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

Digital 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

(Formerly CCITT Recommendation)

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**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 ITU-T M.3010 Telecommunications Management Network (TMN) architecture for the management of the Radio-Relay Network Elements.

Document History	
Issue	Notes
2001	First revision incorporated the changes documented in the Implementors Guide
4/1997	Initial version of the Recommendation

Source

ITU-T Recommendation G.774.8 was revised by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 9 February 2001.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 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.

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As of the date of approval of this Recommendation, 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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ITU-T Recommendation G.774.8

Synchronous digital hierarchy (SDH) – Management of radio-relay systems for the network element view

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.

Structure of this Recommendation

Clauses 5 to 6 describe the information model using the notation mechanisms defined in ITU-T X.722: Guidelines for the Definition of Managed Objects. Clauses 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 ITU-T X.680-X.683. 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: 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.

- ITU-T G.707/Y.1322 (2000), *Network-node interface for the synchronous digital hierarchy (SDH)*.
- ITU-T G.773 (1993), *Protocol suites for Q-interface protocols for management of transmission systems*.
- ITU-T G.774 (2001), *Synchronous digital hierarchy (SDH) – Management information model for the network element view*.
- ITU-T G.783 (2000), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks*.
- ITU-T G.784 (1999), *Synchronous digital hierarchy (SDH) management*.
- ITU-T G.803 (2000), *Architectures of transport networks based on the synchronous digital hierarchy (SDH)*.
- ITU-T G.831 (2000), *Management capabilities of transport networks based on the synchronous digital hierarchy (SDH)*.
- ITU-T G.958 (1994), *Digital line systems based on the synchronous digital hierarchy for use on optical fibre cables*.
- ITU-T M.60 (1993), *Maintenance terminology and definitions*.

- ITU-T M.2120 (2000), *PDH path, section and transmission system and SDH path and multiplex section fault detection and localization procedures.*
- ITU-T M.3010 (2000), *Principles for a telecommunications management network.*
- ITU-T M.3013 (2000), *Considerations for a telecommunications management network.*
- ITU-T M.3100 (1995), *Generic network information model.*
- ITU-T Q.811 (1997), *Lower layer protocol profiles for the Q3 and X interfaces.*
- ITU-T Q.812 (1997), *Higher layer protocol profiles for the Q3 and X interfaces.*
- ITU-T Q.822 (1994), *Stage 1, Stage 2 and Stage 3 description for the Q3-interface – Performance management.*
- ITU-T X.680 to X.683 (1997), *Information technology – Abstract Syntax Notation One (ASN.1).*
- ITU-T X.701 (1997), *Information technology – Open Systems Interconnection – Systems management overview.*
- ITU-T X.710 (1997), *Information technology – Open Systems Interconnection – Common management information service.*
- ITU-T X.711 (1997), *Information technology – Open Systems Interconnection – Common management information protocol: Specification.*
- ITU-T X.720 (1992), *Information technology – Open Systems Interconnection – Structure of Management Information: Management information model, plus Amd.1 (1995) and Cor.1 (1994).*
- ITU-T X.721 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information, plus Cor.1 (1994), Cor.2 (1996), Cor.3 (1998) and Cor.4 (2000).*
- ITU-T X.722 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects, plus Amd.1 (1995), Amd.2 (1997) and Cor.1 (1996).*
- ITU-T X.730 (1992), *Information technology – Open Systems Interconnection – Systems Management: Object management function, plus Amd.1 (1995) and Amd.1/Cor.1 (1996).*
- ITU-T X.731 (1992), *Information technology – Open Systems Interconnection – Systems Management: State management function, plus Amd.1 (1995), Cor.1 (1995) and Amd.1/Cor.1 (1996).*
- ITU-T X.733 (1992), *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function, plus Cor.1 (1994), Amd.1 (1995), Amd.1/Cor.1 (1996) and Cor.2 (1999).*
- ITU-T X.734 (1992), *Information technology – Open Systems Interconnection – Systems Management: Event report management function, plus Cor.1 (1994), Amd.1 (1995), Amd.1/Cor.1 (1996) and Cor.2 (1999).*
- ITU-T X.735 (1992), *Information technology – Open Systems Interconnection – Systems Management: Log control function, plus Amd.1 (1995) and Amd.1/Cor.1 (1996).*

3 Terms and Definitions

This Recommendation uses the terms and definitions defined in ITU-T G.774, ITU-T G.784 and ITU-T M.3100.

