

**This specification** describes the situation of the Belgacom network and services. It will be subject to modifications for corrections or when the network or the services will be modified. Please take into account that modifications can appear at any moment. Therefore, the reader is requested to check regularly with the most recent list of available specifications that the document in one's possession is the latest version.

Belgacom can't be held responsible for any damages due to the use of a version of this specification which is not included in the most recent list of available specifications (list always available with a request to the e-mail address mentioned in the underneath paragraph).

Whilst every care has been taken in the preparation and publication of **this document**, errors in content, typographical or otherwise, may occur. If you have remarks concerning its accuracy, please send a mail to the following address [belgacom.uni.spec@belgacom.be](mailto:belgacom.uni.spec@belgacom.be) and your remark will be transmitted to the right Belgacom department.

The User Network Interface Specifications published via Internet are available for your information but have no official value. The only documents with an official value are printed on a specific paper.

If you want **to get an official version of this User Network Interface Specification**, please order it by sending your request to:

Belgacom / BELCOMLAB  
Rue Carlistraat 2  
B-1140 Evere  
Belgium

E-mail: [belcomlab@belgacom.be](mailto:belcomlab@belgacom.be)

# **Asynchronous Transfer Mode (ATM) Connectivity**

## Table of Contents

<b>0.</b>	<b>DOCUMENT HISTORY</b> .....	<b>1</b>
<b>1.</b>	<b>ABBREVIATIONS</b> .....	<b>2</b>
<b>2.</b>	<b>INTRODUCTION</b> .....	<b>3</b>
<b>3.</b>	<b>PHYSICAL LAYER:</b> .....	<b>5</b>
3.1.	E1 (2 Mbit/s) ATM interface: .....	5
3.1.1.	Physical medium Dependent sublayer : .....	5
3.1.2.	Transmission Convergence sublayer : .....	5
3.2.	E3 (34 Mbps) interface type "G.804/G.832" .....	6
3.2.1.	Physical medium Dependent sublayer : .....	6
3.2.2.	Transmission Convergence sublayer : .....	6
3.3.	IMA (Inverse Multiplexing for ATM) .....	7
3.3.1.	Physical medium Dependent sublayer : .....	7
3.3.2.	IMA sublayer and Transmission Convergence sublayer : .....	7
3.4.	SDH STM1 interface (155,52 Mbps) .....	8
3.4.1.	Physical medium Dependent sublayer : .....	8
3.4.2.	Transmission Convergence sublayer : .....	8
<b>4.</b>	<b>ATM LAYER</b> .....	<b>9</b>
4.1.	General .....	9
4.2.	Traffic contracts and User Parameter Control .....	10
4.3.	ATM layer Services.....	10
<b>5.</b>	<b>REFERENCES</b> .....	<b>11</b>

## 0. Document History

Every update of this document results in a complete new version with new version number and release date.

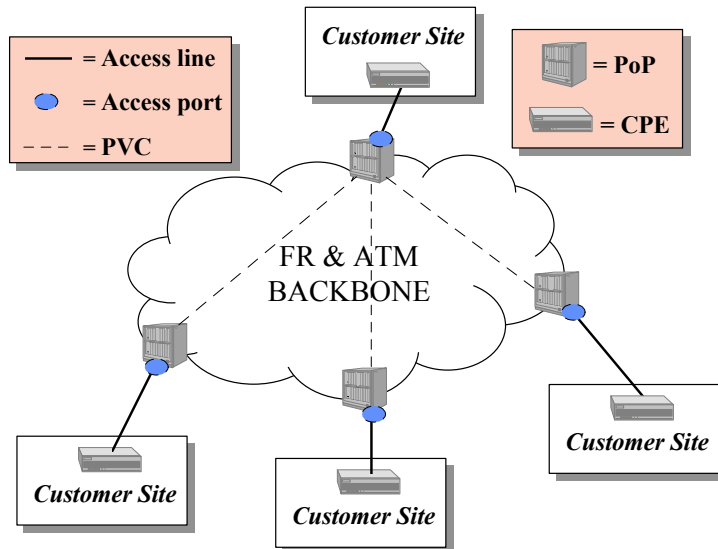
Version	Date	Main or important changes since previous version
1.1	08 FEB 1999	...
1.2	19 OCT 2000	<ul style="list-style-type: none"><li>• General change of layout and a "Document History" has been added</li><li>• Some typewriting corrections</li><li>• <b>§ 2.2. of version 1.1</b> E3 (34 Mbps) interface , type "PLCP" has been deleted</li></ul>

