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SERIES Q: SWITCHING AND SIGNALLING

Specifications of Signalling System No. 7 – Q3 interface

Fault and performance management of V5 interface environments and associated customer profiles

ITU-T Recommendation Q.831

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION Q.831

FAULT AND PERFORMANCE MANAGEMENT OF V5 INTERFACE ENVIRONMENTS AND ASSOCIATED CUSTOMER PROFILES

Summary

The purpose of this Recommendation is to define the Q3 interface between a Local Exchange (LE) and an Access Network (AN) and the Telecommunications Management Network (TMN) related to fault and performance management functions for V5 interfaces, as described in Recommendations G.964 and G.965, and their associated user ports. Management of transmission, media, and services which are not related to V5 interfaces is outside the scope of this Recommendation, as is the management of equipment.

This Recommendation includes the logging of faults and related functions.

Source

ITU-T Recommendation Q.831 was prepared by ITU-T Study Group 4 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 24th October 1997.

Keywords

access network, fault management, performance management, information model, local exchange, line and circuit test management, Q3 interface, TMN, V5 interface.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

INTELLECTUAL PROPERTY RIGHTS

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As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Introduction

V5 interfaces, as described in Recommendations G.964 and G.965, operate between a Local Exchange (LE) and an Access Network (AN) to support various narrow-band Integrated Services Digital Network (ISDN) and Public Switched Telephone Network (PSTN) services. These interfaces and their associated user ports need to be managed by the Operations Systems (OSs) within the Telecommunications Management Network (TMN). This management is performed by means of Q3 interfaces.

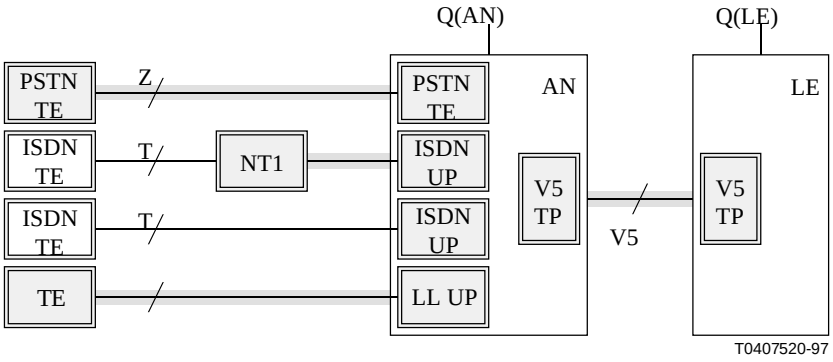
The companion Recommendation Q.824.5 on configuration management defines how the Q3 interface of an AN handles the configuration information for V5 interfaces and their associated user ports. This Recommendation specifies the extension to include fault and performance management.

Fault management of V5 interfaces and associated user ports is part of a management activity which is performed by the operator in order to detect failure conditions and to bring the customer access back to its normal state of operation whenever a deviation occurs.

Performance management of V5 interfaces and associated user ports is part of a management activity which is employed in order to maintain the quality of service levels agreed with the customers. The activities undertaken in performance management are monitoring, analysis and problem alerting, diagnosis, optimization and control.

A customer access is considered as being that part of the local network which extends from the network termination equipment up to and including the exchange termination.

Here, only the parts of the activities are covered which are related directly to a V5 interface between a LE and an AN or to that part of the customer access which extends from the AN to the network termination equipment. An ISDN access extends to but does not include the T reference point. An analogue access extends to and may include the Customer Premises Equipment (CPE).



Scope of V5 fault and performance management

NOTE – Shaded areas are subject to V5 fault and performance management. User ports represent the different configurations for Line Circuit (LC), Line Termination (LT), Exchange Termination (ET) and Network Termination (NT) as given in Figure 2 of the V5 specifications in Recommendations G.964 and G.965. For leased lines (semi-permanent lines), this Recommendation only covers aspects which are common to PSTN and ISDN. With regard to fault and performance management, the TE and LL UP for leased lines are under the control of the access network only.

This Recommendation details only those functions and management information model components for which V5 specific descriptions are required. However, the use of other components which may be applicable from other specifications is not precluded. In this case, combined applications

incorporating both V5 specific and more generic aspects would result. For example, if log control is to be provided in conjunction with the V5 specific alarm reporting function (see Annex A), then other specifications (e.g. Recommendation X.735) are available to define this.

The management information model described in this Recommendation complements that for configuration; both information models will normally share the same physical interface.

Recommendation Q.831

FAULT AND PERFORMANCE MANAGEMENT OF V5 INTERFACE ENVIRONMENTS AND ASSOCIATED CUSTOMER PROFILES

(Geneva, 1997)

1 Scope

This Recommendation specifies the Q3 interface between a Local Exchange (LE) and an Access Network (AN) and the Telecommunications Management Network (TMN) for the support of fault and performance management functions for V5 interfaces, as described in Recommendations G.964 [8] and G.965 [9], and their associated user ports. The management of transmission, of media, and of services which are not related to V5 interfaces is outside the scope of this Recommendation, as is the management of equipment.

This Recommendation includes the logging of faults and related functions. The testing of the lines and line circuits at the user ports associated with the V5 interface is going to be defined in the future Recommendation Q.835.

The location of the Q3 interface to which this Recommendation refers is specified in Recommendation Q.824.5 [18].

This Recommendation does not constrain the logical or physical size of the access network or its geographical dispersion.

Existing protocols are used where possible, and the focus of this Recommendation is on defining the object models. The definition of Operations Systems (OSs) functionality is outside the scope of this Recommendation.

2 References

2.1 Normative references

The following ITU-T Recommendations, and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation G.773 (1993), *Protocol suites for Q-interfaces for management of transmission systems.*

[2] ITU-T Recommendation G.784 (1994), *Synchronous Digital Hierarchy (SDH) management.*

[3] ITU-T Recommendation G.821 (1996), *Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an integrated services digital network.*

[4] ITU-T Recommendation G.826 (1996), *Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate*.

[5] ITU-T Recommendation G.960 (1993), *Access digital section for ISDN basic rate access.*

[6] ITU-T Recommendation G.961 (1993), *Digital transmission system on metallic local lines for ISDN basic rate access.*

[7] ITU-T Recommendation G.962 (1993), *Access digital section for ISDN primary rate at 2048 kbit/s.*

[8] ITU-T Recommendation G.964 (1994), *V-Interfaces at the digital Local Exchange (LE) – V5.1-interface (based on 2048 kbit/s) for the support of Access Network (AN).*

[9] ITU-T Recommendation G.965 (1995), *V-Interfaces at the digital Local Exchange (LE) – V5.2 Interface (based on 2048 kbit/s) for the support of Access Network (AN).*

[10] ITU-T Recommendation M.3010 (1996), *Principles for a telecommunications management network.*

[11] CCITT Recommendation M.3603 (1992), *Application of maintenance principles to ISDN basic rate access.*

[12] CCITT Recommendation M.3604 (1992), *Application of maintenance principles to ISDN primary rate access.*

[13] ITU-T Recommendation M.3100 (1995), *Generic network information model.*

[14] ITU-T Recommendation Q.811 (1997), *Lower layer protocol profiles for the Q3 and x interface*.

[15] ITU-T Recommendation Q.812 (1997), *Upper layer protocol profiles for the Q3 and x interface*.

[16] ITU-T Recommendation Q.821 (1993), *Stage 2 and stage 3 description for the Q3 interface – Alarm surveillance.*

[17] ITU-T Recommendation Q.822 (1994), *Stage 1, stage 2 and stage 3 description for the Q3 interface – Performance management.*

[18] ITU-T Recommendation Q.824.5 (1997), *Stage 2 and stage 3 description for the Q3 interface – Customer administration: Configuration management of V5 interface environments and associated customer profiles.*

[19] CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1).*

[20] CCITT Recommendation X.720 (1992) | ISO/IEC 10165-1:1993, *Information technology – Open Systems Interconnection – Structure of management information: Management information model.*

[21] CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information.*

[22] CCITT Recommendation X.730 (1992) | ISO/IEC 10164-1:1993, *Information technology – Open Systems Interconnection – Systems Management: Object management function.*

[23] CCITT Recommendation X.731 (1992) | ISO/IEC 10164-2:1992, *Information technology – Open Systems Interconnection – Systems management: State management function.*

[24] CCITT Recommendation X.732 (1992) | ISO/IEC 10164-3:1993, *Information technology – Open Systems Interconnection – Systems Management: Attributes for representing relationships.*

[25] CCITT Recommendation X.733 (1992) | ISO/IEC 10164-4:1992, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function.*

[26] CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems Management: Event report management function.*

[27] CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control function.*

[28] ITU-T Recommendation X.680 (1994) | ISO/IEC 8824-1:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

[29] ITU-T Recommendation X.681 (1994) | ISO/IEC 8824-2:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*

[30] ITU-T Recommendation X.682 (1994) | ISO/IEC 8824-3:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification.*

[31] ITU-T Recommendation X.683 (1994) | ISO/IEC 8824-4:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications.*

2.2 Informative references

– ITU-T Recommendation G.831 (1996), *Management capabilities of transport networks based on the synchronous digital hierarchy, (SDH).*

– CCITT Recommendation I.601 (1988), *General maintenance principles of ISDN subscriber access and subscriber installation.*

– ITU-T Recommendation M.3020 (1995), *TMN interface specification methodology.*

– ITU-T Recommendation M.3211.1 (1996), *TMN management service: Fault and performance management of the ISDN access.*

– CCITT Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open systems interconnection – Structure of management information: Guidelines for the definition of managed objects.*

3 Terms and definitions, abbreviations

3.1 Definitions

This Recommendation defines the following term.

3.1.1 V5 interface messages: This term refers to all Function Elements and other V5 protocol messages as defined in Recommendations G.964 [8] and G.965 [9] which are communicated via the V5 interface.

In addition, this Recommendation uses terms defined in ITU-T Recommendations:

– **G.964** [8]: Access Network, Bearer Channel, Communication Channel, Communication Path, Control Protocol, Envelope Function Address, Layer 3 Address, Leased Lines, Local Exchange, V5 Interface.

– **G.965** [9]: Bearer Channel Connection, Protection Protocol.

– **M.3010** [10]: Operations System.

3.2 Abbreviations

This Recommendation uses the following abbreviations:

AIS	Alarm Indication Signal
AN	Access Network
ASN.1	Abstract Syntax Notation One
BA	Basic Access
BCC	Bearer Channel Connection
C-channel	Communication channel
C-path	Communication path
CPE	Customer Premises Equipment
CRC	Cyclic Redundancy Check
DCC	Data Communications Channel
DS	Digital Section
ET	Exchange Termination
ID	Identity, identifier
ISDN	Integrated Services Digital Network
LAPV5	Link Access Protocol for V5 interface
LC	Line Circuit
LE	Local Exchange
LFA	Loss of Frame Alignment
LL	Leased Line
LOS	Loss of Signal
LT	Line Termination
M/C	Mandatory/Conditional
NE	Network Element
NT	Network Termination
OS	Operations System
PM	Performance Management
PRA	Primary Rate Access
PSTN	Public Switched Telephone Network
QOS	Quality of Service
RAI	Remote alarm Indication
RBS	Ring Back Service
SDH	Synchronous Digital Hierarchy
SPM	Subscriber Private Meter
TE	Terminal Equipment
TMN	Telecommunications Management Network
TP	Termination Point
TTP	Trail Termination Point
UP	User Port

4 Fault and performance management functions

4.1 Fault management of V5 interfaces and associated user ports

4.1.1 Description of the service

Fault management of V5 interfaces and associated user ports is part of a management activity which is performed by the operator in order to detect failure conditions and to bring the customer access back to its normal state of operation whenever a deviation occurs. A customer access is considered as being that part of the local network which extends from the network termination equipment up to and including the exchange termination.

Here, only these parts of the activities are covered which are directly related to a V5 interface between a Local Exchange (LE) and an Access Network (AN) or to that part of the customer access which extends from the access network to the network termination equipment. An ISDN access extends to but does not include the T reference point. An analogue access extends to and may include the CPE.

