Chapter 10

ATM over xDSL

Introduction

This chapter describes:

- "Digital Subscriber Line Technologies" and some of their common features
- ADSL (Asymmetric Digital Subscriber Line) technology, available on AR440S and AR441S ADSL routers ("ADSL" on page 10-6)
- SHDSL (Symmetrical High-speed Digital Subscriber Line) technology, available on AR442S SHDSL routers ("SHDSL" on page 10-8)
- ATM (Asymmetric Transfer Mode), which can be configured to run over ADSL or SHDSL interfaces ("ATM" on page 10-11)
- how to configure ATM over ADSL or SHDSL on your router ("Configuration Procedures and Examples" on page 10-20)
- detailed descriptions of the commands used to configure ADSL, SHDSL and ATM on the router ("Command Reference" on page 10-31)

Digital Subscriber Line Technologies

ADSL and SHDSL are two of a range of Digital Subscriber Line technologies collectively known as xDSL. xDSL uses existing twisted-pair telephone lines (Plain Old Telephony System, or POTS) to transport high-bandwidth data, such as multimedia and video, to service subscribers. For definitions of xDSL, ADSL and SHDSL see "Definitions" below.

xDSL can deliver high-bandwidth data rates to dispersed locations with relatively small changes to the existing telecommunications infrastructure. xDSL services provide dedicated, point-to-point, public network access over twisted-pair copper wire. This occurs either on the local loop (also known as the "last mile") between a network service provider's (NSP) central office and the customer's site, or it occurs on local loops that are created either intra-building or intra-campus.

Copper-pair lines can typically transmit usable signals up to approximately 1Mhz in frequency, but voice telephony signals only use signals below 4kHz. DSL transmission technology, including ADSL and SHDSL, takes advantage of the whole of the frequency spectrum. ADSL uses the copper line frequency spectrum from above the voice frequencies up to 1.1 Mhz. SHDSL does not share the line with telephony signals, so it can use the lower voice frequencies as well, for longer reach.

Definitions

xDSL is

- x—represents the distinct variants of DSLs
- Digital—even voice and video are digitised before they are transmitted as modulated analogue representations of digital data
- Subscriber Line—data is carried over a single twisted pair copper 'loop' to the subscriber's premises

ADSL is:

- Asymmetric—data transmission is faster downstream to the subscriber than upstream from the subscriber
- Digital
- Subscriber Line

SHDSL, sometimes referred to as G.shdsl, is defined by ITU-T Recommendation G.991.2, and is:

- Symmetrical—data transmission occurs at the same speed for both upstream and downstream traffic

  SHDSL is sometimes called Single-pair High bit-rate Digital Subscriber Loop, because SHDSL can be used to transfer data over the single pair (two wires) common in existing telephone networks. It can also transmit data at double the speed over dual pairs when these are available.
- High-speed—significantly faster than the earlier HDSL, HDSL2 and SDSL
- Digital
- Subscriber Line

Why use ADSL or SHDSL?

Typically, Web browsing involves downloading five times as much data as it transmits, so ADSL users who mainly use their connection for Web browsing do not need a high bi-directional transmission speed. ADSL also allows service providers to limit web hosting on subscriber lines, or sell it separately; a web server cannot run effectively over ADSL.

The symmetry of upstream and downstream data rates makes SHDSL more suitable than ADSL for organisations with significant two-way traffic, such as for Virtual Private Networks (VPN) or public servers.

xDSL in the OSI Model

In the seven layer OSI Model, ADSL, SHDSL and other xDSL variants are at the Physical Layer (Layer 1), encoding technology over which may be deployed higher layer protocols, such as ATM. The Physical Layer handles the basic ADSL or SHDSL encoding and data rates, and offers compatibility with other technologies in the subscriber line. For example, SHDSL can share a binder with a POTS service, or with an ADSL service.

Line conditions and performance

There are a number of factors that can affect frequencies in the DSL band differently to reduce available bandwidth. Each copper line has different impairment characteristics resulting from:

- the length and gauge of the line. The greater the line length, the greater the attenuation. The narrower the gauge, the greater the attenuation.
- bridge taps on the line causing reflections and noise.
- crosstalk from other wires in the same bundle, for instance other T1 lines, depending on their relative position.
- RF (radio frequency) interference from AM radio, amateur radio bands, and other sources.

Most xDSL variants, including ADSL and SHDSL, cannot be transmitted on a line with load coils or Digital Loop Carriers (DLCs).

xDSL network connection process

When an ADSL or SHDSL modem/router connects to a DSL network, it goes through an initialisation process. This process identifies and qualifies the capabilities of both the network equipment and of the underlying physical infrastructure. The initialisation process consists of major phases, shown in the following table.

Phase	Name	What happens ...
1	Activation and Acknowledgement or Handshaking	Power on takes the modem into **activation and acknowlegment** stage, also known as **handshaking**. The goals of initialisation are to determine which tones can be used and to assign bits to each tone. Initialisation uses two pilot tones to start the activation. Normally the modem initiates the process when it is turned on and connected to the DSL line. Messsages are sent using the pilot tones to ensure that both ends are ready for transceiver training.
2	Training	During transceiver **training** the Central Office interface—the ATU-C ("ADSL network components" on page 10-6) or STU-C ("SHDSL network components" on page 10-8) in a DSLAM— measures and adjusts power output and how it equalises the circuit. Unless it is configured otherwise, it negotiates the fastest possible speed for the local loop.
3	Channel Analysis	During **channel analysis**, the Central Office interface tells the subscriber modem which options are configured and sends a predefined medley of tones so the modem can report its signal-to-noise ratio.
4	Exchange	During the exchange phase, the Central Office interface sends the minimum signal-to-noise ratio and decides on the power output per tone.
5	Data or Show Time	Initialisation concludes with the **Data** state (SHDSL), called **Show Time** in ADSL, in which the line is active and higher layer protocols such as ATM can begin negotiation to transfer data over the connection.

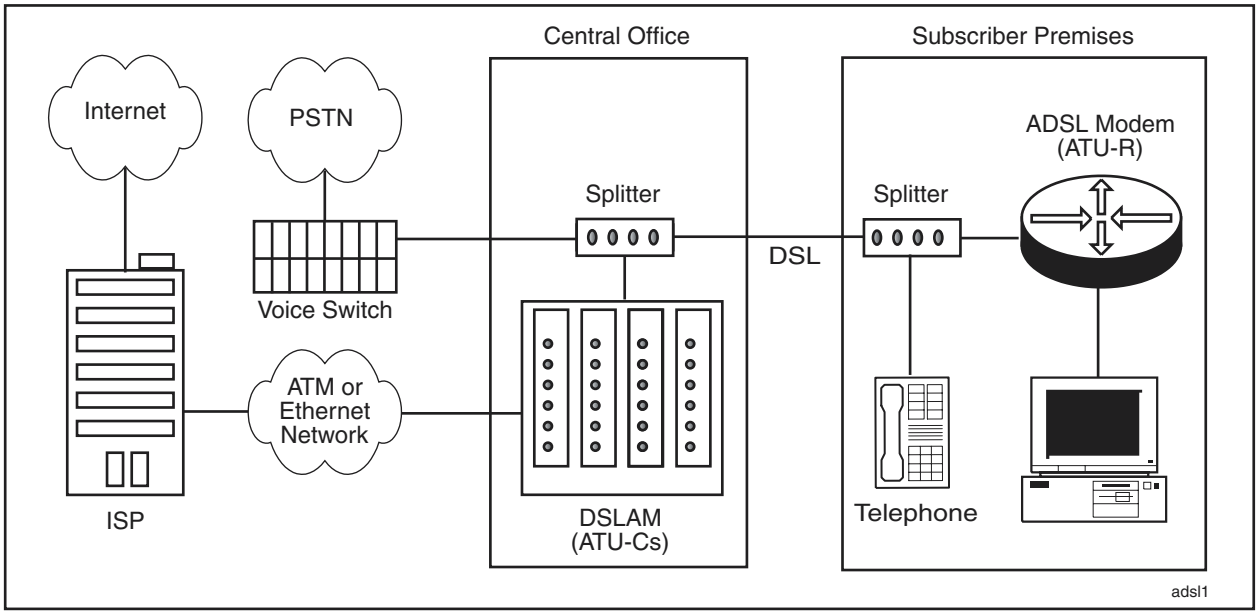
Dying Gasp

If the ADSL or SHDSL device at the subscriber premises supports Dying Gasp, it sends a signal to the DSLAM when it is disabled or powered down. The DSLAM can record this message, so that a network administrator can use it for diagnostic purposes, or so that the DSLAM can free up allocated resources. The dying gasp message shows that the connection went down because of loss of power at the customer premises, and not because the cable was accidentally cut between the subscriber and the service provider.

ADSL

ADSL network components

The main hardware components, shown in the following figure and listed below, are required for a typical ADSL network connection.



- ADSL Modem (ADSL Transmission Unit Remote, ATU-R)

  The ADSL modem at the customer premises, also known as ADSL Transmission Unit Remote (ATU-R), provides local loop termination on the customer side. It may also operate as either a router or a bridge. The AR440S and AR441S ADSL routers have a built-in ADSL modem.

- ADSL Transmission Unit Central Office (ATU-C)

  The ADSL modem at the central office, or ATU-C, terminates the ADSL local loop at the central office premises. Many ATU-Cs can be inserted into a DSLAM.

- DSL Access Multiplexor (DSLAM)

  The ATU-C units are collected together in a chassis unit called a DSLAM. The DSLAM may also incorporate a splitter. The DSLAM can connect through an ATM or Ethernet access network to the Internet.

- ADSL Splitter

  A device called an ADSL splitter separates the voice frequencies (analogue voice or ISDN signal) from the data frequencies when they get to the subscriber premises. For outgoing traffic, it combines the voice and data frequencies onto one line when they are transmitted from the subscriber premises. This allows a POTS phone connection to operate at the same time as ADSL digital data is transmitted or received on the same line. The ADSL splitter uses passive filters, requiring no power, so the voice line remains available even if the ADSL system fails. The splitter at the central office may be incorporated into the DSLAM, or may be a separate device.

ADSL data rates

Downstream data rates can be as high as 12Mbps, while upstream rates are typically around 1Mbps, depending on line conditions ("Line conditions and performance" on page 10-4).

DMT modulation

ADSL transmitters use Discrete MultiTone modulation (DMT), rather than its earlier competitor Carrierless Amplitude Phase modulation (CAP). DMT splits the available frequency range up into sub-bands. There are nominally 224 downstream frequency bins, or carriers (each occupying about 4 kHz of spectrum) and 32 upstream frequency bins (also each occupying approximately 4 kHz of spectrum). If the line is of good quality, up to 15 bits per signal can be encoded on each carrier frequency.

DMT has a number of advantages over CAP:

- Adapting to impairments

  Because DMT is able to individually tune the throughput at many different frequencies, it can optimally adapt to impairments affecting different frequencies differently. The ADSL we use today, based on DMT, is sometimes referred to as Rate-Adaptive DSL because the data rate being transmitted can be adapted to the quality of the line.

- Reduce RF interference

  To prevent RF interference from the DSL at amateur radio frequencies, a DMT ADSL transmitter turns off certain sub-channels in the spectral region used by amateur radio.

- Impulse Noise Handling

  Impulse noise, a common problem in copper access networks, is generally caused by switching transients from ring generator relays in central offices or electric motors on the customer premise. DMT helps diminish impulse noise. An impulse may wipe out the receive signal for 5 µs (microseconds) or more, but a DMT symbol spans 250 µs. An impulse will therefore destroy only some of the sample.

ADSL frames and superframes

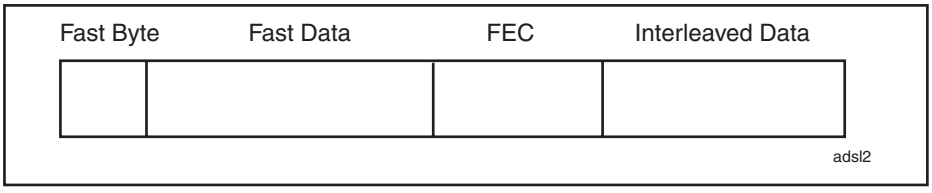
A single ADSL frame contains as many bits as can be sent onto the line in a single time-slice. The bits are distributed across all the active DMT frequencies, in accordance with the number of bits-per-signal being used on each frequency.

After 68 such frames have been sent, a special synchronisation frame is always sent. This combination of 68 normal frames and one sync frame is referred to as an ADSL *superframe*.

The data in the ADSL transport is organized into the following items:

- **Frames -** where each frame starts on a 250µs time boundary. While the timing of the frames remains constant, the actual size and contents of the frames can vary on the basis of the prevailing transport mode.
- **Superframes -** these represent the highest level of data presentation and repeat every 17 ms. Each superframe contains sixty-eight ADSL frames, one of which is used to provide superframe synchronization, identifying the start of a superframe. Some of the remaining frames are also used for special functions.

Both the frames, as shown in the following figure, and superframes have an inherent organization, providing structure for synchronisation.



Each frame contains:

- The **Fast Byte** is used for special superframe-related processing functions.
- The **Fast Data** transmits time-sensitive information such as audio, and is not retransmitted. This can vary in length.
- **Forward Error Correction** (FEC) is used to ensure the accuracy of the fast data.
- **Interleaved Data** is the user data that the ADSL interface transmits, typically data network payload such as Internet data. This can vary in length.

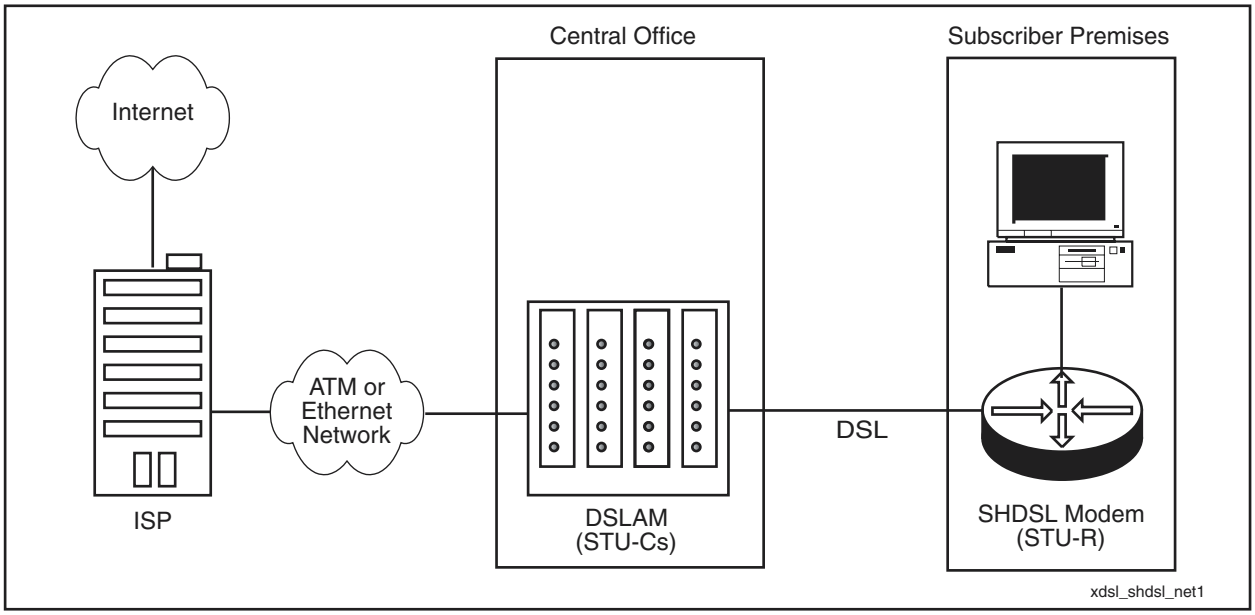
FDM or EC

ADSL can use either Echo Cancellation (EC) or Frequency Division Multiplexing (FDM) on the DSL subcarrier channels. Upstream data uses 25 subcarriers in both methods. FDM separates the upstream and downstream subcarriers, using 224 subcarriers for downstream data, while EC overlaps some of the upstream and downstream carriers to use 249 subcarriers for downstream data. EC is defined as optional in ITU-T Recommendation G.992.1 and may not be implemented by certain DSLAMs.

SHDSL

SHDSL network components

The main hardware components, shown in the following figure and listed below, are required for a typical SHDSL network connection.



- SHDSL Modem (SHDSL Transmission Unit Remote, ATU-R)

  The SHDSL modem at the customer premises, also known as SHDSL Transmission Unit Remote (STU-R), provides local loop termination on the customer side. It may also operate as either a router or a bridge. The AR442S SHDSL router has a built-in SHDSL modem.

- SHDSL Transmission Unit Central Office (STU-C)

  The SHDSL modem at the central office, or STU-C, terminates the SHDSL local loop at the central office premises. Many STU-Cs can be inserted into a DSLAM. The AR442S SHDSL router can operate in Central Office mode, as an STU-C.

- DSL Access Multiplexor (DSLAM)

  The STU-C units are collected together in a chassis unit called a DSLAM. The DSLAM can connect through an ATM or Ethernet access network to the Internet.

1-pair and 2-pair modes

By default, the AR442S router's SHDSL interface operates in 1-pair (2-wire) mode (using pins 3 and 4 only). This enables it to transmit over the single-pair cable commonly available in established telephone networks.

For increased speed, connect the router in 2-pair (4-wire) mode, using pins 3 and 4 for pair one, and pins 2 and 5 for pair two. Because the payload is equally divided between the two pairs, with equal data rates on each, data throughput is approximately doubled. From an application point of view, the 2-pair mode appears as a single interface.

Standard and Enhanced 2-pair modes

On the AR442S router, the SHDSL interface offers both standards-based, and enhanced 2-pair, modes of operation. The standards-based 2-pair mode is compatible with ITU standard G.991.2 (12/2003). The Enhanced 2-pair mode was initially developed prior to the finalization of the standard, and is therefore not compatible with standards-based DSLAMs. Standards-based 2-pair mode is advisable for most installations, but enhanced mode may be useful in circumstances where it is compatible with the DSLAM.

SHDSL data rates

Upstream data rates are the same as downstream rates for SHDSL. In single-pair mode data rates can be set to fixed speeds from 192 kbps (up to 6 km) to 2.3 Mbps (up to 3 km), in 16kbps intervals. 2-pair mode provides greater data rates (384kbps to 4.6 Mbps). On the AR442S router, you can set the data rate to a fixed rate (Table 10-4 on page 10-57), or set it to adapt to find the best rate available as conditions on the line vary. The two SHDSL frequency profiles are designed for optimal performance on slightly different wire gauges: Annex A for 26 AWG (American Wire Gauge), and Annex B for 0.4 mm gauge. The speeds that can be achieved in a particular situation also depend on line conditions ("Line conditions and performance" on page 10-4.)

