The ATM Forum

Technical Committee

Guaranteed Frame Rate
(GFR) Signalling
Specification (PNNI, AINI,
and UNI), Version 1.0

af-cs-0167.000

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Acknowledgments

Contents

1   Introduction
[Informative]

This addendum to ATM Forum UNI v4.0 "ATM User-Network Interface (UNI) Signalling Specification Version 4.0" [SIG 4.0], to ATM Forum PNNI v1.0 "Private Network-Network Interface Specification Version 1.0" [PNNI 1.0], to ATM Forum "PNNI v1.0 Errata and PICS" [PNNI 1.0 Errata], and to ATM Forum "ATM Inter-Network Interface (AINI) Specifications" [AINI], contains the description and specification of signalling and routing extensions for the support of the Guaranteed Frame Rate for PNNI, AINI and UNI interfaces.

Section 1 contains information about the scope of the Guaranteed Frame Rate service, list of references and a table of acronyms. Section 2 contains the coding requirements for messages and information elements, Section 3 specifies the GFR specific procedures for UNI interfaces, section 4 specifies the GFR specific procedures for PNNI interfaces, while section 5 specifies the GFR specific procedures for AINI interfaces. Annex A contains the PICS Proforma for UNI, Annex B contains the PICS Proforma for PNNI and Annex C contains the PICS Proforma for AINI. Finally Annex D contains the modifications to the PNNI Management Information Base

1.1   Scope
[Normative]

The scope of this specification is to specify signalling and routing for the support of Guaranteed Frame Rate (GFR) SVCCs and SPVCCs across private and public UNI interfaces, across PNNI interfaces, and across AINI interfaces. The support of the GFR ATM service category is an optional capability of UNI v4.0, PNNI v1.0, and of AINI. The GFR capability allows:

- The establishment of Guaranteed Frame Rate point-to-point and point-to-multipoint Switched and Soft Permanent Virtual Channel Connections

- The support for GFR.1 and GFR.2

- The ability for the calling user to omit certain traffic parameters and let the Network default them

- Negotiation of traffic parameters during GFR call/connection establishment

- The modification of the traffic descriptor of an active connection to apply for GFR connections

- The ability to advertise GFR specific resource attributes to allow efficient routing over PNNI networks

1.2   References

[SIG 4.0]   ATM Forum Technical Committee, "User-Network Interface (UNI) Signalling Specification", Version 4.0, af-sig-0061.000, April 1996.

[PNNI 1.0]   ATM Forum Technical Committee, Private Network-Network Interface Specification v1.0, af-pnni-0055.000, March 1996

[PNNI ERR]   ATM Forum Technical Committee, PNNI v1.0 Errata and PICS, af-pnni-0081.000, May 1997

[TM 4.1]   ATM Forum Technical Committee, Traffic Management Specification Version 4.1, af-tm-0121.000, September, 1999

[AINI]   ATM Forum Technical Committee, ATM Inter-Network Interface (AINI) Specification, af-cs-0125.000, July 1999

1.3   Acronyms

ABR	Available Bit Rate
AINI	ATM Inter Network Interface
ASC	ATM Service Category
ATC	ATM Transfer Capability
BBC	Broadband Bearer Capability
BCT	Burst Cell Tolerance
BEI	Best Effort Indicator
CBR	Constant Bit Rate
CDV	Cell Delay Variation
CLP	Cell Loss Priority
CLR	Cell Loss Ratio
CRM	Cell Rate Margin
CTD	Cell Transfer Delay
GCAC	Generic Connection Admission Control
GFR	Guaranteed Frame Rate
IG	Information Group
LGN	Logical Group Node
MBS	Maximum Burst Size
MCR	Minimum Cell Rate
MFS	Maximum Frame Size
MIB	Management Information Base
PCR	Peak Cell Rate
PICS	Protocol Implementation Conformance Statement
PNNI	Private Network-to-Network Interface
PTSE	PNNI Topology State Element
PTSP	PNNI Topology State Packet
QoS	Quality of Service
RAIG	Resource Availability Information Group
SCR	Sustainable Cell Rate
SPVCC	Soft Permanent Virtual Channel Connection
SVCC	Switched Virtual Channel Connection
UBR	Unspecified Bit Rate
UNI	User-Network Interface
VBR	Variable Bit Rate
VF	Variance Factor

2   Coding Requirements

[Normative]

This section describes the additional coding requirements for messages and information elements to support point-to-point and point-to-multipoint calls with GFR capability.

2.1   Messages

2.1.1   Coding requirements at the UNI

2.1.1.1   CONNECT

The following modification to section 8.1.1.2 of [SIG 4.0] shall apply

- *The maximum length of the ATM traffic descriptor information element is changed to 36.*

2.1.1.2   SETUP

The following modification to clause 3.1.7/Q.2931 of section 2 of [SIG 4.0] shall apply

- *Add the following:*
  ATM traffic descriptor maximum length is changed to 36.

The following modification to table 8-2 of section 8.1.1.1 of [SIG 4.0] shall apply

- *Change the maximum length of the Minimum acceptable ATM traffic descriptor information element to 34 octets*

2.1.2   Coding requirements at the PNNI

2.1.2.1   CONNECT

The following modification to clause 6.3.1.3/PNNI 1.0 shall apply

- *Extend the maximum length of the ATM traffic descriptor information element to 36 octets.*

2.1.2.2   SETUP

The following modification to clause 6.3.1.6/PNNI 1.0 shall apply

- *Extend the maximum length of the ATM traffic descriptor information element to 36 octets.*
- *Extend the maximum length of the Minimum acceptable ATM traffic descriptor information element to 34 octets.*

2.1.3   Coding requirements at the AINI

For additional message coding requirements for the support of GFR, refer to section 2.1.2 of this specification.

2.2   Information Elements

The modified information elements for the GFR capability are described in this section.

2.2.1   Coding requirements at the UNI

2.2.1.1   Coding rules

The following modification to clause 4.5.1/Q.2931 of section 2 of [SIG 4.0] shall apply:

- *In table 2-1 change the maximum length of the ATM traffic descriptor information element to 36 and the maximum length of the Minimum acceptable ATM traffic descriptor information element to 34.*

2.2.1.2   ATM traffic descriptor

Section 10.1.2.3/SIG 4.0 shall apply with the following changes:

- *Change the occurrence of the words* "ABR Minimum Cell Rate*" to* "Minimum Cell Rate" *throughout this section.*

- *Add the following ATM traffic descriptor subfields (and related notes) to the figure of 10.1.2.3/SIG 4.0:*

8	7	6	5	4	3	2	1	Octet
								Bits
Forward Maximum Frame Size Identifier								21 *
1	0	1	1	1	0	0	0	
Forward Maximum Frame Size								21.1*
Forward Maximum Frame Size (Cont'd)								21.2*
Backward Maximum Frame Size Identifier								22*
1	0	1	1	1	0	0	1	
Backward Maximum Frame Size								22.1*
Backward Maximum Frame Size (Cont'd)								22.2*
Forward Burst Cell Tolerance Identifier								23 *
1	0	1	1	1	0	1	0	
Forward Burst Cell Tolerance								23.1*
Forward Burst Cell Tolerance (Cont'd)								23.2*
Forward Burst Cell Tolerance (Cont'd)								23.3*
Backward Burst Cell Tolerance Identifier								24 *
1	0	1	1	1	0	1	1	
Backward Burst Cell Tolerance Size								24.1*
Backward Burst Cell Tolerance (Cont'd)								24.2*
Backward Burst Cell Tolerance (Cont'd)								24.3*

Figure 2-1: ATM traffic descriptor information element additional subfields for GFR

- *Delete the following sentence in the description of "Forward/Backward Minimum Cell Rate (MCR)":*

These parameters are only present for ABR connections.

- *Add the following text to the end of the section:*

Forward and Backward Maximum Frame Size (MFS)(octets i.1-i.2 where i may have the values 21 or 22)

This value indicates the maximum frame size expressed in cells. It is coded as a 16-bit binary integer with Bit 8 of the first octet being the most significant bit and Bit 1 of the second octet being the least significant bit. For further details, see the ATM Forum Traffic Management specification, Version 4.1.

Forward and Backward Burst Cell Tolerance (BCT)(octets i.1-i.3 where i may have the values 23 or 24)

This value indicates the Burst Cell Tolerance expressed in cells. It is coded as a 24-bit binary integer with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit.