4.1.2 Components of service

1) *Failure detection*

   Observe or supervise the V5 interface and the customer line and collect relevant data in order to detect failures or degradations. Perform continuous or periodic checks of the system functions.

2) *System protection*

   Initiate blocking of V5 interface or parts of it and user access ports. Initiate protection switching for the V5 interface (V5.2 only). The blocking and protection switching is defined in Recommendation Q.824.5 [18]

3) *Failure information*

   Send alarms and event reports from the NE to TMN with failure information related to V5 interfaces and customer lines.

4) *Failure localisation*

   Receive failure information from network elements which may be generated by performing tests on V5 interfaces.

5) *Fault correction*

   Replace faulty V5 interface equipment with working replacements. Restart the V5 interface in order to eliminate NE internal problems (see Recommendation Q.824.5 [18]).

6) *Verification*

   Apply the appropriate tests to the replaced component before bringing it back to service.

7) *Restoration*

   Restore the component to service. Unblock the blocked V5 interfaces (see Recommendation Q.824.5 [18]).

4.1.3 Management function list

1) Request status:

   TMN requests NE to send the current status information related to the V5 interface or to the user access port.

2) Initiate switch-over:

TMN directs NE to switch a specified V5 communication channel:

- to a standby C-channel which then becomes the active C-channel; or
- to an active C-channel which will be pre-empted.

NOTE – This is valid for Q LE only.

3) Report automatic switch-over:

NE notifies TMN that an automatic switch-over to a standby V5 communication channel has occurred.

4) Set service state:

TMN directs NE to place a user access port, a V5 interface or parts of it in a specified service state, e.g. in-service (available for use), standby (not for normal use), out-of-service (unavailable for use).

5) Alarm report:

NE notifies TMN of alarm information concerning user access ports or V5 interfaces or parts of it.

6) Set alarm conditions:

TMN directs NE to assign specific alarm parameters, modes and thresholds to alarms concerning user access ports or V5 interfaces or parts of it.

4.2 Performance management of V5 interfaces and associated user ports

4.2.1 Description of the service

Performance Management (PM) of V5 interfaces and associated user ports is part of a management activity which is employed in order to maintain the quality of service levels agreed with the customers. The activities undertaken in performance management are monitoring, analysis and problem alerting, diagnosis, optimization and control.

Here, only these parts of the activities are covered which are directly related to a V5 interface between a Local Exchange (LE) and an Access Network (AN) or to that part of the customer access which extends from the access network to the network termination equipment. An ISDN access extends to but does not include the T reference point. An analogue access extends to and may include the CPE.

4.2.2 Components of service

1) *Performance monitoring*

Initiate the collection of PM data concerning the load of a C-channel.

2) *Performance information*

Notify the TMN when PM thresholds have been crossed in the monitored ISDN digital section. Send PM data reports related to C-channel load to the TMN.

4.2.3 Management function list

1) Start/stop PM data:

Start or stop the collection of C-channel load data in order to monitor the current load of a particular C-channel.

2) PM data report:

The NE sends a report containing the new transmission quality level to the TMN. It will be generated whenever a predefined threshold has been crossed in an ISDN digital section being monitored. The NE sends reports containing the current load of the C-channels to the TMN periodically or on demand.

4.3 Description of management functions

4.3.1 Alarm surveillance

4.3.1.1 Alarm surveillance functions

Alarm surveillance functions are a set of functions used to monitor or interrogate Network Elements (NEs) about events or conditions (see Figure 1).

Managed systems concerned with V5 fault management need to provide alarm reporting functions. Other alarm surveillance functions may be provided optionally. Event data is generated by a network element upon detection of an abnormal condition. Examples of such events are detection of transmission data errors (layer 1 failures) and V5 protocol entity errors. Alarm surveillance comprises the following functions specified in Recommendation Q.821 [16]:

a) *Alarm reporting functions*

Event data may be reported at the time of occurrence by means of alarm notifications, as specified in CCITT Rec. X.733 | ISO/IEC 10164-4 [25]. Control of the alarm reporting service is provided by mechanisms specified in CCITT Rec. X.734 | ISO/IEC 10164-5 [26].

b) *Alarm summary functions*

The network element may generate summary reports of alarm conditions and provide these reports to TMN on demand or on a scheduled basis.

c) *Alarm event criteria functions*

Particular alarm severity assignments may be specified which are to be used with alarm reports generated in the network element.

d) *Alarm indication management functions*

This function provides services to control alarm indicating devices in the network element via the Q interface.

e) *Log control functions*

Event data may be logged for further access in alarm log objects, as specified in CCITT Rec. X.735 | ISO/IEC 10164-6 [27].

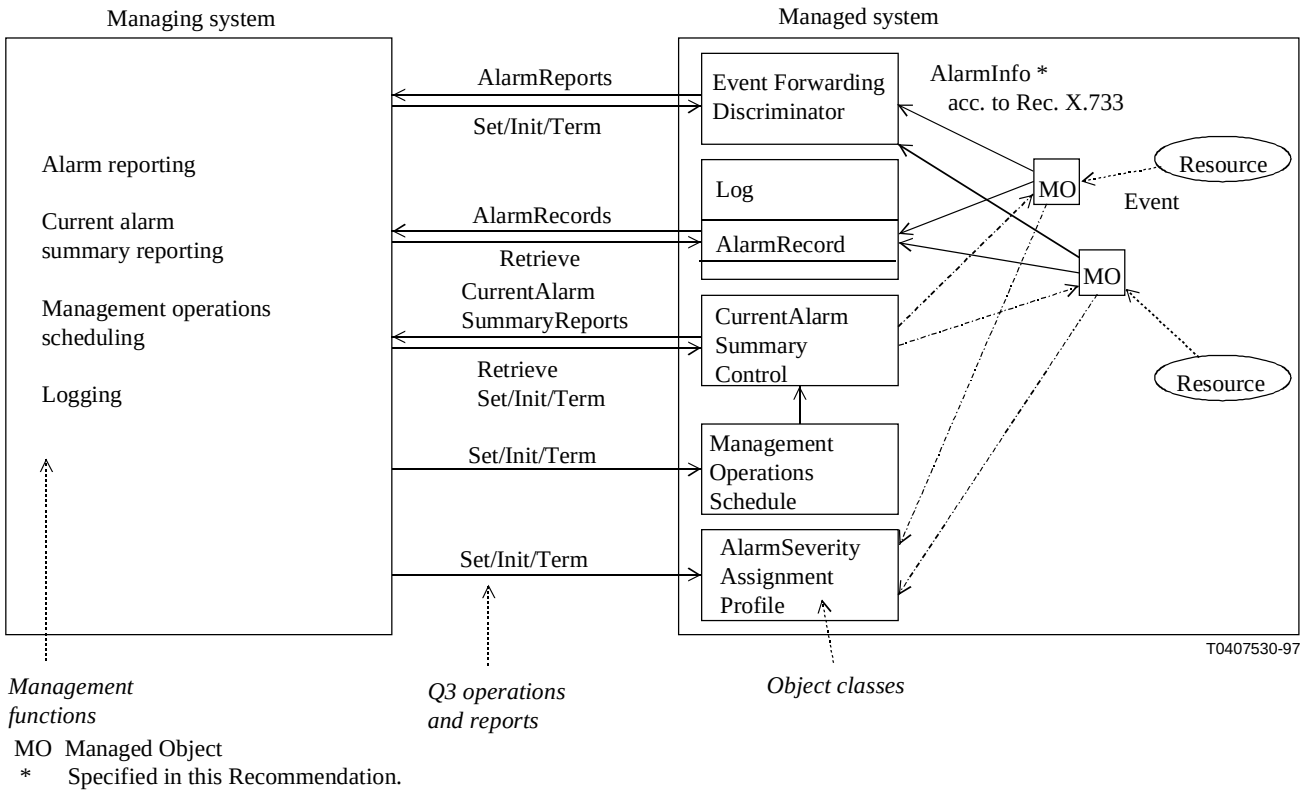


Figure 1/Q.831 – ITU-T Recommendation Q.821 alarm surveillance scenario

4.3.1.2 Alarm reporting function

Alarms are specific types of notifications concerning detected faults or abnormal conditions. By use of the event report management function specified in CCITT Rec. X.734 | ISO/IEC 10164-5 [26], these notifications may result in alarm reports being sent to the TMN. In CCITT Rec. X.733 | ISO/IEC 10164-4 [25], five basic categories of alarms are specified. For V5-related alarms, the communications alarm notification is used. Alarm notifications consist of a standardized set of parameters which provide information about the event to be reported, e.g. source, event type, probable cause and severity. Some of these parameters allow for application-specific values to be added, for some even a specific type can be defined. These possibilities are used within this standard to provide V5 specific alarm information. This Recommendation assigns specific values for the alarms applicable for the V5 interface.

Description of alarm report parameters relevant for V5-related alarm reports:

1) *Event type*

Five basic categories of alarm are specified. These are:

- Communications alarm type, associated with procedures required to convey information from one point to another;
- Quality of service alarm type, associated with degradation in the quality of a service;
- Processing error alarm type, associated with software or processing faults;
- Equipment alarm type, associated with an equipment fault;
- Environmental alarm type, associated with conditions relating to an enclosure in which the equipment resides.

2) *Probable cause*

This parameter further qualifies the probable cause of an alarm. The probable cause values for notifications is indicated in the behaviour clause of the object class definition. The syntax of the probable causes is an ASN.1 type object identifier. Standard probable cause values that have wide applicability across managed object classes are defined in CCITT Rec. X.733 | ISO/IEC 10164-4 [25]. Other probable causes may be defined in other specifications and registered using the procedures defined for ASN.1 object identifier values in Recommendation X.208 [19].

3) *Specific problems*

This parameter identifies further refinements to the probable cause of an alarm. The syntax of the specific problems is an ASN.1 type object identifier.

4) *Perceived severity*

This parameter defines six severity levels, which provide an indication of how it is perceived that the capability of the managed object has been affected. These are:

- Critical, indicates a service affecting condition which needs immediate corrective action.
- Major, indicates a service affecting condition which needs urgent corrective action.
- Minor, indicates a non-service affecting condition and that corrective action is advisable to prevent more serious faults.
- Warning, indicates a potential or impending service affecting fault before any significant effects have been felt. Further diagnostic actions should be taken to prevent more serious effects.
- Indeterminate, indicates that the severity level cannot be determined.
- Cleared, indicates the clearing of one or more previously reported alarms.

5) *Monitored attributes*

This parameter defines one or more attributes of the managed object and their corresponding values at the time of the alarm.

6) *Additional information*

Managed systems may provide additional information like alarm status, related log IDs and a list of suspected objects. In Recommendation Q.821 [16] according to the basic alarm categories, five alarm information packages are introduced which specify this additional information. In the context of V5 alarm reporting, it is used, for example, to report a suspect layer 3 address whenever an address error has been detected.

For the description of other optional parameters of the alarm report, see CCITT Rec. X.733 | ISO/IEC 10164-4 [25].

Object classes which are specified in this Recommendation to be used for V5 fault management shall contain the tmnCommunicationsAlarmInformationPackage. This package constitutes the communicationsAlarm notification with the parameters logRecordId, correlatedRecordName, suspectObjectList and the attributes alarmStatus and currentProblemList.

4.3.2 Performance management

4.3.2.1 Performance management functions

Performance management as defined in Recommendation Q.822 [17] comprises the following functions:

- *Performance management data collection functions*

  PM data collection refers to the ability for the NE to collect the various PM data relating to a single monitored entity in that NE. The following specific functions are associated with the collection activity:

  a) assign PM data collection interval;

  b) suspend/resume PM data collection;

  c) reset PM data;

  d) schedule PM data collection.

- *Performance management data storage functions*

  PM data storage refers to the optional capability for the NE to store historical PM data on each monitored entity for a prescribed time duration. The NE can also store summarized or statistical data derived from various monitored entities. When this capability is available, the following specific functions are associated with the storage activity:

  a) assign PM history duration;

  b) screen PM data storage;

  c) remove PM history data.

- *Performance management thresholding functions*

  PM thresholding refers to the ability for the NE to inform the TMN manager of any threshold crossing. It also provides the TMN manager with the means for establishing thresholding criteria. When this capability is available, the following specific functions are associated with the thresholding activity:

  a) assign PM threshold;

  b) report PM threshold violation.

