



The ATM Forum
Technical Committee

Loop Detection Version 1.0

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Sirak Bahlbi
Andrew Dolganow
Bob Epley
Shawn McAllister
Gert Oster
Ethan Mickey Spiegel

This specification uses three levels for indicating the degree of compliance necessary for specific functions, procedures or coding. They are indicated by the use of key words as follows:

- **Requirement:** "Shall" indicates a required function, procedure or coding necessary for compliance. The word "shall" used in text indicates a conditional requirement when the operation described is dependent on whether or not an objective or option is chosen.
- **Objective:** "Should" indicates an objective which is not required for compliance, but which is considered desirable.
- **Option:** "May" indicates an optional operation without implying a desirability of one operation over another. That is, it identifies an operation that is allowed while still maintaining compliance.

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1. Introduction

1.1. Overview

[Informative]

To provide inter-network SVC or SPVC service, interconnecting ATM Service Providers (ASPs) may use PNNI, AINI or B-ISUP for inter-network SVC signalling. When AINI or B-ISUP is used, route provisioning is manual. In this case, routing loops may occur for the following reasons:

- Provisioning errors.
- When networks are interconnected and rely on one another for alternate routing, and multiple switch or interface failures occur.

In either case, such loops can rapidly consume switch resources, seriously crippling at least a portion of each switch involved in the routing loop. This specification describes a mechanism that can be used to limit the amount of (networking) resources that are consumed due to the presence of loops. This is achieved by using a Remaining Hop Count (RHC). A Remaining Hop Count is an imprecise but simple mechanism that has been used in narrow-band ISUP and in IP's Time To Live (TTL) field for this purpose. A similar counter, called "hop counter", has also been defined for B-ISUP. This document defines such a count.

The Remaining Hop Count is decremented each time an AINI is traversed. The Remaining Hop Count is not decremented when a PNNI is traversed, since PNNI uses source routing to prevent loops, but the count is carried unaltered across the PNNI for use at subsequent AINIs.

If the Remaining Hop Count reaches zero, it is assumed that a loop has occurred and the call/connection is released.

1.2. Scope

[Normative]

This document is an optional addendum to PNNI 1.1 and AINI [3]. This document contains the signalling specification for the support of the Remaining Hop Count (RHC).

A device supporting the Remaining Hop Count shall implement these procedures for point-to-point calls/connections, and shall implement these procedures for point-to-multipoint calls/connections if point-to-multipoint calls/connections are supported. A device shall support the Remaining Hop Count for all supported connection types (SVCCs, SPVCCs, SVPCs, or SPVPCs).

1.2.1. Applicability to PNNI 1.0

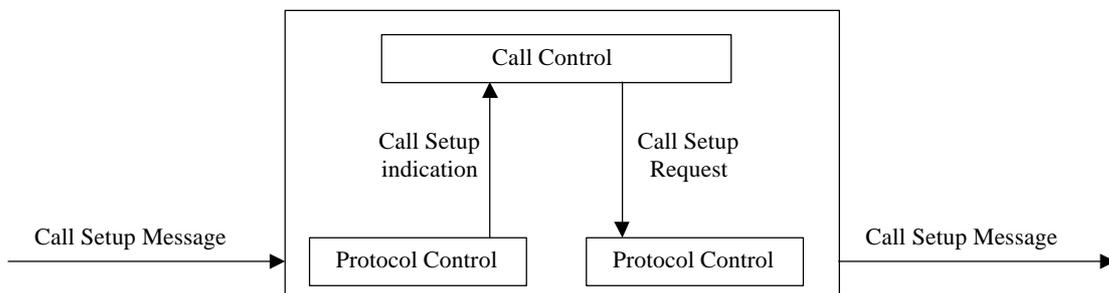
A device supporting PNNI 1.0 [1] may implement functionality defined in this addendum by treating this addendum as if it were an optional addendum to PNNI 1.0 [1], and PNNI 1.0 Errata and PICS [2].

