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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Digital transmission systems – Terminal equipments –
Operations, administration and maintenance features of
transmission equipment

**Synchronous Digital Hierarchy (SDH)
management of radio-relay systems for the
network element view**

ITU-T Recommendation G.774.8

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION G.774.8

SYNCHRONOUS DIGITAL HIERARCHY (SDH) MANAGEMENT OF RADIO-RELAY SYSTEMS FOR THE NETWORK ELEMENT VIEW

Summary

This Recommendation provides an information model for the Synchronous Digital hierarchy (SDH) Radio-Relay Network Elements. This model describes the managed object classes and their properties for the Radio Synchronous Physical Interface and the protection function of sections having such a physical interface. These objects are useful to describe information exchanged across interfaces defined in Recommendation M.3010 [2] Telecommunications Management Network (TMN) architecture for the management of the Radio-Relay Network Elements.

Source

ITU-T Recommendation G.774.8 was prepared by ITU-T Study Group 15 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 8th of April 1997.

Keywords

Action, ASN.1, Attribute, Digital Radio-Relay Systems (DRRS), Information Model, Managed Object Class, Notification, Synchronous Digital Hierarchy.

FOREWORD

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Recommendation G.774.8

SYNCHRONOUS DIGITAL HIERARCHY (SDH) MANAGEMENT OF RADIO-RELAY SYSTEMS FOR THE NETWORK ELEMENT VIEW

(Geneva, 1997)

The ITU-T,

considering

- a) that Recommendation G.707 is a specification for the Synchronous Digital Hierarchy (SDH) and the Network Node Interface (NNI);
- b) that Recommendations G.783 and G.784 form a coherent set of specifications for SDH multiplex equipment functions and management;
- c) that Recommendation M.3010 defines the principles for a Telecommunications Management Network (TMN);
- d) that Recommendation G.773 defines the protocol suites for Q-interfaces;
- e) that Recommendation M.3100 defines a Generic Network Information Model for the exchange of management information;
- f) that Recommendation G.774 defines an SDH Management information Model for the Network Element view,

recommends

that the management of radio-relay SDH equipment be carried out by using the information model defined in accordance with the details contained within this Recommendation.

1 Scope

This Recommendation provides an information model to be used at the interface between Network Elements and Management Systems, for the management of radio-relays equipment which use the Synchronous Digital Hierarchy (SDH). It identifies the Telecommunications Management Network (TMN) object classes required for the management of the Radio-Relay SDH network elements. These objects are relevant to information exchanged across standardized interfaces defined in the M.3010 TMN architecture [2].

1.1 Structure of this Recommendation

Clauses 5 to 6 describe the information model using the notation mechanisms defined in Recommendation X.722: Guidelines for the Definition of Managed Objects [6]. Subclauses 5.6 and 6.7 contain the syntax definitions of the information carried in the protocol using Abstract Syntax Notation One (ASN.1) defined in Recommendation X.208 [7]. Naming and Inheritance are diagrammatically shown in informative Appendix I.

2 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.707 (1996), *Network node interface for the Synchronous Digital Hierarchy (SDH)*.
- [2] ITU-T Recommendation M.3010 (1996), *Principles for a telecommunications management network*.
- [3] ITU-T Recommendation M.3100 (1995), *Generic network information model*.
- [4] ITU-T Recommendation G.783 (1997), *Characteristics of Synchronous Digital Hierarchy (SDH) equipment functional blocks*.
- [5] ITU-T Recommendation G.784 (1994), *Synchronous Digital Hierarchy (SDH) management*.
- [6] CCITT Recommendation X.722 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects*.
- [7] CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1)*.
- [8] CCITT Recommendation X.720 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Management information model*.
- [9] CCITT Recommendation G.774 (1992)/Cor.1 (1996), *Synchronous Digital Hierarchy (SDH) management information model for the network element view*.
- [10] ITU-T Recommendation G.803 (1997), *Architecture of transport networks based on the Synchronous Digital Hierarchy (SDH)*.
- [11] ITU-T Recommendation X.721 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information*.

3 Definitions

None.

4 Abbreviations

This Recommendation uses the following abbreviations.

AIS	Alarm Indication Signal
AP	Access Point
ITU-T	International Telecommunication Union
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CP	Connection Point
CTP	Connection Termination Point
DRR	Digital Radio-Relay
GTP	Group Termination Point
HPA	Higher order Path Adaptation

IA	Indirect Adapter
IOS	Intra-Office Section
ISO	International Organization for Standardization
LOF	Loss of Frame
LPA	Lower order Path Adaptation
NE	Network Element
OS	Operation System
OSI	Open Systems Interconnection
PDH	Plesiochronous Digital Hierarchy
Pkg	Packages
RF	Radio Frequency
RPS	Radio Protection Switching
RRR	Radio-Relay Regenerator
RRT	Radio-Relay Terminal
RS	Regenerator Section
RSPI	Radio Synchronous Physical Interface
SDH	Synchronous Digital Hierarchy
Snk	Sink
Src	Source
STM-n	Synchronous Transport Module n
STM-RR	Synchronous Transport Module for Sub-STM-1 radio-relay
TMN	Telecommunications Management Network
TP	Termination Point
TTP	Trail Termination Point
VC-n	Virtual Container n

5 SDH Radio TP fragment

This clause provides Managed Objects required to model Radio SDH Physical interfaces.

5.1 Object classes definitions

5.1.1 Radio Synchronous Physical Interface

This subclause describes the object classes required to model the Radio SDH physical interface.

```
radioSPITTPBidirectional MANAGED OBJECT CLASS
DERIVED FROM "Recommendation M.3100:1995":trailTerminationPointBidirectional,
                                     radioSPITTPSink,
                                     radioSPITTPSource;
REGISTERED AS { g774-8ObjectClass 1 };
```

```
radioSPITTPSink MANAGED OBJECT CLASS
DERIVED FROM "Recommendation M.3100:1995":trailTerminationPointSink;
```

CHARACTERIZED BY

"Recommendation X.721":administrativeStatePackage,
"Recommendation M.3100:1995":createDeleteNotificationsPackage,
"Recommendation M.3100:1995":stateChangeNotificationPackage,
"Recommendation M.3100:1995":tmnCommunicationsAlarmInformationPackage,
radioSPIPackage,
radioSPITTPSinkPkg PACKAGE

BEHAVIOUR

radioSPITTPSinkPkgBehaviour BEHAVIOUR

DEFINED AS

"This managed object class represents the process of converting the incoming radio frequency signal into an internal logic level STM-N signal and the recovering of the timing from the incoming signal.

The upstream connectivity pointer is NULL for an instance of this class.

The aforementioned process is composed of two subfunctions, namely the RX subfunction and the Demodulation subfunction.

A communicationsAlarm notification shall be issued if the RX subfunction fails. The probableCause parameter of the notification shall indicate rxFail.

A communicationsAlarm notification shall be issued if the Demodulation subfunction fails. The probableCause parameter of the notification shall indicate demodulationFail.

When an alarm is pending on an instance, its operationalState is disabled."

;;;

CONDITIONAL PACKAGES

rxLOSNotificationPackage PRESENT IF "an instance supports it",
demLOSNotificationPackage PRESENT IF "an instance supports it";

REGISTERED AS { g774-8ObjectClass 2 };

radioSPITTPSource MANAGED OBJECT CLASS

DERIVED FROM "Recommendation M.3100:1995":trailTerminationPointSource;

CHARACTERIZED BY

"Recommendation X.721":administrativeStatePackage,
"Recommendation M.3100:1995":createDeleteNotificationsPackage,
"Recommendation M.3100:1995":stateChangeNotificationPackage,
"Recommendation M.3100:1995":tmnCommunicationsAlarmInformationPackage,
radioSPIPackage,
radioSPITTPSourcePkg PACKAGE

BEHAVIOUR

radioSPITTPSourcePkgBehaviour BEHAVIOUR

DEFINED AS

"This managed object class represents the process of converting an outgoing internal logic level STM-N signal into a radio frequency signal.

The downstream connectivity pointer is NULL for an instance of this class.

The aforementioned process is composed of two subfunctions, namely the TX subfunction and the Modulation subfunction.

A communicationsAlarm notification shall be issued if the TX subfunction fails. The probableCause parameter of the notification shall indicate txFail.

A communicationsAlarm notification shall be issued if the Modulation subfunction fails. The probableCause parameter of the notification shall indicate modulationFail.

When an alarm is pending on an instance, its operationalState is disabled.";;

ATTRIBUTES atpcImplemented GET;;

CONDITIONAL PACKAGES

atpcPackage PRESENT IF "the ATPC is implemented and an instance supports it",
txLOSNotificationPackage PRESENT IF "an instance supports it",
modLOSNotificationPackage PRESENT IF "an instance supports it";

REGISTERED AS { g774-8ObjectClass 3 };

5.2 Packages definitions

atpcPackage PACKAGE

ATTRIBUTES

atpcEnabled GET-REPLACE;

REGISTERED AS { g774-8Package 1 };

radioSPIPackage PACKAGE

ATTRIBUTES

radioSPITTPId GET,

radioFrequency GET,

"Recommendation G.774:1996":stmLevel GET;

REGISTERED AS { g774-8Package 2 };

rxLOSNotificationPackage PACKAGE

BEHAVIOUR

rxLOSNotificationPackageBehaviour BEHAVIOUR

DEFINED AS

"A communicationsAlarm notification shall be issued if a loss of the incoming signal for the RX subfunctions is detected. The probableCause parameter of the notification shall indicate rxLOS. The rxLOS probableCause in the communicationsAlarm notification should be used only when the distinction between the fail of the RX subfunction and the loss of the incoming signal can be carried out with sufficient degree of confidence."

::

REGISTERED AS { g774-8Package 3 };

demLOSNotificationPackage PACKAGE

BEHAVIOUR

demLOSNotificationPackageBehaviour BEHAVIOUR

DEFINED AS

"A communicationsAlarm notification shall be issued if a loss of the incoming signal for the Demodulation subfunctions is detected. The probableCause parameter of the notification shall indicate demLOS. The demLOS probableCause in the communicationsAlarm notification should be used only when the distinction between the fail of the Demodulation subfunction and the loss of the incoming signal can be carried out with sufficient degree of confidence."