- *Performance management data reporting functions*

  PM data reporting refers to the optional capability for the NE to report PM data on a scheduled basis, or as a result of a spontaneous request from the TMN manager. A report may contain data from a given monitored entity, or it can contain summarized data or data derived statistically from a set of monitored entities. The following specific functions are associated with the reporting activity:

  a) request PM data;

  b) report PM data;

  c) allow/inhibit PM data reports;

  d) screen PM data reports.

4.3.2.2 Performance management model

The object model for performance management is shown in Figure 2. Current PM data are collected for a monitored object by a currentData object class or its subclasses. Instances of the currentData object class or its subclasses are contained by the monitored object. At the end of each performance interval, the duration of which is determined by the granularityPeriod attribute, a summary report

(scanReport) may be issued and a historyData object may be created to record the performance measurements for that interval. Thresholds may be established by use of the thresholdData object. When a threshold is violated by a performance measurement, an alarm is emitted by the currentData object and logged as required. Performance measurements can be aggregated or statistically summarized by use of Scanner objects as defined in Recommendation X.738.

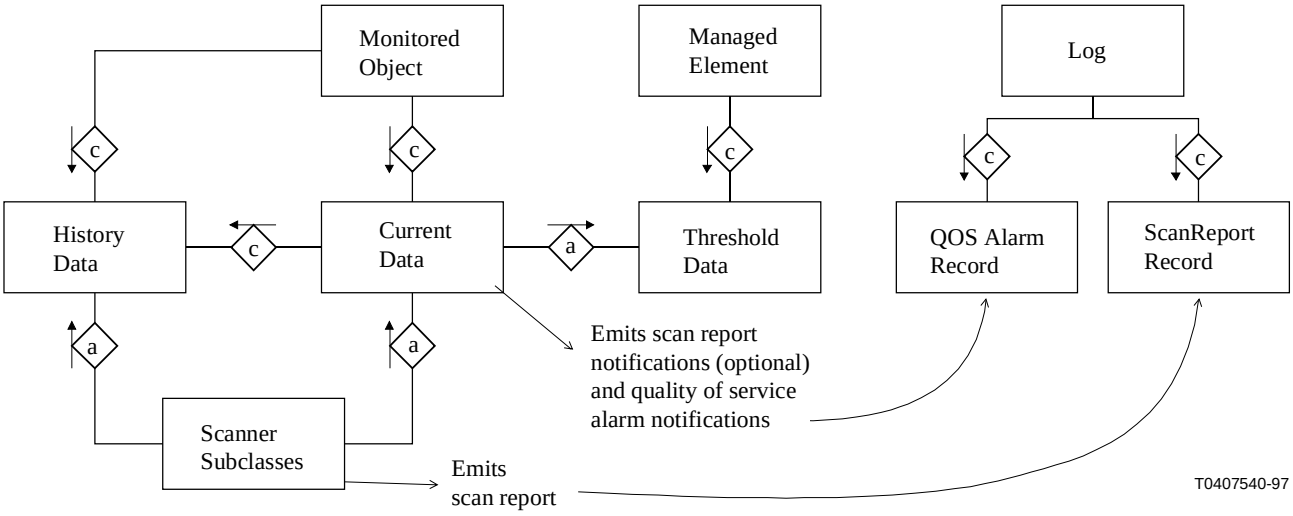


Figure 2/Q.831 – ITU-T Recommendation Q.822 Object model for performance management

The specific objects in the model are:

- *Monitored object*

  This object is the managed object for which the performance measurements are being collected. It represents the resource being measured (e.g. V5 communication channel).

- *currentData object*

  This object contains the measurements for the resource being monitored for a specified time interval (e.g. 15 min.). In most cases the instantiated managed object will be an instance of a subclass of currentData. This subclass will have performance measurement attributes appropriate to the resource represented by the class of the monitored object (e.g. V5 performance measurements). At the end of each interval, the currentData object may emit a scanReport notification which may result in a corresponding event report being sent to a managing system (it is not mandatory that the discriminator construct in the Log object be configured such that this notification is logged). Also, at the end of each interval a historyData object may be created containing the same attributes as the currentData object with values of the performance measurements at the end of the interval.

  The currentData object may contain a pointer to a thresholdData object. If any of the thresholds (defined in the referenced thresholdData object) are violated, a quality of service alarm notification is emitted by the currentData object. The resulting alarm record may be logged.

  The generic currentData object class should not be used for technology specific interfaces where standardized technology specific subclasses of currentData exist.

- *historyData object*

  This object will contain a copy of the performance management and other selected attributes that are present in the currentData object at the end of the current interval (e.g. 15 min.). A new instance of this object class is created at the end of each interval.

- *thresholdData object*

  This object contains a set of threshold values which correspond to a set of measurements defined for one or more classes of currentData. The thresholdData object is referenced from the currentData object by a pointer. If any of the thresholds specified in the thresholdData object are violated by the measurements in the referencing currentData object, the currentData object immediately issues a quality of service alarm notification.

- *Scanners*

  Any of the scanner objects which are defined in Recommendation X.738 may be used to scan the contents of either the currentData or historyData objects. These scanners may be used to aggregate sets of measurements from a number of currentData objects representing a number of different monitored objects and/or a number of historyData objects for one or more monitored entities. These scanner objects may simply aggregate the measurements into a scanReport notification for bulk transfer to a managing system, or they may be used to perform statistics on the measurements (e.g. mean, variance, etc.) for inclusion in a scanReport which can be sent to the managing system or stored in the log.

  Scanners used to aggregate measurements include: simpleScanner and dynamicSimpleScanner. Those used to perform statistics include: meanScanner, meanVarianceScanner and minMaxScanner.

  NOTE – The historyData object provides more flexible access to performance measurements than the scanReport, since the measurements are held in individual attributes, rather than a single complex attribute. The use of historyData also provides a closer association of the contained information with the monitored object that does the scanReport. In the generic log there is no mechanism to restrict log records in a similar way to historyData (which may be implicitly deleted after a number of intervals).

5 Fault and performance management model

The conventions given in Figure 3 are used in the entity relationship diagrams.

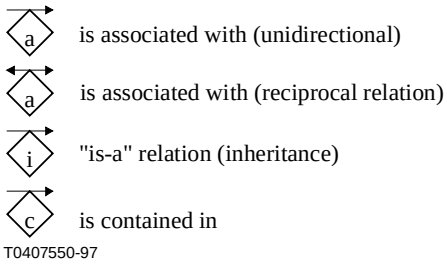


Figure 3/Q.831 – Conventions used in diagrams for entity relationship diagrams

5.1 Information model diagrams for the local exchange

The entity relationship diagram is given in 5.1.1 and the inheritance hierarchy (is-a relationships) and naming hierarchy (containment relationships) are given in 5.1.2 and 5.1.3, respectively.

5.1.1 Entity relationship diagram

Figure 4 shows the various entities related to traffic measurement in the local exchange. It extends the information model described in Recommendation Q.824.5 [18], which covers the configuration aspects.

5.1.1.1 Overview of traffic measurement model

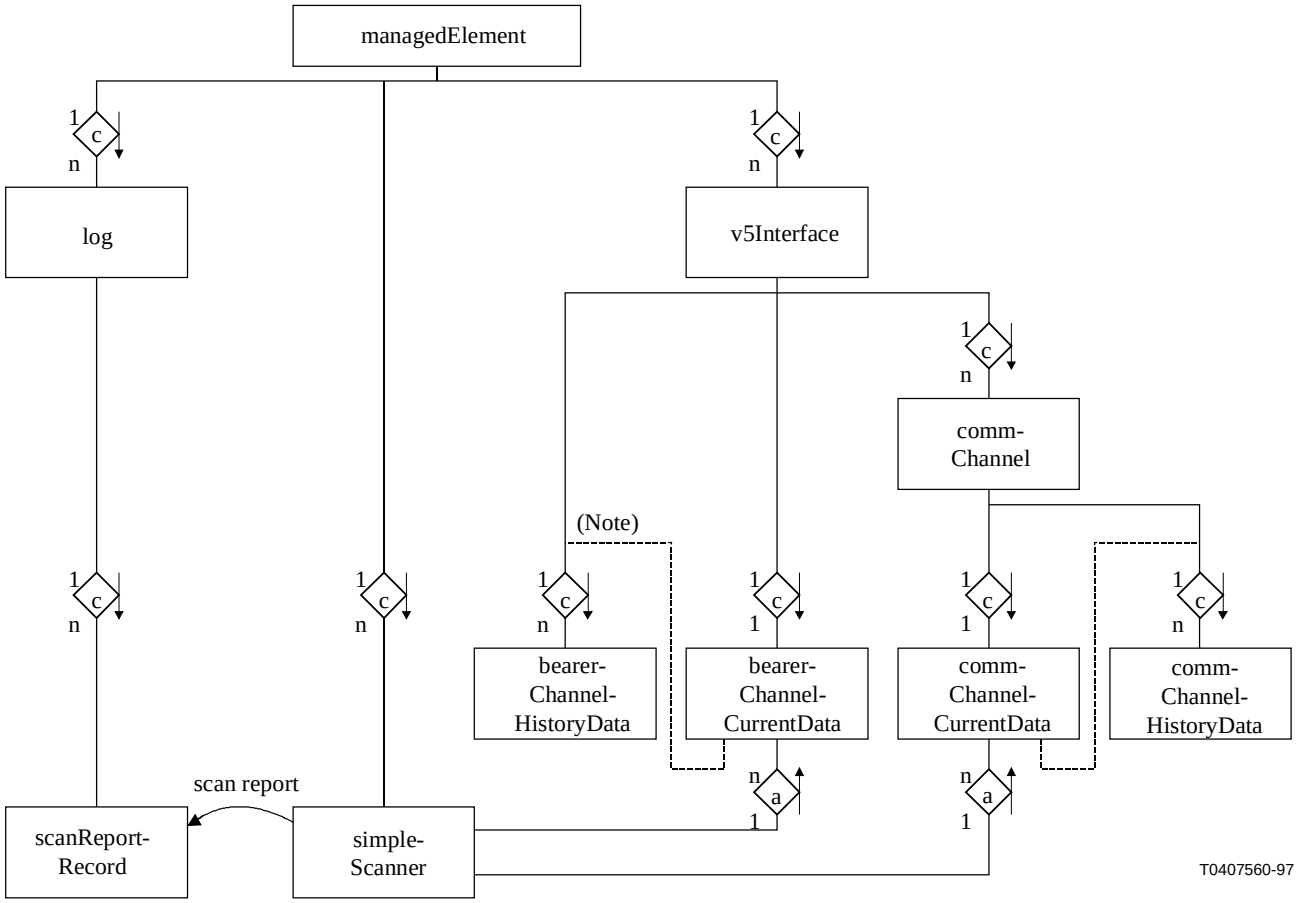
Traffic measurements in the Local Exchange (LE) are concerned with bearer channel allocation and communication channel traffic characteristics. Subclasses of Recommendation Q.822 [17] currentData object class are used to store traffic measurement data obtained from the object instance they are contained in. The current data are updated every 15 minutes.

The object class bearerChannelCurrentData has attributes for bearer channel oriented performance measurements of a V5.2 interface. The measurement results are obtained from the v5Interface object instance representing the V5.2 interface. The object class commChannelCurrentData is contained in an instance of commChannel. It has attributes for communication channel oriented measurements related to a V5 communication channel.

An instance of the X.738 simpleScanner object class collects the traffic measurement results stored in commChannelCurrentData and bearerChannelCurrentData object instances in a certain time interval. It generates a scanReport notification being sent to the managing system. In addition, results may be logged in a scanReportRecord object instance which is contained in a log object.

Instead of generating scan reports, instances of the object classes bearerChannelHistoryData and commChannelHistoryData may be used to store the traffic measurement results. New instances of these object classes are created at the end of each interval.

The same set of objects exists on the access network and the local exchange.