Burst Cell Tolerance (BCT) is a derived parameter used in signalling. For the GFR service it relates to parameters defined in [TM 4.1] in the following way:
    Burst Cell Tolerance = Minimum Cell Rate * Burst Tolerance
and
    Burst Cell Tolerance = (Maximum Burst Size – 1) * (1 – Minimum Cell Rate / Peak Cell Rate)

Via the expression 1 + BCT, the Burst Cell Tolerance provides a measure on the maximum number of cells eligible for the service guarantee that an ATM switch may have to buffer for a GFR connection when the connection is served at a rate of MCR cells/s.

2.2.1.3   Broadband bearer capability

The following modification to clause 4.5.7/Q.2931 of section 2 of [SIG 4.0] shall apply

- In the additions to Table 4-8/Q.2941 add the following to the list of ATM transfer capabilities (octet 5a) used on transmission and reception:

    0 0 0 0 1 1 1 0   GFR.1
    0 0 0 0 1 1 1 1   GFR.2

2.2.1.4   Minimum acceptable ATM traffic descriptor

Make the following changes to section 8.1.2.2/SIG 4.0

- *In the first paragraph, third sentence add "*, GFR*" after* "ABR".

- *In the second paragraph change the maximum length to 34 octets.*

- *Add the following to figure 8-2 of Section 8.1.2.2/SIG 4.0:*

									11* (Note 2)
									11.1* 11.2* 11.3*
									12* (Note 2)
The octet groups 11, 12, 13, and 14 are encoded as octet groups 21, 22, 23, and 24 specified in Figure 2-1 of the GFR Signalling Specification									12.1* 12.2* 12.3*
									13* (Note 2)
									13.1* 13.2*
									14* (Note 2)
									14.1* 14.2*

- *Replace the note in Figure 8-2 in Section 8.1.2.2/SIG 4.0 with the following:*

    Note -   These octets are allowed for the ABR and GFR service categories. For the ABR service, octet groups 5-8 are not allowed.
    Note 2- These octets are allowed for the GFR service category.

- *Replace the last paragraph with the following*

    In a SETUP message, a traffic parameter is allowed in the Minimum acceptable ATM traffic descriptor information element only if the corresponding traffic parameter is in the ATM traffic descriptor information element of the SETUP message [e.g. if there is no forward peak cell rate (CLP = 0+1) parameter in the ATM traffic descriptor information element of a SETUP message, then the forward peak cell rate (CLP = 0+1) is not allowed in the Minimum acceptable ATM traffic descriptor information element of the SETUP message].

2.2.2   Coding requirements at the PNNI

[PNNI 1.0] references [SIG 4.0] for the coding of some information elements. Thus any change specified in section 2.2.1 to a section of the [SIG 4.0] document, which is referenced by [PNNI 1.0], shall also be a change to [PNNI 1.0]. (I.e. the coding of the ATM traffic descriptor, Broadband bearer capability, and Minimum acceptable ATM traffic descriptor are changed).

2.2.2.1   Coding rules

The following modification to section 6.4.5.1 of [PNNI 1.0] shall apply:

- *In table 6-5 change the maximum length of the ATM traffic descriptor information element to 36 and the maximum length of the Minimum acceptable ATM traffic descriptor information element to 34.*

2.2.3   Coding requirements at the AINI

See section 2.2.2.

3   GFR procedures at the UNI

3.1   Signalling procedures
[Normative]

The procedures for basic call/connection control as described in sections 2 and 5 of ATM Forum UNI Signalling specification, Version 4.0 shall apply. Only additional procedures to handle GFR calls/connections are described in this section. These procedures shall apply only when the received SETUP message or received setup request contains a Broadband bearer capability information element indicating "GFR.1" or "GFR.2" in the ATM transfer capability field. For the GFR service, switched virtual path connections are not applicable.

3.1.1   Call/connection establishment at the originating interface

The procedures of section 2/SIG 4.0 clauses 5.1.1/Q.2931 and 5.1.3/Q.2931 shall apply with the following changes:

3.1.1.1   User side procedures

3.1.1.1.1   Procedures for the Sb and coincident Sb/Tb reference point

To request a GFR connection, the user shall send to the network a SETUP message containing a Broadband bearer capability information element indicating "GFR.1" or "GFR.2" in the ATM transfer capability field.

3.1.1.1.1.1   Use of the ATM traffic descriptor information element for a GFR connection

The ATM traffic descriptor information element shall contain the forward and backward Peak Cell Rate (CLP=0+1) subfields. If the Peak Cell Rate (CLP=0+1) subfield, for a given direction, is non-zero then the ATM traffic descriptor information element shall also contain the Maximum Frame Size (MFS), the Minimum Cell Rate (MCR), and the Burst Cell Tolerance (BCT) subfields, for that direction.

If a BCT value is provided by the user, the BCT value shall not be less than the corresponding MFS for the same direction (forward or backward).

If a non-zero MCR value is indicated in the ATM traffic descriptor information element, it shall be less than the corresponding PCR value for the same direction.

If MCR has not been specified by the user application, the recommended default value is zero.

If BCT has not been specified by the user application, it is recommended that negotiation of the BCT is used. The recommended default value is 2^{24}-1. If the minimum acceptable MFS is present, the recommended minimum acceptable BCT is the value of the minimum acceptable MFS. Otherwise, the recommended minimum acceptable BCT is the value of the MFS.

When tagging is applied to a GFR connection, it is performed on a per frame basis. Whether tagging may apply or does not apply is selected by the request for GFR.2 or GFR.1 respectively. Therefore, tagging shall not be requested by the calling user by means of the Tagging indicators in the ATM traffic descriptor information element. On reception, the Tagging indicators in the ATM traffic descriptor information element shall be ignored.

Frame discard is inherent to the GFR service. Therefore, frame discard shall not be requested by means of the Frame discard indicators in the ATM traffic descriptor information element. On reception, the Frame discard indicators in the ATM traffic descriptor information element shall be ignored.

3.1.1.1.2   Procedures for the Tb reference point

The procedures of section 3.1.2.1 shall apply with the distinction that all occurrences of the term "network" shall be changed to "user" and vice versa.

3.1.1.2   Network side procedures

Whether tagging may apply or does not apply is selected by the request for GFR.2 or GFR.1 respectively. Therefore, on reception, the Tagging indicators in the ATM traffic descriptor information element shall be ignored.

Frame discard is inherent to the GFR service. Therefore, the Frame discard indicators in the ATM traffic descriptor information element shall be ignored.

3.1.1.2.1   Procedures for negotiation of parameters in the ATM traffic descriptor information element:

The MCR, PCR, MFS and BCT may be negotiated using the procedures described in section 8/SIG 4.0, with the following additional rules for the relationship between the resulting MCR and PCR in a given direction, and between the resulting MFS and BCT in a given direction:

- The PCR may only be negotiated such that it is greater than the value of MCR as well as being greater than or equal to the corresponding PCR value in the Minimum acceptable ATM traffic descriptor information element, and
- The BCT may only be negotiated such that it is greater than or equal to the value of the MFS as well as the corresponding BCT value in the Minimum acceptable ATM traffic descriptor information element.

3.1.1.2.2   Procedures for call/connection rejection:

In a given direction, if the indicated MFS value is larger than the indicated BCT value, then the call shall be cleared with Cause #73, "Unsupported combination of traffic parameters".

In a given direction, if the indicated MCR value is larger than or equal to the indicated PCR value, the call shall be cleared with Cause #73, "Unsupported combination of traffic parameters".

3.1.2   Call/connection establishment at the destination interface

The procedures of section 2/SIG 4.0 clause 5.2.2.2.1/Q.2931 shall apply with the following changes:

3.1.2.1   Network side procedures

Whether tagging may apply or does not apply is selected by the request for GFR.2 or GFR.1 respectively. Therefore, on reception the tagging indicators in the ATM traffic descriptor information element shall be ignored.

Frame discard is inherent to the GFR service. Therefore, on reception the Frame discard indicators in the ATM traffic descriptor information element shall be ignored.