Using Power Measurement Modulation Sessions (PMMS), also called *Line Probes*, SHDSL interfaces estimate the (signal-to-noise ratio (SNR) on the line, and assess whether they can provide particular data rates within a specified PMMS target margin. The interfaces on a line can then communicate to each other the data rates they can support under the real conditions of the line, either to confirm a fixed data rate, or to allow them to negotiate an adaptive rate.

Power Backoff

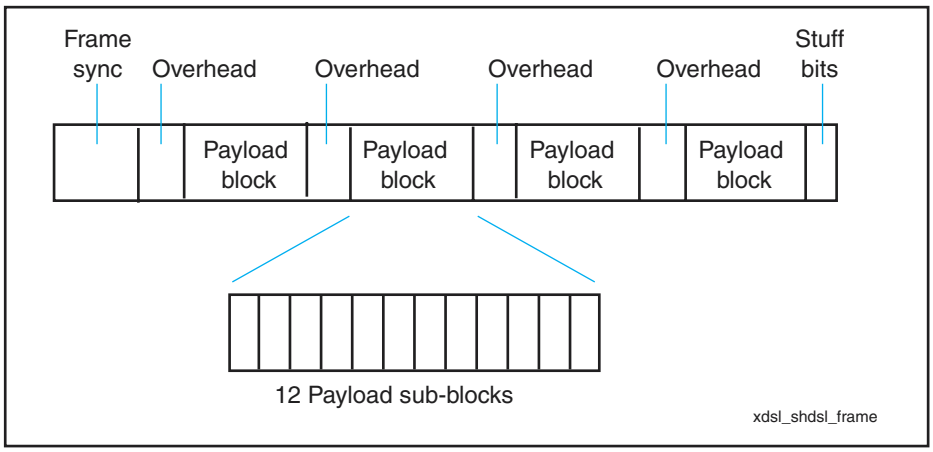
During training, the SHDSL interfaces determine the power of the signals the two ends of the line transmit to each other. At longer distances, both ends transmit at full power. At shorter distances, they reduce the power of the signals they transmit, by 0 to 6dB.

Modulation

SHDSL uses the Trellis Coded Pulse Amplitude Modulation (TC-PAM) format to provide rate adaptive performance over longer links. This format uses a frequency spectrum that makes SHDSL compatible with other DSL traffic, such as ADSL, in the same binder. The shape of the waveforms it transmits allows it to use relatively low power.

SHDSL frames

SHDSL usually operates in synchronous mode, although it can also operate in plesiochronous (near-synchronous) mode. The following figure shows the format of SHDSL frames.



- The **frame synchronisation word (FSW)** beginning each SHDSL frame is used to align frames.
- The **overhead** between the FSW and payload blocks includes bits for the Embedded Operations Channel (EOC) for maintenance, error checking by Cyclic Redundancy Check (CRC), and further synchronisation.
- The four **payload blocks** in an SHDSL frame are used to carry user data. These are each divided into 12 sub-blocks. If the SHDSL interface is operating in a 2-pair mode, the data is interleaved across the 12 sub-blocks on the two cable-pairs.
- The **stuffing bits** at the end of each frame also support synchronisation.

Embedded Operations Channel

STU-Cs and STU-Rs use the Embedded Operations Channel (EOC) channel for line management. When an SHDSL line is activated, the EOC detects and stores on both the STU-C and STU-R the address and location of the STU at the other end of the connection, and of any SHDSL Regenerator Units (SRUs) in between. The STU-C also configures other operational parameters, such as alarm thresholds and signal characteristics on the STU-R and SRUs.

On some SHDSL devices network administrators can send EOC commands to control aspects of the SHDSL line, primarily for diagnostic purposes. On the AR442S SHDSL router, use the **activate shdsl eoccmd** command on page 10-32 and the **deactivate shdsl eoccmd** command on page 10-37.

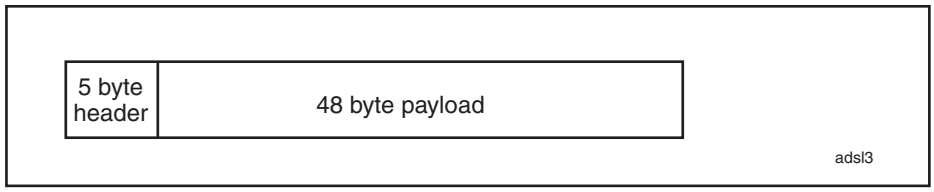
ATM

Asynchronous Transfer Mode (ATM) is a high speed Link Layer (Layer 2) network protocol. ATM can be used to provide access to the physical layer, such as ADSL, for higher layer protocols such as PPP and TCP/IP. ATM is one of the key technologies for enabling broadband on ADSL, and is well suited to such purposes as realtime voice and video.

ATM cells

ATM is transmitted as cells of equal size; each cell has 53 bytes, of which the first 5 bytes are the cell header, and the last 48 bytes are payload.

Figure 10-1: Basic ATM cell structure



ATM channels

A typical ATM network consists of a mesh of ATM switches that switch cells in many directions. To enable the ATM switches to direct cells correctly to their destination, virtual channels are defined through the network. These create– virtual paths through the network to form connections between edge devices.

All the switches along this path have information about this channel, including the direction to the next switch along the channel. When device A sends a cell to device B, it includes in the cell information to identify the virtual channel (VC). The switches recognise this, and forward the cell accordingly. Two parameters define the VC, to enable fast forwarding of cells in the core of the network, and accurate routing at the edge. Effectively, a number of virtual channels that are all going in the same general direction are logically bundled together into a virtual path.

- Virtual Path Identifier (VPI)

  There are fewer Virtual Paths in the network than Virtual Channels. Core switches forward cells on the basis of the VPI, looking the route up quickly in the relatively short list.

- Virtual Channel Identifier (VCI)

  As a cell approaches its destination, switches forward it on the basis of its VCI in order to get it to its own unique destination.

ATM Service Class

Each ATM VC has Quality of Service (QoS) information associated with it. Each switch along the channel can queue, prioritise or drop cells belonging to any particular channel based on the following service categories:

- Constant Bit Rate (**CBR**)

  CBR traffic requires guaranteed levels of service and throughput. The network undertakes to transport the cells of a CBR channel at a specified constant bit rate. This would typically be used for VCs that are carrying delay sensitive applications, such as video and voice, which require a continuous bit stream.

- Variable Bit Rate (**VBR**)

  There are two variable bit rate service categories:

  - Variable Bit Rate–non-real time (**VBR-nrt**) is used by applications that produce traffic of varying bit rates, which produce varying throughput rates, and which are able to tolerate delay (for example, email).
  - Variable Bit Rate–real time (**VBR-rt**) is used by applications that produce traffic of varying bit rates, which produce varying throughput rates, and which are intolerant of delay. The network allows such a VC some leeway in its throughput rate, and undertakes to minimize latency in forwarding its cells.

- Unspecified Bit Rate (**UBR**)

  The UBR service category does not specify traffic related service guarantees. Specifically, UBR does not include a per-connection negotiated bandwidth. The network makes no numerical commitments about the cell loss ratio or the cell transfer delay for cells on a UBR VC.

Table 10-1: Priority of service classes

Priority*	Service Class
1	CBR
2	VBR-RT
3	VBR-NRT
6	UBR

* Priority 1 is the highest priority; priority 6 is the lowest.

The priority of the channel determines who is given bandwidth first. (Priority 1 channels have the highest priority, and priority 6 the lowest.) When assigning channel numbers (and therefore booking order), be aware of the inherent priority of the service classes.

For some of the service categories, other parameters also need to be specified:

- Peak Cell Rate (**PCR**) is the maximum transfer rate that the VC is permitted to transmit.
- Minimal Cell Rate (**MCR**) is the minimal transfer rate that the network guarantees to provide for the VC.
- Sustainable Cell Rate (**SCR**) is the mean transfer rate that the network guarantees to provide for the VC.
- Maximum Burst Size (**MBS**) is a how many cells may be sent at the Peak Cell Rate for the VC. This is used to calculate the Burst Tolerance for the connection.

Set these parameters for an ATM channel when you create it, using the **add atm channel** command on page 10-34, or later, using the **set atm channel** command on page 10-53.

ATM Call Admission Control (CAC)

Call Admission Control (CAC) stops oversubscription of bandwidth for an ATM interface and can prevent QOS service contract violations.

ATM CAC is available on the AR442S router only.

Without CAC, the router uses bandwidth on a link in the priority order of their service classes. Table 10-1 on page 10-12 shows the standard priority scheduling of service classes. The ATM channels with higher priority (for example, CBR) use the available bandwidth before channels with lower priority (for example UBR).

With CAC, the router books bandwidth for ATM channels in the order of their channel numbers. For example, it books bandwidth for ATM channel 1 first, then channel 2, then channel 3 and so on. If there is not enough bandwidth available for a channel, then the router does not book any bandwidth for it, the channel stays down, and the router tries to allocate bandwidth for the following channel. The channels that are booked use the available bandwidth according to their service class priority. So when you create ATM channels that will be controlled by CAC, you may want to give the higher priority channels lower channel numbers.

CAC books or rebooks all the channels on an ATM interface when:

- the ATM instance comes up, if CAC is already enabled
- CAC is enabled, if the ATM instance is already up
- the available bandwidth changes because of line conditions

Enabling CAC

To apply CAC to an ATM interface, use the command:

```
enable atm=0..9 CAC
```

To disable CAC on the interface, use the command:

```
disable atm=0..9 CAC
```

UBR allocation

ATM channels with service class UBR have the lowest priority of all the service classes. How CAC books UBR channels depends on how you specify Peak Cell Rates (PCR):

- If you specify a PCR, CAC books the channel the bandwidth specified by the PCR.
- If you do not specify a PCR, by default CAC books the channel 32 kbps, for the purpose of calculating whether there is enough bandwidth for the channel to come up, and for calculating how much bandwidth is left to book further channels. These UBR channels then use as much bandwidth as is available, which may be more than the 32 kbps booked, up to the maximum bandwidth for the link. If there are two or more of these channels, they use equal shares of the available bandwidth.
- If you specify a PCR for some UBR channels, and not for others, CAC books them as above. Then they use the available bandwidth according to the ratio of PCRs. When it comes to using the bandwidth, those with no PCR specified are counted as having a PCR of maximum bandwidth. For example, if three UBR channels have PCRs: 100, 200 and unspecified on a 400 Mbps link, then CAC books them at: 100, 200 and 32 kbps, and they use all available bandwidth in the ratio 1:2:4.

The default setting for CAC UBR allocation of 32 kbps suits most situations. To change it, use the command:

```
set atm=0..9 ubrallocation=32..8192
```

Overbooking

By default, CAC books 100% of the available bandwidth on an interface. This default (100) suits most situations. You can change this setting to force CAC to book more than the currently available bandwidth; this is called overbooking. In some cases, overbooking may give statistically higher performance for VBR channels, because they can use all idle ATM cells for a link; it is unlikely to give higher performance for CBR or UBR channels, because they do not use such idle cells.

Caution Only use overbooking if you are certain of its effects. Overbooking inappropriately can violate QoS contracts for all channels on an ATM interface.

To force CAC to book more than the available bandwidth on a link, set the percentage booking by using the command:

```
set atm=0..9 overbooking=1..1000
```

For example, to book 1.1 Mbps on a 1 Mbps link (110%), set **overbooking** to **110** using the command:

```
set atm=0 overbooking=110
```

Example: Simple CBR and UBR

The following table shows a simple example of bandwidth allocation for two CBR and two UBR channels on a 1.5 Mbps link with CAC enabled or disabled.

ATM channel	Service class	PCR	Bandwidth used with CAC disabled	Bandwidth booked with CAC enabled	Bandwidth used with CAC enabled
1	CBR	500	500	500	500
2	CBR	500	500	500	500
3	UBR	default	250	500	500
4	UBR	default	250	0	0

Example: UBR bandwidth sharing

The following table shows an example of bandwidth allocation for four UBR channels sharing bandwidth on a 1.2 Mbps link with CAC enabled or disabled. Two of the channels have a Peak Cell Rate (PCR) specified, and two have a default PCR, which is the maximum bandwidth for the link.

ATM channel	Service class	PCR	Bandwidth used with CAC disabled	Bandwidth booked with CAC enabled	Bandwidth used with CAC enabled
1	UBR	500	176	500	176
2	UBR	500	176	500	176
3	UBR	default: max bandwidth: 1200	423	32	423
4	UBR	default: max bandwidth: 1200	423	32	423

Example: CBR, VBR, UBR

The following table shows a complex example of bandwidth allocation for five channels with different service classes on a 782 kbps link with CAC enabled or disabled.

ATM on the router uses a very simple booking algorithm to determine the effective bandwidth of VBR channels:

```
SCR+(PCR-SCR)/2
```

This allows for bursty traffic while getting better efficiency than allocation bandwidth using the PCR parameter.

With CAC enabled, ATM channel 4 is not booked because there is not enough bandwidth for it—it stays down.

ATM channel	Service class	PCR/SCR/ UBRallocation	Bandwidth used with CAC disabled	Bandwidth booked with CAC enabled	Bandwidth used with CAC enabled
1	UBR	PCR: default UBRallocation: 32	0-65*	32	0-82*
2	CBR	PCR: 500	500	500	500
3	VBR	PCR: 200 SCR: 100	100-181*	150	100-182*
4	UBR	PCR: 200	0-16*	down	down
5	CBR	PCR: 100	100	100	100

* If the VBR channel gets a burst of traffic, it uses more bandwidth, and the UBR channels get less.

Typical settings for ATM over ADSL and SHDSL

ATM over ADSL

Most ATM-over-ADSL service providers set all their subscribers to use the service class (traffic type) UBR, and exactly the same VPI and VCI values as the rest of the country. The service provider can configure the DSLAM to change the VCI values in the cells as they go through to give a different VCI value to each subscriber's cells, based on the port through which the cells entered the DSLAM. This simplifies the configuration for the subscribers, who configure their ADSL routers with the same VCI and VPI values as everybody else in the country. On AR440S and AR441S routers, the **country** parameter sets default VCI, VPI and encapsulation values that will work for most service providers in the country (**set system country** command on page 10-59). Otherwise they must supply the appropriate values for these parameters to their subscribers.

ATM over SHDSL

For ATM over SHDSL, the service class, encapsulation, VPI and VCI values may vary from service provider to service provider within a country. For the AR442S router, if the default ATM settings for the country are not suitable for a particular service provider, users must enter the correct values they are given by the service provider.

Data Layers above ATM

ATM Application Layer 5 (AAL5) splits higher layer packets up and puts them into ATM cells for transmission, adding padding as necessary to form good ATM cells. At the receiving end of the link, it extracts the data from cells received, and passes them up to the higher layer.

Implementations of ATM commonly use one of the definitions in RFC 1483 for encapsulating different protocols in ATM cells, so that the receiving end can correctly identify the protocol:

- Virtual Channel Multiplexing (**VCMux**): Using this method, multiple VCs are created on an ADSL link, and a different protocol can be sent over each VC. Then, the receiver knows that all the packets arriving on a particular VC belong to a particular protocol. Because the AAL5 frame contains information about which protocol it is carrying, more bandwidth is available for data.
- **LLC/SNAP** encapsulation: In this method, only one VC is used. Extra headers are put into the front of data packets before they are passed to the AAL5 process to be cut up into ATM cells. The main purpose of these headers is to hold a field that specifies the protocol type of the enclosed data packet. RFC 1483 also defines two different types of LLC/SNAP headers: 'RFC 1483 Routed' and 'RFC 1483 Bridged'. Because the AAL5 frames contain information about the protocol they are carrying, they are larger, and may provide slightly lower performance. This encapsulation is useful if more than one protocol, for example IP, PPP and ARP, are to be carried over a single channel.

On this router, the default encapsulation depends on the country setting (**set system country** command on page 10-59), and you can change it using the **set atm channel** command on page 10-53.

Connection Types Used over ATM

The DSLAM to which an ADSL modem connects may have either an ATM uplink port to an established ATM based network, or an Ethernet uplink port to connect to an Ethernet-based ADSL network. The following table shows how protocols can be combined and sent over AAL5 over ATM to suit different network architecture.

Type	Description
PPPoA	The logical choice for enabling individual clients to gain internet access over an ATM-based network. The PPP layer is introduced in order to make use of the already very popular features of PPP, such as authentication, link monitoring, IP address assignment, DNS address assignment. The exact format of the RFC 1483 header put onto the PPP packets is defined in RFC 2364.
PPPoE	The logical choice for enabling individual clients to gain internet access over an Ethernet-based network (but it is sometimes used over ATM-based networks). As with PPPoA, it gets all the advantages of PPP, but at the cost of some extra packet overhead. The PPPoE packets are encapsulated using the RFC 1483 Bridged method.

Type	Description
IPoA	Designed in an attempt to make IP subnets map directly onto ATM networks in the same way that IP subnets map onto VLANs. So, an ATM address resolution protocol was introduced that enabled the IP stack to obtain the IP address for another IP host connected to its local ATM subnet (RFC 2225). The structure required to make this kind of network operate is rather complex, mostly because trying to make a channel-oriented transport like ATM appear like a broadcast domain is not a very natural fit.
RFC 1483 Bridged	The whole Ethernet packet that arrives on the Ethernet side of the ADSL or SHDSL modem is encapsulated into AAL5 using the 'bridged-data' format defined in RFC 1483, and sent on the ADSL or SHDSL line. The modem forwards packets based on their MAC addresses, that is, it bridges the packets. (See also the definition in "RFC 1483 Multiprotocol Encapsulation".)
RFC 1483 Routed	Only the Layer 3 protocol frame is encapsulated with an RFC 1483 header in the AAL5 frame. The modem forwards packets based on their IP addresses; that is, it routes the packets. (See also the definition in "RFC 1483 Multiprotocol Encapsulation".)

RFC 1483 Multiprotocol Encapsulation

As mentioned at the beginning of this section, *RFC 1483* defines two basic encapsulations for carrying multiple protocols across an ATM network:

- VC Based Multiplexing
- LLC Encapsulation

VC Based Multiplexing

Using this method each higher level protocol is assigned a separate ATM virtual circuit (VC). This enables the router to identify which protocol each packet carries by reference to its VC number.

LLC Encapsulation

Using this method all protocols share the same ATM virtual circuit. The router identifies each protocol from fields within the AAL5 payload portion of the frame.

Interpretations of RFC 1483 Bridging and Routing

The terms Routed and Bridged as used in *RFC 1483* can be interpreted in different ways. An understanding of these interpretations will make it easier to find an ATM configuration that matches your requirements.

RFC 1483 defines formats for encapsulating protocols that are 'bridged', and protocols that are 'routed'. The routed format encapsulates the layer-3 information directly within a specific *RFC 1483* (LLC) header; whereas the bridged format also prepends a protocol specific field before encapsulating the layer-3 information within an *RFC 1483* (LLC) header.

