

9 Service availability

Clause 9 describes functional requirements to achieve interoperable service availability guarantees in EPON systems. Clause 9 specifically addresses functions and requirements related to device and transceiver monitoring, definitions of associated alarms and warnings, and optical link protection.

9.1 Device and transceiver status monitoring and diagnostic functions

9.1.1 Introduction

This subclause specifies a number of device and transceiver monitoring requirements, using mechanisms and capabilities defined in ~~SFF-8472, SFF-8077i~~, IEEE Std 802.3, IEEE Std 802.3.1, IEEE Std 802.3.2, and ITU-T G.984.3.

9.1.2 IEEE Std 802.3-defined monitoring parameters

This subclause specifies a number of device status monitoring parameters as defined in IEEE Std 802.3 ~~and~~, IEEE Std 802.3.1, and IEEE Std 802.3.2.

9.1.2.1 Errored symbol period

The *errored symbol period* monitoring parameter indicates the number of errored symbols detected by the L-ONU in a specified time interval. The number of such symbols is returned in the form of a 64-bit unsigned integer, which is transmitted in the *Errored Symbol Period Event TLV*.

An associated event is typically generated at the end of the event window.

~~For 1000BASE-PX and 10GBASE-PRX PMDs operating at 1.25 GBd, a symbol corresponds to a code bit after the 8B/10B encoding operation, i.e., has the duration of 0.8 ns. For 10GBASE-PR and 10GBASE-PRX-Nx25G-EPON PMDs operating at 10.3125 GBd, a symbol corresponds to a code bit after the 64B/66B encoding operation, i.e., has the duration of approx. 0.097 ns. For Nx25G-EPON PMDs operating at 25.78125 GBd, a symbol corresponds to a code bit after the 64B/66B encoding operation, i.e., has the duration of approx. 0.0388 ns.~~

For more details, see IEEE Std 802.3, 57.5.3.1.

9.1.2.2 Errored frames

The *errored frame* monitoring parameter indicates the number of errored frames detected by the L-ONU in a specified time interval. The number of such frames is returned in the form of a 32-bit unsigned integer, which is transmitted in the *Errored Frame Event TLV*.

An associated event is typically generated at the end of the event window.

For more details, see IEEE Std 802.3, 57.5.3.2.

9.1.2.3 Errored frame period

The *errored frame period* monitoring parameter indicates the number of errored frames detected by the L-ONU in a specified number of observed frames. The number of such frames is returned in the form of a 32-bit unsigned integer, which is transmitted in the *Errored Frame Period Event TLV*.

An associated event is typically generated at the end of the event window.

For more details, see IEEE Std 802.3, 57.5.3.3.

9.1.2.4 Errored frame seconds

The *errored frame seconds* monitoring parameter indicates the number of errored frame seconds detected by the L-ONU in a specified time interval (number of seconds). The number of such errored frame seconds is returned in the form of a 16-bit unsigned integer, which is transmitted in the *Errored Frame Seconds Summary Event* TLV.

An associated event is typically generated at the end of the event window.

For more details, see IEEE Std 802.3, 57.5.3.4.

~~9.1.2.5 1G-EPON corrected FEC block counter~~

~~The 1G-EPON corrected FEC block counter monitoring parameter indicates the number of FEC corrected blocks received by the L-ONU. The number of such blocks is returned in the form of a 64-bit unsigned integer.~~

~~For more details, see IEEE Std 802.3, 30.5.1.1.15, and IEEE Std 802.3.1, 9.6.~~

~~This monitoring parameter is applicable to 1G-EPON only.~~

~~9.1.2.6 1G-EPON uncorrected FEC block counter~~

~~The 1G-EPON uncorrected FEC block counter monitoring parameter indicates the number of FEC uncorrected blocks received by the L-ONU. The number of such blocks is returned in the form of a 64-bit unsigned integer.~~

~~For more details, see IEEE Std 802.3, 30.5.1.1.15, and IEEE Std 802.3.1, 9.6.~~

~~This monitoring parameter is applicable to 1G-EPON only.~~

~~9.1.2.79.1.2.5 10G-EPON and Nx25G-EPON/1GBASE-PRX and 10GBASE-PR corrected FEC codewords counter~~

~~The 10G-EPON and Nx25G-EPON/1GBASE-PRX and 10GBASE-PR corrected FEC codewords counter monitoring parameter indicates the number of FEC corrected codewords received by the L-ONU. The number of such codewords is returned in the form of a 32-bit unsigned integer.~~

~~For more details, see IEEE Std 802.3, 45.2.3.341.~~

~~This monitoring parameter is applicable to 10/1GBASE-PRX and 10GBASE-PR only.~~

~~9.1.2.89.1.2.6 10 10G-EPON and Nx25G-EPON/1GBASE-PRX and 10GBASE-PR uncorrected FEC codewords counter~~

~~The 10G-EPON and Nx25G-EPON/1GBASE-PRX and 10GBASE-PR uncorrected FEC codewords counter monitoring parameter indicates the number of FEC uncorrected codewords received by the L-ONU. The number of such codewords is returned in the form of a 32-bit unsigned integer.~~

~~For more details, see IEEE Std 802.3, 45.2.3.342.~~

~~This monitoring parameter is applicable to 10/1GBASE-PRX and 10GBASE-PR only.~~

9.1.3 Transceiver status monitoring for SFF-8472– and SFF-8077i–compliant DPoE devices

A 25G-EPON or 50G-EPON ONU or OLT designed to meet the requirements of this profile shall monitor the following parameters using the available monitoring interfaces~~the SFF 8472– and SFF 8077i–compliant interfaces~~: optical transceiver temperature, optical transceiver supply voltage, optical transmitter bias current, optical transmitter output power, and optical receiver input power.~~Additional requirements are specified in DPoE-SP-PHY. The associated management, threshold crossing events, fault diagnostics, and performance prediction functions shall be as defined in DPoE-SP-OAM.~~

9.1.3.1 Optical transceiver temperature

The ONU and OLT shall support the measurement of temperature of the optical transceiver, with the measured value represented in the format of a 16-bit signed two's-complement value, with the LSB equal to 1/256 °C, covering the range of –40 °C to +125 °C.