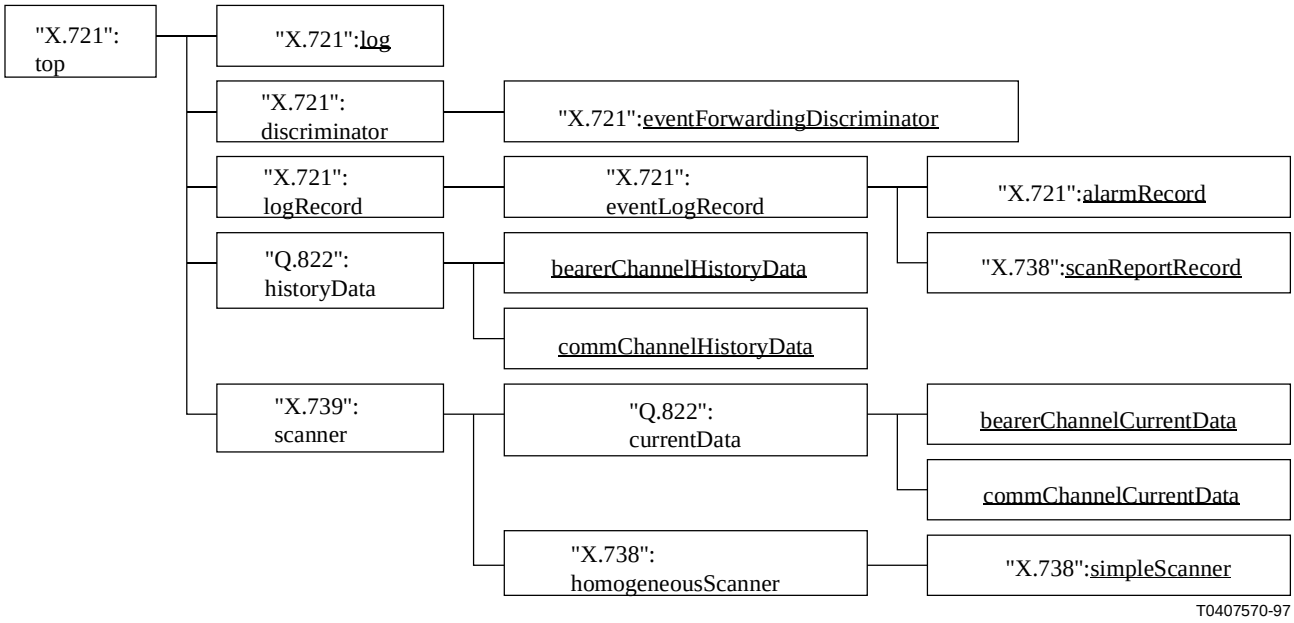


NOTE – History data objects may also be contained in the related current data objects.

Figure 4/Q.831 – Entity-relationship diagram: V5 traffic measurement

5.1.2 Inheritance hierarchy

Figure 5 traces the inheritance from the highest level object (CCITT Rec. X.721 | ISO/IEC 10165-2: "top") to the managed objects defined in this Recommendation.

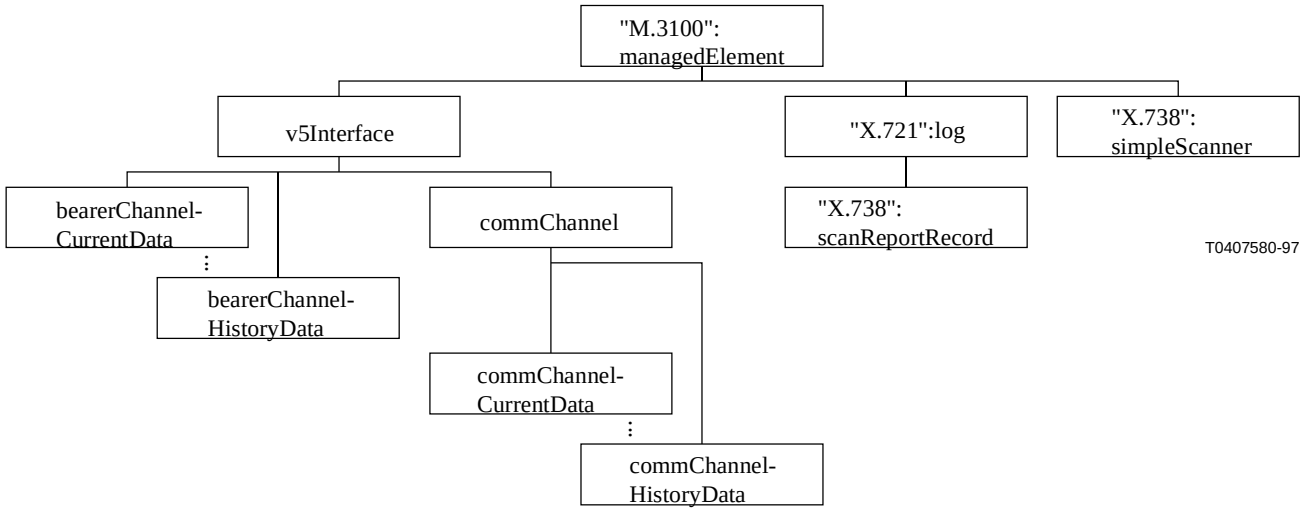


NOTE – Only classes which are underlined may be instantiated.

Figure 5/Q.831 – Inheritance hierarchy – Local exchange

5.1.3 Naming hierarchy

Figure 6 shows the naming (i.e. containment) relationships for the local exchange's managed objects associated with fault and performance management.



NOTE – History data objects may also be named from the related current data objects.

Figure 6/Q.831 – Naming hierarchy – Local exchange

5.2 Information model diagrams for the access network

The entity relationship diagram is given in 5.2.1 and the inheritance hierarchy (is-a relationships) and naming hierarchy (containment relationships) are given in 5.2.2 and 5.2.3, respectively.

5.2.1 Entity relationship diagram

Figure 4 shows the various entities related to traffic measurement in the access networks. It extends the information model described in Recommendation Q.824.5 [18], which covers the configuration aspects.

5.2.1.1 Traffic measurement

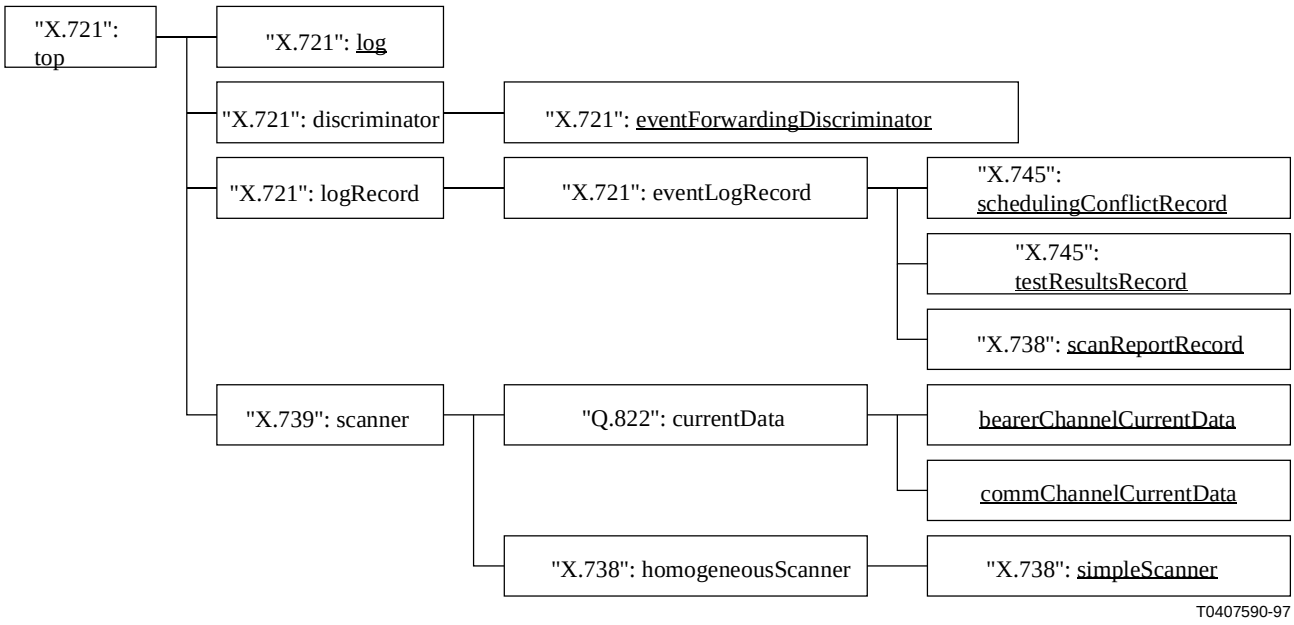
The same set of objects exists on the access network and the local exchange.

5.2.1.2 Performance monitoring of ISDN user ports

Performance monitoring of layer 1 for ISDN user ports can be carried out in accordance with Recommendation Q.822 [17] and ITU-T M.3600-Series Recommendations [11] and [12].

5.2.2 Inheritance hierarchy

Figure 7 traces the inheritance from the highest level object (CCITT Rec. X.721 | ISO/IEC 10165-2: "top") to the managed objects defined in this Recommendation.



NOTE – Only classes which are underlined may be instantiated.

Figure 7/Q.831 – Inheritance hierarchy – Access network

5.2.3 Naming hierarchy

Figure 8 shows the naming (i.e. containment) relationships for the access network's managed objects associated with fault and performance management.

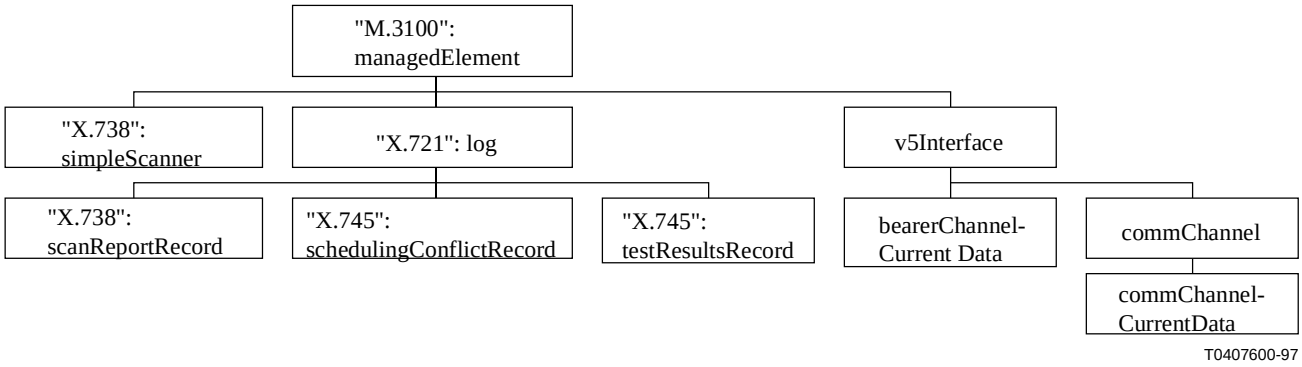


Figure 8/Q.831 – Naming hierarchy – Access network

6 Formal definitions

This clause gives the formal definitions of the managed object classes, name bindings, general packages, behaviours, attributes, actions and notifications.

6.1 Definition of object classes

In this subclause those object classes are specified whose instantiation is within the scope of this Recommendation. These object classes are either defined here or by reference to other ITU-T Recommendations.

6.1.1 Object classes common for local exchange and access network

6.1.1.1 V5 interface fragment

The following classes which are defined in Recommendation Q.824.5 [18] may be instantiated:

– "ITU-T Recommendation Q.824.5":v5Interface;

– "ITU-T Recommendation Q.824.5":v5Ttp;

– "ITU-T Recommendation Q.824.5":v5TimeSlot.

6.1.1.2 Communication path fragment

The following class which is defined in Recommendation Q.824.5 [18] may be instantiated:

– "ITU-T Recommendation Q.824.5":commChannel.

6.1.1.3 V5 protection fragment

The following classes which are defined in Recommendation Q.824.5 [18] may be instantiated:

– "ITU-T Recommendation Q.824.5":v5ProtectionGroup;

– "ITU-T Recommendation Q.824.5":v5ProtectionUnit.