::

REGISTERED AS { g774-8Package 4 };

txLOSNotificationPackage PACKAGE

BEHAVIOUR

txLOSNotificationPackageBehaviour BEHAVIOUR

DEFINED AS

"A communicationsAlarm notification shall be issued if a loss of the *OUT*going signal for the TX subfunctions is detected. The probableCause parameter of the notification shall indicate txLOS. The txLOS probableCause in the communicationsAlarm notification should be used only when the distinction between the fail of the TX subfunction and the loss of the incoming signal can be carried out with sufficient degree of confidence."

::

REGISTERED AS { g774-8Package 5 };

modLOSNotificationPackage PACKAGE

BEHAVIOUR

modLOSNotificationPackageBehaviour BEHAVIOUR

DEFINED AS

"A communicationsAlarm notification shall be issued if a loss of the *OUT*going signal for the Modulation subfunctions is detected. The probableCause parameter of the notification shall indicate modLOS. The modLOS probableCause in the communicationsAlarm notification should be used only when the distinction between the fail of the Modulation subfunction and the loss of the incoming signal can be carried out with sufficient degree of confidence."

;;

REGISTERED AS { g774-8Package 6 };

5.3 Attributes definitions

atpcImplemented ATTRIBUTE

WITH ATTRIBUTE SYNTAX SDHRadioTpASN1.Boolean;

MATCHES FOR EQUALITY;

BEHAVIOUR

atpcImplementedBeh BEHAVIOUR

DEFINED AS

"This attribute specifies whether the ATPC capability is present or not.

A value of TRUE indicates that the ATPC capability is present and a value of FALSE indicates that the ATPC capability is not present." ;;

REGISTERED AS {g774-8Attribute 1};

atpcEnabled ATTRIBUTE

WITH ATTRIBUTE SYNTAX SDHRadioTpASN1.Boolean;

MATCHES FOR EQUALITY;

BEHAVIOUR

atpcEnabledBeh BEHAVIOUR

DEFINED AS

"This attribute specifies whether the ATPC device is currently allowed to work or not.

A value of TRUE indicates that the ATPC device is allowed to work and a value of FALSE indicates that the device is not allowed to work (i.e. the transmit power has a fixed value)." ;;

REGISTERED AS {g774-8Attribute 2};

radioFrequency ATTRIBUTE

WITH ATTRIBUTE SYNTAX SDHRadioTpASN1.RadioFrequency;

MATCHES FOR EQUALITY;

BEHAVIOUR

radioFrequencyBehaviour BEHAVIOUR

DEFINED AS

"This attribute is used to specify the carrier radio frequencies and optionally the related polarization states associated to instances of radioSPITTPSink, radioSPITTPSource and radioSPITTPBidirectional managed object Classes.

It also indicates if each specified radio frequency is used at transmit or receive side.

Frequency value are expressed in MHz.

For instances of radioSPITTPSink (radioSPITTPSource) managed object Class, the FrequencyUsage sub-field can take only the receive (transmit) value."

;;

REGISTERED AS {g774-8Attribute 3};

radioSPITTPId ATTRIBUTE

WITH ATTRIBUTE SYNTAX SDHRadioTpASN1.NameType;

MATCHES FOR EQUALITY;

BEHAVIOUR

radioSPITTPIdBehaviour BEHAVIOUR

DEFINED AS

"This attribute is used as a RDN for naming instances of the radioSPITTP object classes."

;;

REGISTERED AS {g774-8Attribute 4};

5.4 Name bindings definitions

radioSPITTPSink-managedElement NAME BINDING
SUBORDINATE OBJECT CLASS radioSPITTPSink AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS "Recommendation M.3100:1995":managedElement AND
SUBCLASSES;

WITH ATTRIBUTE radioSPITTPId;

BEHAVIOUR

radioSPITTPSink-managedElementBehaviour BEHAVIOUR

DEFINED AS

"The subordinate managed object may be automatically instantiated when the superior managed object is instantiated, according to the make-up and mode of operation of the equipment."

;;

REGISTERED AS { g774-8NameBinding 1};

radioSPITTPSource-managedElement NAME BINDING
SUBORDINATE OBJECT CLASS radioSPITTPSource AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS "Recommendation M.3100:1995":managedElement AND
SUBCLASSES;

WITH ATTRIBUTE radioSPITTPId;

BEHAVIOUR

radioSPITTPSource-managedElementBehaviour BEHAVIOUR

DEFINED AS

"The subordinate managed object may be automatically instantiated when the superior managed object is instantiated, according to the make-up and mode of operation of the equipment."

;;

REGISTERED AS { g774-8NameBinding 2};

rsCTPSink-radioSPITTPSink NAME BINDING
SUBORDINATE OBJECT CLASS "Recommendation G.774:1996":rsCTPSink AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS radioSPITTPSink AND SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774:1996":rsCTPId;

BEHAVIOUR

rsCTPSink-radioSPITTPSinkBehaviour BEHAVIOUR

DEFINED AS

"The subordinate managed object may be automatically instantiated when the superior managed object is instantiated, according to the make-up and mode of operation of the equipment."

;;

REGISTERED AS {g774-8NameBinding 3};

rsCTPSource-radioSPITTPSource NAME BINDING
SUBORDINATE OBJECT CLASS "Recommendation G.774:1996":rsCTPSource AND
SUBCLASSES;

NAMED BY

SUPERIOR OBJECT CLASS radioSPITTPSource AND SUBCLASSES;

WITH ATTRIBUTE "Recommendation G.774:1996":rsCTPId;

BEHAVIOUR

rsCTPSource-radioSPITTPSourceBehaviour BEHAVIOUR

DEFINED AS

"The subordinate managed object may be automatically instantiated when the superior managed object is instantiated, according to the make-up and mode of operation of the equipment."

;;

REGISTERED AS {g774-8NameBinding 4};

5.5 Object relations

radioSPITTPBidirectionalSubordination SUBORDINATION RULE

SUPERIOR OBJECT CLASS

radioSPITTPBidirectional;

NAMES SUBORDINATES

rsCTPSink, rsCTPSource, rsCTPBidirectional;

ACCORDING TO RULE

SET SIZE(1) OF CHOICE {

rsCTPSink, rsCTPSource, rsCTPBidirectional };

;

radioSPITTPSinkSubordination SUBORDINATION RULE

SUPERIOR OBJECT CLASS

radioSPITTPSink;

NAMES SUBORDINATES

rsCTPSink;

ACCORDING TO RULE

SET SIZE(1) OF rsCTPSink;

;

radioSPITTPSourceSubordination SUBORDINATION RULE

SUPERIOR OBJECT CLASS

radioSPITTPSource;

NAMES SUBORDINATES

rsCTPSource;

ACCORDING TO RULE

SET SIZE(1) OF rsCTPSource;

;

5.6 Supporting ASN.1

SDHRadioManagement {itu-t(0) recommendation(0) g(7) g774(774) hyphen(127)
sdhRadioIM(8)}

DEFINITIONS IMPLICIT TAGS ::= BEGIN

-- EXPORTS Everything

sdhRadioManagement OBJECT IDENTIFIER ::= {itu-t(0) recommendation(0) g(7)
g774(774) hyphen(127) sdhRadioIM(8) informationModel(0)}

g774-8ObjectClass OBJECT IDENTIFIER ::= {sdhRadioManagement managedObjectClass(3)}

g774-8Attribute OBJECT IDENTIFIER ::= {sdhRadioManagement attribute(7)}

g774-8NameBinding OBJECT IDENTIFIER ::= {sdhRadioManagement nameBinding(6)}

g774-8Action OBJECT IDENTIFIER ::= {sdhRadioManagement action(9)}

g774-8Notification OBJECT IDENTIFIER ::= {sdhRadioManagement notification(10)}

g774-8Package OBJECT IDENTIFIER ::= {sdhRadioManagement package(4)}

g774-8Parameter OBJECT IDENTIFIER ::= {sdhRadioManagement parameter(5)}

END

**SDHRadioTpASN1 {itu-t(0) recommendation(0) g(7) g774(774) hyphen(127)
sdhRadioIM(8) informationModel(0) asn1Module(2) sdhRadioTp(0)}**

DEFINITIONS IMPLICIT TAGS ::= BEGIN

-- EXPORTS Everything

IMPORTS

**NameType FROM ASN1DefinedTypesModule {itu-t(0) recommendation(0) m(13)
gnm(3100) informationModel(0) asn1Modules(2) asn1DefinedTypesModule(0)}**

**ProbableCause FROM Attribute-ASN1Module {joint-iso-ccitt ms(9) smi(3)
part2(2) asn1Module(2) 1};**

**RadioFrequency ::= SEQUENCE OF SEQUENCE {
 frequencyValue [0] INTEGER,
 frequencyUsage [1] FrequencyUsage,
 polarization [2] Polarization OPTIONAL
 }**

Boolean ::= BOOLEAN

Integer ::= INTEGER

Polarization ::= ENUMERATED {vertical (0), horizontal (1),unspecified (2)}

FrequencyUsage ::= ENUMERATED {receive (0), transmit (1)}

*-- The following value assignments specify the Probable Cause value related to Radio-Relay
-- management within the TMN application context. The chosen values are reserved by
-- Recommendation M.3100 for communication alarm-related probable causes.*

**rxFail ProbableCause ::= localValue : 30
rxLOS ProbableCause ::= localValue : 31
demodulationFail ProbableCause ::= localValue : 32
demLOS ProbableCause ::= localValue : 33
txFail ProbableCause ::= localValue : 34
txLOS ProbableCause ::= localValue : 35
modulationFail ProbableCause ::= localValue : 36
modLOS ProbableCause ::= localValue : 37**

END

6 SDH Radio Protection Fragment

This clause provides Managed Objects required to model the Radio Protection Switching function.

6.1 Object classes definitions

6.1.1 Generic Object definitions

6.1.1.1 SDH Radio Protection Group

**sdhRadioProtectionGroup MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774.03:1996":protectionGroup;
CHARACTERIZED BY
 sdhRadioProtectionGroupPkg PACKAGE
 BEHAVIOUR sdhRadioProtectionGroupBeh;**

ATTRIBUTES

rpsSummaryStatus GET,
"Recommendation G.774.03:1996":protectionSwitchMode GET,
hitless GET;

NOTIFICATIONS

"Recommendation G.774.03:1996":protectionSwitchReporting
radioProtectionStatusParameter;;;

CONDITIONAL PACKAGES

"Recommendation G.774.03:1996":protectionMismatchStatusPkg PRESENT IF
"An APS protocol is used",
radioHoldOffTimePkg PRESENT IF "the hitless functionality is not present and an instance
supports it",
singleExercisePkg PRESENT IF "an instance supports it",
exerciseOnOffPkg PRESENT IF "an instance supports it";

REGISTERED AS {g774-8ObjectClass 4 } ;

sdhRadioProtectionGroupBeh BEHAVIOUR

DEFINED AS

"This object class is used to model all radio protection schemes envisaged for the Radio Protection Switch function. This object class is the focal point for management operations and notifications related to management of the protection system.