4 Abbreviations

This Recommendation uses the following abbreviations:

AIS	Alarm Indication Signal
AP	Access Point
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
ITU-T	International Telecommunication Union – Telecommunication Standardization sector
LOF	Loss of Frame
LPA	Lower order Path Adaptation
NE	Network Element
OS	Operations System
OSI	Open Systems Interconnection
PDH	Plesiochronous Digital Hierarchy
Pkg	Package
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 clause describes the object classes required to model the Radio SDH physical interface.

radioSPITTPBidirectional MANAGED OBJECT CLASS

DERIVED FROM "Recommendation M.3100":trailTerminationPointBidirectional,
radioSPITTPSink,
radioSPITTPSource;

REGISTERED AS { g774-80objectClass 1 };

radioSPITTPSink MANAGED OBJECT CLASS

DERIVED FROM "Recommendation M.3100":trailTerminationPointSink;
CHARACTERIZED BY

"Recommendation X.721":administrativeStatePackage,
"Recommendation M.3100":createDeleteNotificationsPackage,
"Recommendation M.3100":stateChangeNotificationPackage,
"Recommendation M.3100":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 { g774-80objectClass 2 };

radioSPITTPSource MANAGED OBJECT CLASS

DERIVED FROM "Recommendation M.3100":trailTerminationPointSource;

CHARACTERIZED BY

"Recommendation X.721":administrativeStatePackage,
"Recommendation M.3100":createDeleteNotificationsPackage,
"Recommendation M.3100":stateChangeNotificationPackage,
"Recommendation M.3100":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":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
        OUTgoing 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
        OUTgoing 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**

SUBORDINATE OBJECT CLASS

NAMED BY

SUPERIOR OBJECT CLASS

NAME BINDING

radioSPITTPSink AND SUBCLASSES;

"Recommendation M.3100":managedElement AND SUBCLASSES;

WITH ATTRIBUTEradioSPITTPId;

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

SUBORDINATE OBJECT CLASS

NAMED BY

SUPERIOR OBJECT CLASS

NAME BINDING

radioSPITTPSource AND SUBCLASSES;

"Recommendation M.3100":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":rsCTPSink AND
                                SUBCLASSES;

    NAMED BY
    SUPERIOR OBJECT CLASS      radioSPITTPSink AND SUBCLASSES;
    WITH ATTRIBUTE "Recommendation G.774":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":rsCTPSource AND
                                SUBCLASSES;

    NAMED BY
    SUPERIOR OBJECT CLASS      radioSPITTPSource AND SUBCLASSES;
    WITH ATTRIBUTE "Recommendation G.774":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 for modeling 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":protectionGroupR1;
  CHARACTERIZED BY
    sdhRadioProtectionGroupPkg PACKAGE
    BEHAVIOUR sdhRadioProtectionGroupBeh;
    ATTRIBUTES
      rpsSummaryStatus          GET,
      "Recommendation G.774.03":protectionSwitchMode  GET,
      hitless GET;
    NOTIFICATIONS
      "Recommendation G.774.03":protectionSwitchReportingR1
      radioProtectionStatusParameter;;;
  CONDITIONAL PACKAGES
    "Recommendation G.774.03":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 {g774-80objectClass 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":**protectionUnit**;

CHARACTERIZED BY

sdhRadioProtectionUnitPkg PACKAGE

BEHAVIOUR **sdhRadioProtectionUnitBeh** ;

ATTRIBUTES

"Recommendation G.774.03":**channelNumber** GET,

radioProtectionStatus GET,

"Recommendation G.774.03":**reliableResourcePointer** PERMITTED VALUES

SDHRadioProtASN1.SDHRadioResourcePointer,

"Recommendation G.774.03":**unreliableResourcePointer** PERMITTED VALUES

SDHRadioProtASN1.SDHRadioResourcePointer ;;;

CONDITIONAL PACKAGES

"Recommendation G.774.03":**extraTrafficControlPkg** PRESENT IF " extra traffic may be suspended and resumed " ,

privilegedChannelPkg

PRESENT IF "an instance supports it and the instance is protecting";