1.3. Terminology

[Normative]

The term *call setup message* is used in this section to refer to a SETUP or ADD PARTY message. Similarly, *call setup indication* and *call setup request* refer to primitives related to these messages, as shown in Figure 1.:

- The reception of a signalling message over an interface triggers the sending of a corresponding “indication” primitive to the call control entity.
- The reception of a “request” primitive from the call control entity triggers the sending of the corresponding signalling message over the interface.



Figure(1) Messages and Primitives

In this document the term hop refers to traversing an AINI. Traversing a PNNI is not considered to be a hop.

1.4. References

- [1] ATM Forum Technical Committee, *Private Network-Network Interface Specification Version 1.0*, af-pnni-0055.000, March 1996.
- [2] ATM Forum Technical Committee, *PNNI v1.0 Errata and PICS*, af-pnni-0081.000, May 1997.
- [3] ATM Forum Technical Committee, *ATM Inter Network Interface (AINI) Specification*, af-cs-0125.000, July 1999.
- [4] ITU-T Recommendation Q.2610 (1999) B-ISDN Usage of Cause and Location in B-ISDN User Part and DSS2
- [5] ATM Forum Technical Committee, *Private Network-Network Interface Specification Version 1.1*, af-pnni-0055.002, March 2002.

2. Information Element Coding

[Normative]

2.1. Remaining hop count

The purpose of the Remaining hop count information element is to limit the amount of (networking) resources that are consumed due to the presence of loops..

8	7	6	5	4	3	2	1	Octet
Remaining hop count information element identifier								
1	1	1	1	0	1	1	0	1
1 ext	Coding standard	IE Instruction Field						2
Length of Remaining hop count contents								3
Length of Remaining hop count contents (continued)								4
Remaining Hop Count value								5

Figure 2-1 – Remaining hop count Information Element

Coding standard (octet 2)

Bits		Meaning
7	6	
1	1	ATM Forum specific

Remaining Hop Count value (octet 5)

The Remaining Hop Count value is coded as an 8-bit binary integer, with bit 8 being the most significant bit and bit 1 being the least significant bit. The range of the Remaining Hop Count value is 1-255.

2.2. Extension to Cause information element

Cause #25, “Exchange - routing error” is supported with coding standard of “00” ITU standardized (see ITU-T Rec. Q.850 May 1998).

This cause indicates that the destination indicated by the user cannot be reached, because the call or party has been rejected due to reaching a limit in executing the Remaining Hop Count procedures.

3. PNNI Support for the Loop Detection Feature

[Normative]

3.1. Additions to PNNI Signalling Messages

3.1.1. SETUP

Figure 6-8/PNNI SETUP Message Contents is augmented with the following:

Information Element	Reference	Type	Length
Remaining hop count	2.1	O	5

Figure 3-1 - Additional SETUP Message Contents

3.1.2. ADD PARTY

Figure 6-19/PNNI ADD PARTY Message Contents is augmented with the following:

Information Element	Reference	Type	Length
Remaining hop count	2.1	O	5

Figure 3-2 - Additional ADD PARTY Message Contents

3.2. Signalling procedures at PNNI interfaces

The Remaining hop count information element is transported unaltered through a PNNI network. In particular,

- when the preceding side of a PNNI interface receives a Remaining hop count information element in a call setup request, the Remaining hop count information element shall be forwarded unmodified in the outgoing call setup message.
- When the succeeding side of a PNNI interface receives a Remaining hop count information element in a call setup message, the Remaining hop count information element shall be forwarded unmodified in the call setup indication.
- When a RELEASE, RELEASE COMPLETE or ADD PARTY REJECT message containing a Crankback information element is received over the preceding side of a PNNI interface, and alternate routing is attempted, and a new outgoing call setup message is to be sent, and the original outgoing call setup message contained a Remaining hop count information element, the new outgoing call setup message shall include the Remaining hop count information element as included in the original outgoing call setup message.

4. Loop Detection Feature for AINI

[Normative]

4.1. Additions to AINI Signalling Messages

Section 3.1 shall apply.