"RFC 1483 Routed": Example

In this example, an AR440S router is configured for routing over an ATM/ADSL connection that is using *RFC 1483 routed* encapsulation. Its IP address is directly configured onto the ATM channel, using commands sequences such as:

```
enable adsl=0

create atm=0 over=adsl0

add atm=0 channel=1

enable ip

add ip interface=atm0.1 ipaddress=<address>
   mask=<subnetmask>

add ip route=0.0.0.0 int=atm0.1...next hop...
```

"IP Routed over RFC 1483 Bridged": Example

In this example an AR440S router is configured for routing over an ATM/ADSL connection that is using *RFC 1483 bridged* encapsulation. An IP address is configured over a virtual Ethernet interface on the subscriber's ADSL port. This virtual ethernet interface informs the router to perform *RFC 1483 bridged* encapsulation as the frames are passed to the ATM layer.

```
enable adsl=0

create atm=0 over=adsl0

add atm=0 channel=1

create eth=0 over=atm0.1

enable ip

add ip interface=eth0 ipaddress=<address>
   mask=<subnet-mask>

add ip route=0.0.0.0 int=eth0...next hop...
```

"RFC 1483 Bridged": Example

This example shows bridging over an ATM/ADSL connection that is using RFC 1483 *bridged* encapsulation. The virtual eth port is not explicitly configured because when an ATM channel is configured as a bridge port, the router automatically uses *RFC 1483* bridged encapsulation on that interface.

```
ena adsl=0

create atm=0 over adsl0

add atm channel=1

ena bridge

add bridge port=1 int=vlan1

add bridge port=2 int=atm0.1

add bridge prot=ip type=0800

add bridge prot=arp type=0806
```

Support on the Router

ADSL The AR440S ADSL router supports ADSL Annex A for connection to a POTS line. The AR441S ADSL router supports ADSL Annex B for connection to an ISDN line. The routers can be configured to use Frequency Division Multiplexing or Echo Cancellation. When an ADSL port is disabled or powered down, it sends a last **Dying Gasp** signal to indicate to the DSLAM that it is shutting down.

SHDSL The AR442S SHDSL router supports SHDSL variants ITU-T Recommendation G.991.2 Annex A (for 26AWG) and Annex B (for 0.4mm wire gauge), with or without an Access Network Frequency Plan (ANFP) PSD mask.

ATM The routers support ATM permanent virtual channels (PVCs), AAL5, and a number of higher layer protocols that can be configured over ATM and ADSL or SHDSL on the router as shown in Figure 10-2, and described in *"Connection Types Used over ATM" on page 10-16*:

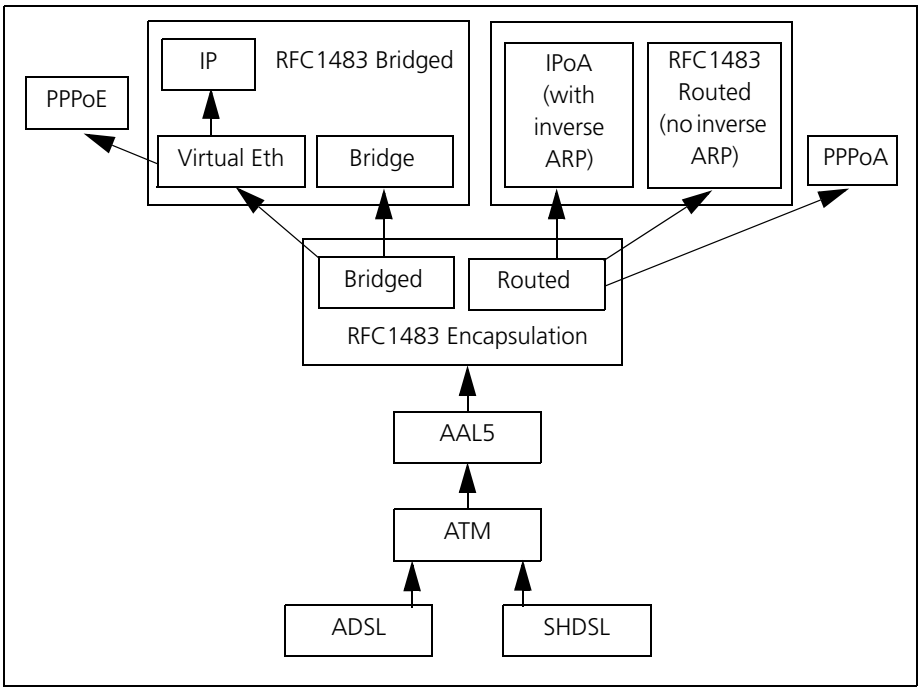
- PPPoE
- PPPoA
- IPoA
- RFC 1483 Routed*
- RFC 1483 Bridged*

* As defined in "RFC 1483 Multiprotocol Encapsulation" on page 10-17.

The router supports the following service categories:

- Unspecified Bit Rate (**UBR**).
- Constant Bit Rate (**CBR**).
- Variable Bit Rate (**VBR-rt** and **VBR-nrt**). Of the two Cell Loss Priority algorithms that can be used for VBR, the router supports Type 1.

Figure 10-2: Protocols configured over ATM and ADSL



Virtual ETH interfaces

You can create a virtual ETH interfaces in order to add an Ethernet header to packets before bridging the resulting Ethernet frames over a lower layer interface, such as an ATM channel over an ADSL or SHDSL port. Virtual ETH interfaces must not use an ETH instance number that is used by any of the physical ETH interfaces on the router.

Configuration Procedures and Examples

This section gives step by step procedures and simple configuration examples for configuring ATM over an ADSL port or an SHDSL port in CPE mode on the router.

- "Configure PPPoE over ATM" on page 10-21
- "Configure PPP over ATM (PPPoA)" on page 10-24
- "Configure IP over ATM (IPoA)" on page 10-27
- "Configure ATM RFC 1483 Routed" on page 10-29

Before you configure

Before you configure, you need the following information from your network service provider:

- VPI (Virtual Path Identifier) and VCI (Virtual Circuit Identifier)
- encapsulation mode—VCMUX (Virtual Circuit Multiplex) or LLCSNAP (also called AAL5SNAP)
- access method, for example PPPoA, PPPoE, or IPoA
- username and password, if using PPP
- IP address assignment method—dynamic or static, if using PPP

Configure PPPoE over ATM

Procedure

To configure PPPoE over ATM over ADSL or SHDSL, use the steps in the following table.

Step	Commands	Description
1	**set system country**={australia|austria|belgium|canada|denmark|eire|finland|france|germany|iceland|italy|netherlands|newzealand|norway|portugal|singapore|spain|switzerland|sweden|turkey|uae|uk|usa|none}	Set the country your router connects in, or omit this command to leave it at the default, **none**. The **country** setting determines default values for ATM channel parameters (**vpi**, **vci**, **encapsulation**).
2	**set adsl**=*interface* [autoretrain={on|off}] [standard={automatic|t1.413|g.dmt|g.lite}] **enable adsl**={*interface*|all} **set shdsl**=*interface* [mode={cpe|co}] [pairmode={1pair|2pairenhanced|2pairstandard}] [standard={annexa|annexb|both|annexbanfp|bothanfp}] [psdmask={symmetric|asymetric}] [autoretrain={on|off}] [bitratemode=adaptive|fixed] [minbitrate=72..4624] [maxbitrate=72..4624] [attenuationthreshold=0..31] [snrmarginthreshold=0..15] **enable shdsl**={*interface*}	Configure and enable ADSL or SHDSL. The default settings for ADSL and SHDSL allow it to automatically detect the ADSL or SHDSL standard to use, and to automatically retrain to make best use of the available bandwidth. Use the **set adsl** or **set shdsl** commands if you need to change from the default settings. For SHDSL, the **pairmode** setting must be the same at both ends of the SHDSL link. For **4wire** (**2pair**) mode, we also recommend setting the **maxbitrate** to the same value at both ends.
3	**create atm**=0..9 over=*phys-interface*	Create an ATM instance to run over the ADSL or SHDSL interface. You can only configure one ATM instance on an ADSL or SHDSL interface.
4	**add atm channel** add atm=0..9 channel=1..30 [serviceclass=ubr] [description=*description*] [pcr=32..155000] [encapsulation={aal5snap|llc|vcmux}][vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass=cbr pcr=32..155000 [description=*description*] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass={vbrnrt|vbrrt} pcr=32..155000 scr=32..155000 mbs=2..10000 [description=*description*] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023]	Add an ATM channel to the ATM instance. Change the defaults for the ATM channel if necessary.
5	**create eth**=0..7 over=*interface*	Create a virtual Ethernet interface to encapsulate traffic over the ATM channel in Ethernet frames.

Step	Commands	Description
6	**create ppp**=*ppp-interface* over=*physical-interface* [iprequest={on|off}] [username=*username*] password=*password*] [*other-ppp-parameters*]	Create a PPP interface over the virtual Ethernet interface.Set PPP parameters as required. For instance: To allow the IP address for the PPP link to be dynamically allocated, set **iprequest** to **on**. Set the **username** and **password** for that will be used to respond to authentication requests.
7	**enable ip** **add ip interface**=*interface* ipaddress={*ipadd*|dhcp} [*other-ip-parameters*]	Enable IP, and assign an IP address to the PPP interface, or set it to accept a dynamically allocated IP address. Then continue with other configuration as required ("After configuring ATM" on page 10-30).

Example The following figure shows a simple script for configuring PPPoE over ATM over ADSL. Modify it to suit your ATM network requirements, or to run over SHDSL.

```
# PPPoE over ATM over xDSL

# Enable the ADSL or SHDSL port.
enable adsl=0

# Set the country for ATM default parameters.
set system country=italy

# Create an ATM instance and channel over the ADSL port.
create atm=0 over=adsl0
add atm=0 channel=1

# Create a virtual Ethernet interface over the ATM channel.
create eth=2 over=atm0.1

# Create a PPP interface over the virtual Eth interface, and
# set it to accept a dynamically allocated IP address.
cre ppp=0 over=eth2-any bap=off iprequest=on user="myname" pass="mypassword" lqr=off

# Enable IP and add an IP interface with remote IP address
# assignment to the PPP interface.
enable ip
enable ip remote
add ip interface=ppp0 ipaddress=0.0.0.0

# Add a local IP address to the default VLAN.
add ip interface=vlan1 ipaddress=192.168.1.1

# Add a default IP route to the PPP interface.
add ip route=0.0.0.0 interface=ppp0 next=0.0.0.0
```

Configure PPP over ATM (PPPoA)

Procedure

To configure PPPoE over ATM (PPPoA) over ADSL or SHDSL, use the steps in the following table.

Step	Commands	Description
1	**set system country**={australia|austria|belgium|canada|denmark|eire|finland|france|germany|iceland|italy|netherlands|newzealand|norway|portugal|singapore|spain|switzerland|sweden|turkey|uae|uk|usa|none}	Set the country your router connects in, or omit this command to leave it at the default, **none**. The **country** setting determines default values for ATM channel parameters (**vpi**, **vci**, **encapsulation**).
2	**set adsl**=*interface* [autoretrain={on|off}] [standard={automatic|t1.413|g.dmt|g.lite}] **enable adsl**={*interface*|all} **set shdsl**=*interface* [mode={cpe|co}] [pairmode={1pair|2pairenhanced|2pairstandard}] [standard={annexa|annexb|both|annexbanfp|bothanfp}] [psdmask={symmetric|asymetric}] [autoretrain={on|off}] [bitratemode=adaptive|fixed] [minbitrate=72..4624] [maxbitrate=72..4624] [attenuationthreshold=0..31] [snrmarginthreshold=0..15] **enable shdsl**={*interface*}	Configure and enable ADSL or SHDSL. The default settings for ADSL and SHDSL allow it to automatically detect the ADSL or SHDSL standard to use, and to automatically retrain to make best use of the available bandwidth. Use the **set adsl** or **set shdsl** command if you need to change from the default settings. For SHDSL, the **pairmode** setting must be the same at both ends of the SHDSL link. For **4wire** (**2pair**) mode, we also recommend setting the **maxbitrate** to the same value at both ends.
3	**create atm**=0..9 over=*phys-interface*	Create an ATM instance to run over the ADSL or SHDSL interface. You can only configure one ATM instance on an ADSL or SHDSL interface.
4	**add atm channel** add atm=0..9 channel=1..30 [serviceclass=ubr] [description=*description*] [pcr=32..155000] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass=cbr pcr=32..155000 [description=*description*] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass={vbrnrt|vbrrt} pcr=32..155000 scr=32..155000 mbs=2..10000 [description=*description*] [encapsulation={aal5snap|llc|vcmux} [vpi=0..255 vci=32..1023]	Add an ATM channel to the ATM instance. Change the defaults for the ATM channel if necessary.

Step	Commands	Description
5	**create ppp**=*ppp-interface* over=*physical-interface* [iprequest={on|off}] [username=*username*] password=*password*] [*other-ppp-parameters*]	Create a PPP interface over the ATM channel. Set PPP parameters as required. For instance: To allow the IP address for the PPP link to be dynamically allocated, set **iprequest** to **on**. Set the **username** and **password** for that will be used to respond to authentication requests.
6	**enable ip** **add ip interface**=*interface* ipaddress={*ipadd*|dhcp} [*other-ip-parameters*]	Enable IP, and assign an IP address to the PPP interface, or set it to accept a dynamically allocated IP address. Then continue with other configuration as required ("After configuring ATM" on page 10-30).

Examples

The following figure shows a simple script for configuring PPP over ATM over ADSL. Modify it to suit your ATM network requirements, or to run over SHDSL.

```
# PPP over ATM over xDSL

# Enable the ADSL or SHDSL port.
enable adsl=0

# Set the country for ATM default parameters.
set system country=italy

# Create an ATM instance and channel over the ADSL port.
create atm=0 over=adsl0
add atm=0 channel=1

# Create a PPP interface over ATM channel, and set it to
# accept a dynamically allocated IP address.
cre ppp=0 over=atm0.1  bap=off iprequest=on user="myname" pass="mypassword" lqr=off

# Enable IP and add an IP interface with remote IP address assignment to the PPP
# interface.
enable ip
enable ip remote
add ip interface=ppp0 ipaddress=0.0.0.0

# Add a local IP address to the default VLAN.
add ip interface=vlan1 ipaddress=192.168.1.1

# Add a default IP route to the PPP interface.
add ip route=0.0.0.0 interface=ppp0 next=0.0.0.0
```

The following figure shows a simple script for configuring PPP over ATM over SHDSL for two AR442S routers with their SHDSL ports connected to each other (back-to-back). Modify it to suit your ATM network requirements.

```
# PPP over ATM over SHDSL

# On one of the two routers, set the SHDSL port to CO (central office) mode; on the
# other, leave the SHDSL port in the default CPE (customer premises equipment) mode.
set shdsl=0 mode=co

# Enable the SHDSL port.
enable shdsl=0

# Set the country for ATM default parameters.
set system country=italy

# Create an ATM instance and channel over the ADSL port.
create atm=0 over=adsl0
add atm=0 channel=1

# Create a PPP interface over the atm channel
create ppp=0 over=atm0.1

# Enable IP and add an IP interface to the PPP interface.
enable ip
add ip interface=ppp0 ipaddress=10.10.10.1

# Add a local IP address to the default VLAN.
add ip interface=vlan1 ipaddress=192.168.1.1

# Add a default IP route to the PPP interface.
add ip route=0.0.0.0 int=ppp0 next=10.10.10.2
```

Configure IP over ATM (IPoA)

Procedure

To configure IP over ATM (IPoA) over ADSL or SHDSL, use the steps in the following table.

Step	Command	Description
1	**set system country**={australia|austria|belgium|canada|denmark|eire|finland|france|germany|iceland|italy|netherlands|newzealand|norway|portugal|singapore|spain|switzerland|sweden|turkey|uae|uk|usa|none}	Set the country your router connects in, or omit this command to leave it at the default, **none**. The **country** setting determines default values for ATM channel parameters (**vpi**, **vci**, **encapsulation**).
2	**set adsl**=*interface* [autoretrain={on|off}] [standard={automatic|t1.413|g.dmt|g.lite}] **enable adsl**={*interface*|all} **set shdsl**=*interface* [mode={cpe|co}] [pairmode={1pair|2pairestandard|2pairenhanced] [standard={annexa|annexb|both|annexbanfp|bothanfp}] [psdmask={symmetric|asymetric}] [autoretrain={on|off}] [bitratemode=adaptive|fixed] [minbitrate=72..4624] [maxbitrate=72..4624] [attenuationthreshold=0..31] [snrmarginthreshold=0..15] **enable shdsl**={*interface*}	Configure and enable ADSL or SHDSL. The default settings for ADSL and SHDSL allow it to automatically detect the ADSL or SHDSL standard to use, and to automatically retrain to make best use of the available bandwidth. Use the **set adsl** or **set shdsl** command if you need to change from the default settings. For SHDSL, the **pairmode** setting must be the same at both ends of the SHDSL link. For **4wire** (**2pair**) mode, we also recommend setting the **maxbitrate** to the same value at both ends.
3	**create atm**=0..9 over=*phys-interface*	Create an ATM instance to run over the ADSL or SHDSL interface. You can only configure one ATM instance on an ADSL or SHDSL interface.
4	**add atm channel** add atm=0..9 channel=1..30 [serviceclass=ubr] [description=*description*] [pcr=32..155000] [encapsulation={aal5snap|llc|vcmux}][vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass=cbr pcr=32..155000 [description=*description*] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass={vbrnrt|vbrrt} pcr=32..155000 scr=32..155000 mbs=2..10000 [description=*description*] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023]	Add an ATM channel to the ATM instance.

Step	Command	Description
5	**enable ip** **add ip interface**=*interface* ipaddress={*ipadd*|dhcp} inversearp=on [*other-ip-parameters*]	Enable IP, assign a static IP address to the ATM channel, and enable Inverse ARP on the IP interface. Then continue with other configuration as required ("After configuring ATM" on page 10-30).

