Network Working Group
Request for Comments: xxxx
Category: Standards Track

B. Ray
Verilink Corporation
R. Abbi
Alcatel

November 2001

Definitions of Managed Objects for HDSL2 and SHDSL Lines
draft-ietf-adslmib-hdsl2-11.txt

Status of this Memo

Copyright Notice

Table of Contents

1. Abstract

This document defines a portion of the Management Information Base (MIB) module for use with network management protocols in the Internet community. In particular, it describes objects used for managing High Bit-Rate DSL - 2nd generation (HDSL2) [18] and Single-Pair High-Speed Digital Subscriber Line (SHDSL) interfaces [19].

This document specifies a MIB module in a manner that is both compliant to the SMIv2 (STD 58 [5, 6, 7]), and semantically identical to the peer SMIv1 definitions (STD 16 [2, 3]).

2. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2571 [1].

- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in STD 16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIv2, is described in STD 58, RFC 2578 [5], STD 58, RFC 2579 [6] and STD 58, RFC 2580 [7].

o Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and

described in STD 15, RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].

- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].

- o A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [16].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [17].

3. Introduction

This document describes an SNMP MIB for managing HDSL2/SHDSL Lines. These definitions are based upon the specifications for the HDSL2 and SHDSL Embedded Operations Channel (EOC) as defined in ANSI T1E1.4/2000-006 [18] and ITU G.991.2 [19].

The MIB is located in the MIB tree under MIB 2 transmission, as discussed in the MIB-2 Integration (RFC 1213 [20] and RFC 2863 [21]) section of this document.

3.1. Relationship of the HDSL2/SHDSL Line MIB to other MIBs

This section outlines the relationship of this MIB with other MIBs

described in RFCs. Specifically, IF-MIB as presented RFC 2863 [21] is discussed.

3.1.1 General IF-MIB Integration (RFC 2863)

The HDSL2/SHDSL Line MIB specifies the detailed attributes of a data interface. As such, it needs to integrate with RFC 2863 [21]. The IANA has assigned the following ifTypes to HDSL2 and SHDSL:

```
IANAifType ::= TEXTUAL-CONVENTION
    ...
SYNTAX INTEGER {
    ...
    hdsl2 (168), -- High Bit-Rate DSL, 2nd generation
    shdsl (169), -- Multirate HDSL2
    ...
    }
```

Note that the ifFixedLengthGroup from RFC 2863 [21] MUST be supported and that the ifRcvAddressGroup does not apply to this MIB.

3.1.2 Usage of ifTable

The MIB branch identified by this ifType contains tables appropriate for this interface type. Most such tables extend the ifEntry table, and are indexed by ifIndex. For interfaces in systems implementing this MIB, those table entries indexed by ifIndex MUST be persistent.

The following attributes are part of the mandatory ifGeneral group in RFC 2863 [21], and are not duplicated in the HDSL2/SHDSL Line MIB.

ifIndex	Interface index.
ifDescr	See interfaces MIB [21].
ifType	hdsl2(168) or shdsl(169).
ifSpeed	Set as appropriate. (This is fixed at 1552000 for HDSL2 lines)
ifPhysAddress	This object MUST have an octet string with zero length.
ifAdminStatus	See interfaces MIB [21].
ifOperStatus	See interfaces MIB [21].
ifLastChange	See interfaces MIB [21].

ifName See interfaces MIB [21].

```
    ifLinkUpDownTrapEnable   Default to enabled(1).

    ifHighSpeed              Set as appropriate.
                             (For HDSL2 lines, this is fixed at 2)

    ifConnectorPresent       Set as appropriate.
```

==========

Figure 1: Use of ifTable Objects

3.2 IANA Considerations

The SNMPv2-TM MIB module requires the allocation of a single object identifier for its MODULE-IDENTITY. IANA should allocate this object identifier in the transmission subtree, defined in the SNMPv2-SMI MIB module.

4. Conventions used in the MIB

4.1. Naming Conventions

A. xtuC refers to a central site terminal unit;
   H2TU-C for HDSL2, or STU-C for SHDSL.
B. xtuR refers to a remote site terminal unit;
   H2TU-R for HDSL2, or STU-R for SHDSL.
C. xtu refers to a terminal unit; either an xtuC or xtuR.
D. xru refer to a regenerator unit;
   H2RU for HDSL2, or SRU for SHDSL.
E. xU refers to any HDSL2/SHDSL unit; either an xtu or xru.
F. CRC is cyclic redundancy check [19].
G. ES means errored second [19].
H. LOSW means loss of sync word [19].
I. LOSWS means LOSW seconds [19].
J. SES means severely errored second [19].
K. SNR means signal-to-noise ratio [19].
L. UAS means unavailable second [19].

4.2. Textual Conventions

The following textual conventions are defined to reflect the line topology in the MIB (further discussed in the following section) and to define the behavior of the statistics to be maintained by an agent.

o Hdsl2ShdslUnitId :

Attributes with this syntax uniquely identify each unit in a HDSL2/SHDSL span. It mirrors the EOC addressing mechanism:

```
   xtuC(1)                 - CO terminal unit
   xtuR(2)                 - CPE terminal unit
```

```
xru1(3) .. xru8(10)    - regenerators, numbered from
                          central office side
```

o Hdsl2ShdslUnitSide:

Attributes with this syntax reference the two sides of a unit:

```
networkSide(1)   - N in figure 2, below
customerSide(2)  - C in figure 2, below
```

o Hdsl2ShdslWirePair:

Attributes with this syntax reference the wire-pairs connecting the units:

```
wirePair1(1)   - First pair for HDSL2/SHDSL.

wirePair2(2)   - Optional second pair for SHDSL only.
```

o Hdsl2ShdslTransmissionModeType:

Attributes with this syntax specify the regional setting for a SHDSL line. Specified as a BITS construct, the two mode types are:

```
region1   - ITU-T G.991.2 Annex A
region2   - ITU-T G.991.2 Annex B
```

o Hdsl2ShdslPerfCurrDayCount:

Attributes with this syntax define the behavior of the 1-day (24 hour) gauges found in the MIB.

o Hdsl2Shdsl1DayIntervalCount:

Attributes with this syntax define the behavior of the 1-day (24 hour) interval counters found in the MIB.

o Hdsl2ShdslPerfTimeElapsed:

Attributes with this syntax define the behavior of the elapsed time counters found in the MIB.

o Hdsl2ShdslPerfIntervalThreshold:

Attributes with this syntax define the behavior of the alarm thresholds found in the MIB.

o Hdsl2ShdslClockReferenceType

Attributes with this syntax define the clock references for the HDSL2/SHDSL span.

4.3. Structure

The MIB is structured into following MIB groups:

o Span Configuration Group:

This group supports MIB objects for configuring parameters for the HDSL2/SHDSL span. It contains the following table:

- hdsl2ShdslSpanConfTable

o Span Status Group:

This group supports MIB objects for retrieving span status information. It contains the following table:

- hdsl2ShdslSpanStatusTable

o Unit Inventory Group:

This group supports MIB objects for retrieving unit inventory information about units in HDSL2/SHDSL lines via the EOC. It contains the following table:

- hdsl2ShdslInventoryTable

o Segment Endpoint Configuration Group:

This group supports MIB objects for configuring parameters for the HDSL2/SHDSL segment endpoints. It contains the following table:

- hdsl2ShdslEndpointConfTable

o Segment Endpoint Current Status/Performance Group:

This group supports MIB objects that provide the current status/performance information relating to segment endpoints. It contains the following table:

- hdsl2ShdslEndpointCurrTable

o Segment Endpoint 15-Minute Interval Status/Performance Group:

This group supports MIB objects that provide historic status/performance information relating to segment endpoints in 15-minute intervals. It contains the following table:

- hdsl2Shdsl15MinIntervalTable

o Segment Endpoint 1-Day Interval Status/Performance Group:

This group supports MIB objects that provide historic

status/performance information relating to segment endpoints in 1-day intervals. It contains the following table:

- hdsl2Shdsl1DayIntervalTable

o Maintenance Group:

This group supports MIB objects for performing maintenance operations such as loopbacks for HDSL2/SHDSL lines. It contains the following table(s):

- hdsl2ShdslEndpointMaintTable
- hdsl2ShdslUnitMaintTable

o Span Configuration Profile Group:

This group supports MIB objects for defining configuration profiles for HDSL2/SHDSL Spans. It contains the following table:

- hdsl2ShdslSpanConfProfileTable

o Segment Endpoint Alarm Configuration Profile Group:

This group supports MIB objects for defining alarm configuration profiles for HDSL2/SHDSL Segment Endpoints. It contains the following table:

- hdsl2ShdslEndpointAlarmConfProfileTable

o Notifications Group:

This group defines the notifications supported for HDSL2/SHDSL lines:

- hdsl2ShdslLoopAttenCrossing
- hdsl2ShdslSNRMarginCrossing
- hdsl2ShdslPerfESThresh
- hdsl2ShdslPerfSESThresh
- hdsl2ShdslPerfCRCanomaliesThresh
- hdsl2ShdslPerfLOSWSThresh
- hdsl2ShdslPerfUASThresh
- hdsl2ShdslSpanInvalidNumRepeaters
- hdsl2ShdslLoopbackFailure
- hdsl2ShdslpowerBackoff
- hdsl2ShdsldeviceFault
- hdsl2ShdsldcContinuityFault
- hdsl2ShdslconfigInitFailure
- hdsl2ShdslprotocolInitFailure
- hdsl2ShdslnoNeighborPresent
- hdsl2ShdslLocalPowerLoss

4.3.1 Line Topology

An HDSL2/SHDSL Line consists of a minimum of two units - xtuC (the central termination unit) and an xtuR (the remote termination unit). The line may optionally support up to 8 repeater/regenerator units (xru) as shown in the figure below.

```
 <-- Network Side                            Customer Side -->

 |<////////////////// HDSL2/SHDSL Span ////////////////////>|

         <~~~>       <~~~> HDSL2/SHDSL Segments  <~~~>

 +-------+   +-------+   +-------+       +-------+   +-------+
 +       C=1=N       C=1=N       C=..1..=N       C=1=N       +
 | xtuC  |   |  xru1 |   |  xru2 |       |  xru8 |   |  xtuR |
 +       C=2=N       C=2=N       C=..2..=N       C=2=N       +
 +-------+   +-------+   +-------+       +-------+   +-------+

 Key:  <////> HDSL2/SHDSL Span
       <~~~~> HDSL2/SHDSL Segment
       =1=    HDSL2/SHDSL    wire-pair-1
       =2=    SHDSL optional wire-pair-2 (Not applicable to HDSL2)
       C      Customer Side Segment Endpoint (modem)
       N      Network  Side Segment Endpoint (modem)
```

Figure 2: General topology for an HDSL2/SHDSL Line

4.4. Counters, Interval Buckets and Thresholds

For SNR Margin, Loop Attenuation, ES, SES, CRC anomalies, LOSW, and UAS, there are event counters, current 15-minute and 0 to 96 15-minute history bucket(s) of "interval-counters", as well as current and 0 to 30 previous 1-day interval-counter(s). Each current 15-minute event bucket has an associated threshold notification.

Unlike RFC 2493 [22] and RFC 2662 [23], there is no representation in the MIB for invalid buckets. In those cases where the data for an interval is suspect or known to be invalid, the agent MUST NOT report the interval. If the current 15-minute event bucket is determined to be invalid, notifications based upon the value of the event bucket MUST NOT be generated.

Not reporting an interval will result in holes in the associated table. For example, the table, hdsl2Shdsl15MinIntervalTable, is indexed by { ifIndex, hdsl2ShdslInvIndex, hdsl2ShdslEndpointSide, hdsl2ShdslEndpointWirePair, hdsl2Shdsl15MinIntervalNumber}. If interval 12 is determined to be invalid but intervals 11 and 13 are valid, a Get Next operation on the indices .1.1.1.1.11 would

return indices .1.1.1.1.13.

There is no requirement for an agent to ensure a fixed relationship between the start of a fifteen minute and any wall clock; however some implementations may align the fifteen minute intervals with quarter hours. Likewise, an implementation may choose to align one day intervals with the start of a day.

Counters are not reset when an xU is reinitialized, only when the agent is reset or reinitialized (or under specific request outside the scope of this MIB).