4.2. Procedures for Remaining Hop Count

When a call setup request without a Remaining hop count information element is received at the preceding side of an AINI interface,

- If Remaining Hop Count generation is turned on, the Remaining hop count information element shall be placed in the call setup message and the Remaining Hop Count in the information element shall be set to the maximum value provisioned for that switch. The default maximum value of the Remaining Hop Count shall be 50.

When a call setup request with a Remaining hop count information element is received at the preceding side of an AINI interface,

- The received Remaining hop count information element shall be placed in the outgoing call setup message unmodified.

When a call setup message with a Remaining hop count information element is received at the succeeding side of an AINI interface,

- If the received Remaining Hop Count value is greater than the node's maximum Remaining Hop Count value, then the Remaining Hop Count value in the Remaining hop count information element may be set to the node's maximum.
- Otherwise, the Remaining Hop Count value in the information element shall be decremented by one.
 - If the Remaining Hop Count value is greater than zero, the resulting Remaining hop count information element shall be placed in the call setup indication.
 - If the Remaining Hop Count value is equal to zero, the following procedures shall apply
 - The call setup shall be rejected by sending a RELEASE, RELEASE COMPLETE or ADD PARTY REJECT message with Cause #25, "Exchange - routing error".
 - The node shall notify the management system of the exchange routing error and provide the following information.

an indication that the Remaining Hop Count has been decremented to 0
the called party number
the identity of the interface where the call setup message was received
the calling party number, if available
the NCCI, if available.

When a RELEASE, RELEASE COMPLETE or ADD PARTY REJECT message with Cause #25, "Exchange - routing error" is received, the node should notify the management system of the exchange routing error and provide the following information.

an indication that the Remaining Hop Count has been decremented to 0
the called party number
the identity of the interface where the call clearing message was received
the calling party number, if available
the NCCI, if available.
the Remaining Hop Count value included in the outgoing setup message

When a RELEASE, RELEASE COMPLETE or ADD PARTY REJECT message containing a Crankback information element is received, and alternate routing is attempted, and a new outgoing call setup message is to be sent, and the original outgoing call setup message contained a Remaining hop count information element, the new outgoing call setup message shall include the Remaining hop count information element as included in the original outgoing call setup message.

When an add party indication is mapped into a setup request, if there was a Remaining hop count information element present in the add party indication then this Remaining hop count information element modified as per the Remaining Hop Count procedures above shall be included in the setup request.

5. Compatibility with Nodes Not Supporting This Feature

[Normative]

The node creating the Remaining hop count information element shall set the IE instruction flag field (bit 5 of octet 2) to “follow explicit instruction” and the pass along request field (bit 4 of octet 2) to “pass along request.” This will ensure that the Remaining hop count information element is passed unmodified through non-supporting nodes.

A node not supporting the Remaining Hop Count feature may receive a RELEASE, RELEASE COMPLETE or ADD PARTY REJECT message with Cause #25, “Exchange - routing error”. Since this will be an unrecognized Cause code the procedures of 5.6.7.2/Q.2931 will apply (e.g., in the case of a RELEASE message with an unrecognized cause value, the RELEASE COMPLETE message sent in response shall contain Cause #100, “Invalid information element contents”, and clearing towards the calling party will be with Cause #31, “Normal, unspecified”).

In this case, upstream nodes involved in the routing loop will not receive Cause #25 "Exchange - routing error" and will therefore not notify the management system as described in Section 4.2.

6. Interworking with B-ISUP

[Normative]

The interworking specified below assumes that the appropriate succeeding side processing, whether AINI or BISUP, has already been performed. The Remaining Hop Count value has already been decremented and tested for zero before reaching the AINI-to-BISUP or BISUP-to-AINI interworking function.

The following row is added to the table of AINI/4.1.1.2.1.1:

AINI to B-ISUP	
SETUP	IAM
Remaining Hop Count	Hop Counter (Note 1)

Note 1 - If, the Remaining Hop Count value is greater than the maximum value provisioned for the B-ISUP Hop Counter, then that maximum value shall be placed in the Hop Counter parameter of the outgoing IAM.