## 1. Abbreviations

ABR	Available Bit Error Rate
ATM	Asynchronous Transfer Mode
CBR	Constant Bit Rate
CDVT	Cell Delay Variation Tolerance
CLP	Cell Loss Priority
CPE	Customer Premises Equipment
FR	Frame Relay
GFC	Generic Flow Control
HEC	Header Error Control
MBS	Maximum Burst Size
PCR	Peak Cell Rate
PMD	Physical Medium Dependent
POP	Point Of Presence
PVC	Permanent Virtual Circuit
SCR	Sustainable Cell Rate
TC	Transmission Convergence Sublayer
UBR	Unspecified Bit Rate
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VPC	Virtual Path Connection
VPI	Virtual Path Identifier
VBR	Variable Bit Rate

## 2. Introduction

The customer gets access to the ATM network over an access line between the customer site and the access port on the ATM PoP of Belgacom (see figure below).

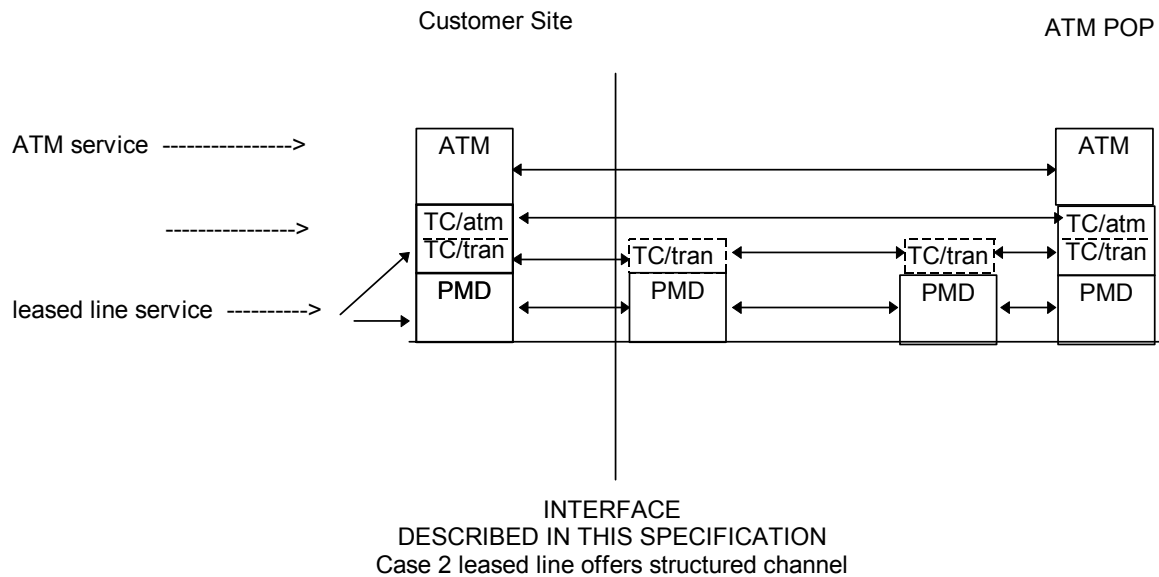
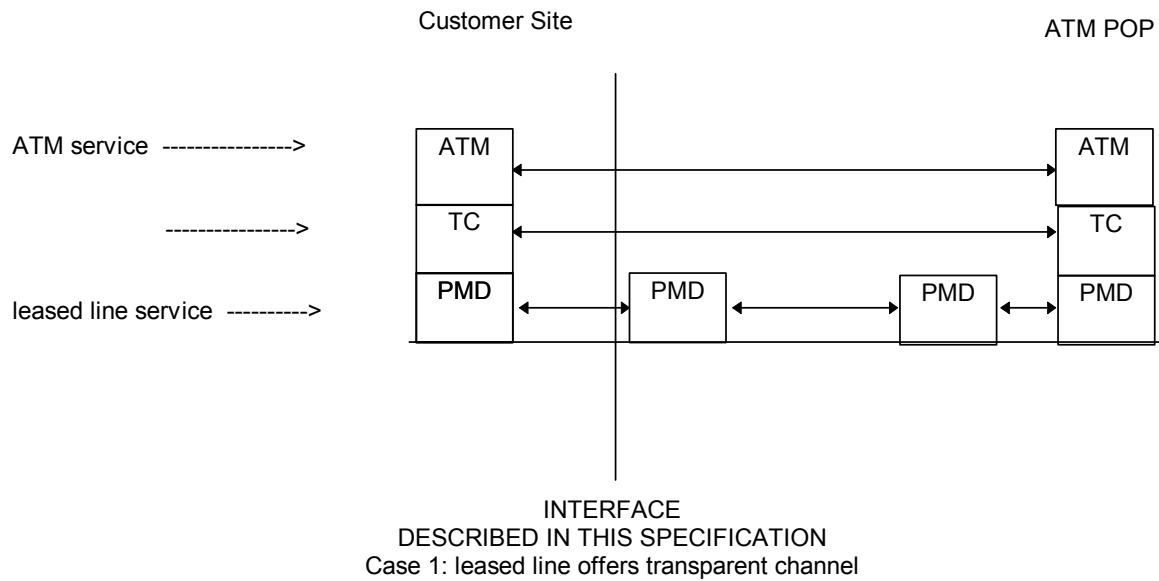