Example

The following figure shows a simple script for configuring IP over ATM over ADSL (IPoA). Modify it to suit your ATM network requirements, or to run over SHDSL.

```
# IP over ATM over xDSL

# Enable the ADSL or SHDSL port.
enable adsl=0

# Set the country for ATM default parameters.
set system country=denmark

# Create an ATM instance and channel over the ADSL port.
create atm=0 over=adsl0
add atm=0 channel=1

# Enable IP and add an IP interface with inverse ARP enabled
# to the ATM channel.
enable ip
add ip interface=atm0.1 ipaddress=203.36.10.12 inversearp=on

# Add a local IP address to the default VLAN.
add ip interface=vlan1 ipaddress=192.168.1.1

# Add a default IP route to the ATM channel.
add ip route=0.0.0.0 interface=atm0.1 next=203.36.10.24
```

Configure ATM RFC 1483 Routed

Procedure

Table 10-2: RFC 1483 Routed ATM over xDSL configuration procedure

Step	Command	Description
1	**set system country**={australia|austria|belgium|canada|denmark|eire|finland|france|germany|iceland|italy|netherlands|newzealand|norway|portugal|singapore|spain|switzerland|sweden|turkey|uae|uk|usa|none}	Set the country your router connects in, or omit this command to leave it at the default, **none**. The **country** setting determines default values for ATM channel parameters (**vpi**, **vci**, **encapsulation**).
2	**set adsl**=*interface* [autoretrain={on|off}] [standard={automatic|t1.413|g.dmt|g.lite}] **enable adsl**={*interface*|all} **set shdsl**=*interface* [mode={cpe|co}] [pairmode={1pair|2pair|2pairstandard|2pairenhanced}] [standard={annexa|annexb|both|annexbanfp|bothanfp}] [psdmask={symmetric|asymetric}] [autoretrain={on|off}] [bitratemode=adaptive|fixed] [minbitrate=72..4624] [maxbitrate=72..4624] [attenuationthreshold=0..31] [snrmarginthreshold=0..15] **enable shdsl**={*interface*}	Configure and enable ADSL or SHDSL. The default settings for ADSL and SHDSL allow it to automatically detect the ADSL or SHDSL standard to use, and to automatically retrain to make best use of the available bandwidth. Use the **set adsl** or **set shdsl** command if you need to change from the default settings. For SHDSL, the **pairmode** setting must be the same at both ends of the SHDSL link. For **4wire** (**2pair**) mode, we also recommend setting the **maxbitrate** to the same value at both ends.
3	**create atm**=0..9 over=*phys-interface*	Create an ATM instance to run over the ADSL or SHDSL interface. You can only configure one ATM instance on an ADSL or SHDSL interface.
4	**add atm channel** add atm=0..9 channel=1..30 [serviceclass=ubr] [description=*description*] [pcr=32..155000] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass=cbr pcr=32..155000 [description=*description*] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023] add atm=0..9 channel=1..30 serviceclass={vbrnrt|vbrrt} pcr=32..155000 scr=32..155000 mbs=2..10000 [description=*description*] [encapsulation={aal5snap|llc|vcmux}] [vpi=0..255 vci=32..1023]	Add an ATM channel to the ATM instance.

Table 10-2: RFC 1483 Routed ATM over xDSL configuration procedure (cont.)

Step	Command	Description
5	**enable ip** **add ip interface**=*interface* ipaddress={*ipadd*|dhcp} [*other-ip-parameters*]	Enable IP and assign an IP address to the ATM virtual channel interface. Then continue with other configuration as required ("After configuring ATM" on page 10-30).

Example The following figure shows a simple script for configuring RFC 1483 Routed ATM over ADSL with DHCP. Modify it to suit your ATM network requirements, or to run over SHDSL.

Figure 10-3: RFC 1483 Routed ATM over ADSL with DHCP configuration example

```
# RFC 1483 Routed ATM over xDSL

# Enable the ADSL or SHDSL port.
enable adsl=0

# Set the country for ATM default parameters.
set system country=denmark

# Create an ATM instance and channel over the ADSL port.
create atm=0 over=adsl0
add atm=0 channel=1

# Enable IP and add an IP interface with DHCP assigned IP
# address to the ATM interface.
enable ip
enable ip remote
add ip interface=atm0.1 ipaddress=192.168.2.1

# Add a local IP address to the default VLAN.
add ip interface=vlan1 ipaddress=192.168.1.1
```

After configuring ATM

Once you have configured ATM over xDSL, you may need to configure other aspects of the router, for instance:

- PPP backup link on ISDN (see Chapter 11, Integrated Services Digital Network (ISDN), Chapter 15, Point-to-Point Protocol (PPP))
- Switch ports and VLANs (see Chapter 8, Switching)
- IP routes, local VLAN IP addresses, and DNS Relay (see Chapter 22, Internet Protocol (IP))
- IP Security for a Virtual Private Network (VPN) (see Chapter 48, IP Security (IPsec))
- Firewall and Network Address Translation (NAT) (see Chapter 46, Firewall)
- SNMP Community (see Chapter 55, Simple Network Management Protocol (SNMP))
- DHCP server for local VLANs (see Chapter 23, Dynamic Host Configuration Protocol (DHCP))

Command Reference

This section describes the commands available for configuring and monitoring ADSL, SHDSL and ATM on the router.

The shortest valid command is denoted by capital letters in the Syntax section. See "Conventions" on page lxv of About this Software Reference for additional conventions used to describe command syntax. See Appendix A, Messages for a complete list of messages and meanings.

activate atm channel oamfunction

Syntax

```
ACTivate ATM=instance CHANnel=channel OAMfunction=LOopback
   TYpe=[F4Ete|F4Seg|F5Ete|F5Seg]
```

Description

This command activates or initiates an OAM (operation and maintenance) function.

Parameter	Description	
ATM	The ATM instance to use for OAM, in the range 0 to 9.	
CHANnel	The virtual channel to use for OAM, in the range 1 to 30.	
OAMfunction	The OAM function to activate.	
	LOopback	Loopback is normally considered to be the ATM equivalent of PING and is sometimes called "ATM ping".
TYpe	The maintenance plane for the loopback.	
	F4Ete	F4 (path) end to end loopback: cells travel to the end of the path, then loopback to the originator.
	F4Seg	F4 (path) segment loopback: cells travel to the end of the closest path segment, usually the next connection point for the ATM network, then loopback to the originator.
	F5Ete	F5 (channel) end to end loopback: cells travel to the end of the channel, then loopback to the originator.
	F5Seg	F5 (channel) segment loopback: cells travel to the end of the closest channel segment, usually the next connection point for the ATM network, then loopback to the originator.

Examples

To loopback a cell at the end of the channel, use the command:

```
act atm=0 chan=1 oam=lo ty=f5e
```

Related Commands

delete atm channel
disable atm channel
enable atm channel
set atm channel
show atm channel

activate shdsl eoccmd

Syntax

```
ACTivate SHDsl=interface
   EOCcmd={LOOPback|SOFTrestart|MAPping}
   DEStination={1..A|F|ALL|CO|CPE}
   [LOOPbacktype={CUSTomer|NETwork|BOTH}]
   [TIMEOut={NONE|1..4095}]
```

Description This command sends an EOC command to one or more SHDSL connection points on the line.

Parameter	Description	
SHDsl	The number of the SHDSL interface to send the command from.	
EOCcmd	The EOC command to send.	
	LOOPback	The router instructs units on the line to enter the loopback mode determined by the **loopbacktype** parameter. If you specify **loopback**, you must also specify the **loopbacktype** and **timeout** parameters. If the **destination** is **all**, the SHDSL interface sends a system loopback message (G.991.2 section 9.5.5.7.18); otherwise it sends an element loopback message (G.991.2 section 9.5.5.7.19).
	SOFTRestart	The router instructs units on the line to soft restart the SHDSL interface. The receiving units wait 5 seconds before restarting the interface.
	MAPping	The router sends a mapping request to units on the line. The mapping response message sent to the console shows which pair is connected to which DSLAM port.
DEStination	The destination for the EOC command. (The source address is determined by the mode the unit is set to: 1 (CO) or 2 (CPE).)	
	CO, 1	The CO end.
	CPE, 2	The CPE end.
	3..A	Repeaters 1 to 8 on the line, in hexadecimal format (3,4,5,6,7,8,9,10, or A).
	All, F	Broadcast to all units.
LOOPbacktype	The type of loopback to configure. The router cannot loopback in both directions at once. **Caution** If you enable an internal loopback on another device, that is, a customer loopback on a CPE or a network loopback on a CO, then the device cannot receive or transmit on the EOC channel. This means that you cannot deactivate the loopback and must wait for the timeout.	
	CUSTomer	The router instructs the units to configure the loopback towards the customer.
	NETwork	The router instructs the units to configure the loopback towards the network.
	BOTH	The router instructs the units to configure the loopback in both directions.

Parameter	Description	
TIMEOut	The loopback timeout in minutes. Default: 1	
	1..4095	The router sends a loopback timeout message (G.991.2 section 9.5.5.7.6) to the unit(s), instructing it to stay in loopback mode for the specified number of minutes.
	NONE	The loopback mode does not time out. The unit continues to loopback data until it receives another message (**deactivate shdsl eoccmd**).

Examples

To activate a loopback of data towards the customer from the CO for 1 minute, use the command:

```
act shd=0 eoc=loop dest=co loop=cust timeo=1
```

To request a soft restart of the interface at the CO, use the command:

```
act shd=0 eoc=soft dest=co
```

To request mapping information from the CO, use the command:

```
act shd=0 eoc=map dest=co
```

Related Commands

activate shdsl eoccmd
deactivate shdsl eoccmd
enable shdsl debug
enable shdsl bert
show shdsl
show shdsl linedetails
show shdsl counter

add atm channel

Syntax

```
ADD ATM=instance CHANnel=channel [SERViceclass=UBR]
   [PCR=0|32..155000] [DESCription=description]
   [ENCapsulation={AAL5Snap|LLC|VCMux}] [VPI=0..15
   VCI=32..1023]

ADD ATM=0..9 CHANnel=1..30 SERViceclass=CBR PCR=1..155000
   [DESCription=description]
   [ENCapsulation={AAL5Snap|LLC|VCMux}] [VPI=0..15
   VCI=32..1023]

ADD ATM=0..9 CHANnel=1..30 SERViceclass={VBRNrt|VBRRt}
   PCR=1..155000 SCR=1..155000 MBS=2..10000
   [DESCription=description]
   [ENCapsulation={AAL5Snap|LLC|VCMux}] [VPI=0..15
   VCI=32..1023]
```

Description

This command creates an ATM (AAL5) virtual channel for the ATM instance. This channel can be referred to as atm*instance.channel* in other commands, for example, atm0.1 is virtual channel 1 on ATM instance 0.

Parameter	Description	
ATM	The ATM instance to create the virtual channel on, in the range 0 to 9.	
CHANnel	The virtual channel to create, in the range 1 to 30.	
DESCription	Description of the channel for administration, up to 62 characters long. It has no effect on the operation of the channel.	
ENCapsulation	The RFC 1483 encapsulation mode to be used by the instance. Default is determined by the **country** parameter set using the **set system country** command on page 10-59. If the **country** parameter has the default value of **none**, then the default for **encapsulation** is **llc**.	
	LLC, AAL5Snap	Logical Link Control mode; a single virtual channel can be used by different protocols.
	VCMux	Virtual Channel Multiplex mode; each protocol uses a separate virtual channel.
MBS	The Maximum Burst Size for the channel, used to calculate the Burst Tolerance for the channel, in the range 2 to 10000. It is required if **serviceclass** is **vbrrt** or **vbrnrt**; otherwise not valid.	
PCR	The VC Peak Cell Rate in kbps. Valid values are from 32 to Max Tx VC bit rate, as displayed using the **show atm** command on page 10-66, up to a maximum of 155000. Required if **serviceclass** is **cbr, vbrrt** or **vbrnrt** (from service provider contract). Optional if **serviceclass** is **ubr**. Default: maximum channel bandwidth (changes dynamically with the bandwidth) To restore the channel's UBR behaviour after **pcr** has been set, either: • delete the channel and add it with no **pcr** value, • disable the channel and specify **pcr=0** using the **set atm channel** command on page 10-53.	
SCR	The VC Sustainable Cell Rate, in kbps. In the range 32..155000. Required if **serviceclass** is **vbrnrt** or **vbrrt**; otherwise not valid.	

Parameter	Description	
SERViceclass	Specifies the service category for the channel. Default: **ubr**	
	CBR	Constant Bit Rate.
	UBR	Unspecified Bit Rate.
	VBRNrt	Variable Bit Rate non-realtime.
	VBRRt	Variable Bit Rate realtime.
VCI	The Virtual Channel Identification number. In the range 32 to 1023. Default is determined by the **set system country** command on page 10-59. If **country** is **none**, the default is 32.	
VPI	The Virtual Path Identification number. In the range 0 to 15. Default is determined by the **set system country** command on page 10-59. If **country** is **none**, the default is 0.	

Examples

To add virtual channel 1 to ATM instance 0 use the command:

```
add atm=0 chan=1
```

To add virtual channel 1 to ATM instance 0 with a VPI of 1, a VCI of 35, and real-time variable bit rate with Peak Cell Rate of 1Mb and Sustainable Cell Rate of 1Mb, use the command:

```
add atm=0 chan=1 vpi=1 vci=35 serv=vbrr pcr=1000 scr=1000
```

To add virtual channel 20 to ATM instance 0 with a VPI of 15, a VCI of 40, a Virtual Channel Multiplexed encapsulation, an Unspecified Bit Rate (default) with Peak Cell Rate of 10Mb, use the command:

```
add atm=0 chan=20 vpi=15 vci=40 encap=vcm pcr=10000
```

Related Commands

create eth in Chapter 9, Interfaces
delete atm channel
disable atm channel
enable atm channel
set atm channel
set system country
show atm channel

create atm

Syntax `CREate ATM=0..9 OVer=`*`phys-interface`*

Description This command creates an ATM instance running over a physical interface. One ATM instance can be created over an ADSL or SHDSL interface.

Parameter	Description
ATM	The number of the ATM instance to create, in the range 0 to 9. There can only be one ATM instance on a physical interface. (For instance, on the AR440S there can only be one ATM instance over the one ADSL interface.)
OVer	The name of physical interface to create the ATM instance over, formed by concatenating the physical interface type with an interface instance (e.g. adsl0). Valid interface types are ADSL or SHDSL.

Examples To create ATM interface 0 over ADSL interface 0, use the command:

```
cre atm=0 ov=adsl0
```

Related Commands
add atm channel
destroy atm
show atm

deactivate shdsl eoccmd

Syntax

```
DEACTivate SHDsl=interface EOCcmd=LOOPback
   DEStination={1..A|F|ALL|CO|CPE}
   LOOPbacktype={CUSTomer|NETwork|BOTH}
```

Description

This command sends an EOC command on the specified SHDSL interface to one or more connection points attached to the line to terminate loopback mode.

Parameter	Description	
SHDsl	The number of the SHDSL interface to send the command from.	
EOCcmd	The EOC command to send:	
	LOOPback	Instructs units on the line to exit a loopback determined by the **loopbacktype** parameter. If the **destination** is **all**, the SHDSL interface sends a system loopback message; otherwise it sends an element loopback message (G.991.2 section 9.5.5.7).
DEStination	The destination for the EOC command. (The source address is determined by the mode the unit is set to: 1 (CO) or 2 (CPE).)	
	CO, 1	The Central Office end.
	CPE, 2	The Customer Premises Equipment end.
	3..A	Repeaters 1-8 in on the line, in hexadecimal format (3,4,5,6,7,8,9,10 or A).
	All, F	Broadcast to all units.
LOOPbacktype	The type of loopback to terminate.	
	CUSTomer	Instructs the unit to terminate the loopback towards the customer.
	NETwork	Instructs the unit to terminate the loopback towards the network.
	BOTH	Instructs the unit to terminate the loopback in both directions.

Examples

To stop the loopback in the customer direction at the central office, use the command:

```
deact shd=0 eoc=loop dest=co loop=cust
```

Related Commands

activate shdsl eoccmd

delete atm channel

Syntax `DELete ATM=0..9 CHANnel=1..30`

Description This command deletes an ATM virtual channel from the ATM instance. The instance must exist and is no longer be available after it is deleted. A channel cannot be deleted when a higher layer protocol is attached to it.

Parameter	Description
ATM	The ATM instance the channel is on, in the range 0 to 9.
CHANnel	The virtual channel to delete, in the range 1 to 30.

Examples To delete virtual channel 1 on ATM instance 0, use the command:

```
del atm=0 chan=1
```

Related Commands
add atm channel
disable atm channel
enable atm channel
show atm channel

destroy atm

Syntax `DESTroy ATM=0..9`

Description This command destroys an ATM instance. The instance must already exist. The instance is no longer available for use by routing modules. The ATM instance can only be destroyed if there are no virtual channels present on the instance. Virtual channels can be deleted using the **delete atm channel** command.

The ATM parameter specifies which ATM instance number to destroy, in the range 0 to 9.

Examples To destroy ATM instance 0, use the command:

```
dest atm=0
```

Related Commands
create atm
delete atm channel
set atm channel
show atm

disable adsl

Syntax `DISable ADSL={`*`interface`*`|ALL}`

Description This command disables the specified ADSL interface or all ADSL interfaces. This clears ADSL connections or special test modes (for example, WHIP or loop-backs). No data can be transmitted or received when the interface is disabled. The ADSL interface can be configured when disabled.

The **adsl** parameter specifies which ADSL interface number to disable. If **all** is specified all ADSL interfaces are disabled. By default all ADSL interfaces are enabled.

Examples To disable ADSL interface 0, use the command:

```
dis ads=0
```

Related Commands **enable adsl**
reset adsl
show adsl

disable adsl debug

Syntax `DISable ADSl={`*`interface`*`|ALL} DEBug={TRaining|ALL}`

Description This command disables ADSL interface debugging modes. By default all debug modes are disabled.

Parameter	Description	
ADSl	The number of the ADSL interface to disable debugging for.	
	ALL	Disables debugging on all ADSL interfaces.
DEBug	The debugging mode to disable.	
	ALL	All debug modes.
	TRaining	The training debug mode.

Examples To disable all debugging on ADSL interface 0, use the command:

```
dis ads=0 deb=all
```

Related Commands **enable adsl debug**
show adsl

disable atm cac

Syntax `DISable ATM=0..9 CAC`

Description This command disables ATM Call Admission Control (CAC) on the specified ATM instance. By default CAC is disabled on an instance.

Examples To disable call admission control for ATM instance 0, use the command:

```
dis atm=0 cac
```

Related Commands **enable atm cac**
set atm cac

disable atm channel

Syntax `DISable ATM=0..9 CHANnel={1..30|ALL}`

Description This command disables an ATM virtual channel. No data is transmitted or received on the channel. By default an ATM channel is enabled when it is added.

Parameter	Description
ATM	The number of the ATM instance, in the range 0 to 9.
CHANnel	The number of the ATM virtual channel to disable, in the range 1 to 30.

Examples To disable virtual channel 1 in ATM instance 0, use the command:

```
dis atm=2 chan=1
```

Related Commands **delete atm channel**
enable atm channel
show atm channel

disable shdsl

Syntax `DISable SHDsl=`*`interface`*

Description This command disables the specified SHDSL interface, and clears any SHDSL connection or special mode (for example, loop-backs). No data can be transmitted or received when the interface is disabled. The SHDSL interface can only be configured (**set shdsl**) when disabled. The default for an SHDSL interface is disabled.