Table 6-1 - Additional SETUP to IAM mapping

The following row is added to the table of AINI/4.1.1.2.1.2:

B-ISUP to AINI	
IAM	SETUP
Hop Counter	Remaining Hop Count

Note 1 - If the Hop Counter value is greater than the maximum value provisioned for the AINI Remaining Hop Count, then that maximum value shall be placed in the Remaining Hop Count value field in the Remaining hop count information element of the outgoing SETUP message.

Table 6-2 - Additional IAM to SETUP mapping

The following row is added to the table of AINI/4.1.4.2.1.2:

AINI to B-ISUP	
ADD PARTY	IAM
Remaining Hop Count	Hop Counter (Note 1)

Note 1 - If the Remaining Hop Count value is greater than the maximum value provisioned for the BISUP Hop Counter, then that maximum value shall be placed in the Hop Counter parameter of the outgoing IAM.

Table 6-3 - Additional ADD PARTY to IAM mapping

The following row is added to the table of AINI/4.1.4.3.1.2:

B-ISUP to AINI	
IAM	ADD PARTY
Hop Counter	Remaining Hop Count

Note 1 - If the Hop Counter value is greater than the maximum value provisioned for the AINI Remaining Hop Count, then that maximum value shall be placed in the Remaining Hop Count value field in the Remaining hop count information element of the outgoing ADD PARTY message.

Table 6-4 - Additional IAM to ADD PARTY mapping

Annex A. – Protocol Implementation Conformance Statement (PICS) for Loop Detection at the AINI

A.1 Introduction

To evaluate conformance of a particular implementation, it is necessary to have a statement of which capabilities and options have been implemented. Such a statement is called a Protocol Implementation Conformance Statement (PICS).

A.1.1 Scope

This document provides the PICS proforma for Loop Detection v1.0 at the AINI, as specified in this document in compliance with the relevant requirements, and in accordance with the relevant guidelines, given in ISO/IEC 9646-2 [2]. In most cases, statements contained in notes in the specification, which were intended as information, are not included in the PICS.

A.1.2 Normative References

- [1] ISO/IEC 9646-1: 1994, Information technology – Open systems interconnection – Conformance testing methodology and framework – Part 1: General Concepts (See also ITU Recommendation X.290 (1995)).
- [2] ISO/IEC 9646-2:1994, Information technology – Open systems interconnection – Conformance testing methodology and interconnection – Part 2: Abstract test suite specification (See also ITU telecommunication X.291 (1995)).

A.1.3 Definitions

The following terms defined in ISO/IEC 9646-1[1] are used in this document:

- A Protocol Implementation Conformance Statement (PICS) is a statement made by the supplier of an implementation or system, stating which capabilities have been implemented for a given protocol.
- A PICS proforma is a document, in the form of a questionnaire, designed by the protocol specifier or conformance test suite specifier, which when completed for an implementation or system becomes the PICS.

In addition the following terms are used:

- call setup message is used to refer to a SETUP or ADD PARTY message
- call setup request is used to refer to a setup request or an add party request
- call setup indication is used to refer to a setup indication or an add party indication

A.1.4 Acronyms

- I.E. Information Element
- IUT Implementation under test
- M Mandatory requirements (these are to be observed in all cases)
- N/A Not supported, not applicable, or the conditions for status are not met.
- O Optional (may be selected to suit the implementation, provided that any requirements applicable to the options are observed)

- O.n Optional, but support is required for either at least one or only one of the options in the group labelled with the same numeral "n".
- PICS Protocol Implementation Conformance Statement
- SUT System under test

A.1.5 Conformance

The supplier of a protocol implementation which is claimed to conform to the ATM Forum Loop Detection v1.0 specification at the AINI is required to complete a copy of the PICS proforma provided in this document and is required to provide the information necessary to identify both the supplier and the implementation.