4.5. Profiles

As a managed node can handle a large number of xUs, (e.g., hundreds or perhaps thousands of lines), provisioning every parameter on every xU may become burdensome. Moreover, most lines are provisioned identically with the same set of parameters. To simplify the provisioning process, this MIB makes use of profiles. A profile is a set of parameters that can be shared by multiple lines using the same configuration.

The following profiles are used in this MIB:

o Span Configuration Profiles - Span configuration profiles contain parameters for configuring HDSL2/SHDSL spans. They are defined in the hdsl2ShdslSpanConfProfileTable. Since span configuration parameters are only applicable for SHDSL, the support for span configuration profiles is optional for HDSL2 interfaces.

  Note that the configuration of the span dictates the behavior for each individual segment end point in the span. If a different configuration is provisioned for any given segment end point within the span, however, the new configuration for this segment end point will override the span configuration for this segment end point only.

o Segment Endpoint Alarm Configuration Profiles - These profiles contain parameters for configuring alarm thresholds for HDSL2/SHDSL segment endpoints. These profiles are defined in the hdsl2ShdslEndpointAlarmConfProfileTable.

  The index value for this profile is a locally-unique administratively assigned name for the profile having the textual convention `SnmpAdminString' (RFC 2571 [1]).

One or more lines may be configured to share parameters of a single profile (e.g., hdsl2ShdslEndpointAlarmConfProfile = `silver') by setting its hdsl2ShdslEndpointAlarmConfProfile objects to the value of this profile. If a change is made to the profile, all lines that refer to it will be reconfigured to the changed parameters. Before a profile can be deleted or taken out of service it must be first

unreferenced from all associated lines.

Implementations MUST provide a default profile whose name is `DEFVAL' for each profile type. The values of the associated parameters will be vendor specific unless otherwise indicated in this document. Before a line's profiles have been set, these profiles will be automatically used by setting hdsl2ShdslEndpointAlarmConfProfile and hdsl2ShdslSpanConfProfile to `DEFVAL' where appropriate. This default profile name, 'DEFVAL', is considered reserved in the context of profiles defined in this MIB.

Profiles are created, assigned, and deleted dynamically using the profile name and profile row status in each of the four profile tables.

Profile changes MUST take effect immediately. These changes MAY result in a restart (hard reset or soft restart) of the units on the line.

4.6. Notifications

The ability to generate the SNMP notifications coldStart/WarmStart (per [21]) which are per agent (e.g., per Digital Subscriber Line Access Multiplexer, or DSLAM, in such a device), and linkUp/linkDown (per [21]) which are per interface (i.e., HDSL2/SHDSL line) is required.

A linkDown notification MAY be generated whenever any of ES, SES, CRC Anomaly, LOSW, or UAS event occurs. The corresponding linkUp notification MAY be sent when all link failure conditions are cleared.

The notifications defined in this MIB are for initialization failure and for the threshold crossings associated with the following events: ES, SES, CRC Anomaly, LOSW, and UAS. Each threshold has its own enable/threshold value. When that value is 0, the notification is disabled.

The hdsl2ShdslEndpointCurrStatus is a bitmask representing all outstanding error conditions associated with a particular Segment Endpoint. Note that since status of remote endpoints is obtained via the EOC, this information may be unavailable for units that are unreachable via EOC during a line error condition. Therefore, not all conditions may always be included in its current status. Notifications corresponding to the bit fields in this object are defined.

Two alarm conditions, SNR Margin Alarm and Loop Attenuation Alarm, are organized in a manner slightly different from that implied in the EOC specifications. In the MIB, these alarm conditions are tied to the two thresholds hdsl2ShdslEndpointThreshSNRMargin and

hdsl2ShdslEndpointThreshLoopAttenuation found in the hdsl2ShdslEndpointAlarmConfProfileTable. In the EOC, the alarm conditions associated with these thresholds are per-unit. In the

MIB, these alarm conditions are per-endpoint. For terminal units, this has no impact. For repeaters, this implies an implementation variance where the agent in the terminal unit is responsible for detecting a threshold crossing. As the reporting of a repeater detected alarm condition to the polling terminal unit occurs in the same EOC message as the reporting of the current SNR Margin and Loop Attenuation values, it is anticipated that this will have very little impact on agent implementation.

A threshold notification occurs whenever the corresponding current 15-minute interval error counter becomes equal to, or exceeds the threshold value. One notification may be sent per interval per interface. Since the current 15-minute counter are reset to 0 every 15 minutes, if the condition persists, the notification may recur as often as every 15 minutes. For example, to get a notification whenever a "loss of" event occurs (but at most once every 15 minutes), set the corresponding threshold to 1. The agent will generate a notification when the event originally occurs.

Note that the Network Management System, or NMS, may receive a linkDown notification, as well, if enabled (via ifLinkUpDownTrapEnable [21]). At the beginning of the next 15 minute interval, the counter is reset. When the first second goes by and the event occurs, the current interval bucket will be 1, which equals the threshold and the notification will be sent again.

A hdsl2ShdslSpanInvalidNumRepeaters notification may be generated following completion of the discovery phase if the number of repeaters discovered on the line differs from the number of repeaters specified in hdsl2ShdslSpanConfNumRepeaters. For those conditions where the number of provisioned repeaters is greater than those encountered during span discovery, all table entries associated with the nonexistant repeaters are to be discarded. For those conditions where the number of provisioned repeaters is less than those encountered during span discovery, additional table entries are to be created using the default span configuration profile.

5. Conformance and Compliance

For both HDSL2 and SHDSL lines, the following group(s) are mandatory:

hdsl2ShdslSpanConfGroup
hdsl2ShdslSpanStatusGroup
hdsl2ShdslInventoryGroup
hdsl2ShdslEndpointConfGroup
hdsl2Shdsl15MinIntervalGroup
hdsl2Shdsl1DayIntervalGroup
hdsl2ShdslMaintenanceGroup
hdsl2ShdslEndpointAlarmConfGroup

hdsl2ShdslNotificationGroup

For HDSL2 lines, the following group(s) are optional:

```
      hdsl2ShdslSpanConfProfileGroup
      hdsl2ShdslSpanShdslStatusGroup
```

6. Definitions

```
HDSL2-SHDSL-LINE-MIB DEFINITIONS ::= BEGIN

IMPORTS
MODULE-IDENTITY,
OBJECT-TYPE,
Counter32,
Gauge32,
NOTIFICATION-TYPE,
Integer32,
transmission                  FROM SNMPv2-SMI
RowStatus,
TEXTUAL-CONVENTION            FROM SNMPv2-TC
ifIndex                       FROM IF-MIB
PerfCurrentCount,
PerfIntervalCount             FROM PerfHist-TC-MIB
SnmpAdminString               FROM SNMP-FRAMEWORK-MIB
MODULE-COMPLIANCE,
OBJECT-GROUP,
NOTIFICATION-GROUP            FROM SNMPv2-CONF;

hdsl2ShdslMIB MODULE-IDENTITY
    LAST-UPDATED "200111150000Z" -- November 15, 2001
    ORGANIZATION "ADSLMIB Working Group"
    CONTACT-INFO "WG-email:  XDSLMIB@LISTSERV.ECIRALEIGH.COM
                Subscribe: LISTSERV@LISTSERV.ECIRALEIGH.COM
                           In Body: subscribe/signoff XDSLMIB
                           Archive: index XDSLMIB/get <archivename>

                Chair:     Mike Sneed
                           ECI Telecom
                Postal:    1017 Main Campus Drive
                           Raleigh NC 27606 USA
                Email:     Mike.Sneed@go.ecitele.com
                Phone:     +1 919 513 1435

                Co-editor: Bob Ray
                           Verilink Corporation
                Postal:    950 Explorer Blvd
                           Huntsville, AL 35806 USA
                Email:     bray@verilink.com
                Phone:     +1 256 327 2380

                Co-editor: Rajesh Abbi
```

Alcatel USA
Postal: 2912 Wake Forest Road
Raleigh, NC 27609-7860 USA

```
                  Email:     Rajesh.Abbi@usa.alcatel.com
                  Phone:     +1 919 850 6194
                 "

   DESCRIPTION
        "This MIB module defines a collection of objects for managing
         HDSL2/SHDSL lines.  An agent may reside at either end of the
         line, however the MIB is designed to require no management
         communication between the modems beyond that inherent in the
         low-level EOC line protocol as defined in ANSI T1E1.4/2000-006
         (for HDSL2 lines), or in ITU G.991.2 (for SHDSL lines)."
    REVISION "200111150000Z" -- November 15, 2001
    DESCRIPTION "Initial version, published as RFC xxxx."

    ::= { transmission xxxx } -- to be assigned by IANA

   hdsl2ShdslMibObjects OBJECT IDENTIFIER ::= { hdsl2ShdslMIB 1 }

   -- Textual Conventions used in this MIB
   --

   Hdsl2ShdslPerfCurrDayCount ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "A gauge associated with interface performance measurements in
         a current 1-day (24 hour) measurement interval.

         The value of this gauge starts at zero at the beginning of an
         interval and is increased when associated events occur, until
         the end of the 1-day interval.  At that time the value of the
         gauge is stored in the previous 1-day history interval, as
         defined in a companion object of type
         Hdsl2Shdsl1DayIntevalCount, and the current interval gauge
         is restarted at zero.

         In the case where the agent has no valid data available for
         this interval the corresponding object instance is not
         available and upon a retrieval request a corresponding error
         message shall be returned to indicate that this instance does
         not exist.  Please note that zero is a valid value."
      SYNTAX  Gauge32

   Hdsl2Shdsl1DayIntervalCount ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "A counter associated with interface performance measurements
         during the most previous 1-day (24 hour) measurement interval.
         The value of this gauge is equal to the value of the current
         day gauge, as defined in a companion object of type
```

Hdsl2ShdslPerfCurrDayCount, at the end of its most recent interval.

```
         In the case where the agent has no valid data available for
         this interval the corresponding object instance is not
         available and upon a retrieval request a corresponding error
         message shall be returned to indicate that this instance does
         not exist."
      SYNTAX  Gauge32

   Hdsl2ShdslPerfTimeElapsed ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "The number of seconds that have elapsed since the beginning of
         the current measurement period.  If, for some reason, such as
         an adjustment in the system's time-of-day clock or the addition
         of a leap second, the current interval exceeds the maximum
         value, the agent will return the maximum value.

         For 15 minute intervals, the range is limited to (0..899).
         For 24 hour intervals, the range is limited to (0..86399)."
      SYNTAX    INTEGER(0..86399)

   Hdsl2ShdslPerfIntervalThreshold ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "This convention defines a range of values that may be set in
         a fault threshold alarm control.  As the number of seconds in
         a 15-minute interval numbers at most 900, objects of this type
         may have a range of 0...900, where the value of 0 disables the
         alarm."
      SYNTAX    INTEGER(0..900)

   Hdsl2ShdslUnitId ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "This is the unique identification for all units in a
         HDSL2/SHDSL Span.  It is based on the EOC unit addressing
         scheme with reference to the xtuC."
      SYNTAX    INTEGER
                {
                xtuC(1),
                xtuR(2),
                xru1(3),
                xru2(4),
                xru3(5),
                xru4(6),
                xru5(7),
                xru6(8),
                xru7(9),
                xru8(10)
                }
```

```
   Hdsl2ShdslUnitSide ::= TEXTUAL-CONVENTION
      STATUS    current
```

```
      DESCRIPTION
        "This is the referenced side of a HDSL2/SHDSL unit - Network
         or Customer side.  The side facing the Network is the Network
         side, while the side facing the Customer is the Customer side."
      SYNTAX    INTEGER
              {
              networkSide(1),
              customerSide(2)
              }

   Hdsl2ShdslWirePair ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "This is the referenced pair of wires in a HDSL2/SHDSL Segment.
         HDSL2 only supports a single pair (wirePair1), while SHDSL
         supports an optional second pair (wirePair2)."
      SYNTAX    INTEGER
              {
              wirePair1(1),
              wirePair2(2)
              }

   Hdsl2ShdslTransmissionModeType ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "Contains the regional setting of the HDSL2/SHDSL span,
        represented as a bit-map of possible settings. The various
        bit positions are:

        Bit   Meaning      Description
        1     region 1     Indicates ITU-T G.991.2 Annex A.
        2     region 2     Indicates ITU-T G.991.2 Annex B."
      SYNTAX      BITS
              {
              region1(0),
              region2(1)
              }

   Hdsl2ShdslClockReferenceType ::= TEXTUAL-CONVENTION
      STATUS    current
      DESCRIPTION
        "The various STU-C symbol clock references for the
        HDSL2/SHDSL span, represented as an enumeration."
      SYNTAX    INTEGER
             {
             localClk(1),          -- Mode-1 per G991.2
             networkClk(2),        -- Mode-2 per G991.2
             dataOrNetworkClk(3),  -- Mode-3a per G991.2
             dataClk(4)            -- Mode-3b per G991.2
```

```
            }

   -- Span Configuration Group
```

```
   --

   hdsl2ShdslSpanConfTable OBJECT-TYPE
      SYNTAX     SEQUENCE OF Hdsl2ShdslSpanConfEntry
      MAX-ACCESS not-accessible
      STATUS     current
      DESCRIPTION
        "This table supports overall configuration of HDSL2/SHDSL
         Spans.  Entries in this table MUST be maintained in a
         persistent manner."
      ::= { hdsl2ShdslMibObjects 1 }

   hdsl2ShdslSpanConfEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslSpanConfEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2ShdslSpanConfTable.  Each entry
         represents the complete Span in a single HDSL2/SHDSL line.
         It is indexed by the ifIndex of the associated HDSL2/SHDSL
         line."
      INDEX { ifIndex }
      ::= { hdsl2ShdslSpanConfTable 1 }

   Hdsl2ShdslSpanConfEntry ::=
      SEQUENCE
      {
      hdsl2ShdslSpanConfNumRepeaters          INTEGER,
      hdsl2ShdslSpanConfProfile               SnmpAdminString,
      hdsl2ShdslSpanConfAlarmProfile          SnmpAdminString
      }

   hdsl2ShdslSpanConfNumRepeaters OBJECT-TYPE
      SYNTAX      INTEGER(0..8)
      UNITS       "repeaters"
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object provisions the number of repeaters/regenerators
        in this HDSL2/SHDSL Span."
      ::= { hdsl2ShdslSpanConfEntry 1 }

   hdsl2ShdslSpanConfProfile OBJECT-TYPE
      SYNTAX      SnmpAdminString (SIZE(1..32))
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object is a pointer to a span configuration profile in
        the hdsl2ShdslSpanConfProfileTable, which applies to this span.
```