The protectionMismatchStatus indicates a mismatch between the provisioned protectionGroupType of this protectionGroup and the provisioned protectionGroupType of the far-end. It also indicates mismatch of uni-directional versus bi-directional switch provisioning between the two protection groups.

Actual signal flow across any specific transport entity is reflected by the connectivity pointers of the TPs involved in the protection scheme represented by an instance of this class.

For instances of this managed object class the REPLACE operation on the attributes revertive, waitToRestoreTime and protectionGroupType is not mandatorily required.

When the exerciseOnOffPkg package is present, it is possible to start and to stop the exercise procedure on the RPS acting on the exerciseOn boolean attribute. When the exerciseOn attribute is TRUE, possible malfunctioning of the exercise procedure shall be signalled setting the 'degraded' component in the availabilityStatus attribute.

If the attributeValueChangeNotification package is present, then changes to the exerciseOn and radioHoldOffTime (if they are present) shall cause an attributeValueChange notification to be emitted.

The protectionUnit sub-field of the protectionSwitchReportingInfo has no meaning in protectionSwitchReporting notification emitted by instances of this managed object class. The conditions for emitting the protectionSwitchReporting notifications are specified in the behaviour of the radioProtectionStatusParameter parameter.";

6.1.1.2 SDH Radio Protection Unit

sdhRadioProtectionUnit MANAGED OBJECT CLASS

DERIVED FROM "Recommendation G.774.03:1996":protectionUnit;

CHARACTERIZED BY

sdhRadioProtectionUnitPkg PACKAGE

BEHAVIOUR sdhRadioProtectionUnitBeh ;

ATTRIBUTES

"Recommendation G.774.03:1996":channelNumber GET,
radioProtectionStatus GET,
"Recommendation G.774.03:1996":reliableResourcePointer PERMITTED VALUES
SDHRadioProtASN1.SDHRadioResourcePointer,
"Recommendation G.774.03:1996":unreliableResourcePointer PERMITTED VALUES
SDHRadioProtASN1.SDHRadioResourcePointer ;;;

CONDITIONAL PACKAGES

```
"Recommendation G.774.03:1996":extraTrafficControlPkg PRESENT IF " extra traffic may be
suspended and resumed " ,
privileged ChannelPkg
PRESENT IF "an instance supports it and the instance is protecting";
REGISTERED AS {g774-8ObjectClass 5 } ;
```

sdhRadioProtectionUnitBeh BEHAVIOUR

DEFINED AS

"This object class is specific to SDH Radio Protection Systems. Instances of this object class are used to represent the assignment between an unreliable resource (termination point) and a reliable resource (termination point) for the purpose of protection of the transport entity involved in any particular RPS protection scheme.

If this is a protecting protection unit , the reliableResourcePointer points to the protected termination point for extra traffic or NULL if there is no extra traffic.

The channelNumber attribute value represents the number of the channel used by the automatic protection switching protocol, if any."

6.1.2 MS Tandem Connection Protection Object definitions

This subclause provides the object classes required to model protection of Multiplex Section Tandem Connections.

6.1.2.1 MS Tandem Connection CTP

msTcCTPBidirectional MANAGED OBJECT CLASS

```
DERIVED FROM "Recommendation G.774:1996":msCTPBidirectional,
msTcCTPSource,
msTcCTPSink ;
```

CHARACTERIZED BY

```
msTcCTPBidirectionalPkg PACKAGE
BEHAVIOUR msTcCTPBidirectionalBeh ;;;
```

```
REGISTERED AS {g774-8ObjectClass 6 } ;
```

msTcCTPBidirectionalBeh BEHAVIOUR

DEFINED AS

"The msTcCTPBidirectional object class is a class of objects that represents either the bidirectional protected resources or the bidirectional unprotected resources in a tandem connection made up of one or more link connections at multiplex section layer.

If a bidirectional SDH Radio Protection Switching function is present, this object class shall be supported." ;

msTcCTPSink MANAGED OBJECT CLASS

```
DERIVED FROM "Recommendation G.774:1996": msCTPSink ;
```

CHARACTERIZED BY

```
"Recommendation M.3100:1995": crossConnectionPointerPackage,
msTcCTPSinkPkg PACKAGE
```

```
BEHAVIOUR msTcCTPSinkBeh ;;;
```

```
REGISTERED AS {g774-8ObjectClass 7 } ;
```

msTcCTPSinkBeh BEHAVIOUR

DEFINED AS

"The msTcCTPSink object class is a class of objects that represents either the protected or the unprotected resources in a tandem connection made up of one or more link connections at multiplex section layer. An instance of this object class defines the tandem connection end-point which terminates a multiplex section connection.

An instance of this object class is pointed to by a `reliableResourcePointer` attribute or by an `unreliableResourcePointer` attribute in an instance of the `protectionUnit` object class according if it represents a protected or an unprotected tandem connection respectively.

The `crossConnectionObjectPointer` attribute in an instance of this object class points to its associated `sdhRadioProtectionUnit` instance which has the `reliableResourcePointer` or `unreliableResourcePointer` attribute pointing back to the instance of this object class.

If an instance of this object class represents a protected tandem connection, then the `downStreamConnectivityPointer` points to either null or its associated `msTcCTP` object instance(s) representing the unprotected tandem connection(s).

If an instance of this object class represents an unprotected tandem connection, then the `downStreamConnectivityPointer` points to either null or its associated `msTcCTP` or `msTcTTP` object instance representing the protected tandem connection.

When a signal is switched to another unit, the value of the pointer is updated." ;

```
msTcCTPSource  MANAGED OBJECT CLASS
  DERIVED FROM  "Recommendation G.774:1996": msCTPSource ;
  CHARACTERIZED BY
    "Recommendation M.3100:1995": crossConnectionPointerPackage,
    msTcCTPSourcePkg PACKAGE
  BEHAVIOUR msTcCTPSourceBeh ;;
REGISTERED AS {g774-8ObjectClass 8 } ;
```

```
msTcCTPSourceBeh BEHAVIOUR
DEFINED AS
```

"The `msTcCTPSource` object class is a class of objects that represents either the protected resources or the unprotected resources in a tandem connection made up of one or more link connections at multiplex section layer. An instance of this object class defines the tandem connection end-point which originates a multiplex section connection.

An instance of this object class is pointed to by a `reliableResourcePointer` attribute or by an `unreliableResourcePointer` attribute in an instance of the `sdhRadioProtectionUnit` object class according if it represents a protected or an unprotected tandem connection respectively.

The `crossConnectionObjectPointer` attribute in an instance of this object class points to its associated `sdhRadioProtectionUnit` instance which has the `reliableResourcePointer` or `unreliableResourcePointer` attribute pointing back to the instance of this object class.

If an instance of this object class represents a protected tandem connection, then the `upStreamConnectivityPointer` points to either null or its associated `msTcCTP` object instance representing the unprotected tandem connection.

If an instance of this object class represents an unprotected tandem connection, then the `upStreamConnectivityPointer` points to either null or its associated `msTcCTP` or `msTcTTP` object instance representing the protected tandem connection.

When a signal is switched to another unit, the value of the pointer is updated." ;

6.1.2.2 MS Tandem Connection TTP

```
msTcTTPBidirectional  MANAGED OBJECT CLASS
  DERIVED FROM  "Recommendation G.774:1996": msTTPBidirectional,
    msTcTTPSource,
    msTcTTPSink ;
  CHARACTERIZED BY
    msTcTTPBidirectionalPkg PACKAGE
  BEHAVIOUR msTcTTPBidirectionalBeh ;;
REGISTERED AS {g774-8ObjectClass 9 } ;
```

**msTcTTPBidirectionalBeh BEHAVIOUR
DEFINED AS**

"The msTcTTPBidirectional object class is a class of objects that represents the bidirectional protected resources in a tandem connection made up of one or more link connections at multiplex section layer.

If a bidirectional SDH Radio Protection Switching function is present, this object class shall be supported." ;

msTcTTPSink MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": msTTPSink ;
CHARACTERIZED BY
"Recommendation M.3100:1995": crossConnectionPointerPackage,
msTcTTPSinkPkg PACKAGE
BEHAVIOUR msTcTTPSinkBeh ;;
REGISTERED AS {g774-8ObjectClass 10 } ;

**msTcTTPSinkBeh BEHAVIOUR
DEFINED AS**

"The msTcTTPSink object class is a class of objects that represents the protected resources in a tandem connection made up of one or more link connections at multiplex section layer. An instance of this object class defines the tandem connection end-point which terminates a multiplex section trail. An instance of this object class is pointed to by a reliableResourcePointer attribute in a instance of the sdhRadioProtectionUnit object class.

The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit instance which has the reliableResourcePointer attribute pointing back to the instance of this object class.

The upStreamConnectivityPointer in an instance of this object class points to either null or its associated msTcCTP object instance representing the unprotected tandem connection. It indicates the actual signal flow and when a signal is switched to another unit, the pointer is updated.

If the attributeValueChangeNotification package is present, then a change in the value of supportedByObjectList shall cause an attributeValueChangeNotification." ;

msTcTTPSource MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": msTTPSource ;
CHARACTERIZED BY
"Recommendation M.3100:1995": crossConnectionPointerPackage,
msTcTTPSourcePkg PACKAGE
BEHAVIOUR msTcTTPSourceBeh ;;
REGISTERED AS {g774-8ObjectClass 11 } ;

**msTcTTPSourceBeh BEHAVIOUR
DEFINED AS**

"The msTcTTPSource object class is a class of objects that represents the protected resources in a tandem connection made up of one or more link connections at multiplex section layer. An instance of this object class defines the tandem connection end-point which originates a multiplex section trail. An instance of this object class is pointed to by a reliableResourcePointer attribute in a instance of the sdhRadioProtectionUnit object class.

The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit instance which has the reliableResourcePointer attribute pointing back to the instance of this object class.

The downStreamConnectivityPointer in an instance of this object class points to either null or its associated msTcCTP object instance(s) representing the unprotected tandem connection(s). It indicates the actual signal flow and when a signal is switched to another unit, the pointer is updated.