6.1.1.4 Performance fragment

6.1.1.4.1 Bearer channel current data

bearerChannelCurrentData MANAGED OBJECT CLASS
DERIVED FROM "ITU-T Recommendation Q.822":currentData;
CHARACTERIZED BY
bearerChannelCurrentDataPackage PACKAGE
BEHAVIOUR
bearerChannelCurrentDataBehaviour BEHAVIOUR

DEFINED AS "The bearerChannelCurrentData object class is a class of managed objects that contain the current bearer channel oriented traffic measurement data which is related to a V5.2 interface.
Instances of this object class are contained in instances of the v5Interface object class.";;
ATTRIBUTES
numberOfCommChannels GET,
numberOfV5Links GET;;;
CONDITIONAL PACKAGES
eachWayBearerChannelCurrentMeasurementsPackage
PRESENT IF "this object class is instantiated in a Local Exchange",
bothWayBearerChannelCurrentMeasurementsPackage
PRESENT IF "this object class is instantiated in an Access Network",
unsuccessfulBearerChannelAllocationAttemptsPackage
PRESENT IF "this object class is instantiated in a Local Exchange";
REGISTERED AS {managedObjectClass 1};

6.1.1.4.2 Bearer channel history data

bearerChannelHistoryData MANAGED OBJECT CLASS
DERIVED FROM "ITU-T Recommendation Q.822":historyData;
CHARACTERIZED BY
bearerChannelHistoryDataPackage PACKAGE
BEHAVIOUR
bearerChannelHistoryDataBehaviour BEHAVIOUR
DEFINED AS "The bearerChannelHistoryData object class is a class of managed objects that contain a copy of the performance measurements present in a bearerChannelCurrentData object at the end of the current interval.
Instances of this object class may be contained in an instance of the v5Interface object class or in an instance of the related bearerChannelCurrentData object class.
The attributes numberOfCommChannels and numberOfV5Links shall be included in PM report (Q.822).";;
ATTRIBUTES
numberOfCommChannels GET,
numberOfV5Links GET;
NOTIFICATIONS
"Rec. X.721|ISO/IEC 10165-2":attributeValueChange;;;
CONDITIONAL PACKAGES
eachWayBearerChannelHistoryMeasurementsPackage
PRESENT IF "this object class is instantiated in a Local Exchange",
bothWayBearerChannelHistoryMeasurementsPackage
PRESENT IF "this object class is instantiated in an Access Network",
unsuccessfulBearerChannelAllocationAttemptsPackage
PRESENT IF "this object class is instantiated in a Local Exchange";
REGISTERED AS {managedObjectClass 2};

6.1.1.4.3 Communication channel current data

commChannelCurrentData MANAGED OBJECT CLASS
DERIVED FROM "ITU-T Recommendation Q.822":currentData;
CHARACTERIZED BY
commChannelCurrentDataPackage PACKAGE
BEHAVIOUR
commChannelCurrentDataBehaviour BEHAVIOUR
DEFINED AS "The commChannelCurrentData object class is a class of managed objects that contain the current data of V5 C-channel related traffic measurement.
Instances of this object class are contained in instances of the commChannel object class.";;
ATTRIBUTES
commChannelOutOfServiceAnyReason GET,
commChannelOutOfServiceFarEndBlock GET,
commChannelOutOfServiceNearEndBlock GET,
commChannelOutages GET,
octetsV5Frame GET,
activeStandby GET;;;
REGISTERED AS {managedObjectClass 3};

6.1.1.4.4 Communication channel history data

commChannelHistoryData MANAGED OBJECT CLASS
DERIVED FROM "ITU-T Recommendation Q.822":historyData;
CHARACTERIZED BY
commChannelHistoryDataPackage PACKAGE
BEHAVIOUR
commChannelHistoryDataBehaviour BEHAVIOUR
DEFINED AS "The commChannelHistoryData object class is a class of managed objects that contain a copy of the performance measurements present in a commChannelCurrentData object at the end of the current interval.
Instances of this object class may be contained in an instance of the commChannel object class or in an instance of the related commChannelCurrentData object class.
The attributes commChannelOutOfServiceAnyReason, commChannelOutOfServiceFarEndBlock, commChannelOutOfServiceNearEndBlock, commChannelOutages, octetsV5Frame and activeStandby shall be included in PM report (Q.822).";;
ATTRIBUTES

commChannelOutOfServiceAnyReason	**GET,**
commChannelOutOfServiceFarEndBlock	**GET,**
commChannelOutOfServiceNearEndBlock	**GET,**
commChannelOutages	**GET,**
octetsV5Frame	**GET,**
activeStandby	**GET;**

NOTIFICATIONS
"Rec. X.721|ISO/IEC 10165-2":attributeValueChange;;;
REGISTERED AS {managedObjectClass 4};

6.1.1.5 Alarm surveillance fragment

The following classes which are defined in Recommendation Q.821 [16] may be instantiated:

– "ITU-T Recommendation Q.821":currentAlarmSummaryControl;

– "ITU-T Recommendation Q.821":managementOperationsSchedule.

6.1.2 Local exchange

6.1.2.1 Access port fragment

The following classes which are defined in Recommendation Q.824.5 [18] may be instantiated:

– "ITU-T Recommendation Q.824.5":virtualAccessPortAnalogue;

– "ITU-T Recommendation Q.824.5":virtualAccessPortBasicRate;

– "ITU-T Recommendation Q.824.5":virtualAccessPortPrimaryRate;

– "ITU-T Recommendation Q.824.5":virtualAccessPortLeased.

6.1.2.2 Support fragment

The following classes which are defined in Recommendation M.3100 [13] may be instantiated:

– "ITU-T Recommendation M.3100":alarmSeverityAssignmentProfile;

– "ITU-T Recommendation M.3100":managedElement.

The following classes which are defined in CCITT Rec. X.721 | ISO/IEC 10165-2 [21] may be instantiated:

– "CCITT Recommendation X.721":alarmRecord;

– "CCITT Recommendation X.721":attributeValueChangeRecord;

– "CCITT Recommendation X.721":eventForwardingDiscriminator;

– "CCITT Recommendation X.721":log.

The following classes which are defined in Recommendation X.738 may be instantiated:

– "ITU-T Recommendation X.738":simpleScanner;

– "ITU-T Recommendation X.738":scanReportRecord.

6.1.3 Access network

6.1.3.1 Access port fragment

The following classes which are defined in Recommendation Q.824.5 [18] may be instantiated:

– "ITU-T Recommendation Q.824.5":pstnUserPort;

– "ITU-T Recommendation Q.824.5":isdnBAUserPort;

– "ITU-T Recommendation Q.824.5":isdnPRAUserPort;

– "ITU-T Recommendation Q.824.5":leasedPort;

– "ITU-T Recommendation Q.824.5":userPortBearerChannelCtp.

6.1.3.2 Support fragment

The following class which is defined in Recommendation M.3100 [13] may be instantiated:

– "ITU-T Recommendation M.3100":alarmSeverityAssignmentProfile.

The following classes which are defined in CCITT Rec. X.721 | ISO/IEC 10165-2 [21] may be instantiated:

– "CCITT Recommendation X.721":alarmRecord;

– "CCITT Recommendation X.721":attributeValueChangeRecord;

– "CCITT Recommendation X.721":eventForwardingDiscriminator;

– "CCITT Recommendation X.721":log.

The following classes which are defined in Recommendation X.745 may be instantiated.

– "ITU-T Recommendation X.745":schedulingConflictRecord;

– "ITU-T Recommendation X.745":testActionPerformer;

– "ITU-T Recommendation X.745":testResultsRecord.

6.2 Name bindings

6.2.1 Name bindings common for local exchange and access network

6.2.1.1 V5 interface fragment

The name bindings used for this fragment are specified in Recommendation Q.824.5 [18].

6.2.1.2 Communication path fragment

The name bindings used for this fragment are specified in Recommendation Q.824.5 [18].

6.2.1.3 V5 protection fragment

The name bindings used for this fragment are specified in Recommendation Q.824.5 [18].

6.2.1.4 Performance fragment

The name binding used for the object class scanReportRecord is specified in CCITT Rec. X.721 | ISO/IEC 10165-2 [21].

For historyData objects another name binding to related currentData objects is defined in Recommendation Q.822 [17]. In a given application, the naming of historyData objects shall be consistent for all instances of historyData subclasses (i.e. all shall be named from v5Interface and commChannel resp. or all shall be named from the currentData objects).

In addition, the following definitions apply.

6.2.1.4.1 bearerChannelCurrentData-v5Interface

bearerChannelCurrentData-v5Interface NAME BINDING
SUBORDINATE OBJECT CLASS bearerChannelCurrentData;
NAMED BY
SUPERIOR OBJECT CLASS "ITU-T Recommendation Q.824.5":v5Interface AND SUBCLASSES;
WITH ATTRIBUTE "ITU-T Recommendation X.739":scannerId;
CREATE WITH-REFERENCE-OBJECT, WITH-AUTOMATIC-INSTANCE-NAMING;
DELETE;
REGISTERED AS {nameBinding 1};

6.2.1.4.2 bearerChannelHistoryData-v5Interface

bearerChannelHistoryData-v5Interface NAME BINDING
SUBORDINATE OBJECT CLASS bearerChannelHistoryData;
NAMED BY
SUPERIOR OBJECT CLASS "ITU-T Recommendation Q.824.5":v5Interface AND SUBCLASSES;
WITH ATTRIBUTE "ITU-T Recommendation Q.822":historyDataId;
CREATE WITH-REFERENCE-OBJECT, WITH-AUTOMATIC-INSTANCE-NAMING;
DELETE;
REGISTERED AS {nameBinding 2};

6.2.1.4.3 commChannelCurrentData-commChannel

commChannelCurrentData-commChannel NAME BINDING
SUBORDINATE OBJECT CLASS commChannelCurrentData;
NAMED BY
SUPERIOR OBJECT CLASS "ITU-T Recommendation Q.824.5":commChannel AND SUBCLASSES;
WITH ATTRIBUTE "ITU-T Recommendation X.739":scannerId;
CREATE WITH-REFERENCE-OBJECT, WITH-AUTOMATIC-INSTANCE-NAMING;
DELETE;
REGISTERED AS {nameBinding 3};

6.2.1.4.4 commChannelHistoryData-commChannel

commChannelHistoryData-commChannel NAME BINDING
SUBORDINATE OBJECT CLASS commChannelHistoryData;
NAMED BY
SUPERIOR OBJECT CLASS "ITU-T Recommendation Q.824.5":commChannel AND SUBCLASSES;
WITH ATTRIBUTE "ITU-T Recommendation Q.822":historyDataId;
CREATE WITH-REFERENCE-OBJECT, WITH-AUTOMATIC-INSTANCE-NAMING;
DELETE;
REGISTERED AS {nameBinding 4};

6.2.1.4.5 simpleScanner-managedElement

simpleScanner-managedElement NAME BINDING
SUBORDINATE OBJECT CLASS "ITU-T Recommendation X.738":simpleScanner AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS "ITU-T Recommendation M.3100":managedElement AND SUBCLASSES;
WITH ATTRIBUTE "ITU-T Recommendation X.739":scannerId;
CREATE WITH-REFERENCE-OBJECT, WITH-AUTOMATIC-INSTANCE-NAMING;
DELETE ONLY-IF-NO-CONTAINED-OBJECTS;
REGISTERED AS {nameBinding 5};

6.2.1.5 Alarm surveillance fragment

The name bindings used for this fragment are specified in Recommendation Q.821 [16].

6.2.2 Local exchange

6.2.2.1 Access port fragment

The name bindings used for this fragment are specified in Recommendation Q.824.5 [18].

6.2.2.2 Support fragment

The following name bindings used for this fragment are defined in Recommendation M.3100 [13]:

a) alarmSeverityAssignmentProfile-managedElement;

b) eventForwardingDiscriminator-managedElement;

c) managedElement-network;

d) log-managedElement.

The following name binding used for this fragment is defined in CCITT Rec. X.721 | ISO/IEC 10165-2 [21]:

– alarmRecord-log.