A.2 Identification of the Implementation

Implementation Under Test (IUT) Identification

IUT Name: _____

IUT Version: _____

System Under Test (SUT) Identification

SUT Name: _____

Hardware Configuration: _____

Operating System: _____

Product Supplier

Name: _____

Address: _____

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

Client

Name: _____

Address:

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

PICS Contact Person

Name: _____

Address: _____

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

PICS/System Conformance Statement

Provide the relationship of the PICS with the System Conformance Statement for the system:

Identification of the protocol

This PICS proforma applies to the following:

- [1] Loop Detection, af-cs-0176.000, ATM Forum Technical Committee, 2002.

A.3 PICS Proforma

A.3.1 Global statement of conformance

The implementation described in this PICS meets all of the mandatory requirements of the reference protocol.

YES

NO

Note: Answering "No" indicates non-conformance to the specified protocol. Non-supported mandatory capabilities are to be identified in the following tables, with an explanation by the implementor explaining why the implementation is non-conforming.

A.3.2 Instructions for Completing the PICS Proforma

The PICS Proforma is a fixed-format questionnaire. Answers to the questionnaire should be provided in the rightmost columns, either by simply indicating a restricted choice (such as Yes or No), or by entering a value or a set of range of values.

A supplier may also provide additional information, categorized as exceptional or supplementary information. These additional information should be provided as items labeled X.<i> for exceptional

information, or S.<i> for supplemental information, respectively, for cross reference purposes, where <i> is any unambiguous identification for the item. The exception and supplementary information are not mandatory and the PICS is complete without such information. The presence of optional supplementary or exception information should not affect test execution, and will in no way affect interoperability verification. The column labeled 'Reference' gives a pointer to sections of the protocol specification for which the PICS Proforma is being written.

A.4 Roles

Item Number	Item Description	Status	Condition for Status	Reference	Support
AROLE1	Does the IUT support loop detection over AINI?	M		1.2	Yes____ No____
AROLE2	Does the IUT support loop detection for SVCCs?	M		1.2	Yes____ No____
AROLE3	Does the IUT support loop detection for SVPCs?	M (Note 1)		1.2	Yes____ No____
AROLE4	Does the IUT support loop detection for SPVCCs?	M		1.2	Yes____ No____
AROLE5	Does the IUT support loop detection for point to multipoint connections?	M (Note 2)		1.2	Yes__ No__
AROLE6	Does the IUT support loop detection for SPVPCs?	M		1.2	Yes____ No____
Comments Note1: If SVPCs are supported at the AINI Note2: If point to multipoint connection is supported.					

A.5 Information Elements

Item Number	Item Description	Status	Conditions for status	Reference	Support
ASIG1	Does the IUT support the Remaining hop count information element in the SETUP message?	M		4.1, 2.1	Yes____ No____
ASIG2	Does the IUT support the Remaining hop count information element in the ADD PARTY message?	M	AROLE5	4.1, 2.1	Yes____ No____
ASIG3	Does the IUT support Cause #25 in the Cause information element?	M		2.2	Yes____ No____
Comments:					