If the attributeValueChangeNotification package is present, then a change in the value of supportedByObjectList shall cause an attributeValueChangeNotification." ;

6.1.3 High Order Path Connection Protection Object definitions

This subclause provides the object classes required to model the High Order Path Connection Protection.

6.1.3.1 High Order Path Connection CTP

au4HopcCTPBidirectional MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": au4CTPBidirectional,
au4HopcCTPSource,
au4HopcCTPSink ;
CHARACTERIZED BY
au4HopcCTPBidirectionalPkg PACKAGE
BEHAVIOUR au4HopcCTPBidirectionalBeh ;;
REGISTERED AS {g774-8ObjectClass 12 } ;

au4HopcCTPBidirectionalBeh BEHAVIOUR
DEFINED AS

"The au4HopcCTPBidirectional object class is a class of objects that represents either the bidirectional protected resources or the bidirectional unprotected resources in a High Order Path Connection protected by an RPS function.

If a bidirectional SDH Radio Protection Switching function, acting as high order path connection protection, is present, this object class shall be supported." ;

au4HopcCTPSink MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": au4CTPSink ;
CHARACTERIZED BY
"Recommendation M.3100:1995" : crossConnectionPointerPackage,
au4HopcCTPSinkPkg PACKAGE
BEHAVIOUR au4HopcCTPSinkBeh ;;
REGISTERED AS {g774-8ObjectClass 13 } ;

au4HopcCTPSinkBeh BEHAVIOUR
DEFINED AS

"The au4HopcCTPSink object class is a class of objects that represents either the protected or the unprotected resources in a High Order Path Connection protected by an RPS function. An instance of this object class defines the path connection end-point which terminates a High Order Path Connection.

An instance of this object class is pointed to by a reliableResourcePointer attribute or by an unreliableResourcePointer attribute in an instance of the sdhRadioProtectionUnit object class according if it represents a protected or an unprotected path connection respectively.

The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit instance which has the reliableResourcePointer or unreliableResourcePointer attribute pointing back to the instance of this object class.

If an instance of this object class represents a protected path connection, then the downstreamConnectivityPointer points to either null or to its associated au4HopcCTP object instance(s) representing the unprotected path connection(s).

If an instance of this object class represents an unprotected path connection, then the downstreamConnectivityPointer points to either null or to its associated au4HopcCTP or to the vc4HopcTTP object instance representing the protected path connection.

When a signal is switched to another unit, the value of the downstreamConnectivityPointer is updated." ;

au4HopcCTPSource MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": au4CTPSource ;
CHARACTERIZED BY
"Recommendation M.3100:1995": crossConnectionPointerPackage,
au4HopcCTPSourcePkg PACKAGE
BEHAVIOUR au4HopcCTPSourceBeh ;;;
REGISTERED AS {g774-8ObjectClass 14 } ;

au4HopcCTPSourceBeh BEHAVIOUR
DEFINED AS

"The au4HopcCTPSource object class is a class of objects that represents either the protected resources or the unprotected resources in a High Order Path Connection protected by an RPS function. An instance of this object class defines the path connection end-point which originates a High Order Path Connection.

An instance of this object class is pointed to by a reliableResourcePointer attribute or by an unreliableResourcePointer attribute in an instance of the sdhRadioProtectionUnit object class according if it represents a protected or an unprotected path connection respectively.

The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit instance which has the reliableResourcePointer or unreliableResourcePointer attribute pointing back to the instance of this object class. If an instance of this object class represents a protected path connection then the upStreamConnectivityPointer points to either null or to its associated au4HopcCTP object instance representing the unprotected path connection.

If an instance of this object class represents an unprotected path connection, then the upStreamConnectivityPointer points to either null or to its associated au4HopcCTP or to the vc4HopcTTP object instance representing the protected path connection.

When a signal is switched to another unit, the value of the upStreamConnectivityPointer is updated." ;

6.1.3.2 Protected High Order Path Connection TTP

vc4HopcTTPBidirectional MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": vc4TTPBidirectional,
vc4HopcTTPSource,
vc4HopcTTPSink ;
CHARACTERIZED BY
vc4HopcTTPBidirectionalPkg PACKAGE
BEHAVIOUR vc4HopcTTPBidirectionalBeh ;;;
REGISTERED AS {g774-8ObjectClass 15 } ;

vc4HopcTTPBidirectionalBeh BEHAVIOUR
DEFINED AS

"The vc4HopcTTPBidirectional object class is a class of objects that represents the bidirectional protected resources in a High Order Path Connection protected by an RPS function.

If a bidirectional SDH Radio Protection Switching function, acting as high order path connection protection, is present, this object class shall be supported." ;

vc4HopcTTPSink MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": vc4TTPSink ;
CHARACTERIZED BY
"Recommendation M.3100:1995": crossConnectionPointerPackage,
vc4HopcTTPSinkPkg PACKAGE
BEHAVIOUR vc4HopcTTPSinkBeh ;;;
REGISTERED AS {g774-8ObjectClass 16 } ;

**vc4HopcTTPSinkBeh BEHAVIOUR
DEFINED AS**

"The vc4HopcTTPSink object class is a class of objects that represents the protected resources in a High Order Path Connection protected by an RPS function. An instance of this object class defines the path end-point which terminates a High Order trail. An instance of this object class is pointed to by a reliableResourcePointer attribute in a instance of the sdhRadioProtectionUnit object class.

The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit instance which has the reliableResourcePointer attribute pointing back to the instance of this object class.

The upStreamConnectivityPointer in an instance of this object class points to either null or to its associated au4HopcCTP object instance representing the unprotected path connection. It indicates the actual signal flow and, when a signal is switched to another unit, it is updated.

If the attributeValueChangeNotification package is present, then a change in the value of supportedByObjectList shall cause an attributeValueChangeNotification." ;

vc4HopcTTPSource MANAGED OBJECT CLASS
DERIVED FROM "Recommendation G.774:1996": vc4TTPSource ;
CHARACTERIZED BY
"Recommendation M.3100:1995": crossConnectionPointerPackage,
vc4HopcTTPSourcePkg PACKAGE
BEHAVIOUR vc4HopcTTPSourceBeh ;;;
REGISTERED AS {g774-8ObjectClass 17 } ;

**vc4HopcTTPSourceBeh BEHAVIOUR
DEFINED AS**

"The vc4HopcTTPSource object class is a class of objects that represents the protected resources in a High Order Path Connection protected by an RPS function. An instance of this object class defines the path end-point which originates a high order trail. An instance of this object class is pointed to by a reliableResourcePointer attribute in a instance of the sdhRadioProtectionUnit object class.

The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit instance which has the reliableResourcePointer attribute pointing back to the instance of this object class.

The downStreamConnectivityPointer in an instance of this object class points to either null or to its associated au4HopcCTP object instance(s) representing the unprotected tandem connection(s). It indicates the actual signal flow and when a signal is switched to another unit, it is updated.

If the attributeValueChangeNotification package is present, then a change in the value of supportedByObjectList shall cause an attributeValueChangeNotification." ;

6.1.4 Multiplex Section Trail Protection (by means of RPS) Object definitions

6.1.4.1 Radio Unprotected CTP

radioUnprotectedCTPBidirectional MANAGED OBJECT CLASS
DERIVED FROM "Recommendation M.3100:1995":connectionTerminationPointBidirectional,
radioUnprotectedCTPSource,
radioUnprotectedCTPSink;
CHARACTERIZED BY
radioUnprotectedCTPBidirectionalPkg PACKAGE
BEHAVIOUR radioUnprotectedCTPBidirectionalBeh;;;
REGISTERED AS {g774-8ObjectClass 18 } ;

**radioUnprotectedCTPBidirectionalBeh BEHAVIOUR
DEFINED AS**

"The radioUnprotectedCTPBidirectional object class is a class of objects that represents the bidirectional unprotected resources in a protection scheme involving RPS function." ;

radioUnprotectedCTPSink MANAGED OBJECT CLASS
 DERIVED FROM "Recommendation M.3100:1995":connectionTerminationPointSink;
 CHARACTERIZED BY
 "Recommendation M.3100:1995":crossConnectionPointerPackage,
 radioUnprotectedCTPSinkPkg PACKAGE
 BEHAVIOUR radioUnprotectedCTPSinkBeh;
 ATTRIBUTES
 radioUnprotectedCTPId GET;;;
 REGISTERED AS {g774-8ObjectClass 19 };

radioUnprotectedCTPSinkBeh BEHAVIOUR
 DEFINED AS
 "The radioUnprotectedCTPSink object class is a class of objects that represents the unprotected resources in a protection scheme involving RPS function. An instance of this object class is pointed to by the unreliableResourcePointer attribute in an instance of the sdhRadioProtectionUnit object class. The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit object instance which has the unreliableResourcePointer attribute pointing back to the instance of this object class.";

radioUnprotectedCTPSource MANAGED OBJECT CLASS
 DERIVED FROM "Recommendation M.3100:1995":connectionTerminationPointSink;
 CHARACTERIZED BY
 "Recommendation M.3100:1995":crossConnectionPointerPackage,
 radioUnprotectedCTPSourcePkg PACKAGE
 BEHAVIOUR radioUnprotectedCTPSourceBeh;
 ATTRIBUTES
 radioUnprotectedCTPId GET;;;
 REGISTERED AS {g774-8ObjectClass 20 };

radioUnprotectedCTPSourceBeh BEHAVIOUR
 DEFINED AS
 "The radioUnprotectedCTPSource object class is a class of objects that represents the unprotected resources in a protection scheme involving RPS function. An instance of this object class is pointed to by the unreliableResourcePointer attribute in an instance of the sdhRadioProtectionUnit object class. The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit object instance which has the reliableResourcePointer attribute pointing back to the instance of this object class.";

6.1.4.2 Radio Protected TTP

radioProtectedTTPBidirectional MANAGED OBJECT CLASS
 DERIVED FROM "Recommendation M.3100:1995":trailTerminationPointBidirectional,
 radioProtectedTTPSource,
 radioProtectedTTPSink;
 CHARACTERIZED BY
 radioProtectedTTPBidirectionalPkg PACKAGE
 BEHAVIOUR radioProtectedTTPBidirectionalBeh;;;
 REGISTERED AS {g774-8ObjectClass 21};

radioProtectedTTPBidirectionalBeh BEHAVIOUR
 DEFINED AS
 "The radioProtectedTTPBidirectional object class is a class of objects that represents the bidirectional protected resources in a protection scheme involving RPS function.";

radioProtectedTTPSink MANAGED OBJECT CLASS
 DERIVED FROM "Recommendation M.3100:1995":trailTerminationPointSink;
 CHARACTERIZED BY
 "Recommendation M.3100:1995":crossConnectionPointerPackage,
 radioProtectedTTPSinkPkg PACKAGE