6.2.3 Access network

6.2.3.1 Access port fragment

The name bindings used for this fragment are specified in Recommendation Q.824.5 [18].

6.2.3.2 Support fragment

The name bindings used for this fragment are specified in Recommendation M.3100 [13].

6.3 Definition of packages

6.3.1 Both-way bearer channel current measurements package

```
bothWayBearerChannelCurrentMeasurementsPackage PACKAGE
    ATTRIBUTES
        bearerChannelAllocations        INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET,
        bearerChannelHoldingTimes       INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET,
        bearerChannelInServiceTimes     INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET;
REGISTERED AS {package 1};
```

6.3.2 Both-way bearer channel history measurements package

```
bothWayBearerChannelHistoryMeasurementsPackage PACKAGE
    ATTRIBUTES
        bearerChannelAllocations        GET,
        bearerChannelHoldingTimes       GET,
        bearerChannelInServiceTimes     GET;
REGISTERED AS {package 2};
```

6.3.3 Each-way bearer channel current measurements package

```
eachWayBearerChannelCurrentMeasurementsPackage PACKAGE
    ATTRIBUTES
        bearerChannelAllocationsOriginating     INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET,
        bearerChannelAllocationsTerminating     INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET,
        bearerChannelHoldingTimesOriginating    INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET,
```

```
        bearerChannelHoldingTimesTerminating  INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET,
        bearerChannelInServiceTimes           INITIAL VALUE ASN1FPLETypeModule.initialCount
            GET;
REGISTERED AS {package 3};
```

6.3.4 Each-way bearer channel history measurements package

```
eachWayBearerChannelHistoryMeasurementsPackage PACKAGE
    ATTRIBUTES
        bearerChannelAllocationsOriginating     GET,
        bearerChannelAllocationsTerminating     GET,
        bearerChannelHoldingTimesOriginating    GET,
        bearerChannelHoldingTimesTerminating    GET,
        bearerChannelInServiceTimes             GET;
REGISTERED AS {package 4};
```

6.3.5 Unsuccessful bearer channel allocation attempts package

```
unsuccessfulBearerChannelAllocationAttemptsPackage PACKAGE
    ATTRIBUTES
        unsuccessfulBearerChannelAllocationAttemptsIncoming     GET,
        unsuccessfulBearerChannelAllocationAttemptsInternal     GET;
REGISTERED AS {package 5};
```

6.4 Definition of attributes

This subclause contains the ASN.1 definitions for all attributes in the described object classes. These definitions identify the function of the attributes and their valid characteristics, such as their valid values, interdependencies, read/write constraints, etc. The attributes are identified by their ASN.1 descriptors.

6.4.1 Active standby

```
activeStandby ATTRIBUTE
    WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ActiveStandby;
    MATCHES FOR EQUALITY;
    BEHAVIOUR
    activeStandbyBehaviour BEHAVIOUR
    DEFINED AS "This attribute indicates if the C-channel is an active or a standby channel or if the
    configuration has changed during the measurement period.";;
REGISTERED AS {attribute 1};
```

6.4.2 Bearer channel allocations

```
bearerChannelAllocations ATTRIBUTE
    WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.Count;
    MATCHES FOR EQUALITY;
    BEHAVIOUR
    bearerChannelAllocationsBehaviour BEHAVIOUR
    DEFINED AS "-- see B.1, item 1a --";;
REGISTERED AS {attribute 2};
```

6.4.3 Bearer channel allocations originating

```
bearerChannelAllocationsOriginating ATTRIBUTE
    WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.Count;
    MATCHES FOR EQUALITY;
    BEHAVIOUR
    bearerChannelAllocationsOriginatingBehaviour BEHAVIOUR
    DEFINED AS "-- see B.1, item 1c --";;
REGISTERED AS {attribute 3};
```

6.4.4 Bearer channel allocations terminating

bearerChannelAllocationsTerminating ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.Count;
MATCHES FOR EQUALITY;
BEHAVIOUR
bearerChannelAllocationsTerminatingBehaviour BEHAVIOUR
DEFINED AS *"-- see B.1, item 1b --"*;;
REGISTERED AS {attribute 4};

6.4.5 Bearer channel holding times

bearerChannelHoldingTimes ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ObservedValue;
MATCHES FOR EQUALITY;
BEHAVIOUR
bearerChannelHoldingTimesBehaviour BEHAVIOUR
DEFINED AS *"-- see B.1, item 2a --"*;;
REGISTERED AS {attribute 5};

6.4.6 Bearer channel holding times originating

bearerChannelHoldingTimesOriginating ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ObservedValue;
MATCHES FOR EQUALITY;
BEHAVIOUR
bearerChannelHoldingTimesOriginatingBehaviour BEHAVIOUR
DEFINED AS *"-- see B.1, item 2c --"*;;
REGISTERED AS {attribute 6};

6.4.7 Bearer channel holding times terminating

bearerChannelHoldingTimesTerminating ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ObservedValue;
MATCHES FOR EQUALITY;
BEHAVIOUR
bearerChannelHoldingTimesTerminatingBehaviour BEHAVIOUR
DEFINED AS *"-- see B.1, item 2b --"*;;
REGISTERED AS {attribute 7};

6.4.8 Bearer channel in-service times

bearerChannelInServiceTimes ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ObservedValue;
MATCHES FOR EQUALITY;
BEHAVIOUR
bearerChannelInServiceTimesBehaviour BEHAVIOUR
DEFINED AS *"-- see B.1, item 4 --"*;;
REGISTERED AS {attribute 8};

6.4.9 Communication channel outages

commChannelOutages ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.Count;
MATCHES FOR EQUALITY;
BEHAVIOUR
commChannelOutagesBehaviour BEHAVIOUR
DEFINED AS *"-- see B.2, item 4 --"*;;
REGISTERED AS {attribute 9};

6.4.10 Communication channel out-of-service any reason

commChannelOutOfServiceAnyReason ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ObservedValue;
MATCHES FOR EQUALITY;
BEHAVIOUR
channelOutOfServiceAnyReasonBehaviour BEHAVIOUR

DEFINED AS *"-- see B.2, item 1 --"*;;
REGISTERED AS {attribute 10};

6.4.11 Communication channel out-of-service far-end block

commChannelOutOfServiceFarEndBlock ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ObservedValue;
MATCHES FOR EQUALITY;
BEHAVIOUR
channelOutOfServiceFarEndBlockBehaviour BEHAVIOUR
DEFINED AS *"-- see B.2, item 3 --"*;;
REGISTERED AS {attribute 11};

6.4.12 Communication channel out-of-service near-end block

commChannelOutOfServiceNearEndBlock ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.ObservedValue;
MATCHES FOR EQUALITY;
BEHAVIOUR
channelOutOfServiceNearEndBlockBehaviour BEHAVIOUR
DEFINED AS *"-- see B.2, item 2 --"*;;
REGISTERED AS {attribute 12};

6.4.13 Number of channels

numberOfCommChannels ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.NumberOfChannels;
MATCHES FOR EQUALITY;
BEHAVIOUR
numberOfCommChannelsBehaviour BEHAVIOUR
DEFINED AS "This attribute gives the number of time slots which are assigned as C-channels in the given V5 link.";;
REGISTERED AS {attribute 13};

6.4.14 Number of V5 links

numberOfV5Links ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.NumberOfV5Links;
MATCHES FOR EQUALITY;
BEHAVIOUR
numberOfV5LinksBehaviour BEHAVIOUR
DEFINED AS "This attribute gives the number of V5 links which comprise the V5 interface.";;
REGISTERED AS {attribute 14};

6.4.15 Octets V5 frame

octetsV5Frame ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.Count;
MATCHES FOR EQUALITY;
BEHAVIOUR
octetsV5FrameBehaviour BEHAVIOUR
DEFINED AS *"-- see B.2, item 5 --"*;;
REGISTERED AS {attribute 15};

6.4.16 Unsuccessful bearer channel allocation attempts incoming

unsuccessfulBearerChannelAllocationAttemptsIncoming ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.Count;
MATCHES FOR EQUALITY;
BEHAVIOUR
unsuccessfulBearerChannelAllocationAttemptsIncomingBehaviour BEHAVIOUR
DEFINED AS *"-- see B.1, item 3a --"*;;
REGISTERED AS {attribute 16};

6.4.17 Unsuccessful bearer channel allocation attempts internal

```
unsuccessfulBearerChannelAllocationAttemptsInternal ATTRIBUTE
        WITH ATTRIBUTE SYNTAX ASN1FPLETypeModule.Count;
        MATCHES FOR EQUALITY;
        BEHAVIOUR
        unsuccessfulBearerChannelAllocationAttemptsInternalBehaviour BEHAVIOUR
        DEFINED AS "-- see B.1, item 3b --";;
REGISTERED AS {attribute 17};
```

6.5 Definitions of actions

No new actions are contained in this Recommendation.

6.6 Definition of notifications

No new notifications are contained in this Recommendation.

6.7 Definition of parameters

6.7.1 Envelope function address

```
envelopeFunctionAddress PARAMETER
CONTEXT EVENT-INFO;
WITH SYNTAX ASN1FPLETypeModule.EnvelopeFunctionAddress;
        BEHAVIOUR
        envelopeFunctionAddress BEHAVIOUR
        DEFINED AS "The envelopeFunctionAddress shall be carried in the additionalInformation field of the
        communicationsAlarm notification for those cases specified in Annex A.";;
REGISTERED AS {parameter 2};
```

6.7.2 Layer 3 port address

```
layer3PortAddress PARAMETER
CONTEXT EVENT-INFO;
WITH SYNTAX ASN1FPLETypeModule.Layer3PortAddress;
        BEHAVIOUR
        layer3PortAddress BEHAVIOUR
        DEFINED AS "The layer3PortAddress shall be carried in the additionalInformation field of the
        communicationsAlarm notification for those cases specified in Annex A.";;
REGISTERED AS {parameter 3};
```

6.8 ASN.1 defined types module

```
ASN1FPLETypeModule {itu-t(0) recommendation(0) q(17) fpv5(831) informationModel(0) asn1Module(2)
fpV5LEModule(0)}
DEFINITIONS IMPLICIT TAGS ::=
BEGIN  -- EXPORTS everything
IMPORTS
        -- Recommendation Q.824.5 [18]
        EnvelopeFunctionAddress,
        Layer3PortAddress,
        FROM ASN1CMLETypeModule
                itu-t(0) recommendation(0) q(17) ca(824) dot(127) v5interface(5) informationModel(0)
        asn1Module(2) asn1TypeModule(0)}
        -- Recommendation X.721 [21]
        Count,
        ObservedValue,
        ProbableCause,
        SpecificProblems
        FROM Attribute-ASN1Module {joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 1};
```

```
informationModel                OBJECT IDENTIFIER ::=  { itu-t(0) recommendation(0) q(17) fpv5(831)
                                                       informationModel(0)}
standardSpecificExtension       OBJECT IDENTIFIER ::=  {informationModel standardSpecificExtension(0)}
managedObjectClass              OBJECT IDENTIFIER ::=  {informationModel managedObjectClass(3)}
package                         OBJECT IDENTIFIER ::=  {informationModel package(4)}
nameBinding                     OBJECT IDENTIFIER ::=  {informationModel nameBinding(6)}
attribute                       OBJECT IDENTIFIER ::=  {informationModel attribute(7)}
notification                    OBJECT IDENTIFIER ::=  {informationModel notification(10)}
parameter                       OBJECT IDENTIFIER ::=  {informationModel parameter(11)}

v5SpecificProblems              OBJECT IDENTIFIER ::=  {standardSpecificExtension 0}
v5ProbableCause                 OBJECT IDENTIFIER ::=  {standardSpecificExtension 1}
v5CauseValue                    OBJECT IDENTIFIER ::=  {standardSpecificExtension 2}
```