REGISTERED AS {g774-80objectClass 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 **unreliableResource** (termination point) and a **reliableResource** (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 clause 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":msCTPBidirectional,
                    msTcCTPSource,
                    msTcCTPSink ;
    CHARACTERIZED BY
        msTcCTPBidirectionalPkg PACKAGE
        BEHAVIOUR msTcCTPBidirectionalBeh ;;;
REGISTERED AS {g774-80objectClass 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": msCTPSink ;
    CHARACTERIZED BY
        "Recommendation M.3100": crossConnectionPointerPackage,
        msTcCTPSinkPkg PACKAGE
        BEHAVIOUR msTcCTPSinkBeh ;;;
REGISTERED AS {g774-80objectClass 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 **msTcCTTP** 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": msCTPSource ;
  CHARACTERIZED BY
    "Recommendation M.3100": crossConnectionPointerPackage,
    msTcCTPSourcePkg  PACKAGE
    BEHAVIOUR msTcCTPSourceBeh ;;;
REGISTERED AS {g774-80objectClass 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": msTTPBidirectional,
                  msTcTTPSource,
                  msTcTTPSink ;
  CHARACTERIZED BY
    msTcTTPBidirectionalPkg  PACKAGE
    BEHAVIOUR msTcTTPBidirectionalBeh ;;;
REGISTERED AS {g774-80objectClass 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": msTTPSink ;
CHARACTERIZED BY
"Recommendation M.3100": crossConnectionPointerPackage,
 msTcTTPSinkPkg **PACKAGE**
 BEHAVIOUR msTcTTPSinkBeh ;;;
REGISTERED AS {g774-80objectClass 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": msTTPSource ;
CHARACTERIZED BY
"Recommendation M.3100": crossConnectionPointerPackage,
 msTcTTPSourcePkg **PACKAGE**
 BEHAVIOUR msTcTTPSourceBeh ;;;
REGISTERED AS {g774-80objectClass 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 clause 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": au4CTPBidirectionalR1,
                    au4HopcCTPSource,
                    au4HopcCTPSink ;
    CHARACTERIZED BY
        au4HopcCTPBidirectionalPkg PACKAGE
        BEHAVIOUR au4HopcCTPBidirectionalBeh ;;;
REGISTERED AS {g774-80objectClass 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": au4CTPSinkR1 ;
    CHARACTERIZED BY
        "Recommendation M.3100" : crossConnectionPointerPackage,
        au4HopcCTPSinkPkg PACKAGE
        BEHAVIOUR au4HopcCTPSinkBeh ;;;
REGISTERED AS {g774-80objectClass 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": au4CTPSource ;
    CHARACTERIZED BY
    "Recommendation M.3100": crossConnectionPointerPackage,
    au4HopcCTPSourcePkg PACKAGE
    BEHAVIOUR au4HopcCTPSourceBeh ;;;
REGISTERED AS {g774-80objectClass 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": vc4TTPBidirectionalR1,
                    vc4HopcTTPSource,
                    vc4HopcTTPSink ;
    CHARACTERIZED BY
    vc4HopcTTPBidirectionalPkg PACKAGE
    BEHAVIOUR vc4HopcTTPBidirectionalBeh ;;;
REGISTERED AS {g774-80objectClass 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": **vc4TTPSinkR1** ;
CHARACTERIZED BY
"Recommendation M.3100": **crossConnectionPointerPackage**,
vc4HopcTTPSinkPkg **PACKAGE**
 BEHAVIOUR **vc4HopcTTPSinkBeh** ;;;
REGISTERED AS {g774-80objectClass 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": **vc4TTPSourceR1** ;
CHARACTERIZED BY
"Recommendation M.3100": **crossConnectionPointerPackage**,
vc4HopcTTPSourcePkg **PACKAGE**
 BEHAVIOUR **vc4HopcTTPSourceBeh** ;;;
REGISTERED AS {g774-80objectClass 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":
    connectionTerminationPointBidirectional,
    radioUnprotectedCTPSource,
    radioUnprotectedCTPSink;
  CHARACTERIZED BY
    radioUnprotectedCTPBidirectionalPkg PACKAGE
  BEHAVIOUR radioUnprotectedCTPBidirectionalBeh;;;
REGISTERED AS {g774-80objectClass 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":connectionTerminationPointSink;
  CHARACTERIZED BY
    "Recommendation M.3100":crossConnectionPointerPackage,
    radioUnprotectedCTPSinkPkg PACKAGE
  BEHAVIOUR radioUnprotectedCTPSinkBeh;
  ATTRIBUTES
    radioUnprotectedCTPId GET;;;
REGISTERED AS {g774-80objectClass 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":connectionTerminationPointSink;
  CHARACTERIZED BY
    "Recommendation M.3100":crossConnectionPointerPackage,
    radioUnprotectedCTPSourcePkg PACKAGE
  BEHAVIOUR radioUnprotectedCTPSourceBeh;
  ATTRIBUTES
    radioUnprotectedCTPId GET;;;
REGISTERED AS {g774-80objectClass 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":trailTerminationPointBidirectional,
radioProtectedTTPSource,
radioProtectedTTPSink;

CHARACTERIZED BY

radioProtectedTTPBidirectionalPkg PACKAGE

BEHAVIOUR radioProtectedTTPBidirectionalBeh;;;

REGISTERED AS {g774-80objectClass 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":trailTerminationPointSink;

CHARACTERIZED BY

"Recommendation M.3100":crossConnectionPointerPackage,

radioProtectedTTPSinkPkg PACKAGE

BEHAVIOUR radioProtectedTTPSinkBeh;

ATTRIBUTES

radioProtectedTTPId GET;;;

REGISTERED AS {g774-80objectClass 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":trailTerminationPointSource;