A.6 Procedures

Item Number	Item Description	Status	Conditions for status	Reference	Support
APROC6	If the IUT receives a call setup request without a Remaining hop count information element at the preceding side of an AINI interface, and if Remaining Hop Count generation is enabled, will the IUT place a Remaining hop count information element with the Remaining Hop Count value set to the initial value provisioned for that switch or defaulted to 50, if the initial value has not been provisioned, into the outgoing call setup message?	M		4.2	Yes____ No____
APROC7	If the IUT receives a call setup request with a Remaining hop count information element at the preceding side of an AINI interface, will the IUT place the Remaining hop count information element in the outgoing call setup message unmodified?	M		4.2	Yes____ No____
APROC8	If the IUT receives a call setup message with a Remaining hop count information element at the succeeding side of an AINI interface, ...			4.2	
APROC8.1	if the received Remaining Hop Count value is greater than the node's maximum value, will the IUT set the Remaining Hop Count value in the Remaining hop count information element to the node's maximum value?	O		4.2	Yes____ No____
APROC8.2	will the IUT decrement the Remaining Hop Count value by one and, if it is not equal to zero, place the resulting Remaining hop count information element in the call setup indication?	M		4.2	Yes____ No____
APROC9	When the IUT decrements the Remaining Hop Count value to zero, ...			4.2	
APROC9.1	will the IUT terminate the call setup message by sending a RELEASE, RELEASE COMPLETE (which ever applies) or ADD PARTY REJECT message with Cause #25?	M		4.2	Yes____ No____
APROC9.2	will the IUT notify the management system of the exchange routing error and provide the following: an indication that the Remaining Hop Count value has been decremented to 0, the called party number, the identity of the preceding interface, the calling party number (if available), and the NCCI (if available)?	M		4.2	Yes____ No____
APROC10	On receiving a RELEASE, RELEASE COMPLETE, or ADD PARTY REJECT message containing a Crankback information element, if the IUT performs alternate routing, and a new outgoing call setup message is to be	M		4.2	Yes____ No____

	sent, and a Remaining hop count information element was included in the original outgoing call setup message, will the IUT include in the new outgoing call setup message the Remaining hop count information element as included in the original outgoing call setup message?				
APROC10	On receiving a RELEASE, RELEASE COMPLETE or ADD PARTY REJECT message with Cause #25, will the IUT notify the management system of the exchange routing error and provide the following: an indication that the Remaining Hop Count value has been decremented to 0, the called party number, the identity of the preceding interface, the calling party number (if available), the NCCI (if available), and the Remaining Hop Count value included in the outgoing setup message?	O		4.2	Yes____ No____
APROC11	When the IUT maps an add party request containing a Remaining hop count information element to a SETUP message, will the IUT include this Remaining hop count information element modified as per the Remaining Hop Count procedures in the setup request?	M		4.2	Yes____ No____
APROC12	When the IUT creates a Remaining hop count information element, does it set the IE instruction flag field to “follow explicit instruction” and the pass along request field to “pass along request”?	M		5	Yes____ No____
Comments:					

Annex B. – Protocol Implementation Conformance Statement (PICS) for Loop Detection at the PNNI

B.1 Introduction

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PICS Protocol Implementation Conformance Statement

SUT System under test

B.1.5 Conformance

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Implementation Under Test (IUT) Identification

IUT Name: _____

IUT Version: _____

System Under Test (SUT) Identification

SUT Name: _____

Hardware Configuration: _____

Operating System: _____

Product Supplier

Name: _____

Address: _____

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

Client

Name: _____

Address:

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

PICS Contact Person

Name: _____

Address: _____

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

PICS/System Conformance Statement

Provide the relationship of the PICS with the System Conformance Statement for the system:

Identification of the protocol

This PICS proforma applies to the following:

- [1] Loop Detection, af-cs-0176.000, ATM Forum Technical Committee, 2001.

B.3 PICS Proforma

B.3.1 Global statement of conformance

The implementation described in this PICS meets all of the mandatory requirements of the reference protocol.

[] YES

[] NO

Note: Answering "No" indicates non-conformance to the specified protocol. Non-supported mandatory capabilities are to be identified in the following tables, with an explanation by the implementor explaining why the implementation is non-conforming.

B.3.2 Instructions for Completing the PICS Proforma

The PICS Proforma is a fixed-format questionnaire. Answers to the questionnaire should be provided in the rightmost columns, either by simply indicating a restricted choice (such as Yes or No), or by entering a value or a set of range of values.

A supplier may also provide additional information, categorized as exceptional or supplementary information. These additional information should be provided as items labeled X.<i> for exceptional information, or S.<i> for supplemental information, respectively, for cross reference purposes, where <i> is

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any unambiguous identification for the item. The exception and supplementary information are not mandatory and the PICS is complete without such information. The presence of optional supplementary or exception information should not affect test execution, and will in no way affect interoperability verification. The column labeled 'Reference' gives a pointer to sections of the protocol specification for which the PICS Proforma is being written.