The value of this object is the index of the referenced profile in the hdsl2ShdslSpanConfProfileTable. Note that span configuration profiles are only applicable to SHDSL lines.

```
        HDSL2 lines MUST reference the default profile, 'DEFVAL'.
        By default, this object will have the value 'DEFVAL' (the index
        of the default profile).

        Any attempt to set this object to a value that is not the value
        of the index for an active entry in the profile table,
        hdsl2ShdslSpanConfProfileTable, MUST be rejected."
      ::= { hdsl2ShdslSpanConfEntry 2 }

   hdsl2ShdslSpanConfAlarmProfile OBJECT-TYPE
      SYNTAX      SnmpAdminString (SIZE(1..32))
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object is a pointer to an Alarm configuration profile in
        the hdsl2ShdslEndpointAlarmConfProfileTable.  The value of this
        object is the index of the referenced profile in the
        hdsl2ShdslEndpointAlarmConfProfileTable.  The alarm threshold
        configuration in the referenced profile will be used by default
        for all segment endpoints in this span.  Individual endpoints
        may override this profile by explicitly specifying some other
        profile in the hdsl2ShdslEndpointConfTable.  By default, this
        object will have the value 'DEFVAL' (the index of the default
        profile).

        Any attempt to set this object to a value that is not the value
        of the index for an active entry in the profile table,
        hdsl2ShdslEndpointAlarmConfProfileTable, MUST be rejected."
      ::= { hdsl2ShdslSpanConfEntry 3 }

   -- Span Status Group
   --

   hdsl2ShdslSpanStatusTable OBJECT-TYPE
      SYNTAX     SEQUENCE OF Hdsl2ShdslSpanStatusEntry
      MAX-ACCESS not-accessible
      STATUS     current
      DESCRIPTION
        "This table provides overall status information of
         HDSL2/SHDSL spans.  This table contains live data from
         equipment.  As such, it is NOT persistent."
      ::= { hdsl2ShdslMibObjects 2 }

   hdsl2ShdslSpanStatusEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslSpanStatusEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2ShdslSpanStatusTable.  Each entry
```

represents the complete span in a single HDSL2/SHDSL line.
It is indexed by the ifIndex of the associated HDSL2/SHDSL
line."

```
      INDEX { ifIndex }
      ::= { hdsl2ShdslSpanStatusTable 1 }

   Hdsl2ShdslSpanStatusEntry ::=
      SEQUENCE
      {
      hdsl2ShdslStatusNumAvailRepeaters        INTEGER,
      hdsl2ShdslStatusMaxAttainableLineRate    INTEGER,
      hdsl2ShdslStatusActualLineRate           INTEGER,
      hdsl2ShdslStatusTransmissionModeCurrent
                Hdsl2ShdslTransmissionModeType
      }

   hdsl2ShdslStatusNumAvailRepeaters OBJECT-TYPE
      SYNTAX      INTEGER(0..8)
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Contains the actual number of repeaters/regenerators
         discovered in this HDSL2/SHDSL span."
      ::= { hdsl2ShdslSpanStatusEntry 1 }

   hdsl2ShdslStatusMaxAttainableLineRate OBJECT-TYPE
      SYNTAX      INTEGER(0..4112000)
      UNITS       "bps"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Contains the maximum attainable line rate in this HDSL2/SHDSL
         span.  This object provides the maximum rate the line is
         capable of achieving.  This is based upon measurements made
         during line probing."
      ::= { hdsl2ShdslSpanStatusEntry 2 }

   hdsl2ShdslStatusActualLineRate OBJECT-TYPE
      SYNTAX      INTEGER(0..4112000)
      UNITS       "bps"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Contains the actual line rate in this HDSL2/SHDSL span.  This
        should equal ifSpeed."
      ::= { hdsl2ShdslSpanStatusEntry 3 }

   hdsl2ShdslStatusTransmissionModeCurrent OBJECT-TYPE
      SYNTAX      Hdsl2ShdslTransmissionModeType
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
```

```
        "Contains the current Power Spectral Density (PSD) regional
         setting of the HDSL2/SHDSL span."
      ::= { hdsl2ShdslSpanStatusEntry 4 }
```

```
   -- Unit Inventory Group
   --

   hdsl2ShdslInventoryTable OBJECT-TYPE
      SYNTAX     SEQUENCE OF Hdsl2ShdslInventoryEntry
      MAX-ACCESS not-accessible
      STATUS     current
      DESCRIPTION
        "This table supports retrieval of unit inventory information
         available via the EOC from units in a HDSL2/SHDSL line.

         Entries in this table are dynamically created during the
         line discovery process.  The life cycle for these entries
         is as follows:

            - xtu discovers a device, either a far-end xtu or an xru
            - an inventory table entry is created for the device
            - the line goes down for whatever reason
            - inventory table entries for unreachable devices are
              destroyed.

         As these entries are created/destroyed dynamically, they
         are NOT persistent."
      ::= { hdsl2ShdslMibObjects 3 }

   hdsl2ShdslInventoryEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslInventoryEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2ShdslInventoryTable.  Each entry
         represents inventory information for a single unit in a
         HDSL2/SHDSL line.  It is indexed by the ifIndex of the
         HDSL2/SHDSL line and the Hdsl2ShdslUnitId of the
         associated unit."
      INDEX { ifIndex, hdsl2ShdslInvIndex }
      ::= { hdsl2ShdslInventoryTable 1 }

   Hdsl2ShdslInventoryEntry ::=
      SEQUENCE
      {
      hdsl2ShdslInvIndex                      Hdsl2ShdslUnitId,
      hdsl2ShdslInvVendorID                   OCTET STRING,
      hdsl2ShdslInvVendorModelNumber          OCTET STRING,
      hdsl2ShdslInvVendorSerialNumber         OCTET STRING,
      hdsl2ShdslInvVendorEOCSoftwareVersion   Integer32,
      hdsl2ShdslInvStandardVersion            Integer32,
      hdsl2ShdslInvVendorListNumber           OCTET STRING,
```

```
      hdsl2ShdslInvVendorIssueNumber          OCTET STRING,
      hdsl2ShdslInvVendorSoftwareVersion      OCTET STRING,
      hdsl2ShdslInvEquipmentCode              OCTET STRING,
```

```
      hdsl2ShdslInvVendorOther                OCTET STRING,
      hdsl2ShdslInvTransmissionModeCapability
                              Hdsl2ShdslTransmissionModeType
      }

   hdsl2ShdslInvIndex OBJECT-TYPE
      SYNTAX      Hdsl2ShdslUnitId
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "Each entry in this table corresponds to a physical element
         in a HDSL2/SHDSL Span.  It is based on the EOC unit addressing
         scheme with reference to the xtuC."
      ::= { hdsl2ShdslInventoryEntry 1 }

   hdsl2ShdslInvVendorID OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(8))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Vendor ID as reported in an Inventory Response message."
      ::= { hdsl2ShdslInventoryEntry 2 }

   hdsl2ShdslInvVendorModelNumber OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(12))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Vendor model number as reported in an Inventory Response
         message."
      ::= { hdsl2ShdslInventoryEntry 3 }

   hdsl2ShdslInvVendorSerialNumber OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(12))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Vendor serial number as reported in an Inventory Response
         message."
      ::= { hdsl2ShdslInventoryEntry 4 }

   hdsl2ShdslInvVendorEOCSoftwareVersion OBJECT-TYPE
      SYNTAX      Integer32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Vendor EOC version as reported in a Discovery Response
         message."
      ::= { hdsl2ShdslInventoryEntry 5 }
```

```
   hdsl2ShdslInvStandardVersion OBJECT-TYPE
      SYNTAX      Integer32
```

```
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Version of the HDSL2/SHDSL standard implemented, as reported
         in an Inventory Response message."
      ::= { hdsl2ShdslInventoryEntry 6 }

   hdsl2ShdslInvVendorListNumber OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(3))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Vendor list number as reported in an Inventory Response
         message."
      ::= { hdsl2ShdslInventoryEntry 7 }

   hdsl2ShdslInvVendorIssueNumber OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(2))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Vendor issue number as reported in an Inventory Response
         message."
      ::= { hdsl2ShdslInventoryEntry 8 }

   hdsl2ShdslInvVendorSoftwareVersion OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(6))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Vendor software version as reported in an Inventory Response
         message."
      ::= { hdsl2ShdslInventoryEntry 9 }

   hdsl2ShdslInvEquipmentCode OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(10))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Equipment code conforming to ANSI T1.213, Coded Identification
         of Equipment Entities."
      ::= { hdsl2ShdslInventoryEntry 10 }

   hdsl2ShdslInvVendorOther OBJECT-TYPE
      SYNTAX      OCTET STRING(SIZE(12))
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Other vendor information as reported in an Inventory Response
```

```
         message."
      ::= { hdsl2ShdslInventoryEntry 11 }
```

```
   hdsl2ShdslInvTransmissionModeCapability OBJECT-TYPE
      SYNTAX      Hdsl2ShdslTransmissionModeType
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Contains the transmission mode capability of the SHDSL unit."
      ::= { hdsl2ShdslInventoryEntry 12 }

   -- Segment Endpoint Configuration Group
   --

   hdsl2ShdslEndpointConfTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2ShdslEndpointConfEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This table supports configuration parameters for segment
         endpoints in a HDSL2/SHDSL line.  As this table is indexed
         by ifIndex, it MUST be maintained in a persistent manner."
      ::= { hdsl2ShdslMibObjects 4 }

   hdsl2ShdslEndpointConfEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslEndpointConfEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2ShdslEndpointConfTable.  Each entry
         represents a single segment endpoint in a HDSL2/SHDSL line.
         It is indexed by the ifIndex of the HDSL2/SHDSL line, the
         UnitId of the associated unit, the side of the unit, and the
         wire-pair of the associated modem."
      INDEX { ifIndex, hdsl2ShdslInvIndex, hdsl2ShdslEndpointSide,
              hdsl2ShdslEndpointWirePair}
      ::= { hdsl2ShdslEndpointConfTable 1 }

   Hdsl2ShdslEndpointConfEntry ::=
      SEQUENCE
      {
      hdsl2ShdslEndpointSide                   Hdsl2ShdslUnitSide,
      hdsl2ShdslEndpointWirePair               Hdsl2ShdslWirePair,
      hdsl2ShdslEndpointAlarmConfProfile       SnmpAdminString
      }

   hdsl2ShdslEndpointSide OBJECT-TYPE
      SYNTAX      Hdsl2ShdslUnitSide
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "The side of the unit associated with this segment endpoint -
```

```
         Network/Customer side - as per the Hdsl2ShdslUnitSide textual
         convention."
      ::= { hdsl2ShdslEndpointConfEntry 1 }
```

```
   hdsl2ShdslEndpointWirePair OBJECT-TYPE
      SYNTAX      Hdsl2ShdslWirePair
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "The wire-pair of the modem associated with this segment
         endpoint as per the Hdsl2ShdslWirePair textual convention."
      ::= { hdsl2ShdslEndpointConfEntry 2 }

   hdsl2ShdslEndpointAlarmConfProfile OBJECT-TYPE
      SYNTAX      SnmpAdminString (SIZE(0..32))
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object configures the alarm threshold values to be used
         for this segment endpoint.  The values are obtained from the
         alarm configuration profile referenced by this object.  The
         value of this object is the index of the referenced profile in
         the hdsl2ShdslEndpointAlarmConfProfileTable, or NULL (a zero-
         length SnmpAdminString).  If the value is a zero-length
         SnmpAdminString, the endpoint uses the default Alarm
         Configuration Profile for the associated span as per the
         hdsl2ShdslSpanConfAlarmProfile object in the
         hdsl2ShdslSpanConfTable.  The default value of this object is
         a zero-length SnmpAdminString.

         Any attempt to set this object to a value that is not the value
         of the index for an active entry in the profile table,
         hdsl2ShdslEndpointAlarmConfProfileTable, MUST be rejected."
      ::= { hdsl2ShdslEndpointConfEntry 3 }

   -- Segment Endpoint Current Status/Performance Group
   --

   hdsl2ShdslEndpointCurrTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2ShdslEndpointCurrEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This table contains current status and performance information
         for segment endpoints in HDSL2/SHDSL Lines.  As with other
         tables in this MIB indexed by ifIndex, entries in this table
         MUST be maintained in a persistent manner."
      ::= { hdsl2ShdslMibObjects 5 }

   hdsl2ShdslEndpointCurrEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslEndpointCurrEntry
      MAX-ACCESS  not-accessible
```

```
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2ShdslEndpointCurrTable.  Each entry
```

```
        contains status and performance information relating to a
        single segment endpoint.  It is indexed by the ifIndex of the
        HDSL2/SHDSL line, the UnitId of the associated unit, the side
        of the unit, and the wire-pair of the associated modem."
      INDEX { ifIndex, hdsl2ShdslInvIndex, hdsl2ShdslEndpointSide,
              hdsl2ShdslEndpointWirePair }
      ::= { hdsl2ShdslEndpointCurrTable 1 }

   Hdsl2ShdslEndpointCurrEntry ::=
      SEQUENCE
      {
      hdsl2ShdslEndpointCurrAtn                INTEGER,
      hdsl2ShdslEndpointCurrSnrMgn             INTEGER,
      hdsl2ShdslEndpointCurrStatus             BITS,
      hdsl2ShdslEndpointES                     Counter32,
      hdsl2ShdslEndpointSES                    Counter32,
      hdsl2ShdslEndpointCRCanomalies           Counter32,
      hdsl2ShdslEndpointLOSWS                  Counter32,
      hdsl2ShdslEndpointUAS                    Counter32,
      hdsl2ShdslEndpointCurr15MinTimeElapsed
                                Hdsl2ShdslPerfTimeElapsed,
      hdsl2ShdslEndpointCurr15MinES            PerfCurrentCount,
      hdsl2ShdslEndpointCurr15MinSES           PerfCurrentCount,
      hdsl2ShdslEndpointCurr15MinCRCanomalies  PerfCurrentCount,
      hdsl2ShdslEndpointCurr15MinLOSWS         PerfCurrentCount,
      hdsl2ShdslEndpointCurr15MinUAS           PerfCurrentCount,
      hdsl2ShdslEndpointCurr1DayTimeElapsed
                                Hdsl2ShdslPerfTimeElapsed,
      hdsl2ShdslEndpointCurr1DayES
                                Hdsl2ShdslPerfCurrDayCount,
      hdsl2ShdslEndpointCurr1DaySES
                                Hdsl2ShdslPerfCurrDayCount,
      hdsl2ShdslEndpointCurr1DayCRCanomalies
                                Hdsl2ShdslPerfCurrDayCount,
      hdsl2ShdslEndpointCurr1DayLOSWS
                                Hdsl2ShdslPerfCurrDayCount,
      hdsl2ShdslEndpointCurr1DayUAS
                                Hdsl2ShdslPerfCurrDayCount
      }

   hdsl2ShdslEndpointCurrAtn OBJECT-TYPE
      SYNTAX      INTEGER(-127..128)
      UNITS       "dB"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "The current loop attenuation for this endpoint as reported in
         a Network or Customer Side Performance Status message."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
```

```
      ::= { hdsl2ShdslEndpointCurrEntry 1 }

   hdsl2ShdslEndpointCurrSnrMgn OBJECT-TYPE
```

```
      SYNTAX      INTEGER(-127..128)
      UNITS       "dB"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "The current SNR margin for this endpoint as reported in a
         Status Response/SNR message."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 2 }

   hdsl2ShdslEndpointCurrStatus OBJECT-TYPE
      SYNTAX      BITS
                  {
                  noDefect(0),
                  powerBackoff(1),
                  deviceFault(2),
                  dcContinuityFault(3),
                  snrMarginAlarm(4),
                  loopAttenuationAlarm(5),
                  loswFailureAlarm(6),
                  configInitFailure(7),
                  protocolInitFailure(8),
                  noNeighborPresent(9),
                  loopbackActive(10)
                  }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Contains the current state of the endpoint.  This is a
        bitmap of possible conditions. The various bit positions
        are:

        noDefect                There no defects on the line.

        powerBackoff            Indicates enhanced Power Backoff.

        deviceFault             Indicates a vendor-dependent
                                diagnostic or self-test fault
                                has been detected.

        dcContinuityFault       Indicates vendor-dependent
                                conditions that interfere with
                                span powering such as short and
                                open circuits.

        snrMarginAlarm          Indicates that the SNR margin
                                has dropped below the alarm threshold.

        loopAttenuationAlarm    Indicates that the loop attenuation
```