9.1.3.2 Optical transceiver supply voltage

The ONU and OLT shall support the measurement of supply voltage of the optical transceiver, with the measured value represented in the format of a 16-bit signed two's-complement value, with the LSB equal to 100 µV, covering the range of 0 to +6.55 V.

9.1.3.3 Optical transmitter bias current

The ONU and OLT shall support the measurement of the bias current of the optical transmitter, with the measured value represented in the format of a 16-bit signed two's-complement value, with the LSB equal to 2 µA, covering the range of 0 to +131 mA.

9.1.3.4 Optical transmitter output power

The ONU and OLT shall support the measurement of the output power of the optical transmitter, with the measured value represented in the format of a 16-bit signed two's-complement value, with the LSB equal to 0.1 µW, covering the range of 0 to +6.5535 mW (~ –40 to +8.2 dBm).

9.1.3.5 Optical receiver input power

The ONU and OLT shall support the measurement of the input power of the optical receiver, with the measured value represented in the format of a 16-bit signed two's-complement value, with the LSB equal to 0.1 µW, covering the range of 0 to +6.5535 mW (~ –40 to +8.2 dBm).

9.1.4 Management for ONU alarms, warnings, and transceiver status

The ONU transceiver status may be polled by the OLT using *ONU Transceiver Status* TLV (0xC7/0x00-05), carried in the *eOAM_Get_Response* eOAMPDU. The structure of this TLV is specified in 14.2.2.4.

The ONU alarm/warning administrative status may be polled by the OLT using the *eOAM_EventStatus_Request* eOAMPDU. The ONU responds to this request using the *eOAM_EventStatus_Response* eOAMPDU. The ONU alarm/warning administrative status may also be set by the OLT using the *eOAM_EventStatus_Set* eOAMPDU. The structures of these eOAMPDUs are specified in 13.2.3.9.

The ONU alarm/warning thresholds may be polled by the OLT using the *eOAM_EventThreshold_Request* eOAMPDU. The ONU responds to this request using the *eOAM_EventThreshold_Response* eOAMPDU. The ONU alarm/warning thresholds may be set by the OLT using *eOAM_EventThreshold_Set* eOAMPDU. The structures of these eOAMPDUs are specified in 13.2.3.9.

9.1.5 Loopback function

The *Loopback Enable* TLV (0xDD/0x06-03) TLV is used by the OLT to request the ONU to enable the loopback function on the given element, as indicated by the *Object Context* TLV.

The OLT and ONU shall implement the L-ONU loopback function as specified in IEEE Std 802.3. The OLT and ONU should implement the UNI port loopback as controlled by the *Loopback Disable* TLV (0xDD/0x06-04) and *Loopback Enable* TLV (0xDD/0x06-03).

This attribute enables MAC or PHY loopback at the specified ONU UNI port. Figure 9-2 shows an example of a UNI port loopback. When the selected UNI port is in loopback, frames sent upstream to the UNI port are dropped. Frames sent downstream are looped back upstream and transmitted out the ONU PON port. Frames flowing to other UNI ports are not affected. This loopback attribute allows the operator test a data path through the entire ONU, in contrast to the IEEE 802.3 (57.2.11) L-ONU loopback, which occurs at the PON port side of the ONU (not illustrated in Figure 9-2).

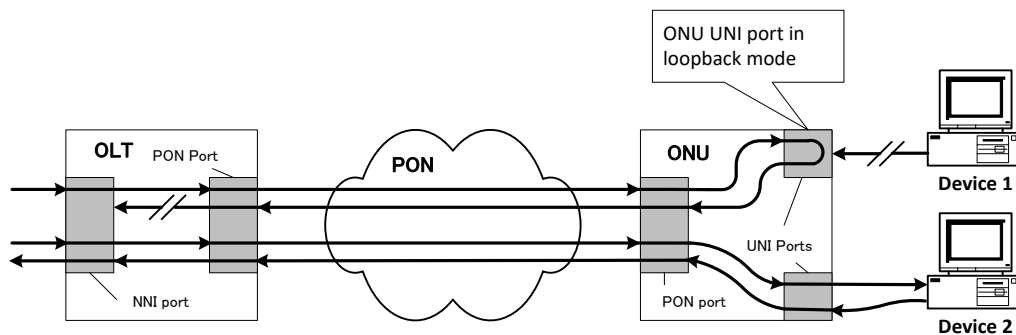


Figure 9-1—UNI port loopback

9.2 Definitions of events

9.2.1 Introduction

This subclause specifies events generated in EPON by ONU and OLT devices. In the case of the ONU-generated events, the associated information is delivered to the OLT using the event notification mechanism specified in 13.2.2.3.2.

9.2.2 Event-related management operations

The following operations are permitted for individual events:

- Read status: allows the NMS (via OLT) to query the status of individual event(s) maintained by the ONU. The number of events accessible through a single read operation may be restricted by the size of the management message.
- Set threshold(s): allows the NMS (via OLT) to control the setting of the detection threshold(s) associated with the given event(s).
- Enable/disable: allows the NMS (via OLT) to control the administrative status of the individual event(s) maintained by the ONU. The NMS in this situation may selectively change the administrative status of the individual event(s), during either the provisioning or operating stage. If the given event is enabled, the monitoring process associated with the given set of parameter(s) generates the event when the configured thresholds are crossed or when the specific event generation conditions are met. When the given event is disabled, the monitoring process stops generating the event.

9.2.2.1 Event set/clear

In the case of high-value events, e.g., TempAlarmH and TempWarningH, the given event is set when the measured value exceeds the SetThreshold value, as provisioned using the *eOAM_EventThreshold_Set* eOAMPDU (see 13.2.3.9.5). The given event is cleared when the measured value drops below the ClearThreshold value, as provisioned using the *eOAM_EventThreshold_Set* eOAMPDU (see 13.2.3.9.5).