BEHAVIOUR radioProtectedTTPSinkBeh;
ATTRIBUTES
 radioProtectedTTPId GET;;;
REGISTERED AS {g774-8ObjectClass 22};

radioProtectedTTPSinkBeh BEHAVIOUR
DEFINED AS

"The radioProtectedTTPSink object class is a class of objects that represents the protected resources in a protection scheme involving RPS function. An instance of this object class is pointed to by the reliableResourcePointer attribute in an instance of the sdhRadioProtectionUnit object class. The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit instance which has the reliableResourcePointer attribute pointing back to the instance of this object class. The upstreamConnectivityPointer in an instance of this object class points to either null or its associated unprotected CTP object instance; it indicates the actual signal flow, and when a signal is switched to another unit, the value of the upstreamConnectivityPointer is updated. If the attributeValueChangeNotification package is present, then a change in the value of the supportedByObjectList shall cause an attributeValueChange notification.";

radioProtectedTTPSource MANAGED OBJECT CLASS
DERIVED FROM "Recommendation M.3100:1995":trailTerminationPointSource;
CHARACTERIZED BY
 "Recommendation M.3100:1995":crossConnectionPointerPackage,
 radioProtectedTTPSourcePkg **PACKAGE**
BEHAVIOUR radioProtectedTTPSourceBeh;
ATTRIBUTES
 radioProtectedTTPId GET;;;
REGISTERED AS {g774-8ObjectClass 23};

radioProtectedTTPSourceBeh BEHAVIOUR
DEFINED AS

"The radioProtectedTTPSource object class is a class of objects that represents the protected resources in a protection scheme involving RPS function. An instance of this object class is pointed to by the reliableResourcePointer attribute in an instance of the sdhRadioProtectionUnit object class. The crossConnectionObjectPointer attribute in an instance of this object class points to its associated sdhRadioProtectionUnit object instance which has the reliableResourcePointer attribute pointing back to the instance of this object class. The downstreamConnectivityPointer in an instance of this object class points to either null or its associated unprotected CTP object instance(s); it indicates the actual signal flow, and when a signal is switched to another unit, the pointer is updated. If the attributeValueChangeNotification package is present, then a change in the value of the supportedByObjectList shall cause an attributeValueChange notification.";

6.2 Packages definitions

exerciseOnOffPkg PACKAGE
BEHAVIOUR exerciseOnOffPkgBeh;
ATTRIBUTES
 exerciseOn GET-REPLACE;

REGISTERED AS {g774-8Package 7};

exerciseOnOffPkgBeh BEHAVIOUR
DEFINED AS "This package is used to start or stop a continuous testing of the RPS functionality.";

singleExercisePkg PACKAGE
BEHAVIOUR singleExercisePkgBeh;
ACTIONS
 invokeRadioExercise;
REGISTERED AS {g774-8Package 8};

singleExercisePkgBeh BEHAVIOUR

DEFINED AS "This package is used to perform a single test operation of the RPS functionality.";

privilegedChannelPkg PACKAGE
ATTRIBUTES
privilegedChannel GET-REPLACE;
REGISTERED AS {g774-8Package 9};

radioHoldOffTimePkg PACKAGE
ATTRIBUTES
radioHoldOffTime GET-REPLACE;
REGISTERED AS {g774-8Package 10};

6.3 Attributes definitions

6.3.1 hitless

hitless ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHRadioProtASN1.Boolean;
MATCHES FOR EQUALITY ;
BEHAVIOUR hitlessBehaviour ;
REGISTERED AS {g774-8Attribute 5 } ;

hitlessBehaviour BEHAVIOUR
DEFINED AS

"This attribute specifies whether the hitless capability is present or not. A value of TRUE indicates that the hitless capability is present in the protection system. A value of FALSE indicates that the hitless capability is not present.";

6.3.2 radioHoldOffTime

radioHoldOffTime ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHRadioProtASN1.Integer ;
MATCHES FOR EQUALITY, ORDERING ;
BEHAVIOUR radioHoldOffTimeBeh ;
REGISTERED AS { g774-8Attribute 6 } ;

radioHoldOffTimeBeh BEHAVIOUR
DEFINED AS

"This attribute specifies the amount of 10 ms. periods, within a valid range of 0... 10 s., which represents the time to wait before performing a protection switch after detection of an automatic switching initiation defect on either the protecting or protected protectionUnit.

The switch is performed only if the defect is still present after the holdOffTime has expired.";

6.3.3 rpsSummaryStatus

rpsSummaryStatus ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHRadioProtASN1.RPSSummaryStatus;
MATCHES FOR EQUALITY;
BEHAVIOUR rpsSummaryStatusBeh;
REGISTERED AS {g774-8Attribute 7 };

rpsSummaryStatusBeh BEHAVIOUR
DEFINED AS

"This single structured attribute represents the whole status of the RPS function. The statusOfRxProtectionSwitches sub-field allows to know the whole status of the bridges in the Rx side. This is achieved by listing all the protecting protection units which are carrying an extra traffic or traffic from a protected unit. If a protecting unit is not listed, it is intended to be free.

The channelStatus sub-field allows to know information about the highest priority automatic switch request currently active on this protection unit instance together with the last operator switch command accepted (if any) for each protection unit. This is achieved by listing all the protection units which have the value of the channelASRequest sub-field different from 'noOne' and the value of radioSwitchStatus sub-field different from noRequest. If a protection unit is not listed, the status shall be considered (noOne, noRequest).";

6.3.4 exerciseOn

exerciseOn ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHRadioProtASN1.Boolean;
MATCHES FOR EQUALITY;
BEHAVIOUR exerciseOnBeh;
REGISTERED AS {g774-8Attribute 8 };

exerciseOnBeh BEHAVIOUR
DEFINED AS
"This attribute is used to start/stop the exercise procedure on a RPS function. If the value is TRUE the procedure is activated, otherwise it is deactivated.";

6.3.5 privilegedChannel

privilegedChannel ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHRadioProtASN1.Privileged;
MATCHES FOR EQUALITY;
BEHAVIOUR privilegedChannelBeh;
REGISTERED AS {g774-8Attribute 9 };

privilegedChannelBeh BEHAVIOUR
DEFINED AS
"This attribute is used to indicate if the protected channel defined in the value of the attribute is permanently bridged in the TX side (in absence of any switching requests) to this protecting channel. A NULL value indicates that there is no bridge active.";

6.3.6 radioProtectionStatus

radioProtectionStatus ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHRadioProtASN1.RadioProtectionStatus;
MATCHES FOR EQUALITY;
BEHAVIOUR radioProtectionStatusBeh;
REGISTERED AS {g774-8Attribute 10 };

radioProtectionStatusBeh BEHAVIOUR
DEFINED AS
"This attribute is used to indicate the status of the radio protection switching in a protectionUnit instance.

The protectionUnitStatus sub-field contains information about the highest priority automatic switch request currently active on this protection unit instance together with the last operator switch command accepted (if any).

The associatedChannel sub-field indicates with the value 'itself' that there is no switch performed. In case of switch presence, the fromPU value is used for a protecting unit to indicate the protected unit which has been switched from; the toPU value is used for a protected unit to indicate the protecting unit which has been switched to.

The requestSource sub-field, when present, indicates if the switch request has been forwarded locally or remotely. ";

6.3.7 radioUnprotectedCTPId

```
radioUnprotectedCTPId ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1DefinedTypesModule.NameType;
MATCHES FOR EQUALITY;
BEHAVIOUR
  radioUnprotectedCTPIdBehaviour BEHAVIOUR
  DEFINED AS
    "This attribute is used as a RDN for naming instances
    of the radioUnprotectedCTP object classes."
  ;;
REGISTERED AS { g774-8Attribute 11 };
```

6.3.8 radioProtectedTTPId

```
radioProtectedTTPId ATTRIBUTE
WITH ATTRIBUTE SYNTAX ASN1DefinedTypesModule.NameType;
MATCHES FOR EQUALITY;
BEHAVIOUR
  radioProtectedTTPIdBehaviour BEHAVIOUR
  DEFINED AS
    "This attribute is used as a RDN for naming instances
    of the radioProtectedTTP object classes."
  ;;
REGISTERED AS { g774-8Attribute 12 };
```

6.4 Actions definitions

```
invokeRadioExercise ACTION
  BEHAVIOUR invokeRadioExerciseBeh ;
  MODE CONFIRMED ;
  WITH INFORMATION SYNTAX SDHRRadioProtASN1.InvokeRadioExerciseArg ;
  WITH REPLY SYNTAX SDHRRadioProtASN1.InvokeRadioExerciseReply ;
REGISTERED AS { g774-8Action 1 } ;
```

```
invokeRadioExerciseBeh BEHAVIOUR
  DEFINED AS
```

"The invokeRadioExercise action can be used to request a protection exercise routine to be performed on one or more protectionUnit instances contained in the protectionGroup object.

The action argument contains indications of the protected and protecting protectionUnits to which the request applies.

If a protecting protectionUnit is identified in the protectedUnit field or if a protected protectionUnit is identified in the protectingUnit field, the action fails.

The protectionEntity field may be absent, indicating that the request applies to all contained protectionUnits.

A single exercise consists in initiating a switching process without actually switching and, therefore, involves one protected and one protecting protectionUnit.

For an exercised protected protectionUnit, the exercise result contains the list of each protecting protectionUnit to which the switching process has been applied together with the respective obtained result.

For an exercised protecting protectionUnit, the exercise result contains the list of each protected protectionUnit to which the switching process has been applied together with the respective obtained result.

While an exercise is in progress the value of the radioProtectionStatus attribute for both the involved protected and protecting units shall indicate No Request, on the contrary the exercise result will indicate a denied value.";

6.5 Parameters definitions

6.5.1 Radio Protection Status Parameter

radioProtectionStatusParameter PARAMETER
CONTEXT EVENT-INFO;
WITH SYNTAX SDHRadioProtASN1.RadioProtectionStatusParameter;
BEHAVIOUR radioProtectionStatusParameterBeh;
REGISTERED AS {g774-8Parameter 1 } ;

radioProtectionStatusParameterBeh BEHAVIOUR
DEFINED AS

"This parameter is included in the additional info parameters of the protection switching reporting notification.