3.1.2.1.1   Procedures for negotiation of parameters in the ATM traffic descriptor information element

The MCR, PCR, MFS and BCT may be negotiated using the procedures described in section 8/SIG 4.0, with the following additional rules for the relationship between the resulting MCR and PCR in a given direction, and between the resulting MFS and BCT in a given direction:

- The PCR may only be negotiated such that it is greater than the value of MCR as well as being greater than or equal to the corresponding PCR value in the Minimum acceptable ATM traffic descriptor information element, and

- The BCT may only be negotiated such that it is greater than or equal to the value of the MFS as well as the corresponding BCT value in the Minimum acceptable ATM traffic descriptor information element.

3.1.2.2 User side procedures

3.1.2.2.1 Procedures for the Sb and coincident Sb/Tb reference point

Whether tagging may apply or does not apply is selected by the request for GFR.2 or GFR.1 respectively. Therefore, the tagging indicators in the ATM traffic descriptor information element shall be ignored. In the CONNECT message, tagging shall not be requested by the called user by means of the Tagging indicators in the ATM traffic descriptor information element.

Frame discard is inherent to the GFR service. Therefore, the Frame discard indicators in the ATM traffic descriptor information element shall be ignored. In the CONNECT message, frame discard shall not be requested by means of the Frame discard indicators in the ATM traffic descriptor information element.

3.1.2.2.1.1   Procedures for negotiation of parameters in the ATM traffic descriptor information element

The MCR, PCR, MFS and BCT may be negotiated using the procedures described in section 8/SIG 4.0, with the following additional rules for the relationship between the resulting MCR and PCR in a given direction, and between the resulting MFS and BCT in a given direction:

- The PCR may only be negotiated such that it is greater than the value of MCR as well as being greater than or equal to the corresponding PCR value in the Minimum acceptable ATM traffic descriptor information element, and
- The BCT may only be negotiated such that it is greater than or equal to the value of the MFS as well as the corresponding BCT value in the Minimum acceptable ATM traffic descriptor information element.

3.1.2.2.2   Procedures for the Tb reference point

The procedures of section 3.1.1.2 shall apply with the distinction that all occurrences of the term "network" shall be changed to "user" and vice versa.

3.1.3   Connection characteristics negotiation during establishment phase

The procedures of section 8/SIG 4.0 shall apply with the following changes:

Make the following general change through out section 8/SIG 4.0 except for section 8.1/SIG 4.0

- *In 2nd bullet item delete "peak cell "*

- *Change all occurrences of the words* "cell rates" *to* "traffic parameter values".

8.0/SIG 4.0   Connection characteristics negotiation during establishment phase

Delete the last sentence of the second paragraph.

Add the following sentence to the end of the last paragraph:

It applies to GFR calls with the restriction that only the Minimum acceptable ATM traffic descriptor information element is supported.

8.1/SIG 4.0   Coding requirements

Changes to section 8.1/SIG 4.0 are provided in section 2.1.1 and 2.2.1 of this specification

3.2   Guidelines on the use of bearer class, traffic parameters, and QoS

This section is an extension to Annex 9 of [SIG 4.0].

3.2.1   Determination of the GFR ATM service category

Table 4-1 below provides the additional information to Table A9-1/[SIG 4.0] for GFR

Table 4-1: Derivation of the GFR ATM service category from signalling information

ASC (a)	BC (b)	ATC (c)	BEI (d)	Equivalent UNI 3.0/3.1 Octet 5a definitions	Comment
GFR	C	14	No	undefined traffic type, timing not indicated	new in UNI 4.0 invalid UNI 3.1 BBC octet 5a coding
	X				
	C	15	No	undefined traffic type, timing not indicated	new in UNI 4.0 invalid UNI 3.1 BBC octet 5a coding
	X				

(a) ATM service category as defined by ATM Forum Traffic Management specification, version 4.1

(b) Broadband bearer class in octet 5 of Broadband bearer capability information element

(c) ATM transfer capability as defined in this specification (octet 5a of the Broadband bearer capability information element)

(d) Best effort indicator - octet 18 of ATM traffic descriptor information element (yes - present, no - not present)

3.2.2   Allowed combination of bearer capabilities, traffic parameters, and QoS for GFR

Table 4.2 provides the extension to table A9-2 of [SIG 4.0] for the GFR ATM service category.

Table 4-2 Allowable combinations of traffic and QoS related parameters for GFR in the SETUP message

ATM service category	GFR			
Conformance	GFR.1		GFR.2	
Bearer capability				
Broadband bearer class	C	X	C	X
ATM transfer capability (note 1)	14		15	
Traffic descriptor for a given direction				
PCR (CLP=0)				
PCR (CLP=0+1)	S		S	
SCR , MBS (CLP=0)				
SCR , MBS (CLP=0+1)				
MCR	S		S	
MFS	S		S	
BCT	S		S	
Best effort				
Tagging	N/A (note 12)		N/A (note 12)	
Frame discard	N/A (note 13)		N/A (note 13)	
QoS classes	0		0	
transit delay (note 2)				
peak-to-peak CDV				
CLR (CLP=0) (Note 11)				
CLR (CLP=0+1) (Note 11)				

Note: The notes 1-11 in this table relates to the notes of table A9-2 of [SIG 4.0]

Note 12: Tagging for the GFR service is done on a frame basis, and whether it should be applied or not is implicitly indicated by the indication of GFR.2 or GFR.1. Therefore, tagging shall not be requested by means of the Tagging indicators in the ATM traffic descriptor information element.

Note 13: Frame discard is inherent to the GFR ATM service categories. Therefore, frame discard shall not be requested by means of the Frame discard indicators in the ATM traffic descriptor information element.

3.3   Compatibility with nodes not supporting the GFR ATM service category [Informative]

Upon receiving a SETUP message requesting a GFR.1 or GFR.2 ATM transfer capability, nodes not supporting the GFR.1 or the GFR.2 ATM transfer capability, respectively, will release the connection in accordance with section 2 [SIG 4.0] clause 5.1.3/Q.2931 as the network is not able to provide the requested transfer capability.

In particular, if a node only supporting the GFR.1 ATM transfer capability, receives a SETUP message requesting a GFR.2 call to be established, or vice versa, the node will release the connection in accordance with section 2 [SIG 4.0] clause 5.1.3/Q.2931.

4   GFR procedures at the PNNI

[PNNI 1.0] references [SIG 4.0]. Thus any change specified in section 3 to a section of the [SIG 4.0] document, which is referenced by [PNNI 1.0], shall also be a change to [PNNI 1.0].

4.1   Signalling procedures

[Normative]

The signalling procedures specified in PNNI 1.0 shall apply for GFR switched virtual channel connections with the following modifications.

6.5/PNNI 1.0   Call/connection control procedures for ATM point-to-point calls

Add the following after the last (third) paragraph:

For the GFR service, however, switched virtual path connections are not applicable.

6.5.2.2.2/PNNI 1.0   Allocation for switched virtual paths

This section does not apply for GFR connections as the GFR ATM service category is not defined for virtual path connections.

6.5.2.3.3/PNNI 1.0   Traffic parameter selection procedures

Add the following after the first paragraph.

For the GFR ATM service category, tagging and frame discard are indicated by means of the GFR.1 and GFR.2 ATM transfer capabilities. In case the setup indication contains any tagging or frame discard indicators, these shall be ignored. The remaining part of this section does not apply for GFR.

6.5.2.3.4/PNNI 1.0   Procedures for negotiation of traffic parameters during call/connection setup

Make the following general change through out this section.

- *Change all occurrences of the words* "cell rates" *to* "traffic parameter values".

- *Add the following note after the first paragraph.*

    Note -   For the GFR calls, negotiation using the Alternative ATM traffic descriptor is not allowed.

- *Add the following after the third paragraph.*

    For GFR, the following additional rules shall apply for the relationship between the resulting MCR and PCR in a given direction, and between the resulting MFS and BCT in a given direction:

    - The PCR may only be negotiated such that it is greater than the value of MCR as well as being greater than or equal to the corresponding PCR value in the Minimum acceptable ATM traffic descriptor information element, and
    - The BCT may only be negotiated such that it is greater than or equal to the value of the MFS as well as the corresponding BCT value in the Minimum acceptable ATM traffic descriptor information element.

6.5.2.6.1/PNNI 1.0   Procedures for traffic parameter selection during call/connection acceptance

Add the following after the first paragraph.