Likewise, in the case of low-value events, e.g., TempAlarmL and TempWarningL, the given event is set when the measured value drops below the SetThreshold value, as provisioned using the *eOAM_EventThreshold_Set* eOAMPDU (see 13.2.3.9.6). The given event is cleared when the measured value exceeds the ClearThreshold value, as provisioned using the *eOAM_EventThreshold_Set* eOAMPDU (see 13.2.3.9.6).

These relations are represented in Figure 9-3.

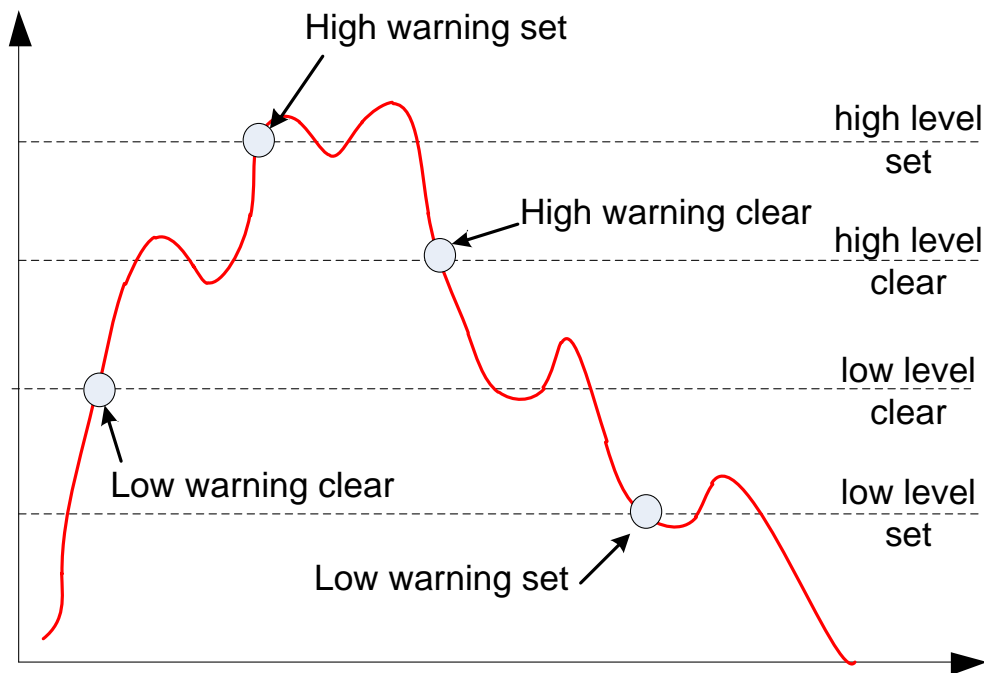


Figure 9-2—Relationship between high/low set/reset actions for the given event (warning in this example)

9.2.3 Events associated with the PON Port object

All the alarms and warnings associated with the PON Port object (shown in Table 9-1) shall use the set/clear mechanism as defined in 9.2.2.1 and shall be delivered to the OLT using the event notification mechanism as specified in 13.2.2.3.2.

Table 9-1—Alarms, warnings, and events associated with the PON Port object

Event name	EventID	Additional information		Mandatory (M)/ Optional (O)
		Definition	Notes	
RXPowerAlarmH	0x01-01	9.2.3.1	^a	M
RXPowerAlarmL	0x01-02	9.2.3.12	^a	M
TXPowerAlarmH	0x01-03	9.2.3.13	^a	M
TXPowerAlarmL	0x01-04	9.2.3.14	^a	M
TXBiasAlarmH	0x01-05	9.2.3.15	^a	M
TXBiasAlarmL	0x01-06	9.2.3.16	^a	M
VccAlarmH	0x01-07	9.2.3.17	^a	M
VccAlarmL	0x01-08	9.2.3.18	^a	M
TempAlarmH	0x01-09	9.2.3.19	^{a, b}	M
TempAlarmL	0x01-0A	9.2.3.20	^{a, b}	M
RXPowerWarningH	0x01-0B	9.2.3.11	^a	M
RXPowerWarningL	0x01-0C	9.2.3.12	^a	M
TXPowerWarningH	0x01-0D	9.2.3.13	^a	M
TXPowerWarningL	0x01-0E	9.2.3.14	^a	M
TXBiasWarningH	0x01-0F	9.2.3.15	^a	M
TXBiasWarningL	0x01-10	9.2.3.16	^a	M
VccWarningH	0x01-11	9.2.3.17	^a	M
VccWarningL	0x01-12	9.2.3.18	^a	M
TempWarningH	0x01-13	9.2.3.19	^{a, b}	M
TempWarningL	0x01-14	9.2.3.20	^{a, b}	M
DownstreamDropEventsAlarm	0x01-15	9.2.3.21		M
UpstreamDropEventsAlarm	0x01-16	9.2.3.22		M
DownstreamCRCErrorFramesAlarm	0x01-17	9.2.3.23		M
UpstreamCRCErrorFramesAlarm	0x01-18	9.2.3.24		M
DownstreamOversizeFramesAlarm	0x01-1B	9.2.3.25		M
UpstreamOversizeFramesAlarm	0x01-1C	9.2.3.26		M
DownstreamDiscardsAlarm	0x01-21	9.2.3.27		M
UpstreamDiscardsAlarm	0x01-22	9.2.3.28		M
DownstreamErrorsAlarm	0x01-23	9.2.3.29		M
UpstreamErrorsAlarm	0x01-24	9.2.3.30		M
DownstreamDropEventsWarning	0x01-25	9.2.3.31		M
UpstreamDropEventsWarning	0x01-26	9.2.3.32		M
DownstreamCRCErrorFramesWarning	0x01-27	9.2.3.33		M
UpstreamCRCErrorFramesWarning	0x01-28	9.2.3.34		M
DownstreamOversizeFramesWarning	0x01-2B	9.2.3.35		M
UpstreamOversizeFramesWarning	0x01-2C	9.2.3.36		M
DownstreamDiscardsWarning	0x01-31	9.2.3.37		M
UpstreamDiscardsWarning	0x01-32	9.2.3.38		M
DownstreamErrorsWarning	0x01-33	9.2.3.39		M
UpstreamErrorsWarning	0x01-34	9.2.3.40		M

^a The value carried in the EventInfo field for RXPowerWarningH, RXPowerWarningL, TXPowerWarningH, TXPowerWarningL, TXBiasWarningH, TXBiasWarningL, VccWarningH, and VccWarningL shall be four octets wide where the actual measured value is carried in the two least significant octets.