CHARACTERIZED BY

"Recommendation M.3100":crossConnectionPointerPackage,

radioProtectedTTPSourcePkg PACKAGE

BEHAVIOUR radioProtectedTTPSourceBeh;

ATTRIBUTES

radioProtectedTTPId GET;;;

REGISTERED AS {g774-80objectClass 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 SDHRRadioProtASN1.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 SDHRRadioProtASN1.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 SDHRRadioProtASN1.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 radioProtectedTTPIId

```
radioProtectedTTPIId ATTRIBUTE
  WITH ATTRIBUTE SYNTAX SDHRadioProtASN1.NameType;
  MATCHES FOR EQUALITY;
  BEHAVIOUR
    radioProtectedTTPIIdBehaviour 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 SDHRadioProtASN1.InvokeRadioExerciseArg ;
  WITH REPLY SYNTAX SDHRadioProtASN1.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":augSink AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS msTcTTPSink AND SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774":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":augSource AND SUBCLASSES;
NAMED BY
SUPERIOR OBJECT CLASS msTcTTPSource AND SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774": 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":rsTTPSink AND
SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774": 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": rsTTPSource AND
SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774": 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":sdhNE;
WITH ATTRIBUTE "Recommendation G.774": 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":sdhNE;
WITH ATTRIBUTE "Recommendation G.774":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":sdhNE;
WITH ATTRIBUTE "Recommendation G.774": 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":sdhNE;
WITH ATTRIBUTE "Recommendation G.774": 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":augSink AND
SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774": 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":augSource AND
SUBCLASSES;
WITH ATTRIBUTE "Recommendation G.774": au4CTPId ;
