these steps to change a port's minimum and maximum data rates. From the Speedlink Multiplexer graphical window:

Table 49: Changing Data Rates

STEP	PROCEDURE
1	Double-left click the Line Card Shelf graphic that corresponds to the subscriber loop specified on the change order. This brings up the Line Card Shelf graphical 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.
2	Right-click the line card that corresponds to the subscriber loop specified on the change order. This brings up the Line Card Shelf dialog window.
3	Click the **Port (x)**[a]**…** button specified on the change order to bring up the Line Card Shelf—Port Details dialog window.
4	Set the new **Maximum** and **Minimum** data rates specified on the change order for both the **Upstream** or **ATUC** and **Downstream** or **ATUR** channels.
5	Click **OK**. **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.
6	Click **Close** in the Line Card Shelf dialog window.
7	The Changing Data Rates procedure is complete. **NOTE:** To close the Line Card Shelf graphical window, click the top left corner of the box, and select **Close**. Do not select **Exit** under the **File** menu option; this step will exit you out of DiamondView.

[a] The "x" represents the position number of the LCS, slot, or port indicated on the change order.

Diamond Lane Communications Glossary and Acronyms

Asymmetric Digital Subscriber Line (ADSL)

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.

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.

Alarm Indication Signal (AIS)

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.

ATM Adaptation Layer (AAL)

ATM Adaptation Layer is located above ATM and converts non-ATM bit streams into ATM cells. The AAL protocol supports higher-layer service requirements.

Asynchronous Transfer Mode (ATM)

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.

Auxiliary Common Systems Interface Panel (CSIP)

Each Auxiliary CSIP connects and distributes central office power to up to four Line Card Shelves (LCS). Auxiliary CSIPs are required for Speedlink Systems with over five Line Card Shelves.

Bit Error Rate (BER)

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.

CAP2

Carrierless Amplitude and Phase (CAP) ADSL line card, 2 ports per line card.

CAP4

Carrierless Amplitude and Phase (CAP) ADSL line card, 4 ports per line card.

CBR (Constant Bit Rate)

Data that are transmitted at a constant rate on an ATM network.

CELL

In general, fast packet-switching technologies—such as ATM (Asynchronous Transfer Mode). The ATM Cell has a 5-byte header and contains 48 bytes of payload.

Central Office (CO)

The Local Exchange switch that terminates individual local telephone subscriber lines for switching and connection to the public network (locally and long distance).

Common Management Information Protocol (CMIP)

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.

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 Master Control Shelf and up to four Line Card Shelves.

Common Systems Interface Panel (CSIP) Alarm Board

All Speedlink 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 Speedlink alarm status.

Constant Bit Rate (CBR)

Applications or services in a digital network that are to be the same bandwidth for the duration of the call.

CPE (Customer Premise Equipment)

Refers to telephone and related equipment located on the customer's premises (office or home).

Customer Network Management (CNM)

A feature of ATM, Frame Relay and SMDS which allows customers to directly view and manage their public data service (communications networks) in the same way they view and manage their local area networks.

Digital Loop Carrier (DLC)

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.

DiamondCraft™

DiamondCraft is the Speedlink's stand-alone craft interface application. It communicates directly with a Speedlink through a serial port connection using Point-to Point Protocol (PPP).

DiamondView™

DiamondView is the Speedlink's Element Management System (EMS). It is a HP Open View® application and operates on a UNIX workstation.

DS1 (Digital Signal Level One)

1.544 Mb/s digital signal.

DS3 (Digital Signal Level Three)

44.736 Mb/s digital signal – equivalent of 28 T-1 channels (also referred to as T-3).

DS3T

The DS3 trunk card provides the interface between ATM backbone facility and the Speedlink. It 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 Speedlink has two DS3T cards in a 1:1 protection group.

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).

Egress

Outgoing direction to a network or network device, as opposed to the ingress (or entrance).

Element Management Systems (EMS)

Software used to manage and monitor components of a telecommunication system at the lower levels of the Telecommunications Management Network.

Graphical User Interface (GUI)

A generic name for the computer interface that substitutes graphics for characters. The GUI permits users to directly manipulate graphical objects displayed on the monitor.

HDSL (High bit rate Digital Subscriber Line)

HDSL provides a DS1 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.

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.

Ingress

Incoming direction to a network or network device, as opposed to the egress (or exit).

IP (Internet Protocol)

A component of the TCP/IP protocol suite. IP operates at the Layer 3 of the OSI Reference model.

ISO (International Standards Organization)

The International Standards Organization is an international organization founded in 1946 to facilitate the development of international data communication standards.

ITU (International Telecommunications Union)

An organization established by the United Nations. The ITU sets telecommunications standards and allocates frequencies to various uses worldwide.

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.

Line Card

A line card serves as the interface between a line and a communications device.