B.4 Roles

Item Number	Item Description	Status	Conditions for Status	Reference	Support
PROLE1	Does the IUT support loop detection over PNNI?	M		1.2	Yes____ No____
PROLE2	Does the IUT support loop detection for SVCCs?	M		1.2	Yes____ No____
PROLE3	Does the IUT support loop detection for SVPCs?	M		1.2	Yes____ No____
PROLE4	Does the IUT support loop detection for SPVCCs?	M		1.2	Yes____ No____
PROLE5	Does the IUT support loop detection for SPVPCs?	M		1.2	Yes____ No____
Comments:					

B.5 Information Elements

Item Number	Item Description	Status	Conditions for Status	Reference	Support
PSIG1	Does the IUT support the Remaining hop count information element in the SETUP message?	M		2.1.1, 2.2.1	Yes____ No____
PSIG2	Does the IUT support the Remaining hop count information element in the ADD PARTY message?	M		2.1.2, 2.2.1	Yes____ No____
PSIG3	Does the IUT support Cause #25 in the Cause information element?	M		2.2.2	Yes____ No____
Comments:					

B.6 Procedures

Item Number	Item Description	Status	Conditions for Status	Reference	Support
PPROC1	When the preceding side of a PNNI interface receives a Remaining hop count information element in a call setup request, does the IUT	M		3.2	Yes____ No____

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	place the Remaining hop count information element it unmodified in the outgoing call setup message?				
PPROC2	When the succeeding side of a PNNI interface receives a Remaining hop count information element in a call setup message, does the IUT place the Remaining hop count information element unmodified in the call setup indication?	M		3.2	Yes____ No____
PPROC10	On receiving a RELEASE, RELEASE COMPLETE, or ADD PARTY REJECT message containing a Crankback information element, if the IUT performs alternate routing, and a new outgoing call setup message is to be sent, and a Remaining hop count information element was included in the original outgoing call setup message, will the IUT include in the new outgoing call setup message the Remaining hop count information element as included in the original outgoing call setup message?	M		3.2	Yes____ No____
Comments:					