^b The value carried in the EventInfo field for TempWarningH and TempWarningL shall be four octets wide where the most significant bit (MSB) represents the sign of the measured value and the 15 least significant bits represent the two's-complement scalar of the measure value, covering the range of -128 °C to +128 °C.

NOTE—Other values of the EventID are reserved and ignored on reception.

9.2.3.1 RXPowerAlarmH

RXPowerAlarmH is set when the optical receiver input power at the ONU exceeds the high alarm set threshold. This alarm is cleared when the optical receiver input power at the ONU drops below the high alarm clear threshold.

9.2.3.2 RXPowerAlarmL

RXPowerAlarmL is set when the optical receiver input power at the ONU drops below the low alarm set threshold. This alarm is cleared when the optical receiver input power at the ONU exceeds the low alarm clear threshold.

9.2.3.3 TXPowerAlarmH

TXPowerAlarmH is set when the optical transmitter output power at the ONU exceeds the high alarm set threshold. This alarm is cleared when the optical transmitter output power at the ONU drops below the high alarm clear threshold.

9.2.3.4 TXPowerAlarmL

TXPowerAlarmL is set when the optical transmitter output power at the ONU drops below the low alarm set threshold. This alarm is cleared when the optical transmitter output power at the ONU exceeds the low alarm clear threshold.

9.2.3.5 TXBiasAlarmH

TXBiasAlarmH is set when the optical transmitter bias current at the ONU exceeds the high alarm set threshold. This alarm is cleared when the optical transmitter bias current at the ONU drops below the high alarm clear threshold.

9.2.3.6 TXBiasAlarmL

TXBiasAlarmL is set when the optical transmitter bias current at the ONU drops below the low alarm set threshold. This alarm is cleared when the optical transmitter bias current at the ONU exceeds the low alarm clear threshold.

9.2.3.7 VccAlarmH

VccAlarmH is set when the optical transceiver supply voltage at the ONU exceeds the high alarm set threshold. This alarm is cleared when the optical transceiver supply voltage at the ONU drops below the high alarm clear threshold.

9.2.3.8 VccAlarmL

VccAlarmL is set when the optical transceiver supply voltage at the ONU drops below the low alarm set threshold. This alarm is cleared when the optical transceiver supply voltage at the ONU exceeds the low alarm clear threshold.

9.2.3.9 TempAlarmH

TempAlarmH is set when the optical transceiver internal temperature at the ONU exceeds the high alarm set threshold. This alarm is cleared when the optical transceiver internal temperature at the ONU drops below the high alarm clear threshold.

9.2.3.10 TempAlarmL

TempAlarmL is set when the optical transceiver internal temperature at the ONU drops below the low alarm set threshold. This alarm is cleared when the optical transceiver internal temperature at the ONU exceeds the low alarm clear threshold.

9.2.3.11 RXPowerWarningH

RXPowerWarningH is set when the optical receiver input power at the ONU exceeds the high warning set threshold. This warning is cleared when the optical receiver input power at the ONU drops below the high warning clear threshold.

9.2.3.12 RXPowerWarningL

RXPowerWarningL is set when the optical receiver input power at the ONU drops below the low warning set threshold. This warning is cleared when the optical receiver input power at the ONU exceeds the low warning clear threshold.

9.2.3.13 TXPowerWarningH

TXPowerWarningH is set when the optical transmitter output power at the ONU exceeds the high warning set threshold. This warning is cleared when the optical transmitter output power at the ONU drops below the high warning clear threshold.

9.2.3.14 TXPowerWarningL

TXPowerWarningL is set when the optical transmitter output power at the ONU drops below the low warning set threshold. This warning is cleared when the optical transmitter output power at the ONU exceeds the low warning clear threshold.

9.2.3.15 TXBiasWarningH

TXBiasWarningH is set when the optical transmitter bias current at the ONU exceeds the high warning set threshold. This warning is cleared when the optical transmitter bias current at the ONU drops below the high warning clear threshold.

9.2.3.16 TXBiasWarningL

TXBiasWarningL is set when the optical transmitter bias current at the ONU drops below the low warning set threshold. This warning is cleared when the optical transmitter bias current at the ONU exceeds the low warning clear threshold.

9.2.3.17 VccWarningH

VccWarningH is set when the optical transceiver supply voltage at the ONU exceeds the high warning set threshold. This warning is cleared when the optical transceiver supply voltage at the ONU drops below the high warning clear threshold.

9.2.3.18 VccWarningL

VccWarningL is set when the optical transceiver supply voltage at the ONU drops below the low warning set threshold. This warning is cleared when the optical transceiver supply voltage at the ONU exceeds the low warning clear threshold.

9.2.3.19 TempWarningH

TempWarningH is set when the optical transceiver internal temperature at the ONU exceeds the high warning set threshold. This warning is cleared when the optical transceiver internal temperature at the ONU drops below the high warning clear threshold.

9.2.3.20 TempWarningL

TempWarningL is set when the optical transceiver internal temperature at the ONU drops below the low warning set threshold. This warning is cleared when the optical transceiver internal temperature at the ONU exceeds the low warning clear threshold.

9.2.3.21 DownstreamDropEventsAlarm

DownstreamDropEventsAlarm is set when the number of downstream drop events at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of downstream drop events at the PON port drops below the clear alarm threshold.

9.2.3.22 UpstreamDropEventsAlarm

UpstreamDropEventsAlarm is set when the number of upstream drop events at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of upstream drop events at the PON port drops below the clear alarm threshold.