For the GFR ATM service category, tagging and frame discard are indicated by means of the GFR.1 and GFR.2 ATM transfer capabilities. In case the CONNECT message contains any tagging or frame discard indicators, these shall be ignored. The remaining part of this section does not apply for GFR.

4.2   Changes to section 5/PNNI 1.0 "PNNI routing specification"
[Normative]

This section provides the changes to Section 5 of PNNI 1.0 required for the support of GFR.

5.8.1.1.3.1/PNNI 1.0   Resource Availability Information Group flags

Modify the first sentences of the second paragraph as follows:

- *delete "5".*

Modify the second sentences of the second paragraph as follows:

- *insert "or a 2-bit" after "1-bit"*

5.8.1.1.3.2/PNNI 1.0   Cell Delay Variation (CDV)

Modify the second paragraph as follows:

Insert ", GFR" after "ABR".

5.8.1.1.3.3/PNNI 1.0   Maximum Cell Transfer Delay (maxCTD)

Modify the second paragraph as follows:

Insert ", GFR" after "UBR".

5.8.1.1.3.5/PNNI 1.0   Cell Loss Ratio for CLP=0 (CLR_0)

Modify the second paragraph as follows:

Insert ", GFR" after "ABR".

5.8.1.1.3.6/PNNI 1.0   Cell Loss Ratio for CLP=0+1 (CLR_{0+1})

Modify the second paragraph as follows:

Insert ", GFR" after "ABR".

5.8.1.1.3.7/PNNI 1.0   Maximum Cell Rate (maxCR)

Modify the second paragraph as follows:

Insert ", GFR" after "ABR".

Modify the third paragraph as follows:

Insert ", GFR" after "UBR".

5.8.1.1.3.8/PNNI 1.0   Available Cell Rate (AvCR)

Modify the first paragraph as follows:

Insert "the GFR and" before "ABR".

Modify the first sentence of the last paragraph as follows:

Insert ", GFR" before "and ABR".

5.8.1.1.3.9/PNNI 1.0   Cell Rate Margin (CRM)

Modify the second paragraph as follows:

Insert "GFR," after "ABR,".

5.8.1.1.3.10/PNNI 1.0   Variance Factor (VF)

Modify the second paragraph as follows:

Insert "GFR," after "ABR,".

Add a new section 5.8.1.1.3.12/PNNI 1.0 as follows:

5.8.1.1.3.12/PNNI 1.0   Acceptable Burst Cell Tolerance (AccBCT)

AccBCT is the largest Acceptable Burst Cell Tolerance for connections belonging to the GFR service category.

AccBCT is a required topology attribute for the GFR service category. AccBCT is not applicable for the CBR, Real Time VBR, Non-Real Time VBR, UBR and ABR service categories. AccBCT is expressed in units of cells.

Add a new section 5.8.5.2.5.10/PNNI 1.0 as follows:

5.8.5.2.5.10/PNNI 1.0   Acceptable Burst Cell Tolerance (AccBCT)

The algorithm used to determine significant change for AccBCT is identical to the one used above used for maxCTD.

Change in AccBCT is measured in terms of a proportional difference from the last value advertised. A proportional multiplier parameter (AccBCT_PM), expressed as a, provides flexible control over the definition of significant change for AccBCT.

Given a previous value for AccBCT the algorithm establishes an upper bound and a lower bound for AccBCT values which define a range of insignificance. Any new value for AccBCT computed that is within the bounds is not a significant change from the previous value. Any new value for AccBCT that is outside the bounds is a significant change.

The bounds of the range of insignificance are computed using the following algorithm:

```
compute_AccBCT_bounds ( PREV_AccBCT, AccBCT_PM )
  {
      /*
              •   PREV_AccBCT = previous/currently advertised value for AccBCT
                  for service category in cells

              •   AccBCT_PM = AccBCT proportional multiplier as a percentage
                  ( 1 <= AccBCT_PM <= 99 )

      */

        delta = PREV_AccBCT * ( AccBCT_PM/100);

     upper_AccBCT_bound = PREV_AccBCT + delta;

     if ( delta > PREV_AccBCT)
        { lower_AccBCT_bound = 0; }      /* set lower bound to zero */
     else
        { lower_AccBCT_bound = PREV_AccBCT - delta; }

  } /* end compute_AccBCT_bounds() */
```

When AccBCT changes, the following algorithm is used to determine if the change is significant:

```
/* NEW_AccBCT = new value for AccBCT */
if (NEW_AccBCT <= lower_AccBCT_bound ||
  NEW_AccBCT => upper_AccBCT_bound)
   { /* change in AccBCT is significant */ }
else
   { /* change AccBCT is NOT significant */ }
```

5.13.5/PNNI 1.0 Generic CAC algorithm for best-effort service

Add the following paragraph:

For GFR connections, a link/node is included if and only if the requested GFR conformance definition is supported, Maximum Cell Rate is not equal to zero, and the advertised Available Cell Rate and Acceptable Burst Cell Tolerance for the GFR service category is greater than or equal to the Minimum Cell Rate and Burst Cell Tolerance specified by the connection.

5.14.3/PNNI 1.0 Information Group summary

Modify Table 5-18"Information Group Summary" as follows:
- *For the Type = 128 row and for the Type =129 row, in the* "Contains IGs one level down" *column, insert* ", AccBCT parameter (162)" *at the end.*
- *Add the following new row:*

Type	IG Name	Contains IGs one level down
162	AccBCT parameter	

Modify Table 5-18"Information Group Summary continued" as follows:
- *Add the following row*

Type	IG Name	Contained in IGs one level up	Contained in packets
162	AccBCT parameter	Outgoing resource availability (128), Incoming resource availability (129)	Hello (1), PTSP (2)

Modify Table 5-19 as follows:
- *In the row for Type = 1 and in the row for Type =2, in the* "Contains IGs" *column, insert* ", AccBCT parameter (162)," *after* "(160)".

5.14.5/PNNI 1.0 The Resource Availability Information Group

Modify the second paragraph by:

- *Inserting the following sentence after the existing first sentence.*
  Each service category is described using a 1-bit or 2-bit field.
- *Inserting the following sentence after the existing second sentence.*
  That the metrics apply for a certain service category is indicated by a non-zero value of the corresponding field.
- *Inserting in the last sentence* "by a non-zero value" *after* "specified".
- *Replacing in the last sentence* "bit-mask" *with* "corresponding field".

Modify Table 5-22/PNNI 1.0 by appending the following at the end of the table

Optional AccBCT parameter:			
44	2	Type	Type = 162 (AccBCT parameter)
46	2	Length	
48	4	AccBCT	Unit : cells

Modify Table 5.23/PNNI 1.0 as follows:

- *Replace the column "Bits 11..2" by:*

Bit 11	Bit 10	Bits 9..2
GFR (Note)		*Reserved*

GFR.2	GFR.1	

- *Add the following note*:
  Note   If both GFR.1 and GFR.2 are supported, the set of routing metrics and attributes that apply for a given direction shall be advertised in one and only one RAIG.

4.3 Compatibility with nodes not supporting the GFR ATM service category [Informative]

Section 6.5.2.3.1/PNNI 1.0 specifies the succeeding side will clear the call if it detects that the requested service category is not available. Therefore, GFR.1 and GFR.2 calls/connections must be routed using links with bit 10 (GFR.1) or bit 11 (GFR.2), respectively, set in the corresponding RAIGs, as defined in section 5.13.5/PNNI 1.0.

5   GFR procedures at the AINI

[AINI] references [PNNI 1.0]. Thus any change specified in section 4 to a section of the [PNNI 1.0] document, which is referenced by [AINI], shall also be a change to [AINI].

5.1   Interworking procedures between AINI and B-ISUP [Normative]

*Add the following statement at the end of Note 1 in section **4.1.1.2.1.1/AINI***

If a GFR.1 or a GFR.2 call is requested to be setup by the AINI protocol and this ATM transfer capability is not supported by B-ISUP, then the call shall be rejected with cause #65 "Bearer capability not supported".

5.2   Compatibility with nodes not supporting the GFR ATM service category [Informative]

Upon receiving a SETUP message requesting a GFR.1 or GFR.2 ATM transfer capability, nodes not supporting the GFR.1 or the GFR.2 ATM transfer capability, respectively, will follow the procedures specified in section 6.5.2.3.1/PNNI 1.0, and thus crankback the call.