The access line is provisioned by the leased line service of Belgacom and is specified as such elsewhere.

The reference model, used in this specification is based on the B-ISDN protocol reference model ITU-T Rec. I.321, which is structured as following:

LAYER	SUBLAYER	Function group
ATM Layer	n/a	n/a
Physical Layer	Transmission Convergence Sublayer (TC)	ATM Specific TC Functions: e.g. ATM cell mapping, cell rate decoupling...
	Physical Medium Dependent Sublayer (PMD):	Transport Specific TC Functions : e.g. G.704 frame

The reference model of this specification is shown in following figure.  
 Note that the Transport Specific Functions (e.g. G.704 frame) may or may not be included in the Leased Line service, so 2 cases are distinguished:



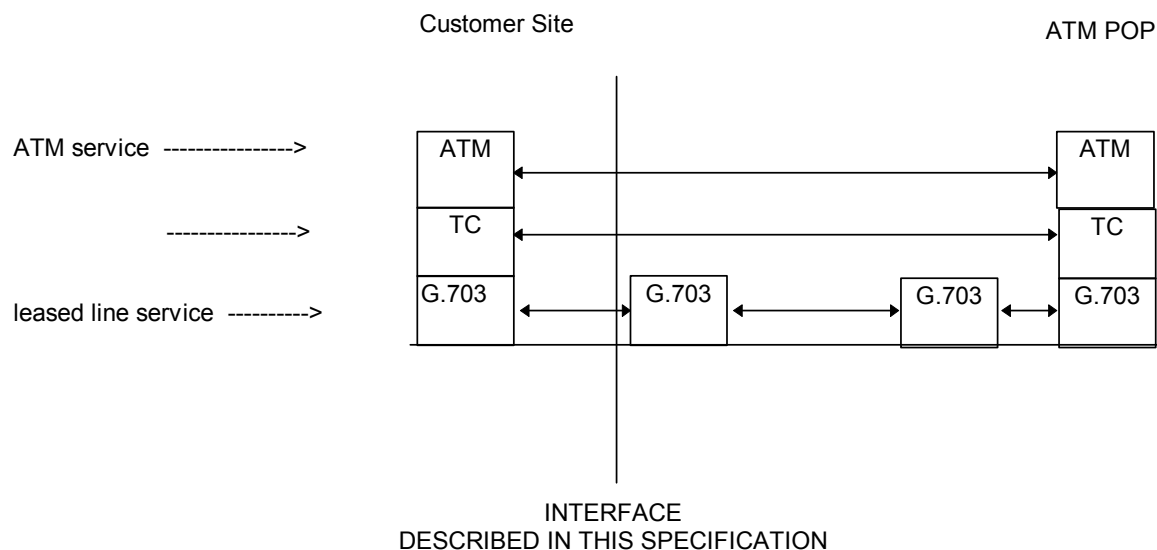
This specification specifies:

- what leased line service (2Mbps, 34Mbps or 155,52Mbps) is needed
- the ATM specific sub layers of the Physical Layers
- the ATM Layer

The first and second bullets are treated in the section Physical Layer and are specific for the access techniques, the third one, the ATM Layer, is common for all access techniques and is treated in the next section.