The protectionSwitchReporting notification is emitted from the sdhRadioProtectionGroup object only in the following cases:

- a) when a failed protection switch request (an automatic request that cannot be satisfied) occurs and the severity of the alarm causing the request is highBER or signalFail.
- b) as a consequence of invoked or released switch requests sent by operator commands and successfully accepted.
- c) when a hardware forcing is performed or released locally on the NE.
- d) when a previously invoked manual switch is released by an automatic switch request.";

6.6 Name bindings definitions

6.6.1 augSink

augSink-msTcTTPSink NAME BINDING
SUBORDINATE OBJECT CLASS "Recommendation G.774:1996":augSink AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS msTcTTPSink AND SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774:1996":augId ;
BEHAVIOUR augSink-msTcTTPSinkBeh;
REGISTERED AS {g774-8NameBinding 5 } ;

augSink-msTcTTPSinkBeh BEHAVIOUR
DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present.";

6.6.2 augSource

augSource-msTcTTPSource NAME BINDING
SUBORDINATE OBJECT CLASS "Recommendation G.774:1996":augSource AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS msTcTTPSource AND SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774:1996": augId ;
BEHAVIOUR augSource-msTcTTPSourceBeh;
REGISTERED AS {g774-8NameBinding 6 } ;

augSource-msTcTTPSourceBeh BEHAVIOUR
DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present.";

6.6.3 msTcCTPSink

msTcCTPSink-rsTTPSink NAME BINDING

SUBORDINATE OBJECT CLASS msTcCTPSink AND SUBCLASSES;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774:1996":rsTTPSink AND
SUBCLASSES;

WITH ATTRIBUTE "Recommendation G.774:1996": msCTPId ;

BEHAVIOUR msTcCTPSink-rsTTPSinkBeh;

REGISTERED AS {g774-8NameBinding 7 } ;

msTcCTPSink-rsTTPSinkBeh BEHAVIOUR

DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.6.4 msTcCTP Source

msTcCTPSource-rsTTPSource NAME BINDING

SUBORDINATE OBJECT CLASS msTcCTPSource AND SUBCLASSES;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774:1996": rsTTPSource AND
SUBCLASSES;

WITH ATTRIBUTE "Recommendation G.774:1996": msCTPId ;

BEHAVIOUR msTcCTPSource-rsTTPSourceBeh;

REGISTERED AS {g774-8NameBinding 8 } ;

msTcCTPSource-rsTTPSourceBeh BEHAVIOUR

DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.6.5 msTcTTP Sink

msTcTTPSink-sdhNE NAME BINDING

SUBORDINATE OBJECT CLASS msTcTTPSink AND SUBCLASSES;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774:1996":sdhNE;
WITH ATTRIBUTE "Recommendation G.774:1996": msTTPId ;

BEHAVIOUR msTcTTPSink-sdhNEBeh;

REGISTERED AS {g774-8NameBinding 9 } ;

msTcTTPSink-sdhNEBeh BEHAVIOUR

DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.6.6 msTcTTP Source

msTcTTPSource-sdhNE NAME BINDING

SUBORDINATE OBJECT CLASS msTcTTPSource AND SUBCLASSES;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774:1996":sdhNE;
WITH ATTRIBUTE "Recommendation G.774:1996":msTTPId ;

BEHAVIOUR msTcTTPSource-sdhNEBeh;

REGISTERED AS {g774-8NameBinding 10 } ;

msTcTTPSource-sdhNEBeh BEHAVIOUR

DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.6.7 vc4HopcTTP Sink

vc4HopcTTPSink-sdhNE NAME BINDING

SUBORDINATE OBJECT CLASS vc4HopcTTPSink **AND SUBCLASSES**;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774 :1996":sdhNE;
WITH ATTRIBUTE "Recommendation G.774:1996": vc4TTPId ;
BEHAVIOUR vc4HopcTTPSink-sdhNEBeh;

REGISTERED AS {g774-8NameBinding 11 } ;

vc4HopcTTPSink-sdhNEBeh BEHAVIOUR

DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.6.8 vc4HopcTTP Source

vc4HopcTTPSource-sdhNE NAME BINDING

SUBORDINATE OBJECT CLASS vc4HopcTTPSource **AND SUBCLASSES**;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774:1996":sdhNE;
WITH ATTRIBUTE "Recommendation G.774:1996": vc4TTPId ;
BEHAVIOUR vc4HopcTTPSource-sdhNEBeh;

REGISTERED AS {g774-8NameBinding 12 } ;

vc4HopcTTPSource-sdhNEBeh BEHAVIOUR

DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.6.9 au4HopcCTPSink

au4HopcCTPSink-augSink NAME BINDING

SUBORDINATE OBJECT CLASS au4HopcCTPSink **AND SUBCLASSES**;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774:1996":augSink **AND**
SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774:1996": au4CTPId ;

BEHAVIOUR au4HopcCTPSink-augSinkBeh;

REGISTERED AS {g774-8NameBinding 13 } ;

au4HopcCTPSink-augSinkBeh BEHAVIOUR

DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.6.10 au4HopcCTP Source

au4HopcCTPSource-augSource NAME BINDING

SUBORDINATE OBJECT CLASS au4HopcCTPSource **AND SUBCLASSES**;
NAMED BY SUPERIOR OBJECT CLASS "Recommendation G.774:1996":augSource **AND**
SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774:1996": au4CTPId ;

BEHAVIOUR au4HopcCTPSource-augSourceBeh;

REGISTERED AS {g774-8NameBinding 14 } ;

au4HopcCTPSource-augSourceBeh BEHAVIOUR
DEFINED AS

"The subordinate managed objects are instantiated when the radio protection switching function is present. Instances of this object may also be instantiated when other types of tandem connection protections in multiplex section layer are present.";

6.7 Supporting ASN.1

SDHRadioProtASN1 {itu-t(0) recommendation(0) g(7) g774(774) hyphen(127)
sdhRadioIM(8) informationModel(0) asn1Module(2) sdhRadioProtASN1(1)}

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

-- EXPORTS everything

IMPORTS

RelativeDistinguishedName

FROM

InformationFramework {joint-iso-ccitt ds(5) modules(1) informationFramework(1)}

ProtectionEntity,

ResourcePointer,

RequestSource,

InvokeExerciseArg

FROM SDHProtASN1 { itu-t(0) recommendation(0) g(7) g774(774) hyphen(127) sdhProt(03)
informationModel(0) asn1Module(2) sdhmsp(0) };

-- supporting productions

Boolean ::= BOOLEAN

Integer ::= INTEGER

InvokeRadioExerciseArg ::= InvokeExerciseArg

InvokeRadioExerciseReply ::= SET OF SEQUENCE {
 exercisedPU **RelativeDistinguishedName,**
 exerciseResult **SEQUENCE OF SingleExerciseResult}**

SingleExerciseResult ::= SEQUENCE {
 protectionUnit **RelativeDistinguishedName,**
 result **Result }**

Result ::= ENUMERATED { success (0), denied (1), failed (2) }

Privileged ::= CHOICE {
 noBridge **[0] NULL,**
 privilegedUnit **[1] RelativeDistinguishedName**
}

RadioProtectionStatusParameter ::= RPSSummaryStatus

SDHRadioResourcePointer ::= ResourcePointer (SIZE(1))

RPSSummaryStatus ::= SEQUENCE {
 statusOfRxProtectionSwitches **StatusOfRxProtectionSwitches,**
 channelStatus **ChannelStatus**
}

```

StatusOfRxProtectionSwitches ::= SET OF SEQUENCE {
    protectingSectionId RelativeDistinguishedName,
    protectingSectionStatus ProtectingSectionStatus
}

ProtectingSectionStatus ::= CHOICE {
    extraTraffic [0] NULL,
    protectedUnit [1] RelativeDistinguishedName
}

ChannelStatus ::= SET OF SEQUENCE {
    protUnitId RelativeDistinguishedName,
    protUnitStatus ProtUnitStatus
}

ProtUnitStatus ::= SEQUENCE {
    channelASRequest ChannelASRequest,
    radioSwitchStatus RadioSwitchStatus
}

ChannelASRequest ::= ENUMERATED {noOne(0), waitToRestore(1), earlyWarning(2),
    lowBER(3), highBER(4), signalFail(5)}
RadioSwitchStatus ::= ENUMERATED { noRequest(0), manualSwitch(1), forcedSwitch(2),
    lockout(3), hwForcing(4) }

RadioProtectionStatus ::= SEQUENCE {
    protectionUnitStatus [0] ProtUnitStatus,
    associatedChannel [1] AssociatedChannel,
    requestSource [2] RequestSource OPTIONAL
}

AssociatedChannel ::= CHOICE {
    itself [0] NULL,
    fromPU [1] RelativeDistinguishedName,
    toPU [2] RelativeDistinguishedName
}

END

```


APPENDIX I

Figures

Naming and Inheritance are diagrammatically shown in Figures I.1 to I.8.