has dropped below the alarm threshold.

loswFailureAlarm Indicates a forward LOSW alarm.

```
        configInitFailure      Endpoint failure during initialization
                               due to paired endpoint not able to
                               support requested configuration.

        protocolInitFailure    Endpoint failure during initialization
                               due to incompatible protocol used by
                               the paired endpoint.

        noNeighborPresent      Endpoint failure during initialization
                               due to no activation sequence detected
                               from paired endpoint.

        loopbackActive         A loopback is currently active at this
                               Segment Endpoint.

        This is intended to supplement ifOperStatus.  Note that there
        is a 1-1 relationship between the status bits defined in this
        object and the notification thresholds defined elsewhere in
        this MIB."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 3 }

   hdsl2ShdslEndpointES OBJECT-TYPE
      SYNTAX      Counter32
      UNITS       "seconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Count of Errored Seconds (ES) on this endpoint since the xU
         was last restarted."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 4 }

   hdsl2ShdslEndpointSES OBJECT-TYPE
      SYNTAX       Counter32
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Severely Errored Seconds (SES) on this endpoint
         since the xU was last restarted."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 5 }

   hdsl2ShdslEndpointCRCanomalies OBJECT-TYPE
      SYNTAX       Counter32
      UNITS        "detected CRC Anomalies"
      MAX-ACCESS   read-only
```

```
      STATUS       current
      DESCRIPTION
        "Count of CRC anomalies on this endpoint since the xU was
```

```
         last restarted."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 6 }

   hdsl2ShdslEndpointLOSWS OBJECT-TYPE
      SYNTAX       Counter32
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Loss of Sync Word (LOSW) Seconds on this endpoint
         since the xU was last restarted."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 7 }

   hdsl2ShdslEndpointUAS OBJECT-TYPE
      SYNTAX       Counter32
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Unavailable Seconds (UAS) on this endpoint since
         the xU was last restarted."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 8 }

   hdsl2ShdslEndpointCurr15MinTimeElapsed OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfTimeElapsed
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Total elapsed seconds in the current 15-minute interval."
      ::= { hdsl2ShdslEndpointCurrEntry 9 }

   hdsl2ShdslEndpointCurr15MinES OBJECT-TYPE
      SYNTAX       PerfCurrentCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Errored Seconds (ES) in the current 15-minute
         interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 10 }

   hdsl2ShdslEndpointCurr15MinSES OBJECT-TYPE
      SYNTAX       PerfCurrentCount
      UNITS        "seconds"
```

```
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
```

```
        "Count of Severely Errored Seconds (SES) in the current
         15-minute interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 11 }

   hdsl2ShdslEndpointCurr15MinCRCanomalies OBJECT-TYPE
      SYNTAX       PerfCurrentCount
      UNITS        "detected CRC Anomalies"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of CRC anomalies in the current 15-minute interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 12 }

   hdsl2ShdslEndpointCurr15MinLOSWS OBJECT-TYPE
      SYNTAX       PerfCurrentCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Loss of Sync Word (LOSW) Seconds in the current
         15-minute interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 13 }

   hdsl2ShdslEndpointCurr15MinUAS OBJECT-TYPE
      SYNTAX       PerfCurrentCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Unavailable Seconds (UAS) in the current 15-minute
         interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 14 }

   hdsl2ShdslEndpointCurr1DayTimeElapsed OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfTimeElapsed
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Number of seconds that have elapsed since the beginning of
         the current 1-day interval."
      ::= { hdsl2ShdslEndpointCurrEntry 15 }

   hdsl2ShdslEndpointCurr1DayES OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfCurrDayCount
```

```
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
```

```
      DESCRIPTION
        "Count of Errored Seconds (ES) during the current day as
         measured by hdsl2ShdslEndpointCurr1DayTimeElapsed."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 16 }

   hdsl2ShdslEndpointCurr1DaySES OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfCurrDayCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Severely Errored Seconds (SES) during the current
         day as measured by hdsl2ShdslEndpointCurr1DayTimeElapsed."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 17 }

   hdsl2ShdslEndpointCurr1DayCRCanomalies OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfCurrDayCount
      UNITS        "detected CRC Anomalies"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of CRC anomalies during the current day as measured
         by hdsl2ShdslEndpointCurr1DayTimeElapsed."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 18 }

   hdsl2ShdslEndpointCurr1DayLOSWS OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfCurrDayCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Loss of Sync Word (LOSW) Seconds during the current
         day as measured by hdsl2ShdslEndpointCurr1DayTimeElapsed."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 19 }

   hdsl2ShdslEndpointCurr1DayUAS OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfCurrDayCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Unavailable Seconds (UAS) during the current day as
         measured by hdsl2ShdslEndpointCurr1DayTimeElapsed."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2ShdslEndpointCurrEntry 20 }
```

```
   -- Segment Endpoint 15-Minute Interval Status/Performance Group
   --
```

```
   hdsl2Shdsl15MinIntervalTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2Shdsl15MinIntervalEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This table provides one row for each HDSL2/SHDSL endpoint
         performance data collection interval.  This table contains
         live data from equipment.  As such, it is NOT persistent."
      ::= { hdsl2ShdslMibObjects 6 }

   hdsl2Shdsl15MinIntervalEntry OBJECT-TYPE
      SYNTAX      Hdsl2Shdsl15MinIntervalEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2Shdsl15MinIntervalTable."
      INDEX { ifIndex, hdsl2ShdslInvIndex, hdsl2ShdslEndpointSide,
              hdsl2ShdslEndpointWirePair, hdsl2Shdsl15MinIntervalNumber}
      ::= { hdsl2Shdsl15MinIntervalTable 1 }

   Hdsl2Shdsl15MinIntervalEntry ::=
      SEQUENCE
      {
      hdsl2Shdsl15MinIntervalNumber         INTEGER,
      hdsl2Shdsl15MinIntervalES             PerfIntervalCount,
      hdsl2Shdsl15MinIntervalSES            PerfIntervalCount,
      hdsl2Shdsl15MinIntervalCRCanomalies   PerfIntervalCount,
      hdsl2Shdsl15MinIntervalLOSWS          PerfIntervalCount,
      hdsl2Shdsl15MinIntervalUAS            PerfIntervalCount
      }

   hdsl2Shdsl15MinIntervalNumber OBJECT-TYPE
      SYNTAX      INTEGER(1..96)
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "Performance Data Interval number. 1 is the the most recent
         previous interval; interval 96 is 24 hours ago. Intervals
         2..96 are optional."
      ::= { hdsl2Shdsl15MinIntervalEntry 1 }

   hdsl2Shdsl15MinIntervalES OBJECT-TYPE
      SYNTAX      PerfIntervalCount
      UNITS       "seconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Count of Errored Seconds (ES) during the interval."
```

```
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl15MinIntervalEntry 2 }
```

```
   hdsl2Shdsl15MinIntervalSES OBJECT-TYPE
      SYNTAX      PerfIntervalCount
      UNITS       "seconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Count of Severely Errored Seconds (SES) during the interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl15MinIntervalEntry 3 }

   hdsl2Shdsl15MinIntervalCRCanomalies OBJECT-TYPE
      SYNTAX      PerfIntervalCount
      UNITS       "detected CRC Anomalies"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Count of CRC anomalies during the interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl15MinIntervalEntry 4 }

   hdsl2Shdsl15MinIntervalLOSWS OBJECT-TYPE
      SYNTAX      PerfIntervalCount
      UNITS       "seconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Count of Loss of Sync Word (LOSW) Seconds during the
         interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl15MinIntervalEntry 5 }

   hdsl2Shdsl15MinIntervalUAS OBJECT-TYPE
      SYNTAX      PerfIntervalCount
      UNITS       "seconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Count of Unavailable Seconds (UAS) during the interval."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl15MinIntervalEntry 6 }

   -- Segment Endpoint 1-Day Interval Status/Performance Group
   --

   hdsl2Shdsl1DayIntervalTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2Shdsl1DayIntervalEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
```