Examples To disable SHDSL interface 0, use the command:

```
dis shd=0
```

Related Commands
enable shdsl
reset shdsl
set shdsl
show shdsl

disable shdsl bert

Syntax `DISable SHDsl=`*`interface`* `BERT`

Description This command disables a bit error rate test (BERT) on the specified SHDSL instance. Stopping a BERT session may desynchronise the SHDSL framer; we recommend setting **autoretrain** to **off** at both ends of the test, using the **set shdsl** command on page 10-55.

Examples To disable a BERT on SHDSL interface 0, use the command:

```
dis shd=0 bert
```

Related Commands
enable shdsl bert
show shdsl

disable shdsl debug

Syntax `DISable SHDsl=`*`interface`* `DEBug={ALARM|EOC|TRAINing|ALL}`

Description This command disables SHDSL interface debug modes on the specified SHDSL interface. By default all debug modes are disabled.

Parameter	Description	
SHDsl	The SHDSL interface on which to disable debugging.	
DEBug	The debugging mode to disable.	
	ALARM	Disables SHDSL alarm messages to the console.
	EOC	Disables embedded operations channel (EOC) debug information.
	TRAINing	Disables training debug information.
	ALL	Disables all SHDSL debugging.

Examples To disable all debug modes on SHDSL interface 0, use the command:

```
dis shd=0 deb=all
```

Related Commands **enable shdsl debug**

enable adsl

Syntax `ENAble ADSl={`*`interface`*`|ALL}`

Description This command enables a previously disabled ADSL interface, so that data can be transmitted or received on the interface. By default ADSL interfaces are disabled.

The **adsl** parameter specifies which ADSL interface to enable. If **all** is specified, all ADSL interfaces are enabled.

Examples To enable ADSL interface 0, use the command:

```
ena ads=0
```

Related Commands **create atm**
disable adsl
reset adsl
show adsl

enable adsl debug

Syntax

```
ENAble ADSl={interface|ALL} DEBug={ALL|TRaining}
   [TTy=tty-num]
```

Description

This command enables ADSL interface debugging on an ADSL interface, or on all ADSL interfaces. By default all debugging modes are disabled.

Parameter	Description	
ADSl	The number of the ADSL interface on which to enable debugging.	
	ALL	Enables debugging on all ADSL interfaces.
DEBug	The debugging mode to enable.	
	ALL	All debug modes.
	TRaining	Displays the current ADSL connection status.
TTy	The TTY instance number of the ASYN port or telnet session (terminal device) to send the debug output to. This enables debugging to be enabled in a script. To display the TTY instance number of the terminal device that is currently being used, use the **show tty** command on page 61-30 of Chapter 61, Terminal Server. Default: the terminal or Telnet session from which the command was executed.	

Examples

To enable all debugging modes on ADSL interface 0, use the command:

```
ena ads=0 deb=all
```

Related Commands

disable adsl debug

enable atm cac

Syntax

```
ENAble ATM=0..9 CAC
```

Description

This command enables ATM Call Admission Control (CAC) on the specified ATM instance immediately. By default CAC is disabled on an instance. For more information about CAC, see "ATM Call Admission Control (CAC)" on page 10-13.

ATM CAC is available on the AR442S router only.

Examples

To enable call admission control for ATM instance 0, use the command:

```
ena atm=0 cac
```

Related Commands

disable atm cac
set atm cac

enable atm channel

Syntax `ENAble ATM=`*`instance`* `CHANnel={1..30|ALL}`

Description This command enables a previously disabled ATM virtual channel, or all channels on an ATM instance. Data can be transmitted or received on the channel. By default an ATM channel is enabled.

Parameter	Description
ATM	The number of the ATM instance, in the range 0 to 9.
CHANnel	The number of the ATM virtual channel to enable, in the range 1 to 30.

Examples To enable all virtual channels on ATM instance 0, use the command:

```
ena atm=0 chan=all
```

Related Commands
add atm channel
delete atm channel
disable atm channel
enable adsl
set atm channel
show atm channel

enable shdsl

Syntax `ENAble SHDsl=`*`interface`*

Description This command enables the specified SHDSL interface. The default is disabled.

Examples To enable SHDSL interface 0, use the command:

```
ena shd=0
```

Related Commands
disable shdsl
reset shdsl
set shdsl
show shdsl

enable shdsl bert

Syntax `ENAble SHDsl=`*`interface`* `BERT`

Description This command enables a bit error rate test (BERT) on the specified SHDSL interface. Before a BERT can be conducted the SHDSL interface must have successfully trained in **data**, **analogloopback** or **digitalloopback** modes.

If a BERT is to be conducted in **data** mode, the remote unit must also be performing a BERT. Starting a BERT session may desynchronise the SHDSL framer; we recommend setting **autoretrain** to **off** at both ends of the test, using the **set shdsl** command on page 10-55.

Examples To enable a BERT on SHDSL interface 0, use the command:

```
ena shd=0 bert
```

Related Commands **disable shdsl bert**
show shdsl

enable shdsl debug

Syntax `ENAble SHDsl=`*`interface`* `DEBug={ALARM|EOC|TRAINing|ALL} [TTY=`*`tty-num`*`]`

Description This command enables SHDSL interface debug modes. By default all debug modes are disabled.

Parameter	Description	
SHDsl	The SHDSL interface on which to enable debugging.	
DEBug	The debugging mode to enable.	
	ALARM	When the router detects an SHDSL alarm condition, it sends a message to the console.
	EOC	Displays embedded operations channel debug information
	TRAINing	Displays training debug information, including SHDSL states (Table 10-15) and training substates (Table 10-3).
	ALL	All debug modes.
TTy	The TTY instance number (16 to 255) of the ASYN port or telnet session (terminal device) to send the debug output to. This allows debugging to be enabled in a script. To display the TTY instance number of the terminal device that is currently being used, use the command **show tty**. Default: the terminal or Telnet session from which the command was executed.	

Table 10-3: SHDSL training sub-states

State	Meaning
No Activity	Nothing is happening.
Pre Activation	PSD pre-Activation sequence.
Activation	SHDSL Activation sequence started.
Check Bitrate	Checking bit rates for correctness.
Transmit Ar	Transmit handshake transaction A from HSTU-R.
Receive Ar	Receive handshake transaction A from HSTU-R.
Transmit Bc	Transmit handshake transaction B from HSTU-C.
Receive Bc	Receive handshake transaction B from HSTU-C.
Transmit Ar'	Retransmitting Ar.
Wait for Ar'	Waiting for retransmission of AR.
Transmit Bc'	Retransmitting Bc.
Transmit Cr	Transmitting the Cr Signal.
Transmit Sc	Received Cr signal responding with Sc signal .
Transmit Sr	Transmitting the Sr signal after the Cr signal.
Line Agc	Automatic gain control initialisation.
FD EC Train	Echo or FDM detection and calibration.
Equalizer Train	Calibration of SHDSL equalizer.
Tip Ring Aligned	Detection and alignment of power tip and ring.

Table 10-3: SHDSL training sub-states (cont.)

State	Meaning
Transmit Tc	Receiver converged and now progressing on Tc signal and waiting for the Tr signal.
Receive Tr	Tc signal detected responding with Tr signal.
Transmit Fc1	Tr signal received. Sending first Fc frame.
Transmit Fc2	Sent first Fc frame sending second Fc frame.
Receive Fc	Received both FC frames OK.
Framer Sync	Synchronising the ATM Framer with the incoming framed cells.
Spect Test OK	Line testing.
Alb Test OK	Analog loopback activation OK.
Dlb Test OK	Digital loopback activation OK.
Load cppa	Loading code onto interface hardware.
Load cptrain	Loading code onto interface hardware.
Load cptom	Loading code onto interface hardware.
Load cpdm	Loading code onto interface hardware.
Load copa	Loading code onto interface hardware.
Load cotrain	Loading code onto interface hardware.
Load cotom	Loading code onto interface hardware.
Load codm	Loading code onto interface hardware.

Examples To enable all debug modes on SHDSL interface 0 use the command:

```
ena shd=0 deb=all
```

Related Commands

disable shdsl
disable shdsl debug
show shdsl
show shdsl linedetails
show shdsl counter

reset adsl

Syntax `RESET ADSl={`*`interface`*`|ALL}`

Description This command brings down the specified ADSL link and restarts the interface. If **all** is specified, it resets all ADSL interfaces and reapplies ADSL configuration settings.

Examples To reset ADSL interface 0, use the command:

```
reset ads=0
```

Related Commands
disable adsl
enable adsl
reset adsl counter
set adsl
show adsl

reset adsl counter

Syntax `RESET ADSl={`*`interface`*`|ALL} COUnter`

Description This command resets the counters for the specified ADSL interfaces to 0. If **all** is specified, counters for all ADSL interfaces are set to 0.

Examples To reset ADSL interface 0 counters, use the command:

```
reset ads=0 cou
```

Related Commands
reset adsl
show atm counter

reset atm channel counter

Syntax `RESET ATM=0..9 CHANnel=1..30 COUnter`

Description This command resets the ATM counters for an ATM channel to 0 (zero).

Parameter	Description
ATM	The number of the ATM instance on which to reset the channel counters.
CHannel	The channel number on the instance.

Examples To reset counters on channel 1 on instance 0.

```
reset atm=0 ch=1 cou
```

Related Commands
reset atm counter
show atm counter

reset atm counter

Syntax `RESET ATM=0..9 COUnter`

Description This command resets the ATM counters for the specified an ATM instance to 0 (zero).

Examples To reset the counters on instance 0

```
reset atm=0 cou
```

Related Commands
reset atm channel counter
show atm counter

reset shdsl

Syntax `RESET SHDsl=`*`interface`*

Description This command brings the SHDSL link down and restarts the interface.

Examples To reset SHDSL interface 0, use the command:

```
reset shd=0
```

Related Commands
disable shdsl
enable shdsl
set shdsl
show shdsl

reset shdsl counter

Syntax `RESET SHDsl=`*`interface`* `COUnter`

Description This command resets the counters for the specified SHDSL interface to zero.

Examples To reset the counters for SHDSL interface 0, use the command:

```
reset shd=0 cou
```

Related Commands **show shdsl counter**

set adsl

Syntax

```
SET ADSl=interface [AUtoretrain={ON|OFF}] [CARRier=EC|FDM]
   [MODe={ANAlogloopback|CELlloopback|DIGitalloopback|
   NORMal}] STandard={AUtomatic|T1.413|G.Dmt|G.Lite}]
```

Description

This command changes the operational parameters of an ADSL interface. The ADSL interface must be disabled. It is disabled by default (**disable adsl** command on page 10-39).

Parameter	Description	
ADSl	The ADSL interface to configure.	
CARRier	How ADSL uses the frequency-based subcarriers on the DSL for upstream and downstream traffic. Default: **fdm**	
	EC	The Echo Cancellation method.
	FDM	The Frequency Division Multiplexing method.
MODe	The operational mode for the ADSL interface. Default: **normal**	
	NORMal	For standard operation. Data is passed normally through the ADSL hardware.
	DIGitalloopback	For hardware testing only. Loops data back at in the digital component of the ADSL hardware.
	ANAlogloopback	For hardware testing only. Loops data back at the interface to the analogue front end of the ADSL hardware.
	CELlloopback	For hardware testing only. Loops back data at the interface between the CPU and the ADSL hardware.
STandard	The ADSL standard that the interface attempts to connect on. The possibility of setting the standard manually exists so that if there is a particular problem with the auto-detection the operating standard can be manually set. Default: **automatic**	
	AUtomatic	Automatically detects and uses the relevant standard for operation.
	T1.413	Uses the T1.413 DSL forum standard
	G.Dmt	Uses G.DMT, the ITU-T Recommendation G.992.3
	G.Lite	Uses G.LITE, the ITU-T Recommendation G.992.4
AUtoretrain	Whether automatic retraining is on or off. Default: **on**	
	ON	The interface retrains and resets its operational conditions when the link conditions change enough to warrant this.
	OFF	Disables automatic retraining on the ADSL interface.

Examples

To set ADSL interface 0 to digitalloopback testing mode using the T1.413 standard, with automatic retraining on, use the command:

```
set ads=0 mod=dig st=T1.413 au=on
```

To set ADSL interface 0 back to normal operation after testing, with automatic standard selection and automatic retraining, use the command:

```
set ads=0 au=on mod=norm st=au
```

Related Commands

disable adsl
enable adsl
enable adsl debug
reset adsl
reset adsl counter
show adsl
show adsl counter

set atm cac

Syntax

```
SET ATM=0..9 CAC [UBRAllocation=32..8192]
   [OVERBooking=1..1000]
```

Description

This command sets the parameters for Call Admission Control (CAC) on an ATM instance, and rebooks all channels on the ATM instance. For more information about CAC, see "ATM Call Admission Control (CAC)" on page 10-13.

Parameter	Description
ATM	The number (0 to 9) of the ATM instance on which to set CAC parameters
UBRAllocation	The bandwidth (32 to 8192) in kbps to allocate a PVC UBR channel that does not have a PCR specified. If the entered value is not a multiple of 32, it will be rounded up to the nearest 32kbps. The value cannot be higher than the maximum bandwidth for the instance. To display the maximum bandwidth, use the command **show atm**=*instance*. Default: **32**
OVERBooking	The percentage (1 to 1000) that CAC will attempt to book the channel at. This is a percentage of the total bandwidth of the underlying interface (the train-up bitrate). **Caution** Only use this parameter for overbooking if you are certain of its effects. Overbooking inappropriately can violate QoS contracts for all channels on an ATM interface. Default:**100**

Examples

To set the default effective bandwidth for UBR channels that do not have a PCR (Peak Cell Rate) configured on ATM instance 0 to 128kbps, use the command:

```
set atm=0 cac ubra=128
```

To overbook ATM instance 0 by 10 percent, use the command:

```
set atm=0 cac overb=110
```

Related Commands

disable atm cac
enable atm cac
set atm cac

set atm channel

Syntax

```
SET ATM=instance CHANnel=channel [SERViceclass=UBR]
   [PCR=0|32..155000] [DESCription=description]
   [ENCapsulation={AAL5Snap|LLC|VCMux}] [VPI=0..15
   VCI=32..1023]

SET ATM=instance CHANnel=channel [SERViceclass=CBR]
   [PCR=32..155000] [DESCription=description]
   [ENCapsulation={AAL5Snap|LLC|VCMux}] [VPI=0..15
   VCI=32..1023]

SET ATM=instance CHANnel=channel
   [SERViceclass={VBRNrt|VBRRt}] [PCR=32..155000]
   [SCR=32..155000] [MBS=2..10000]
   [DESCription=description]
   [ENCapsulation={AAL5Snap|LLC|VCMux}] [VPI=0..15
   VCI=32..1023]
```

Description

This command changes the operational parameters of an ATM (AAL5) virtual channel for the ATM instance. The channel must already have been added to the ATM instance using the **add atm channel**, and disabled using the **disable atm channel**.

Parameter	Description	
ATM	The ATM instance to create the virtual channel on, in the range 0 to 9.	
CHANnel	The virtual channel to create., in the range 1 to 30.	
DESCription	Description of the channel for administration, up to 62 characters long. Has no effect on the operation of the channel.	
ENCapsulation	The RFC 1483 encapsulation mode to be used by the instance. Default is determined by the **country** parameter set using the **set system country** command on page 10-59. If the **country** parameter has the default value of **none**, then the default for **encapsulation** is **llc**.	
	LLC, AAL5Snap	Logical Link Control mode; a single virtual channel can be used by different protocols.
	VCMux	Virtual Channel Multiplex mode; each protocol uses a separate virtual channel.
MBS	The Maximum Burst Size for the channel. In the range 1 to 1000. Valid if **serviceclass** is **vbrrt** or **vbrnrt**; otherwise not valid.	
PCR	The VC Peak Cell Rate, in kbps. Default: maximum channel bandwidth (changes dynamically with the bandwidth)	
	32..155000	Valid values are from 32 to Max Tx VC bit rate, as displayed using the **show atm** command on page 10-66.
	0	Restores the default after **pcr** has been set to another value, for **serviceclass**=**ubr** only.
SCR	1..155000	The VC Sustainable Cell Rate, in kbps. Valid if **serviceclass** is **vbrnrt** or **vbrrt**; otherwise not valid.

Parameter	Description	
SERViceclass	Specifies the service category for the channel. Default: **ubr**	
	CBR	Constant Bit Rate.
	UBR	Unspecified Bit Rate.
	VBRNrt	Variable Bit Rate non-realtime.
	VBRRt	Variable Bit Rate realtime.
VCI	The Virtual Channel Identification number. In the range 32..1023. Default is determined by the **set system country** command on page 10-59. If **country** is **none**, the default is 32.	
VPI	The Virtual Path Identification number. In the range 0 to 15. Default is determined by the **set system country** command on page 10-59. If **country** is **none**, the default is 0.	

Examples

To set ATM instance 0 virtual channel 1 to have a VPI of 1, a VCI of 35 and a real-time variable bit rate with Peak Cell Rate of 1Mb and Sustainable Cell Rate of 1Mb, use the command:

```
set atm=0 chan=1 vpi=1 vci=35 serv=vbrr pcr=1000 scr=1000
```

To set ATM instance 0 virtual channel 2 to have VPI=15, VCI=40 a VC Multiplexed Encapsulation, an Unspecified Bit Rate (default) with Peak Cell Rate of 10Mb and Minimum Cell Rate of 1Mb, use the command:

```
set atm=0 chan=2 vpi=15 vci=40 enc=vcm pcr=10000 mcr=1000
```

Related Commands

add atm channel
create eth in Chapter 9, Interfaces
delete atm channel
disable atm channel
enable atm channel
set system country
show atm channel

set shdsl

Syntax

```
SET SHDsl=interface
   [MOde={CPE|CO}]
   [PAIRmode={2Wire|4WIREStandard|4WIREEnhanced|
   1Pair|2PAIRStandard|2PAIREnhanced}]
   [STAndard={ANNEXA|ANNEXB|BOTH|ANNEXBAnfp|BOTHAnfp}]
   [PSDmask={SYMmetric|ASYMetric}] [AUTOretrain={ON|OFF}]
   [BITratemode=ADAptive|FIXed] [MINbitrate=72..4624]
   [MAXbitrate=72..4624] [ATTENuationthreshold=0..31]
   [SNRmarginthreshold=0..15]
```

Description

This command configures the SHDSL interface. The SHDSL interface must be disabled (**disable shdsl**) before any parameters can be configured on the interface.