9.2.3.23 DownstreamCRCErrorFramesAlarm

DownstreamCRCErrorFramesAlarm is set when the number of downstream CRC-errored frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of downstream CRC-errored frames at the PON port drops below the clear alarm threshold.

9.2.3.24 UpstreamCRCErrorFramesAlarm

UpstreamCRCErrorFramesAlarm is set when the number of upstream CRC-errored frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of upstream CRC-errored frames at the PON port drops below the clear alarm threshold.

9.2.3.25 DownstreamOversizeFrameAlarm

DownstreamOversizeFrameAlarm is set when the number of downstream oversized frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of downstream oversized frames at the PON port drops below the clear alarm threshold.

9.2.3.26 UpstreamOversizeFrameAlarm

UpstreamOversizeFrameAlarm is set when the number of upstream oversized frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of upstream oversized frames at the PON port drops below the clear alarm threshold.

9.2.3.27 DownstreamDiscardsAlarm

DownstreamDiscardsAlarm is set when the number of downstream discarded frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of downstream discarded frames at the PON port drops below the clear alarm threshold.

9.2.3.28 UpstreamDiscardsAlarm

UpstreamDiscardsAlarm is set when the number of upstream discarded frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of upstream discarded frames at the PON port drops below the clear alarm threshold.

9.2.3.29 DownstreamErrorsAlarm

DownstreamErrorsAlarm is set when the number of downstream errored frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of downstream errored frames at the PON port drops below the clear alarm threshold.

9.2.3.30 UpstreamErrorsAlarm

UpstreamErrorsAlarm is set when the number of upstream errored frames at the PON port exceeds the set alarm threshold. This alarm is cleared when the number of upstream errored frames at the PON port drops below the clear alarm threshold.

9.2.3.31 DownstreamDropEventsWarning

DownstreamDropEventsWarning is set when the number of downstream drop events at the PON port exceeds the set warning threshold. This warning is cleared when the number of downstream drop events at the PON port drops below the clear warning threshold.

9.2.3.32 UpstreamDropEventsWarning

UpstreamDropEventsWarning is set when the number of upstream drop events at the PON port exceeds the set warning threshold. This warning is cleared when the number of upstream drop events at the PON port drops below the clear warning threshold.

9.2.3.33 DownstreamCRCErrorFramesWarning

DownstreamCRCErrorFramesWarning is set when the number of downstream CRC-errored frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of downstream CRC-errored frames at the PON port drops below the clear warning threshold.

9.2.3.34 UpstreamCRCErrorFramesWarning

UpstreamCRCErrorFramesWarning is set when the number of upstream CRC-errored frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of upstream CRC-errored frames at the PON port drops below the clear warning threshold.

9.2.3.35 DownstreamOversizeFramesWarning

DownstreamOversizeFramesWarning is set when the number of downstream oversized frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of downstream oversized frames at the PON port drops below the clear warning threshold.

9.2.3.36 UpstreamOversizeFramesWarning

UpstreamOversizeFramesWarning is set when the number of upstream oversized frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of upstream oversized frames at the PON port drops below the clear warning threshold.

9.2.3.37 DownstreamDiscardsWarning

DownstreamDiscardsWarning is set when the number of downstream discarded frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of downstream discarded frames at the PON port drops below the clear warning threshold.

9.2.3.38 UpstreamDiscardsWarning

UpstreamDiscardsWarning is set when the number of upstream discarded frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of upstream discarded frames at the PON port drops below the clear warning threshold.

9.2.3.39 DownstreamErrorsWarning

DownstreamErrorsWarning is set when the number of downstream errored frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of downstream errored frames at the PON port drops below the clear warning threshold.

9.2.3.40 UpstreamErrorsWarning

UpstreamErrorsWarning is set when the number of upstream errored frames at the PON port exceeds the set warning threshold. This warning is cleared when the number of upstream errored frames at the PON port drops below the clear warning threshold.

9.2.4 Events associated with the ONU object

All the events associated with the ONU object (shown in Table 9-2) shall use the set/clear mechanism as defined in 9.2.2.1 and shall be delivered to the OLT using the event notification mechanism as specified in 13.2.2.3.2.

Table 9-2—Event types associated with the ONU object

Event name	EventID	Additional information		Mandatory (M)/ Optional (O)
		Definition	Notes	
EquipmentAlarm	0x00-01	9.2.4.1	b	M
PowerAlarm	0x00-02	9.2.4.2	b	M
BatteryMissing	0x00-03	9.2.4.3	b, d	M
BatteryFailure	0x00-04	9.2.4.4	b, d	M
BatteryVoltLow	0x00-05	9.2.4.5	b, d	M
IntrusionAlarm	0x00-06	9.2.4.6	c, e	M
SelfTestFailure	0x00-07	9.2.4.7	b	M
ONUTempHighAlarm	0x00-09	9.2.4.7	b	M
ONUTempLowAlarm	0x00-0A		b	M
PON_IF_Switch	0x00-0C	9.2.4.8	b	M ^a
SleepStatusUpdate	0x00-0D	9.2.4.9	b	M

^a Required for ONUs supporting tree optical link protection mechanism.

^b The EventInfo field in the *Organization Specific Event* TLV carries four octets of data with the alarm-specific error codes, providing additional information related to the given alarm.

^c The EventInfo field in the *Organization Specific Event* TLV does not carry an additional four octets of data with the alarm-specific error codes.

^d Required for ONUs supporting a battery backup.

^e Required for ONUs supporting intrusion detection.

NOTE—Other values of the EventID are reserved and ignored on reception.

9.2.4.1 EquipmentAlarm

The EquipmentAlarm event identifies a functional failure on any of the internal interfaces. The following failure codes are defined for the EquipmentAlarm event:

- 0x00-00-00-01: ONU reset failure.
- Other values are reserved and ignored on reception.

9.2.4.2 PowerAlarm

The PowerAlarm event identifies the loss of external power. The following failure codes are defined for the PowerAlarm event:

- 0x00-00-00-01: loss of ac power—ac mains feeding the ONU are below minimum specification of the equipment.
- 0x00-00-00-02: overvoltage—the input voltage to the ONU is above maximum operating specification of the equipment.
- 0x00-00-00-03: low voltage—the input voltage to the ONU is below minimum operating specification of the equipment.
- Other values are reserved and ignored on reception.