"This table provides one row for each HDSL2/SHDSL endpoint performance data collection interval. This table contains live data from equipment. As such, it is NOT persistent."

```
      ::= { hdsl2ShdslMibObjects 7 }

   hdsl2Shdsl1DayIntervalEntry OBJECT-TYPE
      SYNTAX      Hdsl2Shdsl1DayIntervalEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2Shdsl1DayIntervalTable."
      INDEX { ifIndex, hdsl2ShdslInvIndex, hdsl2ShdslEndpointSide,
              hdsl2ShdslEndpointWirePair, hdsl2Shdsl1DayIntervalNumber }
      ::= { hdsl2Shdsl1DayIntervalTable 1 }

   Hdsl2Shdsl1DayIntervalEntry ::=
      SEQUENCE
      {
      hdsl2Shdsl1DayIntervalNumber         INTEGER,
      hdsl2Shdsl1DayIntervalMoniSecs       Hdsl2ShdslPerfTimeElapsed,
      hdsl2Shdsl1DayIntervalES             Hdsl2Shdsl1DayIntervalCount,
      hdsl2Shdsl1DayIntervalSES            Hdsl2Shdsl1DayIntervalCount,
      hdsl2Shdsl1DayIntervalCRCanomalies   Hdsl2Shdsl1DayIntervalCount,
      hdsl2Shdsl1DayIntervalLOSWS          Hdsl2Shdsl1DayIntervalCount,
      hdsl2Shdsl1DayIntervalUAS            Hdsl2Shdsl1DayIntervalCount
      }

   hdsl2Shdsl1DayIntervalNumber OBJECT-TYPE
      SYNTAX      INTEGER(1..30)
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "History Data Interval number. Interval 1 is the the most
         recent previous day; interval 30 is 30 days ago. Intervals
         2..30 are optional."
      ::= { hdsl2Shdsl1DayIntervalEntry 1 }

   hdsl2Shdsl1DayIntervalMoniSecs OBJECT-TYPE
      SYNTAX       Hdsl2ShdslPerfTimeElapsed
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "The amount of time in the 1-day interval over which the
         performance monitoring information is actually counted.
         This value will be the same as the interval duration except
         in a situation where performance monitoring data could not
         be collected for any reason."
      ::= { hdsl2Shdsl1DayIntervalEntry 2 }

   hdsl2Shdsl1DayIntervalES OBJECT-TYPE
      SYNTAX       Hdsl2Shdsl1DayIntervalCount
```

```
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
```

```
      DESCRIPTION
        "Count of Errored Seconds (ES) during the 1-day interval as
         measured by hdsl2Shdsl1DayIntervalMoniSecs."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl1DayIntervalEntry 3 }

   hdsl2Shdsl1DayIntervalSES OBJECT-TYPE
      SYNTAX       Hdsl2Shdsl1DayIntervalCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Severely Errored Seconds (SES) during the 1-day
         interval as measured by hdsl2Shdsl1DayIntervalMoniSecs."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl1DayIntervalEntry 4 }

   hdsl2Shdsl1DayIntervalCRCanomalies OBJECT-TYPE
      SYNTAX       Hdsl2Shdsl1DayIntervalCount
      UNITS        "detected CRC Anomalies"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of CRC anomalies during the 1-day interval as
         measured by hdsl2Shdsl1DayIntervalMoniSecs."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl1DayIntervalEntry 5 }

   hdsl2Shdsl1DayIntervalLOSWS OBJECT-TYPE
      SYNTAX       Hdsl2Shdsl1DayIntervalCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Loss of Sync Word (LOSW) Seconds during the 1-day
         interval as measured by hdsl2Shdsl1DayIntervalMoniSecs."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl1DayIntervalEntry 6 }

   hdsl2Shdsl1DayIntervalUAS OBJECT-TYPE
      SYNTAX       Hdsl2Shdsl1DayIntervalCount
      UNITS        "seconds"
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
        "Count of Unavailable Seconds (UAS) during the 1-day interval
         as measured by hdsl2Shdsl1DayIntervalMoniSecs."
      REFERENCE   "HDSL2 Section 7.5.3.7; SHDSL Section 9.5.5.7"
      ::= { hdsl2Shdsl1DayIntervalEntry 7 }
```

```
-- Maintenance Group
--
```

```
   hdsl2ShdslEndpointMaintTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2ShdslEndpointMaintEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This table supports maintenance operations (eg. loopbacks)
         to be performed on HDSL2/SHDSL segment endpoints.  This table
         contains live data from equipment.  As such, it is NOT
         persistent."
      ::= { hdsl2ShdslMibObjects 8 }

   hdsl2ShdslEndpointMaintEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslEndpointMaintEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2ShdslEndpointMaintTable.  Each entry
         corresponds to a single segment endpoint, and is indexed by the
         ifIndex of the HDSL2/SHDSL line, the UnitId of the associated
         unit and the side of the unit."
      INDEX { ifIndex, hdsl2ShdslInvIndex, hdsl2ShdslEndpointSide }
      ::= { hdsl2ShdslEndpointMaintTable 1 }

   Hdsl2ShdslEndpointMaintEntry ::=
      SEQUENCE
      {
      hdsl2ShdslMaintLoopbackConfig      INTEGER,
      hdsl2ShdslMaintTipRingReversal     INTEGER,
      hdsl2ShdslMaintPowerBackOff        INTEGER,
      hdsl2ShdslMaintSoftRestart         INTEGER
      }

   hdsl2ShdslMaintLoopbackConfig OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  noLoopback(1),
                  normalLoopback(2),
                  specialLoopback(3)
                  }
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object controls configuration of loopbacks for the
         associated segment endpoint.  The status of the loopback
         is obtained via the hdsl2ShdslEndpointCurrStatus object."
      ::= { hdsl2ShdslEndpointMaintEntry 1 }

   hdsl2ShdslMaintTipRingReversal OBJECT-TYPE
```

```
      SYNTAX      INTEGER
                  {
                  normal(1),
```

```
                  reversed(2)
                  }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "This object indicates the state of the tip/ring pair at the
         associated segment endpoint."
      ::= { hdsl2ShdslEndpointMaintEntry 2 }

   hdsl2ShdslMaintPowerBackOff OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  default(1),
                  enhanced(2)
                  }
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object configures the receiver at the associated
         segment endpoint to operate in default or enhanced power
         backoff mode."
      ::= { hdsl2ShdslEndpointMaintEntry 3 }

   hdsl2ShdslMaintSoftRestart OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  ready(1),
                  restart(2)
                  }
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object enables the manager to trigger a soft restart
         of the modem at the associated segment endpoint.  The manager
         may only set this object to the 'restart(2)' value, which
         initiates a restart.  The agent will perform a restart after
         approximately 5 seconds.  Following the 5 second period, the
         agent will restore the object to the 'ready(1)' state."
      ::= { hdsl2ShdslEndpointMaintEntry 4 }

   hdsl2ShdslUnitMaintTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2ShdslUnitMaintEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This table supports maintenance operations for units in a
         HDSL2/SHDSL line.  Entries in this table MUST be maintained
         in a persistent manner."
      ::= { hdsl2ShdslMibObjects 9 }
```

```
   hdsl2ShdslUnitMaintEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslUnitMaintEntry
```

```
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the hdsl2ShdslUnitMaintTable.  Each entry
         corresponds to a single unit, and is indexed by the ifIndex
         of the HDSL2/SHDSL line and the UnitId of the associated
         unit."
      INDEX { ifIndex, hdsl2ShdslInvIndex  }
      ::= { hdsl2ShdslUnitMaintTable 1 }

   Hdsl2ShdslUnitMaintEntry ::=
      SEQUENCE
      {
      hdsl2ShdslMaintLoopbackTimeout     Integer32,
      hdsl2ShdslMaintUnitPowerSource     INTEGER
      }

   hdsl2ShdslMaintLoopbackTimeout OBJECT-TYPE
      SYNTAX      Integer32(0..4095)
      UNITS       "minutes"
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "This object configures the timeout value for loopbacks
         initiated at segments endpoints contained in the associated
         unit.  A value of 0 disables the timeout."
      ::= { hdsl2ShdslUnitMaintEntry 1 }

   hdsl2ShdslMaintUnitPowerSource OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  local(1),
                  span(2)
                  }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "This object indicates the DC power source being used by the
         associated unit."
      ::= { hdsl2ShdslUnitMaintEntry 2 }

   -- Span Configuration Profile Group
   --

   hdsl2ShdslSpanConfProfileTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2ShdslSpanConfProfileEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
```