-- The value assignments for the SpecificProblems parameter of the V5 specific communications
-- alarm notification are specified below

```
bccProtocolDataLinkError                SpecificProblems ::= {{v5SpecificProblems  1}}
bccProtocolSyntaxError                  SpecificProblems ::= {{v5SpecificProblems  2}}
bccProtocolTimeOutError                 SpecificProblems ::= {{v5SpecificProblems  3}}
cessationOfFlagsError                   SpecificProblems ::= {{v5SpecificProblems  4}}
commonControlProtocolDataLinkError      SpecificProblems ::= {{v5SpecificProblems  5}}
commonControlProtocolSyntaxError        SpecificProblems ::= {{v5SpecificProblems  6}}
commonControlProtocolTimeOutError SpecificProblems ::= {{v5SpecificProblems  7}}
crcError                                SpecificProblems ::= {{v5SpecificProblems  8}}
internalFailure                         SpecificProblems ::= {{v5SpecificProblems  9}}
isdnLayer1ActivationFault               SpecificProblems ::= {{v5SpecificProblems 10}}
isdnLayer2Fault                         SpecificProblems ::= {{v5SpecificProblems 11}}
isdnLayer3Fault                         SpecificProblems ::= {{v5SpecificProblems 12}}
linkControlProtocolDataLinkError        SpecificProblems ::= {{v5SpecificProblems 13}}
linkControlProtocolLayer3AddressError   SpecificProblems ::= {{v5SpecificProblems 14}}
linkControlProtocolOutOfService         SpecificProblems ::= {{v5SpecificProblems 15}}
linkControlProtocolSyntaxError          SpecificProblems ::= {{v5SpecificProblems 16}}
linkControlProtocolTimeOutError         SpecificProblems ::= {{v5SpecificProblems 17}}
linkIdFailure                           SpecificProblems ::= {{v5SpecificProblems 18}}
portControlProtocolError                SpecificProblems ::= {{v5SpecificProblems 19}}
portControlProtocolLayer3AddressError   SpecificProblems ::= {{v5SpecificProblems 20}}
portControlProtocolSyntaxError          SpecificProblems ::= {{v5SpecificProblems 21}}
portControlProtocolTimeOutError         SpecificProblems ::= {{v5SpecificProblems 22}}
protectionProtocolDataLinkError         SpecificProblems ::= {{v5SpecificProblems 23}}
protectionProtocolSyntaxError           SpecificProblems ::= {{v5SpecificProblems 24}}
protectionProtocolTimeOutError          SpecificProblems ::= {{v5SpecificProblems 25}}
pstnProtocolDataLinkError               SpecificProblems ::= {{v5SpecificProblems 26}}
pstnProtocolLayer3AddressError          SpecificProblems ::= {{v5SpecificProblems 27}}
pstnProtocolSyntaxError                 SpecificProblems ::= {{v5SpecificProblems 28}}
pstnProtocolTimeOutError                SpecificProblems ::= {{v5SpecificProblems 29}}
v5InterfaceIdFailure                    SpecificProblems ::= {{v5SpecificProblems 30}}
v5InterfaceProvisioningMismatchFailure  SpecificProblems ::= {{v5SpecificProblems 31}}
losLofAtDSLopAtNT1                      SpecificProblems ::= {{v5SpecificProblems 32}}
losLofAtT                               SpecificProblems ::= {{v5SpecificProblems 33}}
loopBackUnintentional                   SpecificProblems ::= {{v5SpecificProblems 34}}
powerFeedingFailure                     SpecificProblems ::= {{v5SpecificProblems 35}}
```

-- Additional value assignments for the ProbableCause parameter of the V5 specific communications
-- alarm notification are specified below

```
lossOfFrameLossOfSignal         ProbableCause ::= globalValue {v5ProbableCause 1}
unintentionalLoopBack           ProbableCause ::= globalValue {v5ProbableCause 2}
```

-- The value assignments for the causeValue are specified below

```
protocolDiscriminatorError      CauseValue ::= {v5CauseValue  0}
messageTypeUnrecognized         CauseValue ::= {v5CauseValue  1}
outOfSequenceElement            CauseValue ::= {v5CauseValue  2}
```

```
repeatedOptionalElement                 CauseValue ::= {v5CauseValue  3}
mandatoryElementMissing                 CauseValue ::= {v5CauseValue  4}
unrecognizedElement                     CauseValue ::= {v5CauseValue  5}
mandatoryElementContentError            CauseValue ::= {v5CauseValue  6}
optionalElementContentError             CauseValue ::= {v5CauseValue  7}
messageNotCompatible                    CauseValue ::= {v5CauseValue  8}
repeatedMandatoryElement                CauseValue ::= {v5CauseValue  9}
tooManyElements                         CauseValue ::= {v5CauseValue 10}

-- The initial value definitions are specified below
initialCount                    Count ::= 0
ActiveStandby  ::= ENUMERATED {
        active          (0),
        standby         (1),
        changed         (2)}
CauseValue  ::= OBJECT IDENTIFIER
NumberOfChannels  ::= INTEGER
NumberOfV5Links  ::= INTEGER
END -- of ASN1FPLETypeModule
```

7 Protocol requirements

Protocol suites are specified in Recommendations Q.811 [14], Q.812 [15], G.773 [1] and the SDH DCC part of Recommendation G.784 [2].

In addition, it will be possible to use 64 kbit/s bearer channels and p-type and f-type data channels on a V5 interface. These will act like as user ports (see Recommendation G.964 [8]) and the initial port addresses cannot be configurable over the Q3 interface of the AN. Layer 1 and the envelope part of layer 2 of the V5 interface will be used for the lower layers of the protocol stack, but the higher layers will be the same as the stacks already specified in this clause. The initial configuration of a V5 interface to enable the use of 64 kbit/s bearer channels and p-type and f-type data channels may be through predefinition of a default configuration or using a local craft interface.

ANNEX A

Specification of parameters for V5 interface specific alarm reports

Alarm reports shall be generated using the communicationsAlarm notification, as defined in CCITT Rec. X.721 | ISO/IEC 10165-2 [21], whenever one of the following events occur. The reports shall use the alarm report parameters as specified below.

The parameters are defined in Recommendation Q.821 [16] and CCITT Rec. X.721 | ISO/IEC 10165-2 [21], respectively.

The values for the parameter perceived severity as given below are defaults. They may be modified by means of the alarm event criteria function as specified in Recommendation Q.821 [16].

NOTE – All parameters and parameter values given in the following list are mandatory in the context of V5 alarm reporting if not marked as optional.

A.1 Alarm reports related to the V5 interface object class

A.1.1 Control protocol errors

Event:	Control protocol timer expiration error.
Reference:	V5.1 and V5.2: 14.4.4.6/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsSubsystemFailure (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	commonControlProtocolTimeOutError.
Perceived Severity:	major.

Event:	Control protocol syntax errors.
Reference:	V5.1 and V5.2: 14.4.4.2/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	commonControlProtocolSyntaxError.
Perceived Severity:	major.

NOTE 1 – Reporting of this event is optional.

Event:	Port control protocol layer 3 address error.
Reference:	V5.1 and V5.2: 14.4.4.2.2/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	portControlProtocolLayer3AddressError.
Perceived Severity:	warning.
Additional Information:	layer3PortAddress or envelopeFunctionAddress.

NOTE 2 – This event report shall be used to indicate that an unknown layer 3 address has been received.

A.1.2 Link control protocol errors

Event:	Link control protocol layer 3 address error.
Reference:	V5.2: 16.3.5.2/G.965 [9].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	linkControlProtocolLayer3AddressError.
Perceived Severity:	major.
Additional Information:	layer3PortAddress.

NOTE – This event report shall be used to indicate that an unknown layer 3 address has been received.

A.1.3 BCC protocol errors

Event:	BCC protocol timer expiration error.
Reference:	V5.2: subclauses 17.5.2 to 17.5.4/G.965, 17.5.6 and 17.5.7/G.965 [9].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsSubsystemFailure (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	bccProtocolTimeOutError.
Perceived Severity:	major.
Additional Information:	causeValue.

NOTE 1 – If a protocol error message has been received in the local exchange the cause value contained in this message shall be included in the additional information parameter.

Event:	BCC protocol syntax errors.
Reference:	V5.2: 17.5.8/G.965 [9]
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	bccProtocolSyntaxErrors.
Perceived Severity:	major.

NOTE 2 – Reporting of this event is optional.

A.1.4 Protection protocol errors

Event:	Protection protocol timer expiration error.
Reference:	V5.2: subclauses 18.6.2.3.2, 18.6.3.3 and 18.6.5.4/G.965 [9].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	protectionProtocolTimeOutError.
Perceived Severity:	major.

NOTE 1 – If a protocol error message has been received in the local exchange, the cause value contained in this message shall be included in the additional information parameter.

Event:	Protection protocol syntax error.
Reference:	V5.2: subclause 18.6.6/G.965 [9].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	protectionProtocolSyntaxError.
Perceived Severity:	major.

NOTE 2 – Reporting of this event is optional.

A.1.5 PSTN protocol errors

Event:	Restart timer error.
Reference:	For V5.1: subclause 13.5.4.3 and C.14/G.964 [8]. For V5.2: C.14/G.965 [9].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	pstnProtocolTimeOutError.
Perceived Severity:	major.

Event:	PSTN protocol layer 3 address errors.
Reference:	V5.1 and V5.2: 13.5.2.3/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	pstnProtocolLayer3AddressError.
Perceived Severity:	warning.
Additional Information:	layer3PortAddress.

NOTE – This event report shall be used to indicate that an unknown layer 3 address has been received.

A.1.6 Interface control failures

Event:	Interface identification failure.
Reference:	V5.1 and V5.2: subclause 14.5.4 and C.13/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	configurationOrCustomizationError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	v5InterfaceIdFailure.
Perceived Severity:	critical.

Event:	V5 interface provisioning mismatch failure.
Reference:	V5.1 and V5.2: subclause 14.5.4 and C.13/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	configurationOrCustomizationError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	v5InterfaceProvisioningMismatchFailure.
Perceived Severity:	major.

A.1.7 V5 data link failures

Event:	Persistent link control protocol data link failures.
Reference:	V5.1 and V5.2: subclauses 10.4.1, 10.4.5.1.3 and C.17/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsSubsystemFailure (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	linkControlProtocolDataLinkError.
Perceived Severity:	critical.

Event:	Persistent BCC protocol data link failures.
Reference:	V5.1 and V5.2: subclauses 10.4.1, 10.4.5.1.3 and C.17/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsSubsystemFailure (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	bccProtocolDataLinkError.
Perceived Severity:	critical.

Event:	Persistent protection protocol data link failures.
Reference:	V5.1 and V5.2: subclauses 10.4.1, 10.4.5.1.3 and C.17/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsSubsystemFailure (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	protectionProtocolDataLinkErrorr.
Perceived Severity:	critical.

Event:	Persistent common control protocol data link failures.
Reference:	V5.1 and V5.2: subclauses 10.4.1, 10.4.5.1.3 and C.17/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsSubsystemFailure (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	commonControlProtocolDataLinkError.
Perceived Severity:	critical.

Event:	Persistent PSTN protocol data link failures.
Reference:	V5.1 and V5.2: subclauses 10.4.1, 10.4.5.1.3 and C.17/G.964 [8].
Managed Object Class:	v5Interface and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	pstnProtocolDataLinkError.
Perceived Severity:	major.

A.2 Alarm reports related to the V5 trail termination point object class

A.2.1 Link control failures

Event:	Link identification failure.
Reference:	V5.2: 16.2.4.3.5/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	configurationOrCustomizationError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	linkIdFailure.
Perceived Severity:	critical.

Event:	Link control protocol timer expiration error.
Reference:	V5.2: 16.3.4.4/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsSubsystemFailure (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	linkControlProtocolTimeOutError.
Perceived Severity:	major.

Event:	Link control protocol syntax errors.
Reference:	V5.2: 16.3.5/G.965 [9], (excluding 16.3.5.2).
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	linkControlProtocolSyntaxError.
Perceived Severity:	major.

NOTE – Reporting of this event is optional.

Event:	Link control protocol error while "Out Of Service".
Reference:	V5.2: 16.3.4.2/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	linkControlProtocolOutOfService.
Perceived Severity:	major.

A.2.2 Link Layer 1 Failures

Event:	Reception of Alarm Indication Signal (AIS).
Reference:	For V5.1: 14.3/G.964 [8]. For V5.2: 16.1/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Causes:	aIS (Recommendation M.3100 [13]).
Perceived Severity:	minor.