### 3. Physical layer:

#### 3.1. E1 (2 Mbit/s) ATM interface:



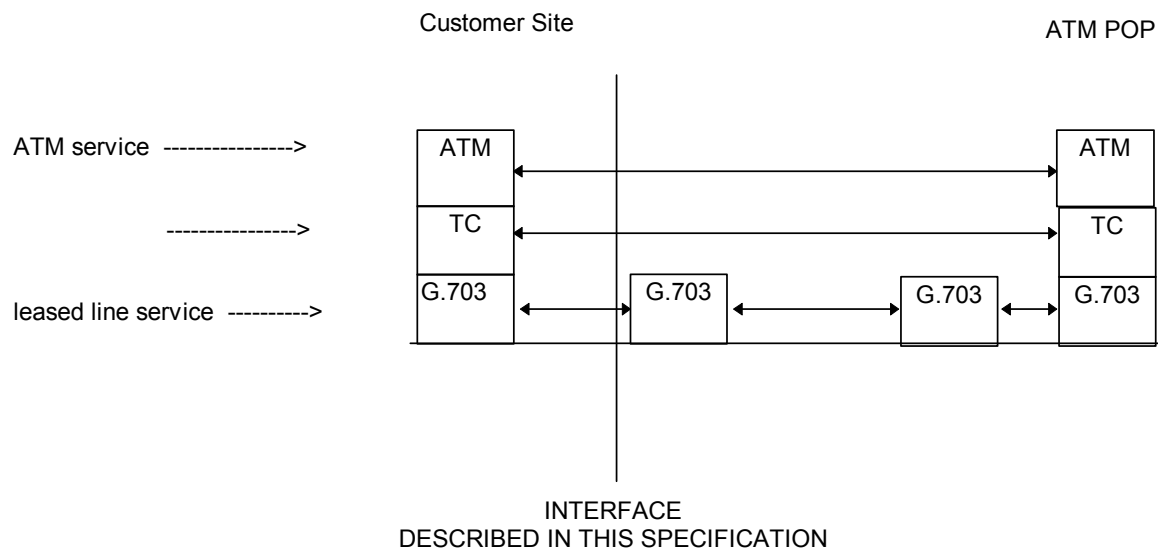
##### 3.1.1. Physical medium Dependent sublayer :

- This service is offered by the Belgacom transparent 2Mbps leased line service , which is based on ITU-T G.703 2048 kbit/s specification. The physical interface shall be 120 Ohm symmetrical shielded pair. The clock shall be derived from the bitstream, received from the Belgacom ATM network.

##### 3.1.2. Transmission Convergence sublayer :

- Transport Specific TC Function: The ITU-T G.704 transmission frame shall be used: CRC-4 in TS0 should be enabled and TS16 contains idles . Note however that the G.704 functionality will not be terminated in the leased line service, but in the ATM node interface.
- ATM cell mapping in the transmission frame shall correspond to ITU-T G.804. The timeslots 0 and 16 should not be used for ATM cell mapping.
- Cell rate decoupling shall be performed by the insertion of idle cells, as is defined in ITU-T Rec. I.432.
- The ATM Header Error Control (HEC) value shall be verified and generated as specified in ITU-T Rec I.432.
- Cell delineation function and Scrambling shall be performed using the HEC mechanism, as defined in ITU-T Rec. I.432.