BEHAVIOUR au4HopcCTPSource-augSourceBeh;

REGISTERED AS {g774-8NameBinding 14 } ;

au4HopcCTPSrcSource-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)}

NameType

FROM

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

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 ( WITH COMPONENTS { ...,
objectInstances (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.

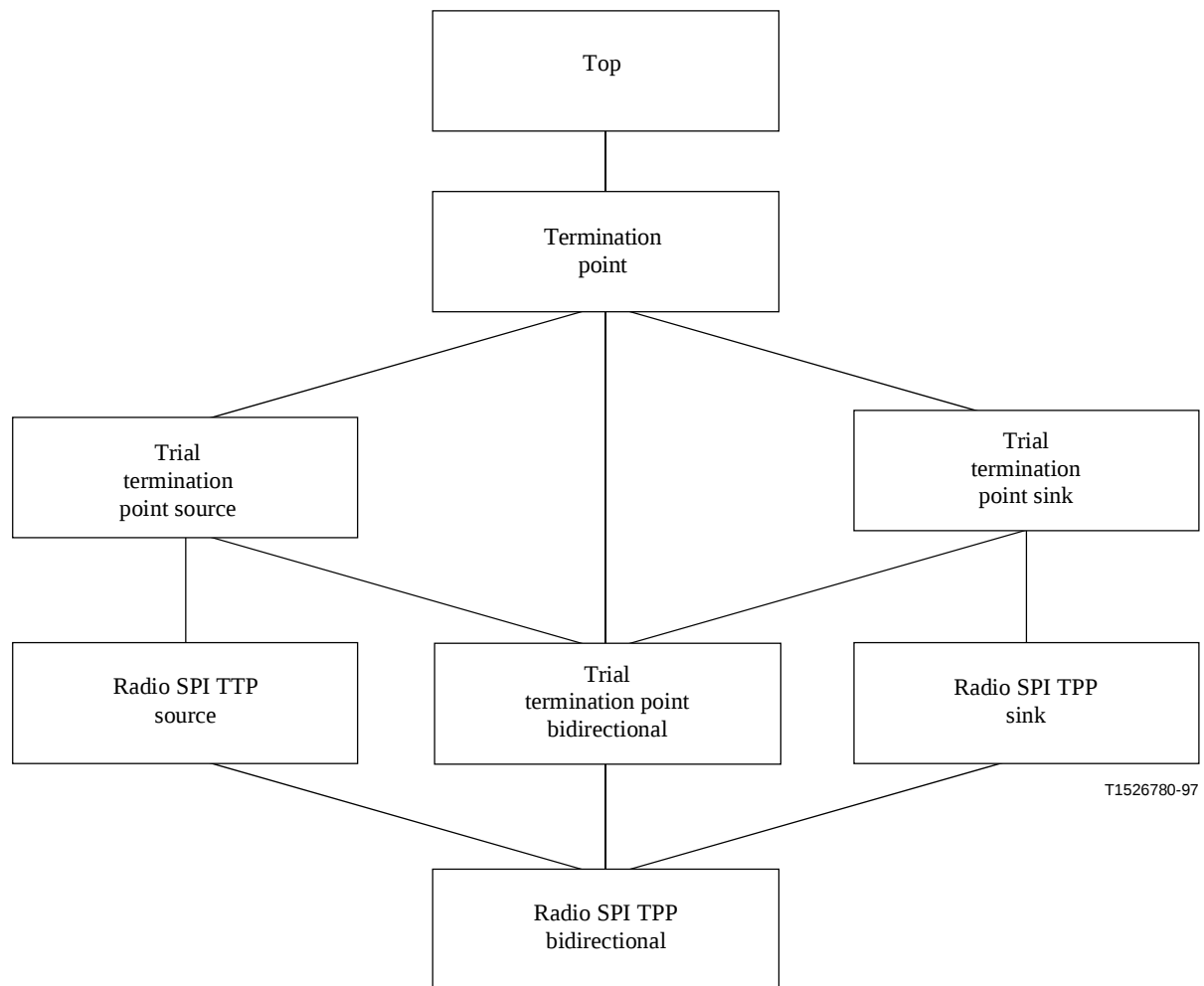


Figure I.1/G.774.8 – Radio fragment objects inheritance

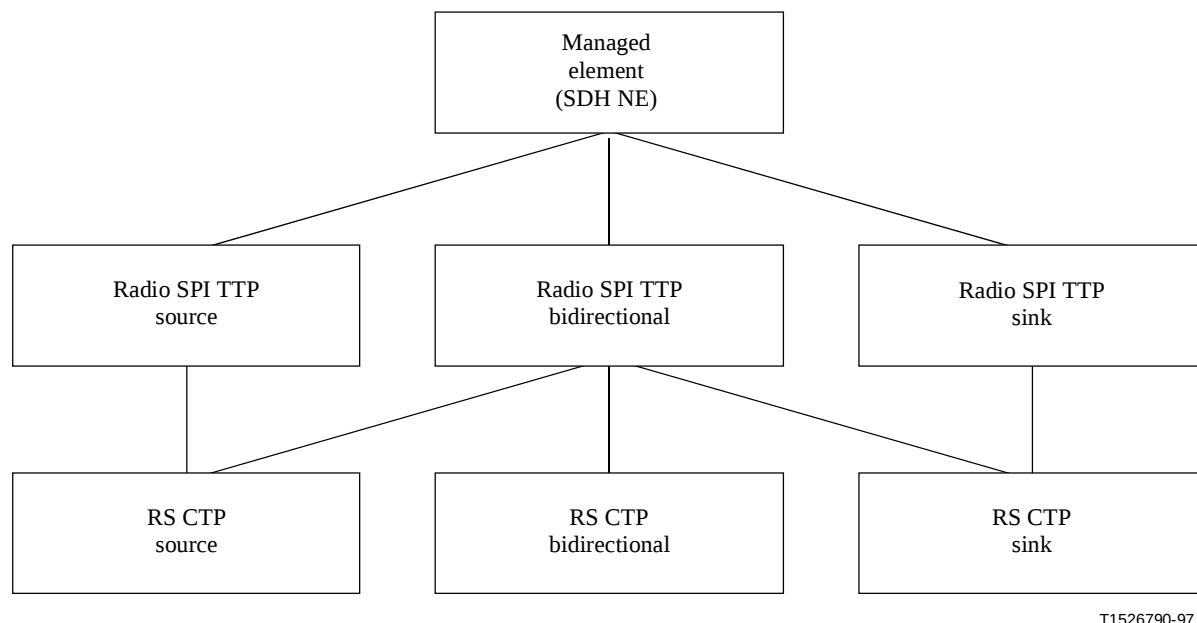
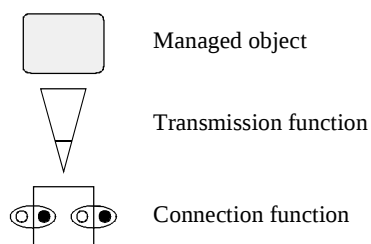
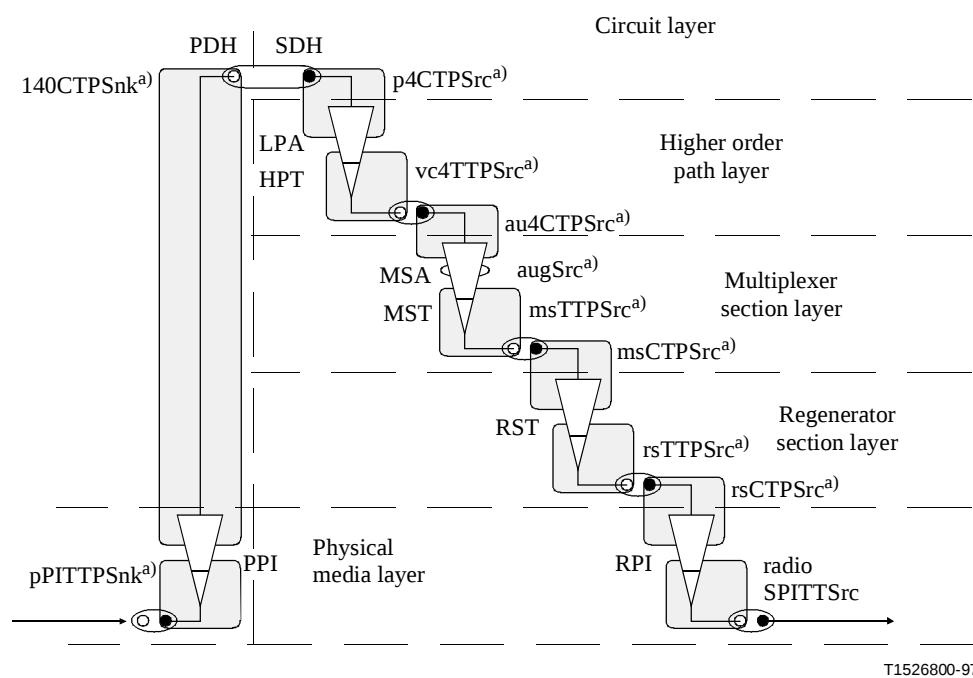
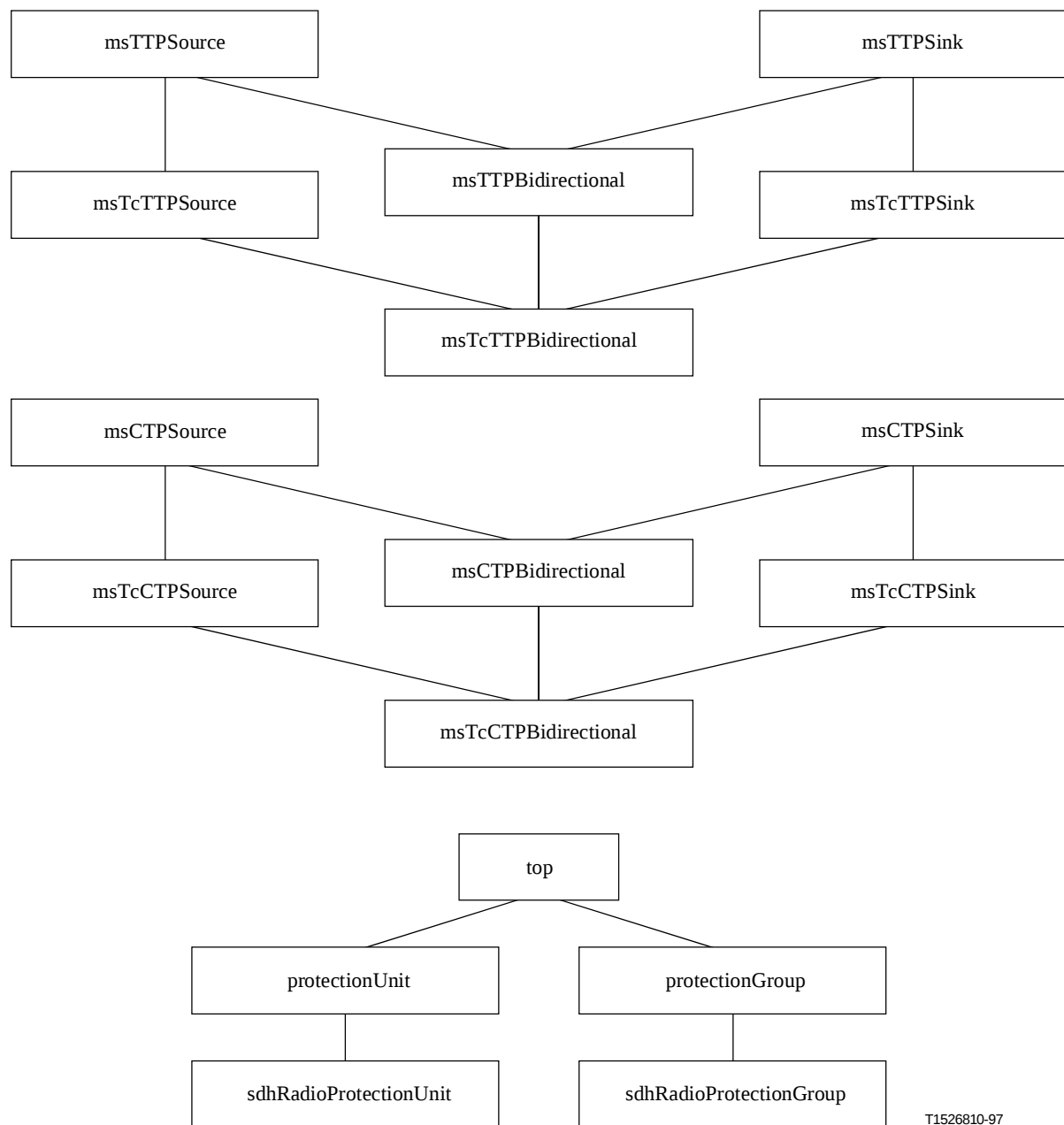


Figure I.2/G.774.8 – Radio fragment objects naming