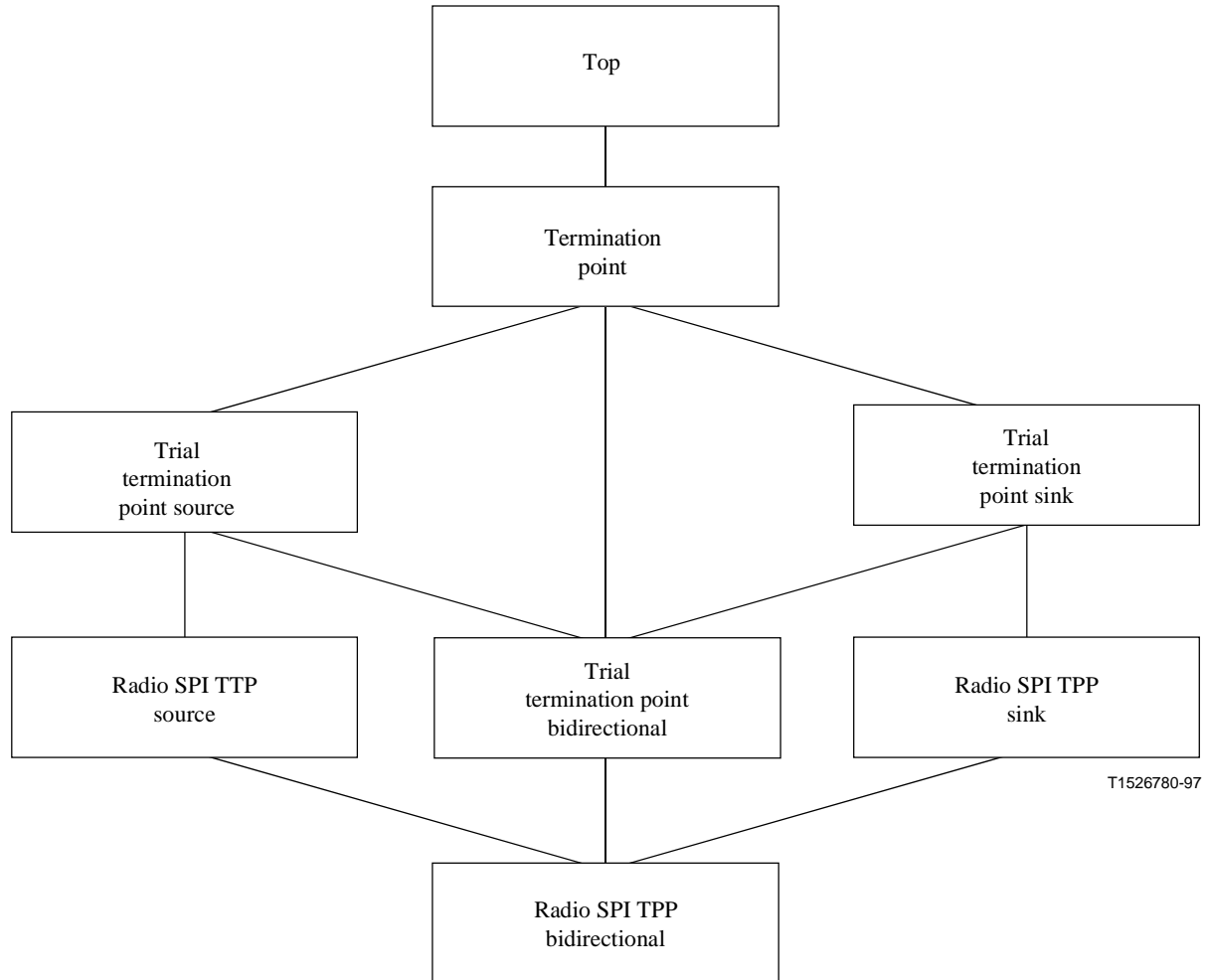
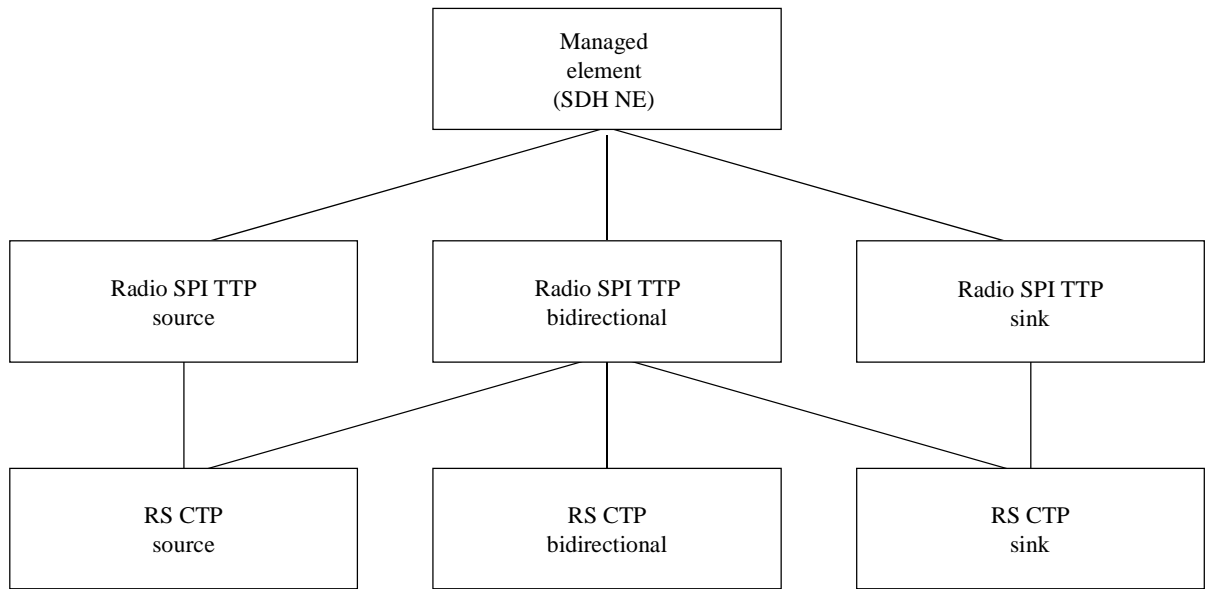
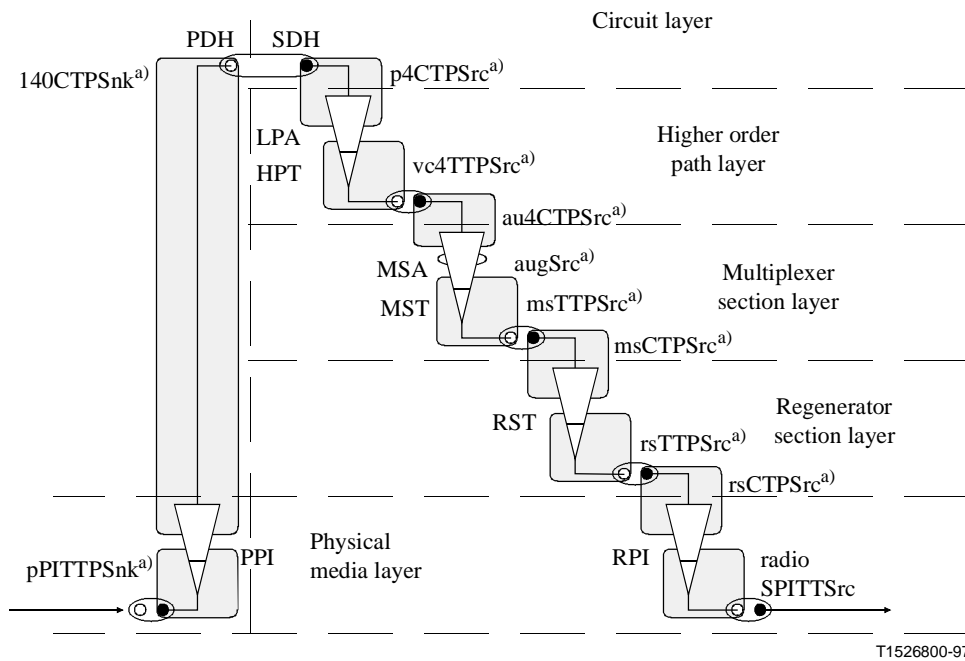


Figure I.1/G.774.8 – Radio fragment objects inheritance

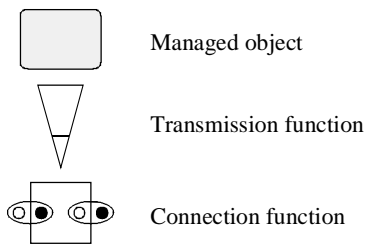


T1526790-97

Figure I.2/G.774.8 – Radio fragment objects naming

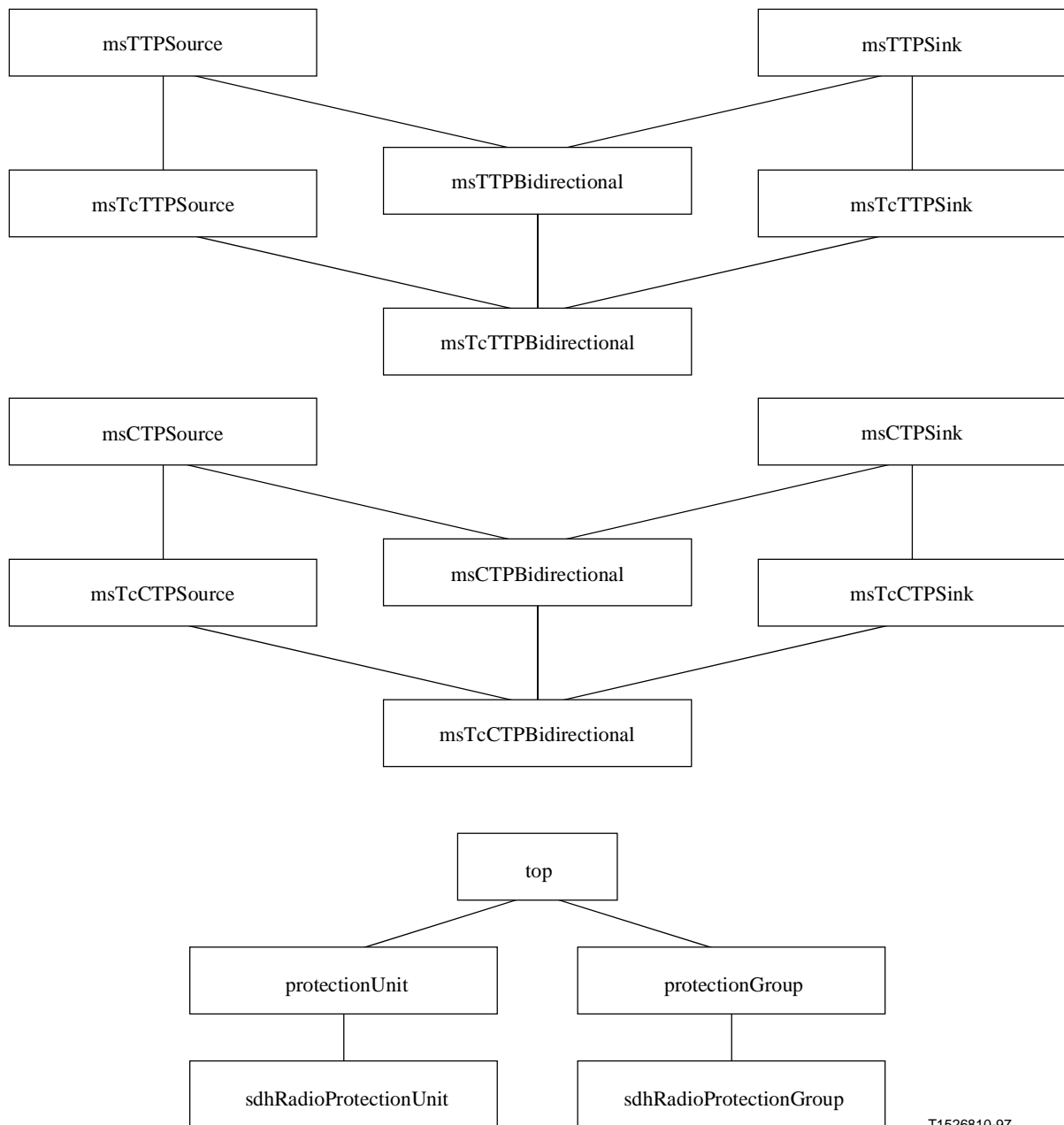


T1526800-97



^{a)} Not defined in this Recommendation.