9.2.4.3 BatteryMissing

The BatteryMissing alarm identifies that the battery is provisioned but missing from the device.

9.2.4.4 BatteryFailure

The BatteryFailure alarm identifies that the battery is provisioned and present in the device but cannot recharge.

9.2.4.5 IntrusionAlarm

The IntrusionAlarm event is applicable to ONUs supporting the intrusion alarm, and it is raised when the door or box of the given ONU is open.

9.2.4.6 SelfTestFailure

The SelfTestFailure alarm identifies that the given ONU failed an autonomous self-test. Specification of VoIP or E1/T1 service-specific functions is outside the scope of this standard. The following failure codes are defined for the SelfTestFailure event:

- 0x00-00-00-01: self-test failure of the internal LAN switch.
- 0x00-00-00-02: self-test failure of the internal VoIP hardware.
- 0x00-00-00-03: test failure of the E1/T1 hardware.
- Other values are reserved and ignored on reception.

9.2.4.7 ONUTempHighAlarm and ONUTempLowAlarm

The ONUTempHighAlarm and ONUTempLowAlarm events identify the situations in which the ONU internal temperature exceeds the high/low alarm level, respectively.

The values carried in the `EventInfo` field for the `ONUTempHighAlarm` and the `ONUTempLowAlarm` events shall represent the internal ONU temperature at the time when the high-temperature alarm or the low-temperature alarm is crossed, with the temperature value expressed in the form of a 32-bit signed two's-complement integer where the most significant bit represents the sign of the measured value and the least significant 15 bits represent the two's-complement scalar of the measured value, covering the range of $-128\text{ }^{\circ}\text{C}$ to $+128\text{ }^{\circ}\text{C}$. The measurement accuracy is better than $\pm 3\text{ }^{\circ}\text{C}$ across the total measurement range.

9.2.4.8 PON_IF_Switch

The `PON_IF_Switch` alarm identifies the detection of a link failure. PON port is switched after the detection, and the ONU informs the OLT about this fact. The following failure codes are defined for the `PON_IF_Switch` event:

- 0x00-00-00-01: loss of signal (LoS) condition on the active PON interface.
- 0x00-00-00-02: MPCP timeout.
- 0x00-00-00-03: bit error ratio (BER) overrun.
- 0x00-00-00-04: PON interface failure.
- 0x00-00-00-05: switched to backup PON interface at the request of the OLT.
- Other values are reserved and ignored on reception.

9.2.4.9 SleepStatusUpdate

The `SleepStatusUpdate` alarm indicates that the ONU left the power-saving mode and entered the active mode either as requested by the OLT using the *ONU Sleep Control* TLV (0xC9/0x00-02) or autonomously, e.g., due to detected activity on the ONU UNI ports. The following return codes are defined for this event:

- 0x00-00-00-01: ONU left the power-saving mode autonomously (subscriber data frames pending transmission).
- 0x00-00-00-02: ONU left the power-saving mode autonomously (watchdog expiration).
- 0x00-00-00-03: ONU left the power-saving mode as requested by the OLT.
- Other values are reserved and ignored on reception.

9.2.5 Events associated with the Service Port object

All the events associated with the Service Port object (shown in Table 9-3) shall use the set/clear mechanism as defined in 9.2.2.1 and shall be delivered to the OLT using the event notification mechanism as specified in 13.2.2.3.2.

Table 9-3—Event types associated with the Service Port object

Event name	EventID	Additional information		Mandatory (M)/ Optional (O)
		Definition	Notes	
EthPortAutoNegFailure	0x03-01	9.2.5.1	b	M ^a
EthPortLOS	0x03-02	9.2.5.2	b	M ^a
EthPortConnectionFailure	0x03-03	9.2.5.3	b	M ^a
EthPortLoopback	0x03-04	9.2.5.4	b	M ^a
EthPortCongestion	0x03-05	9.2.5.5	b	M ^a
DownstreamDropEventsAlarm	0x03-06	9.2.5.6	b	M
UpstreamDropEventsAlarm	0x03-07	9.2.5.7	b	M
DownstreamCRCErrorFramesAlarm	0x03-08	9.2.5.8	b	M
UpstreamCRCErrorFramesAlarm	0x03-09	9.2.5.9	b	M

Event name	EventID	Additional information		Mandatory (M)/ Optional (O)
		Definition	Notes	
DownstreamUndersizeFramesAlarm	0x03-0A	9.2.5.10	^b	M
UpstreamUndersizeFramesAlarm	0x03-0B	9.2.5.11	^b	M
DownstreamOversizeFramesAlarm	0x03-0C	9.2.5.12	^b	M
UpstreamOversizeFramesAlarm	0x03-0D	9.2.5.13	^b	M
DownstreamFragmentsAlarm	0x03-0E	9.2.5.14	^b	M
UpstreamFragmentsAlarm	0x03-0F	9.2.5.15	^b	M
DownstreamJabbersAlarm	0x03-10	9.2.5.16	^b	M
UpstreamJabbersAlarm	0x03-11	9.2.5.17	^b	M
DownstreamDiscardsAlarm	0x03-12	9.2.5.18	^b	M
UpstreamDiscardsAlarm	0x03-13	9.2.5.19	^b	M
DownstreamErrorsAlarm	0x03-14	9.2.5.20	^b	M
UpstreamErrorsAlarm	0x03-15	9.2.5.21	^b	M
StatusChangeTimesAlarm	0x03-16	9.2.5.22	^b	M
DownstreamDropEventsWarning	0x03-17	9.2.5.23	^b	M
UpstreamDropEventsWarning	0x03-18	9.2.5.24	^b	M
DownstreamCRCErrorFramesWarning	0x03-19	9.2.5.25	^b	M
UpstreamCRCErrorFramesWarning	0x03-1A	9.2.5.26	^b	M
DownstreamUndersizeFramesWarning	0x03-1B	9.2.5.27	^b	M
UpstreamUndersizeFramesWarning	0x03-1C	9.2.5.28	^b	M
DownstreamOversizeFramesWarning	0x03-1D	9.2.5.29	^b	M
UpstreamOversizeFramesWarning	0x03-1E	9.2.5.30	^b	M
DownstreamFragmentsWarning	0x03-1F	9.2.5.31	^b	M
UpstreamFragmentsWarning	0x03-20	9.2.5.32	^b	M
DownstreamJabbersWarning	0x03-21	9.2.5.33	^b	M
UpstreamJabbersWarning	0x03-22	9.2.5.34	^b	M
DownstreamDiscardsWarning	0x03-23	9.2.5.35	^b	M
UpstreamDiscardsWarning	0x03-24	9.2.5.36	^b	M
DownstreamErrorsWarning	0x03-25	9.2.5.37	^b	M
UpstreamErrorsWarning	0x03-26	9.2.5.38	^b	M
StatusChangeTimesWarning	0x03-27	9.2.5.39	^b	M