"This table supports definitions of span configuration
profiles for SHDSL lines. HDSL2 does not support these
configuration options. This table MUST be maintained

```
         in a persistent manner."
      ::= { hdsl2ShdslMibObjects 10 }

   hdsl2ShdslSpanConfProfileEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslSpanConfProfileEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "Each entry corresponds to a single span configuration
         profile.  Each profile contains a set of span configuration
         parameters.  The configuration parameters in a profile are
         applied to those lines referencing that profile (see the
         hdsl2ShdslSpanConfProfile object).  Profiles may be
         created/deleted using the row creation/deletion mechanism
         via hdsl2ShdslSpanConfProfileRowStatus.  If an active
         entry is referenced in hdsl2ShdslSpanConfProfile, the
         entry MUST remain active until all references are removed."
      INDEX { IMPLIED hdsl2ShdslSpanConfProfileName }
      ::= { hdsl2ShdslSpanConfProfileTable 1 }

   Hdsl2ShdslSpanConfProfileEntry ::=
      SEQUENCE
      {
      hdsl2ShdslSpanConfProfileName               SnmpAdminString,
      hdsl2ShdslSpanConfWireInterface             INTEGER,
      hdsl2ShdslSpanConfMinLineRate               INTEGER,
      hdsl2ShdslSpanConfMaxLineRate               INTEGER,
      hdsl2ShdslSpanConfPSD                       INTEGER,
      hdsl2ShdslSpanConfTransmissionMode
                                     Hdsl2ShdslTransmissionModeType,
      hdsl2ShdslSpanConfRemoteEnabled             INTEGER,
      hdsl2ShdslSpanConfPowerFeeding              INTEGER,
      hdsl2ShdslSpanConfCurrCondTargetMarginDown  INTEGER,
      hdsl2ShdslSpanConfWorstCaseTargetMarginDown INTEGER,
      hdsl2ShdslSpanConfCurrCondTargetMarginUp    INTEGER,
      hdsl2ShdslSpanConfWorstCaseTargetMarginUp   INTEGER,
      hdsl2ShdslSpanConfUsedTargetMargins         BITS,
      hdsl2ShdslSpanConfReferenceClock
                                     Hdsl2ShdslClockReferenceType,
      hdsl2ShdslSpanConfLineProbeEnable           INTEGER,
      hdsl2ShdslSpanConfProfileRowStatus          RowStatus
      }

   hdsl2ShdslSpanConfProfileName OBJECT-TYPE
      SYNTAX      SnmpAdminString (SIZE(1..32))
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This object is the unique index associated with this profile.
```

```
         Entries in this table are referenced via the object
         hdsl2ShdslSpanConfProfile in Hdsl2ShdslSpanConfEntry."
      ::= { hdsl2ShdslSpanConfProfileEntry 1 }
```

```
   hdsl2ShdslSpanConfWireInterface OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  twoWire(1),
                  fourWire(2)
                  }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the two-wire or optional four-wire
         operation for SHDSL Lines."
      DEFVAL      { twoWire }
      ::= { hdsl2ShdslSpanConfProfileEntry 2 }

   hdsl2ShdslSpanConfMinLineRate OBJECT-TYPE
      SYNTAX      INTEGER(0..4112000)
      UNITS       "bps"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the minimum transmission rate for
         the associated SHDSL Line in bits-per-second (bps).  If
         the minimum line rate equals the maximum line rate
         (hdsl2ShdslSpanMaxLineRate), the line rate is considered
         'fixed'.  If the minimum line rate is less than the maximum
         line rate, the line rate is considered 'rate-adaptive'."
      DEFVAL      { 1552000 }
      ::= { hdsl2ShdslSpanConfProfileEntry 3 }

   hdsl2ShdslSpanConfMaxLineRate OBJECT-TYPE
      SYNTAX      INTEGER(0..4112000)
      UNITS       "bps"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the maximum transmission rate for
         the associated SHDSL Line in bits-per-second (bps).  If
         the minimum line rate equals the maximum line rate
         (hdsl2ShdslSpanMaxLineRate), the line rate is considered
         'fixed'.  If the minimum line rate is less than the maximum
         line rate, the line rate is considered 'rate-adaptive'."
      DEFVAL      { 1552000 }
      ::= { hdsl2ShdslSpanConfProfileEntry 4 }

   hdsl2ShdslSpanConfPSD OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  symmetric(1),
```

```
                  asymmetric(2)
                  }
      MAX-ACCESS  read-create
```

```
      STATUS      current
      DESCRIPTION
        "This object configures use of symmetric/asymmetric PSD (Power
         Spectral Density) Mask for the associated SHDSL Line.  Support
         for symmetric PSD is mandatory for all supported data rates.
         Support for asymmetric PSD is optional."
      DEFVAL      { symmetric }
      ::= { hdsl2ShdslSpanConfProfileEntry 5 }

   hdsl2ShdslSpanConfTransmissionMode OBJECT-TYPE
      SYNTAX      Hdsl2ShdslTransmissionModeType
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object specifies the regional setting for the SHDSL
         line."
      DEFVAL      { { region1 } }
      ::= { hdsl2ShdslSpanConfProfileEntry 6 }

   hdsl2ShdslSpanConfRemoteEnabled OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  enabled(1),
                  disabled(2)
                  }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object enables/disables support for remote management
         of the units in a SHDSL line from the STU-R via the EOC."
      DEFVAL      { enabled }
      ::= { hdsl2ShdslSpanConfProfileEntry 7 }

   hdsl2ShdslSpanConfPowerFeeding OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  noPower(1),
                  powerFeed(2),
                  wettingCurrent(3)
                  }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object enables/disables support for optional power
         feeding in a SHDSL line."
      DEFVAL      { noPower }
      ::= { hdsl2ShdslSpanConfProfileEntry 8 }

   hdsl2ShdslSpanConfCurrCondTargetMarginDown OBJECT-TYPE
```

```
      SYNTAX      INTEGER(-10..21)
      UNITS       "dB"
      MAX-ACCESS  read-create
```

```
      STATUS      current
      DESCRIPTION
        "This object specifies the downstream current condition target
         SNR margin for a SHDSL line.  The SNR margin is the difference
         between the desired SNR and the actual SNR.  Target SNR margin
         is the desired SNR margin for a unit."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslSpanConfProfileEntry 9 }

   hdsl2ShdslSpanConfWorstCaseTargetMarginDown OBJECT-TYPE
      SYNTAX      INTEGER(-10..21)
      UNITS       "dB"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object specifies the downstream worst case target SNR
         margin for a SHDSL line.  The SNR margin is the difference
         between the desired SNR and the actual SNR.  Target SNR
         margin is the desired SNR margin for a unit."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslSpanConfProfileEntry 10 }

   hdsl2ShdslSpanConfCurrCondTargetMarginUp OBJECT-TYPE
      SYNTAX      INTEGER(-10..21)
      UNITS       "dB"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object specifies the upstream current condition target
         SNR margin for a SHDSL line.  The SNR margin is the difference
         between the desired SNR and the actual SNR.  Target SNR margin
         is the desired SNR margin for a unit."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslSpanConfProfileEntry 11 }

   hdsl2ShdslSpanConfWorstCaseTargetMarginUp OBJECT-TYPE
      SYNTAX      INTEGER(-10..21)
      UNITS       "dB"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object specifies the upstream worst case target SNR
         margin for a SHDSL line.  The SNR margin is the difference
         between the desired SNR and the actual SNR.  Target SNR margin
         is the desired SNR margin for a unit."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslSpanConfProfileEntry 12 }

   hdsl2ShdslSpanConfUsedTargetMargins OBJECT-TYPE
```

```
      SYNTAX      BITS
                  {
                  currCondDown(0),
```

```
                  worstCaseDown(1),
                  currCondUp(2),
                  worstCaseUp(3)
                  }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "Contains indicates whether a target SNR margin is enabled or
         disabled.  This is a bit-map of possible settings.  The
         various bit positions are:

         currCondDown     current condition downstream target SNR
                          margin enabled

         worstCaseDown    worst case downstream target SNR margin
                          enabled

         currCondUp       current condition upstream target SNR
                          margin enabled

         worstCaseUp      worst case upstream target SNR margin
                          enabled."
      DEFVAL      { { currCondDown } }
      ::= { hdsl2ShdslSpanConfProfileEntry 13 }

   hdsl2ShdslSpanConfReferenceClock OBJECT-TYPE
      SYNTAX      Hdsl2ShdslClockReferenceType
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the clock reference for the STU-C
        in a SHDSL Line."
      DEFVAL      { localClk }
      ::= { hdsl2ShdslSpanConfProfileEntry 14 }

   hdsl2ShdslSpanConfLineProbeEnable OBJECT-TYPE
      SYNTAX      INTEGER
                  {
                  disable(1),
                  enable(2)
                  }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object enables/disables support for Line Probe of
        the units in a SHDSL line.  When Line Probe is enabled, the
        system performs Line Probing to find the best possible
        rate.  If Line probe is disabled, the rate adaptation phase
        is skipped to shorten set up time."
```

```
      DEFVAL      { disable }
      ::= { hdsl2ShdslSpanConfProfileEntry 15 }
```

```
   hdsl2ShdslSpanConfProfileRowStatus OBJECT-TYPE
      SYNTAX      RowStatus
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object controls creation/deletion of the associated
         entry in this table per the semantics of RowStatus.  If an
         active entry is referenced in hdsl2ShdslSpanConfProfile, the
         entry MUST remain active until all references are removed."
      ::= { hdsl2ShdslSpanConfProfileEntry 16 }

   -- Segment Endpoint Alarm Configuration Profile group
   --

   hdsl2ShdslEndpointAlarmConfProfileTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF Hdsl2ShdslEndpointAlarmConfProfileEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This table supports definitions of alarm configuration
         profiles for HDSL2/SHDSL segment endpoints.  This table
         MUST be maintained in a persistent manner."
      ::= { hdsl2ShdslMibObjects 11 }

   hdsl2ShdslEndpointAlarmConfProfileEntry OBJECT-TYPE
      SYNTAX      Hdsl2ShdslEndpointAlarmConfProfileEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "Each entry corresponds to a single alarm configuration profile.
         Each profile contains a set of parameters for setting alarm
         thresholds for various performance attributes monitored at
         HDSL2/SHDSL segment endpoints.  Profiles may be created/deleted
         using the row creation/deletion mechanism via
         hdsl2ShdslEndpointAlarmConfProfileRowStatus.  If an active
         entry is referenced in either hdsl2ShdslSpanConfAlarmProfile
         or hdsl2ShdslEndpointAlarmConfProfile, the entry MUST remain
         active until all references are removed."
      INDEX { IMPLIED hdsl2ShdslEndpointAlarmConfProfileName }
      ::= { hdsl2ShdslEndpointAlarmConfProfileTable 1 }

   Hdsl2ShdslEndpointAlarmConfProfileEntry ::=
      SEQUENCE
      {
      hdsl2ShdslEndpointAlarmConfProfileName       SnmpAdminString,
      hdsl2ShdslEndpointThreshLoopAttenuation      INTEGER,
      hdsl2ShdslEndpointThreshSNRMargin            INTEGER,
      hdsl2ShdslEndpointThreshES
                  Hdsl2ShdslPerfIntervalThreshold,
```

```
      hdsl2ShdslEndpointThreshSES
                  Hdsl2ShdslPerfIntervalThreshold,
      hdsl2ShdslEndpointThreshCRCanomalies         Integer32,
```

```
      hdsl2ShdslEndpointThreshLOSWS
                  Hdsl2ShdslPerfIntervalThreshold,
      hdsl2ShdslEndpointThreshUAS
                  Hdsl2ShdslPerfIntervalThreshold,
      hdsl2ShdslEndpointAlarmConfProfileRowStatus  RowStatus
      }

   hdsl2ShdslEndpointAlarmConfProfileName OBJECT-TYPE
      SYNTAX      SnmpAdminString (SIZE(1..32))
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "This object is the unique index associated with this profile."
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 1 }

   hdsl2ShdslEndpointThreshLoopAttenuation OBJECT-TYPE
      SYNTAX      INTEGER(-127..128)
      UNITS       "dB"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the loop attenuation alarm threshold.
         When the current value of hdsl2ShdslEndpointCurrAtn reaches
         or drops below this threshold, a hdsl2ShdslLoopAttenCrossing
         MAY be generated."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 2 }

   hdsl2ShdslEndpointThreshSNRMargin OBJECT-TYPE
      SYNTAX      INTEGER(-127..128)
      UNITS       "dB"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the SNR margin alarm threshold.
         When the current value of hdsl2ShdslEndpointCurrSnrMgn
         reaches or drops below this threshold, a
         hdsl2ShdslSNRMarginCrossing MAY be generated."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 3 }

   hdsl2ShdslEndpointThreshES OBJECT-TYPE
      SYNTAX      Hdsl2ShdslPerfIntervalThreshold
      UNITS       "seconds"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the threshold for the number of
         errored seconds (ES) within any given 15-minute performance
```