Parameter	Description	
SHDsl	The SHDSL interface to configure.	
MODe	The operating mode of the SHDSL interface. For back-to-back operation of SHDSL equipment (one SHDSL port connected to another), one side must be set to **cpe** mode and the other to **co** mode. This way one side initiates the connection and the other listens for the initiation. Default: **cpe**	
	CPE	Customer Premise Equipment mode. This mode initiates the SHDSL handshake to the CO equipment.
	CO	Central Office mode for equipment on the central office side of the SHDSL connection. In this mode the interface waits for CPE equipment to start the handshake.
PAIRmode	Selects whether the SHDSL interface attempts to transmit data over 1 pair or 2 pairs (2 wires or 4 wires). For 2 pair operation the parameter also selects either a standards-based mode, or a non-standards based enhanced mode. Default: **1Pair** mode	
	1Pair, 2Wire	A single pair of wires (2 wires).
	2PAIRStandard, 4WIREStandard	Two pairs of wires (4 wires) operating in standards based mode (ITU standard G.991.2). In this mode, the **bitratemode** parameter must be set to **fixed**. Automatic fallback to single-pair mode is NOT supported.
	2PAIREnhanced, 4WIREEnhanced	Two pairs of wires (4 wires) operating in non standards based, enhanced mode. In this mode, the **bitratemode** parameter must be set to **fixed**. Automatic fallback to single-pair mode IS supported by compatible DSLAMs.

Parameter	Description	
STAndard	The SHDSL standard that should be used. These are defined in ITU-T Recommendation G.991.2 Annex A and Annex B. Default: **both**	
	ANNEXA	The ANSI standard operation—optimal for 26AWG.
	ANNEXB	The local STU supports Annex B—optimal for 0.4mm wire gauge.
	BOTH	The SHDSL interface detects whether the other end of the SHDSL line is set up to use Annex A or Annex B, and uses this.
	ANNEXBAnfp	Annex B with Access Network Frequency Plan (ANFP) PSD mask.
	BOTHAnfp	The SHDSL interface detects whether the other end of the SHDSL line is set up to use Annex A or Annex B with ANFP PSD mask, and uses this.
PSDMask	The PSD mask to be used as defined in ITU-T Recommendation G.991.2 Annex A section 4 or Annex B section 4. Default: **symmetric**	
	SYMmetric	The SHDSL interface uses a symmetric PSD mask.
	ASYMmetric	The SHDSL interface uses an asymmetric PSD mask.
AUtoretrain	Whether automatic retraining is enabled. Default: **on**	
	ON	Enables automatic retraining on the SHDSL interface. The interface retrains and comes up again if the link is dropped due to link conditions.
	OFF	Disables automatic retraining on the SHDSL interface. (To bring the link back up if it goes down, use the command **enable shdsl**.)
BITratemode	Whether the SHDSL port uses a fixed or adaptive bit rate. If the **pairmode** is either **2PAIRStandard** or **2PAIREnhanced**, the **bitratemode** must be **fixed**. Default: **adaptive**	
	ADAptive	The SHDSL interface negotiates with the remote end to select the highest possible rate between **minbitrate** and **maxbitrate**.
	FIXed	The SHDSL interface links at the **maxbitrate** or not at all. The remote end must be able to support the specified **maxbitrate**. If **bitratemode** is set to **fixed** the **minbitrate** parameter is invalid.

Parameter	Description	
MINbitrate	The minimum supported bit rate for rate adaptation, when **bitratemode=adaptive**. Certain bitrates in the range 72 to 4624 are supported on the SHDSL interface, as shown in Table 10-4. If you enter a number that is not supported, the router rounds it down to the nearest supported bitrate. Rates above 2312 are only available if the **pairmode** parameter is set to **2PAIREnhanced** or **2PAIRStandard**. Default: **72**	
MAXbitrate	The maximum bit rate for rate adaption or the bit rate for fixed rate mode. Certain bitrates in the range 72 to 4624 are supported on the SHDSL interface, as shown in Table 10-4. If you enter a number that is not supported, the router rounds it down to the nearest supported bitrate. Rates above 2312 are only available if the **pairmode** parameter is set to **4wire** or **2pair**. Set the **maxbitrate** to the same value at both ends of the connection. If **bitratemode** is **fixed** and the link does not train up, you may need to reduce the **maxbitrate** value. Default: **2312**	
SNRmarginthreshold	The threshold SNR (signal-to-noise ratio) margin for the interface. Default: **0** (off)	
	1..15	The SNR margin threshold in decibels for the SHDSL interface. If the measured SNR margin rises above this threshold, the router sends an alarm message. To forward SHDSL alarm messages to the console when they occur, use the command **enable shdsl debug** with the **alarm** parameter. To display current alarm states, use the command **show shdsl linedetails**.
	0	Off. No alarms are sent.
ATTENuationthreshold	The attenuation threshold for the selected SHDSL interface. Default: **0** (off)	
	1..127	The attenuation threshold in decibels. If the measured attenuation (loss of signal power) rises above the threshold, an alarm will be sent. To forward SHDSL alarm messages to the console when they occur, use the command **enable shdsl debug** with the **alarm** parameter. To display current alarm states, use the command **show shdsl linedetails**.
	0	Off. No alarms are sent.

Table 10-4: Supported bit rates on SHDSL interfaces

Pair mode	Supported bit rates							
1pair	72	136	200	264	328	392	456	520
	584	648	712	776	840	904	968	1032
	1096	1160	1224	1288	1352	1416	1480	1544
	1608	1672	1736	1800	1864	1928	1992	2056
	2120	2184	2248	2312				

Table 10-4: Supported bit rates on SHDSL interfaces (cont.)

Pair mode	Supported bit rates							
2pairstandard, 2pairenhanced	144	272	400	528	656	784	912	1040
	1168	1296	1424	1552	1680	1808	1936	2064
	2192	2320	2448	2576	2704	2832	2960	3088
	3216	3344	3472	3600	3728	3856	3984	4112
	4240	4368	4496	4624				

Examples

To set SHDSL interface 0 to Central Office mode, use the command:

```
set shdsl=0 mode=co
```

To set SHDSL interface 0 to 2pairstandard mode, use the command:

```
set shdsl=0 pairmode=2pairstandard bitrate=fixed
   maxbitrate=4624
```

Related Commands

disable shdsl
enable shdsl
show shdsl

set system country

Syntax

```
SET SYStem COUntry={AUSTRAlia|AUSTRIa|BELgium|CANada|
   DENMark|EIRE|FINLand|FRAnce|GERmany|ICELand|ITAly|
   NETHerlands|NEWZealand|NORWay|PORTUgal|SINGapore|SPAIn|
   SWITZerland|SWEden|TURkey|UAE|UK|USA|NONE}
```

Description

This command sets the country identifier for the router, and sets corresponding defaults for ATM.

Parameter	Description
COUntry	Which country to set the ATM defaults for. Default: **none**

Country option	Default VPI	Default VCI	Default encapsulation mode
NONE	0	35	LLC
AUSTRAlia	8	35	LLC
AUSTRIa	8	48	VCMux
BELgium	8	35	VCMux
CANada	0	35	LLC
DENMark	0	35	LLC
EIRE	0	38	VCMux
FINLand	0	40	LLC
FRAnce	8	35	VCMux
GERmany	1	32	LLC
GREece	8	35	VCMux
ICELand	0	35	VCMux
ITAly	8	35	VCMux
NETHerlands	0	48	VCMux
NEWZealand	0	100	VCMux
NORWay	8	35	LLC
PORTUgal	8	32	LLC
SINGapore	0	100	VCMux
SPAIn	8	32	LLC
SWITZerland	8	48	VCMux
SWEden	8	35	LLC
TURKey	8	35	LLC
UAE	0	100	VCMux
UK	0	38	VCMux
USA	0	35	LLC

Example

To set the county to Australia use the command.

```
set sys cou=austra
```

Related Commands

add atm channel
set atm channel
show system in Chapter 4, Configuring and Monitoring the System

show adsl

Syntax `SHow ADSl[={`*interface*`|ALL}]`

Description This command displays interface information for the specified ADSL interface, or all ADSL interfaces. If no value is specified, summary information about all ADSL interfaces is displayed. If an interface is specified, detailed information about the ADSL interface is displayed. If **all** is specified, detailed information about all ADSL interfaces is displayed.

Figure 10-4: Example output from the **show adsl** command

```
ADSL Interface Information
------------------------------------------------------------
  Instance        State
------------------------------------------------------------
   adsl0           Off
   adsl1           Training
   adsl2           Connected
```

Table 10-5: States in the output of the **show adsl** command

State	Meaning
Clearing	The ADSL interface is clearing the current connection or loopback mode.
Connected	The ADSL interface has established an ADSL connection or loopback mode.
Connecting	The ADSL interface is trying to establish an ADSL connection.
Faulty	The ADSL interface is faulty and cannot be used.
Initialising	The ADSL interface is performing initialisation.
Off	The ADSL interface is idle; it has been disabled.
WHIP	The ADSL interface is operating in the special WHIP test mode.

Figure 10-5: Example output from the **show adsl=0** command

```
ADSL Interface Information
------------------------------------------------------------
 adsl0:
  Status ..................... ENABLED
  State ...................... Connected
  Mode ....................... NORMAL
  Standard ................... AUTOMATIC
  Bert ....................... OFF
  Autoretrain ................ ON
  Link state ................. Up
  Up time .................... 523 sec
  Connection ................. n/a
  Rx rate .................... n/a
  Tx rate .................... n/a
  ATU-R SNR margin ........... n/a
  ATU-C SNR margin ........... n/a
```

Table 10-6: Parameters in the output of the **show adsl=0** command

Parameter	Meaning
Status	Whether or not the ADSL interface is enabled.
State	The current ADSL interface state (see Table 11).
Mode	The configured ADSL operating mode setting.
Standard	The configured ADSL standard setting.
Bert	The configured ADSL BERT setting.
Autoretrain	The configured ADSL auto-retrain setting.
Link state	Whether the data link is up or down.
Up time	The length of time that the link has currently been up.
Signal to noise	The local signal to noise margin.
Rx rate	The downstream (receive) ADSL bit rate. This is the raw figure including ATM/protocol overheads.
Tx rate	The upstream (transmit) ADSL bit rate. This is the raw figure including ATM/protocol overheads.

Examples To display a summary of all ADSL interfaces, use the command:

```
sh ads
```

To display detailed information on ADSL interface 5, use the command:

```
sh ads=0
```

To display detailed information on all ADSL interfaces, use the command:

```
sh ads=all
```

Related Commands

create atm
disable adsl
enable adsl
reset adsl
reset adsl counter
set adsl
show adsl counter

show adsl counter

Syntax `SHow ADSl[={`*interface*`|ALL}] COUnter`

where *interface* is the number of the ADSL interface.

Description This command displays counter information for the specified one or more ADSL interfaces.

The **adsl** parameter specifies which ADSL interface to show counter information about. If **all** is specified then counters for all ADSL interfaces are displayed.

Figure 10-6: Example output from the **show adsl=0 counter** command.

```
ADSL Interface Counter Information
-------------------------------------------------------------------------------
adsl0:
  Tx Cell ....................... 110324386
  Rx Cell ....................... 110323598
  Connections ................... 1
  Failed to connect ............. 0
  Retrains ...................... 0
  Fault recovers total .......... 0
  Fault recovers current ........ 0
  Last Up time .................. 0 Sec
  Total Up time ................. 58472 Sec
  Current Down time ............. 0 Sec
  Last Down time ................ 29 Sec
  Total Down time ............... 29 Sec

  BERT errors ................... 0

  DMT counter info:
  ATU-R FEC-I ................... 0       ATU-C FFEC-I ................... 0
  ATU-R FEC-F ................... 0       ATU-C FFEC-F ................... 0
  ATU-R CRC-I ................... 0       ATU-C FEBE-I ................... 0
  ATU-R CRC-F ................... 0       ATU-C FEBE-F ................... 0
  ATU-R SEF ..................... 0       ATU-C RDI ...................... 0
  ATU-R LOS ..................... 0       ATU-C LOS ...................... 0
  ATU-R NCD-I ................... 0       ATU-C FNCD-I ................... 0
  ATU-R NCD-F ................... 0       ATU-C FNCD-F ................... 0
  ATU-R HEC-I ................... 0       ATU-C FHEC-I ................... 0
  ATU-R HEC-F ................... 0       ATU-C FHEC-F ................... 0
  ATU-R OCD-I ................... 0
  ATU-R OCD-F ................... 0

  Failures:
  Overall ....................... 0
  ATU-R LOS ..................... 0       ATU-C LOS ...................... 0
  ATU-R SEF ..................... 0       ATU-C RDI ...................... 0
  ATU-R NCD-I ................... 0       ATU-C FNCD-I ................... 0
  ATU-R NCD-F ................... 0       ATU-C FNCD-F ................... 0
  ATU-R LCD-I ................... 0       ATU-C FLCD-I ................... 0
  ATU-R LCD-F ................... 0       ATU-C FLCD-F ................... 0

  Other:
  utopiaDrop .................... 0
```

Table 10-7: Parameters in the output of the **show adsl=0 counter** command

Parameter	Meaning
Tx Cell	Number of transmitted ATM cells.
Rx Cell	Number of received ATM cells.
Connections	Number of times the ADSL connection has been established.
Failed to Connect	Number of times the ADSL connection has failed to connect.
Retrains	Number of times the ADSL connection has spontaneously retrained.
Fault Recovers Total	Total number of fault recovers attempted.
Fault Recovers Current	Current number of fault recovers. This is automatically reset to zero when a fault is successfully recovered. If this counter reaches five recovery is abandoned.
Last Up time	Time that the last (previous) link remained up.
Total Uptime	Total time the link has been up (including current period if currently up).
Current Down time	Time the link has currently been down (or zero if currently up).
Last Down time	Length of the previous link down time.
Total Down time	Total time the link has been down (including current period if currently down).
BERT errors	Number of Bit Error Ratio Test errors when running in loop back mode with BERT on. N/a will be shown if the remote and local ends are out of sync.
DMT counter info	
ATU-R FEC-I	Count of near-end Reed-Solomon forward error correction anomalies for the interleaved data-stream.
ATU-C FFEC-I	Count of far-end Reed-Solomon forward error correction anomalies for the interleaved data-stream.
ATU-R FEC-F	Count of near-end CRC anomalies for the fast data stream.
ATU-C FFEC-F	Count of far-end CRC anomalies for the fast data stream.
ATU-R CRC-I	Count of near-end CRC anomalies for the interleaved data stream.
ATU-C FEBE-I	Count of far-end CRC anomalies for the interleaved data stream.
ATU-R CRC-F	Count of near-end CRC anomalies for the fast data stream
ATU-C FEBE-F	Count of far-end CRC anomalies for the fast data stream
ATU-R SEF	Count of near-end Severely Errored Frame defects.
ATU-C RDI	Count of far-end Severely Errored Frame defects.
ATU-R LOS	Count of near-end Loss of Signal defects.
ATU-C LOS	Count of far-end Loss of Signal defects.
ATU-R NCD-I	Count of near-end No Cell Delineation anomalies for the interleaved data stream.
ATU-C FNCD-I	Count of far-end No Cell Delineation anomalies for the interleaved data stream.

Table 10-7: Parameters in the output of the **show adsl=0 counter** command (cont.)

Parameter	Meaning
ATU-R NCD-F	Count of near-end No Cell Delineation anomalies for the fast data stream.
ATU-C FNCD-F	Count of fast-end No Cell Delineation anomalies for the fast data stream.
ATU-R HEC-I	Count of near-end Header Error Control anomalies for the interleaved data stream.
ATU-C FHEC-I	Count of far-end Header Error Control anomalies for the interleaved data stream.
ATU-R HEC-F	Count of near-end Header Error Control anomalies for the fast data stream.
ATU-C FHEC-F	Count of far-end Header Error Control anomalies for the fast data stream.
ATU-R OCD-I	Count of near-end Out of Cell Delineation anomalies for the interleaved data stream.
ATU-R OCD-F	Count of near-end Out of Cell Delineation anomalies for the fast data stream.
Failures	
Overall	Non-zero value if any failures have occurred
ATU-R LOS	Count of near-end Loss of Signal. A LOS failure has occurred if counter has surpassed 127.
ATU-R SEF	Count of near-end Severely Errored Frames. A SEF failure has occurred if this counter has surpassed 127.
ATU-R NCD-I	Count of near-end No Cell Delineations for the interleaved data stream. A NCD-I failure has occurred if this counter has surpassed 127.
ATU-R NCD-F	Count of near-end No Cell Delineations for the fast data stream. A NCD-I failure has occurred if this counter has surpassed 127.
ATU-R LCD-I	Count of near-end Loss of Cell Delineations for the interleaved data stream. A LCD-I failure has occurred if this counter has surpassed 127.
ATU-R LCD-F	Count of near-end Loss of Cell Delineations for the fast data stream. A LCD-I failure has occurred if this counter has surpassed 127.
ATU-C LPR	Count of far-end Dying Gasp frames. A LPR failure has occurred if this counter has surpassed 127.
ATU-C LOS	Count of far-end Loss of Signal. A failure has occurred if this counter has surpassed 127.
ATU-C RDI	Count of far-end Severely Errored Frames. A failure has occurred if this counter has surpassed 127.
ATU-C FNCD-I	Count of far-end No Cell Delineation for the interleaved data stream. A failure has occurred if this counter has surpassed 127.
ATU-C FNCD-F	Count of far-end No Cell Delineation for the fast data stream. A failure has occurred if this counter has surpassed 127.

Table 10-7: Parameters in the output of the **show adsl=0 counter** command (cont.)

Parameter	Meaning
ATU-C FLCD-I	Count of far-end Loss of Cell Delineations for the interleaved data stream. A LCD-I failure has occurred if this counter has surpassed 127.
ATU-C FLCD-F	Count of far-end Loss of Cell Delineations for the fast data stream. A LCD-I failure has occurred if this counter has surpassed 127.
Other	
UtopiaDropped	The number of cells dropped on the utopia bus in the transmit direction because of errors in timing or signalling. This is a hardware counter that indicates a possible faulty unit.

Example To show the counters for ADSL interface 0 use the command:

```
sh ads=0 cou
```

Related Commands

reset adsl counter
show adsl

show atm

Syntax `SHow ATM[=0..9]`

Description This command displays information about the general ATM configuration, or the specified ATM instance.

Figure 10-7: Example output from the **show atm** command

```
ATM Module configuration
-------------------------------------------------
Number of instances.............. 1

Table of instances
-------------------------------------------------------------
Instance      L1 interface      No. VCs   Status   CAC
-------------------------------------------------------------
0             adsl0             3         Up       Enabled
-------------------------------------------------------------
```

Table 10-8: Parameters in the output from the **show atm** command

Parameter	Meaning
Number of instances	The number of ATM instances.
Instance	The number of the ATM instance.
L1 interface	The Layer 1 interface that the instance is attached to: the ADSL interface.
No. VCs	The number of ATM virtual channels added to this ATM instance.
Status	The status of the instance; either Up or Down.
CAC	Whether Call Admission Control (CAC) is enabled or disabled on the instance.