^a Required only for single-family unit (SFU) or single-business unit (SBU) ONUs.

^b The EventInfo field in the *Organization Specific Event* TLV does not carry an additional four octets of data with the alarm-specific error codes.

NOTE—Other values of the EventID are reserved and ignored on reception.

9.2.5.1 EthPortAutoNegFailure

When set, the EthPortAutoNegFailure alarm indicates the failure of auto-negotiation for a specific Ethernet port.

9.2.5.2 EthPortLOS

When set, the EthPortLOS alarm indicates a loss of signal for a specific Ethernet port.

9.2.5.3 EthPortConnectionFailure

When set, the EthPortConnectionFailure alarm indicates a connection failure of a specific Ethernet port.

9.2.5.4 EthPortLoopback

When set, the EthPortLoopback alarm indicates that a loop condition was detected on a specific Ethernet port.

9.2.5.5 EthPortCongestion

When set, the EthPortCongestion alarm indicates that a congestion condition was detected on a specific Ethernet port.

9.2.5.6 DownstreamDropEventsAlarm

DownstreamDropEventsAlarm is set when the number of downstream drop events at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream drop events at the UNI port drops below the clear alarm threshold.

9.2.5.7 UpstreamDropEventsAlarm

UpstreamDropEventsAlarm is set when the number of upstream drop events at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of upstream drop events at the UNI port drops below the clear alarm threshold.

9.2.5.8 DownstreamCRCErrorFramesAlarm

DownstreamCRCErrorFramesAlarm is set when the number of downstream CRC-errored data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream CRC-errored data frames at the UNI port drops below the clear alarm threshold.

9.2.5.9 UpstreamCRCErrorFramesAlarm

UpstreamCRCErrorFramesAlarm is set when the number of upstream CRC-errored data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of upstream CRC-errored data frames at the UNI port drops below the clear alarm threshold.

9.2.5.10 DownstreamUndersizeFramesAlarm

DownstreamUndersizeFramesAlarm is set when the number of downstream undersized data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream undersized data frames at the UNI port drops below the clear alarm threshold.

9.2.5.11 UpstreamUndersizeFramesAlarm

UpstreamUndersizeFramesAlarm is set when the number of upstream undersized data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of upstream undersized data frames at the UNI port drops below the clear alarm threshold.

9.2.5.12 DownstreamOversizeFrameAlarm

DownstreamOversizeFrameAlarm is set when the number of downstream oversized data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream oversized data frames at the UNI port drops below the clear alarm threshold.

9.2.5.13 UpstreamOversizeFrameAlarm

UpstreamOversizeFrameAlarm is set when the number of upstream oversized data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of upstream oversized data frames at the UNI port drops below the clear alarm threshold.

9.2.5.14 DownstreamFragmentsAlarm

DownstreamFragmentsAlarm is set when the number of downstream fragments at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream fragments at the UNI port drops below the clear alarm threshold.

9.2.5.15 UpstreamFragmentsAlarm

UpstreamFragmentsAlarm is set when the number of upstream fragments at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of upstream fragments at the UNI port drops below the clear alarm threshold.

9.2.5.16 DownstreamJabbersAlarm

DownstreamJabbersAlarm is set when the number of downstream jabbers at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream jabbers at the UNI port drops below the clear alarm threshold.

9.2.5.17 UpstreamJabbersAlarm

UpstreamJabbersAlarm is set when the number of upstream jabbers at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of upstream jabbers at the UNI port drops below the clear alarm threshold.

9.2.5.18 DownstreamDiscardsAlarm

DownstreamDiscardsAlarm is set when the number of downstream discarded data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream discarded data frames at the UNI port drops below the clear alarm threshold.

9.2.5.19 UpstreamDiscardsAlarm

UpstreamDiscardsAlarm is set when upstream discarded data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when upstream discarded data frames at the UNI port drops below the clear alarm threshold.

9.2.5.20 DownstreamErrorsAlarm

DownstreamErrorsAlarm is set when the number of downstream errored data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of downstream errored data frames at the UNI port drops below the clear alarm threshold.

9.2.5.21 UpstreamErrorsAlarm

UpstreamErrorsAlarm is set when the number of upstream errored data frames at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of upstream errored data frames at the UNI port drops below the clear alarm threshold.

9.2.5.22 StatusChangeTimesAlarm

StatusChangeTimesAlarm is set when the number of status change times at the UNI port exceeds the set alarm threshold. This alarm is cleared when the number of status change times at the UNI port drops below the clear alarm threshold.

9.2.5.23 DownstreamDropEventsWarning

DownstreamDropEventsWarning is set when the number of downstream drop events at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream drop events at the UNI port drops below the clear warning threshold.

9.2.5.24 UpstreamDropEventsWarning

UpstreamDropEventsWarning is set when the number of upstream drop events at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream drop events at the UNI port drops below the clear warning threshold.