In particular, if a node only supporting the GFR.1 ATM transfer capability, receives a SETUP message requesting a GFR.2 call to be established, or vice versa, the node will also in this case follow the procedures specified in section 6.5.2.3.1/PNNI 1.0, and thus crankback the call.

Annex A. UNI GFR signalling PICS Proforma

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). For further details on PICS see the Implementation Conformance Statement Proforma Style Guide [A.5].

A.1.1 Scope

This document provides the PICS Proforma for the Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0, when applied at a UNI 4.0 interface, as specified in this document, in compliance with the relevant requirements, and in accordance with the relevant guidelines, given in ISO/IEC 9646-7 [A.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

[A.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)).

[A.2]   ISO/IEC 9646-7: "Information technology – Open systems interconnection – Conformance testing methodology and framework – Part 7: Implementation Conformance Statements".

[A.3]   ATM User-Network Interface (UNI) Signalling Specification, Version 4.0, af-sig-0061.000, July 1996.

[A.5]   ATM Forum Technical Committee, "Implementation Conformance Statement Proforma Style Guide", af-test-0137-000, February 2000.

A.1.3 Definitions

This document uses the following terms defined in ISO/IEC 9646-1 [A.1]:

• 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.

A.1.4 Acronyms

I.E.   Information Element
IUT   Implementation Under Test
M   Mandatory requirements (these are to be observed in all cases)
MBS   Maximum Burst Size
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 labeled with the same numeral "n".
PCR   Peak Cell Rate

PICS   Protocol Implementation Conformance Statement
SCR   Sustainable Cell Rate
SUT   System Under Test

A.1.5 Conformance

The supplier of a protocol implementation which is claimed to conform to the ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0 at the UNI 4.0 interface 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

Date of the Statement

_____

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 (if different from product supplier)

Name: _____

Address:

_____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address:_____

Additional Information: _____

PICS Contact Person

Name: _____

Address: _____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address:_____

Additional Information: _____
_____
_____
_____

Identification of the protocol

This PICS Proforma applies to the following specification:

af-cs-0167.000, Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0

A.3 PICS Proforma

A.3.1 Global statement of conformance

Are all mandatory capabilities implemented? (Yes/No) _____

Note: Answering "No" indicates non-conformance to the protocol specification. Non-supported mandatory capabilities are to be identified in the PICS, with an explanation of why the implementation is non-conforming, on pages attached to the PICS Proforma.

A.3.2   Instructions for Completing the PICS Proforma

The supplier of the implementation shall complete the PICS Proforma in each of the spaces provided. In particular, an explicit answer shall be entered, in each of the support column entries provided, using the specified notation.

The support column shall be filled in by the supplier of the implementation. The following common notations, defined in ISO-IEC 9646-7 [A.2], are used for the support column:

Y or y   supported by the implementation.

N or n   not supported by the implementation.

N/A, n/a or -no answer required (allowed only if the status is n/a, directly or after evaluation of a conditional status).

The following notations, defined in ISO/IEC 9646-7 [A.2] are used for the status column:

M   mandatory - the capability is required to be supported.

O   optional - the capability may be supported or not.

N/A   not applicable - in the given context, it is impossible to use the capability.

X   prohibited (excluded) - there is a requirement not to use this capability in the given context.

O.i   qualified optional - for mutually exclusive or selectable options from a set. "i" is an integer which identifies an unique group of related optional items and the logic of their selection which is defined immediately following the table.

A.4 Roles

Item	Major role: Does the implementation support...	Conditions for status	Status	Reference	Support
R 1.1	the user role at the Sb or coincident Sb/Tb reference point?		O.1		[ ] Yes [ ] No
R 1.2	the user role at the Tb reference point?		O.1		[ ] Yes [ ] No
R 2	the network role?		O.1		[ ] Yes [ ] No
Comments: O.1 support of at least one of these options is required					

A.5 Major capabilities

Item	Does the IUT support ...	Conditions for status	Status	Reference	Support
MCU1.1	The GFR.1 ATM transfer capability?		O.1	1.1	[ ] Yes [ ] No
MCU1.2	The GFR.2 ATM transfer capability?		O.1	1.1	[ ] Yes [ ] No
MCU2	Negotiation during call establishment, using the Minimum acceptable ATM traffic descriptor information element?		M	1.1, 3.1.3	[ ] Yes [ ] No
Comments: O.1. = mandatory to support at least one of these procedures.					

A.6 Information element encoding

Item	Does the IUT support ...	Conditions for status	Status	Reference	Support
IEU1	the GFR extensions to the ATM traffic descriptor information element?		M	2.2.1.2	[ ] Yes [ ] No
IEU2	the GFR extensions to the Broadband bearer capability information element?		M	2.2.1.3	[ ] Yes [ ] No
IEU3	the GFR extensions to the Minimum acceptable ATM traffic descriptor information element?		M	2.2.1.4	[ ] Yes [ ] No
Comments:					

A.7 Procedures at the originating interface

A.7.1   User side procedures at the Sb and coincident Sb/Tb reference point

Item	Calling user Procedures Does the IUT ...	Prerequisite	Status	Reference	Support
SPIS1	Indicate either the GFR.1 or GFR.2 ATC in the Broadband bearer capability information element when requesting a GFR connection?	R1.1	M	3.1.1.1.1	[ ]Yes [ ]No
SPIS2	Always set the Tagging indicators to zero if the Traffic management options octet group is included in the ATM traffic descriptor information element?	R1.1	M	3.1.1.1.1.1	[ ]Yes [ ]No
SPIS3	Always set the Frame discard indicators to zero if the Traffic management options octet group is included in the ATM traffic descriptor information element?	R1.1	M	3.1.1.1.1.1	[ ]Yes [ ]No
SPIS4	Include the PCR, MCR, MFS, and BCT parameters in the ATM traffic descriptor information element in the SETUP message?	R1.1	M	3.1.1.1.1.1	[ ]Yes [ ]No
Comments:					

A.7.2   User side procedures at the Tb reference point

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
SPIT1	Ignore the Tagging indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?	R1.2	M	3.1.1.1.2, 3.1.2.1	[ ]Yes [ ]No
SPIT2	Ignore the Frame discard indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?	R1.2	M	3.1.1.1.2, 3.1.2.1	[ ]Yes [ ]No
Comments:					

A.7.3   GFR procedures for network side

Item	Network side procedures Does the IUT ...	Prerequisite	Status	Reference	Support
SPIN1	Ignore the Tagging indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?	R2	M	3.1.1.2	[ ]Yes [ ]No
SPIN2	Ignore the Frame discard indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?	R2	M	3.1.1.2	[ ]Yes [ ]No
Comments:					

A.8 Procedures at the destination interface

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
SPD1	Ignore the Tagging indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?		M	3.1.2.2.1, 3.1.2.2.2, 3.1.2.1	[ ]Yes [ ]No
SPD2	Ignore the Frame discard indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?		M	3.1.2.2.1, 3.1.2.2.2, 3.1.2.1	[ ]Yes [ ]No
Comments:					

A.9 Procedures for negotiation

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
NEG1	support negotiation of the PCR?		M	3.1.3	[ ]Yes [ ]No
NEG2	support negotiation of the MCR?		M	3.1.3	[ ]Yes [ ]No
NEG3	support negotiation of the MFS?		M	3.1.3	[ ]Yes [ ]No
NEG4	support negotiation of the BCT?		M	3.1.3	[ ]Yes [ ]No
Comments:					

Annex B. PNNI GFR signalling PICS Proforma

B.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). For further details on PICS see the Implementation Conformance Statement Proforma Style Guide [A.7].

B.1.1 Scope

This document provides the PICS Proforma for the Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0, when applied at a PNNI 1.0 interface, as specified in this document, in compliance with the relevant requirements, and in accordance with the relevant guidelines, given in ISO/IEC 9646-7 [A.2]. In most cases, statements contained in notes in the specification, which were intended as information, are not included in the PICS.

B.1.2 Normative References

[A.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)).

[A.2]   ISO/IEC 9646-7: "Information technology – Open systems interconnection – Conformance testing methodology and framework – Part 7: Implementation Conformance Statements".

[A.3]   ATM User-Network Interface (UNI) Signalling Specification, Version 4.0, af-sig-0061.000, July 1996.