data collection interval. If the value of errored seconds in a particular 15-minute collection interval reaches/ exceeds this value, a hdsl2ShdslPerfESThresh MAY be

```
         generated.  At most one notification will be sent per
         interval per endpoint."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 4 }

   hdsl2ShdslEndpointThreshSES OBJECT-TYPE
      SYNTAX      Hdsl2ShdslPerfIntervalThreshold
      UNITS       "seconds"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the threshold for the number of
         severely errored seconds (SES) within any given 15-minute
         performance data collection interval.  If the value of
         severely errored seconds in a particular 15-minute collection
         interval reaches/exceeds this value, a hdsl2ShdslPerfSESThresh
         MAY be generated.  At most one notification will be sent per
         interval per endpoint."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 5 }

   hdsl2ShdslEndpointThreshCRCanomalies OBJECT-TYPE
      SYNTAX      Integer32
      UNITS       "detected CRC Anomalies"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the threshold for the number of
         CRC anomalies within any given 15-minute performance data
         collection interval.  If the value of CRC anomalies in a
         particular 15-minute collection interval reaches/exceeds
         this value, a hdsl2ShdslPerfCRCanomaliesThresh MAY be
         generated.  At most one notification will be sent per
         interval per endpoint."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 6 }

   hdsl2ShdslEndpointThreshLOSWS OBJECT-TYPE
      SYNTAX      Hdsl2ShdslPerfIntervalThreshold
      UNITS       "seconds"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the threshold for the number of
         Loss of Sync Word (LOSW) Seconds within any given 15-minute
         performance data collection interval.  If the value of LOSW
         in a particular 15-minute collection interval reaches/exceeds
         this value, a hdsl2ShdslPerfLOSWSThresh MAY be generated.
         At most one notification will be sent per interval per
```

```
         endpoint."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 7 }
```

```
   hdsl2ShdslEndpointThreshUAS OBJECT-TYPE
      SYNTAX      Hdsl2ShdslPerfIntervalThreshold
      UNITS       "seconds"
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object configures the threshold for the number of
         unavailable seconds (UAS) within any given 15-minute
         performance data collection interval.  If the value of UAS
         in a particular 15-minute collection interval reaches/exceeds
         this value, a hdsl2ShdslPerfUASThresh MAY be generated.
         At most one notification will be sent per interval per
         endpoint."
      DEFVAL      { 0 }
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 8 }

   hdsl2ShdslEndpointAlarmConfProfileRowStatus OBJECT-TYPE
      SYNTAX      RowStatus
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
        "This object controls creation/deletion of the associated
         entry in this table as per the semantics of RowStatus.
         If an active entry is referenced in either
         hdsl2ShdslSpanConfAlarmProfile or
         hdsl2ShdslEndpointAlarmConfProfile, the entry MUST remain
         active until all references are removed."
      ::= { hdsl2ShdslEndpointAlarmConfProfileEntry 9 }

   -- Notifications Group
   --

   hdsl2ShdslNotifications OBJECT IDENTIFIER ::= { hdsl2ShdslMIB 0 }

   hdsl2ShdslLoopAttenCrossing NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurrAtn,
      hdsl2ShdslEndpointThreshLoopAttenuation
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that the loop attenuation
         threshold (as per the hdsl2ShdslEndpointThreshLoopAttenuation
         value) has been reached/exceeded for the HDSL2/SHDSL segment
         endpoint."
      ::= { hdsl2ShdslNotifications 1 }
```

```
   hdsl2ShdslSNRMarginCrossing NOTIFICATION-TYPE
      OBJECTS
      {
```

```
      hdsl2ShdslEndpointCurrSnrMgn,
      hdsl2ShdslEndpointThreshSNRMargin
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that the SNR margin threshold (as
         per the hdsl2ShdslEndpointThreshSNRMargin value) has been
         reached/exceeded for the HDSL2/SHDSL segment endpoint."
      ::= { hdsl2ShdslNotifications 2 }

   hdsl2ShdslPerfESThresh NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurr15MinES,
      hdsl2ShdslEndpointThreshES
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that the errored seconds threshold
         (as per the hdsl2ShdslEndpointThreshES value) has been reached/
         exceeded for the HDSL2/SHDSL segment endpoint."
      ::= { hdsl2ShdslNotifications 3 }

   hdsl2ShdslPerfSESThresh NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurr15MinSES,
      hdsl2ShdslEndpointThreshSES
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that the severely errored seconds
         threshold (as per the hdsl2ShdslEndpointThreshSES value) has
         been reached/exceeded for the HDSL2/SHDSL Segment Endpoint."
      ::= { hdsl2ShdslNotifications 4 }

   hdsl2ShdslPerfCRCanomaliesThresh NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurr15MinCRCanomalies,
      hdsl2ShdslEndpointThreshCRCanomalies
      }
      STATUS    current
      DESCRIPTION
        "This notification indicates that the CRC anomalies threshold
         (as per the hdsl2ShdslEndpointThreshCRCanomalies value) has
         been reached/exceeded for the HDSL2/SHDSL Segment Endpoint."
      ::= { hdsl2ShdslNotifications 5 }
```

```
   hdsl2ShdslPerfLOSWSThresh NOTIFICATION-TYPE
      OBJECTS
      {
```

```
      hdsl2ShdslEndpointCurr15MinLOSWS,
      hdsl2ShdslEndpointThreshLOSWS
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that the LOSW seconds threshold
         (as per the hdsl2ShdslEndpointThreshLOSWS value) has been
         reached/exceeded for the HDSL2/SHDSL segment endpoint."
      ::= { hdsl2ShdslNotifications 6 }

   hdsl2ShdslPerfUASThresh NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurr15MinUAS,
      hdsl2ShdslEndpointThreshUAS
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that the unavailable seconds
         threshold (as per the hdsl2ShdslEndpointThreshUAS value) has
         been reached/exceeded for the HDSL2/SHDSL segment endpoint."
      ::= { hdsl2ShdslNotifications 7 }

   hdsl2ShdslSpanInvalidNumRepeaters NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslSpanConfNumRepeaters
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that a mismatch has been detected
         between the number of repeater/regenerator units configured
         for a HDSL2/SHDSL line via the hdsl2ShdslSpanConfNumRepeaters
         object and the actual number of repeater/regenerator units
         discovered via the EOC."
      ::= { hdsl2ShdslNotifications 8 }

   hdsl2ShdslLoopbackFailure NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslMaintLoopbackConfig
      }
      STATUS     current
      DESCRIPTION
        "This notification indicates that an endpoint maintenance
         loopback command failed for an HDSL2/SHDSL segment."
      ::= { hdsl2ShdslNotifications 9 }

   hdsl2ShdslpowerBackoff NOTIFICATION-TYPE
```

```
      OBJECTS
      {
      hdsl2ShdslEndpointCurrStatus
```

```
      }
      STATUS    current
      DESCRIPTION
        "This notification indicates that the bit setting for
         powerBackoff in the hdsl2ShdslEndpointCurrStatus object for
         this endpoint has changed."
      ::= { hdsl2ShdslNotifications 10 }

   hdsl2ShdsldeviceFault NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurrStatus
      }
      STATUS    current
      DESCRIPTION
        "This notification indicates that the bit setting for
         deviceFault in the hdsl2ShdslEndpointCurrStatus object for
         this endpoint has changed."
      ::= { hdsl2ShdslNotifications 11 }

   hdsl2ShdsldcContinuityFault NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurrStatus
      }
      STATUS    current
      DESCRIPTION
        "This notification indicates that the bit setting for
         dcContinuityFault in the hdsl2ShdslEndpointCurrStatus object
         for this endpoint has changed."
      ::= { hdsl2ShdslNotifications 12 }

   hdsl2ShdslconfigInitFailure NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurrStatus
      }
      STATUS    current
      DESCRIPTION
        "This notification indicates that the bit setting for
         configInitFailure in the hdsl2ShdslEndpointCurrStatus object
         for this endpoint has changed."
      ::= { hdsl2ShdslNotifications 13 }

   hdsl2ShdslprotocolInitFailure NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurrStatus
      }
```

```
      STATUS    current
      DESCRIPTION
        "This notification indicates that the bit setting for
```

```
         protocolInitFailure in the hdsl2ShdslEndpointCurrStatus
         object for this endpoint has changed."
      ::= { hdsl2ShdslNotifications 14 }

   hdsl2ShdslnoNeighborPresent NOTIFICATION-TYPE
      OBJECTS
      {
      hdsl2ShdslEndpointCurrStatus
      }
      STATUS    current
      DESCRIPTION
        "This notification indicates that the bit setting for
         noNeighborPresent in the hdsl2ShdslEndpointCurrStatus object
         for this endpoint has changed."
      ::= { hdsl2ShdslNotifications 15 }

   hdsl2ShdslLocalPowerLoss NOTIFICATION-TYPE
      OBJECTS
      {
      ifIndex,
      hdsl2ShdslInvIndex
      }
      STATUS    current
      DESCRIPTION
        "This notification indicates impending unit failure due to
         loss of local power (last gasp)."
      ::= { hdsl2ShdslNotifications 16 }

   -- conformance information
   --

   hdsl2ShdslConformance OBJECT IDENTIFIER ::= { hdsl2ShdslMIB 3 }
   hdsl2ShdslGroups      OBJECT IDENTIFIER ::=
                { hdsl2ShdslConformance 1 }
   hdsl2ShdslCompliances OBJECT IDENTIFIER ::=
                { hdsl2ShdslConformance 2 }

   -- agent compliance statements

   hdsl2ShdslLineMibCompliance MODULE-COMPLIANCE
      STATUS  current
      DESCRIPTION
        "The section outlines compliance requirements for this MIB."
      MODULE
      MANDATORY-GROUPS
      {
      hdsl2ShdslSpanConfGroup,
      hdsl2ShdslSpanStatusGroup,
      hdsl2ShdslInventoryGroup,
```

```
      hdsl2ShdslEndpointConfGroup,
      hdsl2ShdslEndpointCurrGroup,
      hdsl2Shdsl15MinIntervalGroup,
```

```
      hdsl2Shdsl1DayIntervalGroup,
      hdsl2ShdslMaintenanceGroup,
      hdsl2ShdslEndpointAlarmConfGroup,
      hdsl2ShdslNotificationGroup
      }

   GROUP  hdsl2ShdslInventoryShdslGroup
      DESCRIPTION
        "Support for this group is only required for implementations
        supporting SHDSL lines."

   GROUP  hdsl2ShdslSpanShdslStatusGroup
      DESCRIPTION
        "Support for this group is only required for implementations
        supporting SHDSL lines."

   GROUP  hdsl2ShdslSpanConfProfileGroup
      DESCRIPTION
        "Support for this group is only required for implementations
        supporting SHDSL lines."

      ::= { hdsl2ShdslCompliances 1 }

   -- units of conformance
   --

   hdsl2ShdslSpanConfGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslSpanConfNumRepeaters,
      hdsl2ShdslSpanConfProfile,
      hdsl2ShdslSpanConfAlarmProfile
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects for configuring span related
         parameters for HDSL2/SHDSL lines."
      ::= { hdsl2ShdslGroups 1 }

   hdsl2ShdslSpanStatusGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslStatusNumAvailRepeaters
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects for retrieving span related
         status for HDSL2/SHDSL lines."
      ::= { hdsl2ShdslGroups 2 }
```

```
   hdsl2ShdslInventoryShdslGroup OBJECT-GROUP
      OBJECTS
```

```
      {
      hdsl2ShdslInvTransmissionModeCapability
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects for retrieving SHDSL-specific
         inventory information."
      ::= { hdsl2ShdslGroups 3 }

   hdsl2ShdslSpanShdslStatusGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslStatusMaxAttainableLineRate,
      hdsl2ShdslStatusActualLineRate,
      hdsl2ShdslStatusTransmissionModeCurrent
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects for retrieving SHDSL-specific
         span related status."
      ::= { hdsl2ShdslGroups 4 }

   hdsl2ShdslInventoryGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslInvIndex,
      hdsl2ShdslInvVendorID,
      hdsl2ShdslInvVendorModelNumber,
      hdsl2ShdslInvVendorSerialNumber,
      hdsl2ShdslInvVendorEOCSoftwareVersion,
      hdsl2ShdslInvStandardVersion,
      hdsl2ShdslInvVendorListNumber,
      hdsl2ShdslInvVendorIssueNumber,
      hdsl2ShdslInvVendorSoftwareVersion,
      hdsl2ShdslInvEquipmentCode,
      hdsl2ShdslInvVendorOther
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects that provide unit inventory
         information about the units in HDSL2/SHDSL lines."
      ::= { hdsl2ShdslGroups 5 }

   hdsl2ShdslEndpointConfGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslEndpointSide,
      hdsl2ShdslEndpointWirePair,
      hdsl2ShdslEndpointAlarmConfProfile
```

```
      }
      STATUS      current
      DESCRIPTION
```

```
        "This group supports objects for configuring parameters for
         segment endpoints in HDSL2/SHDSL lines."
      ::= { hdsl2ShdslGroups 6 }

   hdsl2ShdslEndpointCurrGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslEndpointSide,
      hdsl2ShdslEndpointWirePair,
      hdsl2ShdslEndpointCurrAtn,
      hdsl2ShdslEndpointCurrSnrMgn,
      hdsl2ShdslEndpointCurrStatus,
      hdsl2ShdslEndpointES,
      hdsl2ShdslEndpointSES,
      hdsl2ShdslEndpointCRCanomalies,
      hdsl2ShdslEndpointLOSWS,
      hdsl2ShdslEndpointUAS,
      hdsl2ShdslEndpointCurr15MinTimeElapsed,
      hdsl2ShdslEndpointCurr15MinES,
      hdsl2ShdslEndpointCurr15MinSES,
      hdsl2ShdslEndpointCurr15MinCRCanomalies,
      hdsl2ShdslEndpointCurr15MinLOSWS,
      hdsl2ShdslEndpointCurr15MinUAS,
      hdsl2ShdslEndpointCurr1DayTimeElapsed,
      hdsl2ShdslEndpointCurr1DayES,
      hdsl2ShdslEndpointCurr1DaySES,
      hdsl2ShdslEndpointCurr1DayCRCanomalies,
      hdsl2ShdslEndpointCurr1DayLOSWS,
      hdsl2ShdslEndpointCurr1DayUAS
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects which provide current status and
         performance measurements relating to segment endpoints in
         HDSL2/SHDSL lines."
      ::= { hdsl2ShdslGroups 7 }

   hdsl2Shdsl15MinIntervalGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2Shdsl15MinIntervalES,
      hdsl2Shdsl15MinIntervalSES,
      hdsl2Shdsl15MinIntervalCRCanomalies,
      hdsl2Shdsl15MinIntervalLOSWS,
      hdsl2Shdsl15MinIntervalUAS
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects which maintain historic
```

```
         performance measurements relating to segment endpoints in
         HDSL2/SHDSL lines in 15-minute intervals."
      ::= { hdsl2ShdslGroups 8 }
```

```
   hdsl2Shdsl1DayIntervalGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2Shdsl1DayIntervalMoniSecs,
      hdsl2Shdsl1DayIntervalES,
      hdsl2Shdsl1DayIntervalSES,
      hdsl2Shdsl1DayIntervalCRCanomalies,
      hdsl2Shdsl1DayIntervalLOSWS,
      hdsl2Shdsl1DayIntervalUAS
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects which maintain historic
         performance measurements relating to segment endpoints in
         HDSL2/SHDSL lines in 1-day intervals."
      ::= { hdsl2ShdslGroups 9 }

   hdsl2ShdslMaintenanceGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslMaintLoopbackConfig,
      hdsl2ShdslMaintTipRingReversal,
      hdsl2ShdslMaintPowerBackOff,
      hdsl2ShdslMaintSoftRestart,
      hdsl2ShdslMaintLoopbackTimeout,
      hdsl2ShdslMaintUnitPowerSource
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects that provide support for
         maintenance actions for HDSL2/SHDSL lines."
      ::= { hdsl2ShdslGroups 10 }

   hdsl2ShdslEndpointAlarmConfGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslEndpointThreshLoopAttenuation,
      hdsl2ShdslEndpointThreshSNRMargin,
      hdsl2ShdslEndpointThreshES,
      hdsl2ShdslEndpointThreshSES,
      hdsl2ShdslEndpointThreshCRCanomalies,
      hdsl2ShdslEndpointThreshLOSWS,
      hdsl2ShdslEndpointThreshUAS,
      hdsl2ShdslEndpointAlarmConfProfileRowStatus
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects that allow configuration of alarm
```

```
         thresholds for various performance parameters for HDSL2/SHDSL
         lines."
      ::= { hdsl2ShdslGroups 11 }
```

```
   hdsl2ShdslNotificationGroup NOTIFICATION-GROUP
      NOTIFICATIONS
      {
      hdsl2ShdslLoopAttenCrossing,
      hdsl2ShdslSNRMarginCrossing,
      hdsl2ShdslPerfESThresh,
      hdsl2ShdslPerfSESThresh,
      hdsl2ShdslPerfCRCanomaliesThresh,
      hdsl2ShdslPerfLOSWSThresh,
      hdsl2ShdslPerfUASThresh,
      hdsl2ShdslSpanInvalidNumRepeaters,
      hdsl2ShdslLoopbackFailure,
      hdsl2ShdslpowerBackoff,
      hdsl2ShdsldeviceFault,
      hdsl2ShdsldcContinuityFault,
      hdsl2ShdslconfigInitFailure,
      hdsl2ShdslprotocolInitFailure,
      hdsl2ShdslnoNeighborPresent,
      hdsl2ShdslLocalPowerLoss
      }
      STATUS      current
      DESCRIPTION
        "This group supports notifications of significant conditions
        associated with HDSL2/SHDSL lines."
      ::= { hdsl2ShdslGroups 12 }

   hdsl2ShdslSpanConfProfileGroup OBJECT-GROUP
      OBJECTS
      {
      hdsl2ShdslSpanConfWireInterface,
      hdsl2ShdslSpanConfMinLineRate,
      hdsl2ShdslSpanConfMaxLineRate,
      hdsl2ShdslSpanConfPSD,
      hdsl2ShdslSpanConfTransmissionMode,
      hdsl2ShdslSpanConfRemoteEnabled,
      hdsl2ShdslSpanConfPowerFeeding,
      hdsl2ShdslSpanConfCurrCondTargetMarginDown,
      hdsl2ShdslSpanConfWorstCaseTargetMarginDown,
      hdsl2ShdslSpanConfCurrCondTargetMarginUp,
      hdsl2ShdslSpanConfWorstCaseTargetMarginUp,
      hdsl2ShdslSpanConfUsedTargetMargins,
      hdsl2ShdslSpanConfReferenceClock,
      hdsl2ShdslSpanConfLineProbeEnable,
      hdsl2ShdslSpanConfProfileRowStatus
      }
      STATUS      current
      DESCRIPTION
        "This group supports objects that constitute configuration
```

```
         profiles for configuring span related parameters in SHDSL
         lines."
      ::= { hdsl2ShdslGroups 13 }
```

```
END
```