Figure 10-8: Example output from the **show atm=0** command

```
ATM instance 0
------------------------------------------------------------
Status ..................... ENABLED
Over ....................... adsl0
L1 Link status ............. Up
L1 Link Rx rate ............ 10016 Kbps
L1 Link Tx rate ............ 1024 Kbps
Max Tx VC bit Rate ......... 1024 Kbps
Min Tx VC bit Rate ......... 32 Kbps
Max number of Channels ..... 30
Number of Channels ......... 2

CAC
  Status ................... Enabled
  Overbooking percent ..... 110
  UBR booking allocation ... 32 kbps
  CAC bandwidth ............ 1126 Kbps
  Booked Bandwidth ......... 864 kbps
  Available Bandwidth ..... 262 kbps

Utilisation Information
  Tx max data rate ......... 4173283 bps
  Tx current throughput .... 0.0 bps
  Tx utilisation ........... 0.0 %
  Rx max data rate ......... 4173283 bps
  Rx current throughput .... 0.0 bps
  Rx utilisation ........... 0.0 %

Channel Table
------------------------------------------------------------
Channel  Encap.   VPI/VCI   Status     Class    Description
------------------------------------------------------------

  1      LLCSNAP   0/35     Enabled    VBR-RT   None
  2      LLCSNAP   0/101    Disabled   UBR      UBRtoISP
------------------------------------------------------------
```

Table 10-9: Parameters in the output of the **show atm=0** command

Parameter	Meaning
Status	Status of the instance
Over	The Layer 1 interface that the ATM is sent over
Max bit rate	The maximum bit rate that a CHANNEL can be configured to use
L1 Link status	The physical layer connection link status.
L1 Link Rx rate	The receive rate that the Layer 1 interface reported to ATM.
L1 Link Tx rate	The transmit rate that the Layer 1 interface reported to ATM.
Max Tx VC bit Rate	The maximum transmit bit rate allowed for a given channel. I.e The maximum PCR allowed.
Min Tx VC bit Rate	The minimum transmit bit rate that a CHANNEL can be scheduled to use, that is, the minimum **mcr** or **scr** bit rate
Max number of Channels	The maximum number of channels that can be configured on this instance.
Number of channels	The number of channel's added to the instance

Table 10-9: Parameters in the output of the **show atm=0** command (cont.)

Parameter	Meaning
CAC	
Status	The status of Call Admission Control (CAC) on the instance
Overbooking percent	The overbooking percentage of the interface.
UBR Booking allocation	The amount of bandwidth that is used to allocate to a UBR Channel if no PCR is specified for the UBR connection.
CAC bandwidth	The total bandwidth that CAC uses CAC to book channels. This includes the calculation of the overbooking percentage.
Booked bandwidth	The amount of bandwidth that has been booked to existing channels.
Available bandwidth	The bandwidth that has not been allocated. Note that UBR channels without a PCR will use all available bandwidth but only be booked at the UBR booking rate.
Channel Table	Parameters for individual channels on the ATM instance.
Number	The channel number
Encap.	The channel's configured encapsulation
VPI/VCI	The VCI and VPI pair for the PVC
Status	The user configured status of the channel. Enabled or disabled.
Link	The Link status of the Instance.
Class	The traffic class of the channel
Description	The user description given to the VC.

Examples

To display a summary of all ATM instances, use the command:

```
sh atm
```

To display detailed information on ATM instance 0, use the command:

```
sh atm=0
```

Related Commands

add atm channel
create atm
delete atm channel
destroy atm
disable atm channel
enable atm channel
set atm channel
show atm channel
show atm counter

show atm channel

Syntax `SHow ATM=0..9 CHANnel={1..30|ALL}`

Description This command displays information about the specified ATM virtual channel, or all ATM channels.

Figure 10-9: Example output from the **show atm=0 channel=1** command

```
ATM interface atm0.2
-----------------------------------------------------
  Channel Number ............. 1
  Channel Description ........ description of channel
  Channel Type ............... PVC
  VPI ........................ 0
  VCI ........................ 102
  Encapsulation .............. LLCSNAP
  Service Class .................. VBRRT
   Configured
    pcr ....................... 350 Kbps
    mcr ....................... 0 Kbps
    scr ....................... 200 Kbps
    mbs ....................... 100 Cells
    bt  ....................... 978 Cells (calculated)
   Actual
    pcr ....................... 349 Kbps (825 cps)
    mcr ....................... 0 Kbps (0 cps)
    scr ....................... 200 Kbps (471 cps)
    bt  ....................... 977 Cells

  Utilisation Information
    Tx max data rate ......... 249056 bps
    Tx current throughput .... 115264.0 bps
    Tx utilisation ........... 46.28 %
    Rx max data rate ......... 2086641 bps
    Rx current throughput .... 1175687.4 bps
    Rx utilisation ........... 56.3 %

  Attached User Modules ...... PPP IP ETH
  L1 interface ............... adsl0
  Configured Status .......... Enabled
  Link Status ................ Up
-----------------------------------------------------
```

Table 10-10: Parameters in the output of the **show atm=0 channel=1** command

Parameter	Meaning
ATM interface	The ATM instance that the virtual channel belongs to.
Channel Number	The channel number
Channel Description	The description of the channel
Channel Type	The type of channel; PVC.
VPI	The virtual path identifier.
VCI	The virtual channel identifier.
Encapsulation	The encapsulation, either VCMux or LLCSNAP

Table 10-10: Parameters in the output of the **show atm=0 channel=1** command (cont.)

Parameter	Meaning
Service Class	Service category (**serviceclass**) for the channel; one of CBR, UBR, VBRRT or VBRNRT.
PCR	Peak Cell Rate.
MCR	Minimum Cell Rate.
SCR	Sustain Cell Rate.
MBS	Maximum Burst Size.
BT	VBR burst tolerance. This is calculated from the **pcr**, **scr**, and **mbs**. The number in the parentheses is the actual rate the VC is running at. The actual BT and the requested BT may be different because some Layer 1 ports can change their rates dynamically and because of rounding factors. If the configured rate is given before the Layer 1 port (e.g., ADSL or SHDSL) is trained up, or the rate changes while up, then the parameters may change.
Tx max data rate	The maximum bits per second that can be transmitted on this channel. For a VBR channel, this is: **scr** + ((**pcr** - **scr**)/2) For other channels it is **pcr**. This excludes the ATM overhead, that is, it counts 48 bytes of data per cell.
Tx current throughput	Current data throughput transmitted on the ATM channel.
Tx utilisation	Utilisation as a percentage of the maximum bit rate for the transmit direction.
Rx max data rate	The maximum bits per second that can be received on this Layer 1 interface.This excludes the ATM overhead, that is, it counts 48 bytes of data per cell.
Rx current throughput	Current data throughput received on the ATM channel.
Rx utilization	Utilisation as a percentage of the maximum bit rate for the receive direction.
Attached User modules	Other modules (e.g. protocols) attached to this channel.
L1 Interface	The layer 1 physical interface over which the ATM channel is configured.
Configured Status	The user configured status of the channel; either Enabled or Disabled.
Link status	The status of the instance link for this channel; either Up or Down.

Examples

To display detailed information about virtual channel 1 on ATM instance 0, use the command:

```
sh atm=0 chan=1
```

Related Commands

add atm channel
create atm
delete atm channel
destroy atm
disable atm channel
enable atm channel
set atm channel
show atm
show atm counter

show atm counter

Syntax `SHOW ATM=0..9 [CHANnel={1..30|ALL}] COUnter`

Description This command displays ATM counters.

Parameter	Description	
ATM	The number of the ATM instance, in the range 0 to 9.	
CHANnel	The virtual channel number on the ATM instance to display counters for. Default: No channel specific counters are displayed.	
	1..30	The number of the ATM virtual channel to display.
	ALL	All the channels on the ATM instance are displayed one after the other

Figure 10-10: Example output from the **show atm=0 counter** command

```
ATM instance 0
-------------------------------------------------
UTOPIA dropped cells .......... 9
CRC 10 error .................. 90
Mis-inserted cells ............ 10
Total packet queue length ..... 0
Interface MIB Counters
  ifInOctets ..................... 0       ifOutOctets ..................... 0
  ifInUcastPkts .................. 0       ifOutUcastPkts .................. 0
  ifInErrors ..................... 0       ifOutErrors ..................... 0
  ifInUnknownProtos .............. 0        ................................
  ifInDiscards ................... 0       ifOutDiscards ................... 0
  ifInMulticastPkts .............. 0       ifOutMulticastPkts .............. 0
  ifInMulticastPkts .............. 0       ifOutMulticastPkts .............. 0
  ifInBroadcastPkts .............. 0       ifOutBroadcastPkts .............. 0
-------------------------------------------------
```

Table 10-11: Parameters in the output of the **show atm=0 counter** command

Parameter	Meaning
Utopia dropped Cells	Cells dropped due UTOPIA bus errors. This is internal communication with the PHY.
CRC 10 Errors	Cells dropped due to CRC10 checksums. These are for ATM operation cells present in OAM and RM functions.
Misinserted cells	This counter shows the number of cells dropped due to addressing errors. This means that either the VPI or VCI does not match any active channels or the cell is corrupted.
Out packet Queue Length	The total current packet queue length of the instance's channels.
Interface MIB Counters	These are defined in RFC 2515 section 5.2.1
ifInOctets	The number of received octets over the interface, i.e., the number of received, assigned cells multiplied by 53.
ifOutOctets	The number of transmitted octets over the interface, i.e., the number of transmitted, assigned cells multiplied by 53.
ifInErrors	The number of cells dropped due to uncorrectable HEC errors.

Table 10-11: Parameters in the output of the **show atm=0 counter** command (cont.)

Parameter	Meaning
ifOutErrors	The number of cells packets that could not be transmitted because of errors
ifInUnknownProtos	The number of received cells discarded during cell header validation, including cells with unrecognized VPI/VCI values, and cells with invalid cell header patterns.

Figure 10-11: Example output from the **show atm=0 channel=1 counter** command

```
ATM instance 0 channel 1 (atm0.1)
-------------------------------------------------------------------------------
Output queue length .......... 0
Interface MIB Counters
  ifInOctets ..................... 0       ifOutOctets ..................... 0
  ifInUcastPkts .................. 0       ifOutUcastPkts .................. 0
  ifInErrors ..................... 0       ifOutErrors ..................... 0
  ifInUnknownProtos  ............. 0        ................................
  ifInDiscards ................... 0       ifOutDiscards ................... 0
  ifInMulticastPkts .............. 0       ifOutMulticastPkts .............. 0
  ifInBroadcastPkts .............. 0       ifOutBroadcastPkts .............. 0
Miscellaneous counters
  InCongestionSet ................ 0       InCLPSet ........................ 0
  InCRCErrors .................... 0       InAbortedPdu .................... 0
  InChainedPdu ................... 0       InLengthError ................... 0
  InOversizedSDU ................. 0       InLLCUnsupported ................ 0
  InLLCInvalid ................... 0        ................................ 0
  outFragmentDiscard ............. 0       outFrameToolong ................. 0
-------------------------------------------------------------------------------
```

Table 10-12: Parameters in the output of the **show atm=0 channel=1 counter** command

Parameter	Meaning
Output queue length	The current packet queue length on the interface.
Interface MIB counters	These are defined in RFC 2515 section 7.3
ifInOctets	The number of received AAL5 CPCS PDU octets.
ifOutOctets	The number of AAL5 CPCS PDU octets transmitted.
ifInUcastPkts	The number of received AAL5 CPCS PDUs passed to a higher-layer.
ifOutUcastPkts	The number of AAL5 CPCS PDUs received from a higher-layer for transmission. [Note: The number of AAL5 PDUs actually transmitted is the number received from a higher-layer for transmission minus any which are counted by ifOutErrors and ifOutDiscards.]
ifInErrors	Number of errors in AAL5 CPCS PDUs received. The types of errors counted include CRC-32 errors, SAR time-out errors, and oversized SDU errors.
ifInUnknownProtos	Always set to 0. As defined by the MIB
ifInDiscards	Number of received AAL5 CPCS PDUs discarded. Possible reason may be input buffer overflow.
ifOutErrors	Number of AAL5 CPCS PDUs that could not be transmitted due to errors.

Table 10-12: Parameters in the output of the **show atm=0 channel=1 counter** command (cont.)

Parameter	Meaning
ifOutDiscards	Number of AAL5 CPCS PDUs received for transmission that are discarded. Possible reason may be output buffer overflow.
ifInMulticastPkts	Always set to 0. As defined by the MIB
ifInBroadcastPkts	Always set to 0. As defined by the MIB
IfOutMulticastPkts	Always set to 0. As defined by the MIB
IfOutBroadcastPkts	Always set to 0. As defined by the MIB
InCongestionSet	The number of AAL5 frames received with the congestion bit set.
InCLPSet	The number of AAL5 frames received with the cell loss priority (CLP) set.
InCRCErrors	The number of AAL5 frames dropped due to CRC 32 errors.
InAbortedPdu	The number of AAL5 frames aborted with a zero cell.
InChainedPdu	The number of AAL5 frames that were internally chained (larger than 1600 bytes)
InLengthError	The number of AAL5 frames that were dropped due to ATM length reporting errors (dropped cells etc.)
InOversizedSDU	The number of AAL5 frames that are over the 1600 byte internal size
InLLCUnsupported	The number of AAL5 frames received that had an LLC type that is not supported
InLLCInvalid	The number of AAL5 frames received with invalid or corrupt LLC headers
OutFragmentDiscard	The number of Frames discarded from transmitting because they had too many fragments
OutFrameToolong	The number of frames discarded from transmitting because they exceed the internal frame size limit.

Examples To display the counters for ATM instance 0, use the command:

```
sh atm=0 cou
```

Related Commands

add atm channel
create atm
delete atm channel
destroy atm
disable atm channel
enable atm channel
set atm channel
show atm
show atm channel

show shdsl

Syntax `SHow SHDsl[={`*interface*`|ALL}]`

Description This command displays summary information about the specified SHDSL interface, or all SHDSL interfaces. If no value is specified, summary information for all SHDSL interfaces is displayed.

Figure 10-12: Example output from the **show shdsl** command

```
SHDSL Interface Summary
------------------------------------------------------------
Interface  Status    Mode   State    Speed            Uptime
------------------------------------------------------------
shdsl0     enabled   CPE    Data     4624(4608)kbps   10 s
```

Table 10-13: Parameters displayed in the output of the **show shdsl** command

Parameter	Meaning
Interface	The full interface name.
Status	Whether the SHDSL interface is enabled or disabled.
Mode	The configured operating mode setting, CO or CPE.
State	The current interface state (Table 10-15).
Speed	The SHDSL link train-up speed. In parentheses is the usable bit rate, which is the raw bit rate minus the management overhead.
Uptime	The current up time for the interface.

Figure 10-13: Example output from the **show shdsl=0** command

```
SHDSL Interface Information
-----------------------------------------------------------
shdsl0:
  Status ..................... Enabled
  Up time .................... 118 sec
  Link state ................. Up

                               Pair 1              Pair 2
                               ------              ------
  State ...................... Data                Data
  Last failed state .......... no_startup          no_startup
  Speed ...................... 2312(2304) kbps     2312(2304) kbps
  Standard ..................  Annex A             Annex A

Line settings:
  Mode ....................... CPE
  Bert ....................... OFF
  Auto-retrain ............... ON
  Pair mode .................. 4WIRESTANDARD
  Annex standard ............. BOTH
  Bit rate mode .............. FIXED
  Minimum bit rate ........... 144 kbps
  Maximum bit rate ........... 4624 kbps
  SNR margin threshold ....... 0 dB
  Attenuation threshold ...... 0 dB
  PSD mask type .............. SYMMETRIC
```

Table 10-14: Parameters displayed in the output of the **show shdsl=0** command

Parameter	Meaning
Status	Whether or not the SHDSL interface is enabled.
State	The current interface state (*Table 10-15*).
Link State	The current reported MIB operation state.
Last failed state	The last state reached in the training state before start-up failed (*Table 10-16 on page 10-76*).
Mode	The operating mode, either CO or CPE.
Speed	The raw SHDSL link train-up speed. In parentheses is the usable bit rate, which is the raw bit rate minus the management overhead.
BERT	The current BERT configuration.
Auto-Retrain	The configuration of the Auto-Retrain feature.
Standard	The configured annex standard setting.
Pair mode	The current configuration of the interfaces pair mode.
Uptime	The current up time for the interface

Table 10-15: SHDSL interface states

State	Meaning
Idle	Waiting for commands to enable it or change configuration.
Data	The connection settings were successfully negotiated and the connection is now able to send data.
Handshake	Waiting for or sending handshakes from the other side.
PMMS	Power Measurement Modulation Session (Line Probe). Determining the possible data rates given the line conditions.
Training	Received a handshake or response from a handshake and proceeding to negotiate the connection settings.

Table 10-16: Last failed state (during training) for an SHDSL interface

Name	Meaning
No Startup	No reported startup failures.
Preactivation	PMD pre-activation failure. Pre-activation sequence was not detected or caused an exception. C991.2 section 6.3
Activation	SHDSL Activation sequence started
Check Bit rate	Checking bit rates for correctness
CPE Transmit Ar	Transmit handshake transaction A from HSTU-R
CO Receive Ar	Receive handshake transaction A from HSTU-R
CPE Transmit Bc	Transmit handshake transaction B from HSTU-C
CO Receive Bc	Receive handshake transaction B from HSTU-C
CPE Transmit Ar'	Retransmitting Ar
CO Wait for Ar'	Waiting for retransmission of AR
CPE Transmit Bc'	Retransmitting Bc
CPE Transmit Cr	Transmitting the Cr Signal
CO Transmit Sc	Received Cr signal responding with Sc signal
CPE Transmit Sr	Transmitting the Sr signal after the Cr signal.
CO Line AGC	Automatic gain control initialisation.
CPE Line AGC	Automatic gain control initialisation.
FD EC Training	Echo or FDM detection and calibration.
Equalizer Training	Calibration of SHDSL equalizer
Tip Ring Aligned	Detection and alignment of power tip and ring.
CO Transmit Tc	Receiver converged and now progressing on Tc signal and waiting for the Tr signal.
CO Receive Tr	Tc signal detected responding with Tr signal.
CO Transmit Fc1	Tr signal received. Sending first Fc frame.
CO Transmit Fc2	Sent first Fc frame sending second Fc frame.
CPE Receive Tc	Tc signal detected responding with Tr signal.
CPE Transmit Tr	Tr signal received. Waiting for FC frames.
CPE Receive Fc	Received both FC frames OK.
Load cppa	Loading code onto interface hardware.
Load cptrain	Loading code onto interface hardware.

Table 10-16: Last failed state (during training) for an SHDSL interface (cont.)