### 3.2. E3 (34 Mbps) interface type "G.804/G.832"



#### 3.2.1. Physical medium Dependent sublayer :

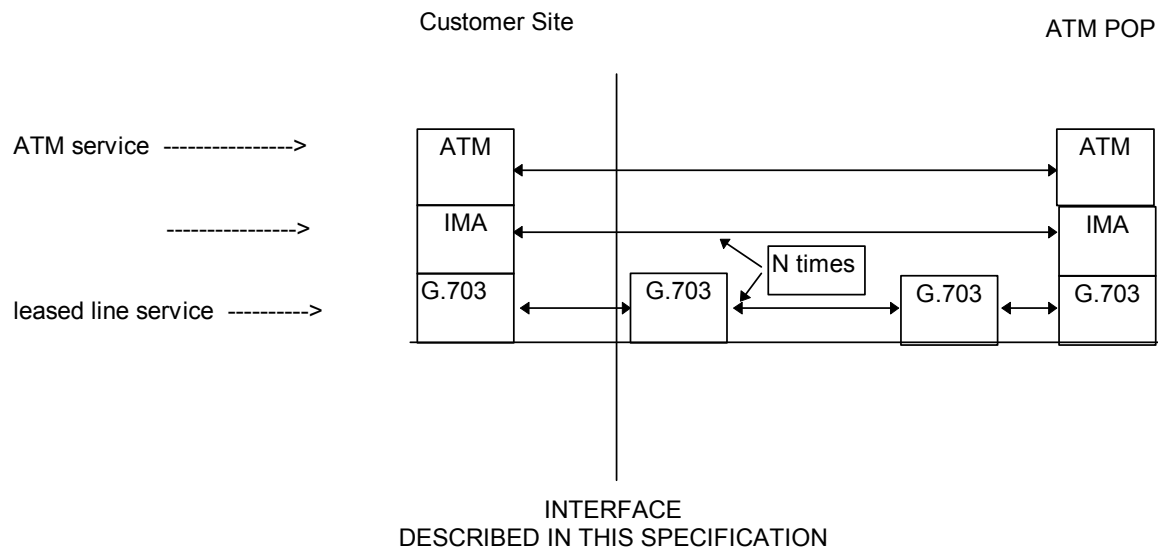
- This service is offered by the Belgacom transparent 34 Mbps leased line service, which is based on ITU-T G.703 transparent channel 34 Mbps. The clock shall be derived from the bitstream, received from the Belgacom ATM network.

#### 3.2.2. Transmission Convergence sublayer :

- The ITU-T G.832 transmission frame shall be used. Note however that the ITU-T G.832 functionality will not be terminated in the leased line service, but in the ATM node interface.
- ATM cell mapping in the transmission frame shall correspond to ITU-T G.804.
- Cell rate decoupling shall be performed by the insertion of idle cells, as is defined in ITU-T Rec. I.432.
- The ATM Header Error Control (HEC) value shall be verified and generated as specified in ITU-T Rec I.432.
- Cell delineation function and Scrambling shall be performed using the HEC mechanism, as defined in ITU-T Rec. I.432.

### 3.3. IMA (Inverse Multiplexing for ATM)

- This interface provides access to the ATM network via inverse multiplexing of an ATM stream over multiple physical links and by retrieving the original ATM stream at the ingress of the ATM network.  
Two until N physical 2Mbps lines can be inverse multiplexed (N=8).



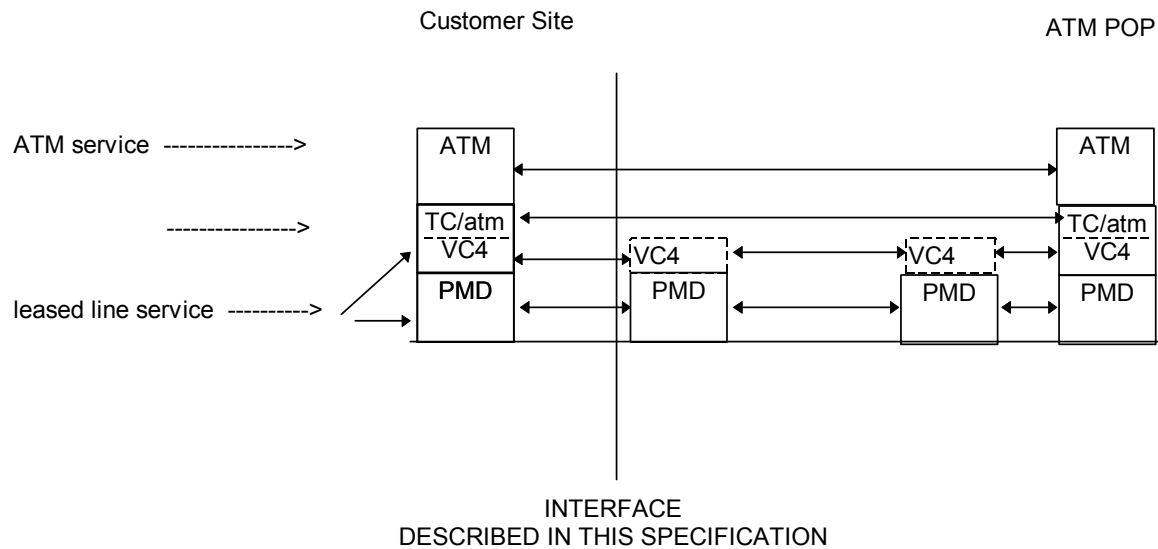
#### 3.3.1. Physical medium Dependent sublayer :