7. Security Considerations

Blocking unauthorized access to the HDSL2-SHDSL MIB via the element management system is outside the scope of this document. It should be noted that access to the MIB permits the unauthorized entity to modify the profiles (section 6.4) such that both subscriber service and network operations can be interfered with. Subscriber service can be altered by modifying any of a number of service characteristics such as rate partitioning and maximum transmission rates. Network operations can be impacted by modification of notification thresholds such as SES thresholds.

There are a number of managed objects in this MIB that may be considered to contain sensitive information. In particular, certain objects may be considered sensitive in many environments, since access to these objects would allow an intruder to obtain information about which vendor's equipment is in use on the network. Therefore, it may be important in some environments to control read access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

It is recommended that the implementors consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [12] and the View-based Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to those objects only to those principals (users) that have legitimate rights to access them.

HDSL2-SHDSL layer connectivity from the xtuR will permit the subscriber to manipulate both the HDSL2-SHDSL link directly and the HDSL2-SHDSL embedded operations channel (EOC) for their own loop. For example, unchecked or unfiltered fluctuations initiated by the subscriber could generate sufficient notifications to potentially overwhelm either the management interface to the network or the element manager.

It should be noted that interface indices in this MIB are maintained persistently. VACM data relating to these should be stored persistently.

There are a number of management objects defined in this MIB that have a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network

environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on

network operations.

8. Acknowledgments

The authors are deeply grateful to the authors of the ADSL LINE MIB (RFC 2662 [23]), Gregory Bathrick and Faye Ly, as much of the text and structure of this document originates in their documents.

The authors are also grateful to the authors of FR MFR MIB (RFC 3020 [24]), Prayson Pate, Bob Lynch, and Kenneth Rehbehn, as the entirety of the Security Considerations section was lifted from their document.

The authors also acknowledge the importance of contributions and suggestions regarding interface indexing structures received from David Horton of CITR.

Other contributions were received from the following:

Philip Bergstresser (Adtran)

Steve Blackwell (Centillium)

Umberto Bonollo (NEC Australia)

Yagal Hachmon (RAD)

Mark Johnson (Red Point)

Sharon Mantin (Orckit)

Moti Morgenstern (ECI)

Raymond Murphy (Ericsson)

Lee Nipper (Verilink)

Randy Presuhn (BMC Software)

Katy Sherman (Orckit)

Mike Sneed (ECI)

Jon Turney (DSL Solutions)

Aron Wahl (Memotec)

Bert Wijnen (Lucent)

Michael Wrobel (Memotec)

9. References

[1] Harrington, D., Presuhn, R., and Wijnen, B., "An Architecture for Describing SNMP Management Frameworks", RFC 2571, April 1999.

[2] Rose, M., and McCloghrie, K., "Structure and Identification of Management Information for TCP/IP-based Internets", STD 16, RFC 1155, May 1990.

[3] Rose, M., and McCloghrie, K., "Concise MIB Definitions", STD 16, RFC 1212, March 1991.

[4] Rose, M., "A Convention for Defining Traps for use with the SNMP", RFC 1215, March 1991.

[5] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and Waldbusser, S., "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.

[6] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and Waldbusser, S., "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.

[7] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and Waldbusser, S., "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.

[8] Case, J., Fedor, M., Schoffstall, M., and Davin, J., "Simple Network Management Protocol", STD 15, RFC 1157, May 1990.

[9] Case, J., McCloghrie, K., Rose, M., and Waldbusser, S., "Introduction to Community-based SNMPv2", RFC 1901, January 1996.

[10] Case, J., McCloghrie, K., Rose, M., and Waldbusser, S., "Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1906, January 1996.

[11] Case, J., Harrington D., Presuhn, R., and Wijnen, B., "Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)", RFC 2572, April 1999.

[12] Blumenthal, U., and Wijnen, B., "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", RFC 2574, April 1999.

[13] Case, J., McCloghrie, K., Rose, M., and Waldbusser, S., "Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1905, January 1996.

[14] Levi, D., Meyer, P., and Stewart, B., "SNMPv3 Applications", RFC 2573, April 1999.

[15] Wijnen, B., Presuhn, R., and McCloghrie, K., "View-based Access Control Model (VACM) for the Simple Network Management Protocol

(SNMP)", RFC 2575, April 1999.

[16] Case, J., Mundy, R., Partain, D., and Stewart, B., "Introduction to Version 3 of the Internet-standard Network Management Framework", RFC 2570, April 1999.

[17] Bradner, S., "Key Words for use in RFCs to Indicate Requirement Levels", RFC 2119, March 1997.

[18] American National Standards Institute, ANSI T1E1.4/2000-006, February 2000.

[19] Blackwell, S., Editor, "Single-Pair High-Speed Digital Subscriber Line (SHDSL) Transceivers", ITU-T Draft G.991.2, April 2000.

[20] McCloghrie, K., and Rose, M., Editors, "Management Information Base for Network Management of TCP/IP-based internets: MIB-II", STD 17, RFC 1213, March 1991.

[21] McCloghrie, K., and Kastenholz, F., "The Interfaces Group MIB", RFC 2863, June 2000.

[22] Tesink, K., "Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals", RFC 2493, January 1999.

[23] Bathrick, G., Ly, F., "Definitions of Managed Objects for the ADSL Lines", RFC 2662, August 1999.

[24] Pate, P., Lynch, B., Rehbehn, K., "Definitions of Managed Objects for Monitoring and Controlling the UNI/NNI Multilink Frame Relay Function", RFC 3020, December 2000.

[25] American National Standards Institute, "Coded Identification of Equipment Entities of the North American Telecommunications System for the Purpose of Information Exchange", T1.213-2001.

10. Intellectual Property Notice

obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can

be obtained from the IETF Secretariat.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights which may cover technology that may be required to practice this standard. Please address the information to the IETF Executive Director.

11. Authors' Addresses

Rajesh Abbi
Alcatel USA
2912 Wake Forest Road
Raleigh, NC 27609-7860 USA
Tel: +1 919-850-6194
Fax: +1 919-850-6670
E-mail: Rajesh.Abbi@usa.alcatel.com

Bob Ray
Verilink Corporation
950 Explorer Blvd
Huntsville, AL 35806 USA
Tel: +1 256-327-2380
Fax: +1 256-327-2880
E-mail: bray@verilink.com

12. Full Copyright Statement