Figure I.3/G.774.8 – Example: 140 Mbit/s signals multiplexed to STM-1 signal



T1526810-97

Figure I.4/G.774.8 – SDH radio protection inheritance diagram

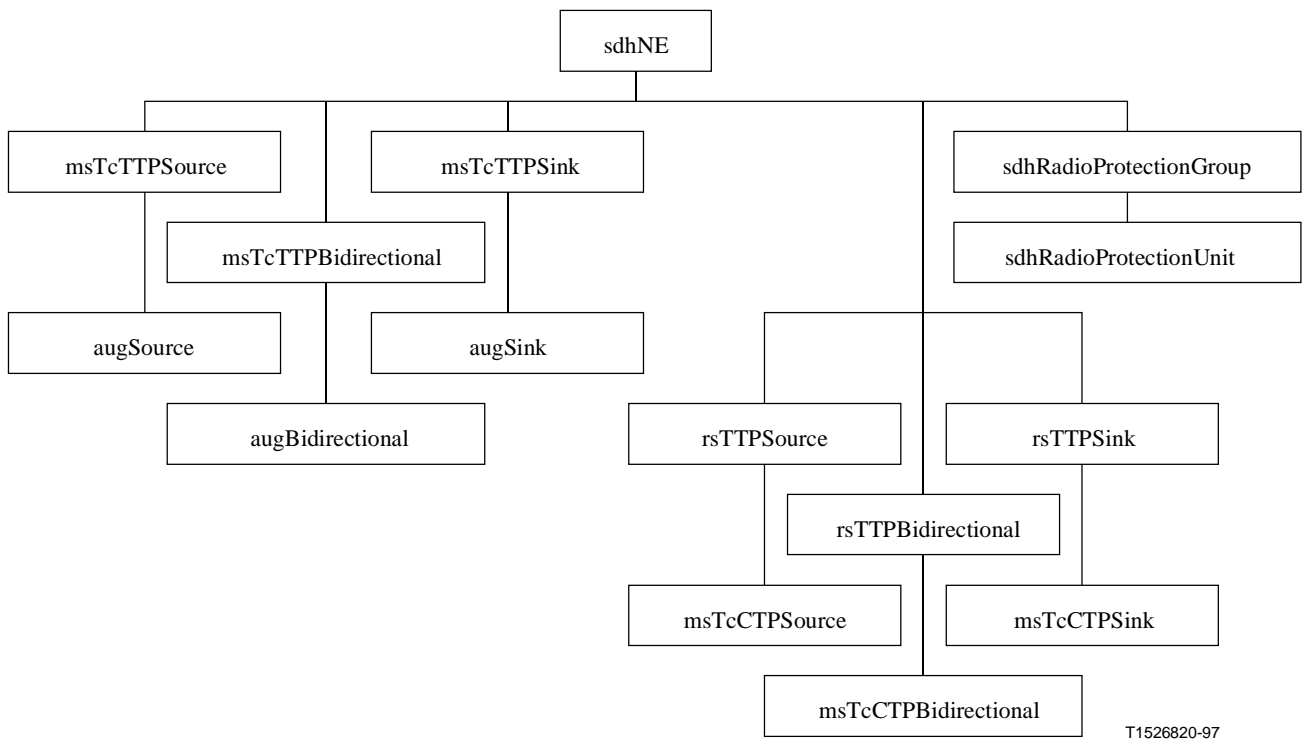


Figure I.5/G.774.8 – SDH radio protection naming diagram

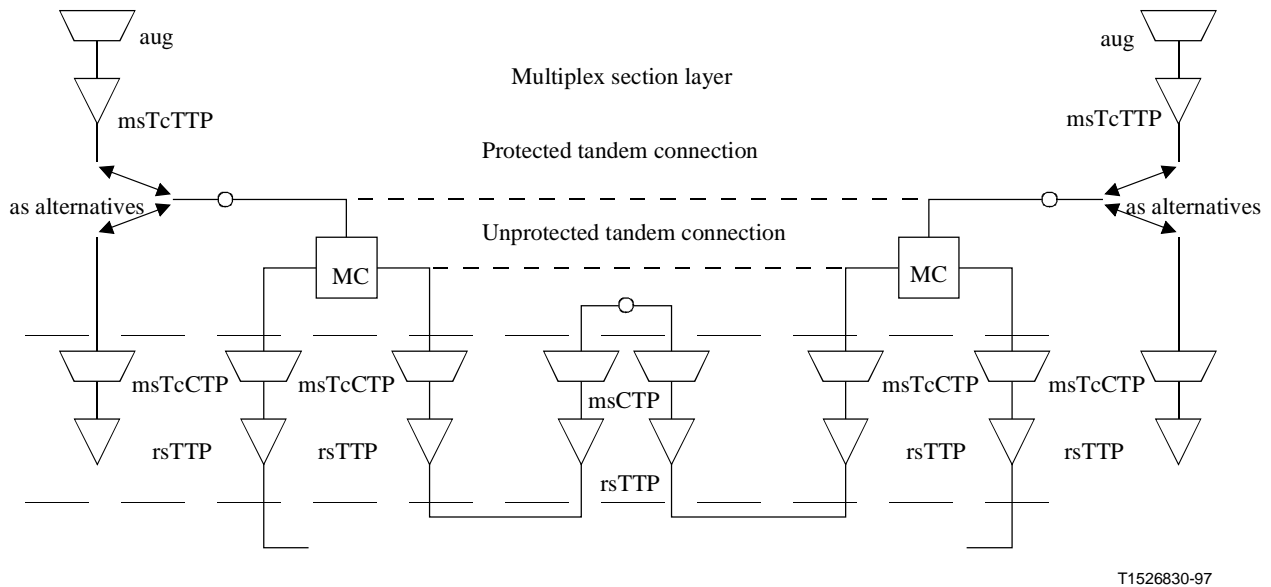
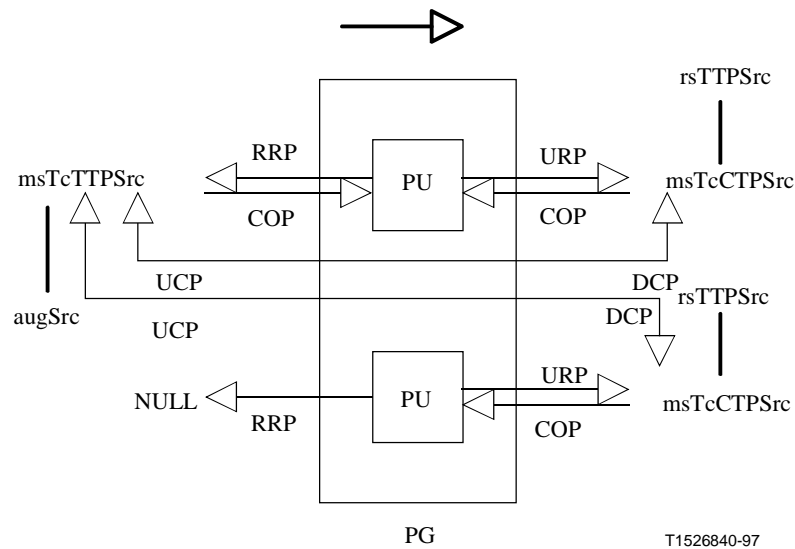


Figure I.6/G.774.8 – RPS applications for MS-tandem connection protection



- SK Sink
- Src Source
- COP Cross connection
- RRP Reliable Resource Pointer
- PU Protection Unit
- PG Protection Group
- URP Unreliable resource pointer object pointer
- UCP/DCP Up/Down stream Connectivity Pointer

Figure I.7/G.774.8 – Example: Radio section = multiplex section 1 + 1 protection – source side

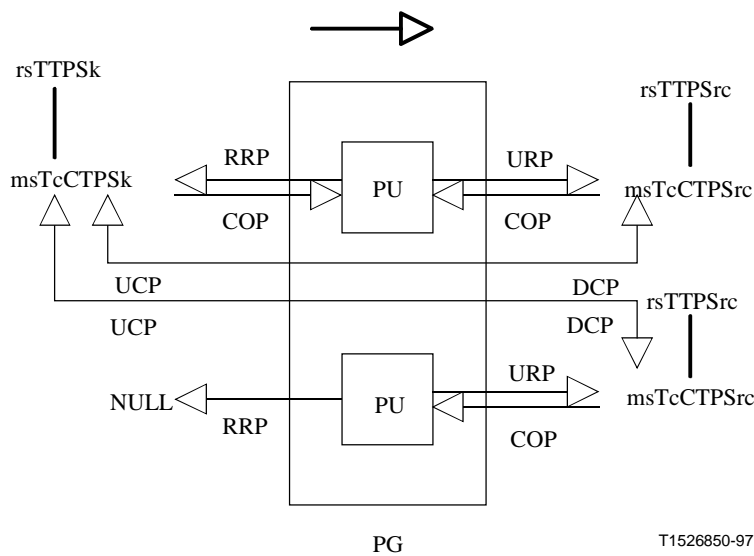


Figure I.8/G.774.8 – Example: Radio section = tandem connection of regenerator sections 1 + 1 protection – source side

ITU-T RECOMMENDATIONS SERIES

- Series A Organization of the work of the ITU-T
- Series B Means of expression: definitions, symbols, classification
- Series C General telecommunication statistics
- Series D General tariff principles
- Series E Overall network operation, telephone service, service operation and human factors
- Series F Non-telephone telecommunication services
- Series G Transmission systems and media, digital systems and networks**
- Series H Audiovisual and multimedia systems
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- Series M TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
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- Series S Telegraph services terminal equipment
- Series T Terminals for telematic services
- Series U Telegraph switching
- Series V Data communication over the telephone network
- Series X Data networks and open system communication
- Series Z Programming languages