Name	Meaning
Load cptom	Loading code onto interface hardware.
Load cpdm	Loading code onto interface hardware.
Load copa	Loading code onto interface hardware.
Load cotrain	Loading code onto interface hardware.
Load cotom	Loading code onto interface hardware.
Load codm	Loading code onto interface hardware.
Load corate	Loading code onto interface hardware.
Load coregfilt	Loading code onto interface hardware.
Load cprate	Loading code onto interface hardware.
Load cpregfilt	Loading code onto interface hardware.

Examples To display summary information about SHDSL interfaces use the command:

```
sh shd
```

To display detailed information about SHDSL interface 0 use the command

```
sh shd=0
```

Related Commands

disable shdsl
enable shdsl
set shdsl
show shdsl
show shdsl linedetails
show shdsl counter

show shdsl counter

Syntax `SHow SHDsl={`*interface*`|ALL} COUnter`

Description This command displays counter information for the specified SHDSL interface, or all SHDSL interfaces.

Figure 10-14: Example output from the **show shdsl=0 counter** command

```
SHDSL Counter Information
-------------------------------------------------------------
shdsl0:
  Tx cells ..................... 4417785
  Rx cells ..................... 12
  Dropped cells ................ 0
  HEC errors ................... 0
  Cell deliniation ............. 01
  Trains ....................... 1
  Train failures ............... 0
  Retrains ..................... 1
  Up time current .............. 2 days 23:00:32
  Up time prevous .............. 01:00:10
  Up time total ................ 3 days 00:00:42
  Down time current ............ 00:00:00
  Down time previous ........... 00:00:17
  Down time total .............. 00:00:17

  Local(CPE):
    Pair 1              Current     15 min   24 hours
      CRC ..........          5          0          5
      SEGA .........          6          0          6
      LOSW .........          4          0          4
      CV ...........          0          0          0
      ES ...........          1          0          1
      SES ..........          1          0          1
      UAS ..........          0          0          0

    Pair 2              Current     15 min   24 hours
      CRC ..........          6          0          6
      SEGA .........         10          0         10
      LOSW .........          4          0          4
      CV ...........          0          0          0
      ES ...........          1          0          1
      SES ..........          1          0          1
      UAS ..........          0          0          0

  Remote(CO):
    Pair 1              Current     15 min   24 hours
      CRC ..........          0          0          0
      SEGA .........          0          0          0
      LOSW .........          0          0          0
      CV ...........          0          0          0
      ES ...........          0          0          0
      SES ..........          0          0          0
      UAS ..........          0          0          0
```

Figure 10-14: Example output from the **show shdsl=0 counter** command (cont.)

```
  Pair 2              Current     15 min   24 hours
    CRC ..........          0          0          0
    SEGA .........          0          0          0
    LOSW .........          0          0          0
    CV ...........          0          0          0
    ES ...........          0          0          0
    SES ..........          0          0          0
    UAS ..........          0          0          0

BERT counters
                                Pair 1              Pair 2
                                ------              ------
  Status ..................... Enabled             Enabled
  Sync ....................... Framed              Framed
  BERT errors ................ 0                   2
  Seconds .................... 289                 289

EOC counters
  Rx QueueDiscard ........... 0
  Rx CRCError ............... 1
  Rx UnknownType ............ 0
  Rx InvalidAddress ......... 0
  Rx ReadError .............. 0
  Rx Messages ............... 2122

  Tx QueueDiscard ........... 0
  Tx WriteError ............. 0
  Tx Messages ............... 2122
```

Table 10-17: Parameters displayed in the output of the **show shdsl=0 counter** command

Parameter	Meaning
TX cells	The number of cells transmitted on the line.
Rx cells	The number of user cells received on the line
Dropped cells	The number of ATM cells dropped by the SHDSL interface.
HEC errors	The number of ATM cell errors encountered by the SHDSL interface.
Cell delineation	The current state of the ATM cell delineation on the SHDSL interface. Under normal operation the value for this is always 01.
Trains	The number of times the SHDSL interface has needed to train up.
Train failures	The number of times the SHDSL interface has begun training an not proceeded through to the Data state.
Retrains	The number of times the SHDSL interface has retrained due to line conditions.
Up time current	The current length of time the interface has been in the connected state.
Up time previous	The length of time the interface was in the connected state before the last loss of connection.
Up time total	The length of time the interface has spent in the connected state since booting and enabling the interface.
Down time current	The length of time the interface has spent out of the connected state since the interface was last connected or enabled.

Table 10-17: Parameters displayed in the output of the **show shdsl=0 counter** command (cont.)

Parameter	Meaning
Down Time previous	The length of time the interface spent out of the connected state since the last connected state.
Down time total	The length of time the interface has spent out of the connected state since the interface was enabled and the device was started.
Local (CPE) and Remote (CO)	Counters for each end of the SHDSL connection. For definitions, see ITU-T Recommendation G.991.2.
CRC	The number of CRC anomalies on the STU since the STU was last restarted.
SEGA	The number of Segment Anomalies on the STU since the STU was last restarted.
LOSW	The number of Loss of Sync Word (LOSW) Seconds on this endpoint since the STU was last restarted.
CV	The number of Code Violations on the STU since the STU was last restarted.
ES	The number of Errored Seconds (ES) on the STU since the STU was last restarted.
SES	The number of Severely Errored Seconds (SES) on the STU since the STU was last restarted.
UAS	The number of Unavailable Seconds (UAS) on the STU since the STU was last restarted.
BERT counters	Bit-rate error test results for the current or most recent BERT.
Status	Whether there is a BERT running: Enabled if a BERT has been started Disabled if no BERT is running
Sync	Whether the BERT has begun successfully: Framed, if the BERT test has successfully begun No sync, if the BERT has not successfully been able to start. This usually indicates that the remote end is not conducting a BERT.
Bert errors	The number of errors for the current BERT. Overflow, if more than 255 BERT errors have been encountered in the last second. Once the counter has overflowed, you must stop the BERT and start it again.
Seconds	The number of seconds the BERT has been running for.
EOC counters	Counters for the SHDSL Embedded Operation Channel (EOC).
Rx QueueDiscard	The number of EOC messages that were discarded due to a full receive queue.
Rx CRCError	The number of received EOC messages that were discarded due to CRC errors in the message.
Rx CRCError	The number of received EOC messages that were discarded due to errors in the message detected by checking the CRC.
Rx UnknownType	The number of received EOC messages that had either a corrupted second byte or a message ID that the router did not recognise.
Rx InvalidAddress	The number of received EOC messages that were discarded because the destination address was neither the router address, the broadcast address nor the next hop address.
Rx ReadError	The number of errors due to the software not being able to read the received EOC messages from the hardware.

Table 10-17: Parameters displayed in the output of the **show shdsl=0 counter** command (cont.)

Parameter	Meaning
Rx Messages	The number of messages received on the EOC channel.
Tx QueueDiscard	The number of EOC messages discarded because the EOC queue was full.
Tx WriteError	The number of EOC messages discarded because the software failed to write to the hardware.
Tx Messages	The number of EOC messages sent over the EOC channel.

Examples To display counter information for SHDSL interface 0, use the command

```
sh shd=0 cou
```

Related Commands

disable shdsl
enable shdsl
enable shdsl debug
set shdsl

show shdsl linedetails

Syntax `SHow SHDsl={`*interface*`|ALL} LINEdetails`

Description This command displays the current negotiated configuration information for the specified SHDSL interface or all SHDSL interfaces. If the SHDSL interface is not in the data state, the parameters displayed in the output are the last received or known parameters for the connection.

Figure 10-15: Example output from the **show shdsl=0 linedetails** command for an SHDSL interface in data state

```
SHDSL Line Details
--------------------------------------------------------------------------------
shdsl0:
                                Pair 1              Pair 2
                                ------              ------
  Standard ..................... Annex A            Annex A
  Pair mode .................... 2 pair standard    2 pair standard
  Loop status .................. slave              master
  Line swapped(4wire) ......... unswapped          unswapped
  Pmms mode .................... Remote             Remote
  Transmit power ............... 8.5 dB             8.5 dB
  Bit rate mode ................ Fixed              Fixed
  Current data rate ............ 2312(2304) kbps    2312(2304) kbps
  Tip & ring status ............ reversed           reversed
  Remote country code ......... United States      United States
  Remote provider code ........ NPSG(4e505347)     NPSG(4e505347)
  Remote encoder coeff A ...... 6e010000           6e010000
  Remote encoder coeff B ...... 31030000           31030000

Signal information:
                                Pair 1              Pair 2
                                ------              ------
  Local(CPE):
    SNR ........................ 39.83 dB           40.07 dB
    SNR Margin ................. 17.13 dB           17.37 dB
    Attenuation ................ 0 dB               0 dB
  Remote(CO):
    SNR Margin ................. 18 dB              17 dB
    Attenuation ................ 0 dB               0 dB

Remote unit information:

  Remote(CO) VendorID ......... 0x4154490000000000          (ATI.....)
  Remote(CO) Model ............ 0x41542d4152343432530000000  (AT-AR442S...)
  Remote(CO) SerialNumber ..... 0x3631363831343633000000000  (61681463....)
  Remote(CO) SoftwareVersion .. 0x332e302e3500              (3.0.5.)
  Remote(CO) SHDSLVersion ..... 8
  Remote(CO) CLEI ............. 0x00000000000000000000      (..........)
  Remote(CO) VendorList ....... 0x000000                    (..........)
  Remote(CO) VendorIssue ...... 0x0000                      (..)
  Remote(CO) VendorOther ...... 0x322e392e312d303000000000  (2.9.1-00....)
```

Figure 10-15: Example output from the **show shdsl=0 linedetails** command for an SHDSL interface in data state (cont.)

```
Alarm information:
                               Pair 1              Pair 2
                               ------              ------
  Local(CPE):
    LOSW fail alarm ........... No alarm            No alarm
    SNR Margin alarm .......... No alarm            No alarm
    Attenuation alarm ......... No alarm            No alarm
  Remote(CO):
    LOSW fail alarm ........... No alarm            No alarm
    SNR margin alarm .......... No alarm            No alarm
    Attenuation alarm ......... No alarm            No alarm

Handshake status:
                               Pair 1              Pair 2
                               ------              ------
  Frame result ................ Ok                  Ok
  Message result .............. Ok                  Ok
  Session result .............. Sent ok             Sent ok

Local handshake details (Pair 1):

4 Wire Support ............................ Yes
Annex support ............................. A, B

Transmit
Symmetric bitrates supported (kbps) ......   64,  128,  192,  256,  320,  384
                                            448,  512,  576,  640,  704,  768
                                            832,  896,  960, 1024, 1088, 1152
                                           1216, 1280, 1344, 1408, 1472, 1536
                                           1600, 1664, 1728, 1792, 1856, 1920
                                           1984, 2048, 2112, 2176, 2240, 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... n/a

Receive
Symmetric bitrates supported (kbps) ......   64,  128,  192,  256,  320,  384
                                            448,  512,  576,  640,  704,  768
                                            832,  896,  960, 1024, 1088, 1152
                                           1216, 1280, 1344, 1408, 1472, 1536
                                           1600, 1664, 1728, 1792, 1856, 1920
                                           1984, 2048, 2112, 2176, 2240, 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... n/a

Local handshake details (Pair 2):

4 Wire Support ............................ Yes
Annex support ............................. A, B

Transmit
Symmetric bitrates supported (kbps) ......   64,  128,  192,  256,  320,  384
                                            448,  512,  576,  640,  704,  768
                                            832,  896,  960, 1024, 1088, 1152
                                           1216, 1280, 1344, 1408, 1472, 1536
                                           1600, 1664, 1728, 1792, 1856, 1920
                                           1984, 2048, 2112, 2176, 2240, 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... n/a
```

Figure 10-15: Example output from the **show shdsl=0 linedetails** command for an SHDSL interface in data state (cont.)

```
Receive
Symmetric bitrates supported (kbps) ......   64,  128,  192,  256,  320,  384
                                            448,  512,  576,  640,  704,  768
                                            832,  896,  960, 1024, 1088, 1152
                                           1216, 1280, 1344, 1408, 1472, 1536
                                           1600, 1664, 1728, 1792, 1856, 1920
                                           1984, 2048, 2112, 2176, 2240, 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... n/a

Remote handshake details (Pair 1):

Not master pair

Remote handshake details (Pair 2):

4 Wire Support ........................... Yes
Annex support ............................ A, B

Transmit
Symmetric bitrates supported (kbps) ......   64,  128,  192,  256,  320,  384
                                            448,  512,  576,  640,  704,  768
                                            832,  896,  960, 1024, 1088, 1152
                                           1216, 1280, 1344, 1408, 1472, 1536
                                           1600, 1664, 1728, 1792, 1856, 1920
                                           1984, 2048, 2112, 2176, 2240, 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... n/a

Receive
Symmetric bitrates supported (kbps) ......   64,  128,  192,  256,  320,  384
                                            448,  512,  576,  640,  704,  768
                                            832,  896,  960, 1024, 1088, 1152
                                           1216, 1280, 1344, 1408, 1472, 1536
                                           1600, 1664, 1728, 1792, 1856, 1920
                                           1984, 2048, 2112, 2176, 2240, 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... n/a

Handshake result (Pair 1):

4 Wire Support ........................... Yes
Annex support ............................ A

Transmit
Symmetric bitrates supported (kbps) ...... 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... 6

Receive
Symmetric bitrates supported (kbps) ...... 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... 6
```

Figure 10-15: Example output from the **show shdsl=0 linedetails** command for an SHDSL interface in data state (cont.)

```
Handshake result (Pair 2):

4 Wire Support ........................... Yes
Annex support ............................ A

Transmit
Symmetric bitrates supported (kbps) ...... 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... 6

Receive
Symmetric bitrates supported (kbps) ...... 2304
Asymmetric support (kbps) ................ n/a
Sub rate support (kbps) .................. 0
Power backoff (dB) ....................... 6
--------------------------------------------------------------------------------
```

Table 10-18: Parameters displayed in the output of the **show shdsl=0 linedetails** command

Parameter	Meaning
Standard	The SHDSL G.991.2 standard being used on the line; either Annex A or Annex B.
Pair Mode	Whether the SHDSL line is operating in 1-pair or 2-pair mode, and if in 2-pair mode whether it is in standards-based or enhanced mode.
Loop status	For standards-based 2-pair mode only, whether the pair is the master pair or the slave pair.
Line swapped	Whether the pairs used in a 2-pair (4-wire) mode are swapped (pair 1 at the CPE connected to pair 2 at the CO) or unswapped.
PmmsMode	Power measurement modulation session: either Local or Remote.
Transmit Power	The local STU transmit power. This value is determined during training—it is not monitored.
Bit Rate Mode	Indicates if the unit adapts its rate at start-up or uses a fixed rate: either Adaptive or Fixed.
Current data rate	The current raw data rate that the line is operating at. In parentheses is the usable bit rate, which is the raw bit rate minus the management overhead.
Tip and ring status	Whether the line polarity of the tip and ring wires is normal or reversed.
Remote country code	Country code for the remote end of the SHDSL link.
Remote provider code	The service provider code for the remote end of the SHDSL link.
Remote encoder coeff A	Encoding coefficient A for the remote end of the SHDSL link.
Remote encoder coeff B	Encoding coefficient B for the remote end of the SHDSL link.

Table 10-18: Parameters displayed in the output of the **show shdsl=0 linedetails** command (cont.)

Parameter	Meaning
Signal information	For Pair 1 and Pair 2.
Local (CO|CPE) SNR	Local SNR calculated for the line.
Local (CO|CPE) SNR Margin	The current Margin calculated to maintain 10E-7 BER.
Local (CO|CPE) Attenuation	The local calculated loop attenuation.
Remote (CO|CPE) SNR margin	Reported SNR margin from the remote side CPE or CO.
Remote (CO|CPE) attenuation threshold	Reported attenuation threshold.
Remote unit information	
Remote (CO|CPE) VendorID	Vendor ID (system integrator) as reported in an Inventory Response message.
Remote (CO|CPE) Model	Vendor model number as reported in an Inventory Response message.
Remote (CO|CPE) SerialNumber	Vendor serial number as reported in an Inventory Response message.
Remote (CO|CPE) SoftwareVersion	Vendor software version as reported in an Inventory Response message.
Remote (CO|CPE) SHDSLVersion	Version of the SHDSL standard implemented, as reported in an Inventory Response message.
Remote (CO|CPE) CLEI	The unique Common Language Equipment Code (CLEI), as reported in an Inventory Response message.
Remote (CO|CPE) VendorList	The modem hardware version as reported in an Inventory Response message.
Remote (CO|CPE) VendorIssue	The modem issue number as reported in an Inventory Response message.
Remote (CO|CPE) VendorOther	Other vendor information as reported in an Inventory Response message.
Alarm information	For Pair 1 and Pair 2.
Local (CO|CPE) LOSW fail alarm	The status of the local LOSW alarm; either "No alarm" or "***Alarm***".
Local (CO|CPE) SNR Margin alarm	The status of the local SNR margin alarm; either "No alarm" or "***Alarm***".
Local (CO|CPE) Attenuation alarm	The status of the local attenuation alarm; either "No alarm" or "***Alarm***".
Remote (CO|CPE) LOSW fail alarm	The status of the remote LOSW alarm; either "No alarm" or "***Alarm***".
Remote (CO|CPE) SNR Margin alarm	The status of the remote SNR margin alarm; either "No alarm" or "***Alarm***".
Remote (CO|CPE) Attenuation alarm	The status of the remote attenuation alarm; either "No alarm" or "***Alarm***".
Handshake status	For Pair 1 and Pair 2.
Frame Result	The result of frame reception during handshake.
Message Result	The result of message parsing during handshake.
Session Result	The result of the handshake session.

Table 10-18: Parameters displayed in the output of the **show shdsl=0 linedetails** command (cont.)

Parameter	Meaning
Local handshake Details	These are the parameters on the local unit's handshake to the remote unit. This is the information sent in the last handshake.
Remote handshake Details	These are the handshake parameters received from the remote unit. This is the information received in the last handshake. For standards-based 2-pair mode handshake information is not received from the remote unit over the slave pair.
Handshake result	Only valid once the connection is in data mode. It contains the parameters used in the connection. This information represents the final parameters that were selected for the connection.
4 Wire Support	States whether the other end supports 2-pair (4-wire) mode.
Annex support	The supported standards (annexes) advertised in the handshake.
Transmit	Parameters that only apply to the transmit direction
Receive	Parameters that only apply to the receive direction
Symmetric bitrates supported (kbps)	These are the symmetric bit rates advertised in the handshake.
Asymmetric support (kbps)	These are the asymmetric bitrates that are advertised in the handshake
Sub rate support (kbps)	These are the subrate bitrates that are advertised in the handshake
Power backoff (dB)	The power back off. This is only valid in the handshake result once the connection is in data mode.

Examples

To display line status information about SHDSL interface 0, use the command:

```
sh shd=0 line
```

Related Commands

disable shdsl
enable shdsl
set shdsl
show shdsl
show shdsl linedetails
show shdsl counter