9.2.5.25 DownstreamCRCErrorFramesWarning

DownstreamCRCErrorFramesWarning is set when the number of downstream CRC-errored data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream CRC-errored data frames at the UNI port drops below the clear warning threshold.

9.2.5.26 UpstreamCRCErrorFramesWarning

UpstreamCRCErrorFramesWarning is set when the number of upstream CRC-errored data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream CRC-errored data frames at the UNI port drops below the clear warning threshold.

9.2.5.27 DownstreamUndersizeFramesWarning

DownstreamUndersizeFramesWarning is set when the number of downstream undersized data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream undersized data frames at the UNI port drops below the clear warning threshold.

9.2.5.28 UpstreamUndersizeFramesWarning

UpstreamUndersizeFramesWarning is set when the number of upstream undersized data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream undersized data frames at the UNI port drops below the clear warning threshold.

9.2.5.29 DownstreamOversizeFramesWarning

DownstreamOversizeFramesWarning is set when the number of downstream oversized data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream oversized data frames at the UNI port drops below the clear warning threshold.

9.2.5.30 UpstreamOversizeFramesWarning

UpstreamOversizeFramesWarning is set when the number of upstream oversized data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream oversized data frames at the UNI port drops below the clear warning threshold.

9.2.5.31 DownstreamFragmentsWarning

DownstreamFragmentsWarning is set when the number of downstream fragments at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream fragments at the UNI port drops below the clear warning threshold.

9.2.5.32 UpstreamFragmentsWarning

UpstreamFragmentsWarning is set when the number of upstream fragments at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream fragments at the UNI port drops below the clear warning threshold.

9.2.5.33 DownstreamJabbersWarning

DownstreamJabbersWarning is set when the number of downstream jabbers at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream jabbers at the UNI port drops below the clear warning threshold.

9.2.5.34 UpstreamJabbersWarning

UpstreamJabbersWarning is set when the number of upstream jabbers at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream jabbers at the UNI port drops below the clear warning threshold.

9.2.5.35 DownstreamDiscardsWarning

DownstreamDiscardsWarning is set when the number of downstream discarded data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream discarded data frames at the UNI port drops below the clear warning threshold.

9.2.5.36 UpstreamDiscardsWarning

UpstreamDiscardsWarning is set when the number of upstream discarded data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream discarded data frames at the UNI port drops below the clear warning threshold.

9.2.5.37 DownstreamErrorsWarning

DownstreamErrorsWarning is set when the number of downstream errored data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of downstream errored data frames at the UNI port drops below the clear warning threshold.

9.2.5.38 UpstreamErrorsWarning

UpstreamErrorsWarning is set when the number of upstream errored data frames at the UNI port exceeds the set warning threshold. This warning is cleared when the number of upstream errored data frames at the UNI port drops below the clear warning threshold.

9.2.5.39 StatusChangeTimesWarning

StatusChangeTimesWarning is set when the number of status change times at the UNI port exceeds the set warning threshold. This warning is cleared when the number of status change times at the UNI port drops below the clear warning threshold.

9.2.6 Events defined in IEEE Std 802.3, Clause 57

This standard lists all the critical link events derived from IEEE Std 802.3, 57.2.10.1, and supported in EPON. Other events derived from IEEE Std 802.3 are described in 9.1.2. For more details, see IEEE Std 802.3, 57.2.10.1.

9.2.6.1 Downstream link fault

This event is generated when a critical status of the downstream link on the L-ONU is detected using any type of vendor-specific mechanism.

Upon the occurrence of this event, the ONU notifies the OLT about the detected link fault condition, as specified in IEEE Std 802.3, Table 57–3, and the L-ONU detecting the link fault stops all upstream transmissions. Upon receiving the notification on the downstream link fault from the ONU, the OLT may deregister the given ONU.

If the ONU no longer detects the alarm condition using any type of vendor-specific mechanism, the ONU clears this event, then notifies the OLT of the status as specified in IEEE Std 802.3, Table 57–3, and may resume upstream transmissions if not deregistered. The OLT clears this event upon receiving notification from the ONU, or this event may be cleared explicitly by the NMS or automatically if the OLT deregisters the ONU.

9.2.6.2 Upstream link fault

This event is generated when the OLT detects the link fault condition for the upstream transmission channel associated with the ONU. The OLT, upon the detection of this event condition, may deregister the given ONU.

This event may be cleared explicitly by the NMS or automatically by the OLT when the given ONU is deregistered.

9.2.6.3 Dying Gasp

This event shall be generated when an L-ONU detects unexpected power failure. This event may be caused by external loss of power or by an unrecoverable local system failure that leads to an imminent ONU shutdown such as hardware problems, ac supply breakdown, etc. Once such an event is detected, the ONU makes an attempt to send the Dying Gasp event to the OLT.

If the Dying Gasp event is generated and sent to the OLT, it is transmitted using the mechanism specified in IEEE Std 802.3, Table 57–3.

If the ONU no longer detects the alarm condition using any type of vendor-specific mechanism, the ONU clears this event and notifies the OLT of the status as specified in IEEE Std 802.3, Table 57–3. The OLT clears this event upon receiving notification from the ONU, or this event may be cleared explicitly by the NMS or automatically if the OLT deregisters the ONU.

9.2.6.4 ONU critical event

This event is generated when any type of critical event occurs at the ONU. This event message is then sent to the OLT from each L-ONU using the mechanism specified in IEEE Std 802.3, Table 57–3. The OLT may choose to deregister the ONU depending on the local conditions and processing algorithm, outside the scope of this standard.

If the ONU remains registered and it no longer detects the alarm condition using any type of vendor-specific mechanism, the ONU clears this event and then notifies the OLT of the status as specified in

IEEE Std 802.3, Table 57–3. The OLT clears this event upon receiving notification from the ONU, or this event may be cleared explicitly by the NMS or automatically if the OLT deregisters the ONU.

9.2.6.5 OLT critical event

This event is generated when any type of critical event occurs at the OLT. This event message is then sent to the NMS using the selected event notification mechanism. The further course of action of the NMS is outside the scope of this standard.

This event is explicitly cleared by the NMS.