Line Card Shelf (LCS)

The Speedlink System is made up of one Master Control Shelf and up to twelve Line Card Shelves. Each LCS has 24 mounting slots for line cards, a Line Card Shelf Multiplexer (LSM or LSM2) card, and an optional LSM or LSM2 card for Remote Line Card Shelf protection group application.

Line Card Shelf Multiplexer (LSM or LSM2) card

The LSM or LSM2 card communicates with the Master Line Card Adapter (MLA) card over multi-mode optical cable at OC-3 rates. The LSM or LSM2 multiplexes and demultiplexes ATM cell streams for up to 24 line cards in a Line Card Shelf.

Low Pass Filter Shelf (LPFS)

Data plus voice frequency signals are received from the customer at the Low Pass Filter Shelf. the LPF card “splits” the low frequency voice signal from the high frequency ADSL signal. The voice signal is sent onto the voice switch unimpeded; while data signal is received by the CAP2 line card.

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).

LPF2

Low Pass Filter card, 2 ports per card.

LPF4

Low Pass Filter card, 4 ports per card.

Master Control Shelf (MCS)

The MCS contains the central control and communication functions for the Speedlink System and serves as the ATM network interface.

Master Control Processor (MCP) card

The MCP card is the central control and communications for the Speedlink, it stores program and provisioning database information. The Speedlink has two MCP cards in a 1:1 protection group.

Master Line Card Adapter (MLA) card

Each MLA card provides the broadband interface to one Line Card Shelf at OC-3 rates over optical fiber. 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.

Management Information Base (MIB)

The MIB contains all the provisioning information for the Speedlink Multiplexer. (The MIB contains data available to a network management program. The network manager queries the MIB.)

Multiplexer

Equipment that aggregates two or more channels onto a single transmission channel.

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 Speedlink System shipping today is already NEBS-compliant.

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 Diamond Lane 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.

Network Management Processor (NMP) card

The NMP card controls the Speedlink's network management interfaces and provides the protocol support for communication for DiamondView and DiamondCraft.

OC-1 (Optical Carrier Level-1)

A SONET line rate of 51.840 Mb/s. Direct electrical-to-optical mapping of the STS signal with frame synchronous scrambling.

OC-3 (Optical Carrier Level-3)

A SONET line rate of 155.520 Mb/s. 3 x OC-1. Direct electrical-to-optical mapping of the STS signal with frame synchronous scrambling.

OC-12

Sonet channel of 622.08 Mbps.

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.

PCI (Peripheral Component Interconnect)

Bus of an Intel PC. PCI transfers data between the PC's main microprocessor and peripherals at up to 132Mbps.

PCR (Peak Cell Rate)

PDR (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 functions as defined in IEEE 802.6-1990.

POP (Point-of-Presence)

The physical place within a LATA (the long distance carrier's local office) where the IEC provides services to the LEC, 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.

PVC (Permanent Virtual Circuit)

A permanent association between two DTEs 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. The parameters apply to virtual channel connections and virtual path connections.

Remote Line Card Shelf (RLCS)

A RLCS allows customers served off of long loops — beyond 18,000 ft from the central office — access to xDSL 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 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 a standard Network Interface Device housing and a standalone 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.

SDSL (Symmetric Digital Subscriber Line)

Also referred to as Single-Line Digital Subscriber Line, SDSL supports symmetrical T1/E1 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.

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 a 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 a agents MIB.

SNR (Signal-to-Noise Ratio)

In a 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 before the signal loss is unacceptably high. The SNR also helps determine whether a particular type of cable is appropriate for the intended use.

SOHO (Small Office – Home Office)

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 51.84Mbps to 13.22Gbps.

Speedlink Multiplexer

The Speedlink Multiplexer is classified as a Digital Subscriber Line Access Multiplexer (DSLAM). The Speedlink Multiplexer uses Digital Subscriber Line (xDSL) and Asynchronous Transfer Mode (ATM) technologies to deliver high speed data rates over the exiting copper network.

SVC (Switched Virtual Circuit)

A virtual connection set up on demand via a signaling protocol connection that is established for a communications session that is 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 megabits per second (Mbps), which comes from two dozen 64 kilobit per second (Kbps) channels, together with one 8Kbps framing channel.

TCP/IP (Transmission Control Protocol / Internet Protocol)

TCP/IP is a 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.

Trap

A method used to isolate an abnormal condition or operation.

TMN (Telecommunications Management Network)

A concept where all Operation and Maintenance Centers are linked together to form a network.

UBR (Unspecified Bit Rate)

In ATM networks, a UBR connection transmits at variable rates.

UNI (User-to-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.

VBR (Variable Bit Rate)

In ATM networks, a VBR connection transmits in bursts, at variable speeds.

VDSL (Very-high-speed Digital Subscriber Line)

VDSL provides DSL service at a data rate in excess of 10Mbps (up to 52Mbps). VDSL has a maximum operating range from 1,000 feet to 4,500 feet on 24-gauge wire.

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, or VDSL.

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