[A.4]   ATM Forum Technical Committee, Private Network-Network Interface Specification v1.0, af-pnni-0055.000, March 1996

[A.5]   ATM Forum Technical Committee, PNNI v1.0 Errata and PICS, af-pnni-0081.000, May 1997

 [A.7]   ATM Forum Technical Committee, "Implementation Conformance Statement Proforma Style Guide", af-test-0137-000, February 2000.

B.1.3 Definitions

This document uses the following terms defined in ISO/IEC 9646-1 [A.1]:

- 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.

B.1.4 Acronyms

I.E.   Information Element
IUT   Implementation Under Test
M   Mandatory requirements (these are to be observed in all cases)
MBS   Maximum Burst Size
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 labeled with the same numeral "n".

PCR   Peak Cell Rate

PICS   Protocol Implementation Conformance Statement

SCR   Sustainable Cell Rate

SUT   System Under Test

B.1.5 Conformance

The supplier of a protocol implementation which is claimed to conform to the ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0 at the PNNI 1.0 interface 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.

B.2 Identification of the Implementation

Date of the Statement

_____

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 (if different from product supplier)

Name: _____

Address:
_____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address:_____

Additional Information: _____

PICS Contact Person

Name: _____

Address: _____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address:_____

Additional Information: _____
_____
_____
_____

Identification of the protocol

This PICS Proforma applies to the following specification:

af-cs-0167.000, Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0

B.3 PICS Proforma

B.3.1 Global statement of conformance

Are all mandatory capabilities implemented? (Yes/No) _____

Note: Answering "No" indicates non-conformance to the protocol specification.   Non-supported mandatory capabilities are to be identified in the PICS, with an explanation of why the implementation is non-conforming, on pages attached to the PICS Proforma.

B.3.2   Instructions for Completing the PICS Proforma

The supplier of the implementation shall complete the PICS Proforma in each of the spaces provided. In particular, an explicit answer shall be entered, in each of the support column entries provided, using the specified notation.

The support column shall be filled in by the supplier of the implementation. The following common notations, defined in ISO-IEC 9646-7 [A.2], are used for the support column:

  Y or y   supported by the implementation.

  N or n   not supported by the implementation.

  N/A, n/a or -no answer required (allowed only if the status is n/a, directly or after evaluation of a conditional status).

The following notations, defined in ISO/IEC 9646-7 [A.2] are used for the status column:

  M   mandatory - the capability is required to be supported.

  O   optional - the capability may be supported or not.

  N/A   not applicable - in the given context, it is impossible to use the capability.

  X   prohibited (excluded) - there is a requirement not to use this capability in the given context.

  O.i   qualified optional - for mutually exclusive or selectable options from a set. "i" is an integer which identifies an unique group of related optional items and the logic of their selection which is defined immediately following the table.

B.4 Major capabilities

Item	Does the IUT support ...	Conditions for status	Status	Reference	Support
MCP1.1	The GFR.1 ATM transfer capability?		O.1	1.1	[ ] Yes [ ] No
MCP1.2	The GFR.2 ATM transfer capability?		O.1	1.1	[ ] Yes [ ] No
MCP2	Negotiation during call establishment, using the Minimum acceptable ATM traffic descriptor information element?		M	1.1	[ ] Yes [ ] No
Comments: O.1. = mandatory to support at least one of these procedures.					

B.5 Information element encoding

Item	Does the IUT support ...	Conditions for status	Status	Reference	Support
IEP1	the GFR extensions to the ATM traffic descriptor information element?		M	2.2.2, 2.2.1.2	[ ] Yes [ ] No
IEP2	the GFR extensions to the Broadband bearer capability information element?		M	2.2.2, 2.2.1.3	[ ] Yes [ ] No
IEP3	the GFR extensions to the Minimum acceptable ATM traffic descriptor information element?		M	2.2.2, 2.2.1.4	[ ] Yes [ ] No
Comments:					

B.6 Basic Signalling Procedures

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
SPP1	Ignore the Tagging indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?		M	4.1 [6.5.2.3.3/PNNI]	[ ]Yes [ ]No
SPP2	Ignore the Frame discard indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?		M	4.1 [6.5.2.3.3/PNNI]	[ ]Yes [ ]No
Comments:					

B.7 Procedures for negotiation

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
NEG1	support negotiation of the PCR?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
NEG2	support negotiation of the MCR?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
NEG3	support negotiation of the MFS?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
NEG4	support negotiation of the BCT?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
Comments:					

B.8 GFR routing procedures

Item	GFR routing procedures Does the IUT ...	Prerequisite	Status	Reference	Support
RT-1	Indicate topology metrics and attributes relating to GFR capable resources by setting Bit 11-10 two-bit field of the RAIG flags to a value different than "00" in one and only one Resource availability information group?		M	4.2	[ ]Yes [ ]No
RT-2	Indicate that GFR.1 is supported for a resource by setting Bit 10 of the RAIG flags to "1" in one and only one Resource availability information group?		M	4.2	[ ]Yes [ ]No
RT-3	Indicate that GFR.2 is supported for a resource by setting Bit 11 of the RAIG flags to "1" in one and only one Resource availability information group?		M	4.2	[ ]Yes [ ]No
RT-4	Include the AccBCT topology attribute in the RAIG for the GFR service category formatted according to Table 5-22?		M	4.2	[ ]Yes [ ]No
Comments:					

Annex C. AINI GFR signalling PICS Proforma

C.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). For further details on PICS see the Implementation Conformance Statement Proforma Style Guide [A.8].

C.1.1 Scope

This document provides the PICS Proforma for the Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0, when applied at an AINI interface, as specified in this document, in compliance with the relevant requirements, and in accordance with the relevant guidelines, given in ISO/IEC 9646-7 [A.2]. In most cases, statements contained in notes in the specification, which were intended as information, are not included in the PICS.

C.1.2 Normative References

[A.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)).

[A.2]   ISO/IEC 9646-7: "Information technology – Open systems interconnection – Conformance testing methodology and framework – Part 7: Implementation Conformance Statements".

[A.3]   ATM User-Network Interface (UNI) Signalling Specification, Version 4.0, af-sig-0061.000, July 1996.

[A.4]   ATM Forum Technical Committee, Private Network-Network Interface Specification v1.0, af-pnni-0055.000, March 1996

[A.5]   ATM Forum Technical Committee, PNNI v1.0 Errata and PICS, af-pnni-0081.000, May 1997

 [A.7]   ATM Forum Technical Committee, ATM Inter-Network Interface (AINI) Specification, af-cs-0125.000, July 1999

[A.8]   ATM Forum Technical Committee, "Implementation Conformance Statement Proforma Style Guide", af-test-0137-000, February 2000.

C.1.3 Definitions

This document uses the following terms defined in ISO/IEC 9646-1 [A.1]:

• 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.

C.1.4 Acronyms

I.E.   Information Element
IUT   Implementation Under Test

M   Mandatory requirements (these are to be observed in all cases)
MBS   Maximum Burst Size
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 labeled with
           the same numeral "n".
PCR   Peak Cell Rate
PICS   Protocol Implementation Conformance Statement
SCR   Sustainable Cell Rate
SUT   System Under Test

C.1.5 Conformance

The supplier of a protocol implementation which is claimed to conform to the ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0 at the AINI interface 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.

C.2 Identification of the Implementation

Date of the Statement

_____

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 (if different from product supplier)

Name: _____

Address:

_____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address:_____

Additional Information: _____

PICS Contact Person

Name: _____

Address: _____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address:_____

Additional Information: _____
_____
_____
_____

Identification of the protocol

This PICS Proforma applies to the following specification:

af-cs-0167.000, Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), Version 1.0

C.3 PICS Proforma

C.3.1 Global statement of conformance

Are all mandatory capabilities implemented? (Yes/No) _____

Note: Answering "No" indicates non-conformance to the protocol specification. Non-supported mandatory capabilities are to be identified in the PICS, with an explanation of why the implementation is non-conforming, on pages attached to the PICS Proforma.

C.3.2 Instructions for Completing the PICS Proforma

The supplier of the implementation shall complete the PICS Proforma in each of the spaces provided. In particular, an explicit answer shall be entered, in each of the support column entries provided, using the specified notation.