Event:	Loss of frame alignment.
Reference:	For V5.1: 14.3/G.964 [8]. For V5.2: 16.1/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Causes:	lossOfFrame (Recommendation M.3100 [13] and CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Perceived Severity:	minor.

Event:	Reception of Remote Alarm Indication (RAI).
Reference:	For V5.1: 14.3/G.964 [8]. For V5.2: 16.1/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Causes:	remoteAlarm Indication (Recommendation M.3100 [13]).
Perceived Severity:	minor.

Event:	Persistent CRC error.
Reference:	For V5.1: 14.3/G.964 [8]. For V5.2: 16.1.4/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Causes:	transmissionError (Recommendation M.3100 [13]).
Specific Problem:	crcError.
Perceived Severity:	minor.

NOTE – The exact specification of the meaning of "persistent" is outside the scope of this Recommendation.

Event:	Internal failure.
Reference:	For V5.1: 14.3/G.964 [8]. For V5.2: 16.1.4/G.965 [9].
Managed Object Class:	v5Ttp and subclasses.
Event Type:	communicationsAlarm.
Probable Causes:	localNodeTransmissionError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problem:	internalFailure.
Perceived Severity:	minor.

A.3 Alarm reports related to the V5 time slot object class

A.3.1 V5 communication channel failures

Event:	Cessation of flags on a C-channel.
Reference:	V5.2: 18.1.5.2/G.965 [9].
Managed Object Class:	v5TimeSlot and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	localNodeTransmissionError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	cessationOfFlagsError.
Perceived Severity:	critical.

A.4 Alarm reports related to the virtual access port object class and subclasses

A.4.1 Control protocol errors

Event:	Port control protocol timer expiration errors.
Reference:	V5.1 and V5.2: 14.4.4.5/G.964 [8].
Managed Object Class:	LE: virtualAccessPort and subclasses. AN: userPortTtp and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	portControlProtocolTimeOutError.
Perceived Severity:	minor.

Event:	Port control protocol errors while "Out of Service".
Reference:	V5.1 and V5.2: 14.4.4.3/G.964 [8].
Managed Object Class:	LE: virtualAccessPort and subclasses. AN: userPortTtp and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	portControlProtocolError.
Perceived Severity:	warning.

Event:	Port control protocol syntax errors.
Reference:	V5.1 and V5.2: 14.4.4.2/G.964 [8], (excluding 14.4.4.2.2).
Managed Object Class:	LE: virtualAccessPort and subclasses. AN: userPortTtp and subclasses.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	portControlProtocolSyntaxError.
Perceived Severity:	warning.

NOTE – Reporting of this event is optional.

A.4.2 PSTN protocol errors

Event:	PSTN protocol syntax errors.
Reference:	V5.1 and V5.2: 13.5.2/G.964 [8], (excluding 13.5.2.3).
Managed Object Class:	LE: virtualAccessPortAnalogue. AN: pstnUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	pstnProtocolSyntaxError.
Perceived Severity:	warning.

NOTE – Reporting of this event is optional.

Event:	PSTN protocol timer expiration errors.
Reference:	V5.1 and V5.2: 13.5.5.2.11 and 13.5.7/G.964 [8].
Managed Object Class:	LE: virtualAccessPortAnalogue. AN: pstnUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	pstnProtocolTimeOutError.
Perceived Severity:	minor.

A.4.3 ISDN layer faults

A.4.3.1 Local exchange at Q(LE) only

Event:	ISDN layer 1 fault.
Reference:	–
Managed Object Class:	virtualAccessPortBasicRate, virtualAccessPortPrimaryRate.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	isdnLayer1ActivationFault.
Perceived Severity:	warning.

NOTE 1 – This event indicates a layer 1 activation fault. It is relevant for ISDN access with permanent layer 1 only.

Event:	ISDN layer 2 fault.
Reference:	–
Managed Object Class:	virtualAccessPortBasicRate, virtualAccessPortPrimaryRate.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	isdnLayer2Fault.
Perceived Severity:	warning.

NOTE 2 – This event is relevant for ISDN access with permanent layer 2 only.

Event:	ISDN layer 3 fault.
Reference:	–
Managed Object Class:	virtualAccessPortBasicRate, virtualAccessPortPrimaryRate.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	isdnLayer3Fault.
Perceived Severity:	warning.

A.4.3.2 Access network Q(AN) only

A.4.3.2.1 ISDN BA layer 1 faults at Q(AN) only

Event:	LOS/LFA in DS or loss of power at NT1.
Reference:	–
Managed Object Class:	isdnBAUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	losLofAtDSLopAtNT1.
Perceived Severity:	warning.

Event:	LOS/LFA at T reference point.
Reference:	–
Managed Object Class:	isdnBAUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	losLofAtT.
Perceived Severity:	minor.

Event:	ISDN layer 1 activation fault.
Reference:	–
Managed Object Class:	isdnBAUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	isdnLayer1ActivationFault.
Perceived Severity:	warning.

NOTE – These events indicate layer 1 faults. They are relevant only when the AN is responsible for the activation.

A.4.3.2.2 ISDN PRA layer 1 faults at Q(AN) only

Event:	Unintentional loopback.
Reference:	V5.2: Table 3/G.965 [9].
Managed Object Class:	isdnpraUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	loopBackUnintentional (this parameter may be used for specific detailed indications related to the unintentional loopback).
Perceived Severity:	warning.

Event:	LOS/LFA and power failure.
Reference:	–
Managed Object Class:	isdnpraUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	losLofAtDSLopAtNT1 (this parameter may be used for specific detailed indications related to the LOS/LFA and power failure).
Perceived Severity:	warning.

Event:	Performance monitoring.
Reference:	–
Managed Object Class:	isdnpraUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	this parameter may be used for specific detailed indications related to the performance monitoring.
Perceived Severity:	minor.

NOTE – These events indicate layer 1 faults. They are relevant only when the AN is responsible for the activation.

A.4.4 ISDN layer 2 faults at Q(AN) only

Event:	ISDN layer 2 fault.
Reference:	–
Managed Object Class:	isdnBAUserPort, isdnPRAUserPort.
Event Type:	communicationsAlarm.
Probable Cause:	communicationsProtocolError (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	isdnLayer2Fault.
Perceived Severity:	warning.

NOTE – This event indicates a layer 2 fault of an ISDN access with PL service and permanent layer 2. It is relevant only when the AN is responsible for the activation.

A.4.5 Line faults at Q(AN) only

Event:	Power feeding problem.
Reference:	–
Managed Object Class:	userPortTtp.
Event Type:	communicationsAlarm.
Probable Cause:	powerProblem (CCITT Rec. X.721 | ISO/IEC 10165-2 [21]).
Specific Problems:	powerFeedingFailure (this parameter may be used for specific detailed indications related to the power feeding problem).
Perceived Severity:	warning.

ANNEX B

V5 specific traffic measurement

B.1 Bearer channel oriented measurements at the V5 interface

The following bearer channel oriented traffic measurements may be performed whenever a V5.2 interface is used to connect subscriber accesses to the LE. The measurements shall be performed per V5 interface on the basis of 15-minute intervals.

1a) Total number of bearer channel allocations both way:

This measurement gives the number of bearer channel allocations to user ports in the AN per V5 interface for calls terminating or originating at subscriber terminals which are connected to these ports.

In the AN bearer channel allocations are identified by a MDU-BCC (Allocation indication) sent from the BCC protocol entity to the resource manager and answered by a MDU-BCC (Allocation response complete) primitive.

Units: number of events.

NOTE 1 – Measurement 1a) is to performed in the AN only.

1b) Measurement of the total number of bearer channel allocations for terminating traffic:

This measurement gives the number of bearer channel allocations to user ports in the AN per V5 interface for calls terminating at subscriber terminals which are connected to these ports.

In the LE bearer channel allocations are identified by a MDU-BCC (Allocation request) sent from the resource manager to the BCC protocol entity and answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE 2 – Measurement 1b) is to performed in the LE only.

1c) Total number of bearer channel allocations for originating traffic:

This measurement gives the number of bearer channel allocations to user ports in the AN per V5 interface for calls originating at subscriber terminals which are connected to these ports.

In the LE bearer channel allocations are identified by a MDU-BCC (Allocation request) sent from the resource manager to the BCC protocol entity and answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE 3 – Measurement 1c) is to performed in the LE only.

2a) Total sum of bearer channel holding times both way:

This measurement gives the total sum of bearer channel allocation duration for calls terminating or originating at subscriber terminals which are connected to user ports in the AN and can be reached via this V5 interface.

In the AN, the bearer channel allocation duration may start with the MDU-BCC (Allocation response complete) primitive and stop with the MDU-BCC (Deallocation response complete) primitive sent from the resource manager to the BCC protocol entity.

Units: seconds.

NOTE 4 – Measurement 2a) is to performed in the AN only.

2b) Total sum of bearer channel holding times for terminating traffic:

This measurement gives the total sum of bearer channel allocation duration for calls terminating at subscriber terminals which are connected to user ports in the AN and can be reached via this V5 interface.

In the LE, the bearer channel allocation duration starts with the MDU-BCC (Allocation confirmation) primitive and stops with the MDU-BCC (Deallocation confirmation) primitive received in the resource manager.

Units: seconds.

NOTE 5 – Measurement 2b) is to performed in the LE only.

2c) Total sum of bearer channel holding times for originating traffic:

This measurement gives the total sum of bearer channel allocation duration for calls originating at subscriber terminals which are connected to user ports in the AN and can be reached via this V5 interface.

In the LE, the bearer channel allocation duration starts with the MDU-BCC (Allocation confirmation) primitive and stops with the MDU-BCC (Deallocation confirmation) primitive received in the resource manager.

Units: seconds.

NOTE 6 – Measurement 2c) is to performed in the LE only.

3a) Number of unsuccessful bearer channel allocation attempts for incoming traffic:

This measurement gives the number of bearer channel allocation requests for calls from the transit network to the BCC protocol entity, which do not receive a bearer channel.

These unsuccessful attempts are identified by a MDU-BCC (Allocation request) primitive sent from the resource manager to the BCC protocol entity which is not answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE 7 – Measurement 3a) is to performed in the LE only.

3b) Number of unsuccessful bearer channel allocation attempts for LE internal traffic:

This measurement gives the number of bearer channel allocation requests for LE internal calls to the BCC protocol entity, which do not receive a bearer channel.

These unsuccessful attempts are identified by a MDU-BCC (Allocation request) primitive sent from the resource manager to the BCC protocol entity which is not answered by a MDU-BCC (Allocation confirmation) primitive.

Units: number of events.

NOTE 8 – Measurement 3b) is to performed in the LE only.

4) Total sum of bearer channel in-service times:

This measurement gives the total sum of in-service times of all V5 time slots which can be used for bearer channels during the measurement interval.

Units: seconds.

B.2 Communication channel oriented measurements at the V5 interface

The following C-channel oriented traffic measurements may be performed whenever a V5.1 or V5.2 interface is used to connect subscriber accesses to the LE. The measurements shall be performed per V5 C-channel on the basis of 15-minute intervals.

1) Duration of C-channel out-of-service due to any reason:

This measurement gives the total sum of duration a C-channel has been out-of-service due to any reason.

Units: seconds/C-channel.

2) Duration of C-channel out-of-service due to near-end blocking:

This measurement gives the total sum of duration a C-channel has been out-of-service due to blockings initiated locally.

Units: seconds/C-channel.

3) Duration of C-channel out-of-service by far-end blocking:

This measurement gives the total sum of duration a C-channel has been out-of-service due to blockings initiated by the remote side.

Units: seconds/C-channel.

4) Number of C-channel outages:

This measurement gives the total number of times a C-channel has been out-of-service due to any reason.

Units: number of events.

5) Number of LAPV5-Envelope Function frame octets on a C-channel:

This measurement gives the total number of frame octets which have been transmitted or received within a LAPV5 frame in this C-channel including the overhead octets (see also 11.3/G.964 [8]). It includes the start flag of the LAPV5 frame and all octets between this and the stop flag. The stop flag and any idle flags are excluded from this measurement.

Units: number of events.

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