^{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

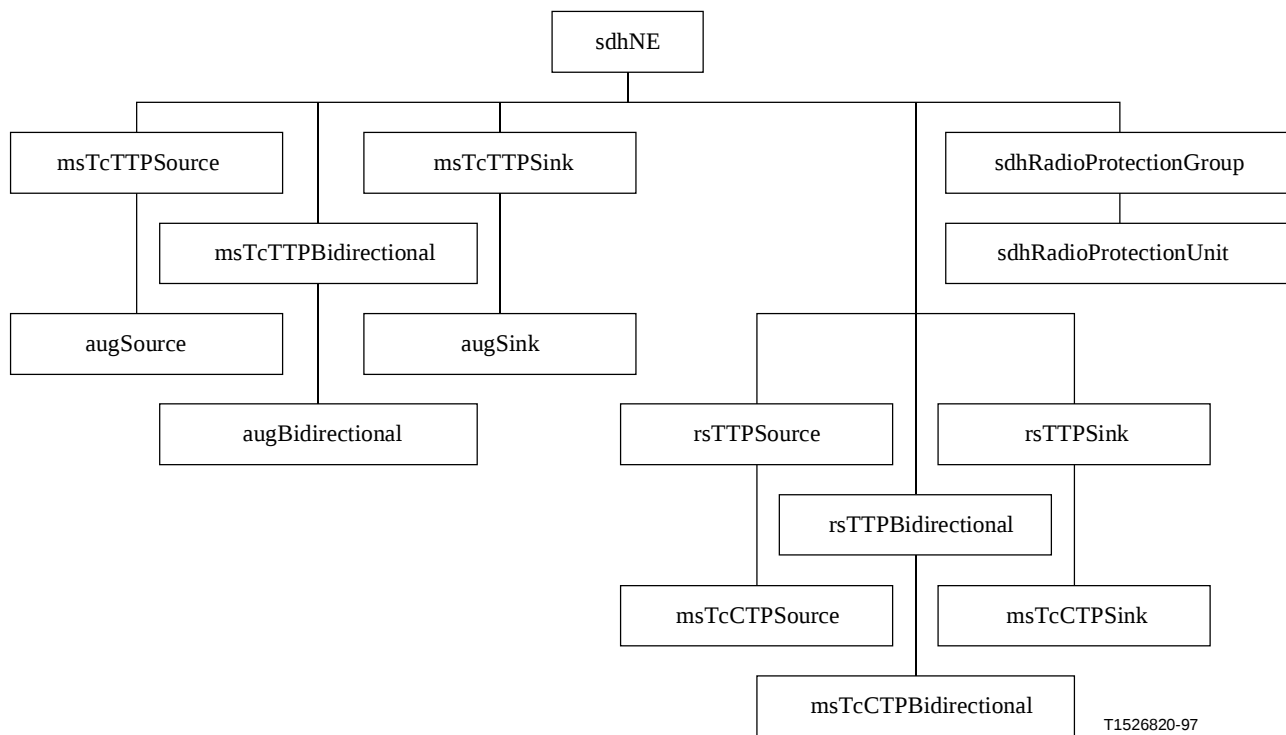


Figure I.5/G.774.8 – SDH radio protection naming diagram

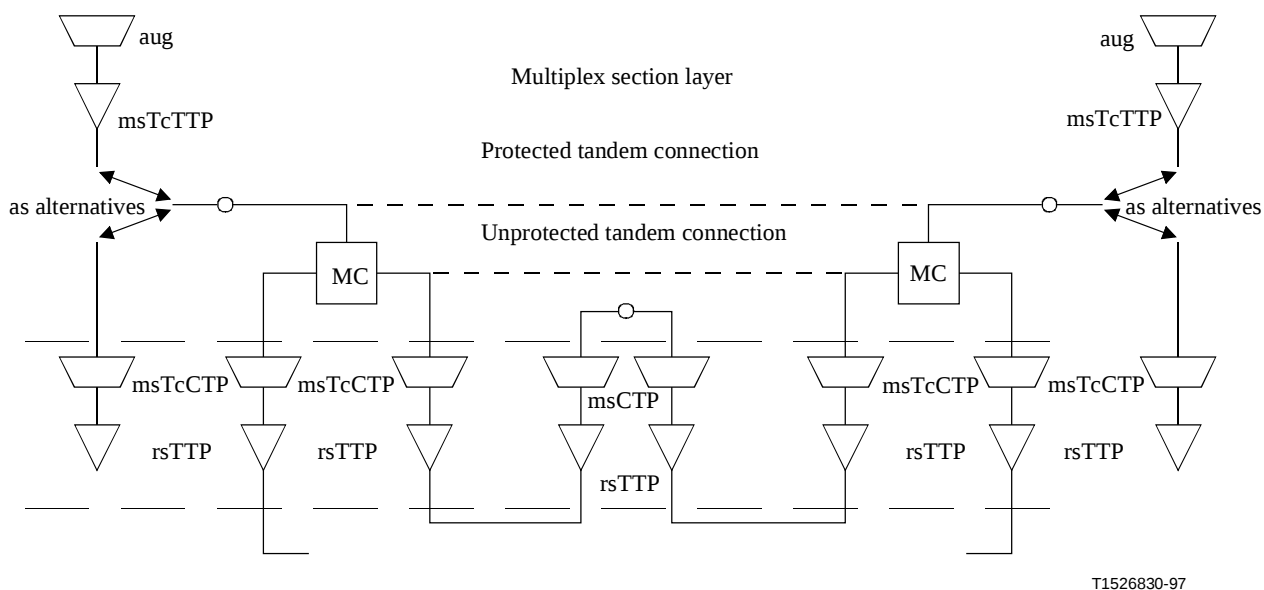
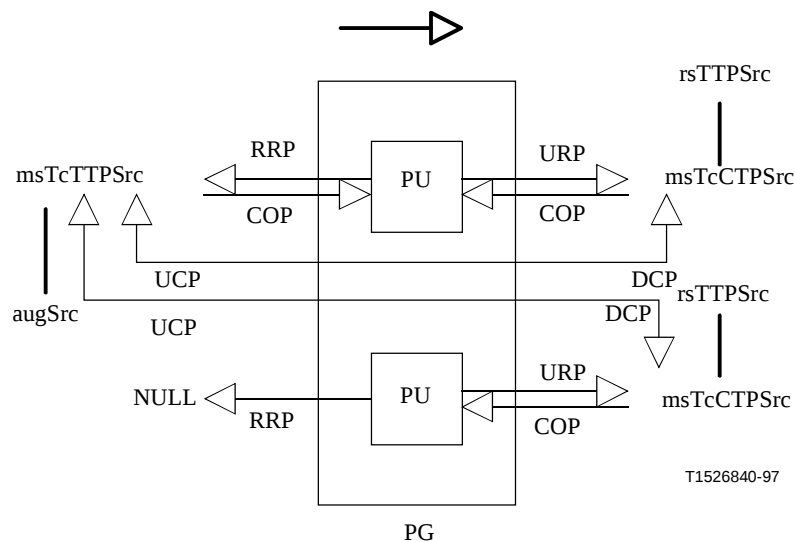


Figure I.6/G.774.8 – RPS applications for MS-tandem connection protection



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/Downstream Connectivity Pointer

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

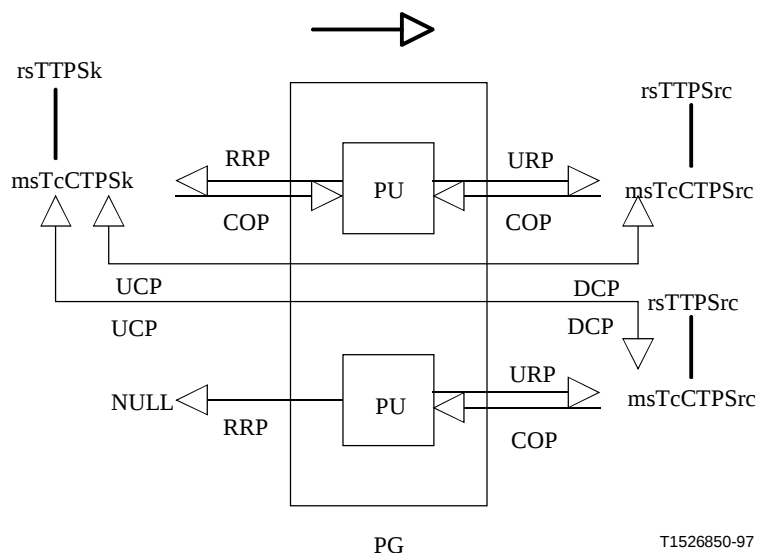


Figure I.8/G.774.8 – Example: Radio section = tandem connection of regenerator sections 1 + 1 protection – source side

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