- This service is offered by the Belgacom transparent 2Mbps leased line service, which is based on ITU-T G.703 transparent channel 2048 kbps. The physical interface shall be 120 Ohm symmetrical shielded pair. The clock shall be derived from the bitstream, received from the Belgacom ATM network. N lines have to be used.

#### 3.3.2. IMA sublayer and Transmission Convergence sublayer :

- Is based on ATM Forum document: AF-PHY-0086.000

### 3.4. SDH STM1 interface (155,52 Mbps)



#### 3.4.1. Physical medium Dependent sublayer :

- This service is offered by the Belgacom leased line service, which is based on transport of a VC-4 in a physical interface of 155,52 Mbps. The Belgacom leased line service is in accordance with BGC\_D\_48\_9902\_20.19\_E.doc (SDH leased lines). The clock shall be derived from the bitstream, received from the Belgacom ATM network.

#### 3.4.2. Transmission Convergence sublayer :

- VC-4 mapping of ATM cells as defined in ITU-T recommendation I.432 and G.709, shall be used. The ATM related functions of the transmission convergence sublayer (i.e. cell delineation, scrambling and header error control) shall conform to ITU-T Rec. I.432.
- Cell rate decoupling shall be performed by the insertion of idle cells, as is defined in ITU-T Rec. I.432.
- The ATM Header Error Control (HEC) value shall be verified and generated as specified in ITU-T Rec I.432.
- Cell delineation function and Scrambling shall be performed using the HEC mechanism, as defined in ITU-T Rec. I.432.

## 4. ATM layer

### 4.1. General

- A Virtual Path Connection (VPC) and Virtual Channel Connection (VCC) are defined as in ITU-T Recommendation I.311.
- A connection (VPC or VCC) is always bi-directional.
- The ATM layer specification shall conform to ITU-T Rec. I.321, and the cell structure as defined in ITU-T Rec. I.361.
- The VPC service transports the VC's transparently, all 65 536 VC's. The VPI uniquely defines the VPC at the user interface and is used for the downstream as well as for the upstream cell flow. In the case of VPC service, a subset of VPI values can be chosen from the 256 values available in the 8 bit format (ITU-T Rec. I.361). This subset is defined in agreement with Belgacom.
- The GFC field (ITU-T Rec.I.361) is set on 0000 on egress and ignored on ingress by the Belgacom network.
- The PT field and CLP field are used as defined in ITU-T Rec. I.361. The network may pass the CLP field transparently or set it to "low priority" (=1) and discard "low priority" cells, depending on the ATM service offered to the connection.
- The ATM network will provide ATM cell multiplexing and de-multiplexing as defined in ITU-T Rec. I.150.
- The pre-assigned VPI/VCI header values, as specified in ITU-T Recommendations I.361 and I.432 shall not be used for other than their designated purposes.
- Operations, Administration and Maintenance (OAM) cell headers are defined in ITU-T Rec. I.432 and the utilisation is defined in ITU-T Rec.I.610. The OAM cells shall not be used for other than their designated purposes. Appropriate usage by the network may be foreseen in the future.