The support column shall be filled in by the supplier of the implementation. The following common notations, defined in ISO-IEC 9646-7 [A.2], are used for the support column:

  Y or y   supported by the implementation.

  N or n   not supported by the implementation.

  N/A, n/a or -no answer required (allowed only if the status is n/a, directly or after evaluation of a conditional status).

The following notations, defined in ISO/IEC 9646-7 [A.2] are used for the status column:

  M   mandatory - the capability is required to be supported.

  O   optional - the capability may be supported or not.

  N/A   not applicable - in the given context, it is impossible to use the capability.

  X   prohibited (excluded) - there is a requirement not to use this capability in the given context.

  O.i   qualified optional - for mutually exclusive or selectable options from a set. "i" is an integer which identifies an unique group of related optional items and the logic of their selection which is defined immediately following the table.

C.4 Major Capabilities

Item	Does the IUT support ...	Conditions for status	Status	Reference	Support
MCA1.1	The GFR.1 ATM transfer capability?		O.1	1.1	[ ] Yes [ ] No
MCA1.2	The GFR.2 ATM transfer capability?		O.1	1.1	[ ] Yes [ ] No
MCA2	Negotiation during call establishment, using the Minimum acceptable ATM traffic descriptor information element?		M	1.1	[ ] Yes [ ] No
Comments: O.1. = mandatory to support at least one of these procedures.					

C.5 Information element encoding

Item	Does the IUT support ...	Conditions for status	Status	Reference	Support
IEA1	the GFR extensions to the ATM traffic descriptor information element?		M	2.2.3, 2.2.2, 2.2.1.2	[ ] Yes [ ] No
IEA2	the GFR extensions to the Broadband bearer capability information element?		M	2.2.3, 2.2.2, 2.2.1.3	[ ] Yes [ ] No
IEA3	the GFR extensions to the Minimum acceptable ATM traffic descriptor information element?		M	2.2.3, 2.2.2, 2.2.1.4	[ ] Yes [ ] No
Comments:					

C.6 Basic Signalling Procedures

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
SPP1	Ignore the Tagging indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?		M	4.1 [6.5.2.3.3/PNNI]	[ ]Yes [ ]No
SPP2	Ignore the Frame discard indicators if the Traffic management options octet group is included in the ATM traffic descriptor information element?		M	4.1 [6.5.2.3.3/PNNI]	[ ]Yes [ ]No
Comments:					

C.7 Procedures for negotiation

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
NEG1	support negotiation of the PCR?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
NEG2	support negotiation of the MCR?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
NEG3	support negotiation of the MFS?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
NEG4	support negotiation of the BCT?		M	4.1 [6.5.2.3.4/PNNI]	[ ]Yes [ ]No
Comments:					

C.8 Procedures for interworking with B-ISUP

Item	Called user procedures : Does the IUT ...	Prerequisite	Status	Reference	Support
IW1	in case of interworking AINI -> B-ISUP for a GFR.1 call and the B-ISUP does not support GFR.1, reject the call with cause #65?	MCA1.1	M	5.1	[ ]Yes [ ]No
IW2	in case of interworking AINI -> B-ISUP for a GFR.2 call and the B-ISUP does not support GFR.2, reject the call with cause #65?	MCA1.2	M	5.1	[ ]Yes [ ]No
Comments:					

Annex D. GFR Extensions to the PNNI MIB

This annex is for information only to summarize the changes made to the PNNI 1.0 MIB. The normative MIB text can be found in …….mib.txt. The normative MIB has precedence over this section in case of any discrepancies.

D.1 Add new revision clause

Add a new revision clause to the Module-identity:

```
pnniMIB MODULE-IDENTITY
        LAST-UPDATED    "200101220000Z"
        ORGANIZATION    "The ATM Forum"
        CONTACT-INFO
            "The ATM Forum
             1000 Executive Parkway, Suite 220
             St. Louis, MO 63141-6372 USA
             Phone: +1 314-205-0200
             Fax: +1 314-576-7960
             info@atmforum.com"
        DESCRIPTION
            "The MIB module for managing ATM Forum PNNI routing."
        REVISION        "200101220000Z"
        DESCRIPTION
            "Updated version of the PNNI MIB adding support for the GFR
             ATM Service capability (af-cs-0167.000)."
        REVISION        "200006160000Z"
        DESCRIPTION
            "Updated version of the PNNI MIB adding support for the UBR
             with MDCR capability (af-cs-0147.000)."
        REVISION        "9810240000Z"
        DESCRIPTION
            "Updated version of the PNNI MIB released with the PNNI
             Addendum on PNNI/B-QSIG Interworking and Generic
             Functional Protocol for the Support of Supplementary
             Services (af-cs-0102.000)."
        REVISION        "9705010000Z"
        DESCRIPTION
            "Updated version of the PNNI MIB released with the PNNI
             V1.0 Errata and PICS (af-pnni-0081.000)."
        REVISION        "9602270000Z"
        DESCRIPTION
            "Initial version of the MIB for monitoring and controlling
             PNNI routing."
        ::= { atmfPnni 1 }
```

D.2 The Unsigned32 Textual convention

Delete the current Unsigned32 Textual convention and import from SNMPv2-SMI

```
        IMPORTS
                MODULE-IDENTITY, OBJECT-TYPE, OBJECT-IDENTITY,
                Counter32, Gauge32, Integer32, Unsigned32, enterprises
                    FROM SNMPv2-SMI
                TEXTUAL-CONVENTION, RowStatus, DisplayString,
                TimeStamp, TruthValue
                    FROM SNMPv2-TC
                InterfaceIndex, ifIndex
```

```
                        FROM IF-MIB
            AtmTrafficDescrParamIndex
                    FROM ATM-MIB
            MODULE-COMPLIANCE, OBJECT-GROUP
                    FROM SNMPv2-CONF;
```

D.3 The ServiceCategory textual convention

Replace the ServiceCategory textual convention with the following:

```
ServiceCategory ::= TEXTUAL-CONVENTION
        STATUS          current
        DESCRIPTION
            "Indicates the service category."
        REFERENCE
            "ATM Forum Traffic Management 4.1 Section 2"
        SYNTAX          INTEGER { other(1),
                                  cbr(2),
                                  rtVbr(3),
                                  nrtVbr(4),
                                  abr(5),
                                  ubr(6),
                                  gfr(7) }
```

D.4 The pnniIfAdmWeightGfr object type

Add a new pnniIfAdmWeightGfr object type and include it in the PnniIfEntry sequence:

```
PnniIfEntry ::=
        SEQUENCE {
                pnniIfNodeIndex         PnniNodeIndex,
                pnniIfPortId            PnniPortId,
                pnniIfAggrToken         PnniAggrToken,
                pnniIfVPCapability      TruthValue,
                pnniIfAdmWeightCbr      Unsigned32,
                pnniIfAdmWeightRtVbr    Unsigned32,
                pnniIfAdmWeightNrtVbr   Unsigned32,
                pnniIfAdmWeightAbr      Unsigned32,
                pnniIfAdmWeightUbr      Unsigned32,
                pnniIfRccServiceCategory    ServiceCategory,
                pnniIfRccTrafficDescrIndex  AtmTrafficDescrParamIndex,
                pnniIfAdmWeightGfr      Unsigned32
                }

pnniIfAdmWeightGfr OBJECT-TYPE
        SYNTAX          Unsigned32 (1..16777215)
        MAX-ACCESS      read-write
        STATUS          current
        DESCRIPTION
            "The administrative weight of this interface for the
             guaranteed frame rate service category."
        REFERENCE
            "ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification
            (PNNI, AINI,and UNI), Version 1.0 Section 4.2"
        DEFVAL { 5040 }
        ::= { pnniIfEntry 12 }
```