Annex C. – Remaining Hop Count MIB

```
HOPCOUNT-MIB DEFINITIONS ::= BEGIN

    IMPORTS
        IfIndex
            FROM IF-MIB
        MODULE-IDENTITY, OBJECT-TYPE, Integer32, enterprises
            FROM SNMPv2-SMI
        TruthValue
            FROM SNMPv2-TC
        MODULE-COMPLIANCE, OBJECT-GROUP
            FROM SNMPv2-CONF;

atmfHopCountMIB MODULE-IDENTITY
    LAST-UPDATED      "200111010000Z"
    ORGANIZATION      "The ATM Forum"
    CONTACT-INFO
        "The ATM Forum
        Presidio of San Francisco
        P.O. Box 29920 (mail)
        572B Ruger Street (surface)
        San Francisco, CA 94129-0920
        Phone:   +1.415.561-6275
        Fax:     +1.415.561-6120
        info@atmforum.com"
    DESCRIPTION
        "The MIB module for managing the ATM Forum
        Loop Detection v1.0 specification."
    REVISION "200111010000Z"
    DESCRIPTION
        "Initial version of the MIB module for managing the ATM Forum
        Loop Detection v1.0."
    ::= { atmHopCount 1 }

-- The object identifier subtree for the ATM Forum Hop Count MIBs

atmForum      OBJECT IDENTIFIER ::= { enterprises 353 }
atmForumNetworkManagement OBJECT IDENTIFIER ::= { atmForum 5 }
atmfSignalling OBJECT IDENTIFIER ::= { atmForumNetworkManagement 9 }
atmfHopCount  OBJECT IDENTIFIER ::= { atmfSignalling 4 } -- to be
assigned

hopCountMIBObjects OBJECT IDENTIFIER ::= { atmfHopCountMIB 1 }
```

```
-- =====
-- Per Switch Hop Count Configuration
-- =====

atmSwHopCountGen OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "Indicates whether a Remaining Hop Count will be generated
        at AINI interfaces on this switch for outgoing
        calls, when not already present and when atmIfHopCountGen
        for that interface is set to true. Both the switch and
        interface settings must be true to cause a Remaining Hop
        Count to be generated.
        "
    REFERENCE
        "ATM Forum Loop Detection v1.0, section 3.2.1"
    DEFVAL { true }
 ::= { hopCountMIBObjects 1 }

atmSwHopCountMax OBJECT-TYPE
    SYNTAX      Integer32 (1..255)
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The Hop Count Maximum is an initial (and maximum)
        value for the Hop Count. It is configurable per
        switch. It is an integer with a value of at least 1
        and at most 255. It defaults to 50.
        "
    REFERENCE
        "ATM Forum Loop Detection v1.0, section 3.2.1"
    DEFVAL { 50 }
 ::= { hopCountMIBObjects 2 }

-- =====
-- Per Interface Hop count Configuration
-- =====

atmIfHopCountGenTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF AtmIfHopCountGenEntry
    MAX-ACCESS   not-accessible
```

```
STATUS          current
DESCRIPTION
    "This table is used to manage the generation of Remaining
    Hop Counts on a per interface basis. One row exists in
    this table for each row in the ifTable with ifType value
    atm(37) or atmLogical(80) that is configured to run the
    AINI signalling protocol."
REFERENCE
    "ATM Forum Loop Detection v1.0"
 ::= { hopCountMIBObjects 3 }
```

```
atmIfHopCountGenEntry OBJECT-TYPE
SYNTAX          AtmIfHopCountGenEntry
MAX-ACCESS     not-accessible
STATUS         current
DESCRIPTION
    "An entry used to manage generation of Remaining Hop Count
    on an AINI."
INDEX { ifIndex }
 ::= { atmIfHopCountGenTable 1 }
```

```
AtmIfHopCountGenEntry ::=
SEQUENCE {
    atmIfHopCountGen          TruthValue
}
```

```
atmIfHopCountGen OBJECT-TYPE
SYNTAX          TruthValue
MAX-ACCESS     read-write
STATUS         current
DESCRIPTION
    "Indicates whether a Remaining Hop
    Count will be generated at this AINI interface
    for outgoing calls when not already present and
    when atmSwHopCountGen is set to true. Both the switch
    and interface settings must be true to cause a Remaining
    Hop Count to be generated.
    "
REFERENCE
    "ATM Forum Loop Detection v1.0, section 3.2.1"
DEFVAL { true }
 ::= { atmIfHopCountGenEntry 1 }
```

-- conformance information

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```
hopCountMIBConformance
    OBJECT IDENTIFIER ::= { atmHopCountMIB 2 }
hopCountMIBCompliances
    OBJECT IDENTIFIER ::= { hopCountMIBConformance 1 }
hopCountMIBGroups
    OBJECT IDENTIFIER ::= { hopCountMIBConformance 2 }

-- compliance statements

hopCountMIBCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The compliance statement for entities which implement
        the Hop Count. All objects are required."

    MODULE -- this module
        MANDATORY-GROUPS {
            hopCountSwGroup,
            hopCountIfGroup
        }

        ::= { hopCountMIBCompliances 1 }

-- units of conformance

hopCountSwGroup OBJECT-GROUP
    OBJECTS {
        atmSwHopCountGen,
        atmSwHopCountMax
    }
    STATUS current
    DESCRIPTION
        "A collection of per switch Hop Count management objects
        required for managing the Hop Count extension in a
        switching system."
    ::= { hopCountMIBGroups 1 }

hopCountIfGroup OBJECT-GROUP
    OBJECTS {
        atmIfHopCountGen
    }
    STATUS current
    DESCRIPTION
        "A collection of per interface Hop Count objects required
```

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```
        for managing the Hop Count extension in a switching  
        system."  
 ::= { hopCountMIBGroups 2 }
```

END