#### 4.2. Traffic contracts and User Parameter Control

- Each connection (VPC or VCC) shall be subject to a Traffic Contract, that specifies the characteristics, negotiated with Belgacom.
- The set of parameters of a connection is called the Source Traffic Descriptor. The parameters are defined in ATM Forum User-Network Interface Specification V3.1 (af-uni-0010.002):
  - PCR (Peak Cell Rate),
  - CDVT (Cell Delay variation Tolerance),
  - SCR (Sustainable Cell Rate),
  - MBS (Maximum Burst size),A subset of this list shall be used in the Source Traffic Descriptor and the same subset applies to both directions. However, the values of the parameters may be different for both directions (asymmetrical connections).
- The parameters shall be calculated taking into account all cells of the connection or just the "high priority" cells (CLP=0). The former is indicated by \_0+1, the latter by \_0. Example : PCR\_0+1 and SCR\_0.
- The PCR value shall be between zero and link rate. The zero value shall be used for the cell flow towards the root of a Point-to-multipoint connection, and may be used for the return cell flow of uni directional connections.
- The CDVT value will be allocated by Belgacom, depending on the PCR value.
- The SCR value shall be between zero and the PCR value.
- The MBS value shall be between zero and 210.
- The Source Traffic Descriptor of a connection will be enforced by applying appropriate action on the cells that do not conform to the negotiated traffic contract, at the ingress of the Belgacom ATM network. Conformity will be defined using the Generic Cell Rate Algorithm (GCRA) following ATM Traffic Management 4.0, ATM Forum :  
CBR.1  
VBR.3

#### 4.3. ATM layer Services

Following ATM service categories are offered by the Belgacom ATM network, for VCC's as well as for VPC's (based on ATM Forum Traffic Management Specification Version 4.0 af-tm-0056.000):

CBR : Constant Bitrate  
VBR : Variable Bit Rate

Note that UBR and ABR are not offered now but may be in the future.

- CBR service category guarantees transfer of a cell flow conforming to Source Traffic Descriptor containing a PCR\_0+1 and CDVT parameter. Non conforming cells are discarded. The network offers a very low delay, very low delay jitter and very low cell loss
- VBR service category guarantees transfer of a cell flow conforming to Source Traffic Descriptor containing a PCR\_0+1, CDVT, SCR\_0 and MBS\_0 parameter. Cells non conforming to PCR\_0+1 are discarded, "high priority" cells (CLP=0) non conforming to SCR\_0 / MBS are tagged (put CLP on "low priority" = 1). The network offers a low delay, low delay jitter. Low cell loss is offered to cells conforming to SCR\_0.

## 5. References

ITU-T :

- G.703 Physical/electrical characteristics of hierarchical digital interfaces, 1991
- G.704 Synchronous frame structures used at primary and secondary hierarchy levels, 1991
- G.707 Synchronous digital hierarchy bit rates, June 1992
- G.708 Network node interface for the synchronous digital hierarchy, June 1992
- G.709 Synchronous multiplexing structure, 1991
- G.804 ATM Cell mapping into Plesiochronous Digital Hierarchy (PDH), 1993
- G.832 Transport of SDH elements on PDH Networks - Frame and Multiplexing Structures, 1995
- G.957 Optical interfaces for equipments and systems relating to the Synchronous Digital Hierarchy, May 1992
- I.121 Broadband aspects of ISDN, 1991
- I.150 B-ISDN ATM functional characteristics, 1991
- I.311 B-ISDN General network aspects, June 1992
- I.361 B-ISDN ATM layer specification, June 1992
- I.371 Traffic control and congestion control in B-ISDN, June 1992
- I.413 B- ISDN user network interface.
- I.432 B-ISDN user network interface - Physical layer specification
- I.610 B-ISDN operation and maintenance principles and functions.

ATM Forum: . <http://www.atmforum.com/>

- UNI 3.1 User Network Interface (UNI) Specification , Version 3.1
- TM4.0 Traffic Management Specification Version 4.0 af tm 0056.000
- AF-PHY-0086.001 Inverse Multiplexing for ATM (IMA) Specifications Version 1.1

BELGACOM

- SDH leased lines BGC\_D\_48\_9902\_20.19\_E.DOC