D.5 The pnniNodeAccBctPm object type

Add a new pnniNodeAccBctPm object types and include it in the PnniNodeTimerEntry sequence:

```
PnniNodeTimerEntry ::=
        SEQUENCE {
                pnniNodePtseHolddown              Integer32,
                pnniNodeHelloHolddown             Integer32,
                pnniNodeHelloInterval             Integer32,
                pnniNodeHelloInactivityFactor     Integer32,
                pnniNodeHlinkInact                Integer32,
                pnniNodePtseRefreshInterval       Integer32,
                pnniNodePtseLifetimeFactor        INTEGER,
                pnniNodeRxmtInterval              Integer32,
                pnniNodePeerDelayedAckInterval    Integer32,
                pnniNodeAvcrPm                    INTEGER,
                pnniNodeAvcrMt                    INTEGER,
                pnniNodeCdvPm                     INTEGER,
                pnniNodeCtdPm                     INTEGER,
                pnniNodeBeCRT                     INTEGER,
                pnniNodeGenerateUbrAvCR           TruthValue,
                pnniNodeGenerateBeCR              TruthValue,
                pnniNodeBeCRTuningFactor          INTEGER,
                pnniNodeAccBctPm                  INTEGER }

pnniNodeAccBctPm OBJECT-TYPE
        SYNTAX         INTEGER (1..99)
        UNITS          "percent"
        MAX-ACCESS     read-create
        STATUS         current
        DESCRIPTION
            "The proportional multiplier used in the algorithms that
             determine significant change for AccBCT parameters, expressed
             as a percentage."
        REFERENCE
            "ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification
            (PNNI, AINI,and UNI), Version 1.0 Section 4.2"
        DEFVAL  { 25 }
        ::= { pnniNodeTimerEntry 18 }
```

D.6 The new GfrCapability Textual convention

Add the new GfrCapability textual convention as follows:

```
GfrCapability ::= TEXTUAL-CONVENTION
        STATUS         current
        DESCRIPTION
            "Indicates the GFR conformance definitions supported."
        REFERENCE
            "ATM Forum Traffic Management 4.1 Section 2"
        SYNTAX         INTEGER { gfrDot1(1),
                                  gfrDot2(2),
                                  gfrDot1AndGfrDot2(3) }
```

D.7 The pnniMetricsGfrCapability object type

Add new pnniMetricsGfrCapability object type and a new object type Pnnimetrics10 for the AccBCT attribute and include them in the PnniMetricsEntry sequence:

```
PnniMetricsEntry ::=
        SEQUENCE {
                pnniMetricsTag          PnniMetricsTag,
                pnniMetricsDirection    INTEGER,
```

```
                pnniMetricsIndex          Integer32,
                pnniMetricsClasses        INTEGER,
                pnniMetricsGcacClp        ClpType,
                pnniMetricsAdminWeight    Unsigned32,
                pnniMetrics1              Unsigned32,
                pnniMetrics2              Unsigned32,
                pnniMetrics3              Unsigned32,
                pnniMetrics4              Unsigned32,
                pnniMetrics5              Unsigned32,
                pnniMetrics6              Unsigned32,
                pnniMetrics7              Unsigned32,
                pnniMetrics8              Unsigned32,
                pnniMetricsRowStatus      RowStatus,
                pnniMetricsAvcrIndicatorForUbr   TruthValue,
                pnniMetrics9              Unsigned32,
                pnniMetricsGfrCapability       GfrCapability,
                pnniMetrics10             Unsigned32
                }

pnniMetricsGfrCapability OBJECT-TYPE
        SYNTAX        GfrCapability
        MAX-ACCESS    read-create
        STATUS        current
        DESCRIPTION
            "When bit 6 of the of the pnniMetricsClasses is set to one this
            object indicates the GFR Conformance definitions supported.
            This object does not apply when bit 6 of the pnniMetricsClasses
            is set to zero."
        REFERENCE
            "ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification
            (PNNI, AINI,and UNI), Version 1.0 Section 4.2"
        ::= { pnniMetricsEntry 18 }

pnniMetrics10 OBJECT-TYPE
        SYNTAX        Unsigned32
        MAX-ACCESS    read-create
        STATUS        current
        DESCRIPTION
            "An alternate routing parameter from the advertising node
            to the remote end of the PNNI entity or to the reachable
            address or transit network, for the specified service
            categories.
            For information learned from PNNI nodes, this is the
            AccBCT expressed in units of cells.  This value is applicable
            only for the GFR service category.
            If this parameter is not used, its value should be set to
            0xFFFFFFFF."
        REFERENCE
            "ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification
            (PNNI, AINI,and UNI), Version 1.0 Section 4.2"
        ::= { pnniMetricsEntry 19 }
```

D.8 The pnniMetricsClasses object type

Replace the pnniMetricsClasses object type with the following:

```
pnniMetricsClasses OBJECT-TYPE
        SYNTAX          INTEGER(0..63)
        MAX-ACCESS      read-create
        STATUS          current
```

```
        DESCRIPTION
            "The service categories to which this set of parameters
             applies.  This is an integer used as a bit mask with each
             bit that is set representing a single service category for
             which the resources indicated are available.  Bit 6
             represents GFR, bit 5
             represents CBR, bit 4 represents real-time VBR, bit 3
             represents non-real-time VBR, bit 2 represents ABR, and
             bit 1 (LSB) represents UBR."
        REFERENCE
            "ATM Forum Traffic Management 4.1 Section 2,
            ATM Forum PNNI 1.0 Section 5.8.1.1.3.1,
            ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification
            (PNNI, AINI,and UNI), Version 1.0 Section 4.2"
        ::= { pnniMetricsEntry 4 }
```

D.9 The pnniRouteNodeGfrCapability object type

Add a new pnniRouteNodeGfrCapability object type and include it in the PnniRouteNodeEntry sequence:

```
PnniRouteNodeEntry ::=
        SEQUENCE {
                pnniRouteNodeClass          ServiceCategory,
                pnniRouteNodeDestNodeId     PnniNodeId,
                pnniRouteNodeDTL            Integer32,
                pnniRouteNodeDestPortId     PnniPortId,
                pnniRouteNodeProto          INTEGER,
                pnniRouteNodeTimeStamp      TimeStamp,
                pnniRouteNodeInfo           OBJECT IDENTIFIER,
                pnniRouteNodeGcacClp        ClpType,
                pnniRouteNodeFwdMetricAW    Unsigned32,
                pnniRouteNodeFwdMetric1     Unsigned32,
                pnniRouteNodeFwdMetric2     Unsigned32,
                pnniRouteNodeFwdMetric3     Unsigned32,
                pnniRouteNodeFwdMetric4     Unsigned32,
                pnniRouteNodeFwdMetric5     Unsigned32,
                pnniRouteNodeFwdMetric6     Unsigned32,
                pnniRouteNodeFwdMetric7     Unsigned32,
                pnniRouteNodeFwdMetric8     Unsigned32,
                pnniRouteNodeBwdMetricAW    Unsigned32,
                pnniRouteNodeBwdMetric1     Unsigned32,
                pnniRouteNodeBwdMetric2     Unsigned32,
                pnniRouteNodeBwdMetric3     Unsigned32,
                pnniRouteNodeBwdMetric4     Unsigned32,
                pnniRouteNodeBwdMetric5     Unsigned32,
                pnniRouteNodeBwdMetric6     Unsigned32,
                pnniRouteNodeBwdMetric7     Unsigned32,
                pnniRouteNodeBwdMetric8     Unsigned32,
                pnniRouteNodeVPCapability   TruthValue,
                pnniRouteNodeStatus         RowStatus,
                pnniRouteNodeGfrCapability      GfrCapability
                }

pnniRouteNodeGfrCapability OBJECT-TYPE
        SYNTAX       GfrCapability
        MAX-ACCESS   read-create
        STATUS       current
        DESCRIPTION
            "When pnniRouteNodeClass is set to 'gfr', this object
            indicates the GFR conformance definitions supported
```

```
        on this route. This object does not apply when the
        pnniRouteNodeClass is set to any other value than 'gfr'."
    REFERENCE
        "ATM Forum Guaranteed Frame Rate (GFR) Signalling Specification
        (PNNI, AINI,and UNI), Version 1.0 Section 4.2"
    ::= { pnniRouteNodeEntry 29 }
```

D.10 The pnniGfrOptionalGroup object group

Define a new conformance group containing the new objects for GFR

```
pnniGfrOptionalGroup OBJECT-GROUP
    OBJECTS  {
            pnniIfAdmWeightGfr,
            pnniMetricsGfrCapability,
            pnniMetrics10,
            pnniRouteNodeGfrCapability,
            pnniNodeAccBctPm}
    STATUS   current
    DESCRIPTION
            "A collection of optional PNNI objects used for the management
            of the GFR ATM Service Category."
    ::= { pnniMIBGroups 34 }
```